

CAT7301/CAT7302 (Preliminary Version 0) Six-Channel Digital Still Camera Power Supplies

ABSTRACT:

The CAT7301/CAT7302 provides a complete power supply solution for digital still cameras. It improves performance, component count, and size compared to conventional controllers in 2-cell AA, 1-cell Li-Ion, and dual-battery designs. The CAT7301/CAT7302 includes six high efficiency dc-dc conversion channels: three current mode converters and three voltage mode controllers. The current-mode converters, CH1, CH2 and CH3, with on-chip MOSFETs provide up to 95% efficiency for critical power supplies. The CH2 can be configured to either step-up or step-down converter. The CH4, CH5 and CH6 voltage mode controllers operate with external MOSFETs to optimum design flexibility. The CH5 is the inverting controller in CAT7301 and the step-up controller in CAT7302. The CH6 can be used as switch-mode boost current source for white LEDs or as a conventional step-up controller.

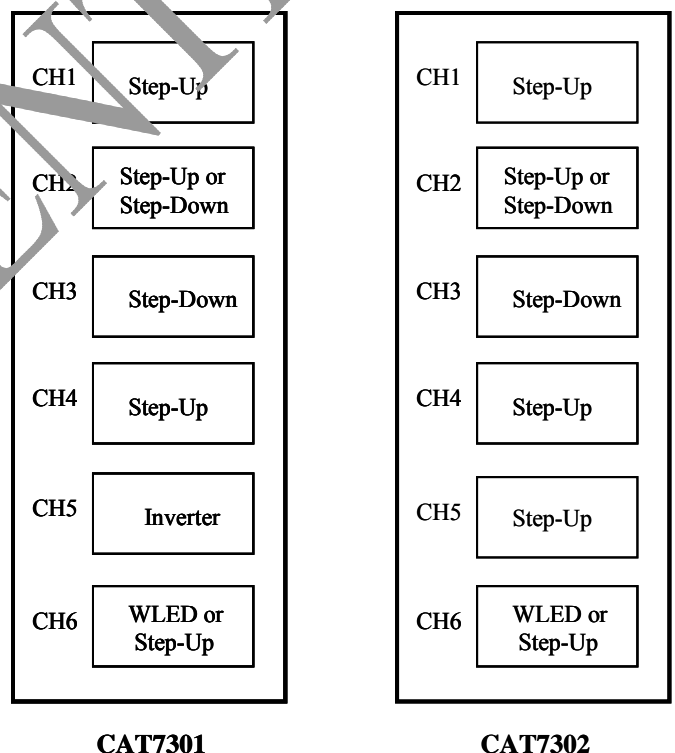
FEATURES:

- 95% Efficient Step-Up (CH1) Converter
- 95% Efficient Step-Down (CH3) Converter
- Combine CH1 and CH3 for 90% Efficient Boost-Buck
- Low Start-Up Voltage : 1.2V (CH1)
- CH2 Converter as Either Step-Up or Step-Down
- Built-in Soft-Start Function
- Independent On/Off Control for CH1~CH6
- Regulate LED Current for 1~6 or More LEDs
- Open LED Overvoltage Protection
- Transformerless Inverting Controller for CCD Bias (CAT7301)
- Up to 1MHz Operating Frequency
- Built-in Overload Protection Function
- Shutdown Current < 10 μ A
- QFN 40 Package

APPLICATIONS:

- DSC Power Supply
- PDAs
- CCD Devices

SIMPLIFIED BLOCK DIAGRAM:



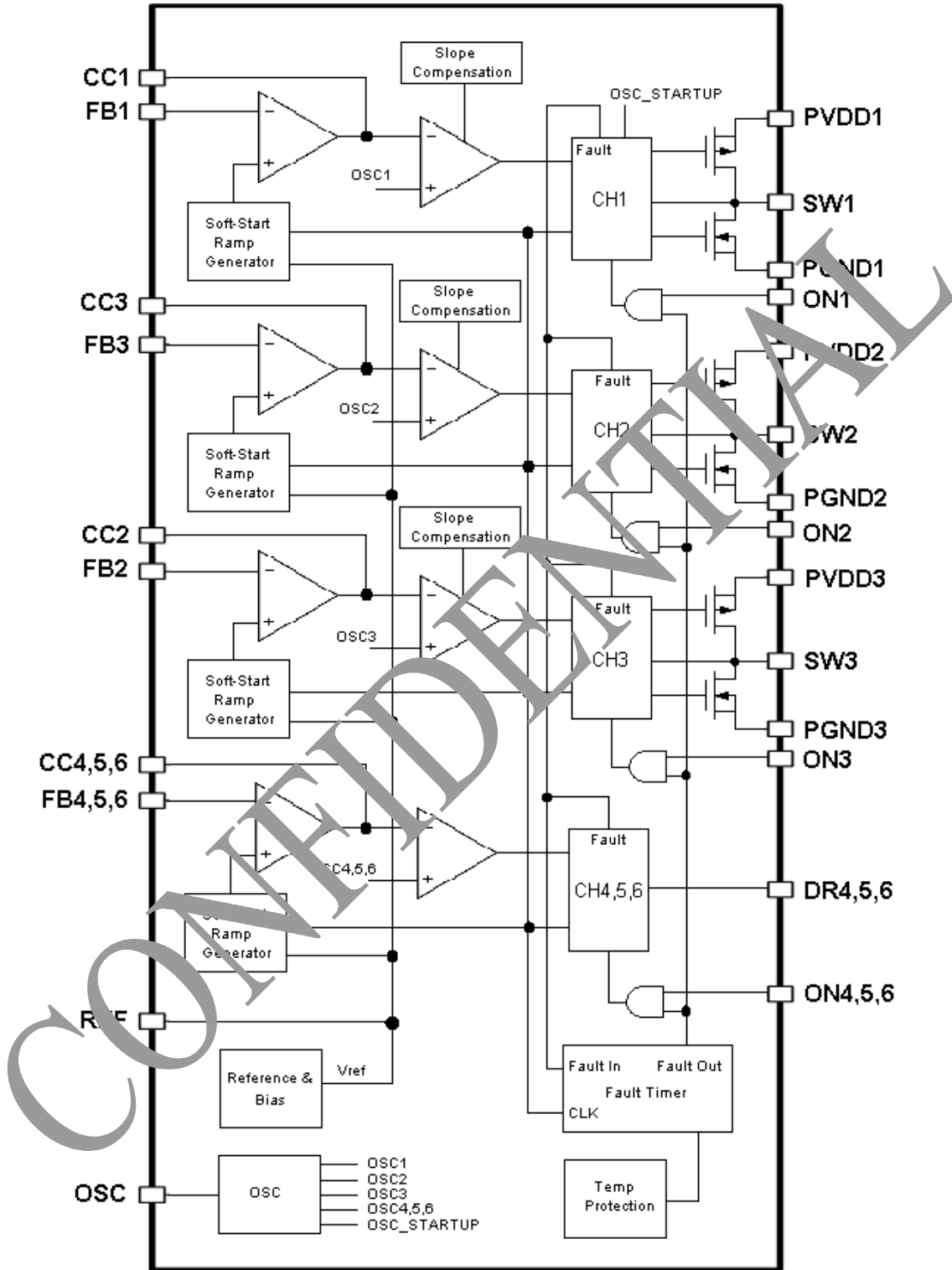
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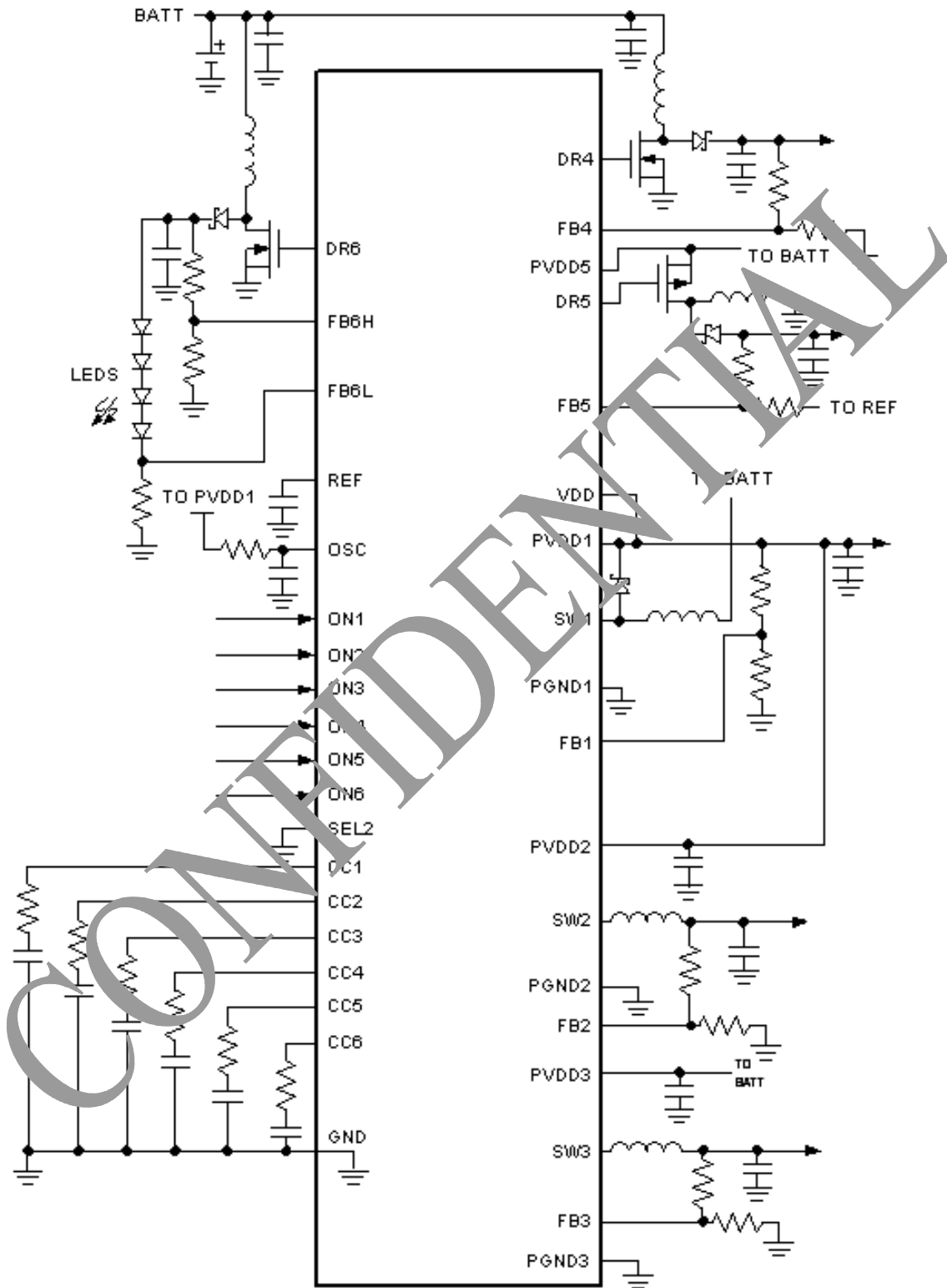
ORDERING INFORMATION

PART NUMBER	TEMP. (°C)	PACKAGE
CAT7301CF	0 to 70	40-Ld QFN (Green)
CAT7302CF	0 to 70	40-Ld QFN (Green)

FUNCTION BLOCK:

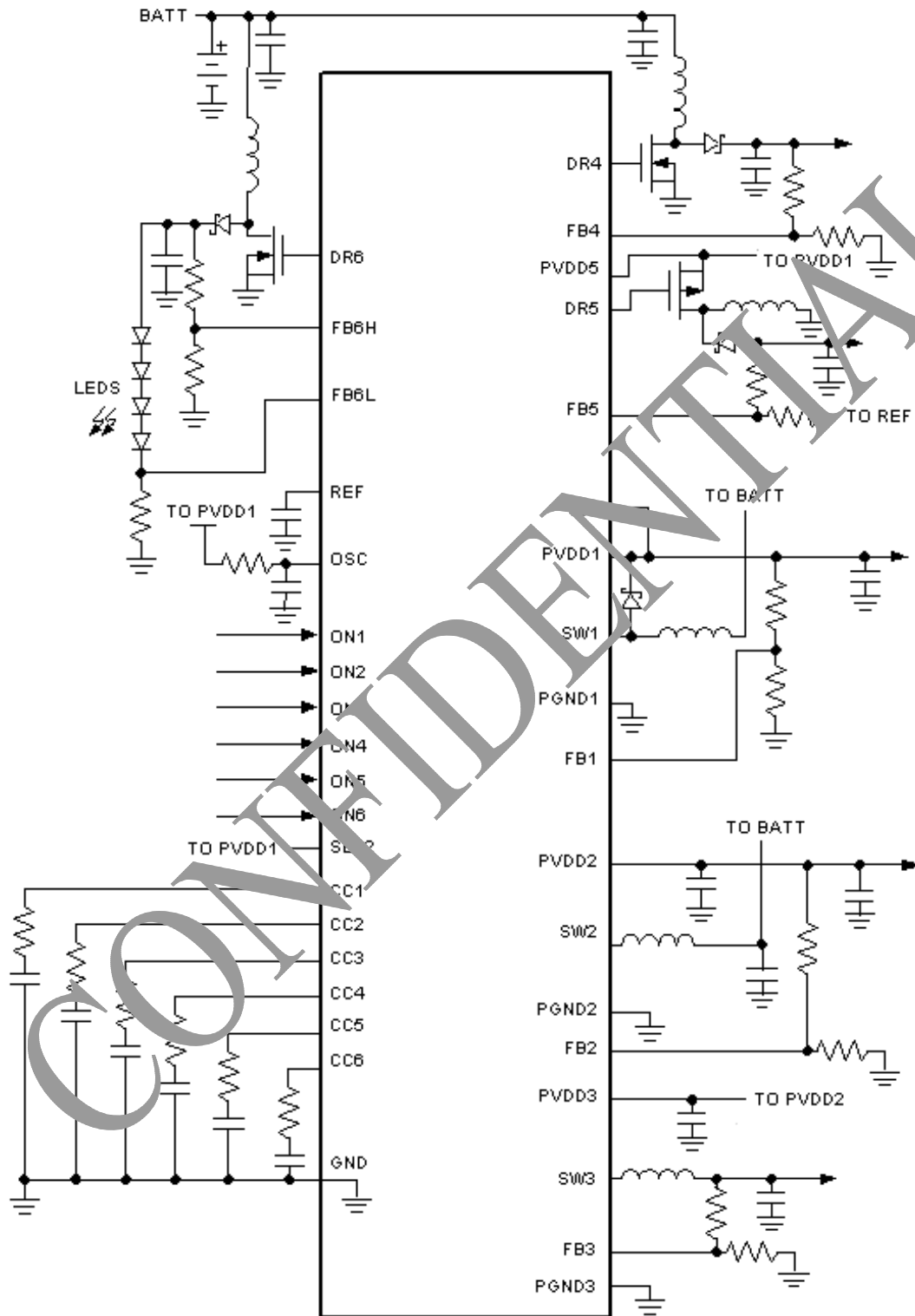


TYPICAL APPLICATIONS:



CH2 Converter acts as Step-Down

TYPICAL APPLICATIONS:



CH2 Converter acts as Step-Up

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Absolute Maximum Ratings

VDD, PVDD1, ON_, FB_, SCP, POKN3, POKN4, SEL2 to GND	-0.3V to +6V
PG_	-0.3 to +0.3V
DR4, DR5, PVDD5, PVDD2, PVDD3 to GND	-0.3V to PVDD1 + 0.3V
DR2 to GND	-0.3V to PVDD5 + 0.3V
SW1 Current	3.6A
SW2 Current	3.6A
SW3 Current	2.25A
REF, OSC, CC_ to GND	-0.3V to PVDD1 + 0.3V

Thermal Information

Continuous Power Dissipation (TA = +70°C) 40-Pin Thin QFN (derate 26.3mW/°C above +70°C)	.2105mW
Maximum Junction Temperature	125°C
Maximum Storage Temperature Range	-40°C to 150°C
Maximum Lead Temperature (Soldering 10s)	260°C

SPECIFICATIONS:

(V_{PVDD1} = V_{VDD} = V_{PVDD2} = V_{PVDD3} = V_{PVDD5} = 3.6V, TA = 0°C to +85°C, unless otherwise noted.)

Parameter	Test Conditions	Min	Typ	Max	Units
SYSTEM					
Input Voltage Range				5.5	
CH1 Minimum Startup Voltage	LOAD < 1mA, TA = +25°C; startup voltage tempco is -2300ppm/°C (typ) (Note 3)				V
Shutdown Supply Current into VDD	VDD = 3.6V		0.1	10	uA
CH1 Switch-Off Supply Current into VDD	ON1 = 3.6V, FB1 = 1.5V (not include switching losses)		300	450	uA
CH1, CH3 Switch-Off Supply Current into VDD	ON1 = ON3 = 3.6V, FB1 = FB3 = 1.5V (not include switching losses)		450	700	uA
CH1, CH2 Switch-Off Supply Current into VDD	ON1 = ON2 = 3.6V, FB1 = FB2 = 1.5V (not include switching losses)		450	700	uA
CH1, CH4 Switch-Off Supply Current from VDD and PVDD1	ON1 = ON4 = 3.6V, FB1 = FB4 = 1.5V (not include switching losses)		400	650	uA
REFERENCE					
Reference Output Voltage	I _{REF} = 20uA	1.23	1.25	1.27	V
Reference Load Regulation	10uA < I _{REF} < 200uA		5	10	mV
Reference Line Regulation	2.7V < PVDD1 < 5.5V			5	mV
OSCILLATOR					
Frequency	R _{OSC} = 47kΩ, C _{OSC} = 100pF	240	320	400	kHz
Adjustment Range		100		1000	kHz
OSC Discharge Pulse Width			200		nS
CH1					
Startup-to-Normal Operating Threshold	Rising or falling edge		2.5		V

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Voltage Adjust Range		3.0		5.5	V
Startup-to-Normal Operating Threshold Hysteresis			80		mV
Start Delay of ON2, ON3, ON4, ON5, and ON6 after CH1 in Regulation			1024		OSC cycles
FB1 Regulation Voltage		1.23	1.25	1.27	V
FB1 to CC1 Transconductance	FB1 = CC1	80		185	uS
FB1 Input Leakage Current	FB1 = 1.25V	-100		100	nA
Current-Sense Amplifier Transresistance			0.275		V/A
PVDD Leakage Current	$V_{SW1} = 0V, PVDD1 = 3.6V$			5	uA
SW1 Leakage Current	$V_{SW1} = PVDD1 = 3.6V$			5	uA
Maximum Duty Cycle	FB1 = 1V	80	85	90	%
N-Channel Switch On-Resistance			95	150	mΩ
P-Channel Switch On-Resistance			150	250	mΩ
N-Channel Current Limit		1.8	2.1	2.4	A
P-Channel Turn-Off Current			20		mA
Startup Current Limit	PVDD1 = 1.8V		450		mA
Startup Frequency	PVDD1 = 1.8V	200			kHz
CH2					
FB2 Regulation Voltage		1.23	1.25	1.27	V
CH2 Step-Up Voltage Adjust Range	SEL2 = PVDD1	3		5	V
CH2 Step-Down Voltage Adjust Range	SEL2 = GND, PVDD2 must be greater than output	2.45		5	V
PVDD2 Undervoltage Lockout in Step-Down Mode	SEL2 = GND	2.45	2.5	2.55	V
FB2 to CC2 Transconductance	FB2 = CC2	80		185	uS
FB2 Input Leakage Current	FB2 = 1.25V	-100		100	nA
Step-Up mode Current-Sense Amplifier Transresistance			0.25		V/A
Step-Down mode Current-Sense Amplifier Transresistance			0.5		V/A
Maximum Duty Cycle	FB2 = 1V	80	85	90	%
SW2 Leakage Current	$V_{SW2} = 0 \text{ to } 3.6V, PVDD1 = 3.6V$			5	uA
Soft-Start Interval			4096		OSC cycles
N-Channel Switch On-Resistance			95	150	mΩ

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P-Channel Switch On-Resistance			150	250	mΩ
Step-Up Mode Switch Current Limit		1.8	2.1	2.4	A
Step-down Mode Switch Current Limit		0.7	0.8	0.95	A
Step-Up Mode Synchronous Rectifier Turn-Off Current			20		mA
Step-Down Mode Synchronous Rectifier Turn-Off Current			20		mA
CH3					
Voltage Adjust Range		1.25		5	V
FB3 Regulation Voltage		1.23	1.25	1.27	V
FB3 to CC3 Transconductance	FB3 = CC3	80		185	uS
FB3 Input Leakage Current	FB3 = 1.25V	-100		100	nA
Current-Sense Amplifier Transresistance			0.5		V/A
SW3 Leakage Current	V _{SW3} = 0 to 3.6V , PVDD1 = 3.6V			5	uA
Soft-Start Interval			2048		OSC cycles
N-Channel Switch On-Resistance			95	150	mΩ
P-Channel Switch On-Resistance			150	250	mΩ
P-Channel Current Limit		0.65	0.77	0.9	A
N-Channel Turn-Off Current			20		mA
POKN3 Output Low Voltage	0.1mA into POKN3			0.1	V
POKN3 Leakage Current	ON1 = GND			1	uA
CH4, CH5, CH6					
FB4, FB6H Regulation Voltage		1.23	1.25	1.27	V
FB5 Regulation Voltage		-0.01	0	0.01	V
FB6L Regulation Voltage		0.19	0.2	0.21	V
Maximum Duty Cycle	FB_ = 1V	80	85	90	%
PVDD5 Undervoltage Lockout		2.45	2.5	2.55	V
FB_ to CC_ Transconductance	FB_ = CC_	80		185	uS
FB_ Input Leakage Current	FB_ = 1.25V	-100		100	nA
DL_ Driver Resistance	Output high or low		2.5	7	Ω
DL_ Drive Current	Sourcing or sinking		0.5		A
Soft-Start Interval			4096		OSC cycles
POKN4 Output Low Voltage	0.1mA into POKN4			0.1	V
POKN4 Leakage Current	ON1 = GND			1	uA

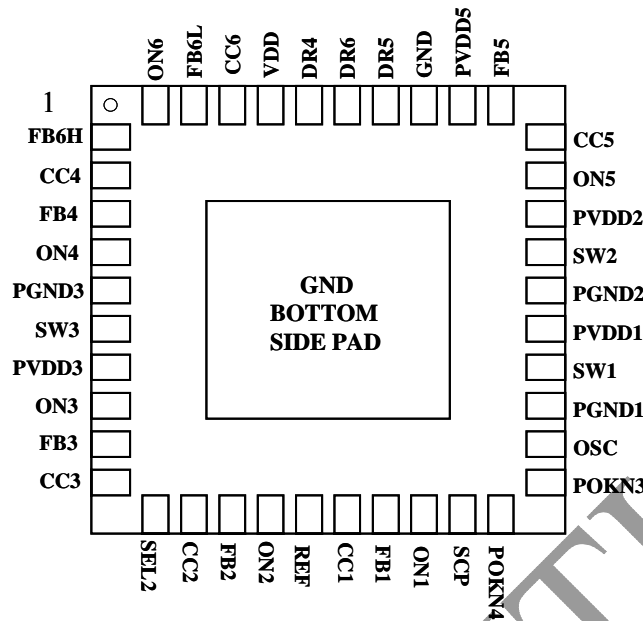
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OVERLOAD PROTECTION					
Overload Protection Fault Delay			100000		OSC cycles
SCP Output Low Voltage	0.1mA into SCP			0.1	V
SCP Leakage Current	ON1 = PVDD1, FB1 = 1.5V			1	uA
THERMAL-LIMIT PROTECTION					
Thermal Shutdown			160		°C
Thermal Hysteresis			20		°C
LOGIC INPUTS (ON_, SUSD)					
ON1 Input Low Voltage				0.5	V
ON1 Input High Voltage	PVDD1 < 1.8V	PVSU-0.2			V
	1.8V <= PVDD1 < 5.5V	1.6			V
ON2, ON3, ON4, ON5, ON6, SEL2 Input Low Level	2.7V < PVDD1 < 5.5V			0.5	V
ON2, ON3, ON4, ON5, ON6, SUSD Input High Level	2.7V < PVDD1 < 5.5V	1.6			V
SEL2 Input Leakage Current				1	uA
ON_ impedance to GND			330		kΩ

Notes :

- * Specifications are subjected to change without notice.
- * 2 PENTENT PENDING for CAT7301/CAT7302.

PIN CONFIGURATION



40 LD 6mm x 6mm QFN-40

PIN DESCRIPTION

1. FB6H

CH6 Controller Voltage Feedback Input. Connect a resistive voltage-divider from the CH1 converter output to FB6H to set the output voltage. The feedback threshold is 1.25V. FB6H can provide conventional voltage feedback (with FB3L grounded) or open-LED protection in white LED drive circuits.

2. CC4

CH4 Controller Compensation Pin. Connect a series resistor-capacitor from this pin to GND to compensate the converter control loop.

3. FB4

CH4 Controller Feedback Input. The feedback threshold is 1.25V.

4. ON4

CH4 Controller On/Off Input. Logic high = on; however, turn-on is locked out until 1024 OSC cycles after the CH1 Converter has reached regulation.

5. PGND3

CH3 Converter On Chip MOSFET Ground.

6. SW3

CH3 Converter Switching Pin. Connect to the inductor of the CH3 converter.

7. PVDD3

CH3 Converter On Chip MOSFET Power Supply. Bypass to GND with a 1 uF ceramic capacitor.

8. ON3

CH3 Converter On/Off Input. Logic high = on; however, turn-on is locked out until 1024 OSC cycles after the CH1 Converter has reached regulation.

9. FB3

CH3 Converter Feedback Input. The feedback threshold is 1.25V.

10. CC3

CH3 Converter Compensation Pin. Connect a series resistor-capacitor from this pin to GND to compensate the converter control loop.

11. SEL2

Configures the CH2 Converter as a Step-Up or a

Step-Down. This function can not change on-the-fly. With SEL2 connected to VDD, the CH2 is configured as a step-up and PVDD2 is the converter output. With SEL2 connected to GND, the CH2 is configured as a step-down and PVDD2 is the on chip MOSFET power input.

12. CC2

CH2 Converter Compensation Pin. Connect a series resistor-capacitor from this pin to GND to compensate the converter control loop.

13. FB2

CH2 Converter Feedback Input. The feedback threshold is 1.25V.

14. ON2

CH2 Converter On/Off Input. Logic high = on; however, turn-on is locked out until 1024 OSC cycles after the CH1 Converter has reached regulation.

15. REF

Reference Output. Bypass REF to GND with a 0.1 μ F or greater capacitor. The maximum-allowed REF load is 200 μ A.

16. CC1

CH1 Converter Compensation Pin. Connect a series resistor-capacitor from this pin to GND to compensate the converter control loop.

17. FB1

CH1 Converter Feedback Input. The feedback threshold is 1.25V.

18. ON1

CH1 Converter On/Off Control. Logic high = on. All other ON_ pins are locked out until 1024 OSC cycles after the CH1 DC-to-DC converter output has reached its final value.

19. SCP

Open-Drain, Short-Circuit-Protection Flag Output. SCP goes open when overload protection occurs. Under normal operation, SCP pulls low.

20. POKN4

Open-Drain, Active-Low, Power-OK Signal for CH4 Controller. POKN4 goes low when the CH4 controller has successfully completed soft-start.

21. POKN3

Open-Drain, Active-Low, Power-OK Signal for CH3 Converter. POKN3 goes low when the CH3 has successfully completed soft-start.

22. OSC

Oscillator Control. Connect a timing capacitor from OSC to GND and a timing resistor from OSC to PVDD (or other DC voltage) to set the oscillator frequency between 100kHz and 1MHz.

23. PGND1

CH1 Converter On Chip MOSFET Ground.

24. SW1

CH1 Converter Switching Pin. Connect to the inductor of the CH1 converter.

25. PVDD1

Power Output of the CH1 DC-to-DC Converter. PVDD1 can also power other converter channels. Connect PVDD1 and VDD together.

26. PGND2

CH2 Converter On Chip MOSFET Ground.

27. SW2

CH2 Converter Switching Pin. Connect to the inductor of the CH2 converter.

28. PVDD2

When SEL2 = PVDD1, the CH2 converter is configured as a step-up and PVDD2 is the CH2 output. When SEL2 = GND, the CH2 is configured as a step-down and PVDD2 is the on chip MOSFET power input.

29. ON5

CH5 Controller On/Off Input. Logic high = on; however, turn-on is locked out until 1024 OSC cycles after the CH1 Converter has reached regulation.

30. CC5

CH5 Controller Compensation Pin. Connect a series resistor-capacitor from this pin to GND to compensate the converter control loop.

31. FB5

CH5 Controller Feedback Input. The feedback threshold is 0V.

32. PVDD5

Voltage Input for CH5 Controller Gate Driver. The voltage at PVDD5 sets the high gate-drive voltage.

33. GND

Analog Ground.

34. DR5

CH5 Controller Gate-Drive Output. DR5 drives between PVDD5 and GND.

35. DR6

CH6 Controller Gate-Drive Output.

36. DR4

CH4 Controller Gate-Drive Output.

37. PVDD

Chip Power input.

38. CC6

CH6 Controller Compensation Pin. Connect a series resistor-capacitor from this pin to GND to compensate the converter control loop.

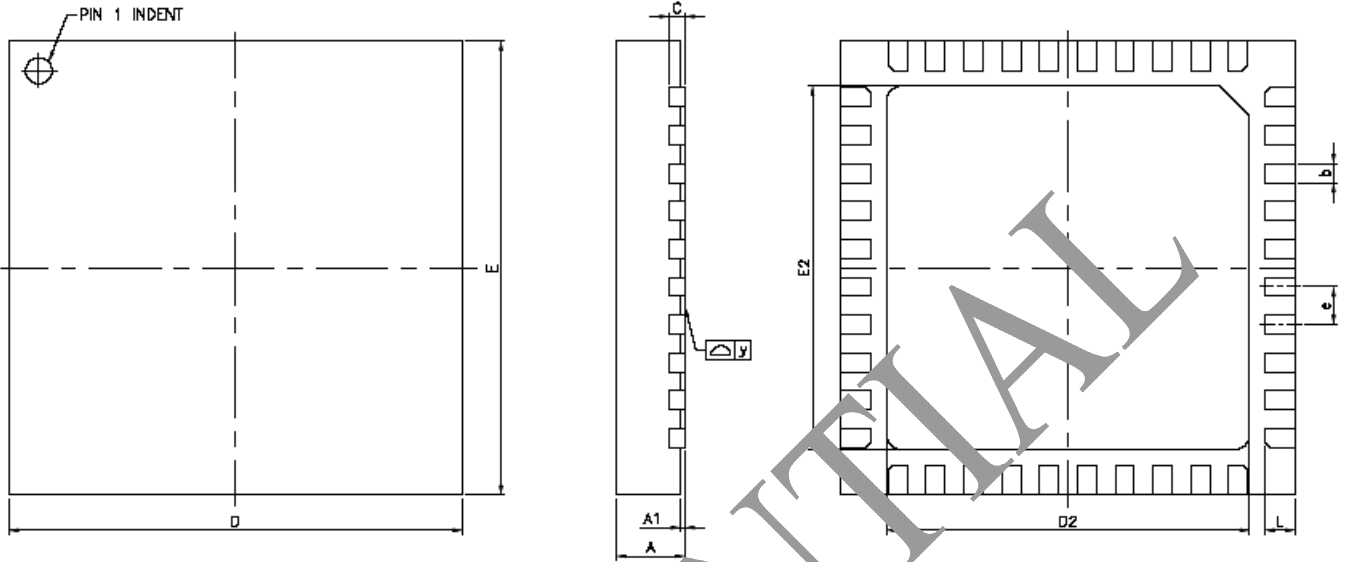
39. FB6L

CH6 Controller Current-Feedback Input. Connect a resistor from FB6L to GND to set LED current in LED boost-drive circuits. The feedback threshold is 0.2V. Connect this pin to GND if using only the FB6H feedback.

40. ON6

CH6 Controller On/Off Input. Logic high = on; however, turn-on is locked out until 1024 OSC cycles after the CH1 Converter has reached regulation.

MECHANICAL DIMENSION:



SYMBOLS	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	0.80	0.90	1.00
A1	0.00	0.02	0.05
b	0.18	0.25	0.30
C	—	0.20 REF.	—
D	5.90	6.00	6.10
D2	4.65	4.80	4.95
E	5.90	6.00	6.10
E2	4.65	4.80	4.95
e	—	0.50	—
L	0.35	0.40	0.45
y	0.00	—	0.076