Power Management Selection Guide

4Q 2004

TI Power Solutions: Power Behind Your Designs

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Texas Instruments (TI) offers complete power solutions with a full line of high-performance products. These products, which range from standard linear ICs to plug-in and integrated power solutions, are tailored to meet your design challenges. And, TI makes designing easier by providing leading-edge support tools such as training, a broad selection of evaluation modules (EVMs), application notes, comprehensive technical documentation and more. TI also offers samples and small orders (shipped within 24 hours via TI authorized distributors) that will help you accelerate your time-to-market.

Included in this selection guide you will find design factors, featured products, graphic representations of portfolios and parametric tables. A list of application notes and evaluation modules is included in each section of the guide.

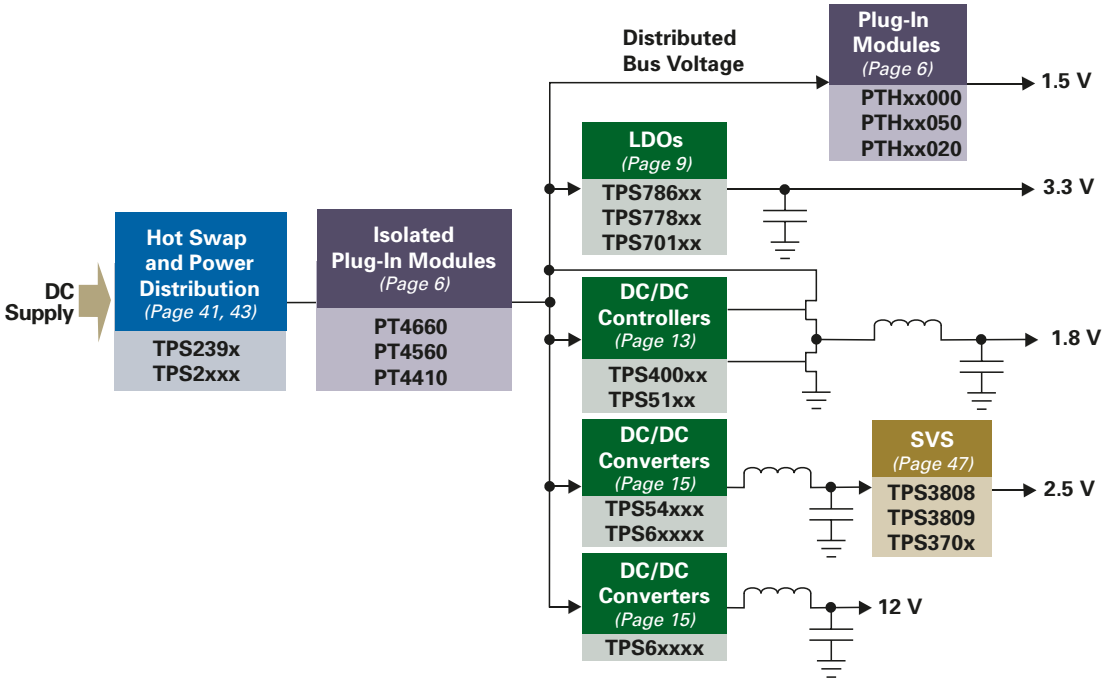
TI Power Solutions: Power Behind Your Designs

TI provides power management integration, technology and value to help you drive innovation and grow market opportunities. This is coupled with collaboration, tools, service and delivery to help you get there faster. For more information or technical assistance, please see TI Worldwide Technical Support on page 59 of this selection guide or visit TI's Power Management web site at:

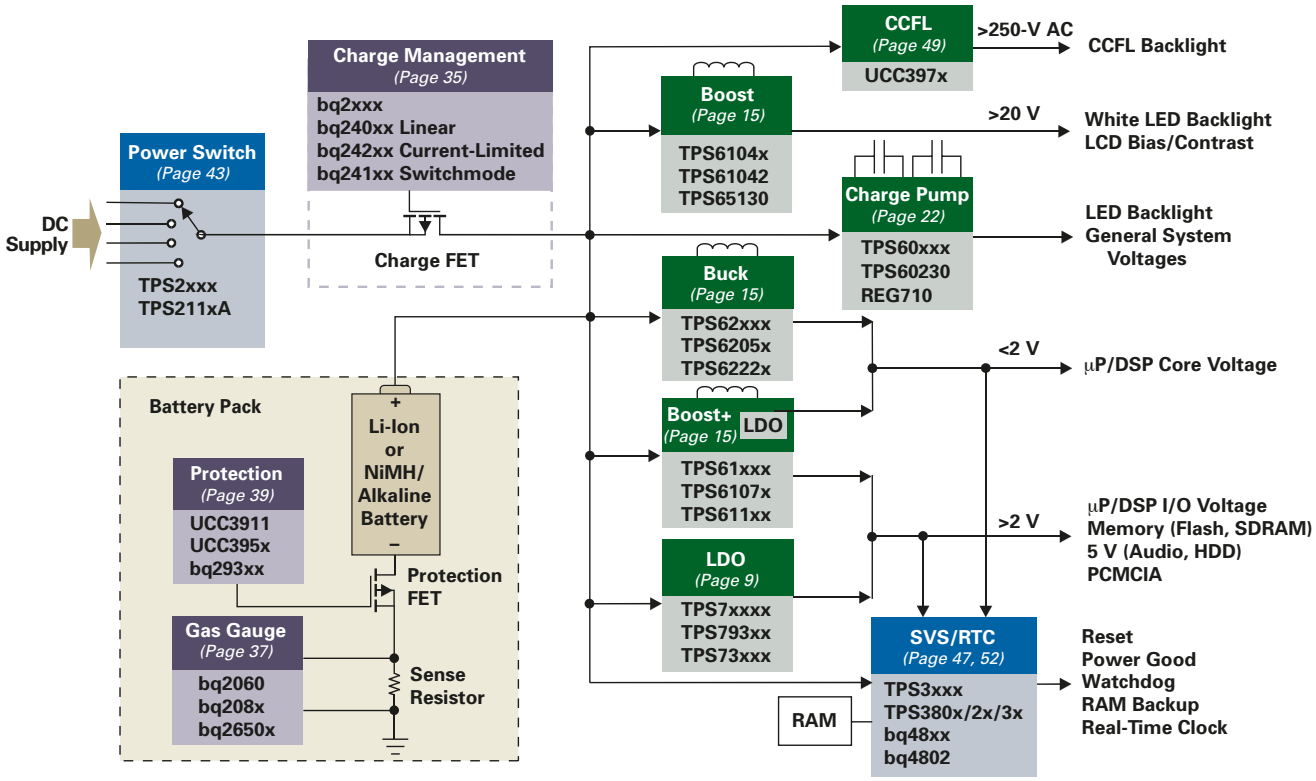
power.ti.com

Note: Military versions of some Power Management products are available. Please visit:
power.ti.com/militaryproducts

System Power and Plug-In Solutions



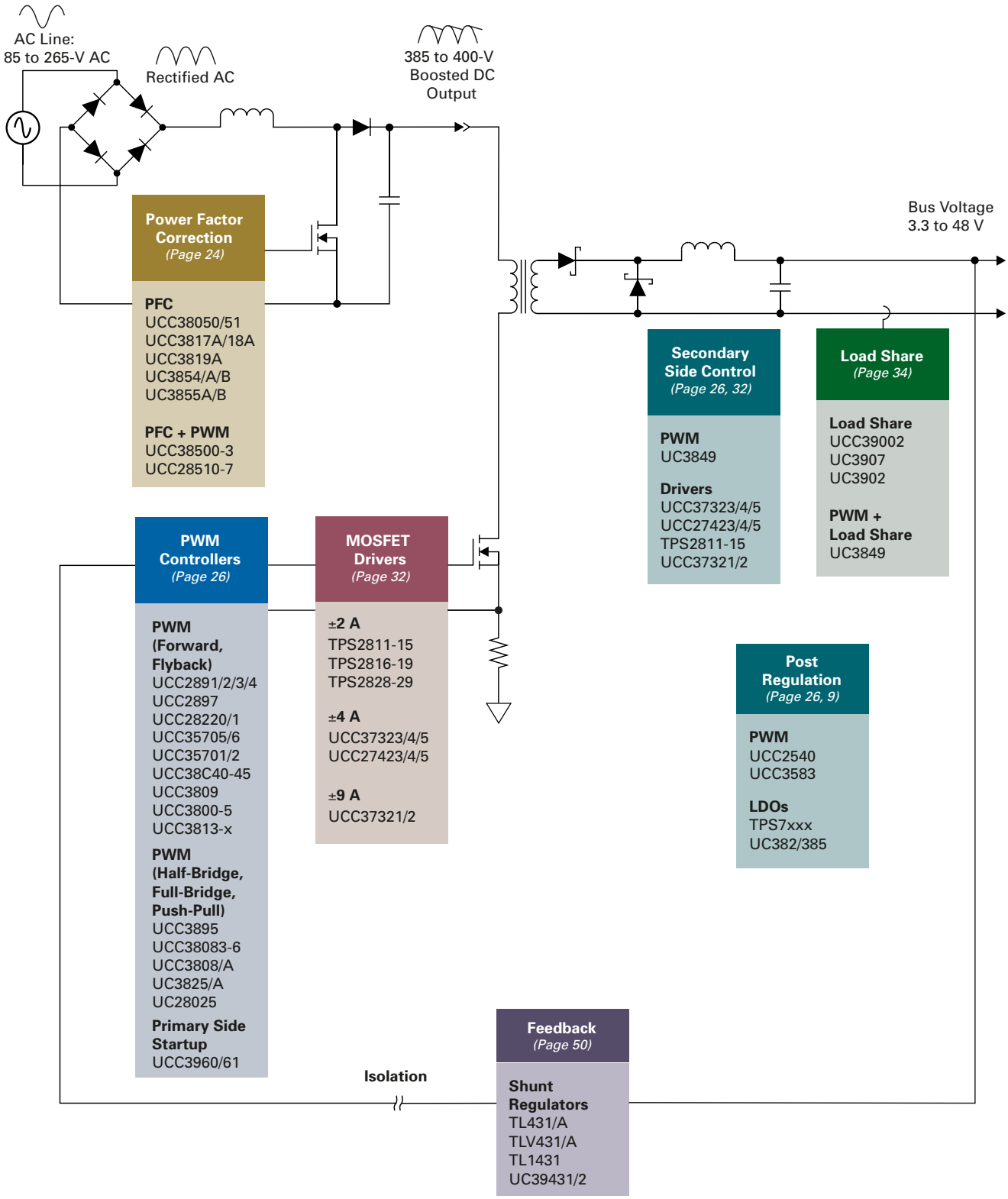
Portable Power Solutions



Typical Power Applications

AC/DC Solutions

Isolated DC/DC Solutions

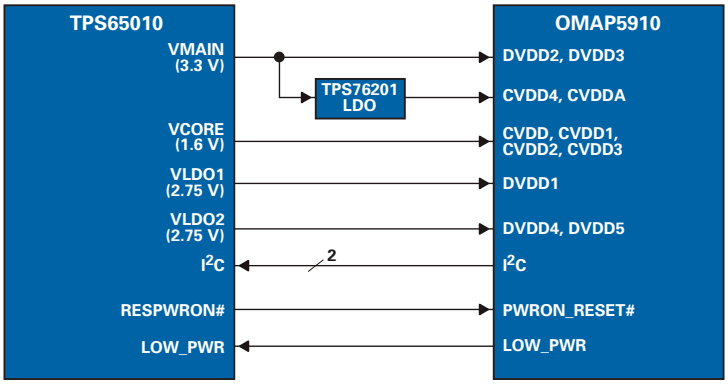


DSP Power Solutions

www.ti.com/dsppower

Visit the site for one-stop DSP power management support, including downloading the latest *DSP Power Management Reference Guide* or reviewing application notes such as the SPRA954A, *OMAP5910 Low-Power System Design*.

OMAP™ Low-Power Solution

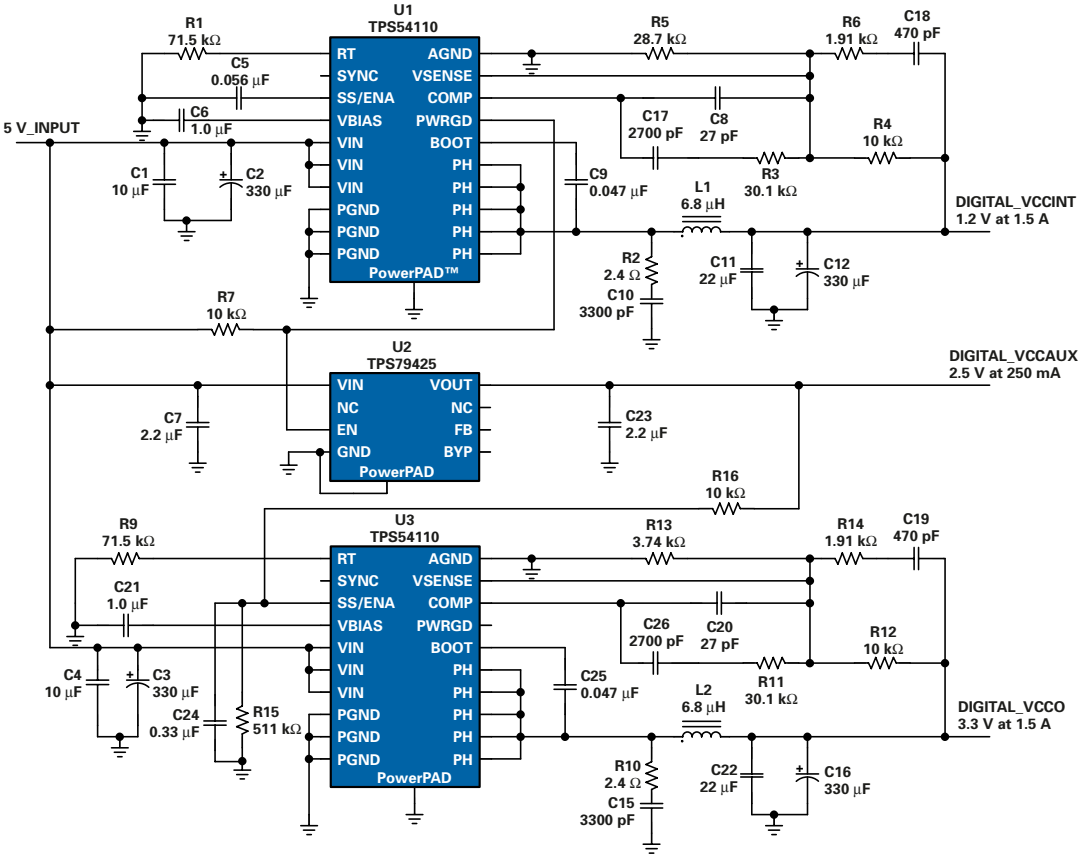


FPGA Power Solutions

www.ti.com/xilinxfpga or **www.ti.com/alterafpga**

Visit these sites for one-stop power management support for Xilinx® and Altera® FPGAs. Download the latest FPGA Power Management Reference Guides, complete schematics and BOMs for the reference designs in the guides, plus bonus designs such as the one below.

Xilinx® Spartan™-3 FPGA Power Management Solution Providing I_{CCINT} = 1.5 A



Plug-In Power Solutions

Design Factors

Plug-in power solutions are board-mounted, completely integrated, DC/DC converters requiring only one or two external components.

Input Voltage (V_{IN}) — Plug-in power solutions are designed to work from industry-standard DC bus voltages.

Output Current (I_{OUT}) — The I_{OUT} of the converter should match the maximum current need of your application.

Output Voltage (V_{OUT}) — Choose an adjustable or fixed V_{OUT} that meets your requirements.

Isolation — Converters with electrical input to output isolation are usually more complex and more expensive.

Single/Multiple Outputs — Compare the flexibility and cost of several single output converters with a multiple output converter.

Features — Adjustable/programmable output voltage, Auto-Track,™ remote sense, over-temperature, over-current and output inhibit are some of the many features offered.

Airflow Requirements — The max current of converters often depends on airflow. SOA curves determine the airflow needs of converters at specific currents.

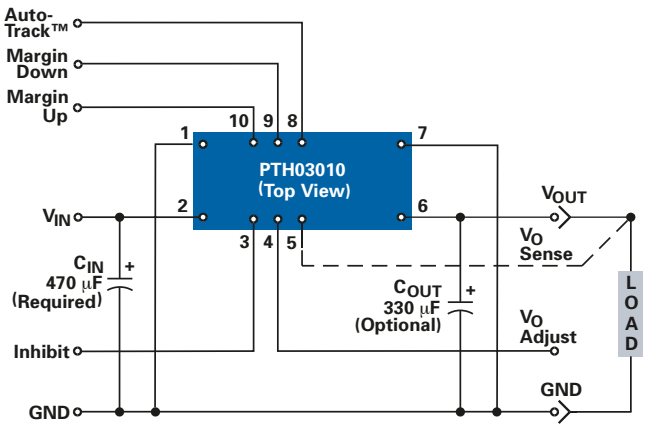
Protection — Fault protection can include short circuit, over-temperature, over-current and over-voltage protection.

Package — Vertical mounting uses the smallest footprint. Surface mount and horizontal through-hole are available in most product series.

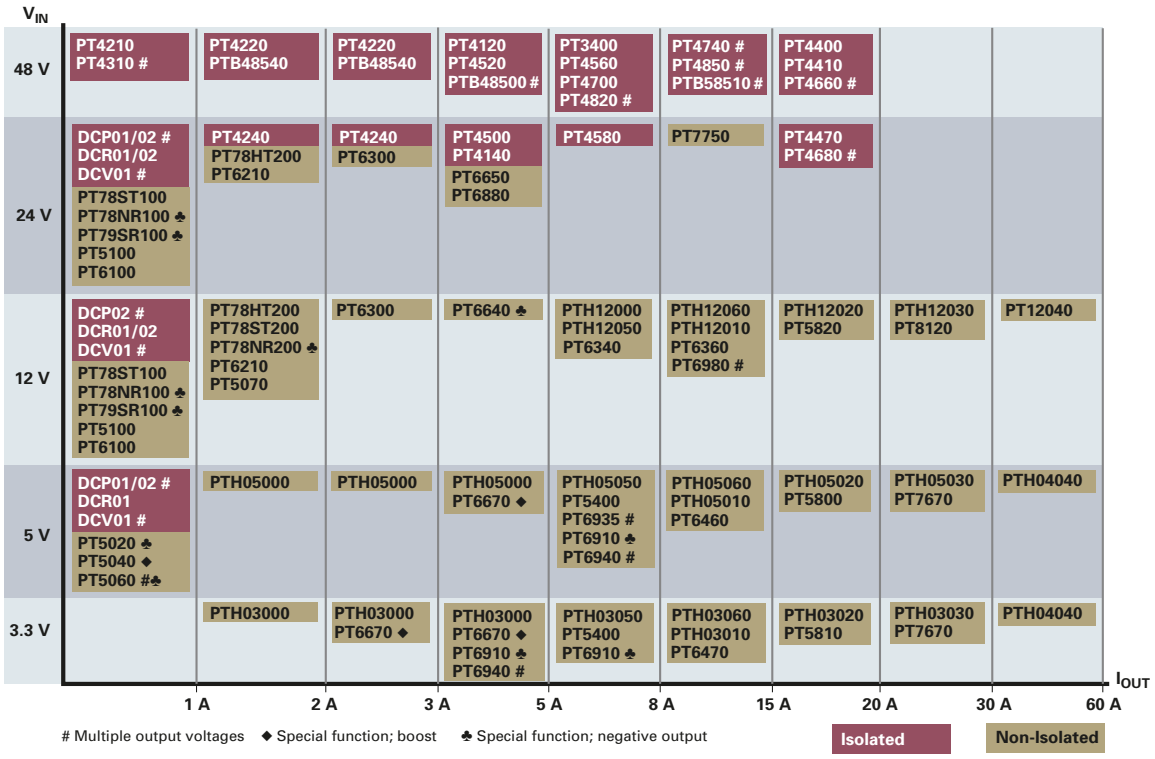
15-A, 3.3-V Input, Adjustable Plug-In Power Module
PTH03010

Get samples and datasheets at: **www.ti.com/sc/device/PTH03010W**

The PTH03010 15-A series operates from a 3.3-V input and offers Auto-Track™ sequencing, margin up/down and an adjustable output voltage range of 0.8 to 2.6 V in a 1.3" x 0.6" x 0.35" package.



Plug-In Power Solutions Family of Products

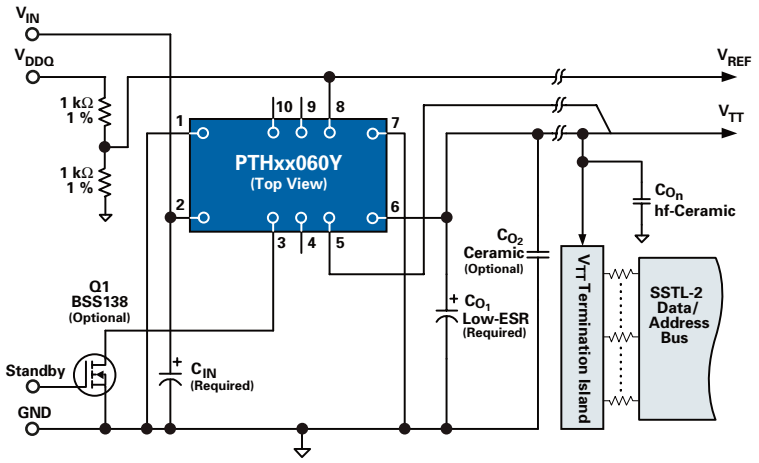


PTH QDR/DDR Series Power Modules
PTHxx060Y

Get samples and datasheets at: **www.ti.com/sc/device/PARTnumber**
(Replace **PARTnumber** with **PTH03060Y**, **PTH05060Y** or **PTH12060Y**)

Key Features

- Non-isolated DC/DC modules for double data rate (DDR) and quad data rate (QDR) I and II memory bus terminations
- Generates termination voltage (V_{TT}) that will source or sink current to track an external reference voltage (V_{REF})
- V_{TT} tracks V_{DDQ} voltage with tolerance of ±40 mV under transient conditions
- Supports V_{TT} range from 0.55 to 1.8 V
- 3.3-, 5- and 12-V input models
- Output currents up to 15 A
- Point-of-Load Alliance (POLA™) compatible



Standard application.

Selection Guide

Device[1]	Input Bus Voltage	Description	P_{OUT} or I_{OUT}	V_O Range (V)	V_O Adjustable	Auto-Track™ Sequencing	POLA™	DDR-QDR	Price[2]
Non-Isolated Single Positive Output									
PT5040	5 V	1-A 5-V Input Step-Up ISR	1 A	8 to 18					9.50
PT5100	V_O + 4 to 38 V	1-A Wide-Input Positive Step-Down ISR	1 A	3.3 to 15					7.35
PT5400	3.3 V/5 V	3.3-V/5-V Input 6-A SWIFT™ Adjustable ISR	6 A	1.0 to 3.3	✔				11.85
PT5800/10	3.3 V/5 V	3.3-V/5-V Input 20-A Adjustable Low Profile (8mm) ISR	20 A	1.0 to 3.6	✔				22.55
PT5820	12 V	12-V Input 16-A Adjustable Low Profile (8mm) ISR	16 A	1.0 to 5.5	✔				22.55
PT6100	V_O + 4 to 38 V	1-A Wide-Input Adjustable Step-Down ISR	1 A	1.9 to 22	✔				7.55
PT6210	V_O + 4 to 38 V	2-A Wide-Input Adjustable Step-Down ISR	2 A	1.9 to 22	✔				10.60
PT6300	V_O + 4 to 38 V	3-A Wide-Input Adjustable Step-Down ISR	3 A	1.9 to 22	✔				11.90
PT6340	12 V	12-V Input 6-A Adjustable ISR	6 A	1.5 to 5	✔				18.10
PT6360	12 V	12-V Input 11-A Adjustable Low Profile (8mm) ISR	11 A	1.0 to 5.5	✔				17.55
PT6460/70	3.3 V/5 V	3.3-V/5-V Input 14-A Adjustable Low Profile (8mm) ISR	14 A	1.0 to 3.6	✔				17.55
PT6670	3.3 V	3.3-V Input 20-W Boost ISR	20 W	3.8 to 12.8	✔				19.50
PT6880	24 V	5-A 18- to 36-V Input Adjustable ISR	5 A	1.8 to 17	✔				19.00
PT7670	3.3 V/5 V	3.3-V/5-V Input 30-A Programmable ISR	30 A	0.8 to 3.5	5-bit Prog				30.25
PT78HT200	V_O + 4 to 38 V	5-V_{OUT} 2-A Wide-Input Positive Step-Down ISR	2 A	3.3 to 6.5					10.80
PT78ST100	V_O + 4 to 38 V	1.5-A Wide-Input Positive Step-Down ISR	1.5 A	3.3 to 15					8.65
PT8120	12 V	12-V Input 30-A Multi-Phase Programmable ISR	30 A	0.8 to 7.6	5-bit Prog				47.75
PTH03000W	3.3 V	3.3-V Input 6-A ISR	6 A	0.8 to 2.5	✔				6.90
PTH03010W	3.3 V	3.3-V Input 15-A ISR with Auto-Track Sequencing	15 A	0.8 to 2.5	✔	✔	✔		11.60
PTH03020W	3.3 V	3.3-V Input 22-A ISR with Auto-Track Sequencing	22 A	0.8 to 2.5	✔	✔	✔		18.15
PTH03030W	3.3 V	3.3-V Input 30-A ISR with Auto-Track Sequencing	30 A	0.8 to 2.5	✔	✔	✔		25.00
PTH03050W	3.3 V	3.3-V Input 6-A ISR with Auto-Track Sequencing	6 A	0.8 to 2.5	✔	✔	✔		6.90
PTH03060W	3.3 V	3.3-V Input 10-A ISR with Auto-Track Sequencing	10 A	0.7 to 2.5	✔	✔	✔		9.80
PTH04040W	3.3 V/5 V	3-V to 5.5-V Input 60-A ISR with Auto-Track Sequencing	60 A	0.8 to 3.6	✔	✔	✔		30.00
PTH05000W	5 V	5-V Input 6-A ISR	6 A	0.8 to 3.6	✔				6.90
PTH05010W	5 V	5-V Input 15-A ISR with Auto-Track Sequencing	15 A	0.8 to 3.6	✔	✔	✔		11.60
PTH05020W	5 V	5-V Input 22-A ISR with Auto-Track Sequencing	22 A	0.8 to 3.6	✔	✔	✔		18.15
PTH05030W	5 V	5-V Input 30-A ISR with Auto-Track Sequencing	30 A	0.8 to 3.6	✔	✔	✔		25.00
PTH05050W	5 V	5-V Input 6-A ISR with Auto-Track Sequencing	6 A	0.8 to 3.6	✔	✔	✔		6.90
PTH05060W	5 V	5-V Input 10-A ISR with Auto-Track Sequencing	10 A	0.8 to 3.6	✔	✔	✔		9.80

[1] *See **power.ti.com** for a complete product offering.*
[2] *Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

Plug-In Power Solutions

Selection Guide (Continued)

Device[1]	Input Bus Voltage	Description	P_{OUT} or I_{OUT}	V_O Range (V)	V_O Adjustable	Auto-Track™ Sequencing	POLA™	DDR-QDR	Price[2]
Non-Isolated Single Positive Output (Continued)									
PTH12000L/W	12 V	12-V Input 6-A ISR	6 A	0.8 to 1.8/1.2 to 5.5	✔				6.90
PTH12010L/W	12 V	12-V Input 12-A ISR with Auto-Track Sequencing	12 A	0.8 to 1.8/1.2 to 5.5	✔	✔	✔		11.60
PTH12020L/W	12 V	12-V Input 18-A ISR with Auto-Track Sequencing	18 A	0.8 to 1.8/1.2 to 5.5	✔	✔	✔		18.15
PTH12030L/W	12 V	12-V Input 26-A ISR with Auto-Track Sequencing	26 A	0.8 to 1.8/1.2 to 5.5	✔	✔	✔		25.00
PTH12040W	12 V	12-V Input 50-A ISR with Auto-Track Sequencing	50 A	0.8 to 5.5	✔	✔	✔		30.00
PTH12050L/W	12 V	12-V Input 6-A ISR with Auto-Track Sequencing	6 A	0.8 to 1.8/1.2 to 5.5	✔	✔	✔		6.90
PTH12060L/W	12 V	12-V Input 10-A ISR with Auto-Track Sequencing	10 A	0.8 to 1.8/1.2 to 5.5	✔	✔	✔		9.80
PTH03010Y	3.3 V	3.3-V Input 15-A DDR Terminating Module	15 A	Follows V_{REF}	✔		✔	✔	13.95
PTH03050Y	3.3 V	3.3-V Input 6-A DDR Terminating Module	6 A	Follows V_{REF}	✔		✔	✔	9.95
PTH03060Y	3.3 V	3.3-V Input 10-A DDR Terminating Module	10 A	Follows V_{REF}	✔		✔	✔	11.50
PTH05010Y	5 V	5-V Input 15-A DDR Terminating Module	15 A	Follows V_{REF}	✔		✔	✔	13.95
PTH05050Y	5 V	5-V Input 6-A DDR Terminating Module	6 A	Follows V_{REF}	✔		✔	✔	9.95
PTH05060Y	5 V	5-V Input 10-A DDR Terminating Module	10 A	Follows V_{REF}	✔		✔	✔	11.50
PTH12010Y	12 V	12-V Input 12-A DDR Terminating Module	12 A	Follows V_{REF}	✔		✔	✔	13.95
PTH12050Y	12 V	12-V Input 6-A DDR Terminating Module	6 A	Follows V_{REF}	✔		✔	✔	9.95
PTH12060Y	12 V	12-V Input 8-A DDR Terminating Module	8 A	Follows V_{REF}	✔		✔	✔	11.50
PTV03010W	3.3 V	5-V Input 8-A Vertical SIP with Auto-Track Sequencing	8 A	0.8 to 2.5	✔	✔	✔		9.95
PTV03020W	3.3 V	5-V Input 18-A Vertical SIP with Auto-Track Sequencing	8 A	0.8 to 2.5	✔	✔	✔		13.95
PTV05010W	5 V	5-V Input 8-A Vertical SIP with Auto-Track Sequencing	8 A	0.8 to 3.6	✔	✔	✔		9.95
PTV05020W	5 V	5-V Input 18-A Vertical SIP with Auto-Track Sequencing	8 A	0.8 to 3.6	✔	✔	✔		13.95
PTV12010L/W	12 V	12-V Input 8-A Vertical SIP with Auto-Track Sequencing	18 A	0.8 to 1.8/1.2 to 5.5	✔	✔	✔		9.95
PTV12020L/W	12 V	12-V Input 18-A Vertical SIP with Auto-Track Sequencing	18 A	0.8 to 1.8/1.2 to 5.5	✔	✔	✔		13.95
Non-Isolated Single Negative Output									
PT5020	5 V	1-A 5-V Input Positive to Negative ISR	–1 A	–1.7 to –15					9.50
PT6640	12 V	12-V Input 24-W Adjustable Plus to Minus Voltage Converter	24 W	–1.8 to –17	✔				19.50
PT6910	3.3 V/5 V	3.3-V/5-V Input 12-W Adjustable Plus to Minus Voltage Converter	12 W	–1.2 to –6.5	✔				26.25
PT78NR100	V_O + 4 to 38 V	1-A Wide-Input Plus to Minus Voltage ISR	–1 A	–3.0 to –15					8.65
PT79SR100	V_O + 4 to 38 V	1.5-A Wide-Input Negative Step-Down ISR	–1.5 A	–5 to –15					11.30
Non-Isolated Multiple Output									
PT5060	5 V	5- to ±12/15-V_{OUT} 9-W Dual Output Adjustable ISR	9 W	±8 to ±20	✔				10.80
PT6935	5 V	35-W 5-V Input Adjustable Dual Output ISR	35 W	1.3 to 3.6	✔				27.40
PT6940	3.3 V/5 V	6-A 3.3-V/5-V Input Adjustable Dual Output ISR	Dual 6 A	1.2 to 3.3	✔				32.40
PT6980	12 V	10-A 12-V Input Adjustable Dual Output ISR	10 A	1.3 to 3.6	✔				27.40
Isolated Single Output									
DCP01_B	5, 24	1-W Unregulated Isolated DC/DC Converter with Synchronization	1 W	5, 12, 15					5.35
DCP02	5, 12, 24	2-W Unregulated Isolated DC/DC Converter with Synchronization	2 W	3.3, 5, 7, 9, 12, 15					6.95
DCR01	5, 12, 24	1-W Regulated Isolated DC/DC Converter with Synchronization	1 W	3.3, 5					5.95
PT3400	48 V	30-W 48-V Input Isolated DC/DC Converter (8-mm Height)	30 W	1.0 to 5.0	✔				42.40
PT4210	48 V	3- to 7-W 48-V Input Isolated DC/DC Converter	3 to 7 W	3.3 to 12					18.75
PT4220	48 V	10-W 48-V Input Isolated DC/DC Converter	10 W	1.5 to 12	✔				26.90
PT4410	48 V	100-W 30-A 48-V Input Isolated Programmable DC/DC Converter	100 W	1.05 to 5.7	5-bit Prog				70.20
PT4520	48 V	20-W 48-V Input Isolated DC/DC Converter	20 W	1.5 to 15	✔				32.45
PTB78520W	18 V to 60 V	20-A 18-V to 60-V Input Isolated POL Converter with Track I/O	65 W	1.8 to 3.6	✔				50.00
Isolated Multiple Output									
DCP01_DB	5, 15, 24	1-W Unregulated Dual Isolated DC/DC Converter with Synchronization	1 W	±5, ±12, ±15					5.90
DCP02_D	5, 12, 24	2-W Unregulated Dual Isolated DC/DC Converter with Synchronization	2 W	±5, ±12, ±15					6.95
PT4660	48 V	20-A 48-V Input Dual Isolated DC/DC Converter	20 A	1.5 to 5	✔				99.20
PT4820	48 V	35-W 48-V Input Triple Low-Voltage Isolated DC/DC Converter	35 W	1.2 to 5.0	✔				64.85
PT4850	48 V	75-W 48-V Input Triple Low-Voltage Isolated DC/DC Converter	75 W	1.2 to 3.3	✔				81.85
PTB48540	48 V	10-W 48-V Input Isolated PoE Module	10 W	3.3, 5, 12	✔				26.00
PTB48500	48 V	30-W 48-V Input Isolated Dual DC/DC Converter	30 W	3.3/1.2	✔				43.00
PTB48510	48 V	65-W 48-V Input Isolated Dual xDSL Line Driver Converter	65 W	±5	✔				43.00

[1] *See **power.ti.com** for a complete product offering.*

*New devices are listed in **bold red**.*

[2] *Suggested resale price in U.S. dollars in quantities of 1,000.*

Linear and Low Dropout (LDO) Regulators

Texas Instruments (TI) offers an extremely broad LDO portfolio covering applications from microampere keep-alive circuits to 7.5-A telecom loads. Key products are highlighted in the diagram on this page and the table on page 10. For a more comprehensive selection, please review pages 11–12 or visit **power.ti.com** for our complete portfolio.

LDO selection or support questions can be sent to: **ldoquestions@list.ti.com**

Design Factors

Input Voltage — The minimum V_{IN} must be larger than $V_{OUT} + V_{DO}$, independent from the minimum value given in the selection table.

Efficiency — By neglecting the quiescent current (I_q) of the LDO, efficiency can be calculated as V_{OUT}/V_{IN}.

Power Dissipation — $P_D = (V_{IN} - V_{OUT}) \times I_{OUT}$; P_D is limited by package, T_A and T_{JMAX}. Refer to application note SLVA118, "Digital Designer's Guide to Linear Voltage Regulators and Thermal Management," for support. For higher power dissipation or requirements for higher efficiency, TI recommends step-down (buck) DC/DC converters/controllers (refer to pages 6–20 for products).

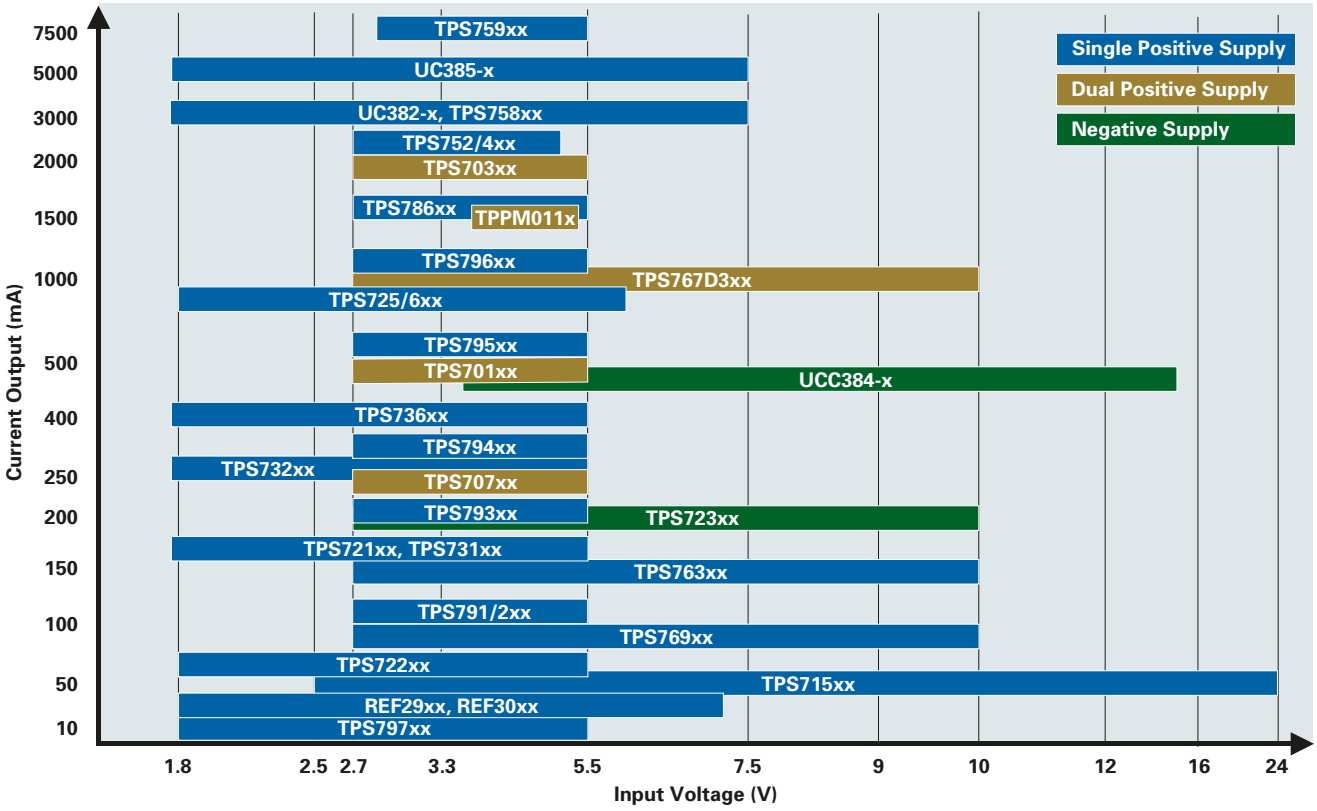
Capacitor Requirements — The output capacitor and especially its ESR are critical for stability. Therefore some LDOs require tantalum output capacitors, which have high ESR. If an LDO is stable with no output capacitor or with low-ESR ceramic output capacitors, it is usually stable with all types of capacitors.

RF, Audio, and Other Noise-Sensitive Applications — Select an LDO with high power supply ripple rejection (PSRR) for noise immunity from the input supply, and low output noise (< 50 µVrms). Some LDOs have a bypass (BP) pin for adding capacitance to lower the output noise.

PG/SVS — Devices such as microprocessors, DSPs and FPGAs require a minimum voltage for proper operation. The supply voltage supervisor (SVS) function monitors the system voltages and outputs a signal when the voltages drop below a certain value, so the system can reset and prevent malfunction. An SVS asserts the reset signal after a specified delay, while a power-good (PG) function does not have a delay.

Reverse Leakage Protection — In special applications where the voltage on the output of the LDO is higher than at the input, the reverse leakage protection feature prevents current from flowing from the LDO output to the input, which can be damaging to the input supply, especially if it is a battery.

Linear and Low Dropout (LDO) Regulators Family of Products (selected models shown)

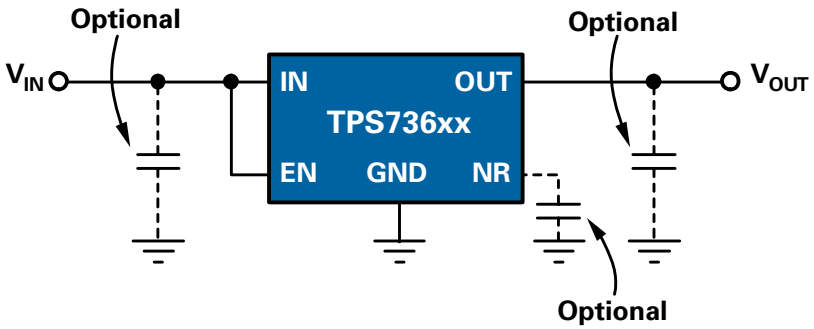


Linear and Low Dropout (LDO) Regulators

Product Applications

Device	I_{OUT} (mA)	Highlights	Target Applications: Handset	WLAN	RF (High PSRR + Low Noise)	Portables/PDA/DSC	Reverse Leakage Protection	MSP430 Processor	OMAP™ Processor	DSP and FPGA	DDR Termination	High Voltage	Low Profile (≤1.2 mm)	Low Cost	Price[1]
TPS797xx	10	1.2-µA I_q, Power Good for brown-out protection, ceramic cap, SC70	✔			✔		✔					✔		0.34
REF30xx	25	0.2% accuracy, 50-µA max I_Q, SOT-23				✔		✔							0.59
REF29xx	25	2% accuracy, 50-µA max I_Q, SOT-23				✔		✔							0.49
TPS715xx	50	3.4-µA I_q, 24-V_{IN} max, ceramic cap, SC70 (80-mA version in QFN coming)	✔			✔		✔				✔	✔		0.34
TPS769xx	100	17-µA I_q, low-cost option for <100-mA apps, SOT23				✔								✔	0.29
TPS761xx	100	16-V_{IN} max, SOT23										✔			0.37
TPS731xx	150	Cap-free, 1% acc, 1.7- to 5.5-V V_{IN}, custom V_{OUT} available, SOT23				✔	✔			✔					0.45
TPS763xx	150	Low-cost option for 150-mA apps, SOT23								✔				✔	0.25
TPS793xx	200	RF performance, LP2985/LP3985 cross, ceramic cap, SOT23/WCSP	✔	✔	✔	✔			✔	✔			✔		0.40
TPS794xx	250	RF, ceramic cap, thermally enhanced PowerPAD™ MSOP8			✔	✔			✔	✔			✔		0.65
TPS732xx	250	Cap-free, 1% acc, 1.7- to 5.5-V V_{IN}, custom V_{OUT} available, SOT23/QFN				✔			✔	✔			✔		0.65
TPS766xx	250	35-µA I_q, Power Good, low-cost option for 250-mA apps, SOIC8				✔			✔	✔				✔	0.40
TPS711xx	250/250	Dual RF LDO in tiny WCSP package, ceramic cap	✔	✔	✔	✔							✔		0.49
TPS712xx	250/250	Dual RF LDO in QFN package, ceramic cap	✔	✔	✔	✔			✔	✔			✔		0.80
TPS736xx	400	Cap-free, 1% acc, 1.7- to 5.5-V V_{IN}, custom V_{OUT} avail., SOT23/QFN/SOT223				✔	✔			✔			✔		0.85
TPS776xx	500	Low-cost option for 500-mA apps, SOIC and PowerPAD TSSOP (PWP) package								✔			✔	✔	0.70
TPS795xx	500	RF performance, ceramic cap, SOT223			✔					✔					1.05
TPS725xx	1000	Low input voltage (down to 1.8 V), any cap LDO, SOT223/TO263/SOIC								✔					1.10
TPS796xx	1000	RF performance, ceramic cap, SOT223/TO263			✔					✔					1.10
TPS768xx	1000	Low-cost option for 1-A apps, SOIC and PowerPAD TSSOP (PWP)								✔				✔	0.90
TPS786xx	1500	RF performance, ceramic cap, SOT223/TO263			✔					✔					1.35
UC382-x	3000	Separate V_{bias} allows regulation from as low as 1.7 V_{IN}, TO220/TO263								✔					2.70
TPS51100	3000	Source/sink LDO; see page 21 for details									✔				0.80
UC385-x	5000	Separate V_{bias} allows regulation from as low as 1.7 V_{IN}, TO220/TO263								✔					3.15

[1] *Suggested resale price in U.S. dollars in quantities of 1,000.*



Typical application circuit for TPS736xx 400-mA cap-free LDO.

Low Dropout (LDO) Regulators Selection Guide

Device[1]	I_O (mA)	V_{DO} @ I_O (mV)	I_q (µA)	Output Options: Fixed Voltage (V)	Output Options: Adj. (V)	Min V_{IN}	Max V_{IN}	Accuracy (%)	Packages: WCSP	SC70	SOT23	MSOP	QFN	SO8	SOT223	PWP	TO220	PW	TO263	Features[2]	C_O[3]	Comments	Price[4]
Positive Voltage, Single Output Devices																							
TPS797xx	10	105	1.2	1.8, 3.0, 3.3	—	1.8	5.5	4		✔										PG	0.47 µF C	MSP430; Lowest Iq	0.34
REF30xx	25	300	42	1.25, 2.048, 2.5, 3.0, 3.3, 4.096	—	1.8	7	0.2			✔									—	No Cap	High Accuracy, Low Noise[5]	0.59
REF29xx	25	300	42	1.25, 2.048, 2.5, 3.0, 3.3, 4.096	—	1.8	7	2			✔									—	No Cap	High Accuracy, Low Noise[5]	0.49
TPS715xx	50	415	3.2	2.5, 3.0, 3.3, 5.0	1.2 to 15	2.5	24	4		✔										—	0.47 µF C	Ultra-Low I_q; QFN Avail 4Q04	0.34
TPS770xx	50	35	17	1.2, 1.5, 1.8, 2.5, 2.7, 2.8, 3.0, 3.3, 5.0	1.2 to 5.5	2.7	10	3			✔									/EN	4.7 µF T	Low I_q	0.34
TPS722xx	50	50	80	1.5, 1.6, 1.8	1.2 to 2.5	1.8	5.5	3			✔									EN	0.1 µF C	Low Noise and Low V_{IN}	0.41
TPS760xx	50	120	90	3.0, 3.2, 3.3, 3.8, 5.0	—	3.2	16	2			✔									EN	2.2 µF T	Bipolar, Low Cost	0.36
TPS792xx	100	38	185	2.5, 2.8, 3	1.2 to 5.5	2.7	5.5	2			✔									EN, BP	1 µF C	RF Low Noise; High PSRR	0.40
TPS791xx	100	38	185	1.8, 3.3, 4.7	1.2 to 5.5	2.7	5.5	2			✔									/EN, BP	1 µF C	RF Low Noise; High PSRR	0.40
TPS769xx	100	70	18	1.2, 1.5, 1.8, 2.5, 2.7, 2.8, 3.0, 3.3, 5.0	1.2 to 5.5	2.7	10	3			✔									/EN	4.7 µF T	Low Cost	0.29
TPS76201	100	100	22	—	0.7 to 5.5	2.7	10	3			✔									/EN	4.7 µF T	Lowest V_{OUT} LDO	0.37
TPS761xx	100	170	90	3.0, 3.2, 3.3, 3.8, 5.0	—	3.4	16	2			✔									EN	4.7 µF T	Bipolar, Low Cost	0.37
REG101	100	60	400	2.5, 2.8, 2.85, 3.0, 3.3, 5.0	2.5 to 5.5	2.6	10	1.5			✔			✔						EN, BP	No Cap	Low Noise	0.95
TPS731xx	150	30	400	1.5, 1.8, 2.5, 3.0, 3.3, 5.0, EEPROM[6]	1.20 to 5.5	1.7	5.5	1			✔									EN, BP	No Cap	Reverse Leakage Protection	0.45
TPS763xx	150	180	85	1.6, 1.8, 2.5, 2.7, 2.8, 3.0, 3.3, 3.8, 5.0	1.5 to 6.5	2.7	10	3			✔									EN	4.7 µF T	Low Cost	0.25
TPS764xx	150	300	85	2.5, 2.7, 2.8, 3.0, 3.3	—	2.7	10	3			✔									EN, BP	4.7 µF T	TPS763xx and Low Noise	0.29
TPS788xx	150	150	18	2.5, 3.3	—	2.7	10	3			✔									/EN	4.7 µF T	USB Inrush Control	0.38
TPS721xx	150	150	90	1.5, 1.6, 1.8	1.2 to 2.5	1.8	5.5	3			✔									EN	0.1 µF C	Low Noise and Low V_{IN}	0.41
TPS771xx	150	75	90	1.5, 1.8, 2.7, 2.8, 3.3, 5.0	1.5 to 5.5	2.7	10	2				✔								/EN, SVS	10 µF T	Low Noise	0.60
SN105125	150	1 V	150	1.2	—	3	5.25	2			✔									EN, PG	1 µF C	Low Cost	0.30
TL750/1Lxx	150	600	1 mA	5, 10, 12	—	6	26	4						✔			✔			/EN	10 µF T	60-V Load Dump	0.31/0.52
TPS793xx	200	77	180	1.8, 2.5, 2.8, 2.85, 3.0, 3.3, 4.75	1.2 to 5.5	2.7	5.5	2	✔		✔									EN, BP	2.2 µF C	RF Low Noise, High PSRR	0.40
TPS794xx	250	145	172	1.8, 2.5, 2.8, 3.0, 3.3	1.2 to 5.5	2.7	5.5	3				✔			✔					EN, BP	2.2 µF C	RF Low Noise, High PSRR	0.65
TPS732xx	250	40	400	1.5, 1.8, 2.5, 3.0, 3.3, 5.0, EEPROM[6]	1.20 to 5.5	1.7	5.5	1			✔		✔		✔					EN, BP	No Cap	Reverse Leakage Protection	0.65
TPS766xx	250	140	35	1.5, 1.8, 2.5, 2.7, 2.8, 3.0, 3.3, 5.0	1.25 to 5.5	2.7	10	3						✔						/EN, PG	4.7 µF T	Low Cost	0.40
TPS773xx	250	125	90	1.5, 1.6, 1.8, 2.7, 2.8, 3.3, 5.0	1.5 to 5.5	2.7	10	2				✔								/EN, SVS	10 µF T	Low Noise	0.70
TPS779xx	250	250	90	1.8, 2.5, 3.0	1.5 to 5.5	2.7	10	2				✔								EN, SVS	10 µF T	Low Noise	0.70
REG102	250	150	400	2.5, 2.8, 2.85, 3.0, 3.3, 5.0	2.5 to 5.5	2.6	10	1.5			✔			✔	✔					EN, BP	No Cap	Capacitor Free, DMOS	1.05
TPS736xx	400	75	300	1.5, 1.8, 2.5, 3.0, 3.3, EEPROM[6]	1.20 to 5.5	1.7	5.5	1			✔		✔		✔					EN, BP	No Cap	Reverse Leakage Protection	0.85
REG113	400	250	400	2.5, 2.85, 3.0, 3.3, 5.0	—	2.6	10	1.5			✔	✔								EN, BP	No Cap	Capacitor Free, DMOS	1.10
TPS795xx	500	105	265	1.6, 1.8, 2.5, 3.0, 3.3	1.2 to 5.5	2.7	5.5	2							✔					EN, BP	1 µF C	RF Low Noise, High PSRR	1.05
TPS775xx	500	169	87	1.5, 1.6, 1.8, 2.5, 3.3	1.5 to 5.5	2.7	10	2						✔		✔				/EN, SVS	10 µF T	Fast Transient Response	0.95
TPS776xx	500	169	87	1.5, 1.8, 2.5, 2.8, 3.3	1.20 to 5.5	2.7	10	2						✔		✔				/EN, PG	10 µF T	Fast Transient Response	0.70
TLV2217-xx	500	500	19 mA	2.5, 3.3	—	3	12	1									✔	✔		—	—	PowerFLEX™ Package Avail	0.50
TPS777xx	750	260	85	1.5, 1.8, 2.5, 3.3	1.5 to 5.5	2.7	10	2						✔		✔				/EN,SVS	10 µF T	Fast Transient Response	1.05
TPS725xx	1000	170	75	1.5, 1.6, 1.8, 2.5	1.2 to 5.5	1.8	6	2						✔	✔				✔	EN, SVS	No Cap	Low Noise; SVS Delay 50 ms	1.10
TPS726xx	1000	170	75	1.5, 1.6, 1.8, 2.5	—	1.8	6	2							✔				✔	EN, SVS	No Cap	Low Noise; SVS Delay 200 ms	1.10
TPS796xx	1000	200	310	1.8, 2.5, 2.8, 3.0, 3.3	1.2 to 5.5	2.7	5.5	2							✔				✔	EN, BP	1 µF C	RF Low Noise, High PSRR	1.10
TPS767xx	1000	230	85	1.5, 1.8, 2.5, 2.7, 2.8, 3.0, 3.3, 5.0	1.5 to 5.5	2.7	10	2						✔		✔				/EN, SVS	10 µF T	Fast Transient Response	1.10
TPS768xx	1000	230	80	1.5, 1.8, 2.5, 2.7, 2.8, 3.0, 3.3, 5.0	1.2 to 5.5	2.7	10	2						✔		✔				/EN, PG	10 µF T	Fast Transient Response	0.90
REG104	1000	230	600	2.5, 2.7, 3.0, 3.3, 5.0	2.5 to 5.5	2.6	15	2							✔				✔	EN	No Cap	Capacitor Free, DMOS	2.35
REG1117A	1000	1200	4 mA	1.8, 2.5, 2.85, 3.3, 5.0	1.25 to 13.5	3.8	15	1							✔				✔	—	10 µF T	REG1118 for Source/Sink	0.85
TPS786xx	1500	390	310	1.8, 2.5, 2.8, 3.0, 3.3	1.2 to 5.5	2.7	5.5	2							✔				✔	EN, BP	1 µF C	RF Low Noise, High PSRR	1.35
TPS751xx	1500	160	75	1.5, 1.8, 2.5, 3.3	1.5 to 5.0	2.7	5	2								✔				/EN, PG	47 µF T	Fast Transient Response	1.60
TPS752xx	2000	210	75	1.5, 1.8, 2.5, 3.3	1.5 to 5.0	2.7	5	2								✔				/EN, SVS	47 µF T	Fast Transient Response	1.80
TPS754xx	2000	210	75	1.5, 1.8, 2.5, 3.3	1.5 to 5.0	2.7	5	2								✔				/EN, PG	47 µF T	Fast Transient Response	1.75
UC382-x	3000	350	6 mA	1.5, 2.1, 2.5	1.20 to 6.0	1.7	7.5	1									✔		✔	—	100 µF T	Fast LDO with Reverse Leak.	2.70
UCC383-x	3000	400	400	3.3, 5.0	1.2 to 8.5	1.8	9	2.5									✔		✔	/EN	22 µF T	Reverse Leakage Protection	2.70
TPS758xx	3000	150	110	1.5, 1.8, 2.5, 3.3	1.2 to 5.0	2.8	5.5	3									✔		✔	EN	47 µF T	Fast Transient Response	2.70
UC385-x	5000	350	8 mA	1.5, 2.1, 2.5	1.20 to 6.0	1.7	7.5	1									✔		✔	—	100 µF T	Fast LDO with Reverse Leak.	3.15
TPS756xx	5000	250	110	1.5, 1.8, 2.5, 3.3	1.2 to 5.0	2.8	5.5	3									✔		✔	EN	47 µF T	Fast Transient Response	3.00
TPS759xx	7500	400	110	1.5, 1.8, 2.5, 3.3	1.2 to 5.0	2.8	5.5	3									✔		✔	/EN, PG	47 µF T	Fast Transient Response	3.20
Negative Voltage, Single Output Devices																							
TPS723xx	200	280	130	–2.5	–1.2 to –9	–10	–2.7	2			✔									EN, BP	2.2 µF C	Low Noise, High PSRR	1.05
UCC384-x	500	150	200	–12.0, –5.0	–1.25 to –15	–15	–3.5	3						✔						/EN	4.7 µF T	Duty Cycled Short	1.86

[1] *xx represents the voltage option. For example, 33 represents the 3.3-V option. The adjustable output voltage option is represented by 01.*

[2] *PG = Power Good, EN = active high enable, /EN = active low enable, SVS = supply voltage supervisor, BP = bypass pin for noise reduction capacitor.*

[3] *C = ceramic, T = tantalum, No Cap = capacitor-free LDO.*

[4] *Suggested resale price in U.S. dollars in quantities of 1,000.*

[5] *MSP430.*

[6] *TI's TPS73xxx series of LDOs are EEPROM programmable at the factory, allowing production of custom fixed voltages (as well as custom current limits). Minimum quantities apply. Please contact TI.*

Linear and Low Dropout (LDO) Regulators

Dual Output LDOs Selection Guide

Device	I_{O1} (mA)	I_{O2} (mA)	V_{DO1} @ I_{O1} (mV)	V_{DO2} @ I_{O2} (mV)	I_q (µA)	Output Options: Fixed Voltage (V)	Output Options: Adj.	Accuracy (%)	Package	V_O (min) (V)	V_O (max) (V)	Features: Enable	PG	SVS	Seq	Low Noise	V_{IN} (min) (V)	V_{IN} (max) (V)	C_O[1]	Comments	Price[2]
TPS712xx	250	250	145	145	400	See Note 3	✔	2	QFN	1.2	5.5	EN				✔	2.7	5.5	2.2 µF C	See TPS711xx[4]	0.80
TPS707xx	250	150	83	125	187	See Note 5	✔	2	PWP	1.2	5	$\overline{EN}$	✔	✔	✔	✔	2.7	5.5	10 µF T	See TPS708xx[6]	1.20
TPS701xx	500	250	170	220	187	See Note 5	✔	2	PWP	1.2	5	$\overline{EN}$	✔	✔	✔	✔	2.7	5.5	10 µF T	See TPS702xx[6]	1.50
TPS767D3xx	1000	1000	350	350	85	3.3/2.5, 3.3/1.8	✔	2	PWP	1.5	5.5	$\overline{EN}$		✔			2.7	10	10 µF T	Dual Output Fast LDO with Integrated SVS	2.00
TPS703xx	1000	2000	160	190	185	See Note 5	✔	2	PWP	1.2	5.5	$\overline{EN}$	✔	✔	✔	✔	2.7	5.5	22 µF T	See TPS704xx[6]	2.35
TPPM0110	1500	300	1000	2500	1000	3.3/1.8		2	—	1.8	3.3	—					4.7	5.3	100 µF T	See TPPM0111 for 3.3-V/1.5-V Output	1.60

[1] C = ceramic, T = tantalum.
[2] Suggested resale price in U.S. dollars in quantities of 1,000.
[3] 1.8/2.85, 1.8/Adj., 2.8/2.8, 2.8/Adj., 2.85/2.85.
[4] For chipscale package.
[5] 3.3/2.5, 3.3/1.8, 3.3/1.5, 3.3/1.2.
[6] For independent enables instead of integrated sequencing.

Standard Linear Voltage Regulators Selection Guide

Device	V_{OUT} (nom) (V)	V_{OUT}/V_{REF} Tol. Over Temp. (%)	I_{OUT} (max) (mA)	Min I_{OUT} for Regulation (mA)	I_q (max) (mA)	V_{DO} (typ) (V)	V_{DO} (max) (V)	V_{IN} (max) (V)	$V_{IN} - V_{OUT}$ (max) (V)	Price[1]
LM237, LM337	Adj. (–1.2 to –37)	4	1500	1.2, 1.5	—	—	3	—	–40	0.29
LM317, LM317M	Adj. (1.2 to 37)	4	1500, 500	3.5	—	—	3	—	40	0.27
MC79Lxx/A	–5, –12, –15	5, 10	100	—	6 to 6.5	1.7	2 to 2.5	–20, –27, –30	—	0.13
TL317	Adj. (1.2 to 35)	4	100	1.5	—	—	2.5	—	35	0.13
TL780-xx	5, 12, 15	2	1500	—	8	2	2 to 2.5	25, 30, 30	—	0.32
TL783	Adj. (1.25 to 125)	6	700	15	—	—	20	—	125	1.15
UA723	Adj. (2 to 37)	5 (25°C)	150	—	4	—	3	—	38	0.29
UA78Lxx/A	2.6, 5, 6.2, 8, 9, 10, 12, 15	5, 10	100	—	6 to 6.5	1.7	2 to 2.5	20 to 30	—	0.11
UA78Mxx	3.3, 5, 6, 8, 9, 12	5	500	—	6	2	2 to 2.5	25 to 30	—	0.25
UA78xx	5, 8, 10, 12, 15, 24	5	1500	—	8	2	2 to 3	25 to 38	—	0.23
UA79xx	–5, –8, –12, –15	5	1500	—	2	1.1	2 to 2.5	–25 to 30	—	0.25
UA79Mxx	–5, –8	5	500	—	2	1.1	2 to 2.5	–25	—	0.25

[1] Suggested resale price in U.S. dollars in quantities of 1,000.

LDO Controllers Selection Guide

Device	I_q (mA)	I_{drive} (max) (mA)	V_{IN} (max) (V)	V_{OUT} (min) (V)	Tolerance (%)	Shutdown	Short Circuit Limit Type	Comments	Price[1]
UC3832/3	3.3	100	40	2	2	Yes	Duty Cycle	Precise	2.50
UC3834	5.5	200	40	1.5	4	Yes	Foldback	High Efficiency	5.33
UC3835/6	3.75	250	40	5.0/2.5	2	Yes	Foldback	High Efficiency	3.05
UCC3837	1.2	500	12	1.5	1	No	Duty Cycle	8-Pin	1.95
LFC789D25	2	10	18	2.5	2	No	—	Dual	0.36

[1] Suggested resale price in U.S. dollars in quantities of 1,000.

Automotive Qualified LDOs

Device	I_O (typ) (mA)
TPS769xx-Q1	100
TPS791xx-Q1	100
TPS792xx-Q1	100
TPS793xx-Q1	200
TPS766xx-Q1	250
TPS775xx-Q1	500
TPS776xx-Q1	500
TPS725xx-Q1	1000

Device	I_O (typ) (mA)
TPS767xx-Q1	1000
TPS768xx-Q1	1000
TPS751xx-Q1	1500
TPS753xx-Q1	1500
TPS752xx-Q1	2000
TPPM0110-Q1	1500/300
TPPM0111-Q1	1500/300

Above parts are screened in accordance to AEC-Q100 and are suited for automotive applications. Additional devices can be released for automotive by contacting TI. Please see electrical specifics on previous page.

Resources *For a complete list of Resources, visit power.ti.com*

Literature Number	Description
Free Development Boards	
DEM-SOT23LDO	Compatible with most positive-output LDOs in the SOT23 (DBV) package
DEM-SOT223LDO	Compatible with most positive-output LDOs in the SOT223 (DCQ) package
Application Notes	
SLVA118	Digital Designer's Guide to Linear Regs and Thermal Management
SLVA072	Technical Review of LDO Operation and Performance
SLVA115	ESR, Stability and the LDO Regulator
SLVA119	Extending the Input Voltage Range of an LDO Regulator
SLUA256	Adjusting High Current LDOs down to 0.5-V Output Voltage
SLMA002	PowerPAD Thermally Enhanced Package Application Report
SLVA076	Supply Voltage Drop on Fast Current Demand

Design Factors

Input Voltage — More than one voltage may be available on the circuit board. One voltage can operate the controller IC, while another voltage can be used in the power conversion section. Choose the most suitable voltage that can handle the current needed by the system.

Output Voltage — The output voltage can be adjusted down to the controller reference voltage by using a voltage divider.

Output Current — Output current is often set by external power MOSFETs. Paralleling multiple power MOSFETs can control higher currents, as long as the MOSFET drivers can adequately drive the external FETs.

Efficiency — Higher efficiency will help with thermal issues, since wasted power is converted into heat. Higher currents quickly generate more heat, so airflow and board space must be considered.

Accuracy — Today's advanced processors need better accuracy to support lower core voltages. There is a cost tradeoff when a more accurate controller is needed.

System Costs — A fast transient response time reduces the output capacitance. For higher currents, this can save considerable cost. Also, reducing the number of external passive components in the power section can save cost.

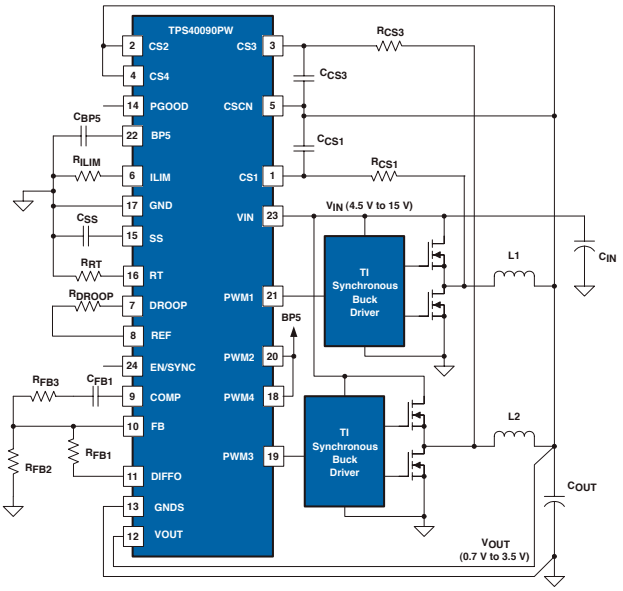
Protection Features — Applications that use many expensive processors and peripheral ICs on a single board can benefit from the long-term reliability ensured by implementing the controller's protection features.

TPS40K™ Series — Software Tool Available
Designer software available at:
power.ti.com/40kswifttool

Multiphase DC/DC Controller
TPS40090

Get samples, datasheets and EVMs at: **www.ti.com/sc/device/TPS40090**

The TPS40090 is a two-, three- or four-phase programmable synchronous buck controller that is optimized for low-voltage, high-current applications powered by a 5-V to 15-V distributed supply. A multiphase converter offers several advantages over a single power stage including lower current ripple on the input and output capacitors, faster transient response to load steps, improved power-handling capabilities and higher system efficiency.



Simplified two-phase application diagram.

Resources *For a complete list of Resources, visit power.ti.com*

Part Number	Description	Price[1]
Evaluation Modules (EVMs)		
TPS40007EVM-001	TPS40007-Based Converter Delivers 10-A Output	49
TPS40009EVM-001	TPS40009-Based 5-A Converter in Less Than One Square Inch	49
TPS40021EVM-001	Highly Efficient Sync. Buck Converter with PWM Controller. Input Range 2.5 to 5.0 V, at 3.3 V_{IN} Steps Down to 1.5 V at 20 A	49
TPS40055EVM-001	TPS40055-Based Design Converts Bus from 12 to 1.8 V at 15 A	49
TPS40055EVM-002	Wide Range Input TPS40055 Converter Delivers 5 V at 2 A	49
TPS40071EVM-001	Step-Down Converter Delivers 10 A from 5- to 12-V Bus Voltages	49
TPS40090EVM-001	Multiphase Buck Converter Steps Down from 12 to 1.5 V at 100 A with UCC27222 Driver	49
TPS43000EVM-001	1-MHz, 3.3-V, High-Efficiency Synchronous Buck Converter with TPS43000 Controller	49
TPS51020EVM-001	Highly Efficient Dual DDR Selectable EVM	49
TPS5124EVM-001	Accepts Wide V_{IN} (6.5- to 15-V) 12-V Step-Down to Dual 2.0-V Outputs at 6 A	49

Literature Number	Description
Application Notes	
SLUA285	Predictive Gate Drive™—Frequently Asked Questions
SLUA281	Predictive Gate Drive Boosts Converter Efficiency

[1] *Suggested resale price in U.S. dollars.*

DC/DC Controllers

Selection Guide

Device	V_{IN} (V)	V_O (max) (V)	V_O (min) (V)	V_{REF} Tol (%)	Driver Current (A)	Output Current (A)[1]	Multiple Outputs	Frequency (kHz)	Protection[2]				Application[3]					Light Load Efficient	Price[4]
									OCP	OVP	UVLO	PG	Source Only	Source/ Sink	Prebias Operation	PGD	DDR		
General-Purpose DC/DC Controllers																			
TPS40000	2.25 to 5.5	4	0.7	1.5	1	15	No	300	✔		✔		✔			✔		✔	0.99
TPS40002	2.25 to 5.5	4	0.7	1.5	1	15	No	600	✔		✔		✔			✔		✔	0.99
TPS40007	2.25 to 5.5	4	0.7	1.5	1	15	No	300	✔		✔			✔	✔	✔		✔	0.99
TPS40009	2.25 to 5.5	4	0.7	1.5	1	15	No	600	✔		✔			✔	✔	✔		✔	0.99
TPS40020	2.25 to 5.5	4	0.7	1	2	25	No	Program up to 1 MHz	✔		✔	✔	✔			✔		✔	1.15
TPS40021	2.25 to 5.5	4	0.7	1	2	25	No	Program up to 1 MHz	✔		✔	✔		✔		✔		✔	1.15
TPS40052	10 to 40	35	0.7	1	1	20	No	Program up to 1 MHz	✔		✔						✔	✔	1.35
TPS40054	8 to 40	35	0.7	1	1	20	No	Program up to 1 MHz	✔		✔		✔					✔	1.35
TPS40055	8 to 40	35	0.7	1	1	20	No	Program up to 1 MHz	✔		✔			✔					1.35
TPS40057	8 to 40	35	0.7	1	1	20	No	Program up to 1 MHz	✔		✔				✔			✔	1.35
TPS40060	10 to 55	40	0.7	1	1	10	No	Program up to 1 MHz	✔		✔		✔					✔	1.40
TPS40061	10 to 55	40	0.7	1	1	10	No	Program up to 1 MHz	✔		✔			✔					1.40
TPS40070	4.5 to 28	23	0.7	1	1	20	No	Program up to 1 MHz	✔		✔	✔	✔			✔		✔	1.35
TPS40071	4.5 to 28	23	0.7	1	1	20	No	Program up to 1 MHz	✔		✔	✔		✔		✔			1.35
TPS51020	4.5 to 28	24	0.85	1	2	20	2	450	✔	✔	✔	✔					✔	✔	3.15
TPS5124	4.5 to 15	12	0.85	1	2	20	2	500	✔	✔	✔								2.20
Multiphase DC/DC Controllers																			
TPS40090	4.5 to 15	3.3	0.7	1	—	30 per phase	No	Program up to 1 MHz	✔		✔	✔							1.90
TPS40091 (w/Tristate)	4.5 to 15	3.3	0.7	1	—	30 per phase	No	Program up to 1 MHz	✔		✔	✔			✔				1.90
TPS40120 (VID DAC)	4.5 to 5.5	1.6	0.8375	0.3	—	—	—	—											0.49
TPS40130	3.0 to 40	6	0.7	1	1 to 2	30 per phase	No	Program up to 1 MHz	✔	✔	✔	✔		✔			✔		1.15
DC/DC Controllers with Light Load Efficiency													**Comments**						
TPS51020	4.5 to 28	24	0.85	1	2	20	2	270, 360, 450	✔	✔	✔	✔	Dual, DDR selectable w/skip mode				✔	✔	3.15
TPS5110	2.5 to 28	3.5	0.9	1	1.5	1.2/1.5	1 + 1	Up to 500	✔	✔	✔	✔	Single buck w/NMOS LDO controller					✔	2.35
TPS51116	3 to 28	3.4	1.5	1	0.8	10	1 + 2	Up to 500	✔	✔	✔	✔	Sync switcher w/3-A tracking LDO				✔	✔	1.20
TPS5130	4.5 to 28	5.5	0.9	1.5	1.5	1.2/1.5	3 + 1	Up to 500	✔	✔	✔	✔	Triple buck w/NMOS LDO controller					✔	3.65
DC/DC Controllers (Without Drivers)													**Comments**						
TL1451A	3.6 to 50	50	2.5	4	0.02	—	2	500			✔		Dual PWM buck/boost						0.95
TL5001	3.6 to 40	50	1	5	0.02	—	No	400			✔		PWM buck boost, typ. ref. voltage tolerance ±5%						0.45
TL5001A	3.6 to 40	50	1	3	0.02	—	No	400			✔		PWM buck boost, typ. ref. voltage tolerance ±3%						0.55
Other Topology DC/DC Controllers													**Comments**						
TPS43000	1.8 to 9	8	0.8	2	1.25	7	No	2 MHz	✔	✔	✔	✔	High-frequency, buck, boost, or sepic controller						0.99
TPS6420x	1.8 to 6.5	6.5	1.2	—	—	3	No	—	✔		✔		Simple, hysteretic high-efficiency controller in SOT-23						0.59
UC3572	4.75 to 30	0	–48	2	0.5	5	No	300	✔		✔		Simple inverting PWM controller						1.05

[1]Current levels of this magnitude can be supported.

[2]OCP = over-current protection, OVP = over-voltage protection, UVLO = under-voltage lockout, PG = Power Good.

[3]The controller of choice for most applications will be the source/sink version, which has two-quadrant operation and will source or sink output current. PGD = Predictive Gate Drive™ technology included; DDR = supports DDR memory.

[4]Suggested resale price in U.S. dollars in quantities of 1,000.

*New devices are listed in **bold red**.*

DC/DC Converters (Integrated Switch)

Design Factors

Efficiency and Solution Size — Use of inductive switching converters with integrated switches is recommended when highest conversion efficiency and smallest solution size are desired.

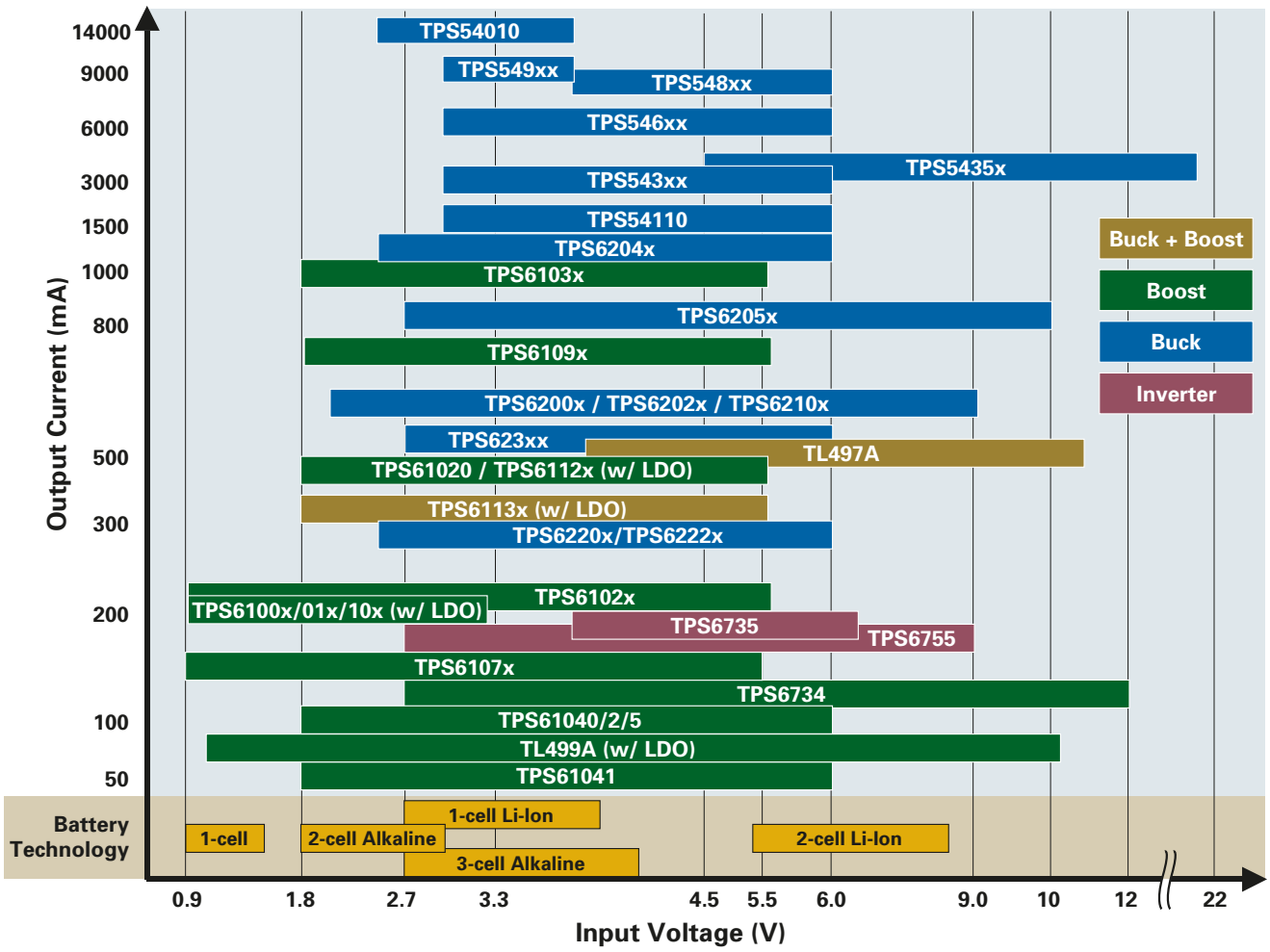
TI's family of low-power DC/DC converters (TPS6xxxx) and SWIFT™ (TPS54xxx) point-of-load step-down DC/DC converters achieve 97% peak efficiencies. Synchronous rectification not only replaces the cost of an external Schottky rectifier diode but also increases the converter efficiency by up to 10%. Higher efficiency will directly translate into additional operating time in battery-powered applications and smaller power dissipation in high-current applications, easing thermal design.

Integrating the high- and low-side switching FETs reduces board space, as only resistors and capacitors along with one inductor are required externally for operation. Depending on the output current, DC/DC converters come in packages such as SOT-23 (400 mA), QFN-10 (1.2 A) and TSSOP-28 (13 A), further reducing solution size.

Output Current — Output current is typically limited by the size of the integrated FETs and is rated for the minimum input voltage (end-of-discharge voltage in battery systems) for the TPS6xxxx series. The TPS54xxx output current denotes the continuously available output current; higher peak-currents are achievable to ensure proper supply at start-up of high-performance DSP, FPGA and ASIC systems. For Boost converters, the datasheet specifies the current limit of the built-in switches. A rough estimate of the output current can be obtained using the formula:

$$I_{OUT} = 0.65 \times I_{Switch(min)} \times (V_{IN}/V_{OUT})$$

DC/DC Converters (Integrated Switch) Family of Products



DC/DC Converters (Integrated Switch)

For output currents below 300 mA and efficiencies under 90%, inductor-less charge-pump DC/DC converters can be a cost and space-efficient alternative (see pages 22–23).

Input Voltage — DC/DC converters can operate from a wide range of input sources: power modules, wall supplies or batteries. The TPS6xxxx series with its small packaging and quiescent current is optimized for low-power, battery-operated applications. For battery-powered systems the input voltage changes over a wide range while the battery is being discharged. For this reason converter selection depends on the given battery technology and number of cells.

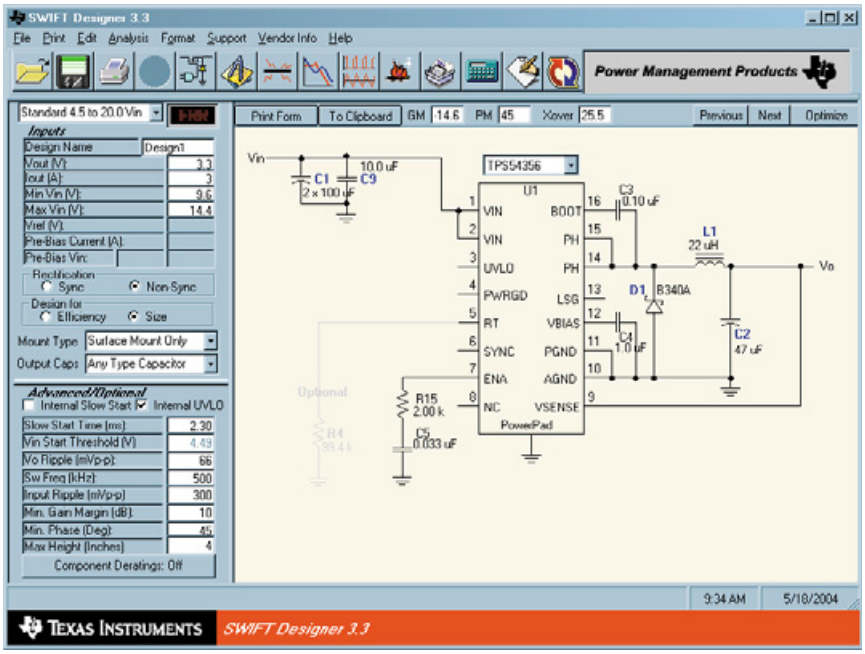
The TPS54xxx SWIFT™ series can operate from preregulated 12-, 5- or 3.3-V bus voltages.

Output Voltage — Lower voltages are required for today's advanced DSPs, FPGAs and ASICs. To allow maximum flexibility, both fixed and adjustable output voltages down to 0.7 V are available. The TPS61xxx allows input voltage step-up to as high as 28 V.

Power Supply Design Tool
SWIFT™ Designer Software Tool

Get software at: **power.ti.com/swift**

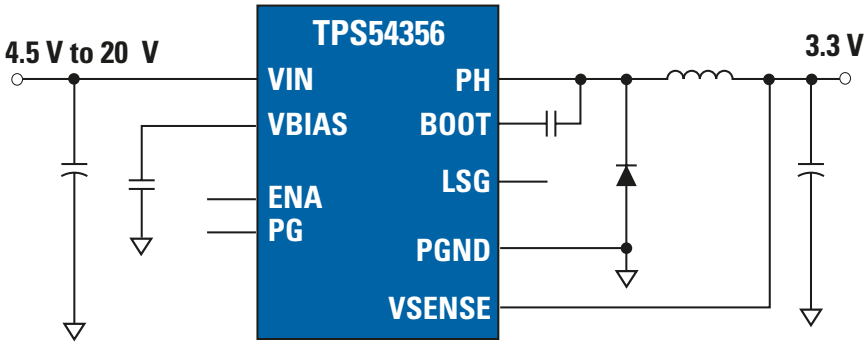
SWIFT™ is an interactive development tool that speeds novice designers and veteran power supply engineers through the entire component selection process. It requires only simple inputs such as output voltage, maximum current and input voltage range.



4.5- to 20-V Input, 3-A Step-Down Converter in TSSOP-16
TPS5435x

Get samples, datasheets, EVMs, software tools and app reports at: **www.ti.com/sc/device/PARTnumber**
(Replace **PARTnumber** with **TPS54350**, **TPS54352**, **TPS54353**, **TPS54354**, **TPS54355**, **TPS54356** or **TPS54357**)

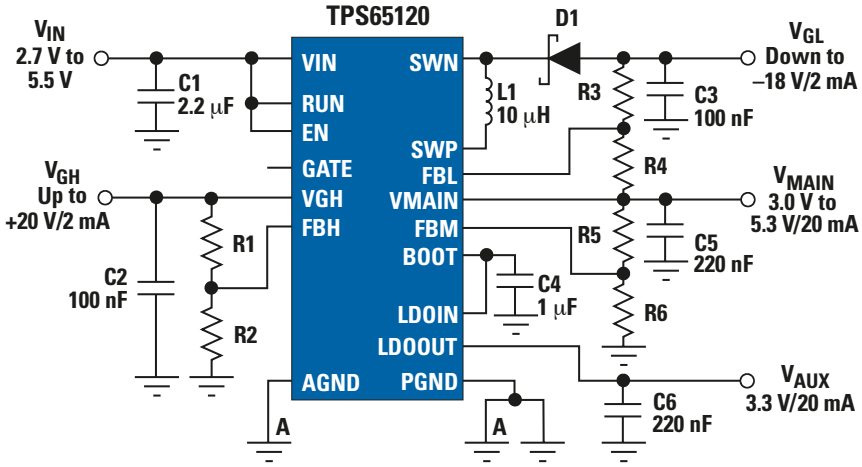
The TPS5435x devices are a family of high-efficiency step-down DC/DC converters with an integrated high-side MOSFET and a gate driver for an optional low-side external MOSFET. The devices are ideal for powering performance DSPs, FPGAs and ASICs from a 5-V, 12-V or unregulated wall-adapter power supply.



4-Channel, High-Accuracy Power Supply for Small Form-Factor TFT Displays
TPS65120

Get samples, datasheets and app reports at: **www.ti.com/sc/device/TPS65120**

The TPS65120 provides a fully integrated, highly accurate 4-channel power supply solution to provide all necessary voltages for small form-factor TFT displays. The device offers unparalleled integration and requires only one inductor. The TPS65120 comes in a 3 x 3 mm^2 QFN package and allows the industry's smallest implementations.



Resources *For a complete list of Resources, visit power.ti.com*

Literature Number	Description
Application Notes	
SLVA107	Designing for Small-Size, High-Frequency Applications with SWIFT™ Regulators
SLVA126	SWIFT Regulators w/Ceramic Output Caps Worst Case Analysis and Measurement
SLVA109	Designing with the TPS54310 Synchronous Buck Regulator
SLVA111	Designing with the TPS54311 Through TPS54316 Synchronous Buck Regulators
SLVA104A	Designing with the TPS54610 Synchronous Buck Regulator
SLVA105A	Designing with the TPS54611 Through TPS54616 Synchronous Buck Regulators
SLVA113A	Optimizing the Layout of the TPS5461x for Thermal Performance
SLUA273	Using the TPS54372 Tracking/Termination Synchronous PWM Switcher
SLVA112	Using the TPS54672 Tracking/Termination Synchronous PWM Switcher
SLVA121	Using the TPS54872 Tracking/Termination Synchronous PWM Switcher
SLVA120	Using the TPS54972 Tracking/Termination Synchronous PWM Switcher
SLVA007	Sequencing with TPS54x80 and TPS54x73 SWIFT DC/DC Converters
SLVA117	Dual Output Power Supply Sequencing for High Performance Processors
SLPB008A	TI Power Solutions for Xilinx® FPGAs
SLUA278	TI Power Solutions for Altera® FPGAs
SLVA123	DVS For OMAP1510 Using TPS62200
SLVA006	Maximum Output Current of TPS62050
SLUA272	High Voltage Power Supply Using the TPS61040
SLEA004	Extending Battery Life with the TPS61040 White Light LED Driver
SLVA125	TPS61042 White Light LED Driver Boost Converter
SLVA131	TPS61042 Dual Li-Ion and Higher Input Voltages
SLVA122	White Light LED Driver With Gradual Dimming
SLUA271	QFN/SON PCB Attachment Application Note
SLVA134	Adjusting the Output Voltage of Fixed-Voltage SWIFT Devices

DC/DC Converters (Integrated Switch)

Selection Guide

Device	I_{OUT} (mA)	Switch Current Limit (typ) (mA)	V_{IN} (V)	V_{OUT} Adj. (V)	V_{OUT} Fixed (V)	Peak Efficiency (%)	Switching Frequency (kHz)	Quiescent Current (mA)	Shutdown Current (µA)	Integrated LDO I_{OUT} (mA)/ V_{OUT} (V)	Description	Package: Chipscale (WCSP)	Package: SOT-23	Package: MSOP	Package: QFN	Package: TSSOP	EVM	Price[1]
Integrated Power Management for PDA, Smartphone, GPS and DSC (OMAP,™ Intel XScale,® DMxxx)																		
TPS65010/1/2	1000	2100	2.5 to 6.0	2.5 to 3.3	Discrete steps	95	1500	0.07	0.015	2 x 200/Adj.	Charger, DC/DC, LDOs, I^2C combo IC				48		✔	4.40
	400	900	2.5 to 6.0	0.85 to 1.8	Discrete steps	90	1500	—	—	—	for OMAP and others							
TPS65500	20 to 500	8 channels	1.5 to 5.0	Various	—	—	—	—	—	2 x 150/Adj.	8-ch DC/DC for DSC				64			5.90
TPS65550	2000	3000	1.8 to 12	50-V switch	—	—	—	1.5	—	—	Photo flash charger for DSC			10	10			1.90
Power Management for Displays: Display Bias Supply, White LED Backlight																		
TPS65100/5	400 @ 15 V	2600/1560	2.7 to 5.8	5 to 15	—	90	2100	3.5	1	LDO Ctrl/3.3	4-ch, high-accuracy TFT LCD supply,				24	24	✔	2.70
	20 @ 30 V	Charge pump	—	Up to 30	—	—	—	—	—	—	vcom buffer, power-up sequencing							
	20 @ –12 V	Charge pump	—	Up to –12	—	—	—	—	—	—	for large displays							
TPS65110/1	16	Charge pump	2.4 to 5.5	—[2]	3.3/5.0	86/90	520	0.05	1	—	3-ch, high-accuracy, LTPS LCD supply				24			1.70
	2	Charge pump	—	—[2]	7.5/9.0	70/88	520	—	—	—	for small form-factor (SFF) displays							
	1	Charge pump	—	—[2]	–2.7/–3	82/58	520	—	—	—								
TPS65120/1	20	175	2.5 to 5.5	3.0 to 5.6	—	83	—	—	0.1	20/1.8, 3.3	4-ch, high-accuracy, LTPS and a-Si				16		✔	2.95
	2 @ 20 V	Charge pump	—	Up to 20	—	—	—	—	—	—	LCD supply with LDO, sequencing for							
	2 @ –18 V	Charge pump	—	Up to –18	—	—	—	—	—	—	SFF displays							
TPS65130	200	900	2.7 to 5.5	Up to 15	—	89	1500	0.5	0.2	—	2-ch, positive/negative supply for				24		✔	2.95
	200	900	—	Up to –12	—	81	1500	—	—	—	SFF OLED, TFT, CCD							
TPS65140/5	400 @ 15 V	2600/1560	2.7 to 5.8	5 to 15	—	90	2100	3.5	1	LDO Ctrl/3.3	4-ch, high-accuracy TFT LCD supply,				24	24	✔	2.70
	20 @ 30 V	Charge pump	—	Up to 30	—	—	—	—	—	—	Power Good, power-up sequencing							
	20 @ –12 V	Charge pump	—	Up to –12	—	—	—	—	—	—	for large displays							
REG71050/55	WLED (3+)	Charge pump	3.2 to 5.5	—	5.0/5.5	85	1000	0.065	0.01	—	60-mA charge pump, TSOT-23		6				✔	0.95
TPS61043	WLED (4+)	500	1.8 to 6.0	28	—	85	1000	0.025	1	—	Inductive, current regulated				8		✔	0.99
TPS60230	WLED (5+)	Charge pump	2.7 to 6.5	—	5.5	85	1250	0.16	0.01	—	5-ch, regulated charge pump				16		✔	1.80
TPS61042	WLED (6+)	500	1.8 to 6.0	28	—	85	1000	0.025	1	—	Inductive, current regulated				8		✔	1.20
TPS61045	LCD drive	450	1.8 to 6.0	28	—	85	1000	0.035	1	—	Digitally adjustable LCD bias				8		✔	1.35
TPS61060	WLED (4+)	350	2.5 to 6	Up to 20	—	82	1200	—	—	—	Synchronous, current-regulated, CSP	8			8		✔	1.60

[1] *Suggested resale price in U.S. dollars in quantities of 1,000.*
[2] *EEPROM programmable. Contact factory.*

*New devices are listed in **bold red**.*
*Preview devices are listed in **bold blue**.*

DC/DC Converters (Integrated Switch)

Selection Guide (Continued)

Device	I_{OUT} (mA)	Switch Current Limit (typ) (mA)	V_{IN} (V)	V_{OUT} Adj. (V)	V_{OUT} Fixed (V)	Peak Efficiency (%)	Switching Frequency (max) (kHz)	Recommended Inductor Size (µH)	Quiescent Current (typ) (mA)	Shutdown Current (typ) (µA)	Low Battery	Power Good	Undervoltage Lockout	Thermal and/or Short-Circuit Protection	Package: Chipscale (WCSP)	Package: SOT-23	Package: MSOP	Package: QFN	Package: SOIC	EVM	Price[1]
Low Power Step Down (Buck) Converters — Small, Efficient, Low I_q																					
TPS62200	300	670	2.5 to 6.0	0.7 to 6.0	—	97	1000	10	0.015	0.1			✔	✔		6				✔	1.35
TPS62201/2/3	300	670	2.5 to 6.0	—	1.5, 1.8, 3.3	97	1000	10	0.015	0.1			✔	✔		6				✔	1.35
TPS62204/5/6/7	300	670	2.5 to 6.0	—	1.2, 1.6, 2.5. 2.6	97	1000	10	0.015	0.1			✔	✔		6					1.35
TPS62220	400	880	2.5 to 6.0	0.7 to 6.0	—	95	1850	4.7	0.015	0.1			✔	✔		6				✔	1.50
TPS62221/2/3/4	400	880	2.5 to 6.0	—	1.5, 1.6, 1.8, 2.3	95	1850	4.7	0.015	0.1				✔		6				✔	1.50
TPS62300	500	740	2.5 to 6.0	0.6 to 5.4	—	90	3300	1	0.086	0.1			✔	✔	8			10		✔	1.95
TPS62301/2/3/5	500	740	2.5 to 6.0	—	1.5, 1.6, 1.8, 1.875	93	3300	1	0.086	0.1			✔	✔	8			10		✔	1.95
TPS62100/1/2/3	500	—	2.5 to 9.0	0.8 to 8.0	—	92	2000	10	0.625	1				✔					8	✔	1.90
TPS62000	600	1600	2.0 to 5.5	0.8 to 5.0	—	95	1000	10	0.05	0.1	✔	✔	✔	✔	8		10			✔	1.60
TPS62001/2/3	600	1600	2.0 to 5.5	—	0.9, 1, 1.2	95	1000	10	0.05	0.1	✔	✔	✔	✔			10				1.60
TPS62004/5/6	600	1600	2.0 to 5.5	—	1.5, 1.8, 2.5	95	1000	10	0.05	0.1	✔	✔	✔	✔			10			✔	1.60
TPS62007/8	600	1600	2.0 to 5.5	—	1.9, 3.3	95	1000	10	0.05	0.1	✔	✔	✔	✔			10				1.60
TPS62020	600	1150	2.5 to 6.0	0.7 to 6.0	—	95	1500	6.2	0.018	0.1			✔	✔			10	10		✔	1.80
TPS62050	800	1400	2.7 to 10.0	0.7 to 6.0	—	95	1000	10	0.012	1.5	✔	✔	✔	✔			10			✔	1.85
TPS62051	800	1400	2.7 to 10.0	0.7 to 6.0	—	95	1000	10	0.012	1.5	✔	✔	✔	✔			10				1.85
TPS62052/4/6	800	1400	2.7 to 10.0	—	1.5, 1.8, 3.3	95	1000	10	0.012	1.5	✔	✔	✔	✔			10			✔	1.85
TPS62040	1200	2000	2.5 to 6.0	0.7 to 6.0	—	95	1500	6.2	0.018	0.1			✔	✔			10			✔	2.20
TPS62042/3/4/6	1200	2000	2.5 to 6.0	—	1.5, 1.6, 1.8, 3.3	95	1500	6.2	0.018	0.1			✔	✔			10	10		✔	2.20

Device	I_{OUT} (mA)	V_{IN} (V)	V_{OUT} (V)	Max Frequency (kHz)	Power Good	Enable	Current Limit	Thermal Shutdown	UVLO	Sync Pin	Soft Start	EVM	Package	Comments	Price[1]
SWIFT™ Synchronous Step Down (Buck) Converters — Up to 14 A															
TPS54110	1500	3.0 to 6.0	Adj. to 0.9	700	✔	✔	✔	✔	✔	✔	✔	✔	20 HTSSOP	Adjustable Output Only	2.15
TPS54350/2/3/4/5/6/7	3000	4.5 to 20	Adj. and fixed	700	✔	✔	✔	✔	✔	✔	✔	✔	16 HTSSOP	Sync. or Non-sync. Buck	2.35
TPS54310/1/2/3/4/5/6	3000	3.0 to 6.0	Adj. and fixed	700	✔	✔	✔	✔	✔	✔	✔	✔	20 HTSSOP	Adj., 0.9, 1.2, 1.5, 1.8, 2.5, 3.3 V	2.95
TPS54372	3000	3.0 to 6.0	Adj. to 0.2	700	✔	✔	✔	✔	✔			✔	20 HTSSOP	Active Bus Termination/DDR	2.95
TPS54373	3000	3.0 to 6.0	Adj. to 0.9	700	✔	✔	✔	✔	✔	✔	✔	✔	20 HTSSOP	Prebias	2.95
TPS54380	3000	3.0 to 6.0	Adj. to 0.9	700	✔	✔	✔	✔	✔			✔	20 HTSSOP	Sequencing (TRACKIN pin)	2.95
TPS54610/1/2/3/4/5/6	6000	3.0 to 6.0	Adj. and fixed	700	✔	✔	✔	✔	✔	✔	✔	✔	28 HTSSOP	Adj., 0.9, 1.2, 1.5, 1.8, 2.5, 3.3 V	3.90
TPS54672	6000	3.0 to 6.0	Adj. to 0.2	700	✔	✔	✔	✔	✔			✔	28 HTSSOP	Active Bus Termination/DDR	3.90
TPS54673	6000	3.0 to 6.0	Adj. to 0.9	700	✔	✔	✔	✔	✔	✔	✔	✔	28 HTSSOP	Prebias	3.90
TPS54680	6000	3.0 to 6.0	Adj. to 0.9	700	✔	✔	✔	✔	✔			✔	28 HTSSOP	Sequencing (TRACKIN pin)	3.90
TPS54810	8000	4.0 to 6.0	Adj. to 0.9	700	✔	✔	✔	✔	✔	✔	✔	✔	28 HTSSOP	Adjustable Output Only	4.20
TPS54872	8000	4.0 to 6.0	Adj. to 0.2	700	✔	✔	✔	✔	✔			✔	28 HTSSOP	Active Bus Termination/DDR	4.20
TPS54873	8000	4.0 to 6.0	Adj. to 0.9	700	✔	✔	✔	✔	✔	✔	✔	✔	28 HTSSOP	Prebias	4.20
TPS54880	8000	4.0 to 6.0	Adj. to 0.9	700	✔	✔	✔	✔	✔			✔	28 HTSSOP	Sequencing (TRACKIN pin)	4.20
TPS54910	9000	3.0 to 4.0	Adj. to 0.9	700	✔	✔	✔	✔	✔	✔	✔	✔	28 HTSSOP	Adjustable Output Only	4.40
TPS54972	9000	3.0 to 4.0	Adj. to 0.2	700	✔	✔	✔	✔	✔			✔	28 HTSSOP	Active Bus Termination/DDR	4.40
TPS54973	9000	3.0 to 4.0	Adj. to 0.9	700	✔	✔	✔	✔	✔	✔	✔	✔	28 HTSSOP	Prebias	4.40
TPS54980	9000	3.0 to 4.0	Adj. to 0.9	700	✔	✔	✔	✔	✔			✔	28 HTSSOP	Sequencing (TRACKIN pin)	4.40
TPS54010	14000	2.25 to 4.0	Adj. to 0.9	700	✔	✔	✔	✔	✔	✔	✔	✔	28 HTSSOP	Dual Input Bus (2.5, 3.3 V)	5.30

[1] *Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

DC/DC Converters (Integrated Switch)

Selection Guide (Continued)

Device	I_{OUT} (mA)[1]	Switch Current Limit (typ) (mA)	V_{IN} (V)	V_{OUT} Adj. (V)	V_{OUT} Fixed (V)	Peak Efficiency (%)	Switching Frequency (max) (kHz)	Recommended Inductor Size (µH)	Quiescent Current (typ) (mA)	Shutdown Current (typ) (µA)	Integrated LDO I_{OUT} (mA)/ V_{OUT} (V)	Low Battery	Power Good	Undervoltage Lockout	Thermal and/or Short-Circuit Protection	Package: SOT-23	Package: MSOP	Package: QFN	Package: TSSOP	Package: SOIC	EVM	Price[2]
Boost (Step Up) Converters — Up to 4.5-A Switch Limit																						
TPS61041	50	250	1.8 to 6.0	V_{IN} to 28	—	87	1000	10	0.028	0.1	—			✔	✔	6					✔	0.75
TPS61040	90	400	1.8 to 6.0	V_{IN} to 28	—	87	1000	10	0.028	0.1	—			✔	✔	6					✔	0.95
TPS61045	100	450	1.8 to 6.0	V_{IN} to 28	—	85	1000	4.7	0.035	1	—			✔	✔			8			✔	1.35
TPS6734	120	—	2.7 to 12	—	12	86	170	18	1.2	3	—				✔					8	✔	1.25
TPS61000	200	1100	0.8 to 3.3	1.5 to 3.3	—	85	840	33	0.05	0.2	—	✔		✔	✔		10				✔	0.95
TPS61001/2/3	100	500/650/900	0.8 to 3.3	—	1.5/1.8/2.5	85	840	33	0.05	0.2	—	✔		✔	✔		10					0.95
TPS61004/5/6	200	950/1000/1100	0.8 to 3.3	—	2.8/3/3.3	85	840	33	0.05	0.2	—	✔		✔	✔		10					0.95
TPS61007	200	1100	0.8 to 3.3	1.5 to 3.3	—	85	840	33	0.05	0.2	—	✔		✔	✔		10					0.95
TPS61010	200	1130	0.8 to 3.3	1.5 to 3.3	—	95	840	10	0.036	1	—	✔		✔	✔		10				✔	1.10
TPS61011/2/3	100	480/560/930	0.8 to 3.3	—	1.5/1.8/2.5	95	840	10	0.036	1	—	✔		✔	✔		10					1.10
TPS61014/5/6	200	1010/1060/1130	0.8 to 3.3	—	2.8/3/3.3	95	840	10	0.036	1	—	✔		✔	✔		10					1.10
TPS61020	500	1800	0.9 to 5.5	1.8 to 5.5	—	96	720	6.8	0.025	0.1	—	✔			✔			10			✔	1.40
TPS61024/5/7	500	1800	0.9 to 5.5	1.8 to 5.5	3/3.3/5	96	720	6.8	0.025	0.1	—	✔			✔			10				1.40
TPS61070	150	700	0.9 to 5.5	1.8 to 5.5	—	90	1440[3]	4.7	0.019	0.1	—			✔	✔	6						0.95
TPS61071	150	700	0.9 to 5.5	1.8 to 5.5	—	90	1440[4]	4.7	0.019	0.1	—			✔	✔	6						0.95
TPS61090	700	2000	1.8 to 5.5	1.8 to 5.5	—	96	700	6.8	0.02	0.1	—	✔		✔	✔			16			✔	1.70
TPS61091/2	700	2000	1.8 to 5.5	—	3.3/5	96	700	6.8	0.02	0.1	—	✔		✔	✔			16				1.70
TPS61030	1000	4500	1.8 to 5.5	1.8 to 5.5	—	96	700	6.8	0.02	0.1	—	✔		✔	✔			16	16		✔	2.10
TPS61031/2	1000	4500	1.8 to 5.5	—	3.3/5	96	700	6.8	0.02	0.1	—	✔		✔	✔			16	16		✔	2.10
Boost (Step Up) Converters with Integrated LDO																						
TPS61100	200	1500	0.8 to 3.3	1.5 to 5.5	—	95	800	10	0.065	0.5	120/Adj.	✔	✔		✔			24	20		✔	1.85
TPS61103/6/7	200	1500	0.8 to 3.3	—	3.3/3.3/3.3	95	800	10	0.065	0.5	120/Adj., 1.5, 1.8	✔	✔		✔			24	20		✔	1.85
TL499A	100	—	1.1 to 10	2.9 to 30	—	85	—	—	—	15	100/Adj.											0.67
TPS61120	500	1600	1.8 to 5.5	2.5 to 5.5	—	95	600	10	0.04	0.2	200/Adj.	✔	✔		✔			16	16		✔	1.95
TPS61121/2	500	1600	1.8 to 5.5	—	3.3/3.6	95	600	10	0.04	0.2	200/1.5, 3.3	✔	✔		✔			16	16		✔	1.95
Step Down (Buck) — Boost (Step Up) Converters																						
TPS61130	300	1600	1.8 to 5.5	2.5 to 5.5	—	90	600	10	0.04	0.2	200/Adj.	✔	✔		✔			16	16		✔	2.05
TPS61131/2	300	1600	1.8 to 5.5	—	3.3/3.3	90	600	10	0.04	0.2	200/1.5, 3.3	✔	✔		✔			16	16			2.05
TL497A	500	—	4.5 to 12	1.2 to 30	—	85	—	—	11	6000	—								14	14		1.36
Inverting Converters																						
TPS6735	200	—	4 to 6.2	—	–5.0	78	160	10	1.9	1	—			✔						8		1.25
TPS6755	200	—	2.7 to 9	Yes	—	78	160	10	1.9	1	—				✔					8		1.25
TL497A	500	—	4.5 to 12	–1.2 to –25	—	85	—	—	11	6000	—								14	14		1.36

[1] *For boost converters, max. I_{OUT} can be estimated with 0.65 x switch limit x (V_{IN}/V_{OUT}).*

[2] *Suggested resale price in U.S. dollars in quantities of 1,000.*

[3] *PWM/PFM.*

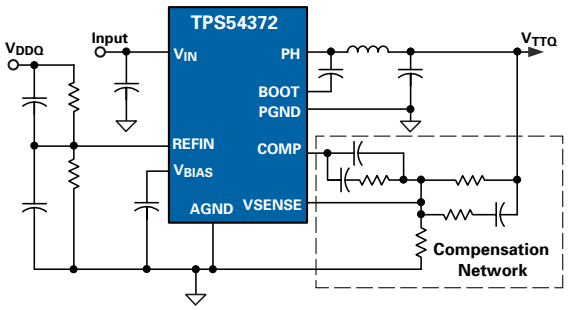
[4] *PWM only.*

*New devices are listed in **bold red**.*

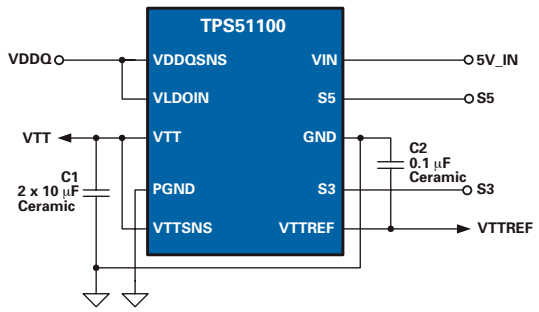
Active-Bus Termination Solutions (DDR/QDR/GTL/SSTL/HSTL)

Texas Instruments (TI) offers a wide selection of active-bus termination solutions from LDOs and switching controllers to plug-in power. Typical application diagrams and product parameters are provided to aid product selection.

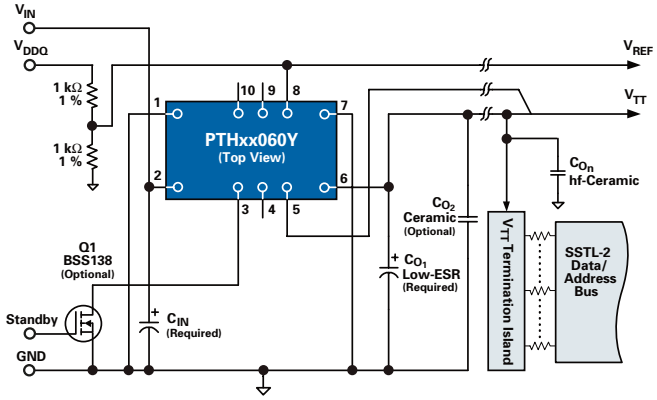
TPS54372: SWIFT™



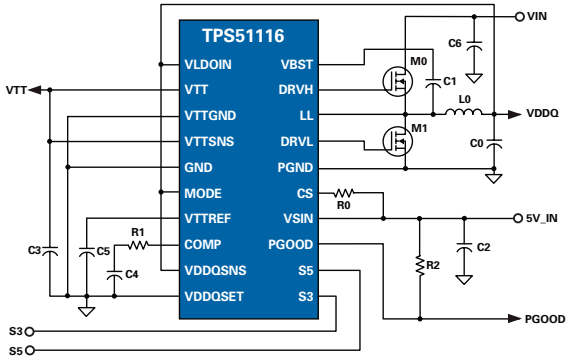
TPS51100: LDO



PTHxx060Y: Plug-In Power



TPS51116: Controller + LDO



Active-Bus Termination Solutions

Device	Input Bus Voltage (V)	I_{OUT} (A)	Isolated Outputs	V_O Range (V)	V_O Adjustable	Price[1]
Plug-In Power Modules						
PTH03010/50/60	3.3	6, 10, 15	No	0.55 to 1.8	Yes	13.95, 9.95, 11.50
PTH05010/50/60	5	6, 10, 15	No	0.55 to 1.8	Yes	13.95, 9.95, 11.50
PTH12010/50/60	12	6, 8, 12	No	0.55 to 1.8	Yes	13.95, 9.95, 11.50

Device	I_{OUT} (mA)	V_{IN} (V)	Adj. Out (V)	V_{OUT} Efficiency (%)	Switching Frequency (max) (kHz)	Package Pin Count HTSSOP	EVM	Price[1]
Converters (with Integrated FETs)								
TPS54372	3000	3.0 to 6.0	0.2 to 4.5	90	700	20	Yes	2.95
TPS54672	6000	3.0 to 6.0	0.2 to 4.5	90	700	28	Yes	3.90
TPS54872	8000	4.0 to 6.0	0.2 to 4.5	85	700	28	Yes	4.20
TPS54972	9000	3.0 to 4.0	0.2 to 4.5	90	700	28	Yes	4.40

Device	I_{OUT1} (V_{DDQ}) (A)	I_{OUT2} (V_{TT}) (A)	I_{OUT3} (Buf. V_{REF}) (mA)	V_{IN} (V)	V_{OUT1} (V_{DDQ}) Adj. (V)	V_{OUT2} (V_{TT}) Fixed (V)	V_{OUT3} (Buf. V_{REF}) Fixed (V)	Switching Frequency Selectable (kHz)	Light Load Eff. Mode	Control Scheme	Selectable Output Discharge	Package(s)	Price[1]
Controllers (with External FETs)													
TPS51020	>10 Switcher	>3 Switcher	3	4.5 to 28	2.5,1.8, Adj.	$V_{DDQ}/2$	$V_{DDQ}/2$	270, 360, 450	Yes	Voltage Mode	Yes	30 TSSOP	3.15
TPS51116	>10 Switcher	+3/–3 LDO	10	3 to 28	2.5,1.8, Adj.	$V_{DDQ}/2$	$V_{DDQ}/2$	400	Yes	D-CAP/ Current Mode	Yes	20 HTSSOP[2] 24 QFN[2]	1.20
Controller LDOs													
TPS51100	—	+3/–3 LDO	10	1.2 to 3.6[3]	—	$V_{DDQ}/2$	$V_{DDQ}/2$	—	—	—	Yes	10 MSOP[2]	0.80

[1] *Suggested resale price in U.S. dollars in quantities of 1,000.* [2] *PowerPAD™.* [3] *Requires separate 5-V supply.*

Charge Pump DC/DC Converters

Design Factors

Efficiency and Solution Size — Use of charge pumps is recommended when a tradeoff between efficiency and solution size needs to be made. Higher efficiency will directly translate into additional operating time in battery-powered applications. Charge pumps achieve peak efficiencies of 90% and typically require only a few capacitors for operation. No inductors, diodes or FETs are needed. Charge pumps come in small packages such as SOT-23 and MSOP-8, which further reduce solution size.

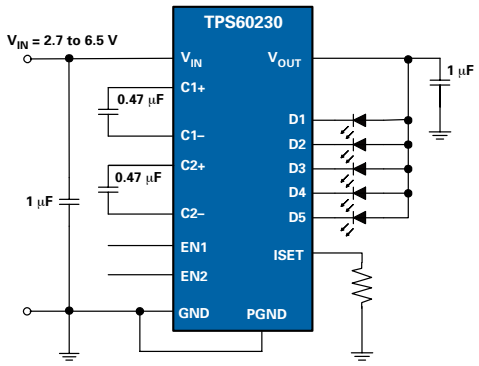
Output Current — Charge pump converters allow for small, power-efficient and cost-effective DC/DC solutions with output currents less than 300 mA and output voltage less than 6 V. If larger output currents, higher output voltages or greater efficiency are required, use of an inductive switching converter is more cost- and space-efficient (pages 13–20).

Output Ripple and Noise – TI charge pumps reduce output voltage ripple to a minimum by operating a pair of integrated charge pump loops with a phase shift of 180 degrees. This helps to avoid the cost of additional filtering at the output. Charge pumps also tend to generate less noise than an equivalent inductive switching converter of equal output current rating. This may be important in RF-sensitive or low-noise applications.

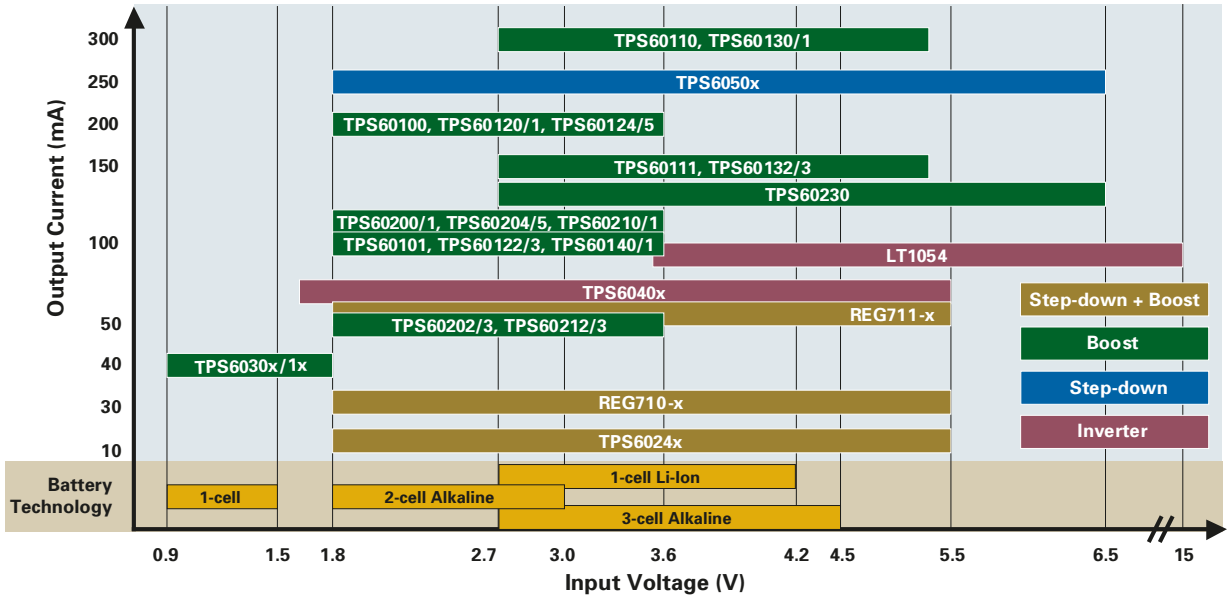
White LED Charge-Pump Current Source TPS60230

Get samples and datasheet at: **www.ti.com/sc/device/TPS60230**

The TPS60230 drives five white LEDs with a total regulated current of up to 125 mA while requiring only four small capacitors for operation. It comes in a space-saving 3 x 3 mm^2 QFN package for smallest solution size.



Charge Pump DC/DC Converters Family of Products



Resources *For a complete list of Resources, visit power.ti.com*

Literature Number	Description
Application Notes	
SLVA082	Powering the TMS320VC5402 DSP Using the TPS60100, TPS76918, and the TPS3305-18
SLVA070A	TPS6010x/TPS6011x Charge Pump
SLVA098	Additional Negative Output with TPS601xx
SLVA099	Improved Start-up Performance for Charge Pumps TPS6030x
SLVA128	Optimizing Output Voltage Ripple for the REG710
SLVA133	TPS6031x Evaluation Using the TPS6030xEVM

Charge Pump DC/DC Converters

Selection Guide

Device	I_{OUT} (mA)	V_{IN} (V)	V_{OUT} Adj. (V)	V_{OUT} Fixed (V)	Efficiency (%)	Switching Frequency (max) (kHz)	Quiescent Current (typ) (µA)	Shutdown Current (typ) (µA)	Features						Packaging				EVM	Price[1]
									Shutdown	Low Battery	Power Good	Undervoltage Lockout	Current Limit	Thermal Limit	SOT-23	QFN	MSOP	TSSOP		
Buck (Step Down) and Boost																				
REG710-2.5	30	1.8 to 5.5	—	2.5	90	1000	65	0.01	✔				✔	✔	6					0.95
REG710-2.7	30	1.8 to 5.5	—	2.7	90	1000	65	0.01	✔				✔	✔	6					0.95
REG710-3	30	1.8 to 5.5	—	3.0	90	1000	65	0.01	✔				✔	✔	6					0.95
REG710-3.3	30	1.8 to 5.5	—	3.3	90	1000	65	0.01	✔				✔	✔	6				✔	0.95
REG71050	60	2.7 to 5.5	—	5.0[2]	90	1000	65	0.01	✔				✔	✔	6				✔	0.95
REG710-5	60	2.7 to 5.5	—	5.0[2]	90	1000	65	0.01	✔				✔	✔	6				✔	0.95
REG71055	60	3.0 to 5.5	—	5.5[2]	90	1000	65	0.01	✔				✔	✔	6					0.95
REG711-2.5	50	1.8 to 5.5	—	2.5	90	1000	60	0.01	✔				✔	✔			8			1.10
REG711-2.7	50	1.8 to 5.5	—	2.7	90	1000	60	0.01	✔				✔	✔			8			1.10
REG711-3	50	1.8 to 5.5	—	3.0	90	1000	60	0.01	✔				✔	✔			8			1.10
REG711-3.3	50	1.8 to 5.5	—	3.3	90	1000	60	0.01	✔				✔	✔			8			1.10
REG711-5	50	2.7 to 5.5	—	5.0	90	1000	60	0.01	✔				✔	✔			8			1.10
Boost																				
TPS60100	200	1.8 to 3.6	—	3.3	90	300	50	0.05	✔			✔	✔					20	✔	1.25
TPS60101	100	1.8 to 3.6	—	3.3	90	300	50	0.05	✔			✔	✔					20		1.05
TPS60110	300	2.7 to 5.4	—	5.0	90	300	60	0.05	✔			✔	✔					20	✔	1.30
TPS60111	150	2.7 to 5.4	—	5.0	90	300	60	0.05	✔			✔	✔					20		1.15
TPS60120/1	200	1.8 to 3.6	—	3.3	85	450	55	0.05	✔	✔[3]	✔[3]	✔	✔					20	✔	1.25
TPS60122/3	100	1.8 to 3.6	—	3.3	85	450	55	0.05	✔	✔[3]	✔[3]	✔	✔					20		1.05
TPS60124/5	200	1.8 to 3.6	—	3.0	85	450	55	0.05	✔	✔[3]	✔[3]	✔	✔					20		1.25
TPS60130/1	300	2.7 to 5.4	—	5.0	90	450	60	0.05	✔	✔[3]	✔[3]	✔						20	✔	1.30
TPS60132/3	150	2.7 to 5.4	—	5.0	90	450	60	0.05	✔	✔[3]	✔[3]	✔						20		1.15
TPS60140/1	100	1.8 to 3.6	—	5.0	70	450	65	0.05	✔	✔[3]	✔[3]	✔	✔					20	✔	1.05
TPS60200/1	100	1.8 to 3.6	—	3.3	90	400	40	0.05	✔	✔[3]	✔[3]	✔					10		✔	1.05
TPS60202/3	50	1.8 to 3.6	—	3.3	90	400	40	0.05	✔	✔[3]	✔[3]	✔					10			0.95
TPS60204/5	100	1.8 to 3.6	—	3.3	90	400	35	0.05	✔	✔[3]	✔[3]	✔					10			1.05
TPS60210/1	100	1.8 to 3.6	—	3.3	90	400	35	2	Snooze	✔[3]	✔[3]	✔					10		✔	1.05
TPS60212/3	50	1.8 to 3.6	—	3.3	90	400	35	2	Snooze	✔[3]	✔[3]	✔					10			0.95
TPS60230	125	2.7 to 6.5	—	5.5[2]	85	1250	160	0.1	✔			✔	✔	✔		16			✔	1.55
TPS60240	12	1.8 to 5.5	—	3.3	90	160	250	0.1					✔	✔			8			1.15
TPS60241	12	2.7 to 5.5	—	5.0	90	160	250	0.1					✔	✔			8		✔	1.15
TPS60242	12	1.8 to 5.5	—	3.0	90	160	250	0.1					✔	✔			8			1.15
TPS60243	12	1.8 to 5.5	—	2.7	90	160	250	0.1					✔	✔			8			1.15
TPS60300/2	20	0.9 to 1.8	—	3.3	90	900	35	1	✔		✔[4]	✔					10		✔	0.95
TPS60301/3	20	0.9 to 1.8	—	3.0	90	900	35	1	✔		✔[4]	✔					10			0.95
TPS60310/2	20	0.9 to 1.8	—	3.3	90	900	35	2	Snooze		✔[4]	✔					10			1.05
TPS60311/3	20	0.9 to 1.8	—	3.0	90	900	35	2	Snooze		✔[4]	✔					10			1.05
Buck (Step Down)																				
TPS60500	250	1.8 to 6.5	0.8 to 3.3	—	90	1200	40	0.05	✔		✔	✔	✔	✔			10		✔	0.80
TPS60501	250	1.8 to 6.5	—	3.3	90	1200	40	0.05	✔		✔	✔	✔	✔			10			0.80
TPS60502	250	1.8 to 6.5	—	1.8	90	1200	40	0.05	✔		✔	✔	✔	✔			10			0.80
TPS60503	250	1.8 to 6.5	—	1.5	90	1200	40	0.05	✔		✔	✔	✔	✔			10			0.80
Inverter																				
LT1054	100	3.5 to 15	—	–5.0	—	25	2500	100	✔											1.52
TPS60400	60	1.6 to 5.5	–(1.6 to 5.5)	—	99	50 to 250	125	—							5				✔	0.33
TPS60401	60	1.6 to 5.5	–(1.6 to 5.5)	—	99	28	65	—							5					0.33
TPS60402	60	1.6 to 5.5	–(1.6 to 5.5)	—	99	70	120	—							5					0.33
TPS60403	60	1.6 to 5.5	–(1.6 to 5.5)	—	99	300	425	—							5					0.33

[1] *Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

[2] *White LED driver.*

[3] *Features apply respectively to device numbers shown. For example, only the TPS60120 has the Low Battery feature and only the TPS60121 has the Power Good feature.*

[4] *Feature applies only to second device shown. For example, only the TPS60302 has the Power Good feature.*

Power Factor Correction (PFC)

Design Factors

Control Method

Average Current Mode ACM — Optimum control method to achieve PFC and low harmonic distortion.

Transition Mode — Simpler inexpensive control with high peak currents and filtering requirements.

ZVT Mode — A type of soft switching technique, which reduces EMI and allows for higher frequency operations.

Protection

- Soft-start (programmable) provides controlled start-up.
- Over-current protection (OCP) provides protection during overload conditions.
- Over-voltage protection (OVP) prevents output capacitor, switches and load from overcharge condition.

Performance

- Voltage feed-forward for linearized performance and faster transient response over wide line voltage range.
- Multiplier linearity and zero power detect functions improve light load operation.
- Onboard high output current drive capability without external MOSFET drivers.

Flexibility

- Ability to work with a wide line voltage range.
- Different levels of under-voltage lockout thresholds for self bias and auxiliary bias applications.
- Ability to synchronize controllers to eliminate noise issues.

Power Level

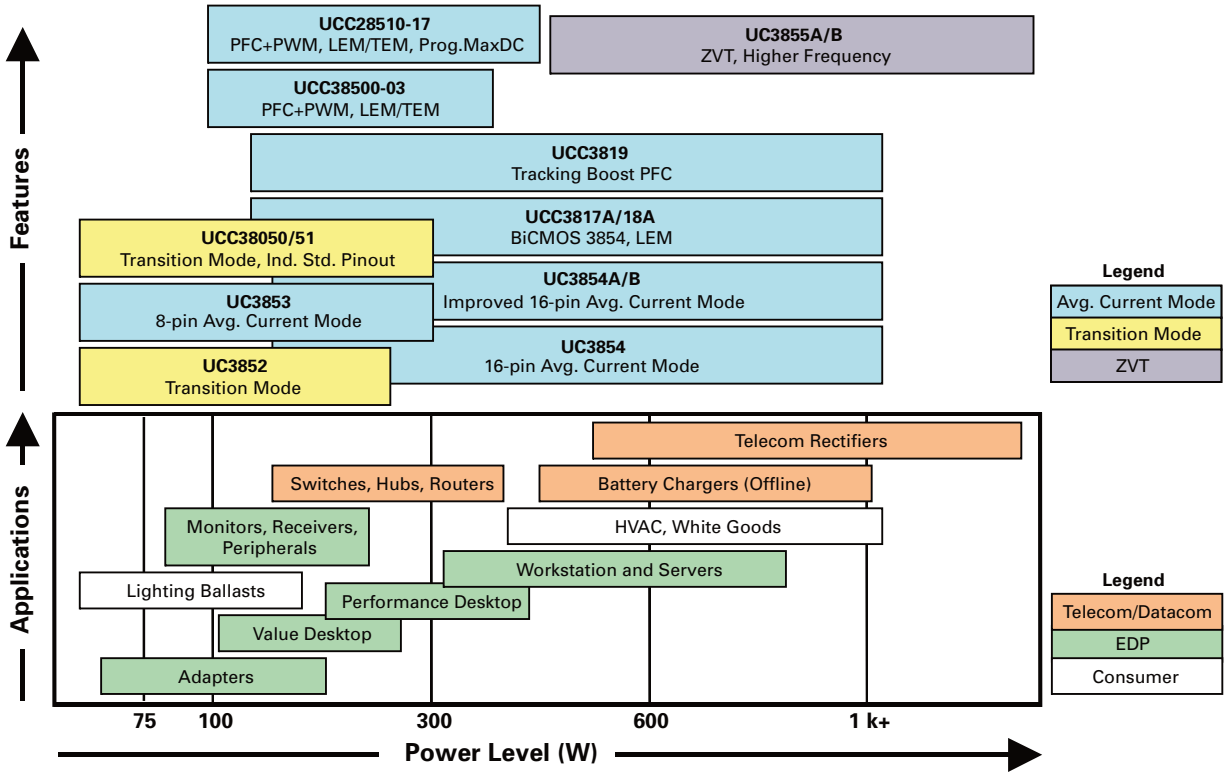
- IEC requirements are applicable to all power supplies above 150 W.
- Higher power converters may require ZCT/ZVT techniques to achieve high efficiencies.
- Some of the simpler control techniques not usable at high power levels.

Features

From 50 W to 5 kW, TI PFC controllers deliver EN61000-3-2 compliance.

- Industry standard architecture.
- Deliver PF > 0.993.
- New BiCMOS generation reduces complexity.
- Optimized PFC/PWM "combo" controllers.
- Superior applications support.

Power Factor Correction (PFC) Family of Products



Power Factor Correction (PFC)

Selection Guide

Device	Description	Control Method[1]	Typical Power Level	Soft Switching[2]	Max Frequency (kHz)	Start-Up Current (mA)	UVLO Thresholds (V)	PWM Prog. Max Duty Cycle	PWM Freq. Option	OVP	Price[3]
UC3852	Transition Mode PFC Controller	CRM	<150 W	—	Variable	1	16.3/11.5	—	—	—	1.70
UC3853	8-Pin PFC Controller	ACM	75 W to 300 W	—	125	0.25	11.5/9.5	—	—	✔	0.99
UC3854	PFC Controller	ACM	200 W to 2 kW+	—	200	1.5	16/10	—	—	—	1.15
UC3854A/B	Improved PFC Controller	ACM	200 W to 2 kW+	—	200	0.3	16/10 ('3854A) 10.5/10 ('3854B)	—	—	—	1.35
UC3855A/B	High Performance Soft Switching PFC Controller	ACM	400 W to 2 kW+	ZVT	500	0.15	16/10 ('3855A) 10.5/10 ('3855B)	—	—	✔	5.70
UCC38050/1	Transition Mode PFC Controller	CRM	50 W to 400 W	—	Variable	0.75	15.8/9.7 ('38050) 12.5/9.7 ('38051)	—	—	✔	0.70
UCC3817A/8A	BiCMOS PFC Controller	ACM	75 W to 2 kW+	—	400	0.1	16/10 ('3817A) 10.5/10 ('3818A)	—	—	✔	1.15
UCC3819A	Tracking Boost PFC Controller	ACM	75 W to 2 kW+	—	400	0.1	10.2/9.7	—	—	✔	1.15
UCC38500/1/2/3	PFC+PWM Combo Controller	ACM	75 W to 1 kW+	—	400	0.1	16/10 ('38500/2) 10.5/10 ('38501/3)	—	1x	✔	1.55
UCC28510/1/2/3	Advanced PFC+PWM Combo Controller	ACM	75 W to 1 kW+	—	600	0.1	16.6/9.3 ('28510/2) 10.2/9.7 ('28511/3)	✔[4]	1x	✔	1.80
UCC28514/5/6/7	Advanced PFC+PWM Combo Controller	ACM	75 W to 1 kW+	—	600	0.1	16.6/9.3 ('28514/6) 10.2/9.7 ('28515/7)	✔[4]	2x	✔	1.80

[1] *CRM = critical conduction mode, ACM = average current mode.*
[2] *ZVT = zero voltage transition.*
[3] *Suggested resale price in U.S. dollars in quantities of 1,000.*
[4] *Up to 90%.*

Resources *For a complete list of Resources, visit power.ti.com*

Part Number	Description	Price[1]
Evaluation Modules (EVMs)		
UCC28051EVM	100-W Offline AC/DC Voltage Converter with PFC	49
UCC28514EVM	100-W AC/DC Power Converter with PFC Regulating a 12-V DC Output	49
UCC28517EVM	100-W AC/DC Power Converter with PFC Regulating 2 DC Outputs	49
UCC38050EVM	110-W Universal Line Input PFC Boost Converter	49
UCC38500	UCC38500 Evaluation Module: 100-W, Universal Line to 12-V Regulated Output	49
UCC3817	UCC3817 Evaluation Module: 385-V, 250-W PFC Boost Converter	49

Literature Number	Part Number	Description
Application Notes		
SLUA144	UC3854	UC3854 Controlled Power Factor Correction Circuit Design
SLVC018.ZIP	UCC38050	MathCAD Application Design Tool for Use with the UCC38050
SLUU138	UCC38050	100-W Critical Conduction Power Factor Corrected Preregulator
SLUU134	UCC38050	User's Guide: 100-W Universal Line Input PFC Boost Converter Using the UCC38050
SLUA269	UCC3819	UCC3819 250-W PFC Boost Follower Preregulator Design
SLUA245	UCC3817	Synchronizing a PFC Controller from a Downstream Controller Gate Drive
SLUA196	UC3854A/B, UC3855A/B	UC3854A/B and UC3855A/B Provide Power Limiting with Sinusoidal Input Current for PFC Front Ends
SLUA177	UC3854A/B	UC3854A and UC3854B Advanced Power Factor Correction Control ICs
SEM1500	UCC28510	Designing High Power Factor Off-Line Power Supplies
SEM700	UC3854	Optimizing the Design of High Power Factor Switching Preregulator
Reference Designs		
SLUU117	UCC28517	User's Guide: UCC28517 Prototype Reference Design Module: 385-V, 100-W PFC + 12-V, 8-W Bias Supply
SLUU077	UCC3817	User's Guide: UCC3817 BiCMOS Power Factor Preregulator Evaluation Board
SLUU068	UCC38500	User's Guide: UCC38500 EVM

[1] *Suggested resale price in U.S. dollars.*

PWM Power Supply Controllers

Single-Ended Topologies

Control Method

Voltage Mode — Simple, low-noise control method for wide input and output range requirements.

Current Mode — Fast transient response with built-in current limiting.

Level of Integration

- Integrated soft-start (programmable) provides predictable start-up.
- Internal leading edge blanking to suppress switching spike from MOSFET turn-on.

Performance

- Many voltage mode controllers have input voltage feedforward for instantaneous response to input line changes.
- Most controllers have onboard high current drive capability without external MOSFET drivers.
- Lower start-up current for offline applications (for BiCMOS products with UCC prefix).
- Low operating current (for BiCMOS products with UCC prefix) for light-load efficiency.
- Programmable minimum duty cycle clamp for light-load efficiency (UCC3581).

Features

- 10-W to 350-W offline and DC/DC power supplies.
- Single-ended topology power supplies, buck, boost, flyback and forward.

Double-Ended Topologies

Current Mode — Control technique featuring fast transient response with inherent cycle-by-cycle current limiting.

Voltage Mode — Versatile, low-noise control method for wide duty cycle ranges.

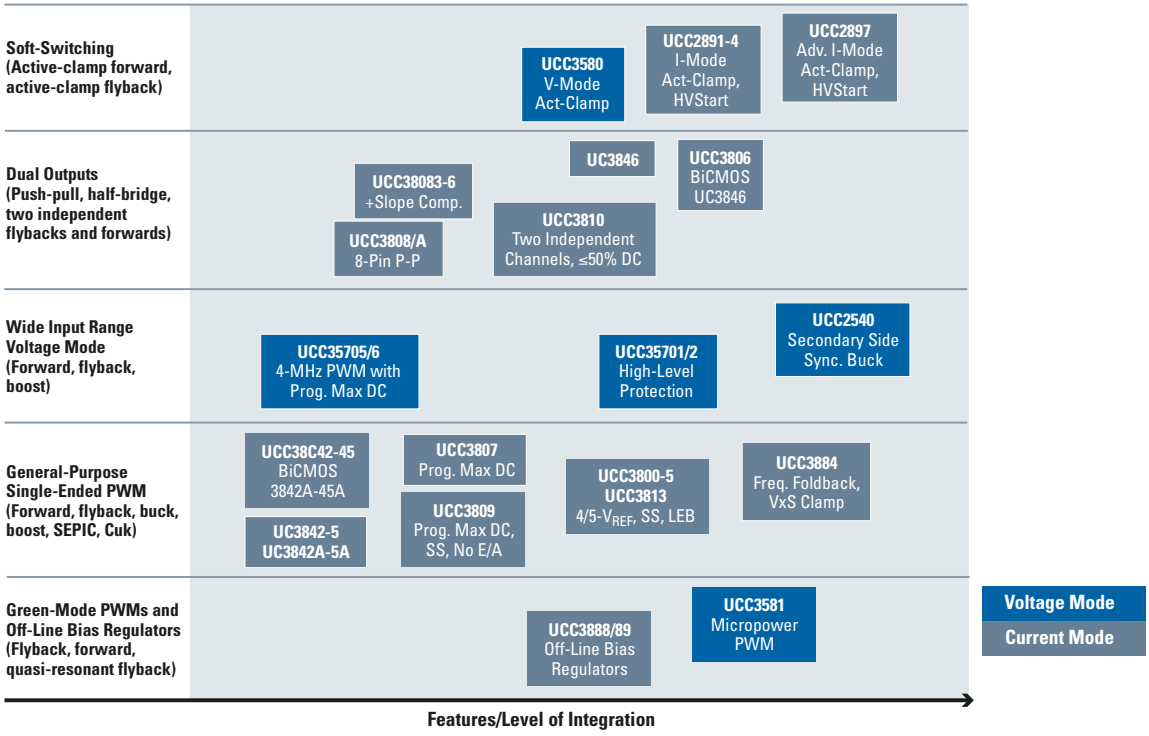
Soft Switching

- Zero Voltage Transition (ZVT) soft switching techniques minimize power loss at turn-on.
- Phase shifted, ZVT controllers maximize efficiency in full-bridge converters.

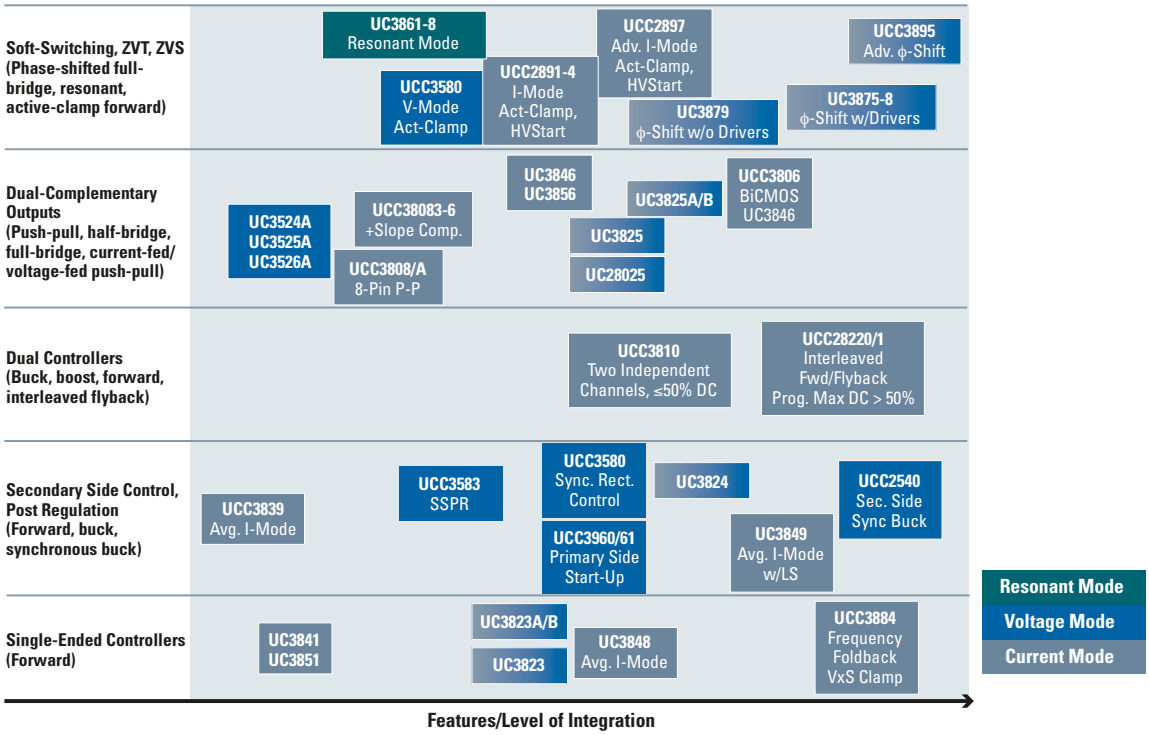
Protection

- Flexible over-current limiting circuitry provides programmable fault protection modes.
- Programmable soft-start executes predictable start-up on initialization and after faults.
- High speed, cycle-by-cycle current limiting.
- Maximum duty cycle clamp to prevent transformer saturation.
- Programmable deadtime control to prevent cross conduction of power switches.

Low- to Medium-Power PWM Controllers (25 W – 350 W)



Medium- to High-Power PWM Controllers (>300 W)



Resources *For a complete list of Resources, visit power.ti.com*

Part Number	Description	Price[1]
Evaluation Modules (EVMs)		
UCC28221EVM	A 200-W Power Converter Using Two-Channel Interleaved Forward Converter Topology	49
UCC2891EVM	48-V to 3.3-V Forward Converter with Active Clamp Reset Using the UCC2891	49
UCC35705EVM	48-V to 3.3-V RCD Forward with the UCC35705	49
UCC3895EVM-001	UCC3895EVM Configuring for Direct Control Driven Synchronous Rectifier Applications	99
UCC3809EVM	10-W Flyback Converter Utilizing the UCC3809	49
UCC3889EVM	A Dual-Output, Non-Isolated Off-Line Power Supply Highlighting the UCC3889 and TPS77401	49

Literature Number	Description
Application Notes	
SLUA149	UCC3800/1/2/3/4/5 BiCMOS Current Mode Control ICs
SLUA303	Designing for High Efficiency with the Active Clamp UCC2891 PWM Controller
SLUA276	25-W Forward Converter Design Review
SLUA213	Comparing the UC3842, UCC3802, and UCC3809 Primary Side PWM Controllers
SLUA246	A Comparison Between the BiCMOS UCC3895 Phase Shift Controller and the UC3875
SLUA257	The UCC38C42 Family of High-Speed, BiCMOS Current-Mode PWM Controllers
SLUA286	Low Voltage Feedback in PWM Applications
SLUA287	Control Driven Synchronous Rectifiers in Phase Shifted Full Bridge Converters
Reference Designs	
SLUU135A	UCC38083 50-W Push-Pull Converter
SLUA276	UCC38C42 25-W Forward Converter
SLUA274	UCC38C44 12-V Isolated Bias Supply
SLUA275	UCC3895 OUTC/OUTD Asymmetric Duty Cycle Operation
SLUU192A	48-V to 3.3-V Forward Converter with Active Clamp Reset Using the UCC2897 PWM Controller
SLUA303	Designing with the UCC2891 Active Clamp Controller
SLUU178	Using the UCC2891 Active Clamp and Reset PWM
SLUU173A	UCC28220 EVM User's Guide

[1] *Suggested resale price in U.S. dollars.*

PWM Power Supply Controllers

Selection Guide

(Device parameters continued on next page)

Device	Typical Power Level (W)	Control Method			Topologies														Maximum Practical Frequency	Start-Up Current	Operating Current	Supply Voltage (V)	110-V Start-Up Circuit	UVLO: On/Off (V)
		Voltage Mode	Current Mode	Avg. Current Mode	Buck	Boost	Flyback (SEPIC, Cuk)	Fwd (Including 2-Switch Fwd)	Forward (D > 50%)	Interleaved Fwd/Flyback/Boost	Act-Clamp Fwd/Flyback	Push-Pull	I-Fed/V-Fed Push-Pull	Half-Bridge	Full-Bridge	Φ-Shifted FB							
Green Mode Controllers and Offline Bias Regulators																								
UCC3581	10 to 200	✔			✔	✔	✔		✔										100 kHz	85 µA	300 µA	6.8 to 15	—	7.3/6.8
UCC3888/89	<10	✔					✔												250 kHz	150 µA	1.2 mA	9	—	8.4/6.3
General-Purpose Single-Ended Controllers																								
TL3842	30 to 350	✔	✔		✔	✔	✔		✔										500 kHz	0.5 mA	11 mA	10 to 30	—	16/10
TL3843	30 to 350	✔	✔		✔	✔	✔		✔										500 kHz	0.5 mA	11 mA	7.6 to 30	—	8.4/7.6
TL3844	30 to 350	✔	✔		✔	✔	✔	✔											500 kHz	0.5 mA	11 mA	10 to 30	—	16/10
TL3845	30 to 350	✔	✔		✔	✔	✔	✔											500 kHz	0.5 mA	11 mA	7.6 to 30	—	8.4/7.6
UCC3800	10 to 200	✔	✔		✔	✔	✔		✔										1 MHz	100 µA	500 µA	7.2 to 15	—	7.2/6.9
UCC3801	10 to 200	✔	✔		✔	✔	✔	✔											1 MHz	100 µA	500 µA	9.4 to 15	—	9.4/7.4
UCC3802	10 to 200	✔	✔		✔	✔	✔		✔										1 MHz	100 µA	500 µA	12.5 to 15	—	12.5/8.3
UCC3803	10 to 200	✔	✔		✔	✔	✔		✔										1 MHz	100 µA	500 µA	4.1 to 15	—	4.1/3.6
UCC3804	10 to 200	✔	✔		✔	✔	✔	✔											1 MHz	100 µA	500 µA	12.5 to 15	—	12.5/8.3
UCC3805	10 to 200	✔	✔		✔	✔	✔	✔											1 MHz	100 µA	500 µA	4.1 to 15	—	4.1/3.6
UCC3807-1	10 to 200	✔	✔		✔	✔	✔		✔										1 MHz	100 µA	1.3 mA	6.9 to 15	—	7.2/6.9
UCC3807-2	10 to 200	✔	✔		✔	✔	✔		✔										1 MHz	100 µA	1.3 mA	8.3 to 15	—	12.5/8.3
UCC3807-3	10 to 200	✔	✔		✔	✔	✔		✔										1 MHz	100 µA	1.3 mA	4.1 to 15	—	4.3/4.1
UCC3809-1	10 to 200	✔	✔		✔	✔	✔		✔										1 MHz	50 µA	500 µA	8 to 19	—	10.0/8.0
UCC3809-2	10 to 200	✔	✔		✔	✔	✔		✔										1 MHz	50 µA	500 µA	8 to 19	—	15.0/8.0
UCC3813-0	10 to 200	✔	✔		✔	✔	✔		✔										1 MHz	100 µA	500 µA	7.2 to 15	—	7.2/6.9
UCC3813-1	10 to 200	✔	✔		✔	✔	✔	✔											1 MHz	100 µA	500 µA	9.4 to 15	—	9.4/7.4
UCC3813-2	10 to 200	✔	✔		✔	✔	✔		✔										1 MHz	100 µA	500 µA	12.5 to 15	—	12.5/8.3
UCC3813-3	10 to 200	✔	✔		✔	✔	✔		✔										1 MHz	100 µA	500 µA	4.1 to 15	—	4.1/3.6
UCC3813-4	10 to 200	✔	✔		✔	✔	✔	✔											1 MHz	100 µA	500 µA	12.5 to 15	—	12.5/8.3
UCC3813-5	10 to 200	✔	✔		✔	✔	✔	✔											1 MHz	100 µA	500 µA	4.1 to 15	—	4.1/3.6
UC28023	50 to 750	✔	✔		✔	✔	✔		✔										1 MHz	1.1 mA	22 mA	9 to 30	—	9.2/8.4
UC3842	30 to 350	✔	✔		✔	✔	✔		✔										500 kHz	0.5 mA	11 mA	10 to 30	—	16.0/10.0
UC3843	30 to 350	✔	✔		✔	✔	✔		✔										500 kHz	0.5 mA	11 mA	7.6 to 30	—	8.4/7.6
UC3844	30 to 350	✔	✔		✔	✔	✔	✔											500 kHz	0.5 mA	11 mA	10 to 30	—	16.0/10.0
UC3845	30 to 350	✔	✔		✔	✔	✔	✔											500 kHz	0.5 mA	11 mA	7.6 to 30	—	8.4/7.6
UC3842A	30 to 350	✔	✔		✔	✔	✔		✔										500 kHz	0.3 mA	11 mA	10 to 30	—	16.0/10.0
UC3843A	30 to 350	✔	✔		✔	✔	✔		✔										500 kHz	0.3 mA	11 mA	7.9 to 30	—	8.5/7.9
UC3844A	30 to 350	✔	✔		✔	✔	✔	✔											500 kHz	0.3 mA	11 mA	10 to 30	—	16.0/10.0
UC3845A	30 to 350	✔	✔		✔	✔	✔	✔											500 kHz	0.3 mA	11 mA	7.9 to 30	—	8.5/7.9
UCC38C40	10 to 250	✔	✔		✔	✔	✔		✔										1 MHz	50 µA	2.3 mA	6.6 to 20	—	7.0/6.6
UCC38C41	10 to 250	✔	✔		✔	✔	✔	✔											1 MHz	50 µA	2.3 mA	6.6 to 20	—	7.0/6.6
UCC38C42	10 to 250	✔	✔		✔	✔	✔		✔										1 MHz	50 µA	2.3 mA	9 to 20	—	14.5/9
UCC38C43	10 to 250	✔	✔		✔	✔	✔		✔										1 MHz	50 µA	2.3 mA	7.6 to 20	—	8.4/7.6
UCC38C44	10 to 250	✔	✔		✔	✔	✔	✔											1 MHz	50 µA	2.3 mA	9 to 20	—	14.5/9
UCC38C45	10 to 250	✔	✔		✔	✔	✔	✔											1 MHz	50 µA	2.3 mA	7.6 to 20	—	8.4/7.6
UCC3884	50 to 250	✔	✔		✔	✔	✔		✔										1 MHz	200 µA	5 mA	8.9 to 15	—	8.9/8.3
UC3823	50 to 750	✔	✔		✔	✔	✔		✔										1 MHz	1.1 mA	22 mA	9 to 30	—	9.2/8.4
UC3823A/B	50 to 750	✔	✔		✔	✔	✔		✔										1 MHz	100 µA	28 mA	9 to 22	—	9.2/8.416/10
UCC35705	25 to 250	✔				✔	✔		✔										4 MHz	50 µA	2.5 mA	8.2 to 15	—	8.8/8.2

[1] *Suggested resale price in U.S. dollars in quantities of 1,000.*

PWM Power Supply Controllers

(Device parameters continued from previous page)

Device	V_{REF} (V)	V_{REF} Tol. (%)	Max Duty Cycle (%)	Soft Start	E/A	Shut-down Pin	Voltage Feed-forward	Output Drive (Sink/Source) (A)	Slope Comp	Sync Pin	Leading Edge Blanking	Available Packages									Price[1]
												MSOP	SSOP	TSSOP	HTSSOP-PowerPAD™	SOIC	SOIC-W (300 mil)	SOIC-W Power	PLCC	DIL (PDIP)	
Green Mode Controllers and Offline Bias Regulators																					
UCC3581	4	1.5	Prog.	✔	—	✔	—	1/1	—	✔	—					14				14	1.61
UCC3888/89	2.5	3	5.5	✔	—	—	✔	0.2/0.15	—	—	—						8			8	1.05
General-Purpose Single-Ended Controllers																					
TL3842	5	2	100	—	✔	—	—	1/1	—	—	—					8/14				8	0.36
TL3843	5	2	100	—	✔	—	—	1/1	—	—	—					8/14				8	0.36
TL3844	5	2	50	—	✔	—	—	1/1	—	—	—					8/14				8	0.36
TL3845	5	2	50	—	✔	—	—	1/1	—	—	—					8/14				8	0.36
UCC3800	5	1.5	100	✔	✔	—	—	1/1	—	—	100 ns			8		8				8	1.35
UCC3801	5	1.5	50	✔	✔	—	—	1/1	—	—	100 ns			8		8				8	1.35
UCC3802	5	1.5	100	✔	✔	—	—	1/1	—	—	100 ns			8		8				8	1.35
UCC3803	4	1.5	100	✔	✔	—	—	1/1	—	—	100 ns			8		8				8	1.35
UCC3804	5	1.5	50	✔	✔	—	—	1/1	—	—	100 ns			8		8				8	1.35
UCC3805	4	1.5	50	✔	✔	—	—	1/1	—	—	100 ns			8		8				8	1.35
UCC3807-1	2 (Int)	—	Prog.	✔	✔	—	—	1/1	—	—	100 ns					8				8	1.85
UCC3807-2	2 (Int)	—	Prog.	✔	✔	—	—	1/1	—	—	100 ns					8				8	1.85
UCC3807-3	2 (Int)	—	Prog.	✔	✔	—	—	1/1	—	—	100 ns					8				8	1.85
UCC3809-1	5	5	90	✔	—	✔	—	0.8/0.4	—	—	—	8		8		8				8	0.85
UCC3809-2	5	5	90	✔	—	✔	—	0.8/0.4	—	—	—	8		8		8				8	0.85
UCC3813-0	5	2	100	✔	✔	—	—	1/1	—	—	100 ns			8		8				8	0.80
UCC3813-1	5	2	50	✔	✔	—	—	1/1	—	—	100 ns			8		8				8	0.80
UCC3813-2	5	2	100	✔	✔	—	—	1/1	—	—	100 ns			8		8				8	0.80
UCC3813-3	4	2	100	✔	✔	—	—	1/1	—	—	100 ns			8		8				8	0.80
UCC3813-4	5	2	50	✔	✔	—	—	1/1	—	—	100 ns			8		8				8	0.80
UCC3813-5	4	2	50	✔	✔	—	—	1/1	—	—	100 ns			8		8				8	0.80
UC28023	5.1	1	Prog.	✔	✔	—	—	1.5/1.5	—	✔	—						16			16	1.35
UC3842	5	1.5	100	—	✔	—	—	1/1	—	—	—					8/14				8	0.80
UC3843	5	1.5	100	—	✔	—	—	1/1	—	—	—					8/14				8	0.80
UC3844	5	1.5	50	—	✔	—	—	1/1	—	—	—					8/14				8	0.80
UC3845	5	1.5	50	—	✔	—	—	1/1	—	—	—					8/14				8	0.80
UC3842A	5	1.5	100	—	✔	—	—	1/1	—	—	—					8/14				8	0.80
UC3843A	5	1.5	100	—	✔	—	—	1/1	—	—	—					8/14				8	0.80
UC3844A	5	1.5	50	—	✔	—	—	1/1	—	—	—					8/14				8	0.80
UC3845A	5	1.5	50	—	✔	—	—	1/1	—	—	—					8/14				8	0.80
UCC38C40	5	2	100	—	✔	—	—	1/1	—	—	—	8				8				8	0.95
UCC38C41	5	2	50	—	✔	—	—	1/1	—	—	—	8				8				8	0.95
UCC38C42	5	2	100	—	✔	—	—	1/1	—	—	—	8				8				8	0.95
UCC38C43	5	2	100	—	✔	—	—	1/1	—	—	—	8				8				8	0.95
UCC38C44	5	2	50	—	✔	—	—	1/1	—	—	—	8				8				8	0.95
UCC38C45	5	2	50	—	✔	—	—	1/1	—	—	—	8				8				8	0.95
UCC3884	5	2.5	100	✔	✔	—	✔	1/0.5	—	—	—					16				16	1.60
UC3823	5.1	1	Prog.	✔	✔	—	✔	1.5/1.5	—	✔	—						16		20	16	1.60
UC3823A/B	5.1	1	Prog.	✔	✔	—	✔	2/2	—	✔	—						16		20	16	4.90
UCC35705	—	—	93	—	—	—	✔	0.1/0.1	N/A	—	—	8				8				8	1.05

[1] *Suggested resale price in U.S. dollars in quantities of 1,000.*

PWM Power Supply Controllers

Selection Guide (Continued)

(Device parameters continued on next page)

Device	Typical Power Level (W)	Control Method: Voltage Mode	Control Method: Current Mode	Control Method: Avg. Current Mode	Topologies: Buck	Boost	Flyback (SEPIC, Cuk)	Fwd (Including 2-Switch Fwd)	Forward (D > 50%)	Interleaved Fwd/Flyback/Boost	Act-Clamp Fwd/Flyback	Push-Pull	I-Fed/V-Fed Push-Pull	Half-Bridge	Full-Bridge	Φ-Shifted FB	Maximum Practical Frequency	Start-Up Current	Operating Current	Supply Voltage (V)	110-V Start-Up Circuit	UVLO: On/Off (V)
General-Purpose Single-Ended Controllers (Continued)																						
UCC35706	25 to 250	✔				✔	✔	✔									4 MHz	50 µA	2.5 mA	8.0 to 15	—	12/8
UC3849	50 to 250			✔				✔	✔								1 MHz	—	21 mA	8.4 to 20	—	8.4/8
Wide-Input Range Voltage Mode Controllers																						
TL494	50 to 500	✔			✔	✔	✔	✔	✔	✔		✔		✔	✔		300 kHz		7.5 mA	7 to 40		—
TL594	50 to 500	✔			✔	✔	✔	✔	✔	✔		✔		✔	✔		300 kHz		12.4 mA	7 to 40		6.1/6
TL598	50 to 500	✔			✔	✔	✔	✔	✔	✔		✔		✔	✔		300 kHz		15 mA	7 to 40		6.1/6
UCC3570	25 to 250	✔					✔	✔	✔								500 kHz	85 µA	1 mA	9.0 to 15	—	13.0/9
UCC35701	25 to 250	✔					✔	✔	✔								700 kHz	130 µA	750 µA	9.0 to 15	—	13.0/9
UCC35702	25 to 250	✔					✔	✔	✔								700 kHz	130 µA	750 µA	8.8 to 15	—	9.6/8.8
UCC35705	25 to 250	✔				✔	✔	✔	✔								4 MHz	50 µA	2.5 mA	8.2 to 15	—	8.8/8.2
UCC35706	25 to 250	✔				✔	✔	✔	✔								4 MHz	50 µA	2.5 mA	8.0 to 15	—	12/8
Dual Output Controllers																						
UC3825	50 to 750	✔	✔									✔		✔	✔		1 MHz	1.1 mA	22 mA	9 to 30	—	9.2/8.4
UC3825A/B	50 to 750	✔	✔									✔		✔	✔		1 MHz	100 µA	28 mA	9 to 22	—	16/109.2/8.4
UC3846	50 to 750	✔	✔									✔		✔	✔		500 kHz	1.5 mA	17 mA	8 to 40	—	7.7/7
UC3856	50 to 750	✔	✔									✔		✔	✔		1 MHz	1.5 mA	17 mA	8 to 40	—	7.7/7
UC28025	50 to 750	✔	✔									✔		✔	✔		1 MHz	1.1 mA	22 mA	9 to 30	—	9.2/8.4
UCC3806	50 to 750	✔	✔									✔		✔	✔		350 kHz	100 µA	1.4 mA	7 to 15	—	7.5/6.7
UCC3808-1/-2/A-1/A-2	50 to 500		✔									✔		✔	✔		1 MHz	130 µA	1 mA	4.3 to 15	—	12.5/8.34.3/4.1
UCC38083-86	50 to 500		✔									✔		✔	✔		1 MHz	130 µA	20 mA	8.3 to 15	—	12.5/8.3
UC3524	50 to 500	✔										✔		✔	✔		250 kHz	—	—	8 to 40	—	—
UC3524A	50 to 500	✔										✔		✔	✔		250 kHz	4 mA	5 mA	8 to 40	—	7.5/7
UC3525A/B	50 to 500	✔										✔		✔	✔		250 kHz	—	14 mA	8 to 40	—	7.0/7.0
UC3526A	50 to 500	✔										✔		✔	✔		250 kHz	—	14 mA	8 to 35	—	—
UCC28220	50 to 800		✔							✔							1 MHz/ch.	200 µA	3 mA	8 to 14.5	—	10/8
UCC28221	50 to 800		✔							✔							1 MHz/ch.	500 µA	3 mA	8 to 14.5	✔	13/8
UC3827-1/-2	50 to 500		✔										✔				450 kHz	1000 µA	32 mA	8.4 to 20	—	9/8.4
UCC3810	50 to 500	✔	✔		✔	✔	✔	✔		✔							1 MHz	150 µA	2 mA	8.3 to 11	—	11.3/8.3
Soft-Switching, ZVT and ZVS Controllers																						
UCC3580-1/-2/-3/-4	50 to 500	✔							✔		✔						500 kHz	100 µA	1.5 mA	7 to 15	—	15/8.5,9.8/5
UCC2891/2/3/4	75 to 600		✔						✔		✔						1 MHz	300 µA	2 mA	8.5 to 14.5	✔[2]	13/8.0
UCC2897	75 to 600		✔						✔		✔						1 MHz	300 µA	2 mA	8.5 to 14.5	✔	13/8.0
UC3875-8	200 W to 2 kW	✔	✔	✔							✔					✔	1+ MHz	150 µA	45 mA	10.7 to 20	—	10.7/9.315/9
UC3879	200 W to 2 kW	✔	✔													✔	500 kHz	150 µA	27 mA	11 to 20	—	15.2/910.7/9
UC3895	200 W to 2 kW	✔	✔	✔												✔	1 MHz	150 µA	5 mA	11 to 17	—	11/ 9
Secondary-Side, Post Regulation																						
UC3824	50 to 250	✔	✔														1 MHz	1.1 mA	22 mA	9 to 30	—	9.2/8.4
UCC3583	50 to 500																500 kHz	100 µA	3 mA	8.5 to 15	—	9/8.4
UCC2540	50 to 500	✔			✔												1000 kHz	—	12 mA	2.8 to 36	—	—
UCC3580-1/-2/-3/-4	50 to 500	✔									✔						500 kHz	100 µA	1.5 mA	7 to 15	—	15/8.5,9.8/5
UCC3960	25 to 250	✔			✔	✔	✔	✔									400 kHz	150 µA	2.3 mA	8.0 to 19	—	9.5/10.5
UCC3961	25 to 250	✔			✔	✔	✔	✔									400 kHz	150 µA	2.3 mA	8.0 to 19	—	9.5/10.5

[1] *Suggested resale price in U.S. dollars in quantities of 1,000.*
[2] *UCC2891 and UCC2893.*

PWM Power Supply Controllers

(Device parameters continued from previous page)

Device	V_{REF} (V)	V_{REF} Tol. (%)	Max Duty Cycle (%)	Soft Start	E/A	Shut-down Pin	Voltage Feed-forward	Output Drive (Sink/Source) (A)	Slope Comp	Sync Pin	Leading Edge Blanking	Available Packages									Price[1]
												MSOP	SSOP	TSSOP	HTSSOP-PowerPAD™	SOIC	SOIC-W (300 mil)	SOIC-W Power	PLCC	DIL (PDIP)	
General-Purpose Single-Ended Controllers (Continued)																					
UCC35706	—	—	93	—	—	—	✔	0.1/0.1	N/A	—	—	8				8				8	1.05
UC3849	5	2	Prog	✔	✔	—	—	0.3/0.3	—	—	✔						24		28	24	3.05
Wide-Input Range Voltage Mode Controllers																					
TL494	5	5	45	—	✔	—	—	0.2/0.2	N/A	✔	—			16		16				16	0.23
TL594	5	1	45	—	✔	—	—	0.2/0.2	N/A	✔	—			16		16				16	0.38
TL598	5	1	45	—	✔	—	—	0.2/0.2	N/A	✔	—					16				16	0.81
UCC3570	5	2	Prog.	✔	—	✔	✔	1.2/1.2	N/A	—	N/A					14				14	3.45
UCC35701	5	1.5	VS Clamp	✔	—	✔	✔	1.2/1.2	N/A	✔	N/A			14		14				14	2.95
UCC35702	5	1.5	VS Clamp	✔	—	✔	✔	1.2/1.2	N/A	✔	N/A			14		14				14	1.93
UCC35705	—	—	93	—	—	—	✔	0.1/0.1	N/A	—	N/A	8				8				8	1.05
UCC35706	—	—	93	—	—	—	✔	0.1/0.1	N/A	—	N/A	8				8				8	1.05
Dual Output Controllers																					
UC3825	5.1	1	Prog.	✔	✔	—	—	1.5/1.5	—	✔	—						16		20	16	1.60
UC3825A/B	5.1	1.5	Prog.	✔	✔	—	—	2/2	—	✔	—						16		20	16	2.65
UC3846	5	2	Prog.	✔	✔	—	—	0.5/0.5	—	✔	—						16		20	16	1.60
UC3856	5	2	Prog.	✔	✔	—	—	0.5/0.5	—	✔	—						16		20	16	1.70
UC28025	5.1	1	Prog.	✔	✔	—	—	1.5/1.5	—	✔	—						16			16	1.35
UCC3806	5.1	3	Prog.	✔	✔	✔	—	0.5/0.5	—	✔	—		16	16		16	16		20	16	4.10
UCC3808-1/-2/A-1/A-2	—	—	Prog.	✔	✔	—	—	1.0/0.5	—	✔	—			8		8				8	1.20
UCC38083-86	5	2	50	✔	—	—	—	1.0/0.5	Prog.	—	—			8		8				8	1.30
UC3524	5	4	45	—	✔	✔	—	0.1/0.1	N/A	✔	—					16				16	0.67
UC3524A	5	2	Prog.	✔	✔	✔	—	0.2/0.2	—	✔	—					16				16	1.70
UC3525A/B	5	2	Prog.	✔	✔	✔	—	0.2/0.2	—	✔	—					16			20	16	1.05
UC3526A	5.1	1.3	Prog.	✔	✔	✔	—	0.2/0.2	—	✔	—					16			20	16	1.05
UCC28220	3.3	4.5	Prog.	✔	—	—	—	0.01/0.01	Prog.	—	—			16		16					1.13
UCC28221	3.3	4.5	Prog.	✔	—	—	—	0.01/0.01	Prog.	—	—			20		16					1.20
UC3827-1/-2	5	4	—	✔	✔	—	—	1/0.8	—	✔	—						24		28	24	5.65
UCC3810	5	2	50	—	✔	✔	—	1/1	—	✔	—					16				16	1.85
Soft-Switching, ZVT and ZVS Controllers																					
UCC3580-1/-2/-3/-4	5	1	Prog.	✔	✔	✔	✔	0.5/1, 0.3/0.3	—	—	—					16				16	2.40
UCC2891/2/3/4	5	1	Prog.	✔	—	✔	—	2/2, 2/2	Prog.	✔	—			16		16					1.57
UCC2897	5	1	Prog.	✔	—	✔	—	2/2, 2/2	Prog.	✔	—			20		16					1.80
UC3875-8	5	2	Prog.	✔	✔	—	—	Four @ 2/2	—	✔	—							20	28	20	4.85
UC3879	5	2.5	Prog.	✔	✔	—	—	Four @ 0.1/0.1	—	✔	—						20		28	20	3.70
UCC3895	5	3	Prog.	✔	✔	✔	—	Four @ 0.1/0.1	—	✔	—						20		20	20	4.35
Secondary-Side, Post Regulation																					
UC3824	5.1	1	Prog.	✔	✔	—	—	1.5/1.5	—	✔	—						16			16	4.55
UCC3583	5	1.5	9.5	✔	✔	—	—	0.5/1.5	—	✔	—					14			20	14	2.10
UCC2540	3.3	0.6	100	✔	✔	—	—	3/3	—	✔	—				20						1.85
UCC3580-1/-2/-3/-4	5	1	Prog.	✔	✔	✔	✔	0.5/1, 0.3/0.3	—	—	—					16				16	2.40
UCC3960	—	—	72	✔	—	—	—	0.75/1.5	—	—	—					8				8	1.25
UCC3961	—	—	72	✔	—	—	—	0.75/1.5	—	—	—					14				14	1.35

[1] *Suggested resale price in U.S. dollars in quantities of 1,000.*

MOSFET Drivers

Design Factors

Supply Voltage Range — With internal voltage regulators, MOSFET drivers can operate over a wide input voltage range, making them flexible for many applications.

Number of Outputs — Single and dual drivers are available to complement DC/DC switching and motor control applications.

Output Configuration — Inverting, non-inverting, AND and NAND configurations are available.

TrueDrive™ Output Stage —- Used in TI high-current gate drivers and controllers, the TrueDrive output architecture is constructed of bipolar and CMOS transistors in parallel. TrueDrive technology delivers high current where it is needed most—at the MOSFET Miller plateau region thresholds—and provides switching efficiency gains.

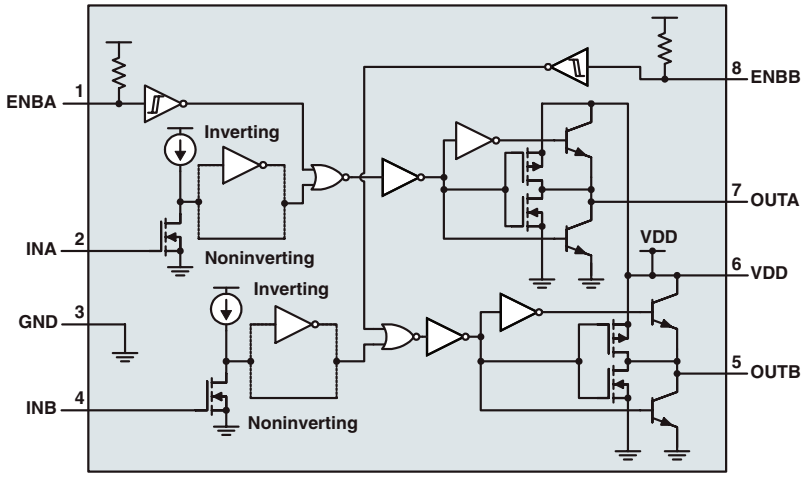
Predictive Gate Drive™ — This patented TI technology is a digital control technique to control delay times in high-efficiency, low-output-voltage synchronous buck converters. See our application notes (SLUA281 and SLUA285) on Predictive Gate Drive for a complete description.

Dual 4-A MOSFET Drivers with Enable
UCC27423, UCC27424, UCC27425

Get samples and datasheets at: **www.ti.com/sc/device/PARTnumber**
(Replace **PARTnumber** with **UCC27423**, **UCC27424** or **UCC27425**)

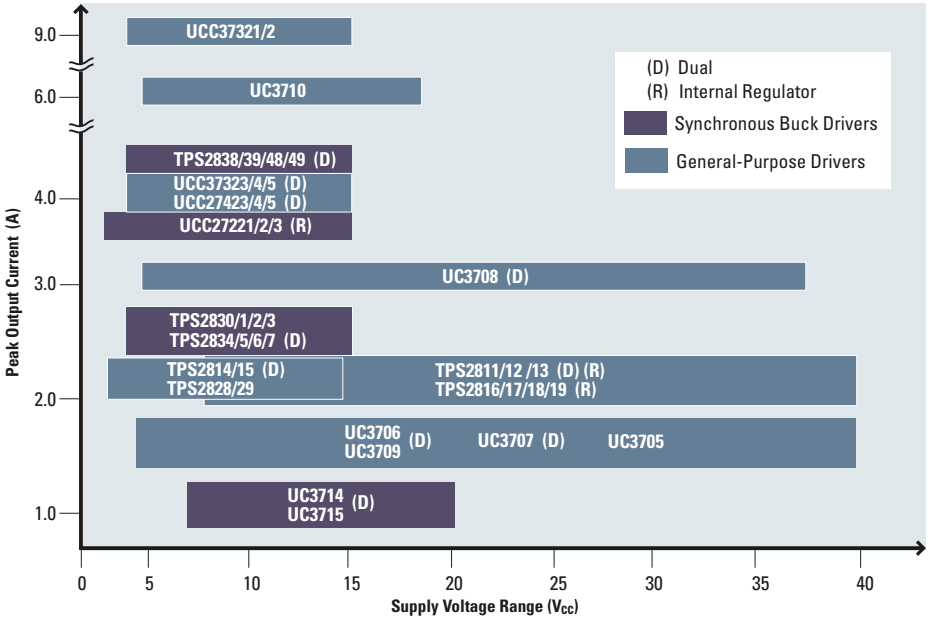
Key Features

- Independent enable functions for each driver
- Industry-standard pinout
- High-current drive capability of ±4 A
- Unique bipolar and CMOS TrueDrive™ output stage provides high current at MOSFET Miller thresholds



UCC27423/24/25 block diagram.

MOSFET Drivers Family of Products



Selection Guide

Device	No. of Outputs	Output Configuration	Output Type[1]	Peak I_{OUT} Source/Sink (A)	Rise/Fall Time (ns)	V_{CC} Range (V)	Prop Delay (ns)	Input Threshold	Enable	Dead Time Control	Protection Features[2]	Internal Regulator	Price[3]
General-Purpose Low-Side Drivers													
TPS2811	2	Inverting	TrueDrive™	2.0/2.0	25/25	4 to 40	40	CMOS	—	—	—	✔	0.90
TPS2812	2	Non-inverting	TrueDrive	2.0/2.0	25/25	4 to 40	40	CMOS	—	—	—	✔	0.90
TPS2813	2	See Note 5	TrueDrive	2.0/2.0	25/25	4 to 14	40	CMOS	—	—	—	✔	0.90
TPS2814	2	Dual 2-input AND; one inverting	TrueDrive	2.0/2.0	25/25	4 to 14	40	CMOS	✔	—	—	—	0.90
TPS2815	2	2-input NAND	TrueDrive	2.0/2.0	25/25	4 to 14	40	CMOS	✔	N/A	—	—	0.65
TPS2816	1	Inverting	TrueDrive	2.0/2.0	25/25	4 to 40	40	CMOS	—	N/A	—	✔	0.65
TPS2817	1	Non-inverting	TrueDrive	2.0/2.0	25/25	4 to 40	40	CMOS	—	N/A	—	✔	0.65
TPS2818	1	Inverting	TrueDrive	2.0/2.0	25/25	4 to 40	40	CMOS	—	N/A	—	✔	0.65
TPS2819	1	Non-inverting	TrueDrive	2.0/2.0	25/25	4 to 40	40	CMOS	—	N/A	—	✔	0.65
TPS2828	1	Inverting	TrueDrive	2.0/2.0	25/25	4 to 14	40	CMOS	—	N/A	—	—	0.60
TPS2829	1	Non-inverting	TrueDrive	2.0/2.0	25/25	4 to 14	40	CMOS	—	N/A	—	—	0.60
UC3714	2	Non-inverting	Bipolar	0.5/1.0	30/25	7 to 20	50	TTL/PWM	✔	Adj.	—	—	0.85
UC3715	2	See Note 5	Bipolar	1.0/2.0	30/25	7 to 20	50	TTL/PWM	✔	Adj.	—	—	0.85
UCC27423	2	Inverting	TrueDrive	4.0/4.0	25/25	4 to 15	35	TTL/CMOS	✔	—	—	—	0.99
UCC27424	2	Non-inverting	TrueDrive	4.0/4.0	25/25	4 to 15	35	TTL/CMOS	✔	—	—	—	0.99
UCC27425	2	See Note 5	TrueDrive	4.0/4.0	25/25	4 to 15	35	TTL/CMOS	✔	—	—	—	0.99
UCC37321	1	Inverting	TrueDrive	9/9	20/20	4 to 15	30	TTL/CMOS	✔	—	—	—	0.99
UCC37322	1	Non-inverting	TrueDrive	9/9	20/20	4 to 15	30	TTL/CMOS	✔	—	—	—	0.99
UCC37323	2	Inverting	TrueDrive	4.0/4.0	25/25	4 to 15	35	TTL/CMOS	—	—	—	—	0.99
UCC37324	2	Non-inverting	TrueDrive	4.0/4.0	25/25	4 to 15	35	TTL/CMOS	—	—	—	—	0.99
UCC37325	2	See Note 5	TrueDrive	4.0/4.0	25/25	4 to 15	35	TTL/CMOS	—	—	—	—	0.99
Synchronous Buck Drivers													
TPS2830	2	Non-inverting	TrueDrive	2.4/2.4	50/50	4.5 to 15	75	CMOS	✔	Adaptive	OVPC	—	1.05
TPS2831	2	Inverting	TrueDrive	2.4/2.4	50/50	4.5 to 15	75	CMOS	✔	Adaptive	OVPC	—	1.05
TPS2832	2	Non-inverting	TrueDrive	2.4/2.4	50/50	4.5 to 15	75	CMOS	—	Adaptive	—	—	1.00
TPS2833	2	Inverting	TrueDrive	2.4/2.4	50/50	4.5 to 15	75	CMOS	—	Adaptive	—	—	1.00
TPS2834	2	Non-inverting	TrueDrive	2.4/2.4	30/30	4.5 to 15	70	TTL	✔	Adaptive	OVPC	—	1.05
TPS2835	2	Inverting	TrueDrive	2.4/2.4	30/30	4.5 to 15	70	TTL	✔	Adaptive	OVPC	—	1.05
TPS2836	2	Non-inverting	TrueDrive	2.4/2.4	30/30	4.5 to 15	70	TTL	—	Adaptive	—	—	1.25
TPS2837	2	Inverting	TrueDrive	2.4/2.4	30/30	4.5 to 15	70	TTL	—	Adaptive	—	—	1.25
TPS2838	2	Non-inverting	TrueDrive	4/4	120	10 to 15	40	TTL	✔	Adaptive	—	✔	1.30
TPS2839	2	Inverting	TrueDrive	4/4	120	10 to 15	40	TTL	✔	Adaptive	—	✔	1.30
TPS2848	2	Non-inverting	TrueDrive	4/4	120	10 to 15	20	TTL	✔	Adaptive	—	✔	1.25
TPS2849	2	Inverting	TrueDrive	4/4	120	10 to 15	20	TTL	✔	Adaptive	—	✔	1.25
UCC27221	2	Inverting	TrueDrive	3.3/3.3	20/20	3.7 to 20	82/103	TTL	—	PGD[4]	—	✔	1.35
UCC27222	2	Non-Inverting	TrueDrive	3.3/3.3	20/20	3.7 to 20	82/103	TTL	—	PGD[4]	—	✔	1.35
UCC27223	2	Non-Inverting	TrueDrive	3.3/3.3	25/35	4.15 to 20	82/103	TTL	✔	PGD[4]	—	✔	1.35

[1] *Output type: TrueDrive is the hybrid bipolar/CMOS output architecture for improved current drive capability at low voltages (at Miller threshold).*
[2] *OVPC = over-voltage protection crowbar.*
[3] *Suggested resale price in U.S. dollars in quantities of 1,000.*
[4] *Predictive Gate Drive™.*
[5] *One inverting, one non-inverting.*

*New devices are listed in **bold red**.*

Resources *For a complete list of Resources, visit power.ti.com*

Part Number	Description	Price[1]
Evaluation Modules (EVMs)		
TPS2817	Power Supply Evaluation Module with TPS2817 MOSFET Driver	50
UCC27222EVM-001	Synchronous Buck Converter Providing a Variable Output Between 0.9 V and 1.8 V at 20 A from a 5-V Input	49
UCC27223EVM	Synchronous Buck Converter Providing a Variable Output Between 0.9 V and 1.8 V at 20 A from a 5-V Input	49

Literature Number	Description
Application Notes	
SLUA281	Predictive Gate Drive™ Boosts Synchronous DC/DC Power Converter Efficiency
SLUA285	Predictive Gate Drive FAQs
SLMA002	PowerPAD™ Thermally Enhanced Package Technical Brief
SEM1400	Design and Applications Guide for High-Speed MOSFET Gate Drive Circuits

[1] *Suggested resale price in U.S. dollars.*

Loadshare Controllers

Design Factors

Current Sensing — The power supply output current can be sensed in either the high- or low-side of the output being loadshared. Two controllers (UC3907, UCC39002) can be used in either arrangement, however the UC3902 is for dedicated low-side (ground referenced) current sensing.

Single or Differential Current Sensing — Optimal results can be obtained using a differential current-sense technique in both high- and low-side applications. The single-ended configuration reduces pin count for dedicated, ground-referenced applications.

Single or Differential Share Bus — Depending on the amount of noise in any specific application, designers can choose to use either a single-ended or differential type common loadshare bus command among the modules being shared. True differential mode offers the most noise immunity, but the single-ended variety can also yield excellent results when designed with a high amplitude loadshare signal.

Master/Slave Status — One loadshare controller (the UC3907) features a master/slave output signal for interfacing with other power supplies and end-system diagnostic circuits.

Hot-Swap/Hot-Plug — The new UCC39002 features the ability to hot-swap or hot-plug modular power supplies without disturbing the loadshare bus "share" command.

Current Loop Compensation — Each of these loadshare controllers offers designers the ability to compensate the current share loop as required by the system or individual power supplies.

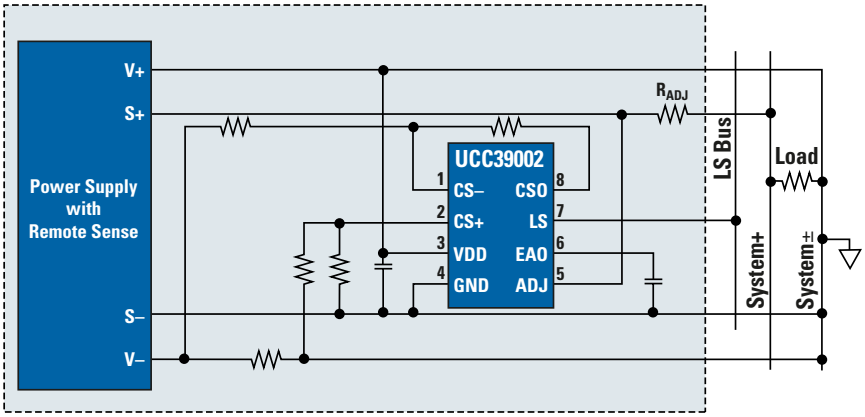
Intel SSI Compliance — The UCC39002 meets the Intel SSI spec requirements of 1) single connection between parallel modules and 2) scalable loadshare voltage independent of the CS resistor.

Advanced 8-Pin Loadshare Controller
UCC39002

Get samples, datasheets and app reports at: **www.ti.com/sc/device/UCC39002**

Key Features

- High accuracy, better than 1% current share error at full load
- High-side or low-side (GND reference) current-sense capability
- Ultra-low offset current-sense amplifier using post package trimming



Selection Guide

Device	V_{IN} (min)	V_{IN} (max)	Reference Accuracy (%)	Share Bus	Pin Count	Supply Current (mA)	Price[1]
UC3902	2.7	20	—	Differential	8	6	1.85
UC3907	4.5	35	1.25	Single Ended	16	6	2.10
UCC39002	4	15	—	Single Ended	8	2.5	0.95

[1]*Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

Resources

For a complete list of Resources, visit power.ti.com

Part Number	Description	Price[1]
Evaluation Module (EVM)		
UCC39002EVM	Advanced Loadshare Controller User's Guide, HPA027A	49

Literature Number	Description
Application Notes	
SLUA270A	48-V_{IN}, 12-V_{OUT} Loadshare System Using the UCC39002 with 3 DC/DC Modules
SLUA128	The UC3902 Loadshare Controller and its Performance in Distributed Power
SLUA147	UC3907 Loadshare IC Simplifies Parallel Power Supply Design

[1]*Suggested resale price in U.S. dollars.*

Design Factors

Battery Chemistry — Each battery chemistry has unique requirements for its charge algorithm, which is critical for maximizing its capacity, cycle life and safety.

Control Topology — A simple linear topology works well in applications with low-power (e.g., one- or two-cell Li-Ion) battery packs that are charged at less than 1 A.

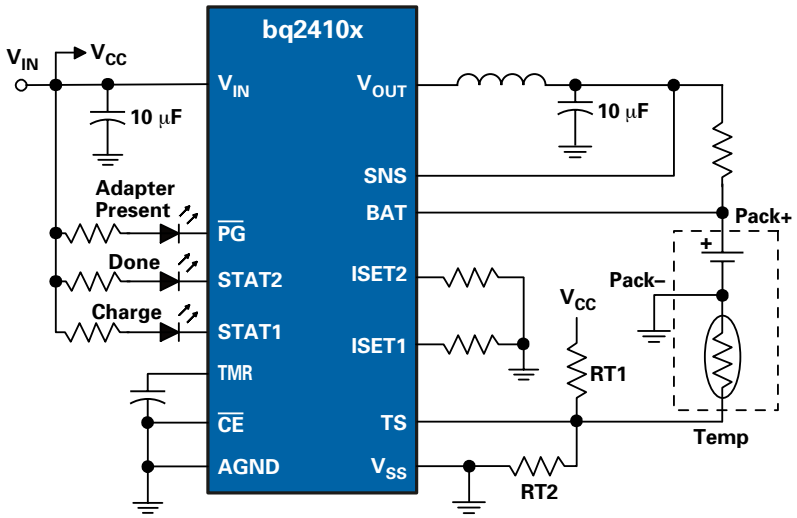
A switchmode topology is ideally suited for large (e.g., 3 or 4 series Li-Ion or multiple NiCd/NiMH) battery packs that require charge rates >1 A. The switchmode conversion minimizes heat generation during charging.

A charger using a current-limited topology requires a regulated or limited supply and simply gates the charging current.

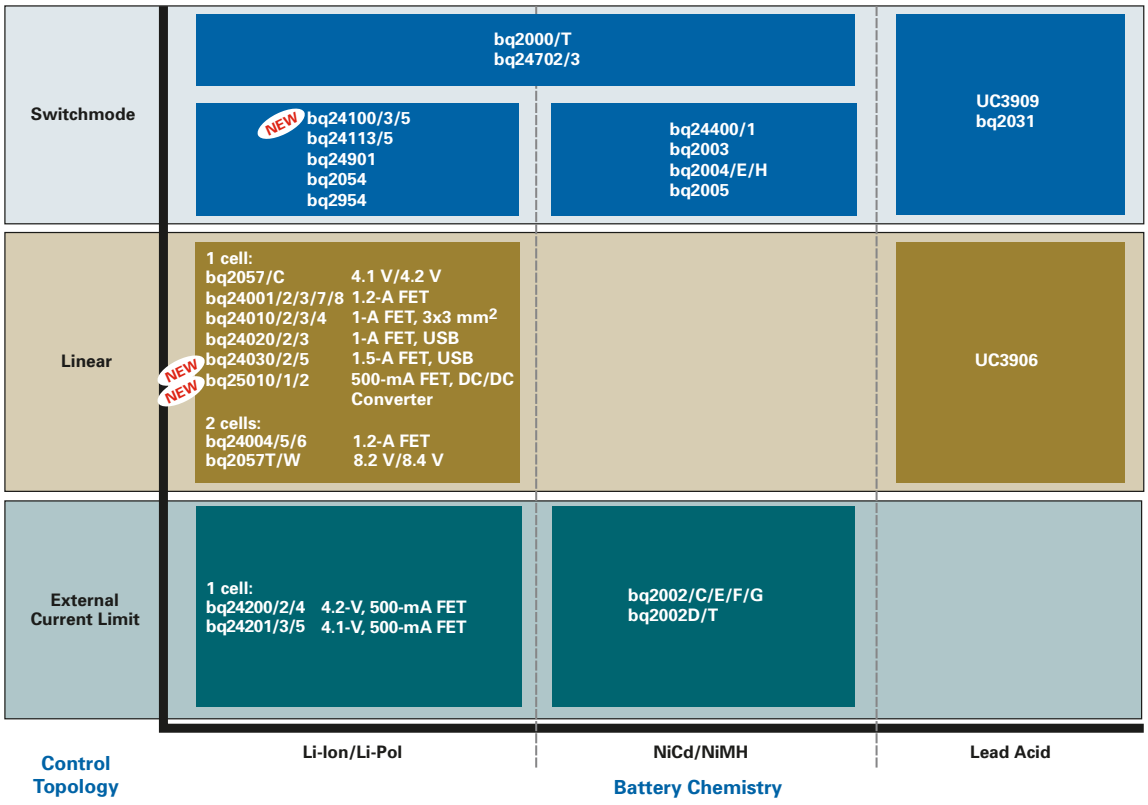
2-A Synchronous Switchmode Charger
bq2410x

Get datasheets at: **www.ti.com/sc/device/bq24100**

The bq2410x are 2-A synchronous switchmode charge management devices for 1, 2 and 3 series Li-Ion or Li-polymer battery packs.



Charge Management Family of Products



Charge Management

Selection Guide

Device	Number of Cells	Control Topology[1]	Integrated Power FET	Charge Current Internal FET	Comments	Primary Charge Termination Method[2]	Safety Timer	Temp Monitor	Charge Status Outputs	Packaging					EVM	Price[3]
										QFN/MLP	MSOP	TSSOP	SOIC	DIP		
Multi-Chemistry (Li-Ion and NiCd/NiMH)																
bq2000	Multiple	Switching	No	—	Charges NiCd, NiMH, and Li-Ion	PVD, min current	Yes	Yes	1			8	8	8	✔	1.70
bq2000T	Multiple	Switching	No	—	Charges NiCd, NiMH, and Li-Ion	ΔT/Δt, min current	Yes	Yes	1			8	8	8	✔	1.70
bq24702/3	Multiple	Switching	No	—	Charges any chemistry, Dynamic Power Management	Host controlled	No	No	0			24			✔	3.10
Li-Ion Chemistry																
bq24200	1	Current-limited	Yes	500 mA	4.2-V regulation	Min current	Yes	Yes	1		8				✔	1.50
bq24201	1	Current-limited	Yes	500 mA	4.1-V regulation	Min current	Yes	Yes	1		8					1.50
bq24202	1	Current-limited	Yes	500 mA	4.2-V regulation	Min current	Yes	No	1		8					1.50
bq24203	1	Current-limited	Yes	500 mA	4.1-V regulation	Min current	Yes	No	1		8					1.50
bq24204	1	Current-limited	Yes	500 mA	4.2-V regulation	Min current	Yes	No	0		8					1.50
bq24205	1	Current-limited	Yes	500 mA	4.1-V regulation	Min current	Yes	No	0		8					1.50
bq2057/C	1	Linear	No	—	Low dropout, 4.1-V[4] regulation, AutoComp™	Min current	No	Yes	1		8	8	8		✔	1.35
bq2057T	2	Linear	No	—	Low dropout, 8.2-V regulation, AutoComp	Min current	No	Yes	1			8	8		✔	1.35
bq2057W	2	Linear	No	—	Low dropout, 8.4-V regulation, AutoComp	Min current	No	Yes	1			8	8		✔	1.35
bq24001	1	Linear	Yes	1.2 A	4.1-V or 4.2-V regulation	Min current	Yes	Yes	1	20		20			✔	1.80
bq24002	1	Linear	Yes	1.2 A	4.1-V or 4.2-V regulation	Min current	Yes	Yes	2	20		20			✔	1.80
bq24003	1	Linear	Yes	1.2 A	4.1-V or 4.2-V regulation	Min current	Yes	Yes	Bicolor	20		20			✔	1.80
bq24004	2	Linear	Yes	1.2 A	8.2-V or 8.4-V regulation	Min current	Yes	Yes	1	20		20			✔	1.80
bq24005	2	Linear	Yes	1.2 A	8.2-V or 8.4-V regulation	Min current	Yes	Yes	2	20		20				1.80
bq24006	2	Linear	Yes	1.2 A	8.2-V or 8.4-V regulation	Min current	Yes	Yes	Bicolor	20		20				1.80
bq24007	1	Linear	Yes	1.2 A	4.1-V or 4.2-V regulation, timer enable/disable pin	Min current	Yes	Yes	1	20		20			✔	1.80
bq24008	1	Linear	Yes	1.2 A	4.1-V or 4.2-V regulation, timer enable/disable pin	Min current	Yes	Yes	Bicolor			20				1.80
bq24010	1	Linear	Yes	1.0 A	4.2-V regulation, ac present (PG) and temp sense (TS)	Min current	Yes	Yes	2	10					✔	1.60
bq24012	1	Linear	Yes	1.0 A	4.2-V regulation, ac present (PG) and chip enable pins (CE)	Min current	Yes	No	2	10					✔	1.60
bq24013	1	Linear	Yes	1.0 A	4.2-V regulation, CE and termination enable (TTE)	Min current	Yes	No	2	10					✔	1.60
bq24014	1	Linear	Yes	1.0 A	4.2-V regulation, CE and TS	Min current	Yes	Yes	2	10						1.60
bq24020	1	Linear	Yes	1.0 A	Integrated USB charging, 4.2-V reg., CE and TS	Min current	Yes	Yes	2	10					✔	1.85
bq24022	1	Linear	Yes	1.0 A	Integrated USB charging, 4.2-V reg., PG and CE	Min current	Yes	No	2	10					✔	1.85
bq24023	1	Linear	Yes	1.0 A	Integrated USB charging, 4.2-V reg., CE and TTE	Min current	Yes	No	2	10					✔	1.85
bq24024	1	Linear	Yes	1.0 A	Integrated USB charging, 4.2-V reg., TTE and TS	Min current	Yes	Yes	2	10						1.85
bq24025	1	Linear	Yes	1.0 A	Integrated USB charging, 4.2-V reg., CE and TS, 7-hr timer	Min current	Yes	Yes	2	10						1.85
bq24026	1	Linear	Yes	1.0 A	Integrated USB charging, 4.2-V reg., TE and TS, 7-hr timer	Min current	Yes	Yes	2	10						1.85
bq24030	1	Linear	Yes	1.5 A	USB, dynamic power mgmt, 4.2-V reg., AC regulated to 6 V	Min current	Yes	Yes	2	20					✔	2.30
bq24032	1	Linear	Yes	1.5 A	USB, dynamic power mgmt, 4.2-V reg., AC regulated to 4.4 V	Min current	Yes	Yes	2	20					✔	2.30
bq24035	1	Linear	Yes	1.5 A	USB, dynamic power mgmt, 4.2-V reg., AC cutoff at 6 V	Min current	Yes	Yes	2	20					✔	2.30
bq24100	1	Switching	Yes	2.0 A	Synchronous PWM with 20-V input	Min current	Yes	Yes	2	20						2.10
bq24103/113	1 or 2	Switching	Yes	2.0 A	Synchronous PWM with 20-V input	Min current	Yes	Yes	2	20						2.20
bq24105/115	Multiple	Switching	Yes	2.0 A	Synchronous PWM with 20-V input, prog. output voltage	Min current	Yes	Yes	2	20						3.50
bq25010	1	Linear	Yes	500 mA	USB, 4.2-V reg. integrated DC/DC converter, V_{OUT} adjustable	Min current	Yes	No	2	20					✔	2.05
bq25011	1	Linear	Yes	500 mA	USB, 4.2-V reg. integrated DC/DC converter, V_{OUT} = 3.3 V	Min current	Yes	No	2	20					✔	2.05
bq25012	1	Linear	Yes	500 mA	USB, 4.2-V reg. integrated DC/DC converter, V_{OUT} = 1.8 V	Min current	Yes	No	2	20					✔	2.05
bq24901	1	Switching	No	—	Primary-side controller for offline chargers, 4.2-V regulation	Min current	Yes	Yes	2				14			2.10
bq2054	Multiple	Switching	No	—	PWM control, low-side current sense	Min current	Yes	Yes	3				16	16	✔	2.30
bq2954	Multiple	Switching	No	—	PWM control, low/high-side current sense	Min current	Yes	Yes	2				16	16	✔	2.50
NiCd/NiMH Chemistry																
bq2002/C/E/F	Multiple	Current-limited	No	—	Low-cost nickel charge ICs, different charge timers	–ΔV, PVD	Yes	Yes	1				8	8	✔	1.05
bq2002D/T	Multiple	Current-limited	No	—	Low-cost nickel charge ICs, different charge timers	ΔT/Δt	Yes	Yes	1				8	8	✔	1.05
bq24400	Multiple	Switching	No	—	Simple switching controller	PVD	Yes	Yes	1			8	8			1.55
bq24401	Multiple	Switching	No	—	Simple switching controller	ΔT/Δt	Yes	Yes	1			8	8			1.55
bq2003	Multiple	Switching	No	—	Discharge-before-charge option for NiCd batteries	–ΔV, ΔT/Δt	Yes	Yes	2				16	16	✔	2.20
bq2004/E/H	Multiple	Switching	No	—	Dual-LED charge status display with three user modes	–ΔV, PVD, ΔT/Δt	Yes	Yes	2				16	16	✔	2.20
bq2005	Multiple	Switching	No	—	Sequential fast charge of two NiCd/NiMH battery packs	–ΔV, ΔT/Δt	Yes	Yes	4				20		✔	2.20
Lead-Acid Chemistry																
UC3906	Multiple	Linear	No	—	Temp-compensated internal reference, 40-V V_{CC} rating	Max V, min I	No	No	1				16	16		2.75
UC3909	Multiple	Switching	No	—	Differential current sense input, 40-V V_{CC} rating	Max V, min I	No	Yes	2				20	20		3.05
bq2031	Multiple	Switching	No	—	Three user-selectable charge algorithms to accommodate cyclic and standby applications	Max V, $-\Delta^2$V, min I	Yes	Yes	3				16	16	✔	2.80

[1]Current-limited = gating control of external, current-regulated/limited source. [2]PVD = peak voltage detection; ΔT/Δt = rate of temperature rise; host controlled = system processor must terminate charging; –ΔV = negative voltage change; max V = maximum voltage; min I = minimum current; Δ^2V = second difference of cell voltage. [3]Suggested resale price in U.S. dollars in quantities of 1,000. [4]bq2057C provides 4.2-V regulation.

*New devices are listed in **bold red**. Preview devices are listed in **bold blue**.*

Design Factors

Battery Chemistry — Each battery chemistry has different operating characteristics, such as discharge profiles and self-discharge rate. TI gas gauge ICs are developed by chemistry to account for these differences to accurately display remaining energy in the battery.

Charge/Discharge Relationship — The charge and discharge rates dictate the sense resistor value.

Features

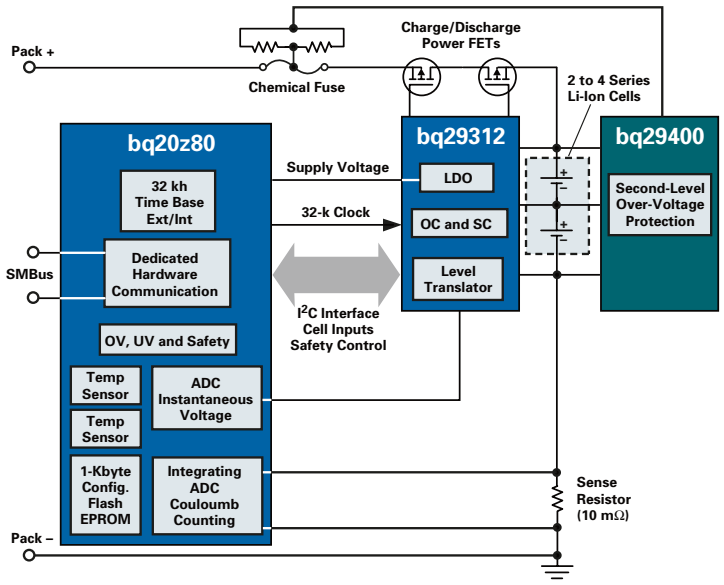
TI gas gauges and battery monitors accurately track battery activity to compute the remaining battery capacity and system run-time. They feature:

- Simple communication protocols.
- High-resolution analog-to-digital converters for accurate charge/discharge measurement.
- Integrated CPU on gas gauges to compute remaining battery capacity and run-time.

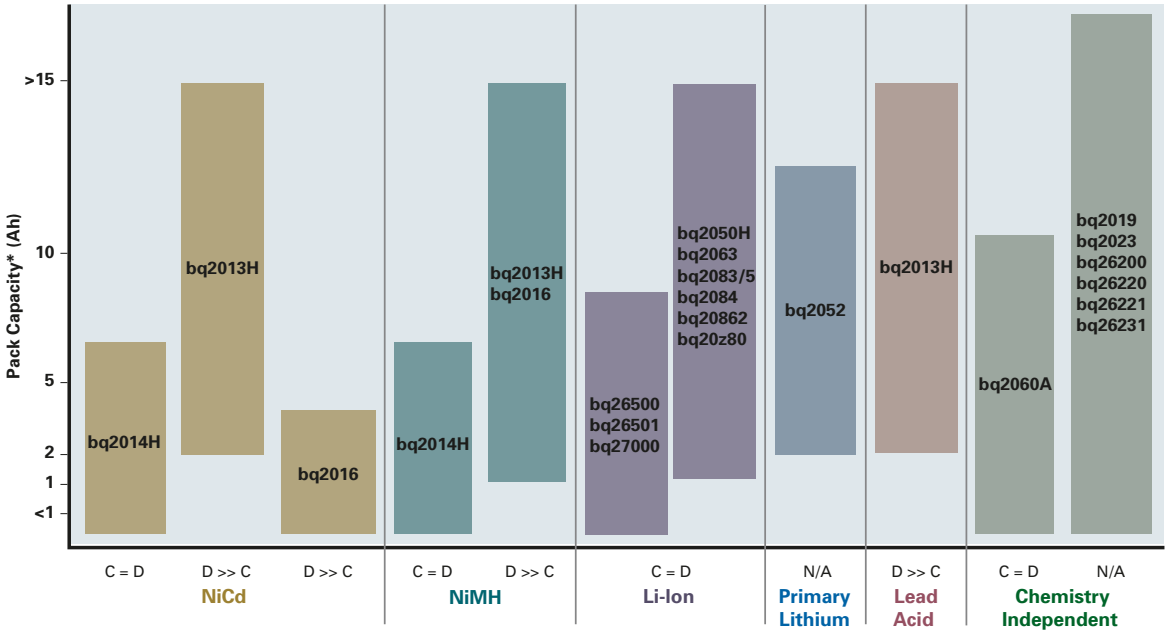
99% Accurate Gas Gauge Maximizes System Run-Time bq20z80

Get more information at: **www.ti.com/impedancetrack**

The dynamic Impedance Track™ gas-gauge algorithm in the bq20z80 extends battery usability, allowing use of the full chemical capacity available in a battery pack. Additional features include instant state-of-charge and real-time impedance learning. Impedance Track also enables reduction in development and production time. Remaining capacity is reported over the entire life of the battery pack with better than 99% accuracy. The bq20z80 is ideally suited for battery packs used in medical and industrial equipment, back-up batteries and laptop computers.



Battery Gas Gauges and Monitors Family of Products



C = D: Charge rate similar to discharge rate.
D>>C: Discharge rate much greater than charge rate.
N/A: Not Applicable.
*Pack capacity ratings provide an approximate range for each gas gauge.

Battery Gas Gauges and Monitors

Battery Gas Gauges Selection Guide

Device	Approx. Battery Capacity (mAh)[1]	Charge/Discharge Relationship[2]	Number of LEDs	Communication Protocol[3]	Other Features	Safety Enhancement	Available Packages	Price[4]
NiCd, NiMH Chemistry								
bq2013H	2000 to 15000	D>>C	5	HDQ	Programmable offset error compensation	No	16-pin SOIC	3.49
bq2014H	500 to 6000	C = D	5	HDQ	Register compatible with bq2050H	No	16-pin SOIC	3.49
bq2016	1000 to 4500	D>>C	5	HDQ	Automatic offset calibration	No	28-pin SSOP	3.29
Lithium-Ion, Lithium-Polymer Chemistry								
bq2050H	500 to 6000	C = D	5	HDQ	Register compatible with bq2014H	Yes	16-pin SOIC	3.49
bq2063	800 to 10000	C = D	4 or 5	SMBus or HDQ16	SBS 1.1 compliant with protector interfaces with S-8243	Yes	28-pin SSOP	3.69
bq2083	800 to 10000	C = D	3, 4 or 5	SMBus	SBS 1.1 works with bq29311	Yes	38-pin TSSOP	4.25
bq2085	800 to 10000	C = D	3, 4 or 5	SMBus	SBS 1.1 bq2083 with integrated time base	Yes	38-pin TSSOP	4.35
bq2084	800 to 10000	C = D	3, 4 or 5	SMBus	SBS 1.1 works with bq29312 with enhanced safety and data features	Yes	38-pin TSSOP	4.25
bq20862	800 to 10000	C = D	3, 4 or 5	DQ	SBS 1.1 works with bq29312 bq2084 with single-wire interface	Yes	38-pin TSSOP	4.25
bq20z80	800 to 10000	C = D	3, 4 or 5	SMBus	SBS 1.1 with Impedance Track™ technology	Yes	38-pin TSSOP	4.50
bq26500	300 to 6000	C = D	—	HDQ	Single- and dual-cell complete gas gauge	No	8-pin TSSOP	2.35
bq26501	300 to 6000	C = D	—	HDQ	Single- and dual-cell complete gas gauge with aligned interface to OMAP™ processor	No	8-pin TSSOP	2.35
bq27000	300 to 6000	C = D	—	HDQ or I^2C	Single- and dual-cell gas gauge with runtime to empty and charge time to full based on measured current	No	10-pin DRK	2.35
Primary Lithium Chemistry								
bq2052	1000 to 12000	NA	2, 4 or 5	HDQ	Automatic discharge compensation	No	16-pin SOIC	3.80
Lead Acid Chemistry								
bq2013H	2000 to 15000	D>>C	5	HDQ	Programmable offset error compensation	No	16-pin SOIC	3.49
Multi-Chemistry								
bq2060A	800 to 10000	C = D	4 or 5	SMBus or HDQ16	SBS 1.1 extended cold temp cell modeling and high temp safety enhancement, improved bq2060	Yes	28-pin SSOP	3.69

Battery Monitors Selection Guide

Device	VFC Resolution (µVh)	Temperature Measurement Resolution (°C)	Communication Protocol[3]	ID-ROM (Bits)	Memory	Program Output Ports	Other Features	Available Packages	Price[4]
bq2019	3.05	1	HDQ	64	RAM, FLASH	1	Non-volatile memory	8-pin TSSOP	1.82
bq2023	3.05	0.25	SDQ	64	RAM, FLASH	1	Automatic offset error compensation	8-pin TSSOP	1.87
bq26220	3.05	0.25	HDQ	64	RAM, FLASH	1	On-chip voltage measurement	8-pin TSSOP	1.92
bq26231	12.5	10	HDQ	—	—	0	—	8-pin TSSOP	1.42

[1]Battery capacity ratings provide an approximate range for each gas gauge.

*New devices are listed in **bold red**.*

[2]C = D — charge rate similar to discharge rate; D>>C — discharge rate much greater than charge rate; NA — not applicable.

[3]DQ = 1-wire 8-bit at 300 bps; HDQ = 1-wire 8-bit at 2 kbps; HDQ16 = 1-wire 16-bit at 5 kbps; I^2C = 2-wire interface; SDQ = 1-wire interface; SMBus = 2-wire 100 kHz.

[4]Suggested resale price in U.S. dollars in quantities of 1,000.

Resources *For a complete list of Resources, visit power.ti.com*

Part Number	Description	Price[1]
Evaluation Modules (EVMs)		
bq2013HEVM-001	bq2013H Evaluation Kit for NiCd, 16.8 V	99
bq2014HEVM-001	bq2014H Evaluation Kit for NiMH, 10.8 V	99
bq2050HEVM-002	bq2050H Evaluation Kit for Li-Ion, 10.8 V	99
bq2060AEVM-001	bq2060A Evaluation Kit for Li-Ion	99
bq2060AEVM-002	bq2060A Evaluation Kit for NiMH	99
bq2063EVM-001	bq2063 Evaluation Kit for Li-Ion	99
bq2083EVM-001	bq2083 Evaluation Kit for Li-Ion also features the bq29311	99
bq2084EVM-001	bq2084 Evaluation Kit also features the bq29312 and bq29400	99
bq20z80EVM-001	bq20z80 Evaluation kit also features the bq29312 and bq29400	99
bq26220EVM-001	bq26220 Evaluation Kit for Multi-Chemistry, 2.6 to 4.5 V	99
bq26500EVM-001	bq26500 Single-Cell Battery Fuel Evaluation Module	99

[1]Suggested resale price in U.S. dollars.

Literature Number	Description
Application Notes	
SLUA300	Multicell Li-Ion and Li-Pol Battery Gas-Gauge Application Using bq26500
SLUA304	bq2083 and bq2085 Board Offset Charaterization and Compensation
SLVA100	Advanced Gas Gauge Host Firmware Guide for the TI Battery Monitor ICs
SLVA101	HDQ Communication Basics for TI's Battery Monitor ICs
SLVA102	Gas Gauging Basics Using TI's Battery Monitor ICs
SLVA114	Advanced Gas Gauge Host Firmware Flow Chart for the TI Battery Monitor ICs
SLVA 148	bq2083, bq2084, and bq2085 Calibration Procedure
SLVA149	Configuring the bq2060 and bq2060a EEPROMs
SLVA150	Avoiding Clock Jitter with the bq2085 Advanced Gas Gauge
SLVA151	Using Advance Features of the bq2060A Gas-Gauge IC
SLVA155	Cell balancing in the bq208X advanced gas gauge solutions

Design Factors

Number of Series Cells — A battery is constructed from a string of series and parallel cells. Each series cell, or group of paralleled cells, requires protection from overcharge, overdischarge and short-circuit conditions.

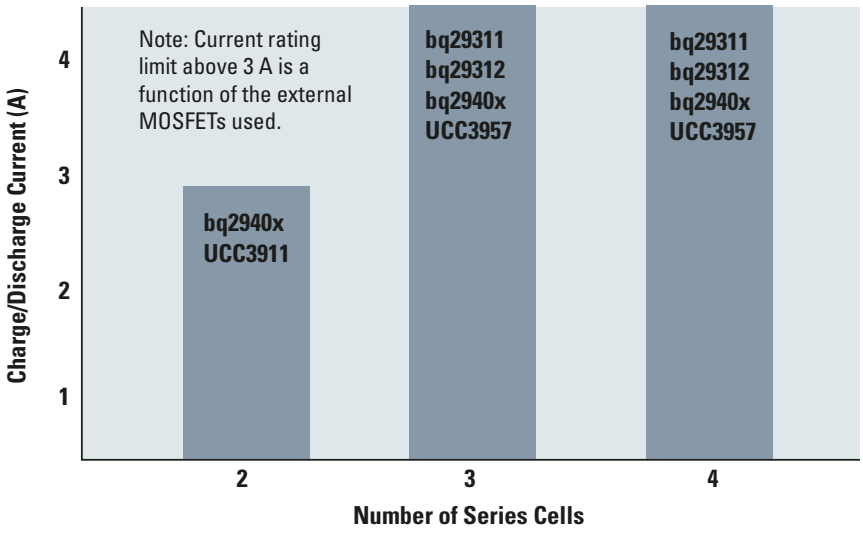
Threshold Voltage — Li-Ion and Li-polymer cells are produced by many manufacturers. Some manufacturers' technologies create cells of different maximum stress voltages, otherwise known as the "over-voltage threshold." This data is available from the cell supplier.

Threshold Tolerance — The over-voltage threshold has a tolerance that needs to be accounted for in the design for safety reasons.

Shutdown Current — In battery pack applications, constant current draw needs to be very low to preserve battery life.

Charge/Discharge Current — The pass element associated with each protection IC is rated for maximum current whether it be an internal or external FET.

Li-Ion Protection Family of Products



Features

- BiCMOS process results in low current consumption.
- Different over-voltage thresholds allow one design to work with several cell suppliers.
- Sleep current consumption of less than 3.5 µA enables extended battery life.
- 50 mV precision internally trimmed thresholds maximize safety.
- Short-circuit protection eliminates the need for an external fuse.

Selection Guide

Device	Number of Series Cells	Charge/Discharge Current (A)	Threshold Voltage (V_{OV})	Shutdown Current (µA)	Other Features	Available Packages	Price[1]
bq29311	3 or 4	External FET	bq2083/5[2]	1	Integrated LDO, can work directly with bq2083 gas gauge	24-pin TSSOP	1.20
bq29312	2, 3 or 4	External FET	bq2084[2]	1	Integrated LDO, can work directly with bq2084 gas gauge	24-pin TSSOP	1.20
bq2940x	2, 3 or 4	N/A	4.35/4.45[3]	1	2nd level overvoltage safety fuse blower for Li-ion/Li-poly battery packs	8-pin TSSOP	0.75
UCC3911-x	2	3	4.2/4.25/4.3/4.35	3.5	User controllable delay for tripping short circuit current protection	16-pin SOIC	2.02
UCC3957-x	3 or 4	External FET	4.2/4.25/4.3/4.35	3.5	Detection of loss of cell sense connections	16-pin SSOP	1.47

[1]Suggested resale price in U.S. dollars in quantities of 1,000.
[2]Controlled by bq208x gas gauge.
[3]See TI Web page for more voltage options.
See individual datasheets for full details.

Resources *For a complete list of Resources, visit power.ti.com*

Part Number	Description	Price[1]
Evaluation Modules (EVMs)		
bq2083EVM-001	bq2083 Evaluation Kit for Li-Ion also features the bq29311	99
bq2084EVM-001	bq2084 Evaluation Kit also features the bq29312 and bq29400	99

[1]Suggested resale price in U.S. dollars.

Power-over-Ethernet

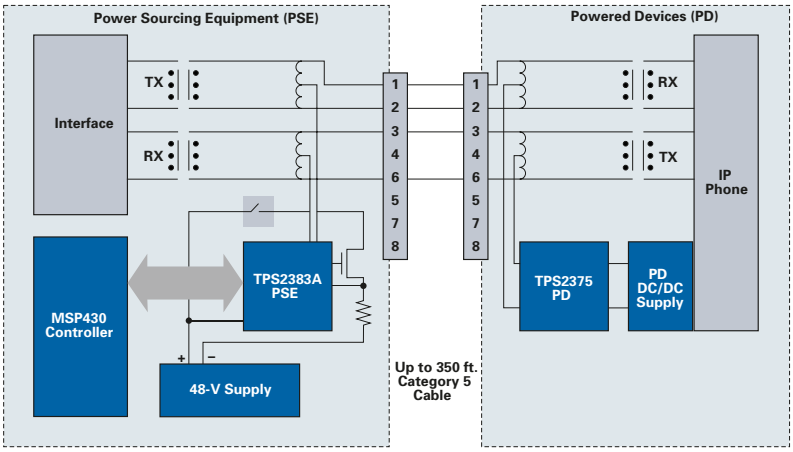
Design Factors

IEEE 802.3af Power-over-Ethernet — With approval of the IEEE 802.3af Power-over-Ethernet (PoE) standard, all data terminal equipment (DTE) now has the option to receive power over existing CAT-5 and CAT-3 cabling that is used for data transmission. The IEEE 802.3af standard defines the requirements associated with providing and receiving PoE cables. The Power Sourcing Equipment (PSE) provides the power on the cable and the Powered Device (PD) receives the power. As part of the IEEE 802.3af standard, the interface between the PSE and the PD is defined as it relates to the detection and classification protocol.

Power Sourcing Equipment (PSE) — The TPS2383A Octal PSE Manager independently manages power for up to eight Ethernet ports, reporting system status over a standard I^2C serial interface.

Powered Devices (PDs) — Acting as an interface between the PSE and PD, the TPS2375/6/7 performs all detection, classification, inrush current limiting and switch FET control that is necessary for compliance with the IEEE 802.3af standard.

Power-over-Ethernet (PoE) Applications Diagram

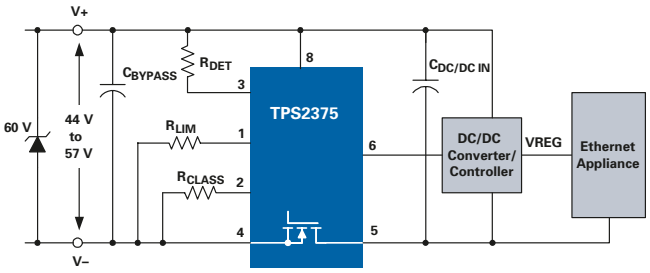


The new TPS237x and TPS2383A are IEEE 802.3af compliant power management ICs designed for managing the connection between Power Sourcing Equipment (PSE) and Powered Devices (PDs) over Ethernet cables.

IEEE 802.3af PoE Powered Device Controller
TPS2375, TPS2376, TPS2377

Get samples, datasheets, EVMs and app reports at: **www.ti.com/sc/device/TPS2375**

The TPS2375/6/7 performs all detection, classification, inrush current limiting and switch FET control that is necessary for compliance with the IEEE 802.3af standard.



Selection Guide

Device	Detection	Classification	Abs Max V_{IN} (V)	Operating Temp (°C)	Inrush Current Limiting	Full Current Limit (mA)	UVLO	DC/DC Interface	8-pin SOIC	8-pin TSSOP	Price[1]
Power-over-Ethernet (PoE) Powered Device (PD) Interface Switches											
TPS2375	✔	Yes, Class 0-4	100	–40 to 85	Programmable	450	802.3af (30.6/39.4 V)	PG	✔	✔	1.25
TPS2376	✔	Yes, Class 0-4	100	–40 to 85	Programmable	450	Adjustable	PG	✔	✔	1.25
TPS2377	✔	Yes, Class 0-4	100	–40 to 85	Programmable	450	Legacy (30.5/35.0 V)	PG	✔	✔	1.25

Device	Applications	Channels	Abs Max V_{IN} (V)	Operating Temp (°C)	IEEE Compliant	Interface	Disconnect	Measurements	Power FET	Options	Price[1]
PoE Power Sourcing Equipment (PSE) Controllers											
TPS2383A	Routers, switches, hubs, mid-spans	8	80	–40 to 85	Yes	I^2C	Both AC and DC	Current, voltage and capacitance	External	64-pin LQFP	7

[1] *Suggested resale price in U.S. dollars in quantities of 1,000.*

*Preview devices are listed in **bold blue**.*

*For additional resources on PoE, including reference designs and evaluation modules, please see **power.ti.com/poe***

Power Limiting

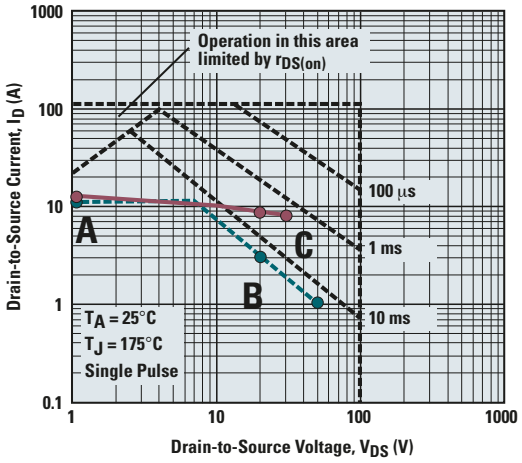
What Is It?

Used correctly, power limiting will guarantee the external FET never operates outside its Safe Operating Area (SOA) in applied voltage, current and time. During normal operation, the external FET operates with the gate-to-source voltage maximized to provide the lowest possible channel resistance. During start-up and short-circuit events, the gate-to-source voltage is controlled to provide a defined turn-on time and to prevent damage to the external FET. The timer function limits how long the device will be in power limit mode. The power limit circuitry monitors the drain current and drain-to-source voltage of the external FET, computes the power dissipation and controls the gate-to-source voltage to prevent the FET from dissipating power greater than the user-programmed level. When the drain-to-source voltage of the external FET is low, the circuitry operates in a current limit mode, preventing the drain current from surpassing the user-programmed level.

The **Short-Circuit Event** diagram illustrates a typical power FET SOA curve set with operating parameters of two control methods superimposed onto it. The red plot results when the external FET is controlled by a foldback current limit method, and the green plot results when the external FET is controlled by TI's power limit method. The condition simulated is for an output overload following normal operation.

- **Point A** is taken at time = 0, just as the current limit of 10 A has been reached.
- **Point B** is taken 0.5 ms after the surge occurs. You can see the competitor's controller has activated its foldback current and reacts in a linear response. The TPS2490/1 activates its power limiting feature to ensure the FET is inside its SOA.
- **Point C** is taken 9 ms after the surge occurs. This further shows how the competitor's IC reacts linearly and the FET is now outside its SOA. The TPS2490/1 continues to follow the power curve and guarantees that the FET is safe.

Short-Circuit Event



Safe operating area of a power FET.

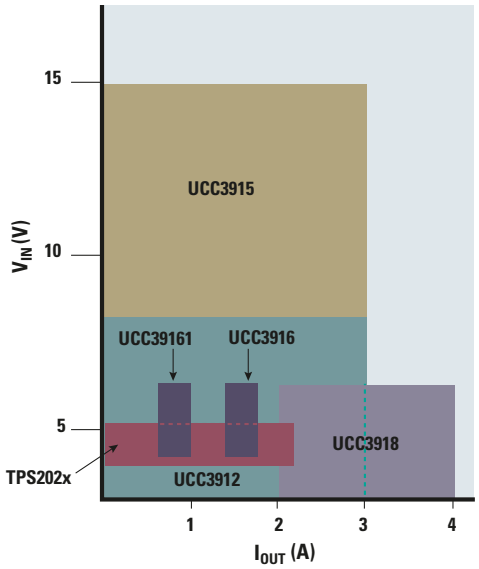
Red Plot — With foldback current limiting, the competitor's IC[1] is out of SOA, so the FET would be damaged.

Green Plot — TPS2490/1 is always within SOA, so the FET safety is guaranteed.

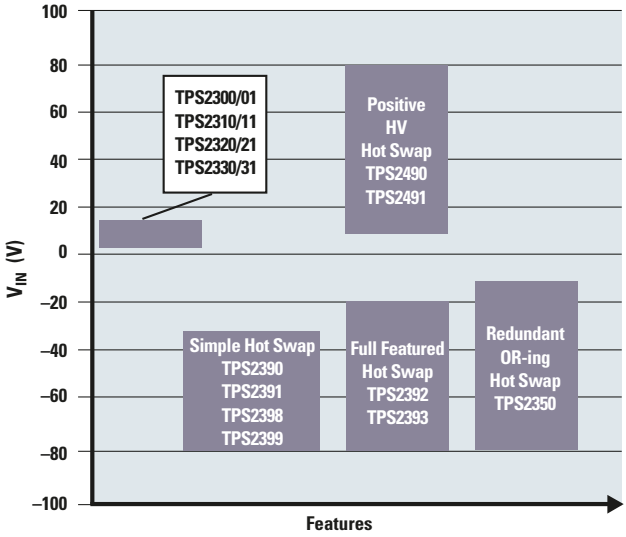
[1]Competitor's "PG" is set to 46 V for a 48-V input.

Hot Swap Power Managers Family of Products

Hot Swap Power Switch ICs (Integrated Power FET)



Hot Swap Power Controller ICs (External Power FET)



Hot Swap Power Managers

Hot Swap Switches (Integrated FET) Selection Guide

Device	Target Applications	Channels	V_{IN} (V)	Current Limit (A)	$r_{DS(on)}$ per FET (typ) (mΩ)	Enable/ Shutdown	Ramp	Package Options	Price[1]
UCC3915	Enclosure Management, General	1	7 to 15	0 to 3	150	1L	Current	SOIC-16, TSSOP-24	2.40
UCC3912	RAID, SCSI, General	1	3 to 8	0 to 3	150	1L	Current	SOIC-16, TSSOP-24	2.15
UCC3918	RAID, SCSI, General	1	3 to 6	0 to 4	75	1L	Current	SOIC-16, TSSOP-24	2.20
UCC3916	SCSI, General	1	4 to 6	1.65	220	1L	Current	SOIC-8	1.60

[1]*Suggested resale price in U.S. dollars in quantities of 1,000.*

Hot Swap Controllers (External FET) Selection Guide

Device	Target Applications	Channels	V_{IN} Range (V)	Enable/ Shutdown	UV	OV	Fault	PG	Latch	Auto Retry	Ramp	Power Limiting	Package	Price[1]
TPS2300/01	CompactPCI, General	2	3 to 13/3 to 5.5	1L/1H	✔		✔	✔	✔		Voltage	No	20-pin TSSOP	1.50
TPS2310/11	CompactPCI, General	2	3 to 13/3 to 5.5	1L/1H	✔		✔	✔	✔		Voltage	No	20-pin TSSOP	1.50
TPS2320/21	CompactPCI, General	2	3 to 13/3 to 5.5	1L/1H	✔		✔	✔	✔		Voltage	No	16-pin SOIC/TSSOP	1.25
TPS2330/31	CompactPCI, General	1	3 to 13	1L/1H	✔		✔	✔	✔		Voltage	No	14-pin SOIC/TSSOP	1.15
TPS2341	CompactPCI, PCI-X, PCI Express	8	3.3, 5, +12, –12	1L	✔			✔	✔		Voltage	No	48-pin HTQFP	4.00
TPS2350	Redundant –48-V Telecom, Replace OR-ing Diodes	2	–12 to –80	1H	✔	✔	✔	✔		✔	Current	No	14-pin SOIC/TSSOP	1.90
TPS2390	Simple –48-V Telecom	1	–36 to –80	1H			✔		✔		Current	No	8-pin MSOP	1.15
TPS2391	Simple –48-V Telecom	1	–36 to –80	1H			✔			✔	Current	No	8-pin MSOP	1.15
TPS2392	Full Featured –48-V Telecom	1	–20 to –80	1H	✔	✔	✔	✔	✔		Current	No	14-pin TSSOP	1.95
TPS2393	Full Featured –48-V Telecom	1	–20 to –80	1H	✔	✔	✔	✔		✔	Current	No	14-pin TSSOP	1.95
TPS2398	Simple –48-V Telecom with PG	1	–36 to –80	1H				✔	✔		Current	No	8-pin MSOP	1.15
TPS2399	Simple –48-V Telecom with PG	1	–36 to –80	1H				✔		✔	Current	No	8-pin MSOP	1.15
TPS2490	Servers, Basestations, +48 V	1	9 to 80	1H	✔			✔	✔		Current	Yes	10-pin MSOP	1.70
TPS2491	Servers, Basestations, +48 V	1	9 to 80	1H	✔			✔		✔	Current	Yes	10-pin MSOP	1.70

[1]*Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

Resources *For a complete list of Resources, visit power.ti.com*

Part Number	Description	Price[1]
Evaluation Modules (EVMs) and Tools		
TPS2301EVM-153	Dual Hot Swap Power Controller Evaluation Module and Interface Board	49
UCC3913-21EVM-001	UCC3913 Evaluation Module	49
TPS2390/1EVM	Simplified –48-V Hot Swap Power Management in Telecom Systems Evaluation Module	49
TPS2392/3EVM	Full Featured –48-V Hot Swap Power Management in Telecom Systems Evaluation Module	49
TPS2398/9EVM	Simplified –48-V Hot Swap Power Management in Telecom Systems Evaluation Module	49
TPS2350EVM	–48-V Supply Selector with Hot Swap Power Management for Redundant Telecom Supplies Evaluation Module	49
TPS2490EVM-001	+48-V Hot Swap Power Manager Evaluation Module	49
TPS2491EVM-002	+48-V Hot Swap Power Manager Evaluation Module	49
SLVC033A	TPS2490/TPS2491 Software Design-In Calculation Tool	—
SLVC031	TPS2390/TPS2391 Software Design Calculation Tool	—
SLVC032	TPS2398/TPS2399 Software Design Calculation Tool	—
SLVC064	Telecom –48-V OR-ing Diode Replacement Product TPS2350 Evaluation Module	49

Literature Number	Part Number	Description
Application Notes		
SLVS368	—	Comparing Performance of Current Ramp and Voltage Ramp Hot Swap Controller ICs
SLUA187	UCC3912/15	Programmable Hot Swap Power Manager
SLUA198	UCC3912	Electronic Circuit Breaker ICs
SLUA131	UCC3912	Integrated Electronic Circuit Breaker IC for Hot Swap
SLUA211	UCC3918	Hot Swap Power Manager Evaluation Board and Schematic
SLUA283	TPS239x	A Universal Telecommunications Hot Swap Device Family
SLUA302	TPS2398/99, TPS2390/91	A Comparison of Telecom Hot Swap Managers TPS2398/99 vs TPS2390/91
SLUA291	TPS239x	–48-V Hot Swap Performance Competitive Comparison
SLUA306	TPS2398/99	Using the TPS2398/99 Hot Swap Controller with Power Trends PT4485
SLUA297	TPS2350	Boosting Supply Select Hysteresis on the TPS2350

[1]*Suggested resale price in U.S. dollars.*

Power Distribution Devices *(PCMCIA/CardBus Power Switches, Current-Limiting Power Switches and Power MUX ICs)*

Design Factors

PCMCIA/CardBus Power Switches

Standard PC cards require that V_{CC} be switched between ground, 3.3 V and 5 V, while V_{PP} is switched between ground, 3.3 V, 5 V and 12 V. CardBay sockets have the standard requirements for V_{CC}, but require ground, 3.3 V and 5 V to V_{PP}, and ground, 1.8 V or 3.3 V to V_{CORE}. Other PC card applications may simply not need 12 V or V_{PP} while still having the standard requirements for V_{CC}. Therefore, consider the voltage requirements of the application when selecting a PCMCIA power switch.

Current-Limiting Power Switches

Power switches are used to intelligently turn power on and off, while providing fault protection. They are useful anywhere controlled allocation of power is needed to circuit blocks, modules, add-in cards or cabled connections. They are ideal for power sequencing or segmentation.

To minimize voltage drop, select devices with the lowest $r_{DS(on)}$ or Drain-to-Source on-resistance.

Universal Serial Bus (USB) Power Switches and LDO+ Power Switch Combination ICs are covered on pages 45–46.

Power MUX ICs

Power MUX ICs are designed to transition from a main power supply to an auxiliary source when the main supply shuts down (e.g., switching from battery operation to a wall adapter).

Power Distribution Devices Family of Products

Current-Limiting Power Switch ICs

	Current Limit (min) (A)							
	0.22	0.3	0.345	0.66	0.7	1.1	1.65	2.2
Fault Reporting								
Quad	—	TPS2048A/58A TPS2095/6/7	TPS2048/58[1]	—	TPS2044/54[2] TPS2044B/54B TPS2085/6/7	—	—	—
Triple	—	TPS2047B/57A	TPS2047/57[1]	—	TPS2043/53[2] TPS2043B/53A	—	—	—
Dual	—	TPS2046B/56B TPS2090/1/2	TPS2046/56[1]	—	TPS2042/52[2] TPS2042A/52A TPS2080/1/2	—	—	—
Single	TPS2020/30[1]	TPS2045A/55A	TPS2045/55[1]	TPS2021/31[1]	TPS2041/51[2] TPS2041B/51B	TPS2022/32	TPS2023/33	TPS2024/34
No Fault Reporting								
Single	TPS2010A	—	—	TPS2011A	—	TPS2012A	TPS2013A	—

[1] *Nemko recognized.* [2] *UL and Nemko recognized.*

PCMCIA/CardBus Power Switch Matrix ICs

	Current Limit (min) (A)			
	0.3	0.7	1.0	2.5
3.3 V, 5 V, 12 V, V_{PP}				
Dual	—	—	TPS2224(A), TPS2226(A), TPS2204A, TPS2206A, TPS2205,	—
Single	TPS2212	—	TPS2204A, TPS2210A, TPS2211(A), TPS2220A	TPS2231
No 12 V				
Dual	—	—	TPS2223A	—
Single	—	TPS2044B/54B	—	—
No V_{PP}				
Dual	—	TPS2044B/54B	—	—

Power MUX ICs

Configuration	Device	I_{OUT} (mA)	Transition	Comments
	TPS2100/1	IN1: 500, IN2: 10	Manual	SOT-23, 0 to 70°C
	TPS2102/3	IN1: 500, IN2: 100	Manual	SOT-23, 0 to 70°C
	TPS2104/5	IN1: 500, IN2: 100	Manual	SOT-23, –40 to 85°C
IN1 	TPS2110A	Adj. 310 to 750	Auto/Manual	TSSOP
IN2	TPS2111A	Adj. 630 to 1250	Auto/Manual	TSSOP
	TPS2112A	Adj. 310 to 750	Auto	TSSOP, Status pin
	TPS2113A	Adj. 630 to 1250	Auto	TSSOP, Status pin
	TPS2114A	Adj. 310 to 750	Auto/Manual	TSSOP, Status pin
	TPS2115A	Adj. 630 to 1250	Auto/Manual	TSSOP, Status pin

See also TPPM0301/2/3 (for NIC cards) in this selection guide on page 44.

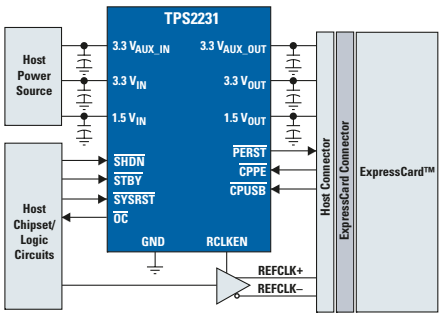
Integrated ExpressCard™ Power Interface Switch

TPS2231

Get datasheets at: **www.ti.com/sc/device/TPS2231**

Key Features

- Meets PC card standard for ExpressCard™ technology
- TTL-logic compatible inputs
- Short-circuit and thermal protection
- 50-µA (typ) quiescent current on 3.3-V auxiliary input (single)



Typical ExpressCard™ power-distribution application.

Power Distribution Devices *(PCMCIA/CardBus Power Switches, Current-Limiting Power Switches and Power MUX ICs)*

Selection Guide

Device	Number of FETs	I_{OS} (min) (A)	$r_{DS(on)}$ (mΩ)	V_{IN} Range (V)	Supply Current (µA)	OC Logic Output	OT Logic Output	Enable	Predecessor	Price[1]
Current-Limiting Power Switch ICs										
TPS2010A	1	0.22	30	2.7 to 5.5	73	No	No	L	TPS2010	0.71
TPS2011A	1	0.66	30	2.7 to 5.5	73	No	No	L	TPS2011	0.71
TPS2012A	1	1.1	30	2.7 to 5.5	73	No	No	L	TPS2012	0.71
TPS2013A	1	1.65	30	2.7 to 5.5	73	No	No	L	TPS2013	0.71
TPS2020/30	1	0.22	33	2.7 to 5.5	73	Yes	Yes	L/H	—	0.99
TPS2021/31	1	0.66	33	2.7 to 5.5	73	Yes	Yes	L/H	TPS2014	0.99
TPS2022/32	1	1.1	33	2.7 to 5.5	73	Yes	Yes	L/H	TPS2015	0.99
TPS2023/33	1	1.65	33	2.7 to 5.5	73	Yes	Yes	L/H	—	0.99
TPS2024/34	1	2.2	33	2.7 to 5.5	73	Yes	Yes	L/H	—	0.99
TPS2041B/51B	1	0.7	80	2.7 to 5.5	80	Yes	Yes	L/H	TPS2041/51	0.57
TPS2042B/52B	2	0.7 ea	80	2.7 to 5.5	80	Each	Yes	L/H	TPS2042/52	0.77
TPS2043B/53A	3	0.7 ea	80	2.7 to 5.5	160	Each	Yes	L/H	TPS2043/53	0.95
TPS2044B/54B	4	0.7 ea	80	2.7 to 5.5	160	Each	Yes	L/H	TPS2044/54	1.10
TPS2045A/55A	1	0.3	80	2.7 to 5.5	80	Yes	Yes	L/H	TPS2045/55	0.57
TPS2046B/56A	2	0.3 ea	80	2.7 to 5.5	80	Each	Yes	L/H	TPS2046/56	0.77
TPS2047B/57B	3	0.3 ea	80	2.7 to 5.5	160	Each	Yes	L/H	TPS2047/57	0.95
TPS2048A/58A	4	0.3 ea	80	2.7 to 5.5	160	Each	Yes	L/H	TPS2048/58	1.10
TPS2080/1/2[2]	2	0.7 ea	80	2.7 to 5.5	85	Yes	Yes	2H, 1L/1H, 2L	—	0.61
TPS2085/6/7[2]	4	0.7 ea	80	2.7 to 5.5	85	Yes	Yes	4H, 2L/2H, 4L	—	1.00
TPS2090/1/2[2]	2	0.3 ea	80	2.7 to 5.5	85	Yes	Yes	2H, 1L/1H, 2L	—	0.61
TPS2095/6/7[2]	4	0.3 ea	80	2.7 to 5.5	85	Yes	Yes	4H, 2L/2H, 4L	—	1.00

Device	Interface	Number of Ports	3.3-V $r_{DS(on)}$ (typ) (mΩ)	5.0-V $r_{DS(on)}$ (typ) (mΩ)	I_{OS} (min) (A)	Predecessor	Price[1]
PCMCIA/CardBus Switch Matrix ICs							
TPS2210A	3-line Serial	1	85	95	1	—	0.90
TPS2204A	3-line Serial	2	85	95	1	TPS2214/14A	2.05
TPS2220A	3-line Serial	1	85	95	1	—	0.90
TPS2223A	3-line Serial	2	85	95	1	—	1.85
TPS2224A	3-line Serial	2	85	95	1	TPS2214/14A	2.05
TPS2226A	3-line Serial	2	85	95	1	TPS2206, TPS2216/16A	2.20
TPS2206A	3-line Serial	2	85	95	1	TPS2206, TPS2216/16A	2.20
TPS2205	8-line Parallel	2	70	100	1	TPS2201	2.75
TPS2211A	4-line Parallel	1	70	57	1	TPS2211	0.90
TPS2212	4-line Parallel	1	160	160	0.3	—	1.35
TPS2231	4-line Parallel	1	68	—	2.5	—	1.00
TPS2044A or 54A	Parallel	1 or 2	80	80	0.7	TPS2044, TPS2054	1.10
TPS2221	Interface Parallel	1	72	97	1	—	1.72
TPS2228	Interface Serial	2	72	97	1	—	3.05

Device	Number of Inputs	IN1 $r_{DS(on)}$ (mΩ)	IN2 $r_{DS(on)}$ (mΩ)	IN1 Output Current (mA)	IN2 Output Current (mA)	IN1 Supply Current (µA)	IN2 Supply Current (µA)	Input Voltage Range (V)	Transition Time IN1 to IN2 (µs)	Transition Time IN2 to IN1 (µs)	Transition	Price[1]
Power MUX ICs												
TPPM0301/2	3	—	—	400	400	2500	250	3 to 5.5	—	—	Autoswitch	1.60
TPPM0303	3	—	—	250	250	2500	250	3 to 5.5	—	—	Autoswitch	1.07
TPS2100/1	2	250	1300	500	10	10	0.75	2.7 to 4.0	4	900	L/H enable	0.59
TPS2102/3	2	250	1300	500	100	14	0.75	2.7 to 4.0	3	700	L/H enable	0.69
TPS2104/5	2	250	1300	500	100	18	0.75	2.7 to 5.5	3	700	L/H enable	0.85
TPS2110A/2A/4A	2	120	120	312 to 750	312 to 750	85	85	2.8 to 5.5	40	40	Autoswitch	0.70
TPS2111A/3A/5A	2	84	84	625 to 1250	625 to 1250	85	85	2.8 to 5.5	40	40	Autoswitch	0.70

[1] *Suggested resale price in U.S. dollars in quantities of 1,000.*
[2] *Can be configured as power MUX ICs.*

*New devices are listed in **bold red**.*

Design Factors

USB High-Power Peripheral Switch With Dual Current Limit + LDO

TPS2140/41/50/51 — The TPS2140/41/50/51 target high-power USB peripherals such as ADSL modems. The devices contain a power switch and an LDO. The dual-current-limiting switch allows the use of high-value capacitance to stabilize the voltage from the USB bus.

Dual Power Switch + LDO for USB Bus-Powered Peripherals and Hubs

TPS2148/49 — TPS2148 is a complete power management solution for USB bus-powered peripherals such as zip drives, while TPS2149 is for USB bus-powered hubs, such as keyboards with integrated hubs. TPS2148/9 each combine a 3.3-V LDO and dual power switch in a single MSOP. The TPS2148 switch configuration allows power and board capacitance segmentation to meet USB system current requirements. The TPS2149 switches manage two independent or 4 ganged USB ports.

4-Port USB Hub Power Controllers

TPS207x — The TPS207x family provides the complete power solution for 4-port self-powered, bus-powered or hybrid USB hubs by incorporating current-limited switches for four ports, a 3.3-V 100-mA LDO, a 5-V LDO controller for self power (TPS2070, TPS2071) and a DP0 line control to signal an attach to the host.

Ease of Use — USB allows simplified installation and improved performance for peripheral devices by eliminating the need to repeatedly load new drivers and establish individual settings. USB combines a multitude of existing interfaces into a single easy-to-use connector, greatly reducing system complexity and offering manufacturers the ability to develop highly integrated products.

USB Power Managers Family of Products

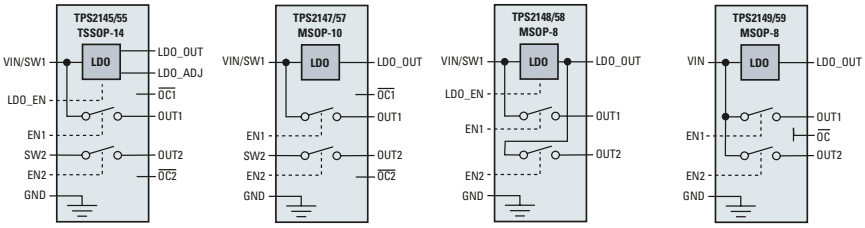
USB Power Distribution Switches

	Current Limit (min) (A)						
	0.22	0.3	0.66	0.7	1.1	1.65	2.2
Quad	—	TPS2048A/58A	—	TPS2044B/54B	—	—	—
Triple	—	TPS2047B/57A	—	TPS2043B/53A	—	—	—
Dual	—	TPS2046B/56A	—	TPS2042B/52B	—	—	—
Single	TPS2020/30	TPS2045A/55A	TPS2021/31	TPS2041B/51B	TPS2022/32	TPS52023/33	TPS2024/34

4-Port USB Hub Power Controllers

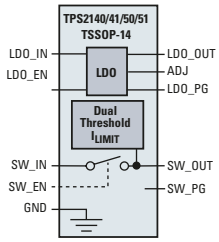
Device	5-V LDO Controller	Bus Power Mode Indicator	Pins	Package
TPS2070	Yes	Active Low	32	HTSSOP
TPS2071	Yes	Active High	32	HTSSOP
TPS2074	No	Active Low	24	SSOP
TPS2075	No	Active High	24	SSOP

Dual Power Switch + LDO for USB Bus-Powered Peripherals and Hubs



USB High-Power Peripheral Bus Switch + LDO

Device	Switch Voltage	Description
TPS2140	3.3 V	3.3-V, 500-mA switch with active-low enable, 250-mA LDO
TPS2141	5.0 V	5.0-V, 500-mA switch with active-low enable, 250-mA LDO
TPS2150	3.3 V	3.3-V, 500-mA switch with active-high enable, 250-mA LDO
TPS2151	5.0 V	5.0-V, 500-mA switch with active-high enable, 250-mA LDO



Power Distribution Switches

TPS204xB/5xB — The TPS204xB/5xB families of 80-mΩ current-limiting power switches meet all the USB power management requirements for controlling downstream ports, and include additional features to improve the design reliability. For example, when an over-current condition exists, the device intelligently shuts down only the port that sees the fault.

TPS202x/3x/6x — The TPS202x/3x/6x families of low on-resistance current-limiting power switches allow ganging of multiple ports to a single switch, as described in Application Note SLVA049. Though ganging can be cost-effective, all ports are affected by a fault.

For detailed information regarding USB solutions, visit:

www.ti.com/sc/usbsolutions

Universal Serial Bus (USB) Power Managers

Selection Guide

Device	Number of FETs	I_{OS} (min) (A)	$r_{DS(on)}$ (mΩ)	V_{IN} Range (V)	Supply Current (µA)	OC Logic Output	OT Logic Output	Enable	Predecessor	Price[1]
USB Power Distribution Switches										
TPS2020/30	1	0.22	33	2.7 to 5.5	73	Yes	Yes	L/H	—	0.99
TPS2021/31	1	0.66	33	2.7 to 5.5	73	Yes	Yes	L/H	TPS2014	0.99
TPS2022/32	1	1.1	33	2.7 to 5.5	73	Yes	Yes	L/H	TPS2015	0.99
TPS2023/33	1	1.65	33	2.7 to 5.5	73	Yes	Yes	L/H	—	0.99
TPS2024/34	1	2.2	33	2.7 to 5.5	73	Yes	Yes	L/H	—	0.99
TPS2041B/51B	1	0.7	80	2.7 to 5.5	80	Yes	Yes	L/H	TPS2041A/51A	0.50
TPS2042B/52B	2	0.7	80	2.7 to 5.5	80	Each	Yes	L/H	TPS2042/52	0.70
TPS2043B/53A	3	0.7	80	2.7 to 5.5	160	Each	Yes	L/H	TPS2043A/53	0.90
TPS2044B/54B	4	0.7	80	2.7 to 5.5	160	Each	Yes	L/H	TPS2044A/54A	1.00
TPS2045A/55A	1	0.3	80	2.7 to 5.5	80	Yes	Yes	L/H	TPS2045/55	0.57
TPS2046B/56A	2	0.3	80	2.7 to 5.5	80	Each	Yes	L/H	TPS2046A/56	0.65
TPS2047B/57A	3	0.3	80	2.7 to 5.5	160	Each	Yes	L/H	TPS2047A/57A	1.07
TPS2048A/58A	4	0.3	80	2.7 to 5.5	160	Each	Yes	L/H	TPS2048/58	1.00

Device	Application	Number of FETs	Switch Enable	Bus Power Indicator (BPMODE)	V_{IN} (min) (V)	V_{IN} (max) (V)	Bus Powered $r_{DS(on)}$ per FET (typ) (mΩ)	Bus Powered Current Limit (min) (A)	Self Powered $r_{DS(on)}$ per FET (typ) (mΩ)	Self Powered Current Limit (min) (A)	LDO Controller (A)	LDO	Price[1]
USB Power Controllers													
TPS2070	USB 4-port hub	8	L	1L	4.5	5.5	560	0.12	107	0.6	5 V, 3 A	3.3 V, 100 mA	2.42
TPS2071	USB 4-port hub	8	L	1H	4.5	5.5	560	0.12	107	0.6	5 V, 3 A	3.3 V, 100 mA	2.42
TPS2074	USB 4-port hub	8	L	1L	4.5	5.5	500	0.12	100	0.6	—	3.3 V, 100 mA	2.43
TPS2075	USB 4-port hub	8	L	1H	4.5	5.5	500	0.12	100	0.6	—	3.3 V, 100 mA	2.43
TPS2140	USB peripheral	1	L	—	2.7	5.5	70	0.1 and 1.2	—	—	—	Adj. 0.9 to 3.3 V, 250 mA	1.05
TPS2141	USB peripheral	1	L	—	4	5.5	70	0.1 and 1.2	—	—	—	Adj. 0.9 to 3.3 V, 250 mA	1.05
TPS2150	USB peripheral	1	H	—	2.7	5.5	70	0.1 and 1.2	—	—	—	Adj. 0.9 to 3.3 V, 250 mA	1.05
TPS2151	USB peripheral	1	H	—	4	5.5	70	0.1 and 1.2	—	—	—	Adj. 0.9 to 3.3 V, 250 mA	1.05
TPS2145	DSP, PDA	2	L	—	2.9	5.5	340	0.2	—	—	—	3.3 V, 200 mA	1.09
TPS2147	DSP, PDA	2	L	—	2.9	5.5	340	0.2	—	—	—	3.3 V, 200 mA	1.01
TPS2148	USB peripheral	2	L	—	2.9	5.5	340	0.2	—	—	—	3.3 V, 200 mA	0.94
TPS2149	USB 2-port hub	2	L	—	2.9	5.5	340	0.2	—	—	—	3.3 V, 200 mA	0.87
TPS2155	DSP, PDA	2	H	—	2.9	5.5	340	0.2	—	—	—	3.3 V, 200 mA	1.09
TPS2157	DSP, PDA	2	H	—	2.9	5.5	340	0.2	—	—	—	3.3 V, 200 mA	1.01
TPS2158	USB peripheral	2	H	—	2.9	5.5	340	0.2	—	—	—	3.3 V, 200 mA	0.94
TPS2159	USB 2-port hub	2	H	—	2.9	5.5	340	0.2	—	—	—	3.3 V, 200 mA	0.87

[1]*Suggested resale price in U.S. dollars in quantities of 1,000.*

Design Factors

System Voltages — The version of supervisor you require is dependent on the voltage rail(s) within the system. For example, supervisors designed to support a processor need to be selected according to the voltage driving the processor.

Number of Channels — Typically the number of supervisor functions required in a system is dependent on the processor and peripheral(s) voltages. For example, split-voltage processors may require supervision of both rails, while the memory in the system may also require supervision and be operating on a third (different) voltage rail.

Manual Reset (MR) — This feature allows the user to manually reset the circuit or control the supervisory circuit by another device of the application.

Watchdog Input (WDI) — In situations where the system processor may not be functioning properly, its onboard watchdog feature may fail to reset. Supervisors with integrated watchdog functionality increase system reliability by being able to trigger a reset.

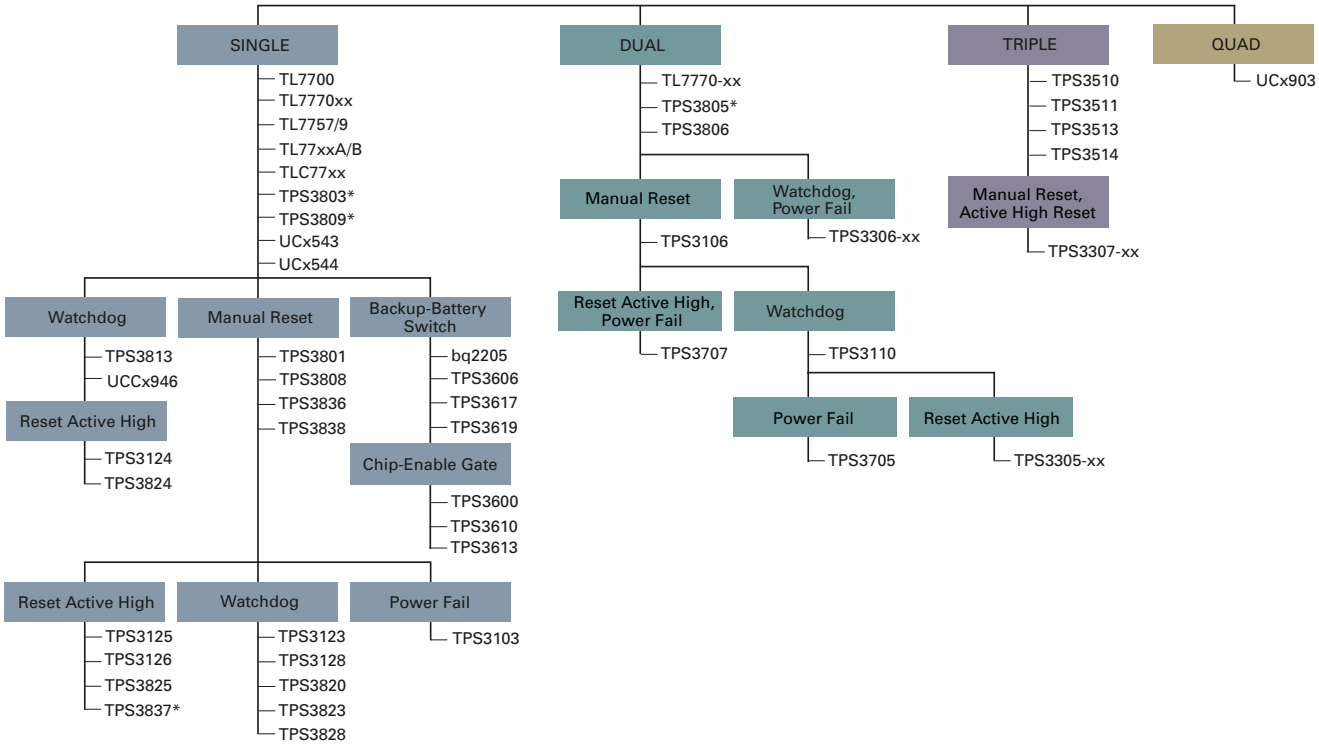
Active High Output — Allows the use of processors with active high reset input without additional components.

Power Fail Input/Output (PFI/PFO) — Allows for more flexibility by using this comparator, e.g., for long-term battery observation and pre-warning.

Delay Time — Allows the voltage and other components in the circuit to stabilize first before the normal operation starts again.

Chip Enable Gating — Chip enable gating prevents erroneous data from corrupting CMOS RAM during an undervoltage condition.

Supervisors Family of Products



*For low-cost solutions, start here

Supervisors

Selection Guide

Device	Number of Supervisors	Supervised Voltages	Packages	I_{DD} (typ) (µA)	Time Delay (ms)	Watchdog Timer WDI (sec)	Reset Threshold Accuracy (%)	Manual Reset Input/MR	Active-Low Reset Output	Active-High Reset Output	Reset Output Topology[1]	Power-Fail PFI/PFO	Over-Voltage Detection	Over-Current Detection	Backup-Battery Switchover	Chip-Enable Gating	Price[2]
TPS3808	1	Adj./0.9/1.2/1.5/1.8/ 2.5/3.0/3.3/5.0	SOT-23	2.4	Prog	—	0.5	✔	✔		OD						0.70
TPS3103	1	1.2/1.5/2.0/3.3	SOT-23	1.2	130	—	0.75	✔	✔		OD	✔					0.90
TPS3123	1	1.2/1.5/1.8	SOT-23	14	180	1.4	3.6	✔	✔		PP						0.85
TPS3124	1	1.2/1.5/1.8	SOT-23	14	180	1.4	3.6		✔	✔	PP						0.85
TPS3125	1	1.2/1.5/1.8/3.0	SOT-23	14	180	—	3.6	✔	✔	✔	PP						0.80
TPS3126	1	1.2/1.5/1.8	SOT-23	14	180	—	3.5	✔	✔	✔	OD						0.80
TPS3128	1	1.2/1.5/1.8	SOT-23	14	180	1.4	3.5	✔	✔		OD						0.85
TPS3600	1	2.0/2.5/3.3/5.0	TSSOP-14	20	100	0.8	2.3	✔	✔		PP	✔			✔	✔	2.30
TPS3606-33	1	3.3	MSOP-10	20	100	0.8	2	✔	✔		PP	✔			✔		1.80
TPS3610	1	1.8/5.0	TSSOP-14	20	100	0.8	2		✔		PP	✔			✔	✔	2.10
TPS3613-01	1	Adjustable	MSOP-10	20	100	—	1.7	✔	✔	✔	PP				✔	✔	1.60
TPS3617-50	1	5	MSOP-8	20	100	0.8	2		✔		PP	✔			✔		1.35
TPS3619	1	3.3/5.0	MSOP-8	15	100	—	2	✔	✔		PP	✔			✔		1.10
bq2205LY	1	3.3	TSSOP-16	0.2 mA	55	—	1.7		✔		OD				✔	Two	1.75
TPS3800	1	2.7	SC-70	9	100	—	2	✔	✔		PP						0.49
TPS3801	1	Adj./1.8/2.5/3.0/3.3/5.0	SC-70	9	200	—	2	✔	✔		PP						0.49
TPS3802	1	3.0/3.3	SC-70	9	400	—	2	✔	✔		PP						0.49
TPS3803	1	Adj./1.5	SC-70	3	5 µs	—	1.5		✔		OD						0.29
TPS3809	1	2.5/3.0/3.3/5.0	SOT-23	9	200	—	2.2		✔		PP						0.29
TPS3813	1	2.5/3.0/3.3/5.0	SOT-23	9	25	Prog	2.2		✔		OD						0.90
TPS3820/8-xx	1	3.3/5.0	SOT-23	15	25/200	0.2/1.6	2.4	✔	✔		PP/OD						0.65
TPS3823	1	2.5/3.0/3.3/5.0	SOT-23	15	200	1.6	2.4	✔	✔		PP						0.65
TPS3824-xx	1	2.5/3.0/3.3/5.0	SOT-23	15	200	1.6	2.2		✔	✔	PP						0.65
TPS3825-xx	1	3.3/5.0	SOT-23	15	200	—	2.2	✔	✔	✔	PP						0.55
TPS3836/8	1	1.8/2.5/3.0/3.3	SOT-23	0.25	10/200	—	2.5	✔	✔		PP/OD						0.85
TPS3837	1	1.8/2.5/3.0/3.3	SOT-23	0.25	10/200	—	2.4	✔		✔	PP						0.85
TL7700	1	Adjustable	DIP-8, SOP-8	0.6 mA	Prog	—	1		✔		OC						2.25
TL7757	1	5	SO-8, SOT-89, TO-92	1.4 mA	5 µs	—	2.6		✔		OC						0.32
TL77xxA	1	2.7/5/9/12/15	SO-8, DIP-8, SOP-8	1.8 mA	Prog	—	2	✔	✔	✔	OC						0.25
TL77xxB	1	2.7/3.3/5	SO-8, DIP-8	1.8 mA	Prog	—	2	✔	✔	✔	OC						0.27
TLC77xx	1	Adj./2.5/3.3/3.0/5.0	SO-8, DIP-8, TSSOP-8	9	Prog	—	5.5		✔	✔	PP						0.65
UCx543	1	Adjustable	DIP-16, PLCC-20	7 mA	Prog	—	1		✔	✔	OC		✔				2.85
UCCx946	1	Adjustable	SO-8, DIL-8, TSSOP-8	10	Prog	Prog	2		✔		PP						1.40
TPS3106	2	Adj./0.9/1.6/3.3	SOT-23	1.2	130	—	0.75	✔	✔		OD						0.90
TPS3110	2	Adj./0.9/1.2/1.5/3.3	SOT-23	1.2	130	1.1	0.75	✔	✔		PP						0.99
TPS3305-xx	2	1.8/2.5/3.3/5.0	SO-8, MSOP-8	15	200	1.6	2.7	✔	✔	✔	PP						1.00
TPS3306-xx	2	1.5/1.8/2.0/2.5/3.3/5.0	SO-8, MSOP-8	15	100	0.8	2.7		✔		OD	✔	✔				1.05
TPS3705-xx	2	3.0/3.3/5.0	SO-8, MSOP-8	30	200	1.6	2.1	✔	✔		PP	✔					0.80
TPS3707-xx	2	2.5/3.0/3.3/5.0	SO-8, MSOP-8	20	200	—	2.2	✔	✔	✔	PP	✔					0.75
TPS3805	2	Adj./3.3	SC-70	3	5 µs	—	1.5		✔		PP						0.34
TPS3806	2	Adj./2.0/3.3	SOT-23	3	5 µs	—	2		✔		OD						0.60
TL7770-xx	2	5.0/12.0, Adj.	SO-16, DIP-16	5 mA	Prog	—	2	✔	✔	✔	OC		✔				2.16
TPS3307-xx	3	Adj./1.8/2.5/3.3/5.0	SO-8, MSOP-8	15	200	—	2.7	✔	✔	✔	PP						1.05
TPS3510	3	3.3/5.0/12.0	SO-8, DIP-8	1 mA	300	—	9.1		✔		OD	✔	✔				0.55
TPS3511	3	3.3/5.0/12.0	SO-8, DIP-8	1 mA	150	—	5.7		✔		OD	✔	✔				0.55
TPS3513	3	3.3/5.0/12.0	SO-14, DIP-14	1 mA	300	—	9.1		✔		OD	✔	✔	✔			0.85
TPS3514	3	3.3/5.0/12.0	SO-14, DIP-14	1 mA	300	—	5.2		✔		OD	✔	✔	✔			0.85
UCx903	4	Adjustable	DIP-18, PLCC-20	7 mA	Prog	—	5		✔	✔	OC	✔	✔				2.45

[1]*PP = push-pull, OD = open drain, OC = open collector.* [2]*Suggested resale price in U.S. dollars in quantities of 1,000.*

Note: Custom voltages can be provided. Minimum order quantities may apply. Contact TI for details and availability.

Resources *For a complete list of Resources, visit power.ti.com*

Part Number	Description	Price[1]
Evaluation Module (EVM)		
TPS3600EVM	Battery-Backup Supervisor	50

[1]*Suggested resale price in U.S. dollars.*

CCFL Backlight Converters

Design Factors

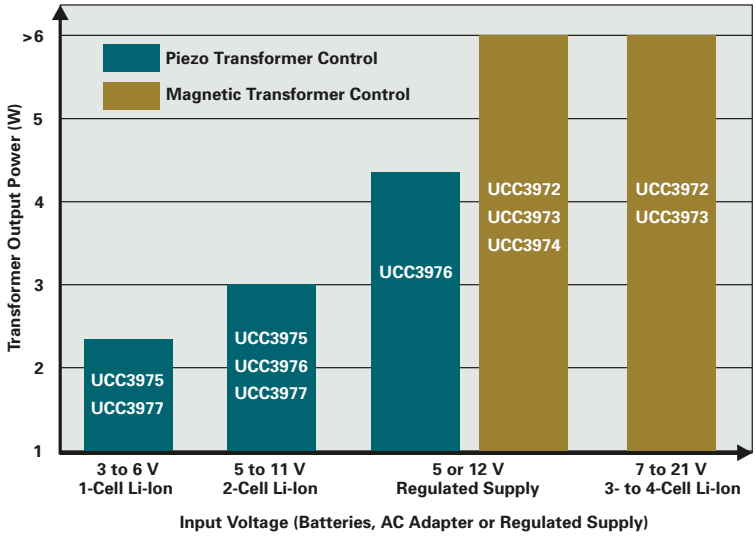
Input Voltage — Backlight power supplies run from the battery or a regulated supply. It is important to know the input voltage available for the backlight supply to select the best IC and power conversion topology to generate the output power required to light the lamp.

Lamp Characteristics (Output Power) — Common CCFL lamps require 250- to 1000-VAC (2 to 10 mA) for operation. The relationship between the input voltage and output voltage dictates the best IC and power topology.

Power Topology — The parts control the transformer in different ways. Sometimes the input/output relationship dictates a certain topology. Different topologies also have different power conversion efficiencies.

Transformer Type — Piezo for smaller size and higher efficiency in some applications.

CCFL Backlight Converters Family of Products



Control Options — Single or dual lamp control and dimming control.

Features

- Complete power-supply control for CCFL.
- Magnetic or piezo transformer control.
- Open lamp and transformer protection.
- Burst-dimming control for efficient, wide dimming range.
- Four different power topologies:
  - Half-bridge
  - Flyback
  - Royer
  - Push-pull

Selection Guide

Device	Input Voltage (V)	Power Control Topology	Transformer Type	Dual Transformer Control	Internal Switching FETs	Dimming and Protection Control	Industrial Temp Version	Packages	Price[1]
Input Voltage = 3 to 6 V (1-cell Li-ion application)									
UCC3975	3 to 13.5	Flyback	Piezo	No	No	Yes	UCC2975	8-pin TSSOP	1.70
UCC3977	3 to 13.5	Push-pull	Piezo	No	No	Yes	UCC2977	8-pin TSSOP	1.70
Input Voltage = 5 to 11 V (2-cell Li-ion application)									
UCC3975	3 to 13.5	Flyback	Piezo	No	No	Yes	UCC2975	8-pin TSSOP	1.70
UCC3976	3 to 13.5	Half-bridge	Piezo	No	No	Yes	UCC2976	8-pin TSSOP	1.70
UCC3977	3 to 13.5	Push-pull	Piezo	No	No	Yes	UCC2977	8-pin TSSOP	1.70
Input Voltage = 5 or 12 V (regulated supply)									
UCC3972/3[2]	4.5 to 25	Royer	Magnetic	No	No	Yes	UCC2972/3	8-pin TSSOP or SOIC	1.75/1.75
UCC3974	4.5 to 25	Royer	Magnetic	Yes	No	Yes	UCC2974	8-pin TSSOP or SOIC	2.10
UCC3976	3 to 13.5	Half-bridge	Piezo	No	No	Yes	UCC2976	8-pin TSSOP	1.70
Input Voltage = 7 to 21 V (3- or 4-cell Li-ion application)									
UCC3972/3[2]	4.5 to 25	Royer	Magnetic	No	No	Yes	UCC2972/3	8-pin TSSOP or SOIC	1.75/1.75

[1]Suggested resale price in U.S. dollars in quantities of 1,000.
[2]The UCC3973 adds a programmable voltage clamp on the transfomer primary for additional protection versus the UCC3972.
The selection guide is a general reference tool. External components dictate most of the circuit parameters in the circuit; therefore, designs outside of the input voltage/device boundaries in the selection guide can be achieved.

Resources *For a complete list of Resources, visit power.ti.com*

Part Number	Description	Price[1]
Evaluation Modules (EVMs)		
UCC3972EVM	UCC3972 Evaluation Module	50
UCC3973EVM	UCC3973 Evaluation Module	50
UCC3976-77EVM	UCC3976 and UCC3977 Evaluation Module	50

[1]Suggested resale price in U.S. dollars.

References and Shunt Regulators

Design Factors

Topology — Shunt (two-terminal) vs. series (three-terminal). Shunt references are very similar to Zener diodes in operation as both require an external resistor for biasing. The external resistor determines the maximum current that can be supplied to the load as well as provide the minimum biasing current to maintain regulation. Shunt references should be considered when the load is nearly constant and power supply variations are minimal. Series references do not require any external components and they should be considered when the load is variable and lower voltage overhead is of the importance. They are also more immune to the power supply changes than shunt references.

Initial Accuracy — This parameter is of primary concern in systems where calibration is impossible or inconvenient. Usually, it is accomplished by the calibration of the overall system. Initial accuracy is specified with fixed input voltage and no load current (for series type) or fixed bias current (for shunt type).

Temperature Drift — Temperature drift is the change in output voltage due to the temperature change, expressed in ppm/°C. Buried Zener type references (e.g., REF02, REF102) typically have a lower temperature drift than bandgap type voltage references. Temperature drift can be specified in several ways (slope, butterfly and box), but the most common way is the box method calculated as:

$$TC\left(\frac{ppm}{°C}\right) = \frac{(V_{max} - V_{min}) \times 10^6}{(T_{max} - T_{min}) \times V_{nom}}$$

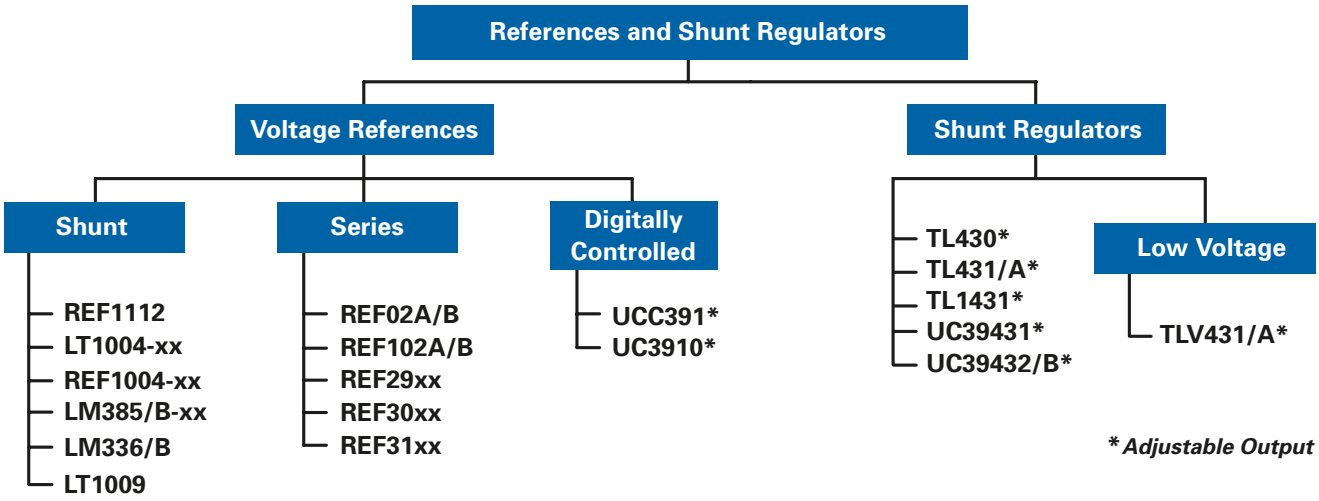
Long-Term Stability — The output of a voltage reference changes very gradually as time goes by. The greatest change occurs in the first 500 hours. This parameter can be important in high-performance applications or in applications where periodic calibration is not acceptable. TI specifies long-term stability data based on the observation over 1000 hours at room temperature.

Output Noise — Output noise is usually specified over two frequency ranges: 0.1 Hz to 10 Hz (peak-to-peak noise) and 10 Hz to 1 kHz (RMS noise). Noise can be important because it can reduce dynamic range of the acquisition system. High-resolution data acquisition systems may experience "dither" in the LSBs solely due to reference noise. Noise can be reduced by external filtering (REF102 has noise reduction pin).

Adjustable Output — Both fixed and adjustable outputs are available. The adjustable output can be set via a resistor divider connected to a reference pin.

Packaging — Through-holes (PDIP and TO-92) and surface mount (SOIC, TSSOP, SOT-89, and SOT23) packages are available.

References and Shunt Regulators Family of Products



Selection Guide

Device	V_{OUT} (V)	V_{OUT}/V_{REF} Initial Tolerance @ 25°C (%)	Min I_Z for Regulation (µA)	I_q (max) (mA)	I_{OUT}/I_Z (max) (mA)	V_{IN} (min) (V)	V_{IN} (max) (V)	Adj. V_{OUT} Range (V)	Temp. Co. (typ) (ppm/°C)	Temp. Co. (max) (ppm/°C)	Output Topology	Package	Price[1]
Voltage References and Shunt Regulators													
REF1112	1.25	0.2	1	0.005	5	—	—	—	10	30	Shunt	SOT23	0.79
LM285-xx, LM385/B-xx	1.235, 2.5	1, 1.5, 2, 3	10, 20	—	20	—	—	—	20	—	Shunt	SOIC, PDIP	0.18
LT1004-xx	1.235, 2.5	0.3, 0.8	10, 20	—	20	—	—	—	20	—	Shunt	SOIC, PDIP	0.36
LM236-2.5, LM336/B-2.5	2.5	2, 4	400	—	10	—	—	—	10, 13	33	Shunt	SOIC, PDIP	0.40
REF1004-xx	1.235, 2.5	0.3, 0.4	10, 20	—	20	—	—	—	20	—	Shunt	SOIC, PDIP	1.23
LT1009	2.5	0.2	400	—	10	—	—	—	—	23	Shunt	SOIC, PDIP	0.41
REF31xx	1.25, 2.048, 2.5, 3.0, 3.3, 4.096	0.2	—	0.115	±10	1.8	5.5	—	5	15	Series	SOT23	1.10
REF30xx	1.25, 2.048, 2.5, 3.0, 3.3, 4.096	0.2	—	0.05	25	1.8	5.5	—	20	50	Series	SOT23	0.59
REF29xx	1.25, 2.048, 2.5, 3.0, 3.3, 4.096	2	—	0.05	25	1.8	5.5	—	35	100	Series	SOT23	0.49
REF02A/B	5	0.2, 0.3	—	1.4	21	8	40	—	4	10, 15	Buried Zener	SOIC, PDIP	1.75
REF102A/B	10	0.05, 0.1	—	1.4	10	11.4	36	—	—	5, 10	Buried Zener	SOIC, PDIP	1.75
REF102C	10	0.025	—	1.4	10	11.4	36	—	—	2.5	Buried Zener	SOIC, PDIP	4.85
TL1431	Adj.	0.4	1000	—	100	2.5	—	2.5 to 36	23	114	Shunt	SOIC, PDIP	
TL430	Adj.	5	2000	—	100	2.75	—	2.75 to 30	120	200	Shunt	SOIC, PDIP	0.58
TL431/A/**B**	Adj.	0.5, 1, 2	600, 1000	—	100	2.495	—	2.495 to 36	16	80, 96	Shunt	SOIC, PDIP	0.14
TL432/A/B	Adj.	0.5, 1, 2	600, 1000	—	100	2.495	—	2.495 to 36	16	80, 96	Shunt	SOIC, PDIP	0.14
TLV431/A	Adj.	1, 1.5	80	—	15	1.24	—	1.24 to 6	39	129	Shunt	SOIC, PDIP	0.23
UC3910	5, Adj.	0.6, 0.9	—	3.5	10	5	12	2 to 3.5, 5	—	—	Digitally Controlled	SOIC, PDIP	2.71
UCC391	Adj.	1	—	1.8	0.15	5	8	1.3 to 3.5	—	—	Digitally Controlled	SOIC, PDIP	1.25
UC39431	Adj., 2.82, 3.12, 5.1, 7.8, 10.42, 12.24	0.4	800	0.5	100	2.2	36	2.3 to 36	—	—	Shunt	SOIC, PDIP	2.33
UC39432/B	Adj., 1.3	0.4, 0.8	800	0.5	100	2.2	36	2.2 to 36	—	—	Shunt	SOIC, PDIP	2.09

Device	No. of Outputs	I_{OUT} (µA)	Current Tolerance (max) (%)	Current Match Tolerance (max) (%)	Temp Drift (typ) (ppm/°C)	Voltage Compliance, 1% (V)	Current Mirror Tolerance (max) (%)	Price[1]
Current References								
REF200	2	100	1	1	25	2.5 to 40	0.5	2.60

[1]*Suggested resale price in U.S. dollars in quantities of 1,000.*

*New devices are listed in **bold red**.*

Resources *For a complete list of Resources, visit power.ti.com*

Literature Number	Part Number	Description
Application Notes		
SBVA010	REF102	Improved Voltage Reference Filter Has Several Advantages
SBVA008	REF102	Low Power Operation of REF102 10.0V Precision Voltage Reference
SBVA001	REF102	Make A Precision Current Source or Current Sink
SBVA007	REF102	Make a Precision ±10 V Reference
SBVA006	REF102	Make a Precision –10 V Reference
SBVA002	REF102	Voltage-Reference Filters
SBOA046	REF200	Implementation and Applications of Current Sources and Current Receivers
SBOA14	REF200	Boost Instrument Amp CMR with Common-Mode Driven Supplies
SBOA53	REF200	4- to 20-mA to 0- to 20-mA Converter and Current Summing Current-to-Current Converters
SBAO18	REF200	Single-Supply, Low-Power Measurements of Bridge Networks
SBAA039	REF1004	Comparing the ADS1201 to the CS5321
SBAA017	REF1004	How To Get 23 Bits Of Effective Resolution From Your 24-Bit Converter
SBAA008	—	Voltage Reference Scaling Techniques Increase the Accuracy of the Converter as Well as Resolution

Real-Time Clocks

Design Factors

Data Bus Type — There are two bus types available: (1) address/data multiplexed and (2) parallel. With (1), the memory address lines and data lines share the same pins. With (2), the address lines and data lines are separate and the interface is the same as a static RAM. The address/data multiplexed devices have fewer pins but may require more logic to interface.

3- or 5-V Operation — The RTCs can run from a 5-V or 3-V rail.

CPU Supervisor — Some parts include a full CPU supervisor that provides:

- CPU reset (power-on and push-button).
- Power-fail interrupt.
- Watchdog timer.
- Non-volatile control for additional NVSRAM.

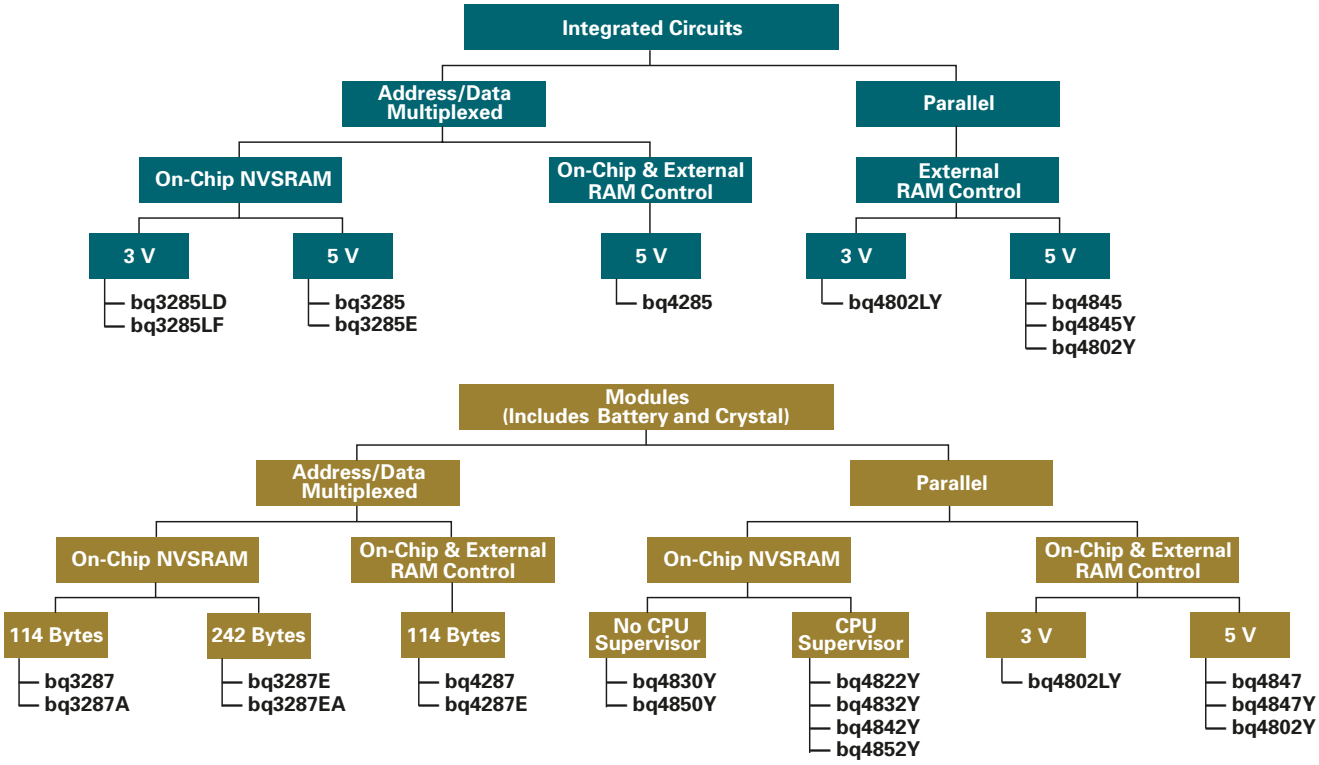
The integration of the supervisor on the RTC can reduce the component count in a design.

- Onboard NVSRAM.
- V_{CC} tolerance.
- Package type.

Features

- Real-time clock counts seconds through centuries in BCD format.
- Complete surface-mount solution with SNAPHAT™ package.
- Less than 500 nA of current consumption in battery backup mode.
- Clock accuracy (modules) better than 1 minute per month.
- Up to 512K x 8 of onboard NVSRAM
- 3- or 5-V operation.
- Fully integrated CPU supervisor.

Real-Time Clocks Family of Products



Selection Guide

Device	V_{CC} Level (V)	V_{CC} Tolerance (%)	CPU Supervisor	Onboard NVSRAM	External NVSRAM Control	Packages	Price[1]
Parallel Interface							
bq4802Y	5	10	Yes	No	Yes	28-pin SOIC, TSSOP or SNAPHAT™	2.50
bq4802LY	3	10	Yes	No	Yes	28-pin SOIC or TSSOP	2.50
bq4845	5	5	Yes	No	Yes	28-pin SOIC	2.50
bq4845Y	5	10	Yes	No	Yes	28-pin SOIC	2.50
bq4830Y	5	10	No	32K x 8	No	28-pin DIP Module	10.50
bq4822Y	5	10	No	8K x 8	No	28-pin DIP Module	9.50
bq4832Y	5	10	No	32K x 8	No	32-pin DIP Module	12.50
bq4842Y	5	10	No	128K x 8	No	32-pin DIP Module	14.50
bq4852Y	5	10	No	512K x 8	No	36-pin DIP Module	29.00
bq4847	5	5	Yes	No	Yes	28-pin DIP Module	4.95
bq4847Y	5	10	Yes	No	Yes	28-pin DIP Module	4.95
bq4850Y	5	10	No	512K x 8	No	32-pin DIP Module	25.00
Address/Data Multiplexed							
bq3285	5	10	No	114 bytes	No	24-pin SOIC	2.10
bq3285E	5	10	No	242 bytes	No	24-pin SOIC or SSOP	2.10
bq3285LD	3	10	No	242 bytes	No	24-pin SSOP	2.10
bq3285LF	3	10	No	240 bytes	No	24-pin SSOP	2.10
bq3287	5	10	No	114 bytes	No	24-pin DIP Module	3.80
bq3287A[2]	5	10	No	114 bytes	No	24-pin DIP Module	3.80
bq3287E	5	10	No	242 bytes	No	24-pin DIP Module	3.80
bq3287EA[2]	5	10	No	242 bytes	No	24-pin DIP Module	3.80
bq4285	5	10	No	114 bytes	Yes	24-pin SOIC	2.35
bq4285E	5	10	No	114 bytes	Yes	24-pin SOIC	2.35
bq4287	5	10	No	114 bytes	Yes	24-pin DIP Module	4.30

[1]Suggested resale price in U.S. dollars in quantities of 1,000.
[2]The "A" versions have a RAM clear input pin.

Non-Volatile SRAM (NVSRAM)

Design Factors

Memory Density

The densities range from 64 Kbit to 16 Mbit organized x 8.

V_{CC} Tolerance

To protect data during power-up/-down sequences, the NVSRAM automatically deselects the SRAM when its supply voltage is 5 or 10% below the nominal 5 V. The tolerance should match the characteristics of the 5-V supply.

Features

- 10-year data retention in the absence of power.
- Standard SRAM pinout and interface.
- Unlimited write cycles.
- Access times of 70 ns.
- Automatic write protection during power cycles.
- Internal battery isolated until initial power-up.
- 28- to 36-pin DIP.

Non-Volatile SRAM (NVSRAM) Family of Products

Device	Description	Price[1]
5% V_{CC} Tolerance		
bq4010	8K x 8 (64 Kbit)	6.50
bq4011	32K x 8 (256 Kbit)	7.50
bq4013	128K x 8 (1 Mbit)	9.50
bq4014	256K x 8 (2 Mbit)	20.00
bq4015	512K x 8 (4 Mbit)	22.00
bq4016	1024K x 8 (8 Mbit)	26.00
bq4017	2048K x 8 (16 Mbit)	50.00
10% V_{CC} Tolerance		
bq4010Y	8K x 8 (64 Kbit)	6.50
bq4011Y	32K x 8 (256 Kbit)	7.50
bq4013Y	128K x 8 (1 Mbit)	9.50
bq4014Y	256K x 8 (2 Mbit)	20.00
bq4015Y	512K x 8 (4 Mbit)	22.00
bq4016Y	1024K x 8 (8 Mbit)	26.00
bq4017Y	2048K x 8 (16 Mbit)	50.00

[1] *Suggested resale price in U.S. dollars in quantities of 1,000.*

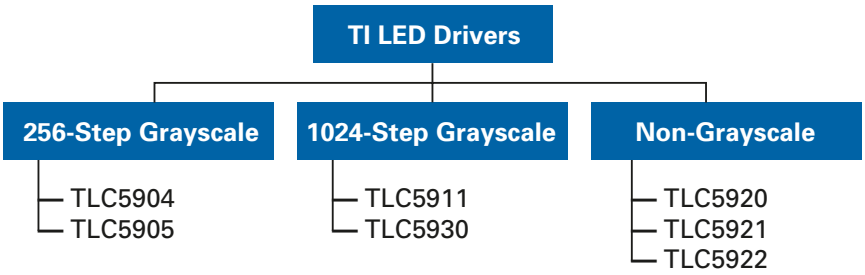
Design Factors

Grayscale Steps — The number of colors that can be created is determined by the number of grayscale steps.

Data Input — Choose either 1-bit serial data input or a parallel input data interface as high as 10 bits in parallel.

Output Current Drive — Depending on the brightness requirements of the LEDs, LED drivers are capable of delivering up to 80 mA per channel.

LED Drivers Family of Products



Dot Correction — Gives the ability to control the output current digitally from 0 to 100% by utilizing the driver's internal DAC.

Selection Guide

Device	Data Input	Brightness Adjustment (Steps)	Output Count (Bits)	Output Current Drive (mA)	Dot Correction	Protection			Package	Price[1]
						OVM	WDT	TSD		
1024-Step Grayscale										
TLC5911	10-bit, 7-bit	64	16	80	Yes	No	Yes	Yes	100-pin HTQFP	7.25
TLC5930	1-bit	64	12	40	Yes	Yes	No	No	24-pin HTSSOP	4.15
256-Step Grayscale										
TLC5904	8-bit parallel	32	8, 16	80 (16-bit), 120 (8-bit)	No	Yes	Yes	Yes	100-pin HTQFP	4.70
TLC5905	1-bit	32	8, 16	80 (16-bit), 120 (8-bit)	No	Yes	Yes	Yes	64-pin HTQFP	3.85
Non-Grayscale										
TLC5920	1-bit	—	16	30	No	No	No	No	32-pin HTSSOP	2.90
TLC5921	1-bit	—	16	80	No	Yes	Yes	Yes	32-pin HTSSOP	1.85
TLC5922	1-bit	16	16	80	Yes	No	No	Yes	48-pin SSOP	1.90

[1] *Suggested resale price in U.S. dollars in quantities of 1,000.*

TMS320C6000™ DSP Platform for Non-Portable Applications[1]

	Output Current							
	250 mA	500 mA	750 mA	1 A	2 A	4 A	6 A	8 A
Dual Plug-in Module	—	—	—	PT6940	PT6940	PT6940	PT6940	—
Plug-in Module	PT5520	PT5520	PT5520	PTH03050	PTH03050	PTH03050	PTH03050	PTH03060
DC/DC Converter (w/FETs)	TPS62200	TPS62000	TPS62040	TPS62040	TPS54310	TPS54610	TPS54610	TPS54910
DC/DC Controller	TPS40007	TPS40007	TPS40007	TPS40007	TPS40007	TPS40007	TPS40007	TPS40007
Low-Dropout (LDO) Regulator	TPS76601	REG103	TPS77701	TPS76701	TPS75201	TPS75601	—	—
Dual LDO[2]	TPS70702	TPS70102	TPS767D301	TPS767D301	TPS70302	—	—	—

	Supervised Voltage					
	1.2 V	1.4 V	1.5 V	1.8 V	2.5 V	3.3 V
Supply Voltage Supervisor	TPS3123J12	TPS3801-01	TPS3123G15	TPS3128E18	TPS3823-25	TPS3823-33
Dual Supply Voltage Supervisor[3]	TPS3110E12	TPS3110K33	TPS3110K33	TPS3305-18	TPS3305-25	—

[1]*Adjustable output voltage part numbers shown. Fixed voltages also available.*
[2]*Current shown for powering DSP core. I/O current capability for the dual LDO is rated approximately 50% of core current.*
[3]*Other supervised voltage is 3.3 V.*
*See **power.ti.com** for a complete product offering.*

TMS320C5000™ DSP Platform for Portable or Non-Portable Applications[1]

	Output Current							
	< 50 mA	100 mA	250 mA	500 mA	750 mA	1 A	2 A	4 A
Dual Plug-in Module	—	—	—	—	—	PT6930	PT6930	PT6940
Plug-in Module	—	—	PTH03050	PTH03050	PTH03050	PTH03050	PTH03050	PTH03050
Step-down Converter (w/FETs)	TPS62200	TPS62200	TPS62200	TPS62000	TPS62040	TPS62040	TPS54310	TPS54610
Step-down Controller	TPS43000	TPS43000	TPS43000	TPS43000	TPS43000	TPS43000	TPS43000	TPS43000
Step-up Converter (w/FETs)	TPS61100/20	TPS61100/20	TPS61100/20	TPS61020	TPS61030	TPS61030	—	—
Step-up Controller	UCC39421	UCC39421	UCC39421	UCC39421	UCC39421	UCC39421	UCC39421	UCC39421
Low Dropout (LDO) Regulator	TPS72201	TPS72101	TPS79401	TPS79501	TPS77701	TPS72501	TPS75201	TPS75601
Dual LDO[2]	TPS70702	TPS70702	TPS70702	TPS70102	TPS767D301	TPS767D301	TPS70302	—

	Supervised Voltage				
	1.5 V	1.6 V	1.8 V	2.5 V	3.3 V
Supply Voltage Supervisor	TPS3123G15	TPS3106E16	TPS3128E18	TPS3823-25	TPS3823-33
Dual Supply Voltage Supervisor[3]	TPS3110K33	TPS3110K33	TPS3305-18	TPS3305-25	—

[1]*Adjustable output voltage part numbers shown. Fixed voltages also available.*
[2]*Current shown for powering DSP core. I/O current capability for the dual LDO is rated approximately 50% of core current.*
[3]*Other supervised voltage is 3.3 V.*
*See **power.ti.com** for a complete product offering.*

TMS320C2000™ DSP Platform for Non-Portable Applications[1]

	Output Current							
	< 50 mA	100 mA	250 mA	500 mA	750 mA	1 A	2 A	4 A
Dual Plug-in Module	—	—	—	—	—	PT6930	PT6930	PT6940
Plug-in Module	—	—	PTH05050	PTH05050	PTH05050	PTH05050	PTH05050	PTH05050
DC/DC Converter (w/FETs)	TPS62200	TPS62200	TPS62200	TPS62000	TPS62040	TPS62040	TPS54310	TPS54610
DC/DC Controller	TPS40007	TPS40007	TPS40007	TPS40007	TPS40007	TPS40007	TPS40007	TPS40007
Low Dropout (LDO) Regulator	TPS72201	TPS72101	TPS79401	TPS79501	TPS77701	TPS72501	TPS75201	TPS75601
Dual LDO[2]	TPS70751	TPS70751	TPS70751	TPS70151	TPS767D318	TPS767D318	TPS70351	—

	Supervised Voltage	
	1.8 V	3.3 V
Supply Voltage Supervisor	TPS3128E18	TPS3823-33
Dual Supply Voltage Supervisor[3]	TPS3305-18	—

[1]*Adjustable output voltage part numbers shown. Fixed voltages also available.*
[2]*Current shown for powering DSP core. I/O current capability for the dual LDO is rated approximately 50% of core current.*
[3]*Other supervised voltage is 3.3 V.*
*See **power.ti.com** for a complete product offering.*

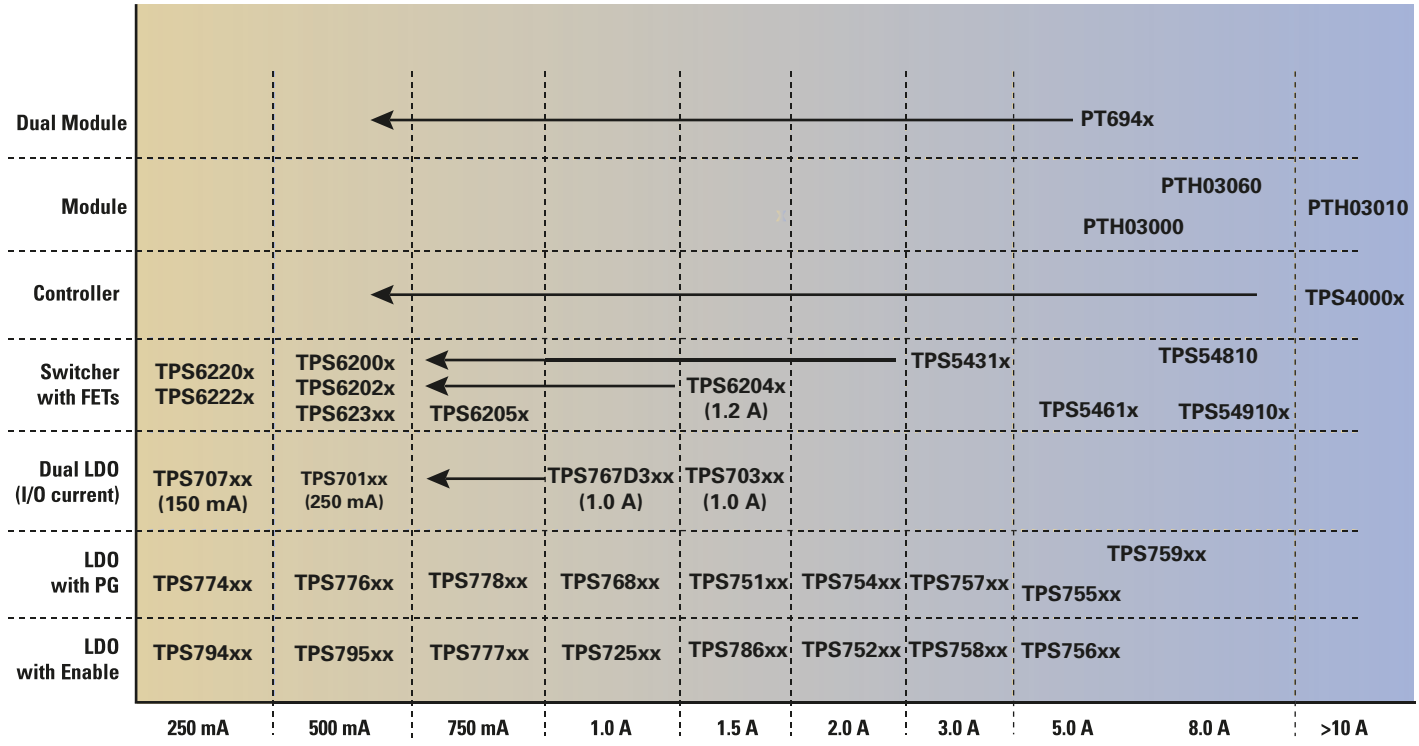
TMS320C3x DSP Platform for Non-Portable Applications[1]

	Output Current							
	< 50 mA	100 mA	250 mA	500 mA	750 mA	1 A	2 A	4 A
Dual Plug-in Module	—	—	—	—	—	PT6930	PT6930	PT6940
Plug-in Module	—	—	PTH03050	PTH03050	PTH03050	PTH03050	PTH03050	PTH03050
DC/DC Converter (w/FETs)	TPS62200	TPS62200	TPS62100	TPS62000	TPS54310	TPS62040	TPS62040	TPS54610
DC/DC Controller	TPS43000	TPS43000	TPS43000	TPS43000	TPS43000	TPS43000	TPS43000	TPS43000
Low Dropout (LDO) Regulator	TPS72201	TPS72101	TPS79401	TPS79501	TPS77701	TPS72501	TPS75201	TPS75601
Dual LDO[2]	TPS70751	TPS70751	TPS70751	TPS70151	TPS767D318	TPS767D318	TPS70351	—

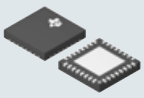
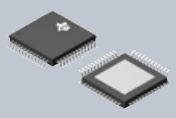
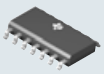
	Supervised Voltage	
	1.8 V	3.3 V
Supply Voltage Supervisor	TPS3128E18	TPS3823-33
Dual Supply Voltage Supervisor[3]	TPS3305-18	—

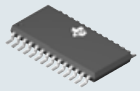
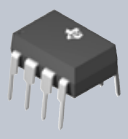
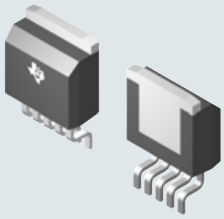
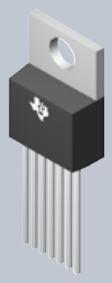
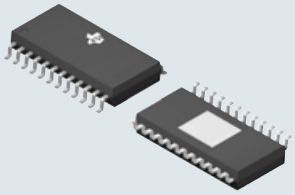
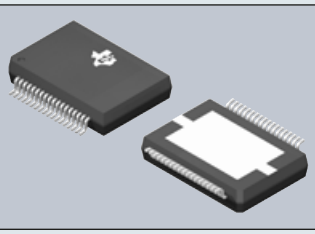
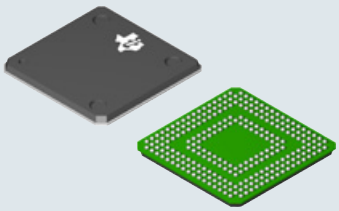
[1]Adjustable output voltage part numbers shown. Fixed voltages also available.
[2]Current shown for powering DSP core. I/O current capability for the dual LDO is rated approximately 50% of core current.
[3]Other supervised voltage is 3.3 V.
*See **power.ti.com** for a complete product offering.*

General-Purpose Power Management Selection Guide for DSPs and FPGAs



High-Performance Analog Packages

	Package Type	Package Designator
	Wafer Scale Package (WSP)	YEG, YEK, YEJ, YEA, YZA, YED, YNA
	Small Outline Transistor Package (SOT23)	DBY, DCN, Thin SOT, DDC
	Transistor Outline (TO236)	DBZ
	Mini Small Outline Package (MSOP)	DGK, DGS
	Small Outline No Leads (SON)	DRD, DRB, DRC
	Shrink Small Outline Package (SSOP)	DBQ, DB, DL
	Quad Flatpack No Leads (QFN)	RGS, RGY, RGT, RGV, RGY, RHC, RGA, RGP, RGW, RGY, RGE, RGU, RHD, RGL, RGD, RHB, RGF, RHA, RTA, RGN, RGZ, RGQ, RGC, RHE, RHF
	Thin Quad Flatpack (TQFP)	PBS, PJT, PFB, PAG
	Small Outline Transistor (SOT223)	DCY, DCQ
	Heat Sink Thin Quad Flatpack (HTQFP)	PHP, PAP
	Small Outline Integrated Circuit (SOIC)	D, DTH, DTC, DW, DWU

	Package Type	Package Designator
	Thin Shrink Small Outline Package (TSSOP)	PW
	Plastic Dual-In-Line Package (PDIP)	P, N, NT, NTD
	Surface Mount Header (DDPak)	KTT, KTW
	Transistor Outline (TO220)	KC
	Heat Sink Small Outline Package (HSOP)	DWP, DWD
	Power Small Outline Package (PSOP3)	DKP (slug down), DKD (slug up)
	Ball Grid Array (BGA)	

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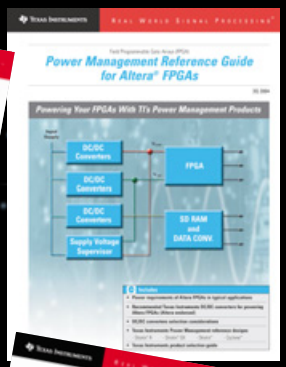

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