

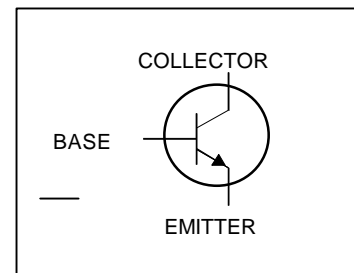
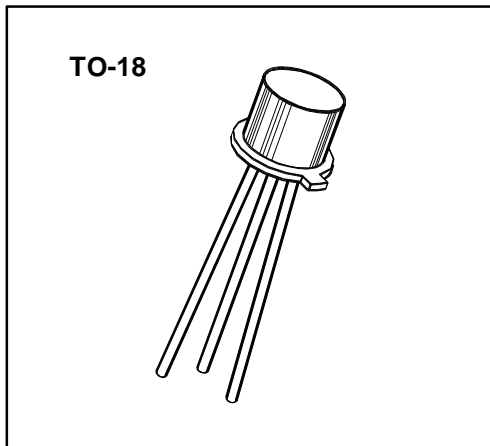
2N2221A

Features

- Meets MIL 19500 /255
- Collector - Base Voltage 75 V
- Collector - Current 800 mA
- High Speed, Medium Current Bipolar Transistor

SWITCHING
 TRANSISTOR
 JAN, JANTX, JANTXV

SMALL SIGNAL
 BIPOLAR
 NPN SILICON



Maximum Ratings

RATING	SYMBOL	VALUE	UNIT
Collector - Emitter Voltage	V_{CE0}	50	Vdc
Collector - Base Voltage	V_{CBO}	75	Vdc
Emitter - Base Voltage	V_{EBO}	6	Vdc
Collector Current -- Continuous	I_C	800	mAdc
Total Device Dissipation @ $T_A = 25\text{ }^\circ\text{C}$	P_D	500	mW
Derate above 25 $^\circ\text{C}$		2.85	mW/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25\text{ }^\circ\text{C}$	P_D	1.8	WATTS
Derate above 25 $^\circ\text{C}$		10.3	mW/ $^\circ\text{C}$
Operating Junction&Storage Temperature Range	T_J, T_{stg}	- 65 to + 200	$^\circ\text{C}$

Thermal Characteristics

CHARACTERISTIC	SYMBOL	MAX	UNIT
Thermal Resistance, Junction to Ambient	R_{qJA}	350	$^\circ\text{C}/\text{W}$

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

OFF CHARACTERISTIC	SYMBOL	MIN	MAX	UNIT
Collector - Emitter Breakdown Voltage (1) ($I_C = 10 \text{ mA dc}, I_B = 0$)	$V(BR)_{CEO}$	50		Vdc
Collector - Base Breakdown Voltage (1) ($I_C = 10 \text{ mAdc}, I_E = 0$)	$V(BR)_{CBO}$	75		Vdc
Emitter - Base Breakdown Voltage (1) ($I_E = 10 \text{ mAdc}, I_C = 0$)	$V(BR)_{EBO}$	6		Vdc
Collector - Emitter Cutoff Current ($V_{CE} = 50 \text{ Vdc}, V_{BE(off)} = 0 \text{ V}$)	I_{CES}		50	nAdc
Collector - Base Cutoff Current ($V_{CB} = 60 \text{ Vdc}, I_E = 0$) ($V_{CB} = 60 \text{ Vdc}, I_E = 0, T_A = 150^\circ\text{C}$)	I_{CBO}		10 10	nAdc mAdc
Emitter - Base Cutoff Current ($V_{EB} = 4 \text{ Vdc}$)	I_{EBO}		10	nAdc

ON CHARACTERISTIC	SYMBOL	MIN	MAX	UNIT
DC Current Gain ($I_C = 100 \text{ mA dc}, V_{CE} = 10 \text{ Vdc}$) ($I_C = 1 \text{ mA dc}, V_{CE} = 10 \text{ Vdc}$) ($I_C = 10 \text{ mA dc}, V_{CE} = 10 \text{ Vdc}$) ($I_C = 150 \text{ mA dc}, V_{CE} = 10 \text{ Vdc}$) (1) ($I_C = 500 \text{ mA dc}, V_{CE} = 10 \text{ Vdc}$) (1) ($I_C = 10 \text{ mA dc}, V_{CE} = 10 \text{ Vdc}, T_J = -55^\circ\text{C}$)	h_{FE}	30 35 40 40 20 15	150	120
Collector - Emitter Saturation Voltage ($I_C = 150 \text{ mAdc}, I_B = 15 \text{ mAdc}$) (1) ($I_C = 500 \text{ mAdc}, I_B = 50 \text{ mAdc}$) (1)	$V_{CE(sat)}$		0.3 1.0	Vdc Vdc
Base - Emitter Saturation Voltage ($I_C = 150 \text{ mAdc}, I_B = 15 \text{ mAdc}$) (1) ($I_C = 500 \text{ mAdc}, I_B = 50 \text{ mAdc}$) (1)	$V_{BE(sat)}$	0.6	1.2 2.0	Vdc Vdc

1. Pulse Test: Pulse Width $\leq 300 \mu\text{s}$, Duty Cycle $\leq 2.0\%$

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Electrical Characteristics (T_A = 25°C unless otherwise noted)

SMALL - SIGNAL CHARACTERISTICS	SYMBOL	MIN	MAX	UNIT
Output Capacitance (V _{CB} = 10 Vdc, I _E = 0, 100kHz &f &f 1 MHz)	C _{obo}		8	pF
Input Capacitance (V _{EB} = 0.5 Vdc, I _C = 0, 100kHz &f &f 1 MHz)	C _{ibo}		25	pF

SWITCHING CHARACTERISTICS	SYMBOL	MIN	MAX	UNIT
Turn - On Time (V _{CC} = 30 Vdc, I _C = 150 mAdc, I _{B1} = 15 mAdc) (See FIGURE 1)	t _{on}		35	ns
Turn - Off Time (V _{CC} = 30 Vdc, I _C = 150 mAdc, I _{B1} = - I _{B2} = 15 mAdc) (See FIGURE 2)	t _{off}		300	ns

Small - Signal AC Characteristics (T_A = 25°C)

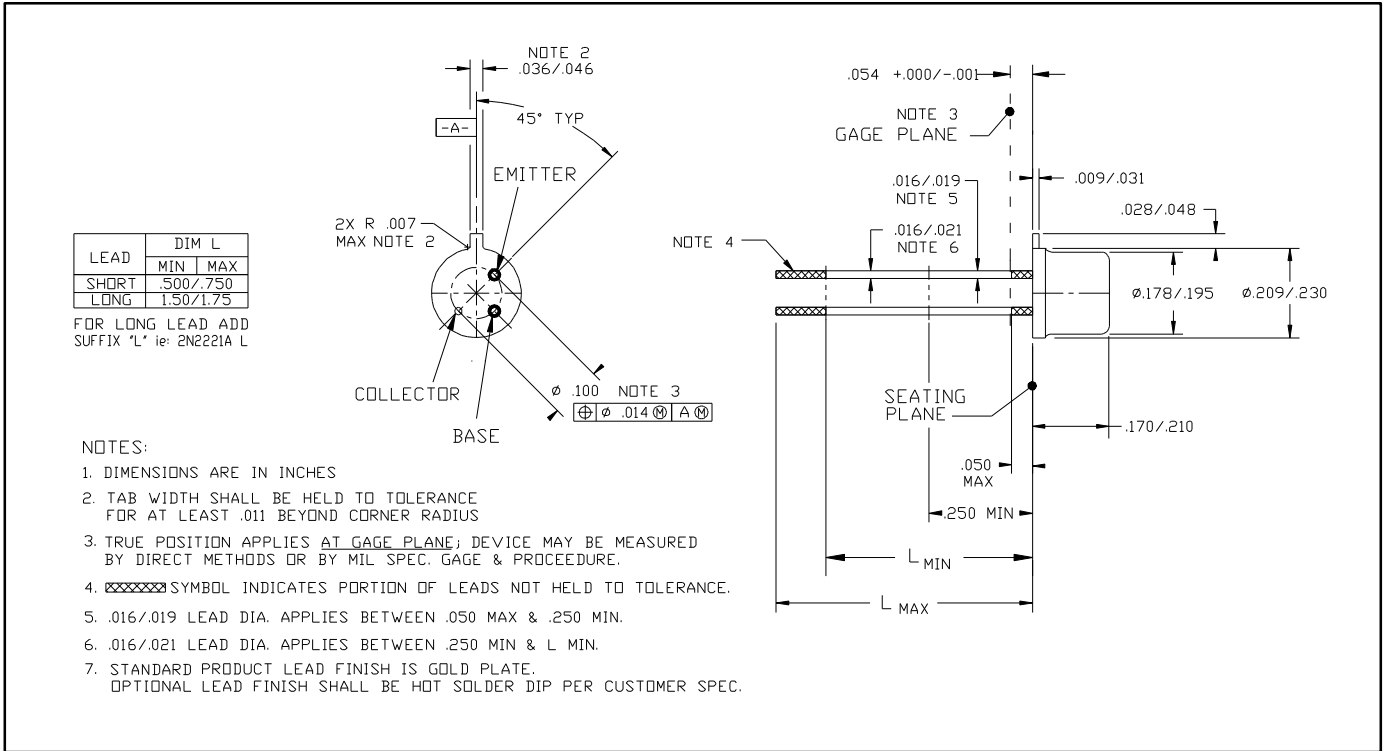
LOW FREQUENCY	SYMBOL	MIN	MAX	UNIT
Common - Emitter Forward Current Transfer Ratio (I _C = 1 mA, V _{CE} = 10 V, f = 1kHz)	h _{fe}	30		
HIGH FREQUENCY				
Common - Emitter Forward Current Transfer Ratio (I _C = 20 mA, V _{CE} = 20 V, f = 100 MHz)	h _{fe}	2.5		

Spice Model (based upon typical device characteristics) *1

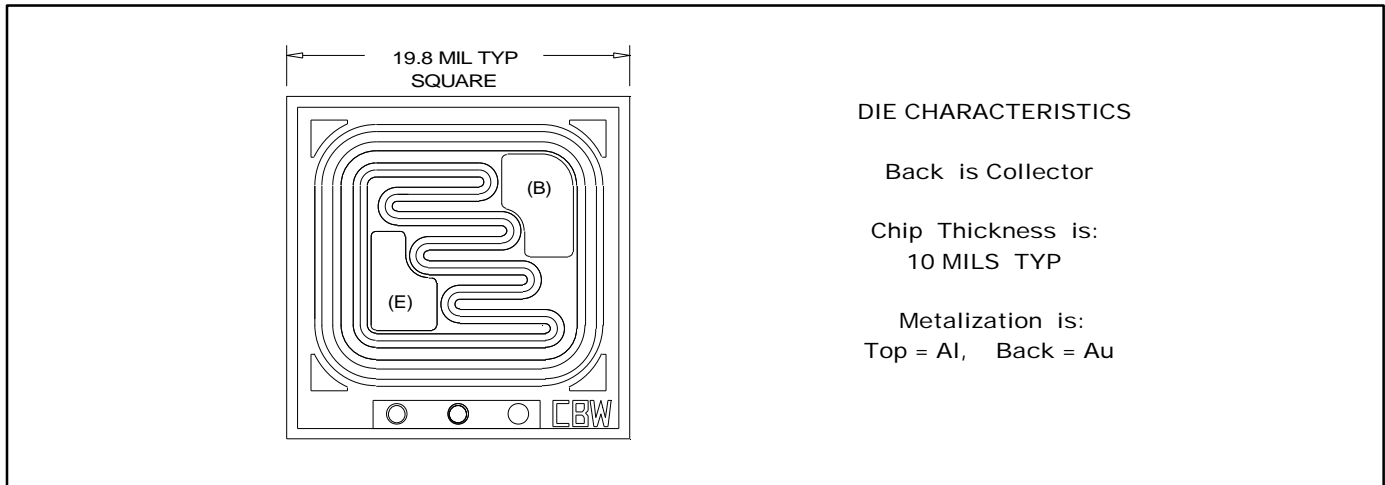
Q2N2221A NPN (IS = 426.3f XTI = 3.0 EG = 1.11 VAF = 250.3 BF = 72.14 ISE = 48.14p
 + NE = 2.935 IKF = 2.935 NK = 1.401 XTB = 1.5 BR = 11.49 ISC = 19.9f
 + NC = 1.88 IKR = 10.75 RC = 0.3567 CJC = 11.02p VJC = 0.3869 MJC = 0.3292
 + FC = 0.5 CJE = 29.31p VJE = 0.9036 MJE = 0.4101 TR = 16.89n TF = 537.5p
 + ITF = 0.1383 XTF = 84.83m VTF = 10)

*1. Microsemi Corp. claims no responsibility for misapplication of Spice Model information. Spice modeling should be used as a precursor guide to in-circuit performance. Actual performance is the responsibility of the user/designer.

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TO 18 CASE OUTLINE



DIE OUTLINE

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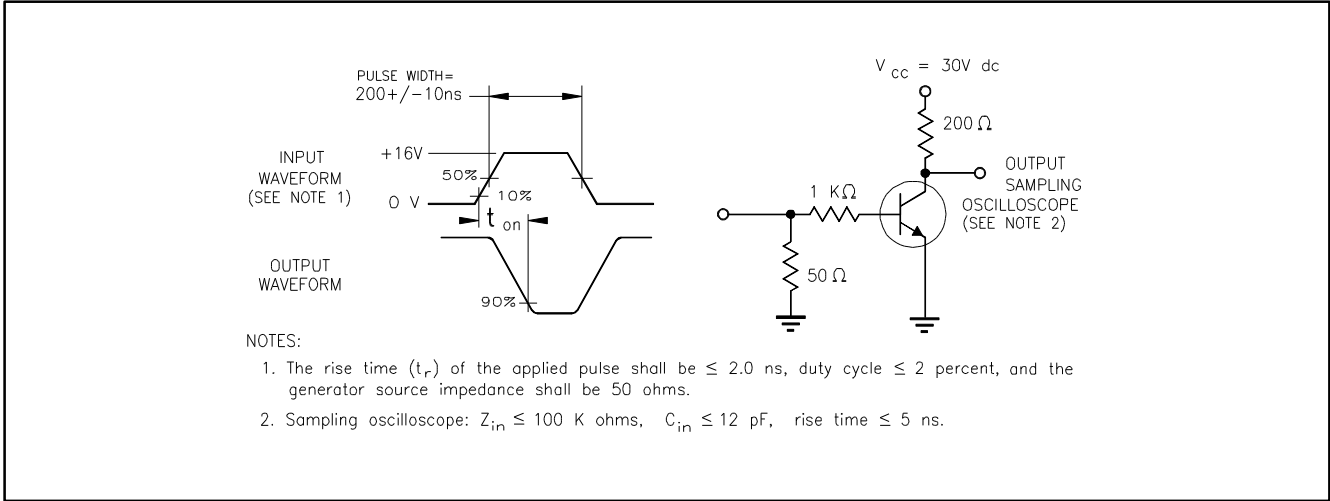


FIGURE 1 Saturated Turn-on Time Test Circuit

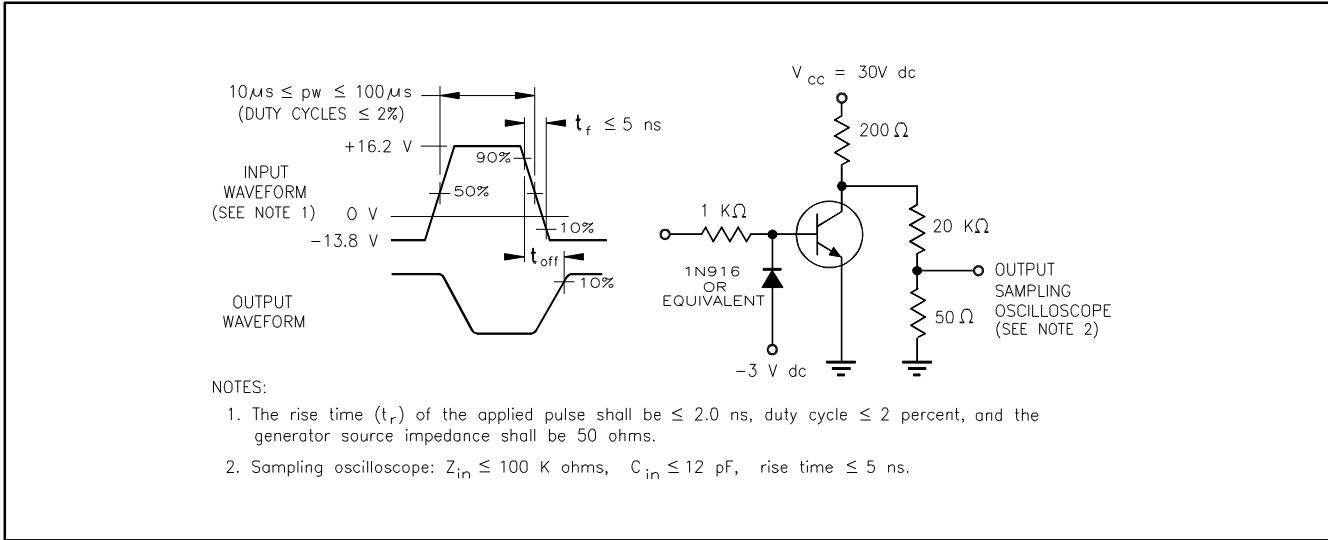


FIGURE 2 Saturated Turn-off Time Test Circuit

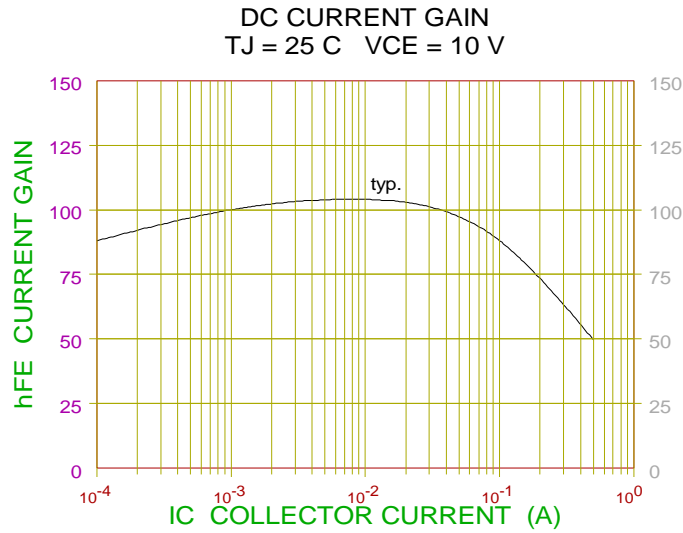


FIGURE 3

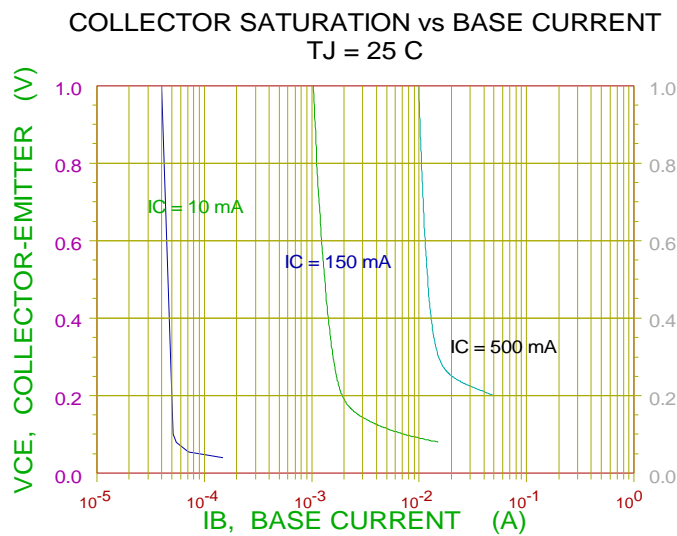


FIGURE 4

BASE SATURATION vs BASE CURRENT
 T_J = 25 C

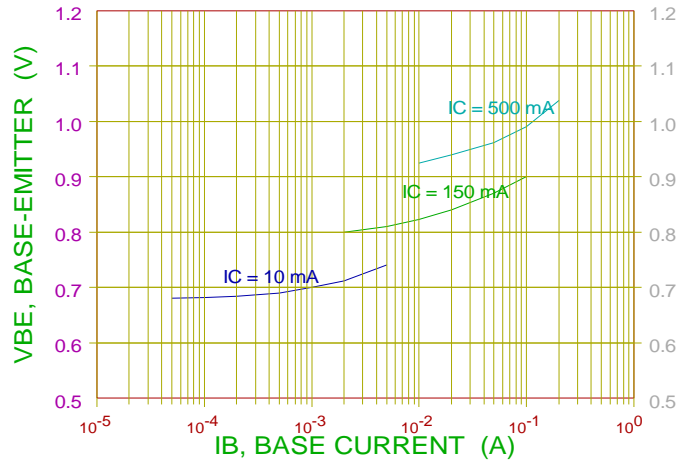


FIGURE 5

JUNCTION CAPACITANCE
 T_J = 25 C 100 kHz < f < 1 MHz

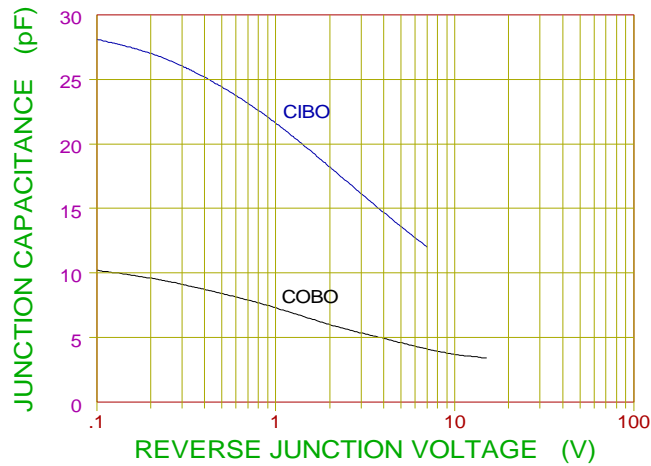


FIGURE 6

SMALL SIGNAL CURENT GAIN vs COLLECTOR CURRENT
TJ = 25 C VCE = 10 V f = 1kHz

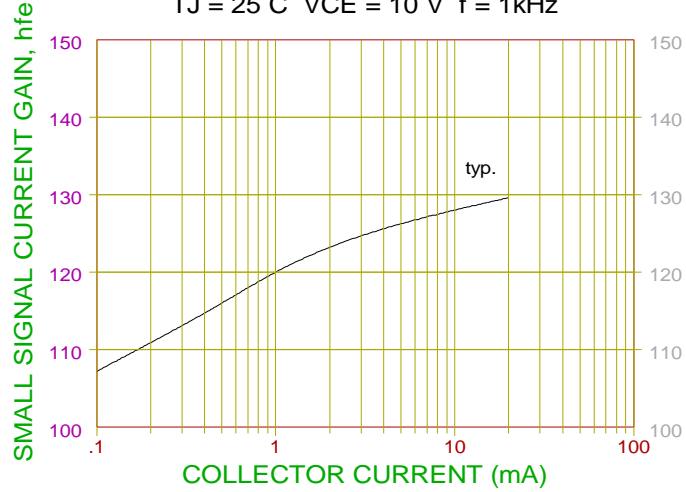


FIGURE 7

HIGH FREQUENCY GAIN
TJ = 25 C VCE = 20 V f = 100 MHz

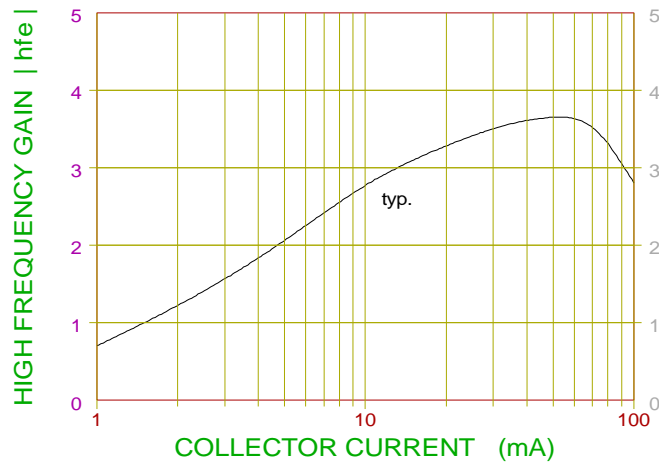


FIGURE 8

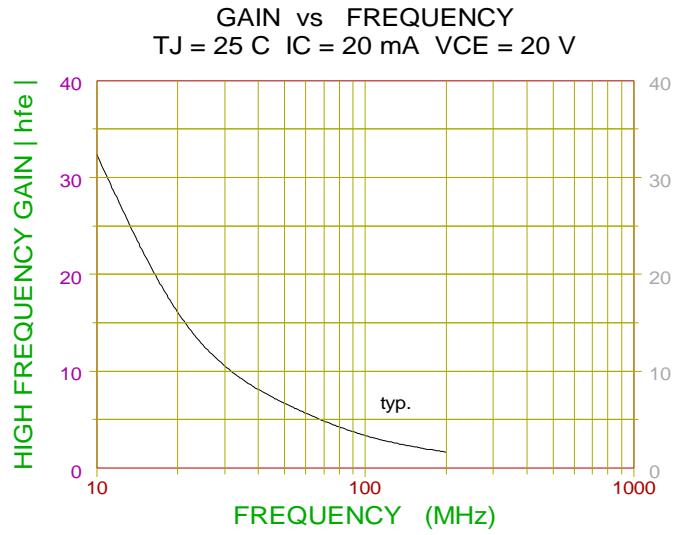


FIGURE 9