General Description

The ELPW5209 is an integrated 90mΩ power switch for self-powered and bus powered Universal Series Bus(USB) applications. Abuilt-in charge pump is used to drive the N-Channel MOSFET that is free of parasitic body diode to eliminate any reversed current flow across the switch when it is powered off. It's low quiescent current(16μA) and small package (SOT-23-5) is particularly suitable in battery-powered portable equipment. Several protection functions include soft start to limit inrush current during plug-in, current limiting at set to meet power requirement, and thermal shutdown to protect damage under over current conditions.

Features

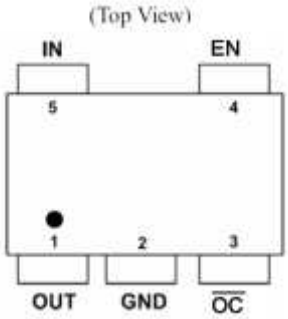
- 90mΩ Low Rdson, High-side NMOSFET
- Guaranteed 2.95ª Continuous Current
- 2.5V to 6V Input Voltage
- Low Quiescent Current:16uA
- Soft Start Function
- Built-In Short-Circuit Protection
- Built-in Thermal Protection
- RoHS Compliant and 100% Lead(Pb) -Free

Applications

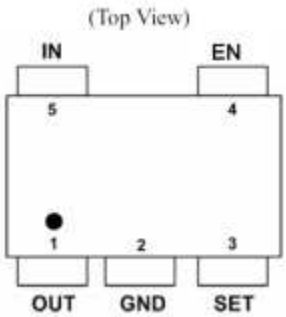
- Power Switch
- USB Device
- Battery Charger Circuits

Pin Assignments

SOT23-5L：



ELP5209B~H



ELP5209A

Pin Description

SOT23-5	Pin Name	Pin Function
1	VOUT	Out put pin.
2	GND	Ground.
3	$\overline{OC}$	Low to indicate over current status.
	SET	Connect a resistor to GND for programming current.
4	EN	Device enable.
5	VIN	In put pin.

Ordering Information

ELPW5209 X X XX X

Over current limited:
A： ADJ
B：2.45A
C：1.75A
E：1.10A
F：1.40A
G：2.95A
H：2.10A

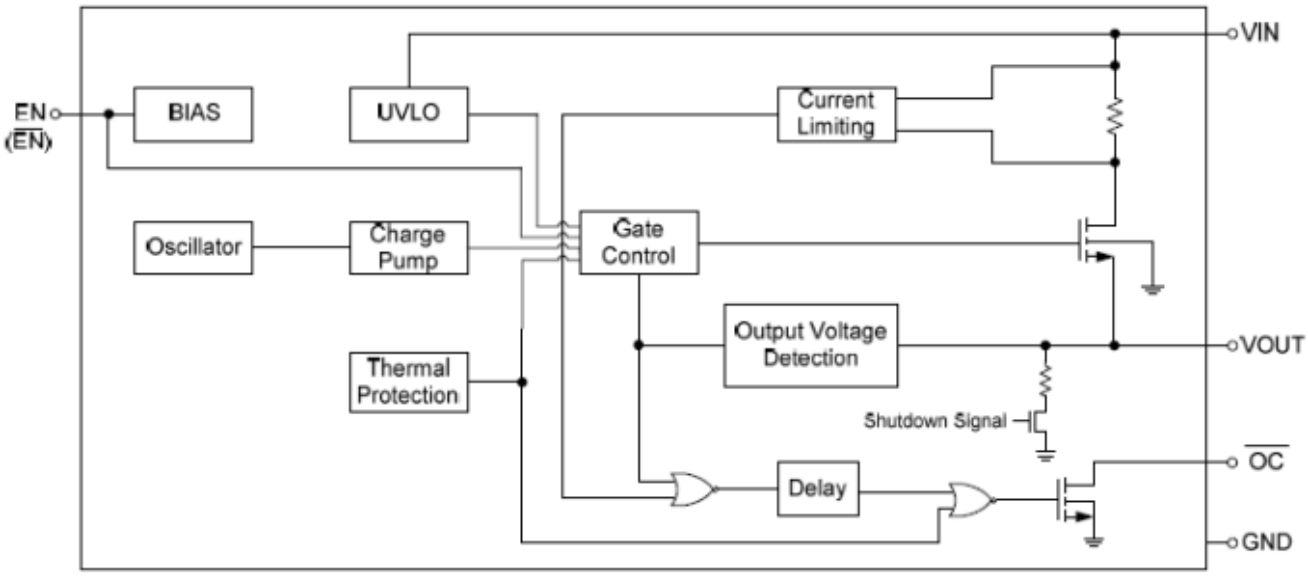
B2：SOT23-5

EN Level:
N：Active high
S：Active low

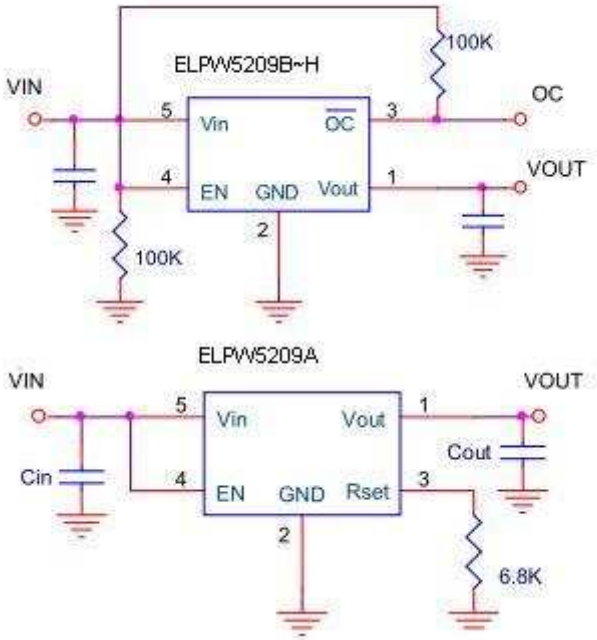
R：Tape & Reel

Part Number	Marking	Information
ELP5209XNB2R		
ELP5209XSB2R		

Function Block Diagram (For ELPW5209B~H)



Typical Application Circuit



Absolute Maximum Ratings

- Input Voltage to GND (V_{INB-H},V_{INA})----------6V
- EN Voltage----------0.3V to 6V
- Operating Junction Temperature Range(TJ)---------- -20℃ to 150℃
- Maximum Soldering Temperature (at leads,10sec)---------- 260℃
- HBM (Human Body Mode)----------2KV

Thermal Information

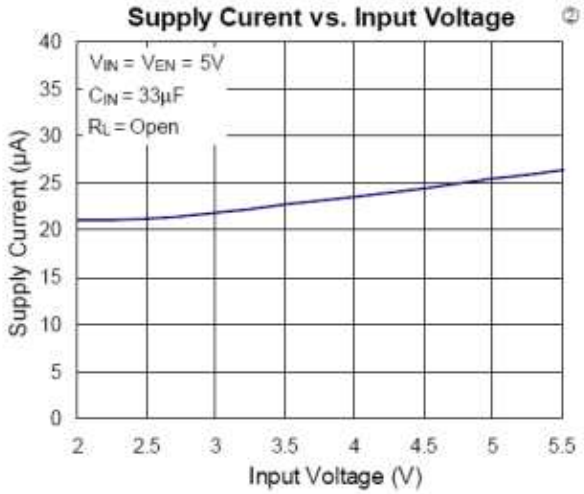
- Maximum Power Dissipation(PD)---------- 0.25W
- Thermal Resistance(JA) ----------250℃/W

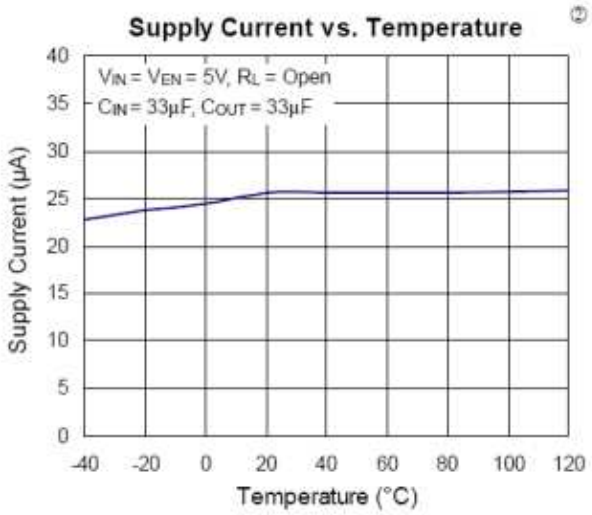
Electrical Characteristics

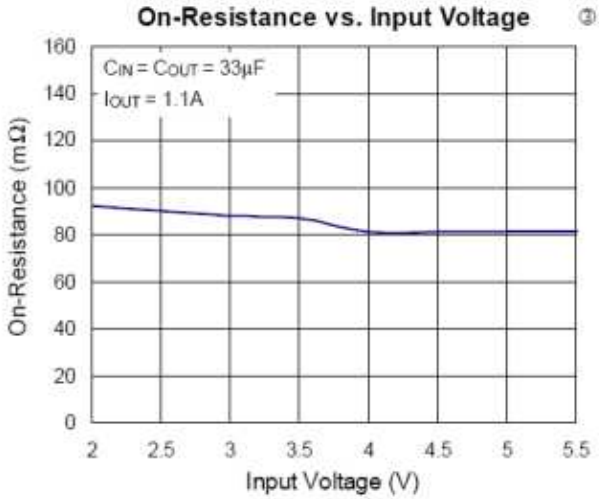
(Over recommended operating conditions unless specified otherwise)VIN=3.6V,EN= High, TA=25℃)

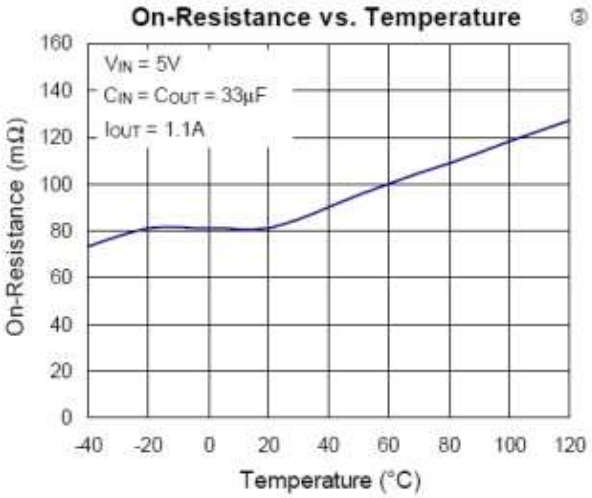
Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_{IN}	Input Voltage		2.5		5.5	V
I_{LIMIT}	Output Current Limit	LPW5209BN		2.45		A
		LPW5209CN		1.75		
		LPW5209EN		1.1		
		LPW5209FN		1.4		
		LPW5209GN		2.95		
		LPW5209HN		2.15		
		LPW5209AN,Rset=6.8K		1		
$R_{DS(ON)}$	Output NMOSFET $R_{DS(ON)}$	SOT23-5		90		mΩ
		SOP8		70		
I_Q	Quiescent Current	Vin=3V		16	28	uA
I_{SHDN}	Shut down Current	EN=GND			1	μA
$V_{EN(L)}$	Enable Threshold Low				0.4	V
$V_{EN(H)}$	Enable Threshold High		1.4			V
I_{EN}	Input Low Current	V_{IN}=V_{EN}=5V	-1		1	μA

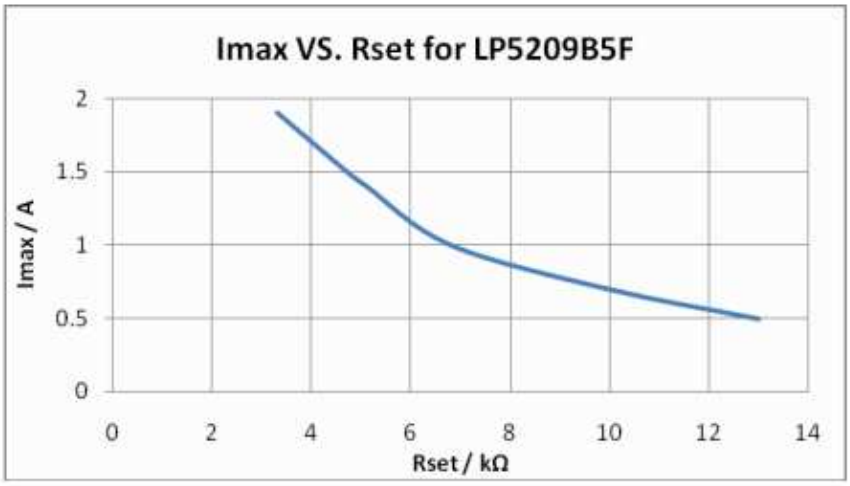
Typical Operation Characteristics



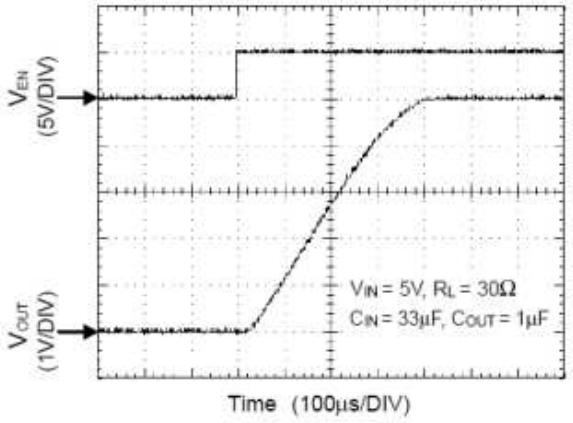




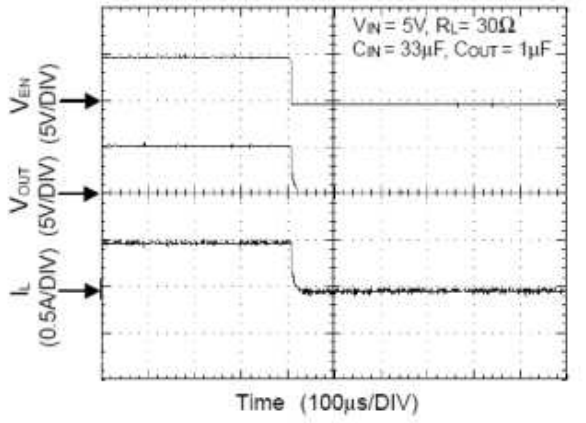




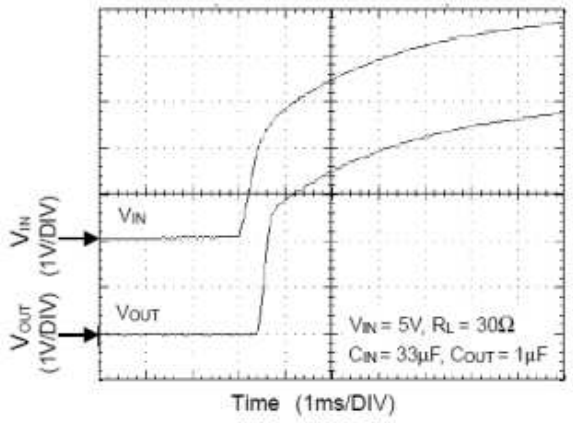
Turn- On Response ①



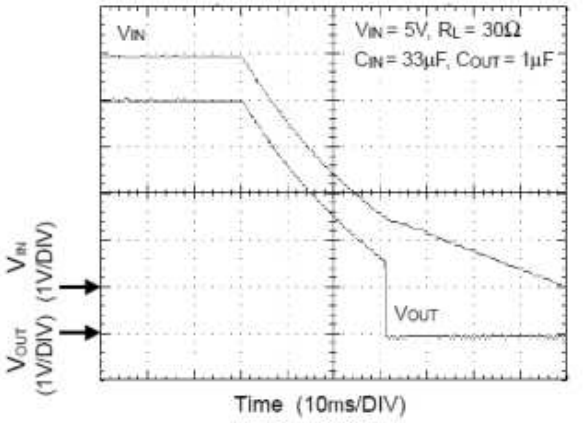
Turn- Off Response ①



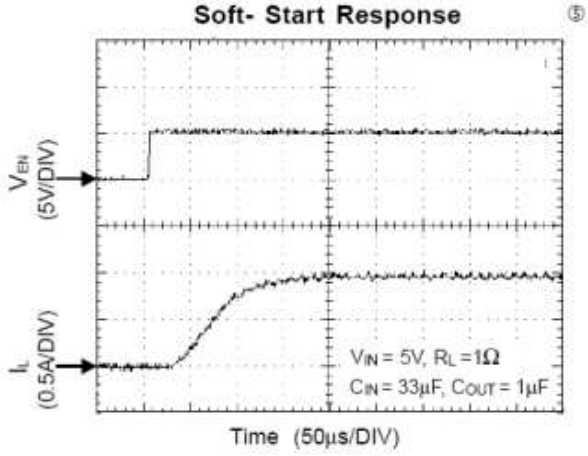
UVLO at Rising ④



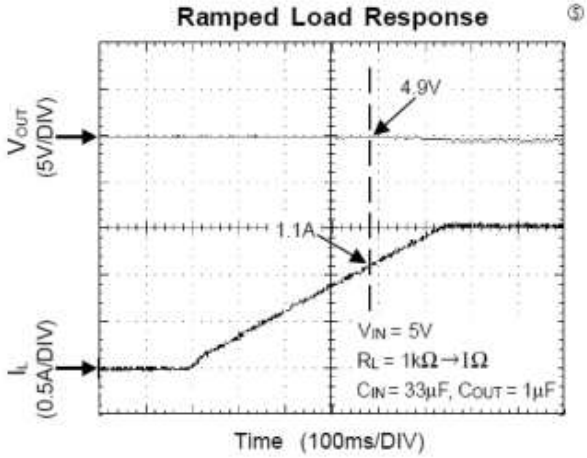
UVLO at Falling ④



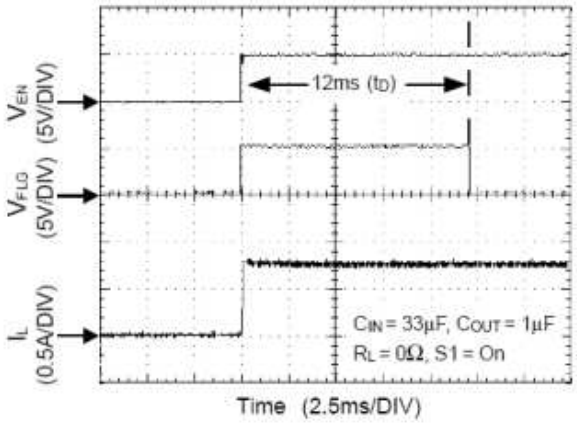
Soft- Start Response ⑤



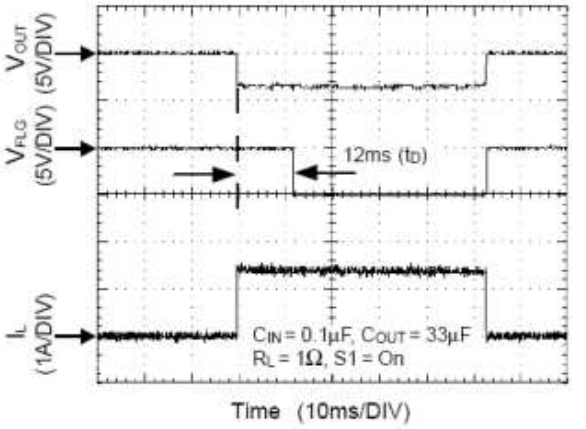
Ramped Load Response ⑤



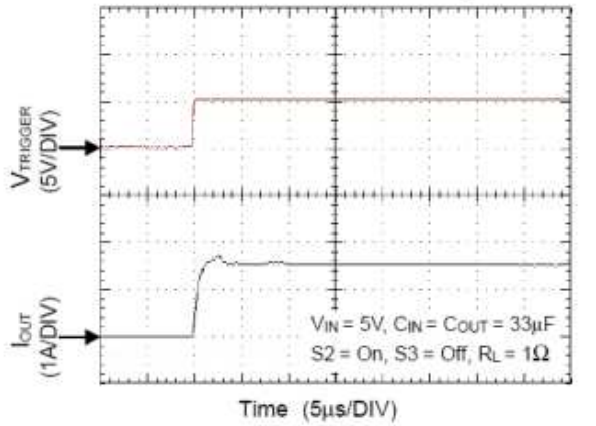
Flag Response (Enable into Short Circuit)



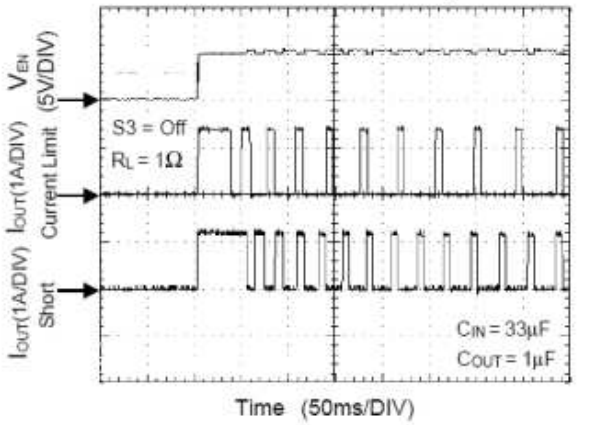
Flag Response ①



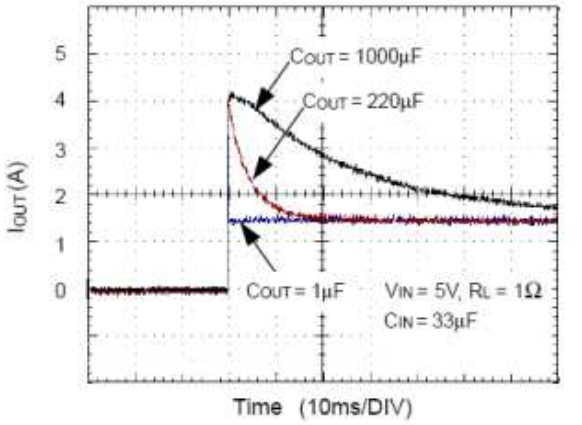
Current Limit Transient Respones ⑤



Thermal Shutdown Response ⑤



Short Circuit Current Response ⑤



Application Information

The ELPW5209 are single N-Channel MOSFET high-side power switches with active-high enable input, optimized for self-powered and bus-powered Universal Serial Bus(USB) applications. The ELPW5209 equipped with a charge pump circuitry to drive the internal NMOS switch; the switch's low $R_{DS(ON)}$, 90mΩ, meets USB voltage drop requirements; and a flag output is available to indicate fault conditions to the local USB controller.

InputandOutput

VIN(input) is the power source connection to the internal circuitry and the drain of the MOSFET.VOUT(output) is the source of the MOSFET. In a typical application, current flows through the switch from VIN to VOUT to ward the load. If VOUT is greater than VIN, current will flow from VOUT to VIN since the MOSFET is bidirectional when on. Unlike a normal MOSFET, there is no a parasitic body diode between drain and source of the MOSFET, the ELPW5209 prevents reverse current flow if VOUT being externally forced to a higher voltage Than VIN when the output disabled (VEN<0.4V).

Chip Enable Input

The switch will be disabled when the EN pin is in a logic low condition(ELP5209A). During this condition, the internal circuit is turned off, reducing the supply current to 0.1μA typical. The maximum guaranteed voltage for a logic low at the EN pin is 0.4V. A minimum guaranteed voltage of 1.4V at the EN pin will turn the ELPW5209 back on. Floating the input may cause un predictable operation. EN should not be allowed to go negative with respect to GND. The EN pin may be directly tied to VIN to keep the part on.

Soft Start for Hot Plug-In Applications

In order to eliminate the up stream voltage droop caused by the large inrush current during hot-plug events, the “soft-start” feature effectively isolates the power source from extremely large capacitive loads, satisfying the USB voltage droop requirements.

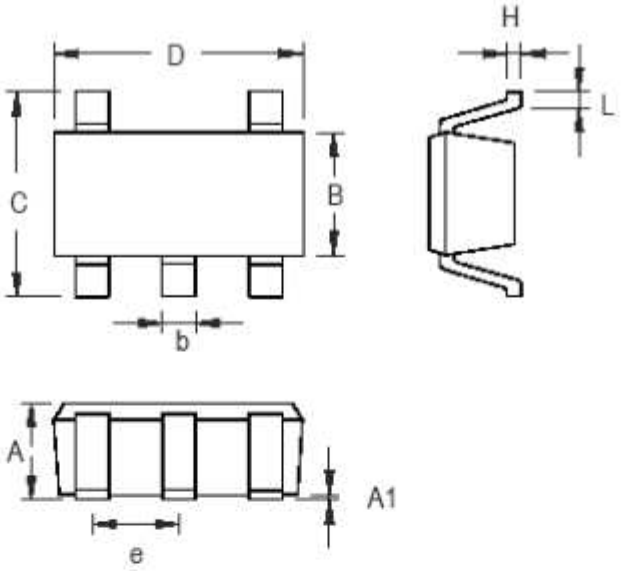
Fault Flag

The ELPW5209 provides a $\overline{OC}$ signal pin which is a N-Channel open drain MOSFET output. This open drain output goes low when VOUT <VIN–1V, current limit or the die temperature exceeds 130℃ approximately. T he $\overline{OC}$ output is capable of sinking a10mA load to typically 200mV above ground. The $\overline{OC}$ pin requires a pull-up resistor, this resistor should be large in value to reduce energy drain. A100kΩ pull-up resistor works well for most applications. In the case of an over-current condition, $\overline{OC}$ will be asserted only after the flag response delay time, TD, has elapsed. This ensures that $\overline{OC}$ is asserted only upon valid over-current conditions and that erroneous error reporting is eliminated. For example, false over-current conditions may occur during hot plug events when extremely large capacitive loads are connected and causes a high transient in rush current that exceeds the current limit threshold. The $\overline{OC}$ response delay time TD is typically 10ms.

Thermal Shut down

Thermal shut down is employed to protect the device from damage if the die temperature exceeds approximately 150℃. If enabled, the switch automatically restarts when the die temperature falls 20℃. The output and $\overline{OC}$ signal will continue to cycle on and off until the device is disabled or the fault is re moved.

Package Information(SOT23-5)



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.889	1.295	0.035	0.051
A1	0.000	0.152	0.000	0.006
B	1.397	1.803	0.055	0.071
b	0.356	0.559	0.014	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

SOT-23-5 Surface Mount Package