

FEATURES

- Fixed and Adjustable Versions Available
- Output Current up to 500mA
- Very Low Quiescent Current
- Input-output Differential less than 0.5V
- Short Circuit Protection
- Internal Thermal Overload Protection
- ENABLE Pin available in selected packages

APPLICATIONS

- Cellular Telephones
- Portable Consumer Equipment
- Portable (Notebook) Computers
- Battery Powered Systems
- Portable Instrumentation
- Radio Control Systems
- CD/DVD drives

GENERAL DESCRIPTION

The AMS5105 series consists of positive fixed and adjustable voltage regulators ideally suited for use in battery-powered systems. These devices feature very low quiescent current (500uA or less) when supplying loads up to 500mA, and a standby current less than 500nA when disabled using the ENABLE pin (available in selected packages). These unique characteristics and the low input-output differential required for proper regulation (0.5V for output currents of 500mA) make the AMS5105 ideal for use in standby power systems. Internal current limiting and thermal shutdown features provide protection for all AMS5105 series devices regardless of package type. The AMS5105 is offered as fixed voltage regulators in the 5 lead SOT-23, SOT-89, SOT-223, and 8 lead SOIC packages, and as adjustable voltage regulators in the 5 lead SOT-23 and 8 lead SOIC packages. All devices in the 5 lead SOT-23 and 8 lead SOIC packages are provided with ENABLE pin.

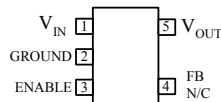
ORDERING INFORMATION

| OUTPUT VOLTAGE | PACKAGE TYPE | | | | TEMP. RANGE |
|-------------------|--------------|------------|-----------|------------|----------------|
| | 5L SOT-23 | SOT-89 | SOT-223 | SO-8 | |
| FIXED | AMS5105M1-X | AMS5105L-X | AMS5105-X | AMS5105S-X | -25C to 125C |
| ADJUSTABLE | AMS5105M1 | | | AMS5105S | -25C to 125C |

X = 1.5V, 1.8V, 2.5V, 2.8V, 3.3V.

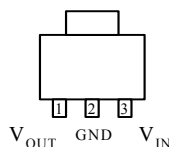
PIN CONNECTIONS

5 Lead SOT-23
(M1)



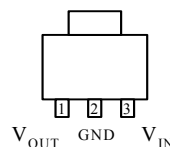
Top View

SOT-89
(L)



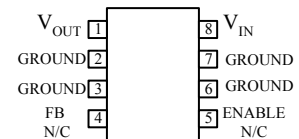
Top View

SOT-223



Top View

8 Lead SOIC
(S)



Top View

ABSOLUTE MAXIMUM RATINGS (Note 1)

| | | | |
|-------------------------------------|--------------------|-------------------------------------|-----------------|
| Input Supply Voltage | -0.3 to +6.5V | Maximum Junction Temperature | +125°C |
| Internal Power Dissipation (Note 4) | Internally Limited | Storage Temperature | -65°C to +150°C |
| ESD | 2000V | Lead Temperature (Soldering 25 sec) | 265°C |

ELECTRICAL CHARACTERISTICS

Electrical Characteristics at $V_{IN}=V_{OUT}+1V$, $I_{OUT}=1mA$, $T_J=25^\circ C$, $C_{OUT}=2.2\mu F$ unless otherwise specified.

| PARAMETER | CONDITIONS | AMS5105-X | | | Units |
|---|---|-----------|------|------|------------|
| | | Min. | Typ. | Max. | |
| Fixed Output Voltage Versions | | | | | |
| Output Voltage Tolerance | | -1.5 | | +1.5 | % |
| | $(V_{OUT}+1V) \leq V_{IN} \leq 6V$, $I_{OUT}=100\text{ mA}$ $-25^\circ C \leq T_J \leq 125^\circ C$ | -3.0 | | +3.0 | % |
| Line Regulation | $(V_{IN}+1V) \leq V_{IN} \leq 6V$ | | 5 | 10 | mV/V |
| | | | 8 | 30 | mV/V |
| Load Regulation | $1\text{ mA} \leq I_{OUT} \leq 100\text{ mA}$ | | 30 | 50 | mV |
| | $5\text{ mA} \leq I_{OUT} \leq 500\text{ mA}$ | | 50 | 70 | mV |
| Dropout Voltage | $I_{OUT} = 10\text{ mA}$ | | 20 | 25 | mV |
| | $I_{OUT} = 100\text{ mA}$ | | 100 | 125 | mV |
| | $I_{OUT} = 500\text{ mA}$ | | 400 | 500 | mV |
| Quiescent Current | $I_{OUT} = 10\text{ mA}$ | | 450 | 550 | μA |
| | $I_{OUT} = 100\text{ mA}$ | | 450 | 550 | μA |
| | $I_{OUT} = 500\text{ mA}$ | | 450 | 550 | μA |
| | $R_L = 500\Omega$, In disabled state, $V_{ENABLE} = 0$ | | 100 | 500 | nA |
| Maximum Operational Input Voltage | | | | 6 | V |
| ENABLE Threshold Voltage | $V_{IN} = 3V$ to $6V$ (Note 6) | 60 | - | | % V_{IN} |
| | | | - | 15 | % V_{IN} |
| ENABLE Threshold Current | $V_{ENABLE} = 0.6 \times V_{IN}$, $V_{IN} = 3V$ to $6V$ | | 0.01 | 1 | nA |
| Wake-Up Response Time (from disabled state) | (Note 7) | - | 20 | 30 | μs |

ELECTRICAL CHARACTERISTICS

Electrical Characteristics at $V_{IN}=6V$, $V_{OUT}=3V$, $I_{OUT}=1mA$, $T_J=25^\circ C$, $C_{OUT}=2.2\mu F$ unless otherwise specified.

| PARAMETER | CONDITIONS (Note 2) | Min. | AMS5105 Typ. | Max. | Units |
|--|---|--------------|-----------------|--------------|------------------|
| Adjustable Version | | | | | |
| Reference Voltage | | 1.231 | 1.250 | 1.269 | V |
| | $I_{OUT} \leq 100 \text{ mA}$, $-25^\circ C \leq T_J \leq 125^\circ C$ Measured from FB pin to GROUND | 1.218 | 1.250 | 1.282 | V |
| Output Voltage Range | | 1.25 | - | 5 | V |
| Line Regulation | $V_{OUT} + 1V \leq V_{IN} \leq 6V$ | | - | 1.5 | % |
| Load Regulation | $1mA \leq I_o \leq 100 \text{ mA}$ | | 0.3 | 1 | % |
| | $5mA \leq I_o \leq 500 \text{ mA}$ | | 1 | 2 | % |
| Dropout Voltage | $I_{OUT} \leq 10 \text{ mA}$ | | 20 | 25 | mV |
| | $I_{OUT} = 100 \text{ mA}$ | | 100 | 125 | mV |
| | $I_{OUT} = 500 \text{ mA}$ (Note 5) | | 400 | 500 | mV |
| Quiescent Current | $I_{OUT} = 10 \text{ mA}$ | | 350 | 450 | μA |
| | $I_{OUT} = 100 \text{ mA}$ | | 350 | 450 | μA |
| | $I_{OUT} = 500 \text{ mA}$ | | 350 | 450 | μA |
| | $R_L = 500\Omega$, In disabled state, $V_{ENABLE} = 0$ | | 100 | 500 | nA |
| Maximum Operational Input Voltage | | | | 6 | V |
| ENABLE Threshold Voltage | $V_{IN} = 3V \text{ to } 6V$ (Note 6) | Enabled | 60 | - | % V_{IN} |
| | | Disabled | - | - | 15 % V_{IN} |
| ENABLE Threshold Current | $V_{ENABLE} = 0.6 \times V_{IN}$, $V_{IN} = 3V \text{ to } 6V$ | | 0.01 | 1 | nA |
| Wake-Up Response Time (from disabled state) | (Note 7) | - | 20 | 30 | μs |

Note 1: Absolute Maximum Ratings are limits beyond which damage to the device may occur. For guaranteed performance limits and associated test conditions, see the Electrical Characteristics tables.

Note 2: To ensure constant junction temperature, low duty cycle pulse testing is used.

Note 3: Limits appearing in **boldface** type apply over the entire junction temperature range for operation. Limits appearing in normal type apply for $T_A = T_J = 25^\circ C$.

Note 4: The maximum allowable power dissipation is a function of the maximum junction temperature $T_J(\text{MAX})$, the junction-to ambient thermal resistance θ_{JA} and the ambient temperature T_A . The maximum allowable power dissipation at any ambient temperature is calculated using:

$$P(\text{MAX}) = \frac{T_J(\text{MAX}) - T_A}{\theta_{JA}}$$

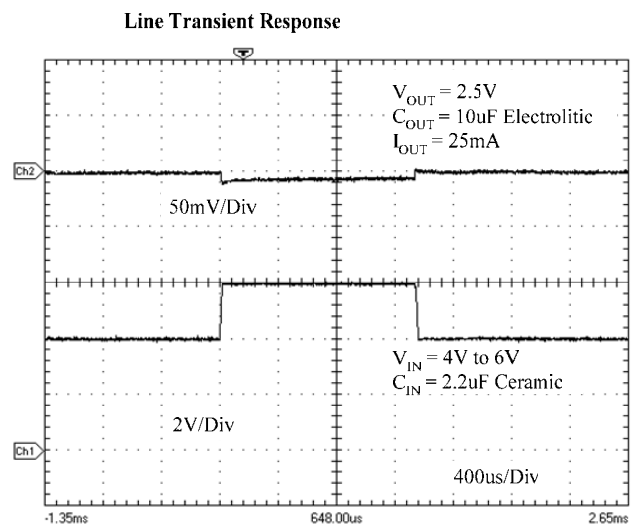
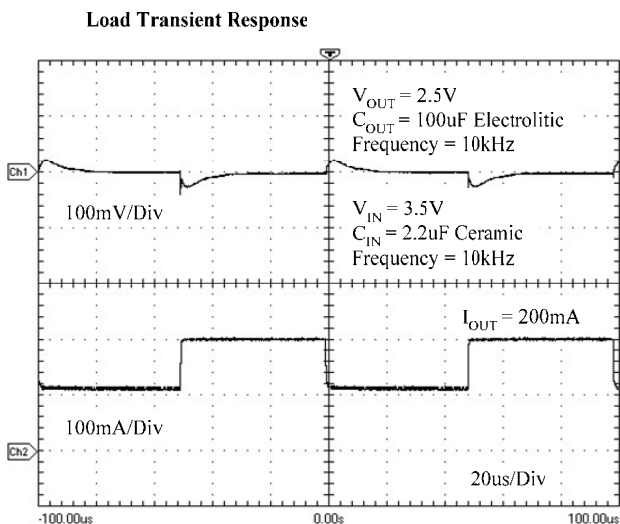
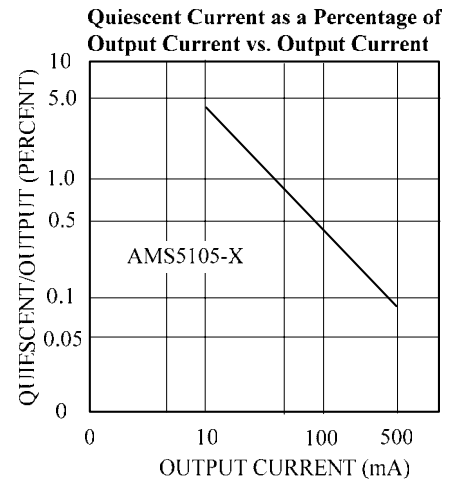
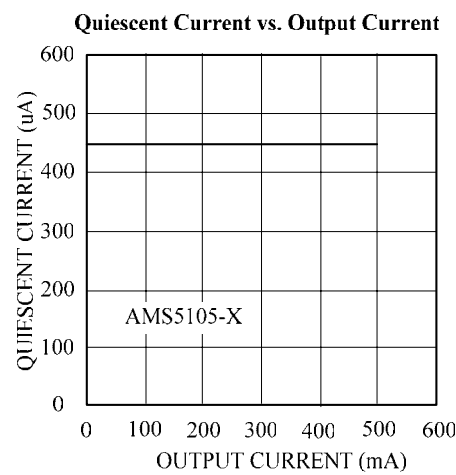
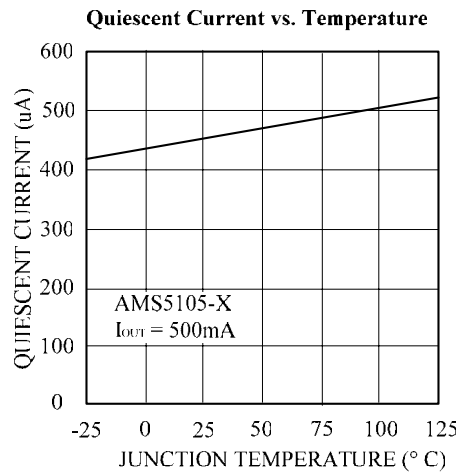
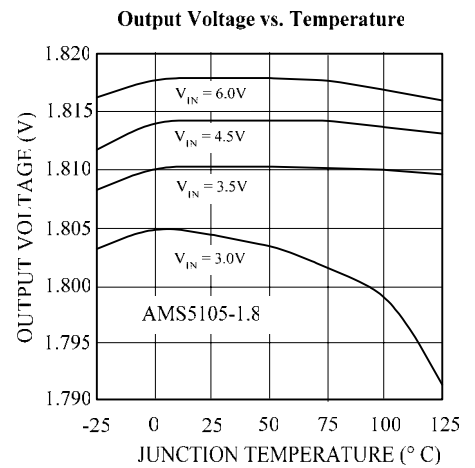
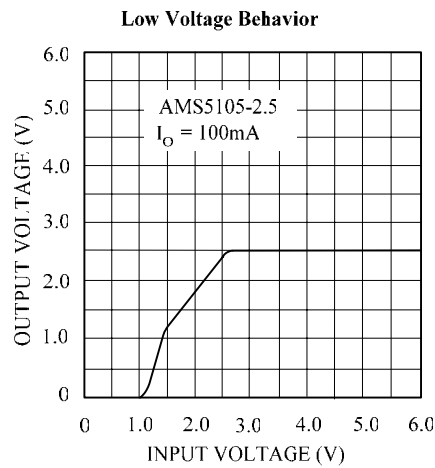
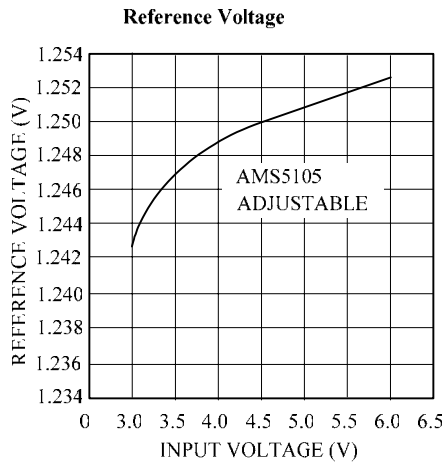
Where the values of the junction-to-ambient thermal resistances are as follows: $220^\circ C/W$ for 5 lead SOT-23 (M1) and $160^\circ C/W$ for the molded plastic SO-8 (S).

Note 5: Dropout Voltage is defined as the input to output differential at which the output voltage drops 100mV below its nominal value measured at 1V differential.

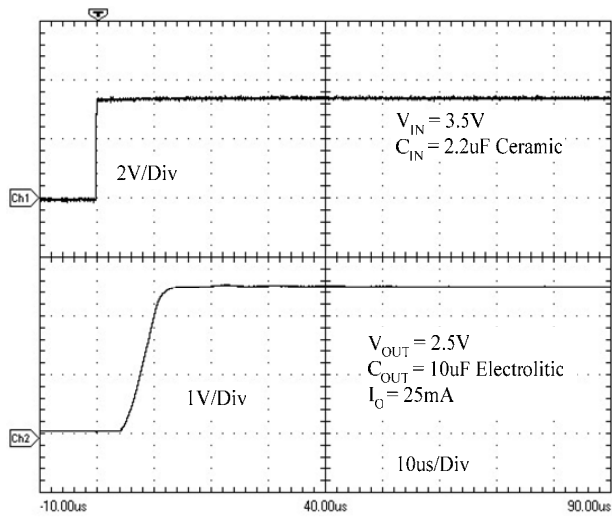
Note 6: ENABLE Threshold Voltage levels are specified as a percentage of input voltage V_{IN} . Quiescent current can be minimized by choosing $V_{ENABLE \text{ HIGH}}$ equal to V_{IN} .

Note 7: Time required for V_{OUT} to reach 95% of output voltage setting after V_{ENABLE} is switched from 0V to V_{IN} .

TYPICAL PERFORMANCE CHARACTERISTICS



Wake-Up Response



| AMS5105/-X Pin Description 5-Lead SOT-23 | | |
|--|-----------|---|
| PIN | NAME | DESCRIPTION |
| 1 | V_{IN} | Unregulated input voltage Connect C_{IN} from V_{IN} to GND |
| 2 | GND | Ground connection for V_{IN} and V_{OUT} |
| 3 | ENABLE | Logical high enables regulator Logical low disables regulator |
| 4 | FB | Feedback from resistor divider Used to set output voltage Adjustable versions only (See Figures 3 and 4) |
| 5 | V_{OUT} | Regulated output voltage Connect C_{OUT} from V_{OUT} to GND |

APPLICATION NOTES

Definition of Terms

Dropout Voltage: The input-output voltage differential at which the circuit stops to regulate against further reduction in input voltage. Measured when the output voltage has dropped 100mV from the nominal voltage obtained at 1V input, dropout voltage is dependent upon load current and junction temperature.

Input Voltage: The DC voltage applied to the input terminal with respect to ground.

Input-Output Differential: The voltage difference between the unregulated input voltage and the regulated output voltage for which the regulator will regulate.

Line Regulation: The change in output voltage for a change in the input voltage. The line regulation is measured under conditions of low dissipation or by using low duty cycle pulse testing 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.

Long term stability: Output voltage stability under accelerated life-test conditions after 1000 hours with maximum rated voltage and junction temperature.

Quiescent Current: That part of the positive input current that does not contribute to the positive load current. The regulator ground lead current.

Temperature Stability of V_O : The percentage change in output voltage for a thermal variation from room temperature to either temperature extreme.

External capacitor

The AMS5105 series requires an output capacitor of 2.2 μ F or greater to ensure device stability, as shown in Figures 1 through 4. Without the capacitor the device may oscillate. Most types of tantalum or electrolytic capacitor can be used in the applications. The value of this capacitor can be increased without limits. For

higher loads, the value of the capacitor should be increased, especially when the output voltage is set for 2.5V or less. The AMS5105 lowest fixed output voltage value is 1.5V.

Programming the Output Voltage

The AMS5105 may be programmed for any output voltage between its 1.25V reference and its 6V maximum rating, allowing for dropout and power dissipation. As shown in Figure 3, an external pair of resistors is required.

The equation for the output voltage is:

$$V_{OUT} = V_{REF} \cdot (1 + R_1 / R_2)$$

where V_{REF} is the nominal 1.25 reference voltage.

Typical application circuit (adjustable output)

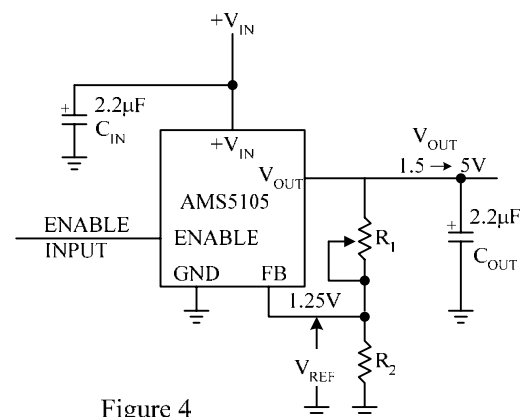


Figure 4

TYPICAL APPLICATION

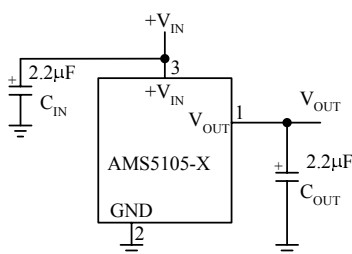


Figure 1

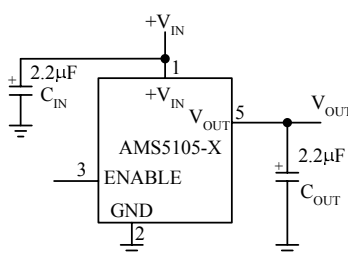


Figure 2

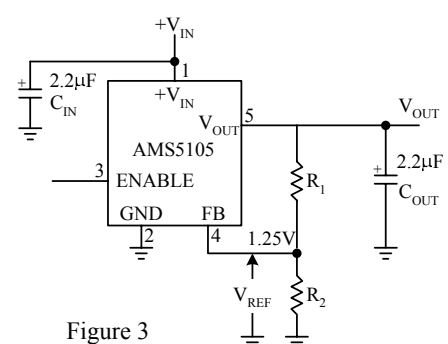
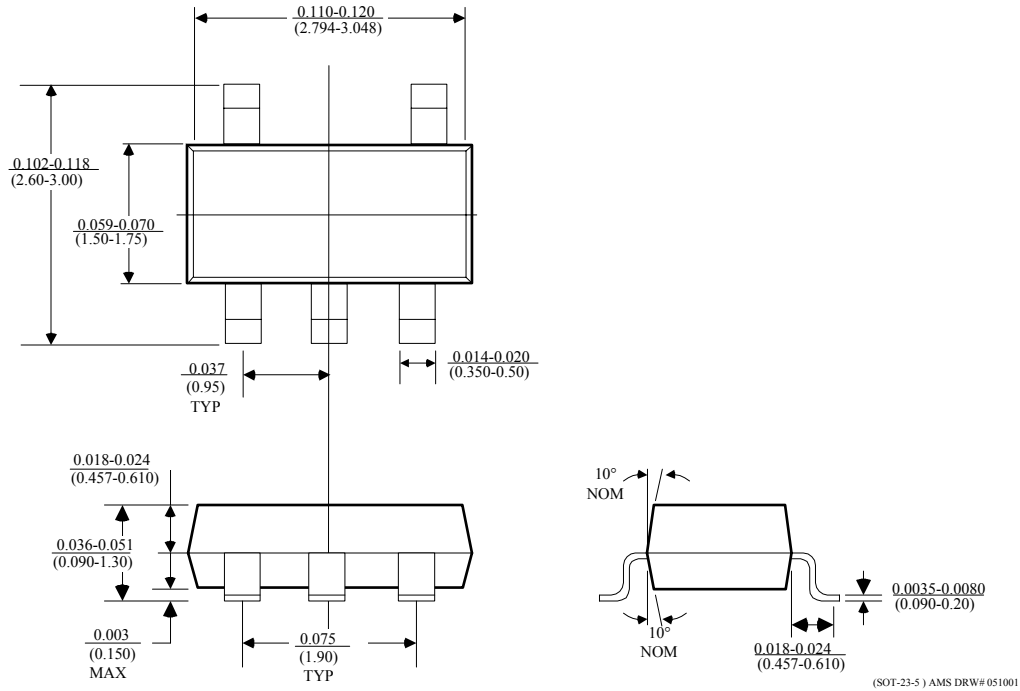


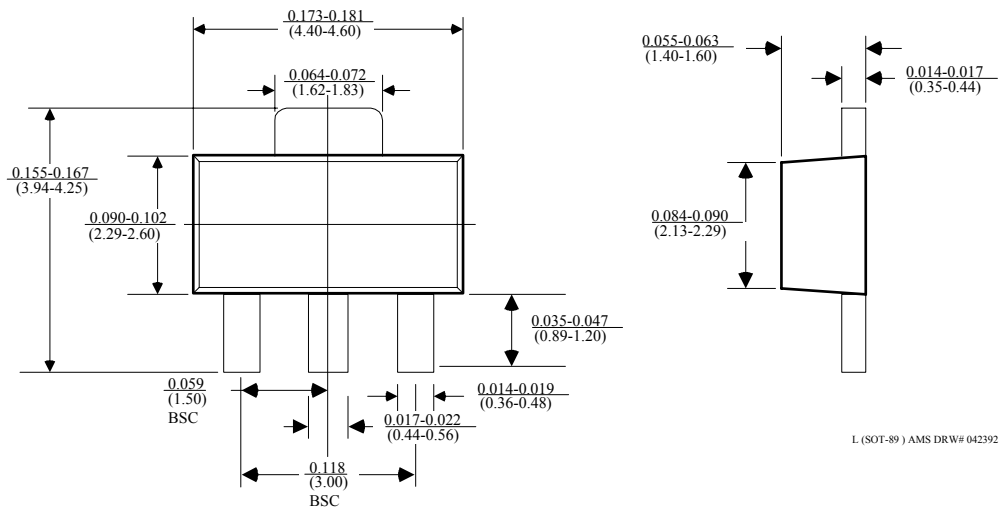
Figure 3

PACKAGE DIMENSIONS inches (millimeters) unless otherwise noted.

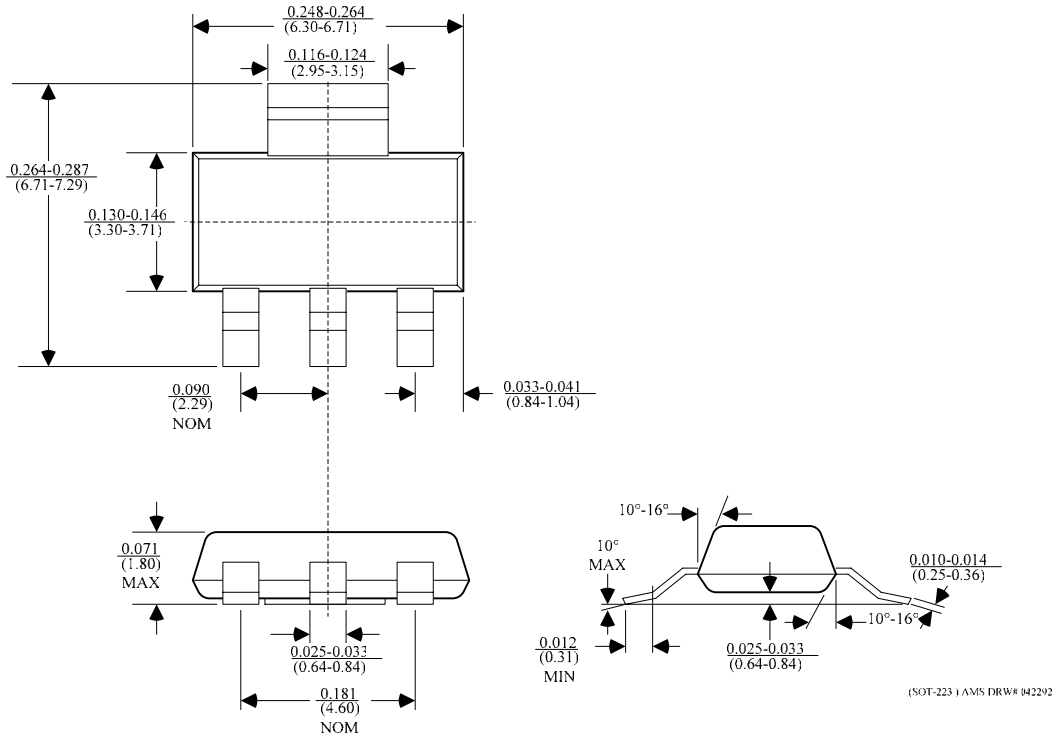
5 LEAD SOT-23 PLASTIC PACKAGE (M1)



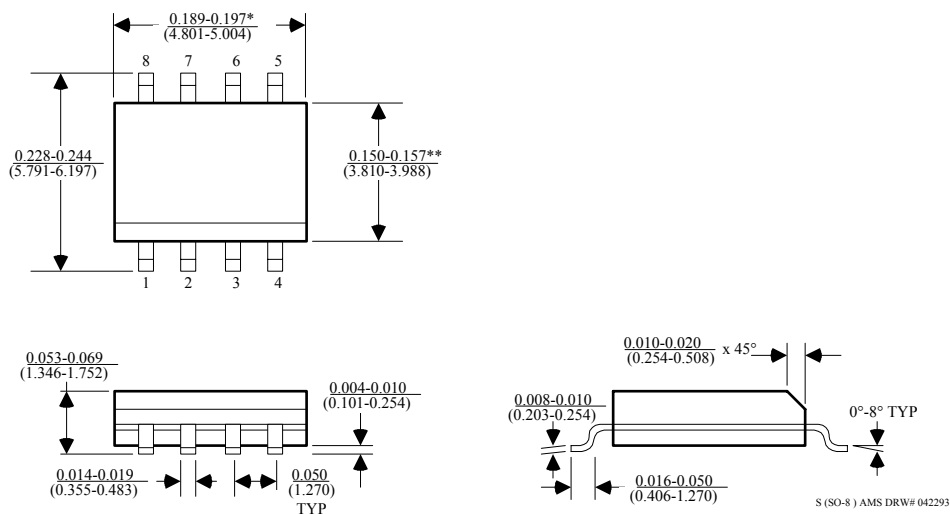
SOT-89 PLASTIC PACKAGE (L)



3 LEAD SOT-223 PLASTIC PACKAGE



8 LEAD SOIC PLASTIC PACKAGE (S)



*DIMENSION DOES NOT INCLUDE MOLD FLASH. MOLD FLASH SHALL NOT EXCEED 0.006" (0.152mm) PER SIDE

**DIMENSION DOES NOT INCLUDE INTERLEAD FLASH. INTERLEAD FLASH SHALL NOT EXCEED 0.010" (0.254mm) PER SIDE