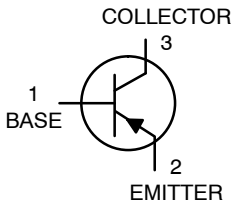
# General Purpose Transistors

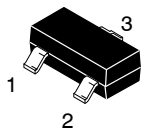
## PNP Silicon

# BC856ALT1G Series



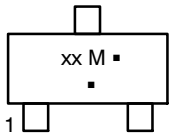

### Features

- S and NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant




**SOT−23 (TO−236)**
**CASE 318**
**STYLE 6**

### MARKING DIAGRAM




xx = Device Code
xx = (Refer to page 6)
M = Date Code*
▪ = Pb−Free Package

(Note: Microdot may be in either location)

*Date Code orientation and/or overbar may vary depending upon manufacturing location.

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

### MAXIMUM RATINGS ($T_A$ = 25°C unless otherwise noted)

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Emitter Voltage<br>BC856, SBC856<br>BC857, SBC857<br>BC858, NSVBC858, BC859 | $V_{CEO}$ | <br>−65<br>−45<br>−30 | V |
| Collector-Base Voltage<br>BC856, SBC856<br>BC857, SBC857<br>BC858, NSVBC858, BC859 | $V_{CBO}$ | <br>−80<br>−50<br>−30 | V |
| Emitter−Base Voltage | $V_{EBO}$ | −5.0 | V |
| Collector Current − Continuous | $I_C$ | −100 | mAdc |
| Collector Current − Peak | $I_C$ | −200 | mAdc |

### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Total Device Dissipation FR−5 Board, (Note 1) $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | <br>225<br>1.8 | <br>mW<br>mW/°C |
| Thermal Resistance, Junction−to−Ambient | $R_{\theta JA}$ | 556 | °C/W |
| Total Device Dissipation Alumina Substrate, (Note 2) $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | <br>300<br>2.4 | <br>mW<br>mW/°C |
| Thermal Resistance, Junction−to−Ambient | $R_{\theta JA}$ | 417 | °C/W |
| Junction and Storage Temperature | $T_J$, $T_{stg}$ | −55 to +150 | °C |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

1. FR−5 = 1.0 x 0.75 x 0.062 in.
2. Alumina = 0.4 x 0.3 x 0.024 in 99.5% alumina.

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**ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector – Emitter Breakdown Voltage ($I_C$ = −10 mA) BC856, SBC856 Series | $V_{(BR)CEO}$ | −65 | – | – | V |
| BC857, SBC857 Series | | −45 | – | – | |
| BC858, NSBVC858 BC859 Series | | −30 | – | – | |
| Collector – Emitter Breakdown Voltage ($I_C$ = −10 μA, $V_{EB}$ = 0) BC856 S, SBC856eries | $V_{(BR)CES}$ | −80 | – | – | V |
| BC857A, SBC857A, BC857B, SBC857B Only | | −50 | – | – | |
| BC858, NSVB858, BC859 Series | | −30 | – | – | |
| Collector – Base Breakdown Voltage ($I_C$ = −10 μA) BC856, SBC856 Series | $V_{(BR)CBO}$ | −80 | – | – | V |
| BC857, SBC857 Series | | −50 | – | – | |
| BC858, NSVBC858, BC859 Series | | −30 | – | – | |
| Emitter – Base Breakdown Voltage ($I_E$ = −1.0 μA) BC856, SBC856 Series | $V_{(BR)EBO}$ | −5.0 | – | – | V |
| BC857, SBC857 Series | | −5.0 | – | – | |
| BC858, NSVBC858, BC859 Series | | −5.0 | – | – | |
| Collector Cutoff Current ($V_{CB}$ = −30 V) | $I_{CBO}$ | – | – | −15 | nA |
| ($V_{CB}$ = −30 V, $T_A$ = 150°C) | | – | – | −4.0 | μA |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain ($I_C$ = −10 μA, $V_{CE}$ = −5.0 V) BC856A, SBC856A, BC857A, SBC857A, BC858A | $h_{FE}$ | – | 90 | – | – |
| BC856B, SBC856B, BC857B, SBC857B, BC858B, NSVBC858B | | – | 150 | – | |
| BC857C, SBC857C BC858C | | – | 270 | – | |
| ($I_C$ = −2.0 mA, $V_{CE}$ = −5.0 V) BC856A, SBC856A, BC857A, SBC857A, BC858A | | 125 | 180 | 250 | |
| BC856B, SBC856B, BC857B, SBC857B, BC858B, NSVBC858B, BC859B | | 220 | 290 | 475 | |
| BC857C, SBC857C, BC858C, BC859C | | 420 | 520 | 800 | |
| Collector – Emitter Saturation Voltage | $V_{CE(sat)}$ | | | | V |
| ($I_C$ = −10 mA, $I_B$ = −0.5 mA) | | – | – | −0.3 | |
| ($I_C$ = −100 mA, $I_B$ = −5.0 mA) | | – | – | −0.65 | |
| Base – Emitter Saturation Voltage | $V_{BE(sat)}$ | | | | V |
| ($I_C$ = −10 mA, $I_B$ = −0.5 mA) | | – | −0.7 | – | |
| ($I_C$ = −100 mA, $I_B$ = −5.0 mA) | | – | −0.9 | – | |
| Base – Emitter On Voltage | $V_{BE(on)}$ | | | | V |
| ($I_C$ = −2.0 mA, $V_{CE}$ = −5.0 V) | | −0.6 | – | −0.75 | |
| ($I_C$ = −10 mA, $V_{CE}$ = −5.0 V) | | – | – | −0.82 | |
| **SMALL– SIGNAL CHARACTERISTICS** | | | | | |
| Current – Gain – Bandwidth Product ($I_C$ = −10 mA, $V_{CE}$ = −5.0 Vdc, f = 100 MHz) | $f_T$ | 100 | – | – | MHz |
| Output Capacitance ($V_{CB}$ = −10 V, f = 1.0 MHz) | $C_{ob}$ | – | – | 4.5 | pF |
| Noise Figure ($I_C$ = −0.2 mA, $V_{CE}$ = −5.0 Vdc, $R_S$ = 2.0 kΩ, f = 1.0 kHz, BW = 200 Hz) | NF | | | | dB |
| BC856, SBC856, BC857, SBC857, BC858, NSVBC858 Series | | – | – | 10 | |
| BC859 Series | | – | – | 4.0 | |
| **SWITCHING CHARACTERISTICS** | | | | | |
| Delay Time ($V_{CC}$ = −3.0 Vdc, $I_C$ = −10 mA, $I_E$ = −1 mA) | $t_d$ | – | 35 | – | ns |
| Rise Time ($V_{CC}$ = −3.0 Vdc, $I_C$ = −10 mA, $I_E$ = −1 mA) | $t_r$ | – | 25 | – | ns |
| Storage Time ($V_{CC}$ = −3.0 Vdc, $I_C$ = −10 mA, $I_E$ = −1 mA) | $t_s$ | – | 310 | – | ns |
| Fall Time ($V_{CC}$ = −3.0 Vdc, $I_C$ = −10 mA, $I_E$ = −1 mA) | $t_f$ | – | 40 | – | ns |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

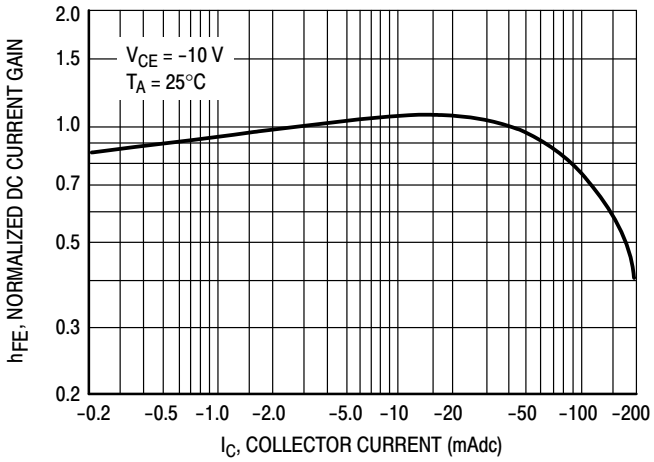



**Figure 1. Normalized DC Current Gain**

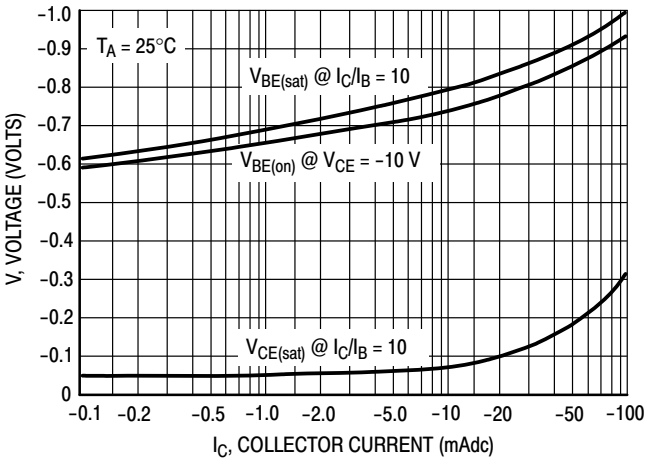



**Figure 2. “Saturation” and “On” Voltages**

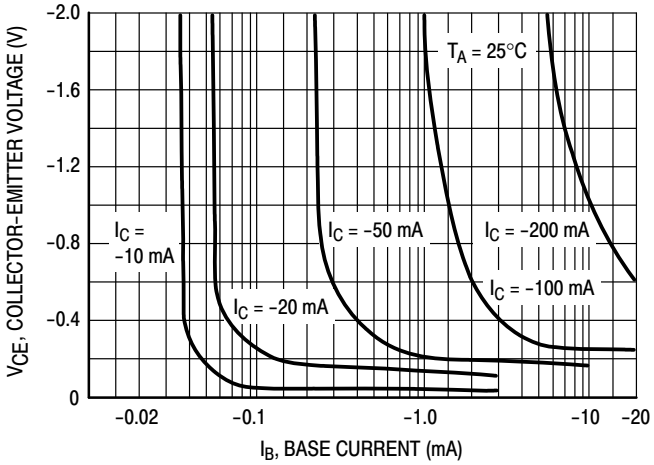



**Figure 3. Collector Saturation Region**

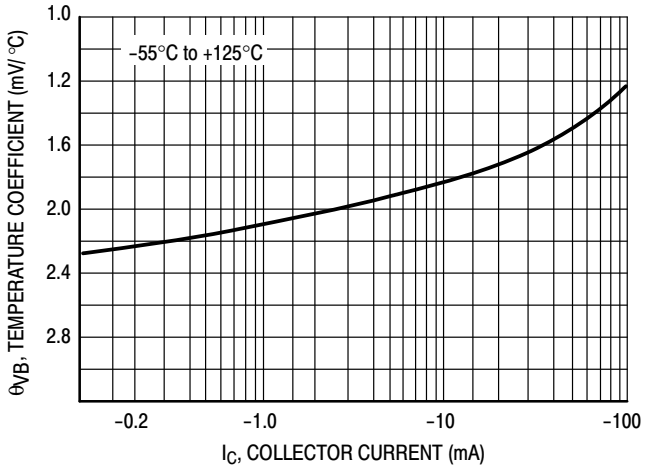



**Figure 4. Base−Emitter Temperature Coefficient**

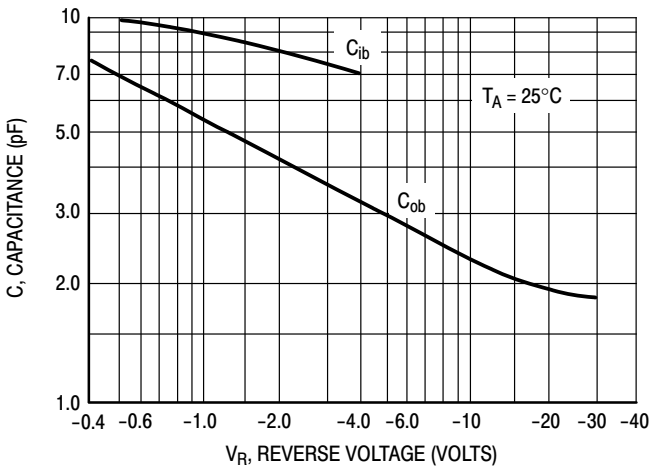



**Figure 5. Capacitances**

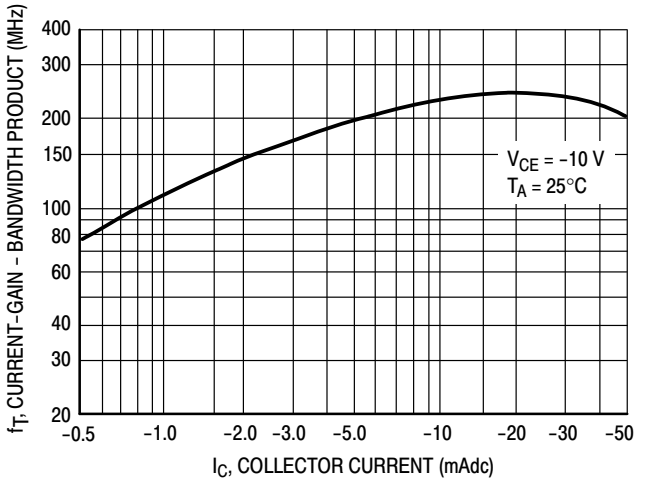



**Figure 6. Current−Gain − Bandwidth Product**

## BC856/SBC856

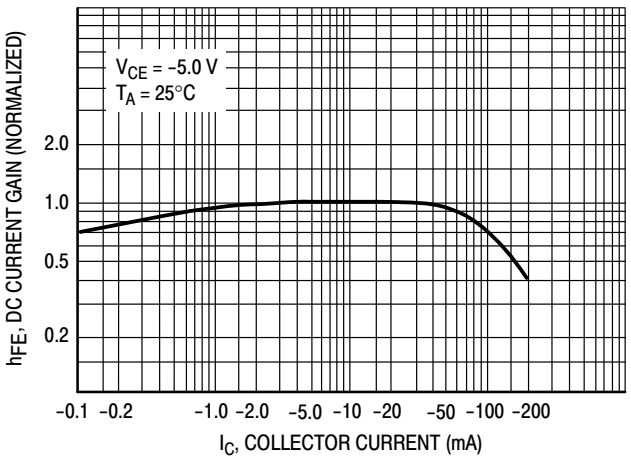



**Figure 7. DC Current Gain**

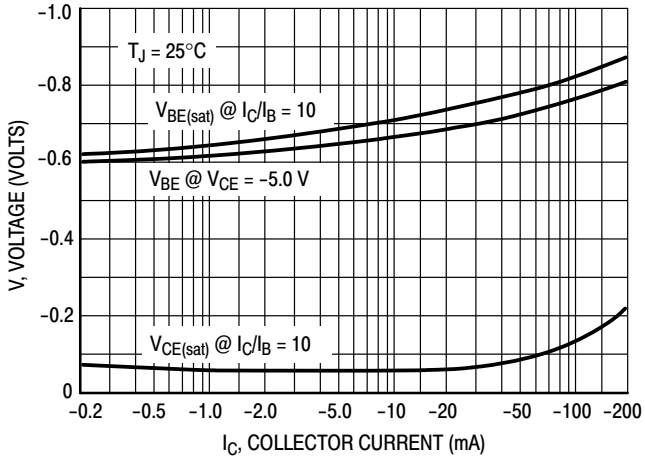



**Figure 8. “On” Voltage**

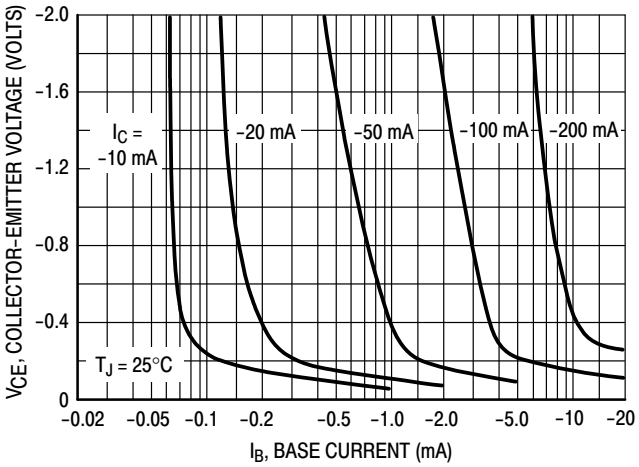



**Figure 9. Collector Saturation Region**

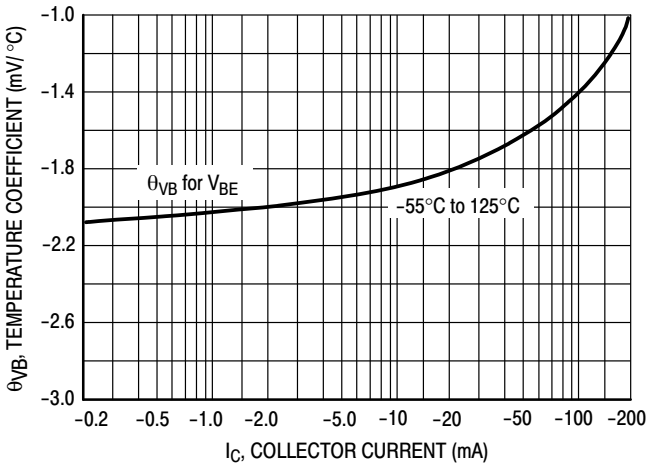



**Figure 10. Base−Emitter Temperature Coefficient**

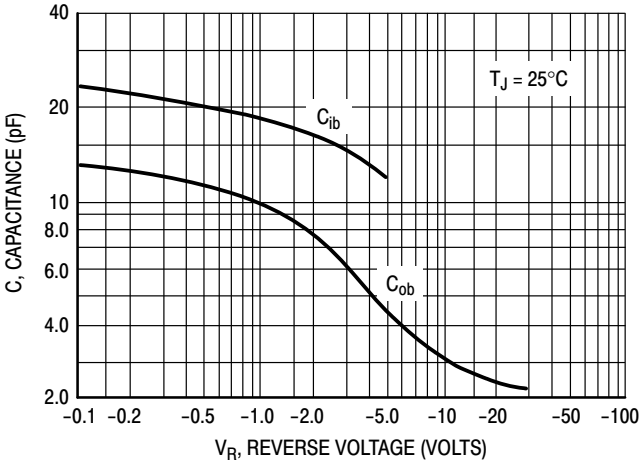



**Figure 11. Capacitance**

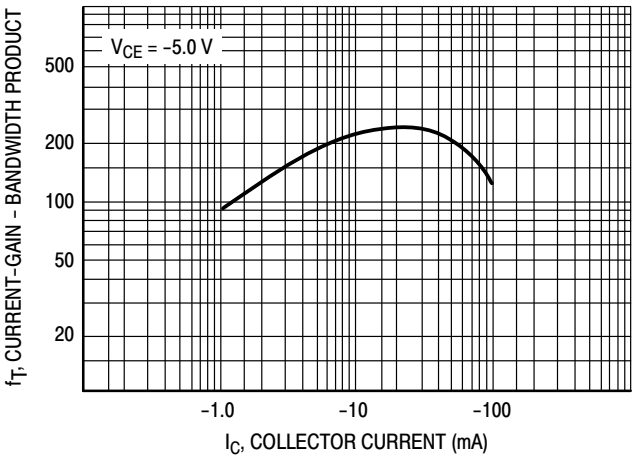



**Figure 12. Current−Gain − Bandwidth Product**

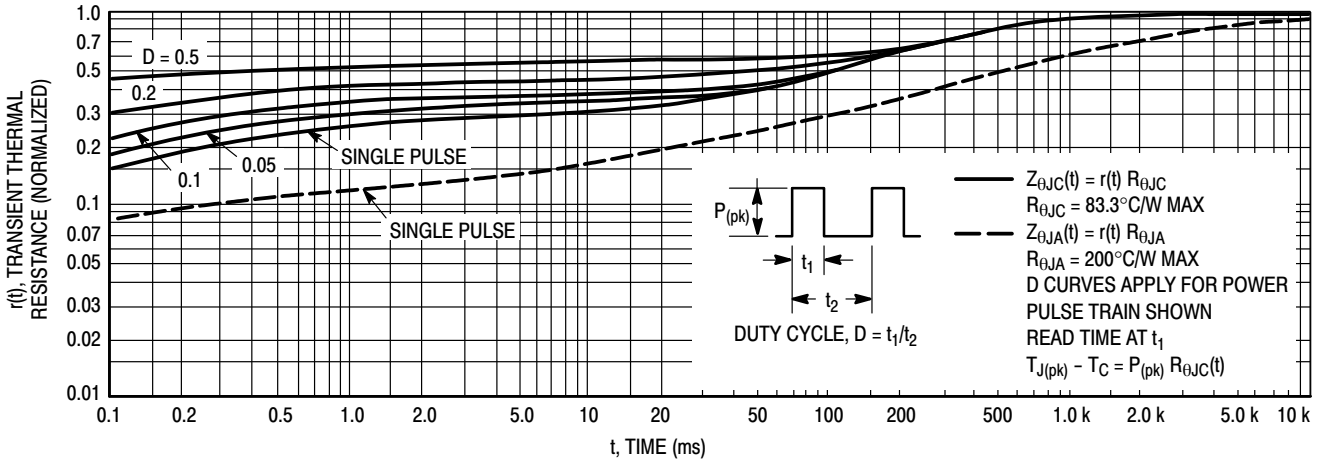



**Figure 13. Thermal Response**

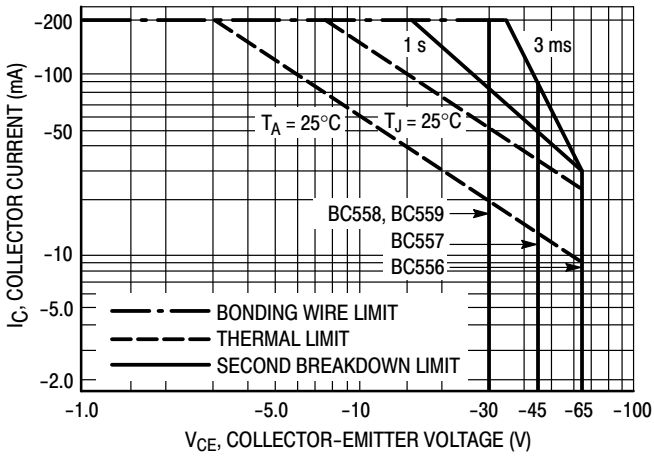



**Figure 14. Active Region Safe Operating Area**

The safe operating area curves indicate $I_C$–$V_{CE}$ limits of the transistor that must be observed for reliable operation. Collector load lines for specific circuits must fall below the limits indicated by the applicable curve.

The data of Figure 14 is based upon $T_{J(pk)}$ = 150°C; $T_C$ or $T_A$ is variable depending upon conditions. Pulse curves are valid for duty cycles to 10% provided $T_{J(pk)} \leq 150°C$. $T_{J(pk)}$ may be calculated from the data in Figure 13. At high case or ambient temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by the secondary breakdown.

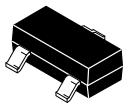
## ORDERING INFORMATION

| Device | Marking | Package | Shipping† |
|---|---|---|---|
| BC856ALT1G | 3A | SOT−23 (Pb−Free) | 3,000 / Tape & Reel |
| SBC856ALT1G* | | | |
| BC856ALT3G | | | 10,000 / Tape & Reel |
| BC856BLT1G | 3B | SOT−23 (Pb−Free) | 3,000 / Tape & Reel |
| SBC856BLT1G* | | | |
| BC856BLT3G | | | 10,000 / Tape & Reel |
| SBC856BLT3G* | | | |
| BC857ALT1G | 3E | SOT−23 (Pb−Free) | 3,000 / Tape & Reel |
| SBC857ALT1G* | | | |
| BC857BLT1G | 3F | SOT−23 (Pb−Free) | 3,000 / Tape & Reel |
| SBC857BLT1G* | | | |
| BC857BLT3G | | | 10,000 / Tape & Reel |
| NSVBC857BLT3G* | | | |
| BC857CLT1G | 3G | SOT−23 (Pb−Free) | 3,000 / Tape & Reel |
| SBC857CLT1G* | | | |
| BC857CLT3G | | | 10,000 / Tape & Reel |
| BC858ALT1G | 3J | SOT−23 (Pb−Free) | 3,000 / Tape & Reel |
| BC858BLT1G | 3K | SOT−23 (Pb−Free) | |
| NSVBC858BLT1G* | | | |
| BC858BLT3G | | SOT−23 (Pb−Free) | 10,000 / Tape & Reel |
| BC858CLT1G | 3L | SOT−23 (Pb−Free) | 3,000 / Tape & Reel |
| BC858CLT3G | | SOT−23 (Pb−Free) | 10,000 / Tape & Reel |
| BC859BLT1G | 4B | SOT−23 (Pb−Free) | 3,000 / Tape & Reel |
| BC859BLT3G | | SOT−23 (Pb−Free) | 10,000 / Tape & Reel |
| BC859CLT1G | 4C | SOT−23 (Pb−Free) | 3,000 / Tape & Reel |
| BC859CLT3G | | SOT−23 (Pb−Free) | 10,000 / Tape & Reel |

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

*S and NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable.

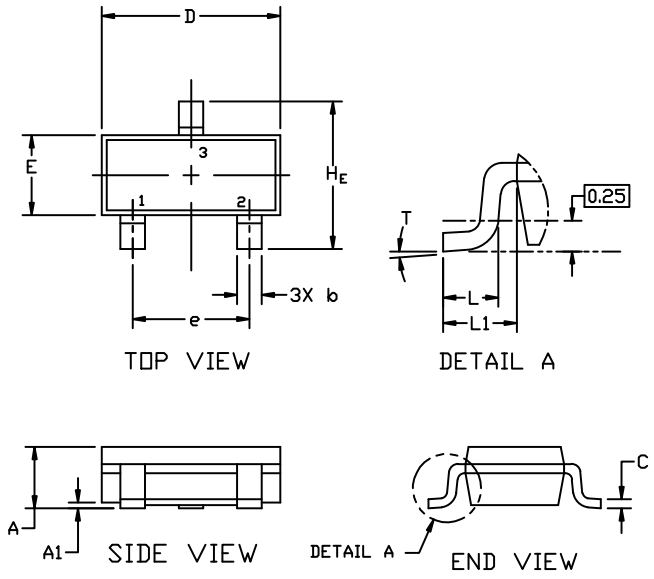
# MECHANICAL CASE OUTLINE
## PACKAGE DIMENSIONS



SCALE 4:1

**SOT−23 (TO−236)**
CASE 318
ISSUE AT

DATE 01 MAR 2023

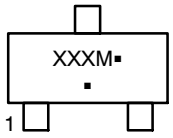



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M,1994.
2. CONTROLLING DIMENSION: MILLIMETERS
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF THE BASE MATERIAL.
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS.

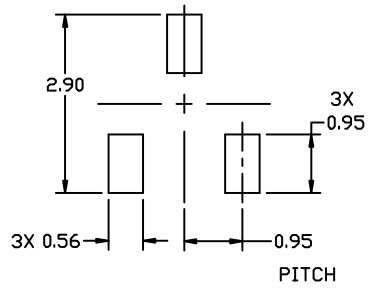
| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | 0.89 | 1.00 | 1.11 | 0.035 | 0.039 | 0.044 |
| A1 | 0.01 | 0.06 | 0.10 | 0.000 | 0.002 | 0.004 |
| b | 0.37 | 0.44 | 0.50 | 0.015 | 0.017 | 0.020 |
| c | 0.08 | 0.14 | 0.20 | 0.003 | 0.006 | 0.008 |
| D | 2.80 | 2.90 | 3.04 | 0.110 | 0.114 | 0.120 |
| E | 1.20 | 1.30 | 1.40 | 0.047 | 0.051 | 0.055 |
| e | 1.78 | 1.90 | 2.04 | 0.070 | 0.075 | 0.080 |
| L | 0.30 | 0.43 | 0.55 | 0.012 | 0.017 | 0.022 |
| L1 | 0.35 | 0.54 | 0.69 | 0.014 | 0.021 | 0.027 |
| $H_E$ | 2.10 | 2.40 | 2.64 | 0.083 | 0.094 | 0.104 |
| T | 0° | --- | 10° | 0° | --- | 10° |

### GENERIC MARKING DIAGRAM*




XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present. Some products may not follow the Generic Marking.




RECOMMENDED MOUNTING FOOTPRINT

* For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

**STYLES ON PAGE 2**

| | | | |
|---|---|---|---|
| **DOCUMENT NUMBER:** | **98ASB42226B** | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped “CONTROLLED COPY” in red. | |
| **DESCRIPTION:** | **SOT−23 (TO−236)** | | **PAGE 1 OF 2** |

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**SOT−23 (TO−236)**
CASE 318
ISSUE AT

DATE 01 MAR 2023

STYLE 1 THRU 5:
CANCELLED

STYLE 6:
PIN 1. BASE
2. EMITTER
3. COLLECTOR

STYLE 7:
PIN 1. EMITTER
2. BASE
3. COLLECTOR

STYLE 8:
PIN 1. ANODE
2. NO CONNECTION
3. CATHODE

STYLE 9:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 10:
PIN 1. DRAIN
2. SOURCE
3. GATE

STYLE 11:
PIN 1. ANODE
2. CATHODE
3. CATHODE−ANODE

STYLE 12:
PIN 1. CATHODE
2. CATHODE
3. ANODE

STYLE 13:
PIN 1. SOURCE
2. DRAIN
3. GATE

STYLE 14:
PIN 1. CATHODE
2. GATE
3. ANODE

STYLE 15:
PIN 1. GATE
2. CATHODE
3. ANODE

STYLE 16:
PIN 1. ANODE
2. CATHODE
3. CATHODE

STYLE 17:
PIN 1. NO CONNECTION
2. ANODE
3. CATHODE

STYLE 18:
PIN 1. NO CONNECTION
2. CATHODE
3. ANODE

STYLE 19:
PIN 1. CATHODE
2. ANODE
3. CATHODE−ANODE

STYLE 20:
PIN 1. CATHODE
2. ANODE
3. GATE

STYLE 21:
PIN 1. GATE
2. SOURCE
3. DRAIN

STYLE 22:
PIN 1. RETURN
2. OUTPUT
3. INPUT

STYLE 23:
PIN 1. ANODE
2. ANODE
3. CATHODE

STYLE 24:
PIN 1. GATE
2. DRAIN
3. SOURCE

STYLE 25:
PIN 1. ANODE
2. CATHODE
3. GATE

STYLE 26:
PIN 1. CATHODE
2. ANODE
3. NO CONNECTION

STYLE 27:
PIN 1. CATHODE
2. CATHODE
3. CATHODE

STYLE 28:
PIN 1. ANODE
2. ANODE
3. ANODE



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