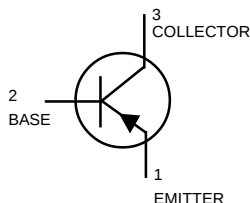
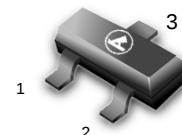


# General Purpose Transistors

## PNP Silicon



**BCW29LT1**  
**BCW30LT1**



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

### MAXIMUM RATINGS

| Rating                         | Symbol    | Value | Unit |
|--------------------------------|-----------|-------|------|
| Collector-Emitter Voltage      | $V_{CEO}$ | -32   | Vdc  |
| Collector-Base Voltage         | $V_{CBO}$ | -32   | Vdc  |
| Emitter-Base Voltage           | $V_{EBO}$ | -5.0  | Vdc  |
| Collector Current — Continuous | $I_C$     | -100  | mAdc |

### THERMAL CHARACTERISTICS

| Characteristic                                                              | Symbol          | Max         | Unit                 |
|-----------------------------------------------------------------------------|-----------------|-------------|----------------------|
| Total Device Dissipation FR-5 Board, (1)<br>$T_A = 25^\circ\text{C}$        | $P_D$           | 225         | mW                   |
| Derate above $25^\circ\text{C}$                                             |                 | 1.8         | mW/ $^\circ\text{C}$ |
| Thermal Resistance, Junction to Ambient                                     | $R_{\theta JA}$ | 556         | $^\circ\text{C/W}$   |
| Total Device Dissipation<br>Alumina Substrate, (2) $T_A = 25^\circ\text{C}$ | $P_D$           | 300         | mW                   |
| Derate above $25^\circ\text{C}$                                             |                 | 2.4         | 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 | $^\circ\text{C}$     |

### DEVICE MARKING

BCW29LT1 = C1; BCW30LT1 = C2

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

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

### OFF CHARACTERISTICS

|                                                                                           |               |      |      |                 |
|-------------------------------------------------------------------------------------------|---------------|------|------|-----------------|
| Collector-Emitter Breakdown Voltage<br>( $I_C = -2.0\text{mA}$ , $I_E = 0$ )              | $V_{(BR)CEO}$ | -32  | —    | Vdc             |
| Collector-Emitter Breakdown Voltage<br>( $I_C = -100\text{ }\mu\text{A}$ , $V_{EB} = 0$ ) | $V_{(BR)CES}$ | -32  | —    | Vdc             |
| Collector-Emitter Breakdown Voltage<br>( $I_C = -10\text{ }\mu\text{A}$ , $I_C = 0$ )     | $V_{(BR)CBO}$ | -32  | —    | Vdc             |
| Emitter-Base Breakdown Voltage<br>( $I_E = -10\text{ }\mu\text{A}$ , $I_C = 0$ )          | $V_{(BR)EBO}$ | -5.0 | —    | Vdc             |
| Collector Cutoff Current<br>( $V_{CB} = -32\text{ Vdc}$ , $I_E = 0$ )                     | $I_{CBO}$     | —    | -100 | nAdc            |
| ( $V_{CB} = -32\text{ Vdc}$ , $I_E = 0$ , $T_A = 100^\circ\text{C}$ )                     |               | —    | -10  | $\mu\text{Adc}$ |

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.

**BCW29LT1 BCW30LT1**
**ELECTRICAL CHARACTERISTICS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted) (Continued)

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

**ON CHARACTERISTICS**

|                                                                                                |                |               |            |            |        |
|------------------------------------------------------------------------------------------------|----------------|---------------|------------|------------|--------|
| DC Current Gain<br>( $I_C = -2.0\text{ mAdc}$ , $V_{CE} = -5.0\text{ Vdc}$ )                   | BCW29<br>BCW30 | $h_{FE}$      | 120<br>215 | 260<br>500 | —<br>— |
| Collector-Emitter Saturation Voltage<br>( $I_C = -10\text{ mAdc}$ , $I_B = -0.5\text{ mAdc}$ ) |                | $V_{CE(sat)}$ | —          | -0.3       | Vdc    |
| Base-Emitter On Voltage<br>( $I_C = -2.0\text{ mAdc}$ , $V_{CE} = -5.0\text{ Vdc}$ )           |                | $V_{BE(on)}$  | -0.6       | -0.75      | Vdc    |

**SMALL-SIGNAL CHARACTERISTICS**

|                                                                                                                                                      |           |   |     |    |
|------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|---|-----|----|
| Output Capacitance<br>( $V_{CB} = -10\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )                                                               | $C_{obo}$ | — | 7.0 | pF |
| Noise Figure<br>( $I_C = -0.2\text{ mAdc}$ , $V_{CE} = -5.0\text{ Vdc}$ , $R_S = 2.0\text{ k}\Omega$ , $f = 1.0\text{ kHz}$ , $BW = 200\text{ Hz}$ ) | NF        | — | 10  | dB |

## BCW29LT1 BCW30LT1

### TYPICAL NOISE CHARACTERISTICS

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

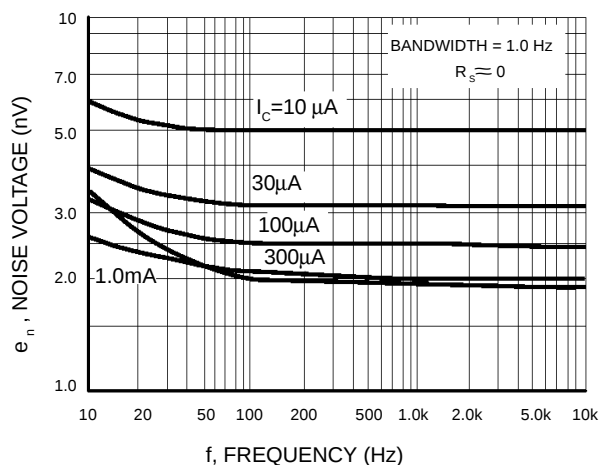


Figure 1. Noise Voltage

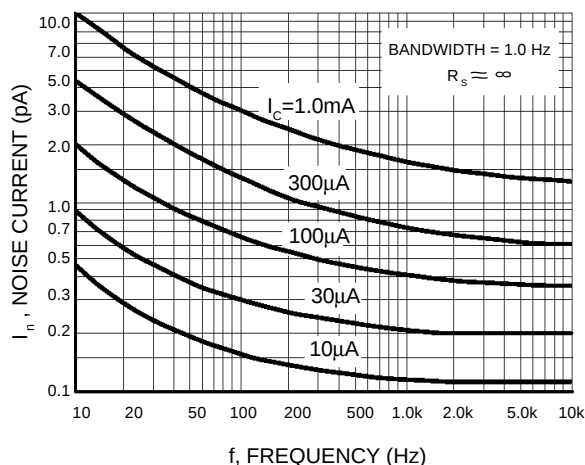


Figure 2. Noise Current

### NOISE FIGURE CONTOURS

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

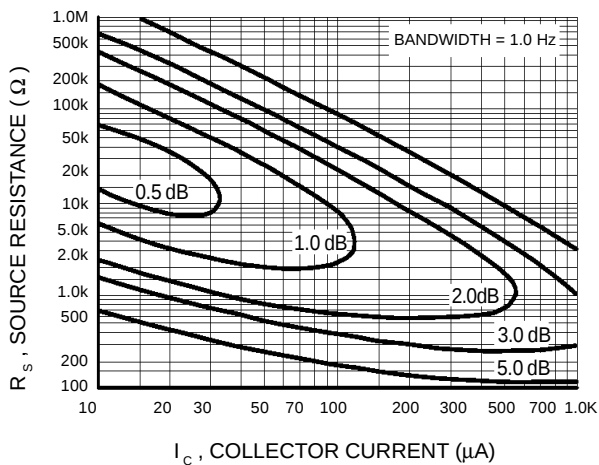


Figure 3. Narrow Band, 100 Hz

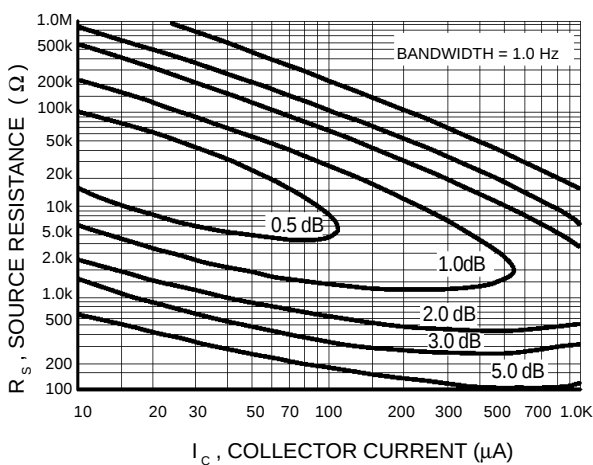


Figure 4. Narrow Band, 1.0 kHz

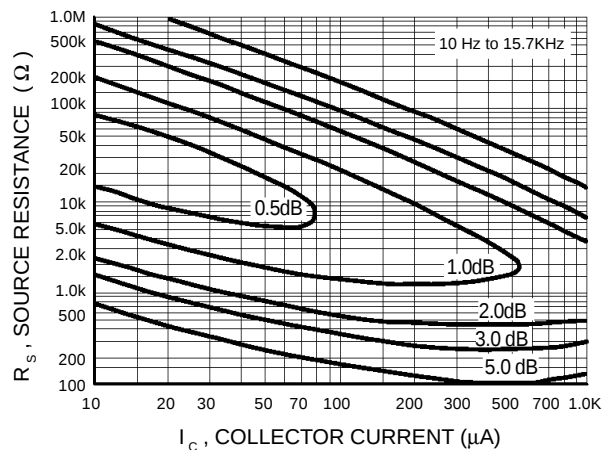


Figure 5. Wideband

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 ( $\Omega$ )

## BCW29LT1 BCW30LT1

### TYPICAL STATIC CHARACTERISTICS

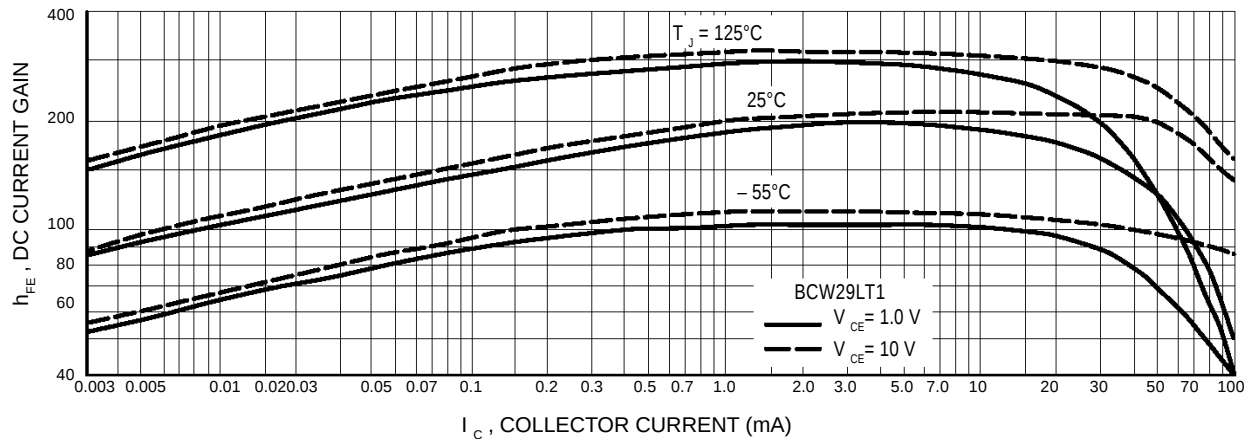


Figure 6. DC Current Gain

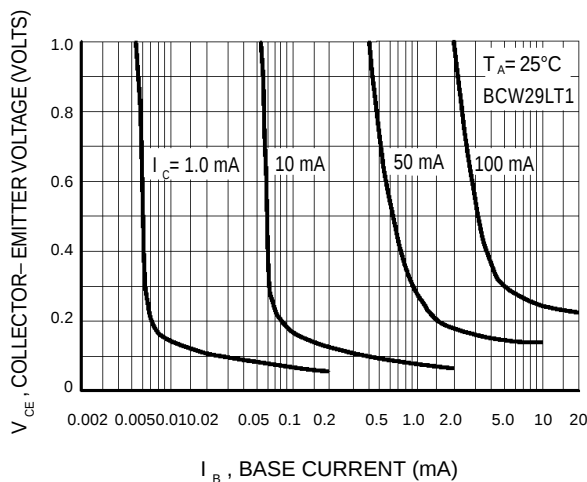


Figure 7. Collector Saturation Region

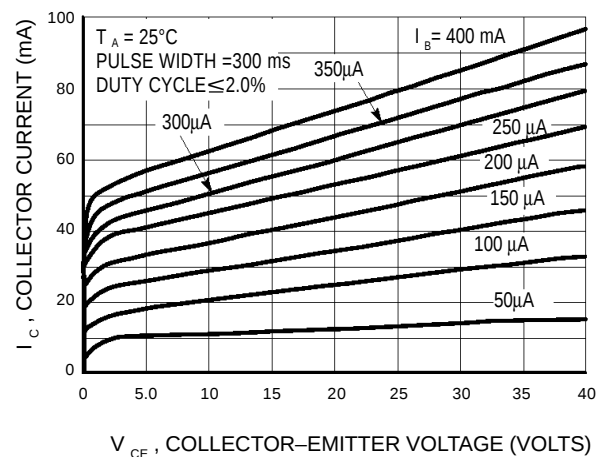


Figure 8. Collector Characteristics

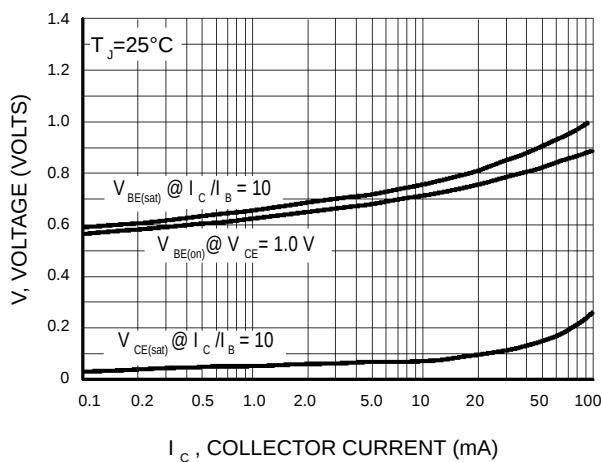


Figure 9. "On" Voltages

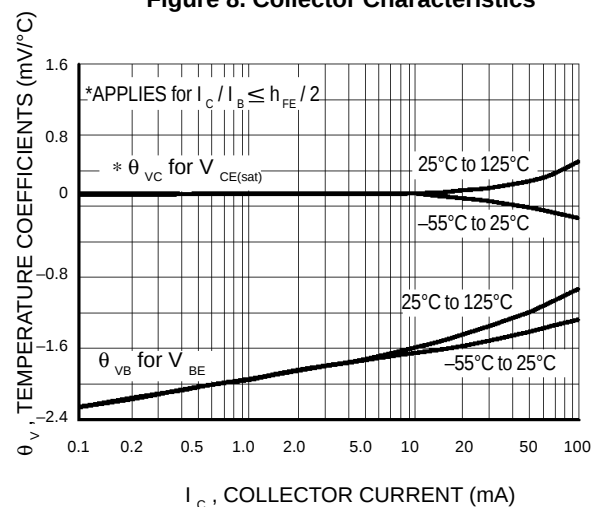


Figure 10. Temperature Coefficients

BCW29LT1 BCW30LT1

TYPICAL DYNAMIC CHARACTERISTICS

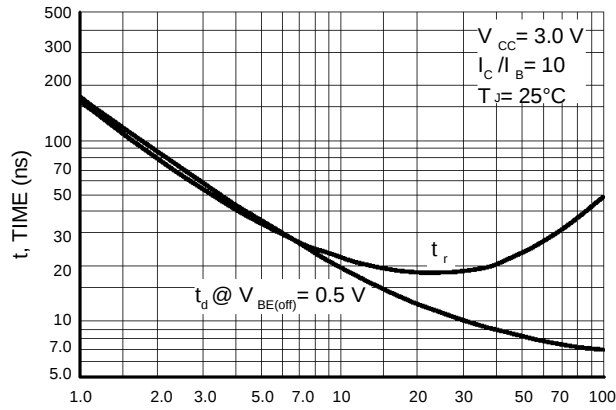


Figure 11. Turn-On Time

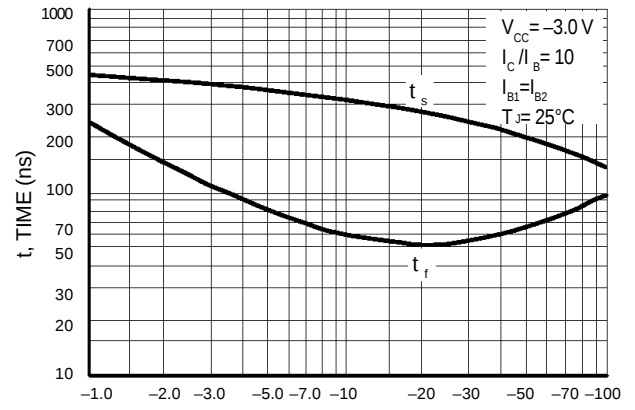


Figure 12. Turn-Off Time

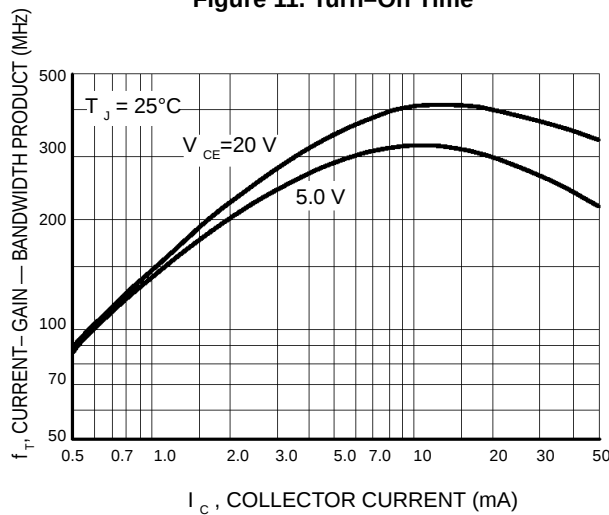


Figure 13. Current-Gain — Bandwidth Product

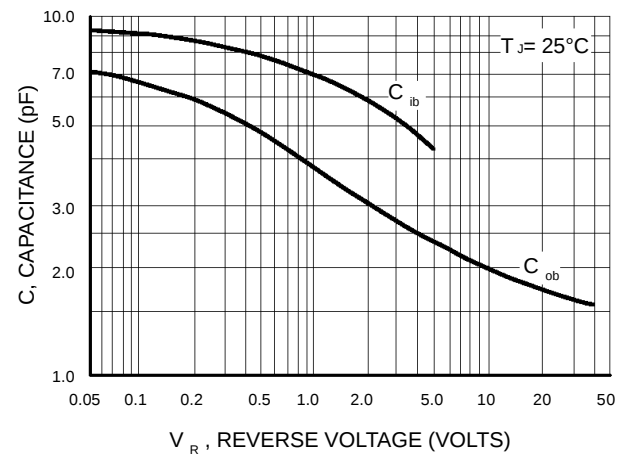


Figure 14. Capacitance

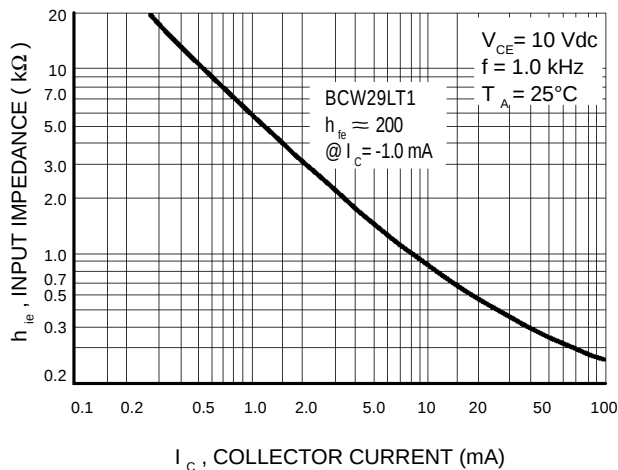


Figure 17. Input Impedance

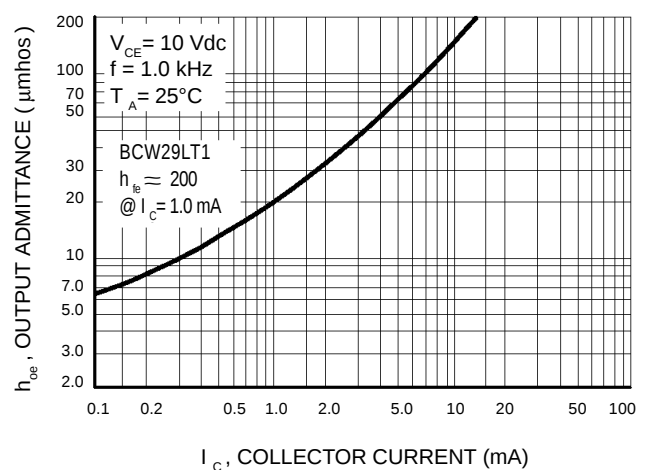


Figure 18. Output Admittance

## BCW29LT1 BCW30LT1

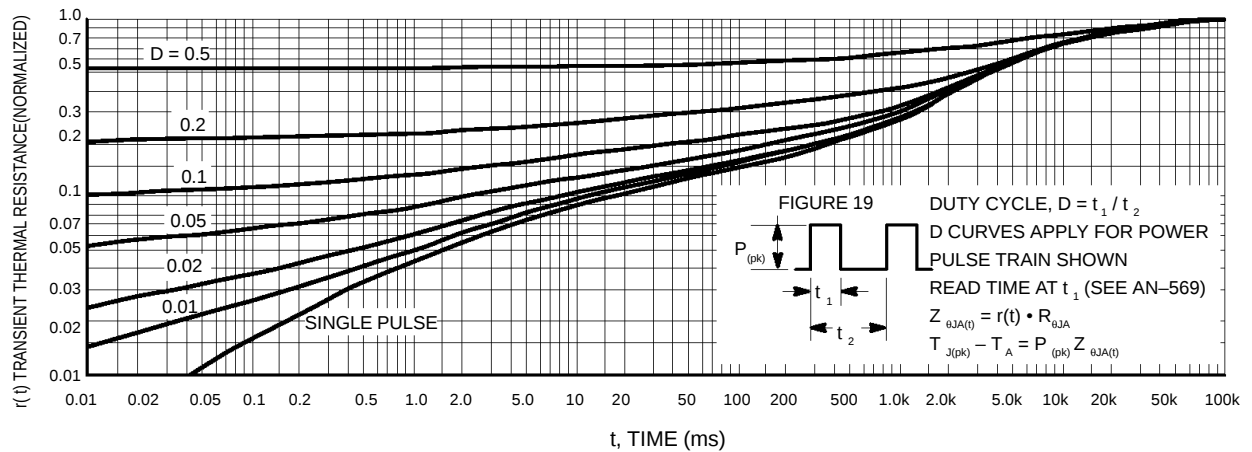


Figure 17. Thermal Response

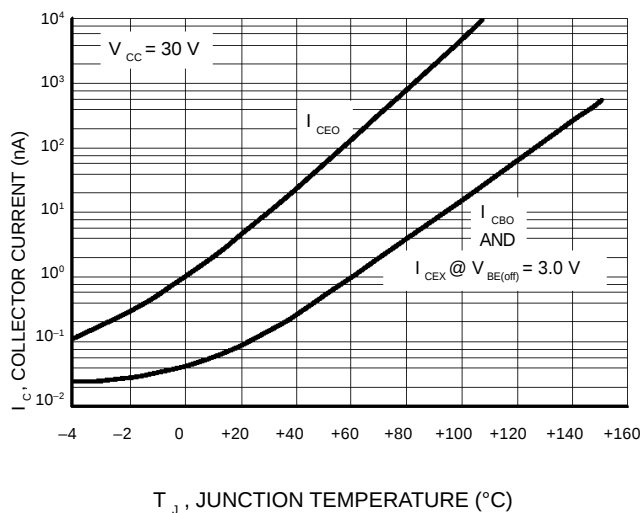


Figure 18. Typical Collector Leakage Current

### DESIGN NOTE: USE OF THERMAL RESPONSE DATA

A train of periodical power pulses can be represented by the model as shown in Figure 19. 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:

The BCW29LT1 is dissipating 2.0 watts peak under the following conditions:

$t_1 = 1.0$  ms,  $t_2 = 5.0$  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

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

For more information, see AN-569.