Renesas Power Supply and Charger IC Products

January, 2004
Analog & Discrete Semiconductor BU
Renesas Technology Corp.

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Contents

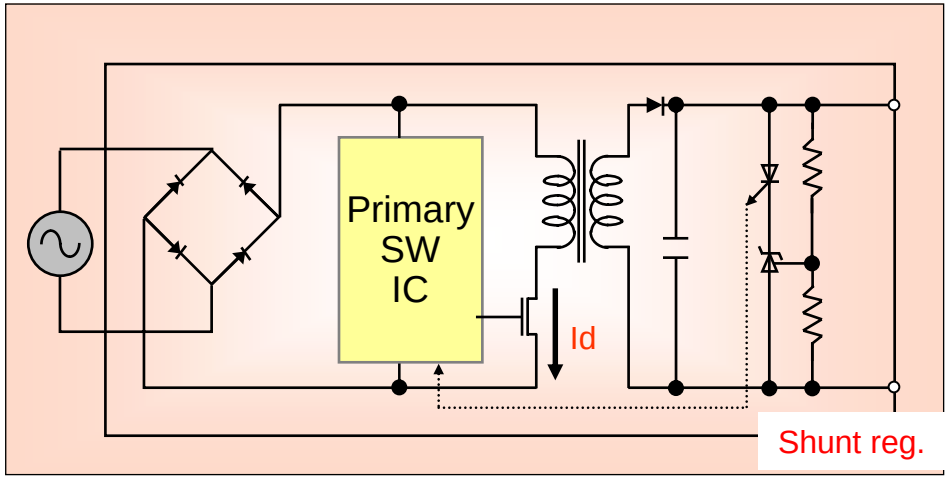
1. General-Purpose Power Supply IC

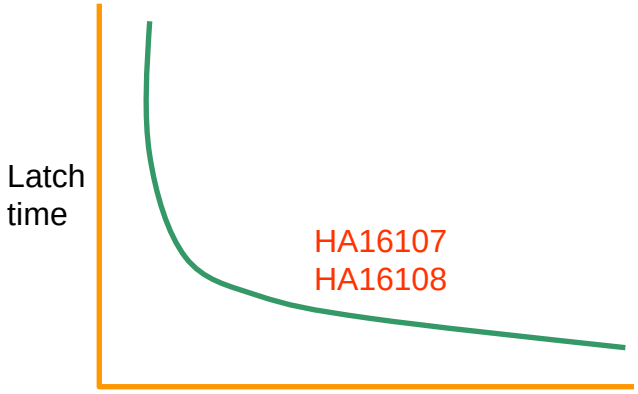
1.1 AC/DC Power Supply, PFC (Power Factor Improvement)

AC/DC Power Supply

Type	SW mode V	SW mode C	f	Package	Main SW	Note
HA17384 HA17385	—	√	500 kHz	DIP-8 SOP-8	Power MOS	C-Mode UC3842
HA16107 HA16108	√	—	600 kHz	DIP-16 SOP-16	Power MOS	Timer latch

Can use more smaller power MOS with the IC.



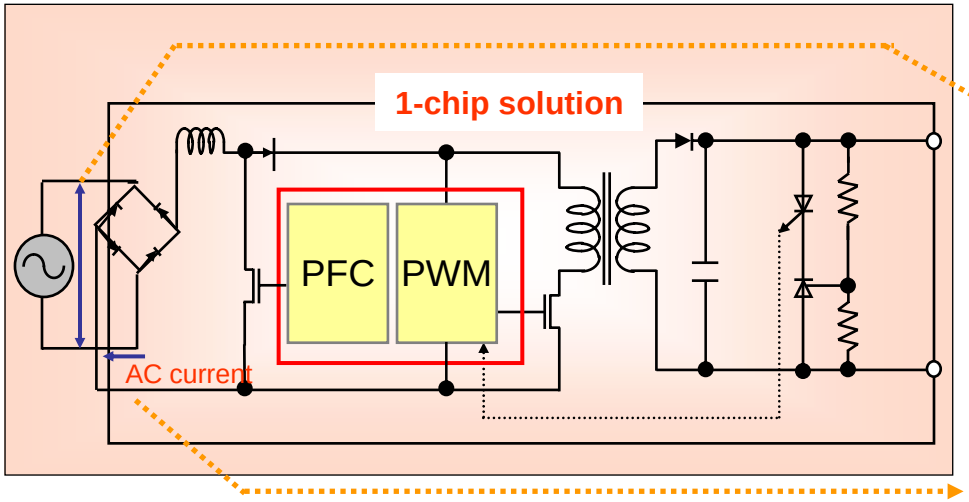


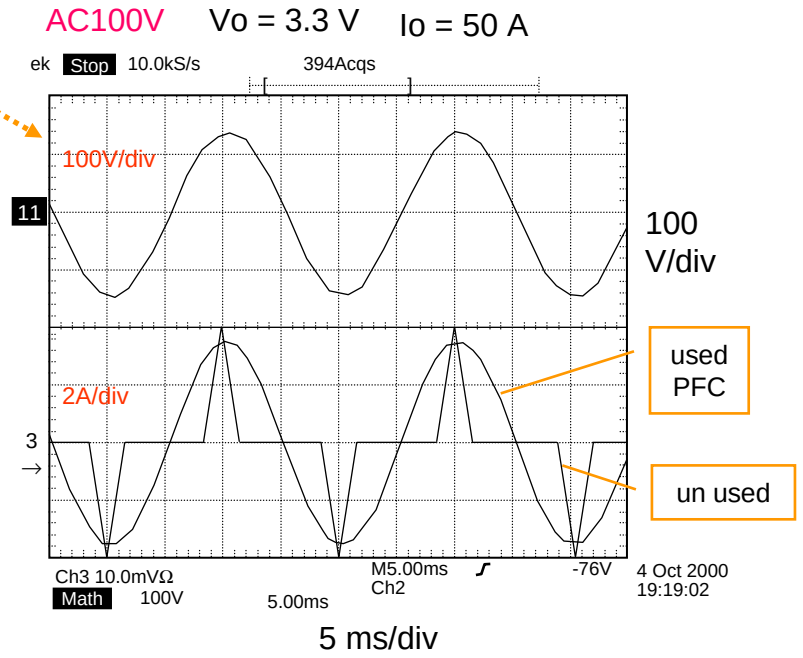
Issued total solution by IC, Shunt Reg. and Power mos.

#V: Voltage mode
#C: Current mode

PFC (Power Factor Correction) IC

Type	SW mode V	SW mode C	f	Package	Main SW	Note
HA16141 HA16142	—	√	PFC: 100 kHz PWM: 200 kHz	DIP-16 SOP-16	Power MOS	Primary IC of HA16341
HA16158	—	√	PFC: 65 kHz PWM: 130 kHz	DIP-16 SOP-16	Power MOS	f adj. f-down

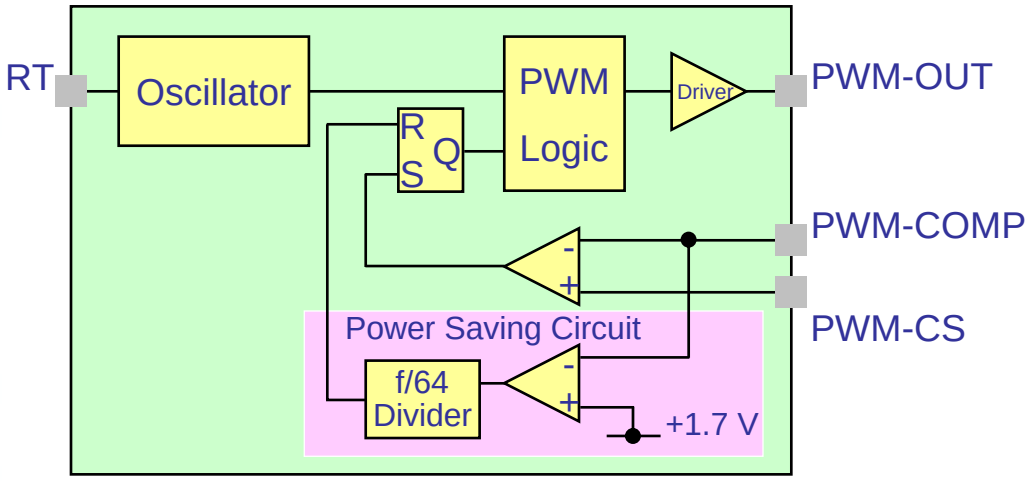




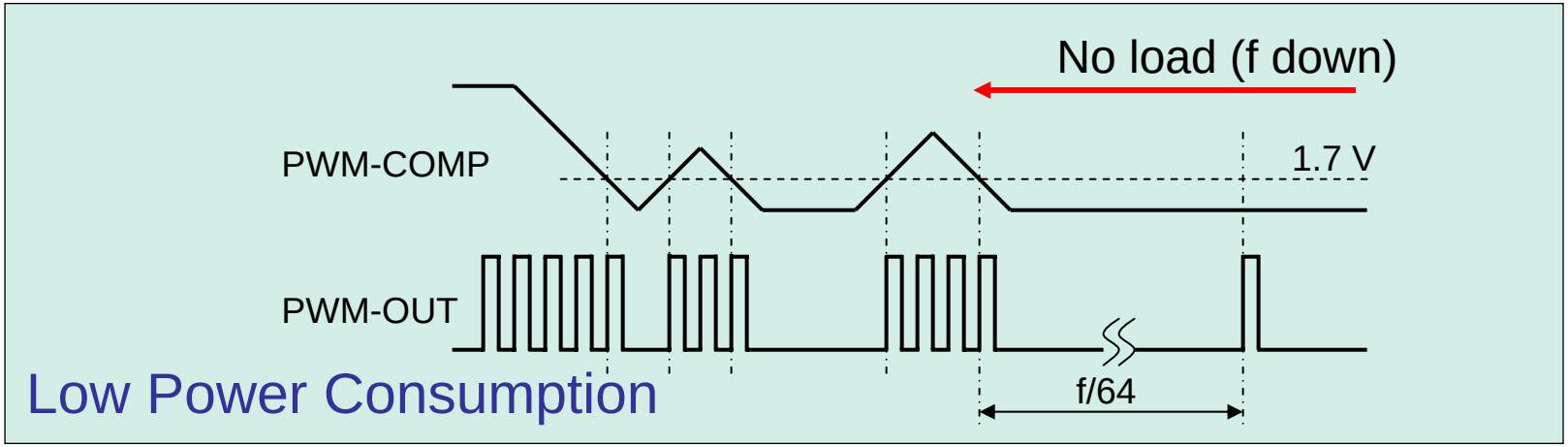
Input ac current becomes fine Sine-curve by PFC.

PFC + PWM IC, HA16158

Power saving at light load



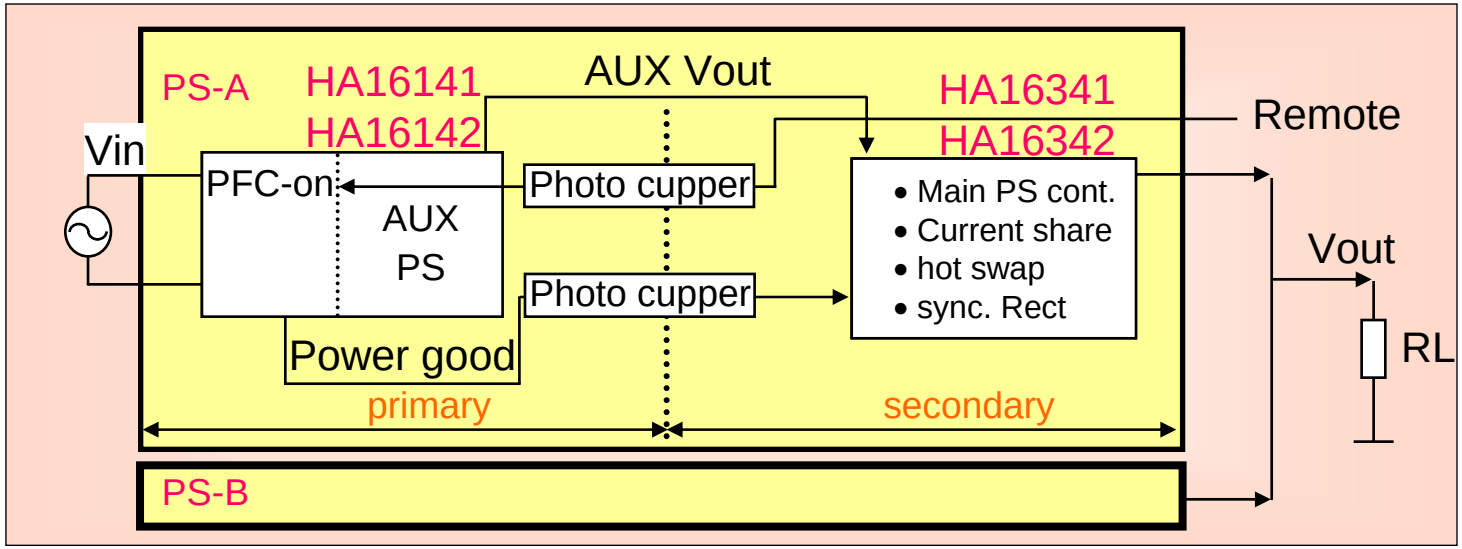
- Features
  - adjust frequency
  - f-down at light load
  - soft start function
  - OVP for PWM



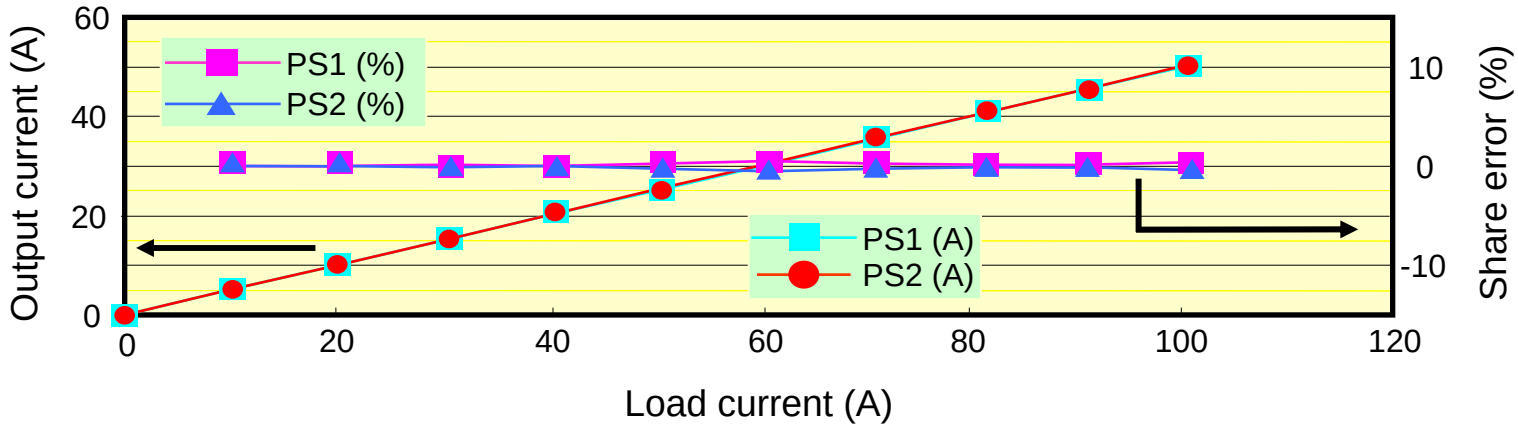
1.2 Parallel Redundant Power Supply

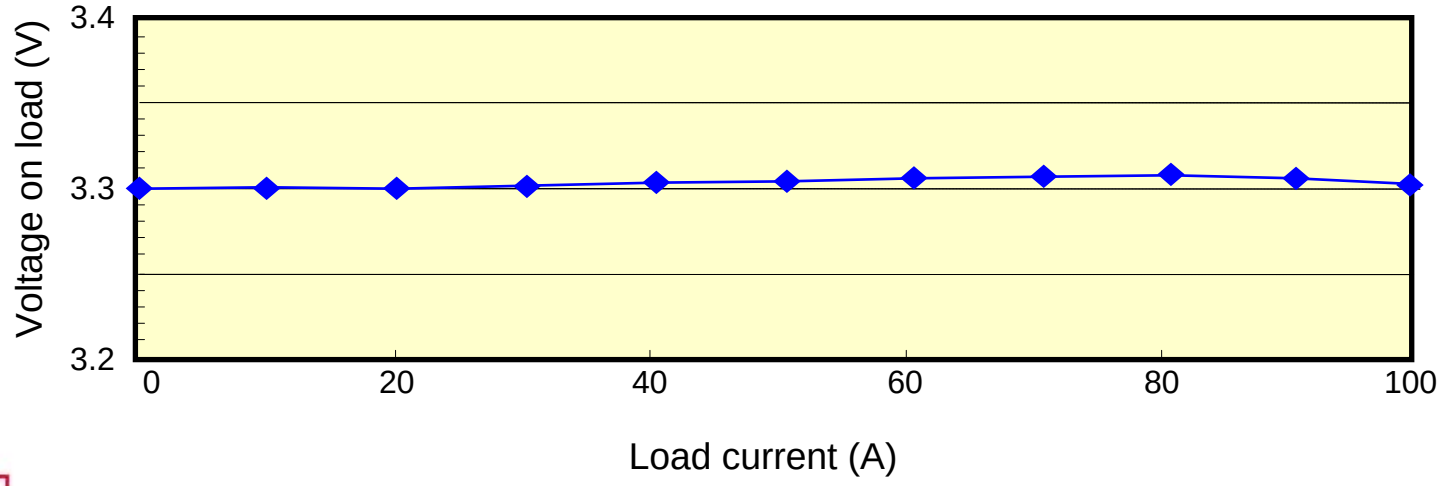
Redundant Power Supply IC

Type	SW mode V	SW mode C	f	Package	Main SW	Note
HA16141 HA16142	—	√	PFC: 100 kHz PWM: 200 kHz	DIP-16 SOP-16	Power MOS	Pair with HA16341
HA16341 HA16342		√	200 kHz	DIP-24 SOP-26	Power MOS	Current share hot swap



Current Share and Load Regulation

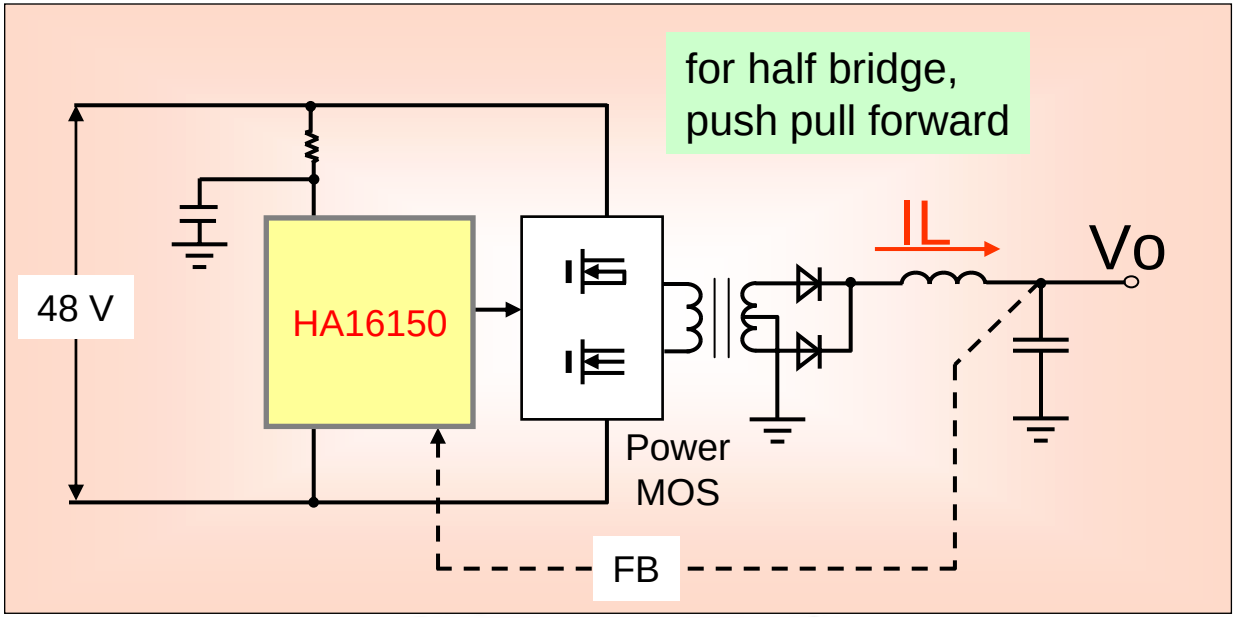




1.3 48-V Input Power Supply

HA16150T (1)

Type	SW mode V	SW mode C	f	Package	Main SW	Note
HA16150	—	√	1 MHz	DIP-16 TSSOP-16	Power MOS	48 V DC/DC



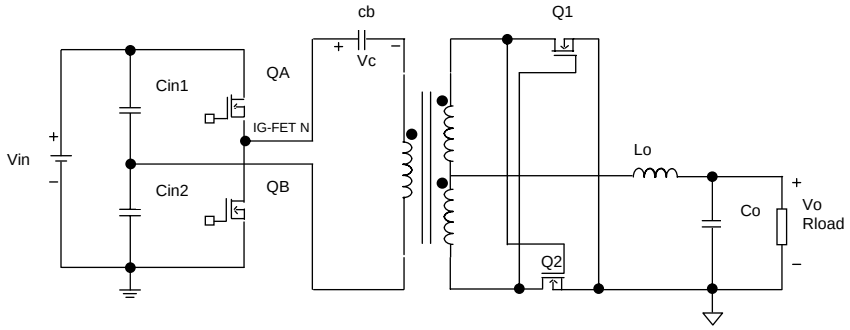
Can be used for brick or high power AC/DC supply (100 W to 300 W)

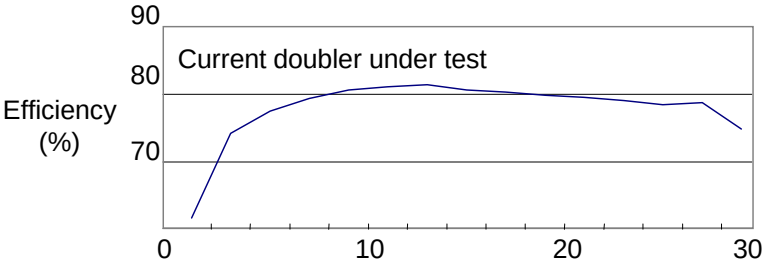
HA16150T (2)

Comparison

		HA16150 Renesas	UCC2806 TI	MC34025 ON semi.
Package		TSSOP-16 DIP-16	PLCC-20 DILP-16	SOP-16 (JEDEC) DILP-16
Vcc max	V	20	15	30
UVL High	V	9.3	7.5	9.2
UVL Low	V	8.3	6.75	8.4
Vref	V	5.0, <1%	5.1, <1.37%	5.1, <0.98%
Stand by current	µA	150typ	50typ	500typ
Soft start		ok	ok	ok
Remote on/off		ok	ng	ng
Current limit adj		ok	ok	ng
Independent DB adj.		ok	ng	ng
Reading edge		ok	ng	ng

Data

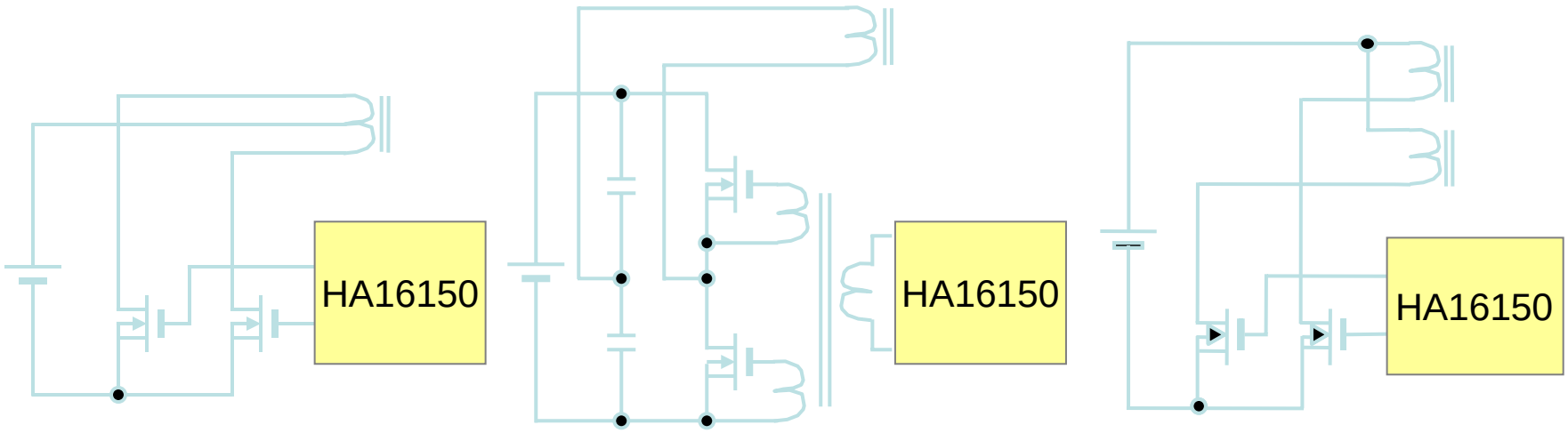




Po = 100 W

for Wide Applications

Dual high current outputs for FET drive



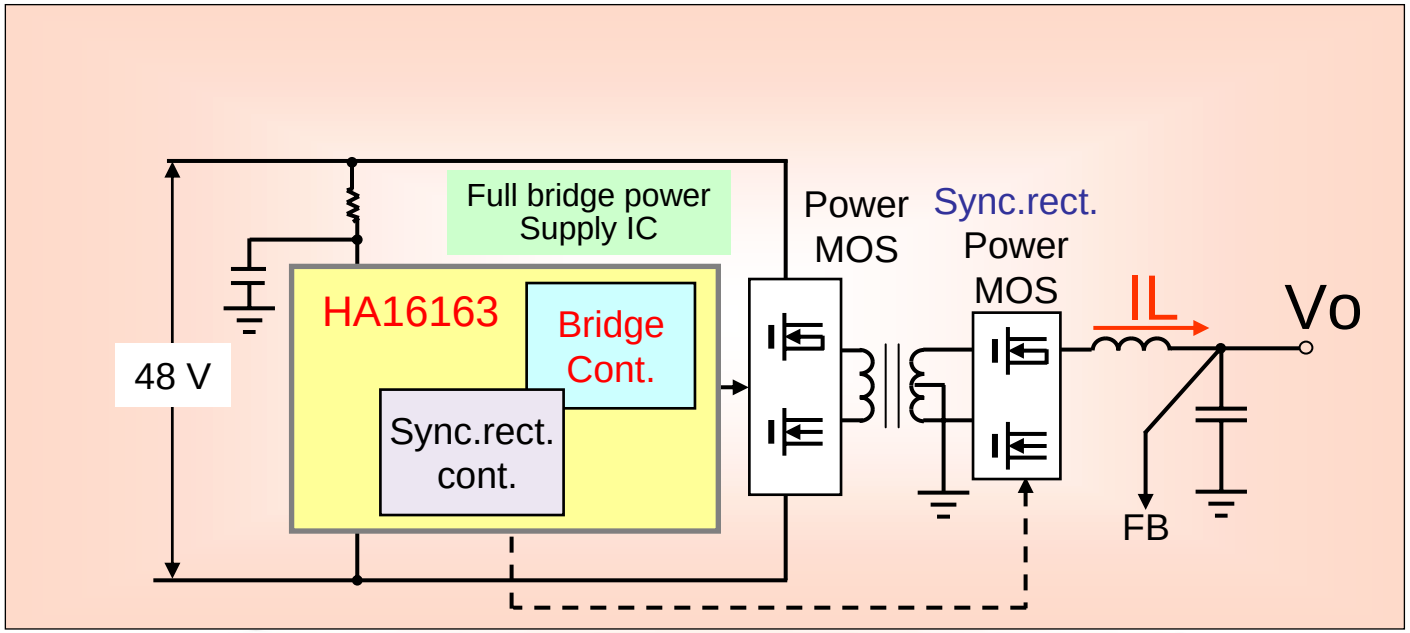
a) Push Pull

b) Half Bridge

c) Double Forward

HA16163T (1)

Type	SW mode V	SW mode C	f	Package	Main SW	Note
HA16163	—	√	2 MHz	TSSOP20	Power MOS	Bridge cont. Sync.rect.

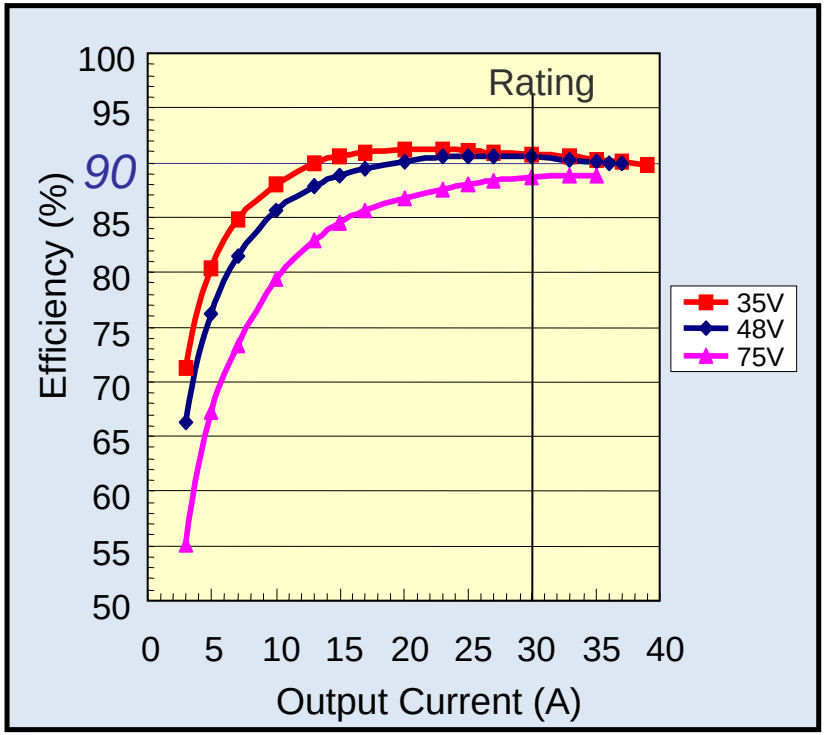


- High efficiency (up to 92%) by ZVS (= phase shift topology).
- Can be used for brick or high power AC/DC supply

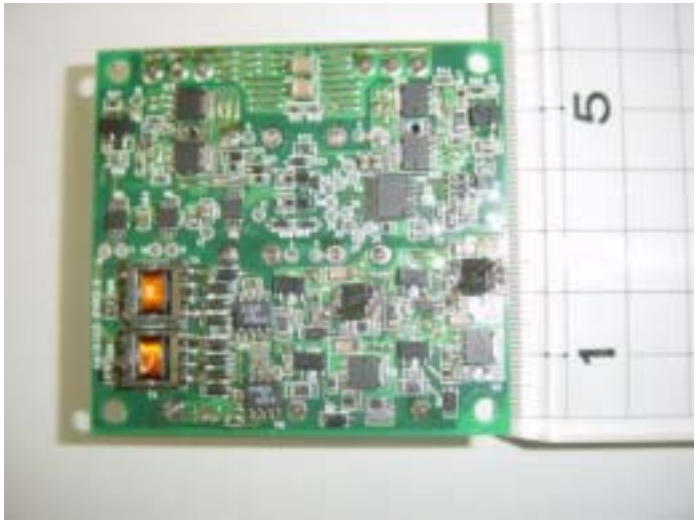
HA16163T (2)

> 90% Efficiency achieved

f = 480 kHz
Po = 100 W, Vo = 3.3 V



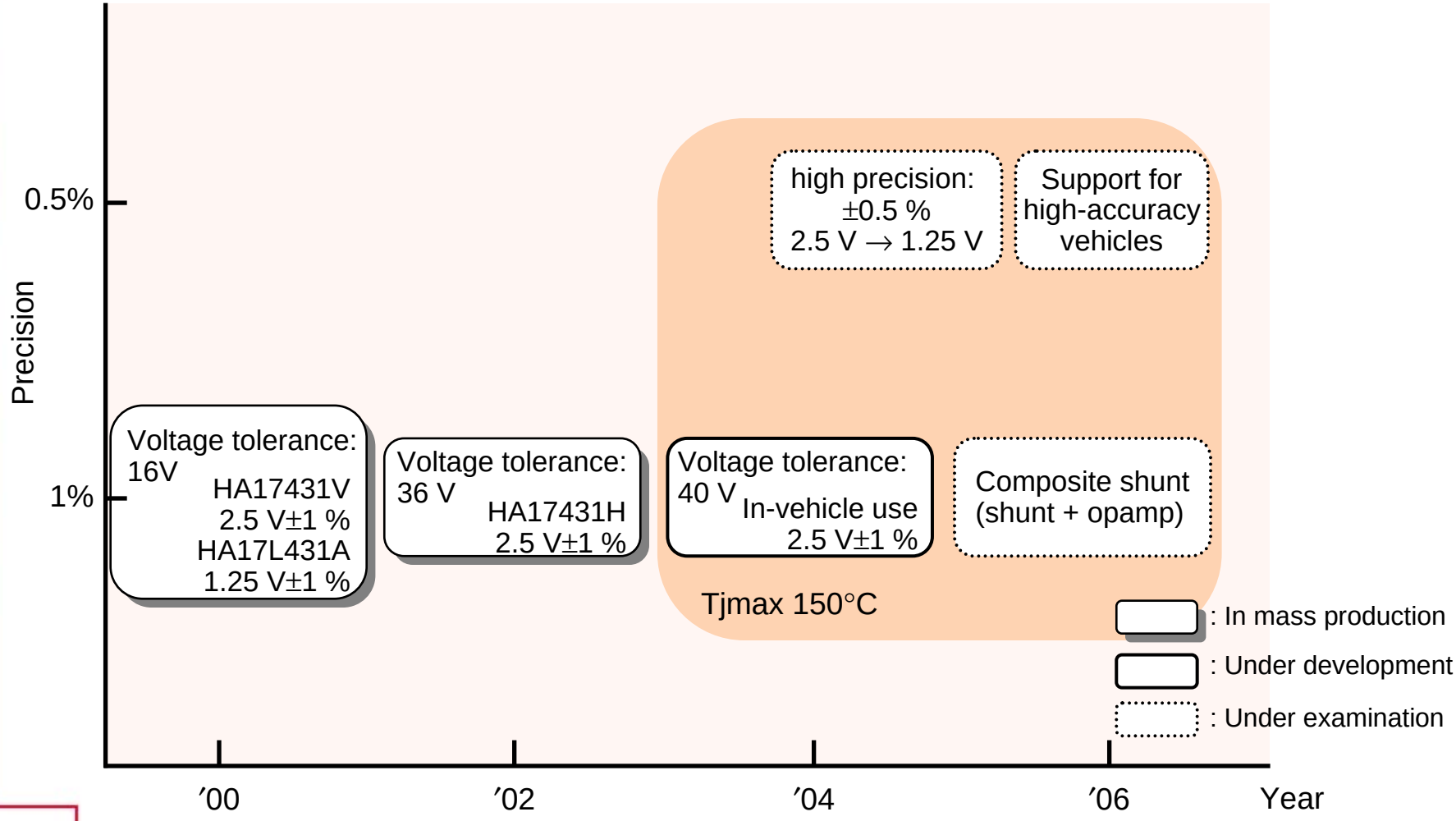
Evaluation Board



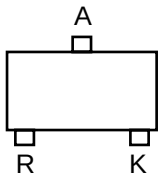
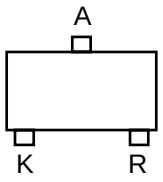
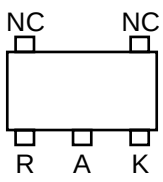
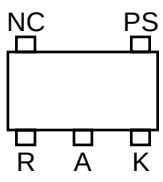
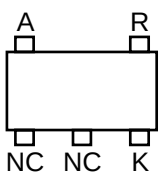
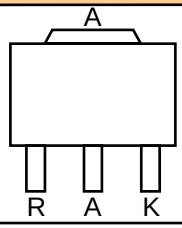
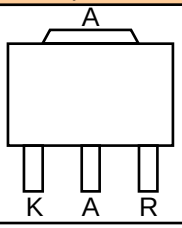
- Very small outline power supply by 100W. It is half brick size.
- Have evaluation board and the manual.

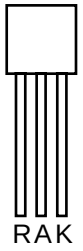
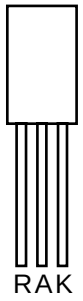
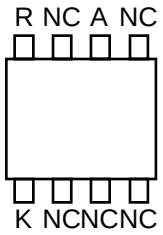
1.4 Shunt Regulator

Shunt Regulator Development Roadmap

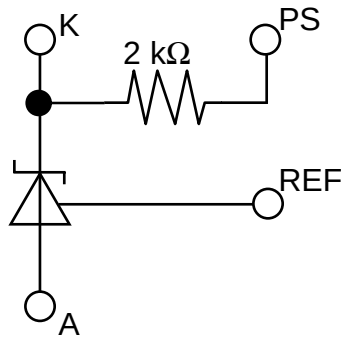


Package Outline and Pin Allocation

Package	MPAK (SOT-23)		MPAK-5 (SOT-23-5)			UPAK (SOT-89)	
Pin allocation (Top view)							
Renesas Type	HA17431HLTP HA17431VLTP HA17L431ALTP	HA17432HLTP HA17432VLTP HA17L432ALTP	HA17431HLP	HA17L431VLP	HA17L431ALP	HA17431UA HA17431UPA HA17431HUP HA17431VUP HA17L431UP	HA17432UA HA17432UPA HA17432HUP HA17432VUP HA17L432UP

Package	TO-92	TO-92MOD	JEITA SOP-8
Pin allocation (Top view)			
Renesas Type	HA17431PNA HA17431PNAJ HA17431HP HA17431VP HA17431VPJ HA17L431AP	HA17431P HA17431PJ HA17431PA HA17431PAJ	HA17431FP HA17431FPA HA17431FPJ HA17431FPAJ

(Notes) R: Reference
A: Anode
K: Cathode
NC: No Connection
PS: Bypass resistor (2 kΩ) for photocoupler



Symbol (HA17431VLP)

Product List

Max, cathode Voltage VKA (V)	Continued cathode Current IK (mA)	Reference Voltage Vref (V)	Reference voltage precision (%)	Operating temperature Range Topr (°C)	Package	Type No.
16	-30 to +50	1.240	±1	-20 to +85	MPAK	HA17L431ALTP HA17L432ALTP
					MPAK-5	HA17L431ALP
					TO-92	HA17L431AP
			±1.5	-20 to +85	UAPK	HA17L431UP HA17L432UP
16	-50 to +50	2.500	±1	-20 to +85	MPAK	HA17431VLTP HA17432VLTP
					MPAK-5	HA17431VLP
					UAPK	HA17431VUP HA17L432VUP
					TO-92	HA17431VP
				-40 to +85	TO-92	HA17431VPJ
36	-50 to +50	2.500	±1	-20 to +85	MPAK	HA17431HLTP HA17432HLTP
					MPAK-5	HA17431HLP
					UAPK	HA17431HUP HA17L432HUP
					TO-92	HA17431HP
40	-100 to +150	2.495	±2.2	-20 to +85	UPAK	HA17431UA HA17431UPA HA17432UA HA17432UPA
					TO-92	HA17431PNA
					TO-92MOD	HA17431PA
					SOP-8	HA17431FPA
				-40 to +85	TO-92	HA17431PNAJ
					TO-92MOD	HA17431PAJ
					SOP-8	HA17431FPAJ
			±4	-20 to +85	TO-92MOD	HA17431P
					SOP-8	HA17431FP
				-40 to +85	TO-92MOD	HA17431PJ
					SOP-8	HA17431FPJ

Comparison with Competitors Products (2.5-V Type)

2.5-V type
Manufacturer/Vrfe/Precision

Package	Renesas 2.500 V ±1%	Toshiba 2.495 V ±2.2%	NEC 2.495 V ±2.2%	JRC 2.495 V ±2.2%	TI 2.495 V ±2.2%,±1%	NS 2.495 V ±2.2%,±1%	ST 2.495 V ±2.2%,±1%	ON 2.495 V ±2.2%,±1%
TO-92	HA17431HP	TA76431S[*1]	µPC1093J	NJM431L NJM2380AL[*2]	TL431CLP TL431ACLP TL431ILP TL431AILP	LM431ACZ LM431BCZ LM431AIZ LM431BIZ	TL431CZ TL431ACZ	TL431CLP TL431ILP TL431ACLP TL431AILP
UPAK	HA17431HUP	TA76431FR		NJM431U NJM2380AU	TL431CPK TL431IPK			
	HA17432HUP	TA76431F	µPC1093T	NJM2390AU				
MPAK	HA17431HLTP							
	HA17432HLTP					LM431ACM3 LM431BCM3 LM431AIM3 LM431BIM3	TS2431ILT[*3] TS2431AILT[*3]	
MPAK-5	HA17431HLP		µPC1093TA	NJM2380AF[*4]	TL431CDBV[*4] TL431IDBV[*4]			

Note: Reference voltage precision and packages are compared

[*1]: TO-92MOD
[*2]: NJM23X0A: 2.465 V±1%
[*3]: TS2431ILT: 2.500V±2%, TS2431AILT: 2.500V±1%
[*4]: Different pin assignment from the HA17431HLP

Comparison with Competitors Products (1.25-V Type)

Manufacturer/Vrfe/Precision

Package	Renesas 1.24 V ±1%	Toshiba 1.26 V ±1.4%	NEC 1.26 V ±2.4%	JRC 1.25 V ±1%	TI 1.24 V ±1.5%, ±1%	NS 1.24 V ±1.5%, ±1%	ST 1.24 V ±2%, ±1%	ON 1.24 V ±1%
TO-92	HA17L431AP	TA76432S*1	µPC1944J		TLV431CLP TLV431ACLP TLV431ILP TLV431AILP	LMV431CZ LMV431ACZ LMV431IZ LMV431AIZ	TS431CZ TS431ACZ	TLV431ALP
UPAK	HA17L431HUP*2	TA76432FR	µPC1943T	NJM2373AU	TL431CPK TL431IPK			
	HA17L432HUP*2	TA76432F	µPC1093T	NJM2376U				
MPAK	HA17L431ALTP							
	HA17L432ALTP							
MPAK-5	HA17L431ALP	TA76432FC*3		NJM2373AF*3 NJM2376F*3	TLV431CDBV*3 TLV431IDBV*3 TLV431ACDBV*3 TLV431AIDBV*3	LMV431CM5*3 LMV431ACM5*3 LMV431IM5*3 LMV431AIM5*3	TS431LT*3 TS431AILT*3	TLV431ASN*3

Note: Reference voltage precision and packages are compared

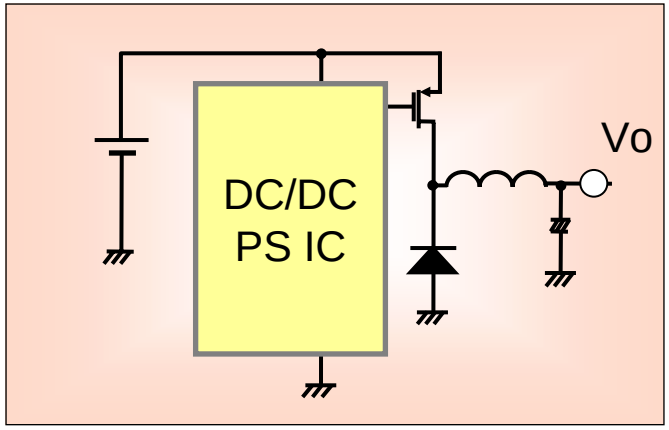
*1: TO-92MOD
*2: HA17L431UP, HA17L432UP: 1.24±1.5%
*3: Different pin assignment from the HA17L431ALP

1.5 DC/DC Power Supply

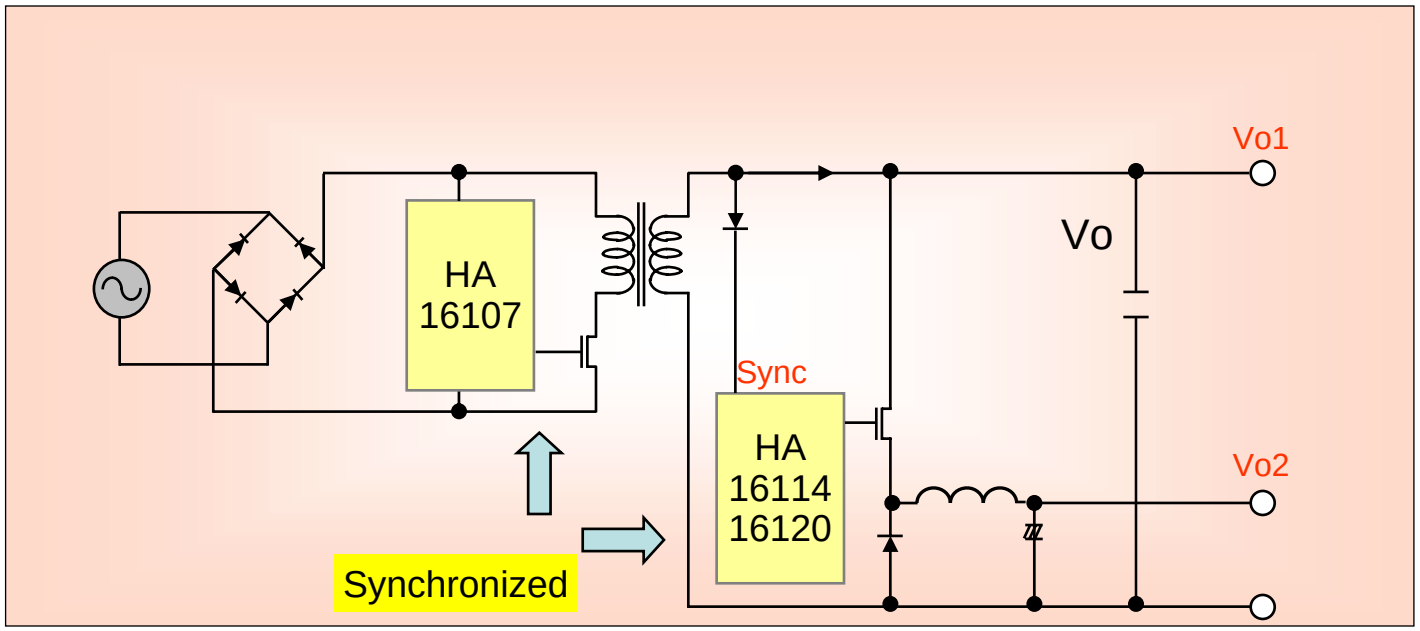
Non Sync. Rec. DC/DC

Type	Application	Ch count	Oscillation frequency	SW mode		Main SW	Package	
				V	C		DIP-16	SOP-16
HA16114	Step down	Single ch	600 kHz	Yes	—	Power MOS	Yes	Yes
HA16120	boost	Single ch	600 kHz	Yes	—	Power MOS	Yes	Yes
HA16116	Step down	Dual ch	600 kHz	Yes	—	Power MOS	Yes	Yes
HA16121	Step down and boost	Dual ch	600 kHz	Yes	—	Power MOS	Yes	Yes

Easily using
for point load.



Sync. opr between primary and secondary



Can operate synchronized switching frequency for multi outputs by using HA16107 Series with HA16114 Series.

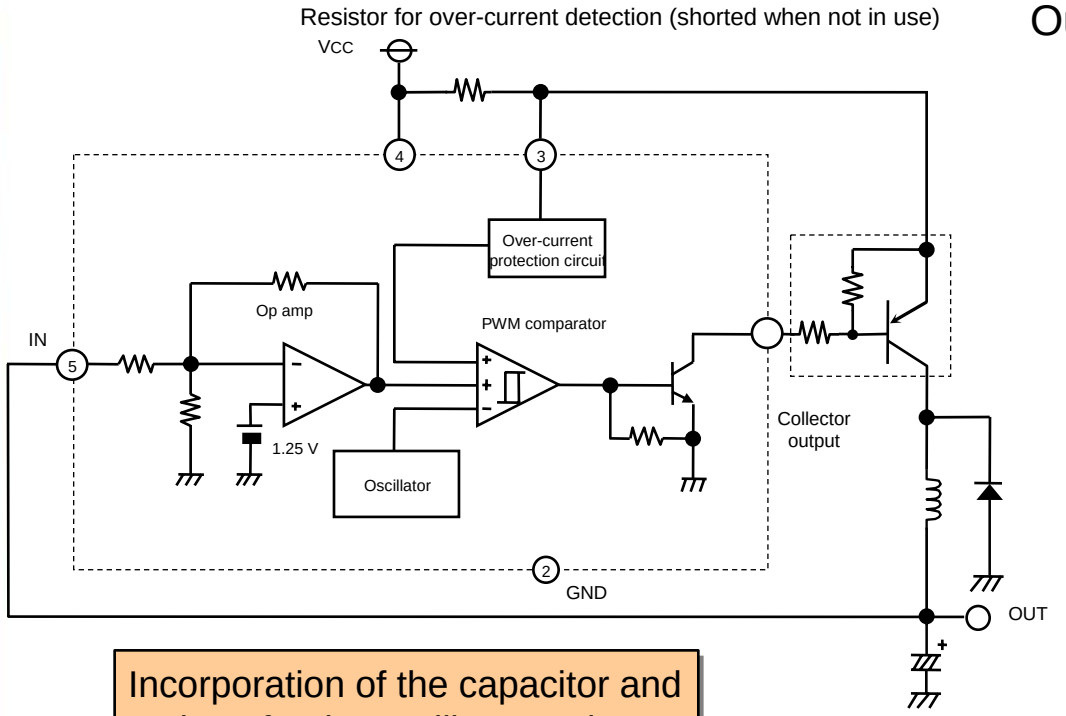
DC/DC Converters (1)

Type No.	Application	Operating-voltage range	Consumption Current	Output			Oscillation Frequency	Max Duty Cycle	Other Functions	Package		
				Type	Output Voltage	Output Current				DIP	SOP	SSOP
M5291	Step-up, step-down, polarity inversion	2.5 to 40 V	1.4 mA	Open collector	Variable	200 mA	100 Hz to 100 kHz	85.7%	Peak-current limitation circuit	P (8)	FP (8)	–
M62212		2.5 to 18 V	1.3 mA			150 mA	To 300 kHz	0 to 100% (Set by the DTC pin)	Output short-circuit protection, on/off control, DTC, soft start	P (8)	FP (8)	GP (8)
M62210	Step-up, step-down, polarity inversion, Backlight control								2-input priority control, on/off control, output short-circuit protection, DTC, soft start	–	FP (10)	–
M62211		2.5 to 35 V					To 500 kHz			P (14)	FP (10)	–
M62215	Step-up, step-down, polarity inversion, inverters	8.6 to 25 V	8 mA	Totem pole		±1 A		90%	2-input priority control, on/off control, output short-circuit protection, DTC, soft start, external input synchronous operation, pulse-by-pulse CLM	–	FP (10)	–
M62216	Step-up	0.9 to 15 V	850 µA	Open collector		200 mA	To 300 kHz	87%	Output on/off control	–	FP (8)	GP (8)

DC/DC Converters (2)

Type No.	Application	Operating-Voltage Range	Consumption Current	Output			Oscillation Frequency	Max Duty Cycle	Other Functions	Package		
				Format	Output Voltage	Output Current				5SIP	8SOP	SOT 23
M62220 M62221 M62222	Step-down	4 to 15 V	660 µA	Open collector	220:3.3 V 221:3.0 V 222:2.7 V	100 mA	110 kHz	90%	Over-current protection circuit	L	FP	–
M62270 M62271 M62272 M62273 M62274 M62275 M62276			500 µA		270:3.3 V 271:3.0 V 272:2.7 V 273:2.4 V 274:2.1 V 275:1.8 V 276:1.5 V					–	–	GP
M62290		6 to 15 V	780 µA		5.0 V		120 kHz			L	FP	–
M62291			570 µA							–	–	GP
M62292 M62293 M62294 M62203		4 to 15 V	1.5 mA		292: 3.3/1.8 V 293: 3.3/2.5 V 294: 3.3/2.0 V 203: 3.3/2.7 V	20 mA	110 kHz		Dual systems for voltage detection (input voltage and 3.3-V output)	–	FP	–

DC/DC Converter Series: Small Packages with Less Peripheral Circuitry M6229X, M6222X, M6227X



Incorporation of the capacitor and resistor for the oscillator and the resistor for output-voltage determination greatly reduces the need for peripheral circuitry.

Output Voltage Lineup

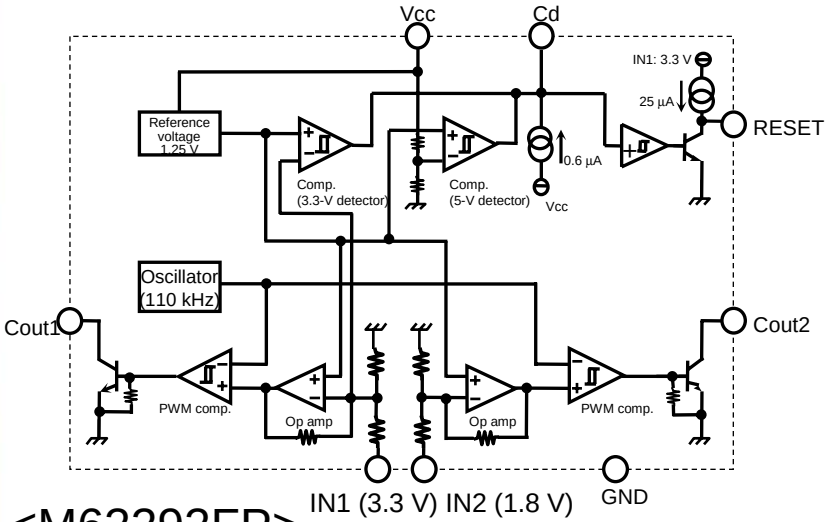
<Type No./Package/Output Voltage>

Type no.		Output voltage
5-pin SIL, 8-pin SOP	SOT23-5-pin	
M62290L/FP	M62291GP	5.0 V
M62220L/FP	M62270GP	3.3 V
M62221L/FP	M62271GP	3.0 V
M62222L/FP	M62272GP	2.7 V
—	M62273GP	2.4 V
—	M62274GP	2.1 V
—	M62275GP	1.8 V
—	M62276GP	1.5 V

DC/DC converter configurable with only 5 external components

5-pin SIL, 8-pin SOP, and 5-pin SOT-23 packages

DC/DC Converter Series: 2-ch Fixed Output with On-Chip Reset Function M6229XFP

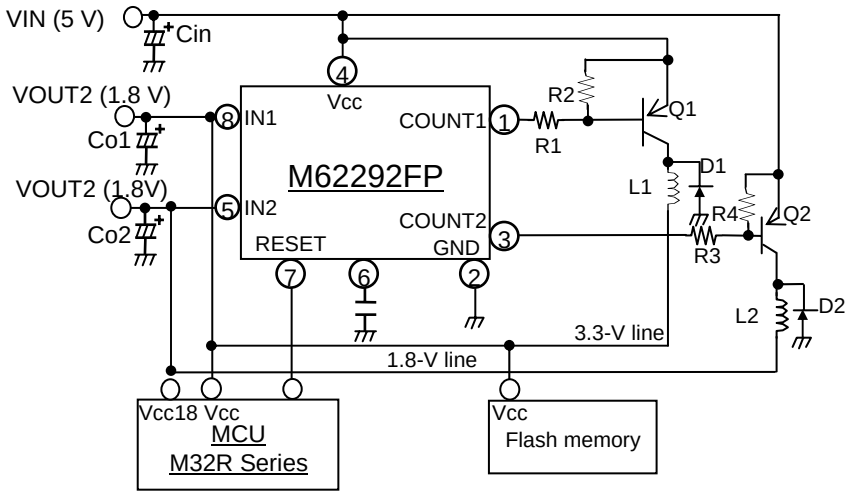


<M62292FP>

Suitable for M32R-series products in combination with flash memory

Type No.	Output Voltage
M62292	3.3 V/1.8 V
M62293	3.3 V/2.5 V
M62294	3.3 V/2.2 V
M62203	3.3 V /2.7 V

Example of an Application Circuit

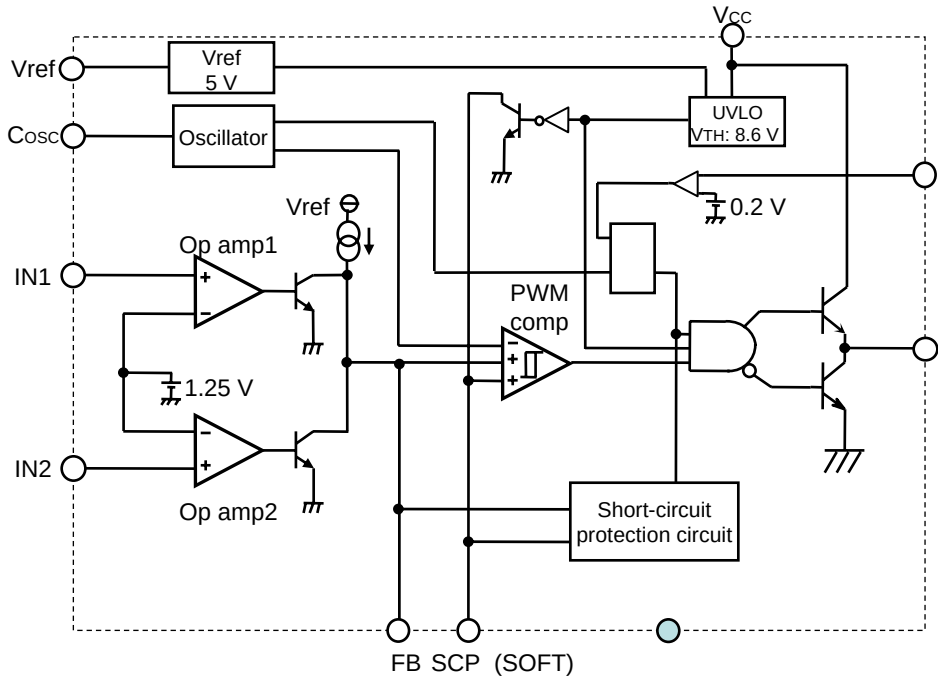


Dual voltage output: 3.3 V and 1.8 V; reset function accomplished with fewer parts; configures a highly efficient DC/DC converter.

General-Purpose Multi-Functional DC/DC Converter: M62215FP

High-precision ±1% on-chip reference-voltage source

High-speed pulse-by-pulse current limiter



Ideal for use with inverters: controllable by voltage or current

High-speed 500-kHz operation: large output current ±1A

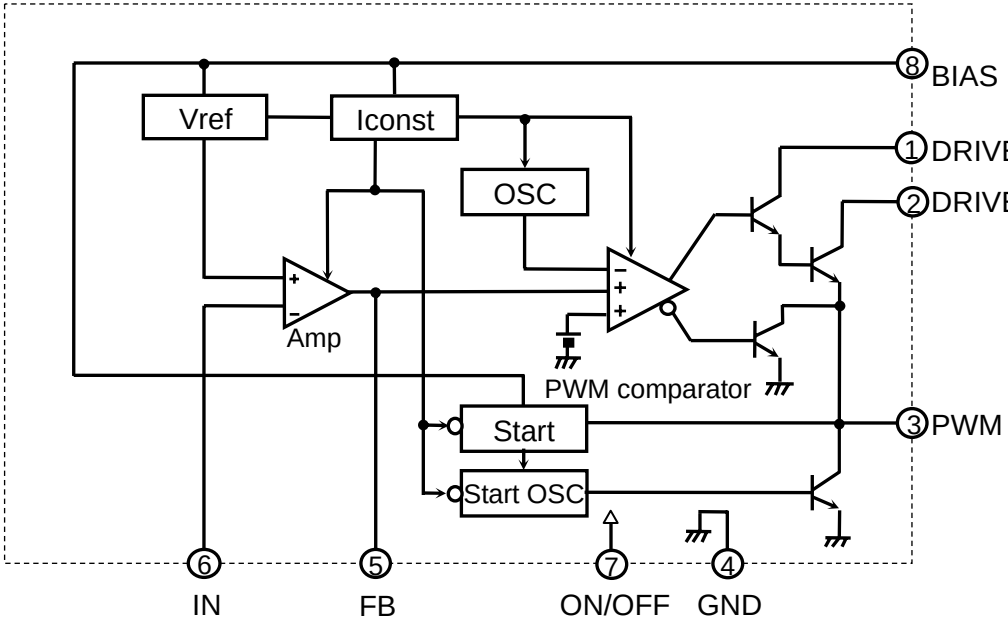
Controllable dead-time makes soft-start operation possible

On-chip output-short-circuit protection circuit

Step-Up DC/DC Converter for Operation from 0.9 V M62216FP

Wide operating-voltage range: 0.9 to 15 V

Output current: 100 mA



Low-voltage operation allows operation with a single battery (from 0.9 V)

Inclusion of C and R elements for the start-up and steady-state oscillators reduces numbers of peripheral elements.

On/off function: in the off state, the converter only draws 25 µA.

2. System Power Supplies

2.1 Synchronized Deflection System Control

Synchronized Deflection System Controller ICs

	Function, feature	Absolute maximum ratings			Electrical characteristics			Remarks	Package
		Power supply voltage	Output voltage	Output current	Circuit current	Reference voltage	Over-voltage detection level		
M62500	• PWM output in synchronization with external signals • PWM control over a wide frequency range: 15 kHz to 150 kHz • Allows phase adjustment of PWM output under external control • Built-in soft-start function • Built-in low-voltage-output malfunction-prevention circuit (UVLO) start VCC > 9 V, stop Vcc < 6 V • Built-in double-speed function	15 V	15 V	±150 mA	40 mA	5.0 V	–	2-ch output	24DIP 24SOP
M62501	• PWM output in synchronization with external signals • PWM control over a wide frequency range: 15 kHz to 150 kHz • Built-in soft-start function • Built-in low-voltage-output malfunction-prevention circuit (UVLO) start VCC>9V, stop Vcc<6V • Built-in OVP, UVP circuit	15 V	15 V	±100 mA	20 mA	5.0 V	5.0 V	1-ch output	16DIP 16SOP
M62502A	• PWM output in synchronization with external signals • PWM control over a wide frequency range: 15 kHz to 150 kHz • Built-in soft-start function • Built-in low-voltage-output malfunction-prevention circuit (UVLO) start VCC > 9 V, stop Vcc < 6 V • Built-in double-speed function	15 V	15 V	±100 mA	20 mA	5.0 V	–	1-ch output	16SOP
M62503	• PWM output in synchronization with external signals • PWM control over a wide frequency range: 15 kHz to 150 kHz • Built-in soft-start function • Built-in low-voltage-output malfunction-prevention circuit (UVLO) start VCC > 9 V, stop Vcc < 6 V • Built-in on/off function	15 V	15 V	±300 mA	20 mA	5.0 V	–	1-ch output	16SOP
M62504	• PWM output in synchronization with external signals • PWM control over a wide frequency range: 15 kHz to150 kHz • Built-in soft start function • Built-in low-voltage output malfunction prevention circuit (UVLO) start VCC > 9 V, stop Vcc < 6 V • Built-in pulse-by-pulse current limiter function • Built-in timer-latch function	15 V	15 V	±100 mA	20 mA	5.0 V	–	1-ch output	16DIP 14SOP

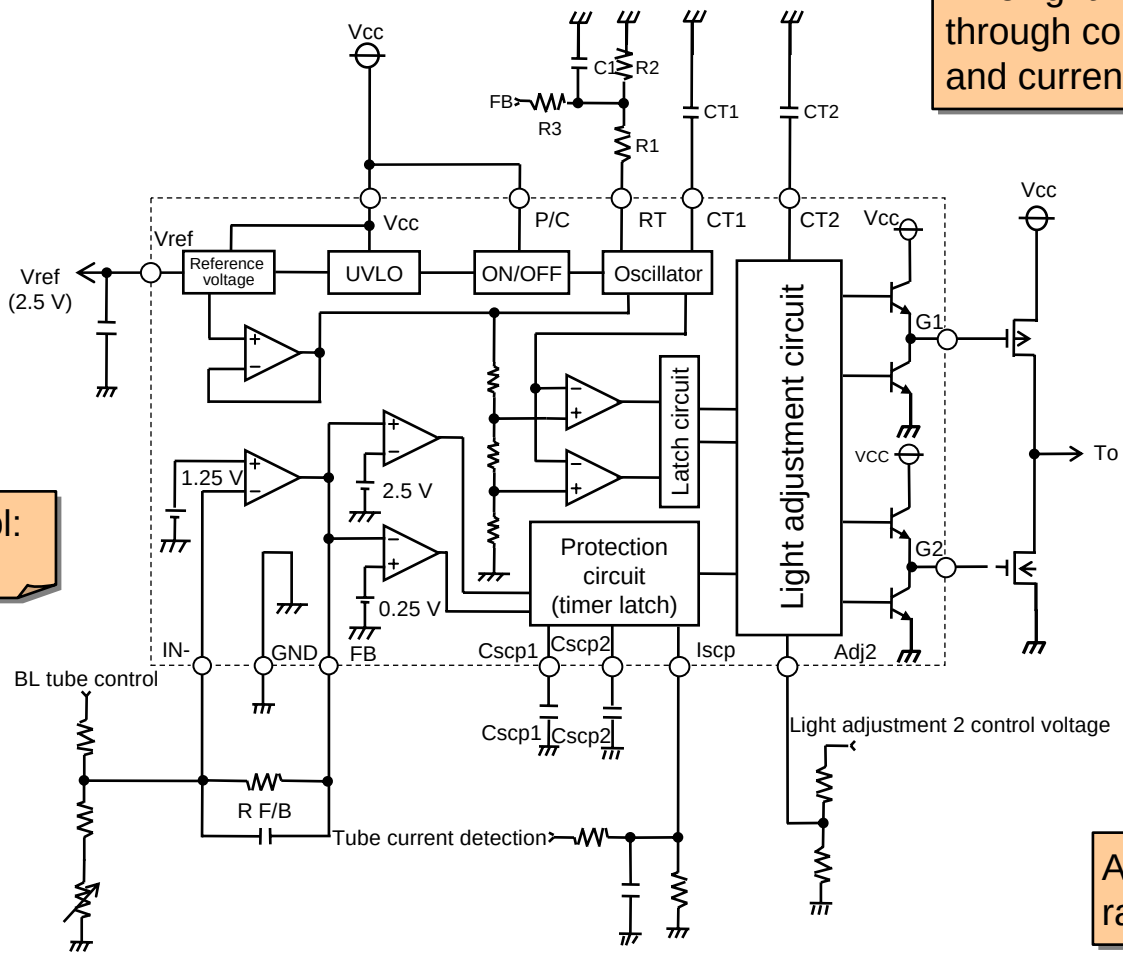
2.2 Backlight Controllers

BL Back-Light Control IC

	Functions, features	Absolute max. ratings		Electrical characteristics				Remarks	Package
		Power-supply voltage	Output current	Operating Voltage range	Circuit current	Reference voltage	Max. Oscillation frequency		
M62295	• Direct driving of either p-ch or n-ch FETs • Fixed 45% output duty-cycle setting • Light-adjustment function • Output OFF period is adjusted with the frequency of the output pulse • On-chip protection function operates by detection of tube current • On-chip power-control function	28 V	±300 mA	3.6 V to 26 V	6 mA (normal) 3 µA (under power Control)	2.5 V	200 kHz	Duty setting range for light adjustment 10% to 100%	16SSOP

Back-Light Control IC for Display Panels M62295GP

Fine lighting-level adjustment through control of the tube voltage and current



On-chip output-short-circuit protection circuit

Power control: Icc = 25 µA

Output current: ±300 mA

Adjustment control range:10-100%

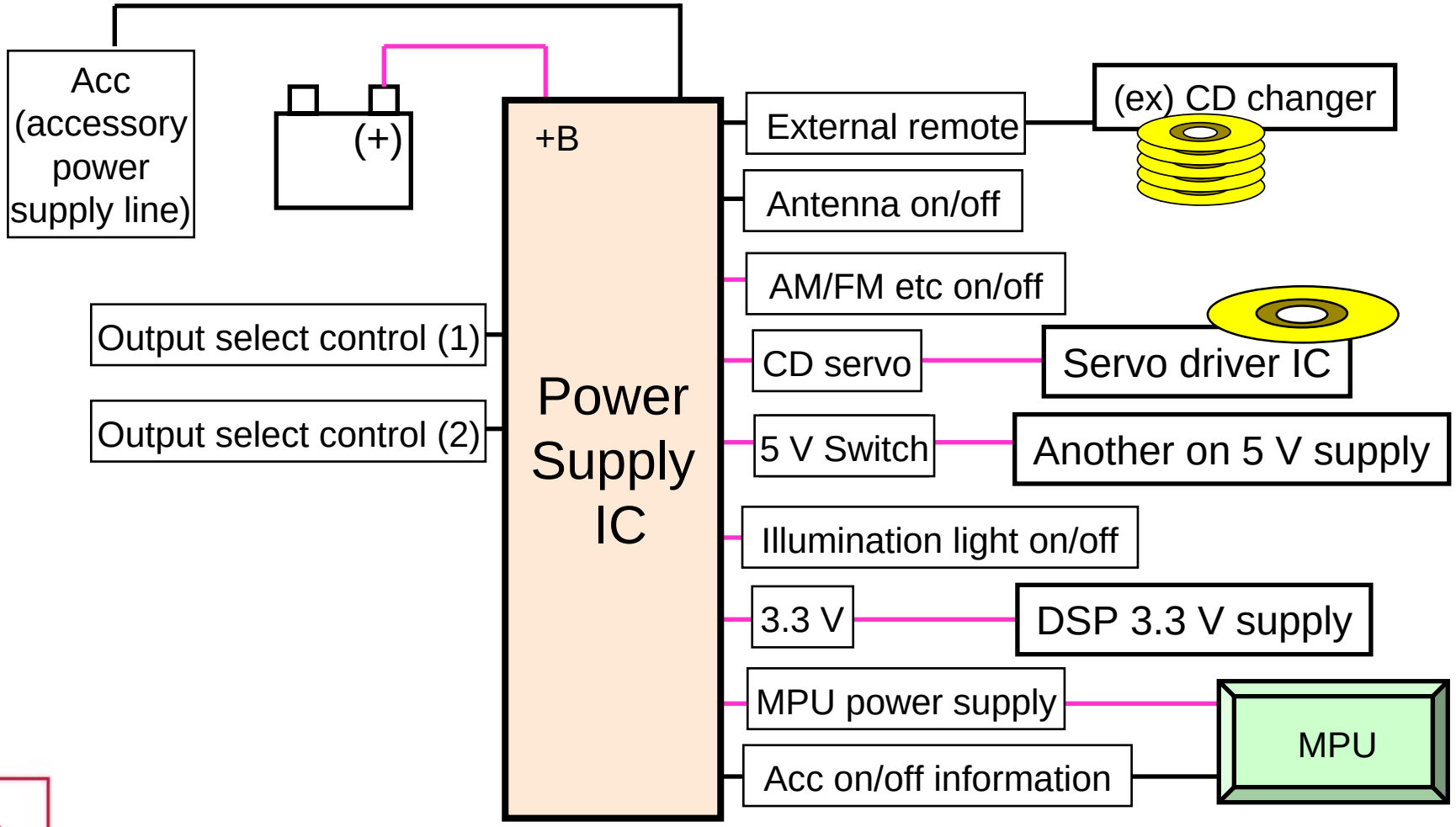
2.3 Car Audio Systems and Car Navigation Systems

Power Supply IC line up for Car Audio

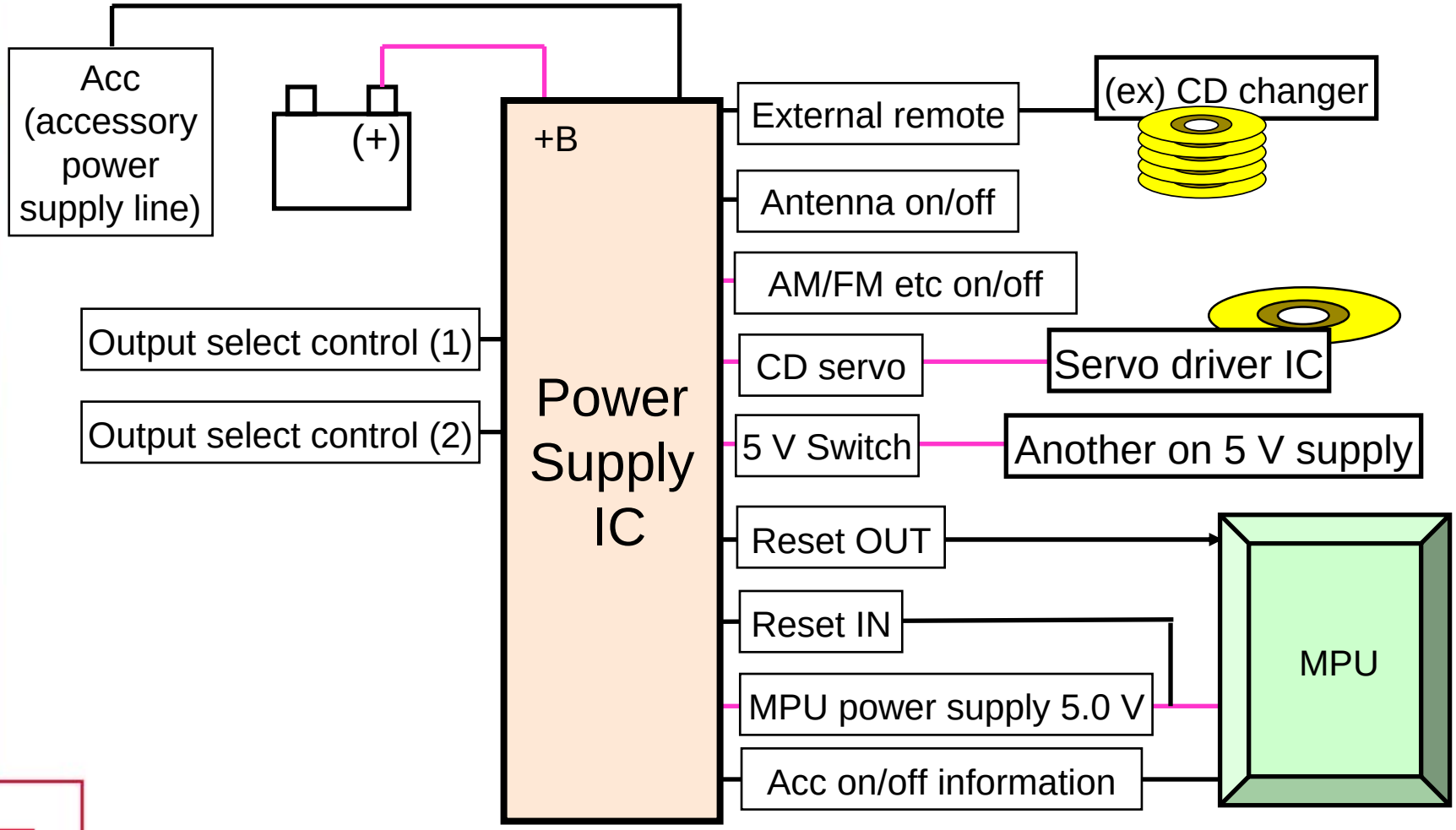
- Can handle multi out put line voltage with small assemble area.
- Possibility to decrease external components.
- Built in several protection.

	HA13164A	HA13165	HA13166	HA13168
Vdd	5.7 V	5.7 V	5.7 V	5.7 V
Audio	9.0 V	8.5 V	9.0 V	9.0 V
CD	8.0 V	7.0 V	8.0 V	8.0 V
DSP	non	non	3.3 V	non
reset function	non	non	non	yes

Function of Renesas Power Supply IC (1)



Function of Renesas Power Supply IC (2)

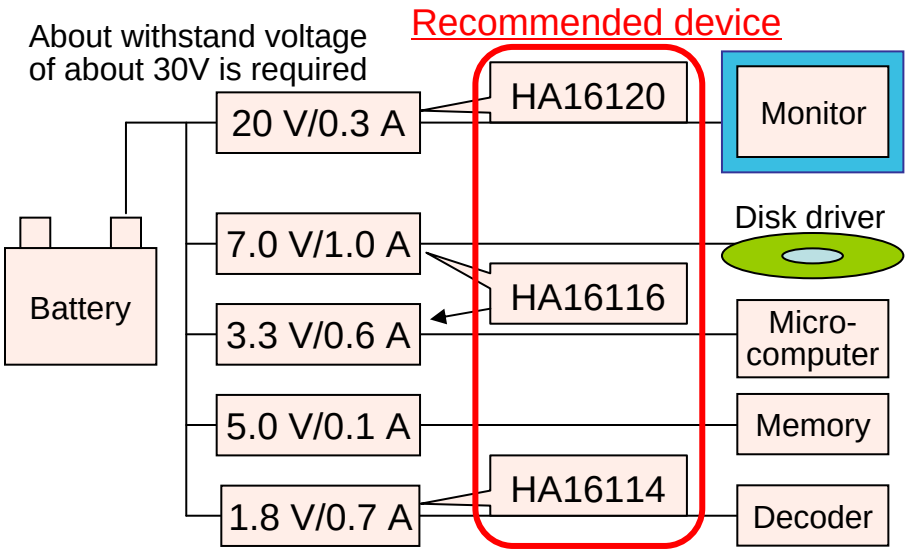


Power Supply IC for In-vehicle navigation system and DVDs

- Application
  - Power-supply section which is not possible with series regulators (large current, low-voltage or step-up voltage)
- Features
  - Withstand voltage of 40 V, plenty of lineup (1/2 ch, step-up/down)

Generally DC/DC Controller IC have moved to low withstand voltage (about 12 V) due to CMOS process. Also, they only have lineup of single products with high functionality such as synchronous rectification. They are not suitable for automobiles.

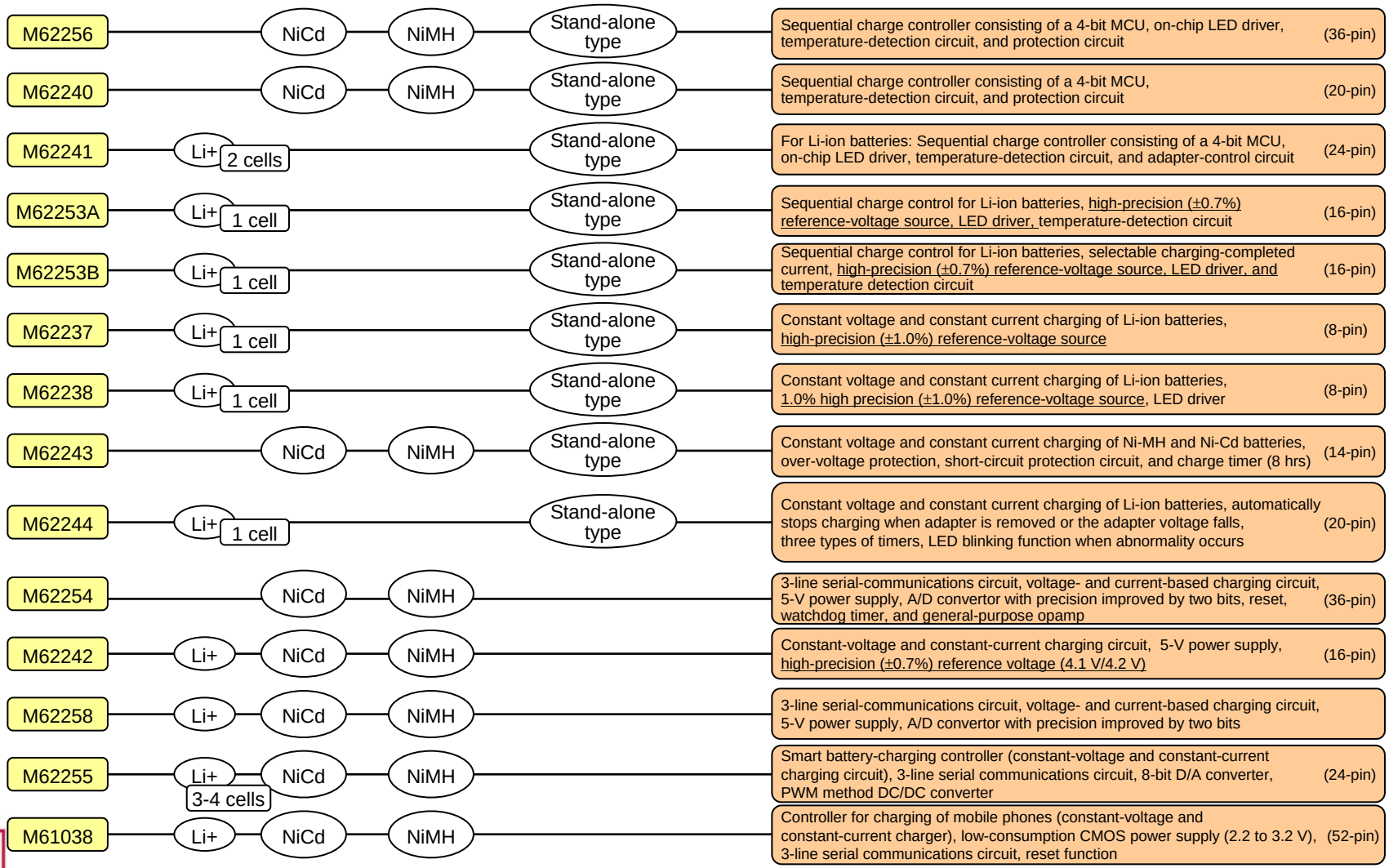
- System Configuration Example



3. Control of Charging

3.1 Control ICs for Charging

Charge-Control IC



Control IC for Charging of Li-Ion Batteries M62253AGP

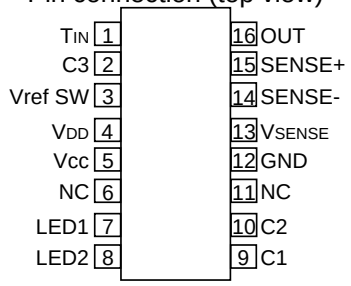
- Outline

Combining constant current and constant voltage periods of charging is particularly effective in the case of Li-ion batteries. The M62253AGP is a semiconductor integrated circuit for use as a charge-controller of this type. On-chip current- and voltage-control circuits look after this. Other on-chip functions include prevention of the further charging of over-charged batteries and charge-control according to the detected battery temperature. These functions greatly simplify the configuration of chargers for Li-ion batteries.

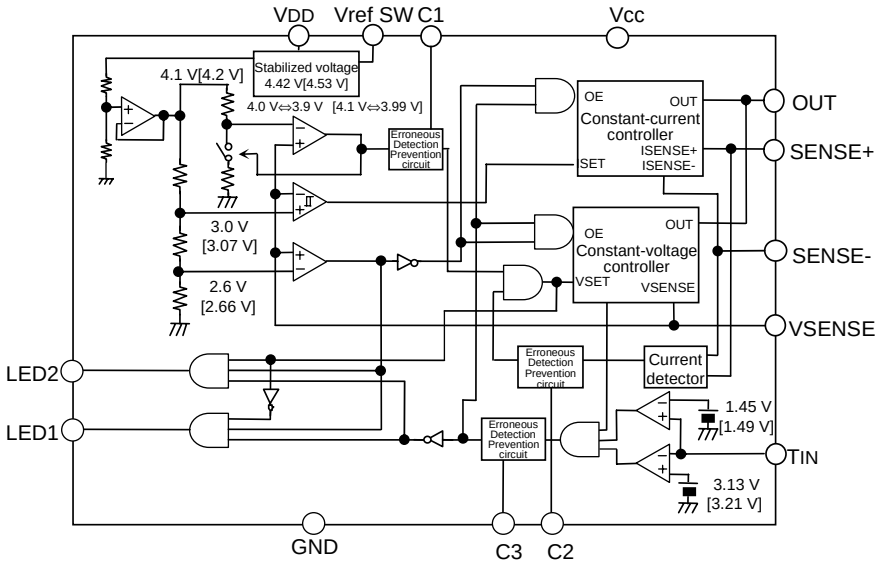
- Features
  - Suitable for 4.1-V and 4.2-V batteries
  - On-chip high-precision reference voltage (charge voltage; 4.2 V±30 mV)
  - Constant-current and constant-voltage charging
  - On-chip protective function 1: Discontinues charging when batteries are overcharged.
  - On-chip protective function 2: Discontinues charging when batteries are too hot or cold
  - On-chip re-charging function
  - Outputs the state of charging for display on two LEDs
  - On-chip delay circuit prevents chattering
- Applications
  - Chargers for Li-ion batteries in electronic devices such as mobile phones, etc.

High-precision **(±0.7%)** voltage source

Pin connection (top view)



Package 16P2E



Voltage values within the brackets [ ] are voltages when a 4.2-V battery is used. Voltage values not in brackets [ ] are for when a 4.1-V battery is used, or are common to 4.1-V and 4.2-V batteries.

Control IC for Charging of Li-Ion Batteries M62253BGP

• Outline

Combining constant current and constant voltage periods of charging is particularly effective in the case of Li-ion batteries. The M62253AGP is a semiconductor integrated circuit for use as a charge-controller of this type. On-chip current- and voltage-control circuits look after this. On-chip functions include the preventing the further charging of over-charged batteries and charge-control according to the detected battery temperature. These functions greatly simplify the configuration of chargers for Li-ion batteries.

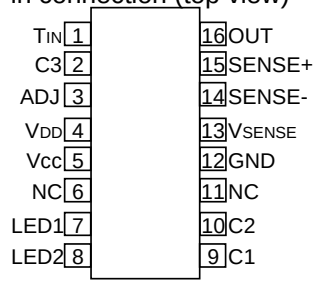
• Features

- Suitable for 4.2-V battery
- On-chip high-precision reference voltage (charge voltage; 4.2 V±30 mV)
- Constant-current and constant-voltage charging
- On-chip protective function 1: Discontinues charging when batteries are overcharged.
- On-chip protective function 2: Discontinues charging when batteries are too hot or cold
- On-chip re-charging function
- Outputs the state of charging for display on two LEDs
- On-chip delay circuit prevents chattering

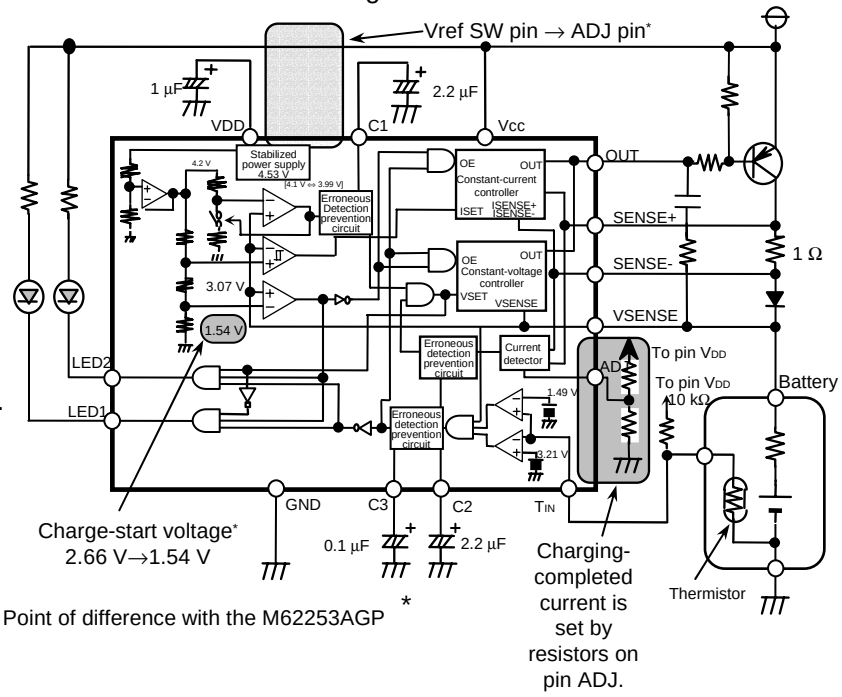
• Applications

- Charger for Li-ion batteries of electronic devices such as mobile phones, etc.

Pin connection (top view)



Package: 16P2E



High-precision **(±0.7%)** voltage source

Constant-Voltage and Constant-Current Charging-Control IC: M62237FP

- Outline

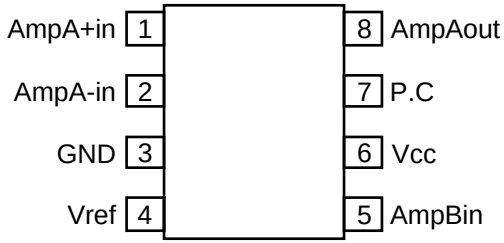
  The M62237FP constant-current /constant-voltage control IC incorporates a high-precision reference voltage source (1.25 V±1.0%) and is suitable for the secondary-side control of chargers and switching power supplies. Includes built-in opamps for current and voltage control. The output of the current-control opamp is connected to an external output pin, which allows phase compensation in stand-alone mode.

- Features
  - Operating power-supply voltage range: 2.5 to 15 V
  - Built-in high-precision reference voltage source: 1.25 V±1.0%
  - PC pin output current: 20 mA

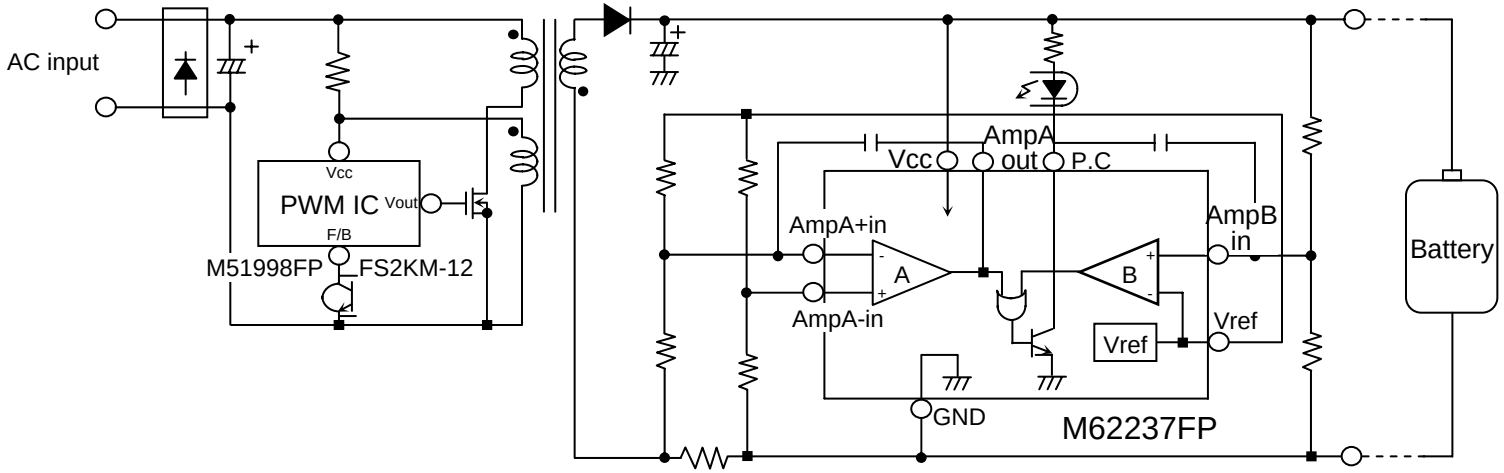
- Applications

  Chargers, switching power supplies, secondary control

Pin connection (top view)



Package: 8P2S-A



Constant-Voltage and Constant-Current Charging-Control IC with Dual-LED Drive: M62238FP

- Outline

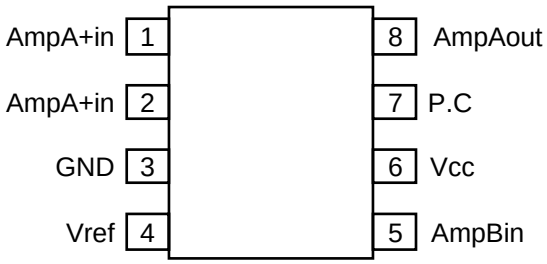
  The M62238FP is a constant-current/constant-voltage controller IC that incorporates a high-precision reference voltage source (1.265 V±1.0%) and is suitable for use in charger control. It incorporates opamps for current and voltage control and two LED drivers. These are used to light a red LED during charging and a green LED on completion of charging. Therefore, a charger can be configured with fewer peripheral components.

- Features
  - Operating power-supply voltage range: 2.5 V to 15 V
  - Built-in high-precision reference-voltage source: 1.265 V±1.0%
  - Two values for separate external adjustment: Fast-charge current and charging-completed current
  - PC-pin output current: 20 mA
  - LED-pin output current: 10 mA

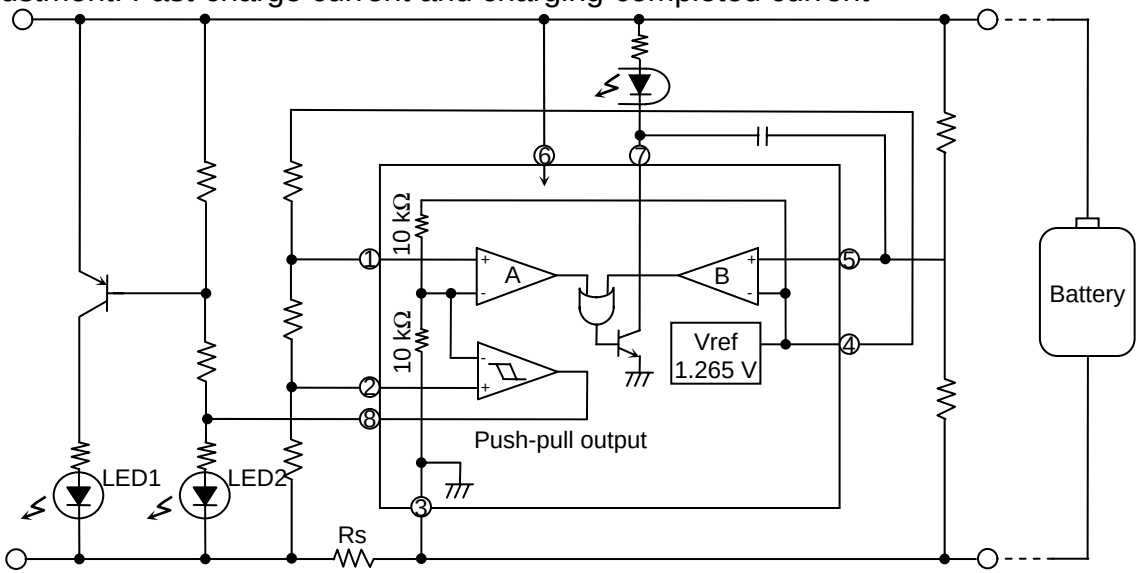
- Applications

  Chargers for the battery units of MP3 players, PDAs, mobile phones, etc.

Pin connection (top view)



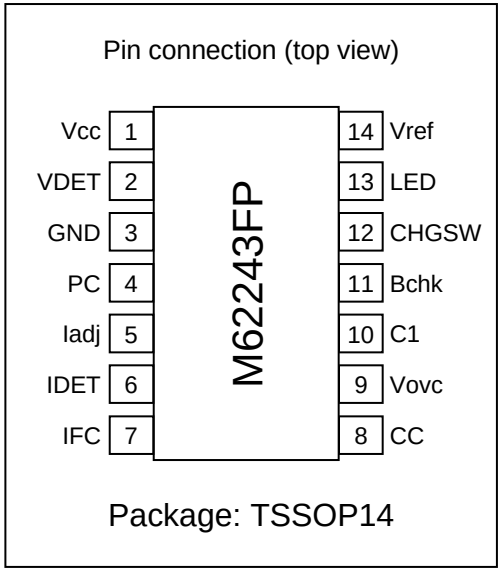
Package: 8P2S-A



Constant-Voltage/Constant-Current Control IC For Charging of Ni-MH Batteries: M62243FP(1)

- Outline

  The M62243FP is a constant-current/constant-voltage controller IC that incorporates a high-precision reference voltage source (1.2 V±2%) and is suitable for controlling the Ni-MH battery charger. Built-in opamps for current control and voltage control, and a built-in LED driver enable LED control for individual modes. Various protection circuits (for over-voltage and short-circuit protection, and for charge timing) are also incorporated, and charging is stopped when abnormalities occur. When the timer overflows, the M62243FP enters the charging-completed mode.

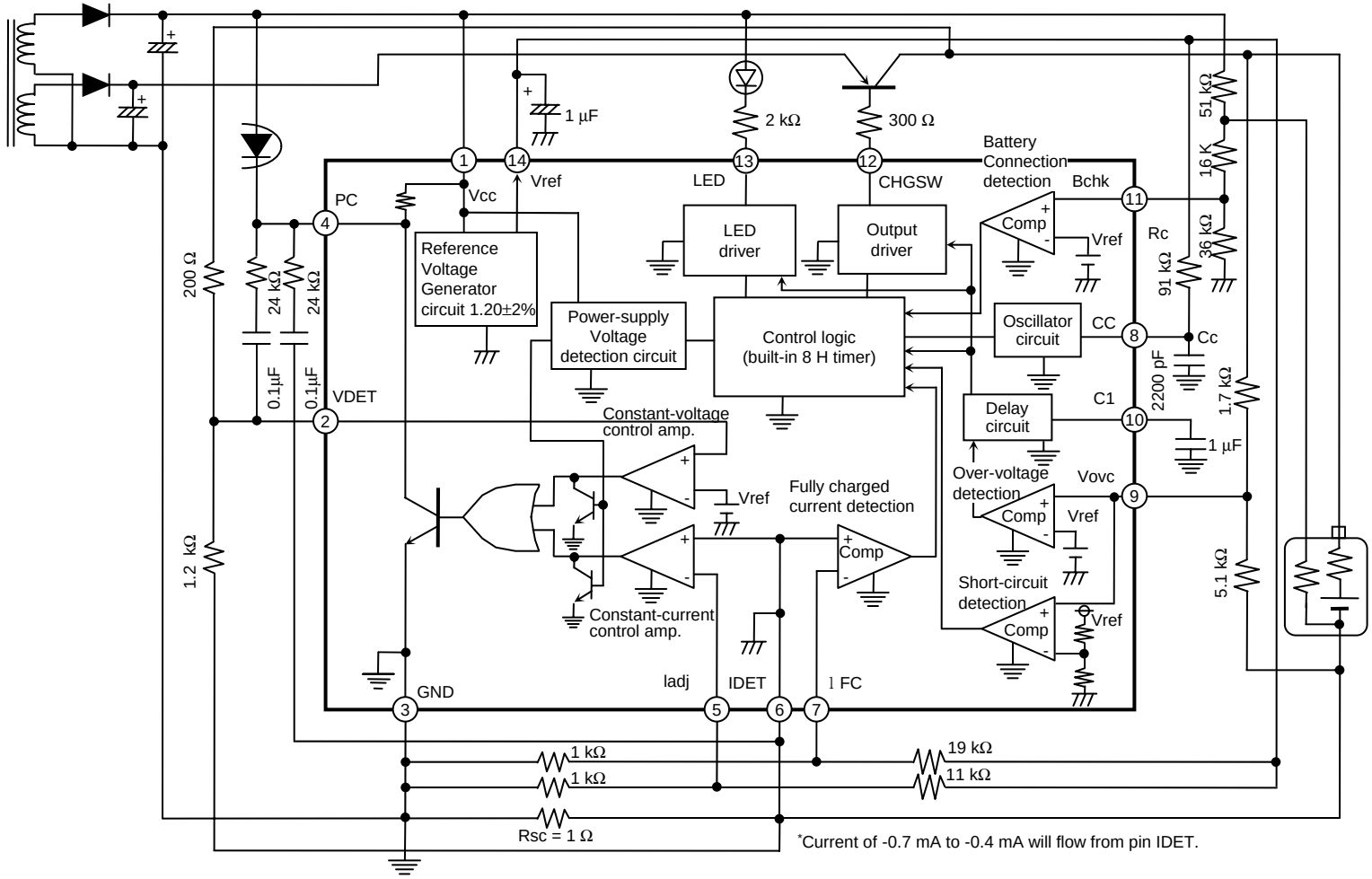


- Features
  - Operating power-supply voltage range: 4.0 V to 15 V
  - On-chip high-precision reference voltage source: 1.2 V±2%
  - On-chip charge timer: (480 min)
  - Various on-chip protective circuits: (over-voltage, short-circuit)

- Application

  Chargers

Constant-Voltage/Constant-Current Control IC for Chargingof Ni-MH Batteries: M62243FP(2)



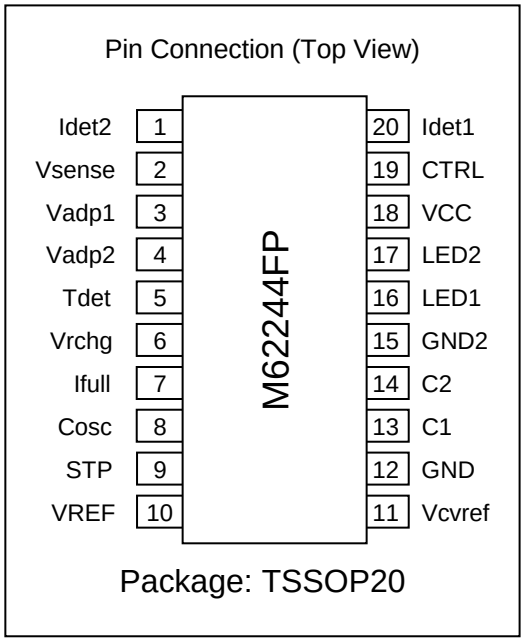
*Current of -0.7 mA to -0.4 mA will flow from pin IDET.

Controller IC for Charging of Li-Ion Batteries: M62244FP

Under development

• Outline

The M62244FP is a semiconductor integrated circuit for use as a charging controller with Li-ion batteries. Both current- and voltage-control circuits are included, so combined constant-current and constant-voltage charging is available for use in charging Li-ion batteries.



• Features

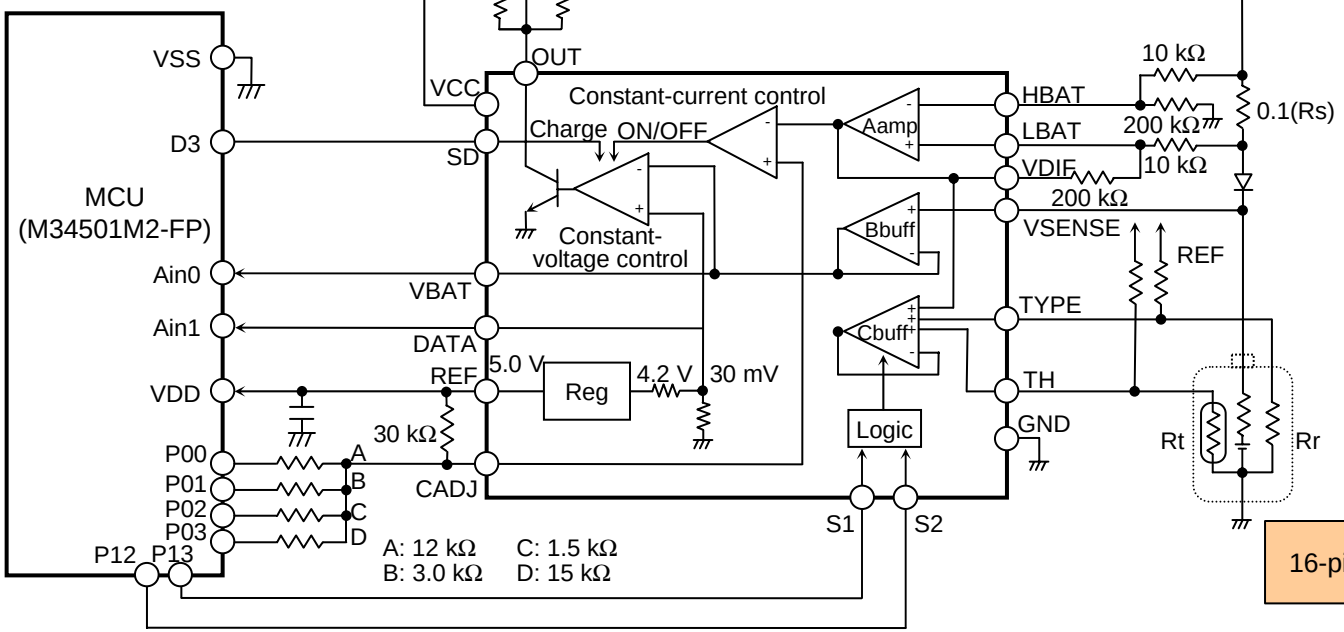
- Suitable for 4.2-V batteries
- Built-in high-precision reference voltage (charge voltage): 4.2 V±30 mV
- Support for constant-current, constant-voltage charging
- Charge-protection function prevents charging of over-charged batteries
- Charge-protection function prevents charging of batteries that are too hot or cold
- Built-in recharge function
- Display of charge state by two LEDs
- On-chip delay circuit for prevention of chattering
- Built-in function switches charging off when the battery is removed from the adapter
- Built-in function switches charging off when the adapter voltage falls
- Charging can be switched on/off under external control
- Three on-chip timers (externally controllable)
  - Initial setting timer: About 5 min.
  - Backup charge timer: About 1 hour
  - Charge timer: About 4 hours
- Built-in function makes the LED blink when abnormalities occur

• Application

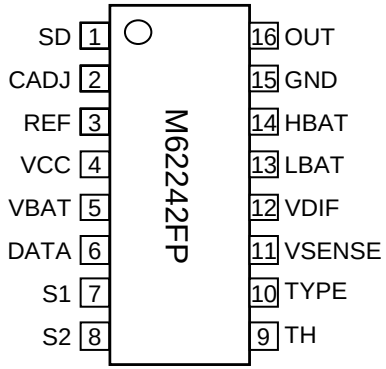
Li-ion battery chargers

Low-Cost Battery-Charger Control for All Li-Ion Batteries: M62242FP

Built-in high-precision reference-voltage source (±0.7% or less)



Pin connection (top view)



Package:16P2E-A

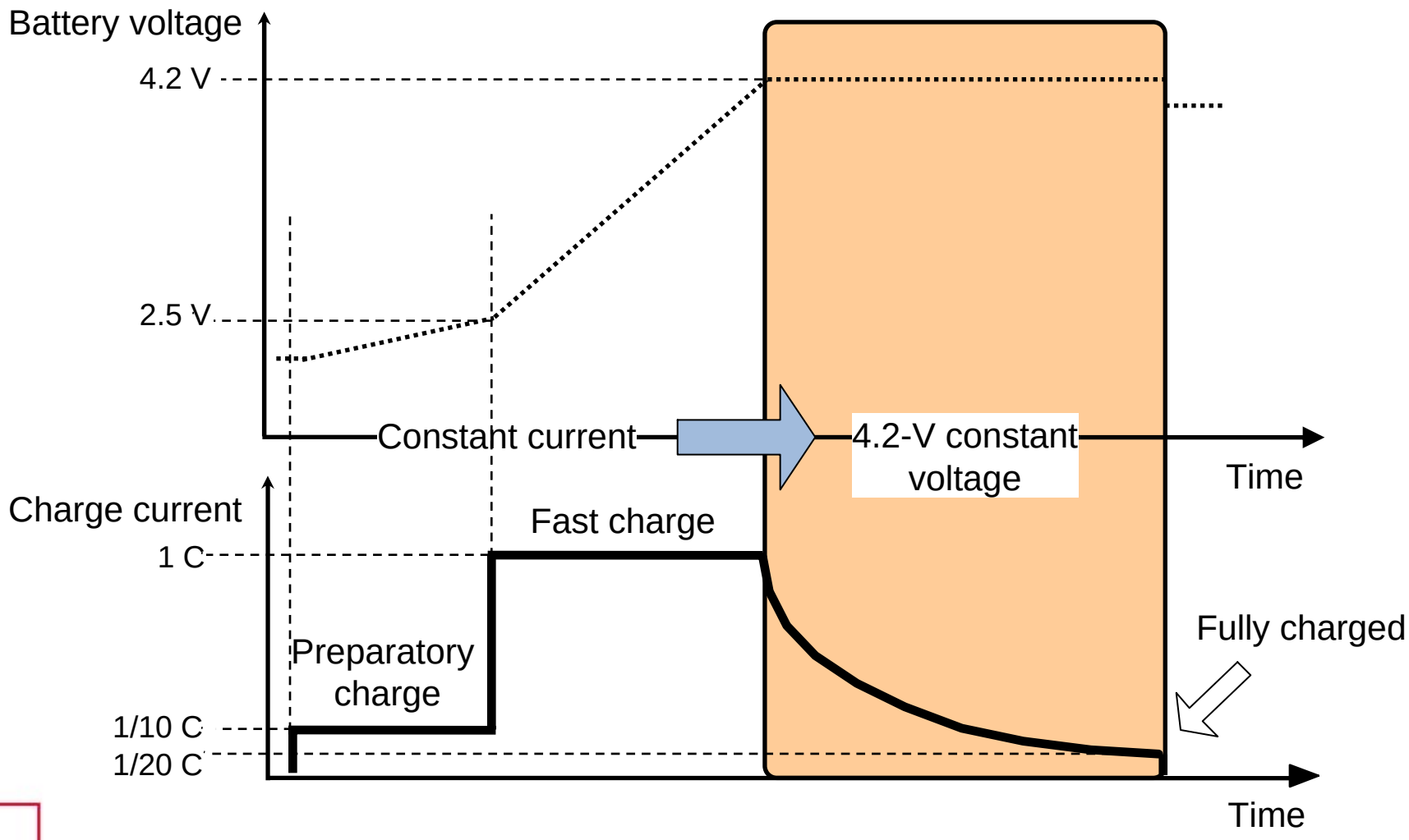
16-pin SSOP for compact products

The setting on pins P0 to P3 selects one of 16 modes. Charge patterns for any battery are realized by an internal table.

Built-in 5 V output for power supply to microcomputers

Automatic prevention of charging when batteries are too cold or at too high a voltage; identification of the capacitance and resistance of battery packs.

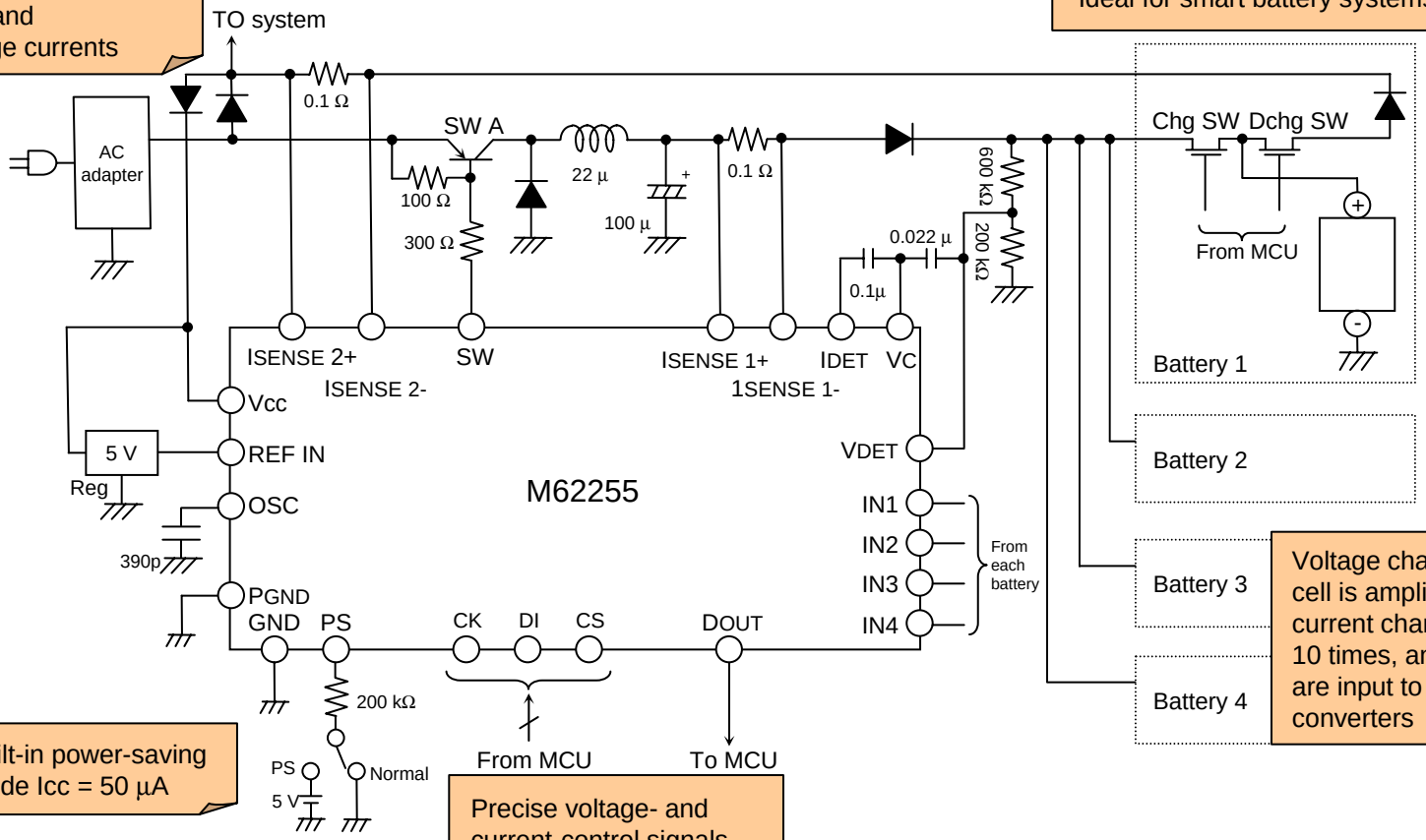
Charging over Time



General-Purpose Battery-Charger Control IC for Notebook PCs: M62255FP

Dual current-detection circuit for control of both charge and discharge currents

Built-in PWM-method DC/DC converter
Ideal for smart battery systems



Voltage change for each cell is amplified four times, current change is amplified 10 times, and the results are input to the MCU's A/D converters

Built-in power-saving mode Icc = 50 µA

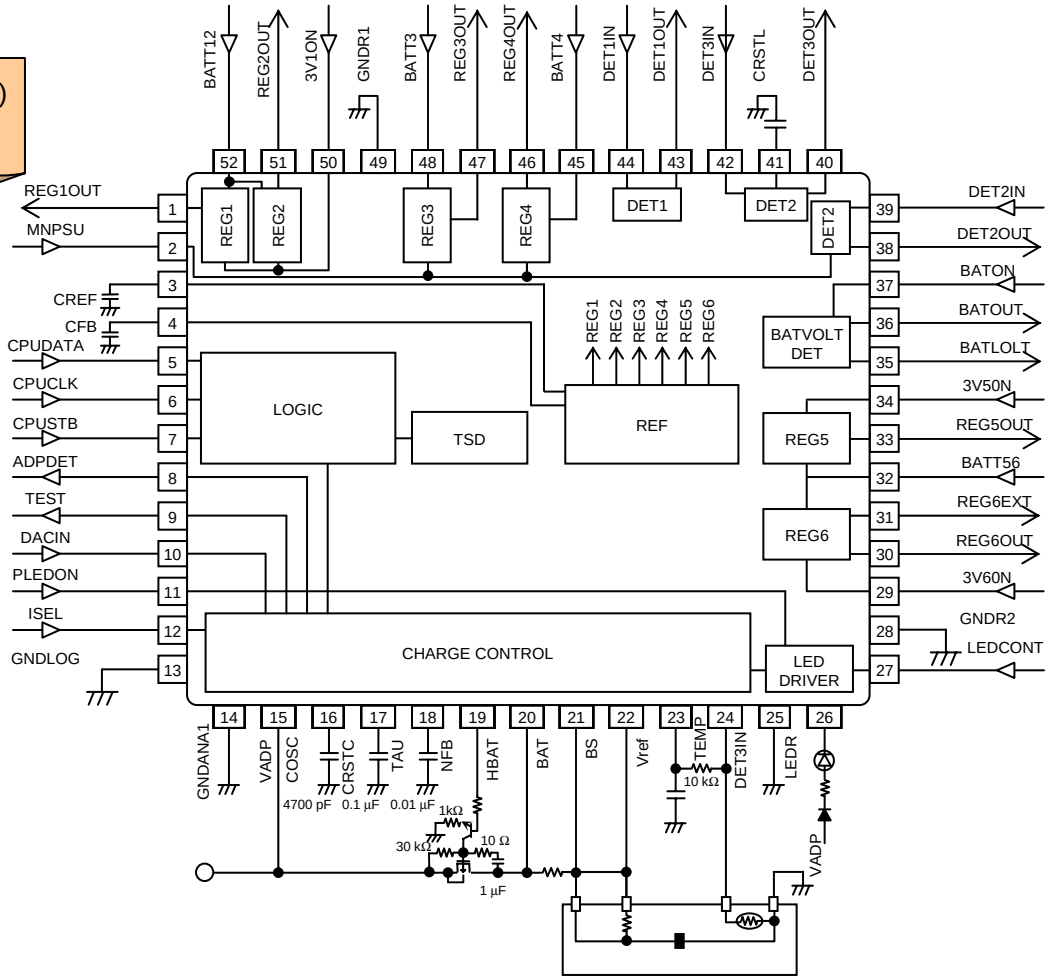
Precise voltage- and current-control signals from 8-bit D/A converters

Complete Mobile-Phone Charger on a Single LSI Chip: M61038FP

On-chip high precision (±1%) constant-voltage/constant current charge circuits

Low-consumption high-precision C-MOS power supply: 6 on-chip circuits

Low current drawn in standby mode: 12 µA



Temperature detection, monitoring for abnormal operation, various protective functions

Various built-in timers for fail-safe operation, e.g.: 15-min. timer for preparatory charging, 4-hr. timer for fast charging, 2-hr. timer for low-voltage charging, etc.

Super-small 52-pin 0.4-mm-pitch QFN

LED driver
Built-in 3-line communications function

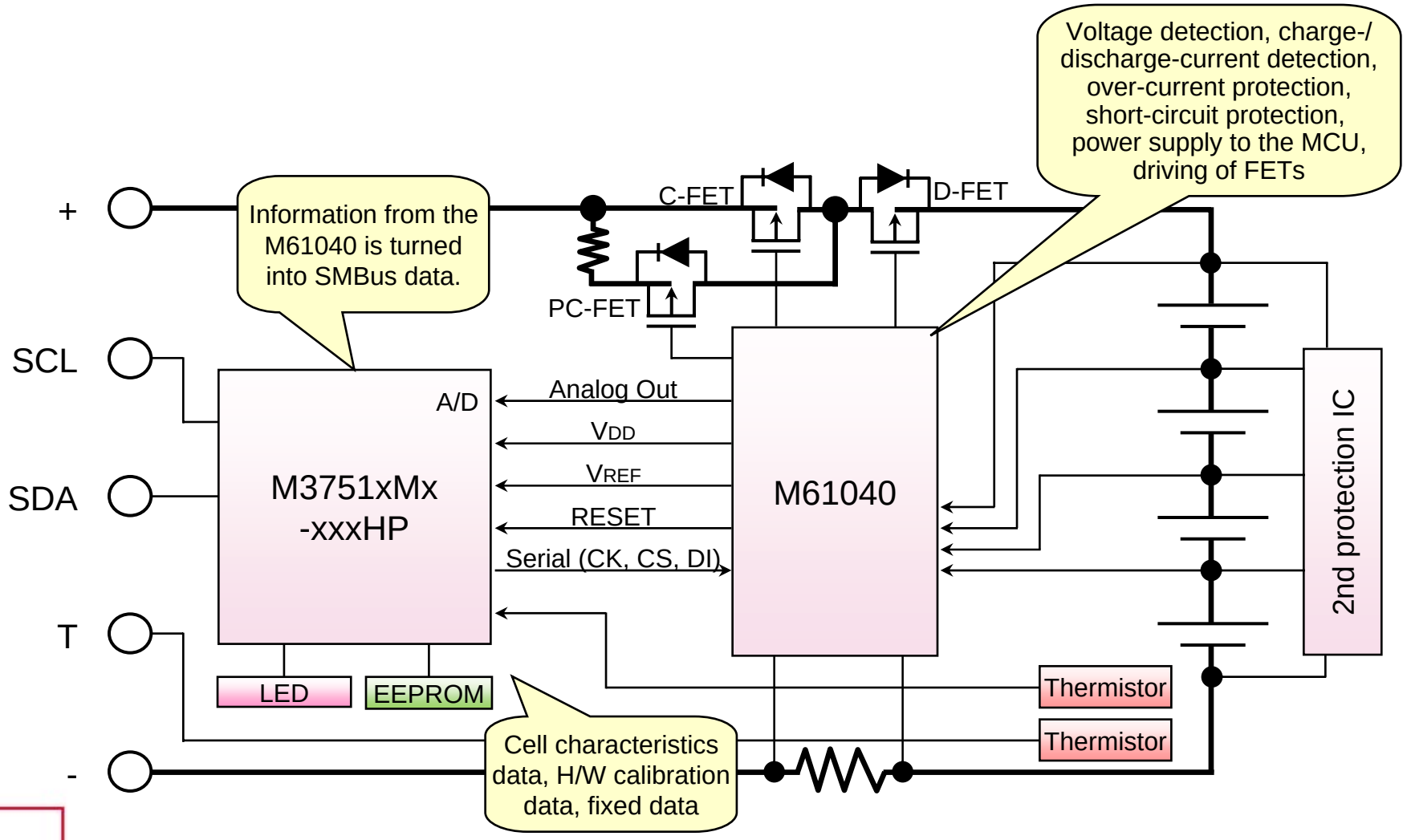
Battery-Protecting Control-IC Series

M61040	Li+	3-4 Cells	Analog control (protection, remaining charge detection) in smart batteries for notebook PCs: high-withstand-voltage CMOS (rated at 33 V), over-current detector, reset circuit, low consumption regulator (5.2 V), on-chip three-line serial communications circuit (20-pin)
M61041	Li+	3-4 Cells	Analog control (protection, remaining charge detection) in smart batterie for notebook PCs: high-withstand-voltage CMOS (rated at 33 V), over-current detector, low consumption regulator (5.2 V), on-chip three-line serial communications circuit (16-pin)
M61042	Li+	3-4 Cells	Analog control (protection, remaining charge detection) in smart batteries for notebook PCs: high-withstand-voltage CMOS (rated at 33 V), over-current detector, low consumption regulator (3.3 V), on-chip three-line serial communications circuit (20-pin)
M61043	Li+	3 Cells	Analog control (protection, remaining charge detection) in smart batteries for notebook PCs: high-withstand-voltage CMOS (rated at 33 V), over-current detector, reset circuit, low consumption regulator (5.2 V), on-chip three-line serial communications circuit (16-pin)
M61044	Li+	2-3 Cells	Analog control (protection, remaining charge detection) in smart batteries for notebook PCs: high-withstand-voltage CMOS (rated at 33 V), over-current detector, reset circuit, low consumption regulator (3.3 V), on-chip three-line serial communications circuit (16-pin)

Differences between the M61040, M61041, M61042, M61043, and M61044

Type name	No. of cells	Reset function	Pre-charge FET cont.	Regulator voltage	Package
M61040	For 3 to 4 cells	Yes	Yes	5.2 V	20-pin TSSOP
M61041	For 3 to 4 cells	No	No	5.2 V	16-pin TSSOP
M61042	For 3 to 4 cells	No	No	3.3 V	16-pin TSSOP
M61043	For 3 cells only	Yes	No	5.2 V	16-pin TSSOP
M61044	For 2 to 3 cells	Yes	No	3.3 V	16-pin TSSOP

Smart Battery: Block Diagram



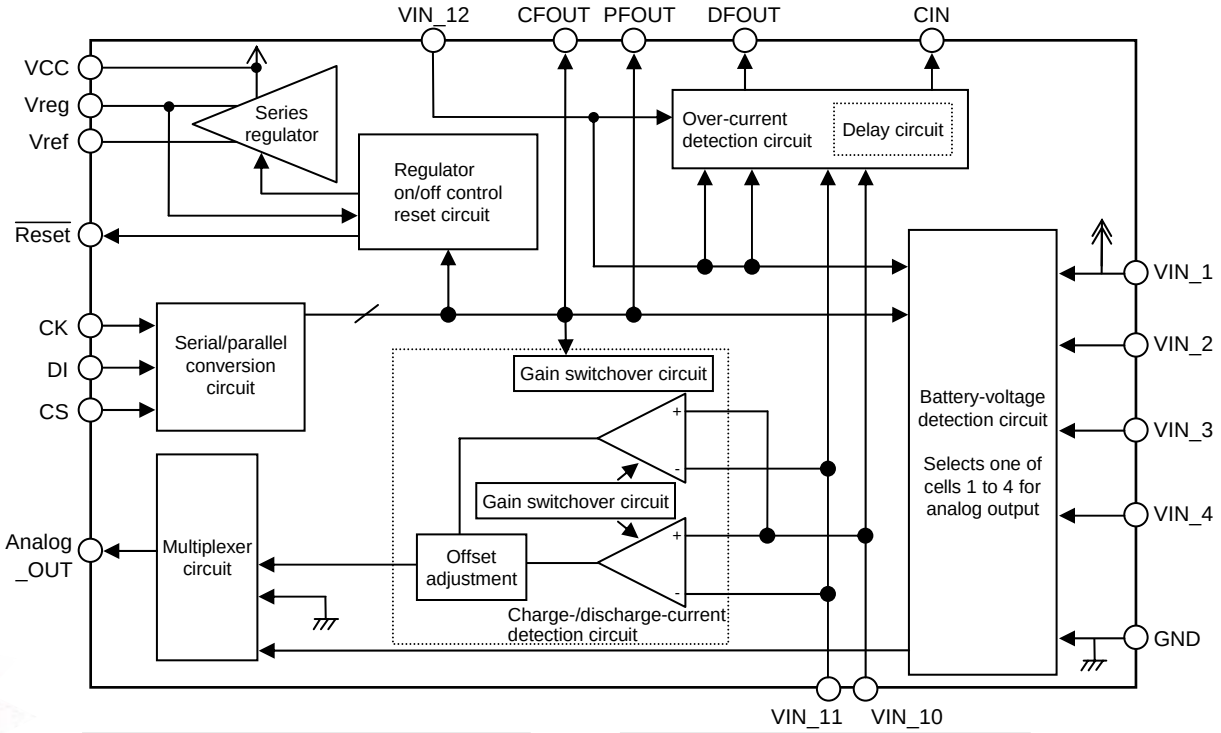
Protection IC for 3 to 4 Li-ion Cells: M61040FP

On-chip over-current-detection circuit for FET protection

On-chip ±1%-precision cell-voltage detector, suitable for control of Li-ion cells within a battery pack

The CMOS process used achieves high withstand voltages (max. 33 V).

Power-saving functions save current.
Normal: Icc = 200 µA
Power-saving: Icc = 60 µA
Power-down: Icc = 0.5 µA max.



Development of a 3-cell low-cost version, the M61041FP, has been completed.

Charge-/discharge-current monitor: on-chip high gain (40 to 200 times) opamp

Built-in cell-balance circuit
Adjusts for voltage differences between cells of the battery

Power Supply and Charger IC Products

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