Watertown, MA
Microsemi
Progress Powered by Technology

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2N2221A

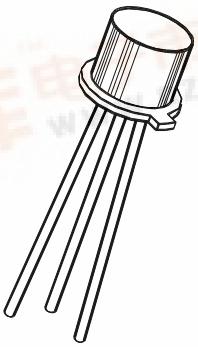
Features

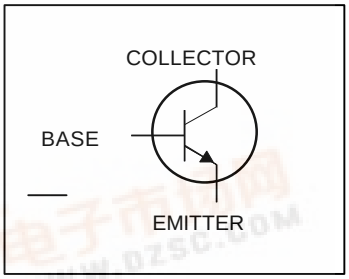
- Meets MIL 19500 /255
- Collector - Base Voltage 75 V
- Collector - Current 800 mA
- High Speed, Medium Current Bipolar Transistor

SWITCHING TRANSISTOR
JAN, JANTX, JANTXV

SMALL SIGNAL BIPOLAR *NPN* SILICON

TO-18





Maximum Ratings

RATING	SYMBOL	VALUE	UNIT
Collector - Emitter Voltage	V_{CEO}	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 ℃	P_D	500	mW
Derate above 25 ℃		2.85	mW/℃
Total Device Dissipation @ T_C = 25 ℃	P_D	1.8	WATTS
Derate above 25 ℃		10.3	mW/℃
Operating Junction&Storage Temperature Range	T_J, T_{stg}	- 65 to + 200	℃

Thermal Characteristics

CHARACTERISTIC	SYMBOL	MAX	UNIT
Thermal Resistance, Junction to Ambient	RqJA	350	℃/W

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

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

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

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%

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

SMALL - SIGNAL CHARACTERISTICS	SYMBOL	MIN	MAX	UNIT
Output Capacitance	C_{obo}			
(V_{CB} = 10 Vdc, I_E = 0, 100kHz £ f £ 1 MHz)			8	pF
Input Capacitance	C_{ibo}			
(V_{EB} = 0.5 Vdc, I_C = 0, 100kHz £ f £ 1 MHz)			25	pF

SWITCHING CHARACTERISTICS	SYMBOL	MIN	MAX	UNIT
Turn - On Time	t_{on}			
(V_{CC} = 30 Vdc, I_C = 150 mAdc,				
I_{B1} =15 mAdc) (See FIGURE 1)			35	ns
Turn - Off Time	t_{off}			
(V_{CC} = 30 Vdc, I_C = 150 mAdc,				
I_{B1} = - I_{B2} = 15 mAdc) (See FIGURE 2)			300	ns

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

LOW FREQUENCY	SYMBOL	MIN	MAX	UNIT
Common - Emitter Forward Current Transfer Ratio	h_{fe}			
(I_C = 1 mA, V_{CE} = 10 V, f = 1kHz)		30		
HIGH FREQUENCY				
Common - Emitter Forward Current Transfer Ratio	$\|h_{fe}\|$			
(I_C = 20 mA, V_{CE} = 20 V, f = 100 MHz)		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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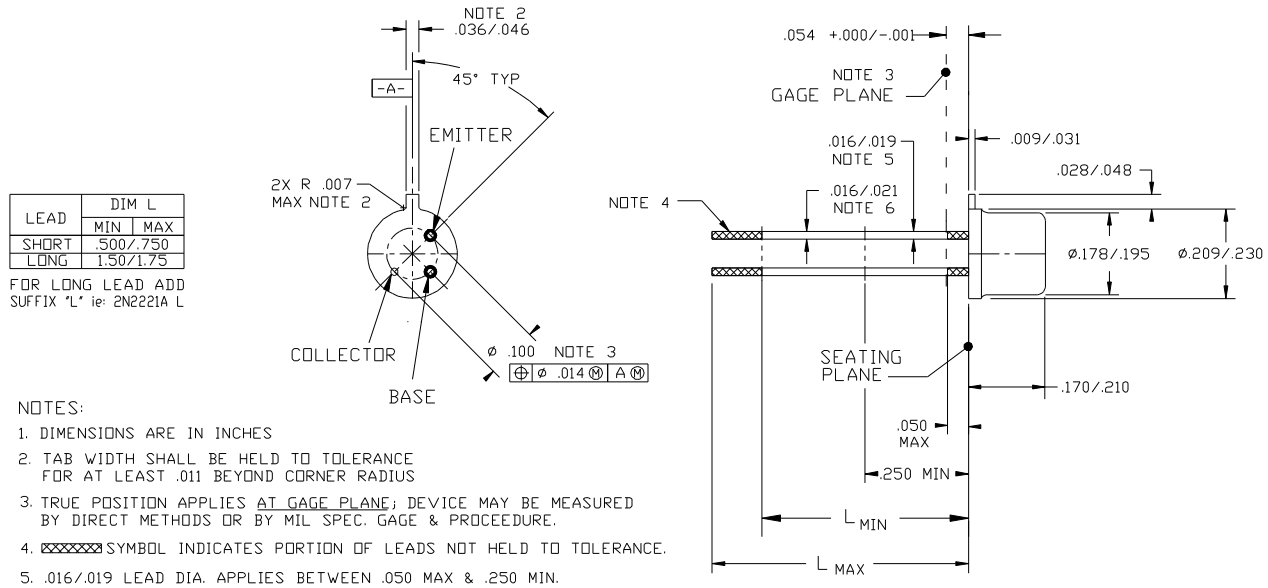


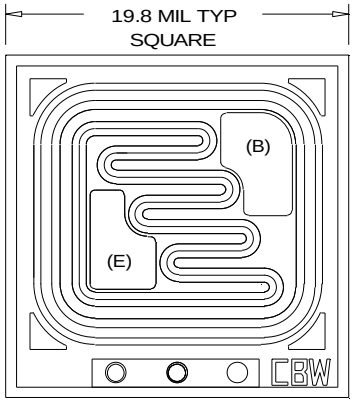
LEAD	DIM L	
	MIN	MAX
SHORT	.500/.750	
LONG	1.50/1.75	

FOR LONG LEAD ADD SUFFIX "L" ie: 2N2221A L

NOTES:

1. DIMENSIONS ARE IN INCHES
2. TAB WIDTH SHALL BE HELD TO TOLERANCE FOR AT LEAST .011 BEYOND CORNER RADIUS
3. TRUE POSITION APPLIES AT GAGE PLANE; DEVICE MAY BE MEASURED BY DIRECT METHODS OR BY MIL SPEC. GAGE & PROCEEDURE.
4. ▨ SYMBOL INDICATES PORTION OF LEADS NOT HELD TO TOLERANCE.
5. .016/.019 LEAD DIA. APPLIES BETWEEN .050 MAX & .250 MIN.
6. .016/.021 LEAD DIA. APPLIES BETWEEN .250 MIN & L MIN.
7. STANDARD PRODUCT LEAD FINISH IS GOLD PLATE. OPTIONAL LEAD FINISH SHALL BE HOT SOLDER DIP PER CUSTOMER SPEC.

TO 18 CASE OUTLINE



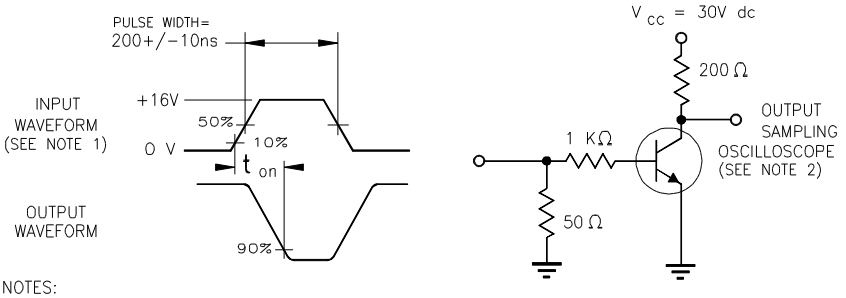
DIE CHARACTERISTICS

Back is Collector

Chip Thickness is:
10 MILS TYP

Metalization is:
Top = Al, Back = Au

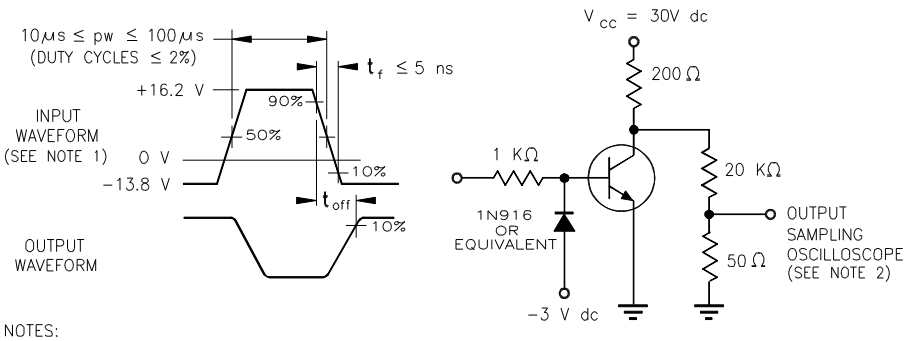
DIE OUTLINE



NOTES:

1. The rise time (t_r) of the applied pulse shall be ≤ 2.0 ns, duty cycle ≤ 2 percent, and the generator source impedance shall be 50 ohms.
2. Sampling oscilloscope: Z_{in} ≤ 100 K ohms, C_{in} ≤ 12 pF, rise time ≤ 5 ns.

FIGURE 1 Saturated Turn-on Time Test Circuit



NOTES:

1. The rise time (t_r) of the applied pulse shall be ≤ 2.0 ns, duty cycle ≤ 2 percent, and the generator source impedance shall be 50 ohms.
2. Sampling oscilloscope: Z_{in} ≤ 100 K ohms, C_{in} ≤ 12 pF, rise time ≤ 5 ns.

FIGURE 2 Saturated Turn-off Time Test Circuit

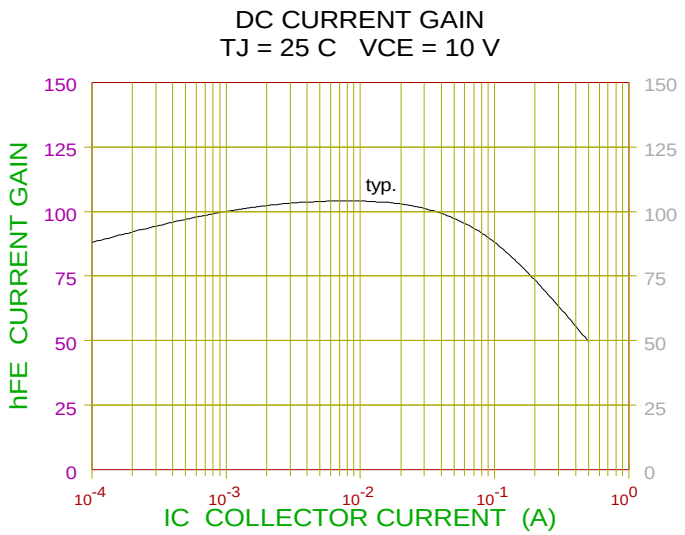


FIGURE 3

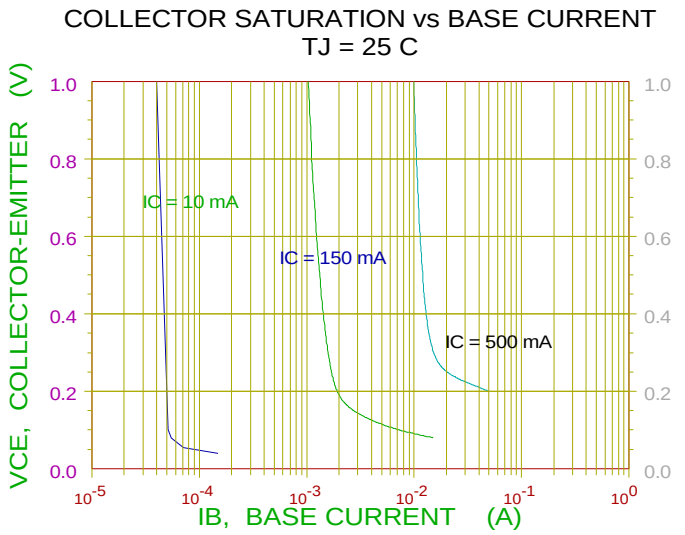


FIGURE 4

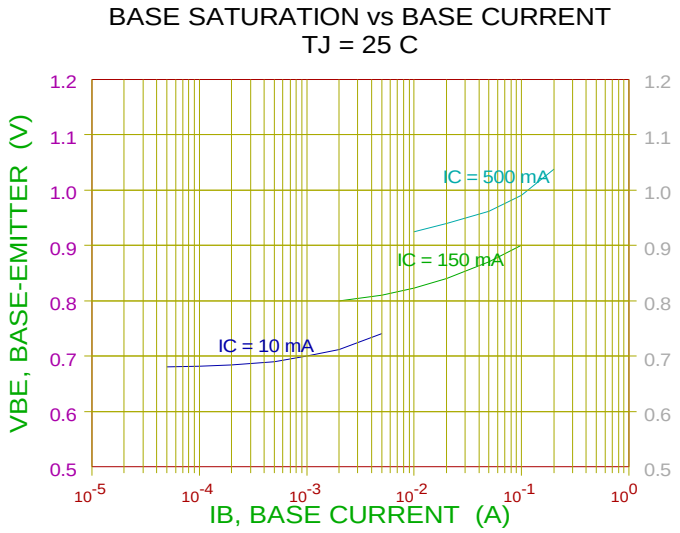


FIGURE 5

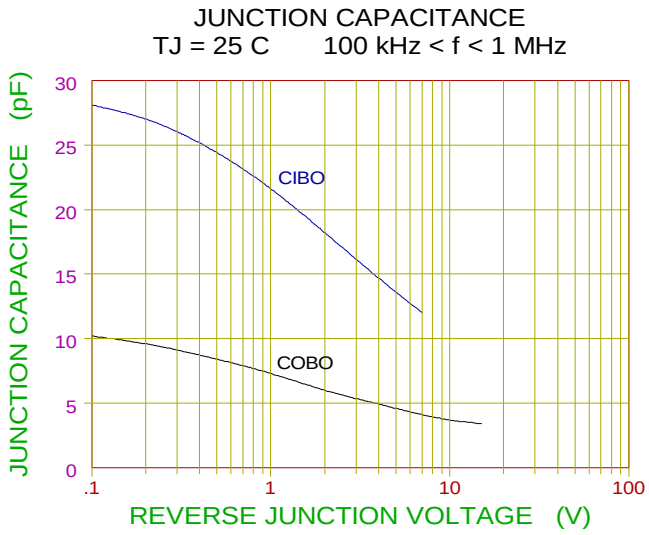


FIGURE 6

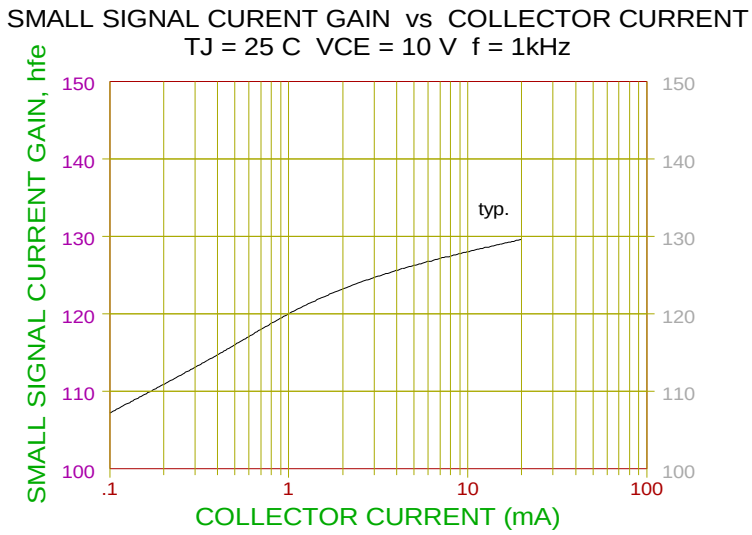


FIGURE 7

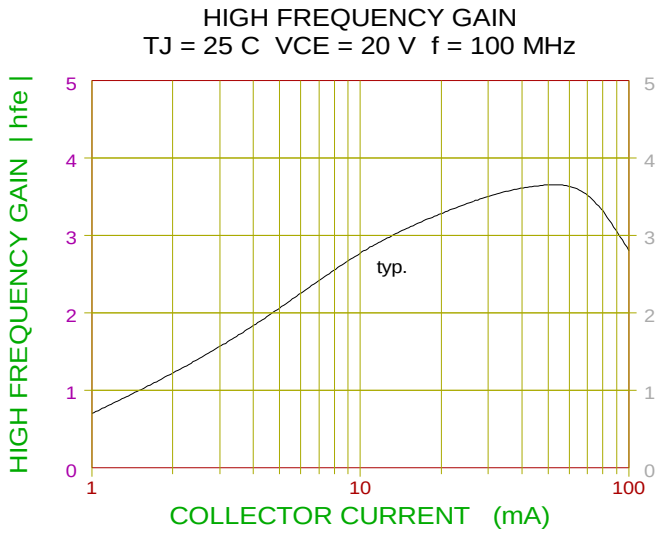


FIGURE 8

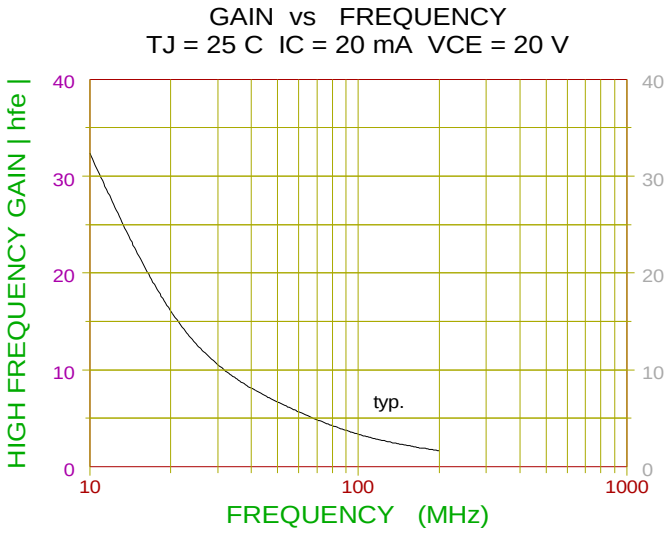

GAIN vs FREQUENCY
TJ = 25 C IC = 20 mA VCE = 20 V
HIGH FREQUENCY GAIN | hfe |
40
30
20
10
0
typ.
10
100
1000
FREQUENCY (MHz)

FIGURE 9