Low I_Q, Low Dropout 300mA Fixed Voltage Regulator

Features

- Low Quiescent Current : 60µA (No load)
- Low Dropout Voltage : 400mV (@300mA)
- Fixed Output Voltage : 1.5V ~ 4.5V by step 0.1V increment
- Stable with 1uF Output Capacitor
- Stable with Aluminum, Tantalum or Ceramic Capacitors .
- No Protection Diodes Needed
- Built in Thermal Protection
- Built in Current Limit Protection
- Controlled Short Circuit Current : 50mA
- Fast Transient Response
- Short Setting Time
- SOT-23 ,SOT-23-5 and SOT-89 Packages

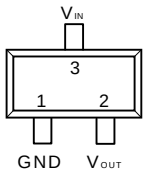
Applications

- 5V to 3.3~4.5V Linear Regulators
- 3.3V to 1.5~2.5V Linear Regulators
- CD-ROM, CD-R/W and DVD Player
- Networking System, LAN Card, ADSL/Cable Modem, Cable Set-Top Box
- PC Peripherals

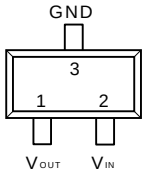
General Description

The APL5308/9 series are micropower, low dropout linear regulators, which operate from 2.7V to 6V input voltage and deliver up to 300mA. Typical dropout voltage is only 400mV at 300mA loading. Designed for use in battery-powered system, the low 60µA quiescent current makes it an ideal choice. Design with an internal P-channel MOSFET pass transistor, the APL5308/9 maintain a low supply current, independent of the load current and dropout voltage. Other features include thermal-shutdown protection current limit protection to ensure specified output current and controlled short-circuit current. The APL5308/9 regulators come in a miniature SOT-23, SOT-23-5 and SOT-89 packages.

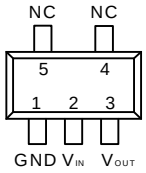
Pin Configuration



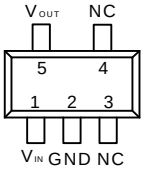
SOT-23 (Top View)
APL5308



SOT-23 (Top View)
APL5309



SOT-23-5 (Top View)
APL5308



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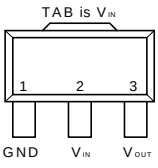
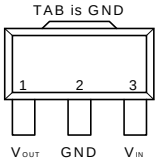
APL5309

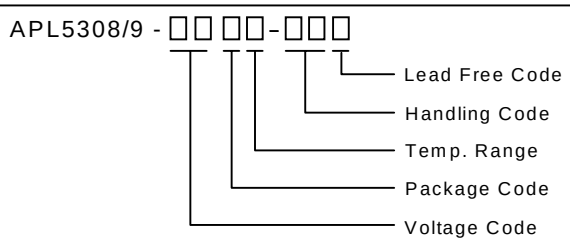


SOT-89 (Top View)
APL5308



SOT-89 (Top View)
APL5309

Ordering and Marking Information



Package Code
A : SOT-23 B : SOT-23-5 D : SOT-89
Temp. Range
C : 0 to 70°C
Handling Code
TR : Tape & Reel
Voltage Code :
15 : 1.5V ~ 45 : 4.5V
Lead Free Code
L : Lead Free Device Blank : Original Device

APL5308/9 -15 D : APL5308/9 XXXXX 15 XXXXX - Date Code ; 15 - 1.5V

Marking Information

SOT-23 and SOT-23-5 packages

Product Name	Marking	Product Name	Marking
APL5308-15A/B	389X	APL5309-15A/B	399X
APL5308-16A/B	38AX	APL5309-16A/B	39AX
APL5308-17A/B	38BX	APL5309-17A/B	39BX
APL5308-18A/B	38CX	APL5309-18A/B	39CX
APL5308-19A/B	38DX	APL5309-19A/B	39DX
APL5308-20A/B	38EX	APL5309-20A/B	39EX
APL5308-21A/B	38FX	APL5309-21A/B	39FX
APL5308-22A/B	38GX	APL5309-22A/B	39GX
APL5308-23A/B	38HX	APL5309-23A/B	39HX
APL5308-24A/B	38IX	APL5309-24A/B	39IX
APL5308-25A/B	38JX	APL5309-25A/B	39JX
APL5308-26A/B	38KX	APL5309-26A/B	39KX
APL5308-27A/B	38LX	APL5309-27A/B	39LX
APL5308-28A/B	38MX	APL5309-28A/B	39MX
APL5308-29A/B	38NX	APL5309-29A/B	39NX
APL5308-30A/B	38OX	APL5309-30A/B	39OX
APL5308-31A/B	38PX	APL5309-31A/B	39PX
APL5308-32A/B	38QX	APL5309-32A/B	39QX
APL5308-33A/B	38RX	APL5309-33A/B	39RX
APL5308-34A/B	38SX	APL5309-34A/B	39SX
APL5308-35A/B	38TX	APL5309-35A/B	39TX
APL5308-43A/B	38UX	APL5309-43A/B	39UX
APL5308-45A/B	38VX	APL5309-45A/B	39VX

The last character “X” in the marking is for data code.

Pin Description

PIN		I/O	Description
No.	Name		
1	V_{IN}	I	Supply voltage input.
2	GND		Ground pins of the circuitry, and all ground pins must be soldered To PCB with proper power dissipation.
3	V_{OUT}	O	Output pin of the regulator.

Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
V_{IN}, V_{OUT}	Input Voltage or Out Voltage	6.5	V
$R_{TH,JA}$	Thermal Resistance – Junction to Ambient	SOT-23 : 260 SOT-23-5 : 260 SOT-89 :180	°C/W
$R_{TH,JC}$	Thermal Resistance – Junction to Case	SOT-23 : 130 SOT-23-5 : 130 SOT-89 : 38	°C/W
P_D	Power Dissipation	Internally Limited	W
T_J	Operating Junction Temperature Control Section Power Transistor	 0 to 125 0 to 150	°C
T_{STG}	Storage Temperature Range	-65 to +150	°C
T_L	Lead Temperature (Soldering, 10 second)	260	°C

Electrical Characteristics

Unless otherwise noted these specifications apply over full temperature, C_{IN}=C_{OUT}=1µF, T_J=0 to 125°C. Typical values refer to T_J=25°C.

Symbol	Parameter	Test Conditions	APL5308/9			Unit
			Min.	Typ.	Max.	
V_{IN}	Input Voltage		2.7		6	V
V_{OUT}	Output Voltage	V_{OUT}+1.0V< V_{CC}<6.0V, 0mA< I_{OUT} <	V_{OUT} -2%	V_{OUT}	V_{OUT} +2%	V
I_{LIMIT}	Circuit Current Limit	V_{IN}=V_{OUT}+1V		650		mA
I_{SHORT}	Short Current	V_{OUT}=0V		50		mA
I_{OUT}	Load Current	V_{IN}=V_{OUT}+1V	300			mA
REG_{LINE}	Line Regulation	V_{OUT}+1V< V_{CC}<6.0V, I_{OUT}=1mA		1	10	mV
REG_{LOAD}	Load Regulation	V_{IN} =V_{OUT}+1V, 0mA< I_{OUT} < I_{MAX}		10	25	mV
	Load Transient	V_{IN}= V_{OUT}+1V , I_{OUT}=1mA-300mA in 1µs		150	250	mV

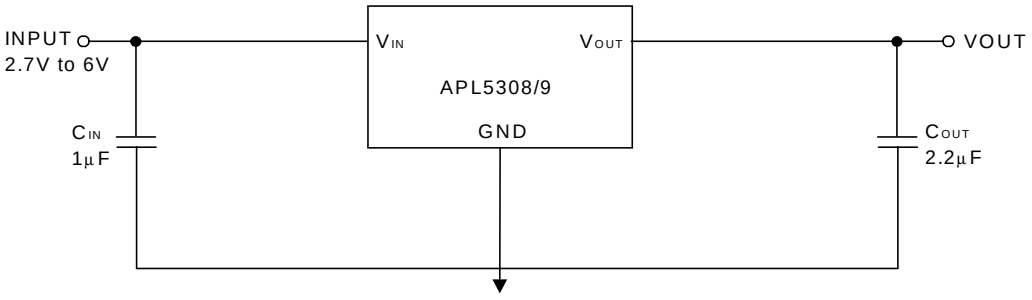
Electrical Characteristics (Cont.)

Unless otherwise noted these specifications apply over full temperature, C_{IN}=C_{OUT}=1µF, T_J=0 to 125°C. Typical values refer to T_J=25°C.

Symbol	Parameter	Test Conditions		APL5308/9			Unit
				Min.	Typ.	Max.	
V_{DROP}	Dropout Voltage(Note1)	I_{OUT} =300mA	1.5V≤V_{OUT}<2.0V		1	1.2	V
			2.0V≤V_{OUT}<2.5V		0.8	0.9	
			2.5V≤V_{OUT}<3V		0.6	0.7	
			3V≤V_{OUT}≤ 3.5V		0.4	0.5	
PSRR	Ripple Rejection	F≤1kHz, 1Vpp at V_{IN} = V_{OUT}+1.0V		45	55		dB
I_Q	Quiescent Current	No load			60	100	µA
		I_{OUT}=300mA			450	500	
OTS	Over Temperature				150		°C
	Over Temperature	Hysteresis			30		°C
TC	Output Voltage Temperature Coefficient				50		ppm/°C
C_{OUT}	Output Capacitor				2.2		µF
	ESR			0.01	0.1	1	Ohm

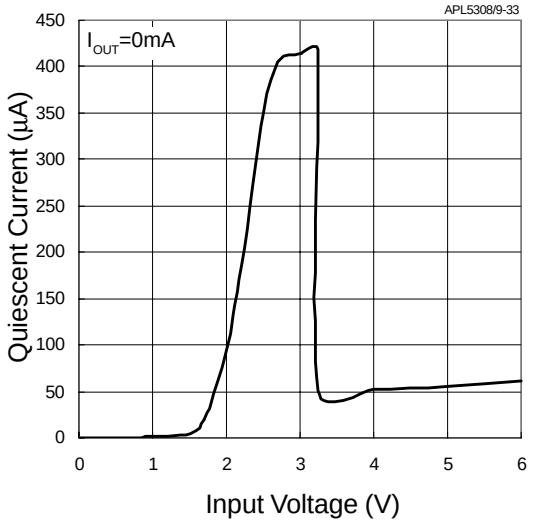
Note1 : Dropout voltage definition : V_{IN}-V_{OUT} when V_{OUT} is 2% below the value of V_{OUT} for V_{IN} = V_{OUT}+1V

Application Circuit

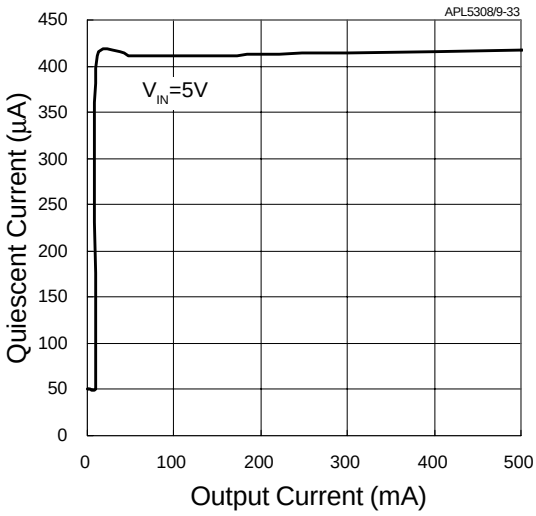


Typical Characteristics

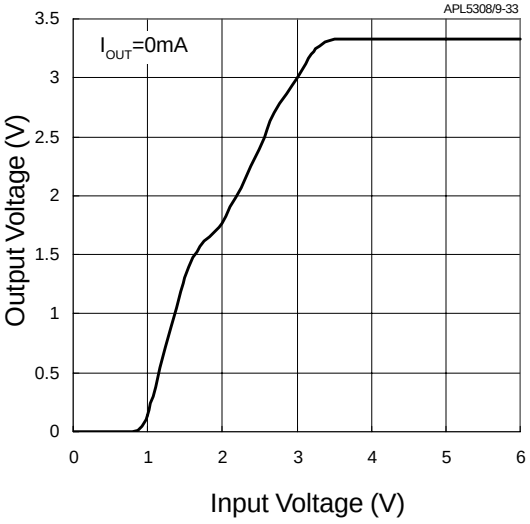
Quiescent Current vs. Input Voltage



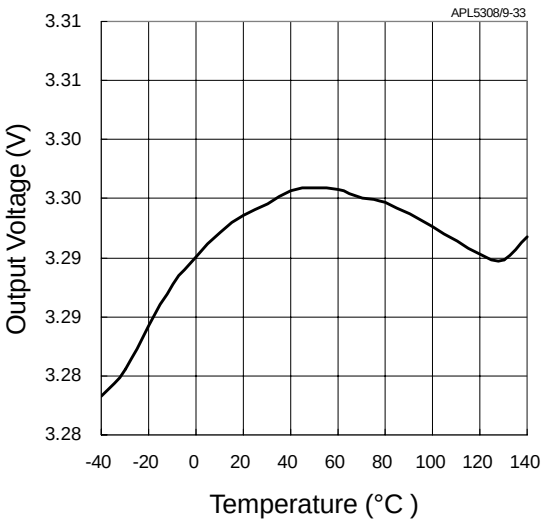
Quiescent Current vs. Output Current



Output Voltage vs. Input Voltage

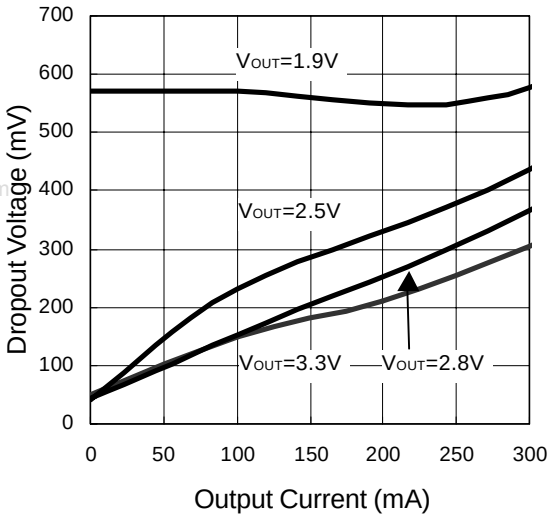


Output Voltage vs. Temperature

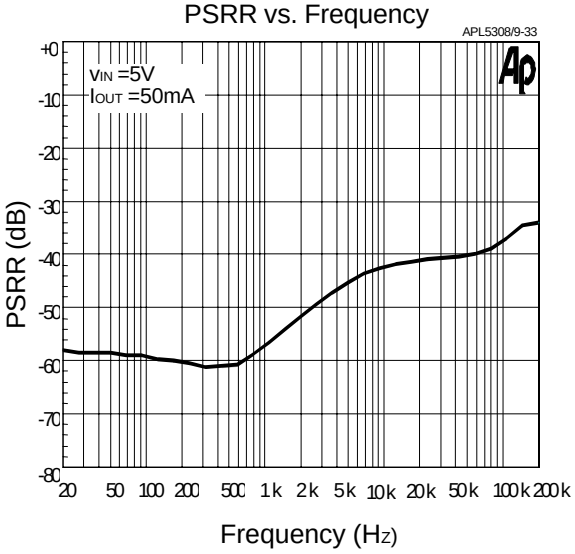


Typical Characteristics

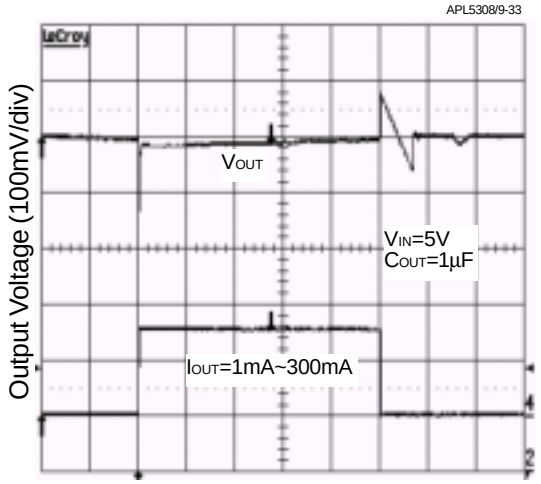
Dropout Voltage vs. Output Current



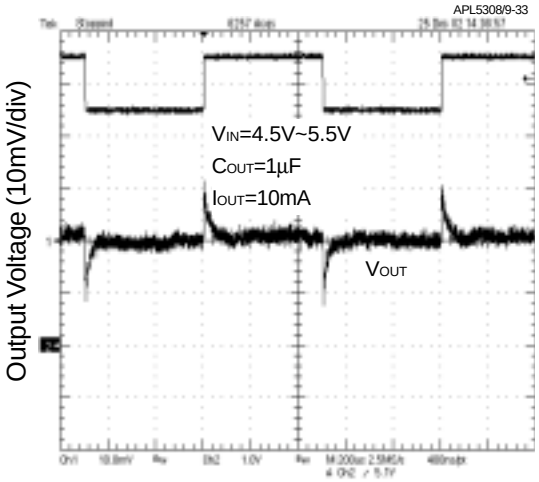
PSRR vs. Frequency



Load-Transient Response

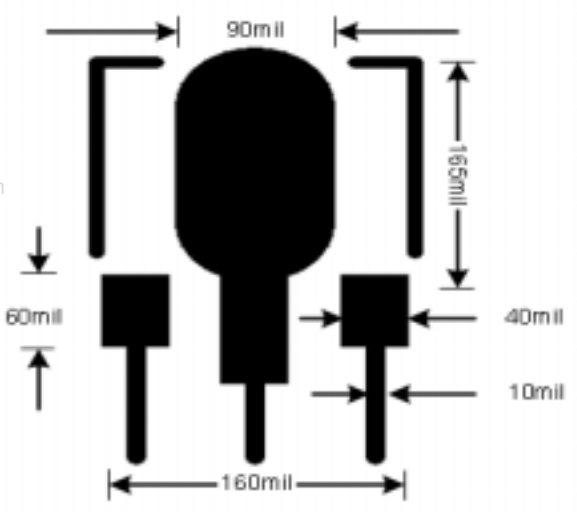


Line-Transient Response



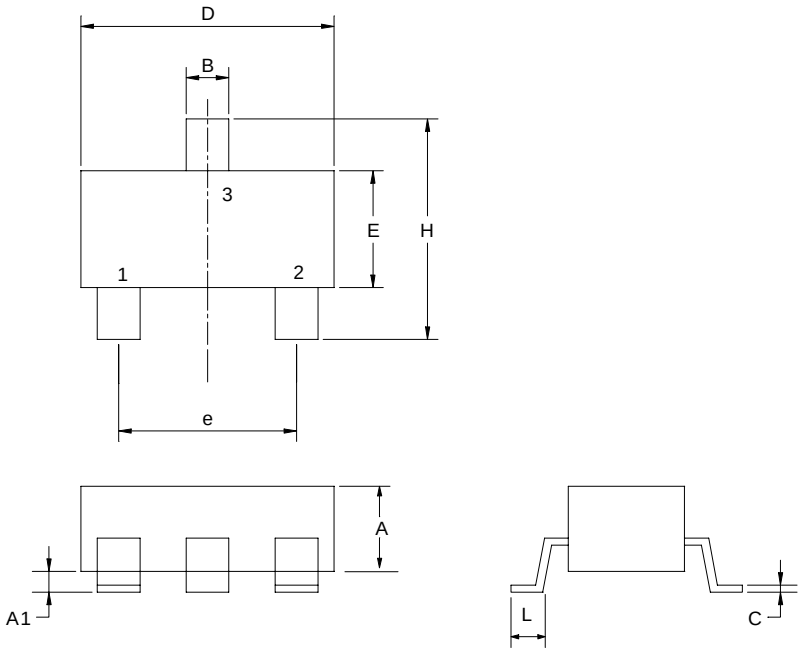
Typical Characteristics

Recommended Minimum Footprint



Packaging Information

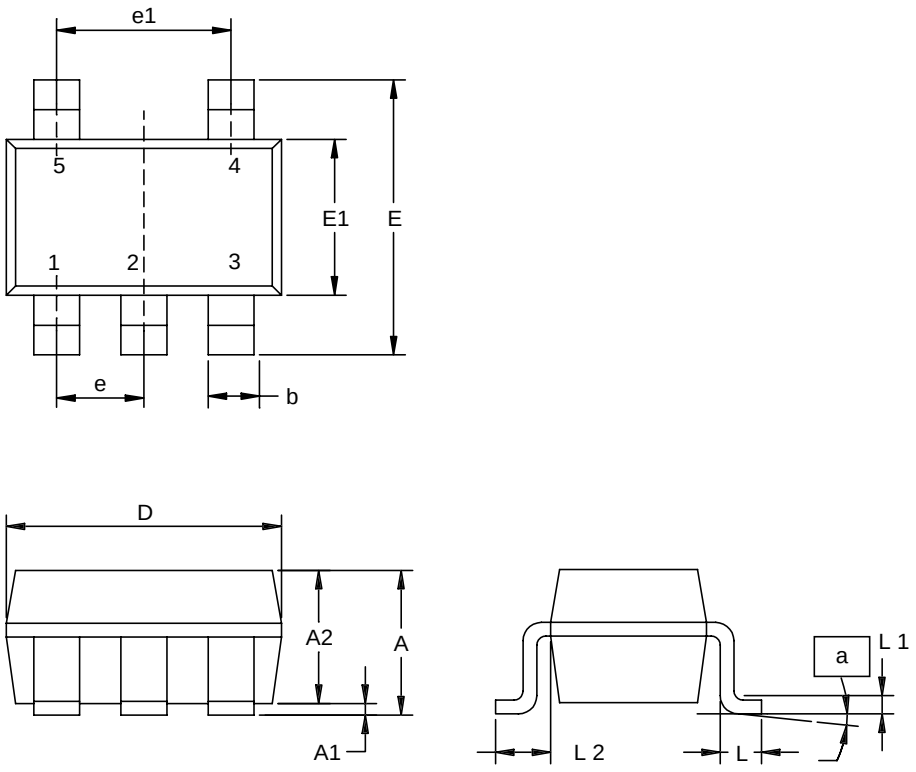
SOT-23



Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.00	1.30	0.039	0.051
A1	0.00	0.10	0.000	0.004
B	0.35	0.51	0.014	0.020
C	0.10	0.25	0.004	0.010
D	2.70	3.10	0.106	0.122
E	1.40	1.80	0.055	0.071
e	1.90/2.1 BSC		0.075/0.083 BSC	
H	2.40	3.00	0.094	0.118
L	0.37		0.015	

Packaging Information

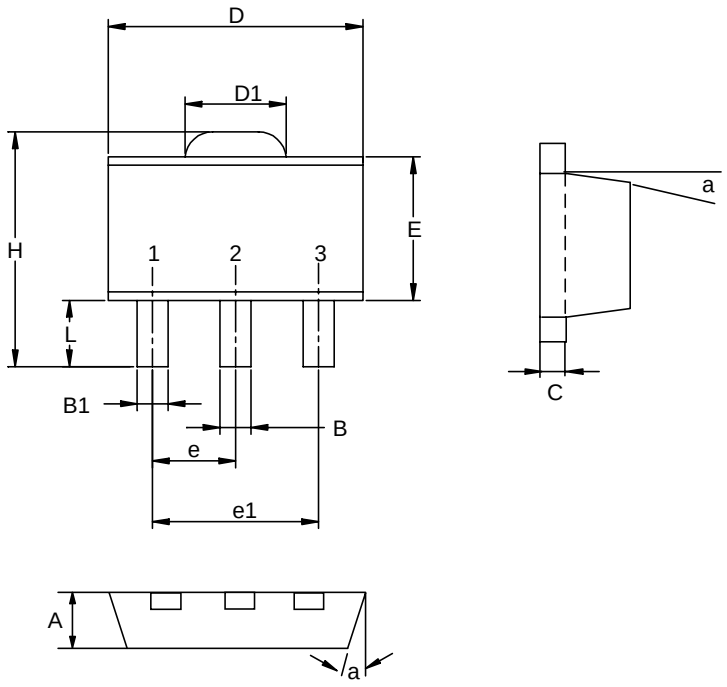
SOT-23-5



Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	0.95	1.45	0.037	0.057
A1	0.05	0.15	0.002	0.006
A2	0.90	1.30	0.035	0.051
D	2.8	3.00	0.110	0.118
E	2.6	3.00	0.102	0.118
E1	1.5	1.70	0.059	0.067
L	0.35	0.55	0.014	0.022
L1	0.20 BSC		0.008 BSC	
L2	0.5	0.7	0.020	0.028
N	5		5	
α	0°	10°	0°	10°

Packaging Information

SOT-89 (Reference EIAJ ED-7500A Reg stration SC-62)

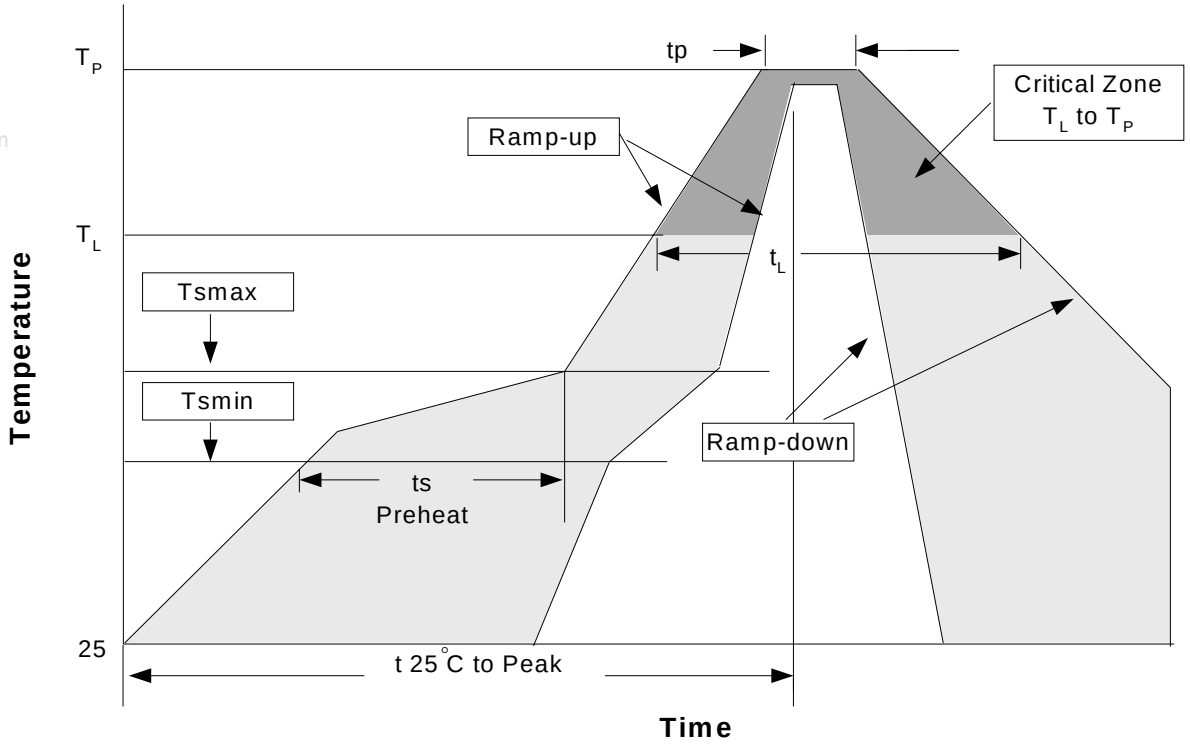


Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.40	1.60	0.055	0.063
B	0.40	0.56	0.016	0.022
B1	0.35	0.48	0.014	0.019
C	0.35	0.44	0.014	0.017
D	4.40	4.60	0.173	0.181
D1	1.35	1.83	0.053	0.072
e	1.50 BSC		0.059 BSC	
e1	3.00 BSC		0.118 BSC	
E	2.29	2.60	0.090	0.102
H	3.75	4.25	0.148	0.167
L	0.80	1.20	0.031	0.047
α		10°		10°

Physical Specifications

Terminal Material	Solder-Plated Copper (Solder Material : 90/10 or 63/37 SnPb), 100%Sn
Lead Solderability	Meets EIA Specification RSI86-91, ANSI/J-STD-002 Category 3.

Reflow Condition (IR/Convection or VPR Reflow)



Classificatin Reflow Profiles

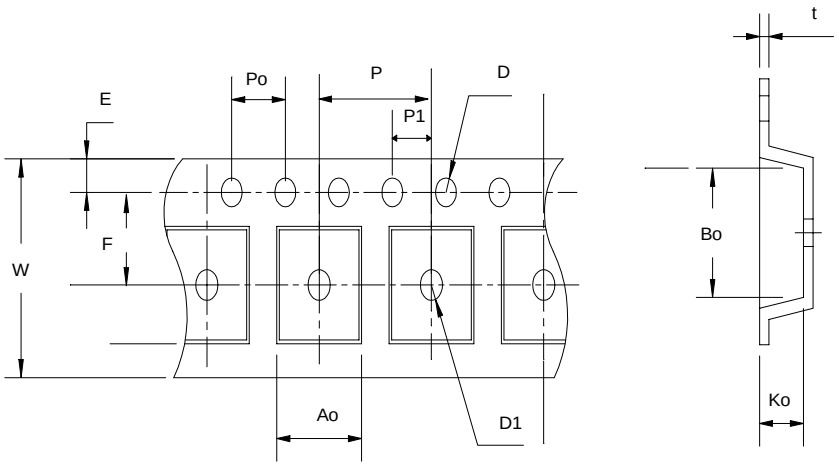
Profile Feature	Sn-Pb Eutectic Assembly		Pb-Free Assembly	
	Large Body	Small Body	Large Body	Small Body
Average ramp-up rate (T_L to T_P)	3°C/second max.		3°C/second max.	
Preheat - Temperature Min (Tsmin) - Temperature Mix (Tsmax) - Time (min to max)(ts)	100°C 150°C 60-120 seconds		150°C 200°C 60-180 seconds	
Tsmax to T_L - Ramp-up Rate			3°C/second max	
Tsmax to T_L - Temperature(T_L) - Time (t_L)	183°C 60-150 seconds		217°C 60-150 seconds	
Peak Temperature(Tp)	225 +0/-5°C	240 +0/-5°C	245 +0/-5°C	250 +0/-5°C
Time within 5°C of actual Peak Temperature(tp)	10-30 seconds	10-30 seconds	10-30 seconds	20-40 seconds
Ramp-down Rate	6°C/second max.		6°C/second max.	
Time 25°C to Peak Temperature	6 minutes max.		8 minutes max.	

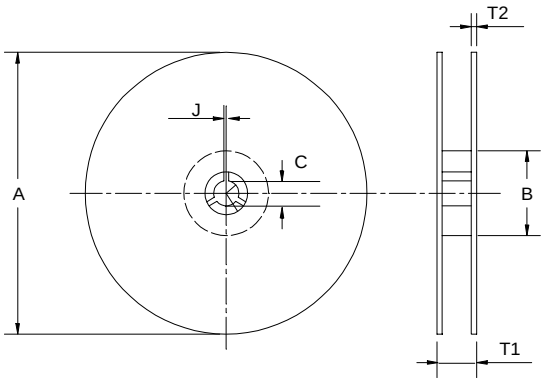
Note: All temperatures refer to topside of the package. Measured on the body surface.

Reliability test program

Test item	Method	Description
SOLDERABILITY	MIL-STD-883D-2003	245°C , 5 SEC
HOLT	MIL-STD-883D-1005.7	1000 Hrs Bias @ 125 °C
PCT	JESD-22-B, A102	168 Hrs, 100 % RH , 121°C
TST	MIL-STD-883D-1011.9	-65°C ~ 150°C, 200 Cycles
ESD	MIL-STD-883D-3015.7	VHBM > 2KV, VMM > 200V
Latch-Up	JESD 78	10ms , I_{tr} > 100mA

Carrier Tape





Carrier Tape

Application	A	B	C	J	T1	T2	W	P	E
SOT-23	178±1	60 ± 1.0	12.0	2.5 ± 0.15	9.0 ± 0.5	1.4	8.0+ 0.3 - 0.3	4.0	1.75
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	3.5 ± 0.05	1.5 +0.1	φ 0.1MIN	4.0	2.0 ± 0.05	3.1	3.0	1.3	0.2±0.03
Application	A	B	C	J	T1	T2	W	P	E
SOT-23-5	178 ±1	72 ± 1.0	13.0 + 0.2	2.5 ± 0.15	8.4 ± 2	1.5 ± 0.3	8.0 ± 0.3	4 ± 0.1	1.75± 0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	3.5 ± 0.05	1.5± 0.1	1.5± 0.1	4.0 ± 0.1	2.0 ± 0.1	3.15 ± 0.1	3.2± 0.1	1.4± 0.1	0.2±0.033
Application	A	B	C	J	T1	T2	W	P	E
SOT-89	178 ±1	70 ± 2	13.5 ± 0.15	3 ± 0.15	14 ± 2	1.3 ± 0.3	12 + 0.3 12 - 0.1	8 ± 0.1	1.75± 0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	5.5 ± 0.05	1.5± 0.1	1.5± 0.1	4.0 ± 0.1	2.0 ± 0.1	4.8 ± 0.1	4.5± 0.1	1.80± 0.1	0.3±0.013

(mm)

Cover Tape Dimensions

Application	Carrier Width	Cover Tape Width	Devices Per Reel
SOT- 23	8	5.3	3000
SOT- 23-5	8	5.3	3000
SOT- 89	12	9.3	1000

Customer Service

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