# Voltage Regulators – Positive

## 1.0 A

# MC7800, MC7800A, MC7800AE, NCV7800

These voltage regulators are monolithic integrated circuits designed as fixed−voltage regulators for a wide variety of applications including local, on−card regulation. These regulators employ internal current limiting, thermal shutdown, and safe−area compensation. With adequate heatsinking they can deliver output currents in excess of 1.0 A. Although designed primarily as a fixed voltage regulator, these devices can be used with external components to obtain adjustable voltages and currents.

### Features

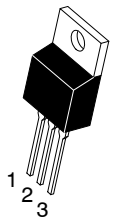
- Output Current in Excess of 1.0 A
- No External Components Required
- Internal Thermal Overload Protection
- Internal Short Circuit Current Limiting
- Output Transistor Safe−Area Compensation
- Output Voltage Offered in 1.5%, 2% and 4% Tolerance
- Available in Surface Mount $D^2PAK$−3, DPAK−3 and Standard 3−Lead Transistor Packages
- NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q100 Qualified and PPAP Capable
- These are Pb−Free Devices

**MAXIMUM RATINGS** ($T_A$ = 25°C, unless otherwise noted)

| Rating | Symbol | Value | | | Unit |
|---|---|---|---|---|---|
| | | 369C | 221A | 936 | |
| Input Voltage (5.0 – 18 V) (24 V) | $V_I$ | 35 40 | | | Vdc |
| Power Dissipation | $P_D$ | Internally Limited | | | W |
| Thermal Resistance, Junction−to−Ambient | $R_{\theta JA}$ | 92 | 65 | Figure 15 | °C/W |
| Thermal Resistance, Junction−to−Case | $R_{\theta JC}$ | 5.0 | 5.0 | 5.0 | °C/W |
| Storage Junction Temperature Range | $T_{stg}$ | −65 to +150 | | | °C |
| Operating Junction Temperature | $T_J$ | +150 | | | °C |

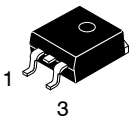
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

*This device series contains ESD protection and exceeds the following tests:
Human Body Model 2000 V per MIL_STD_883, Method 3015.
Machine Model Method 200 V.




**TO−220**
**T SUFFIX**
**CASE 221AB**

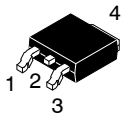
Heatsink surface connected to Pin 2.




Pin 1. Input
2. Ground
3. Output

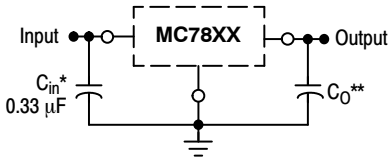
**$D^2PAK$−3**
**D2T SUFFIX**
**CASE 936**

Heatsink surface (shown as terminal 4 in case outline drawing) is connected to Pin 2.




**DPAK−3**
**DT SUFFIX**
**CASE 369C**

### STANDARD APPLICATION




A common ground is required between the input and the output voltages. The input voltage must remain typically 2.0 V above the output voltage even during the low point on the input ripple voltage.

XX, These two digits of the type number indicate nominal voltage.

* $C_{in}$ is required if regulator is located an appreciable distance from power supply filter.

** $C_O$ is not needed for stability; however, it does improve transient response. Values of less than 0.1 μF could cause instability.

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 21 of this data sheet.

### DEVICE MARKING INFORMATION

See general marking information in the device marking section on page 24 of this data sheet.

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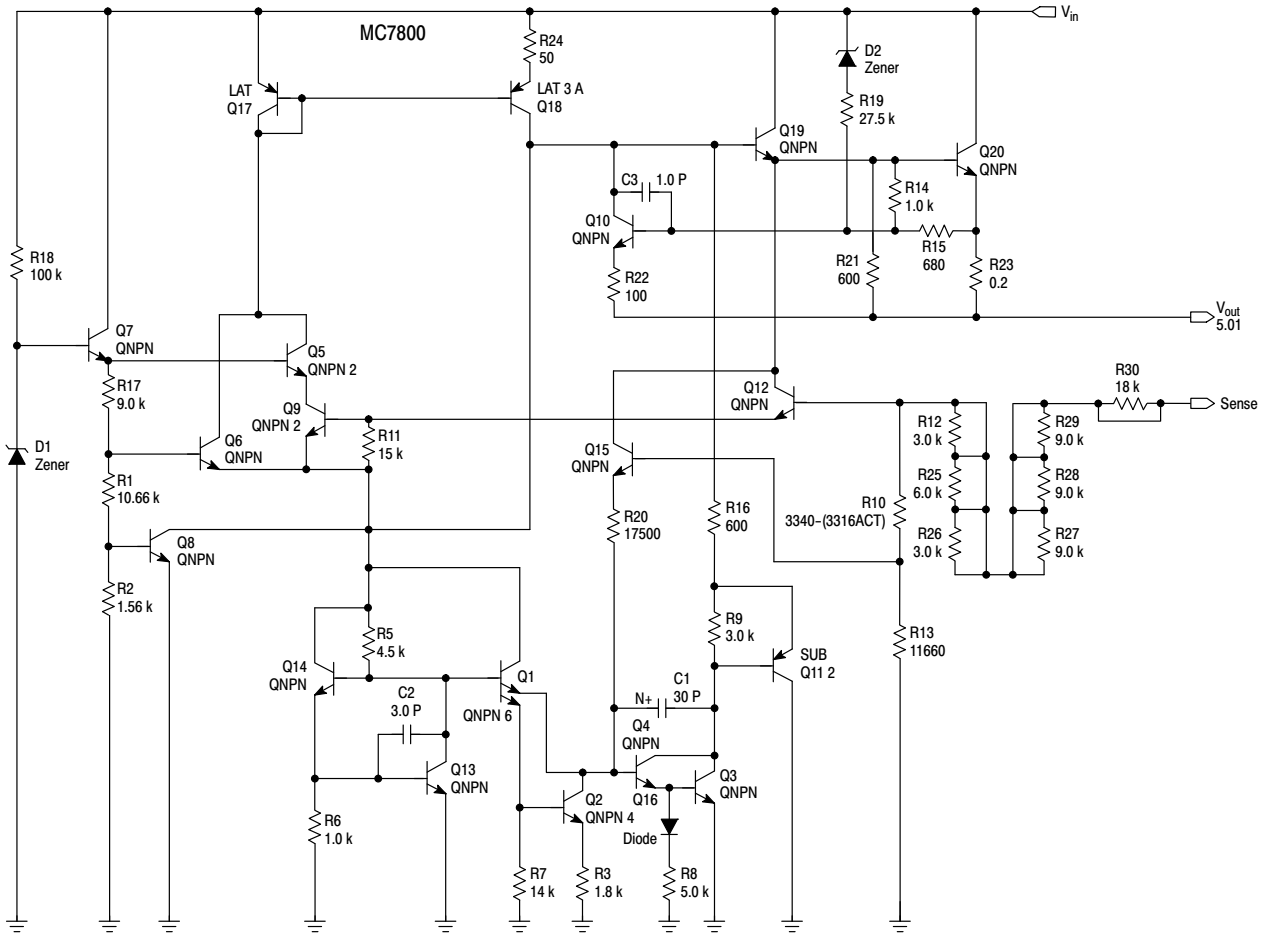


This device contains 22 active transistors.

**Figure 1. Representative Schematic Diagram**



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**ELECTRICAL CHARACTERISTICS** ($V_{in}$ = 10 V, $I_O$ = 500 mA, $T_J$ = $T_{low}$ to 125°C (Note 1), unless otherwise noted)

| Characteristic | Symbol | MC7805B, NCV7805B | | | MC7805C | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | |
| Output Voltage ($T_J$ = 25°C) | $V_O$ | 4.8 | 5.0 | 5.2 | 4.8 | 5.0 | 5.2 | Vdc |
| Output Voltage (5.0 mA ≤ $I_O$ ≤ 1.0 A, $P_D$ ≤ 15 W)<br>7.0 Vdc ≤ $V_{in}$ ≤ 20 Vdc<br>8.0 Vdc ≤ $V_{in}$ ≤ 20 Vdc | $V_O$ | <br>–<br>4.75 | <br>–<br>5.0 | <br>–<br>5.25 | <br>4.75<br>– | <br>5.0<br>– | <br>5.25<br>– | Vdc |
| Line Regulation (Note 4)<br>7.5 Vdc ≤ $V_{in}$ ≤ 20 Vdc, 1.0 A<br>8.0 Vdc ≤ $V_{in}$ ≤ 12 Vdc | $Reg_{line}$ | <br>–<br>– | <br>5.0<br>1.3 | <br>100<br>50 | <br>–<br>– | <br>0.5<br>0.8 | <br>20<br>10 | mV |
| Load Regulation (Note 4)<br>5.0 mA ≤ $I_O$ ≤ 1.0 A<br>5.0 mA ≤ $I_O$ ≤ 1.5 A ($T_A$ = 25°C) | $Reg_{load}$ | <br>–<br>– | <br>1.3<br>0.15 | <br>100<br>50 | <br>–<br>– | <br>1.3<br>1.3 | <br>25<br>25 | mV |
| Quiescent Current | $I_B$ | – | 3.2 | 8.0 | – | 3.2 | 6.5 | mA |
| Quiescent Current Change<br>7.0 Vdc ≤ $V_{in}$ ≤ 25 Vdc<br>5.0 mA ≤ $I_O$ ≤ 1.0 A ($T_A$ = 25°C) | $\Delta I_B$ | <br>–<br>– | <br>–<br>– | <br>–<br>0.5 | <br>–<br>– | <br>0.3<br>0.08 | <br>1.0<br>0.8 | mA |
| Ripple Rejection<br>8.0 Vdc ≤ $V_{in}$ ≤ 18 Vdc, f = 120 Hz | RR | <br>– | <br>68 | <br>– | <br>62 | <br>83 | <br>– | dB |
| Dropout Voltage ($I_O$ = 1.0 A, $T_J$ = 25°C) | $V_I - V_O$ | – | 2.0 | – | – | 2.0 | – | Vdc |
| Output Noise Voltage ($T_A$ = 25°C)<br>10 Hz ≤ f ≤ 100 kHz | $V_n$ | <br>– | <br>10 | <br>– | <br>– | <br>10 | <br>– | μV/$V_O$ |
| Output Resistance f = 1.0 kHz | $r_O$ | – | 0.9 | – | – | 0.9 | – | mΩ |
| Short Circuit Current Limit ($T_A$ = 25°C)<br>$V_{in}$ = 35 Vdc | $I_{SC}$ | <br>– | <br>0.2 | <br>– | <br>– | <br>0.6 | <br>– | A |
| Peak Output Current ($T_J$ = 25°C) | $I_{max}$ | – | 2.2 | – | – | 2.2 | – | A |
| Average Temperature Coefficient of Output Voltage | $TCV_O$ | – | –0.3 | – | – | –0.3 | – | mV/°C |

1. $T_{low}$ = 0°C for MC78XXC, MC78XXAC,
   = −40°C for NCV78XX, MC78XXB, MC78XXAB, and MC78XXAEB
2. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.



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**ELECTRICAL CHARACTERISTICS** ($V_{in}$ = 10 V, $I_O$ = 1.0 A, $T_J$ = $T_{low}$ to 125°C (Note 3), unless otherwise noted)

| Characteristic | Symbol | MC7805AB/MC7805AC/NCV7805AB | | | Unit |
|---|---|---|---|---|---|
| | | Min | Typ | Max | |
| Output Voltage ($T_J$ = 25°C) | $V_O$ | 4.9 | 5.0 | 5.1 | Vdc |
| Output Voltage (5.0 mA ≤ $I_O$ ≤ 1.0 A, $P_D$ ≤ 15 W)<br>7.5 Vdc ≤ $V_{in}$ ≤ 20 Vdc | $V_O$ | 4.8 | 5.0 | 5.2 | Vdc |
| Line Regulation (Note 4)<br>7.5 Vdc ≤ $V_{in}$ ≤ 25 Vdc, $I_O$ = 500 mA<br>8.0 Vdc ≤ $V_{in}$ ≤ 12 Vdc, $I_O$ = 1.0 A<br>8.0 Vdc ≤ $V_{in}$ ≤ 12 Vdc, $I_O$ = 1.0 A, $T_J$ = 25°C<br>7.3 Vdc ≤ $V_{in}$ ≤ 20 Vdc, $I_O$ = 1.0 A, $T_J$ = 25°C | $Reg_{line}$ | <br>–<br>–<br>–<br>– | <br>0.5<br>0.8<br>1.3<br>4.5 | <br>10<br>12<br>4.0<br>10 | mV |
| Load Regulation (Note 4)<br>5.0 mA ≤ $I_O$ ≤ 1.5 A, $T_J$ = 25°C<br>5.0 mA ≤ $I_O$ ≤ 1.0 A<br>250 mA ≤ $I_O$ ≤ 750 mA | $Reg_{load}$ | <br>–<br>–<br>– | <br>1.3<br>0.8<br>0.53 | <br>25<br>25<br>15 | mV |
| Quiescent Current | $I_B$ | – | 3.2 | 6.0 | mA |
| Quiescent Current Change<br>8.0 Vdc ≤ $V_{in}$ ≤ 25 Vdc, $I_O$ = 500 mA<br>7.5 Vdc ≤ $V_{in}$ ≤ 20 Vdc, $T_J$ = 25°C<br>5.0 mA ≤ $I_O$ ≤ 1.0 A | $\Delta I_B$ | <br>–<br>–<br>– | <br>0.3<br>–<br>0.08 | <br>0.8<br>0.8<br>0.5 | mA |
| Ripple Rejection<br>8.0 Vdc ≤ $V_{in}$ ≤ 18 Vdc, f = 120 Hz, $I_O$ = 500 mA | RR | <br>68 | <br>83 | <br>– | dB |
| Dropout Voltage ($I_O$ = 1.0 A, $T_J$ = 25°C) | $V_I - V_O$ | – | 2.0 | – | Vdc |
| Output Noise Voltage ($T_A$ = 25°C)<br>10 Hz ≤ f ≤ 100 kHz | $V_n$ | <br>– | <br>10 | <br>– | μV/$V_O$ |
| Output Resistance (f = 1.0 kHz) | $r_O$ | – | 0.9 | – | mΩ |
| Short Circuit Current Limit ($T_A$ = 25°C)<br>$V_{in}$ = 35 Vdc | $I_{SC}$ | <br>– | <br>0.2 | <br>– | A |
| Peak Output Current ($T_J$ = 25°C) | $I_{max}$ | – | 2.2 | – | A |
| Average Temperature Coefficient of Output Voltage | $TCV_O$ | – | –0.3 | – | mV/°C |

3. $T_{low}$ = 0°C for MC78XXC, MC78XXAC,
   = −40°C for NCV78XX, MC78XXB, MC78XXAB, and MC78XXAEB
4. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.



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**ELECTRICAL CHARACTERISTICS** ($V_{in}$ = 14 V, $I_O$ = 500 mA, $T_J$ = $T_{low}$ to 125°C (Note 5), unless otherwise noted)

| Characteristic | Symbol | MC7808B/NCV7808B | | | MC7808C | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | |
| Output Voltage ($T_J$ = 25°C) | $V_O$ | 7.7 | 8.0 | 8.3 | 7.7 | 8.0 | 8.3 | Vdc |
| Output Voltage (5.0 mA ≤ $I_O$ ≤ 1.0 A, $P_D$ ≤ 15 W)<br>10.5 Vdc ≤ $V_{in}$ ≤ 23 Vdc<br>11.5 Vdc ≤ $V_{in}$ ≤ 23 Vdc | $V_O$ | <br>–<br>7.6 | <br>–<br>8.0 | <br>–<br>8.4 | <br>7.6<br>– | <br>8.0<br>– | <br>8.4<br>– | Vdc |
| Line Regulation, $T_J$ = 25°C, (Note 6)<br>10.5 Vdc ≤ $V_{in}$ ≤ 25 Vdc<br>11 Vdc ≤ $V_{in}$ ≤ 17 Vdc | $Reg_{line}$ | <br>–<br>– | <br>6.0<br>1.7 | <br>160<br>80 | <br>–<br>– | <br>6.0<br>1.7 | <br>32<br>16 | mV |
| Load Regulation, $T_J$ = 25°C (Note 6)<br>5.0 mA ≤ $I_O$ ≤ 1.5 A | $Reg_{load}$ | <br>– | <br>1.4 | <br>160 | <br>– | <br>1.4 | <br>35 | mV |
| Quiescent Current | $I_B$ | – | 3.3 | 8.0 | – | 3.3 | 8.0 | mA |
| Quiescent Current Change<br>10.5 Vdc ≤ $V_{in}$ ≤ 25 Vdc<br>5.0 mA ≤ $I_O$ ≤ 1.0 A | $\Delta I_B$ | <br>–<br>– | <br>–<br>– | <br>–<br>0.5 | <br>–<br>– | <br>–<br>– | <br>1.0<br>0.5 | mA |
| Ripple Rejection<br>11.5 Vdc ≤ $V_{in}$ ≤ 18 Vdc, f = 120 Hz | RR | <br>– | <br>62 | <br>– | <br>56 | <br>62 | <br>– | dB |
| Dropout Voltage ($I_O$ = 1.0 A, $T_J$ = 25°C) | $V_I - V_O$ | – | 2.0 | – | – | 2.0 | – | Vdc |
| Output Noise Voltage ($T_A$ = 25°C)<br>10 Hz ≤ f ≤ 100 kHz | $V_n$ | <br>– | <br>10 | <br>– | <br>– | <br>10 | <br>– | μV/$V_O$ |
| Output Resistance f = 1.0 kHz | $r_O$ | – | 0.9 | – | – | 0.9 | – | mΩ |
| Short Circuit Current Limit ($T_A$ = 25°C)<br>$V_{in}$ = 35 Vdc | $I_{SC}$ | <br>– | <br>0.2 | <br>– | <br>– | <br>0.2 | <br>– | A |
| Peak Output Current ($T_J$ = 25°C) | $I_{max}$ | – | 2.2 | – | – | 2.2 | – | A |
| Average Temperature Coefficient of Output Voltage | $TCV_O$ | – | –0.4 | – | – | –0.4 | – | mV/°C |

5. $T_{low}$ = 0°C for MC78XXC, MC78XXAC,
   = −40°C for NCV78XX, MC78XXB, MC78XXAB, and MC78XXAEB
6. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.



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**ELECTRICAL CHARACTERISTICS** ($V_{in}$ = 14 V, $I_O$ = 1.0 A, $T_J$ = $T_{low}$ to 125°C (Note 7), unless otherwise noted)

| Characteristic | Symbol | MC7808AB/MC7808AC/NCV7808AB | | | Unit |
|---|---|---|---|---|---|
| | | Min | Typ | Max | |
| Output Voltage ($T_J$ = 25°C) | $V_O$ | 7.84 | 8.0 | 8.16 | Vdc |
| Output Voltage (5.0 mA ≤ $I_O$ ≤ 1.0 A, $P_D$ ≤ 15 W)<br>10.6 Vdc ≤ $V_{in}$ ≤ 23 Vdc | $V_O$ | 7.7 | 8.0 | 8.3 | Vdc |
| Line Regulation (Note 8)<br>10.6 Vdc ≤ $V_{in}$ ≤ 25 Vdc, $I_O$ = 500 mA<br>11 Vdc ≤ $V_{in}$ ≤ 17 Vdc, $I_O$ = 1.0 A<br>10.4 Vdc ≤ $V_{in}$ ≤ 23 Vdc, $T_J$ = 25°C | $Reg_{line}$ | <br>–<br>–<br>– | <br>6.0<br>1.7<br>5.0 | <br>15<br>18<br>15 | mV |
| Load Regulation (Note 8)<br>5.0 mA ≤ $I_O$ ≤ 1.5 A, $T_J$ = 25°C<br>5.0 mA ≤ $I_O$ ≤ 1.0 A<br>250 mA ≤ $I_O$ ≤ 750 mA | $Reg_{load}$ | <br>–<br>–<br>– | <br>1.4<br>1.0<br>0.22 | <br>25<br>25<br>15 | mV |
| Quiescent Current | $I_B$ | – | 3.3 | 6.0 | mA |
| Quiescent Current Change<br>11 Vdc ≤ $V_{in}$ ≤ 25 Vdc, $I_O$ = 500 mA<br>10.6 Vdc ≤ $V_{in}$ ≤ 23 Vdc, $I_O$ = 1.0 A, $T_J$ = 25°C<br>5.0 mA ≤ $I_O$ ≤ 1.0 A | $\Delta I_B$ | <br>–<br>–<br>– | <br>–<br>–<br>– | <br>0.8<br>0.8<br>0.5 | mA |
| Ripple Rejection<br>11.5 Vdc ≤ $V_{in}$ ≤ 21.5 Vdc, f = 120 Hz, $I_O$ = 500 mA | RR | 56 | 62 | – | dB |
| Dropout Voltage ($I_O$ = 1.0 A, $T_J$ = 25°C) | $V_I - V_O$ | – | 2.0 | – | Vdc |
| Output Noise Voltage ($T_A$ = 25°C)<br>10 Hz ≤ f ≤ 100 kHz | $V_n$ | – | 10 | – | μV/$V_O$ |
| Output Resistance f = 1.0 kHz | $r_O$ | – | 0.9 | – | mΩ |
| Short Circuit Current Limit ($T_A$ = 25°C)<br>$V_{in}$ = 35 Vdc | $I_{SC}$ | – | 0.2 | – | A |
| Peak Output Current ($T_J$ = 25°C) | $I_{max}$ | – | 2.2 | – | A |
| Average Temperature Coefficient of Output Voltage | $TCV_O$ | – | –0.4 | – | mV/°C |

7. $T_{low}$ = 0°C for MC78XXC, MC78XXAC,
   = −40°C for NCV78XX, MC78XXB, MC78XXAB, and MC78XXAEB
8. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.



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**ELECTRICAL CHARACTERISTICS** ($V_{in}$ = 15 V, $I_O$ = 500 mA, $T_J$ = $T_{low}$ to 125°C (Note 9), unless otherwise noted)

| Characteristic | Symbol | MC7809B/NCV7809B | | | MC7809C | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | |
| Output Voltage ($T_J$ = 25°C) | $V_O$ | 8.65 | 9.0 | 9.35 | 8.65 | 9.0 | 9.35 | Vdc |
| Output Voltage (5.0 mA ≤ $I_O$ ≤ 1.0 A, $P_D$ ≤ 15 W)<br>11.5 Vdc ≤ $V_{in}$ ≤ 24 Vdc | $V_O$ | 8.55 | 9.0 | 9.45 | 8.55 | 9.0 | 9.45 | Vdc |
| Line Regulation, $T_J$ = 25°C (Note 10)<br>11 Vdc ≤ $V_{in}$ ≤ 26 Vdc<br>11.5 Vdc ≤ $V_{in}$ ≤ 17 Vdc | $Reg_{line}$ | –<br>– | 6.2<br>1.8 | 32<br>16 | –<br>– | 6.2<br>1.8 | 32<br>16 | mV |
| Load Regulation, $T_J$ = 25°C (Note 10)<br>5.0 mA ≤ $I_O$ ≤ 1.5 A | $Reg_{load}$ | – | 1.5 | 35 | – | 1.5 | 35 | mV |
| Quiescent Current | $I_B$ | – | 3.4 | 8.0 | – | 3.4 | 8.0 | mA |
| Quiescent Current Change<br>11.5 Vdc ≤ $V_{in}$ ≤ 26 Vdc<br>5.0 mA ≤ $I_O$ ≤ 1.0 A | $\Delta I_B$ | –<br>– | –<br>– | 1.0<br>0.5 | –<br>– | –<br>– | 1.0<br>0.5 | mA |
| Ripple Rejection<br>11.5 Vdc ≤ $V_{in}$ ≤ 21.5 Vdc, f = 120 Hz | RR | 56 | 61 | – | 56 | 61 | – | dB |
| Dropout Voltage ($I_O$ = 1.0 A, $T_J$ = 25°C) | $V_I - V_O$ | – | 2.0 | – | – | 2.0 | – | Vdc |
| Output Noise Voltage ($T_A$ = 25°C)<br>10 Hz ≤ f ≤ 100 kHz | $V_n$ | – | 10 | – | – | 10 | – | μV/$V_O$ |
| Output Resistance f = 1.0 kHz | $r_O$ | – | 1.0 | – | – | 1.0 | – | mΩ |
| Short Circuit Current Limit ($T_A$ = 25°C)<br>$V_{in}$ = 35 Vdc | $I_{SC}$ | – | 0.2 | – | – | 0.2 | – | A |
| Peak Output Current ($T_J$ = 25°C) | $I_{max}$ | – | 2.2 | – | – | 2.2 | – | A |
| Average Temperature Coefficient of Output Voltage | $TCV_O$ | – | −0.5 | – | – | −0.5 | – | mV/°C |

9. $T_{low}$ = 0°C for MC78XXC, MC78XXAC,
   = −40°C for NCV78XX, MC78XXB, MC78XXAB, and MC78XXAEB
10. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.



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**ELECTRICAL CHARACTERISTICS** ($V_{in}$ = 15 V, $I_O$ = 1.0 A, $T_J$ = $T_{low}$ to 125°C (Note 11), unless otherwise noted)

| Characteristic | Symbol | MC7809AB/MC7809AC | | | Unit |
|---|---|---|---|---|---|
| | | Min | Typ | Max | |
| Output Voltage ($T_J$ = 25°C) | $V_O$ | 8.82 | 9.0 | 9.18 | Vdc |
| Output Voltage (5.0 mA ≤ $I_O$ ≤ 1.0 A, $P_D$ ≤ 15 W)<br>11.5 Vdc ≤ $V_{in}$ ≤ 24 Vdc | $V_O$ | 8.65 | 9.0 | 9.35 | Vdc |
| Line Regulation (Note 12)<br>11.5 Vdc ≤ $V_{in}$ ≤ 26 Vdc, $I_O$ = 500 mA<br>12 Vdc ≤ $V_{in}$ ≤ 17 Vdc, $I_O$ = 1.0 A<br>11.5 Vdc ≤ $V_{in}$ ≤ 24 Vdc, $T_J$ = 25°C | $Reg_{line}$ | <br>–<br>–<br>– | <br>6.2<br>1.8<br>5.2 | <br>16<br>7.0<br>16 | mV |
| Load Regulation (Note 12)<br>5.0 mA ≤ $I_O$ ≤ 1.5 A, $T_J$ = 25°C<br>5.0 mA ≤ $I_O$ ≤ 1.0 A<br>250 mA ≤ $I_O$ ≤ 750 mA | $Reg_{load}$ | <br>–<br>–<br>– | <br>–<br>–<br>– | <br>25<br>25<br>15 | mV |
| Quiescent Current | $I_B$ | – | 3.3 | 6.0 | mA |
| Quiescent Current Change<br>11.5 Vdc ≤ $V_{in}$ ≤ 26 Vdc, $I_O$ = 500 mA<br>11.5 Vdc ≤ $V_{in}$ ≤ 24 Vdc, $I_O$ = 1.0 A, $T_J$ = 25°C<br>5.0 mA ≤ $I_O$ ≤ 1.0 A | $\Delta I_B$ | <br>–<br>–<br>– | <br>–<br>–<br>– | <br>0.8<br>0.8<br>0.5 | mA |
| Ripple Rejection<br>11.5 Vdc ≤ $V_{in}$ ≤ 21.5 Vdc, f = 120 Hz, $I_O$ = 500 mA | RR | 56 | 61 | – | dB |
| Dropout Voltage ($I_O$ = 1.0 A, $T_J$ = 25°C) | $V_I$ _ $V_O$ | | 2.0 | | Vdc |
| Output Noise Voltage ($T_A$ = 25°C)<br>10 Hz ≤ f ≤ 100 kHz | Vn | – | 10 | – | μV/$V_O$ |
| Output Resistance f = 1.0 kHz | $r_O$ | – | 1.0 | – | mΩ |
| Short Circuit Current Limit ($T_A$ = 25°C)<br>$V_{in}$ = 35 Vdc | $I_{SC}$ | – | 0.2 | – | A |
| Peak Output Current ($T_J$ = 25°C) | $I_{max}$ | – | 2.2 | – | A |
| Average Temperature Coefficient of Output Voltage | $TCV_O$ | – | –0.5 | – | mV/°C |

11. $T_{low}$ = 0°C for MC78XXC, MC78XXAC,
= −40°C for NCV78XX, MC78XXB, MC78XXAB.
12. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.



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**ELECTRICAL CHARACTERISTICS** ($V_{in}$ = 19 V, $I_O$ = 500 mA, $T_J$ = $T_{low}$ to 125°C (Note 13), unless otherwise noted)

| Characteristic | Symbol | MC7812B/NCV7812B | | | MC7812C | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | |
| Output Voltage ($T_J$ = 25°C) | $V_O$ | 11.5 | 12 | 12.5 | 11.5 | 12 | 12.5 | Vdc |
| Output Voltage (5.0 mA ≤ $I_O$ ≤ 1.0 A, $P_D$ ≤ 15 W)<br>14.5 Vdc ≤ $V_{in}$ ≤ 27 Vdc<br>15.5 Vdc ≤ $V_{in}$ ≤ 27 Vdc | $V_O$ | <br>–<br>11.4 | <br>–<br>12 | <br>–<br>12.6 | <br>11.4<br>– | <br>12<br>– | <br>12.6<br>– | Vdc |
| Line Regulation, $T_J$ = 25°C (Note 14)<br>14.5 Vdc ≤ $V_{in}$ ≤ 30 Vdc<br>16 Vdc ≤ $V_{in}$ ≤ 22 Vdc<br>14.8 Vdc ≤ $V_{in}$ ≤ 27 Vdc, $I_O$ = 1.0 A | $Reg_{line}$ | <br>–<br>–<br>– | <br>7.5<br>2.2<br>– | <br>240<br>120<br>– | <br>–<br>–<br>– | <br>3.8<br>0.3<br>– | <br>24<br>24<br>48 | mV |
| Load Regulation, $T_J$ = 25°C (Note 14)<br>5.0 mA ≤ $I_O$ ≤ 1.5 A | $Reg_{load}$ | <br>– | <br>1.6 | <br>240 | <br>– | <br>8.1 | <br>60 | mV |
| Quiescent Current | $I_B$ | – | 3.4 | 8.0 | – | 3.4 | 6.5 | mA |
| Quiescent Current Change<br>14.5 Vdc ≤ $V_{in}$ ≤ 30 Vdc, $I_O$ = 1.0 A, $T_J$ = 25°C<br>15 Vdc ≤ $V_{in}$ ≤ 30 Vdc<br>5.0 mA ≤ $I_O$ ≤ 1.0 A | $\Delta I_B$ | <br>–<br>–<br>– | <br>–<br>–<br>– | <br>–<br>1.0<br>0.5 | <br>–<br>–<br>– | <br>–<br>–<br>– | <br>0.7<br>0.8<br>0.5 | mA |
| Ripple Rejection<br>15 Vdc ≤ $V_{in}$ ≤ 25 Vdc, f = 120 Hz | RR | <br>– | <br>60 | <br>– | <br>55 | <br>60 | <br>– | dB |
| Dropout Voltage ($I_O$ = 1.0 A, $T_J$ = 25°C) | $V_I - V_O$ | – | 2.0 | – | – | 2.0 | – | Vdc |
| Output Noise Voltage ($T_A$ = 25°C)<br>10 Hz ≤ f ≤ 100 kHz | $V_n$ | <br>– | <br>10 | <br>– | <br>– | <br>10 | <br>– | $\mu V/V_O$ |
| Output Resistance f = 1.0 kHz | $r_O$ | – | 1.1 | – | – | 1.1 | – | mΩ |
| Short Circuit Current Limit ($T_A$ = 25°C)<br>$V_{in}$ = 35 Vdc | $I_{SC}$ | <br>– | <br>0.2 | <br>– | <br>– | <br>0.2 | <br>– | A |
| Peak Output Current ($T_J$ = 25°C) | $I_{max}$ | – | 2.2 | – | – | 2.2 | – | A |
| Average Temperature Coefficient of Output Voltage | $TCV_O$ | – | –0.8 | – | – | –0.8 | – | mV/°C |

13. $T_{low}$ = 0°C for MC78XXC, MC78XXAC,
= −40°C for NCV78XX, MC78XXB, MC78XXAB, and MC78XXAEB
14. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.



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**ELECTRICAL CHARACTERISTICS** ($V_{in}$ = 19 V, $I_O$ = 1.0 A, $T_J$ = $T_{low}$ to 125°C (Note 15), unless otherwise noted)

| Characteristic | Symbol | MC7812AB/MC7812AC/NCV7812AB | | | Unit |
|---|---|---|---|---|---|
| | | Min | Typ | Max | |
| Output Voltage ($T_J$ = 25°C) | $V_O$ | 11.75 | 12 | 12.25 | Vdc |
| Output Voltage (5.0 mA ≤ $I_O$ ≤ 1.0 A, $P_D$ ≤ 15 W)<br>14.8 Vdc ≤ $V_{in}$ ≤ 27 Vdc | $V_O$ | 11.5 | 12 | 12.5 | Vdc |
| Line Regulation (Note 16)<br>14.8 Vdc ≤ $V_{in}$ ≤ 30 Vdc, $I_O$ = 500 mA<br>16 Vdc ≤ $V_{in}$ ≤ 22 Vdc, $I_O$ = 1.0 A<br>14.5 Vdc ≤ $V_{in}$ ≤ 27 Vdc, $T_J$ = 25°C | $Reg_{line}$ | <br>–<br>–<br>– | <br>3.8<br>2.2<br>6.0 | <br>18<br>20<br>120 | mV |
| Load Regulation (Note 16)<br>5.0 mA ≤ $I_O$ ≤ 1.5 A, $T_J$ = 25°C<br>5.0 mA ≤ $I_O$ ≤ 1.0 A | $Reg_{load}$ | <br>–<br>– | <br>–<br>– | <br>25<br>25 | mV |
| Quiescent Current | $I_B$ | – | 3.4 | 6.0 | mA |
| Quiescent Current Change<br>15 Vdc ≤ $V_{in}$ ≤ 30 Vdc, $I_O$ = 500 mA<br>14.8 Vdc ≤ $V_{in}$ ≤ 27 Vdc, $T_J$ = 25°C<br>5.0 mA ≤ $I_O$ ≤ 1.0 A, $T_J$ = 25°C | $\Delta I_B$ | <br>–<br>–<br>– | <br>–<br>–<br>– | <br>0.8<br>0.8<br>0.5 | mA |
| Ripple Rejection<br>15 Vdc ≤ $V_{in}$ ≤ 25 Vdc, f = 120 Hz, $I_O$ = 500 mA | RR | 55 | 60 | – | dB |
| Dropout Voltage ($I_O$ = 1.0 A, $T_J$ = 25°C) | $V_I - V_O$ | – | 2.0 | – | Vdc |
| Output Noise Voltage ($T_A$ = 25°C)<br>10 Hz ≤ f ≤ 100 kHz | $V_n$ | – | 10 | – | μV/$V_O$ |
| Output Resistance (f = 1.0 kHz) | $r_O$ | – | 1.1 | – | mΩ |
| Short Circuit Current Limit ($T_A$ = 25°C)<br>$V_{in}$ = 35 Vdc | $I_{SC}$ | – | 0.2 | – | A |
| Peak Output Current ($T_J$ = 25°C) | $I_{max}$ | – | 2.2 | – | A |
| Average Temperature Coefficient of Output Voltage | $TCV_O$ | – | −0.8 | – | mV/°C |

15. $T_{low}$ = 0°C for MC78XXC, MC78XXAC,
= −40°C for NCV78XX, MC78XXB, MC78XXAB, and MC78XXAEB
16. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.



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**ELECTRICAL CHARACTERISTICS** ($V_{in}$ = 23 V, $I_O$ = 500 mA, $T_J$ = $T_{low}$ to 125°C (Note 17), unless otherwise noted)

| Characteristic | Symbol | MC7815B/NCV7815B | | | MC7815C | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | |
| Output Voltage ($T_J$ = 25°C) | $V_O$ | 14.4 | 15 | 15.6 | 14.4 | 15 | 15.6 | Vdc |
| Output Voltage (5.0 mA ≤ $I_O$ ≤ 1.0 A, $P_D$ ≤ 15 W)<br>17.5 Vdc ≤ $V_{in}$ ≤ 30 Vdc<br>18.5 Vdc ≤ $V_{in}$ ≤ 30 Vdc | $V_O$ | <br>–<br>14.25 | <br>–<br>15 | <br>–<br>15.75 | <br>14.25<br>– | <br>15<br>– | <br>15.75<br>– | Vdc |
| Line Regulation, $T_J$ = 25°C (Note 18)<br>17.9 Vdc ≤ $V_{in}$ ≤ 30 Vdc<br>20 Vdc ≤ $V_{in}$ ≤ 26 Vdc | $Reg_{line}$ | <br>–<br>– | <br>8.5<br>3.0 | <br>300<br>150 | <br>–<br>– | <br>8.5<br>3.0 | <br>30<br>28 | mV |
| Load Regulation, $T_J$ = 25°C (Note 18)<br>5.0 mA ≤ $I_O$ ≤ 1.5 A | $Reg_{load}$ | <br>– | <br>1.8 | <br>300 | <br>– | <br>1.8 | <br>55 | mV |
| Quiescent Current | $I_B$ | – | 3.5 | 8.0 | – | 3.5 | 6.5 | mA |
| Quiescent Current Change<br>17.5 Vdc ≤ $V_{in}$ ≤ 30 Vdc<br>17.5 Vdc ≤ $V_{in}$ ≤ 30 Vdc, $I_O$ = 1.0 A, $T_J$ = 25°C<br>5.0 mA ≤ $I_O$ ≤ 1.0 A | $\Delta I_B$ | <br>–<br>–<br>– | <br>–<br>–<br>– | <br>–<br>1.0<br>0.5 | <br>–<br>–<br>– | <br>–<br>–<br>– | <br>0.8<br>0.7<br>0.5 | mA |
| Ripple Rejection<br>18.5 Vdc ≤ $V_{in}$ ≤ 28.5 Vdc, f = 120 Hz | RR | <br>– | <br>58 | <br>– | <br>54 | <br>58 | <br>– | dB |
| Dropout Voltage ($I_O$ = 1.0 A, $T_J$ = 25°C) | $V_I - V_O$ | – | 2.0 | – | – | 2.0 | – | Vdc |
| Output Noise Voltage ($T_A$ = 25°C)<br>10 Hz ≤ f ≤ 100 kHz | $V_n$ | <br>– | <br>10 | <br>– | <br>– | <br>10 | <br>– | $\mu V/V_O$ |
| Output Resistance f = 1.0 kHz | $r_O$ | – | 1.2 | – | – | 1.2 | – | mΩ |
| Short Circuit Current Limit ($T_A$ = 25°C)<br>$V_{in}$ = 35 Vdc | $I_{SC}$ | <br>– | <br>0.2 | <br>– | <br>– | <br>0.2 | <br>– | A |
| Peak Output Current ($T_J$ = 25°C) | $I_{max}$ | – | 2.2 | – | – | 2.2 | – | A |
| Average Temperature Coefficient of Output Voltage | $TCV_O$ | – | –1.0 | – | – | –1.0 | – | mV/°C |

17. $T_{low}$ = 0°C for MC78XXC, MC78XXAC,
= −40°C for NCV78XX, MC78XXB, MC78XXAB, and MC78XXAEB
18. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.


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**ELECTRICAL CHARACTERISTICS** ($V_{in}$ = 23 V, $I_O$ = 1.0 A, $T_J$ = $T_{low}$ to 125°C (Note 19), unless otherwise noted)

| Characteristic | Symbol | MC7815AB/MC7815AC | | | Unit |
|---|---|---|---|---|---|
| | | Min | Typ | Max | |
| Output Voltage ($T_J$ = 25°C) | $V_O$ | 14.7 | 15 | 15.3 | Vdc |
| Output Voltage (5.0 mA ≤ $I_O$ ≤ 1.0 A, $P_D$ ≤ 15 W)<br>17.9 Vdc ≤ $V_{in}$ ≤ 30 Vdc | $V_O$ | 14.4 | 15 | 15.6 | Vdc |
| Line Regulation (Note 20)<br>17.9 Vdc ≤ $V_{in}$ ≤ 30 Vdc, $I_O$ = 500 mA<br>20 Vdc ≤ $V_{in}$ ≤ 26 Vdc<br>17.5 Vdc ≤ $V_{in}$ ≤ 30 Vdc, $I_O$ = 1.0 A, $T_J$ = 25°C | $Reg_{line}$ | <br>–<br>–<br>– | <br>8.5<br>3.0<br>7.0 | <br>20<br>22<br>20 | mV |
| Load Regulation (Note 20)<br>5.0 mA ≤ $I_O$ ≤ 1.5 A, $T_J$ = 25°C<br>5.0 mA ≤ $I_O$ ≤ 1.0 A<br>250 mA ≤ $I_O$ ≤ 750 mA | $Reg_{load}$ | <br>–<br>–<br>– | <br>1.8<br>1.5<br>1.2 | <br>25<br>25<br>15 | mV |
| Quiescent Current | $I_B$ | – | 3.5 | 6.0 | mA |
| Quiescent Current Change<br>17.5 Vdc ≤ $V_{in}$ ≤ 30 Vdc, $I_O$ = 500 mA<br>17.5 Vdc ≤ $V_{in}$ ≤ 30 Vdc, $I_O$ = 1.0 A, $T_J$ = 25°C<br>5.0 mA ≤ $I_O$ ≤ 1.0 A | $\Delta I_B$ | <br>–<br>–<br>– | <br>–<br>–<br>– | <br>0.8<br>0.8<br>0.5 | mA |
| Ripple Rejection<br>18.5 Vdc ≤ $V_{in}$ ≤ 28.5 Vdc, f = 120 Hz, $I_O$ = 500 mA | RR | 60 | 80 | – | dB |
| Dropout Voltage ($I_O$ = 1.0 A, $T_J$ = 25°C) | $V_I - V_O$ | – | 2.0 | – | Vdc |
| Output Noise Voltage ($T_A$ = 25°C)<br>10 Hz ≤ f ≤ 100 kHz | $V_n$ | – | 10 | – | μV/$V_O$ |
| Output Resistance f = 1.0 kHz | $r_O$ | – | 1.2 | – | mΩ |
| Short Circuit Current Limit ($T_A$ = 25°C)<br>$V_{in}$ = 35 Vdc | $I_{SC}$ | – | 0.2 | – | A |
| Peak Output Current ($T_J$ = 25°C) | $I_{max}$ | – | 2.2 | – | A |
| Average Temperature Coefficient of Output Voltage | $TCV_O$ | – | –1.0 | – | mV/°C |

19. $T_{low}$ = 0°C for MC78XXC, MC78XXAC,
= −40°C for NCV78XX, MC78XXB, MC78XXAB, and MC78XXAEB
20. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.


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**ELECTRICAL CHARACTERISTICS** ($V_{in}$ = 27 V, $I_O$ = 500 mA, $T_J$ = $T_{low}$ to 125°C (Note 21), unless otherwise noted)

| Characteristic | Symbol | MC7818B | | | MC7818C | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | |
| Output Voltage ($T_J$ = 25°C) | $V_O$ | 17.3 | 18 | 18.7 | 17.3 | 18 | 18.7 | Vdc |
| Output Voltage (5.0 mA ≤ $I_O$ ≤ 1.0 A, $P_D$ ≤ 15 W)<br>21 Vdc ≤ $V_{in}$ ≤ 33 Vdc<br>22 Vdc ≤ $V_{in}$ ≤ 33 Vdc | $V_O$ | <br>–<br>17.1 | <br>–<br>18 | <br>–<br>18.9 | <br>17.1<br>– | <br>18<br>– | <br>18.9<br>– | Vdc |
| Line Regulation, (Note 22)<br>21 Vdc ≤ $V_{in}$ ≤ 33 Vdc<br>24 Vdc ≤ $V_{in}$ ≤ 30 Vdc | $Reg_{line}$ | <br>–<br>– | <br>9.5<br>3.2 | <br>360<br>180 | <br>–<br>– | <br>9.5<br>3.2 | <br>50<br>25 | mV |
| Load Regulation, (Note 22)<br>5.0 mA ≤ $I_O$ ≤ 1.5 A | $Reg_{load}$ | <br>– | <br>2.0 | <br>360 | <br>– | <br>2.0 | <br>55 | mV |
| Quiescent Current | $I_B$ | – | 3.5 | 8.0 | – | 3.5 | 6.5 | mA |
| Quiescent Current Change<br>21 Vdc ≤ $V_{in}$ ≤ 33 Vdc<br>5.0 mA ≤ $I_O$ ≤ 1.0 A | $\Delta I_B$ | <br>–<br>– | <br>–<br>– | <br>–<br>0.5 | <br>–<br>– | <br>–<br>– | <br>1.0<br>0.5 | mA |
| Ripple Rejection<br>22 Vdc ≤ $V_{in}$ ≤ 33 Vdc, f = 120 Hz | RR | <br>– | <br>57 | <br>– | <br>53 | <br>57 | <br>– | dB |
| Dropout Voltage ($I_O$ = 1.0 A, $T_J$ = 25°C) | $V_{il} - V_O$ | – | 2.0 | – | – | 2.0 | – | Vdc |
| Output Noise Voltage ($T_A$ = 25°C)<br>10 Hz ≤ f ≤ 100 kHz | $V_n$ | <br>– | <br>10 | <br>– | <br>– | <br>10 | <br>– | $\mu V/V_O$ |
| Output Resistance f = 1.0 kHz | $r_O$ | – | 1.3 | – | – | 1.3 | – | mΩ |
| Short Circuit Current Limit ($T_A$ = 25°C)<br>$V_{in}$ = 35 Vdc | $I_{SC}$ | <br>– | <br>0.2 | <br>– | <br>– | <br>0.2 | <br>– | A |
| Peak Output Current ($T_J$ = 25°C) | $I_{max}$ | – | 2.2 | – | – | 2.2 | – | A |
| Average Temperature Coefficient of Output Voltage | $TCV_O$ | – | –1.5 | – | – | –1.5 | – | mV/°C |

21. $T_{low}$ = 0°C for MC78XXC, MC78XXAC,
= −40°C for NCV78XX, MC78XXB, MC78XXAB, and MC78XXAEB
22. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.


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**ELECTRICAL CHARACTERISTICS** ($V_{in}$ = 27 V, $I_O$ = 1.0 A, $T_J$ = $T_{low}$ to 125°C (Note 23), unless otherwise noted)

| Characteristic | Symbol | MC7818AC | | | Unit |
|---|---|---|---|---|---|
| | | Min | Typ | Max | |
| Output Voltage ($T_J$ = 25°C) | $V_O$ | 17.64 | 18 | 18.36 | Vdc |
| Output Voltage (5.0 mA ≤ $I_O$ ≤ 1.0 A, $P_D$ ≤ 15 W)<br>21 Vdc ≤ $V_{in}$ ≤ 33 Vdc | $V_O$ | 17.3 | 18 | 18.7 | Vdc |
| Line Regulation (Note 24)<br>21 Vdc ≤ $V_{in}$ ≤ 33 Vdc, $I_O$ = 500 mA<br>24 Vdc ≤ $V_{in}$ ≤ 30 Vdc, $I_O$ = 1.0 A<br>24 Vdc ≤ $V_{in}$ ≤ 30 Vdc, $I_O$ = 1.0 A, $T_J$ = 25°C<br>20.6 Vdc ≤ $V_{in}$ ≤ 33 Vdc, $I_O$ = 1.0 A, $T_J$ = 25°C | $Reg_{line}$ | <br>–<br>–<br>–<br>– | <br>9.5<br>3.2<br>3.2<br>8.0 | <br>22<br>25<br>10.5<br>22 | mV |
| Load Regulation (Note 24)<br>5.0 mA ≤ $I_O$ ≤ 1.5 A, $T_J$ = 25°C<br>5.0 mA ≤ $I_O$ ≤ 1.0 A<br>250 mA ≤ $I_O$ ≤ 750 mA | $Reg_{load}$ | <br>–<br>–<br>– | <br>2.0<br>1.8<br>1.5 | <br>25<br>25<br>15 | mV |
| Quiescent Current | $I_B$ | – | 3.5 | 6.0 | mA |
| Quiescent Current Change<br>21 Vdc ≤ $V_{in}$ ≤ 33 Vdc, $I_O$ = 500 mA<br>21.5 Vdc ≤ $V_{in}$ ≤ 30 Vdc, $T_J$ = 25°C<br>5.0 mA ≤ $I_O$ ≤ 1.0 A | $\Delta I_B$ | <br>–<br>–<br>– | <br>–<br>–<br>– | <br>0.8<br>0.8<br>0.5 | mA |
| Ripple Rejection<br>22 Vdc ≤ $V_{in}$ ≤ 32 Vdc, f = 120 Hz, $I_O$ = 500 mA | RR | 53 | 57 | – | dB |
| Dropout Voltage ($I_O$ = 1.0 A, $T_J$ = 25°C) | $V_I - V_O$ | – | 2.0 | – | Vdc |
| Output Noise Voltage ($T_A$ = 25°C)<br>10 Hz ≤ f ≤ 100 kHz | $V_n$ | – | 10 | – | μV/$V_O$ |
| Output Resistance f = 1.0 kHz | $r_O$ | – | 1.3 | – | mΩ |
| Short Circuit Current Limit ($T_A$ = 25°C)<br>$V_{in}$ = 35 Vdc | $I_{SC}$ | – | 0.2 | – | A |
| Peak Output Current ($T_J$ = 25°C) | $I_{max}$ | – | 2.2 | – | A |
| Average Temperature Coefficient of Output Voltage | $TCV_O$ | – | –1.5 | – | mV/°C |

23. $T_{low}$ = 0°C for MC78XXC, MC78XXAC,
= −40°C for NCV78XX, MC78XXB, MC78XXAB, and MC78XXAEB
24. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.



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**ELECTRICAL CHARACTERISTICS** ($V_{in}$ = 33 V, $I_O$ = 500 mA, $T_J$ = $T_{low}$ to 125°C (Note 25), unless otherwise noted)

| Characteristic | Symbol | MC7824B | | | MC7824C | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | |
| Output Voltage ($T_J$ = 25°C) | $V_O$ | 23 | 24 | 25 | 23 | 24 | 25 | Vdc |
| Output Voltage (5.0 mA ≤ $I_O$ ≤ 1.0 A, $P_D$ ≤ 15 W)<br>27 Vdc ≤ $V_{in}$ ≤ 38 Vdc<br>28 Vdc ≤ $V_{in}$ ≤ 38 Vdc | $V_O$ | <br>–<br>22.8 | <br>–<br>24 | <br>–<br>25.2 | <br>22.8<br>– | <br>24<br>– | <br>25.2<br>– | Vdc |
| Line Regulation, (Note 26)<br>27 Vdc ≤ $V_{in}$ ≤ 38 Vdc<br>30 Vdc ≤ $V_{in}$ ≤ 36 Vdc | $Reg_{line}$ | <br>–<br>– | <br>11.5<br>3.8 | <br>480<br>240 | <br>–<br>– | <br>2.7<br>2.7 | <br>60<br>48 | mV |
| Load Regulation, (Note 26)<br>5.0 mA ≤ $I_O$ ≤ 1.5 A | $Reg_{load}$ | <br>– | <br>2.1 | <br>480 | <br>– | <br>4.4 | <br>65 | mV |
| Quiescent Current | $I_B$ | – | 3.6 | 8.0 | – | 3.6 | 6.5 | mA |
| Quiescent Current Change<br>27 Vdc ≤ $V_{in}$ ≤ 38 Vdc<br>5.0 mA ≤ $I_O$ ≤ 1.0 A | $\Delta I_B$ | <br>–<br>– | <br>–<br>– | <br>–<br>0.5 | <br>–<br>– | <br>–<br>– | <br>1.0<br>0.5 | mA |
| Ripple Rejection<br>28 Vdc ≤ $V_{in}$ ≤ 38 Vdc, f = 120 Hz | RR | <br>– | <br>54 | <br>– | <br>50 | <br>54 | <br>– | dB |
| Dropout Voltage ($I_O$ = 1.0 A, $T_J$ = 25°C) | $V_I - V_O$ | – | 2.0 | – | – | 2.0 | – | Vdc |
| Output Noise Voltage ($T_A$ = 25°C)<br>10 Hz ≤ f ≤ 100 kHz | $V_n$ | <br>– | <br>10 | <br>– | <br>– | <br>10 | <br>– | μV/$V_O$ |
| Output Resistance f = 1.0 kHz | $r_O$ | – | 1.4 | – | – | 1.4 | – | mΩ |
| Short Circuit Current Limit ($T_A$ = 25°C)<br>$V_{in}$ = 35 Vdc | $I_{SC}$ | <br>– | <br>0.2 | <br>– | <br>– | <br>0.2 | <br>– | A |
| Peak Output Current ($T_J$ = 25°C) | $I_{max}$ | – | 2.2 | – | – | 2.2 | – | A |
| Average Temperature Coefficient of Output Voltage | $TCV_O$ | – | –2.0 | – | – | –2.0 | – | mV/°C |

25. $T_{low}$ = 0°C for MC78XXC, MC78XXAC,
= −40°C for NCV78XX, MC78XXB, MC78XXAB, and MC78XXAEB
26. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.


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**ELECTRICAL CHARACTERISTICS** ($V_{in}$ = 33 V, $I_O$ = 1.0 A, $T_J$ = $T_{low}$ to 125°C (Note 27), unless otherwise noted)

| Characteristic | Symbol | MC7824AC | | | Unit |
|---|---|---|---|---|---|
| | | Min | Typ | Max | |
| Output Voltage ($T_J$ = 25°C) | $V_O$ | 23.5 | 24 | 24.5 | Vdc |
| Output Voltage (5.0 mA ≤ $I_O$ ≤ 1.0 A, $P_D$ ≤ 15 W)<br>27.3 Vdc ≤ $V_{in}$ ≤ 38 Vdc | $V_O$ | 23.2 | 24 | 25.8 | Vdc |
| Line Regulation (Note 28)<br>27 Vdc ≤ $V_{in}$ ≤ 38 Vdc, $I_O$ = 500 mA<br>30 Vdc ≤ $V_{in}$ ≤ 36 Vdc, $I_O$ = 1.0 A<br>30 Vdc ≤ $V_{in}$ ≤ 36 Vdc, $T_J$ = 25°C<br>26.7 Vdc ≤ $V_{in}$ ≤ 38 Vdc, $I_O$ = 1.0 A, $T_J$ = 25°C | $Reg_{line}$ | <br>–<br>–<br>–<br>– | <br>11.5<br>3.8<br>3.8<br>10 | <br>25<br>28<br>12<br>25 | mV |
| Load Regulation (Note 28)<br>5.0 mA ≤ $I_O$ ≤ 1.5 A, $T_J$ = 25°C<br>5.0 mA ≤ $I_O$ ≤ 1.0 A<br>250 mA ≤ $I_O$ ≤ 750 mA | $Reg_{load}$ | <br>–<br>–<br>– | <br>2.1<br>2.0<br>1.8 | <br>15<br>25<br>15 | mV |
| Quiescent Current | $I_B$ | – | 3.6 | 6.0 | mA |
| Quiescent Current Change<br>27.3 Vdc ≤ $V_{in}$ ≤ 38 Vdc, $I_O$ = 500 mA<br>27 Vdc ≤ $V_{in}$ ≤ 38 Vdc, $T_J$ = 25°C<br>5.0 mA ≤ $I_O$ ≤ 1.0 A | $\Delta I_B$ | <br>–<br>–<br>– | <br>–<br>–<br>– | <br>0.8<br>0.8<br>0.5 | mA |
| Ripple Rejection<br>28 Vdc ≤ $V_{in}$ ≤ 38 Vdc, f = 120 Hz, $I_O$ = 500 mA | RR | 45 | 54 | – | dB |
| Dropout Voltage ($I_O$ = 1.0 A, $T_J$ = 25°C) | $V_I - V_O$ | – | 2.0 | – | Vdc |
| Output Noise Voltage ($T_A$ = 25°C)<br>10 Hz ≤ f ≤ 100 kHz | $V_n$ | – | 10 | – | μV/$V_O$ |
| Output Resistance (f = 1.0 kHz) | $r_O$ | – | 1.4 | – | mΩ |
| Short Circuit Current Limit ($T_A$ = 25°C)<br>$V_{in}$ = 35 Vdc | $I_{SC}$ | – | 0.2 | – | A |
| Peak Output Current ($T_J$ = 25°C) | $I_{max}$ | – | 2.2 | – | A |
| Average Temperature Coefficient of Output Voltage | $TCV_O$ | – | –2.0 | – | mV/°C |

27. $T_{low}$ = 0°C for MC78XXC, MC78XXAC,
= −40°C for NCV78XX, MC78XXB, MC78XXAB, and MC78XXAEB
28. Load and line regulation are specified at constant junction temperature. Changes in $V_O$ due to heating effects must be taken into account separately. Pulse testing with low duty cycle is used.


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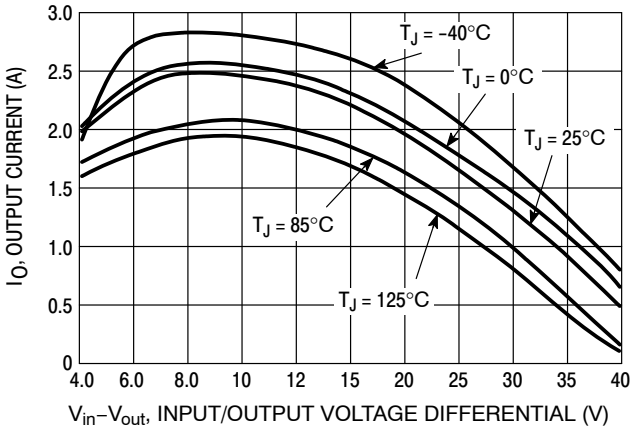


**Figure 2. Peak Output Current as a Function of Input/Output Differential Voltage (MC78XXC, AC, B)**

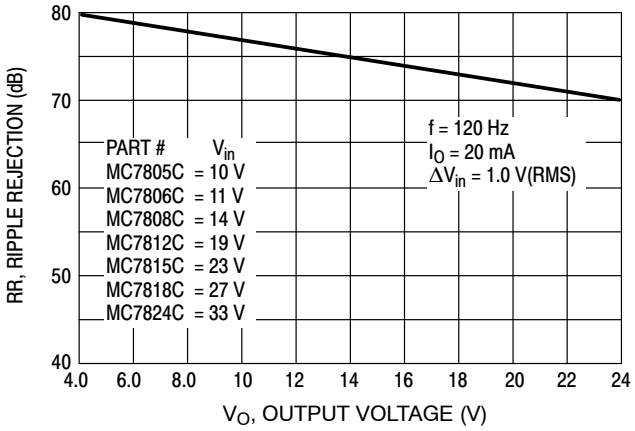


**Figure 3. Ripple Rejection as a Function of Output Voltages (MC78XXC, AC, B)**

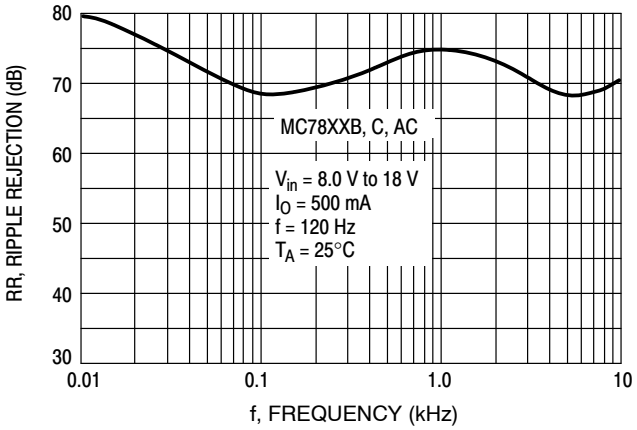


**Figure 4. Ripple Rejection as a Function of Frequency (MC78XXC, AC, B)**

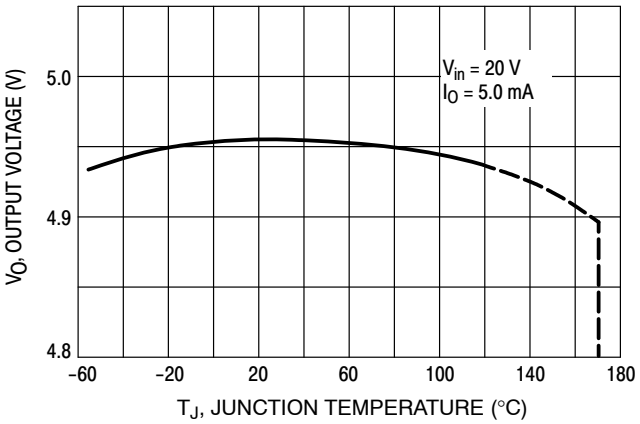


**Figure 5. Output Voltage as a Function of Junction Temperature (MC7805C, AC, B)**

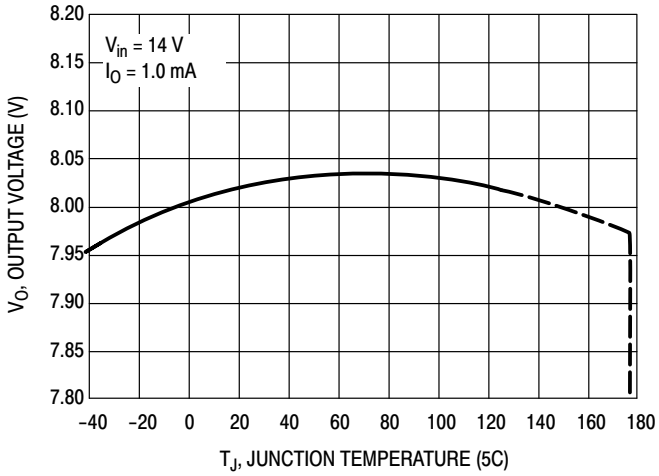


**Figure 6. Output Voltage as a Function of Junction Temperature (MC7808AE)**



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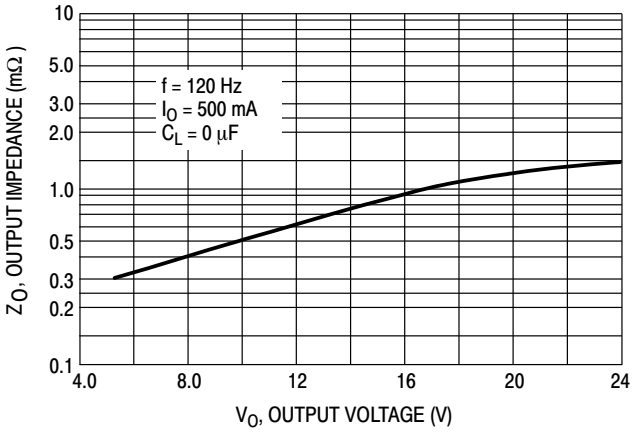


**Figure 7. Output Impedance as a Function of Output Voltage (MC78XXC, AC, B)**

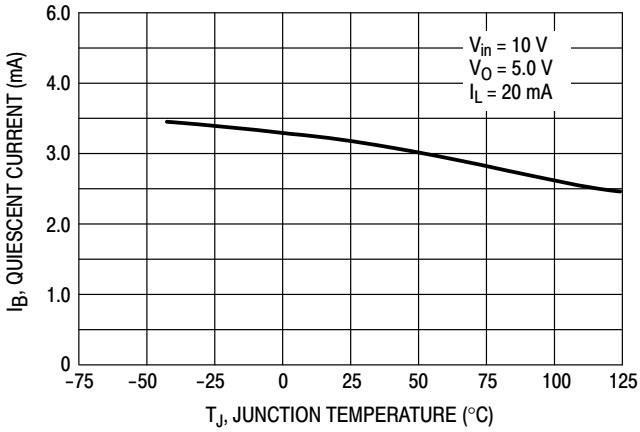


**Figure 8. Quiescent Current as a Function of Temperature (MC78XXC, AC, B)**



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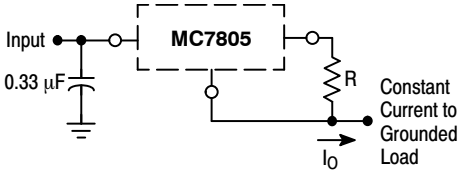
## APPLICATIONS INFORMATION

### Design Considerations

The MC7800 Series of fixed voltage regulators are designed with Thermal Overload Protection that shuts down the circuit when subjected to an excessive power overload condition, Internal Short Circuit Protection that limits the maximum current the circuit will pass, and Output Transistor Safe−Area Compensation that reduces the output short circuit current as the voltage across the pass transistor is increased.

In many low current applications, compensation capacitors are not required. However, it is recommended that the regulator input be bypassed with a capacitor if the regulator is connected to the power supply filter with long wire lengths, or if the output load capacitance is large. An input bypass capacitor should be selected to provide good high−frequency characteristics to insure stable operation under all load conditions. A 0.33 μF or larger tantalum, mylar, or other capacitor having low internal impedance at high frequencies should be chosen. The bypass capacitor should be mounted with the shortest possible leads directly across the regulators input terminals. Normally good construction techniques should be used to minimize ground loops and lead resistance drops since the regulator has no external sense lead.



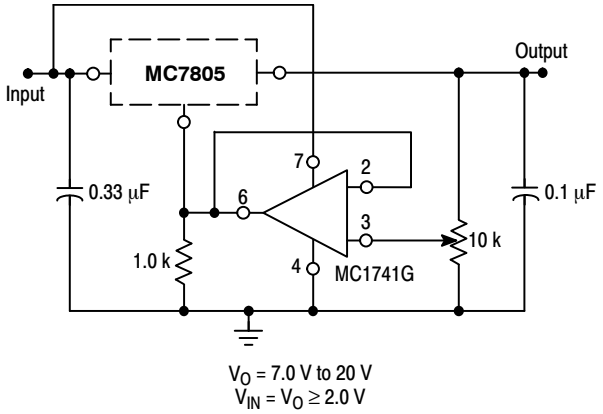

The MC7800 regulators can also be used as a current source when connected as above. In order to minimize dissipation the MC7805C is chosen in this application. Resistor R determines the current as follows:

$$I_O = \frac{5.0\ V}{R} + I_B$$

$I_B \cong 3.2$ mA over line and load changes.

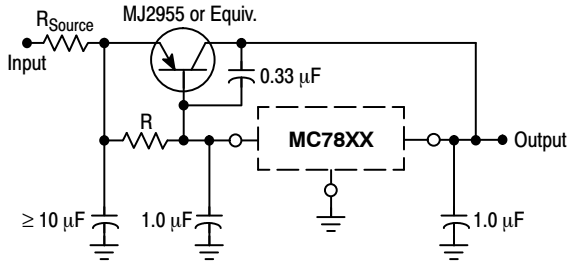
For example, a 1.0 A current source would require R to be a 5.0 Ω, 10 W resistor and the output voltage compliance would be the input voltage less 7.0 V.

**Figure 9. Current Regulator**




The addition of an operational amplifier allows adjustment to higher or intermediate values while retaining regulation characteristics. The minimum voltage obtainable with this arrangement is 2.0 V greater than the regulator voltage.

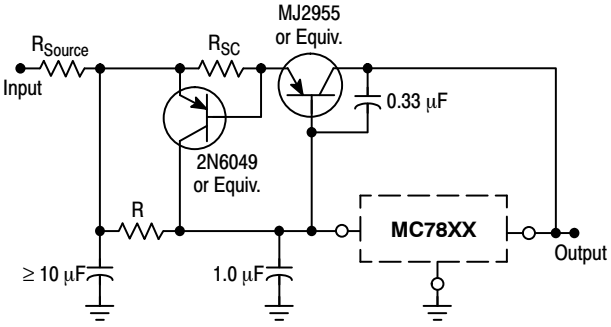
**Figure 10. Adjustable Output Regulator**




XX = 2 digits of type number indicating voltage.

The MC7800 series can be current boosted with a PNP transistor. The MJ2955 provides current to 5.0 A. Resistor R in conjunction with the $V_{BE}$ of the PNP determines when the pass transistor begins conducting; this circuit is not short circuit proof. Input/output differential voltage minimum is increased by $V_{BE}$ of the pass transistor.

**Figure 11. Current Boost Regulator**




XX = 2 digits of type number indicating voltage.

The circuit of Figure 11 can be modified to provide supply protection against short circuits by adding a short circuit sense resistor, $R_{SC}$, and an additional PNP transistor. The current sensing PNP must be able to handle the short circuit current of the three−terminal regulator. Therefore, a four−ampere plastic power transistor is specified.

**Figure 12. Short Circuit Protection**



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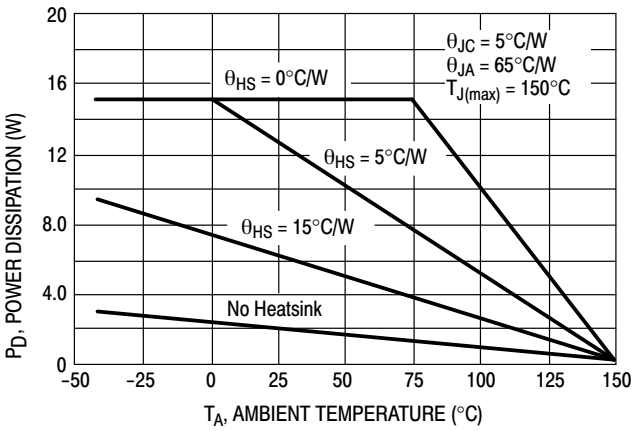


**Figure 13. Worst Case Power Dissipation versus Ambient Temperature (Case 221A)**

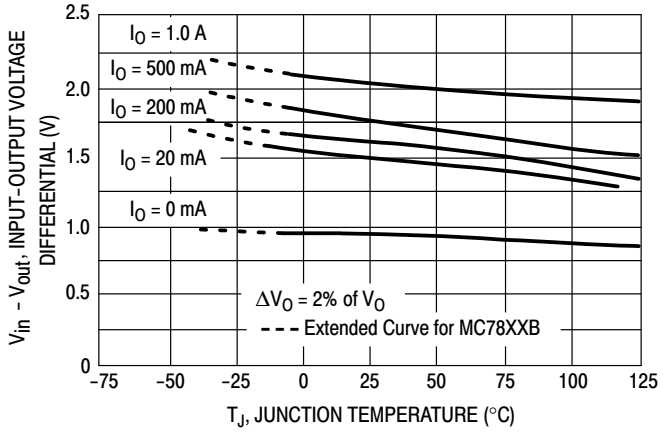


**Figure 14. Input Output Differential as a Function of Junction Temperature (MC78XXC, AC, B)**

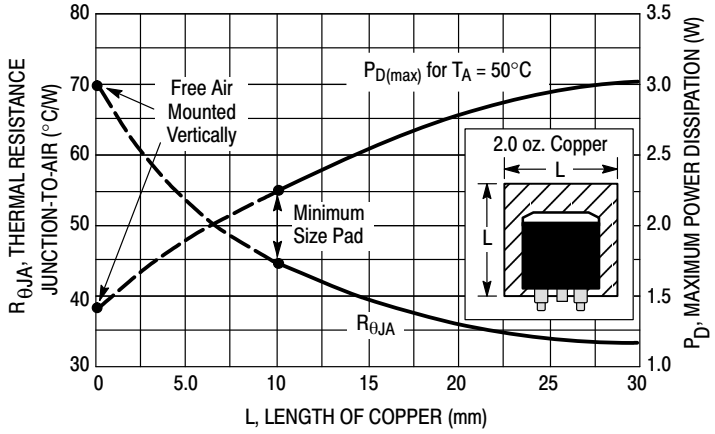


**Figure 15. D²PAK Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length**

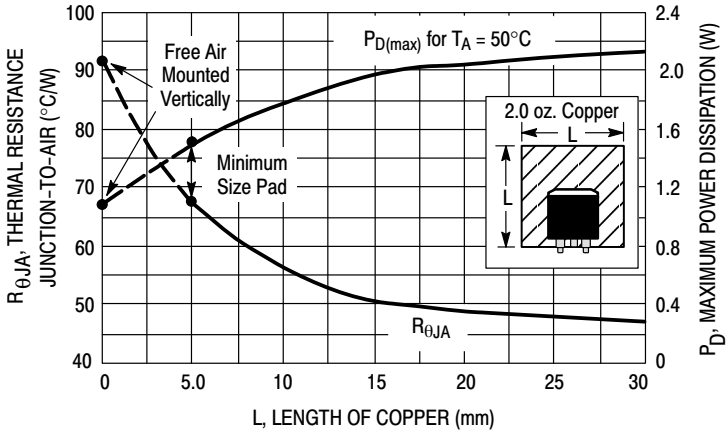


**Figure 16. DPAK Thermal Resistance and Maximum Power Dissipation versus P.C.B. Copper Length**



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## DEFINITIONS

**Line Regulation** – The change in output voltage for a change in the input voltage. The measurement is made under conditions of low dissipation or by using pulse techniques such that the average chip temperature is not significantly affected.

**Load Regulation** – The change in output voltage for a change in load current at constant chip temperature.

**Maximum Power Dissipation** – The maximum total device dissipation for which the regulator will operate within specifications.

**Quiescent Current** – That part of the input current that is not delivered to the load.

**Output Noise Voltage** – The rms ac voltage at the output, with constant load and no input ripple, measured over a specified frequency range.

**Long Term Stability** – Output voltage stability under accelerated life test conditions with the maximum rated voltage listed in the devices' electrical characteristics and maximum power dissipation.

## ORDERING INFORMATION

| Device | Nominal Voltage | Operating Temperature Range | Package | Shipping† |
|---|---|---|---|---|
| MC7805ABD2TR4G | 5.0 V | $T_J$ = −40°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| NCV7805ABD2TR4G* | 5.0 V | $T_J$ = −40°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| MC7805ABTG | 5.0 V | $T_J$ = −40°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |
| MC7805ACD2TG | 5.0 V | $T_J$ = 0°C to +125°C | $D^2PAK$ (Pb−free) | 50 Units /Rail |
| MC7805ACD2TR4G | 5.0 V | $T_J$ = 0°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| MC7805ACTG | 5.0 V | $T_J$ = 0°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |
| MC7805BD2TG | 5.0 V | $T_J$ = −40°C to +125°C | $D^2PAK$ (Pb−free) | 50 Units /Rail |
| MC7805BD2TR4G | 5.0 V | $T_J$ = −40°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| MC7805BDTG | 5.0 V | $T_J$ = −40°C to +125°C | DPAK (Pb−free) | 75 Units / Rail |
| MC7805BDTRKG | 5.0 V | $T_J$ = −40°C to +125°C | DPAK (Pb−free) | 2500 / Tape & Reel |
| NCV7805BDTRKG* | 5.0 V | $T_J$ = −40°C to +125°C | DPAK (Pb−free) | 2500 / Tape & Reel |
| MC7805BTG | 5.0 V | $T_J$ = −40°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |
| NCV7805BTG* | 5.0 V | $T_J$ = −40°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |
| NCV7805BD2TG* | 5.0 V | $T_J$ = −40°C to +125°C | $D^2PAK$ (Pb−free) | 50 Units /Rail |
| NCV7805BD2TR4G* | 5.0 V | $T_J$ = −40°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| MC7805CD2TG | 5.0 V | $T_J$ = 0°C to +125°C | $D^2PAK$ (Pb−free) | 50 Units /Rail |
| MC7805CD2TR4G | 5.0 V | $T_J$ = 0°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| MC7805CDTG | 5.0 V | $T_J$ = 0°C to +125°C | DPAK (Pb−free) | 75 Units / Rail |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*NCV devices: $T_{low}$ = −40°C, $T_{high}$ = +125°C. Guaranteed by design. NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q100 Qualified and PPAP Capable.



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**ORDERING INFORMATION** (continued)

| Device | Nominal Voltage | Operating Temperature Range | Package | Shipping† |
|---|---|---|---|---|
| MC7805CDTRKG | 5.0 V | $T_J$ = 0°C to +125°C | DPAK (Pb−free) | 2500 / Tape & Reel |
| MC7805CTG | 5.0 V | $T_J$ = 0°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |
| NCV7808ABD2TR4G* | 8.0 V | $T_J$ = −40°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| MC7808AEBTG | 8.0 V | $T_J$ = −40°C to +125°C | TO−220 (Pb−free) | 50 Units / Rail |
| NCV7808BD2TR4G* | 8.0 V | $T_J$ = −40°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| NCV7808BDTG* | 8.0 V | $T_J$ = −40°C to +125°C | DPAK (Pb−free) | 75 Units / Rail |
| NCV7808BDTRKG* | 8.0 V | $T_J$ = −40°C to +125°C | DPAK (Pb−free) | 2500 / Tape & Reel |
| NCV7808BTG* | 8.0 V | $T_J$ = −40°C to +125°C | TO−220 (Pb−free) | 50 Units / Rail |
| MC7808CDTRKG | 8.0 V | $T_J$ = 0°C to +125°C | DPAK (Pb−free) | 2500 / Tape & Reel |
| MC7808CTG | 8.0 V | $T_J$ = 0°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |
| MC7809ABTG | 9.0 V | $T_J$ = −40°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |
| NCV7809BD2TR4G* | 9.0 V | $T_J$ = −40°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| NCV7809BTG* | 9.0 V | $T_J$ = −40°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |
| MC7809CTG | 9.0 V | $T_J$ = 0°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |
| MC7812ABD2TR4G | 12 V | $T_J$ = −40°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| NCV7812ABTG* | 12 V | $T_J$ = −40°C to +125°C | TO−220 (Pb−free) | 50 Units / Rail |
| MC7812ACD2TR4G | 12 V | $T_J$ = 0°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| MC7812ACTG | 12 V | $T_J$ = 0°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |
| MC7812BD2TR4G | 12 V | $T_J$ = −40°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| NCV7812BD2TR4G* | 12 V | $T_J$ = −40°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| MC7812BDTG | 12 V | $T_J$ = −40°C to +125°C | DPAK (Pb−free) | 75 Units / Rail |
| MC7812BDTRKG | 12 V | $T_J$ = −40°C to +125°C | DPAK (Pb−free) | 2500 / Tape & Reel |
| MC7812BTG | 12 V | $T_J$ = −40°C to +125°C | TO−220 (Pb−free) | 50 Units / Rail |
| NCV7812BTG* | 12 V | $T_J$ = −40°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*NCV devices: $T_{low}$ = −40°C, $T_{high}$ = +125°C. Guaranteed by design. NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q100 Qualified and PPAP Capable.



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**ORDERING INFORMATION** (continued)

| Device | Nominal Voltage | Operating Temperature Range | Package | Shipping† |
|---|---|---|---|---|
| MC7812CD2TR4G | 12 V | $T_J$ = 0°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| MC7812CDTRKG | 12 V | $T_J$ = 0°C to +125°C | DPAK (Pb−free) | 2500 / Tape & Reel |
| MC7812CTG | 12 V | $T_J$ = 0°C to +125°C | TO−220 (Pb−free) | 50 Units / Rail |
| MC7815ABD2TR4G | 15 V | $T_J$ = −40°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| MC7815ABTG | 15 V | $T_J$ = −40°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |
| MC7815ACTG | 15 V | $T_J$ = 0°C to +125°C | TO−220 (Pb−free) | 50 Units / Rail |
| MC7815BD2TR4G | 15 V | $T_J$ = −40°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| MC7815BDTRKG | 15 V | $T_J$ = −40°C to +125°C | DPAK (Pb−free) | 2500 / Tape & Reel |
| MC7815BTG | 15 V | $T_J$ = −40°C to +125°C | TO−220 (Pb−free) | 50 Units / Rail |
| NCV7815BTG* | 15 V | $T_J$ = −40°C to +125°C | TO−220 (Pb−free) | 50 Units / Rail |
| MC7815CD2TG | 15 V | $T_J$ = 0°C to +125°C | $D^2PAK$ (Pb−free) | 50 Units /Rail |
| MC7815CD2TR4G | 15 V | $T_J$ = 0°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| MC7815CDTRKG | 15 V | $T_J$ = 0°C to +125°C | DPAK (Pb−free) | 2500 / Tape & Reel |
| MC7815CTG | 15 V | $T_J$ = 0°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |
| MC7818BTG | 18 V | $T_J$ = −40°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |
| MC7818CD2TR4G | 18 V | $T_J$ = 0°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| MC7818CTG | 18 V | $T_J$ = 0°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |
| MC7824ACTG | 24 V | $T_J$ = 0°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |
| MC7824BTG | 24 V | $T_J$ = −40°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |
| MC7824CD2TR4G | 24 V | $T_J$ = 0°C to +125°C | $D^2PAK$ (Pb−free) | 800 / Tape & Reel |
| MC7824CTG | 24 V | $T_J$ = 0°C to +125°C | TO−220 (Pb−free) | 50 Units /Rail |

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

*NCV devices: $T_{low}$ = −40°C, $T_{high}$ = +125°C. Guaranteed by design. NCV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q100 Qualified and PPAP Capable.



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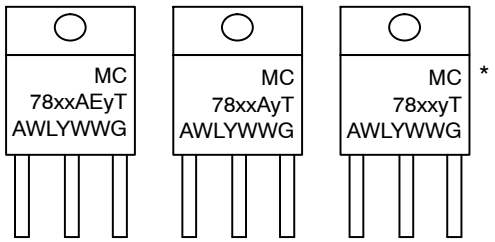
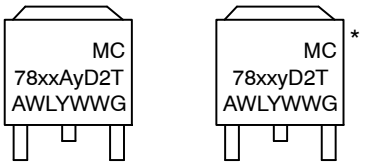
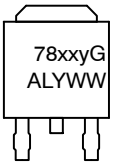
## MARKING DIAGRAMS




**TO−220−3**
**T SUFFIX**
**CASE 221A**




**D$^2$PAK−3**
**D2T SUFFIX**
**CASE 936**




**DPAK−3**
**DT SUFFIX**
**CASE 369C**

*This marking diagram also applies to NCV78xx family.

| | |
|---|---|
| xx | = 05, 06, 08, 09, 12, 15, 18, or 24 |
| y | = B or C |
| A | = Assembly Location |
| WL, L | = Wafer Lot |
| Y | = Year |
| WW | = Work Week |
| G | = Pb−Free Device |

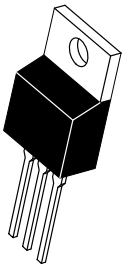


Share Feedback
Your Opinion Matters

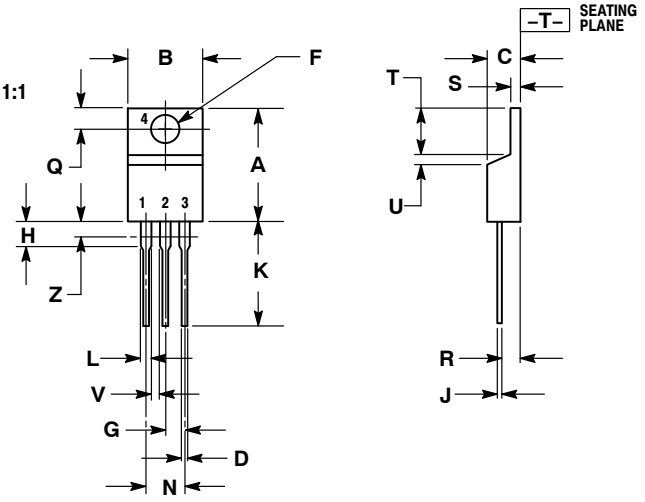
# TO−220, SINGLE GAUGE

CASE 221AB
ISSUE A

DATE 16 NOV 2010



SCALE 1:1




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCHES.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.
4. PRODUCT SHIPPED PRIOR TO 2008 HAD DIMENSIONS S = 0.045 − 0.055 INCHES (1.143 − 1.397 MM)

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.570 | 0.620 | 14.48 | 15.75 |
| B | 0.380 | 0.405 | 9.66 | 10.28 |
| C | 0.160 | 0.190 | 4.07 | 4.82 |
| D | 0.025 | 0.035 | 0.64 | 0.88 |
| F | 0.142 | 0.147 | 3.61 | 3.73 |
| G | 0.095 | 0.105 | 2.42 | 2.66 |
| H | 0.110 | 0.155 | 2.80 | 3.93 |
| J | 0.018 | 0.025 | 0.46 | 0.64 |
| K | 0.500 | 0.562 | 12.70 | 14.27 |
| L | 0.045 | 0.060 | 1.15 | 1.52 |
| N | 0.190 | 0.210 | 4.83 | 5.33 |
| Q | 0.100 | 0.120 | 2.54 | 3.04 |
| R | 0.080 | 0.110 | 2.04 | 2.79 |
| S | 0.020 | 0.024 | 0.508 | 0.61 |
| T | 0.235 | 0.255 | 5.97 | 6.47 |
| U | 0.000 | 0.050 | 0.00 | 1.27 |
| V | 0.045 | --- | 1.15 | --- |
| Z | --- | 0.080 | --- | 2.04 |

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. BASE
2. EMITTER
3. COLLECTOR
4. EMITTER

STYLE 3:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 4:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. MAIN TERMINAL 2

STYLE 5:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 6:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

STYLE 7:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE

STYLE 8:
PIN 1. CATHODE
2. ANODE
3. EXTERNAL TRIP/DELAY
4. ANODE

STYLE 9:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 10:
PIN 1. GATE
2. SOURCE
3. DRAIN
4. SOURCE

STYLE 11:
PIN 1. DRAIN
2. SOURCE
3. GATE
4. SOURCE

| | | |
|---|---|---|
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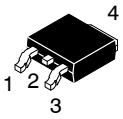
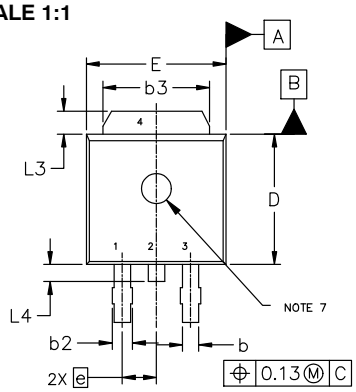


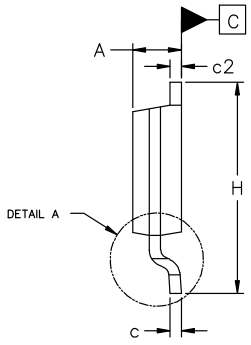

**SCALE 1:1**

**DPAK3 6.10x6.54x2.28, 2.29P**
CASE 369C
ISSUE J

DATE 12 AUG 2025

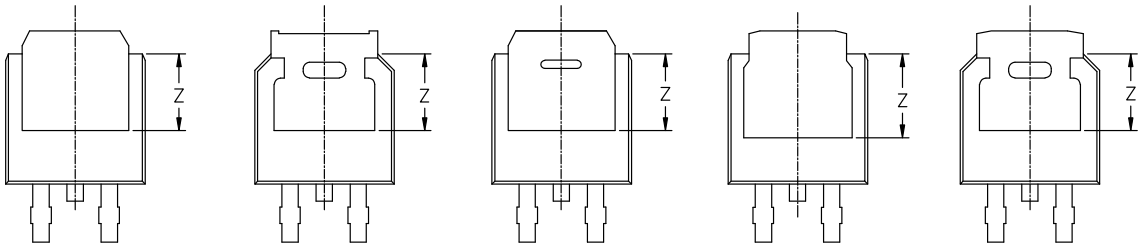



TOP VIEW




SIDE VIEW

| MILLIMETERS | | | |
|---|---|---|---|
| DIM | MIN | NOM | MAX |
| A | 2.18 | 2.28 | 2.38 |
| A1 | 0.00 | --- | 0.13 |
| b | 0.63 | 0.76 | 0.89 |
| b2 | 0.72 | 0.93 | 1.14 |
| b3 | 4.57 | 5.02 | 5.46 |
| c | 0.46 | 0.54 | 0.61 |
| c2 | 0.46 | 0.54 | 0.61 |
| D | 5.97 | 6.10 | 6.22 |
| E | 6.35 | 6.54 | 6.73 |
| e | 2.29 BSC | | |
| H | 9.40 | 9.91 | 10.41 |
| L | 1.40 | 1.59 | 1.78 |
| L1 | 2.90 REF | | |
| L2 | 0.51 BSC | | |
| L3 | 0.89 | --- | 1.27 |
| L4 | --- | --- | 1.01 |
| Z | 3.93 | --- | --- |

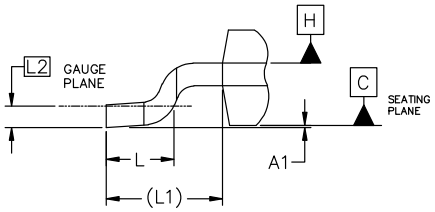



BOTTOM VIEW

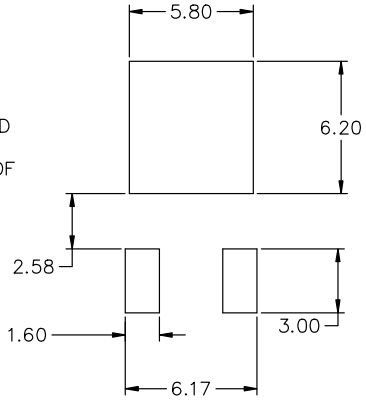
ALTERNATE CONSTRUCTIONS

NOTES:

1. DIMENSIONING AND TOLERANCING ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. THERMAL PAD CONTOUR OPTIONAL WITHIN DIMENSIONS b3, L3, AND Z.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15mm PER SIDE.
5. DIMENSIONS D AND E ARE DETERMINED AT THE OUTERMOST EXTREMES OF THE PLASTIC BODY.
6. DATUMS A AND B ARE DETERMINED AT DATUM PLANE H.
7. OPTIONAL MOLD FEATURE.




DETAIL A
ROTATED 90° CW




RECOMMENDED MOUNTING FOOTPRINT*

*FOR ADDITIONAL INFORMATION ON OUR PB–FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

| | | |
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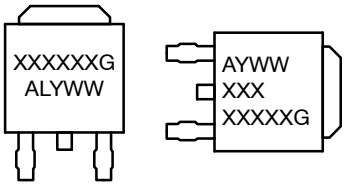
**DPAK3 6.10x6.54x2.28, 2.29P**
CASE 369C
ISSUE J

DATE 12 AUG 2025

## GENERIC MARKING DIAGRAM*




**IC** **Discrete**

| | |
|---|---|
| XXXXXX | = Device Code |
| A | = Assembly Location |
| L | = Wafer Lot |
| Y | = Year |
| WW | = Work Week |
| G | = Pb−Free Package |

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.

STYLE 1:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 2:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

STYLE 4:
PIN 1. CATHODE
2. ANODE
3. GATE
4. ANODE

STYLE 5:
PIN 1. GATE
2. ANODE
3. CATHODE
4. ANODE

STYLE 6:
PIN 1. MT1
2. MT2
3. GATE
4. MT2

STYLE 7:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 8:
PIN 1. N/C
2. CATHODE
3. ANODE
4. CATHODE

STYLE 9:
PIN 1. ANODE
2. CATHODE
3. RESISTOR ADJUST
4. CATHODE

STYLE 10:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE

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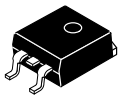
**D²PAK**
CASE 936−03
ISSUE E

DATE 29 SEP 2015



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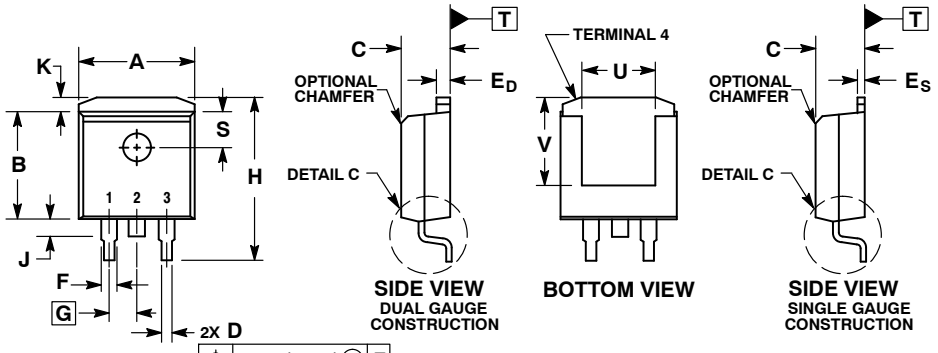
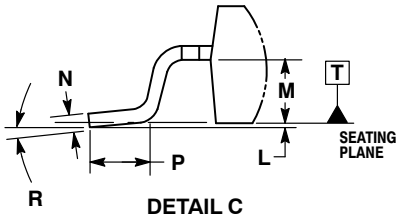
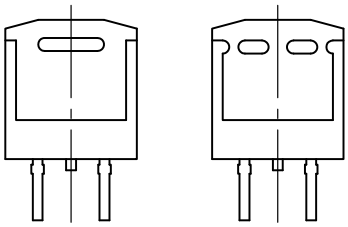


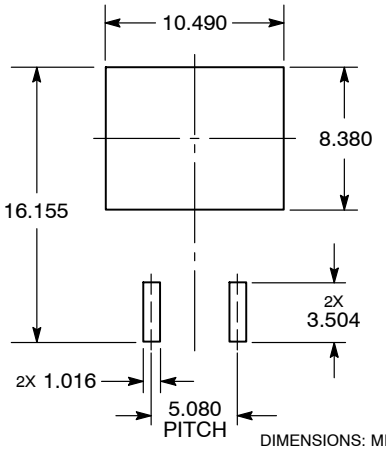



**BOTTOM VIEW**
**OPTIONAL CONSTRUCTIONS**

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCHES.
3. TAB CONTOUR OPTIONAL WITHIN DIMENSIONS A AND K.
4. DIMENSIONS U AND V ESTABLISH A MINIMUM MOUNTING SURFACE FOR TERMINAL 4.
5. DIMENSIONS A AND B DO NOT INCLUDE MOLD FLASH OR GATE PROTRUSIONS. MOLD FLASH AND GATE PROTRUSIONS NOT TO EXCEED 0.025 (0.635) MAXIMUM.
6. SINGLE GAUGE DESIGN WILL BE SHIPPED AFTER FPCN EXPIRATION IN OCTOBER 2011.

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.386 | 0.403 | 9.804 | 10.236 |
| B | 0.356 | 0.368 | 9.042 | 9.347 |
| C | 0.170 | 0.180 | 4.318 | 4.572 |
| D | 0.026 | 0.036 | 0.660 | 0.914 |
| $E_D$ | 0.045 | 0.055 | 1.143 | 1.397 |
| $E_S$ | 0.018 | 0.026 | 0.457 | 0.660 |
| F | 0.051 REF | | 1.295 REF | |
| G | 0.100 BSC | | 2.540 BSC | |
| H | 0.539 | 0.579 | 13.691 | 14.707 |
| J | 0.125 MAX | | 3.175 MAX | |
| K | 0.050 REF | | 1.270 REF | |
| L | 0.000 | 0.010 | 0.000 | 0.254 |
| M | 0.088 | 0.102 | 2.235 | 2.591 |
| N | 0.018 | 0.026 | 0.457 | 0.660 |
| P | 0.058 | 0.078 | 1.473 | 1.981 |
| R | 0° | 8° | 0° | 8° |
| S | 0.116 REF | | 2.946 REF | |
| U | 0.200 MIN | | 5.080 MIN | |
| V | 0.250 MIN | | 6.350 MIN | |

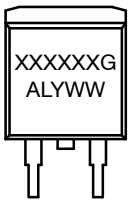
## RECOMMENDED SOLDERING FOOTPRINT*




DIMENSIONS: MILLIMETERS

*For additional information on our Pb−Free strategy and soldering details, please download the **onsemi** Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

## GENERIC MARKING DIAGRAM*




XXXXXX = Specific Device Code
A = Assembly Location
L = Wafer Lot
Y = Year
WW = Work Week
G = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

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