



**THE DATASHEET OF
AS78L15RTR-G1**



Description

The AS78LXX series are three terminal positive regulators designed for a wide variety of applications including local, on-card regulation.

This series of regulators are complete with internal current limiting, thermal shutdown protection, and safe-area compensation which make them virtually immune from output overload. If adequate heat sinking are provided, these regulators can deliver output currents up to 100mA.

The AS78LXX series are available in TO-92 (Bulk Packing)/ TO-92 (Ammo Packing), SOT-89 and SOIC-8 packages.

Features

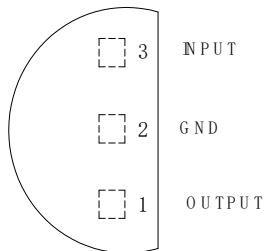
- Output Current up to 100mA
- Fixed Output Voltages of 5V, 12V and 15V
- Output Voltage Accuracy of $\pm 5\%$ over the Full Temperature Range
- Internal Short Circuit Current Limiting
- Internal Thermal Overload Protection
- No External Components
- Output Transistor Safe-Area Protection
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please [contact us](mailto:contact@diodes.com) or your local Diodes representative. <https://www.diodes.com/quality/product-definitions/>**

Applications

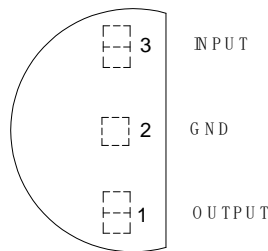
- Consumer electronics
- Microprocessor power supplies
- Mother boards

Pin Assignments

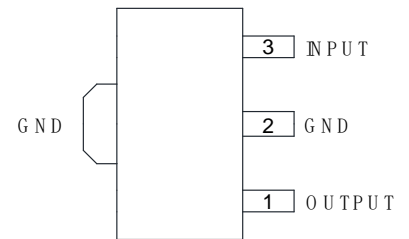
Z Package
(TO-92 (Bulk Packing))



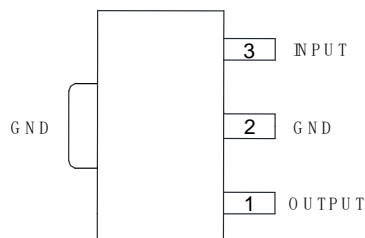
Z Package
(TO-92 (Ammo Packing))



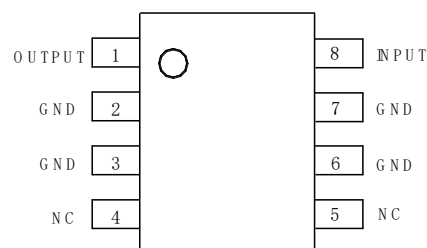
R Package
(SOT-89 Option 1)



R Package
(SOT-89 Option 2)

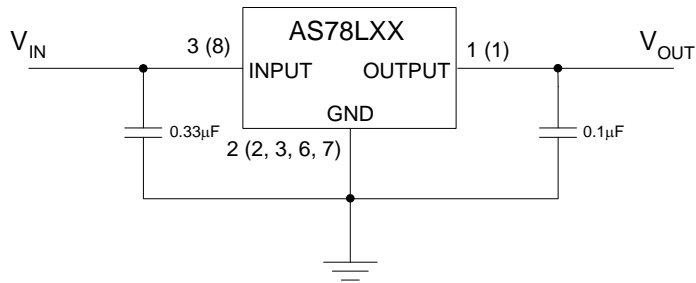


M Package
(SOIC-8)



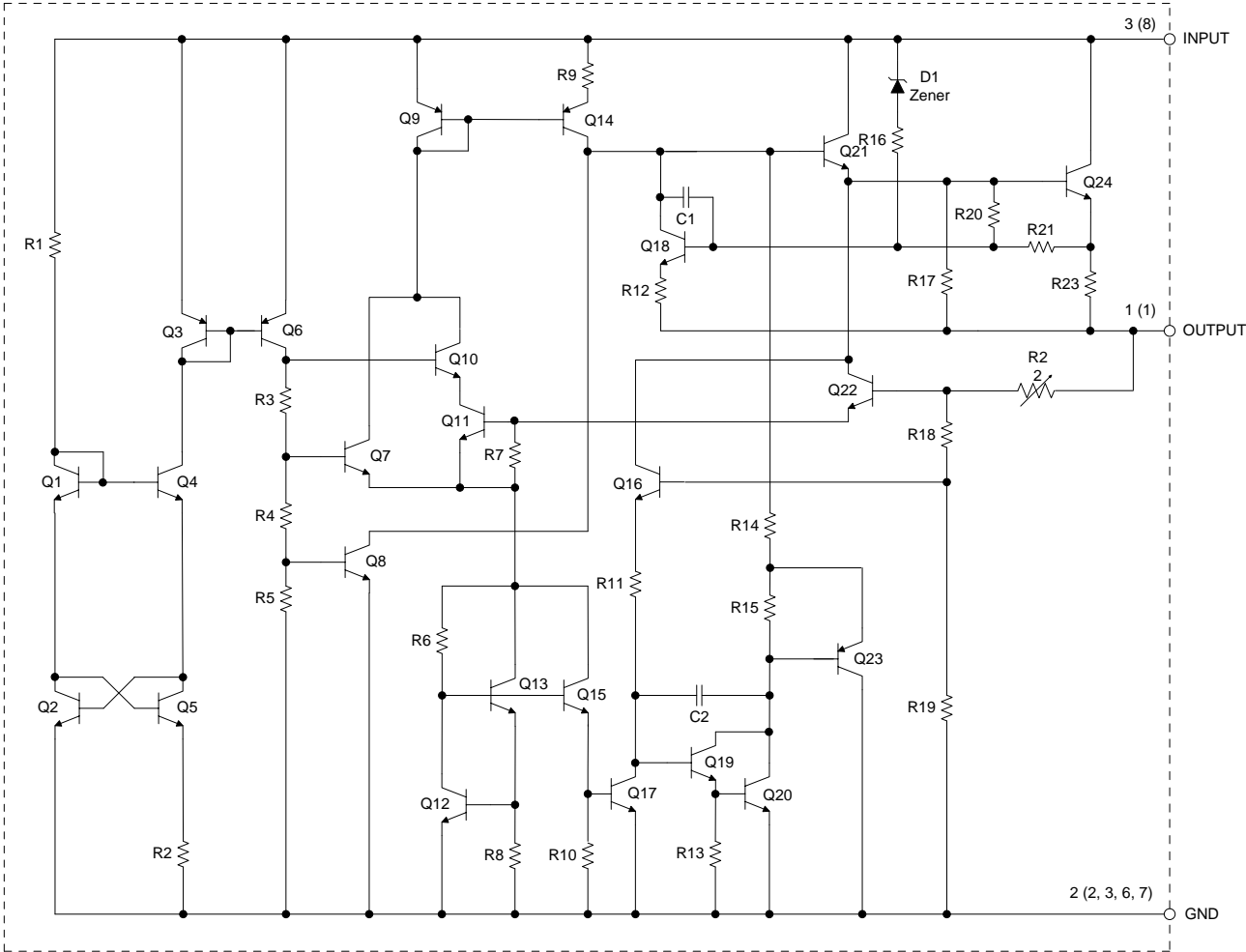
- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
 2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Typical Applications Circuit



A (B)
A for 3-pin B for 8-pin

Functional Block Diagram



A (B)
A for 3-pin B for 8-pin

Absolute Maximum Ratings (Note 4)

| Symbol | Parameter | Rating | Unit | |
|-------------------|-------------------------------------|-------------|------|------|
| V _{IN} | Input Voltage | 36 | V | |
| T _J | Operating Junction Temperature | 150 | °C | |
| T _{LEAD} | Lead Temperature (Soldering, 10sec) | 260 | °C | |
| P _D | Power Dissipation | 750 | mW | |
| T _{STG} | Storage Temperature Range | -65 to +150 | °C | |
| θ _{JA} | Thermal Resistance | TO-92 | +180 | °C/W |
| ESD | ESD (Human Body Model) | 2000 | V | |
| ESD | ESD (Machine Model) | 200 | V | |

Note 4: Stresses greater than those listed under “Absolute Maximum Ratings” can cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “Recommended Operating Conditions” is not implied. Exposure to “Absolute Maximum Ratings” for extended periods can affect device reliability.

Recommended Operating Conditions

| Symbol | Parameter | Min | Max | Unit | |
|-----------------|--------------------------------------|---------|------|------|---|
| V _{IN} | Input Voltage | AS78L05 | — | 30 | V |
| | | AS78L12 | — | 36 | |
| | | AS78L15 | — | 36 | |
| T _J | Operating Junction Temperature Range | -40 | +125 | °C | |

Electrical Characteristics

AS78L05 (@ V_{IN} = 10V, I_{OUT} = 40mA, C_{IN} = 0.33μF, C_{OUT} = 0.1μF, T_J = +25°C, **Bold** typeface applies over -40°C ≤ T_J ≤ +125°C, unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|--|--|------|------|------|--------|
| V _{OUT} | Output Voltage | — | 4.8 | 5.0 | 5.2 | V |
| | | 7V ≤ V _{IN} ≤ 20V, 1mA ≤ I _{OUT} ≤ 100mA, P _D ≤ 0.75W | 4.75 | — | 5.25 | |
| V _{RLINE} | Line Regulation | 7V ≤ V _{IN} ≤ 20V | — | 8 | 150 | mV |
| V _{RLOAD} | Load Regulation | 1mA ≤ I _{OUT} ≤ 100mA | — | 10 | 60 | mV |
| I _Q | Quiescent Current | — | — | 3 | 5.5 | mA |
| Δ I _Q | Quiescent Current Change | 8V ≤ V _{IN} ≤ 20V | — | — | 1.5 | mA |
| | | 1mA ≤ I _{OUT} ≤ 40mA | — | — | 0.1 | |
| PSRR | Ripple Rejection | f = 120Hz, 8V ≤ V _{IN} ≤ 18V | 47 | 62 | — | dB |
| V _{DROP} | Dropout Voltage | I _{OUT} = 40mA | — | 1.7 | 2.0 | V |
| | | I _{OUT} = 100mA | — | 1.8 | 2.3 | |
| N _O | Output Noise Voltage | 10Hz ≤ f ≤ 100kHz (Note 5) | — | 40 | — | μV |
| Δ V _{OUT} /Δ T | Output Voltage Temperature Coefficient | I _{OUT} = 5mA | — | 0.42 | — | mV/°C |
| (Δ V _{OUT} /V _{OUT})/Δ T | | | — | 84 | — | ppm/°C |
| θ _{JC} | Thermal Resistance | TO-92 (Bulk Packing)/ TO-92 (Ammo Packing) | — | 40 | — | °C/W |
| | | SOT-89 | — | 28.3 | — | |
| | | SOIC-8 | — | 62 | — | |

Note: 5. 0.01μF minimum load capacitance is recommended to limit high frequency noise.

Electrical Characteristics (continued)

AS78L05C (@ $V_{IN} = 10V$, $I_{OUT} = 40mA$, $C_{IN} = 0.33\mu F$, $C_{OUT} = 0.1\mu F$, $T_J = +25^\circ C$, **Bold** typeface applies over $-40^\circ C \leq T_J \leq +125^\circ C$, unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|---|-----|------|-----|-----------------|
| V_{OUT} | Output Voltage | — | 5.0 | | 5.1 | V |
| V_{RLINE} | Line Regulation | $7V \leq V_{IN} \leq 20V$ | — | 8 | 150 | mV |
| V_{RLOAD} | Load Regulation | $1mA \leq I_{OUT} \leq 100mA$ | — | 10 | 60 | mV |
| I_Q | Quiescent Current | — | — | 3 | 5.5 | mA |
| ΔI_Q | Quiescent Current Change | $8V \leq V_{IN} \leq 20V$ | — | — | 1.5 | mA |
| | | $1mA \leq I_{OUT} \leq 40mA$ | — | — | 0.1 | |
| PSRR | Ripple Rejection | $F = 120Hz$, $8V \leq V_{IN} \leq 18V$ | 47 | 62 | — | dB |
| V_{DROP} | Dropout Voltage | $I_{OUT} = 40mA$ | — | 1.7 | — | V |
| | | $I_{OUT} = 100mA$ | — | 1.8 | — | |
| N_O | Output Noise Voltage | $10Hz \leq f \leq 100kHz$ (Note 5) | — | 40 | — | μV |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient | $I_{OUT} = 5mA$ | — | 0.42 | — | mV/ $^\circ C$ |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | — | 84 | — | ppm/ $^\circ C$ |
| θ_{JC} | Thermal Resistance | TO-92 (Bulk Packing)/ TO-92 (Ammo Packing) | — | 40 | — | $^\circ C/W$ |
| | | SOT-89 | — | 28.3 | — | |
| | | SOIC-8 | — | 62 | — | |

 Note: 5. 0.01 μF minimum load capacitance is recommended to limit high frequency noise.

Electrical Characteristics (continued)

AS78L12 (@ $V_{IN} = 19V$, $I_{OUT} = 40mA$, $C_{IN} = 0.33\mu F$, $C_{OUT} = 0.1\mu F$, $T_J = +25^\circ C$, **Bold** typeface applies over $-40^\circ C \leq T_J \leq +125^\circ C$, unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|---|------|------|------|-----------------|
| V_{OUT} | Output Voltage | — | 11.5 | 12.0 | 12.5 | V |
| | | $14.5V \leq V_{IN} \leq 27V$, $1mA \leq I_{OUT} \leq 100mA$, $P_D \leq 0.75W$ | 11.4 | — | 12.6 | |
| V_{RLINE} | Line Regulation | $14.5V \leq V_{IN} \leq 27V$ | — | 20 | 250 | mV |
| V_{RLOAD} | Load Regulation | $1mA \leq I_{OUT} \leq 100mA$ | — | 20 | 100 | mV |
| I_Q | Quiescent Current | — | — | 3 | 6 | mA |
| ΔI_Q | Quiescent Current Change | $16V \leq V_{IN} \leq 27V$ | — | — | 1.5 | mA |
| | | $1mA \leq I_{OUT} \leq 40mA$ | — | — | 0.1 | |
| PSRR | Ripple Rejection | $f = 120Hz$, $15V \leq V_{IN} \leq 25V$ | 37 | 42 | — | dB |
| V_{DROP} | Dropout Voltage | $I_{OUT} = 40mA$ | — | 1.7 | — | V |
| | | $I_{OUT} = 100mA$ | — | 1.8 | — | |
| N_O | Output Noise Voltage | $10Hz \leq f \leq 100kHz$ (Note 5) | — | 80 | — | μV |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient | $I_{OUT} = 5mA$ | — | 1 | — | mV/ $^\circ C$ |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | — | 84 | — | ppm/ $^\circ C$ |
| θ_{JC} | Thermal Resistance | TO-92 (Bulk Packing)/ TO-92 (Ammo Packing) | — | 40 | — | $^\circ C/W$ |
| | | SOT-89 | — | 28.3 | — | |
| | | SOIC-8 | — | 62 | — | |

 Note: 5. 0.01 μF minimum load capacitance is recommended to limit high frequency noise.

Electrical Characteristics (continued)

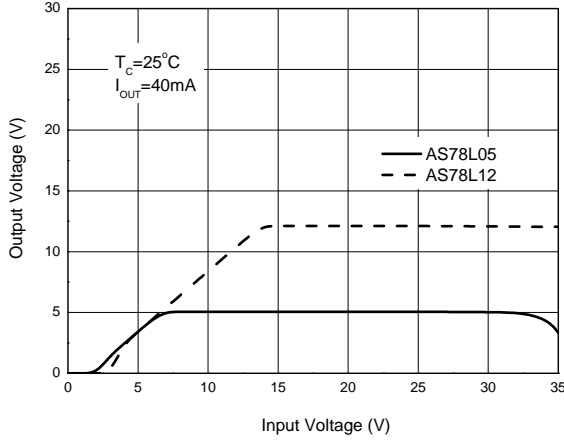
AS78L15 (@ $V_{IN} = 23V$, $I_{OUT} = 40mA$, $C_{IN} = 0.33\mu F$, $C_{OUT} = 0.1\mu F$, $T_J = +25^\circ C$, **Bold** typeface applies over $-40^\circ C \leq T_J \leq +125^\circ C$, unless otherwise specified.)

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|-------------------------------------|--|---|-------|------|-------|-----------------|
| V_{OUT} | Output Voltage | — | 14.4 | 15.0 | 15.6 | V |
| | | $17.5V \leq V_{IN} \leq 30V$, $1mA \leq I_{OUT} \leq 100mA$, $P_D \leq 0.75W$ | 14.25 | — | 15.75 | |
| V_{RLINE} | Line Regulation | $17.5V \leq V_{IN} \leq 30V$ | — | 25 | 250 | mV |
| V_{RLOAD} | Load Regulation | $1mA \leq I_{OUT} \leq 100mA$ | — | 25 | 150 | mV |
| I_Q | Quiescent Current | — | — | 3 | 6 | mA |
| ΔI_Q | Quiescent Current Change | $20V \leq V_{IN} \leq 30V$ | — | — | 1.5 | mA |
| | | $1mA \leq I_{OUT} \leq 40mA$ | — | — | 0.1 | |
| PSRR | Ripple Rejection | $f = 120Hz$, $18.5V \leq V_{IN} \leq 28.5V$ | 34 | 39 | — | dB |
| V_{DROP} | Dropout Voltage | $I_{OUT} = 40mA$ | — | 1.7 | — | V |
| | | $I_{OUT} = 100mA$ | — | 1.8 | — | |
| N_o | Output Noise Voltage | $10Hz \leq f \leq 100kHz$ (Note 5) | — | 90 | — | μV |
| $\Delta V_{OUT}/\Delta T$ | Output Voltage Temperature Coefficient | $I_{OUT} = 5mA$ | — | 1.25 | — | $mV/^\circ C$ |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | — | 84 | — | ppm/ $^\circ C$ |
| θ_{JC} | Thermal Resistance | TO-92 (Bulk Packing)/ TO-92 (Ammo Packing) | — | 40 | — | $^\circ C/W$ |
| | | SOT-89 | — | 28.3 | — | |
| | | SOIC-8 | — | 62 | — | |

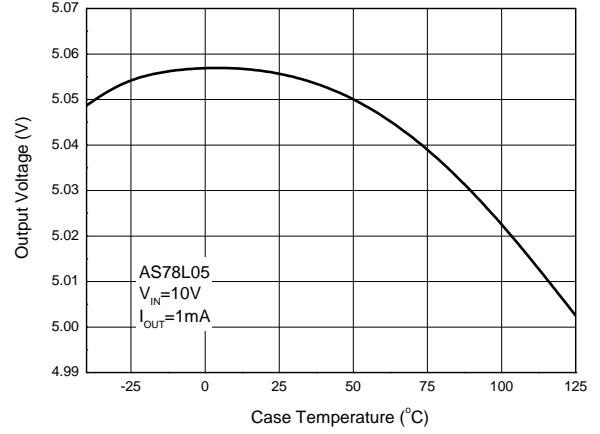
Note: 5. 0.01 μF minimum load capacitance is recommended to limit high frequency noise.

Performance Characteristics

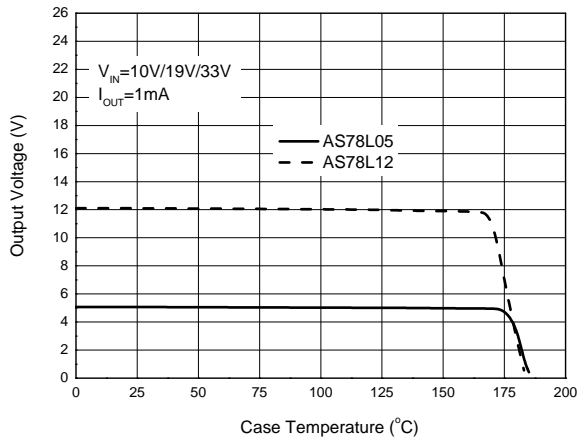
Output Voltage vs. Input Voltage



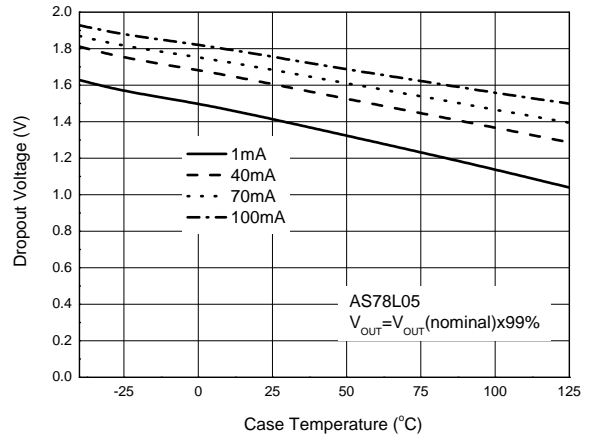
Output Voltage vs. Case Temperature



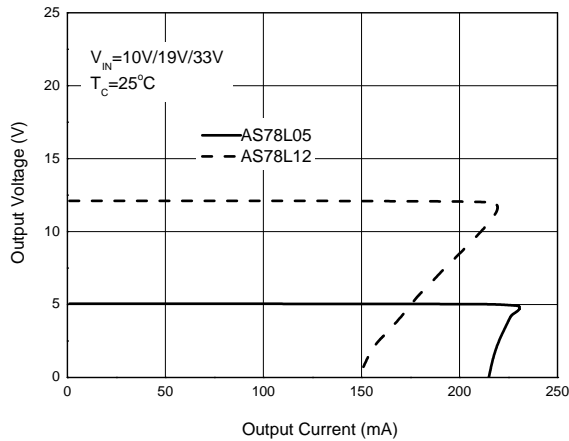
Over Temperature Protection



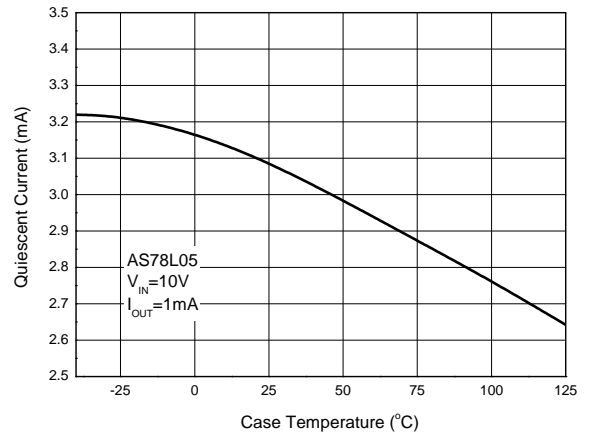
Dropout Voltage vs. Case Temperature



Output Voltage vs. Output Current

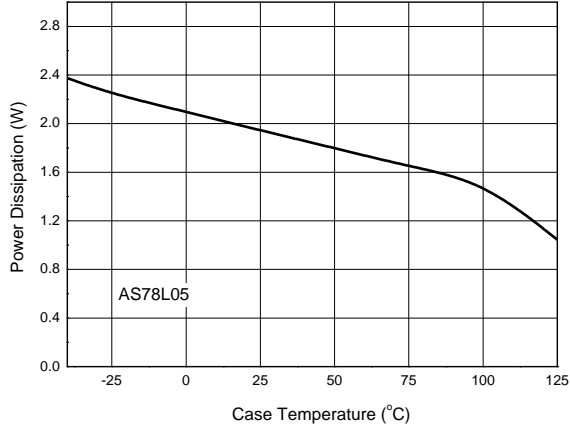


Quiescent Current vs. Case Temperature

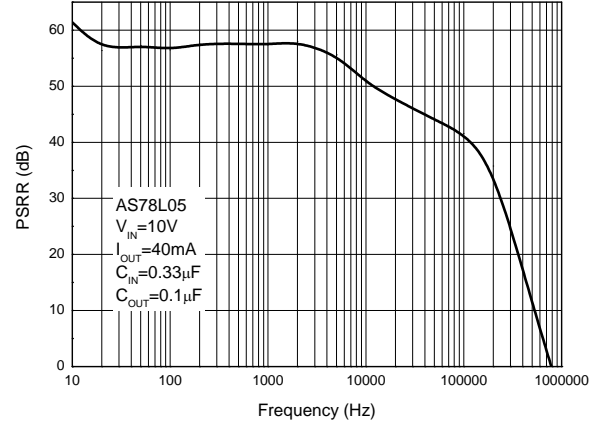


Performance Characteristics (continued)

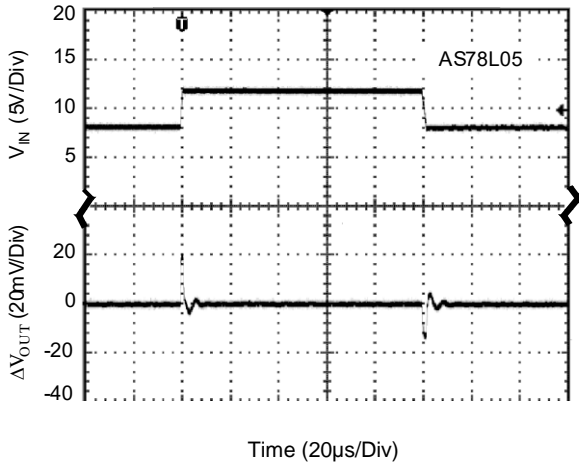
Power Dissipation vs. Case Temperature



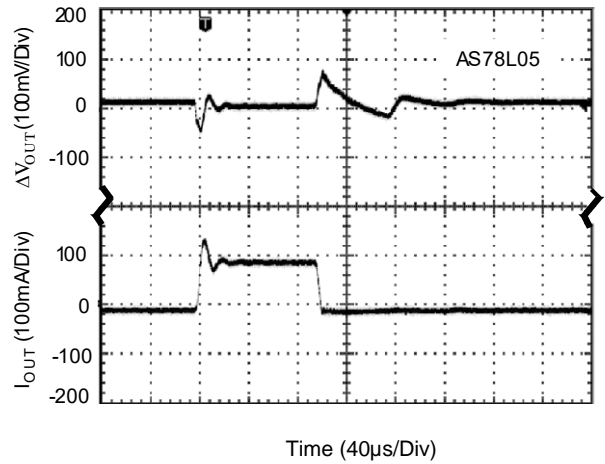
PSRR vs. Frequency



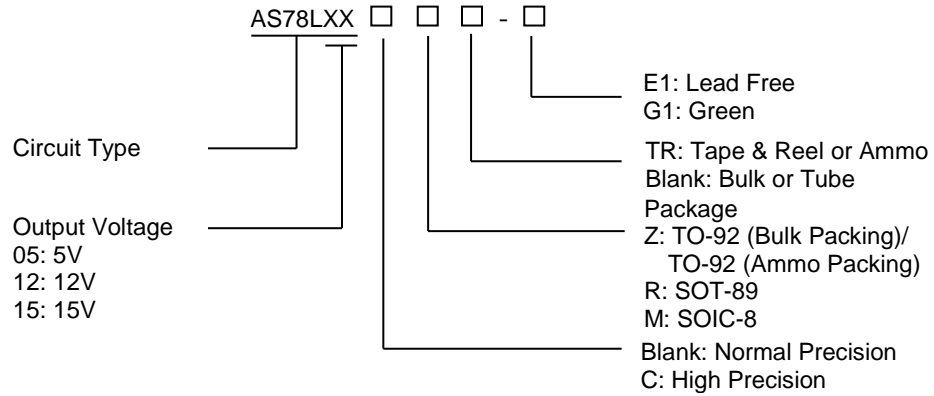
Line Transient
(Conditions: $I_{OUT}=40mA$, $C_{IN}=0.33\mu F$, $C_{OUT}=0.1\mu F$)



Load Transient
(Conditions: $V_{IN}=10V$, $C_{IN}=0.33\mu F$, $C_{OUT}=0.1\mu F$)



Ordering Information



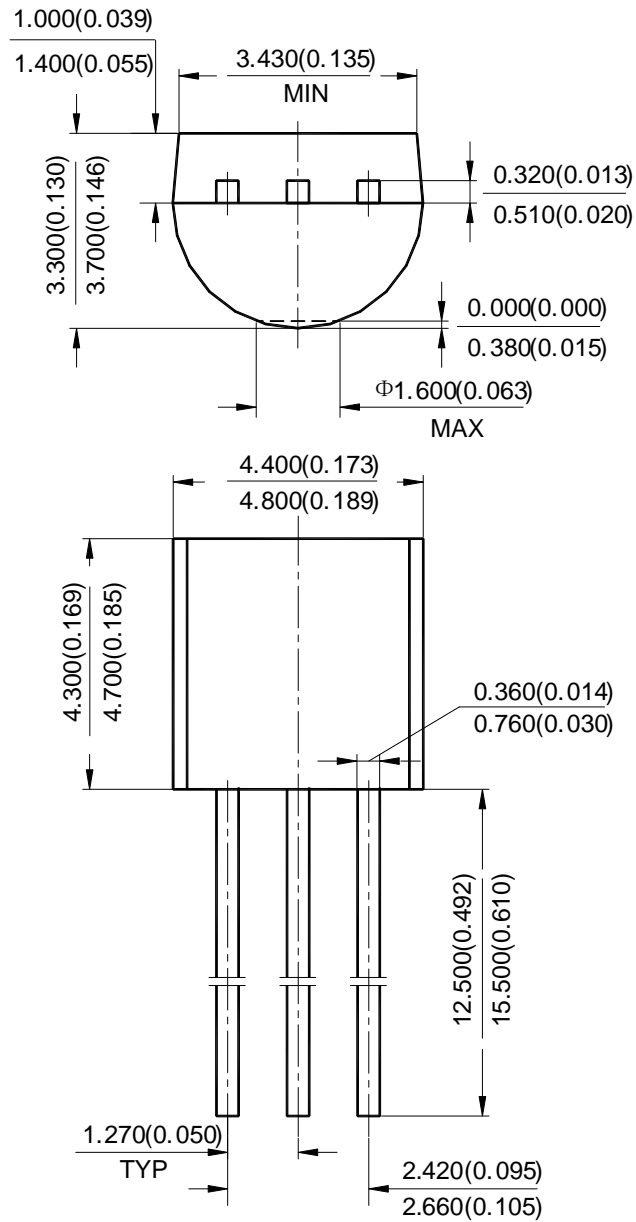
| Part Number | Package | Temperature Range | Status | Marking ID | Packing | |
|----------------|--|-------------------|------------|-----------------|---------|-------------|
| | | | | | Qty. | Carrier |
| AS78L05Z-E1 | TO-92 (Bulk Packing) TO-92 (Ammo Packing) | -40°C to +125°C | Production | AS78L05Z-E1 | 10k | Bulk |
| AS78L05Z-G1 | | | EOL | AS78L05Z-G1 | 10k | Bulk |
| AS78L05ZTR-E1 | | | Production | AS78L05Z-E1 | 2k | Ammo |
| AS78L05ZTR-G1 | | | Production | AS78L05Z-G1 | 2k | Ammo |
| AS78L05CZTR-E1 | | | Production | AS78L05Z-E1 | 2k | Ammo |
| AS78L12ZTR-E1 | | | Production | AS78L12Z-E1 | 2k | Ammo |
| AS78L15ZTR-E1 | | | Production | AS78L15Z-E1 | 2k | Ammo |
| AS78L05RTR-E1 | | | SOT-89 | -40°C to +125°C | NRND | E78E |
| AS78L05RTR-G1 | Production | G78E | | | 1k | Tape & Reel |
| AS78L12RTR-G1 | Production | G78F | | | 1k | Tape & Reel |
| AS78L15RTR-E1 | NRND | E78G | | | 1k | Tape & Reel |
| AS78L15RTR-G1 | Production | G78G | | | 1k | Tape & Reel |
| AS78L05MTR-E1 | SOIC-8 | -40°C to +125°C | NRND | AS78L05M-E1 | 4k | Tape & Reel |
| AS78L05MTR-G1 | | | Production | AS78L05M-G1 | 4k | Tape & Reel |

BCD Semiconductor's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant. Products with "G1" suffix are available in green packages.

Package Outline Dimensions (All dimensions in mm (inch).)

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

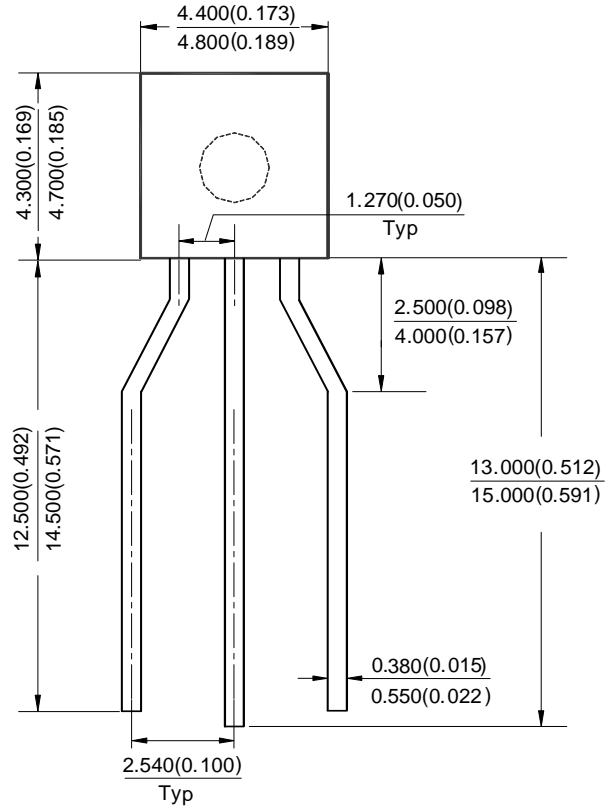
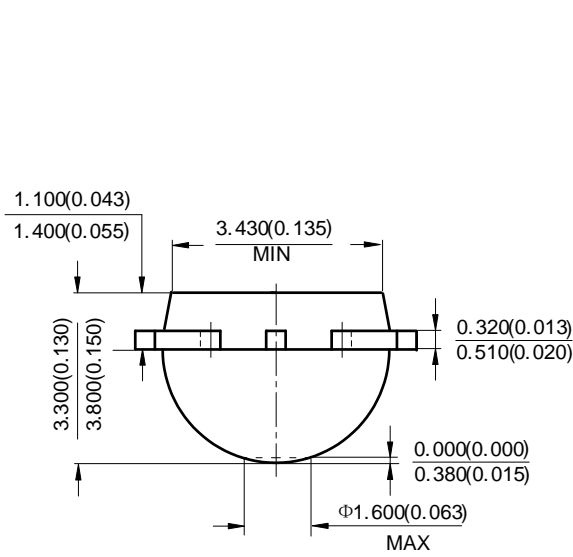
TO-92 (Bulk Packing)



Package Outline Dimensions (continued) (All dimensions in mm (inch).)

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

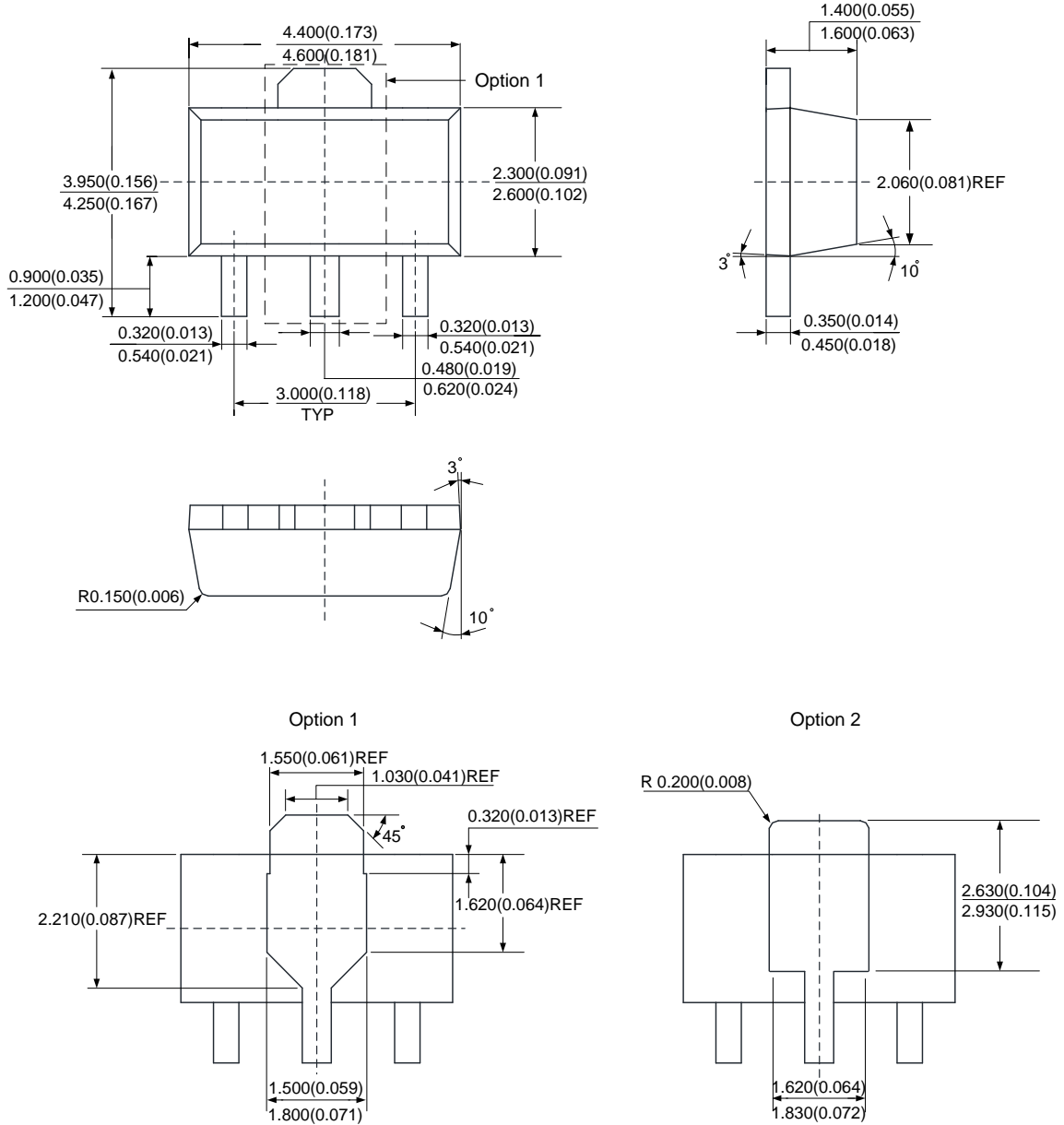
TO-92 (Ammo Packing)



Package Outline Dimensions (continued) (All dimensions in mm (inch).)

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

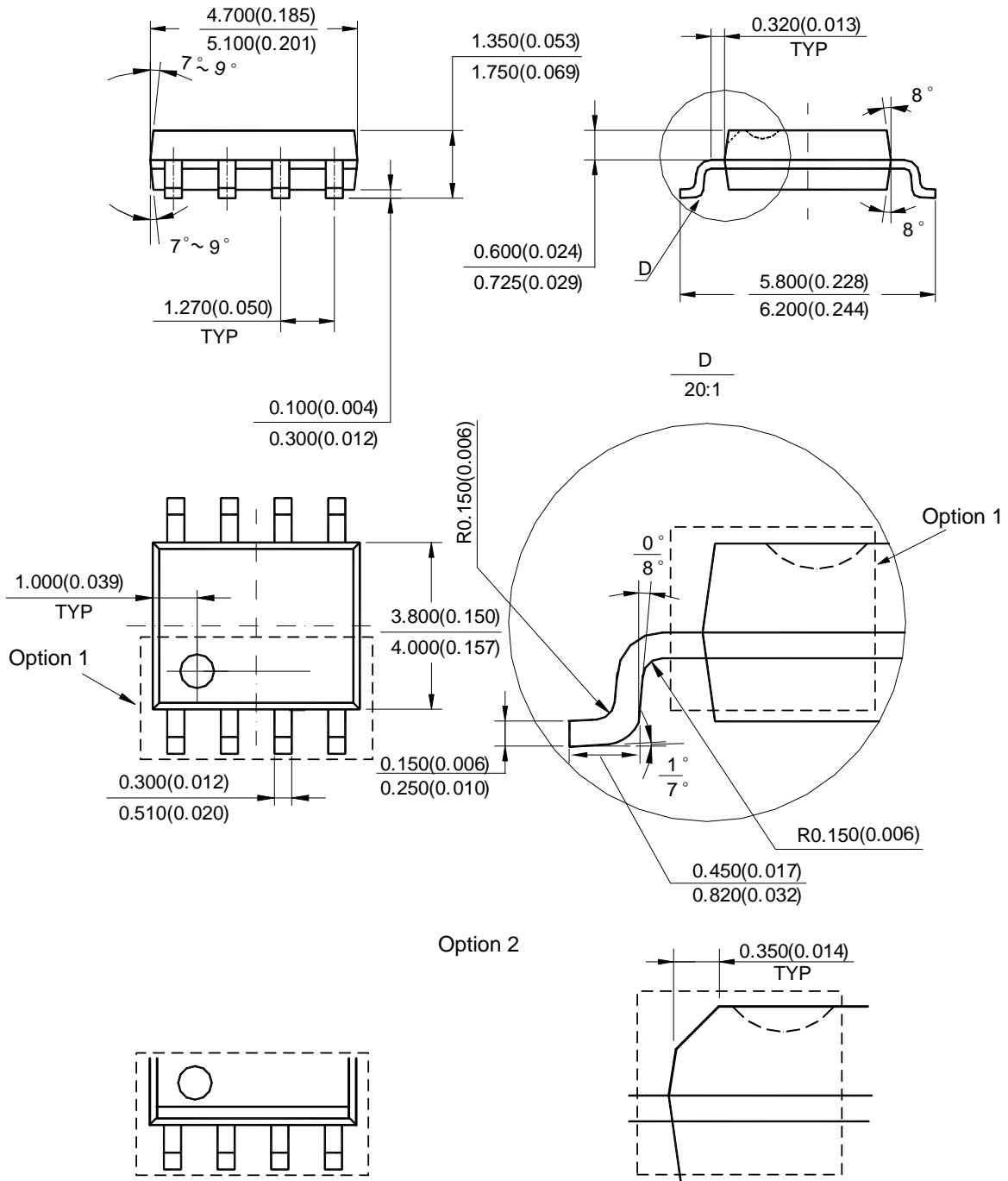
SOT-89



Package Outline Dimensions (continued) (All dimensions in mm (inch).)

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

SOIC-8

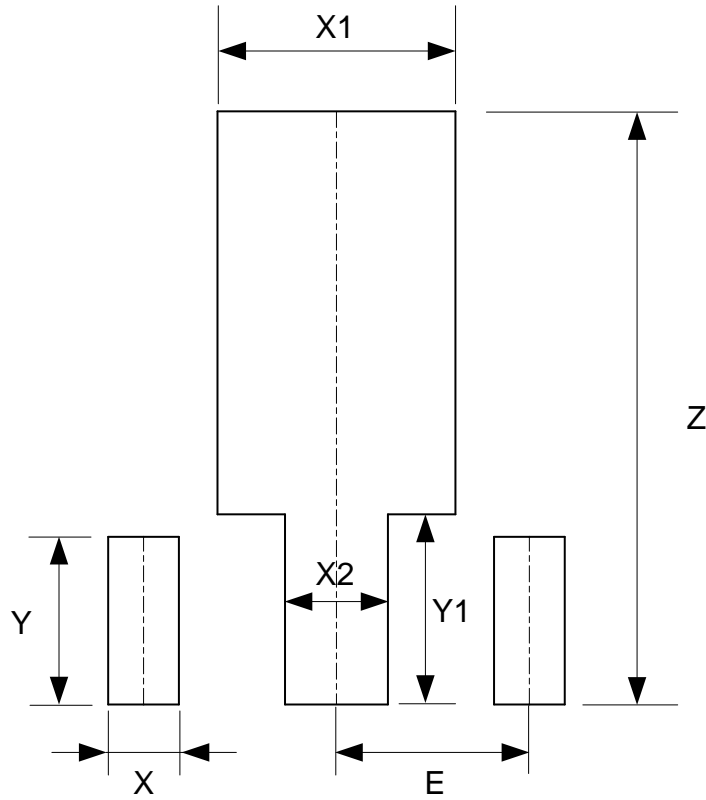


Note: Eject hole, oriented hole and mold mark is optional.

Suggested Pad Layout

Please see <http://www.diodes.com/package-outlines.html> for the latest version.

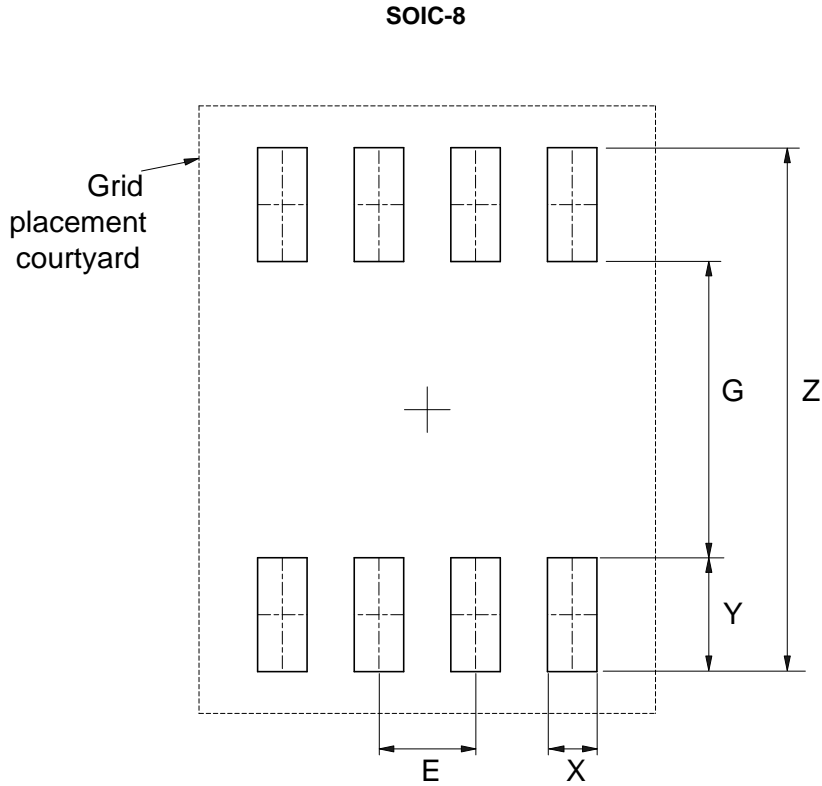
SOT-89



| Dimensions | Z (mm)/(inch) | X (mm)/(inch) | X1 (mm)/(inch) | X2 (mm)/(inch) | Y (mm)/(inch) | Y1 (mm)/(inch) | E (mm)/(inch) |
|------------|------------------|------------------|-------------------|-------------------|------------------|-------------------|------------------|
| Value | 4.600/0.181 | 0.550/0.022 | 1.850/0.073 | 0.800/0.031 | 1.300/0.051 | 1.475/0.058 | 1.500/0.059 |

Suggested Pad Layout (continued)

Please see <http://www.diodes.com/package-outlines.html> for the latest version.



| Dimensions | Z (mm)/(inch) | G (mm)/(inch) | X (mm)/(inch) | Y (mm)/(inch) | E (mm)/(inch) |
|------------|------------------|------------------|------------------|------------------|------------------|
| Value | 6.900/0.272 | 3.900/0.154 | 0.650/0.026 | 1.500/0.059 | 1.270/0.050 |

Mechanical Data

- Moisture Sensitivity: SOT-89: Level 3 per J-STD-020
SOIC-8: Level 1 per J-STD-020
- Terminals: Finish— Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208[Ⓒ]
- Weight:
SOIC-8: 0.076 grams (Approximate)
SOT-89: 0.0561 grams (Approximate)
TO-92 (Bulk Packing)/ TO-92 (Ammo Packing): 0.157 grams (Approximate)

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