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SEMICONDUCTOR



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PLED

MSK1117-xxx

Product specification

General Description

MSK1117-xxx is a series of low dropout three-terminal regulators with a dropout of 1.3V at 1A load current. MSK1117-xxx features a very low standby current 2mA compared to 5mA of competitor.

Other than a fixed version, $V_{out} = 1.2V, 1.5V, 1.8V, 2.5V, 2.85V, 3.3V,$ and 5V, MSK1117-xxx has an adjustable version, which can provide an output voltage from 1.25 to 12V with only two external resistors.

MSK1117-xxx offers thermal shut down function, to assure the stability of chip and power system. And it uses trimming technique to guarantee output voltage accuracy within 2%. Other output voltage accuracy can be customized on demand, such as 1%.

MSK1117-xxx is available in SOT-223, TO-252 and SOT89 power package.

Features

- Output current is 1A
- Range of operation input voltage: 15V
- Line regulation: 0.03%/V (typ.)
- Standby current: 2mA (typ.)
- Load regulation: 0.2%/A (typ.)
- Environment Temperature: $-40^{\circ}C \sim 85^{\circ}C$

Applications

- Power Management for Computer Mother Board, Graphic Card
- LCD Monitor and LCD TV
- DVD Decode Board
- ADSL Modem
- Post Regulators for Switching Supplies

Encapsulation form and pin definition function

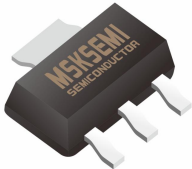
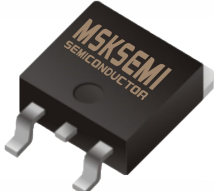
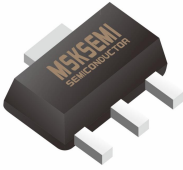
PACKAGE OUTLINE	Marking
 SOT-223	 Note: 1.2 represents fixed voltage, * * * * represents internal production order number
 TO-252	
 SOT-89	

Table1: MSK1117-xxx series (SOT223 PKG)

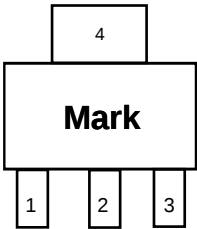
PIN NO.	PIN NAME	FUNCTION	
1	VSS/ADJ	VSS/ADJ pin	
2	VOUT	Output voltage pin	
3	VIN	Input voltage pin	
4	VOUT	Output voltage pin	

Table2: MSK1117CD-xxx series (TO252 PKG)

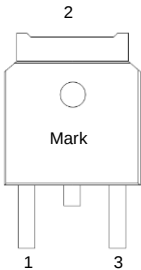
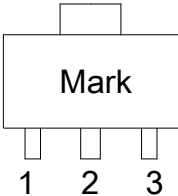
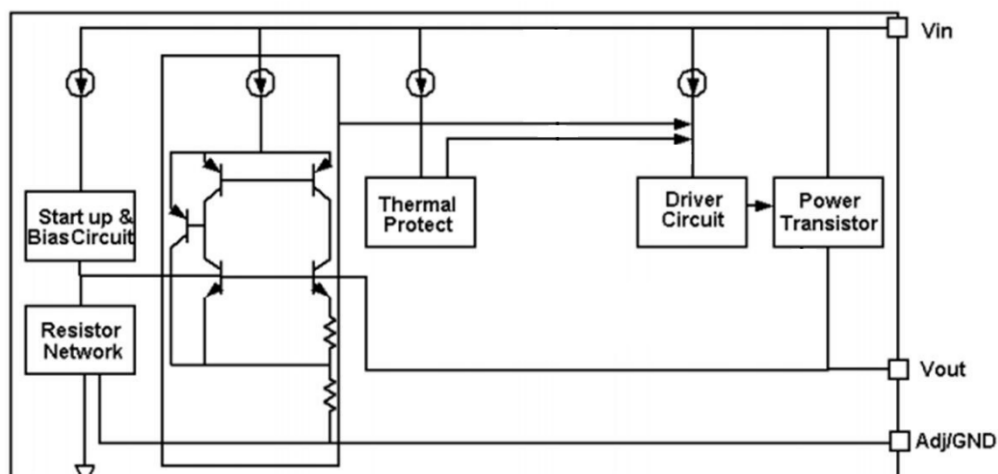
PIN NO.	PIN NAME	FUNCTION	
1	VSS/ADJ	VSS/ADJ pin	
2	VOUT	Output voltage pin	
3	VIN	Input voltage pin	

Table3: MSK1117S-xxx series (SOT89 PKG)

PIN NO.	PIN NAME	FUNCTION	
1	VSS/ADJ	VSS/ADJ pin	
2	VOUT	Output voltage pin	
3	VIN	Input voltage pin	

Block Diagram



Selection Table

Part No.	Part No.	Output Voltage	Package
MSK1117	XX=12	1.2V	SOT-223 TO-252 SOT-89
	XX=15	1.5V	
	XX=18	1.8V	
	XXX=285	2.85V	
	XX=25	2.5V	
	XX=33	3.3V	
	XX=50	5.0V	
	XX=ADJ	ADJ	

Ordering Information

Part No.	Package Type	Packing type
MSK1117S-xxV	SOT89	1000 Tape&Reel
MSK1117-xxV	SOT223	2500 Tape&Reel
MSK1117CD-xxV	TO252	2500 Tape&Reel

Absolute Maximum Ratings

Max Input Voltage 18V
Max Operating Junction Temperature(T_J) 150°C
Storage Temperature(T_s)..... -55°C~150°C
Lead Temperature & Time..... 260°C 10S
Caution: Exceed these limits to damage to the device. Exposure to absolute maximum rating conditions may affect device reliability.

Electrical Characteristics

T_A=25°C , unless otherwise noted.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V _{in}	Input voltage		--	15	18	V
V _{ref}	Reference voltage	MSK1117-Adj 10mA≤I _{out} ≤1A , V _{in} =2.55V	1.225	1.25	1.275	V
V _{out}	Output voltage	MSK1117-1.2V 0≤I _{out} ≤1A , V _{in} =2.5V	1.176	1.2	1.224	V
		MSK1117-1.5V 0≤I _{out} ≤1A , V _{in} =2.8V	1.47	1.5	1.53	V
		MSK1117-1.8V 0≤I _{out} ≤1A , V _{in} =3.1V	1.764	1.8	1.836	V
		MSK1117-2.5V 0≤I _{out} ≤1A , V _{in} =3.8V	2.45	2.5	2.55	V
		MSK1117-2.85V 0≤I _{out} ≤1A , V _{in} =4.15V	2.793	2.85	2.907	V
		MSK1117-3.3V 0≤I _{out} ≤1A , V _{in} =4.6V	3.234	3.3	3.366	V
		MSK1117-5.0V 0≤I _{out} ≤1A , V _{in} =6.3V	4.9	5	5.1	V

ΔV _{out}	Line regulation	MSK1117-1.2V I _{out} =10mA, 2.5V≤V _{in} ≤10V		4	19	mV
		MSK1117-1.5V I _{out} =10mA, 2.8V≤V _{in} ≤10V		5	26	mV
		MSK1117-ADJ I _{out} =10mA, 2.55V≤V _{in} ≤12V		5	24	mV
		MSK1117-1.8V I _{out} =10mA, 3.1V≤V _{in} ≤12V		5	32	mV
		MSK1117-2.5V I _{out} =10mA, 3.8V≤V _{in} ≤12V		8	41	mV
		MSK1117-2.85V I _{out} =10mA, 4.15V≤V _{in} ≤12V		8	46	mV
		MSK1117-3.3V I _{out} =10mA, 4.6V≤V _{in} ≤12V		9	49	mV
		MSK1117-5.0V I _{out} =10mA, 6.3V≤V _{in} ≤12V		10	56	mV

ΔV_{out}	Load regulation	MSK1117-1.2V $V_{in} = 2.5V, 10mA \leq I_{out} \leq 1A$		10	40	mV
		MSK1117-1.5V $V_{in} = 2.8V, 10mA \leq I_{out} \leq 1A$		10	40	mV
		MSK1117-ADJ $V_{in} = 2.55V, 10mA \leq I_{out} \leq 1A$		10	40	mV
		MSK1117-1.8V $V_{in} = 3.1V, 10mA \leq I_{out} \leq 1A$		10	40	mV
		MSK1117-2.5V $V_{in} = 2.8V, 10mA \leq I_{out} \leq 1A$		10	40	mV
		MSK1117-2.85V $V_{in} = 4.15V, 10mA \leq I_{out} \leq 1A$		10	40	mV
		MSK1117-3.3 $V_{in} = 4.6V, 10mA \leq I_{out} \leq 1A$		10	40	mV
		MSK1117-5.0 $V_{in} = 6.3V, 10mA \leq I_{out} \leq 1A$		10	40	mV
Vdrop	Dropout voltage	$I_{out} = 100mA$		1.15	1.3	V
		$I_{out} = 1A$		1.3	1.5	V
Imin	Minimum load current	MSK1117-ADJ		2	10	mA
Iq	Quiescent Current	MSK1117-1.2V, $V_{in} = 10V$		2	5	mA
		MSK1117-1.5V, $V_{in} = 10V$		2	5	mA
		MSK1117-1.8V, $V_{in} = 12V$		2	5	mA
		MSK1117-2.5V, $V_{in} = 12V$		2	5	mA
		MSK1117-2.85V, $V_{in} = 12V$		2	5	mA
		MSK1117-3.3V, $V_{in} = 12V$		2	5	mA
		MSK1117-5.0V, $V_{in} = 12V$		2	5	mA
Iadj	Adjust pin current	MSK1117-ADJ $V_{in} = 5V, 10mA \leq I_{out} \leq 1A$		55	120	μA
Ichange	Iadj change	MSK1117-ADJ $V_{in} = 5V, 10mA \leq I_{out} \leq 1A$		0.2	10	μA
ΔV_{out}	Temperature coefficient	$V_{in} = 4.5V, I_{out} = 10mA$ $V_{OUT} = 3.3V, 20^{\circ}C \leq T_a \leq 120^{\circ}C$		30		mV
θ_{JC}	Thermal resistance	SOT-223		20		$^{\circ}C/W$
		TO-252		10		

Note1: All test are conducted under ambient temperature $25^{\circ}C$ and within a short period of time 20ms

Note2: Load current smaller than minimum load current of MSK1117-ADJ will lead to unstable or oscillation output.

Detailed Description

MSK1117 is a series of low dropout voltage, three terminal regulators. Its application circuit is very simple: the fixed version only needs two capacitors and the adjustable version only needs two resistors and two capacitors to work. It is composed of some modules including start-up circuit, bias circuit, bandgap, thermal shutdown, power transistors and its driver circuit and so on.

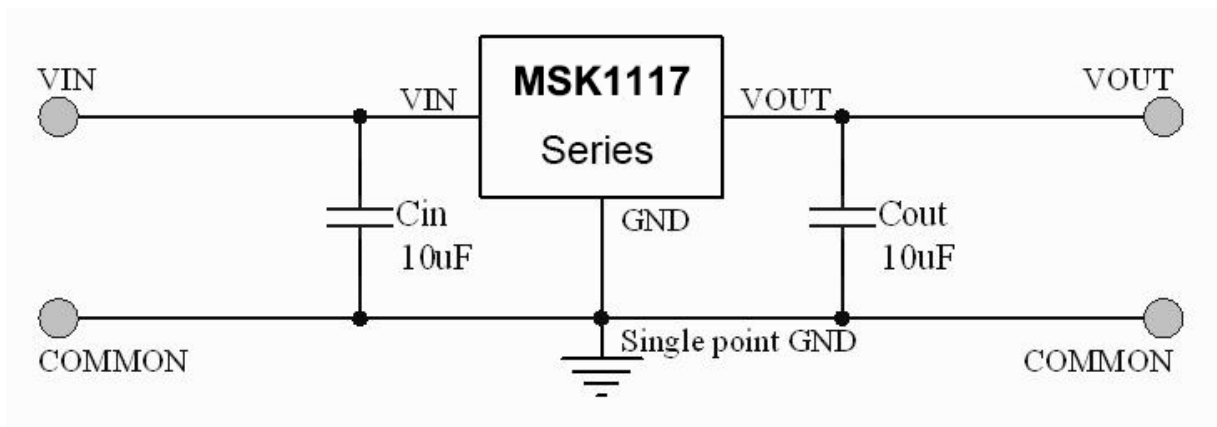
The thermal shut down modules can assure chip and its application system working safety when the temperature is larger than 170°C.

The bandgap module provides stable reference voltage, whose temperature coefficient is compensated by careful design considerations. The temperature coefficient is under 100 ppm/°C. And the accuracy of output voltage is guaranteed by trimming technique.

Typical Application

MSK1117 has an adjustable version and six fixed versions (1.2V, 1.5V, 1.8V, 2.5V, 2.85V, 3.3V and 5V)

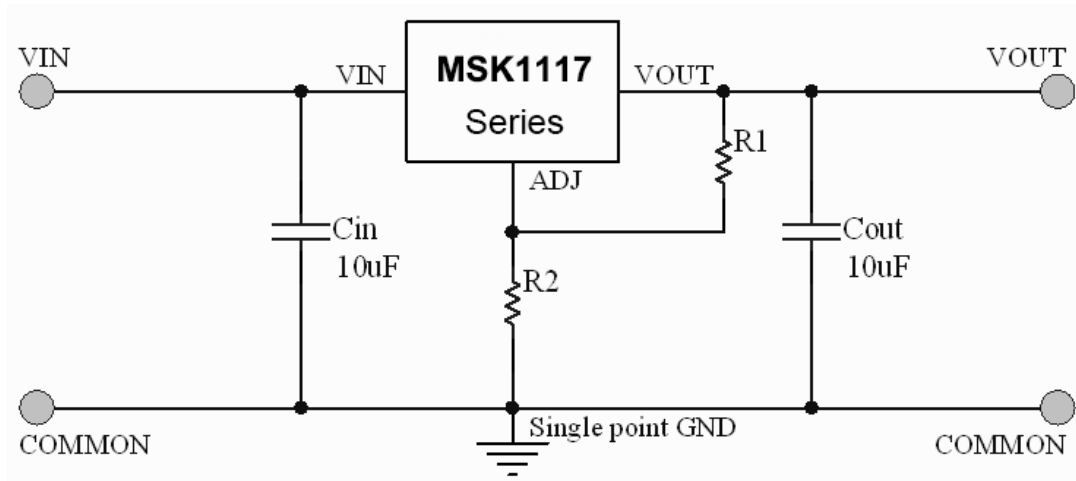
Fixed Output Voltage Version



Application circuit of MSK1117 fixed version

- (1) Recommend using 10uF tan capacitor as bypass capacitor (C₁) for all application circuit.
- (2) Recommend using 10uF tan capacitor to assure circuit stability.

Adjustable Output Voltage Version



Application Circuit of MSK1117-ADJ

The output voltage of adjustable version follows the equation: $V_{out} = 1.25 \times (1 + R_2/R_1) + I_{Adj} \times R_2$. We can ignore I_{Adj} because I_{Adj} (about 50uA) is much less than the current of R_1 (about 2~10mA).

1) To meet the minimum load current (>10mA) requirement, R_1 is recommended to be 125ohm or lower. As MSK1117-ADJ can keep itself stable at load current about 2mA, R_1 is not allowed to be higher than 625ohm.

2) Using a bypass capacitor (C_{ADJ}) between the ADJ pin and ground can improve ripple rejection. This bypass capacitor prevents ripple from being amplified as the output voltage is increased. The impedance of C_{ADJ} should be less than R_1 to prevent ripple from being amplified. As R_1 is normally in the range of 100Ω~500Ω, the value of C_{ADJ} should satisfy this equation: $1/(2\pi \times f_{ripple} \times C_{ADJ}) < R_1$.

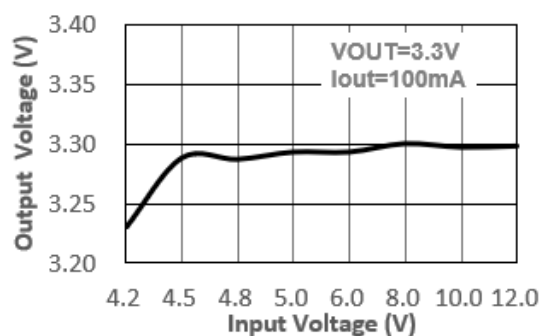
Thermal Considerations

We have to take heat dissipation into great consideration when output current or differential voltage of input and output voltage is large. Because in such cases, the power dissipation consumed by MSK1117 is very large. MSK1117 series uses SOT-223 package type and its thermal resistance is about 20°C/W. And the copper area of application board can affect the total thermal resistance. If copper area is 5cm*5cm (two sides), the resistance is about 30°C/W. So the total thermal resistance is about 20°C/W + 30°C/W. We can decrease total thermal resistance by increasing copper area in application board. When there is no good heat dissipation copper are in PCB, the total thermal resistance will be as high as 120°C/W, then the power dissipation of MSK1117 could allow on itself is less than 1W. And furthermore, MSK1117 will work at junction temperature higher than 125°C under such condition and no lifetime is guaranteed.

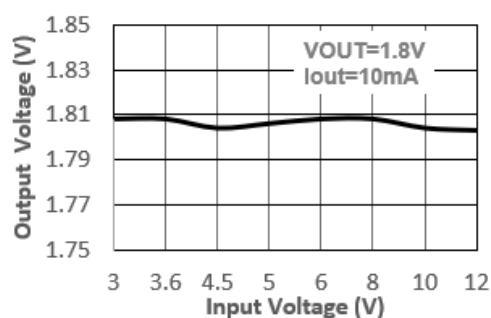
Typical Performance Characteristics

$T_A=25^{\circ}\text{C}$, unless otherwise noted

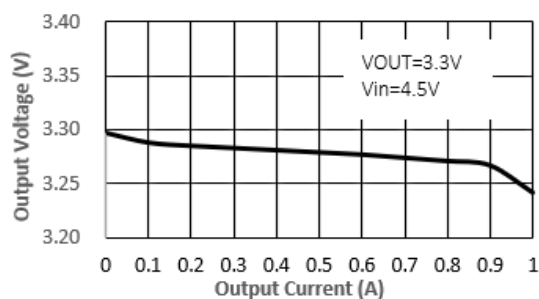
Output Voltage vs. Input Voltage ($V_{OUT}=3.3\text{V}$)



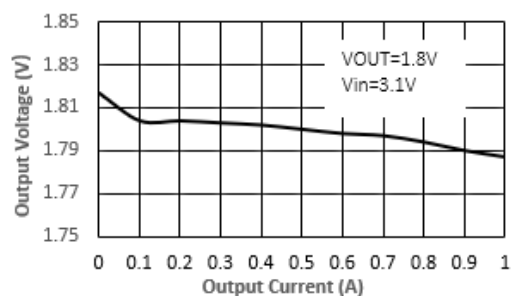
Output Voltage vs. Input Voltage ($V_{OUT}=1.8\text{V}$)



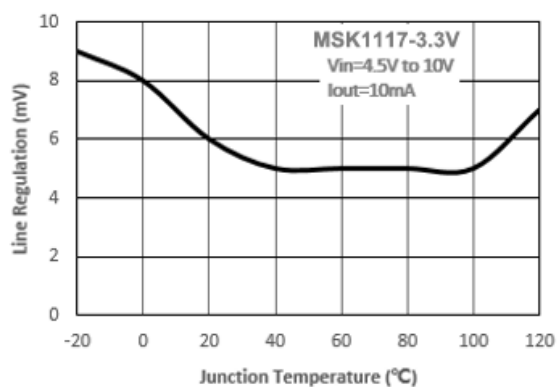
Output Voltage vs. Output Current ($V_{OUT}=3.3\text{V}$)



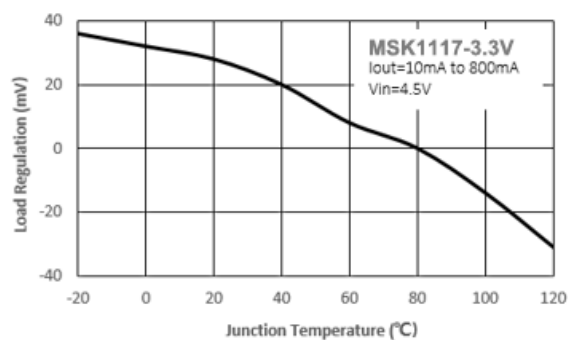
Output Voltage vs. Output Current ($V_{OUT}=1.8\text{V}$)



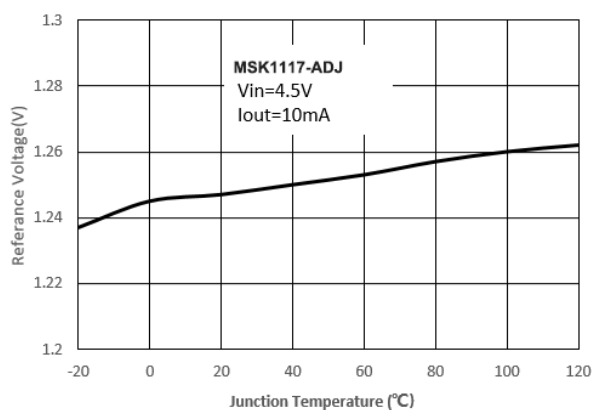
Line Regulation vs. Junction Temperature



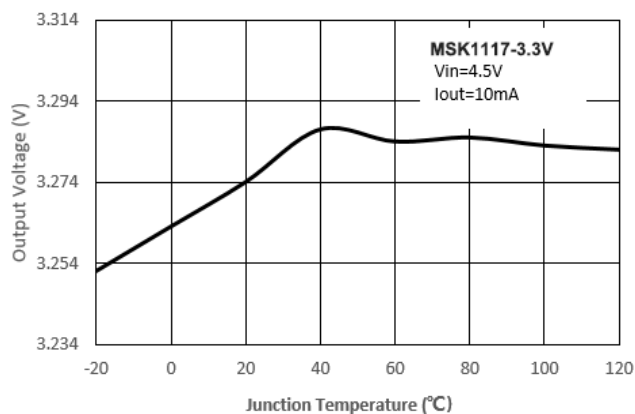
Load Regulation vs. Junction Temperature



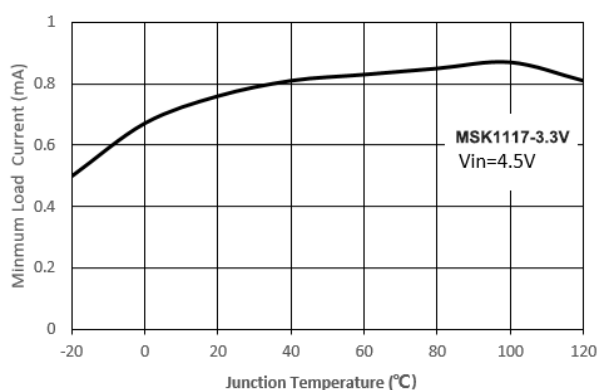
Reference Voltage vs. Junction Temperature



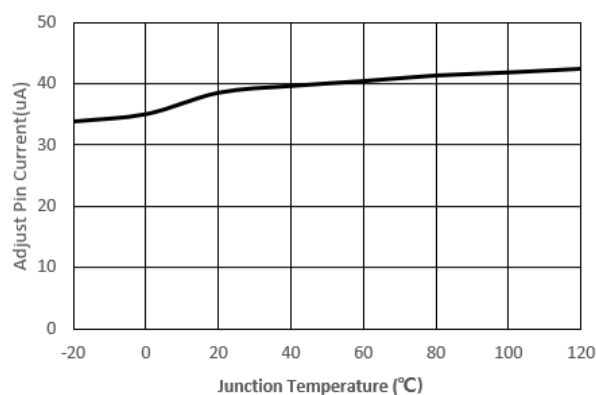
Output Voltage vs. Junction Temperature



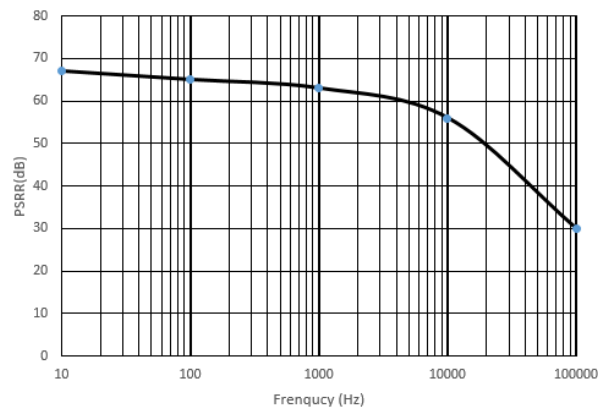
Minimum Load Current vs. Junction Temperature



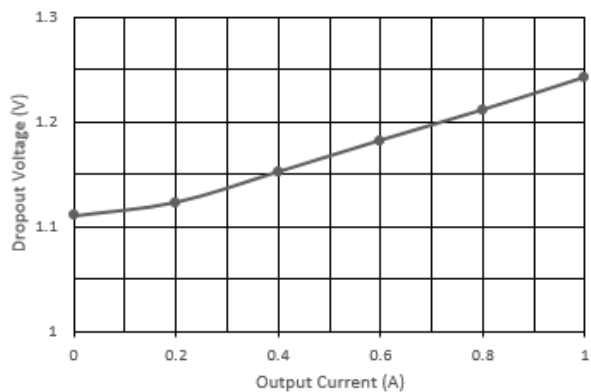
Adjust Pin Current vs. Junction Temperature



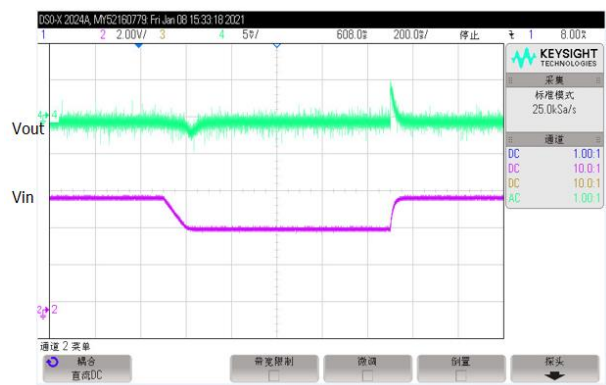
PSRR vs. Frequency



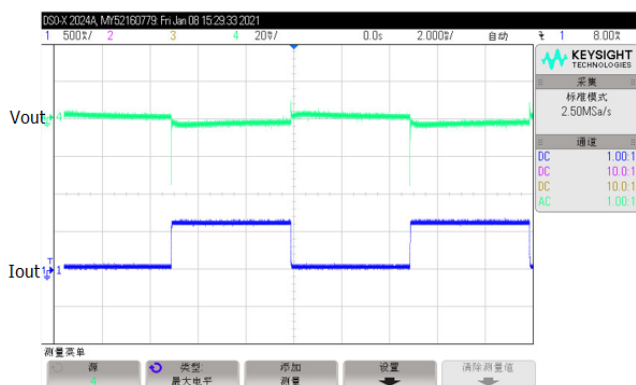
Dropout Voltage vs. Output Current



Line Transient Response

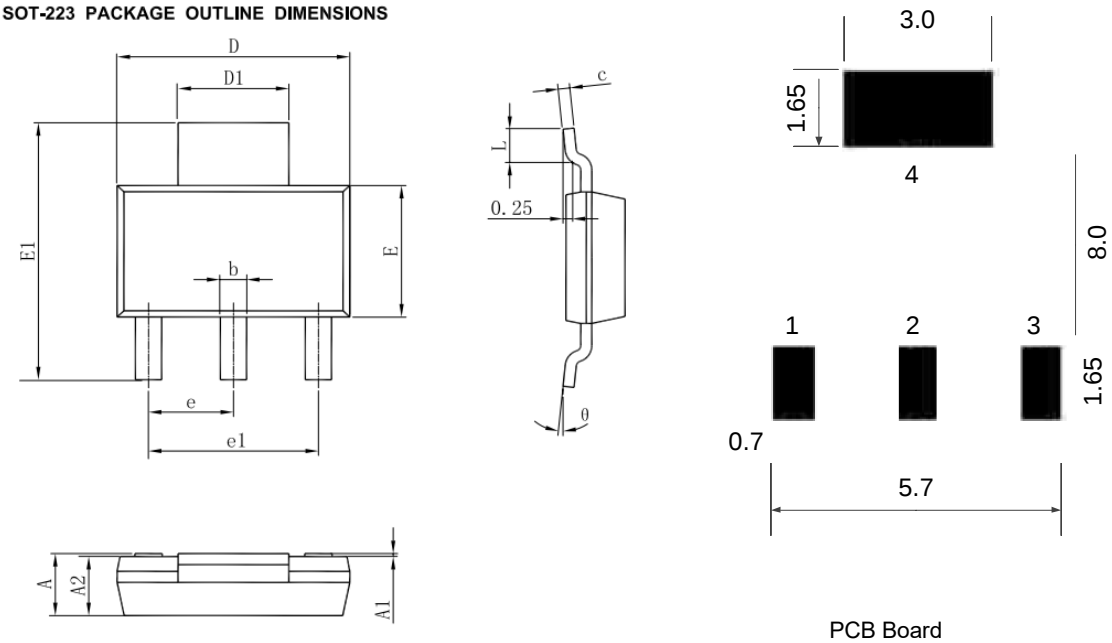


Load Transient Response

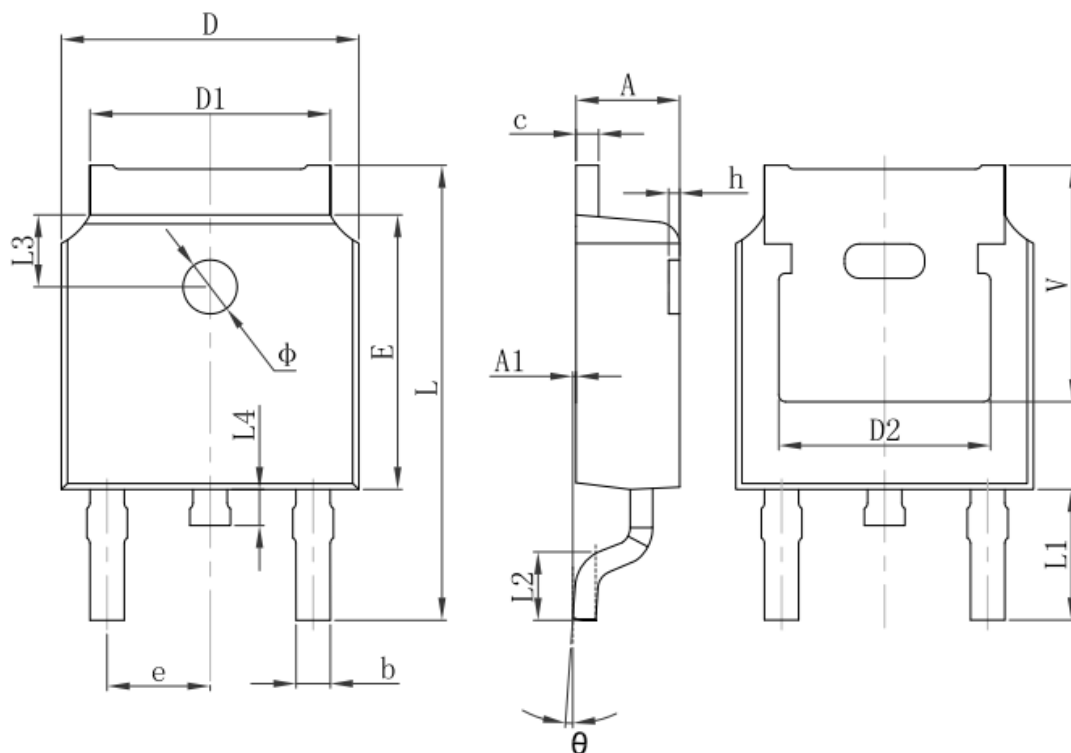


Package Information

SOT-223 PACKAGE OUTLINE DIMENSIONS

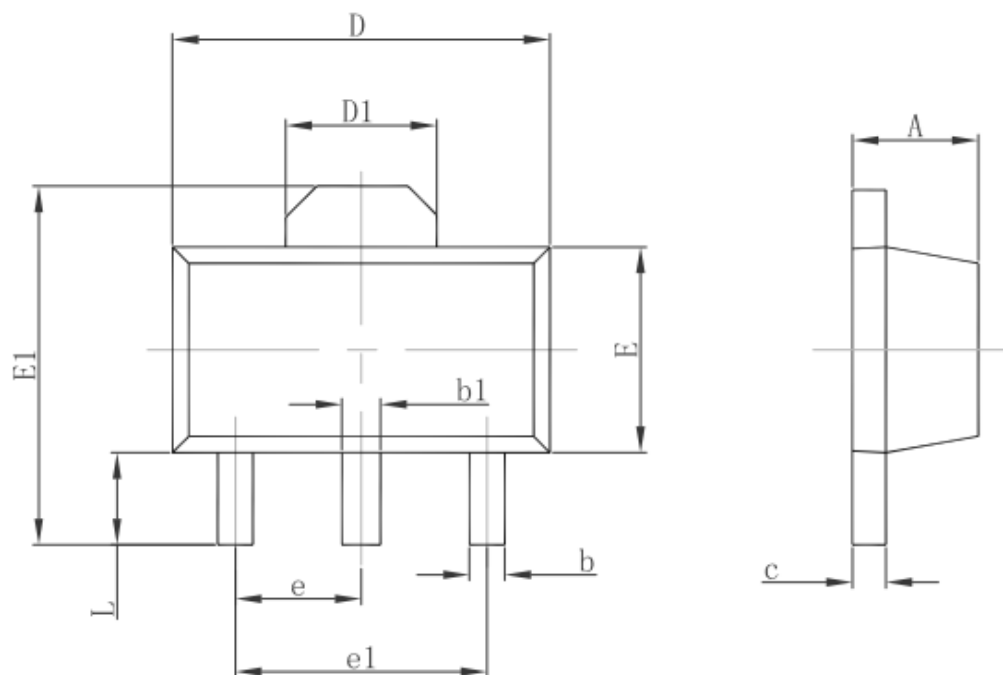


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.520	1.800	0.060	0.071
A1	0.000	0.100	0.000	0.004
A2	1.500	1.700	0.059	0.067
b	0.660	0.820	0.026	0.032
c	0.250	0.350	0.010	0.014
D	6.400	6.600	0.252	0.260
D1	2.900	3.100	0.114	0.122
E	3.300	3.700	0.130	0.146
E1	6.830	7.070	0.269	0.278
e	2.300(BSC)		0.091(BSC)	
e1	4.500	4.700	0.177	0.185
L	0.900	1.150	0.035	0.045
θ	0°	10°	0°	10°

TO-252-2L PACKAGE OUTLINE DIMENSIONS


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	2.200	2.400	0.087	0.094
A1	0.000	0.127	0.000	0.005
b	0.660	0.860	0.026	0.034
c	0.460	0.580	0.018	0.023
D	6.500	6.700	0.256	0.264
D1	5.100	5.460	0.201	0.215
D2	4.830 REF.		0.190 REF.	
E	6.000	6.200	0.236	0.244
e	2.186	2.386	0.086	0.094
L	9.800	10.400	0.386	0.409
L1	2.900 REF.		0.114 REF.	
L2	1.400	1.700	0.055	0.067
L3	1.600 REF.		0.063 REF.	
L4	0.600	1.000	0.024	0.039
Φ	1.100	1.300	0.043	0.051
θ	0°	8°	0°	8°
h	0.000	0.300	0.000	0.012
V	5.350 REF.		0.211 REF.	

SOT-89 Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF.		0.061 REF.	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP.		0.060 TYP.	
e1	3.000 TYP.		0.118 TYP.	
L	0.900	1.200	0.035	0.047

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