



■ Description

The MST56XXB series is a high voltage, ultralow-power regulator. The device can allow an input voltage as high as 60V. The typical quiescent current is only 2 μ A. The device is available in fixed output voltages of 3.3V and 5.0V.

The device features integrated short-circuit and thermal shutdown protection.

Although designed primarily as fixed voltage regulators, the device can be used with external components to obtain variable voltages.

■ Application

- Battery-powered equipment
- Smoke detector and sensor
- Microcontroller Applications
- Home Appliance

■ Features

- Low Quiescent Current: 2 μ A
- High Input Voltage: Up to 60V
- High Output Current: ≥ 100 mA
- Dropout Voltage:
 - 70mV@10mA
 - 700mV@100mA
- Fixed Output Voltages: 3.3V and 5.0V
- High-accuracy Output Voltage
- MST 56XXB $\pm 2\%$
- Good Transient Response
- Integrated Short-Circuit Protection
- Integrated Thermal Protection
- Available Packages:

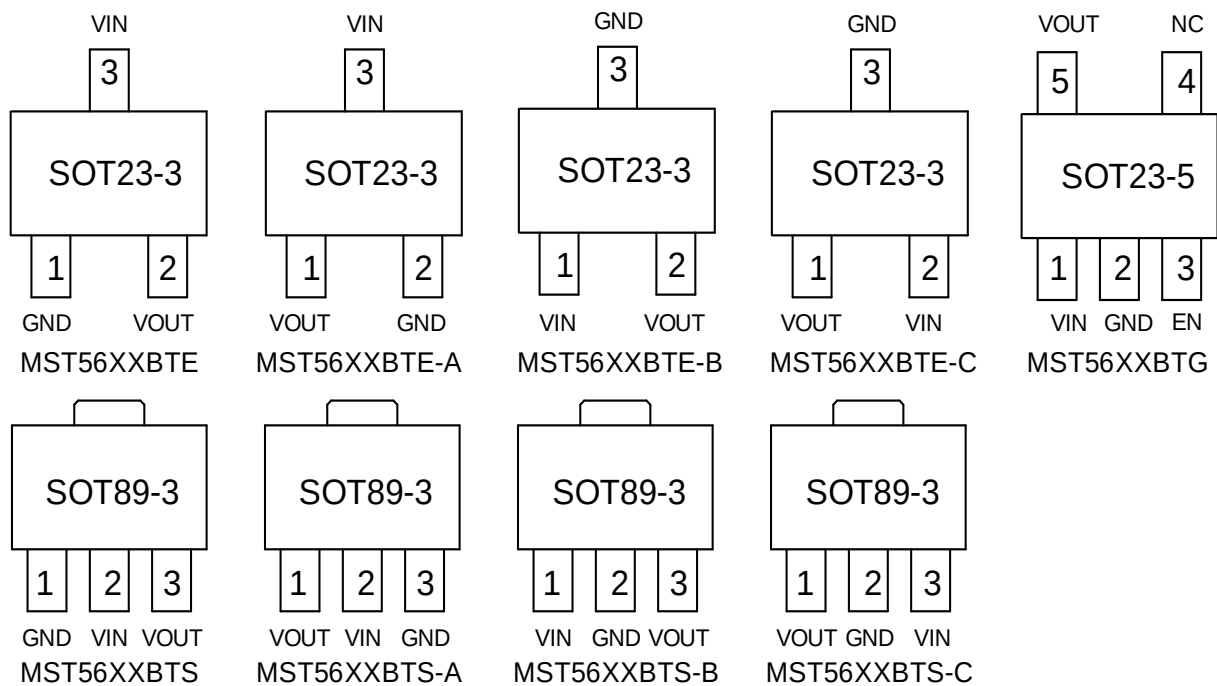
MST56XXBTE MST56XXBTE-A MST56XXBTE-B MST56XXBTE-C	SOT23-3
MST56XXBTS MST56XXBTS-A MST56XXBTS-B MST56XXBTS-C	SOT89-3
MST56XXBTG	SOT23-5

■ Pin Descriptions

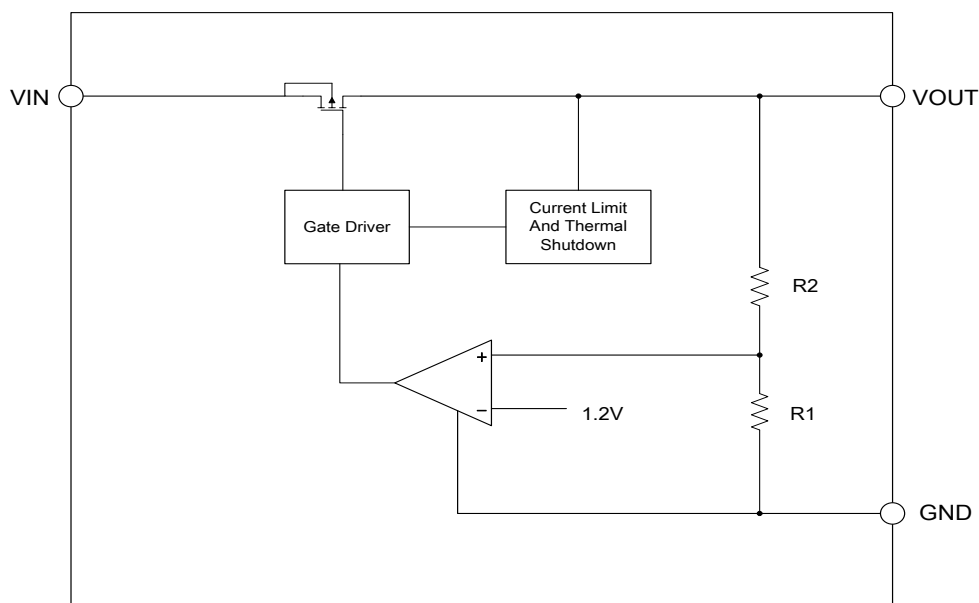
SOT23-3				SOT23-5	PIN NAME	DESCRIPTION
MST56XX BTE	MST56XX BTE-A	MST56XX BTE-B	MST56XX BTE-C	MST56XX BTG		
1	2	3	3	2	GND	Ground Pin
2	1	2	1	5	VOUT	Output Pin
3	3	1	2	1	VIN	Input Pin
				3	EN	Enable pin
				4	NC	No connection

SOT89-3				PIN NAME	DESCRIPTION
MST56XXBTS	MST56XXBTS-A	MST56XXBTS-B	MST56XXBTS-C		
1	3	2	2	GND	Ground Pin
3	1	3	1	VOUT	Output Pin
2	2	1	3	VIN	Intput Pin

■ Packages and Pin Assignment



■ Functional Block Diagram



■ Absolute Maximum Ratings

Item	Description	Min	Max	Unit
Voltage	VIN Pin to GND Pin	-0.3	60	V
	VOUT Pin to GND pin	-0.3	6	V
	VOUT Pin to VIN Pin	-35	0.3	V
Current	Peak output	Internally limited		
Temperature	Operating Ambient Temperature	-40	85	°C
	Storage Temperature	-40	150	°C
	Operating virtual junction Temperature	-	150	°C
Thermal Resistance (Junction to Ambient)	SOT89	180		°C/W
	SOT23-3	380		°C/W
	SOT23-5	300		°C/W
Power Dissipation	SOT89	600		mW
	SOT23-3	300		mW
	SOT23-5	400		mW
Electrostatic discharge rating	Human Body Model (HBM)	4		kV
	Charged Device Model (MM)	100		V

Note : Stresses exceeding the range specified under “Absolute Maximum Ratings” may cause substantial damage to the device. Functional operation of this device at other conditions beyond those listed in the specification is not implied and prolonged exposure to extreme conditions may affect device reliability.

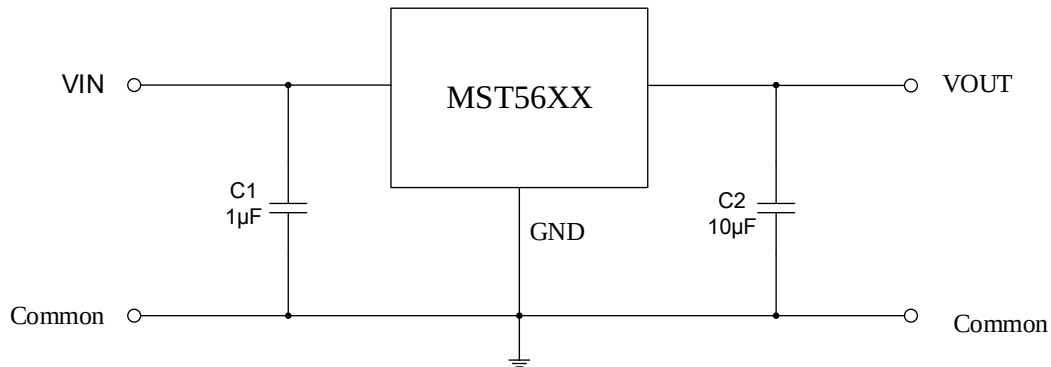
■ Electrical characteristics

(At $T_A=25^{\circ}\text{C}$, $C_{IN}=1\mu\text{F}$, $V_{IN}=V_{OUTNOM}+1.0\text{V}$, $C_{OUT}=10\mu\text{F}$, unless otherwise noted)

Symbol	Parameter	Test Conditions	MIN	TYP	MAX	UNIT
V_{IN}	Input Voltage		—	—	60	V
I_{GND}	Quiescent Current	$V_{IN}=12\text{V}$, No load	—	1.8	—	μA
$V_{OUT(MST56XXB)}$	Output Voltage	$V_{IN}=12\text{V}$, $I_{OUT}=10\text{mA}$	-2%		2%	V_{OUT}
I_{OUT_MAX}	Output Current		—	200	—	mA
V_{DROP}	Dropout Voltage*1 (MST5650)	$I_{OUT}=10\text{mA}$, $\Delta V_{OUT}= - V_{OUTNOM}*2\%$	—	70	—	mV
		$I_{OUT}=100\text{mA}$, $\Delta V_{OUT}= - V_{OUTNOM}*2\%$	—	700	—	mV
	Dropout Voltage*1 (MST5633)	$I_{OUT}=10\text{mA}$, $\Delta V_{OUT}= - V_{OUTNOM}*2\%$	—	70	—	mV
		$I_{OUT}=100\text{mA}$, $\Delta V_{OUT}= - V_{OUTNOM}*2\%$	—	700	—	mV
ΔV_{OUT}	Load Regulation	$1\text{mA} \leq I_{OUT} \leq 100\text{mA}$	—	20	—	mV
$\frac{\Delta V_{OUT} \times 100}{\Delta V_{IN} \times V_{OUT}}$	Line Regulation	$I_{OUT}=1\text{mA}$, $V_{IN}=(V_{OUTNOM}+1\text{V})$ to V_{60}	—	0.2	—	%/V
I_{LIMIT}	Current Limit	$V_{IN}=(V_{OUTNOM}+1\text{V})$ to 60V $R_{LOAD}=V_{OUTNOM}/1\text{A}$	—	400	—	mA
T_{SHDN}	Thermal Shutdown Threshold		—	125	—	$^{\circ}\text{C}$

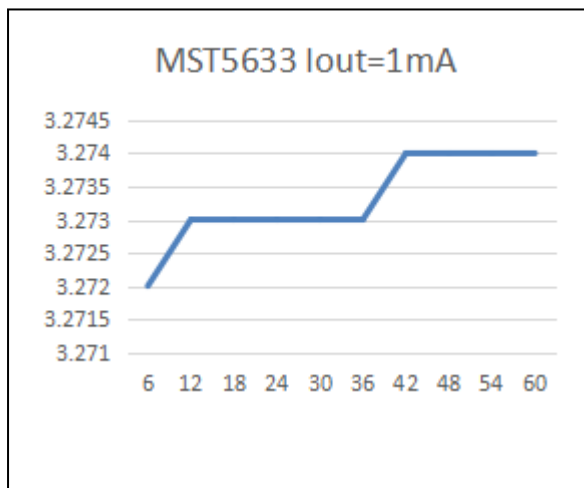
Note : *1 Dropout Voltage is the voltage difference between the input and the output at which the output voltage drops 2% below its nominal value.

■ Application Circuits

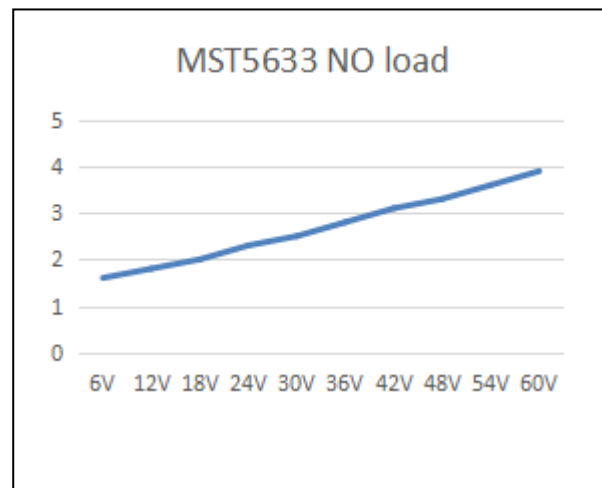


■ Typical Performance Characteristics

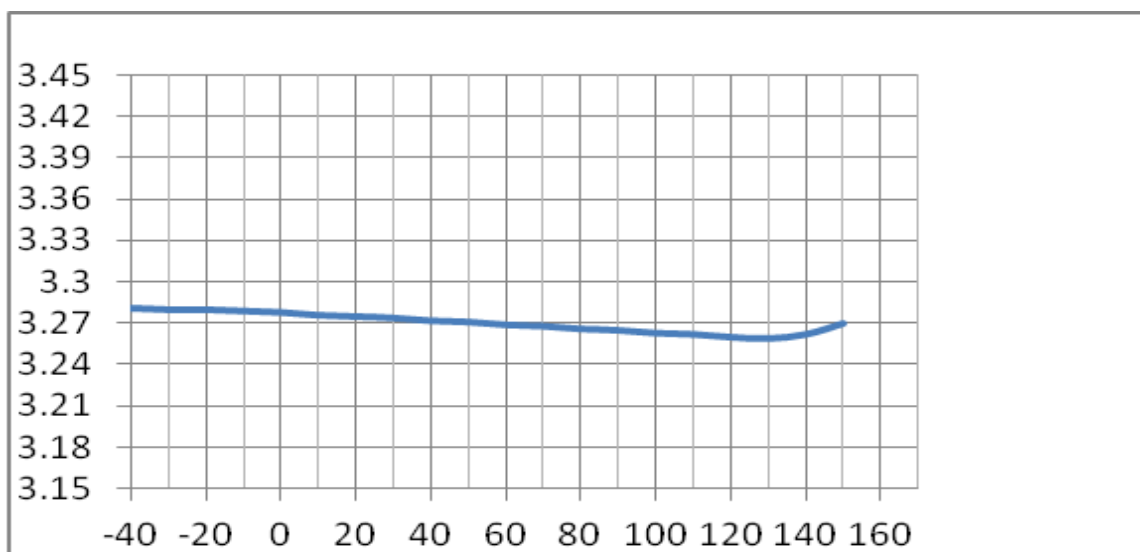
Test Condition: $T_A=25^\circ\text{C}$, $V_{IN}=V_{OUTNOM}+1.0\text{ V}$, $I_{OUT}=1\text{mA}$, $C_{OUT}=10\mu\text{F}$, unless otherwise noted.



Output Voltage vs. Input Voltage



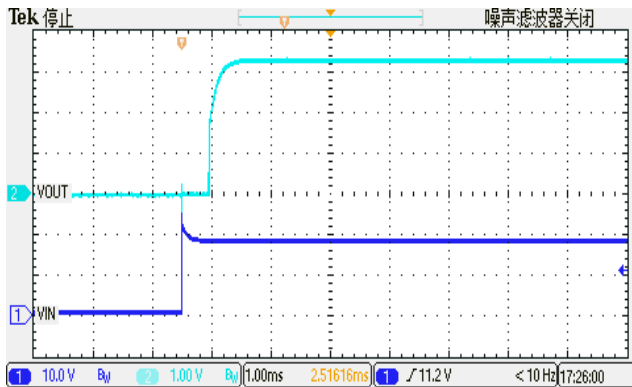
Quiescent Current vs. Input Voltage



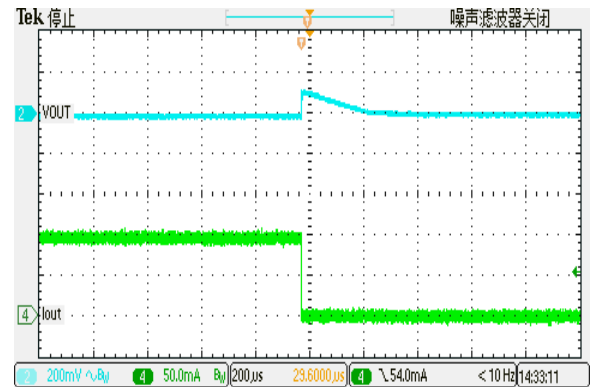
Output Voltage vs. Temperature

Startup

$V_{IN}=24V$, No Load , $C_{OUT}=10\mu F$



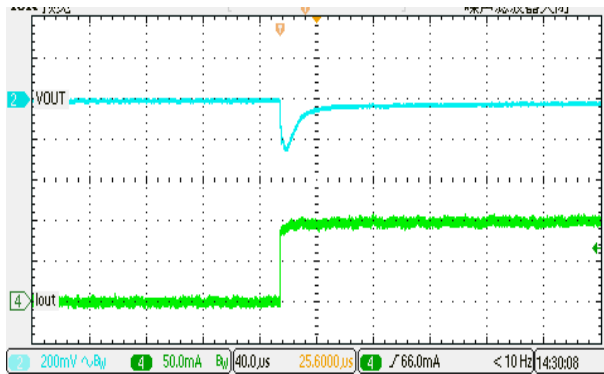
$V_{IN}=12.0V$, $C_{OUT}=10\mu F$, $I_{OUT}=100mA$ to $10mA$



Transient Response

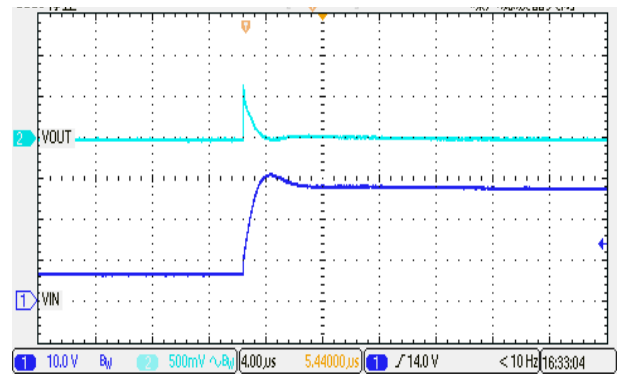
Load Transient

$V_{IN}=12.0V$, $C_{OUT}=10\mu F$, $I_{OUT}=10mA$ to $100mA$

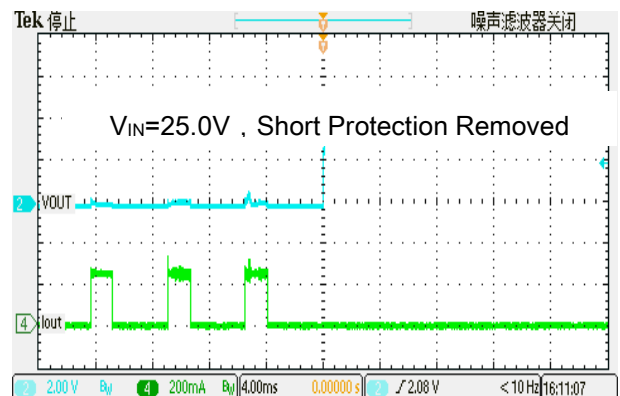
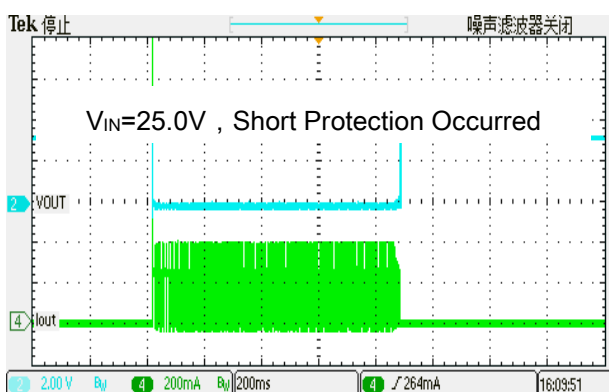


Line Transient

$V_{IN}=6.3V$ to $30V$, $C_{OUT}=10\mu F$, $I_{OUT}=1mA$

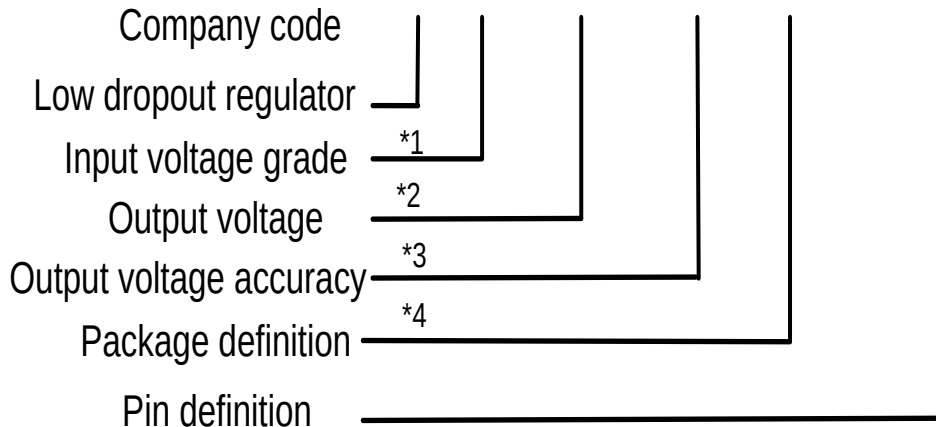


Short Protection



■ Marking Information

MST56XXBTE-A



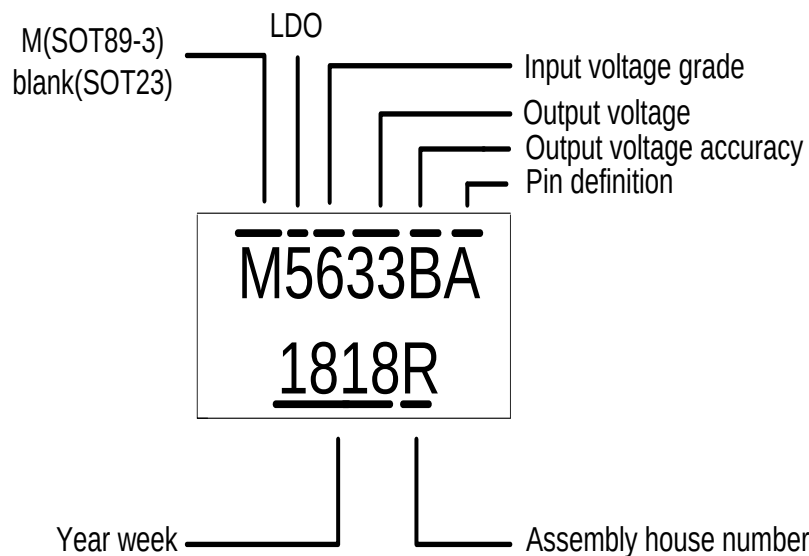
Note:

(*1) 4-60V

(*2) 33(3.3V) 50(5.0V)

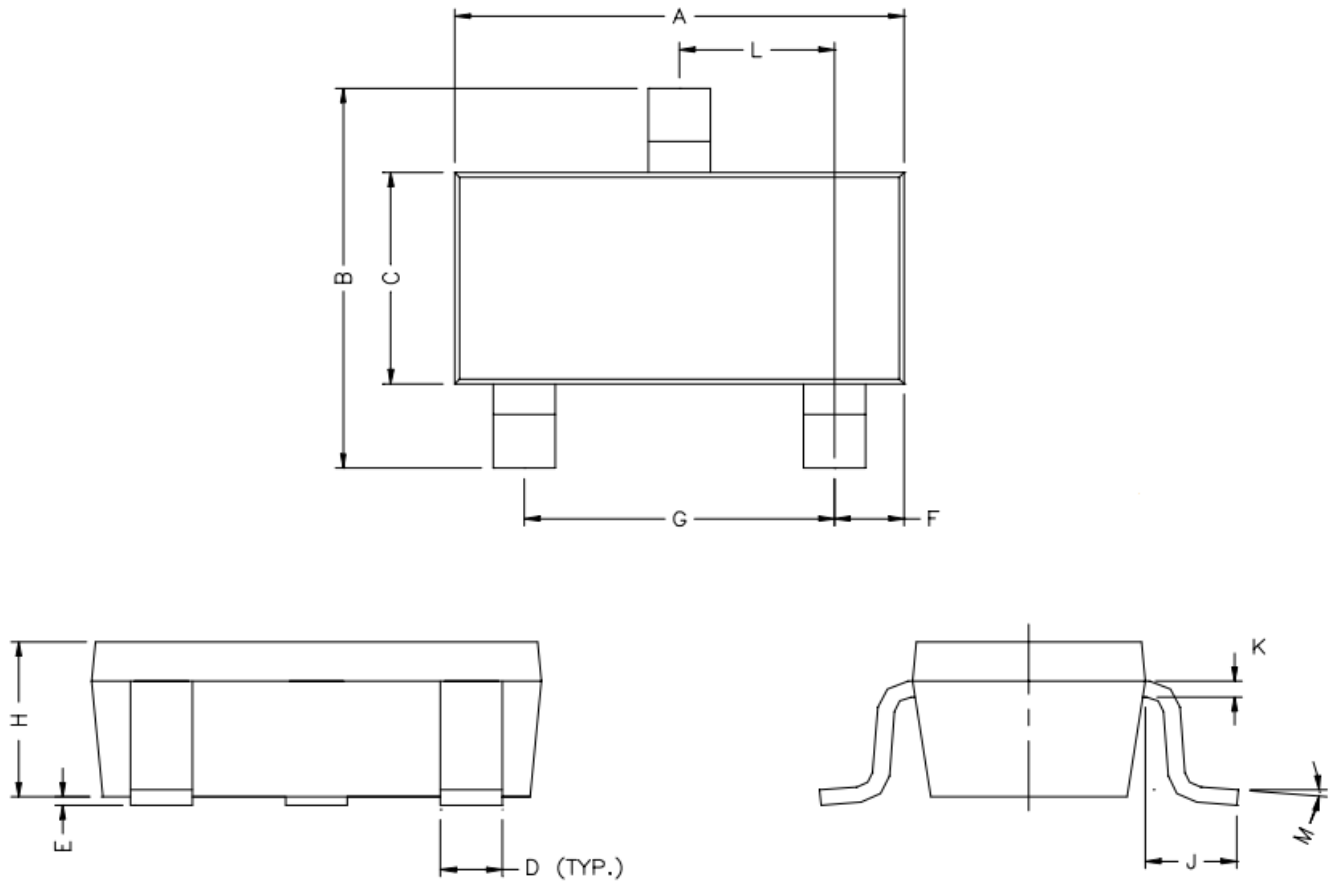
(*3) A($\pm 1\%$) B ($\pm 2\%$) C ($\pm 3\%$)

(*4) TE(SOT23-3) TS(SOT89-3) TG(SOT23-5)



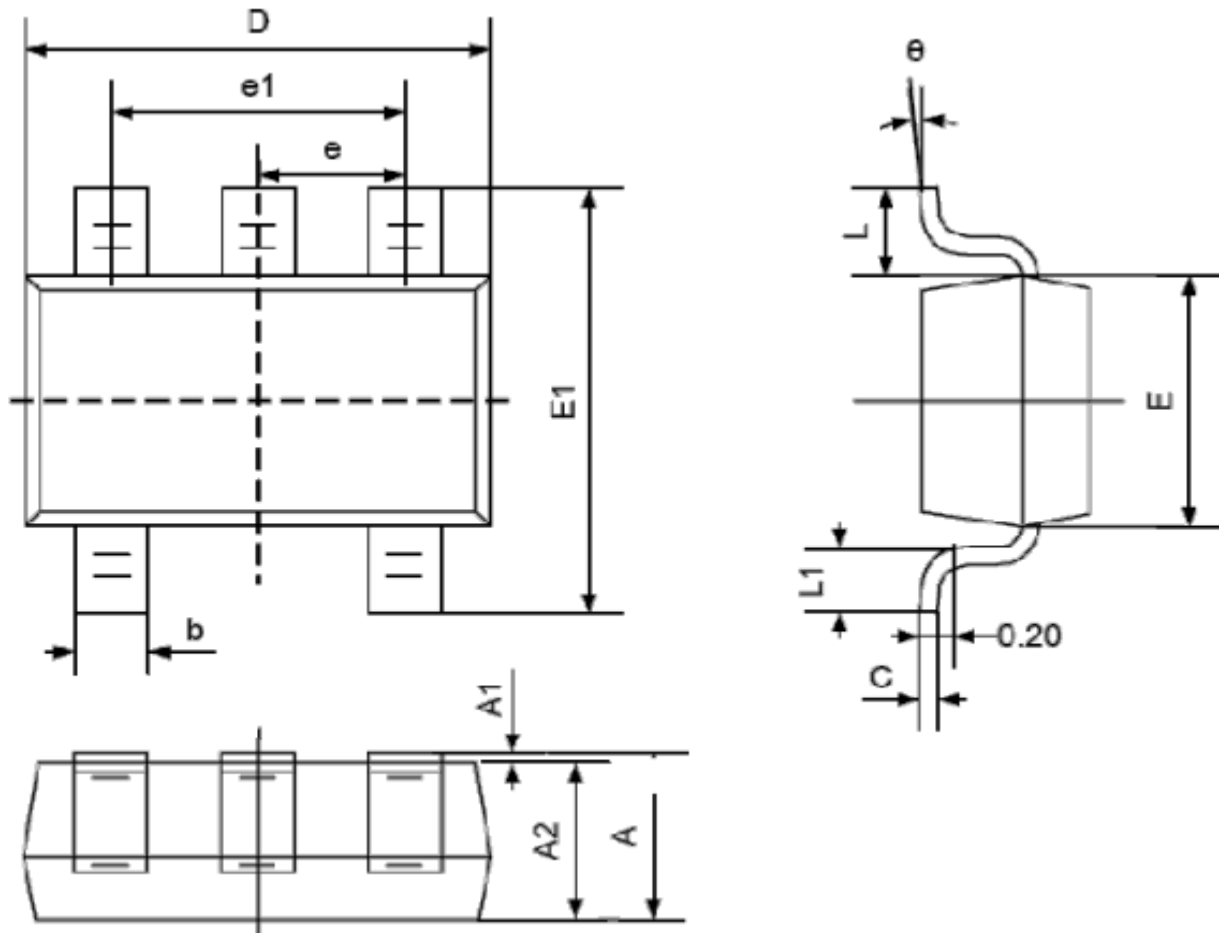
■ Package Information

SOT23-3



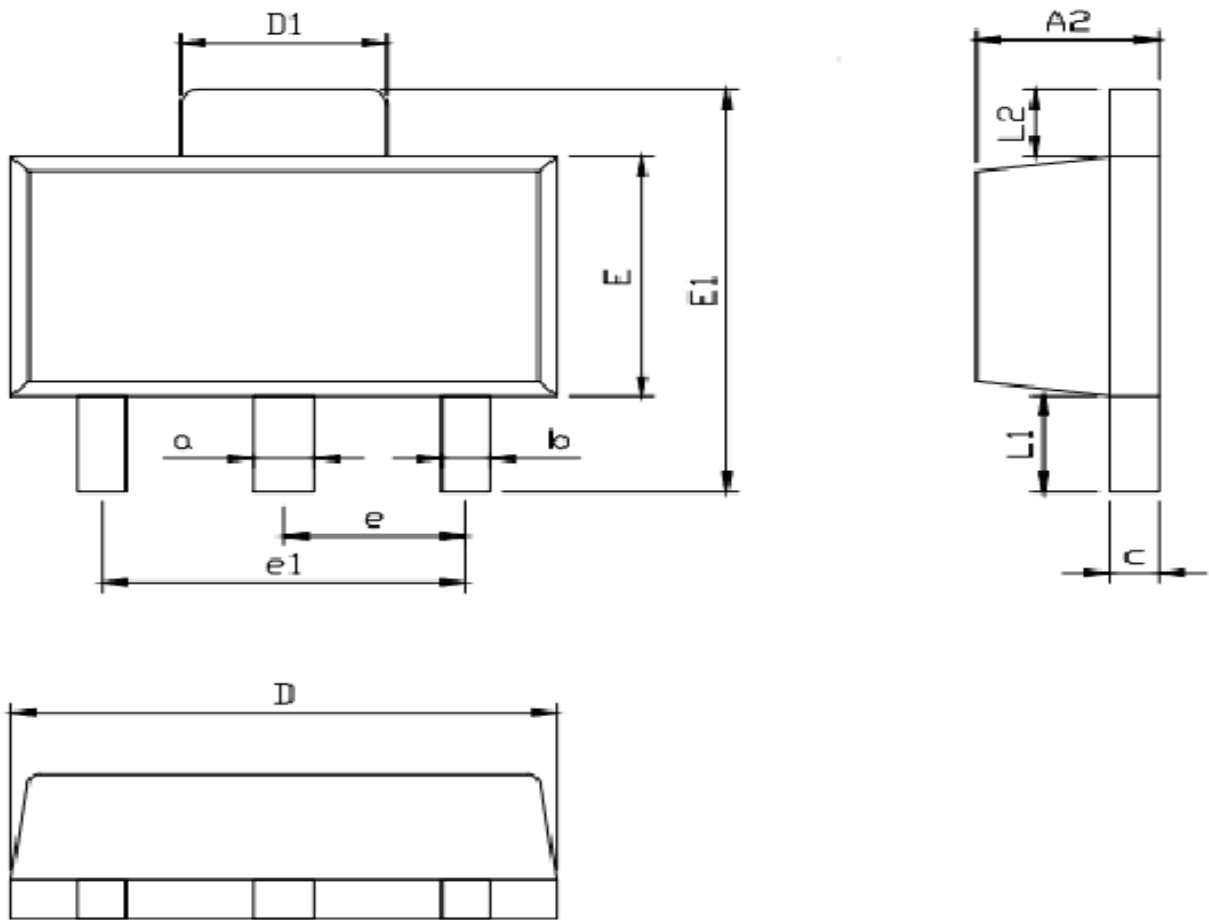
REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	2.82	2.92	G	1.90	REF.
B	2.65	2.95	H	1.0	1.3
C	1.56	1.60	K	0.10	0.20
D	0.35	0.55	J	0.40	—
E	0	0.1	L	0.85	1.15
F	0.45	0.55	M	0°	10°

SOT23-5



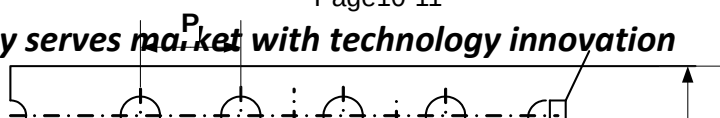
REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A	1.05	1.25	E	1.5	1.7
A1	0	0.1	E1	2.65	2.95
A2	1.05	1.15	e	0.95 (BSC)	
b	0.3	0.5	e1	1.8	2.0
c	0.1	0.2	L	0.3	0.6
D	2.85	3.05	θ	0°	8°

SOT89-3



REF.	Millimeter		REF.	Millimeter	
	Min.	Max.		Min.	Max.
A2	1.4	1.6	E	2.40	2.60
a	0.45	0.55	E1	4.00	4.30
b	0.38	0.48	e	1.00	2.00
c	0.36	0.46	e1	2.95	3.05
D	4.40	4.60	L1	0.80	1.00
D1	1.60	1.80	L2	0.65	0.75

■ Packing information





Type	W(mm)	P(mm)	D(mm)	Qty (pcs)
SOT23-3 SOT23-5	12.0 $\pm$ 0.1 mm	8.0 $\pm$ 0.1 mm	330 $\pm$ 1 mm	3000pcs
SOT89-3	/	/	/	1000pcs