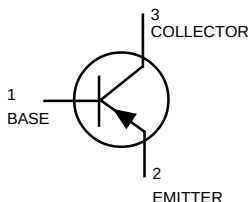


General Purpose Transistors

PNP Silicon



BCW69LT1
BCW70LT1



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

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	- 45	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) $T_A = 25^\circ\text{C}$	P_D	225	mW
Derate above 25°C		1.8	mW/ $^\circ\text{C}$
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	556	$^\circ\text{C/W}$
Total Device Dissipation Alumina Substrate, (2) $T_A = 25^\circ\text{C}$	P_D	300	mW
Derate above 25°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

BCW69LT1 = H1; BCW70LT1 = H2,

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

Characteristic	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage ($I_C = -2.0 \text{ mAdc}, I_B = 0$)	$V_{(BR)CEO}$	- 45	—	Vdc
Collector-Emitter Breakdown Voltage ($I_C = -100 \mu\text{Adc}, V_{EB} = 0$)	$V_{(BR)CES}$	- 50	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = -10 \mu\text{Adc}, I_C = 0$)	$V_{(BR)EBO}$	- 5.0	—	Vdc
Collector Cutoff Current ($V_{CE} = -20 \text{ Vdc}, I_E = 0$)	I_{CEO}	—	- 100	nAdc
($V_{CE} = -20 \text{ Vdc}, I_E = 0, T_A = 100^\circ\text{C}$)		—	- 10	μAdc

1. FR- 5 = $1.0 \times 0.75 \times 0.062 \text{ in.}$

2. Alumina = $0.4 \times 0.3 \times 0.024 \text{ in.}$ 99.5% alumina.

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

Characteristic	Symbol	Min	Max	Unit
ON CHARACTERISTICS				
DC Current Gain ($I_C = -2.0\text{ mA}$, $V_{CE} = -5.0\text{ Vdc}$)	h_{FE}	120	260	—
BCW69LT1				
BCW70LT1		215	500	
Collector-Emitter Saturation Voltage ($I_C = -10\text{ mA}$, $I_B = -0.5\text{ mA}$)	$V_{CE(sat)}$	—	- 0.3	Vdc
Base-Emitter On Voltage ($I_C = -2.0\text{ mA}$, $V_{CE} = -5.0\text{ Vdc}$)	$V_{BE(on)}$	- 0.6	- 0.75	Vdc
SMALL-SIGNAL CHARACTERISTICS				
Output Capacitance ($I_E = 0\text{ V}$, $V_{CB} = -10\text{ Vdc}$, $f = 1.0\text{ MHz}$)	C_{obo}	—	7.0	pF
Noise Figure ($V_{CE} = -5.0\text{ Vdc}$, $I_C = -0.2\text{ mA}$, $R_S = 2.0\text{ k}\Omega$, $f = 1.0\text{ kHz}$, $BW = 200\text{ Hz}$)	N_F	—	10	dB

TYPICAL NOISE CHARACTERISTICS

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

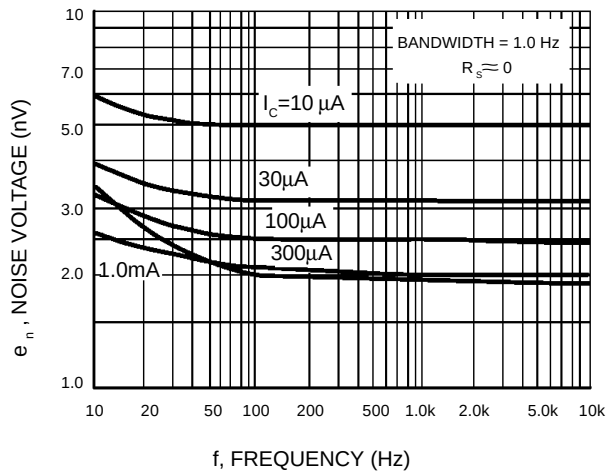


Figure 1. Noise Voltage

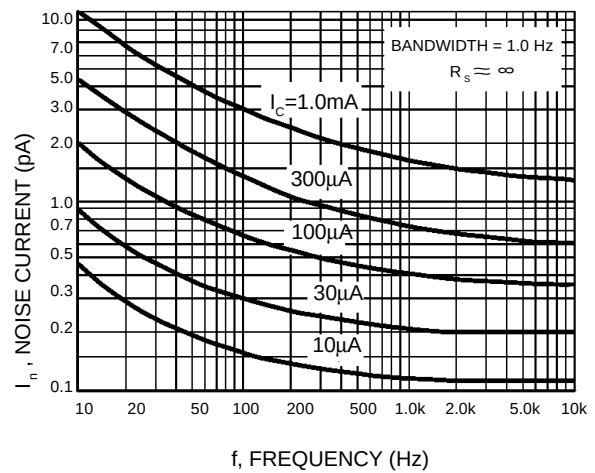


Figure 2. Noise Current

NOISE FIGURE CONTOURS

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

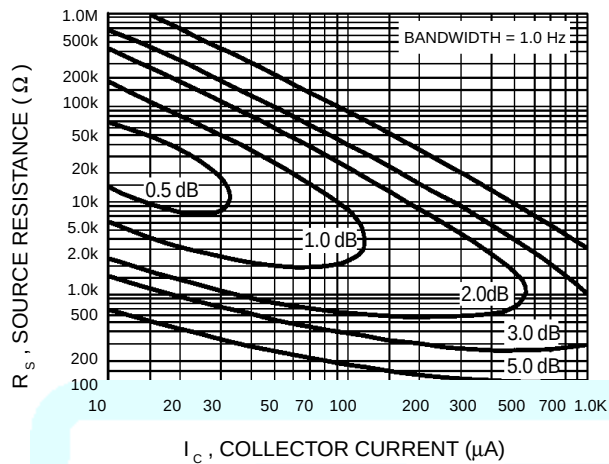


Figure 3. Narrow Band, 100 Hz

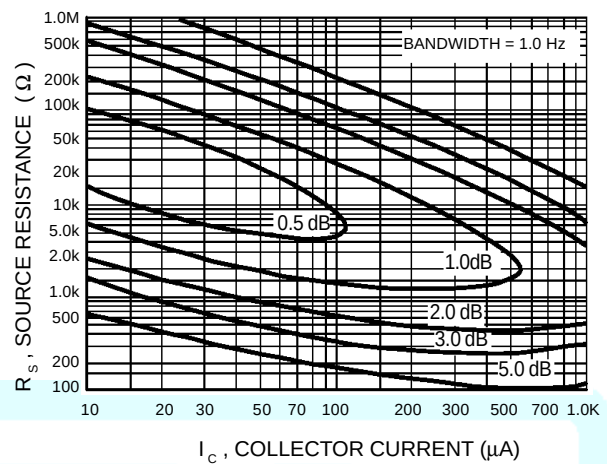


Figure 4. Narrow Band, 1.0 kHz

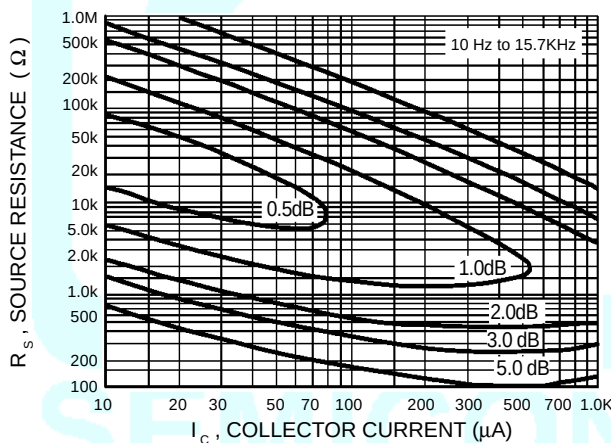


Figure 5. Wideband

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 (Ω)

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TYPICAL STATIC CHARACTERISTICS

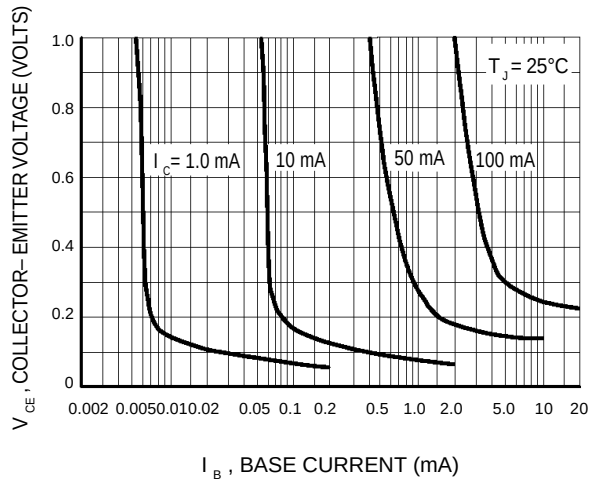


Figure 6. Collector Saturation Region

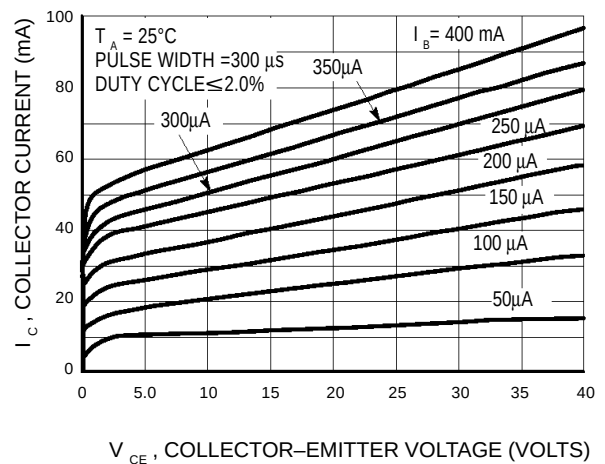


Figure 7. Collector Characteristics

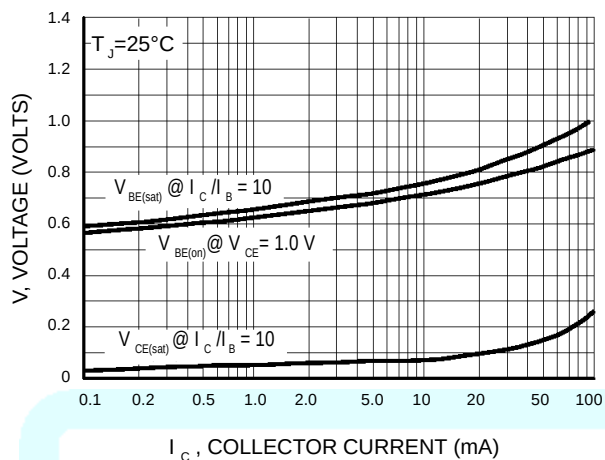


Figure 10. "On" Voltages

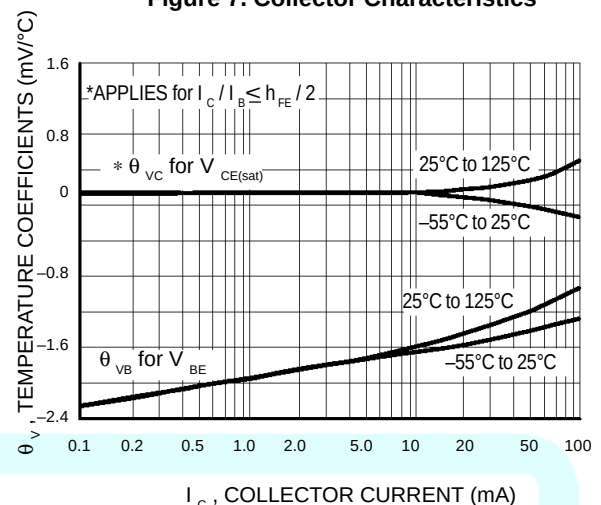
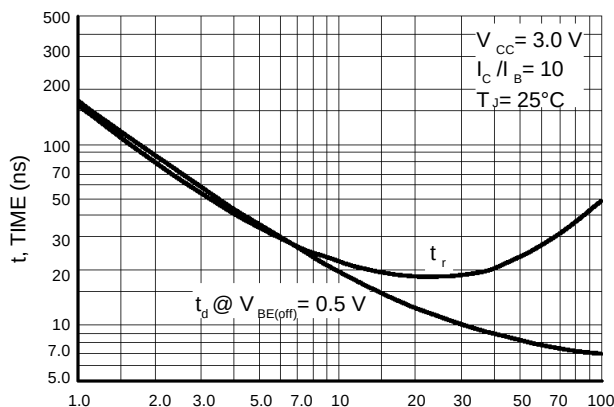


Figure 11. Temperature Coefficients

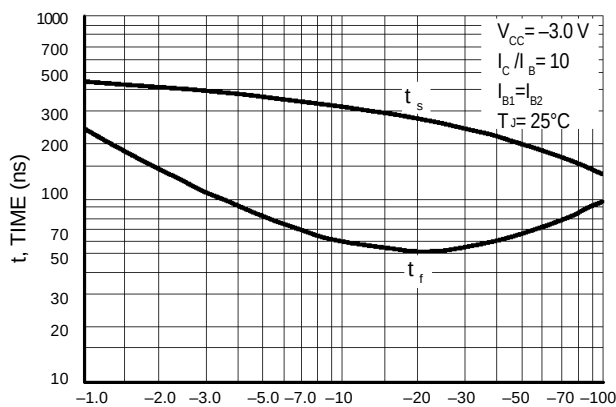
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TYPICAL DYNAMIC CHARACTERISTICS



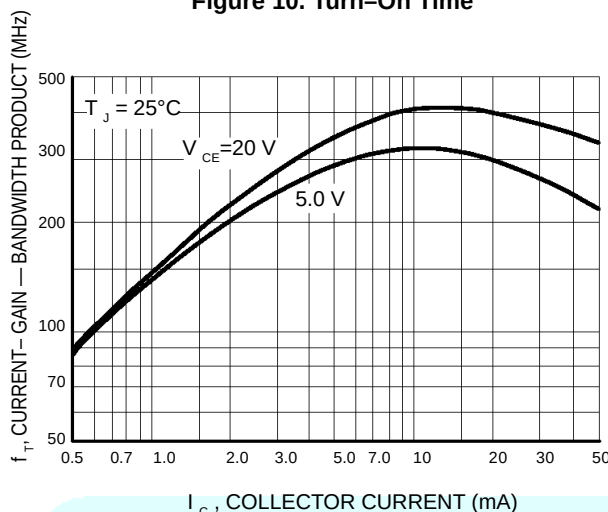
I_C , COLLECTOR CURRENT (mA)

Figure 10. Turn-On Time



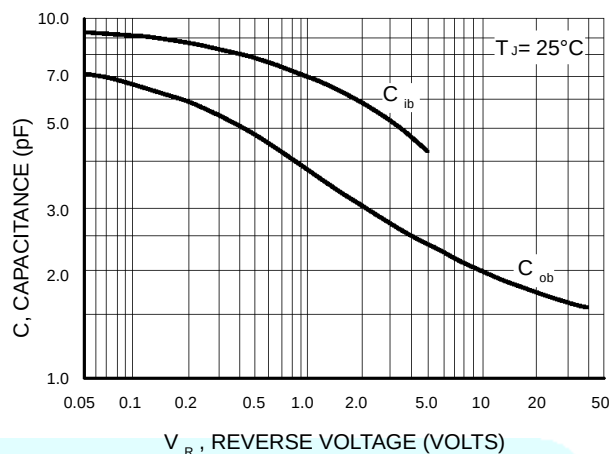
I_C , COLLECTOR CURRENT (mA)

Figure 11. Turn-Off Time



I_C , COLLECTOR CURRENT (mA)

Figure 12. Current-Gain — Bandwidth Product



V_R , REVERSE VOLTAGE (VOLTS)

Figure 13. Capacitance

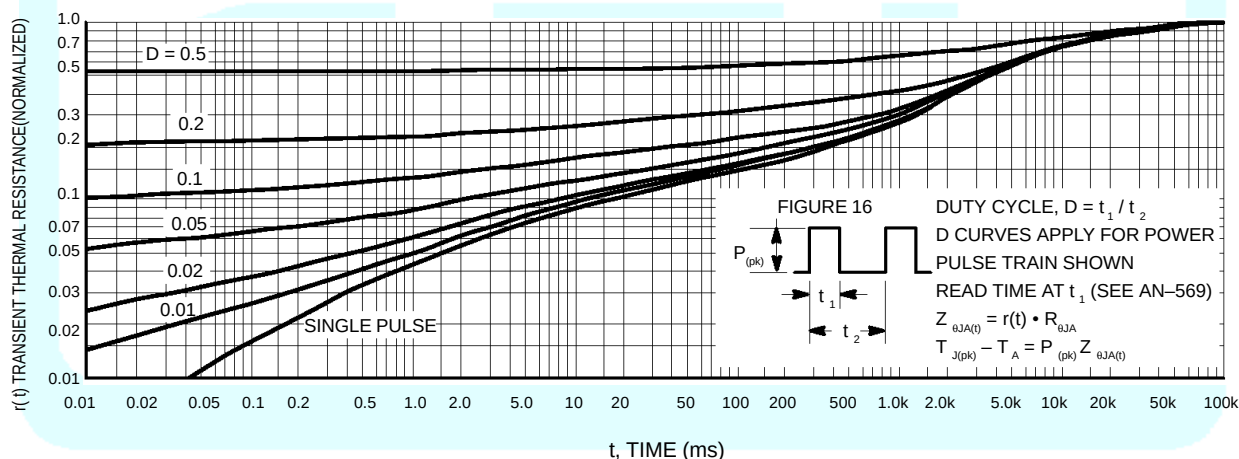


Figure 14. Thermal Response

BCW69LT1 BCW70LT1

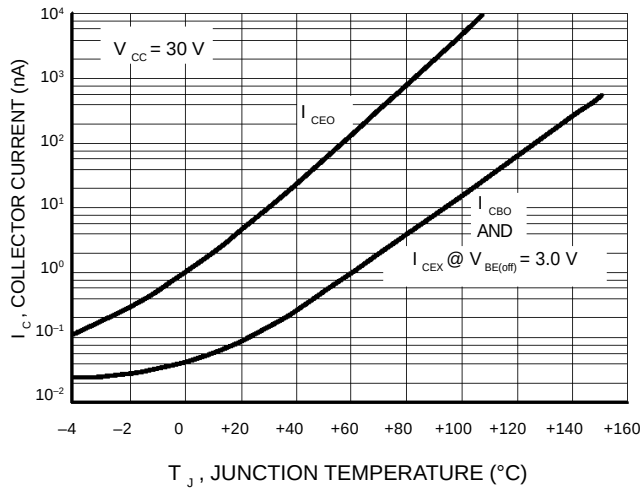


Figure 15. Typical Collector Leakage Current

DESIGN NOTE: USE OF THERMAL RESPONSE DATA

A train of periodical power pulses can be represented by the model as shown in Figure 16. Using the model and the device thermal response the normalized effective transient thermal resistance of Figure 14 was calculated for various duty cycles.

To find $Z_{\theta JA(t)}$, multiply the value obtained from Figure 14 by the steady state value $R_{\theta JA}$.

Example:

Dissipating 2.0 watts peak under the following conditions:

$t_1 = 1.0$ ms, $t_2 = 5.0$ ms. ($D = 0.2$)

Using Figure 14 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.