

### ● 1. General Description

The WP2301 is a single N-MOSFET high-side power switch designed for USB applications. This switch operates with inputs ranging from 2.7V to 6V, making it ideal for both 3.3V and 5V systems. An integrated current-limiting circuit protects the input supply against large currents which may cause the supply to fall out of regulation. The WP2301 includes thermal shutdown protection that prevents damage to the device when a continuous over-current condition causes excessive heating by turning off the switch. The load of the switch can be up to 3A. The quiescent current is only 30 $\mu$ A in active mode while it is less than 1 $\mu$ A in shutdown mode. Fault flag ( $\overline{\text{FLT}}$ ) can indicate over current and fault conditions.

The WP2301 is available in Pb-free packages and is specified over the -40°C to +85°C ambient temperature range.

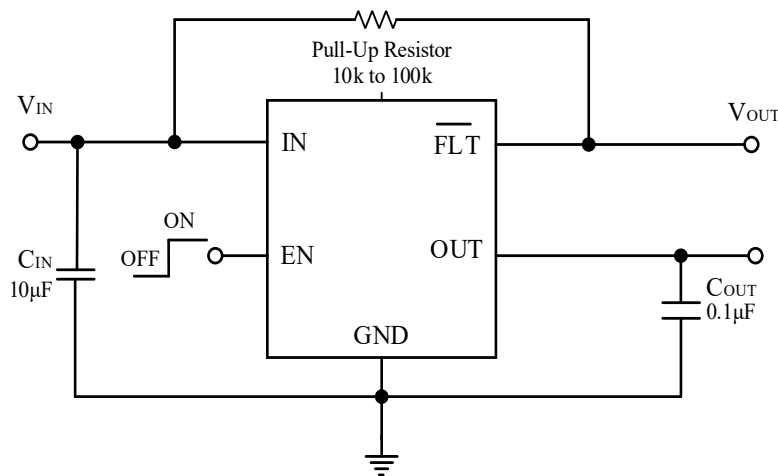
### ● 2. Features

- Input Voltage Range: 2.7V to 6V
- $R_{\text{DS(ON)}}$ : 55m $\Omega$ , N-MOSFET Switch
- Accurate Current Limit
- Reverse Current Blocking
- Very Low Quiescent Current: 30 $\mu$ A (Typ.)
- 1 $\mu$ A Max Shutdown Supply Current
- Fault Flag ( $\overline{\text{FLT}}$ ) output for over current and fault conditions.
- Under-Voltage Lockout
- Thermal Shutdown
- 5kV ESD Rating
- Package: TSOT23-5(FC)

### ● 3. Applications

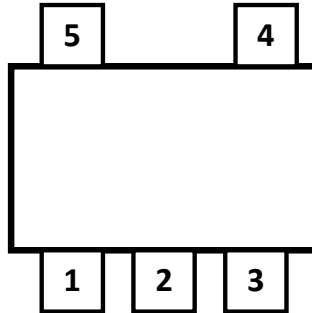
- Notebook PCs
- USB Peripherals

### ● 4. Typical Application



Note: Tantalum or Aluminum Electrolytic capacitors ( $C_{\text{IN}}$  and  $C_{\text{OUT}}$ ) may be required for USB applications

## ● 5. Pin Configuration



TSOT23-5(FC)

## ● 6.Pin Description

PIN NUMBER	PIN NAME	I/O	PIN FUNCTIONS
1	OUT	O	Switch output.
2	GND		Common ground.
3	$\overline{\text{FLT}}$	O	Fault FLAG output. Open drain output that indicates an over current, supply under voltage or over temperature state.
4	EN	I	Enable input. Active High.
5	IN	I	Switch input.

## ● 7. Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

PARAMETER	RATING	UNIT
IN, EN, $\overline{\text{FLT}}$ Voltage	-0.3 to 7	V
OUT Voltage	-0.3 to $V_{\text{IN}} + 0.3$	V
OUT Current	Internal Limited	A
Power Dissipation	790	mW
Package Thermal Resistance( $\theta_{\text{JA}}$ )	126.5	°C/W
Operating Junction Temperature	-40 to 125	°C
Storage Temperature	-55 to 150	°C
Lead Temperature (Soldering, 10 sec)	260	°C
ESD(HBM)	5000	V

(1) Stresses beyond those listed under Absolute maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability. All voltage values are with respect to the network ground terminal unless otherwise noted.

## ● 8. Recommended Operating Conditions

SYMBOL	PARAMETER	MIN	MAX	UNIT
$V_{\text{IN}}$	Input Voltage Range	2.7	6	V
$T_{\text{A}}$	Operating Ambient Temperature	-40	85	°C

## ● 9. Electrical Characteristics

( $V_{IN} = 5\text{ V}$ ,  $V_{EN} = 5\text{ V}$ ,  $C_{IN}=10\mu\text{F}$ ,  $C_{OUT}=0.1\mu\text{F}$ ,  $T_A=25^\circ\text{C}$ , unless otherwise noted)

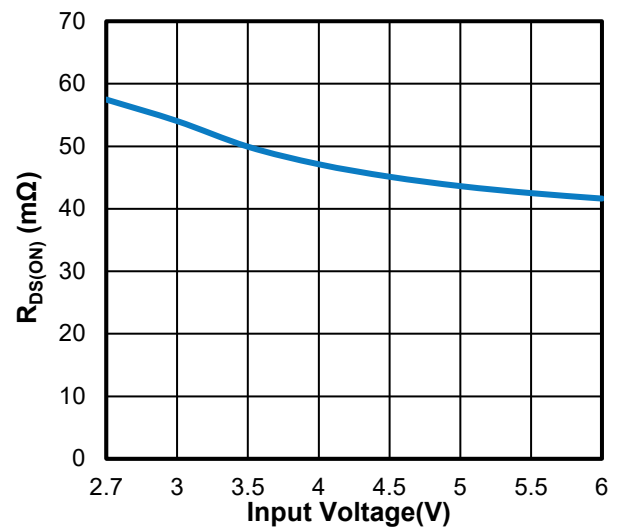
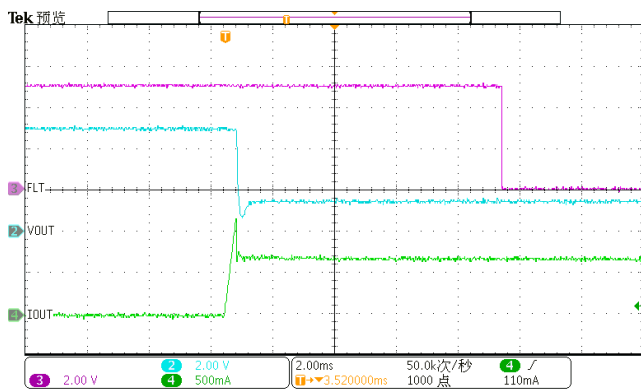
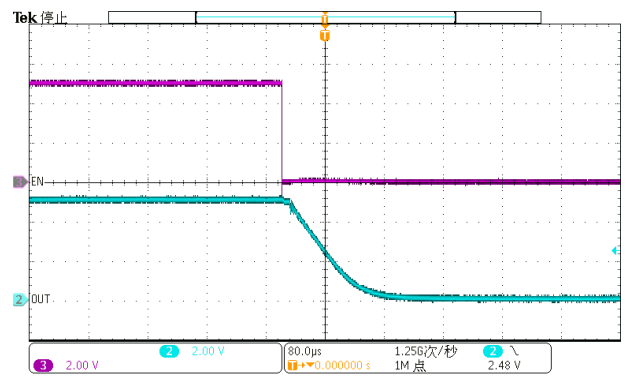
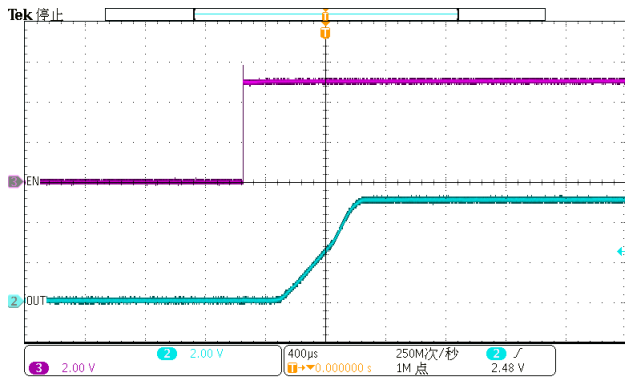
SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP.	MAX	UNIT
$I_{SHDN}$	Shutdown Quiescent Current	Disabled, OUT floating or shorted to ground		0.1		$\mu\text{A}$
$I_Q$	Quiescent Current	Enabled, $I_{OUT}=0\text{A}$		30		$\mu\text{A}$
$R_{DS(ON)}$	Switch On-resistance	$V_{IN}=5\text{V}$		55		$\text{m}\Omega$
$I_{TRIP}$	Over Current Trip Threshold	$V_{IN}=5\text{V}$ , $100\text{A/s}$	WP2301-A/B	0.9		A
			WP2301-C/D	1.4		
			WP2301-E/F	2.1		
			WP2301-G/H	2.8		
			WP2301-I/J	3.4		
			WP2301-K/L	4.1		
$I_{LIM}$	Current Limit	$V_{IN}=5\text{V}$ , $V_{OUT}=1\text{V}$	WP2301-A/B	0.7		A
			WP2301-C/D	1.1		
			WP2301-E/F	1.6		
			WP2301-G/H	2.2		
			WP2301-I/J	2.7		
			WP2301-K/L	3.2		
$V_{IL}$	EN Input Logic Low Voltage				0.75	V
$V_{IH}$	EN Input Logic High Voltage		1.5			V
$R_{\overline{FLT}}$	$\overline{FLT}$ Low Resistance	$I_{SINK} = 1\text{mA}$		6		$\Omega$
$I_{\overline{FLT\_OFF}}$	$\overline{FLT}$ Off Current	$V_{\overline{FLT}}=5\text{V}$		0.1		$\mu\text{A}$
$t_{\overline{FLT\_DELAY}}$	$\overline{FLT}$ Delay Time			10		ms
$V_{UVLO}$	Input UVLO Threshold			2		V

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP.	MAX	UNIT
$V_{UVLO\_HYS}$	Input UVLO Hysteresis			0.1		V
$I_{REV}$	Reverse Leakage Current	$V_{IN} = 0V, V_{OUT} = 5V,$ $I_{REV}$ at $V_{IN}$		0.1	1	$\mu A$
$t_{ON}$	Output Turn-on Delay Time	From enable to 90% of $V_{OUT}$		0.5		ms
$t_R$	Output Turn-on Rise Time	10% to 90% of $V_{OUT}$ rising		0.8		ms
$R_{DIS}$	Output Discharge Resistance	Disabled, $V_{IN} = 5V, V_{OUT}=1V$		5		$\Omega$
$T_{SHDN}$	Thermal Shutdown Threshold	Note 1		140		$^{\circ}C$
$T_{HYS}$	Thermal Shutdown Hysteresis	Note 1		20		$^{\circ}C$

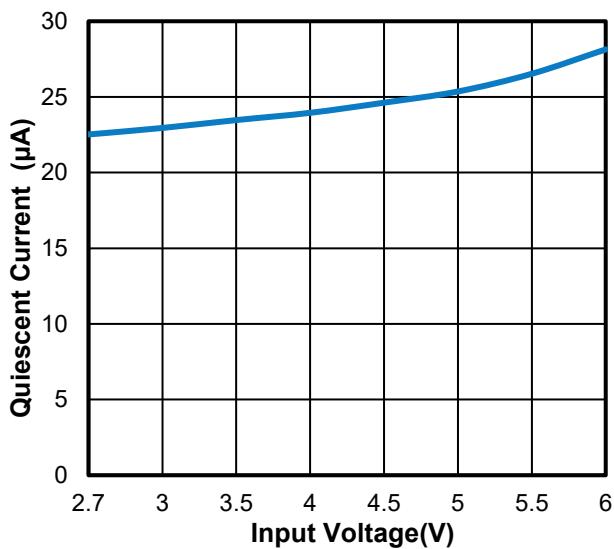
Note 1: Guaranteed by design.

10. Typical Performance Characteristics

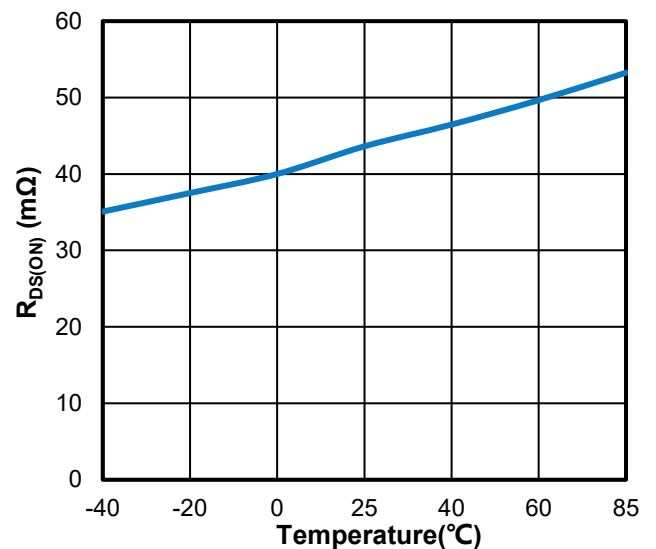
( $V_{IN} = 5V$ ,  $V_{EN} = 5V$ ,  $C_{IN} = 10\mu F$ ,  $C_{OUT} = 0.1\mu F$ ,  $T_A = 25^\circ C$ , unless otherwise noted)



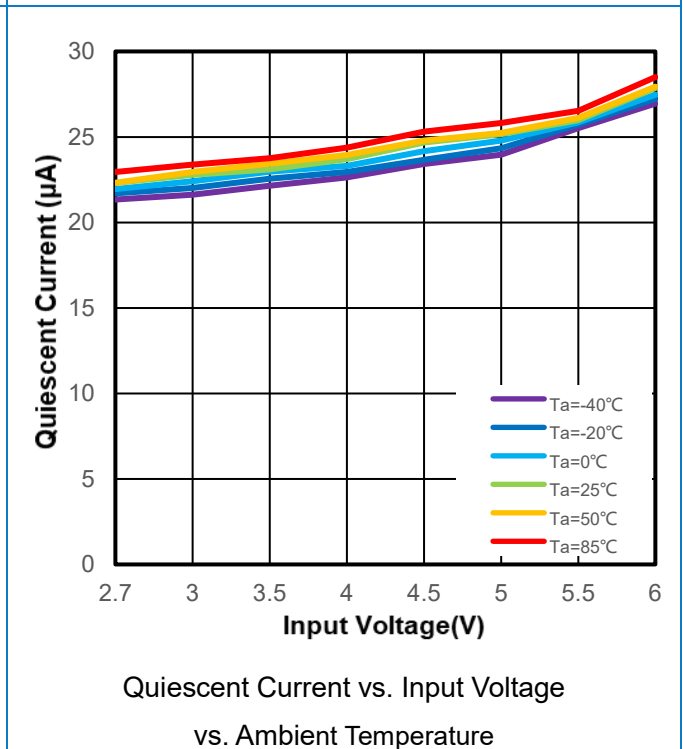
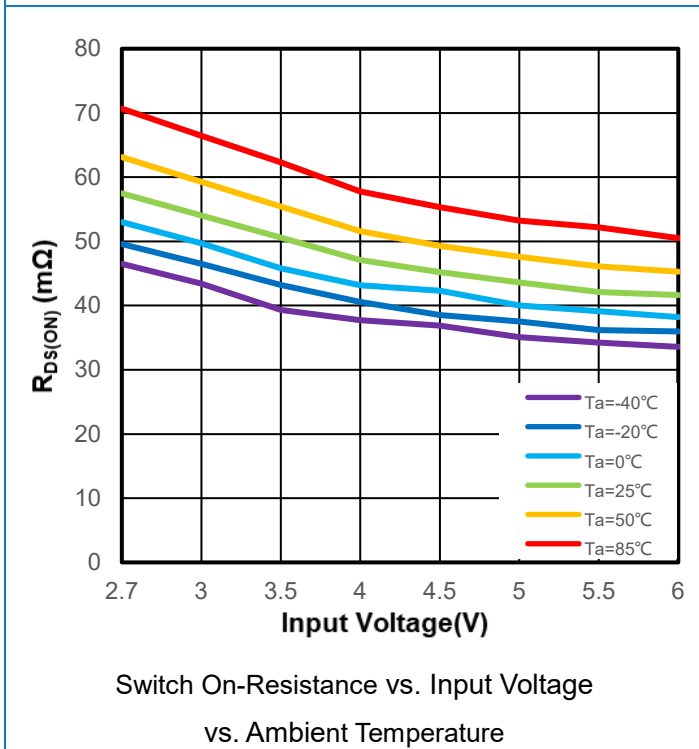
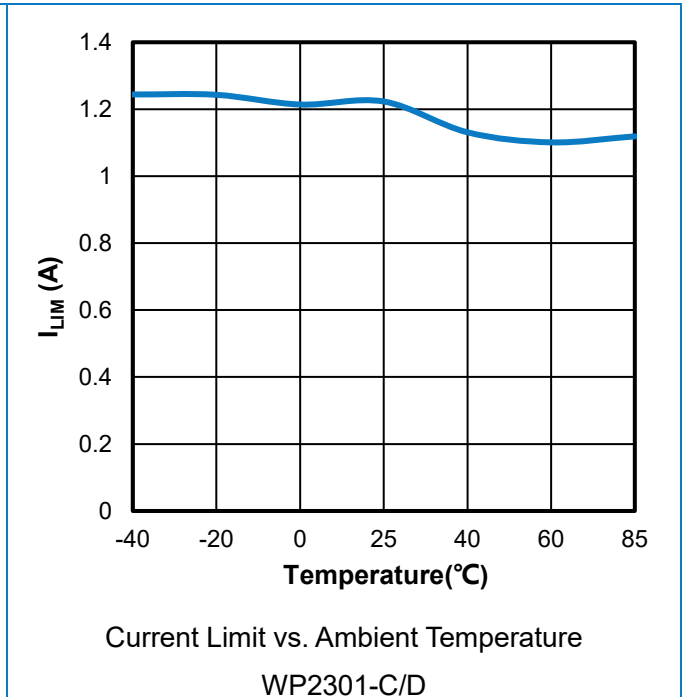
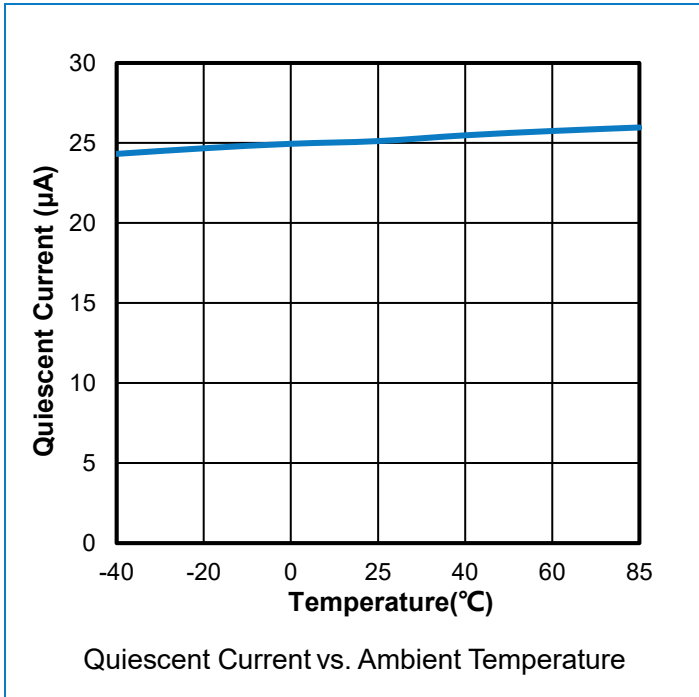
Switch On-Resistance vs. Input Voltage



Quiescent Current vs. Input Voltage



Switch On-Resistance vs. Ambient Temperature

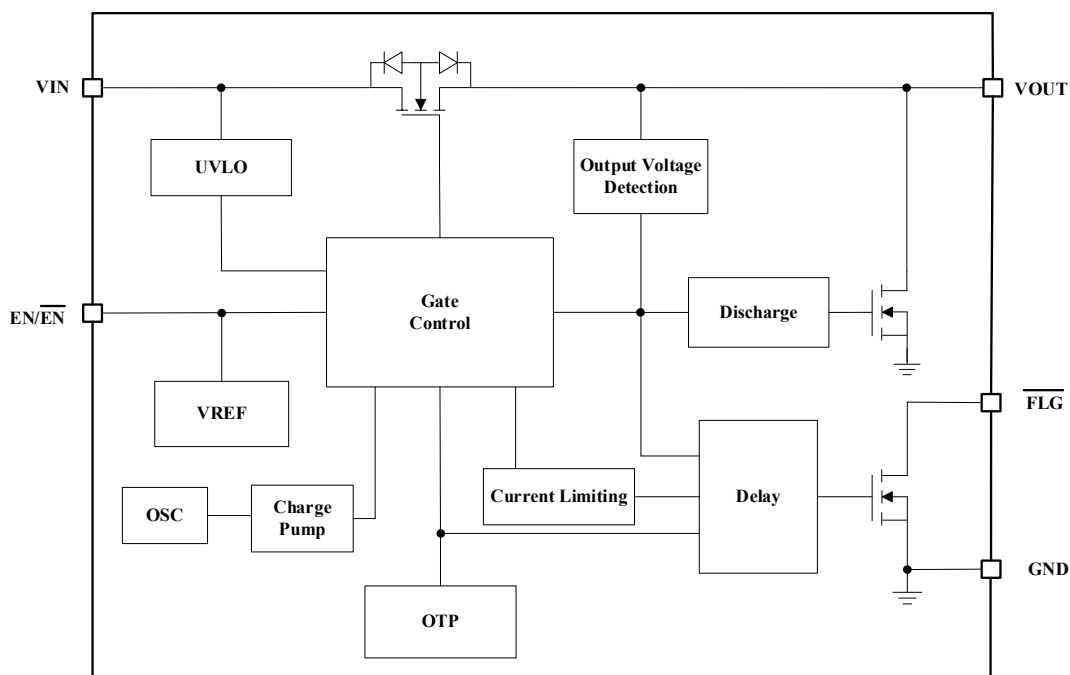


● 11. Function Description

● 11.1 Overview

The WP2301 load switches are 6V, current limited load switches in a TSOT23-5(FC) package. The devices contain a 55 mΩ current-limited N-channel MOSFET that can operate over an input voltage range of 2.7 V to 6V. When the switch current reaches the over current trip threshold, the WP2301 operates in a constant-current mode to prohibit excessive currents from causing damage.

● 11.2 Block Diagram



● 11.3 Feature Description

● 11.3.1 Current Limiting

When the switch current reaches the over current trip threshold, the WP2301 operates in a constant-current mode to prohibit excessive currents from causing damage. A current limit condition immediately pulls the fault signal pin low ( $\overline{\text{FLT}}$  pin), which remains in the constant-current mode until the switch current falls below the current limit.

● 11.3.2 Fault Reporting

When an overcurrent, input undervoltage, or overtemperature condition is detected,  $\overline{\text{FLT}}$  is set active low to indicate the fault mode.  $\overline{\text{FLT}}$  is an open-drain MOSFET and requires a pull up resistor.

● 11.3.3 Thermal Shutdown

Thermal shutdown protects the device from internally or externally generated excessive temperatures. During an overtemperature condition the switch is turned off. The switch automatically turns on again if the temperature of the die drops below the threshold temperature.



- **11.3.4 Quick Output Discharge**

The WP2301 include the Quick Output Discharge (QOD) feature, in order to discharge the application capacitor connected on OUT pin.

- **11.3 Device Functional Modes**

When the EN pin is actively pulled high and no fault conditions are present, the switch will be turned on, connecting  $V_{IN}$  to  $V_{OUT}$ . When the EN pin is actively pulled low regardless of the fault condition, the switch will be turned off. In the event that the current limit is exceeded, the device will operate in a constant-current mode and pull the FLT pin low until the fault condition is removed. During thermal shutdown conditions, the switch will automatically turn off and will turn back on again if the temperature of the die drops below the threshold temperature.

- **12 Application and Implementation**

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- **12.1 Application Information**

- **12.1.1 EN Control**

The EN pin controls the state of the switch. Activating EN continuously holds the switch in the on state as long as there is no fault. An undervoltage lockout or thermal shutdown event will override the EN pin control and turn off the switch.

- **12.1.2 Input Capacitor**

To limit the voltage drop on the input supply caused by transient inrush current, a capacitor 10 $\mu$ F or larger must be placed between the IN and GND pins.

- **12.1.3 Output Capacitor**

A 0.1 $\mu$ F or larger capacitor should be placed between the OUT and GND pins. This capacitor will prevent parasitic board inductances from forcing OUT below GND when the switch turns off.

- **13. Power Supply Recommendations**

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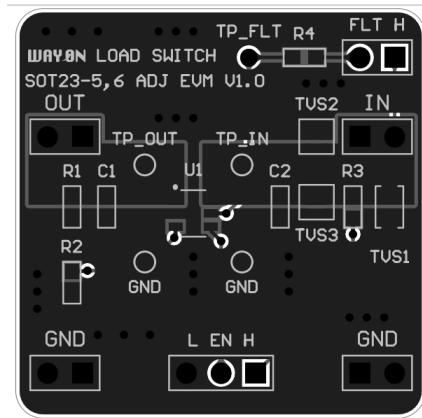
The device is designed to operate from a  $V_{IN}$  range of 2.7 V to 6 V. This supply must be well regulated and placed as close to the device terminal as possible with the recommended bypass capacitor. If the supply is located more than a few inches from the device terminals, additional bulk capacitance may be required in addition to the ceramic bypass capacitors.

- **14. Layout**

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For best performance, all traces should be as short as possible, the input and output capacitors should be placed close to the device to minimize the effects that parasitic trace inductances may have on normal and short-circuit operation. The  $V_{IN}$  terminal should be bypassed to ground with low ESR ceramic bypass capacitors. The typical recommended bypass capacitance is 1 $\mu$ F ceramic with X5R or X7R dielectric. This capacitor should be placed as close to the device terminals as possible. Using wide traces for  $V_{IN}$ ,  $V_{OUT}$ , and GND will help minimize parasitic electrical effects along with minimizing the case to ambient thermal impedance.

● 14.1 Layout Example



● 15 Evaluation Modules

Evaluation Modules (EVMs) are available to help evaluate the device performance. We have evaluation modules for different packages, you can contact us by phone or address at the end to get the evaluation module or schematic.

The module names are listed in the table below.

NAME	PACKAGE	EVALUATION MODULE
WP2301	TSOT23-5(FC)	WAYON LOAD SWITCH SOT23-5 EVM V1.1

● 16 Naming Conventions

**WP AB CC DD EEE F G**

**WP:** WAYON Protection IC;

**A:** Product Category – 1: E-fuse / 2: Load Switch / 3: OVP / 4: OTP/ 5: Type C Protection;

**B:** Maximum Output Current –3: 3A;

**CC:** Serial number;

**DD:** Output Current: A/AN/B/BN:500mA; C/CN/D/DN:1A; E/EN/F/FN:1.5A;

G/GN/H/HN:2A; I/IN/J/JN:2.5A; K/KN/L/LN:3A;

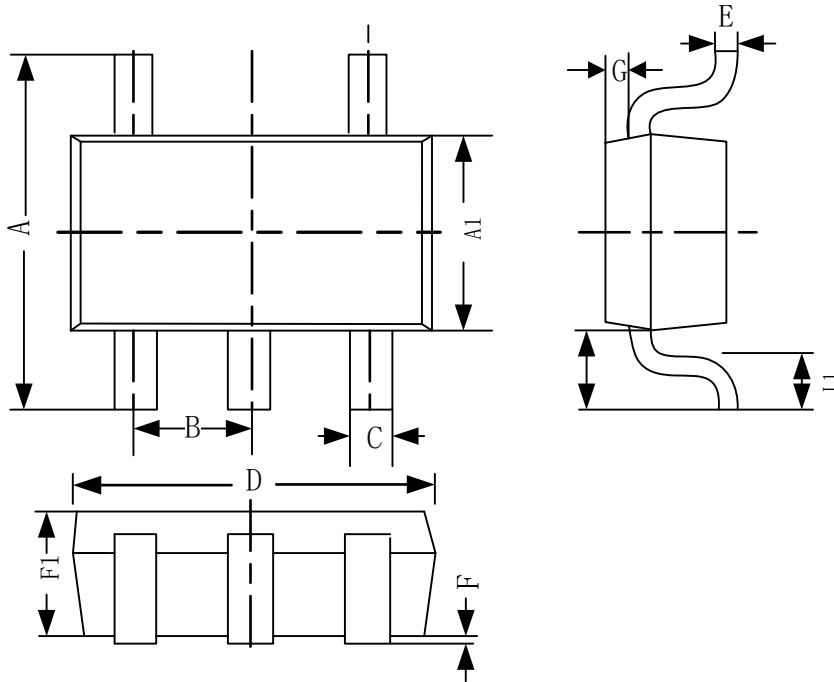
**EEE:** Package –B30: TSOT23-3 / B50: TSOT23-5;

**F:** R-Reel & T-tube;

**G:** F: Flip Chip

● 17 Package Information

**TSOT 23-5(FC)**



SYMBOL	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
<b>A</b>	2.60	2.80	3.00
<b>A1</b>	1.50	1.60	1.70
<b>B</b>	0.95BSC		
<b>C</b>	0.30	0.40	0.50
<b>D</b>	2.80	2.90	3.00
<b>E</b>	0.09	-	0.20
<b>F</b>	0.00	0.05	0.10
<b>F1</b>	0.84	0.86	0.90
<b>L1</b>	0.30	0.40	0.50
<b>G</b>	0.215	0.240	0.265

**● 18 Ordering Information**

PART NUMBER	EN FUNCTION	DISCHARGE	CURRENT	PACKAGE	PACKING QUANTITY	MARKING*
WP2301-AB50RF	Active High	Yes	0.5A	TSOT23-5(FC)	3K/Reel	301AXX
WP2301-BB50RF	Active Low	Yes	0.5A	TSOT23-5(FC)	3k/Reel	301BXX
WP2301-ANB50RF	Active High	No	0.5A	TSOT23-5(FC)	3k/Reel	301ANXX
WP2301-BNB50RF	Active Low	No	0.5A	TSOT23-5(FC)	3K/Reel	301BNXX
WP2301-CB50RF	Active High	Yes	1A	TSOT23-5(FC)	3k/Reel	301CXX
WP2301-DB50RF	Active Low	Yes	1A	TSOT23-5(FC)	3k/Reel	301DXX
WP2301-CNB50RF	Active High	No	1A	TSOT23-5(FC)	3k/Reel	301CNXX
WP2301-DNB50RF	Active Low	No	1A	TSOT23-5(FC)	3k/Reel	301DNXX
WP2301-EB50RF	Active High	Yes	1.5A	TSOT23-5(FC)	3k/Reel	301EXX
WP2301-FB50RF	Active Low	Yes	1.5A	TSOT23-5(FC)	3k/Reel	301FXX
WP2301-ENB50RF	Active High	No	1.5A	TSOT23-5(FC)	3k/Reel	301ENXX
WP2301-FNB50RF	Active Low	No	1.5A	TSOT23-5(FC)	3k/Reel	301FNXX
WP2301-GB50RF	Active High	Yes	2A	TSOT23-5(FC)	3K/Reel	301GXX
WP2301-HB50RF	Active Low	Yes	2A	TSOT23-5(FC)	3k/Reel	301HXX
WP2301-GNB50RF	Active High	No	2A	TSOT23-5(FC)	3k/Reel	301GNXX
WP2301-HNB50RF	Active Low	No	2A	TSOT23-5(FC)	3k/Reel	301HNXX
WP2301-IB50RF	Active High	Yes	2.5A	TSOT23-5(FC)	3k/Reel	301IXX
WP2301-JB50RF	Active Low	Yes	2.5A	TSOT23-5(FC)	3k/Reel	301JXX
WP2301-INB50RF	Active High	No	2.5A	TSOT23-5(FC)	3k/Reel	301INXX
WP2301-JNB50RF	Active Low	No	2.5A	TSOT23-5(FC)	3k/Reel	301JNXX
WP2301-KB50RF	Active High	Yes	3A	TSOT23-5(FC)	3k/Reel	301KXX

PART NUMBER	EN FUNCTION	DISCHARGE	CURRENT	PACKAGE	PACKING QUANTITY	MARKING*
WP2301-LB50RF	Active Low	Yes	3A	TSOT23-5(FC)	3k/Reel	301LXX
WP2301-KNB50RF	Active High	No	3A	TSOT23-5(FC)	3k/Reel	301KNXX
WP2301-LNB50RF	Active Low	No	3A	TSOT23-5(FC)	3k/Reel	301LNXX

### Contact Information

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*Specifications are subject to change without notice.*

*The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time.*

*Users should verify actual device performance in their specific applications.*