



**THE DATASHEET OF
AS78L12RTR-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 or ammo packing), SOT-89 and SOIC-8 packages.

Features

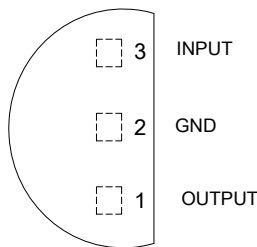
- Output Current up to 100mA
- Fixed Output Voltages of 5V, 12V and 15V
- Output Voltage Accuracy of $\pm 5\%$ over the Full Temperature Range
- Internal Short Circuit Current Limiting
- Internal Thermal Overload Protection
- No External Components
- Output Transistor Safe-area Protection

Applications

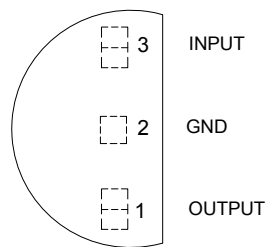
- Consumer Electronics
- Microprocessor Power Supply
- Mother Board

Pin Assignments

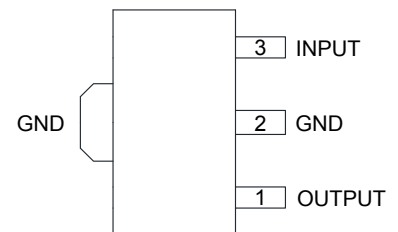
Z Package
(TO-92(Bulk Packing))



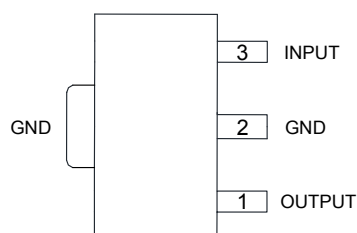
Z Package
(TO-92(Ammo Packing))



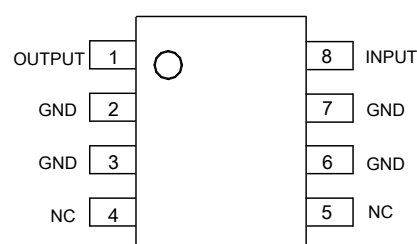
R Package
(SOT-89 Option 1)



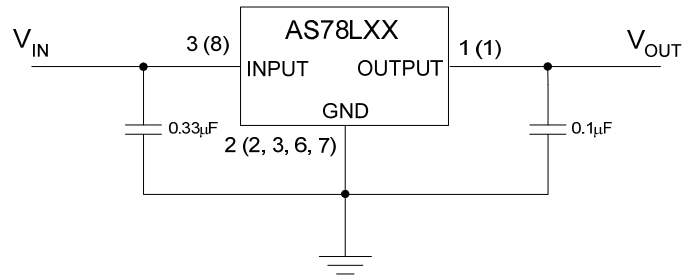
R Package
(SOT-89 Option 2)



M Package
(SOIC-8)

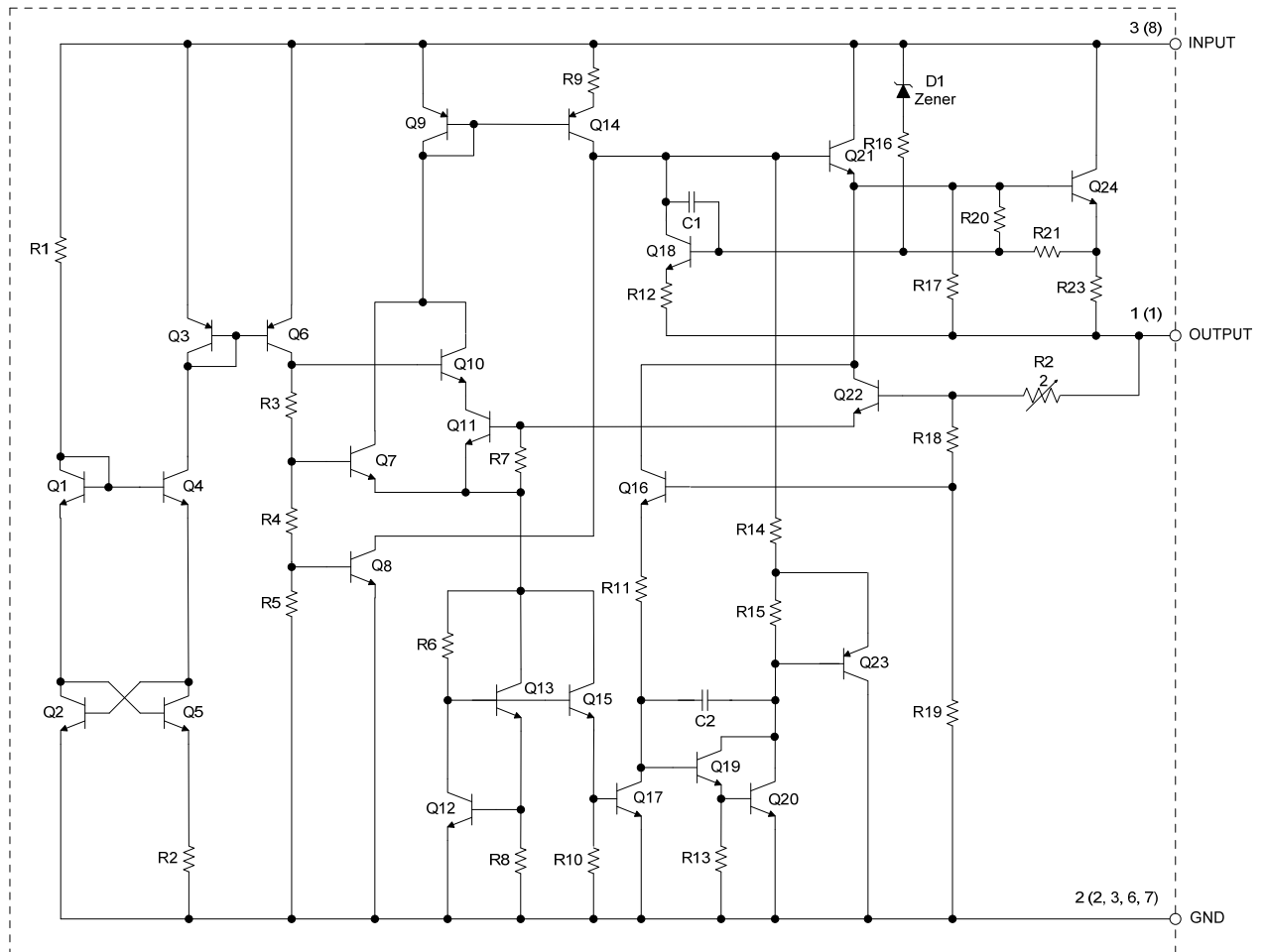


Typical Applications Circuit



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 1)

| 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 1: Stresses greater than those listed under "Absolute Maximum Ratings" may 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 may 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 (@ $V_{IN}=10V$, $I_{OUT}=40mA$, $C_{IN}=0.33\mu F$, $C_{OUT}=0.1\mu F$, $T_J=25^\circ C$, **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 | | 4.8 | 5.0 | 5.2 | V |
| | | $7V \leq V_{IN} \leq 20V$, $1mA \leq I_{OUT} \leq 100mA$, $P_D \leq 0.75W$ | 4.75 | | 5.25 | |
| 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 2) | | 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 | | 40 | | $^\circ C/W$ |
| | | SOT-89 | | 28.3 | | |
| | | SOIC-8 | | 62 | | |

Note 2: 0.01 μF minimum load capacitance is recommended to limit high frequency noise.

Electrical Characteristics (Cont.)

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 2) | | 40 | | μV |
| $\frac{\Delta V_{OUT}}{\Delta T}$ | Output Voltage Temperature Coefficient | $I_{OUT}=5mA$ | | 0.42 | | mV/ $^\circ C$ |
| $\frac{(\Delta V_{OUT}/V_{OUT})}{\Delta T}$ | | | | 84 | | ppm/ $^\circ C$ |
| θ_{JC} | Thermal Resistance | TO-92 | | 40 | | $^\circ C/W$ |
| | | SOT-89 | | 28.3 | | |
| | | SOIC-8 | | 62 | | |

Note 2: 0.01 μF minimum load capacitance is recommended to limit high frequency noise.

Electrical Characteristics (Cont.)

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 2) | | 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 | | 40 | | $^\circ C/W$ |
| | | SOT-89 | | 28.3 | | |
| | | SOIC-8 | | 62 | | |

Note 2: 0.01 μF minimum load capacitance is recommended to limit high frequency noise.

Electrical Characteristics (Cont.)

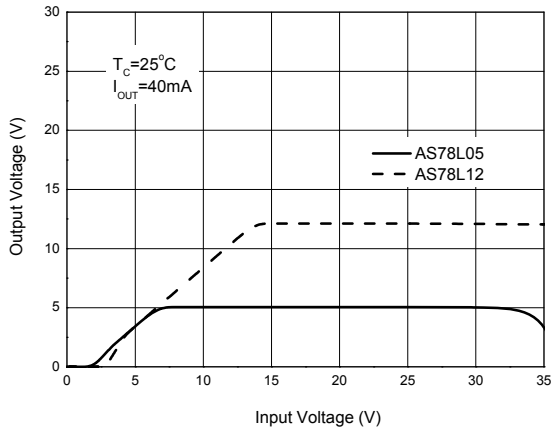
AS78L15 (@ $V_{IN}=23V$, $I_{OUT}=40mA$, $C_{IN}=0.33\mu F$, $C_{OUT}=0.1\mu F$, $T_J=25^\circ C$, **Bold** typeface applies over $-40^\circ C \leq T_J \leq 125^\circ C$, unless otherwise specified.)

| 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 2) | | 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 | | 40 | | $^\circ C/W$ |
| | | SOT-89 | | 28.3 | | |
| | | SOIC-8 | | 62 | | |

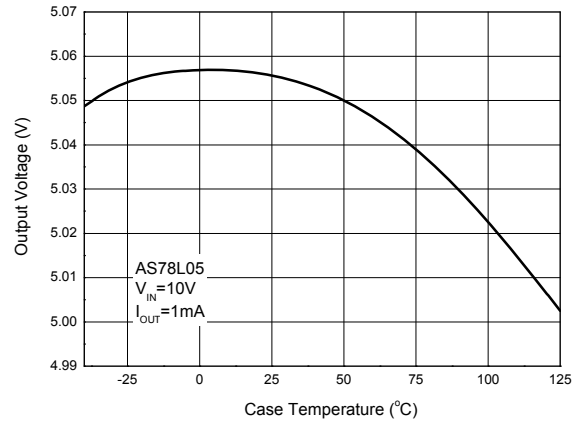
Note 2: 0.01 μF minimum load capacitance is recommended to limit high frequency noise.

Performance Characteristics

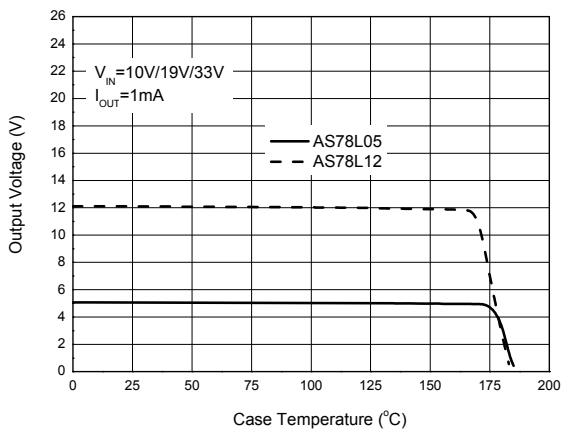
Output Voltage vs. Input Voltage



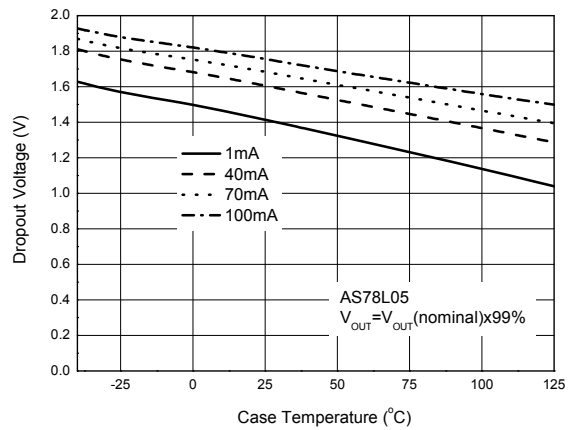
Output Voltage vs. Case Temperature



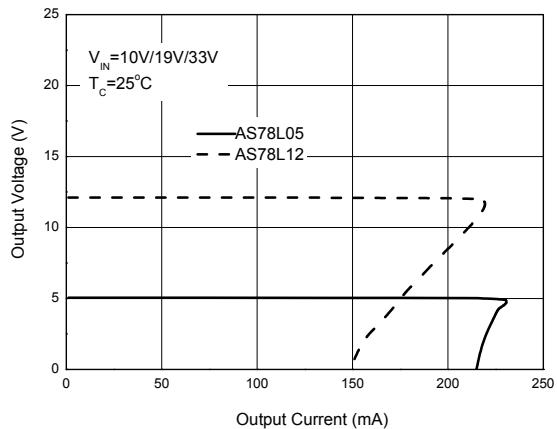
Over Temperature Protection



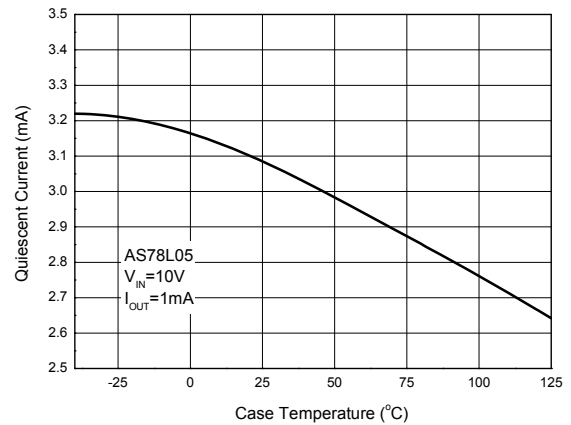
Dropout Voltage vs. Case Temperature



Output Voltage vs. Output Current

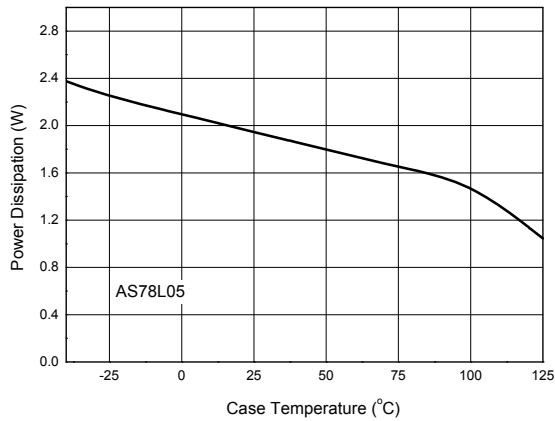


Quiescent Current vs. Case Temperature

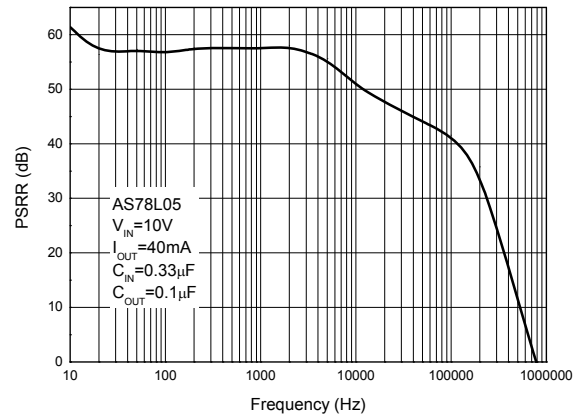


Performance Characteristics (Cont.)

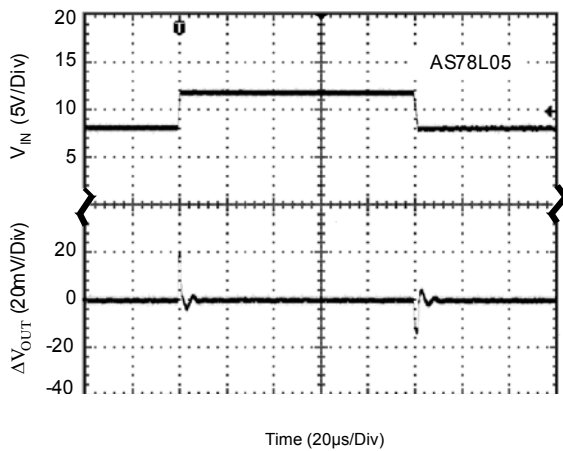
Power Dissipation vs. Case Temperature



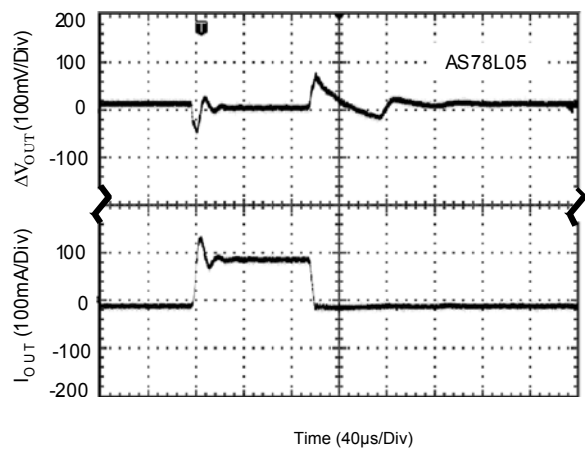
PSRR vs. Frequency



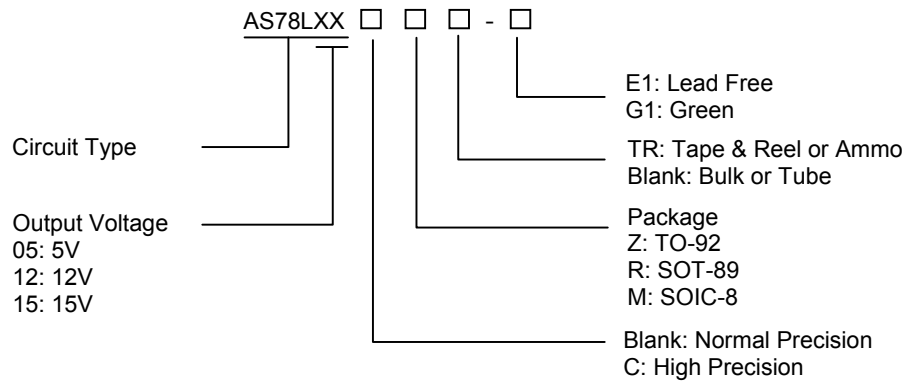
Line Transient
(Conditions: $I_{OUT}=40mA$, $C_{IN}=0.33\mu F$, $C_{OUT}=0.1\mu F$)



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



Ordering Information

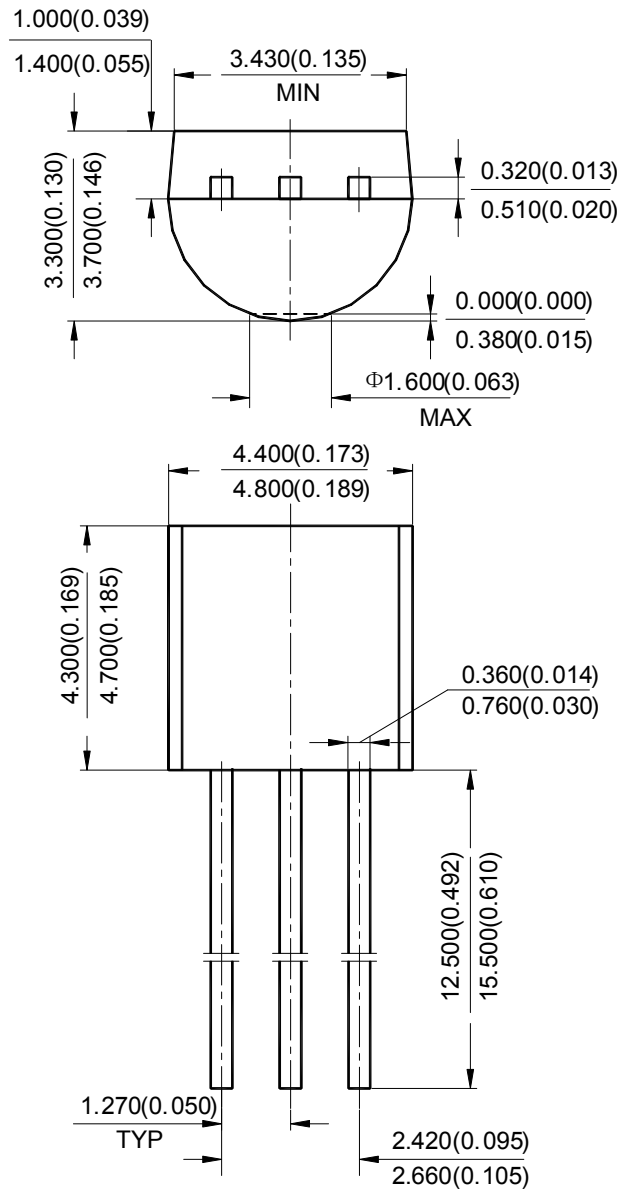


| Package | Temperature Range | Part Number | | Marking ID | | Packing Type |
|---------|-------------------|----------------|----------------|-------------|-------------|--------------|
| | | Lead Free | Green | Lead Free | Green | |
| TO-92 | -40 to 125°C | AS78L05Z-E1 | AS78L05Z-G1 | AS78L05Z-E1 | AS78L05Z-G1 | Bulk |
| | | AS78L05ZTR-E1 | AS78L05ZTR-G1 | AS78L05Z-E1 | AS78L05Z-G1 | Ammo |
| | | AS78L05CZTR-E1 | AS78L05CZTR-G1 | AS78L05Z-E1 | AS78L05Z-G1 | Ammo |
| | | AS78L12Z-E1 | AS78L12Z-G1 | AS78L12Z-E1 | AS78L12Z-G1 | Bulk |
| | | AS78L12ZTR-E1 | AS78L12ZTR-G1 | AS78L12Z-E1 | AS78L12Z-G1 | Ammo |
| | | AS78L15Z-E1 | AS78L15Z-G1 | AS78L15Z-E1 | AS78L15Z-G1 | Bulk |
| | | AS78L15ZTR-E1 | AS78L15ZTR-G1 | AS78L15Z-E1 | AS78L15Z-G1 | Ammo |
| SOT-89 | -40 to 125°C | AS78L05RTR-E1 | AS78L05RTR-G1 | E78E | G78E | Tape & Reel |
| | | AS78L12RTR-E1 | AS78L12RTR-G1 | E78F | G78F | Tape & Reel |
| | | AS78L15RTR-E1 | AS78L15RTR-G1 | E78G | G78G | Tape & Reel |
| SOIC-8 | -40 to 125°C | AS78L05M-E1 | AS78L05M-G1 | AS78L05M-E1 | AS78L05M-G1 | Tube |
| | | AS78L05MTR-E1 | AS78L05MTR-G1 | AS78L05M-E1 | AS78L05M-G1 | Tape & Reel |
| | | AS78L12M-E1 | AS78L12M-G1 | AS78L12M-E1 | AS78L12M-G1 | Tube |
| | | AS78L12MTR-E1 | AS78L12MTR-G1 | AS78L12M-E1 | AS78L12M-G1 | Tape & Reel |
| | | AS78L15M-E1 | AS78L15M-G1 | AS78L15M-E1 | AS78L15M-G1 | Tube |
| | | AS78L15MTR-E1 | AS78L15MTR-G1 | AS78L15M-E1 | AS78L15M-G1 | 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.

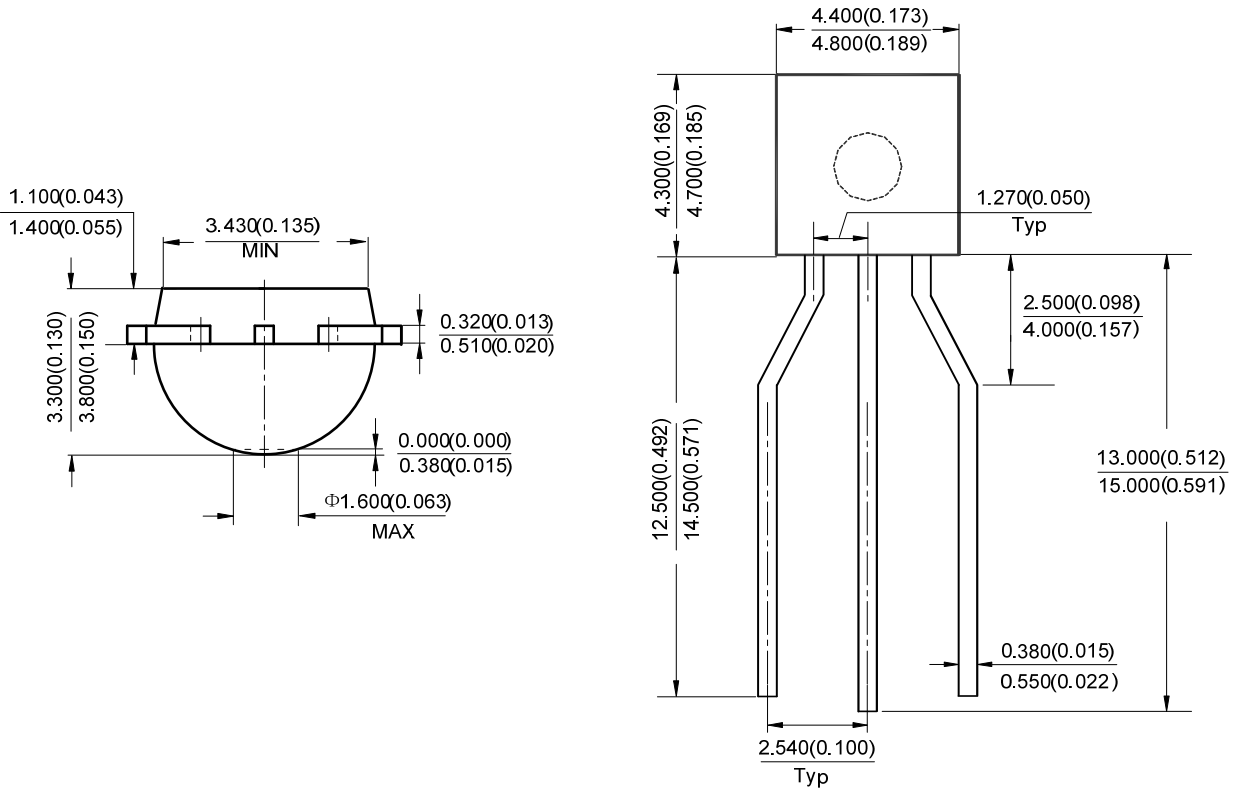
Package Outline Dimensions (All dimensions in mm(inch).)

TO-92 (Bulk Packing)



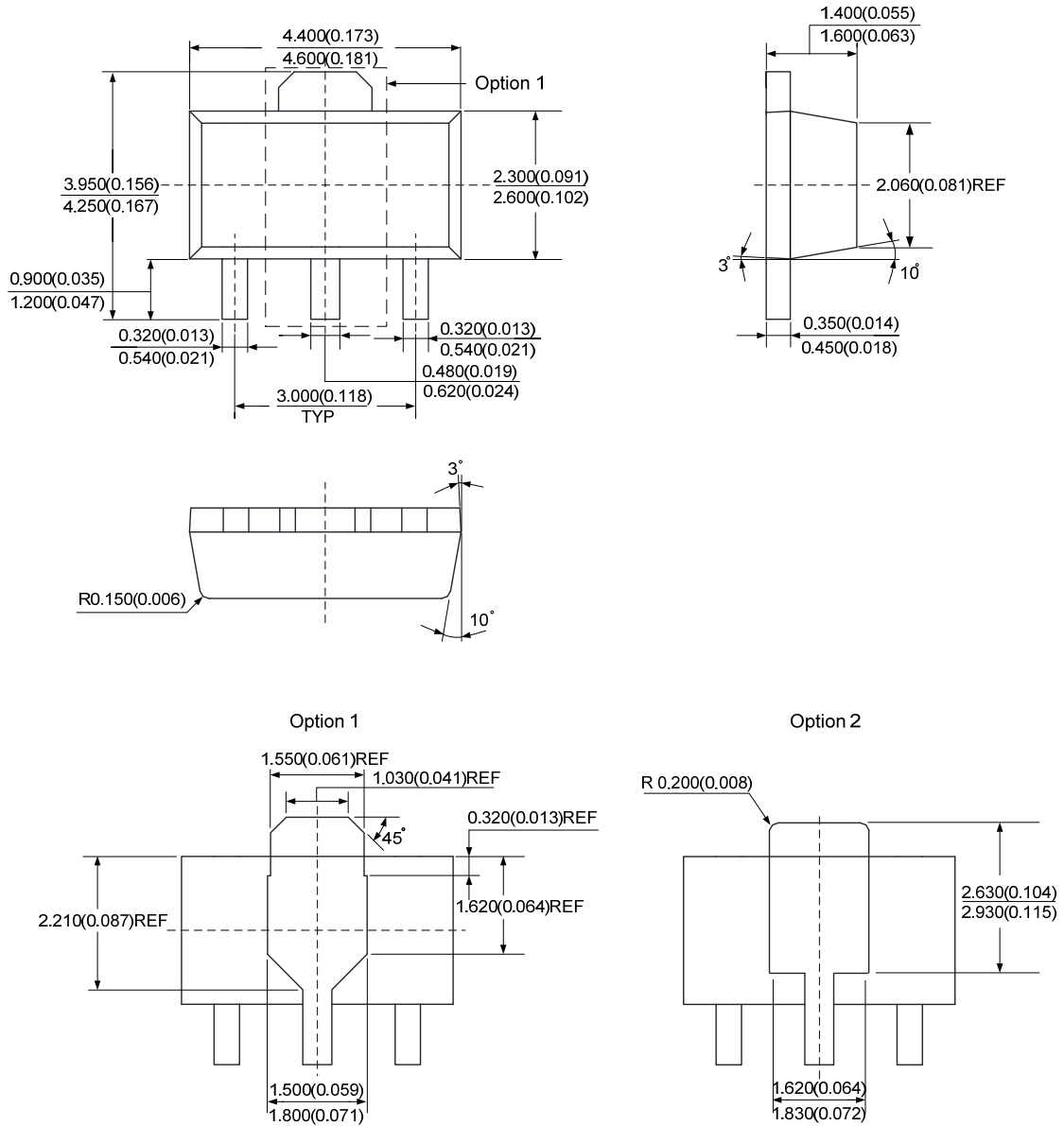
Package Outline Dimensions (Cont. All dimensions in mm(inch).)

TO-92 (Ammo Packing)



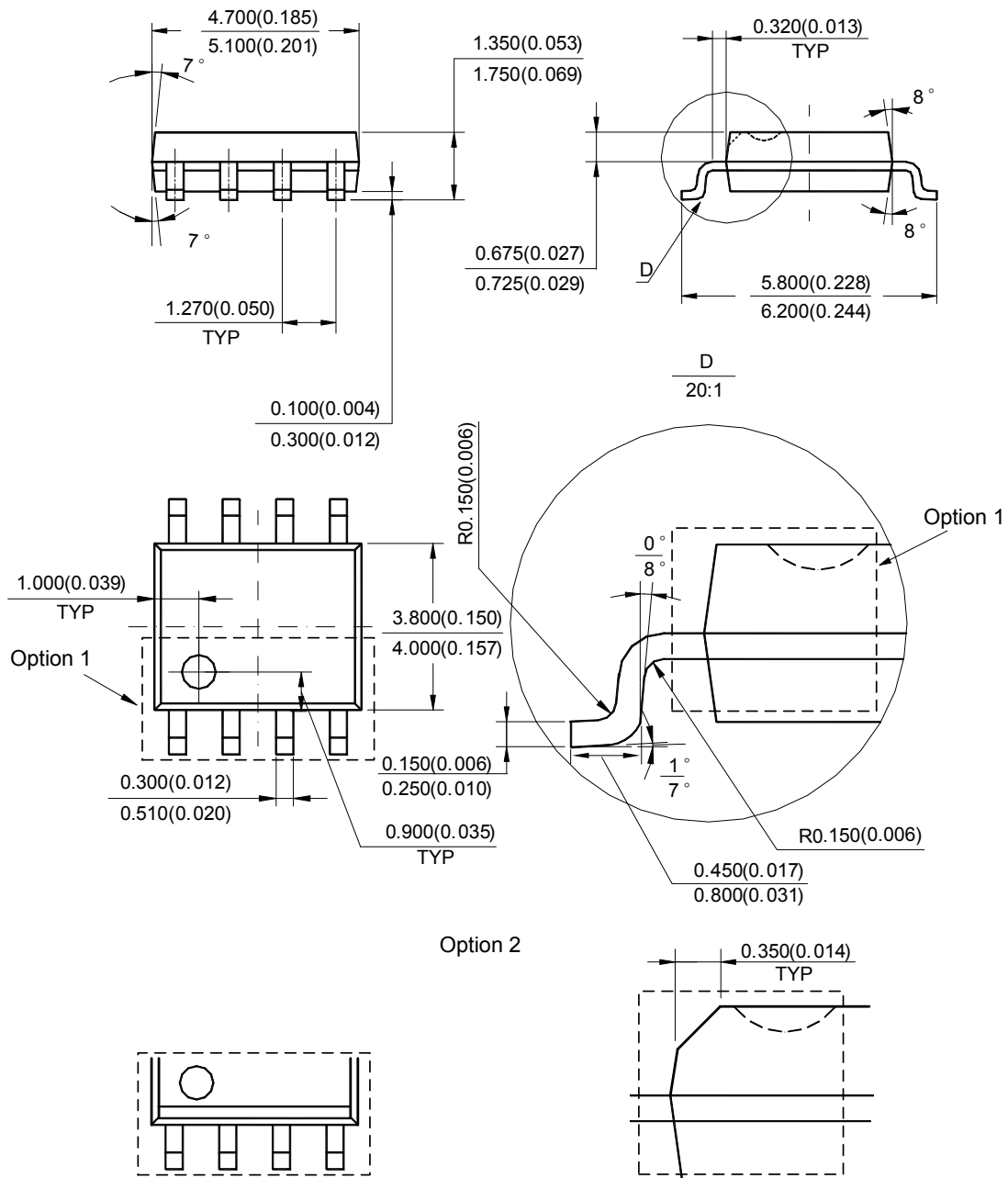
Package Outline Dimensions (Cont. All dimensions in mm(inch).)

SOT-89



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

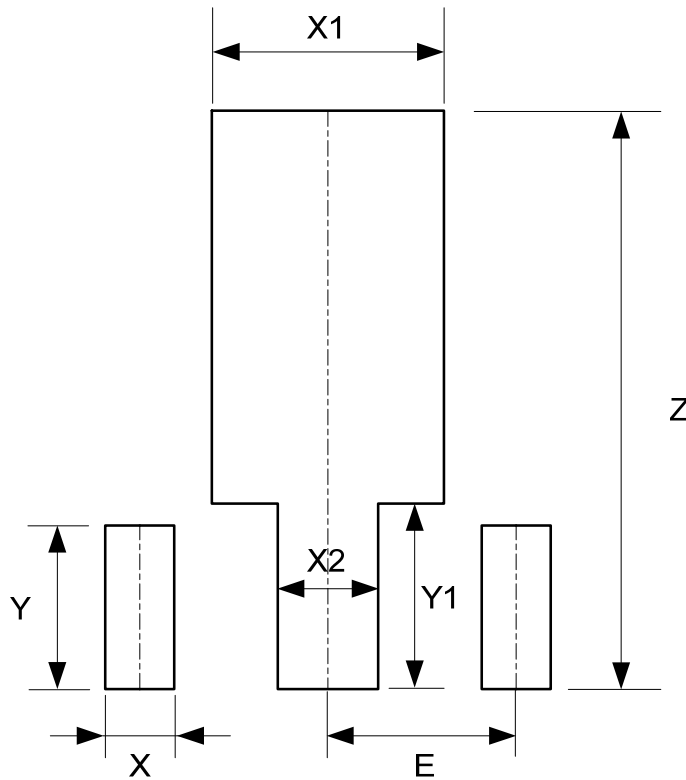
SOIC-8



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

Suggested Pad Layout

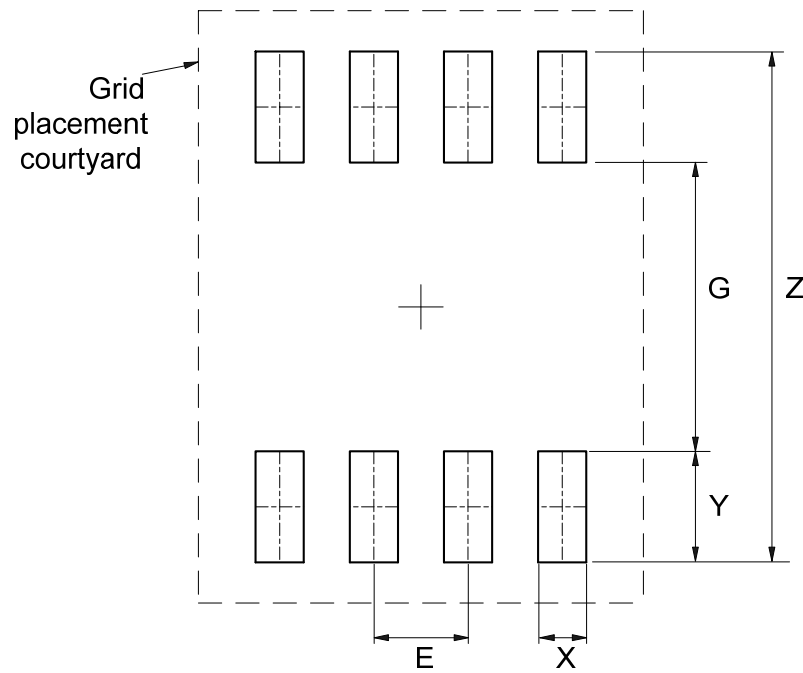
SOT-89



| 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 (Cont.)

SOIC-8



| 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 |

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