1.5A Low Dropout Fast Response Positive Adjustable Regulator and Fixed 1.8V, 2.5V, 2.85V and 3.3V

Features

- Guaranteed Output Voltage Accuracy within 2%
- Fast Transient Response
- Guaranteed Dropout Voltage at Multiple Currents
- Load Regulation : 0.1% Typ.
- Line Regulation : 0.03% Typ.
- Low Dropout Voltage : 1.3V Typ. at I_{OUT} =1.5A
- Current Limit : 1.5A Min. at T_J=125°C
- On-Chip Thermal Limiting : 150 °C Typ.
- Adjustable Output : 1.25~10.7V
- Standard 3-pin SOT-223, TO-252 , TO-220 and TO-263 Power Packages
- Lead Free Available (RoHS Compliant)

Applications

- Active SCSI Terminators
- Low Voltage Logic Supplies
- Battery-Powered Circuitry
- Post Regulator for Switching Power Supply

General Description

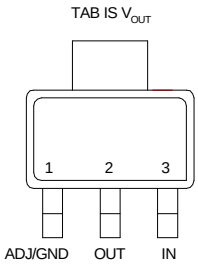
The APL1086 is a low dropout three-terminal adjustable regulators with 1.5A output current capability. In order to obtain lower dropout voltage and faster transient response, which is critical for low voltage applications, the APL1086 has been optimized.

The device is available in an adjustable version and fixed output voltages of 1.8V, 2.5V,2.85V and 3.3V, the output available voltage range is from 1.25~10.7V with an input supply below 12V. Dropout voltage is guaranteed at a maximum of 1.45V at 1.5A.

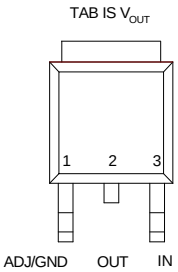
Current limit is trimmed to ensure specified output current and controlled short-circuit current. On-chip thermal limiting provides protection against any combination of overload that would create excessive junction temperatures.

The APL1086 is available in the industry standard 3-pin SOT-223, TO-252, TO-220 or TO-263 power packages.

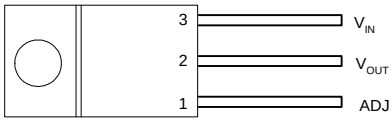
Pin Description



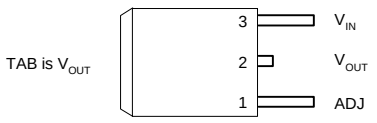
Front View for SOT-223



Front View for TO-252



Front View for TO-220



Front View for TO-263

Ordering and Marking Information

APL1086- □□ □□ - □□□

- Lead Free Code
- Handling Code
- Temp. Range
- Package Code
- Voltage Code

Package Code
F : TO-220 G : TO-263
U : TO-252 V : SOT-223
Temp. Range
C : 0 to 70 °C
Handling Code
TU : Tube TR : Tape & Reel
Voltage Code
18 : 1.8V 25 : 2.5V 285 : 2.85V 33 : 3.3V
Blank : Adjustable Version
Lead Free Code
L : Lead Free Device Blank : Original Device

APL1086 F/G/U :	APL1086 XXXXX	XXXXX - Date Code	APL1086 V : APL1086 XXXXX XXXXX - Date Code
APL1086 -18F/G/U:	18 APL1086 XXXXX	XXXXX - Date Code	APL1086- 18V : APL1086 XXXXX18 XXXXX - Date Code
APL1086 -25F/G/U:	25 APL1086 XXXXX	XXXXX - Date Code	APL1086- 25V : APL1086 XXXXX25 XXXXX - Date Code
APL1086 -285F/G/U:	285 APL1086 XXXXX	XXXXX - Date Code	APL1086- 285V : APL1086 XXXXX285 XXXXX - Date Code
APL1086 -33F/G/U:	33 APL1086 XXXXX	XXXXX - Date Code	APL1086- 33V : APL1086 XXXXX33 XXXXX - Date Code

Note: ANPEC lead-free products contain molding compounds/die attach materials and 100% matte tin plate termination finish; which are fully compliant with RoHS and compatible with both SnPb and lead-free soldiering operations. ANPEC lead-free products meet or exceed the lead-free requirements of IPC/JEDEC J STD-020C for MSL classification at lead-free peak reflow temperature.

Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
V_I	Input Voltage	15	V
P_D	Power Dissipation, T_A=25°C SOT-223 TO-252	 1.7 2	W
θ_{JA}	Thermal Resistance from Junction to Ambient in Free Air SOT-223 TO-252	 60 50	°C/W
T_J	Operating Junction Temperature Range	0 to 150	°C
T_{STG}	Storage Temperature Range	-65 to +150	°C
T_L	Lead Temperature (Soldering, 10 second)	260	°C

Note 1: Stresses beyond the absolute maximum rating may damage the device and operating in the absolute maximum rating conditions may affect device reliability.

Note 2: The maximum allowable power dissipation at any T_A (ambient temperature) is calculated using: P_D (max) = (T_J – T_A) / θ_{JA}; T_J = 125°C. Exceeding the maximum allowable power dissipation will result in excessive die temperature.

Electrical Characteristics

Symbol	Parameter	Test Conditions	APL1086			Unit
			Min.	Typ.	Max.	
V_{REF}	Reference Voltage	10mA≤ I_{OUT}≤1.5A, 1.4V≤(V_{IN} -V_{OUT}) ≤9.75V, T_J =0~125°C	1.225	1.250	1.275	V
V_{OUT}	Output Voltage APL1086-18	T_J =25°C, I_{OUT} =0mA, T_J =0~125°C, 0≤ I_{OUT}≤ 1.5A, 3.5V≤V_{IN}≤9V,	1.782 1.764	1.800 1.800	1.818 1.836	V
	APL1086-25	T_J =25°C, I_{OUT} =0mA, T_J =0~125°C, 0≤ I_{OUT}≤ 1.5A, 4V≤V_{IN}≤9V,	2.475 2.450	2.500 2.500	2.525 2.550	
	APL1086-28	T_J =25°C, I_{OUT} =0mA, T_J =0~125°C, 0≤ I_{OUT}≤ 1.5A, 4.25V≤V_{IN}≤9V,	2.822 2.792	2.850 2.850	2.878 2.910	
	APL1086-33	T_J =25°C, I_{OUT} =0mA, T_J =0~125°C, 0≤ I_{OUT}≤ 1.5A, 4.75V≤V_{IN}≤9V,	3.267 3.235	3.3003 .300	3.333 3.365	
REG_{LINE}	Line Regulation APL1086	T_J =0~125°C I_{OUT}=10mA, 1.5V≤V_{IN} –V_{OUT}≤9V (note1)		0.03	0.2	%
	APL1086-18	I_{OUT}=0mA, 3.5V≤V_{IN}≤9V (note1)		1	6	mV
	APL1086-25	I_{OUT}=0A, 4V≤V_{IN}≤9V (note1)		1	6	
	APL1086-28	I_{OUT}=0A, 4.25V≤V_{IN} ≤9V (note1)		1	6	
	APL1086-33	I_{OUT}=0A, 4.75V≤V_{IN}≤ 9V (note1)		1	6	
REG_{LOAD}	Load Regulation APL1086	T_J =0~125°C (V_{IN} -V_{OUT})=3V, 0≤ I_{OUT} ≤1.5A (note1)		0.1	0.4	%
	APL1086-18	V_{IN} =3.5V, 0≤ I_{OUT} ≤1.5A (note1)		1	10	mV
	APL1086-25	V_{IN} =4V, 0≤ I_{OUT} ≤1.5A (note1)		1	10	
	APL1086-28	V_{IN} =4.25V, 0≤ I_{OUT}≤1.5A (note1)		1	10	
	APL1086-33	V_{IN} =4.75V, 0≤ I_{OUT} ≤1.5A (note1)		1	10	
V_D	Dropout Voltage	I_{OUT}=1.5A ,T_J =0~125°C (note2)		1.3	1.45	V
I_{LIMIT}	Current Limit	(V_{IN} -V_{OUT})=5V, T_J =25°C	1500			mA
I_{ADJ}	Adjust Pin Current	(V_{IN} -V_{OUT})=3V, I_{OUT}=10mA, T_J =0~125°C		60	120	µA
ΔI_{ADJ}	Adjust Pin Current Change	T_J=0~125°C, 10mA≤ I_{OUT} ≤1.5A, 1.4V≤(V_{IN} -V_{OUT}) ≤7.75V		0.2	5	µA
I_O	Minimum Load Current	T_J =0~125°C, (V_{IN} -V_{OUT})=7.75V, (note 3)		1.7		mA
PSRR	Ripple Rejection	F_{RIPPLE}=120Hz, V_{RIPPLE}=1V_{P-P}, (V_{IN} -V_{OUT})=3V, T_J =0~125°C	60	75		dB
T_R	Thermal Regulation	T_J =25°C, 30ms Pulse		0.01	0.02	%/ W
T_S	Temperature Stability			0.5		%
L_S	Long -Term Stability	T_J =125°C,1000Hrs.		0.3		%

Electrical Characteristics (Cont.)

Symbol	Parameter	Test Conditions	APL1086			Unit
			Min.	Typ.	Max.	
V_N	RMS Output Noise	T_J=25°C,10Hz≤F≤10kHz, (% of V_{OUT})		0.003		%
θ_{JC}	Thermal Resistance from Junction to Case	at Tab, SOT-223		15		°C/ W
		at Tab, TO-252		6		
OT	Over Temperature Point			150		°C
	Quiescent Current	T_J=0~125°C,				mA
	APL1086-18	V_{IN}≤9V		5.5	10	
	APL1086-25	V_{IN}≤9V		5.5	10	
	APL1086-28	V_{IN}≤9V		5.5	10	
	APL1086-33	V_{IN}≤9V		5.5	10	

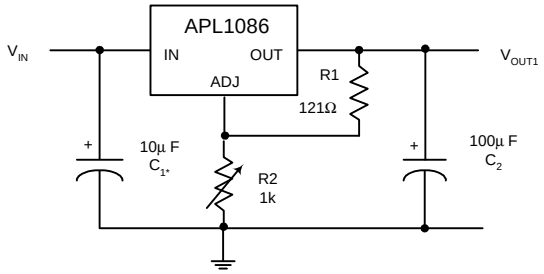
Note 1: See thermal regulation specifications for changes in output voltage due to heating effects. Load line regulations are measured at a constant junction temperature by low duty cycle pulse testing.

Note 2: Dropout voltage is specified over the full output current range of the device. Dropout voltage is defined as the minimum input/output differential measured at the specified output current. Test points and limits are also shown on the Dropout Voltage curve.

Note 3: Minimum load current is defined as the minimum output current required to maintain regulation.

Application Circuits

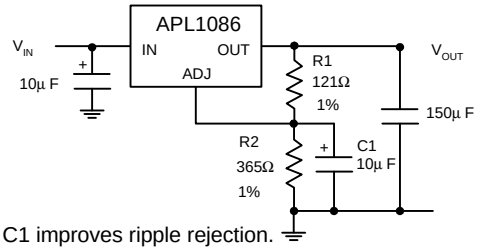
1.25V to 10.7V Adjustable Regulator



* Needed if device is far from filter capacitors

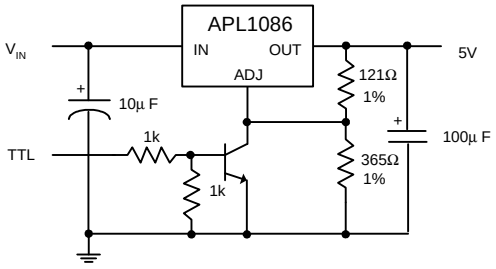
$$V_{OUT} = 1.250V \times \frac{R1 + R2}{R1}$$

Improving Ripple Rejection



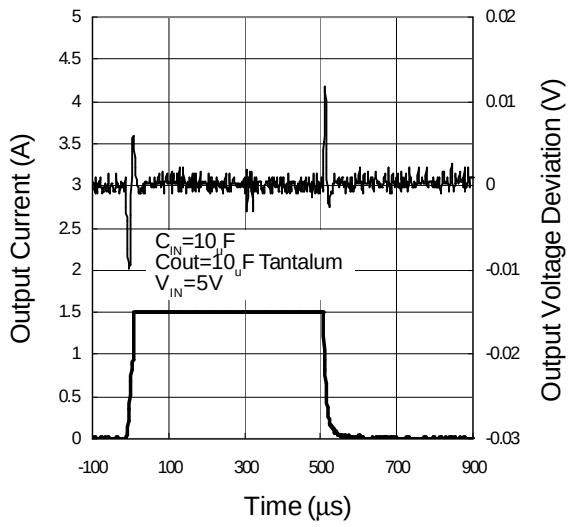
* C1 improves ripple rejection.
X_C should be approximately equal to R1 at ripple frequency

5V Regulator with Shutdown

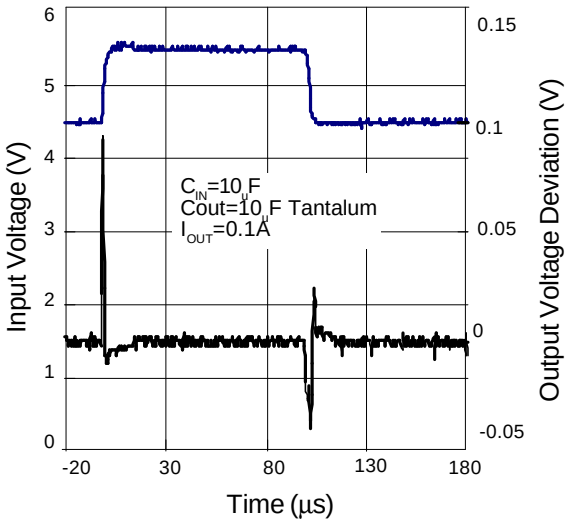


Typical Characteristics

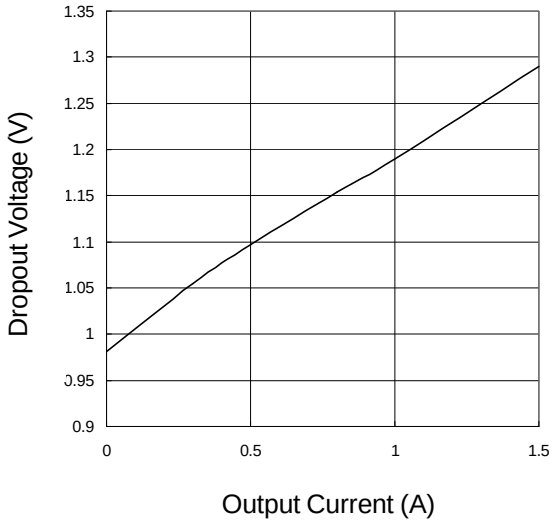
Load Transient Response



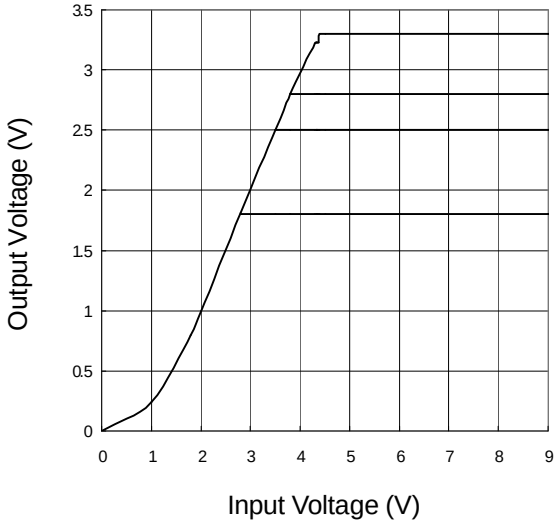
Line Transient Response



Dropout Voltage vs. Output Current

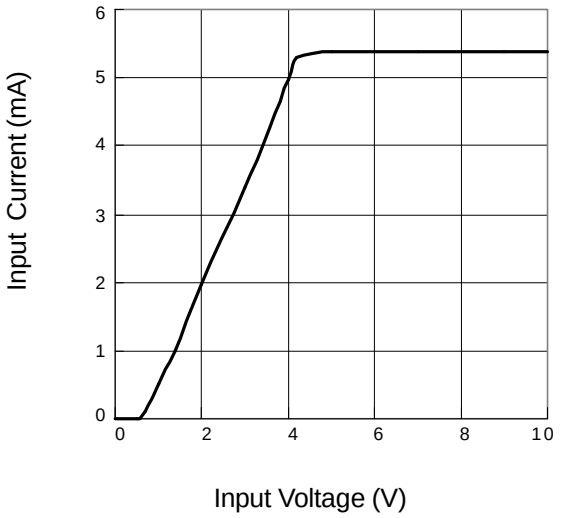


Output Voltage vs. Input Voltage

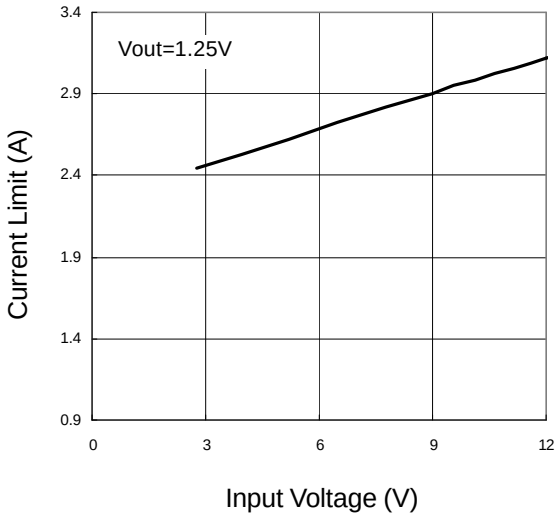


Typical Characteristics (Cont.)

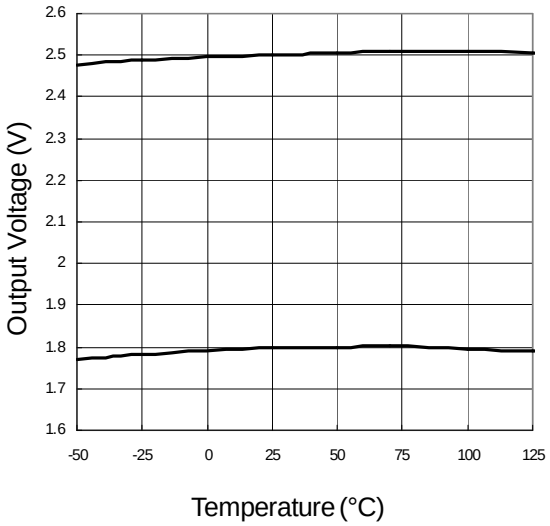
Input Current vs. Input Voltage



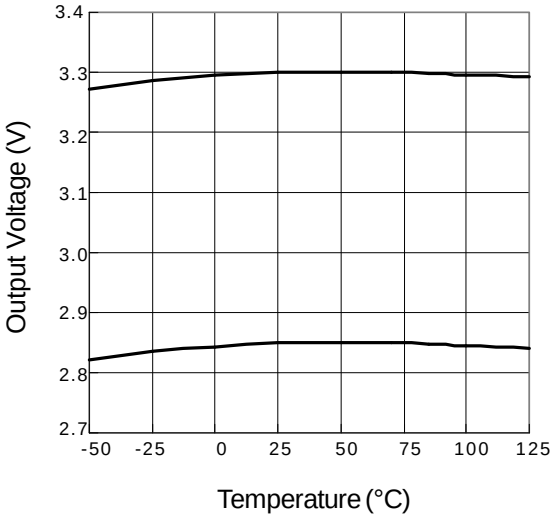
Current Limit vs. Input Voltage



Output Voltage vs. Temperature

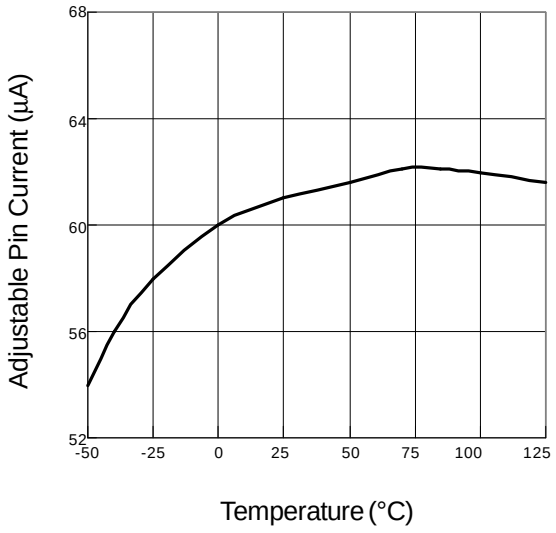


Output Voltage vs. Temperature

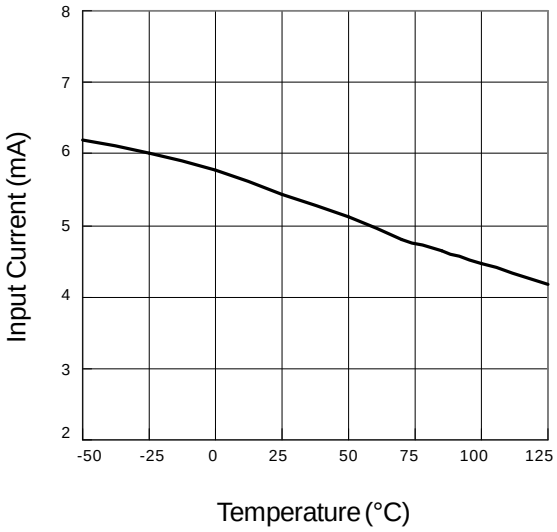


Typical Characteristics (Cont.)

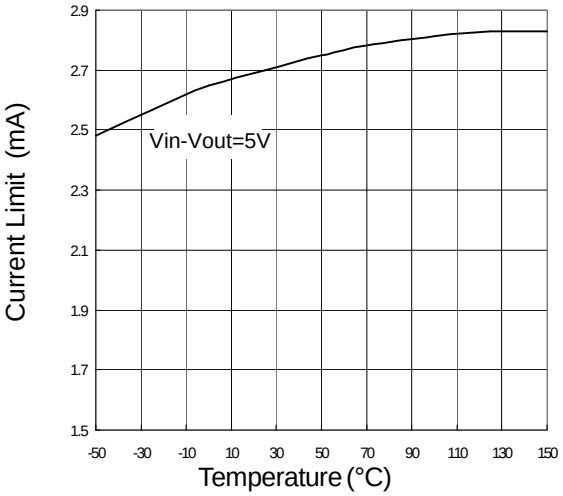
Adjustable Pin Current vs. Temperature



Input Current vs. Temperature

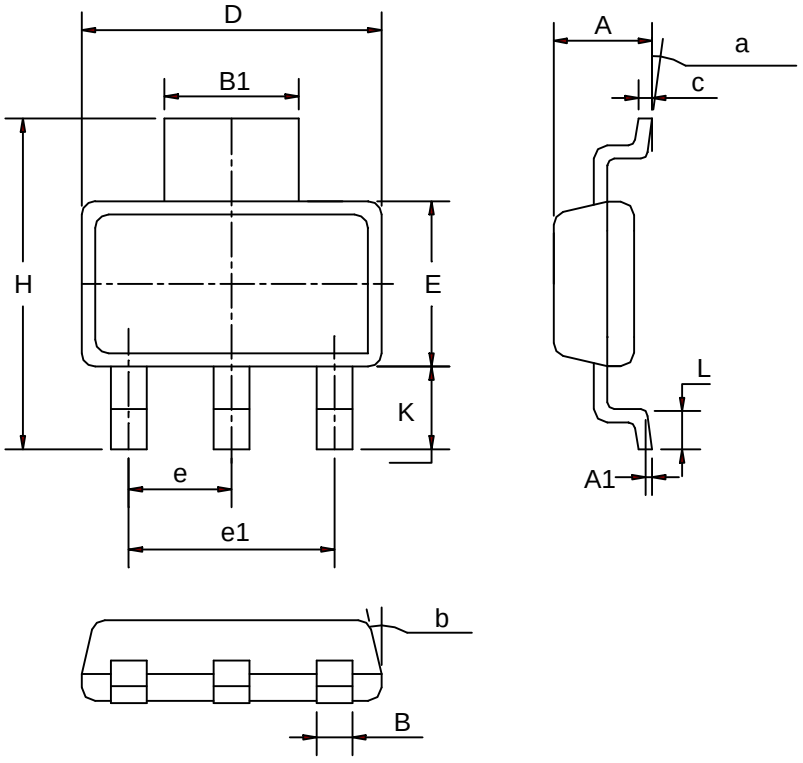


Current Limit vs. Temperature



Package Information

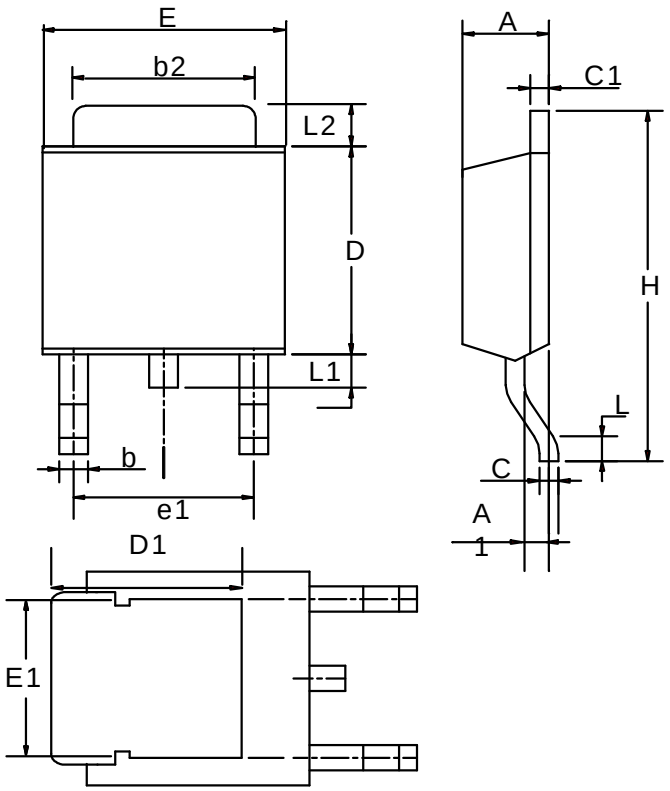
SOT-223 (Reference JEDEC Registration SOT-223)



Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	1.50	1.80	0.059	0.070
A1	0.02	0.08	0.001	0.003
B	0.60	0.80	0.023	0.031
B1	2.90	3.10	0.113	0.121
c	0.28	0.32	0.011	0.012
D	6.30	6.70	0.246	0.261
E	3.30	3.70	0.129	0.144
e	2.3 BSC		0.090 BSC	
E1	4.6 BSC		0.179 BSC	
H	6.70	7.30	0.261	0.285
L	0.91	1.10	0.035	0.043
K	1.50	2.00	0.059	0.078
α	0°	10°	0°	10°
β	13°		°13	

Package Informaion

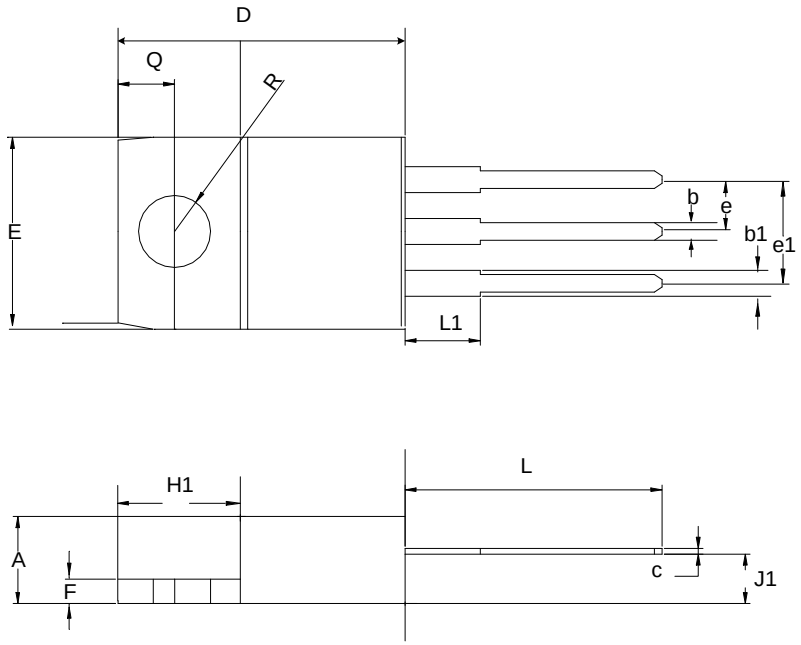
TO-252 (Reference JEDEC Registration TO-252)



Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	2.18	2.39	0.086	0.094
A1	0.89	1.27	0.035	0.050
b	0.508	0.89	0.020	0.035
b2	5.207	5.461	0.205	0.215
C	0.46	0.58	0.018	0.023
C1	0.46	0.58	0.018	0.023
D	5.334	6.22	0.210	0.245
D1	5.2 REF		0.205 REF	
E	6.35	6.73	0.250	0.265
E1	5.3 REF		0.209 REF	
e1	3.96	5.18	0.156	0.204
H	9.398	10.41	0.370	0.410
L	0.51		0.020	
L1	0.64	1.02	0.025	0.040
L2	0.89	2.032	0.035	0.080

Package Informaion

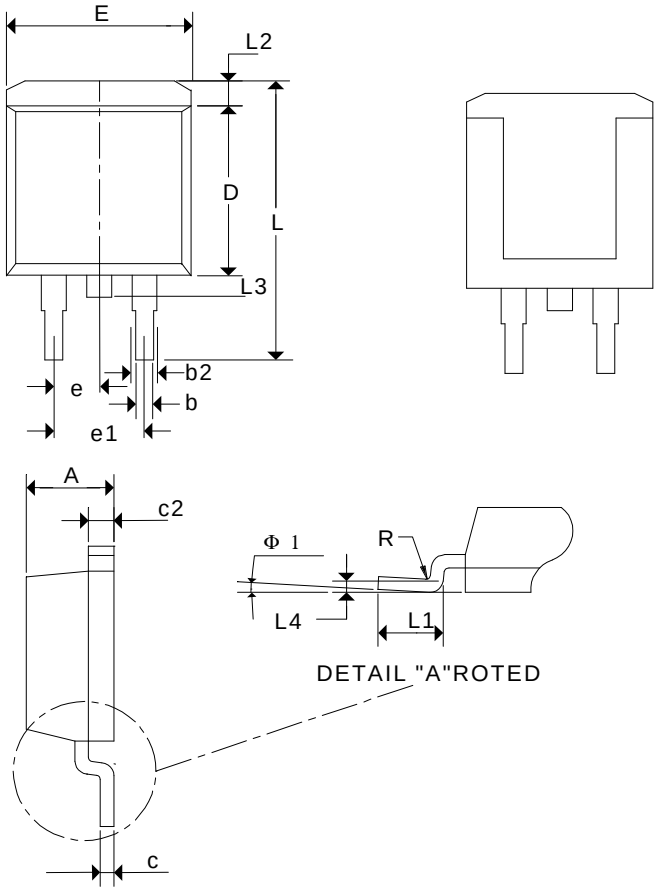
TO-220 (Reference JEDEC Registration TO-220)



Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	3.56	4.83	0.140	0.190
b1	1.14	1.78	0.045	0.070
b	0.51	1.14	0.020	0.045
c	0.31	1.14	0.012	0.045
D	14.23	16.51	0.560	0.650
e	2.29	2.79	0.090	0.110
e1	4.83	5.33	0.190	0.210
E	9.65	10.67	0.380	0.420
F	0.51	1.40	0.020	0.055
H1	5.84	6.86	0.230	0.270
J1	2.03	2.92	0.080	0.115
L	12.7	14.73	0.500	0.580
L1	3.65	6.35	0.143	0.250
R	3.53	4.09	0.139	0.161
Q	2.54	3.43	0.100	0.135

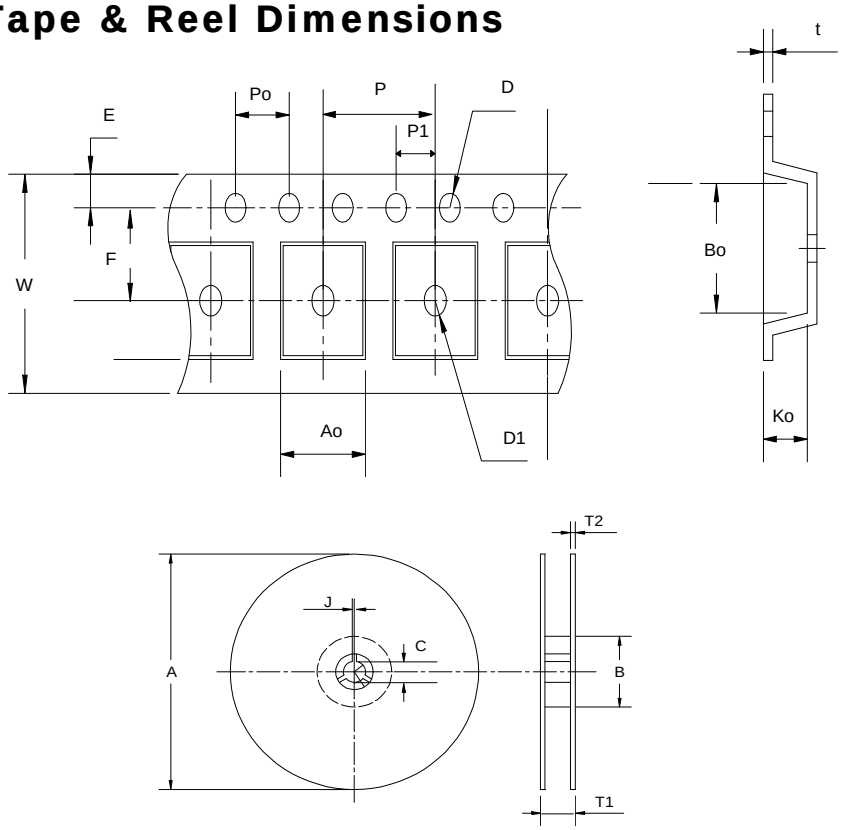
Package Informaion

TO-263 (Reference JEDEC Registration TO-263)



Dim	Millimeters		Inches	
	Min.	Max.	Min.	Max.
A	4.06	4.83	0.160	0.190
b	0.51	1.016	0.02	0.040
b2	1.14	1.651	0.045	0.065
c	0.38 TYP.		0.015 TYP.	
c2	1.14	1.40	0.045	0.055
D	8.64	9.65	0.340	0.380
e	2.54 TYP		0.100 TYP	
e1	4.83	5.33	0.190	0.210
L	14.60	15.88	0.575	0.625
L1	2.24	2.84	0.090	0.110
L2	1.02	2.92	0.040	0.112
L3	1.20	1.78	0.050	0.070

Carrier Tape & Reel Dimensions



Application	A	B	C	J	T1	T2	W	P	E
TO-252	330 ±3	100 ± 2	13 ± 0. 5	2 ± 0.5	16.4 + 0.3 -0.2	2.5± 0.5	16+ 0.3 - 0.1	8 ± 0.1	1.75± 0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	7.5 ± 0.1	1.5 +0.1	1.5± 0.25	4.0 ± 0.1	2.0 ± 0.1	6.8 ± 0.1	10.4± 0.1	2.5± 0.1	0.3±0.05
Application	A	B	C	J	T1	T2	W	P	E
TO-263	380±3	80 ± 2	13 ± 0. 5	2 ± 0.5	24 ± 4	2± 0.3	24 + 0.3 - 0.1	16 ± 0.1	1.75± 0.1
	F	D	D1	Po	P1	Ao	Bo	Ko	t
	11.5 ± 0.1	1.5 +0.1	1.5± 0.25	4.0 ± 0.1	2.0 ± 0.1	10.8 ± 0.1	16.1± 0.1	5.2± 0.1	0.35±0.013
Application	A	B	C	J	T1	T2	W	P	E
SOT-223	330±1	62±1.5	12.75± 0.15	2 ± 0.6	12.4 +0.2	2± 0.2	12 ± 0.3	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 ± 0.05	6.9 ± 0.1	7.5± 0.1	2.1± 0.1	0.3±0.05

(mm)

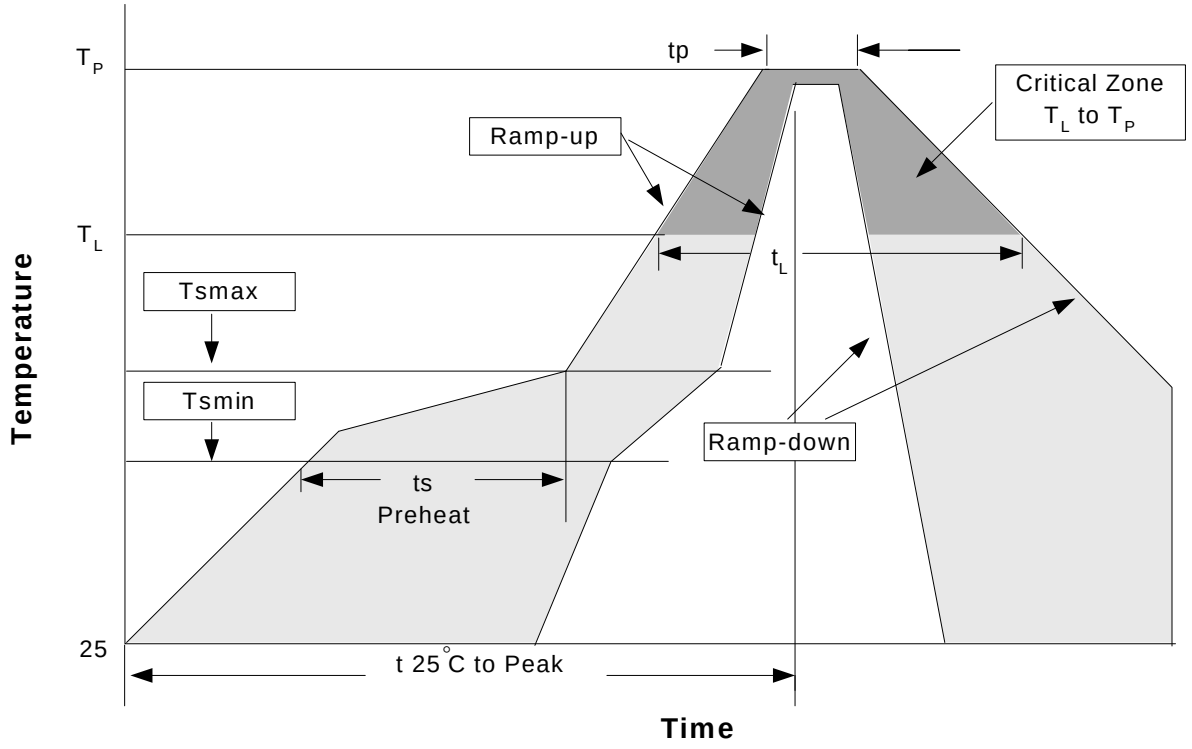
Cover Tape Dimensions

Application	Carrier Width	Cover Tape Width	Devices Per Reel
TO- 252	16	13.3	2500
TO- 263	24	21.3	1000
SOT- 223	12	9.3	2500

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
Average ramp-up rate (T_L to T_P)	3°C/second max.	3°C/second max.
Preheat - Temperature Min (Tsmin) - Temperature Max (Tsmax) - Time (min to max) (ts)	100°C 150°C 60-120 seconds	150°C 200°C 60-180 seconds
Time maintained above: - Temperature (T_L) - Time (t_L)	183°C 60-150 seconds	217°C 60-150 seconds
Peak/Classificatioon Temperature (Tp)	See table 1	See table 2
Time within 5°C of actual Peak Temperature (tp)	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.

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

Classification Reflow Profiles (Cont.)

Table 1. SnPb Entectic Process – Package Peak Reflow Temperatures

Package Thickness	Volume mm^3 <350	Volume mm^3 ³350
<2.5 mm	240 +0/-5°C	225 +0/-5°C
≥2.5 mm	225 +0/-5°C	225 +0/-5°C

Table 2. Pb-free Process – Package Classification Reflow Temperatures

Package Thickness	Volume mm^3 <350	Volume mm^3 350-2000	Volume mm^3 >2000
<1.6 mm	260 +0°C*	260 +0°C*	260 +0°C*
1.6 mm – 2.5 mm	260 +0°C*	250 +0°C*	245 +0°C*
≥2.5 mm	250 +0°C*	245 +0°C*	245 +0°C*
*Tolerance: The device manufacturer/supplier **shall** assure process compatibility up to and including the stated classification temperature (this means Peak reflow temperature +0°C. For example 260°C+0°C) at the rated MSL level.			

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, 1_{tr} > 100mA

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