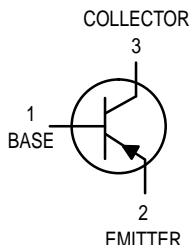


General Purpose Transistors

PNP Silicon



BC856ALT1,BLT1
BC857ALT1,BLT1
BC858ALT1,BLT1,
CLT1

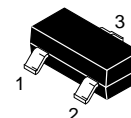
Motorola Preferred Devices

MAXIMUM RATINGS

| Rating | Symbol | BC856 | BC857 | BC858 | Unit |
|--------------------------------|-----------|-------|-------|-------|------|
| Collector–Emitter Voltage | V_{CEO} | –65 | –45 | –30 | V |
| Collector–Base Voltage | V_{CBO} | –80 | –50 | –30 | V |
| Emitter–Base Voltage | V_{EBO} | –5.0 | –5.0 | –5.0 | V |
| Collector Current — Continuous | I_C | –100 | –100 | –100 | mAdc |

THERMAL CHARACTERISTICS

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



CASE 318–08, STYLE 6
SOT–23 (TO–236AB)

DEVICE MARKING

BC856ALT1 = 3A; BC856BLT1 = 3B; BC857ALT1 = 3E; BC857BLT1 = 3F;
BC858ALT1 = 3J; BC858BLT1 = 3K; BC858CLT1 = 3L

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

OFF CHARACTERISTICS

| | | | | | | |
|--|--|---------------|----------------------|-------------|-------------|---------------------|
| Collector–Emitter Breakdown Voltage ($I_C = -10\text{ mA}$) | BC856 Series BC857 Series BC858 Series | $V_{(BR)CEO}$ | –65 –45 –30 | — — — | — — — | V |
| Collector–Emitter Breakdown Voltage ($I_C = -10\ \mu\text{A}, V_{EB} = 0$) | BC856 Series BC857 Series BC858 Series | $V_{(BR)CES}$ | –80 –50 –30 | — — — | — — — | V |
| Collector–Base Breakdown Voltage ($I_C = -10\ \mu\text{A}$) | BC856 Series BC857 Series BC858 Series | $V_{(BR)CBO}$ | –80 –50 –30 | — — — | — — — | V |
| Emitter–Base Breakdown Voltage ($I_E = -1.0\ \mu\text{A}$) | BC856 Series BC857 Series BC858 Series | $V_{(BR)EBO}$ | –5.0 –5.0 –5.0 | — — — | — — — | V |
| Collector Cutoff Current ($V_{CB} = -30\text{ V}$) ($V_{CB} = -30\text{ V}, T_A = 150^\circ\text{C}$) | | I_{CBO} | — — | — — | –15 –4.0 | nA μA |

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.

Thermal Clad is a registered trademark of the Bergquist Company.

Preferred devices are Motorola recommended choices for future use and best overall value.

REV 1

BC856ALT1,BLT1 BC857ALT1,BLT1 BC858ALT1,BLT1,CLT1
ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted) (Continued)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|--|-----------|-------------------|-------------------|-------------------|
| ON CHARACTERISTICS | | | | | |
| DC Current Gain ($I_C = -10\ \mu\text{A}$, $V_{CE} = -5.0\ \text{V}$) | BC856A, BC857A, BC585A BC856A, BC857A, BC858A BC858C | h_{FE} | — — — | 90 150 270 | — — — |
| ($I_C = -2.0\ \text{mA}$, $V_{CE} = -5.0\ \text{V}$) | BC856A, BC857A, BC858A BC856B, BC857B, BC858B BC858C | | 125 220 420 | 180 290 520 | 250 475 800 |
| Collector–Emitter Saturation Voltage ($I_C = -10\ \text{mA}$, $I_B = -0.5\ \text{mA}$) ($I_C = -100\ \text{mA}$, $I_B = -5.0\ \text{mA}$) | $V_{CE(sat)}$ | — — | — — | —0.3 —0.65 | V |
| Base–Emitter Saturation Voltage ($I_C = -10\ \text{mA}$, $I_B = -0.5\ \text{mA}$) ($I_C = -100\ \text{mA}$, $I_B = -5.0\ \text{mA}$) | $V_{BE(sat)}$ | — — | —0.7 —0.9 | — — | V |
| Base–Emitter On Voltage ($I_C = -2.0\ \text{mA}$, $V_{CE} = -5.0\ \text{V}$) ($I_C = -10\ \text{mA}$, $V_{CE} = -5.0\ \text{V}$) | $V_{BE(on)}$ | —0.6 — | — — | —0.75 —0.82 | V |
| SMALL–SIGNAL CHARACTERISTICS | | | | | |
| Current–Gain — Bandwidth Product ($I_C = -10\ \text{mA}$, $V_{CE} = -5.0\ \text{Vdc}$, $f = 100\ \text{MHz}$) | f_T | 100 | — | — | MHz |
| Output Capacitance ($V_{CB} = -10\ \text{V}$, $f = 1.0\ \text{MHz}$) | C_{ob} | — | — | 4.5 | pF |
| Noise Figure ($I_C = -0.2\ \text{mA}$, $V_{CE} = -5.0\ \text{Vdc}$, $R_S = 2.0\ \text{k}\Omega$, $f = 1.0\ \text{kHz}$, $BW = 200\ \text{Hz}$) | NF | — | — | 10 | dB |

BC857/BC858

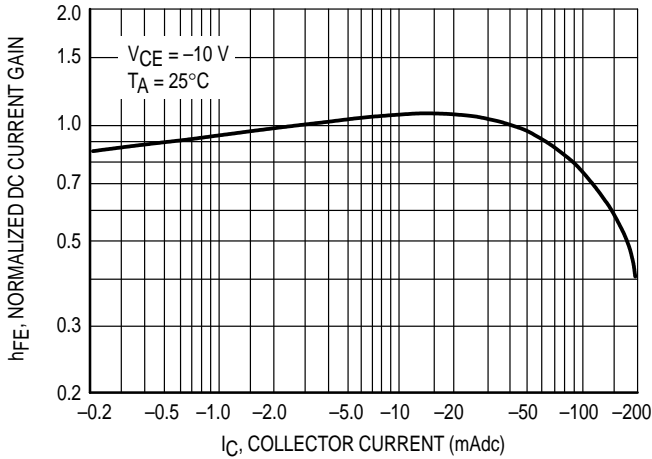


Figure 1. Normalized DC Current Gain

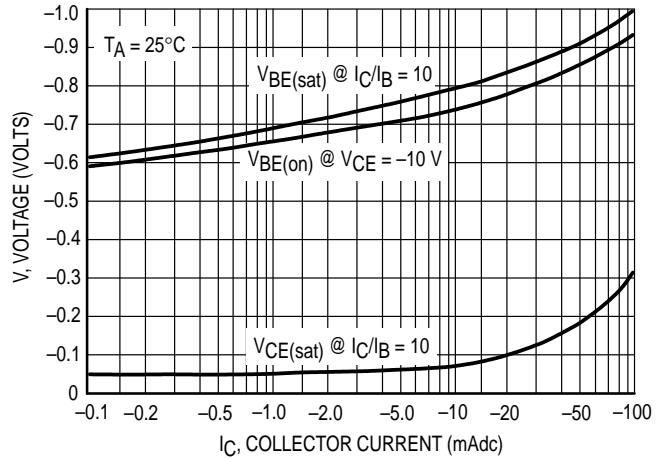


Figure 2. "Saturation" and "On" Voltages

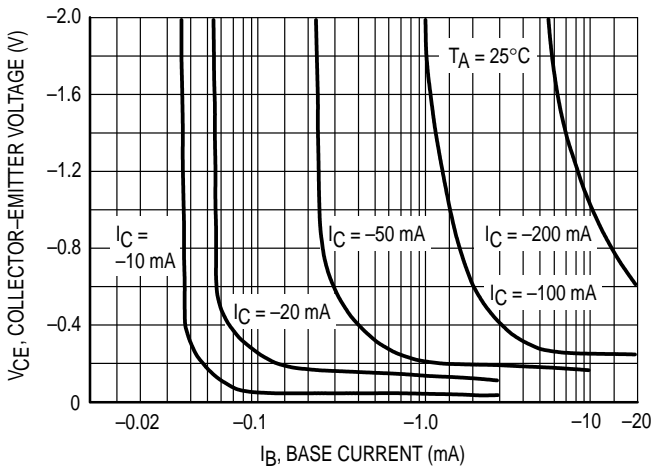


Figure 3. Collector Saturation Region

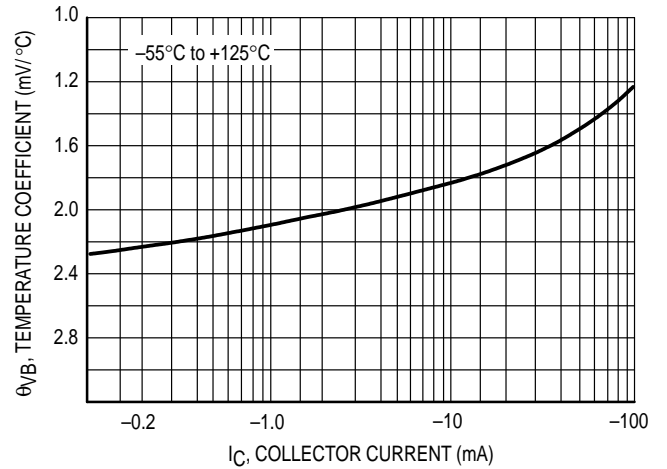


Figure 4. Base-Emitter Temperature Coefficient

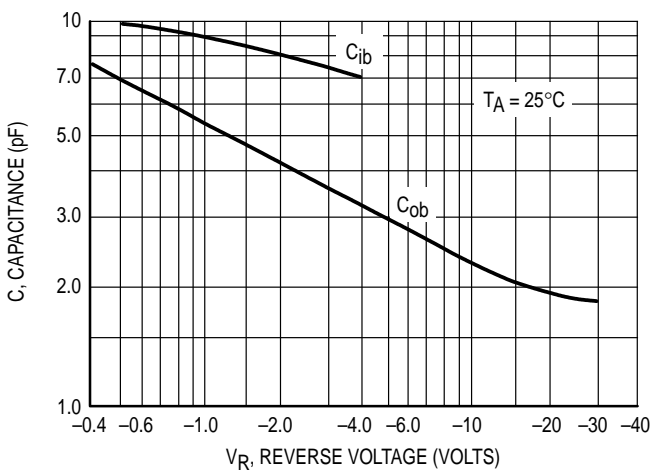


Figure 5. Capacitances

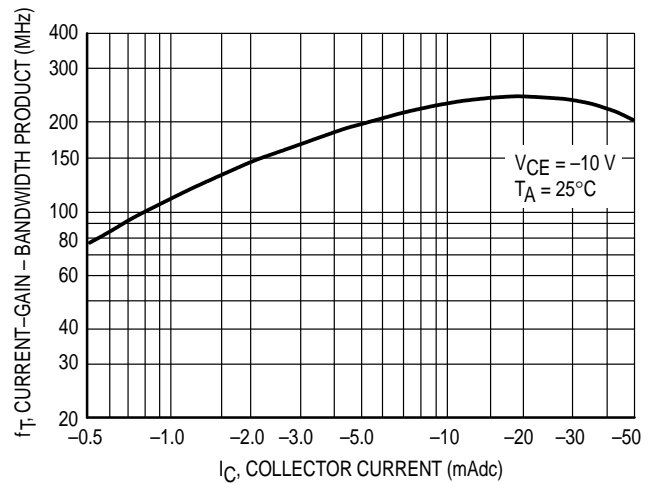


Figure 6. Current-Gain - Bandwidth Product

BC856

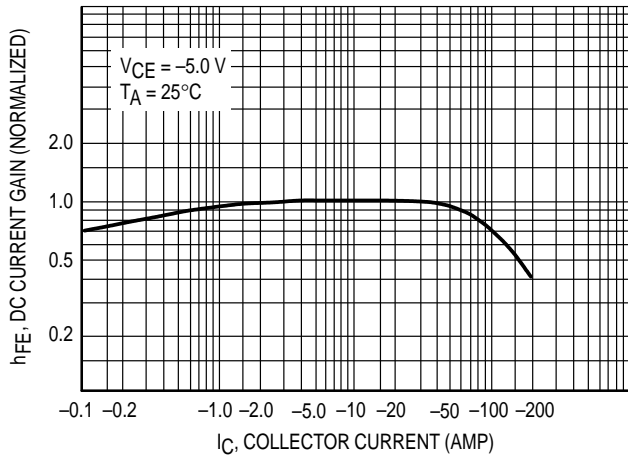


Figure 7. DC Current Gain

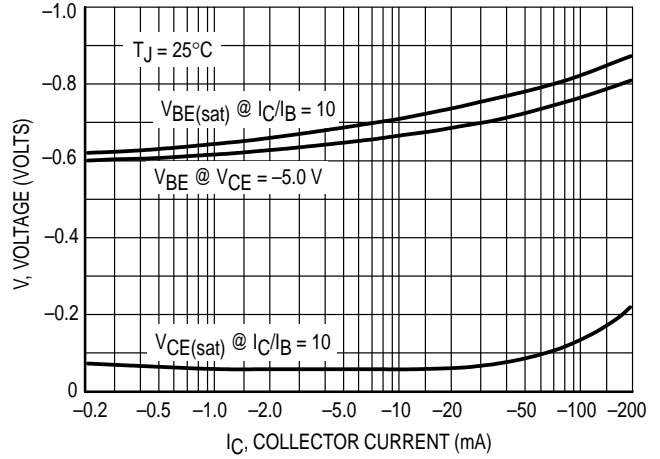


Figure 8. "On" Voltage

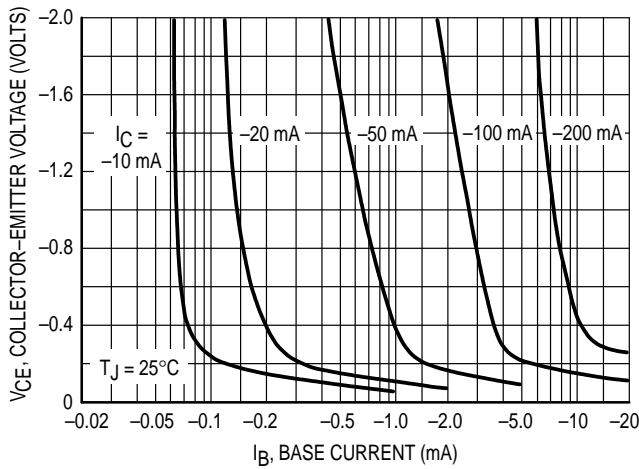


Figure 9. Collector Saturation Region

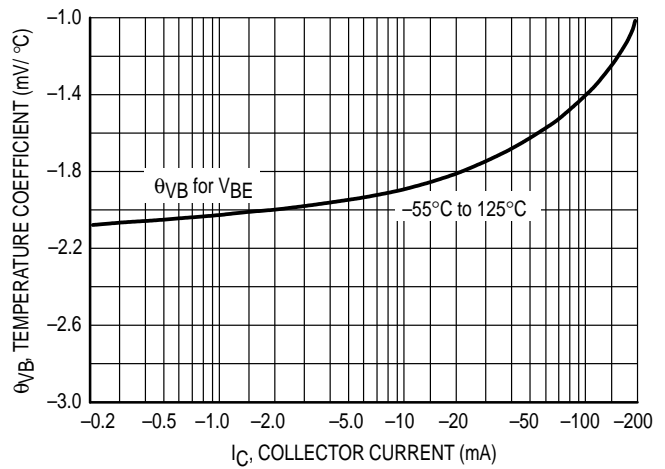


Figure 10. Base-Emitter Temperature Coefficient

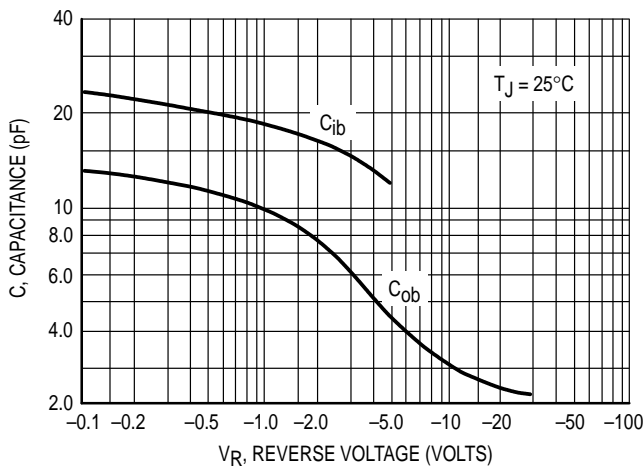


Figure 11. Capacitance

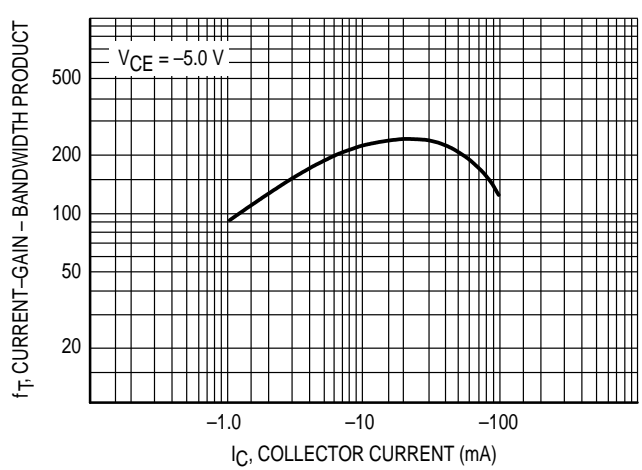


Figure 12. Current-Gain - Bandwidth Product

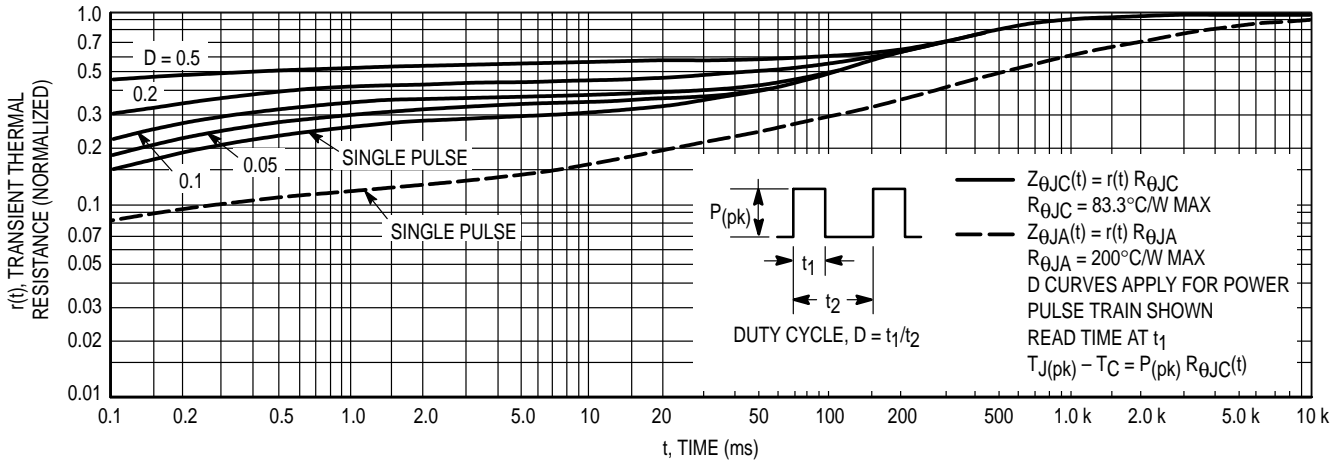


Figure 13. Thermal Response

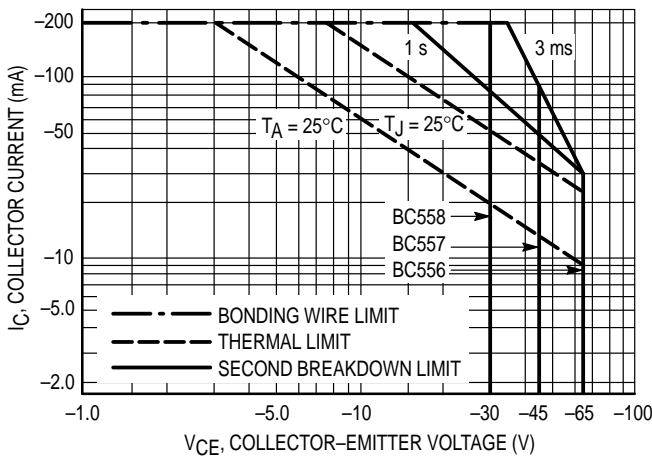


Figure 14. Active Region Safe Operating Area

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.

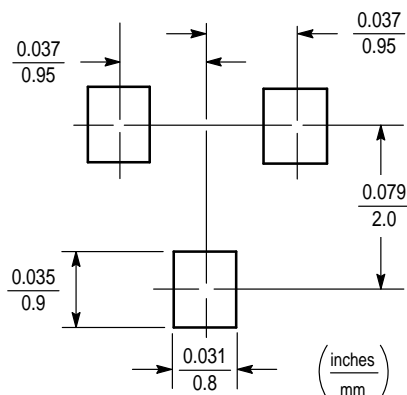
The data of Figure 14 is based upon $T_{J(pk)} = 150^\circ\text{C}$; T_C or T_A is variable depending upon conditions. Pulse curves are valid for duty cycles to 10% provided $T_{J(pk)} \leq 150^\circ\text{C}$. $T_{J(pk)}$ may be calculated from the data in Figure 13. At high case or ambient temperatures,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

INFORMATION FOR USING THE SOT-23 SURFACE MOUNT PACKAGE

MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to insure proper solder connection

interface between the board and the package. With the correct pad geometry, the packages will self align when subjected to a solder reflow process.



SOT-23

SOT-23 POWER DISSIPATION

The power dissipation of the SOT-23 is a function of the pad size. This can vary from the minimum pad size for soldering to a pad size given for maximum power dissipation. Power dissipation for a surface mount device is determined by $T_{J(max)}$, the maximum rated junction temperature of the die, $R_{\theta JA}$, the thermal resistance from the device junction to ambient, and the operating temperature, T_A . Using the values provided on the data sheet for the SOT-23 package, P_D can be calculated as follows:

$$P_D = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

The values for the equation are found in the maximum ratings table on the data sheet. Substituting these values into the equation for an ambient temperature T_A of 25°C, one can calculate the power dissipation of the device which in this case is 225 milliwatts.

$$P_D = \frac{150^\circ\text{C} - 25^\circ\text{C}}{556^\circ\text{C/W}} = 225 \text{ milliwatts}$$

The 556°C/W for the SOT-23 package assumes the use of the recommended footprint on a glass epoxy printed circuit board to achieve a power dissipation of 225 milliwatts. There are other alternatives to achieving higher power dissipation from the SOT-23 package. Another alternative would be to use a ceramic substrate or an aluminum core board such as Thermal Clad™. Using a board material such as Thermal Clad, an aluminum core board, the power dissipation can be doubled using the same footprint.

SOLDERING PRECAUTIONS

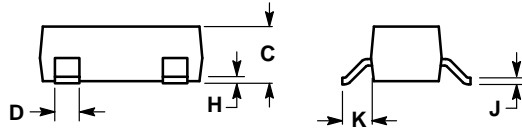
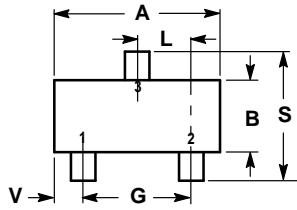
The melting temperature of solder is higher than the rated temperature of the device. When the entire device is heated to a high temperature, failure to complete soldering within a short time could result in device failure. Therefore, the following items should always be observed in order to minimize the thermal stress to which the devices are subjected.

- Always preheat the device.
- The delta temperature between the preheat and soldering should be 100°C or less.*
- When preheating and soldering, the temperature of the leads and the case must not exceed the maximum temperature ratings as shown on the data sheet. When using infrared heating with the reflow soldering method, the difference shall be a maximum of 10°C.
- The soldering temperature and time shall not exceed 260°C for more than 10 seconds.
- When shifting from preheating to soldering, the maximum temperature gradient shall be 5°C or less.
- After soldering has been completed, the device should be allowed to cool naturally for at least three minutes. Gradual cooling should be used as the use of forced cooling will increase the temperature gradient and result in latent failure due to mechanical stress.
- Mechanical stress or shock should not be applied during cooling.

* Soldering a device without preheating can cause excessive thermal shock and stress which can result in damage to the device.

BC856ALT1,BLT1 BC857ALT1,BLT1 BC858ALT1,BLT1,CLT1

PACKAGE DIMENSIONS



NOTES:


1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

| DIM | INCHES | | MILLIMETERS | |
|-----|--------|--------|-------------|-------|
| | MIN | MAX | MIN | MAX |
| A | 0.1102 | 0.1197 | 2.80 | 3.04 |
| B | 0.0472 | 0.0551 | 1.20 | 1.40 |
| C | 0.0350 | 0.0440 | 0.89 | 1.11 |
| D | 0.0150 | 0.0200 | 0.37 | 0.50 |
| G | 0.0701 | 0.0807 | 1.78 | 2.04 |
| H | 0.0005 | 0.0040 | 0.013 | 0.100 |
| J | 0.0034 | 0.0070 | 0.085 | 0.177 |
| K | 0.0180 | 0.0236 | 0.45 | 0.60 |
| L | 0.0350 | 0.0401 | 0.89 | 1.02 |
| S | 0.0830 | 0.0984 | 2.10 | 2.50 |
| V | 0.0177 | 0.0236 | 0.45 | 0.60 |

STYLE 6:

- PIN 1. BASE
2. EMITTER
3. COLLECTOR

**CASE 318-08
ISSUE AE
SOT-23 (TO-236AB)**

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters which may be provided in Motorola data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

Mfax is a trademark of Motorola, Inc.

How to reach us:

USA/EUROPE/Locations Not Listed: Motorola Literature Distribution;
P.O. Box 5405, Denver, Colorado 80217. 303-675-2140 or 1-800-441-2447

JAPAN: Nippon Motorola Ltd.: SPD, Strategic Planning Office, 4-32-1,
Nishi-Gotanda, Shinagawa-ku, Tokyo 141, Japan. 81-3-5487-8488

Mfax™: RMFAX0@email.sps.mot.com – TOUCHTONE 602-244-6609
– US & Canada ONLY 1-800-774-1848

ASIA/PACIFIC: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298

INTERNET: <http://motorola.com/sps>



This datasheet has been downloaded from:

www.DatasheetCatalog.com

Datasheets for electronic components.



LittleDiode supplies new, hard to find or obsolete electronic components and semiconductors all over the world.

With over two million different components listed you are sure to find the part you need.

Feel free to visit us today at our online store:

LittleDiode.com

Looking forward to providing you with the best possible service.