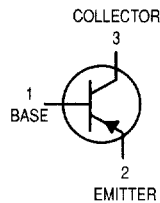
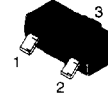


General Purpose Transistors

PNP Silicon



BCW61BLT1
BCW61CLT1
BCW61DLT1



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⁾ $T_A = 25^\circ\text{C}$ 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	$^\circ\text{C}$

DEVICE MARKING

BCW61BLT1 = BB, BCW61CLT1 = BC, BCW61DLT1 = BD

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage ($I_C = -2.0 \text{ mA}$, $I_B = 0$)	$V_{(BR)CEO}$	-32	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = -1.0 \text{ }\mu\text{A}$, $I_C = 0$)	$V_{(BR)EBO}$	-5.0	—	Vdc
Collector Cutoff Current ($V_{CE} = -32 \text{ Vdc}$) ($V_{CE} = -32 \text{ Vdc}$, $T_A = 150^\circ\text{C}$)	I_{CES}	— —	-20 -20	nAdc 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.

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

Characteristic	Symbol	Min	Max	Unit
ON CHARACTERISTICS				
DC Current Gain ($I_C = -10\ \mu\text{Adc}$, $V_{CE} = -5.0\ \text{Vdc}$)	BCW61B BCW61C BCW61D	h_{FE} 30 40 100	— — —	—
($I_C = -2.0\ \text{mAdc}$, $V_{CE} = -5.0\ \text{Vdc}$)	BCW61B BCW61C BCW61D	140 250 380	310 460 630	—
($I_C = -50\ \text{mAdc}$, $V_{CE} = -1.0\ \text{Vdc}$)	BCW61B BCW61C BCW61D	80 100 100	— — —	—
AC Current Gain ($V_{CE} = -5.0\ \text{Vdc}$, $I_C = -2.0\ \text{mAdc}$, $f = 1.0\ \text{kHz}$)	BCW61B BCW61C BCW61D	h_{fe} 175 250 350	350 500 700	—
Collector–Emitter Saturation Voltage ($I_C = -50\ \text{mAdc}$, $I_B = -1.25\ \text{mAdc}$) ($I_C = -10\ \text{mAdc}$, $I_B = -0.25\ \text{mAdc}$)		$V_{CE(sat)}$ — —	— -0.55 -0.25	Vdc
Base–Emitter Saturation Voltage ($I_C = -50\ \text{mAdc}$, $I_B = -1.25\ \text{mAdc}$) ($I_C = -10\ \text{mAdc}$, $I_B = -0.25\ \text{mAdc}$)		$V_{BE(sat)}$ -0.68 -0.6	-1.05 -0.85	Vdc
Base–Emitter On Voltage ($I_C = -2.0\ \text{mAdc}$, $V_{CE} = -5.0\ \text{Vdc}$)		$V_{BE(on)}$ -0.6	-0.75	Vdc
SMALL–SIGNAL CHARACTERISTICS				
Output Capacitance ($V_{CE} = -10\ \text{Vdc}$, $I_C = 0$, $f = 1.0\ \text{MHz}$)	C_{obo}	—	6.0	pF
Noise Figure ($V_{CE} = -5.0\ \text{Vdc}$, $I_C = -0.2\ \text{mAdc}$, $R_S = 2.0\ \text{k}\Omega$, $f = 1.0\ \text{kHz}$, $BW = 200\ \text{Hz}$)	NF	—	6.0	dB
SWITCHING CHARACTERISTICS				
Turn–On Time ($I_C = -10\ \text{mAdc}$, $I_{B1} = -1.0\ \text{mAdc}$)	t_{on}	—	150	ns
Turn–Off Time ($I_{B2} = -1.0\ \text{mAdc}$, $V_{BB} = -3.6\ \text{Vdc}$, $R_1 = R_2 = 5.0\ \text{k}\Omega$, $R_L = 990\ \Omega$)	t_{off}	—	800	ns

TYPICAL NOISE CHARACTERISTICS

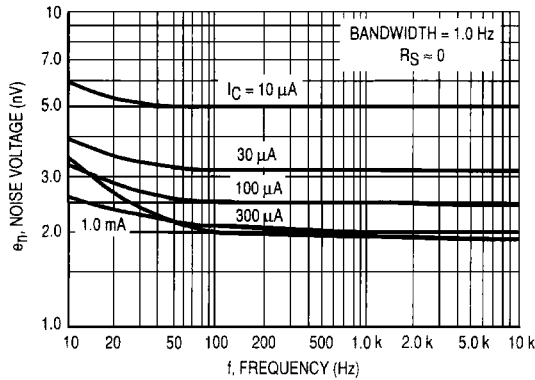
(V_{CE} = -5.0 Vdc, T_A = 25°C)

Figure 1. Noise Voltage

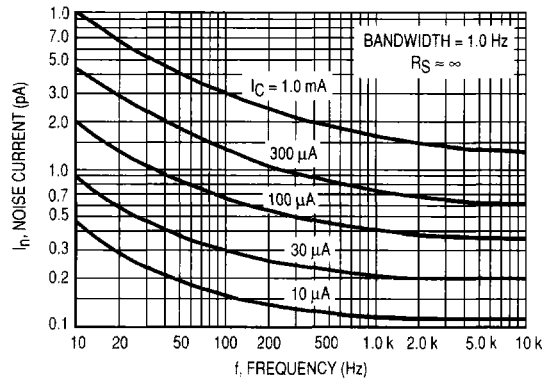


Figure 2. Noise Current

NOISE FIGURE CONTOURS

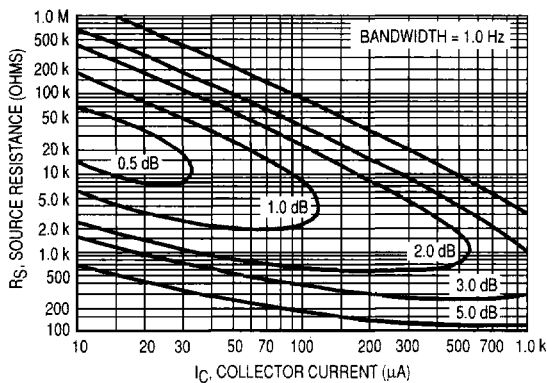
(V_{CE} = -5.0 Vdc, T_A = 25°C)

Figure 3. Narrow Band, 100 Hz

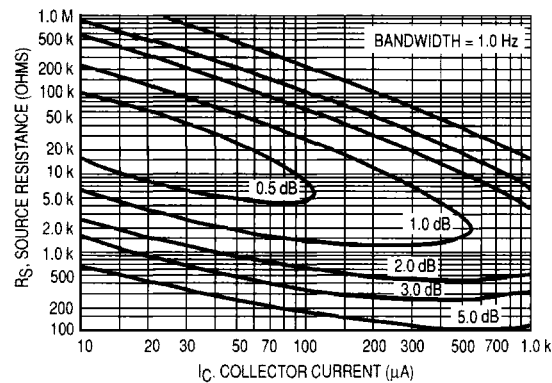


Figure 4. Narrow Band, 1.0 kHz

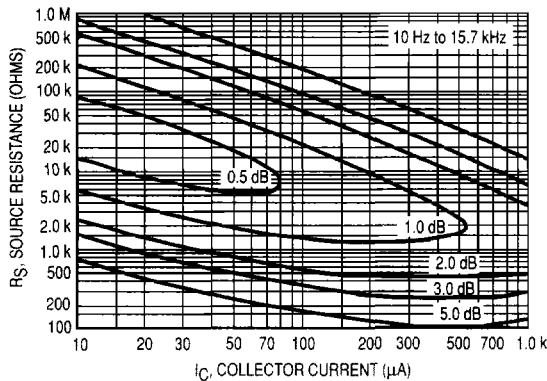


Figure 5. Wideband

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)

TYPICAL STATIC CHARACTERISTICS

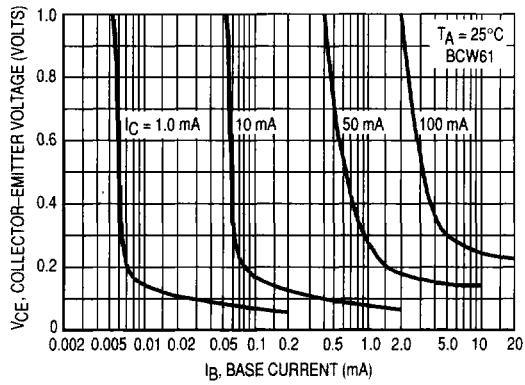


Figure 6. Collector Saturation Region

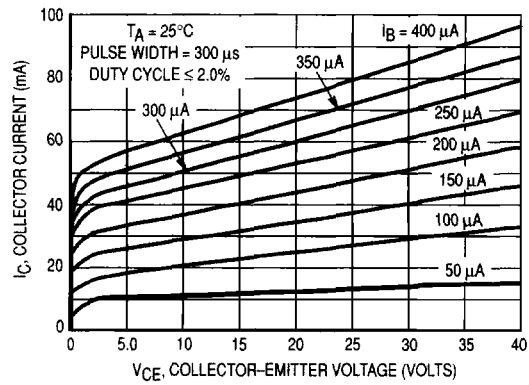


Figure 7. Collector Characteristics

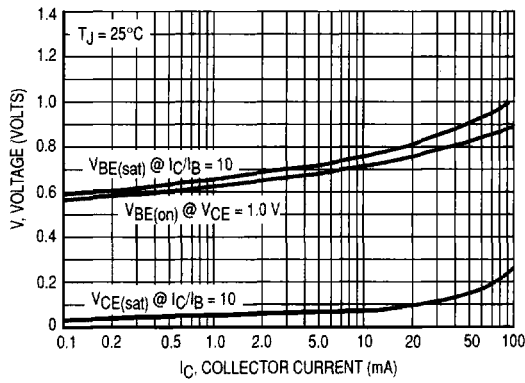


Figure 8. "On" Voltages

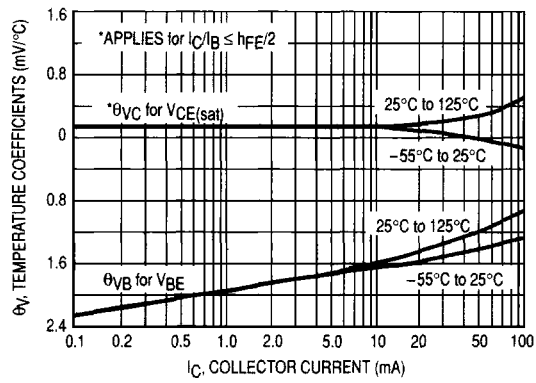


Figure 9. Temperature Coefficients

TYPICAL DYNAMIC CHARACTERISTICS

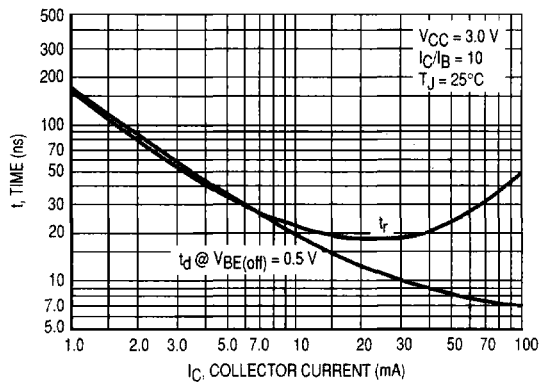


Figure 10. Turn-On Time

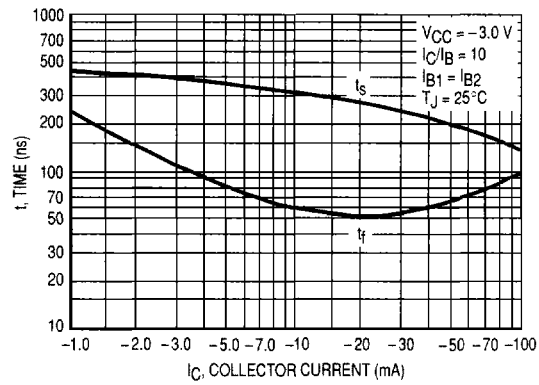


Figure 11. Turn-Off Time

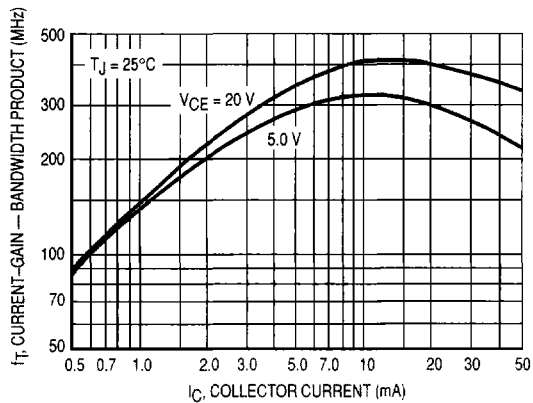


Figure 12. Current-Gain — Bandwidth Product

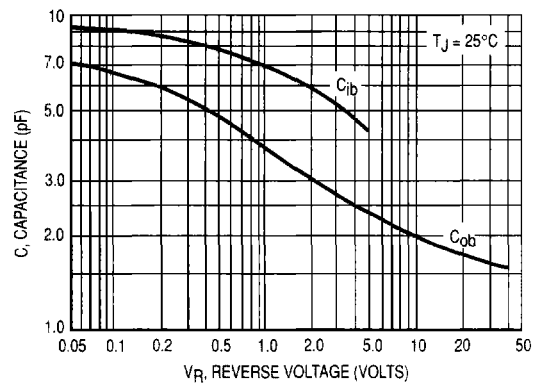


Figure 13. Capacitance

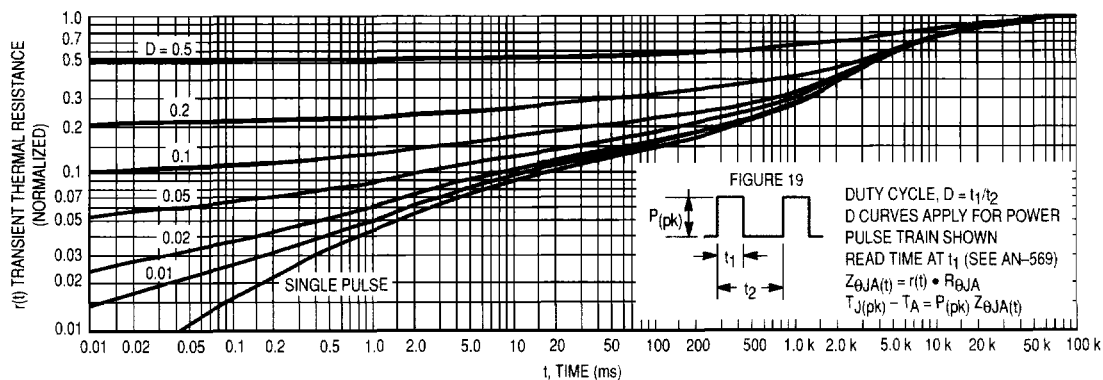


Figure 14. Thermal Response

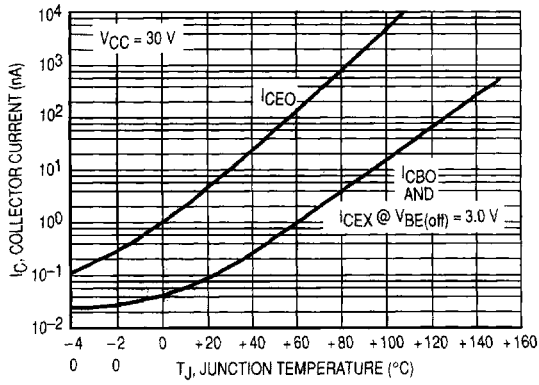


Figure 15. Typical Collector Leakage Current

DESIGN NOTE: USE OF THERMAL RESPONSE DATA

A train of periodical power pulses can be represented by the model as shown in Figure 15. 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:

The MPS3905 is 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 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.