# MMBTA13LT1G, MMBTA14LT1G

# Darlington Amplifier Transistors

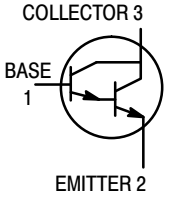
## NPN Silicon

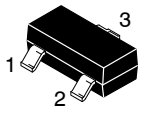
**ON Semiconductor®**

**http://onsemi.com**

### Features

- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant




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

### MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector − Emitter Voltage | $V_{CES}$ | 30 | Vdc |
| Collector − Base Voltage | $V_{CBO}$ | 30 | Vdc |
| Emitter − Base Voltage | $V_{EBO}$ | 10 | Vdc |
| Collector Current − Continuous | $I_C$ | 300 | mAdc |

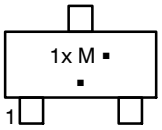
### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Total Device Dissipation FR−5 Board (Note 1) $T_A$ = 25°C<br>Derate above 25°C | $P_D$ | 225<br>1.8 | 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 | $P_D$ | 300<br>2.4 | 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 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−5 = 1.0 × 0.75 × 0.062 in.
2. Alumina = 0.4 × 0.3 × 0.024 in. 99.5% alumina.

### MARKING DIAGRAM




1x = Device Code
x = M for MMBTA13LT1
x = N for MMBTA14LT1
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

| Device | Package | Shipping† |
|---|---|---|
| MMBTA13LT1G | SOT−23 (Pb−Free) | 3,000 / Tape & Reel |
| MMBTA14LT1G | SOT−23 (Pb−Free) | 3,000 / 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.

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

| Characteristic | | Symbol | Min | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector – Emitter Breakdown Voltage ($I_C$ = 100 μAdc, $V_{BE}$ = 0) | | $V_{(BR)CES}$ | 30 | – | Vdc |
| Collector Cutoff Current ($V_{CB}$ = 30 Vdc, $I_E$ = 0) | | $I_{CBO}$ | – | 100 | nAdc |
| Emitter Cutoff Current ($V_{EB}$ = 10 Vdc, $I_C$ = 0) | | $I_{EBO}$ | – | 100 | nAdc |
| **ON CHARACTERISTICS** (Note 3) | | | | | |
| DC Current Gain | | $h_{FE}$ | | | – |
| ($I_C$ = 10 mAdc, $V_{CE}$ = 5.0 Vdc) | MMBTA13 | | 5000 | – | |
| | MMBTA14 | | 10,000 | – | |
| ($I_C$ = 100 mAdc, $V_{CE}$ = 5.0 Vdc) | MMBTA13 | | 10,000 | – | |
| | MMBTA14 | | 20,000 | – | |
| Collector – Emitter Saturation Voltage ($I_C$ = 100 mAdc, $I_B$ = 0.1 mAdc) | | $V_{CE(sat)}$ | – | 1.5 | Vdc |
| Base – Emitter On Voltage ($I_C$ = 100 mAdc, $V_{CE}$ = 5.0 Vdc) | | $V_{BE}$ | – | 2.0 | Vdc |
| **SMALL–SIGNAL CHARACTERISTICS** | | | | | |
| Current – Gain – Bandwidth Product (Note 4) ($I_C$ = 10 mAdc, $V_{CE}$ = 5.0 Vdc, f = 100 MHz) | | $f_T$ | 125 | – | MHz |

3. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
4. $f_T = |h_{fe}| \bullet f_{test}$.

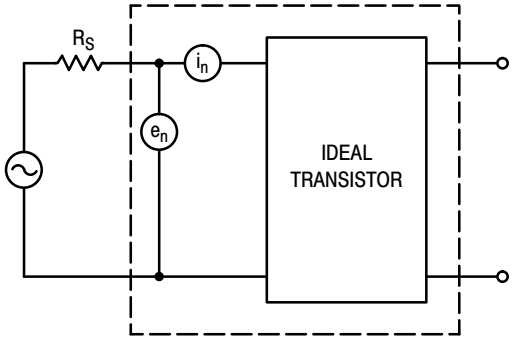



**Figure 1. Transistor Noise Model**

## NOISE CHARACTERISTICS

($V_{CE}$ = 5.0 Vdc, $T_A$ = 25°C)

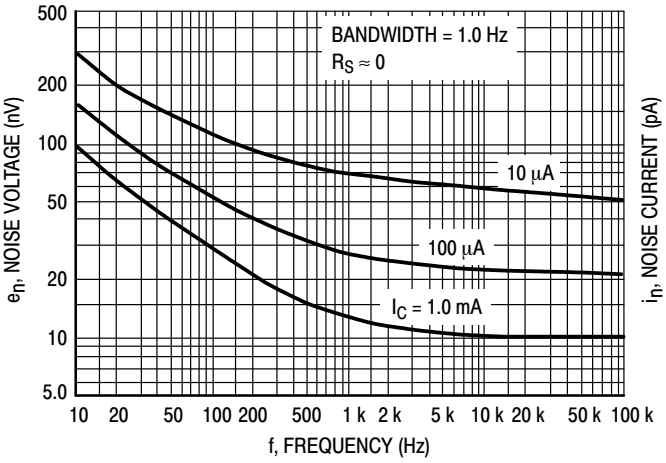



**Figure 2. Noise Voltage**

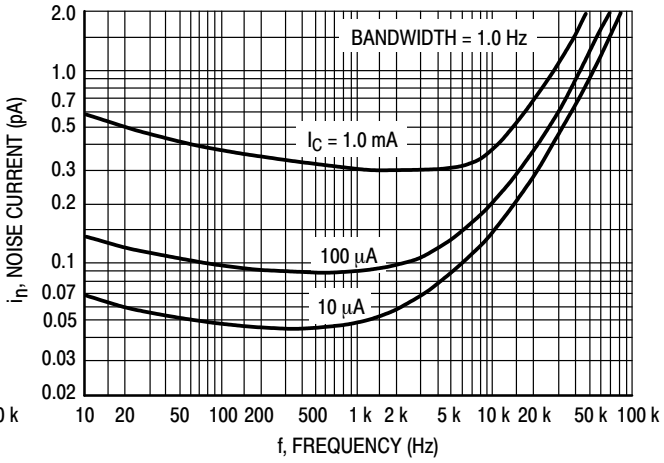



**Figure 3. Noise Current**

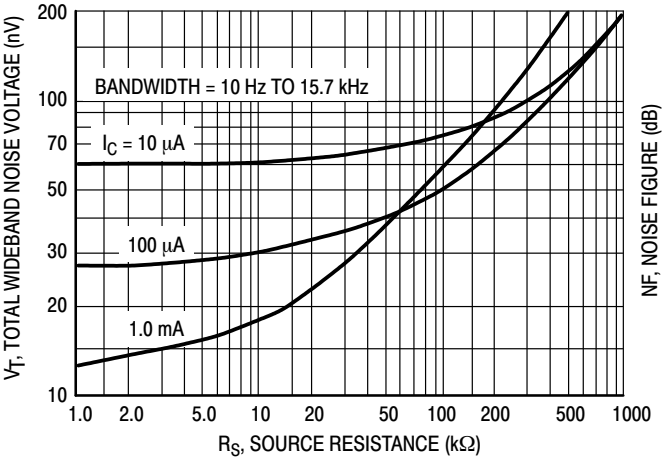



**Figure 4. Total Wideband Noise Voltage**

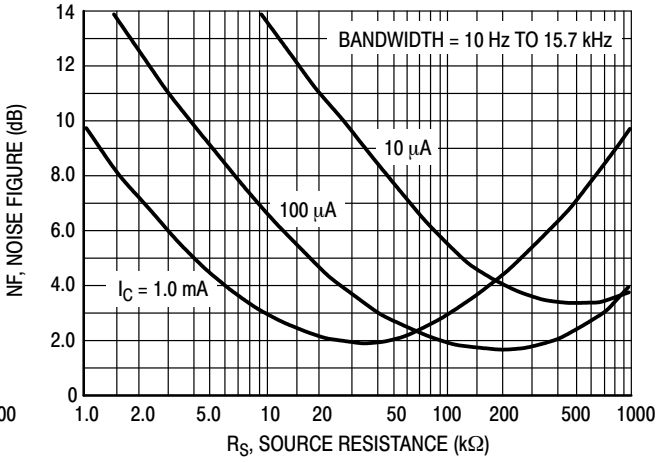



**Figure 5. Wideband Noise Figure**

## SMALL−SIGNAL CHARACTERISTICS

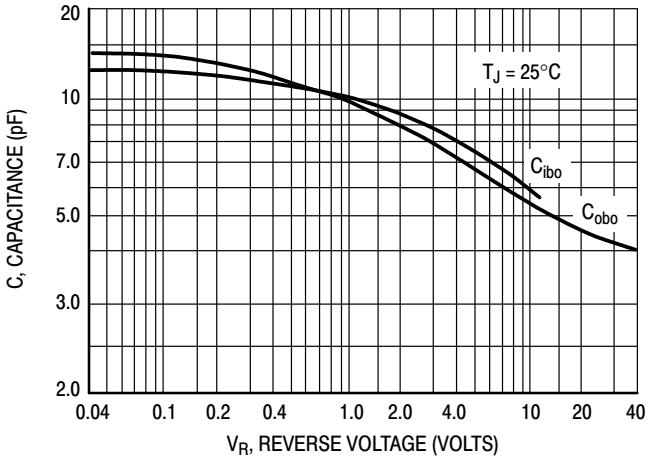



**Figure 6. Capacitance**

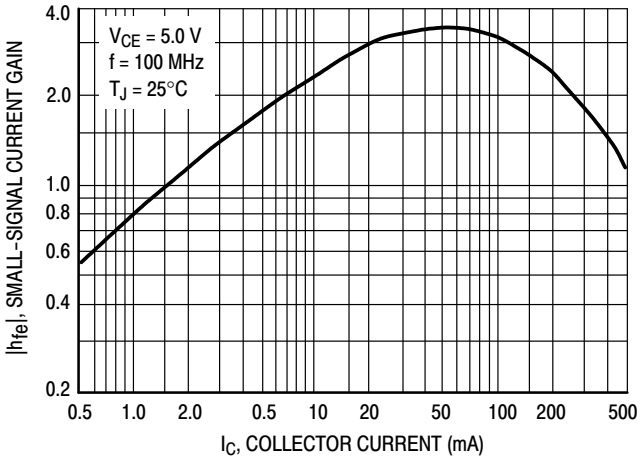



**Figure 7. High Frequency Current Gain**

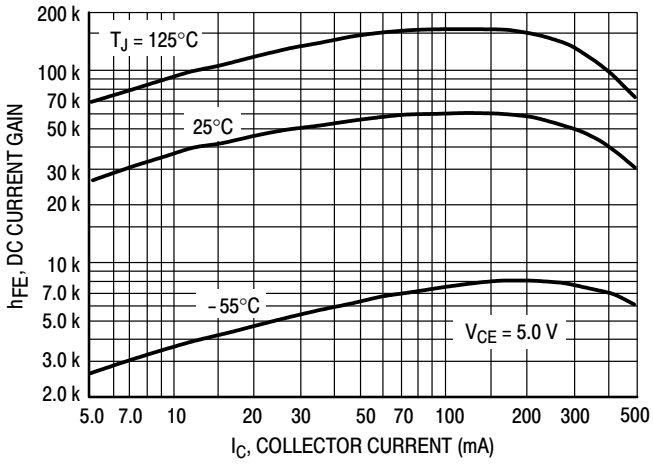



**Figure 8. DC Current Gain**

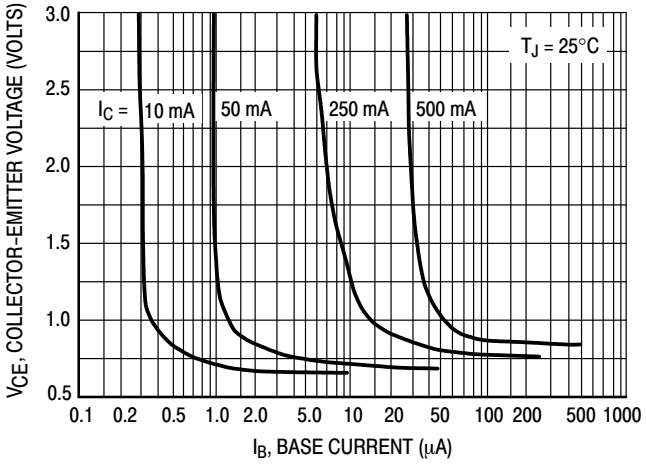



**Figure 9. Collector Saturation Region**

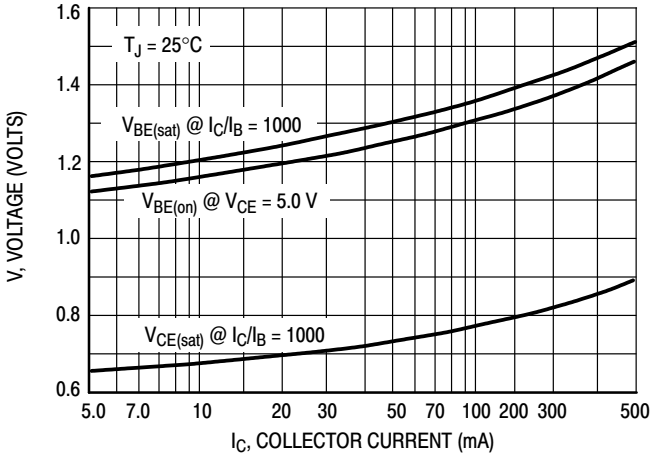



**Figure 10. “On” Voltages**

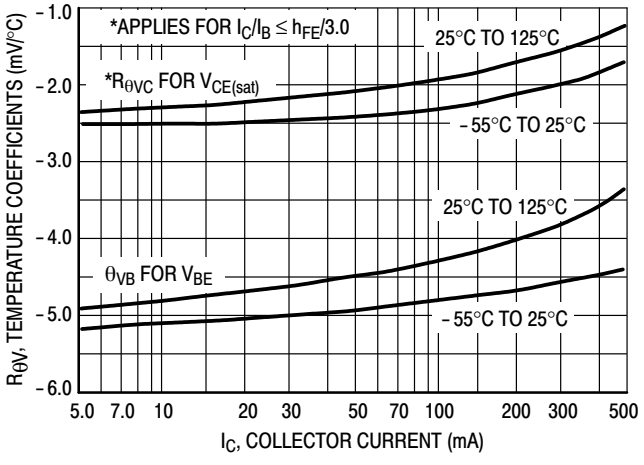



**Figure 11. Temperature Coefficients**

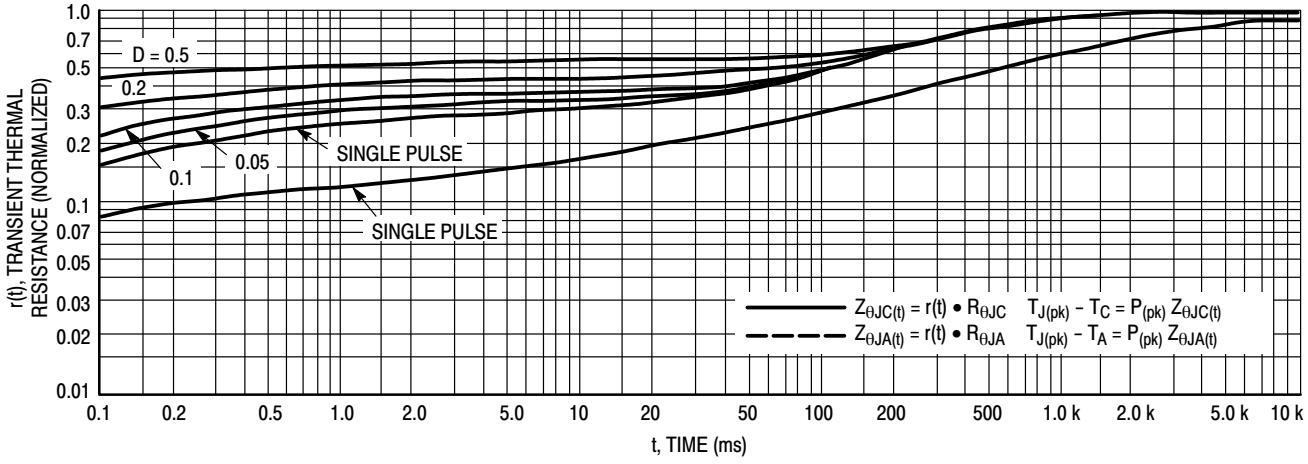



**Figure 12. Thermal Response**

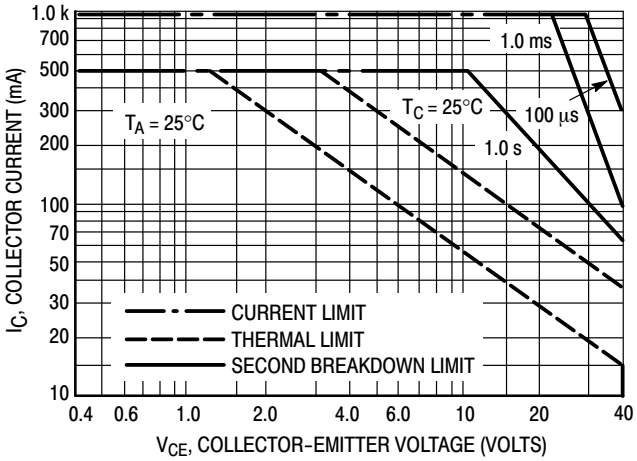
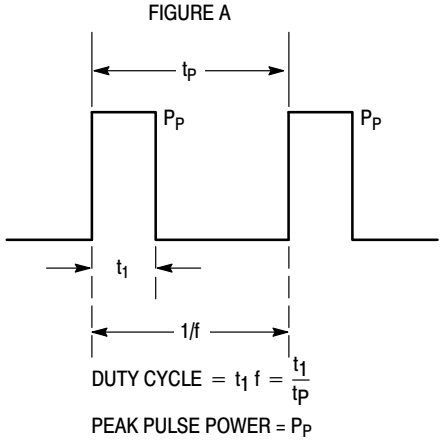


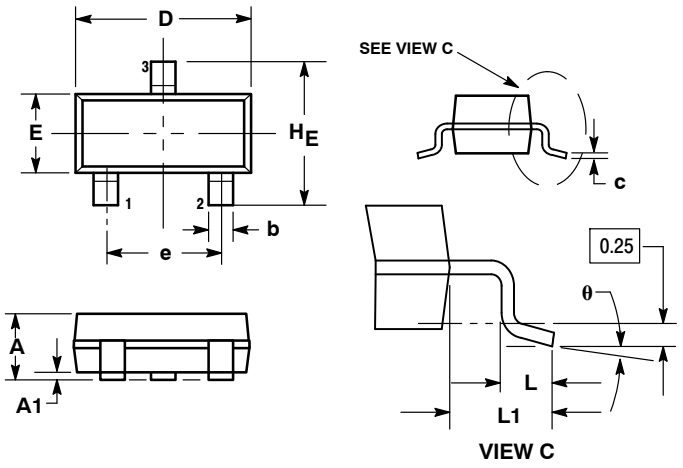

**Figure 13. Active Region Safe Operating Area**




**Design Note: Use of Transient Thermal Resistance Data**

## PACKAGE DIMENSIONS

**SOT−23 (TO−236)**
CASE 318−08
ISSUE AN

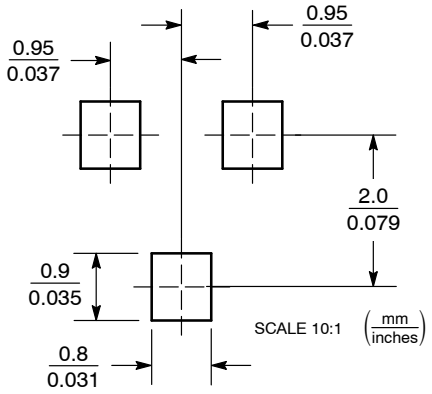



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. 318−01 THRU −07 AND −09 OBSOLETE, NEW STANDARD 318−08.

| | MILLIMETERS | | | INCHES | | |
|---|---|---|---|---|---|---|
| DIM | MIN | NOM | MAX | MIN | NOM | MAX |
| A | 0.89 | 1.00 | 1.11 | 0.035 | 0.040 | 0.044 |
| A1 | 0.01 | 0.06 | 0.10 | 0.001 | 0.002 | 0.004 |
| b | 0.37 | 0.44 | 0.50 | 0.015 | 0.018 | 0.020 |
| c | 0.09 | 0.13 | 0.18 | 0.003 | 0.005 | 0.007 |
| 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 | 0.081 |
| L | 0.10 | 0.20 | 0.30 | 0.004 | 0.008 | 0.012 |
| L1 | 0.35 | 0.54 | 0.69 | 0.014 | 0.021 | 0.029 |
| $H_E$ | 2.10 | 2.40 | 2.64 | 0.083 | 0.094 | 0.104 |

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

## SOLDERING 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.



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