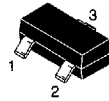
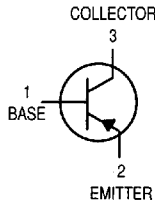


**General Purpose Transistors**  
PNP Silicon

**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 <sup>(1)</sup> $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	225	mW
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	556	$^\circ\text{C}/\text{W}$
Total Device Dissipation Alumina Substrate, <sup>(2)</sup> $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	300	mW
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	$^\circ\text{C}$

**DEVICE MARKING**

BCW61BLT1 = BB, BCW61CLT1 = BC, BCW61DLT1 = BD

**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 ( $I_C = -2.0 \text{ mAdc}, I_B = 0$ )	$V_{(BR)CEO}$	-32	—	Vdc
Emitter-Base Breakdown Voltage ( $I_E = -1.0 \mu\text{Adc}, I_C = 0$ )	$V_{(BR)EBO}$	-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 $\mu\text{Adc}$

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<sub>A</sub> = 25°C unless otherwise noted) (Continued)

Characteristic	Symbol	Min	Max	Unit	
<b>ON CHARACTERISTICS</b>					
DC Current Gain (I <sub>C</sub> = -10 μA <sub>dc</sub> , V <sub>CE</sub> = -5.0 V <sub>dc</sub> )  (I <sub>C</sub> = -2.0 mA <sub>dc</sub> , V <sub>CE</sub> = -5.0 V <sub>dc</sub> )  (I <sub>C</sub> = -50 mA <sub>dc</sub> , V <sub>CE</sub> = -1.0 V <sub>dc</sub> )	BCW61B	h <sub>FE</sub>	30	—	—
	BCW61C		40	—	
	BCW61D		100	—	
	BCW61B		140	310	
	BCW61C		250	460	
	BCW61D		380	630	
	BCW61B		80	—	
	BCW61C		100	—	
	BCW61D		100	—	
AC Current Gain (V <sub>CE</sub> = -5.0 V <sub>dc</sub> , I <sub>C</sub> = -2.0 mA <sub>dc</sub> , f = 1.0 kHz)	BCW61B BCW61C BCW61D	h <sub>fe</sub>	175 250 350	350 500 700	—
Collector-Emitter Saturation Voltage (I <sub>C</sub> = -50 mA <sub>dc</sub> , I <sub>B</sub> = -1.25 mA <sub>dc</sub> ) (I <sub>C</sub> = -10 mA <sub>dc</sub> , I <sub>B</sub> = -0.25 mA <sub>dc</sub> )		V <sub>CE(sat)</sub>	— —	-0.55 -0.25	V <sub>dc</sub>
Base-Emitter Saturation Voltage (I <sub>C</sub> = -50 mA <sub>dc</sub> , I <sub>B</sub> = -1.25 mA <sub>dc</sub> ) (I <sub>C</sub> = -10 mA <sub>dc</sub> , I <sub>B</sub> = -0.25 mA <sub>dc</sub> )		V <sub>BE(sat)</sub>	-0.68 -0.6	-1.05 -0.85	V <sub>dc</sub>
Base-Emitter On Voltage (I <sub>C</sub> = -2.0 mA <sub>dc</sub> , V <sub>CE</sub> = -5.0 V <sub>dc</sub> )		V <sub>BE(on)</sub>	-0.6	-0.75	V <sub>dc</sub>
<b>SMALL-SIGNAL CHARACTERISTICS</b>					
Output Capacitance (V <sub>CE</sub> = -10 V <sub>dc</sub> , I <sub>C</sub> = 0, f = 1.0 MHz)		C <sub>obo</sub>	—	6.0	pF
Noise Figure (V <sub>CE</sub> = -5.0 V <sub>dc</sub> , I <sub>C</sub> = -0.2 mA <sub>dc</sub> , R <sub>S</sub> = 2.0 kΩ, f = 1.0 kHz, BW = 200 Hz)		NF	—	6.0	dB
<b>SWITCHING CHARACTERISTICS</b>					
Turn-On Time (I <sub>C</sub> = -10 mA <sub>dc</sub> , I <sub>B1</sub> = -1.0 mA <sub>dc</sub> )		t <sub>on</sub>	—	150	ns
Turn-Off Time (I <sub>B2</sub> = -1.0 mA <sub>dc</sub> , V <sub>BB</sub> = -3.6 V <sub>dc</sub> , R <sub>1</sub> = R <sub>2</sub> = 5.0 kΩ, R <sub>L</sub> = 990 Ω)		t <sub>off</sub>	—	800	ns

TYPICAL NOISE CHARACTERISTICS

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

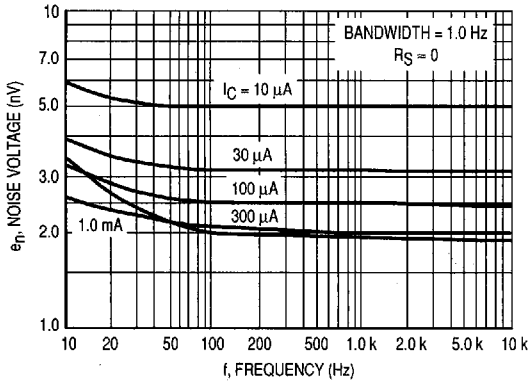


Figure 1. Noise Voltage

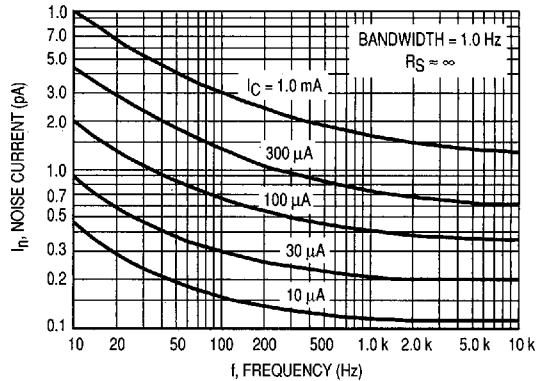


Figure 2. Noise Current

NOISE FIGURE CONTOURS

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

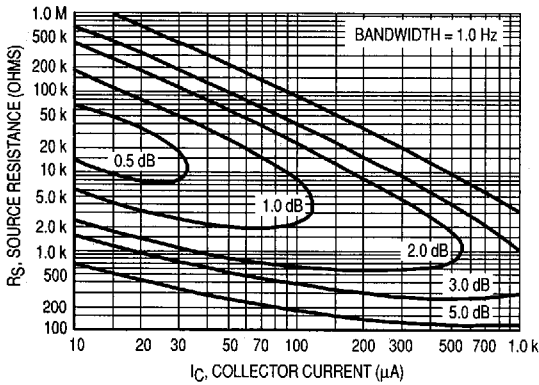


Figure 3. Narrow Band, 100 Hz

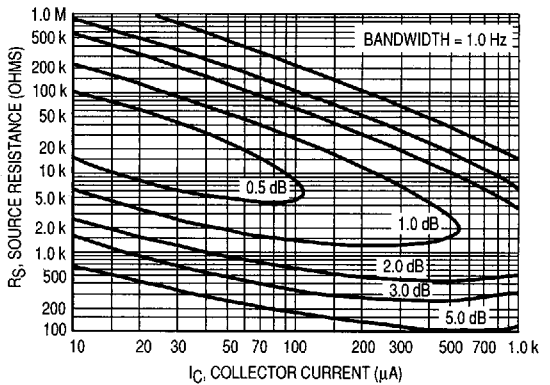


Figure 4. Narrow Band, 1.0 kHz

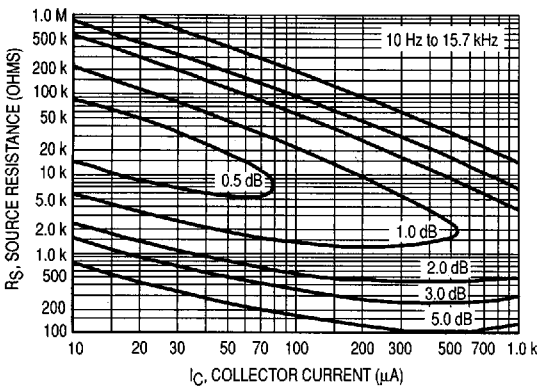


Figure 5. Wideband

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 ( $1.38 \times 10^{-23}$  J/°K)

$T$  = Temperature of the Source Resistance (°K)

$R_S$  = Source Resistance (Ohms)

TYPICAL STATIC CHARACTERISTICS

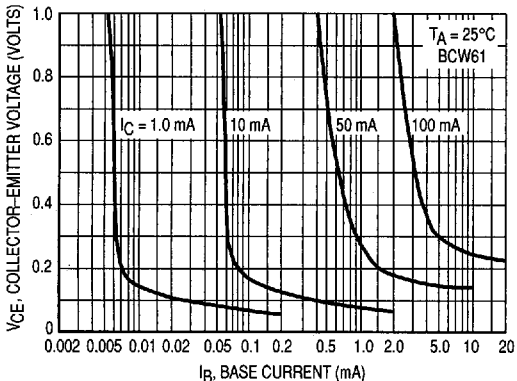


Figure 6. Collector Saturation Region

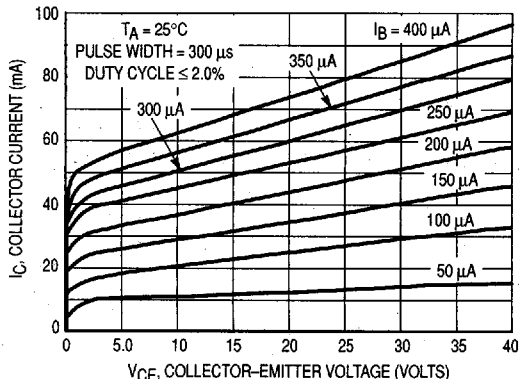


Figure 7. Collector Characteristics

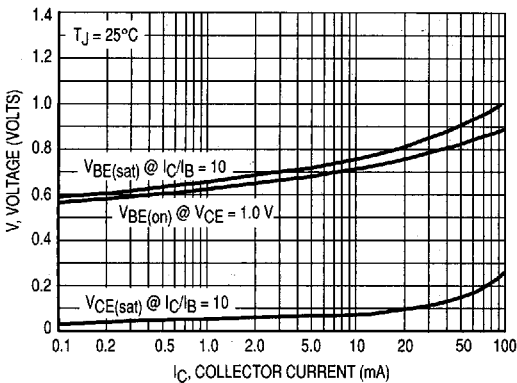


Figure 8. "On" Voltages

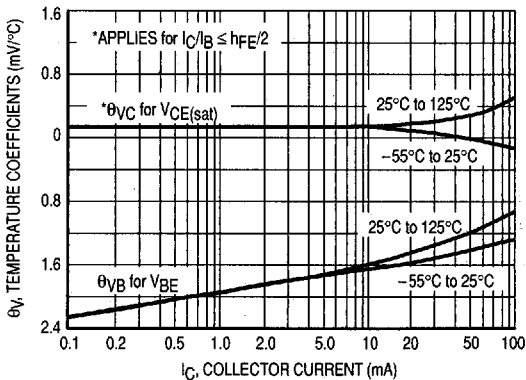


Figure 9. Temperature Coefficients

TYPICAL DYNAMIC CHARACTERISTICS

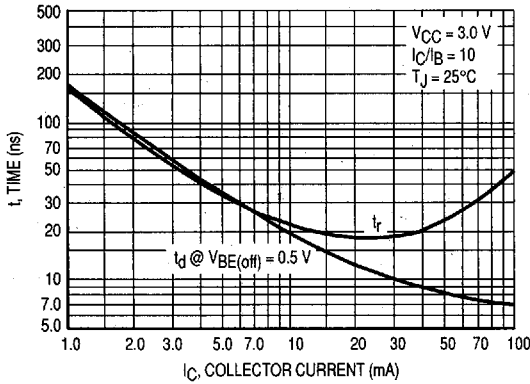


Figure 10. Turn-On Time

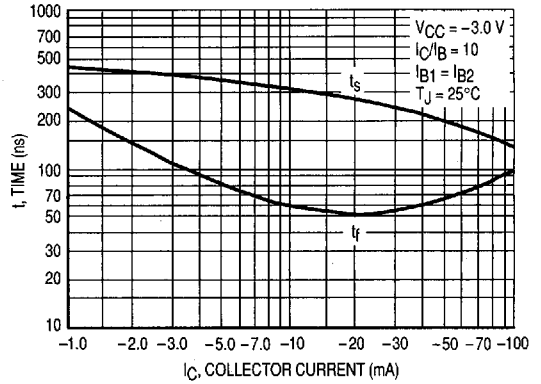


Figure 11. Turn-Off Time

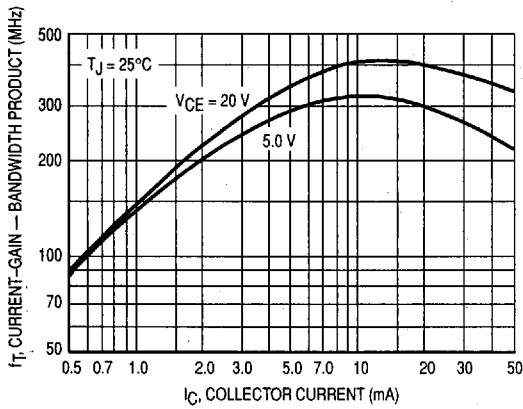


Figure 12. Current-Gain — Bandwidth Product

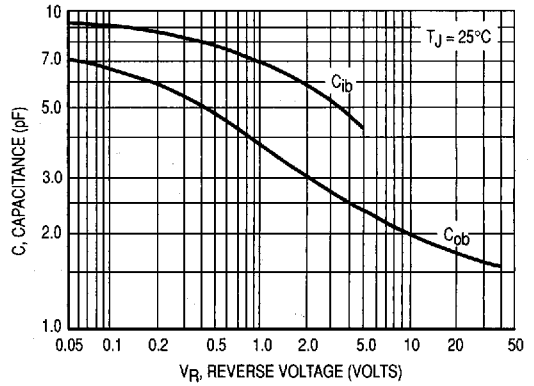


Figure 13. Capacitance

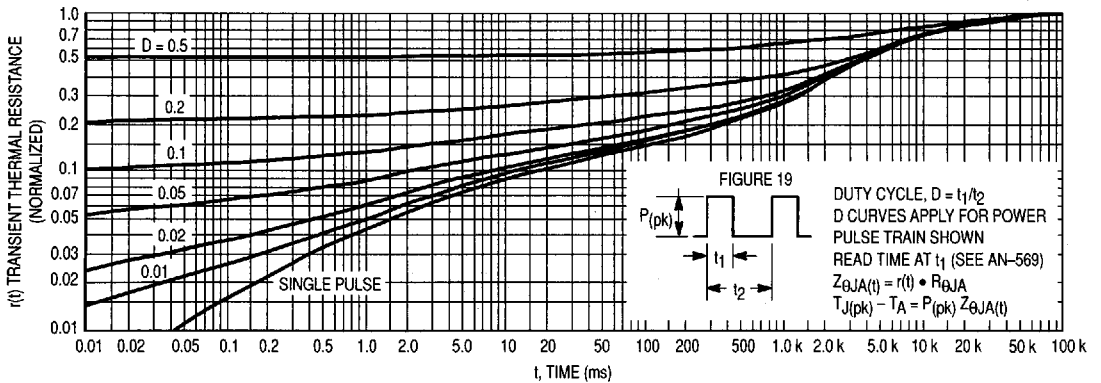


Figure 14. Thermal Response

**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:

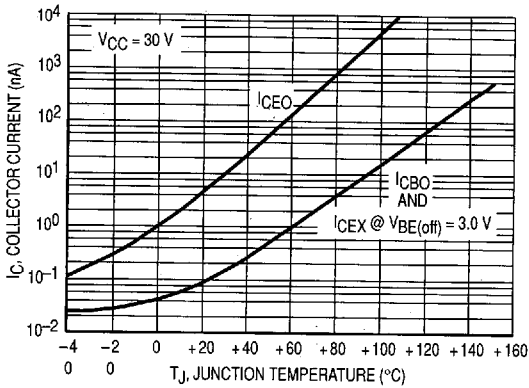
$$t_1 = 1.0 \text{ ms}, t_2 = 5.0 \text{ ms} (D = 0.2)$$

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.



**Figure 15. Typical Collector Leakage Current**