

# MMBTA70LT1G

## General Purpose Transistor

### PNP Silicon

#### Features

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

#### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	-40	Vdc
Emitter-Base Voltage	$V_{EBO}$	-4.0	Vdc
Collector Current - Continuous	$I_C$	-100	mAdc

#### THERMAL CHARACTERISTICS

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

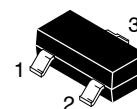
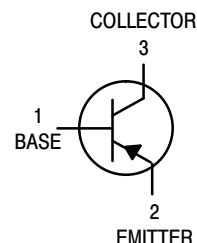
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

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



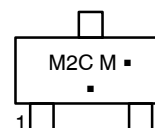
**ON Semiconductor®**

<http://onsemi.com>



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

#### MARKING DIAGRAM



M2C = Specific Device Code  
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†
MMBTA70LT1G	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.

# MMBTA70LT1G

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

Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector-Emitter Breakdown Voltage ( $I_C = -1.0\text{ mAdc}$ , $I_B = 0$ )	$V_{(BR)CEO}$	-40	-	Vdc
Emitter-Base Breakdown Voltage ( $I_E = -100\ \mu\text{Adc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	-4.0	-	Vdc
Collector Cutoff Current ( $V_{CB} = -30\text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$	-	-100	nAdc
<b>ON CHARACTERISTICS</b>				
DC Current Gain ( $I_C = -5.0\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ )	$h_{FE}$	40	400	-
Collector-Emitter Saturation Voltage ( $I_C = -10\text{ mAdc}$ , $I_B = -1.0\text{ mAdc}$ )	$V_{CE(sat)}$	-	-0.25	Vdc
<b>SMALL-SIGNAL CHARACTERISTICS</b>				
Current-Gain - Bandwidth Product ( $I_C = -5.0\text{ mAdc}$ , $V_{CE} = -10\text{ Vdc}$ , $f = 100\text{ MHz}$ )	$f_T$	125	-	MHz
Output Capacitance ( $V_{CB} = -10\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )	$C_{obo}$	-	4.0	pF

## TYPICAL NOISE CHARACTERISTICS

( $V_{CE} = -5.0\text{ Vdc}$ ,  $T_A = 25^\circ\text{C}$ )

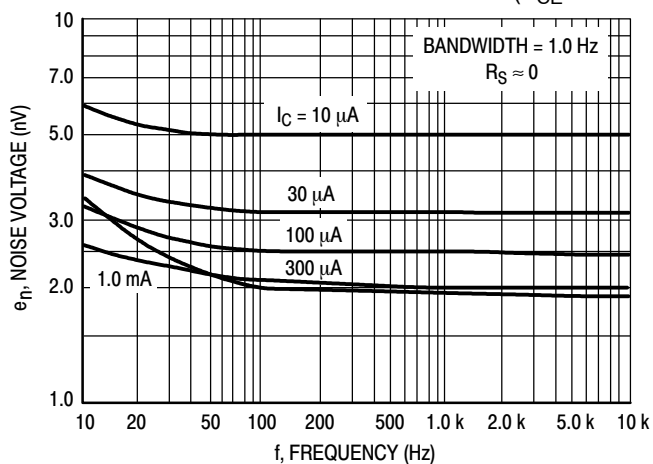


Figure 1. Noise Voltage

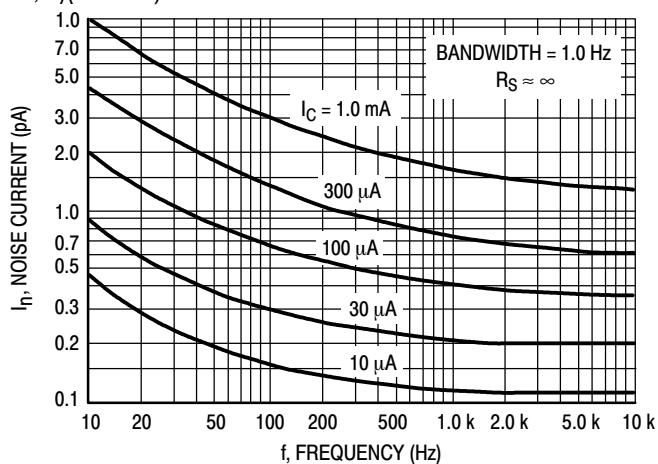


Figure 2. Noise Current

# MMBTA70LT1G

## NOISE FIGURE CONTOURS

( $V_{CE} = -5.0 \text{ Vdc}$ ,  $T_A = 25^\circ\text{C}$ )

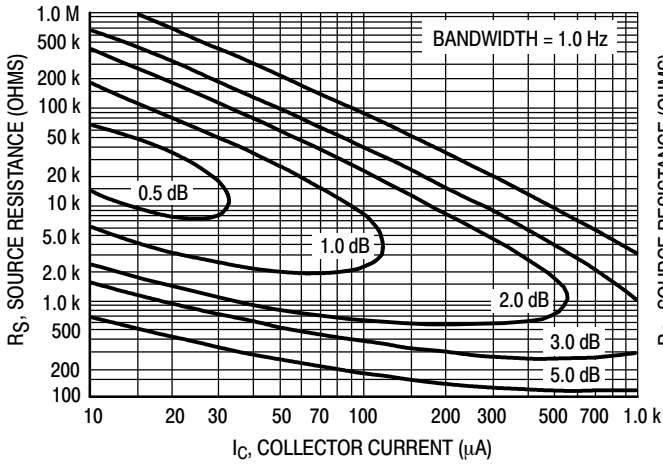


Figure 3. Narrow Band, 100 Hz

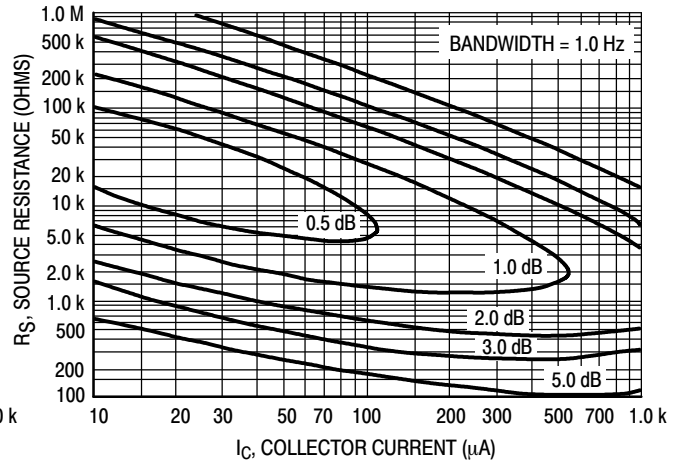


Figure 4. Narrow Band, 1.0 kHz

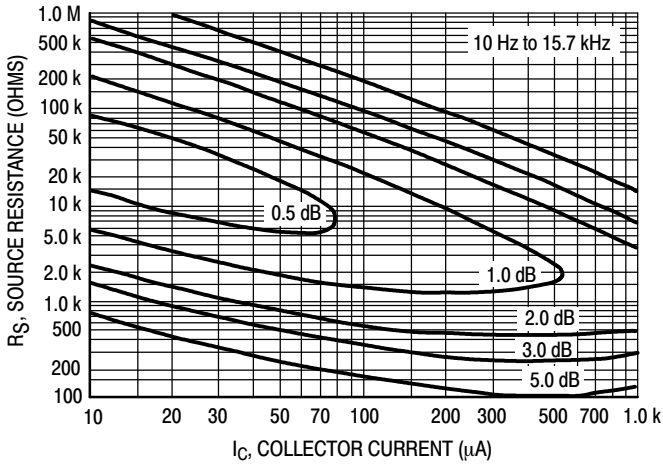


Figure 5. Wideband

Noise Figure is Defined as:

$$NF = 20 \log_{10} \left[ \frac{e_n^2 + 4KTR_S + I_n^2 R_S^2}{4KTR_S} \right]^{1/2}$$

$e_n$  = Noise Voltage of the Transistor referred to the input. (Figure 3)

$I_n$  = Noise Current of the Transistor referred to the input. (Figure 4)

$K$  = Boltzman's Constant ( $1.38 \times 10^{-23} \text{ J}^\circ\text{K}$ )

$T$  = Temperature of the Source Resistance ( $^\circ\text{K}$ )

$R_S$  = Source Resistance (Ohms)

# MMBTA70LT1G

## TYPICAL STATIC CHARACTERISTICS

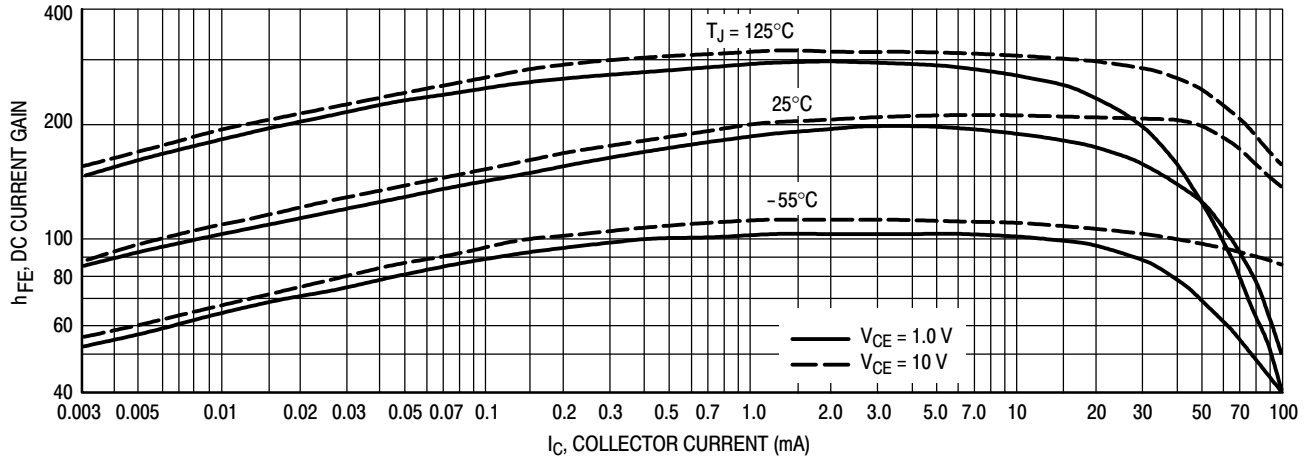


Figure 6. DC Current Gain

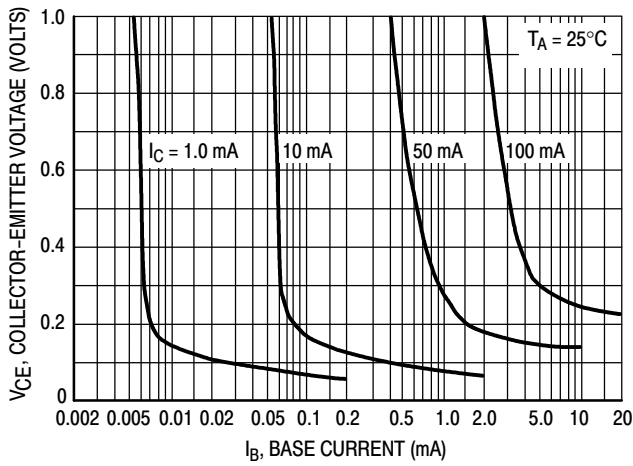


Figure 7. Collector Saturation Region

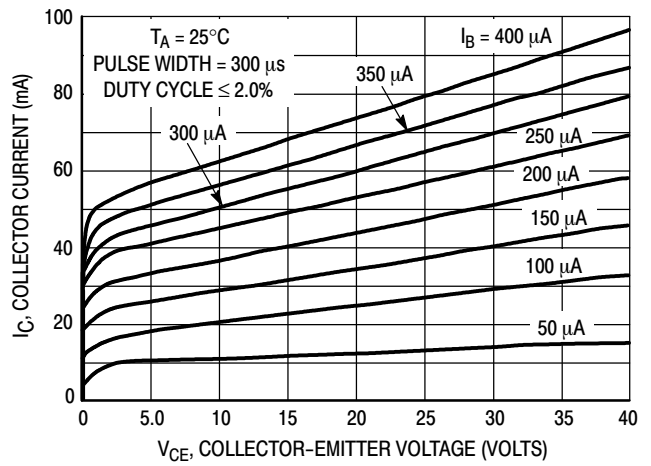


Figure 8. Collector Characteristics

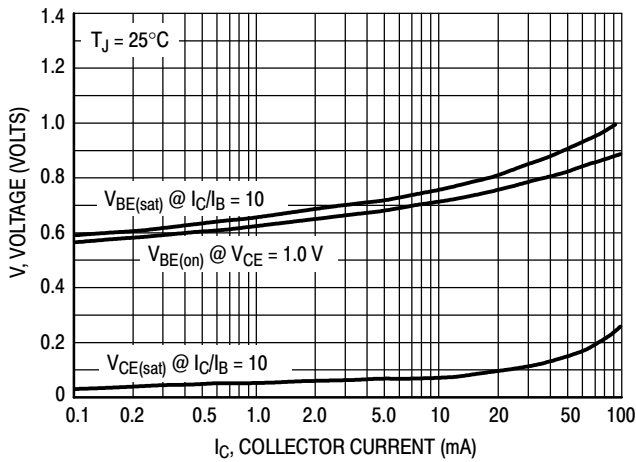


Figure 9. "On" Voltages

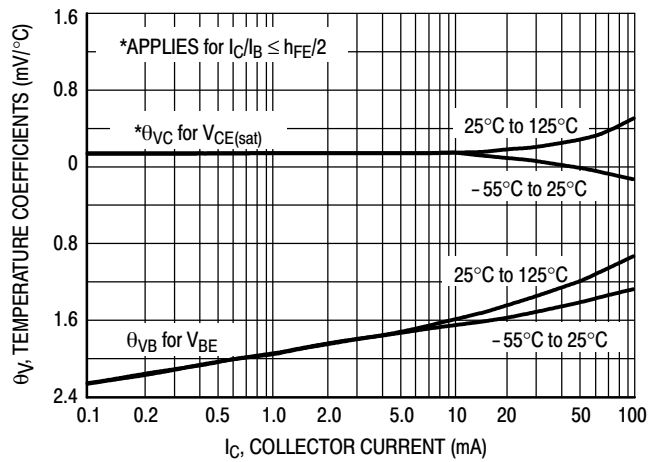


Figure 10. Temperature Coefficients

# MMBTA70LT1G

## TYPICAL DYNAMIC CHARACTERISTICS

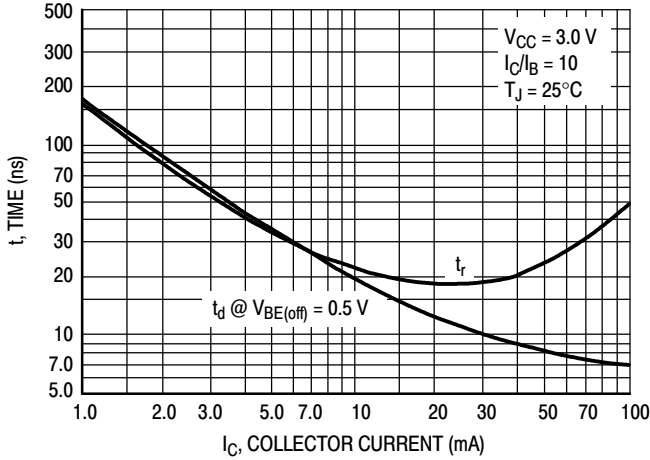


Figure 11. Turn-On Time

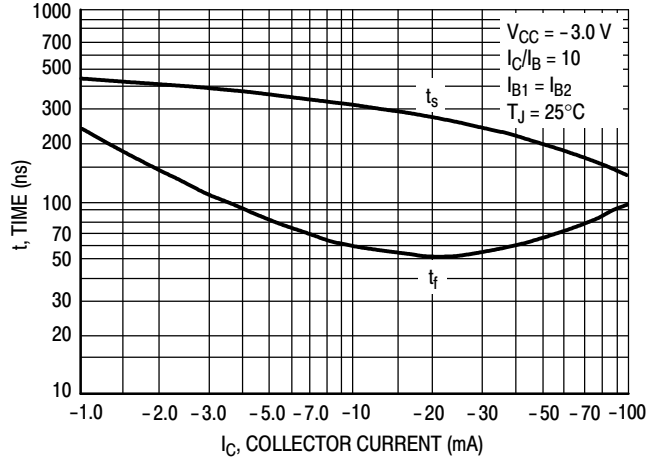


Figure 12. Turn-Off Time

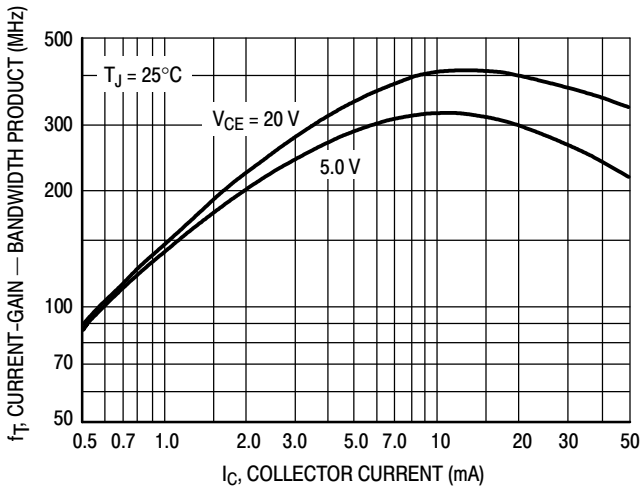


Figure 13. Current-Gain — Bandwidth Product

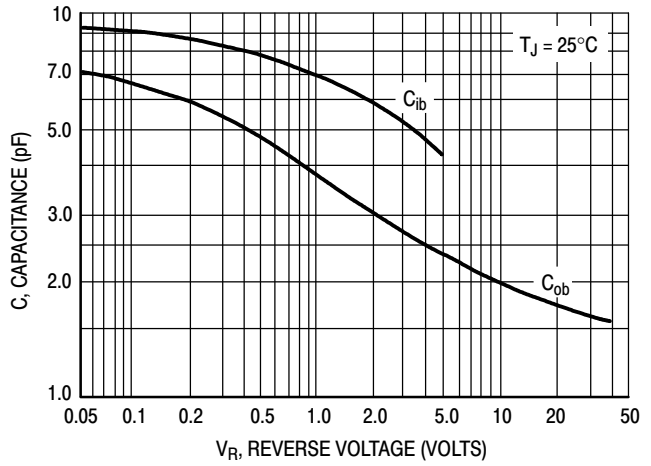


Figure 14. Capacitance

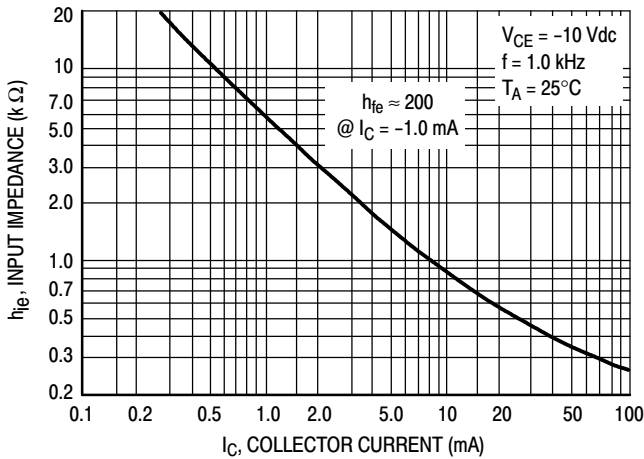


Figure 15. Input Impedance

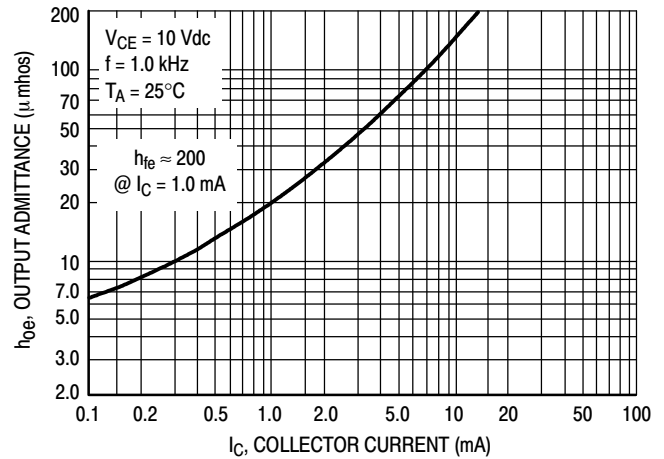


Figure 16. Output Admittance

# MMBTA70LT1G

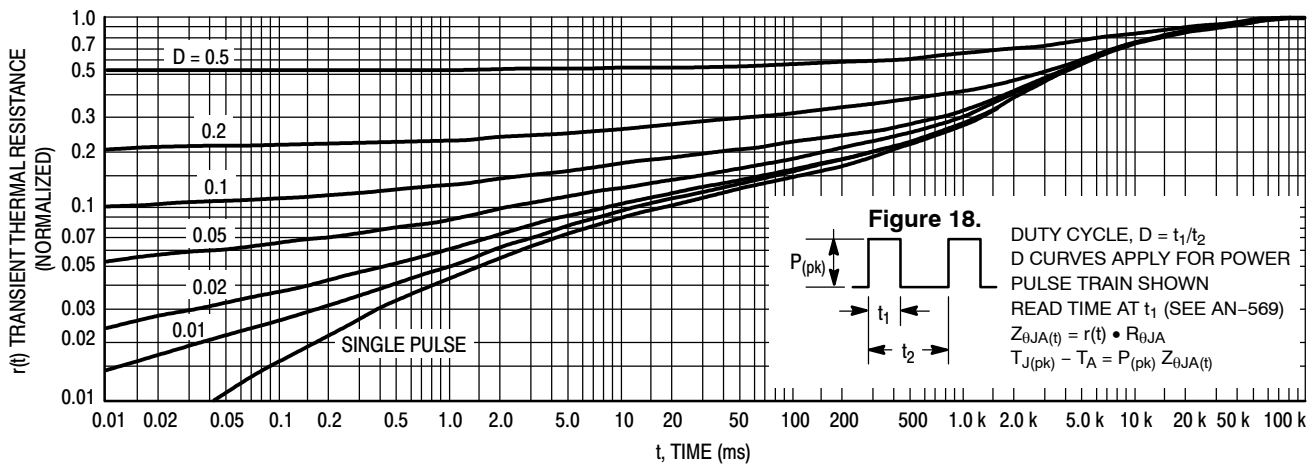


Figure 17. Thermal Response

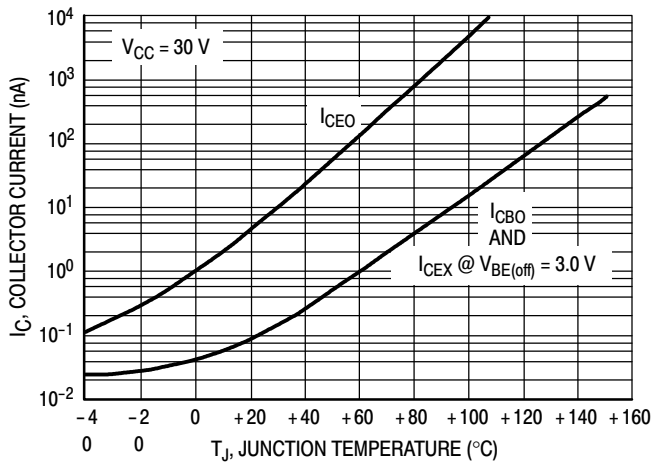


Figure 19. Typical Collector Leakage Current

## DESIGN NOTE: USE OF THERMAL RESPONSE DATA

A train of periodical power pulses can be represented by the model as shown in Figure 18. Using the model and the device thermal response the normalized effective transient thermal resistance of Figure 17 was calculated for various duty cycles.

To find  $Z_{\theta JA(t)}$ , multiply the value obtained from Figure 17 by the steady state value  $R_{\theta JA}$ .

Example:

Dissipating 2.0 watts peak under the following conditions:

$$t_1 = 1.0 \text{ ms}, t_2 = 5.0 \text{ ms} (D = 0.2)$$

Using Figure 17 at a pulse width of 1.0 ms and  $D = 0.2$ , the reading of  $r(t)$  is 0.22.

The peak rise in junction temperature is therefore

$$\Delta T = r(t) \times P_{(pk)} \times R_{\theta JA} = 0.22 \times 2.0 \times 200 = 88^\circ\text{C}.$$

For more information, see AN-569.

**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** 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 special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** 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. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** 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 **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at [www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)