

BM78XX

--- BM7805

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, TO263, TO220 Package

Description

BM78XX regulators employ internal current-limiting and thermal-shutdown, making them essentially indestructible. They can deliver up to 1000mA output. BM7805 can continuously output 1.0A when +8V input

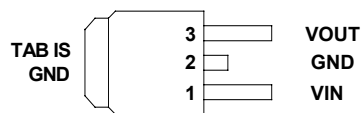
BM7805 TO220 and TO263 can output 0.8A when +12V input

Applications

- LCD-TV tuner
- Car electronics

Pin Assignment

TO-252 FRONT VIEW



2L TO-263 FRONT VIEW



Ordering Information

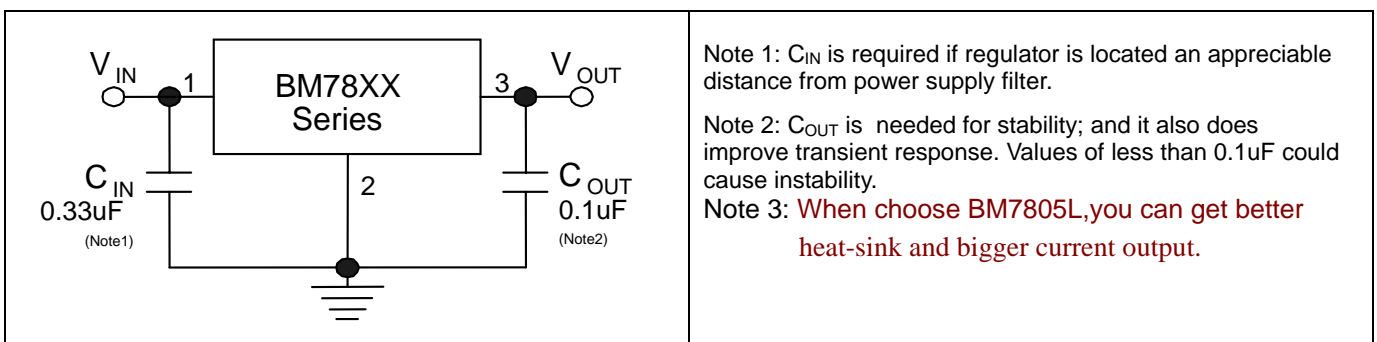
| BM78xxAS | 1A | TO252 / TO220 |
|----------|----|---------------|
| BM7805L | 1A | TO263-2 |

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)

BM7805L, the marking is L7805CVA

Typical Application



BM78XX

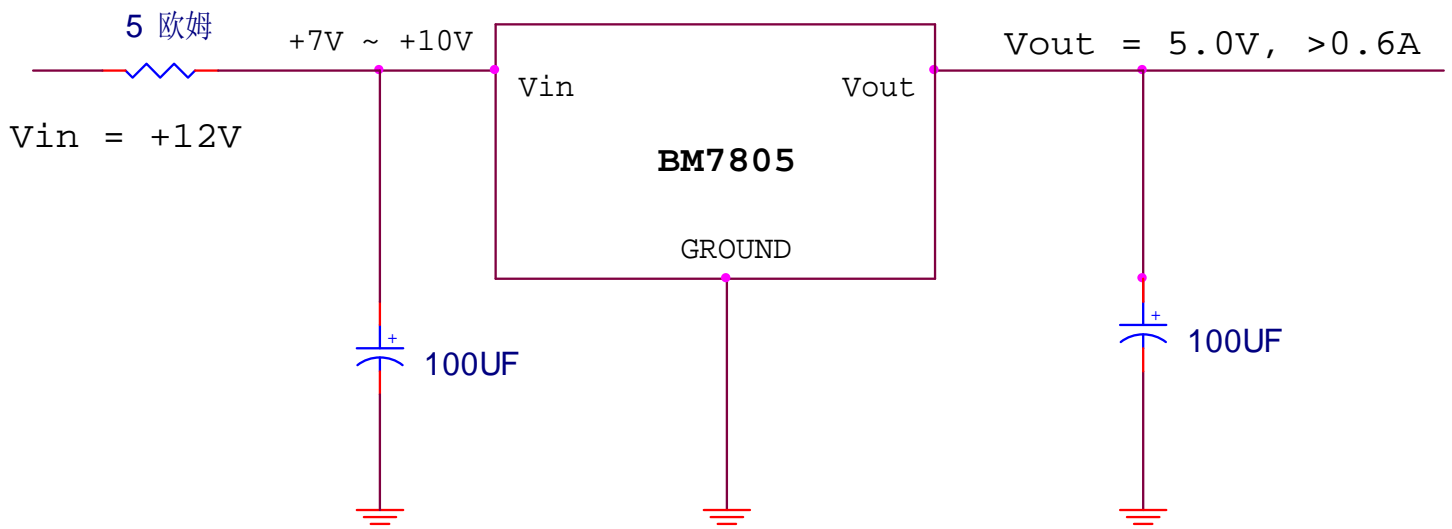
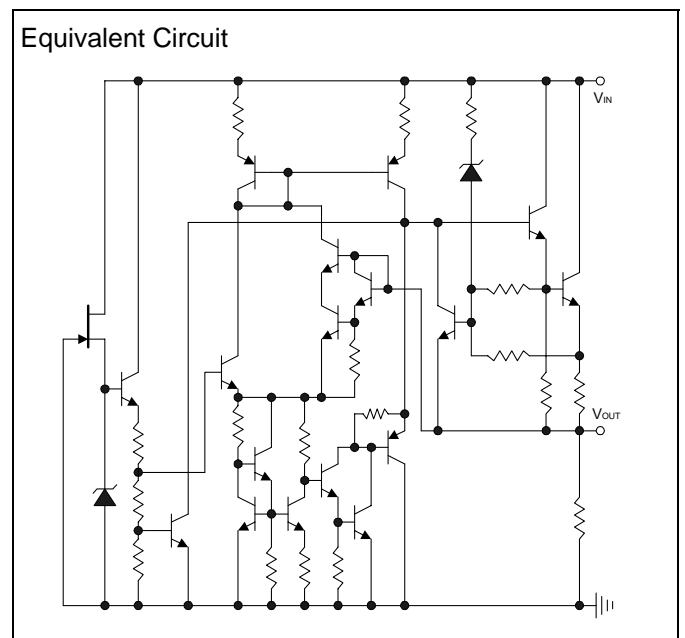
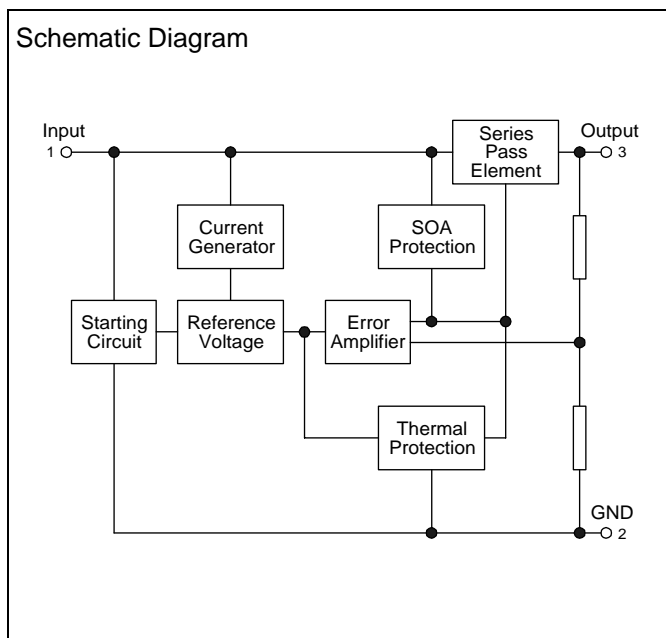
3-TERMINAL POSITIVE VOLTAGE REGULATORS

Absolute Maximum Ratings

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

| Characteristic | Symbol | Rating | Unit |
|-----------------------|---------------|--------------|----------------------|
| Input Voltage | V_{IN} | +37V | |
| 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 Electrical Characteristics

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

| Symbol | Parameter | Conditions | BM7805 | | | 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 | 10 | 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 | 2.5 | - | 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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3-TERMINAL POSITIVE VOLTAGE REGULATORS

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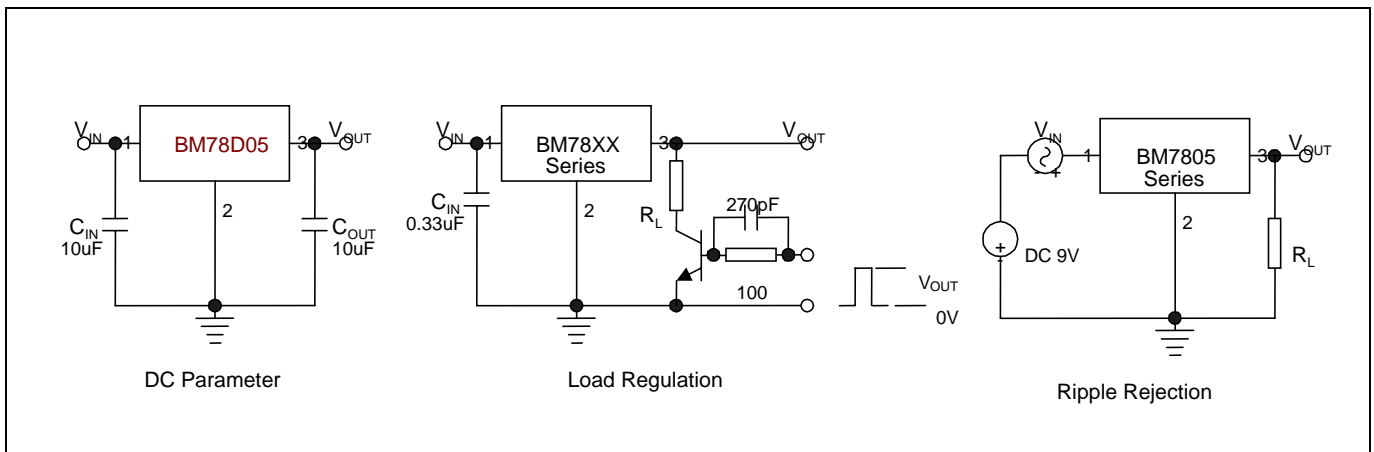
| | | | | | | |
|-----------|---|------------------------|---|-----|---|-------|
| I_{SC} | Short Circuit Current | $T_j=25^\circ\text{C}$ | - | 1.5 | 2 | A |
| T_{CVO} | Average Temperature Coefficient of Output Voltage | $I_{OUT}=5\text{mA}$ | - | - | 1 | mV/°C |

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)

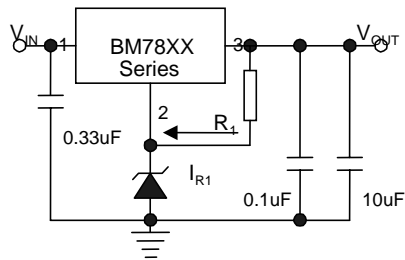
| Symbol | Parameter | Conditions | BM7812 | | | Units |
|---------------------|---|---|--------|-----|------|---------------------|
| | | | Min | Typ | Max | |
| V_O | Output Voltage | $T_j=25^\circ\text{C}$ | 11.5 | 12 | 12.5 | V |
| | | $1\text{mA}\leq I_{OUT}\leq 500\text{mA}$ | 11.5 | 12 | 12.5 | |
| | | $14.5\text{V}\leq V_{IN}\leq 27\text{V}$, $1\text{mA}\leq I_{OUT}\leq 40\text{mA}$ | | | | |
| 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



Application Circuits

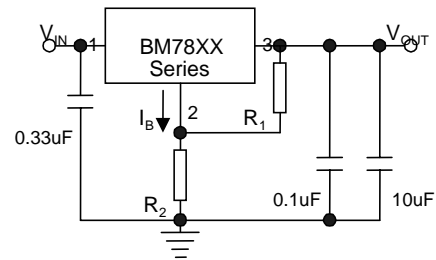
Constant Current Regulator



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

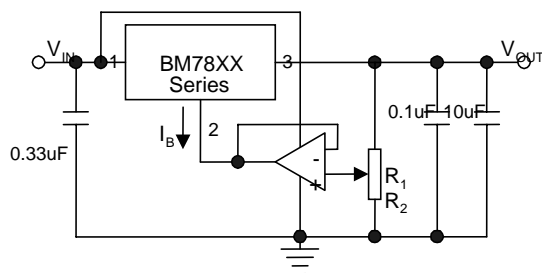
$$I_1 = V_{OUT(IC)} / R_1$$

Circuit for Increasing Output Voltage



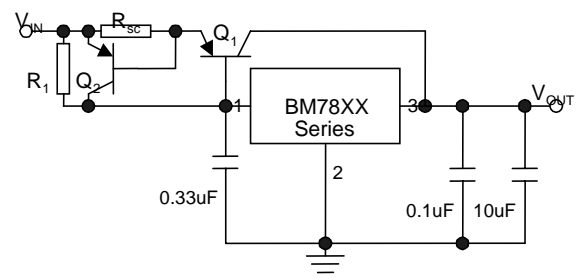
$$V_{OUT} = V_{OUT(IC)}(1 + R_2/R_1) + R_2 * I_B$$

Adjustable Output Regulator



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

High Output Current with Short-circuit Protection



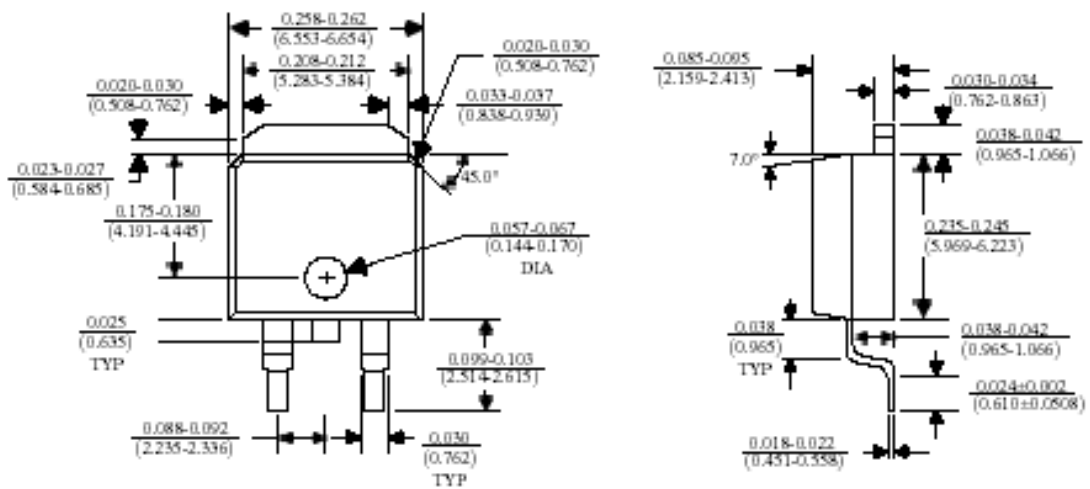
$$R_1 \leq V_{BE1} / I_{B(max)}$$

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

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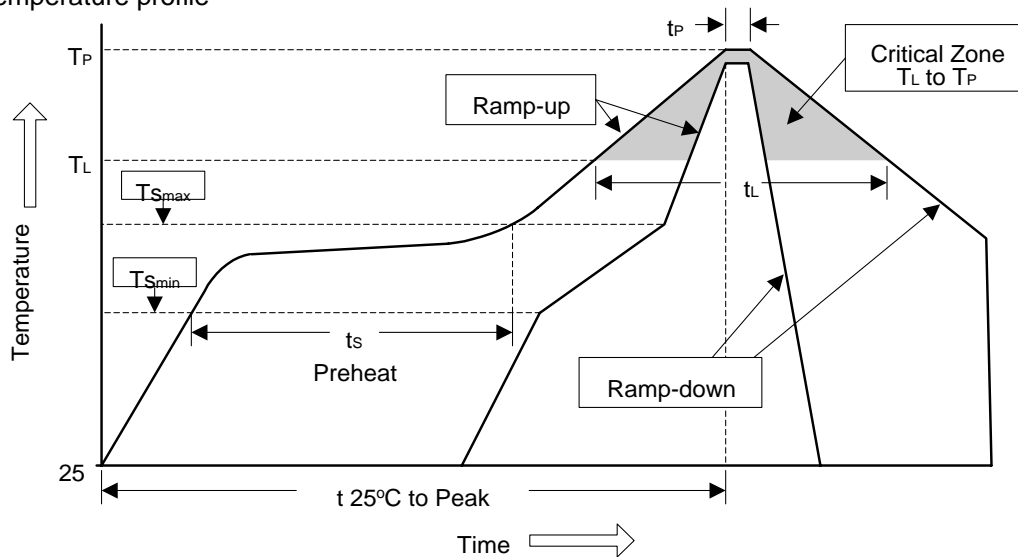
TO252-2 Dimension



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 |