

NSS60600MZ4T1G

60 V, 6.0 A, Low $V_{CE(sat)}$ PNP Transistor

ON Semiconductor's e²PowerEdge family of low $V_{CE(sat)}$ transistors are surface mount devices featuring ultra low saturation voltage ($V_{CE(sat)}$) and high current gain capability. These are designed for use in low voltage, high speed switching applications where affordable efficient energy control is important.

Typical applications are DC-DC converters and power management in portable and battery powered products such as cellular and cordless phones, PDAs, computers, printers, digital cameras and MP3 players. Other applications are low voltage motor controls in mass storage products such as disc drives and tape drives. In the automotive industry they can be used in air bag deployment and in the instrument cluster. The high current gain allows e²PowerEdge devices to be driven directly from PMU's control outputs, and the Linear Gain (Beta) makes them ideal components in analog amplifiers.

- This is a Pb-Free Device

MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$)

| Rating | Symbol | Max | Unit |
|--------------------------------|-----------|-------|------|
| Collector-Emitter Voltage | V_{CEO} | -60 | Vdc |
| Collector-Base Voltage | V_{CBO} | -100 | Vdc |
| Emitter-Base Voltage | V_{EBO} | -6.0 | Vdc |
| Collector Current - Continuous | I_C | -6.0 | A |
| Collector Current - Peak | I_{CM} | -12.0 | A |

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|----------------------------------|----------------|----------------------------|
| Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D (Note 1) | 800 6.5 | mW mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ (Note 1) | 155 | $^\circ\text{C}/\text{W}$ |
| Total Device Dissipation $T_A = 25^\circ\text{C}$ Derate above 25°C | P_D (Note 2) | 2 15.6 | W mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction-to-Ambient | $R_{\theta JA}$ (Note 2) | 64 | $^\circ\text{C}/\text{W}$ |
| Total Device Dissipation (Single Pulse < 10 sec.) | $P_{D\text{single}}$ (Note 3) | 710 | mW |
| Junction and Storage Temperature Range | T_J, T_{stg} | -55 to +150 | $^\circ\text{C}$ |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

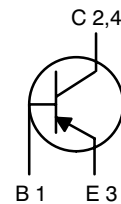
1. FR-4 @ 7.6 mm², 1 oz. copper traces.
2. FR-4 @ 645 mm², 1 oz. copper traces.
3. Thermal response.



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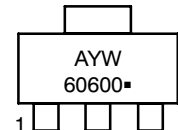
**-60 VOLTS, 6.0 AMPS
2.0 WATTS
PNP LOW $V_{CE(sat)}$ TRANSISTOR
EQUIVALENT $R_{DS(on)} 50 \text{ m}\Omega$**



MARKING DIAGRAM

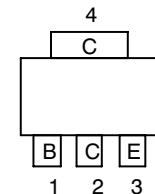


SOT-223
CASE 318E
STYLE 1



A = Assembly Location
Y = Year
W = Work Week
60600 = Specific Device Code
▪ = Pb-Free Package

PIN ASSIGNMENT



Top View Pinout

ORDERING INFORMATION

| Device | Package | Shipping† |
|----------------|----------------------|----------------------|
| NSS60600MZ4T1G | SOT-223 (Pb-Free) | 1000/ Tape & Reel |
| NSS60600MZ4T3G | SOT-223 (Pb-Free) | 4000/ Tape & Reel |

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

NSS60600MZ4T1G

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---------------|------|-----|------|------------------|
| OFF CHARACTERISTICS | | | | | |
| Collector-Emitter Breakdown Voltage ($I_C = -10\text{ mA}$, $I_B = 0$) | $V_{(BR)CEO}$ | -60 | | | Vdc |
| Collector-Base Breakdown Voltage ($I_C = -0.1\text{ mA}$, $I_E = 0$) | $V_{(BR)CBO}$ | -100 | | | Vdc |
| Emitter-Base Breakdown Voltage ($I_E = -0.1\text{ mA}$, $I_C = 0$) | $V_{(BR)EBO}$ | -6.0 | | | Vdc |
| Collector Cutoff Current ($V_{CB} = -100\text{ Vdc}$, $I_E = 0$) | I_{CBO} | | | -0.1 | μA dc |
| Emitter Cutoff Current ($V_{EB} = -6.0\text{ Vdc}$) | I_{EBO} | | | -0.1 | μA dc |

ON CHARACTERISTICS

| | | | | | |
|---|---------------|-------------------------|------------------|--|-----|
| DC Current Gain (Note 4) ($I_C = -500\text{ mA}$, $V_{CE} = -2.0\text{ V}$) ($I_C = -1.0\text{ A}$, $V_{CE} = -2.0\text{ V}$) ($I_C = -2.0\text{ A}$, $V_{CE} = -2.0\text{ V}$) ($I_C = -6.0\text{ A}$, $V_{CE} = -2.0\text{ V}$) | h_{FE} | 150 120 100 70 | | 360 | |
| Collector-Emitter Saturation Voltage (Note 4) ($I_C = -0.1\text{ A}$, $I_B = -2.0\text{ mA}$) ($I_C = -1.0\text{ A}$, $I_B = -0.100\text{ A}$) ($I_C = -2.0\text{ A}$, $I_B = -0.200\text{ A}$) ($I_C = -3.0\text{ A}$, $I_B = -60\text{ mA}$) ($I_C = -6.0\text{ A}$, $I_B = -0.6\text{ A}$) | $V_{CE(sat)}$ | | -0.050 -0.100 | -0.050 -0.070 -0.120 -0.250 -0.350 | V |
| Base-Emitter Saturation Voltage (Note 4) ($I_C = -1.0\text{ A}$, $I_B = -0.1\text{ A}$) | $V_{BE(sat)}$ | | | -1.0 | V |
| Base-Emitter Turn-on Voltage (Note 4) ($I_C = -1.0\text{ A}$, $V_{CE} = -2.0\text{ V}$) | $V_{BE(on)}$ | | | -0.900 | V |
| Cutoff Frequency ($I_C = -500\text{ mA}$, $V_{CE} = -10\text{ V}$, $f = 100\text{ MHz}$) | f_T | 100 | | | MHz |
| Input Capacitance ($V_{EB} = 5.0\text{ V}$, $f = 1.0\text{ MHz}$) | C_{ibo} | | 360 | | pF |
| Output Capacitance ($V_{CB} = 10\text{ V}$, $f = 1.0\text{ MHz}$) | C_{obo} | | 60 | | pF |

SWITCHING CHARACTERISTICS

| | | | | | |
|---|-------|--|-----|--|----|
| Delay ($V_{CC} = -30\text{ V}$, $I_C = 750\text{ mA}$, $I_{B1} = 15\text{ mA}$) | t_d | | 100 | | ns |
| Rise ($V_{CC} = -30\text{ V}$, $I_C = 750\text{ mA}$, $I_{B1} = 15\text{ mA}$) | t_r | | 180 | | ns |
| Storage ($V_{CC} = -30\text{ V}$, $I_C = 750\text{ mA}$, $I_{B1} = 15\text{ mA}$) | t_s | | 540 | | ns |
| Fall ($V_{CC} = -30\text{ V}$, $I_C = 750\text{ mA}$, $I_{B1} = 15\text{ mA}$) | t_f | | 145 | | ns |

4. Pulsed Condition: Pulse Width = 300 msec, Duty Cycle $\leq 2\%$.

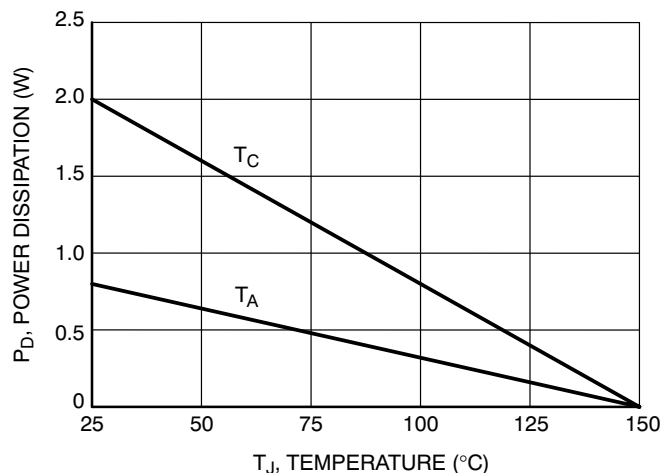


Figure 1. Power Derating

NSS60600MZ4T1G

TYPICAL CHARACTERISTICS

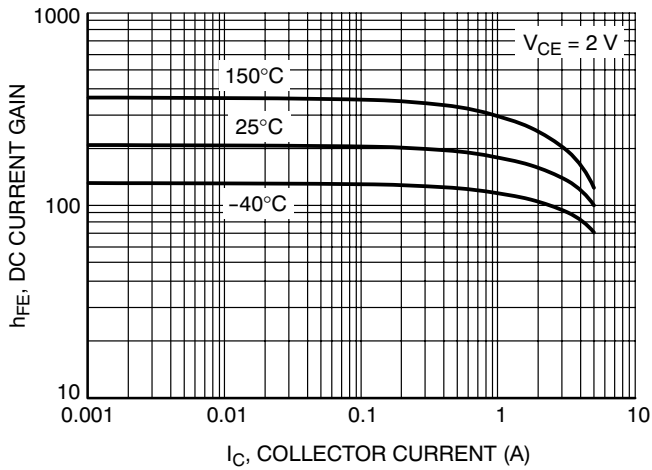


Figure 2. DC Current Gain

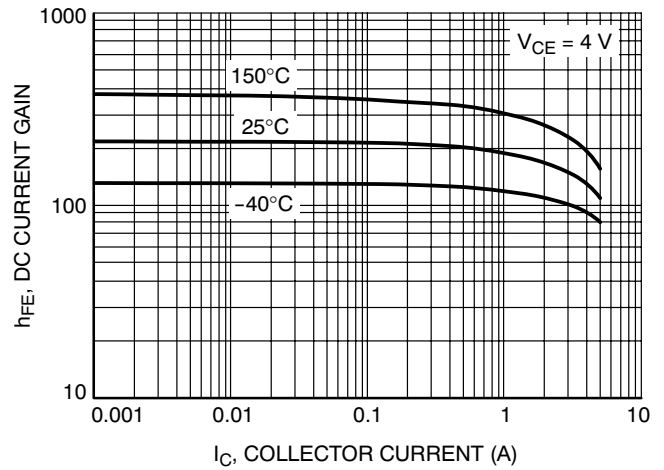


Figure 3. DC Current Gain

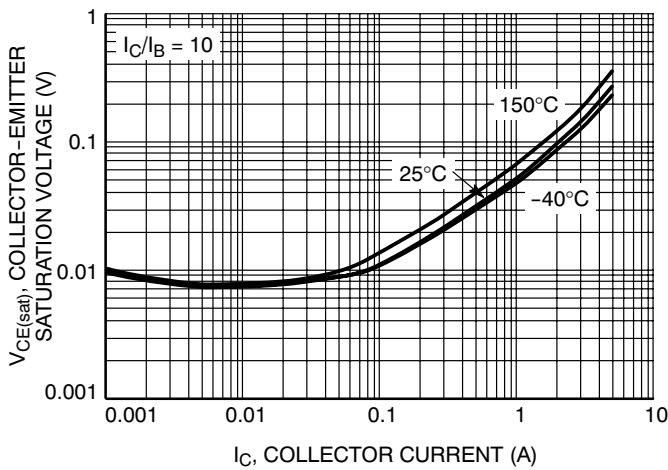


Figure 4. Collector-Emitter Saturation Voltage

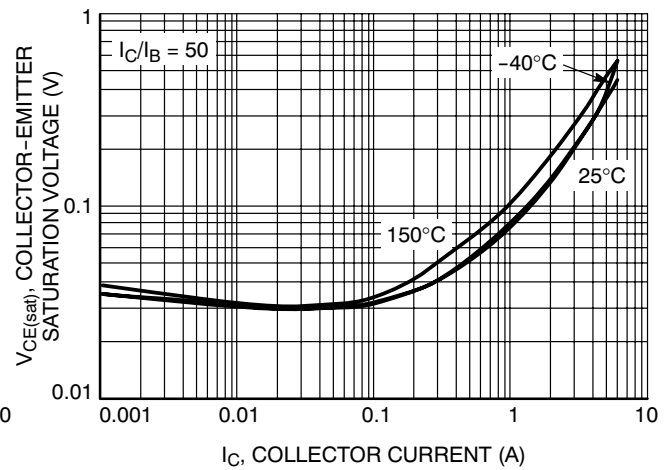


Figure 5. Collector-Emitter Saturation Voltage

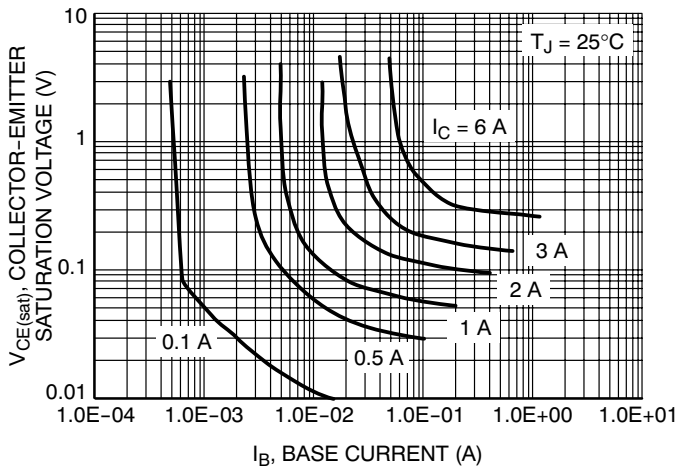


Figure 6. Collector Saturation Region

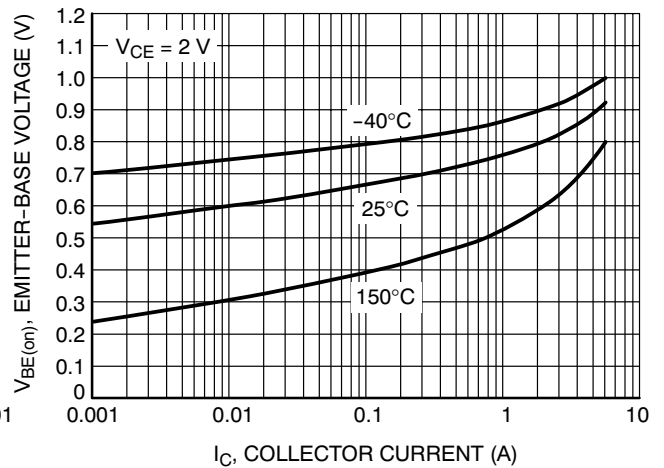


Figure 7. $V_{BE(on)}$ Voltage

NSS60600MZ4T1G

TYPICAL CHARACTERISTICS

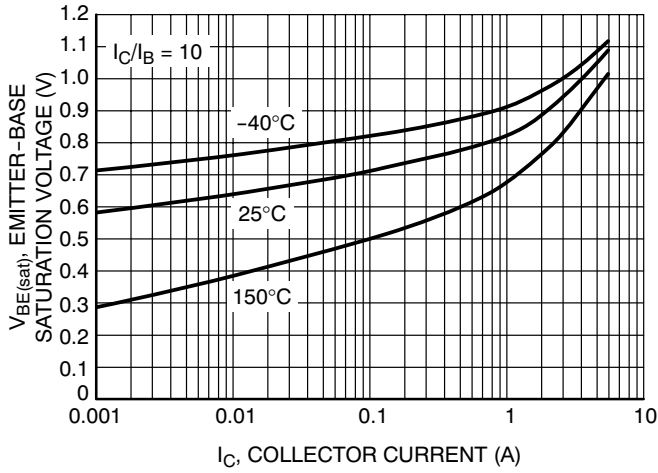


Figure 8. Base-Emitter Saturation Voltage

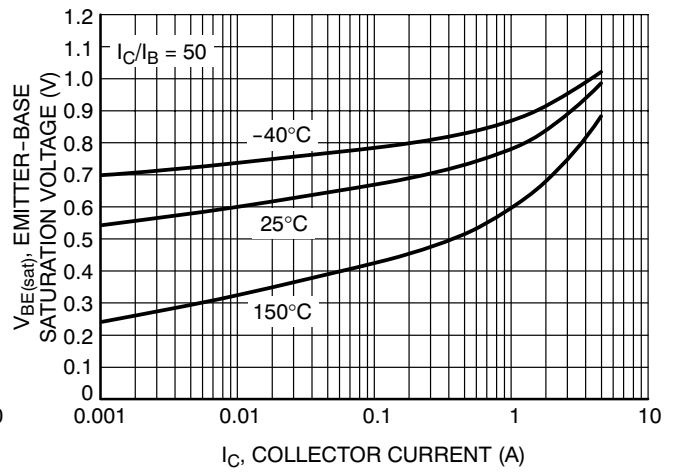


Figure 9. Base-Emitter Saturation Voltage

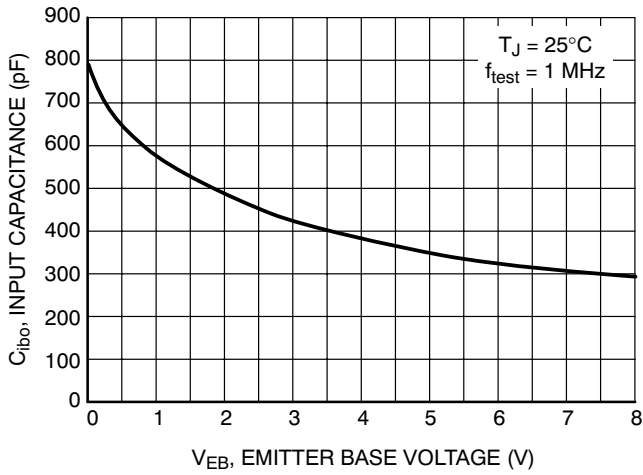


Figure 10. Input Capacitance

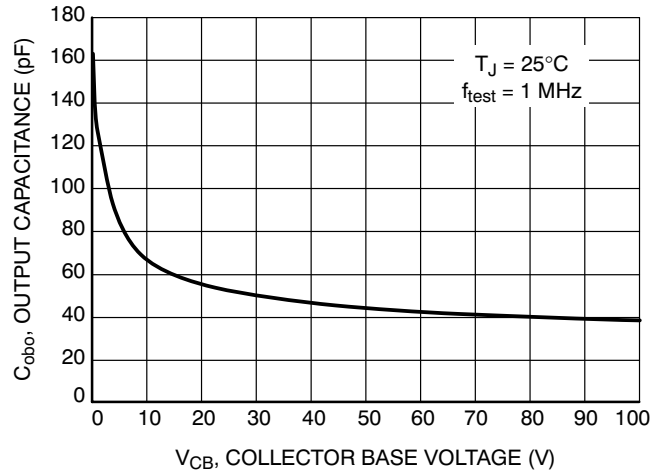


Figure 11. Output Capacitance

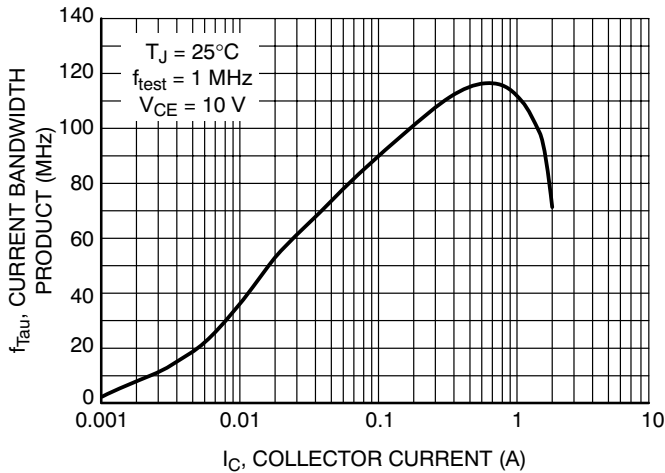


Figure 12. Current-Gain Bandwidth Product

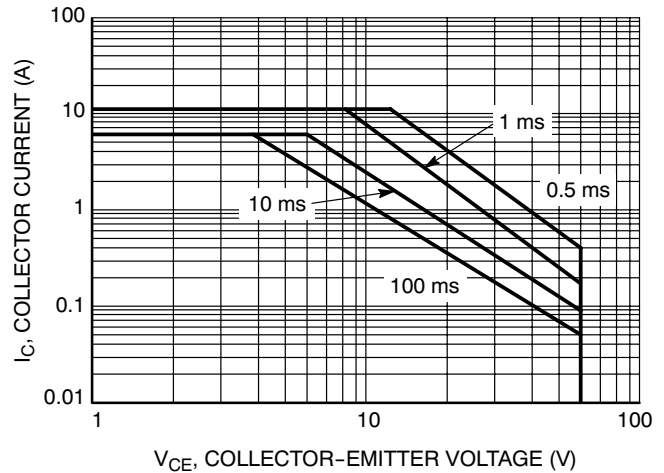
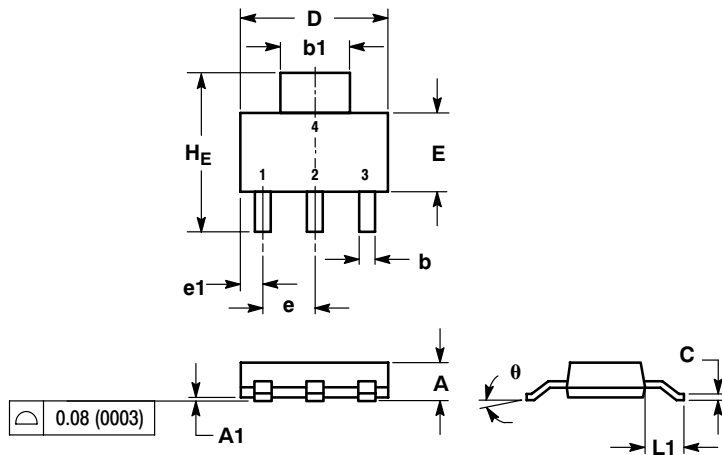


Figure 13. Safe Operating Area

NSS60600MZ4T1G

PACKAGE DIMENSIONS

SOT-223 (TO-261)
CASE 318E-04
ISSUE L



NOTES:

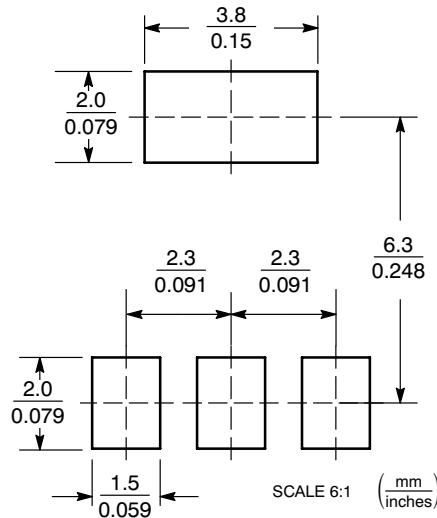
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| DIM | MILLIMETERS | | | INCHES | | |
|----------|-------------|------|------|--------|-------|-------|
| | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 1.50 | 1.63 | 1.75 | 0.060 | 0.064 | 0.068 |
| A1 | 0.02 | 0.06 | 0.10 | 0.001 | 0.002 | 0.004 |
| b | 0.60 | 0.75 | 0.89 | 0.024 | 0.030 | 0.035 |
| b1 | 2.90 | 3.06 | 3.20 | 0.115 | 0.121 | 0.126 |
| c | 0.24 | 0.29 | 0.35 | 0.009 | 0.012 | 0.014 |
| D | 6.30 | 6.50 | 6.70 | 0.249 | 0.256 | 0.263 |
| E | 3.30 | 3.50 | 3.70 | 0.130 | 0.138 | 0.145 |
| e | 2.20 | 2.30 | 2.40 | 0.087 | 0.091 | 0.094 |
| e1 | 0.85 | 0.94 | 1.05 | 0.033 | 0.037 | 0.041 |
| L1 | 1.50 | 1.75 | 2.00 | 0.060 | 0.069 | 0.078 |
| H | 6.70 | 7.00 | 7.30 | 0.264 | 0.276 | 0.287 |
| θ | 0° | - | 10° | 0° | - | 10° |

STYLE 1:

- PIN 1. BASE
- COLLECTOR
- EMITTER
- COLLECTOR

SOLDERING FOOTPRINT



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