

High Efficiency, Low-Side N-Channel DC-DC Controller with Accurate Input Current Limit

GENERAL DESCRIPTION

The PT1304 is a current mode DC-DC controller providing excellent AC and DC line and load regulation. It is suitable for use in topologies requiring low side NMOSFET, such as boost, fly-back or SEPIC. The internal soft-start reduces the inrush current at startup. The PT1304 provides $\pm 2\%$ output voltage accuracy. It consumes only 300uA quiescent current during normal operation and typically 0.1uA during shut down. The PT1304 has built in fault condition protection features such as short-circuit protection, and under voltage lock-out. The PT1304 also has an OVLO function that locks out the EXT when the input voltage is higher than 6.9V, although the EN, VIN, CS and EXT pins can stand up to 18V. The PT1304 incorporates programmable average current limiting with $\pm 2\%$ accuracy, which allows accurate limiting of the average current in the inductors, independent of peak current. The operating input voltage range of the PT1304 is 3V to 5.5V. Excellent EMI performance is achieved with Powtech's proprietary frequency jittering technique together with soft-drive control. The PT1304 is available in SOP8 and MSOP8 packages.

FEATURES

- High Output Voltage Accuracy: $\pm 2\%$
- $\pm 2\%$ Programmable Average Current Limiting
- Current Mode Operation for Excellent Line and Load Transient Response
- Frequency Jittering and Soft-Drive to Minimize EMI
- Internal Soft Start
- 18V Capability at VIN, EN, CS and EXT pins
- 300uA Quiescent and 0.1uA Shutdown Current
- Short-Circuit Protection
- UVLO with Hysteresis
- OVLO with Hysteresis
- RoHS compliant

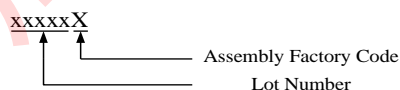
APPLICATIONS

- Battery Chargers
- DC-DC Converters
- Li-ion and USB Powered Systems
- Portable Instruments
- Step-up/step-down and Isolated dc/dc converters
- LCD backlighting

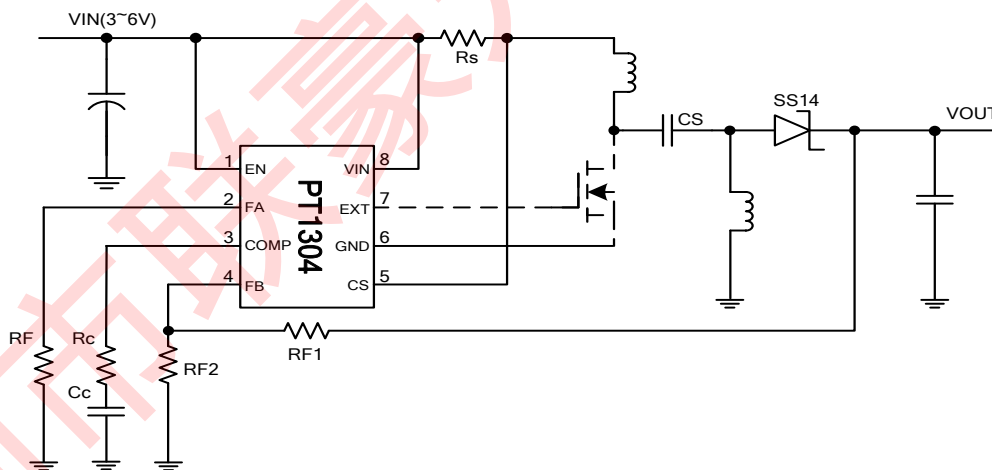
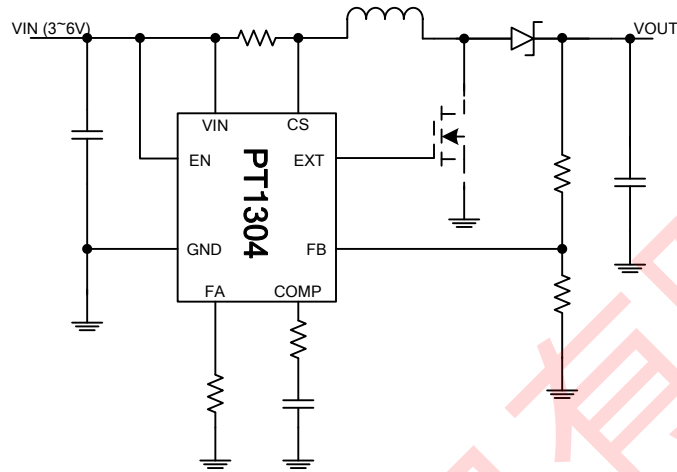
ORDERING INFORMATION

PACKAGE	TEMPERATURE RANGE	ORDERING PART NUMBER	TRANSPORT MEDIA	MARKING
MSOP8	-40~85°C	PT1304EMSH	Tape and Reel	PT1304 xxxxxX
SOP8	-40~85°C	PT1304ESOH	Tape and Reel	PT1304 xxxxxX

Note:

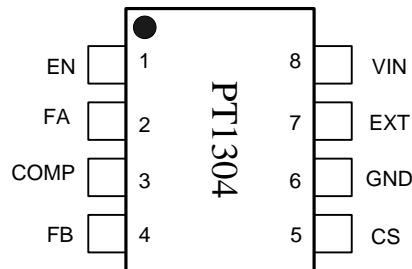


TYPICAL APPLICATIONS



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PIN ASSIGNMENT



PIN DESCRIPTIONS

PIN NO	SYMBOL	FUNCTION
1	EN	Enable input
2	FA	Frequency adjusting pin, a resistor connected to this pin sets the oscillator frequency
3	COMP	Compensation Pin, an RC network connected to this pin provides compensation for the control loop
4	FB	Feedback Pin, a portion of the output voltage is sensed at this pin
5	CS	Current sense Pin, voltage generated across an external resistor is fed into this pin
6	GND	Ground Pin
7	EXT	Drive external low side NMOS
8	VIN	Power supply input Pin

ABSOLUTE MAXIMUM RATINGS (NOTE1)

SYMBOL	DESCRIPTION	VALUE	UNITS
EN	Enable input voltage	-0.3~7	V
COMP	Compensation Pin voltage	-0.3~7	V
FB	Feedback pin voltage	-0.3~7	V
FA	Frequency adjust pin input voltage	-0.3~7	V
EXT	EXT pin output current	±100	mA
VIN	Supply voltage	-0.3~20	V
CS	CS pin input voltage	-0.3~20	V
T _{OPT}	Operation temperature	-40~+85	°C
T _{STG}	Storage temperature range	-55~+125	°C

RECOMMENDED OPERATING CONDITIONS (NOTE2)

SYMBOL	DESCRIPTION	VALUE	UNITS
EN	Enable input voltage	-0.3~5.5	V
COMP	Compensation Pin voltage	-0.3~5.5	V
FB	Feedback pin voltage	-0.3~5.5	V
FA	Frequency adjust pin input voltage	-0.3~5.5	V
EXT	EXT pin output current	±50	mA
VIN	Supply voltage	3~6	V
CS	CS pin input voltage	3~6	V

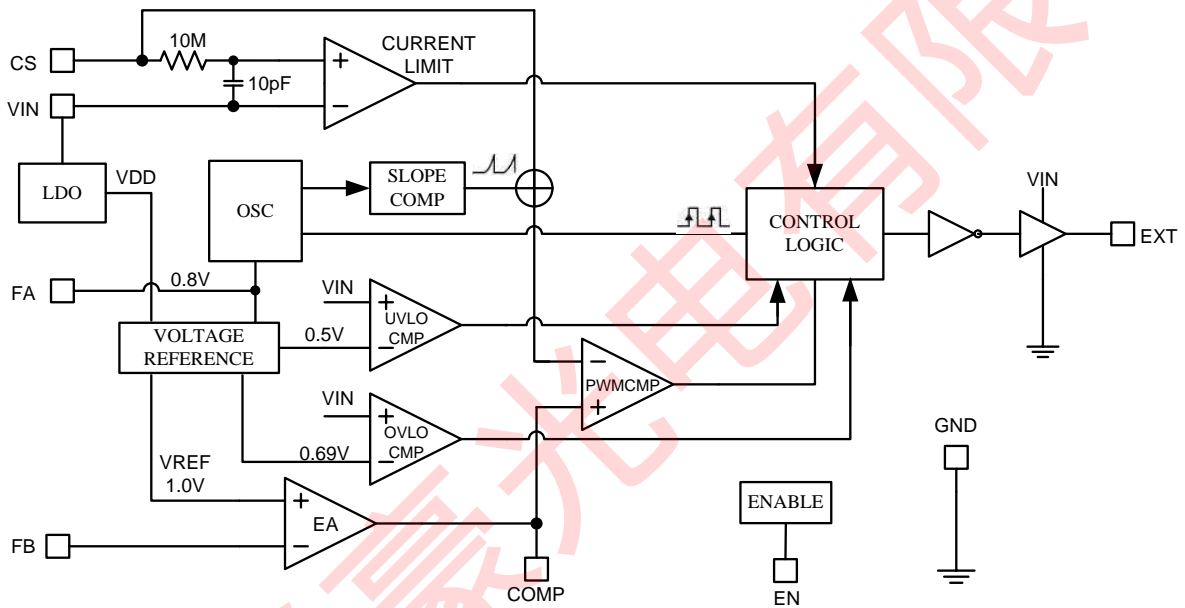
Notes:

1. Exceeding these ratings may damage the device
2. The device is not guaranteed to function outside of its operating rating

THERMAL RESISTANCE

SOP8	-----	105 °C/W
MSOP8	-----	190 °C/W

SIMPLIFIED BLOCK DIAGRAM



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ELECTRICAL CHARACTERISTICS

($V_{IN} = 5V$, $T_A = 25^\circ C$, unless otherwise specified.)

SYMBOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNIT
V_{IN}	Input Voltage Range		3		6	V
V_{FB} (Note3)	FB Reference Voltage	$I_{OUT} = 0$	1	1.02	1.04	V
ΔV_{FB}	Reference Voltage Line Regulation	$V_{IN}=3Vto5V$		0.2		%
$V_{LOADREG}$ (Note4)	Output Voltage Load Regulation	$I_{LOAD}=0$ to 300mA		3		%
FS	Nominal Oscillator Frequency	$R_F=400K$	300	350	400	kHz
D_{MAX}	Maximum Duty Cycle	$R_F=400K$		95		%
I_S	Input DC Bias Current	$V_{FB}=1.2V$		300	500	μA
I_{SHD}	Shut Down Current	$V_{EN}=0$		0.1	1	μA
V_{ENH}	EN "H" Input Threshold		1.5			V
V_{ENL}	EN "L" Input Threshold				0.3	V
V_{UVLO}	Under Voltage LockOut Threshold		2.1	2.3	2.5	V
ΔV_{UVLO}	Under Voltage LockOut Threshold Hysteresis			200		mV
V_{OVLO}	Over Voltage LockOut Threshold		6.4	6.9	7.4	V
ΔV_{OVLO}	Over Voltage LockOut Threshold Hysteresis			200		mV
T_{SS}	Soft Start Time	$R_F=400K$		2		ms
$V_{IN} - V_{CS}$ (Note3,5)	Current Sense Voltage		94	96	98	mV
I_{ST}	Short Circuit Current	$V_{OUT}=0V$		150		mA

Note3: The spec of these parameters can be adjusted in a little range by changing metal layer.

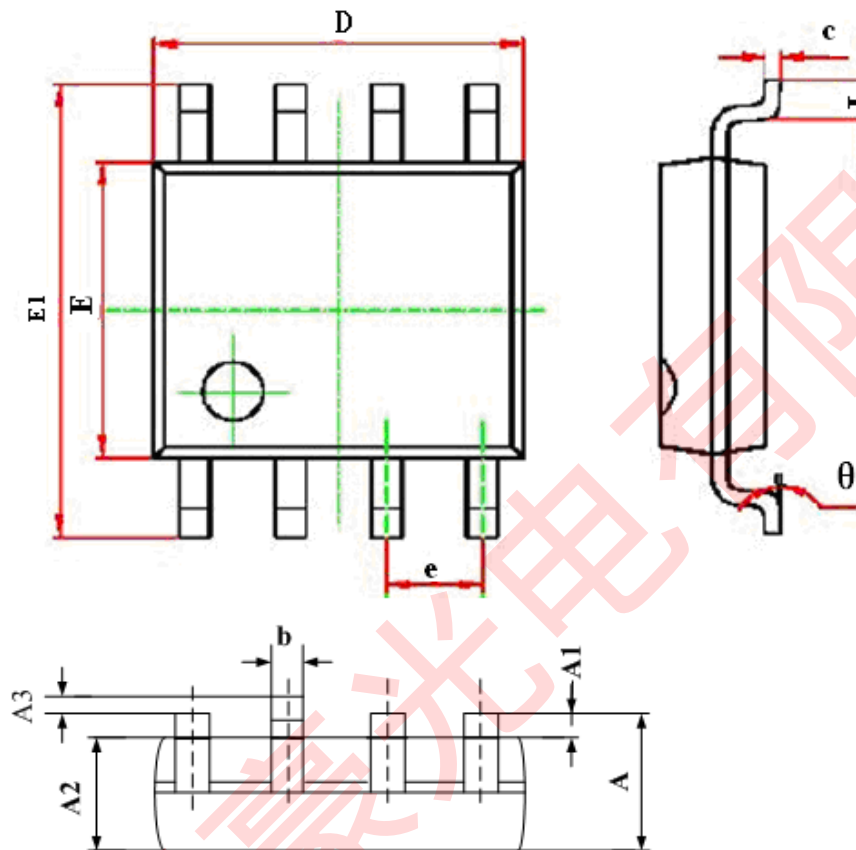
Note4: The 3% regulation only applies to SEPIC applications. For the applications using boost and flyback architectures, the load regulation should typically be 0.5%.

Note5: Average current limit technique is adopted in this IC, the average inductor current, I_{AVG} , is calculated from V_{IN} and V_{CS} according to the following formula:

$$I_{AVG} = \frac{V_{IN} - V_{CS}}{R_S}$$

PACKAGE INFORMATION

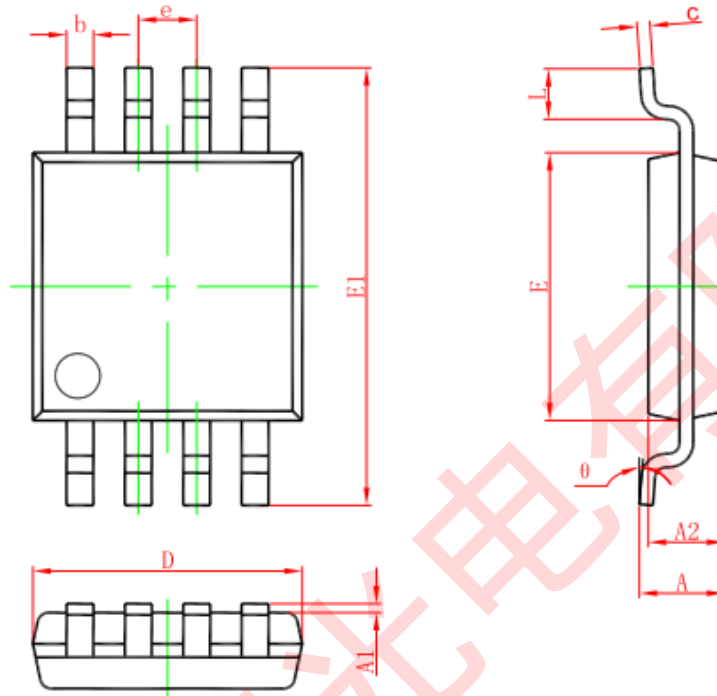
SOP8 Package



SYMBOL	DIMENSIONS IN MILLIMETERS		DIMENSIONS IN INCHES	
	MIN	MAX	MIN	MAX
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
A3	0.000	0.127	0.000	0.005
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270 (BSC)		0.050(BSC)	
L	0.400	1.270		
θ	0°	8°	0°	8°

PACKAGE INFORMATION

MSOP8 Package



SYMBOL	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.220	0.380	0.009	0.015
c	0.080	0.230	0.003	0.009
D	2.900	3.100	0.114	0.122
e	0.650(BSC)		0.026(BSC)	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	8°	0°	8°