



XTP8003

5V/2.5A Synchronous Buck Converter

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5V/2.5A Synchronous Buck Converter

General Description

The XTP8003 is a compact 5V Buck Converter which can deliver 2.5A output current.

XTP8003 employs a proprietary control loop to achieve a fast transient load response. It keeps high converting efficiency in both light load and heavy load. XTP8003 is equipped with all kinds of protection, such as input over voltage protection, output short circuit protection, over current protection and over temperature protection.

XTP8003 consists of internal power tree generator, bandgap voltage reference module, under voltage lockout (UVLO) module, error amplifier, protection circuitry, driver block, current sensing block and two power MOSFETs.

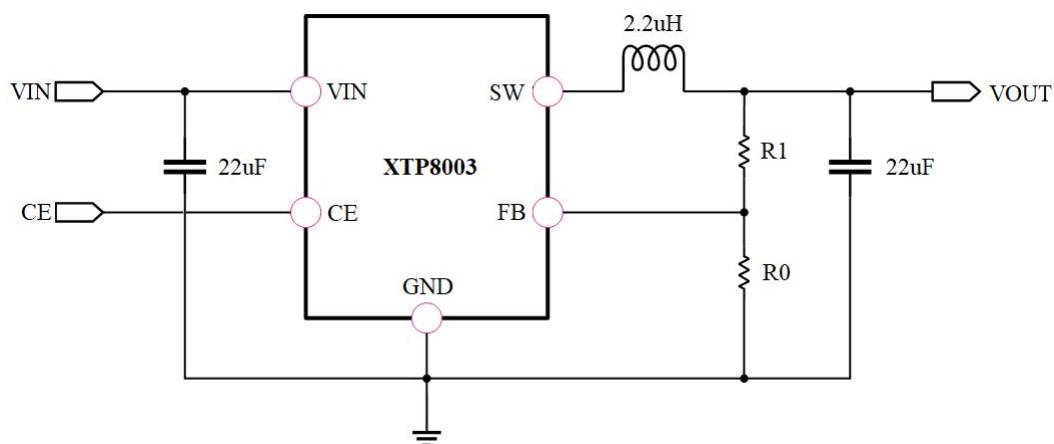
Features

- High Efficiency: Up to 97%
- 2.7V to 5.5V Input Voltage Range
- Input over voltage protection at 6V
- Output current up to 2.5A
- Low Quiescent Current: 40 μ A
- OCP, SCP and OTP protection
- SOT23-5L package

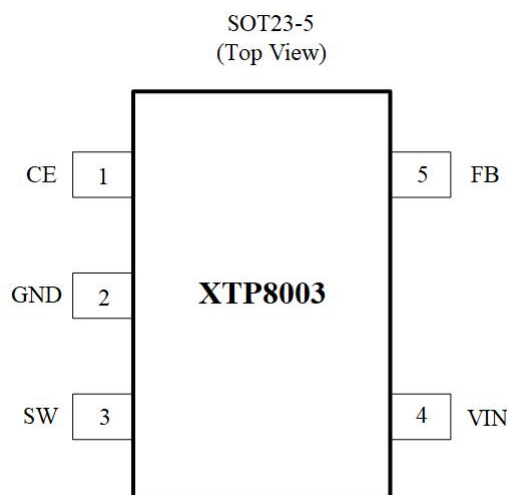
Application

- Set-top Box
- Solid State Drive
- WIFI and Network Devices
- Security surveillance system
- Toys
- TV
- All other electronic devices

Typical Application Circuit



Function Order Information



Pin No	Name	Description
1	CE	Chip enable pin, pull high to turn on the chip
2	GND	Ground
3	SW	The switching node, connecting a 2.2uH inductor to this node
4	VIN	The input power node, connecting a 10uF capacitor to ground.
5	FB	Feedback node, with V_{FB} at 0.6V

Order Information

Part No	Package	Top Marking	Tape & Reel
XTP8003AS2CT	SOT23-5L	P8003 YWZZX	3000/Reel

MARKING INFORMATION

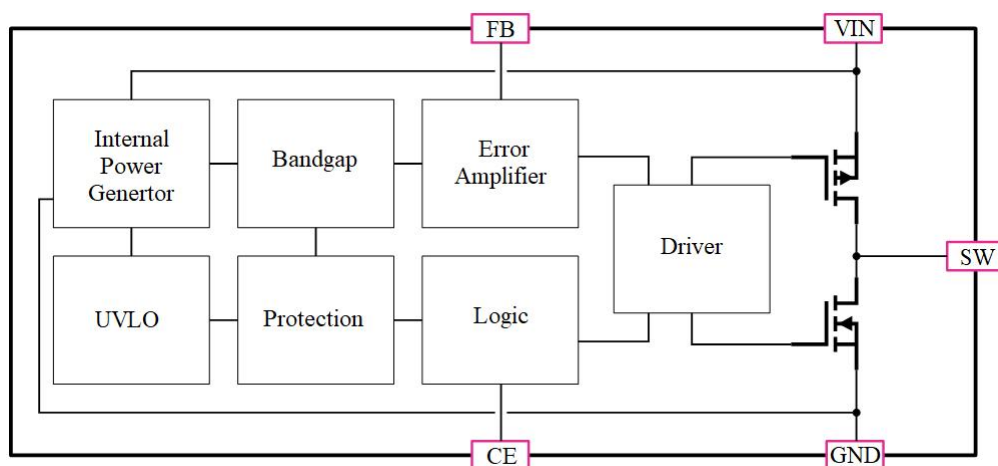
NOTE:

P8003: Device Code

YW: Date Code

ZZX: Inside Code

Function Block Diagram



Absolute Maximum Ratings

PARAMETER	Min	Typ	Max	Unit
V_{IN} to GND ⁽¹⁾	-0.3	-	6.0	V
CE Voltage ⁽¹⁾	-0.3	-	6.0	V
SW Voltage	-0.3	-	5.5	V
Continuous Power Dissipation ($T_A = 25^{\circ}\text{C}$) ⁽²⁾	-	0.4	-	W
Junction Temperature	-40	-	125	$^{\circ}\text{C}$
Lead Temperature	-	260	-	$^{\circ}\text{C}$
Storage Temperature	-65	-	150	$^{\circ}\text{C}$
Thermal Resistance, $\theta_{JA(3)}$	-	170	-	$^{\circ}\text{C}/\text{W}$
Thermal Resistance, $\theta_{JC(3)}$	-	75	-	$^{\circ}\text{C}/\text{W}$

Notes:

- (1) Exceeding these ratings may damage the device.
- (2) The maximum allowable power dissipation is a function of the maximum junction temperature $T_{J(\text{MAX})}$, the junction-to-ambient thermal resistance θ_{JA} , and the ambient temperature T_A . The maximum allowable continuous power dissipation at any ambient temperature is calculated by $P_{D(\text{MAX})} = (T_{J(\text{MAX})} - T_A) / \theta_{JA}$. Exceeding the maximum allowable power dissipation will cause excessive die temperature, and the regulator will go into thermal shutdown. Internal thermal shutdown circuitry protects the device from permanent damage.
- (3) Measured on JESD51-7, 4-layer PCB.

Electrical Characteristics

All typical values are at $T_J=25^{\circ}\text{C}$ (unless otherwise noted)

Parameter	Test Conditions	Min	Typ	Max	Unit
Input Voltage Range		2.7	-	5.5	V
V_{OVP}		5.8	6.0	6.5	V
Input Voltage UVLO	Rising	-	2.55	2.65	V
	Falling	2.25	2.37	-	V
FB Voltage	$V_{IN}=5\text{V}$, No load	588	600	612	mV
Switching Frequency	$V_{IN}=5\text{V}$	1.2	1.5	1.8	MHz
Quiescent Current, I_Q	$V_{IN}=5\text{V}$	20	40	60	μA
Shutdown Current, I_{OFF}	$V_{IN}=5\text{V}$, $V_{CE}=0$	-	0.1	2	μA
Line regulation	$V_{IN}=3\text{V}$ to 5V	-	0.2	-	%/V
Load regulation	$I_{LOAD}=0.1 - 2.0\text{A}$	-	1	2	%/A
NMOS Switch On Resistance	$I_{SW}=100\text{mA}$	-	70	-	$\text{m}\Omega$
PMOS Switch On Resistance	$I_{SW}=100\text{mA}$	-	100	-	$\text{m}\Omega$
Output Current Limit	$V_{IN}=5\text{V}$, $V_{OUT}=3.3\text{V}$	3.5	4	-	A
OTP		-	170	-	$^{\circ}\text{C}$
OTP hysteresis		-	40	-	$^{\circ}\text{C}$
CE Input Threshold ON	$V_{IN}=5\text{V}$	-	0.9	1.1	V
CE Input Threshold OFF	$V_{IN}=5\text{V}$	0.4	0.7	-	V
CE Input Pull Down Resistor		-	750	-	$\text{K}\Omega$
Output Discharge Resistor	$V_{IN}=5\text{V}$	-	50	-	Ω

Application Information

Output Voltage Setting

XTP8003's feedback voltage is set at 0.6V, and it requires a resistor from FB node to ground, named R0, which is suggested to be less than 120K. Assuming the resistor between output node and FB node is R1, the output voltage of DC-DC converting system is given by

$$V_{out} = \frac{0.6V}{R_0} \times (R_1 + R_0)$$

Capacitor Selection

XTP8003 requires one minimal 22uF MLCC capacitor at VIN node and one 22uF MLCC capacitor at VOUT node, however, it is always recommended to have two 22uF MLCC capacitors placed in parallel both at VIN and VOUT node to minimize the noise and withstand the current surge. It is also essential to place both input capacitors and output capacitors as close to XTP8003's VIN pin and VOUT pin as possible. An PCB layout example is shown at PCB layout recommendation section.

Inductor Selection

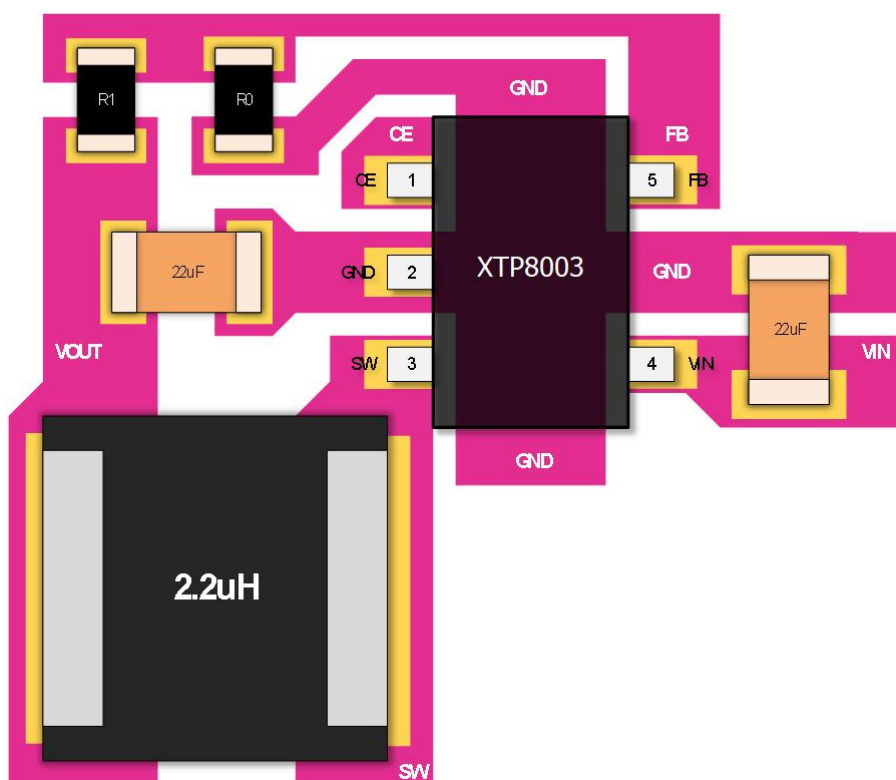
XTP8003 works at a 1.5MHz oscillating frequency which helps to have a small voltage ripple at output. And 2.2uH inductor is found the most suitable value while meeting requirements on small output voltage ripple as well as a high-power conversion efficiency.

Thermal Considerations

Though XTP8003 is a high efficiency DC/DC converter, there will always be some power lost during conversion, most of which becomes heat to make junction temperature higher. PCB design to ensure a good heat dissipation is important. Because the heat dissipation of the SOT23-5L package is conducted through the pin No. 2, which is GND node of XTP8003, please make sure the ground plate of PCB is big enough to carry away the heat generated in the chip.

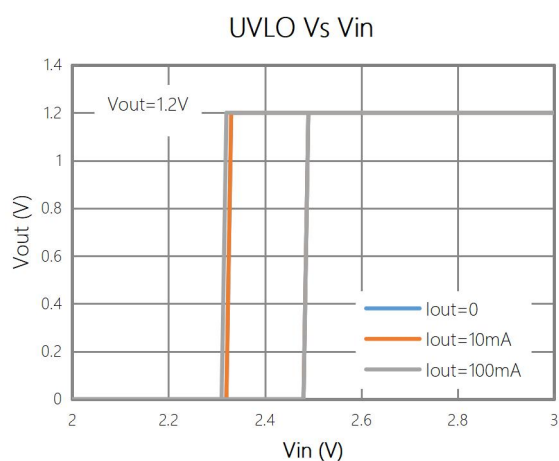
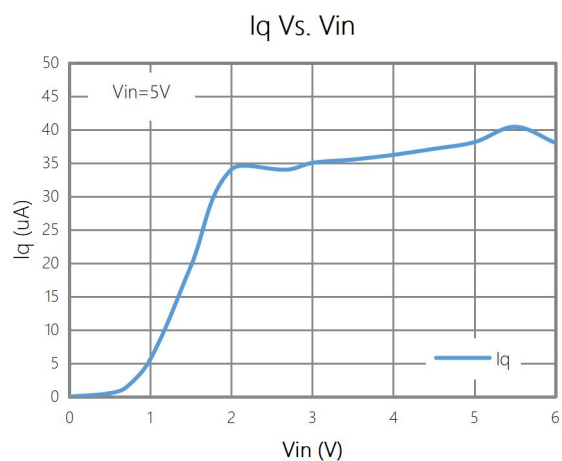
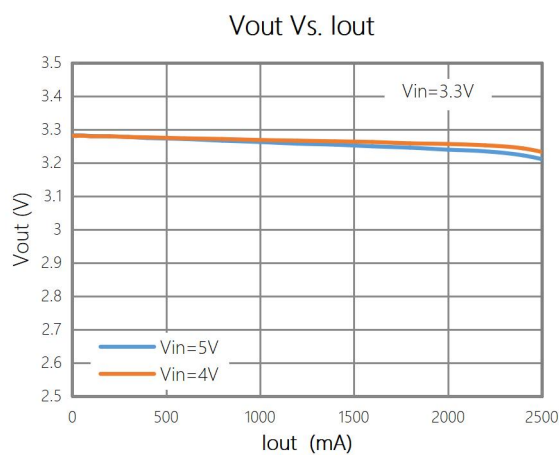
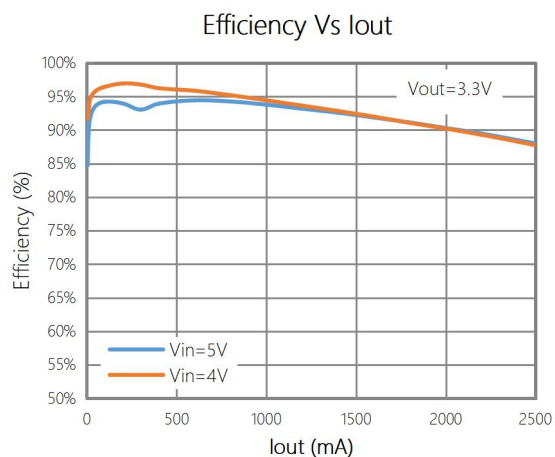
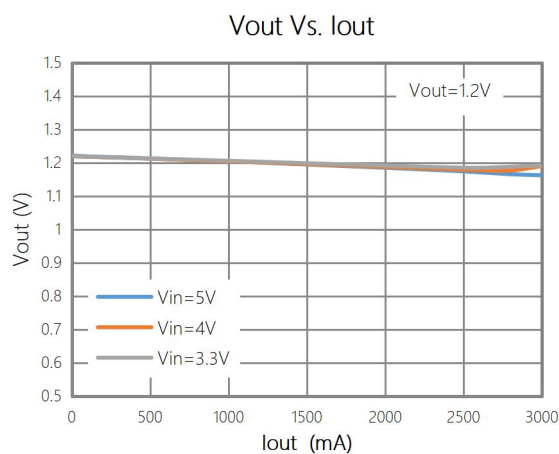
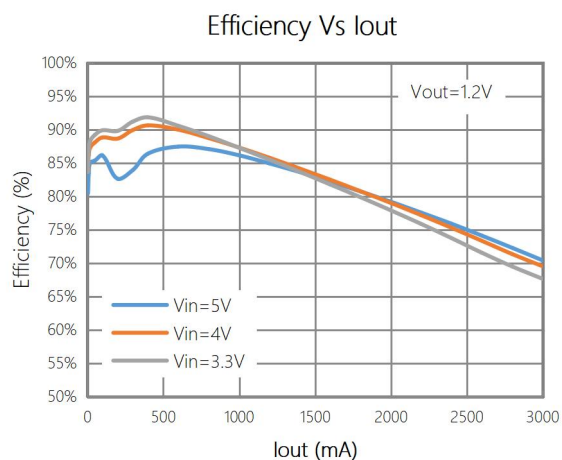
PCB Layout

An illustration of PCB layout recommendation with key elements is laid out as following. Please follow this PCB instruction to place the key peripheral devices such as input capacitors, output capacitors and inductor. And star-like connection for ground node is essential. And keeping power loop area as small as possible will improve the EMI performance.

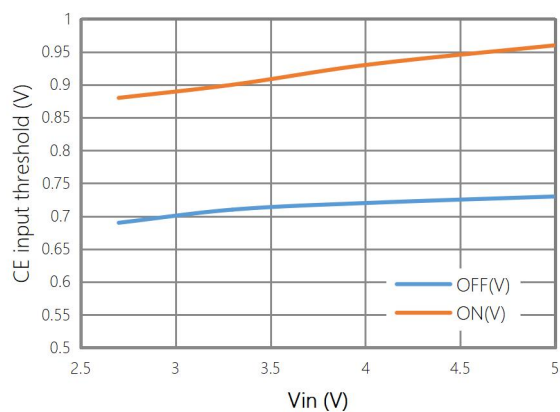


Typical Characteristics

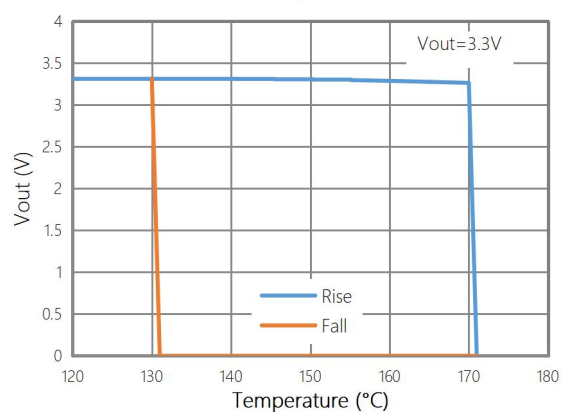
($C_{IN}=C_{OUT}=22\mu F$, $T_A = 25^\circ C$, unless otherwise specified)



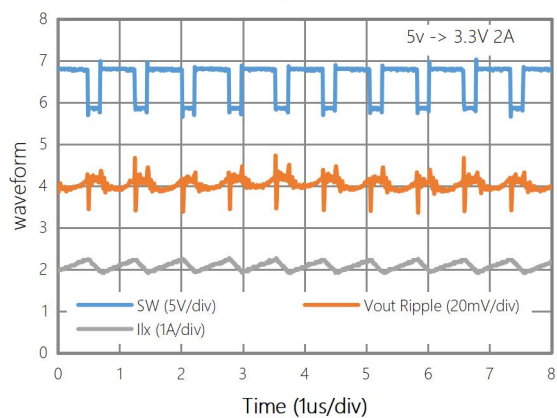
Threshold Vs. Vin



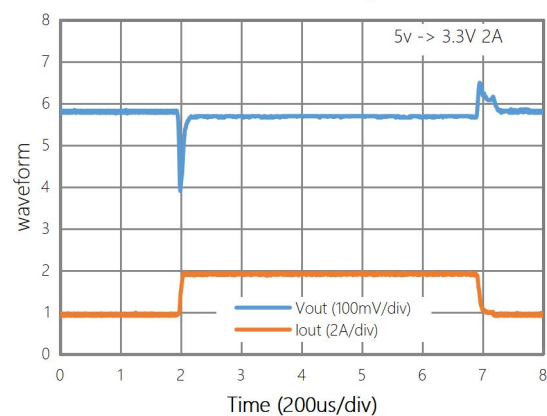
OTP Hysteresis



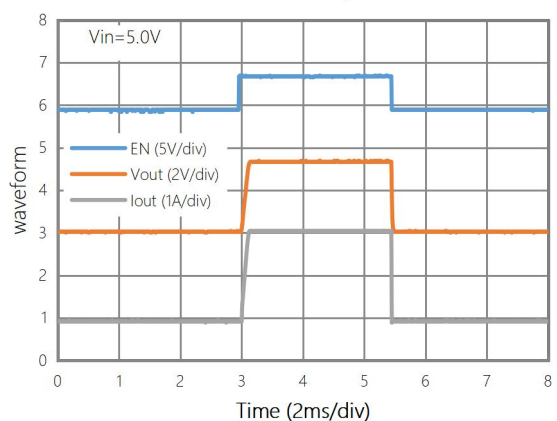
Switching Waveform



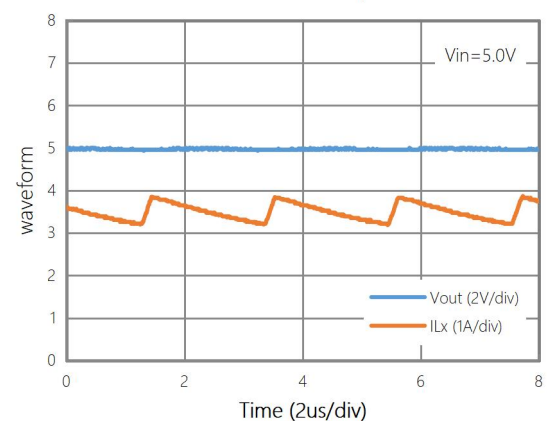
Load Transient Response



EN Startup

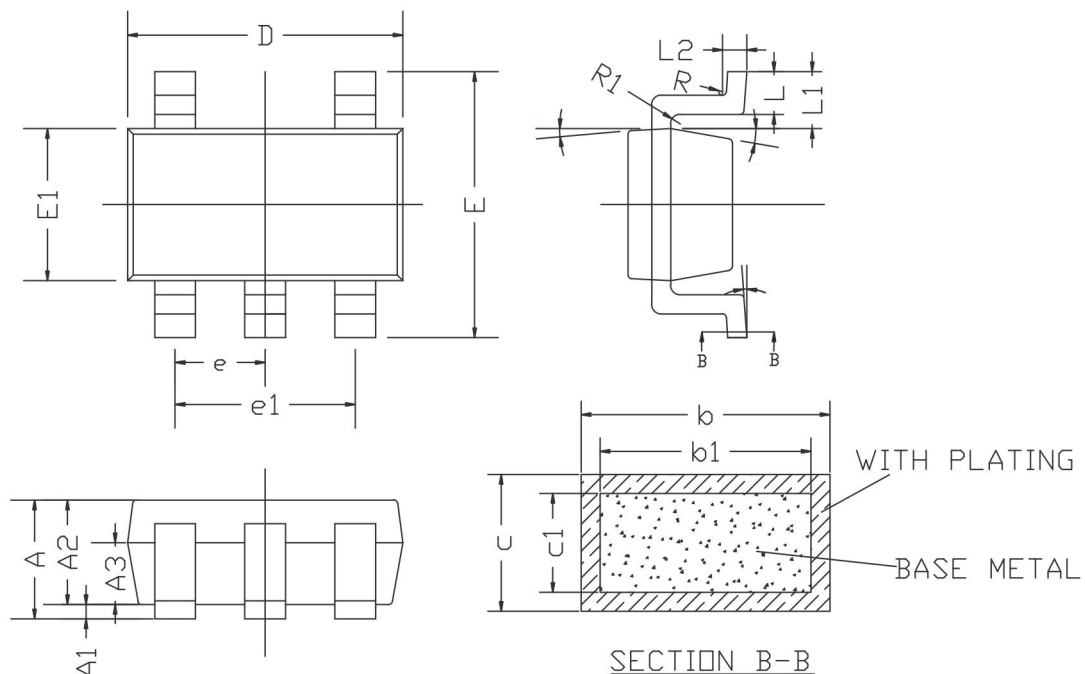


Short Circuit Response



Package Information

Package dimension (mm)



SOT23-5L

Symbol	MIN	NOR	MAX	Symbol	MIN	NOR	MAX
A	-	-	1.25	e	0.90	0.95	1.00
A1	0	-	0.15	e1	1.80	1.90	2.00
A2	1.00	1.10	1.20	L	0.35	0.45	0.60
A3	0.60	0.65	0.70	L1	0.59REF		
b	0.36	-	0.50	L2	0.25BSC		
b1	0.36	0.38	0.45	R	0.05	-	-
c	0.14	-	0.20	R1	0.05	-	0.20
c1	0.14	0.15	0.16	θ	0°		8°
D	2.826	2.926	3.026				
E	2.60	2.80	3.00				
E1	1.526	1.626	1.726				