



**THE DATASHEET OF
SG7815T-JAN**



Positive Fixed Voltage Regulator

Description

The SG78xxA/SG78xx series of positive regulators offer self-contained, fixed-voltage capability with up to 1.5 A of load current and input voltage up to 50 V (SG78xxA series only). These units feature a unique on-chip trimming system to set the output voltages to within $\pm 1.5\%$ of nominal on the SG78xxA series with $\pm 2.0\%$ on the SG78xx series. The SG78xxA versions also offer much improved line and load regulation characteristics. Utilizing an improved bandgap reference design, problems such as drift in output voltage and large changes in the line and load regulation, that are normally associated with the Zener diode references have been eliminated.

All protective features of thermal shutdown, current limiting, and safe-area control have been designed into these units and since these regulators require only a small output capacitor for satisfactory performance, ease of application is assured. Although designed as fixed-voltage regulators, the output voltage can be increased through the use of a simple voltage divider. The low quiescent drain current of the device ensures good regulation when this method is used. Product is available in hermetically sealed TO-257 (both case grounded 'G' and isolated 'IG'), TO-3, TO-39 and leadless chip carrier (LCC) packages.

Features

- Output Voltage Set Internally to $\pm 1.5\%$ on SG78xxA
- Input Voltage Range to 50 V max on SG78xxA
- 2 V Input-Output Differential
- Excellent Line and Load Regulation
- Fold back Current Limiting
- Thermal Overload Protection
- Voltages Available: 5 V, 12 V, 15 V
- Contact Factory for Other Voltage Options
- Available in Surface Mount Package

High Reliability Features

- Available to MIL-STD - 883, ¶ 1.2.1
- MIL-M38510/10702BXA - SG7805T-JAN
- MIL-M38510/10703BXA - SG7812T-JAN
- MIL-M38510/10704BXA - SG7815T-JAN
- MIL-M38510/10706BYA - SG7805K-JAN
- MIL-M38510/10707BYA - SG7812K-JAN
- MIL-M38510/10708BYA - SG7815K-JAN
- MSC-AMSG level "S" Processing Available
- Available to DSCC
- Standard Microcircuit Drawing (SMD)

Circuit Schematic



Figure 1 - Circuit Schematic

Connection Diagrams and Ordering Information

| Ambient Temperature | Type | Package | Part Number | Packaging Type | Connection Diagram |
|---------------------|------|---------------------------------|----------------|-----------------------|--------------------------|
| -55 °C to 125 °C | K | 3-Terminal Metal Can | SG78xxAK-883B | TO-3 | |
| | | | SG7805AK-DESC | | |
| | | | SG7812AK-DESC | | |
| | | | SG7815AK-DESC | | |
| | | | SG78xxAK | | |
| | | | SG78xxK-883B | | |
| | | | SG7805K-JAN | | |
| | | | SG7812K-JAN | | |
| | | | SG7815K-JAN | | |
| | | | SG78xxK | | |
| -55 °C to 125 °C | T | 3-Pin Metal Can | SG78xxAT-883B | TO-39 | |
| | | | SG7805AT-DESC | | |
| | | | SG7812AT-DESC | | |
| | | | SG7815AT-DESC | | |
| | | | SG78xxAT | | |
| | | | SG78xxT-883B | | |
| | | | SG7805T-JAN | | |
| | | | SG7812T-JAN | | |
| | | | SG7815T-JAN | | |
| | | | SG78xxT | | |
| -55 °C to 125 °C | IG | 3-Pin Hermetic Isolated Package | SG78xxAIG-883B | TO-257 | |
| | | | SG7805AIG-DESC | | |
| | | | SG7812AIG-DESC | | |
| | | | SG7815AIG-DESC | | |
| | | | SG78xxAIG | | |
| | | | SG78xxIG-883B | | |
| | | | SG78xxIG | | |
| -55 °C to 125 °C | L | 20-Pin Ceramic Package | SG7805AL-DESC | Leadless Chip Carrier | <p>See Notes 5 and 6</p> |
| | | | SG7812AL-DESC | | |
| | | | SG7815AL-DESC | | |
| | | | SG78xxL-883B | | |
| -55 °C to 125 °C | G | 3-Pin Hermetic Package | SG78xxAG-883B | TO-257 | |
| | | | SG7805AG-DESC | | |
| | | | SG7812AG-DESC | | |
| | | | SG7815AG-DESC | | |
| | | | SG78xxAG | | |
| | | | SG78xxG-883B | | |
| | | | SG78xxG | | |

Notes:

1. Contact factory for JAN and DESC product availability.
2. All parts are viewed from the top.
3. “xx” to be replaced by output voltage of specific fixed regulator.
4. Some products will be available in hermetic flat pack (F). Consult factory for price and availability.
5. Both inputs and outputs must be externally connected together at the device terminals.
6. For normal operation, the V_O SENSE pin must be externally connected to the load.

Absolute Maximum Ratings

| Parameter | Value | Units |
|---|------------|-------|
| Device Output Voltage | 5, 12, 15 | V |
| Input Voltage | 35 | V |
| Input Voltage (Transient) (Note 2) | 50 | V |
| Input Voltage Differential (Output Shorted to Ground) | 35 | V |
| Operating Junction Temperature | 150 | °C |
| Storage Temperature Range | -65 to 150 | °C |
| Lead Temperature (Soldering 10 seconds) | 300 | °C |

Notes:

1. Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground. Currents are positive into, negative out of specified terminal.
2. Operation at high input voltages is dependent upon load current. When load current is less than 5 mA, output will rise out of regulation as input-output differential increases beyond 30 V. Note also from [Figure 2](#), that maximum load current is reduced at high voltages. The 50 V input rating of the SG78xxA series refers to ability to withstand high line or transient conditions without damage. Since the regulator’s maximum current capability is reduced, the output may fall out of regulation at high input voltages under nominal loading.

Thermal Data

| Parameter | Value | Units |
|--|-------|-------|
| K Package TO-3 3-Terminal Metal Can (Two pins and case) | | |
| Thermal Resistance-Junction to Case, θ_{JC} | 3 | °C/W |
| Thermal Resistance-Junction to Ambient, θ_{JA} | 35 | °C/W |
| T Package TO-39 3-Pin Metal Can | | |
| Thermal Resistance-Junction to Case, θ_{JC} | 15 | °C/W |
| Thermal Resistance-Junction to Ambient, θ_{JA} | 120 | °C/W |
| G Package TO-257 3-Pin Hermetic | | |
| Thermal Resistance-Junction to Case, θ_{JC} | 3.5 | °C/W |
| Thermal Resistance-Junction to Ambient, θ_{JA} | 42 | °C/W |
| IG Package TO-257 3-Pin Hermetic (Isolated) | | |
| Thermal Resistance-Junction to Case, θ_{JC} | 4 | °C/W |
| Thermal Resistance-Junction to Ambient, θ_{JA} | 42 | °C/W |
| L Package Leadless Chip Carrier 20-Pin Ceramic | | |
| Thermal Resistance-Junction to Case, θ_{JC} | 35 | °C/W |
| Thermal Resistance-Junction to Ambient, θ_{JA} | 120 | °C/W |
| <i>Notes:</i> | | |
| 1. <i>Junction Temperature Calculation: $T_J = T_A + (P_D \times \theta_{JA})$.</i> | | |
| 2. <i>The θ_{JA} numbers are meant to be guidelines for the thermal performance of the device/pc-board system. All of the above assume no ambient airflow.</i> | | |

Recommended Operating Conditions

| Parameter | SG78xx / 78xxA | | | Units |
|---|----------------|-----|-----|-------|
| | Min | Typ | Max | |
| Operating Junction Temperature Range | -55 | | 150 | °C |
| <i>Note: Range over which the device is functional.</i> | | | | |

Electrical Characteristics

Unless specified, these specifications apply over the operating ambient temperatures for SG7805A / SG7805 with $-55\text{ }^{\circ}\text{C} \leq T_A \leq 125\text{ }^{\circ}\text{C}$, $V_{IN} = 10\text{ V}$, $I_O = 500\text{ mA}$ for the K, G, and IG – Power Packages, $I_O = 100\text{ mA}$ for the T and L packages, $C_{IN} = 0.33\text{ }\mu\text{F}$ and $C_{OUT} = 0.1\text{ }\mu\text{F}$. Low duty cycle pulse testing techniques are used, which maintains junction and case temperatures equal to the ambient temperature.

| Parameter | Test Conditions | SG7805A | | | SG7805 | | | Units |
|--------------------------------|--|---------|-----|------|--------|-----|------|--------------------|
| | | Min | Typ | Max | Min | Typ | Max | |
| Output Voltage | $T_J = 25\text{ }^{\circ}\text{C}$ | 4.92 | 5 | 5.08 | 4.80 | 5 | 5.20 | V |
| Line Regulation (Note 1) | $V_{IN} = 7.5\text{ V to } 20\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | 5 | 25 | | 5 | 25 | mV |
| | $V_{IN} = 8\text{ V to } 12\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | 2 | 12 | | 2 | 25 | mV |
| Load Regulation (Note 1) | Power Pkgs: $I_O = 5\text{ mA to } 1.5\text{ A}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | 15 | 50 | | 15 | 50 | mV |
| | $I_O = 250\text{ mA to } 750\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | 5 | 25 | | 5 | 25 | mV |
| | T, L – Pkg: $I_O = 5\text{ mA to } 500\text{ mA}$, $T_J = 250\text{ }^{\circ}\text{C}$ | | 5 | 25 | | 20 | 25 | mV |
| Total Output Voltage Tolerance | $V_{IN} = 8\text{ V to } 20\text{ V}$ Power Pkgs: $I_O = 5\text{ mA to } 1.0\text{ A}$, $P \leq 20\text{ W}$ | 4.85 | 5 | 5.15 | 4.65 | 5 | 5.35 | V |
| | $V_{IN} = 8\text{ V to } 20\text{ V}$ T, L – Pkg: $I_O = 5\text{ mA to } 500\text{ mA}$, $P \leq 2\text{ W}$ | 4.85 | 5 | 5.15 | 4.65 | 5 | 5.35 | V |
| Quiescent Current | Over Temperature Range | | | 7 | | | 7 | mA |
| | $T_J = 25\text{ }^{\circ}\text{C}$ | | 4 | 6 | | 4 | 6 | mA |
| Quiescent Current Change | With Line: $V_{IN} = 8\text{ V to } 25\text{ V}$ | | | 0.8 | | | 0.8 | mA |
| | With Load: $I_O = 5\text{ mA to } 1.0\text{ A}$ (Power Pkgs) | | | 0.5 | | | 0.5 | mA |
| | $I_O = 5\text{ mA to } 500\text{ mA}$ (T, L) | | | 0.5 | | | 0.5 | mA |
| Dropout Voltage | $\Delta V_O = 100\text{ mV}$, $T_J = 25\text{ }^{\circ}\text{C}$ Power Pkgs: $I_O = 1.0\text{ A}$, T, L -Pkg: $I_O = 500\text{ mA}$ | | 2 | 2.5 | | 2 | 2.5 | V |
| Peak Output Current | Power Pkgs: $V_{IN} = 10\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$ | 1.5 | 2 | 3.3 | 1.5 | 2 | 3.3 | A |
| | T, L – Pkg: $V_{IN} = 10\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$ | 0.5 | 1 | 2 | 0.5 | 1 | 2 | A |
| Short Circuit Current | Power Pkgs: $V_{IN} = 35\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | | 1.2 | | | 1.2 | A |
| | T, L – Pkg: $V_{IN} = 35\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | | 0.7 | | | 0.7 | A |
| Ripple Rejection | $\Delta V_{IN} = 10\text{ V}$, $f = 120\text{ Hz}$, $T_J = 25\text{ }^{\circ}\text{C}$ | 68 | | | 68 | | | dB |
| Output Noise Voltage (rms) | $f = 10\text{ Hz to } 100\text{ kHz}$ (Note 2) | | | 40 | | | 40 | $\mu\text{V/V}$ |
| Long Term Stability | 1000 hours @ $T_J = 125\text{ }^{\circ}\text{C}$ | | 20 | | | 20 | | mV |
| Thermal Shutdown | $I_O = 5\text{ mA}$ | | 175 | | | 175 | | $^{\circ}\text{C}$ |

Notes:

- All regulation tests are made at constant junction temperature with low duty cycle testing.
- This test is guaranteed but is not tested in production.

Electrical Characteristics

Unless specified, these specifications apply over the operating ambient temperatures for SG7812A / SG7812 with $-55\text{ }^{\circ}\text{C} \leq T_A \leq 125\text{ }^{\circ}\text{C}$, $V_{IN} = 19\text{ V}$, $I_O = 500\text{ mA}$ for the K, G, and IG – Power Packages, $I_O = 100\text{ mA}$ for the T and L packages, $C_{IN} = 0.33\text{ }\mu\text{F}$ and $C_{OUT} = 0.1\text{ }\mu\text{F}$. Low duty cycle pulse testing techniques are used, which maintains junction and case temperatures equal to the ambient temperature.

| Parameter | Test Conditions | SG7812A | | | SG7812 | | | Units |
|-----------------------------------|---|---------|-----|------|--------|-----|------|--------------------|
| | | Min | Typ | Max | Min | Typ | Max | |
| Output Voltage | $T_J = 25\text{ }^{\circ}\text{C}$ | 11.8 | 12 | 12.2 | 11.5 | 12 | 12.5 | V |
| Line Regulation (Note 1) | $V_{IN} = 14.5\text{ V to }30\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | 12 | 60 | | 12 | 120 | mV |
| | $V_{IN} = 16\text{ V to }22\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | 6 | 30 | | 6 | 60 | mV |
| Load Regulation (Note 1) | Power Pkgs: $I_O = 5\text{ mA to }1.5\text{ A}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | 28 | 80 | | 28 | 120 | mV |
| | $I_O = 250\text{ mA to }750\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | 10 | 40 | | 10 | 60 | mV |
| | T, L – Pkg: $I_O = 5\text{ mA to }500\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | 10 | 40 | | 10 | 60 | mV |
| Total Output Voltage Tolerance | $V_{IN} = 15.5\text{ V to }27\text{ V}$ Power Pkgs: $I_O = 5\text{ mA to }1.0\text{ A}$, $P \leq 20\text{ W}$ | 11.7 | 12 | 12.3 | 11.4 | 12 | 12.6 | V |
| | $V_{IN} = 15.5\text{ V to }27\text{ V}$ T, L – Pkg: $I_O = 5\text{ mA to }500\text{ mA}$, $P \leq 2\text{ W}$ | 11.7 | 12 | 12.3 | 11.4 | 12 | 12.6 | V |
| Quiescent Current | Over Temperature Range | | | 7 | | | 7 | mA |
| | $T_J = 25\text{ }^{\circ}\text{C}$ | | 4 | 6 | | 4 | 6 | mA |
| Quiescent Current Change | With Line: $V_{IN} = 15\text{ V to }30\text{ V}$ | | | 0.8 | | | 0.8 | mA |
| | With Load: $I_O = 5\text{ mA to }1.0\text{ A}$ (Power Pkgs) | | | 0.5 | | | 0.5 | mA |
| | $I_O = 5\text{ mA to }500\text{ mA}$ (T, L) | | | 0.5 | | | 0.5 | mA |
| Dropout Voltage | $\Delta V_O = 100\text{ mV}$, $T_J = 25\text{ }^{\circ}\text{C}$ Power Pkgs: $I_O = 1.0\text{ A}$, T, L – Pkg: $I_O = 500\text{ mA}$ | | 2 | 2.5 | | 2 | 2.5 | V |
| Peak Output Current | Power Pkgs: $T_J = 25\text{ }^{\circ}\text{C}$ | 1.5 | 2 | 3.3 | 1.5 | 2 | 3.3 | A |
| | T, L – Pkg: $T_J = 25\text{ }^{\circ}\text{C}$ | 0.5 | 1 | 1.7 | 0.5 | 1 | 1.7 | A |
| Short Circuit Current | Power Pkgs: $V_{IN} = 35\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | | 1.2 | | | 1.2 | A |
| | T, L – Pkg: $V_{IN} = 35\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | | 0.7 | | | 0.7 | A |
| Ripple Rejection | $\Delta V_{IN} = 10\text{ V}$, $f = 120\text{ Hz}$, $T_J = 25\text{ }^{\circ}\text{C}$ | 61 | | | 61 | | | dB |
| Output Noise Voltage (rms) | $f = 10\text{ Hz to }100\text{ kHz}$ (Note 2) | | | 40 | | | 40 | $\mu\text{V/V}$ |
| Long Term Stability | 1000 hours @ $T_J = 125\text{ }^{\circ}\text{C}$ | | 48 | | | 48 | | mV |
| Thermal Shutdown | $I_O = 5\text{ mA}$ | | 175 | | | 175 | | $^{\circ}\text{C}$ |

Notes:

- All regulation tests are made at constant junction temperature with low duty cycle testing.
- This test is guaranteed but is not tested in production.

Electrical Characteristics

Unless specified, these specifications apply over the operating ambient temperatures for SG7815A / SG7815 with $-55\text{ }^{\circ}\text{C} \leq T_A \leq 125\text{ }^{\circ}\text{C}$, $V_{IN} = 23\text{ V}$, $I_O = 500\text{ mA}$ for the K, G, and IG – Power Packages, $I_O = 100\text{ mA}$ for the T and L packages, $C_{IN} = 0.33\text{ }\mu\text{F}$ and $C_{OUT} = 0.1\text{ }\mu\text{F}$. Low duty cycle pulse testing techniques are used which maintains junction and case temperatures equal to the ambient temperature.

| Parameter | Test Conditions | SG7815A | | | SG7815 | | | Units |
|--------------------------------|---|---------|-----|------|--------|-----|------|--------------------|
| | | Min | Typ | Max | Min | Typ | Max | |
| Output Voltage | $T_J = 25\text{ }^{\circ}\text{C}$ | 14.8 | 15 | 15.2 | 14.4 | 15 | 15.6 | V |
| Line Regulation (Note 1) | $V_{IN} = 17.5\text{ V to } 30\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | 15 | 75 | | 15 | 150 | mV |
| | $V_{IN} = 20\text{ V to } 26\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | 8 | 40 | | 8 | 75 | mV |
| Load Regulation (Note 1) | Power Pkgs: $I_O = 5\text{ mA to } 1.5\text{ A}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | 30 | 100 | | 30 | 150 | mV |
| | $I_O = 250\text{ mA to } 750\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | 12 | 50 | | 12 | 75 | mV |
| | T, L – Pkg: $I_O = 5\text{ mA to } 500\text{ mA}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | 12 | 50 | | 12 | 75 | mV |
| Total Output Voltage Tolerance | $V_{IN} = 18.5\text{ V to } 30\text{ V}$ Power Pkgs: $I_O = 5\text{ mA to } 1.0\text{ A}$, $P \leq 20\text{ W}$ | 14.6 | 15 | 15.4 | 14.3 | 15 | 15.7 | V |
| | $V_{IN} = 18.5\text{ V to } 30\text{ V}$ T, L – Pkg: $I_O = 5\text{ mA to } 500\text{ mA}$, $P \leq 2\text{ W}$ | 14.6 | 15 | 15.4 | 14.3 | 15 | 15.7 | V |
| Quiescent Current | Over Temperature Range | | | 7 | | | 7 | mA |
| | $T_J = 25\text{ }^{\circ}\text{C}$ | | 4 | 6 | | 4 | 6 | mA |
| Quiescent Current Change | With Line: $V_{IN} = 18.5\text{ V to } 30\text{ V}$ | | | 0.8 | | | 0.8 | mA |
| | With Load: $I_O = 5\text{ mA to } 1.0\text{ A}$ (Power Pkgs) | | | 0.5 | | | 0.5 | mA |
| | $I_O = 5\text{ mA to } 500\text{ mA}$ (T, L) | | | 0.5 | | | 0.5 | mA |
| Dropout Voltage | $\Delta V_O = 100\text{ mV}$, $T_J = 25\text{ }^{\circ}\text{C}$ Power Pkgs: $I_O = 1.0\text{ A}$, T, L – Pkg: $I_O = 500\text{ mA}$ | | 2 | 2.5 | | 2 | 2.5 | V |
| Peak Output Current | Power Pkgs: $T_J = 25\text{ }^{\circ}\text{C}$ | 1.5 | 2.2 | 3.3 | 1.5 | 2.2 | 3.3 | A |
| | T, L – Pkg: $T_J = 25\text{ }^{\circ}\text{C}$ | 0.5 | 0.9 | 1.7 | 0.5 | 0.9 | 1.7 | A |
| Short Circuit Current | Power Pkgs: $V_{IN} = 35\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | | 1.2 | | | 1.2 | A |
| | T, L – Pkg: $V_{IN} = 35\text{ V}$, $T_J = 25\text{ }^{\circ}\text{C}$ | | | 0.7 | | | 0.7 | A |
| Ripple Rejection | $\Delta V_{IN} = 10\text{ V}$, $f = 120\text{ Hz}$, $T_J = 25\text{ }^{\circ}\text{C}$ | 60 | | | 60 | | | dB |
| Output Noise Voltage (rms) | $f = 10\text{ Hz to } 100\text{ kHz}$ (Note 2) | | | 40 | | | 40 | $\mu\text{V/V}$ |
| Long Term Stability | 1000 hours @ $T_J = 125\text{ }^{\circ}\text{C}$ | | 60 | | | 60 | | mV |
| Thermal Shutdown | $I_O = 5\text{ mA}$ | | 175 | | | 175 | | $^{\circ}\text{C}$ |

Notes:

- All regulation tests are made at constant junction temperature with low duty cycle testing.
- This test is guaranteed but is not tested in production.

Characteristic Curves

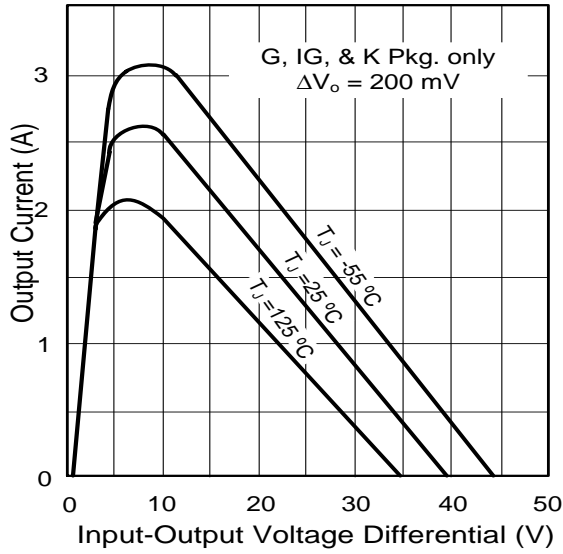


Figure 2 - Peak Output Current versus Input-Output Differential

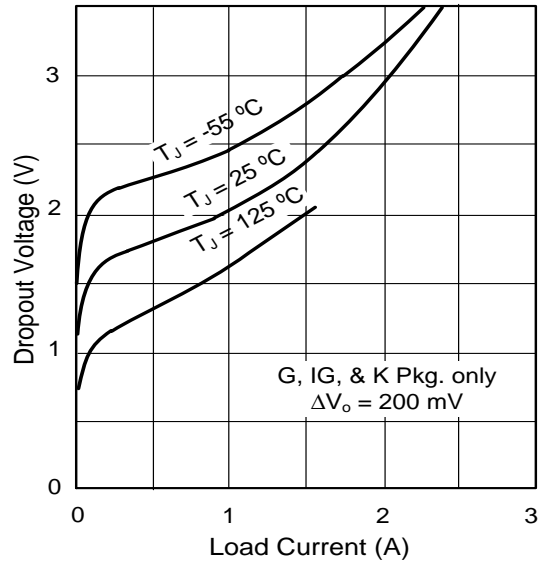


Figure 3 - Minimum Input-Output Voltage versus Load Current

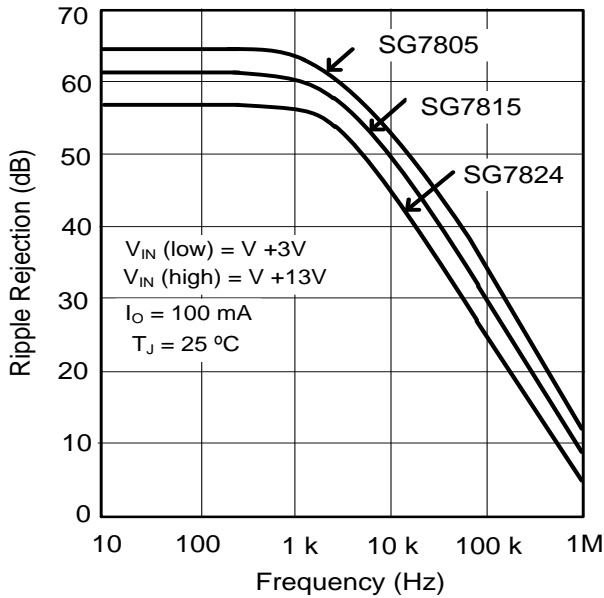


Figure 4 - Ripple Rejection versus Frequency

Application Information



* Increasing value of output capacitor improves system transient response

**Required only if regulator is located an appreciable distance from power supply filter

Figure 5 - Fixed Output Regulator



Figure 6 - Circuit for Increasing Output Voltage



Figure 7 - High Output Current, Short Circuit Protected



Figure 8 - Adjustable Output Regulator, 7 V to 30 V

Package Outline Dimensions

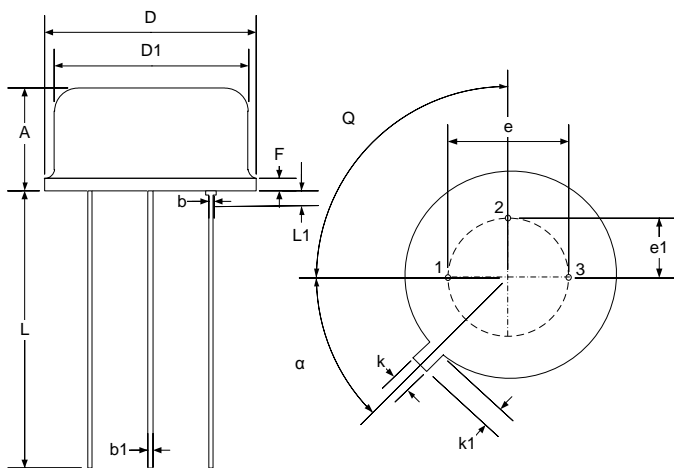
Controlling dimensions are in inches, metric equivalents are shown for general information.



| Dim | MILLIMETERS | | INCHES | |
|----------|-------------|-------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 6.86 | 7.62 | 0.270 | 0.300 |
| q | 29.90 | 30.40 | 1.177 | 1.197 |
| b | 0.97 | 1.09 | 0.038 | 0.043 |
| D | 19.43 | 19.68 | 0.765 | 0.775 |
| S | 16.64 | 17.14 | 0.655 | 0.675 |
| e | 10.67 | 11.18 | 0.420 | 0.440 |
| e1 | 5.21 | 5.72 | 0.205 | 0.225 |
| F | 1.52 | 2.03 | 0.060 | 0.080 |
| ϕ_p | 3.84 | 4.09 | 0.151 | 0.161 |
| L | 10.79 | 12.19 | 0.425 | 0.480 |
| R1 | 3.33 | 4.78 | 0.131 | 0.188 |
| R | 12.57 | 13.34 | 0.495 | 0.525 |

Note: Dimensions do not include protrusions; these shall not exceed 0.155 mm (0.006") on any side. Lead dimension shall not include solder coverage.

Figure 9 - K 3-Pin Metal Can TO-3



| Dim | MILLIMETERS | | INCHES | |
|----------|-------------|-------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.19 | 4.70 | 0.165 | 0.185 |
| b | 0.41 | 0.48 | 0.016 | 0.019 |
| b1 | 0.41 | 0.53 | 0.016 | 0.021 |
| D | 8.89 | 9.40 | 0.350 | 0.370 |
| D1 | 8.13 | 8.51 | 0.320 | 0.335 |
| e | 5.08 BSC | | 0.200 BSC | |
| e1 | 2.54 Typ | | 0.100 Typ | |
| F | - | 1.02 | - | 0.040 |
| k | 0.71 | 0.86 | 0.028 | 0.034 |
| k1 | 0.74 | 1.14 | 0.029 | 0.045 |
| L | 12.70 | 14.48 | 0.500 | 0.570 |
| L1 | - | 1.27 | - | 0.050 |
| Q | 90° Typ | | 90° Typ | |
| α | 45° Typ | | 45° Typ | |

* Lead Coplanarity

Note: Dimensions do not include protrusions; these shall not exceed 0.155 mm (0.006") on any side. Lead dimension shall not include solder coverage.

Figure 10 - T 3-Pin Metal Can TO-39

Package Outline Dimensions (continued)



| Dim | MILLIMETERS | | INCHES | |
|-----|-------------|-------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| A | 4.70 | 5.21 | 0.185 | 0.205 |
| A1 | 0.89 | 1.14 | 0.035 | 0.045 |
| A2 | 2.92 | 3.18 | 0.115 | 0.125 |
| b | 0.71 | 0.081 | 0.027 | 0.032 |
| D | 16.38 | 16.76 | 0.645 | 0.660 |
| D1* | 10.41 | 10.92 | 0.410 | 0.430 |
| e | 2.54 BSC | | 0.100 BSC | |
| E* | 10.41 | 10.67 | 0.410 | 0.420 |
| H | | 0.50 | | 0.020 |
| L | 12.70 | | 0.500 | |
| O | 13.39 | 13.64 | 0.527 | 0.537 |
| P | 3.56 | 3.81 | 0.140 | 0.150 |
| J | | 0.10 | | 0.004 |
| V | 5.13 | 5.38 | 0.202 | 0.212 |
| Z | 1.40 Typ | | 0.055 Typ | |

*Excludes Weld Fillet Around Lid.

Note: Dimensions do not include protrusions; these shall not exceed 0.155 mm (0.006") on any side. Lead dimension shall not include solder coverage.

Figure 11 • G/IG 3-Pin Hermetic TO-257



| Dim | MILLIMETERS | | INCHES | |
|------|-------------|-------|-----------|-------|
| | MIN | MAX | MIN | MAX |
| D, E | 8.64 | 9.14 | 0.340 | 0.360 |
| E3 | - | 8.128 | - | 0.320 |
| e | 1.270 BSC | | 0.050 BSC | |
| B1 | 0.635 Typ | | 0.025 Typ | |
| L | 1.02 | 1.52 | 0.040 | 0.060 |
| A | 1.626 | 2.286 | 0.064 | 0.090 |
| h | 1.016 Typ | | 0.040 Typ | |
| A1 | 1.372 | 1.68 | 0.054 | 0.066 |
| A2 | - | 1.168 | - | 0.046 |
| L2 | 1.91 | 2.41 | 0.075 | 0.95 |
| B3 | 0.203R | | 0.008R | |

Note: All exposed metalized area shall be gold plated 60 μ-inch minimum thickness over nickel plated unless specified in purchase order. Lead dimension shall not include solder coverage

Figure 12 • L 20-Pin Ceramic Leadless Chip Carrier



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