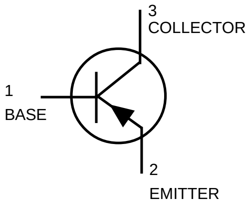
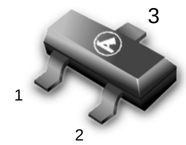
General Purpose Transistor

PNP Silicon

MMBTA70LT1





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

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, (1) T_A = 25°C Derate above 25°C	P_D	225 1.8	mW mW/°C
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	556	°C/W
Total Device Dissipation Alumina Substrate, (2) T_A = 25°C Derate above 25°C	P_D	300 2.4	mW mW/°C
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	417	°C/W
Junction and Storage Temperature	T_J , T_{stg}	–55 to +150	°C

DEVICE MARKING

MMBTA70LT1 = M2C

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted.)

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

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.

MMBTA70LT1

TYPICAL NOISE CHARACTERISTICS

(V_{CE} = –5.0 Vdc, T_A = 25°C)

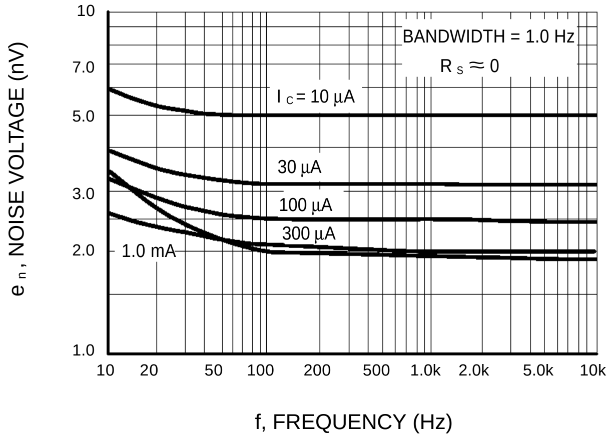


Figure 1. Noise Voltage

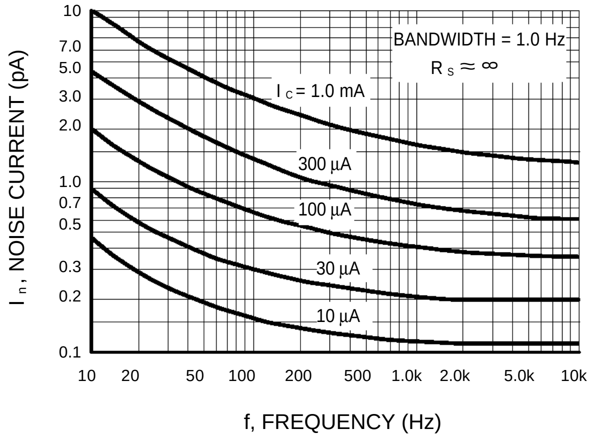


Figure 2. Noise Current

NOISE FIGURE CONTOURS

(V_{CE} = –5.0 Vdc, T_A = 25°C)

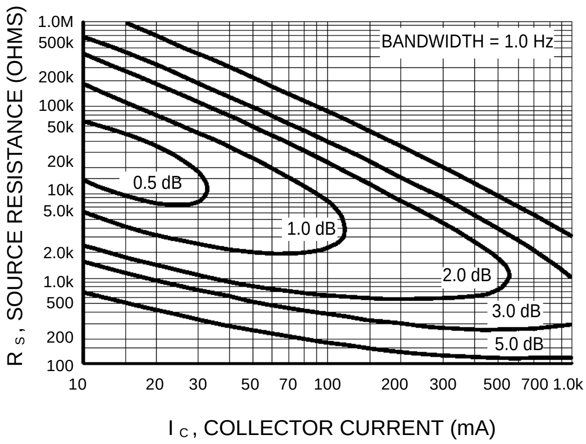


Figure 3. Narrow Band, 100 Hz

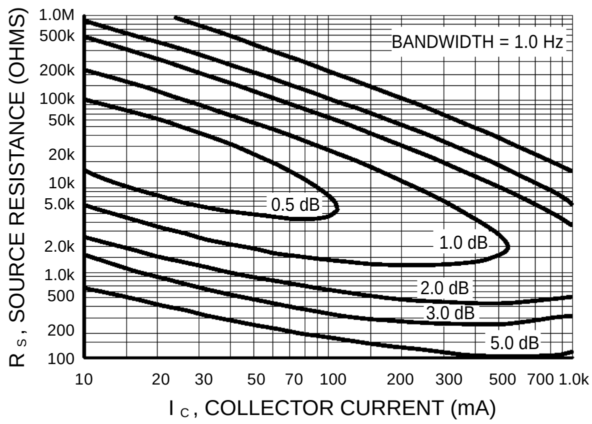


Figure 4. Narrow Band, 1.0 kHz

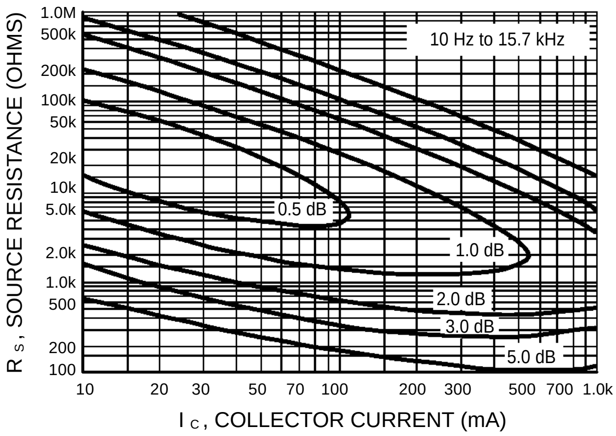


Figure 5. Wideband

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 x 10^{-23} j/°K)
T = Temperature of the Source Resistance (°K)
R_S = Source Resistance (Ohms)

TYPICAL STATIC CHARACTERISTICS

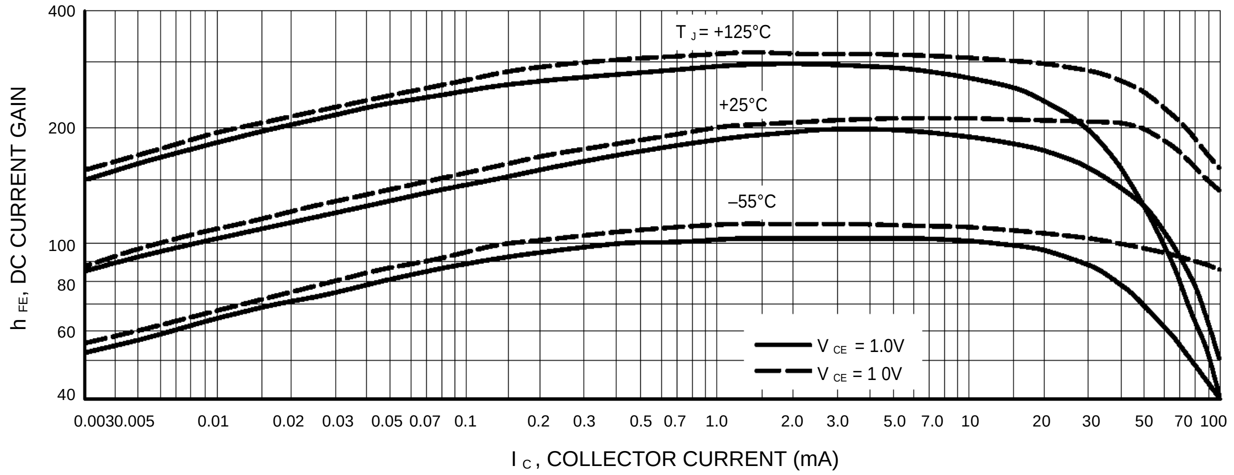


Figure 6. DC Current Gain

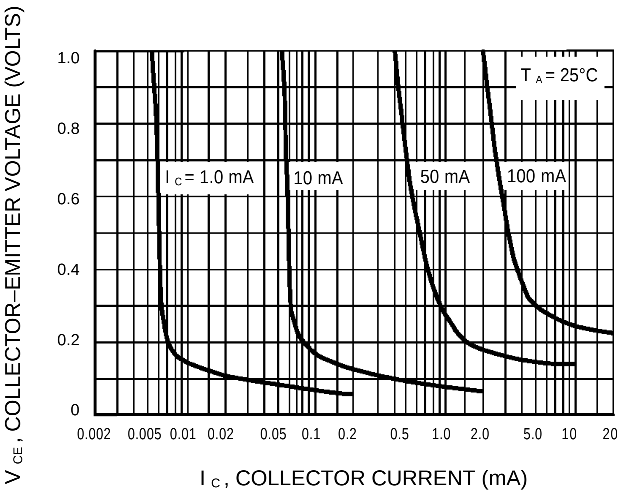


Figure 7. Collector Saturation Region

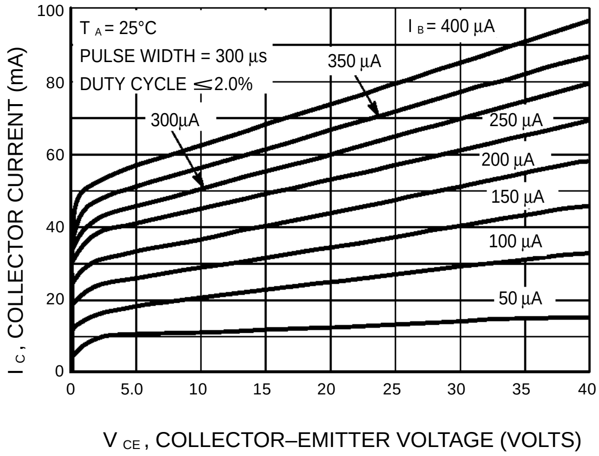


Figure 8. Collector Characteristics

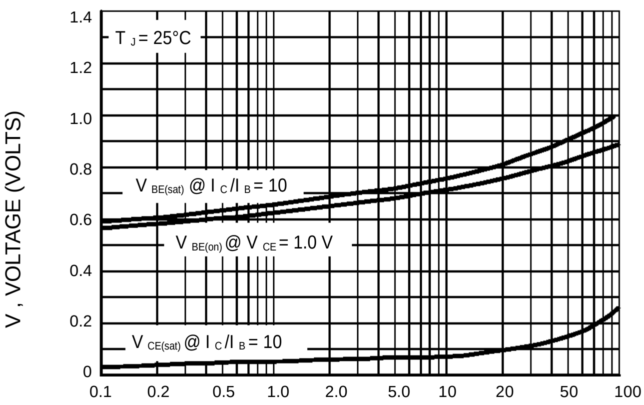


Figure 9. "On" Voltages

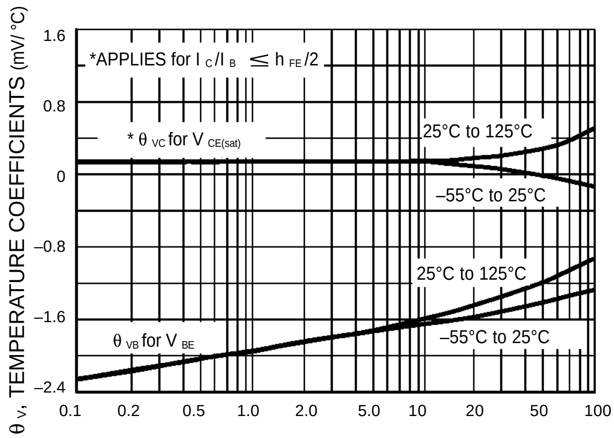


Figure 10. Temperature Coefficients

TYPICAL DYNAMIC CHARACTERISTICS

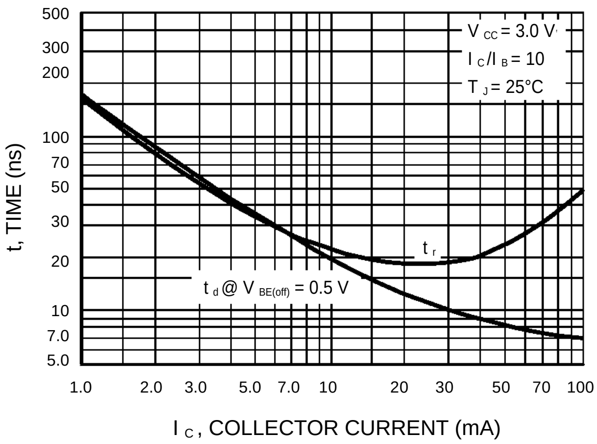


Figure 11. Turn–On Time

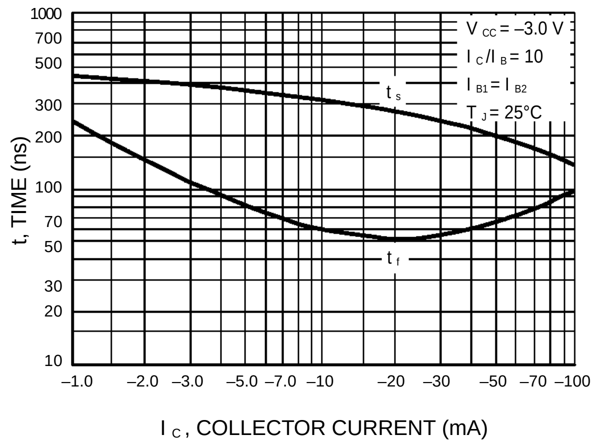


Figure 12. Turn–Off Time

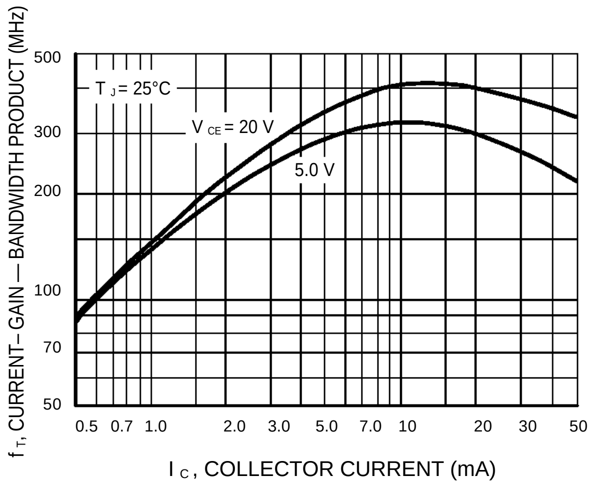


Figure 13. Current–Gain — Bandwidth Product

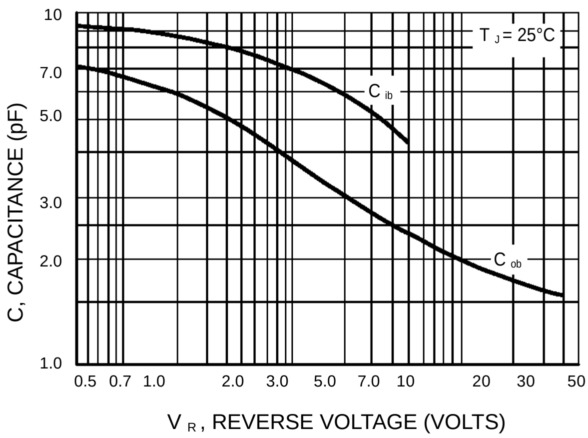


Figure 14. Capacitance

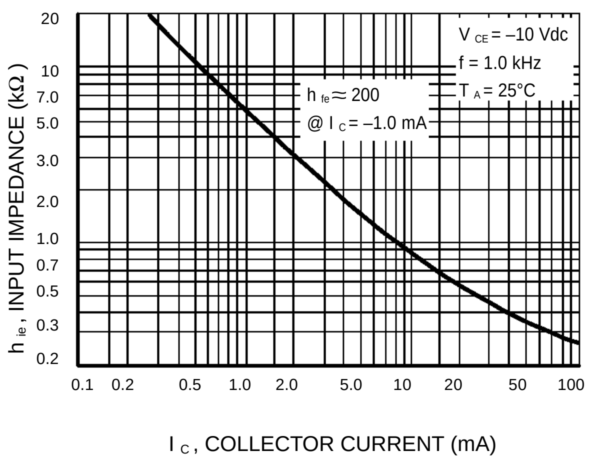


Figure 15. Input Impedance

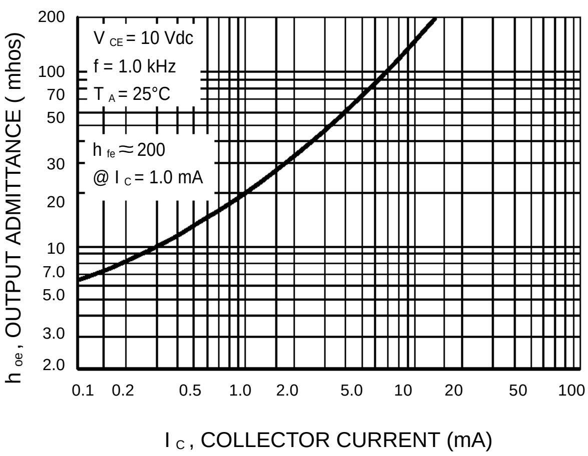


Figure 16. Output Admittance

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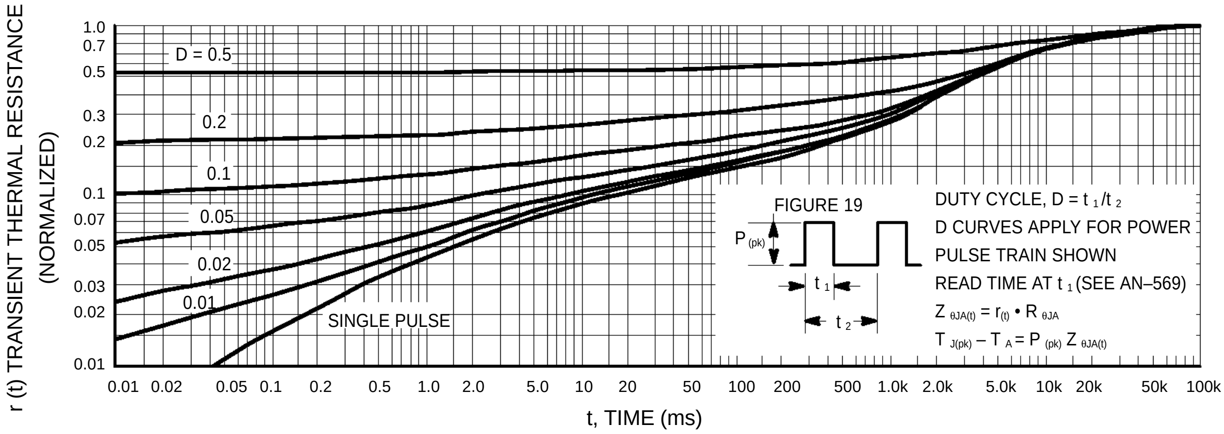

Figure 17. Thermal Response

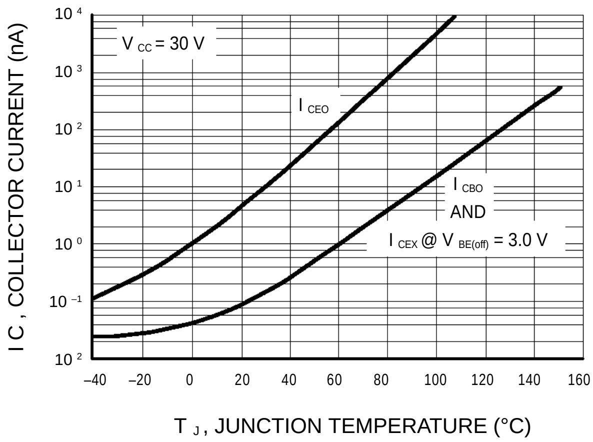

Figure 18. Typical Collector Leakage Current

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:

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

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

For more information, see AN–569.