RS78XX

1.0A Low Dropout Positive Voltage Regulator

General Description

The RS78XX series can provide local on-card regulation, eliminating the distribution problems associated with single point regulation. Each employs internal current limiting, thermal shut-down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

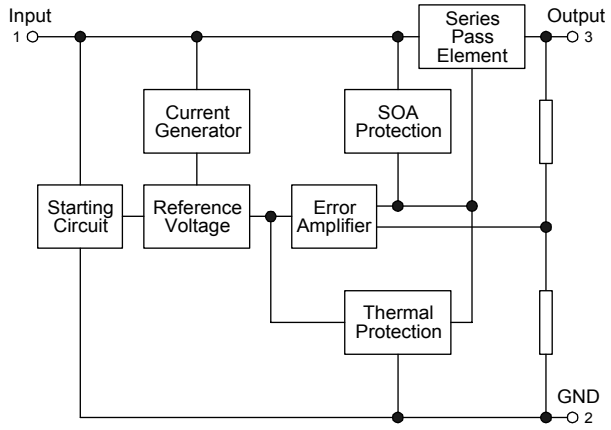
Features

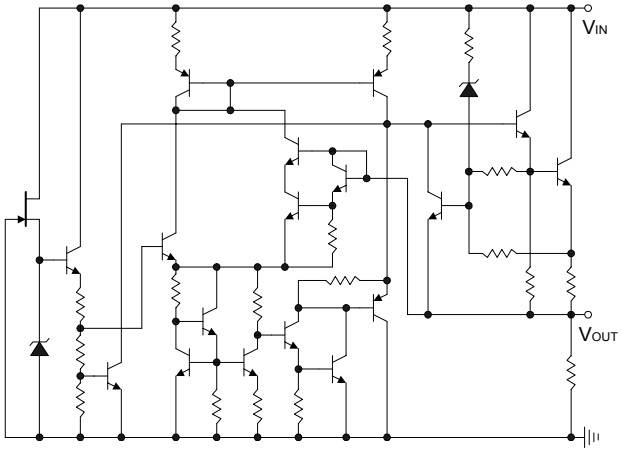
- Output Current In Excess of 1A
- Output Voltages of 5V, 6V, 8V, 9V, 12V
- Internal Short-Circuit Current Limiting & Thermal Overload Protection
- Guaranteed In Extended Temperature Range

Applications

- SCSI-2 Active Termination
- High Efficiency Linear Regulators
- 5V to 3.3V Voltage Converter
- Battery Charger
- Battery Management Circuits For Notebook And Palmtop PCs
- Core Voltage Supply: FPGA, PLD, DSP, CPU

Schematic Diagram & Equivalent Circuit



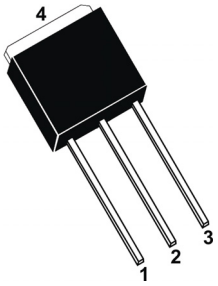


This integrated circuit can be damaged by ESD. Orister Corporation recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

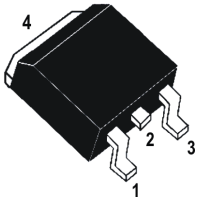
ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

Pin Assignments

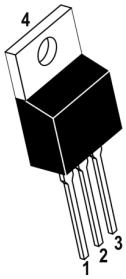
TO-251



TO-252



TO-220-3



PACKAGE	PIN	SYMBOL	DESCRIPTION
TO-251	1	VIN	Regulator Input Pin
	2, 4	GND	Ground Pin
	3	VOUT	Regulator Output Pin

PACKAGE	PIN	SYMBOL	DESCRIPTION
TO-252	1	VIN	Regulator Input Pin
	2, 4	GND	Ground Pin
	3	VOUT	Regulator Output Pin

PACKAGE	PIN	SYMBOL	DESCRIPTION
TO-220-3	1	VIN	Regulator Input Pin
	2, 4	GND	Ground Pin
	3	VOUT	Regulator Output Pin

Ordering Information

Part Number	V_{OUT}	Package
RS7805AJ	5V±0.15V	TO-252
RS7805AE	5V±0.15V	TO-220AB
RS7805AI	5V±0.15V	TO-251
RS7806AJ	6V±0.18V	TO-252
RS7806AE	6V±0.18V	TO-220AB
RS7806AI	6V±0.18V	TO-251
RS7808AJ	8V±0.24V	TO-252
RS7808AE	8V±0.24V	TO-220AB
RS7808AI	8V±0.24V	TO-251
RS7809AJ	9V±0.27V	TO-252
RS7809AE	9V±0.27V	TO-220AB
RS7809AI	9V±0.27V	TO-251
RS7812AJ	12V±0.36V	TO-252
RS7812AE	12V±0.36V	TO-220AB
RS7812AI	12V±0.36V	TO-251

Absolute Maximum Ratings

Parameter	Symbol	Maximum	Unit
Input Voltage	V_{IN}	40	V
Power Dissipation	P_D	Internally limited (Note)	W
Operating Temperature	T_{OPR}	0 to 125	°C
Storage Temperature	T_{STG}	-55 to 150	°C
Junction Temperature	T_J	150	°C

Note:
(1)T_A=25°C, TO-252 / TO-251: 1W, TO-220AB: 2.7W
(2)T_C=25°C, All package: 10W

Thermal Data

Characteristic	Symbol	TO-252 / TO-251	TO-220AB	Unit
Thermal Resistance Junction-Case	$R_{th(j-c)}$	12.5	12.5	°C/W
Thermal Resistance Junction-Ambient	$R_{th(j-a)}$	125	47	°C/W

RS7805A Series Electrical Characteristics

V_{IN}=10V, I_{OUT}=500mA, C_{IN}=0.33uF, C_{OUT}=0.1uF, 0°C≤T_J≤125°C (unless otherwise specified)

Symbol	Parameter	Conditions	RS7805AJ/E/I			Units
			Min	Typ	Max	
V_O	Output Voltage	T_J=25°C, I_{OUT}=500mA	4.85	5	5.15	V
		5mA≤I_{OUT}≤1A	4.85	5	5.15	
		7V≤V_{IN}≤25V, P_{OUT}≤15W				
ΔV_O	Line Regulation	T_J=25°C, 7V≤V_{IN}≤25V	-	3	50	mV
		T_J=25°C, 8V≤V_{IN}≤12V	-	1	25	
ΔV_O	Load Regulation	T_J=25°C, 5mA≤I_{OUT}≤1A	-	15	100	mV
		T_J=25°C, 250mA≤I_{OUT}≤750mA	-	5	50	
I_B	Quiescent Current	I_{OUT}=5mA, T_J=25°C	-	3.9	8	mA
ΔI_B	Quiescent Current Change	I_{OUT}=500mA, 7V≤V_{IN}≤25V, T_J=25°C	-	-	1.3	mA
		5mA≤I_{OUT}≤1A, V_{IN}=10V, T_J=25°C	-	-	0.5	
eN	Output Noise Voltage	B=10Hz~100KHz, I_{OUT}=50mA, T_J=25°C	-	50	-	uV/V_O
RR	Ripple Rejection	10V≤V_{IN}≤18V, f=120Hz, I_{OUT}=50mA, T_J=25°C	57	73	-	dB
V_D	Dropout Voltage	T_J=25°C, I_{OUT}=1A	-	2	2.5	V
R_O	Output Resistance	f=1KHz	-	17	-	mΩ
I_{SC}	Short Circuit Current	T_J=25°C	-	2.3	2.8	A
$\Delta V_O/\Delta T$	Output Voltage Drift	0°C≤T_J≤125°C	-	-	0.6	mV/°C

RS7806A Series Electrical Characteristics

V_{IN}=11V, I_{OUT}=500mA, C_{IN}=0.33uF, C_{OUT}=0.1uF, 0°C≤T_J≤125°C (unless otherwise specified)

Symbol	Parameter	Conditions	RS7806AJ/E/I			Units
			Min	Typ	Max	
V_O	Output Voltage	T_J=25°C, I_{OUT}=500mA	5.82	6	6.18	V
		5mA≤I_{OUT}≤1A	5.82	6	6.18	
		8V≤V_{IN}≤25V, P_{OUT}≤15W				
ΔV_O	Line Regulation	T_J=25°C, 8V≤V_{IN}≤25V	-	3	60	mV
		T_J=25°C, 9V≤V_{IN}≤13V	-	1	25	
ΔV_O	Load Regulation	T_J=25°C, 5mA≤I_{OUT}≤1A	-	15	100	mV
		T_J=25°C, 250mA≤I_{OUT}≤750mA	-	5	50	
I_B	Quiescent Current	I_{OUT}=5mA, T_J=25°C	-	3.9	8	mA
ΔI_B	Quiescent Current Change	I_{OUT}=500mA, 9V≤V_{IN}≤25V, T_J=25°C	-	-	1.3	mA
		5mA≤I_{OUT}≤1A, V_{IN}=11V, T_J=25°C	-	-	0.5	
eN	Output Noise Voltage	B=10Hz~100KHz, I_{OUT}=50mA, T_J=25°C	-	-	55	uV/V_O
RR	Ripple Rejection	11V≤V_{IN}≤19V, f=120Hz, I_{OUT}=50mA, T_J=25°C	56	72	-	dB
V_D	Dropout Voltage	T_J=25°C, I_{OUT}=1A	-	2	2.5	V
R_O	Output Resistance	f=1KHz	-	17	-	mΩ
I_{SC}	Short Circuit Current	V_{IN}=45V, T_J=25°C	-	2.3	2.8	A
$\Delta V_O/\Delta T$	Output Voltage Drift	0°C≤T_J≤125°C	-	-	0.7	mV/°C

RS7808A Series Electrical Characteristics

V_{IN}=14V, I_{OUT}=500mA, C_{IN}=0.33uF, C_{OUT}=0.1uF, 0°C≤T_J≤125°C (unless otherwise specified)

Symbol	Parameter	Conditions	RS7808AJ/E/I			Units
			Min	Typ	Max	
V_O	Output Voltage	T_J=25°C, I_{OUT}=500mA	7.76	8	8.24	V
		5mA≤I_{OUT}≤1A	7.76	8	8.24	
		10V≤V_{IN}≤25V, P_{OUT}≤15W				
ΔV_O	Line Regulation	T_J=25°C, 10.5V≤V_{IN}≤25V	-	3	80	mV
		T_J=25°C, 11V≤V_{IN}≤17V	-	1	40	
ΔV_O	Load Regulation	T_J=25°C, 5mA≤I_{OUT}≤1A	-	15	100	mV
		T_J=25°C, 250mA≤I_{OUT}≤750mA	-	5	50	
I_B	Quiescent Current	I_{OUT}=5mA, T_J=25°C	-	3.9	8	mA
ΔI_B	Quiescent Current Change	I_{OUT}=500mA, 10.5V≤V_{IN}≤25V, T_J=25°C	-	-	1.3	mA
		5mA≤I_{OUT}≤1A, V_{IN}=14V, T_J=25°C	-	-	0.5	
eN	Output Noise Voltage	B=10Hz~100KHz, I_{OUT}=50mA, T_J=25°C	-	-	70	uV/V_O
RR	Ripple Rejection	14V≤V_{IN}≤21.5V, f=120Hz, I_{OUT}=50mA, T_J=25°C	53	69	-	dB
V_D	Dropout Voltage	T_J=25°C, I_{OUT}=1A	-	2	2.5	V
R_O	Output Resistance	f=1KHz	-	17	-	mΩ
I_{SC}	Short Circuit Current	T_J=25°C	-	2.3	2.8	A
$\Delta V_O/\Delta T$	Output Voltage Drift	0°C≤T_J≤125°C	-	-	1	mV/°C

RS7809A Series Electrical Characteristics

V_{IN}=15V, I_{OUT}=500mA, C_{IN}=0.33uF, C_{OUT}=0.1uF, 0°C≤T_J≤125°C (unless otherwise specified)

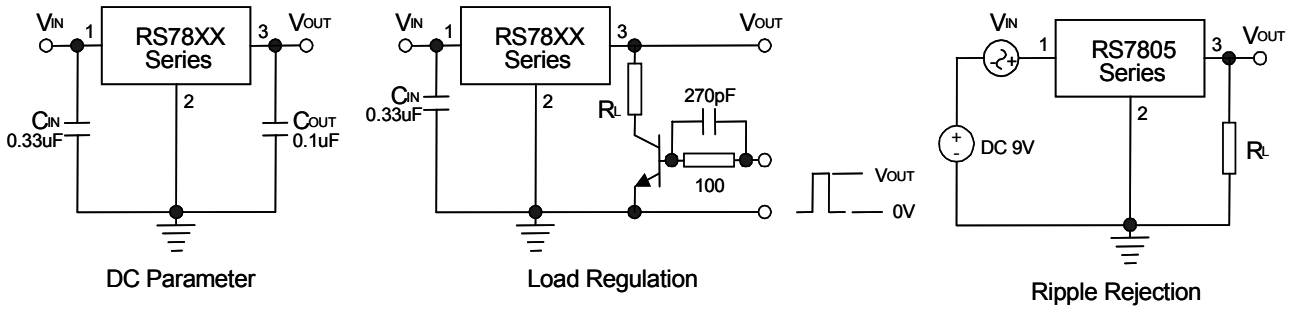
Symbol	Parameter	Conditions	RS7809AJ/E/I			Units
			Min	Typ	Max	
V_O	Output Voltage	T_J=25°C, I_{OUT}=500mA	8.73	9	9.27	V
		5mA≤I_{OUT}≤1A	8.73	9	9.27	
		11V≤V_{IN}≤25V, P_{OUT}≤15W				
ΔV_O	Line Regulation	T_J=25°C, 11.5V≤V_{IN}≤25V	-	3	90	mV
		T_J=25°C, 13V≤V_{IN}≤19V	-	1	45	
ΔV_O	Load Regulation	T_J=25°C, 5mA≤I_{OUT}≤1A	-	15	100	mV
		T_J=25°C, 250mA≤I_{OUT}≤750mA	-	5	50	
I_B	Quiescent Current	I_{OUT}=5mA, T_J=25°C	-	3.9	8	mA
ΔI_B	Quiescent Current Change	I_{OUT}=500mA, 11.5V≤V_{IN}≤26V, T_J=25°C	-	-	1.3	mA
		5mA≤I_{OUT}≤1A, V_{IN}=15V, T_J=25°C	-	-	0.5	
eN	Output Noise Voltage	B=10Hz~100KHz, I_{OUT}=50mA, T_J=25°C	-	-	75	uV/V_O
RR	Ripple Rejection	15V≤V_{IN}≤22.5V, f=120Hz, I_{OUT}=50mA, T_J=25°C	51	67	-	dB
V_D	Dropout Voltage	T_J=25°C, I_{OUT}=1A	-	2	2.5	V
R_O	Output Resistance	f=1KHz	-	17	-	mΩ
I_{SC}	Short Circuit Current	T_J=25°C	-	2.3	2.8	A
$\Delta V_O/\Delta T$	Output Voltage Drift	0°C≤T_J≤125°C	-	-	1.1	mV/°C

RS7812A Series Electrical Characteristics

V_{IN}=19V, I_{OUT}=500mA, C_{IN}=0.33uF, C_{OUT}=0.1uF, 0°C≤T_J≤125°C (unless otherwise specified)

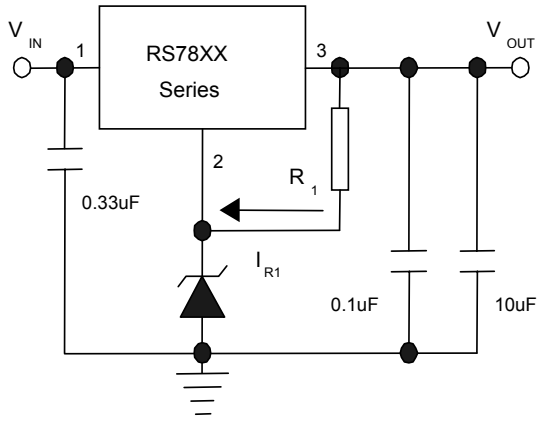
Symbol	Parameter	Conditions	RS7812AJ/E/I			Units
			Min	Typ	Max	
V_O	Output Voltage	T_J=25°C, I_{OUT}=500mA	11.64	12	12.36	V
		5mA≤I_{OUT}≤1A	11.64	12	12.36	
		14V≤V_{IN}≤30V, P_{OUT}≤15W				
ΔV_O	Line Regulation	T_J=25°C, 14.5V≤V_{IN}≤30V	-	10	120	mV
		T_J=25°C, 16V≤V_{IN}≤22V	-	3	60	
ΔV_O	Load Regulation	T_J=25°C, 5mA≤I_{OUT}≤1A	-	12	100	mV
		T_J=25°C, 250mA≤I_{OUT}≤750mA	-	4	60	
I_B	Quiescent Current	I_{OUT}=5mA, T_J=25°C	-	3.9	8	mA
ΔI_B	Quiescent Current Change	I_{OUT}=500mA, 14.5V≤V_{IN}≤30V, T_J=25°C	-	-	1.3	mA
		5mA≤I_{OUT}≤1A, V_{IN}=19V, T_J=25°C	-	-	0.5	
eN	Output Noise Voltage	B=10Hz~100KHz, I_{OUT}=50mA, T_J=25°C	-	-	90	uV/V_O
RR	Ripple Rejection	19V≤V_{IN}≤25V, f=120Hz, I_{OUT}=50mA, T_J=25°C	50	66	-	dB
V_D	Dropout Voltage	T_J=25°C, I_{OUT}=1A	-	2	2.5	V
R_O	Output Resistance	f=1KHz	-	18	-	mΩ
I_{SC}	Short Circuit Current	T_J=25°C	-	2.3	2.8	A
$\Delta V_O/\Delta T$	Output Voltage Drift	0°C≤T_J≤125°C	-	-	1.6	mV/°C

Test Circuits



Application Circuits

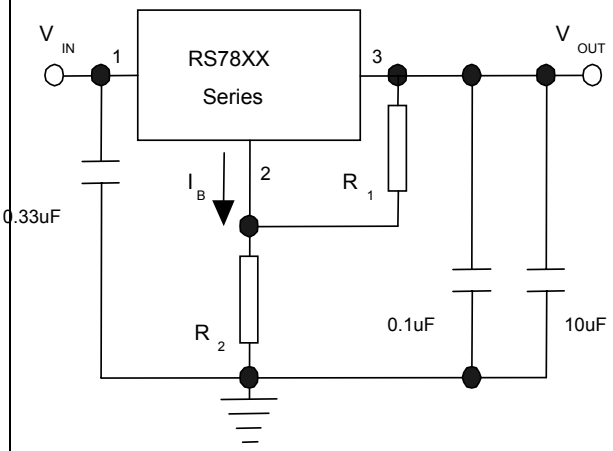
Constant Current Regulator



$V_{OUT}=V_{OUT(IC)}+V_Z$

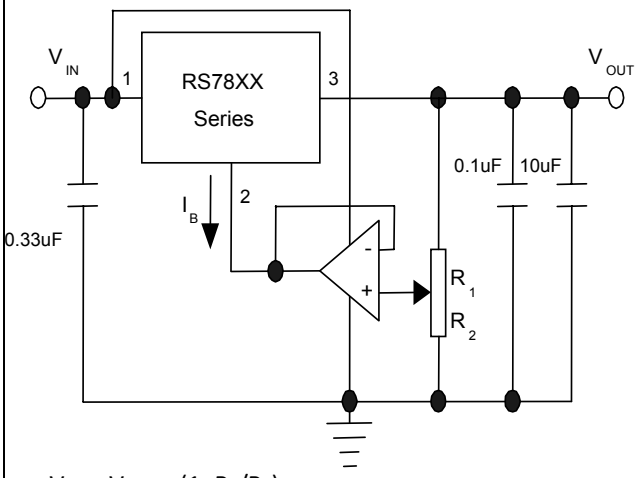
$I_1=V_{OUT(IC)}/R_1$

Circuit for Increasing Output Voltage



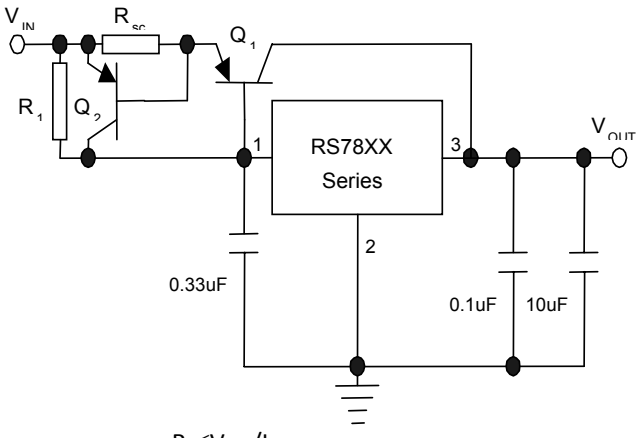
$V_{OUT}=V_{OUT(IC)}(1+R_2/R_1)+R_2*I_B$

Adjustable Output Regulator



$V_{OUT}=V_{OUT(IC)}(1+R_2/R_1)$

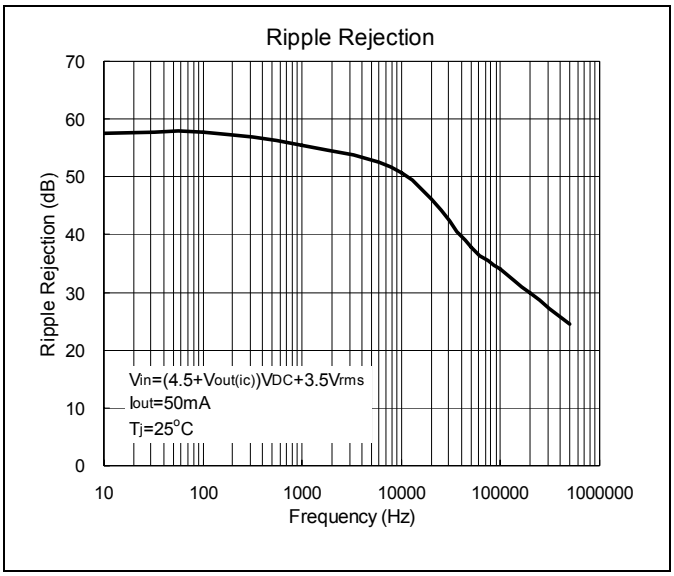
High Output Current with Short-circuit Protection

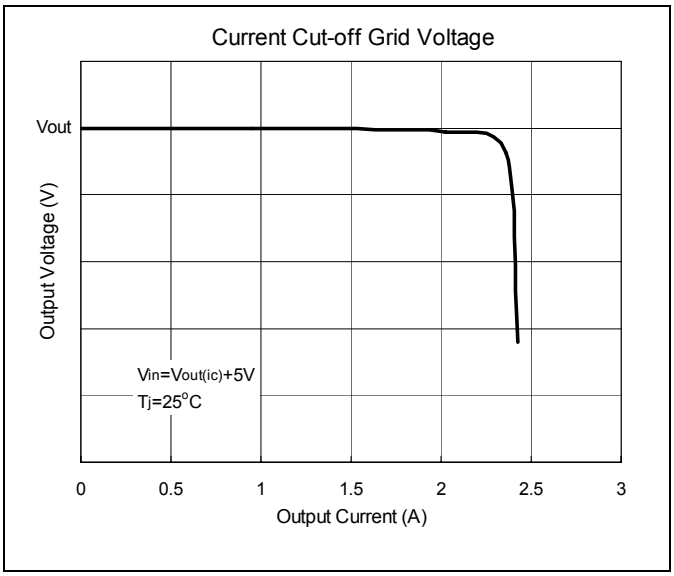


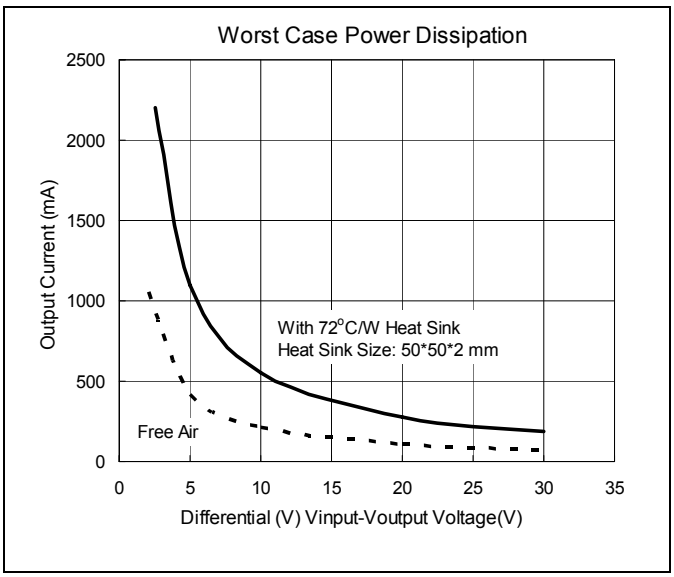
$R_1 \le V_{BE1}/I_{B(max)}$

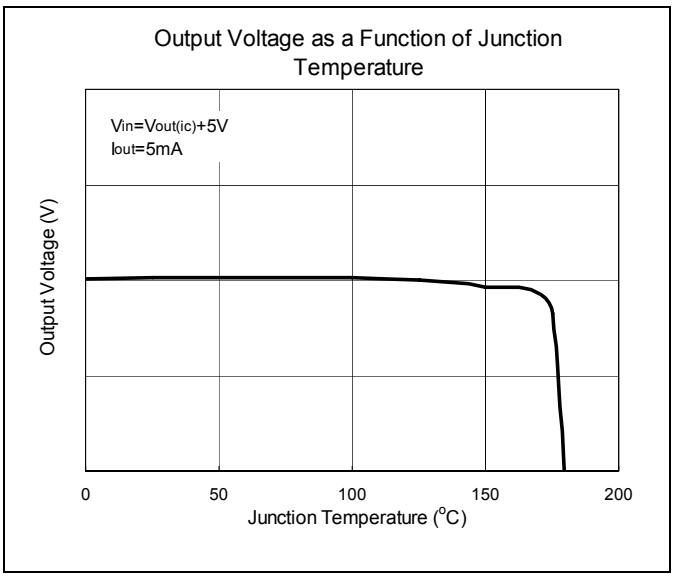
$R_{SC}=V_{BE2}/I_{SC}$, I_{SC}: Short-Circuit Current

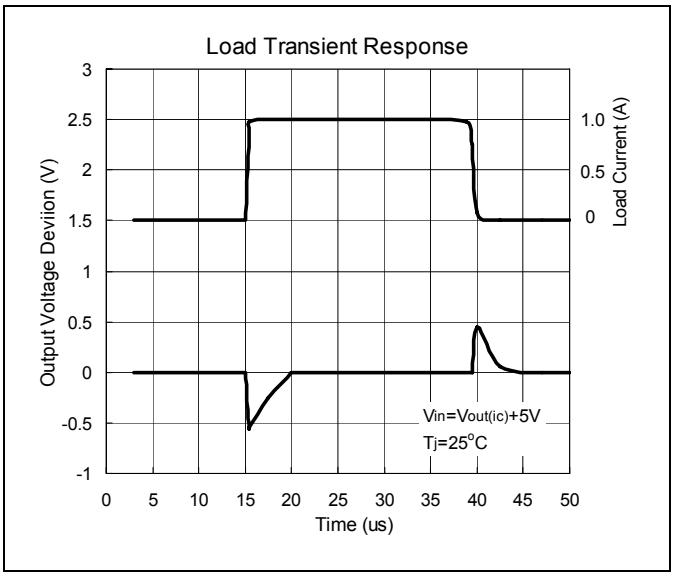
Characteristics Curve

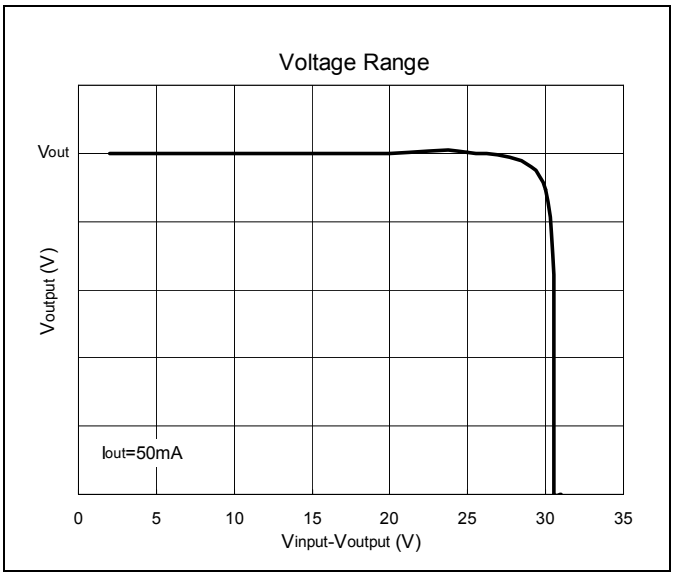




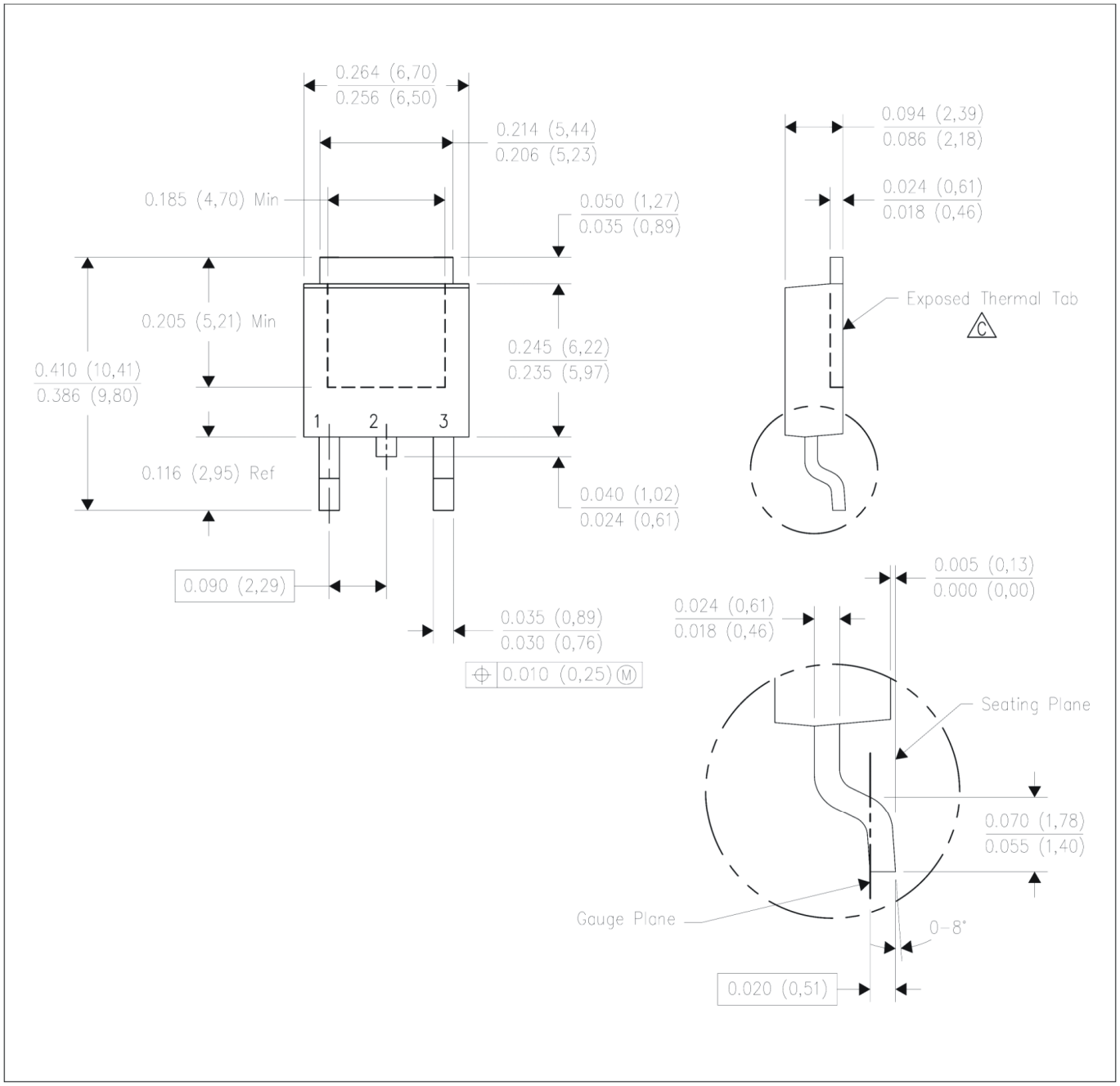








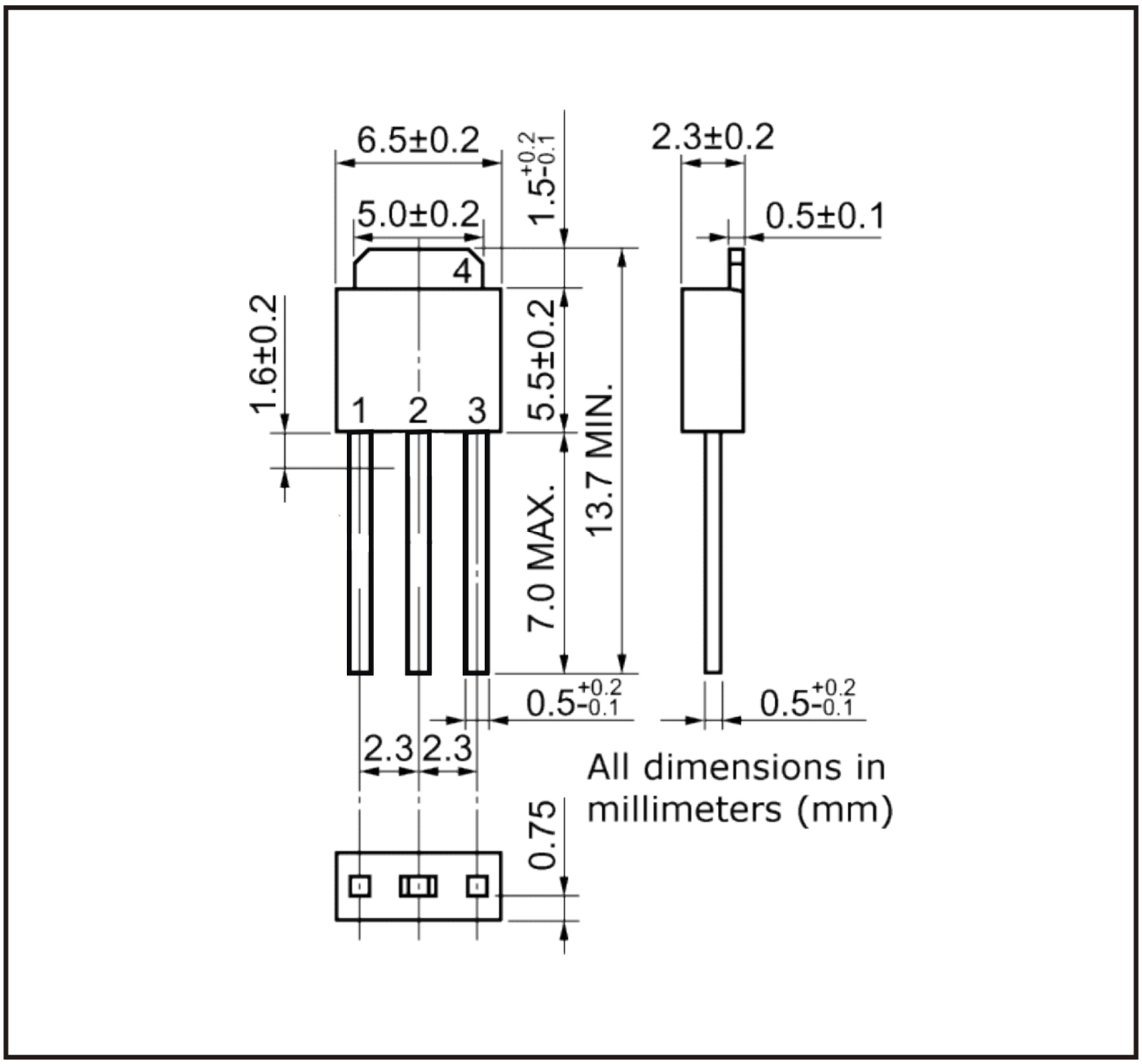
TO-252 Dimension



NOTES:

A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. The center lead is in electrical contact with the tab.
D. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
E. Thermal pad contour optional within these dimensions.
F. Falls within JEDEC TO-252 variation AA.

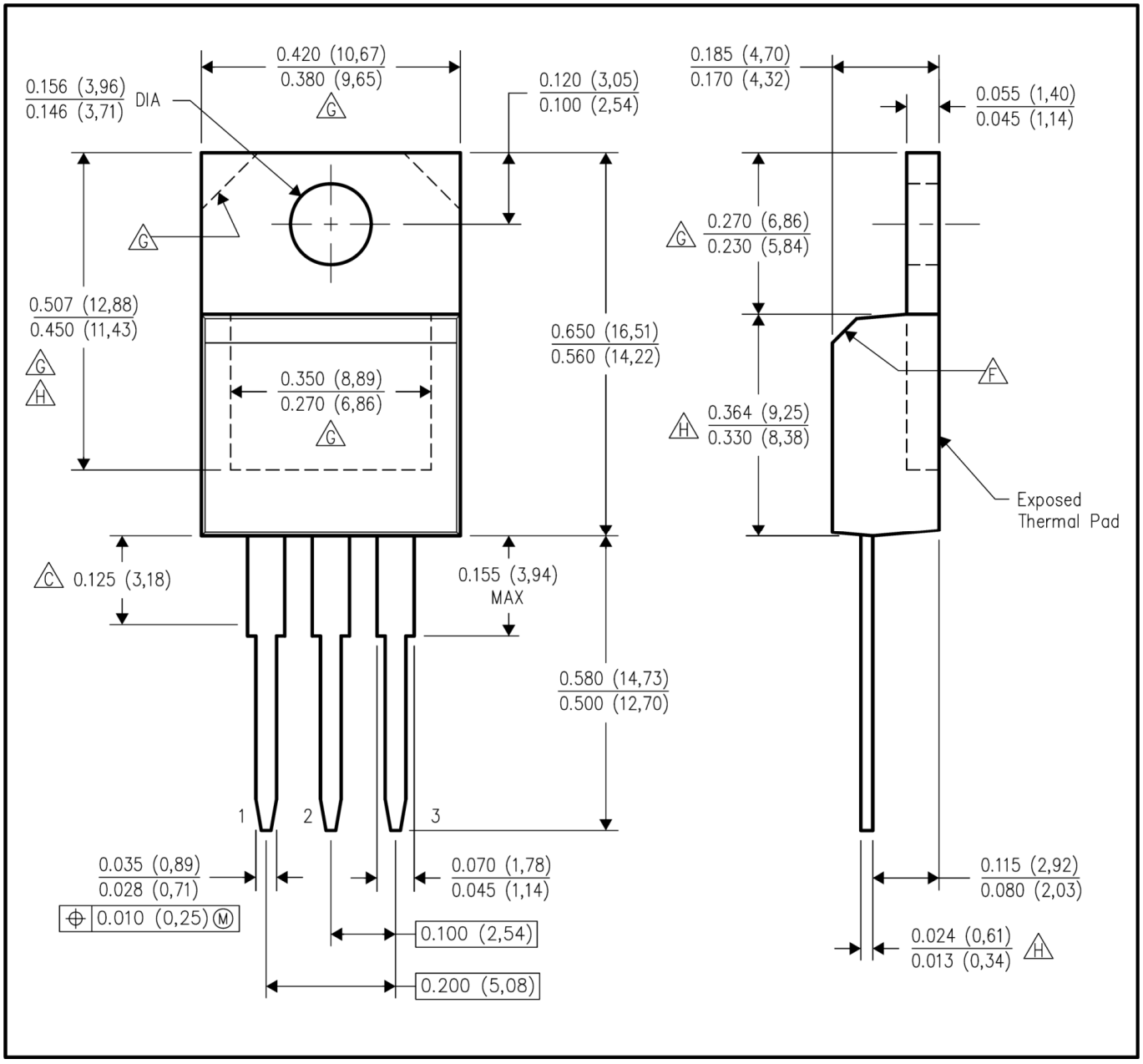
TO-251 Dimension



NOTES:

G. All linear dimensions are in inches (millimeters).
H. This drawing is subject to change without notice.
I. The center lead is in electrical contact with the tab.
J. Body dimensions do not include mold flash or protrusion. Mold flash and protrusion shall not exceed 0.15 per side.
K. Thermal pad contour optional within these dimensions.
L. Falls within JEDEC TO-251 variation AA.

TO-220-3 Dimension



NOTES:

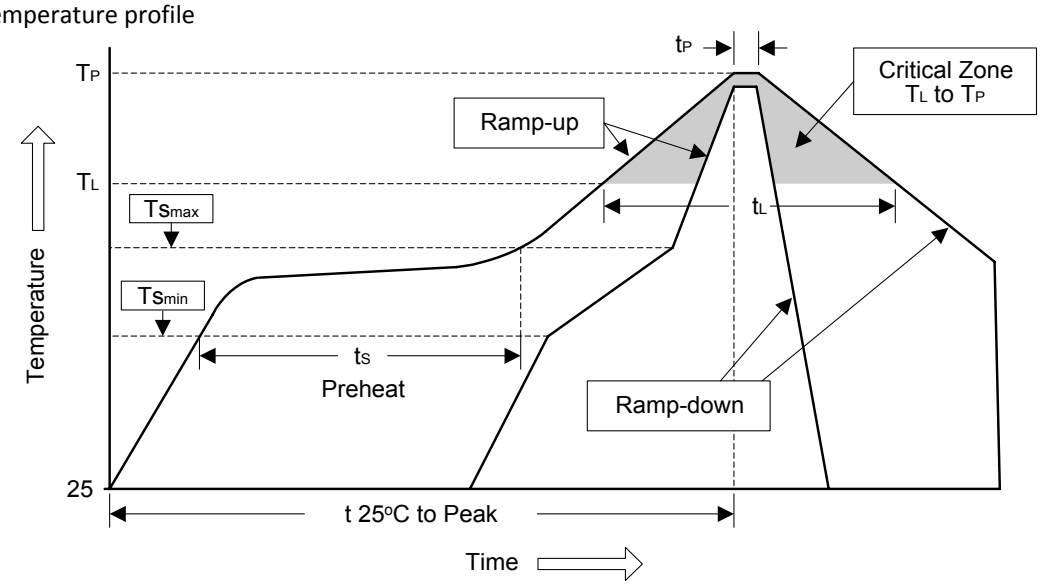
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. All lead dimensions apply before solder dip.
E. The center lead is in electrical contact with the tab.
F. The chamfer is optional.
G. Thermal pad contour optional within these dimensions.
H. Falls within JEDEC TO-220 variation AB. Except minimum lead thickness, minimum exposed pad length, and maximum body length.

Soldering Methods for Orister's Products

1. Storage environment: Temperature=10°C~35°C Humidity=65%±15%

2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	<3°C/sec	<3°C/sec
Preheat - Temperature Min (Ts_{min}) - Temperature Max (Ts_{max}) - Time (min to max) (ts)	 100°C 150°C 60~120 sec	 150°C 200°C 60~180 sec
Tsmax to T_L - Ramp-up Rate	 <3°C/sec	 <3°C/sec
Time maintained above: - Temperature (T_L) - Time (t_L)	 183°C 60~150 sec	 217°C 60~150 sec
Peak Temperature (T_P)	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature (t_P)	10~30 sec	20~40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<8 minutes

3. Flow (wave) soldering (solder dipping)

Products	Peak temperature	Dipping time
Pb devices.	245°C ±5°C	5sec ±1sec
Pb-Free devices.	260°C +0/-5°C	5sec ±1sec

Important Notice: