

BM78XX BM78xx---BM78D05

3-TERMINAL POSITIVE VOLTAGE REGULATORS

Features

- Maximum Output Current of 1000mA ($T_c=25^\circ\text{C}$)
- Internal Short-Circuit Current Limiting
- Internal Thermal Overload Protection
- 3% Output Tolerance
- TO252 Package

Applications

- LCD-TV tuner
- Car electronics

Description

BM78XX regulators employ internal current-limiting and thermal-shutdown, making them essentially indestructible. They can deliver up to 1000mA output current.

BM7805 can continuously output 1.0A when +8V input

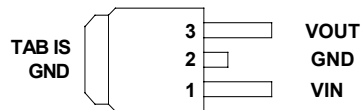
BM78D05 can continuously output 0.75A when +8V input.

BM7805 can continuously output 0.5A when +12V input

BM78D05 can continuously output 0.37A when +12V input

Pin Assignment

TO-252 FRONT VIEW



Ordering Information

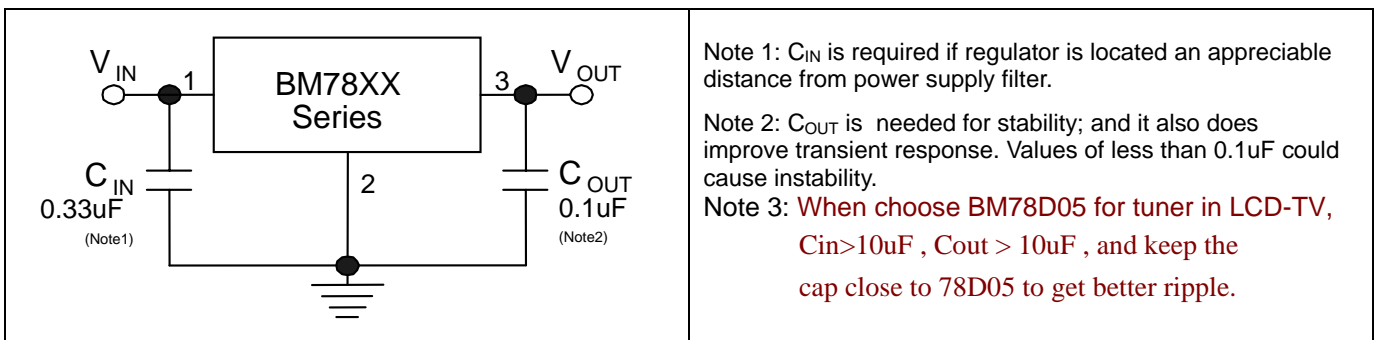
BM78xxAS	1A	input volage up to +36V
BM78D05	0.75A	+18V

Note: XX: Voltage Output. 05(5V); 08(8V), 09(9V), 12(12V)

BM78xxAS, the marking is AS78XX, in datacode, it is BMabcdef(ab=year, cd=weeks, ef=producing number)

BM78D05, the marking is 78D05, in datacode, it is same as above.

Typical Application



BM78XX

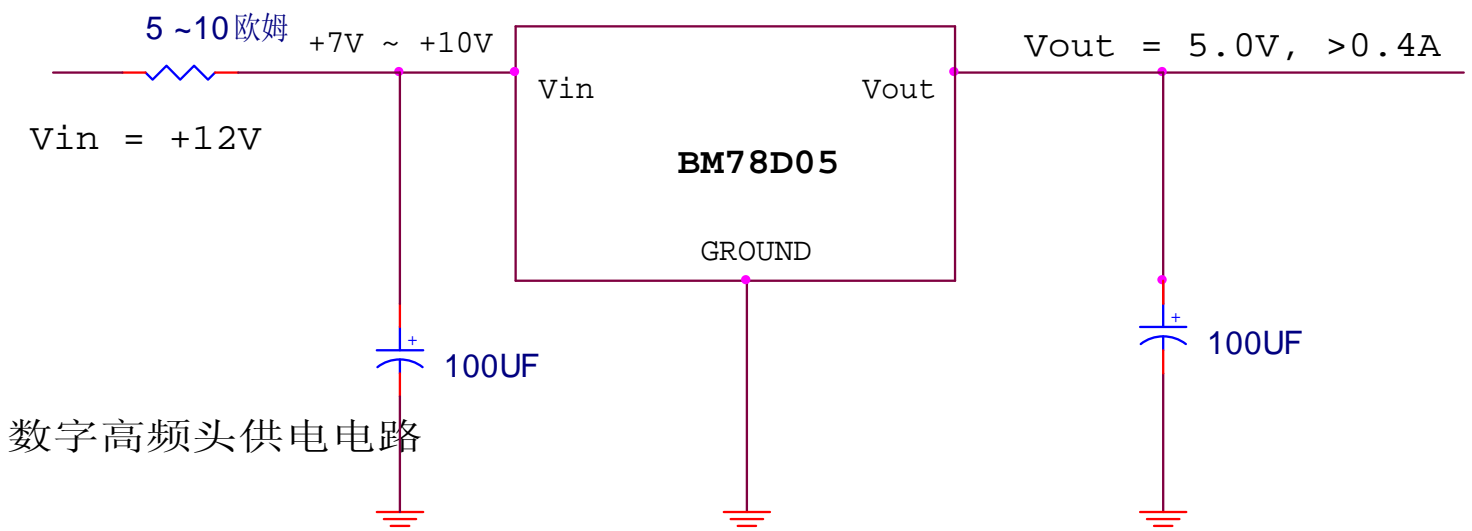
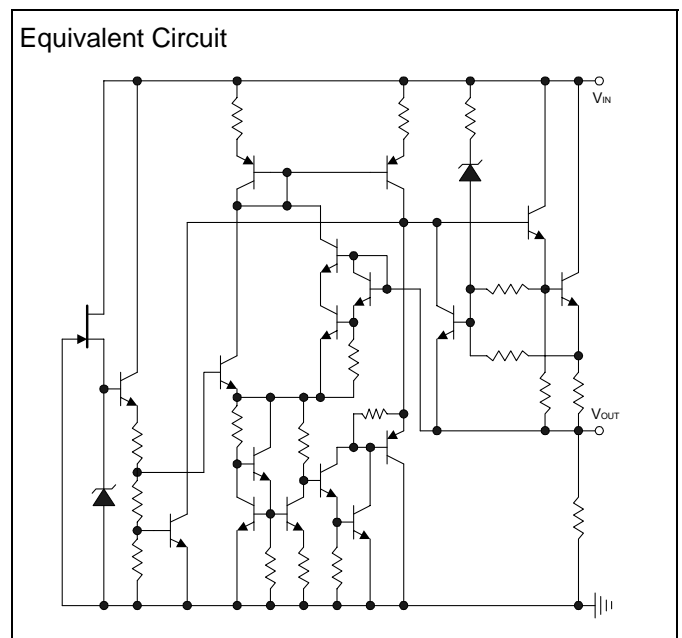
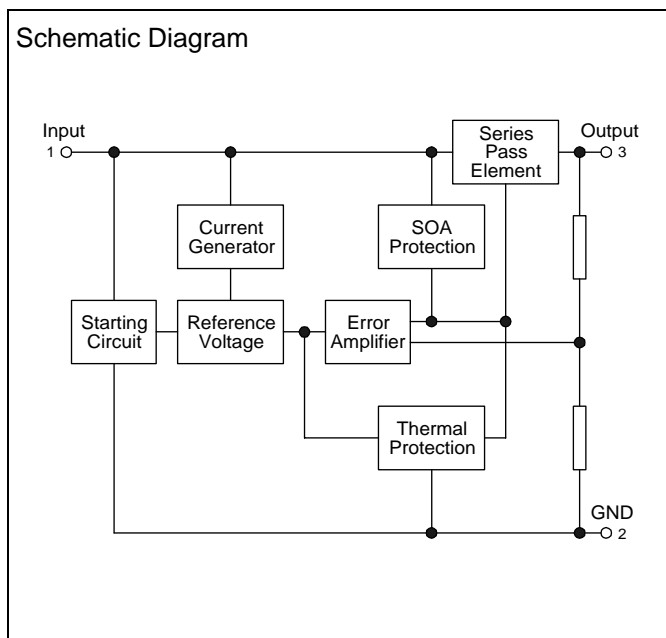
3-TERMINAL POSITIVE VOLTAGE REGULATORS

Absolute Maximum Ratings

($T_a=25^{\circ}\text{C}$, Unless Otherwise Specified)

Characteristic	Symbol	Rating	Unit
Input Voltage	V_{IN}	+37/+20V	V
Power Dissipation	P_D	TO252 3.50	W
Operating Temperature	T_{opr}	-20 to 85	$^{\circ}\text{C}$
Storage Temperature	T_{stg}	-55 to 150	$^{\circ}\text{C}$
Junction Temperature	T_j	150	$^{\circ}\text{C}$
Thermal Resistance	$R_{th(j-a)}$	208	$^{\circ}\text{C/W}$

Schematic Diagram & Equivalent Circuit



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3-TERMINAL POSITIVE VOLTAGE REGULATORS

BM7805/78D05 Electrical Characteristics

$V_{IN}=10V$, $I_{OUT}=40mA$, $C_{IN}=0.33\mu F/10\mu F$, $C_{OUT}=0.1\mu F/10\mu F$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$

Symbol	Parameter	Conditions	BM7805/78D05			Units
			Min	Typ	Max	
V_O	Output Voltage	$T_j=25^{\circ}C$	4.85	5	5.15	V
		$1mA \leq I_{OUT} \leq 800mA$	4.85	5	5.15	
		$7V \leq V_{IN} \leq 18V$, $1mA \leq I_{OUT} \leq 40mA$				
Reg_{line}	Line Regulation	$T_j=25^{\circ}C$, $7V \leq V_{IN} \leq 18V$	-	15	150	mV
		$T_j=25^{\circ}C$, $8V \leq V_{IN} \leq 18V$	-	15	100	
Reg_{load}	Load Regulation	$T_j=25^{\circ}C$, $1mA \leq I_{OUT} \leq 500mA$	-	11	60	mV
		$T_j=25^{\circ}C$, $1mA \leq I_{OUT} \leq 40mA$	-	5	30	
I_B	Quiescent Current	$I_{OUT}=5mA$, $T_j=25^{\circ}C$	-	8/0.08	10/0.1	mA
ΔI_B	Quiescent Current Change	$8V \leq V_{IN} \leq 18V$, $T_j=25^{\circ}C$	-	-	1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$, $T_j=25^{\circ}C$	-	-	0.1	
V_N	Output Noise Voltage	$10Hz \leq f \leq 100KHz$, $T_j=25^{\circ}C$	-	40	-	μV_{rms}
RR	Ripple Rejection	$8V \leq V_{IN} \leq 18V$, $f=120Hz$, $T_j=25^{\circ}C$	41	49	-	dB
V_D	Dropout Voltage	$T_j=25^{\circ}C$, $I_{OUT}=100mA$	1.7/0.4		2.5/0.8	V
R_O	Output Resistance	$f=1KHz$	-	17	-	$m\Omega$
I_{SC}	Short Circuit Current	$V_{IN}=10V$, $T_j=25^{\circ}C$	-	1.5	2	A
T_{CVO}	Average Temperature Coefficient of Output Voltage	$I_{OUT}=5mA$	-	-	0.6	$mV/^{\circ}C$

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BM7808 Electrical Characteristics

$V_{IN}=14V$, $I_{OUT}=40mA$, $C_{IN}=0.33\mu F$, $C_{OUT}=0.1\mu F$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$ (unless otherwise specified)

Symbol	Parameter	Conditions	BM7808			Units
			Min	Typ	Max	
V_O	Output Voltage	$T_j=25^{\circ}C$	7.8	8	8.25	V
		$1mA \leq I_{OUT} \leq 1000mA$	7.8	8	8.25	
		$10.5V \leq V_{IN} \leq 23V$, $1mA \leq I_{OUT} \leq 40mA$				
Reg_{line}	Line Regulation	$T_j=25^{\circ}C$, $10.5V \leq V_{IN} \leq 23V$	-	20	175	mV
		$T_j=25^{\circ}C$, $11V \leq V_{IN} \leq 23V$	-	20	125	
Reg_{load}	Load Regulation	$T_j=25^{\circ}C$, $1mA \leq I_{OUT} \leq 500mA$	-	15	80	mV
		$T_j=25^{\circ}C$, $1mA \leq I_{OUT} \leq 40mA$	-	7	40	
I_B	Quiescent Current	$I_{OUT}=5mA$, $T_j=25^{\circ}C$	-	3.9	6	mA
ΔI_B	Quiescent Current Change	$11V \leq V_{IN} \leq 23V$, $T_j=25^{\circ}C$	-	-	1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$, $T_j=25^{\circ}C$	-	-	0.1	
V_N	Output Noise Voltage	$10Hz \leq f \leq 100KHz$, $T_j=25^{\circ}C$	-	60	-	μV_{rms}
RR	Ripple Rejection	$12V \leq V_{IN} \leq 23V$, $f=120Hz$, $T_j=25^{\circ}C$	37	45	-	dB
V_D	Dropout Voltage	$T_j=25^{\circ}C$, $I_{OUT}=100mA$	-	1.7	2.5	V
R_O	Output Resistance	$f=1KHz$	-	17	-	$m\Omega$
I_{SC}	Short Circuit Current	$T_j=25^{\circ}C$	-	1.5	2	A
T_{CVO}	Average Temperature Coefficient of Output Voltage	$I_{OUT}=5mA$	-	-	0.9	$mV/^{\circ}C$

BM7809 Electrical Characteristics

$V_{IN}=15V$, $I_{OUT}=40mA$, $C_{IN}=0.33\mu F$, $C_{OUT}=0.1\mu F$, $0^{\circ}C \leq T_j \leq 125^{\circ}C$ (unless otherwise specified)

Symbol	Parameter	Conditions	BM7809			Units
			Min	Typ	Max	
V_O	Output Voltage	$T_j=25^{\circ}C$	8.70	9	9.30	V
		$1mA \leq I_{OUT} \leq 500mA$	8.70	9	9.30	
		$11.4V \leq V_{IN} \leq 24V$, $1mA \leq I_{OUT} \leq 40mA$				
Reg_{line}	Line Regulation	$T_j=25^{\circ}C$, $11.4V \leq V_{IN} \leq 24V$	-	80	200	mV
		$T_j=25^{\circ}C$, $12V \leq V_{IN} \leq 24V$	-	20	160	
Reg_{load}	Load Regulation	$T_j=25^{\circ}C$, $1mA \leq I_{OUT} \leq 500mA$	-	17	90	mV
		$T_j=25^{\circ}C$, $1mA \leq I_{OUT} \leq 40mA$	-	8	45	
I_B	Quiescent Current	$I_{OUT}=5mA$, $T_j=25^{\circ}C$	-	3.9	6	mA
ΔI_B	Quiescent Current Change	$12V \leq V_{IN} \leq 24V$, $T_j=25^{\circ}C$	-	-	1.5	mA
		$1mA \leq I_{OUT} \leq 40mA$, $T_j=25^{\circ}C$	-	-	0.1	
V_N	Output Noise Voltage	$10Hz \leq f \leq 100KHz$, $T_j=25^{\circ}C$	-	65	-	μV_{rms}
RR	Ripple Rejection	$12V \leq V_{IN} \leq 24V$, $f=120Hz$, $T_j=25^{\circ}C$	36	44	-	dB
V_D	Dropout Voltage	$T_j=25^{\circ}C$, $I_{OUT}=100mA$	-	1.7	2.5	V
R_O	Output Resistance	$f=1KHz$	-	17	-	$m\Omega$

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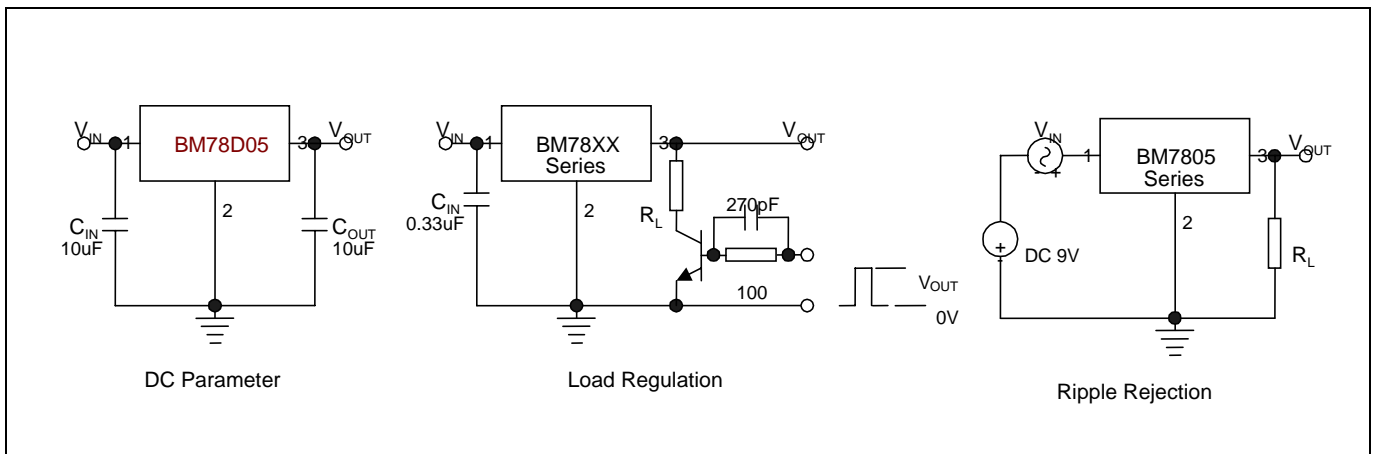
I_{SC}	Short Circuit Current	$T_j=25^\circ\text{C}$	-	1.5	2	A
T_{CVO}	Average Temperature Coefficient of Output Voltage	$I_{OUT}=5\text{mA}$	-	-	1	mV/°C

BM7812 Electrical Characteristics

$V_{IN}=19\text{V}$, $I_{OUT}=40\text{mA}$, $C_{IN}=0.33\mu\text{F}$, $C_{OUT}=0.1\mu\text{F}$, $0^\circ\text{C}\leq T_j\leq 125^\circ\text{C}$ (unless otherwise specified)

Symbol	Parameter	Conditions	BM7812			Units
			Min	Typ	Max	
V_O	Output Voltage	$T_j=25^\circ\text{C}$	11.5	12	12.5	V
		$1\text{mA}\leq I_{OUT}\leq 500\text{mA}$	11.5	12	12.5	
		$14.5\text{V}\leq V_{IN}\leq 27\text{V}$, $1\text{mA}\leq I_{OUT}\leq 40\text{mA}$	11.5	12	12.5	
Reg_{line}	Line Regulation	$T_j=25^\circ\text{C}$, $14.5\text{V}\leq V_{IN}\leq 27\text{V}$	-	120	250	mV
		$T_j=25^\circ\text{C}$, $16\text{V}\leq V_{IN}\leq 27\text{V}$	-	100	200	
Reg_{load}	Load Regulation	$T_j=25^\circ\text{C}$, $1\text{mA}\leq I_{OUT}\leq 500\text{mA}$	-	20	100	mV
		$T_j=25^\circ\text{C}$, $1\text{mA}\leq I_{OUT}\leq 40\text{mA}$	-	10	50	
I_B	Quiescent Current	$I_{OUT}=5\text{mA}$, $T_j=25^\circ\text{C}$	-	3.9	6	mA
ΔI_B	Quiescent Current Change	$16\text{V}\leq V_{IN}\leq 27\text{V}$, $T_j=25^\circ\text{C}$	-	-	1.5	mA
		$1\text{mA}\leq I_{OUT}\leq 40\text{mA}$, $T_j=25^\circ\text{C}$	-	-	0.1	
V_N	Output Noise Voltage	$10\text{Hz}\leq f\leq 100\text{KHz}$, $T_j=25^\circ\text{C}$	-	80	-	μV_{rms}
RR	Ripple Rejection	$15\text{V}\leq V_{IN}\leq 25\text{V}$, $f=120\text{Hz}$, $T_j=25^\circ\text{C}$	36	41	-	dB
V_D	Dropout Voltage	$T_j=25^\circ\text{C}$, $I_{OUT}=100\text{mA}$	-	1.7	2.5	V
R_O	Output Resistance	$f=1\text{KHz}$	-	17	-	$\text{m}\Omega$
I_{SC}	Short Circuit Current	$T_j=25^\circ\text{C}$	-	1.5	2	A
T_{CVO}	Average Temperature Coefficient of Output Voltage	$I_{OUT}=5\text{mA}$	-	-	1.4	mV/°C

Test Circuits

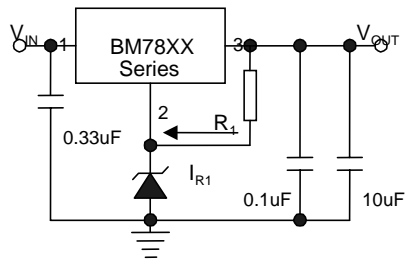


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Application Circuits

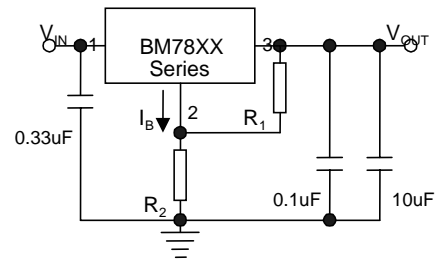
Constant Current Regulator



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

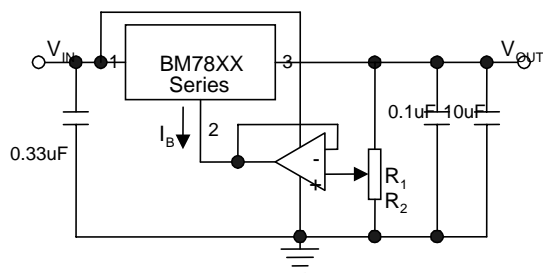
$$I_1 = V_{OUT(IC)} / R_1$$

Circuit for Increasing Output Voltage



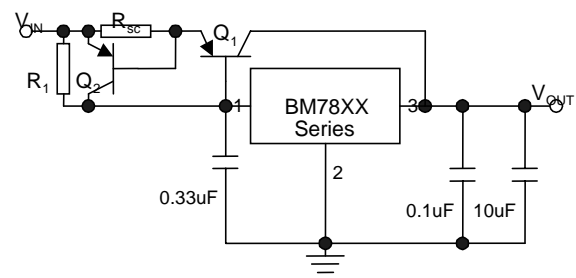
$$V_{OUT} = V_{OUT(IC)}(1 + R_2/R_1) + R_2 * I_B$$

Adjustable Output Regulator



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

High Output Current with Short-circuit Protection



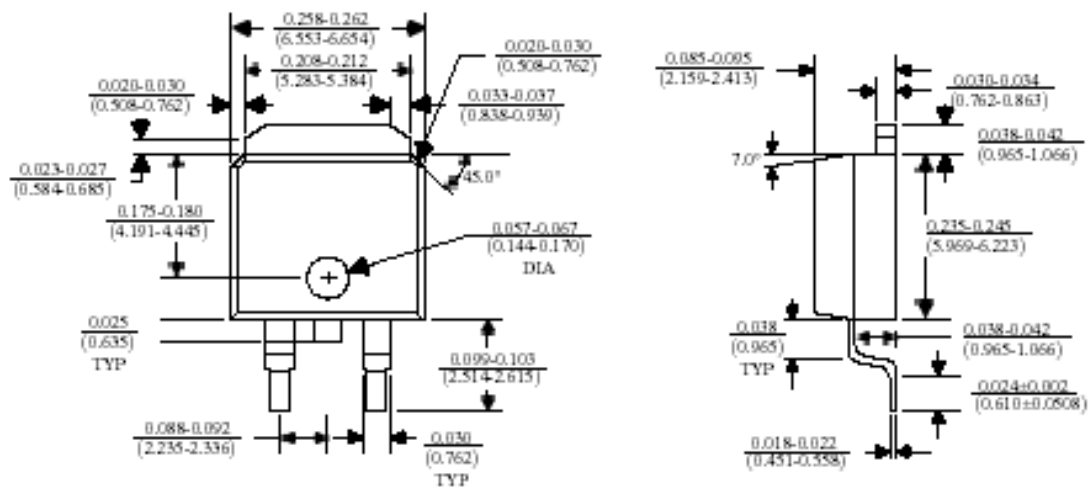
$$R_1 \leq V_{BE1} / I_{B(max)}$$

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

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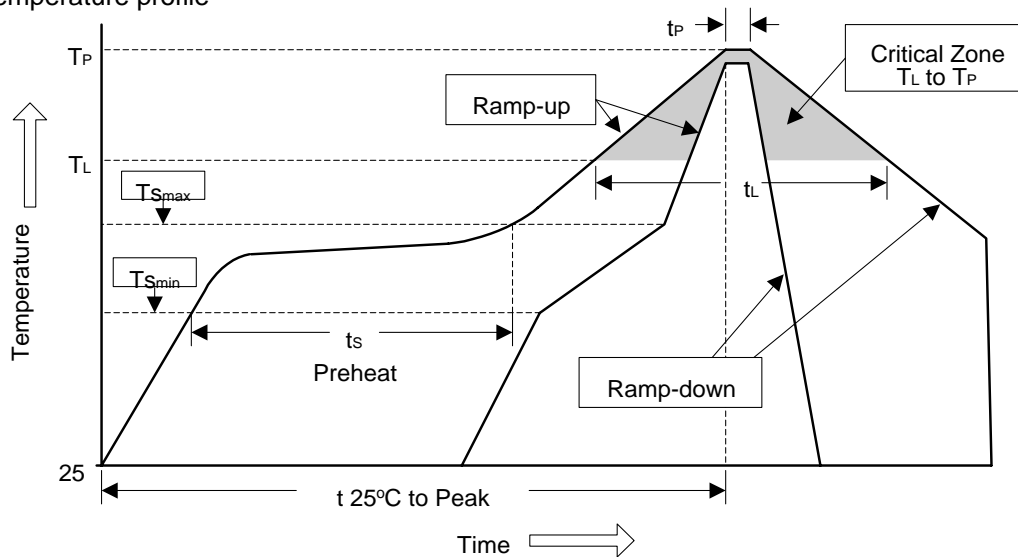
TO252-2 Dimension



Soldering Methods

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 (T_{smin})	100°C	150°C
- Temperature Max (T_{smax})	150°C	200°C
- Time (min to max) (t_s)	60~120 sec	60~180 sec
T_{smax} to T_L		
- Ramp-up Rate	<3°C/sec	<3°C/sec
Time maintained above:		
- Temperature (T_L)	183°C	217°C
- Time (t_L)	60~150 sec	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. STOPPED		
Pb-Free devices.	260°C +0/-5°C	5sec ±1sec