

**SEMICONDUCTOR  
TECHNICAL DATA**

**2N2222,  
2N2222A**

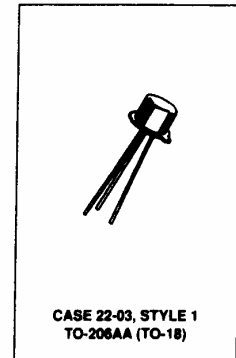
**NPN Silicon  
Small-Signal Transistors**

CRYSTALONCS  
2805 Veterans Highway  
Suite 14  
Ronkonkoma, N.Y. 11779

...designed for general-purpose switching and amplifier applications.

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MAXIMUM RATINGS				
Rating	Symbol	2N2221 2N2222	2N2221A 2N2222A	Unit
Collector-Emitter Voltage	V <sub>CEO</sub>	30	50	Vdc
Collector-Base Voltage	V <sub>CBO</sub>	60	75	Vdc
Emitter-Base Voltage	V <sub>EBO</sub>	5.0	6.0	Vdc
Collector Current — Continuous	I <sub>C</sub>	800		mAdc
Total Device Dissipation	P <sub>T</sub>			W
@ T <sub>A</sub> = 25°C		0.5		W
Derate above 25°C		2.85		mW/°C
@ T <sub>C</sub> = 25°C		1.8		W
Derate above 25°C		10.3		mW/°C
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-65 to 200		°C



ELECTRICAL CHARACTERISTICS (T <sub>A</sub> = 25°C unless otherwise noted.)					
Characteristic	Symbol	Min	Max	Unit	
<b>OFF CHARACTERISTICS</b>					
Collector-Emitter Breakdown Voltage <sup>(1)</sup> (I <sub>C</sub> = 10 mAdc, I <sub>E</sub> = 0)	V <sub>(BR)CEO</sub>	30 50	— —	Vdc	
Collector-Base Breakdown Voltage (I <sub>E</sub> = 10 μAdc)	V <sub>(BR)CBO</sub>	60 75	— —	Vdc	
Emitter-Base Breakdown Voltage (I <sub>E</sub> = 10 μAdc)	V <sub>(BR)EBO</sub>	5.0 6.0	— —	Vdc	
Collector Cutoff Current (V <sub>CE</sub> = 30 Vdc) (V <sub>CE</sub> = 50 Vdc)	I <sub>CES</sub>	— —	1.0 1.0	μAdc	

(1) Pulsed. Pulse Width 250 to 350 μs. Duty Cycle 1.0 to 2.0%.

(continued)

Symbol		Min	Max	Unit
<b>OFF CHARACTERISTICS (continued)</b>				
Collector Cutoff Current ( $V_{CB} = 50 \text{ Vdc}$ ) ( $V_{CB} = 60 \text{ Vdc}$ ) @ $T_A = 150 \text{ C}$ ( $V_{CB} = 50 \text{ Vdc}$ ) ( $V_{CB} = 60 \text{ Vdc}$ )	2N2221, 2N2222 2N2221A, 2N2222A 2N2221, 2N2222 2N2221A, 2N2222A	$I_{CBO}$ — — — —	0.01 0.01 10 10	$\mu\text{Adc}$
Emitter Cutoff Current ( $V_{EB} = 4.0 \text{ Vdc}$ , $I_C = 0$ )		$I_{EBO}$	0.01	$\mu\text{Adc}$
<b>ON CHARACTERISTICS</b>				
DC Current Gain ( $I_C = 0.1 \text{ mAdc}$ , $V_{CE} = 10 \text{ Vdc}$ )	2N2221 2N2222 2N2221A 2N2222A	$h_{FE}$	20 35 30 50	—
( $I_C = 1.0 \text{ mAdc}$ , $V_{CE} = 10 \text{ Vdc}$ )	2N2221 2N2222 2N2221A 2N2222A		25 50 35 75	150 325 150 325
( $I_C = 10 \text{ mAdc}$ , $V_{CE} = 10 \text{ Vdc}$ )	2N2221 2N2222 2N2221A 2N2222A		35 75 40 100	— — — —
( $I_C = 150 \text{ mAdc}$ , $V_{CE} = 10 \text{ Vdc}$ )	2N2221A 2N2222A		40 100	120 300
( $I_C = 500 \text{ mAdc}$ , $V_{CE} = 10 \text{ Vdc}$ ) <sup>(1)</sup>	2N2221, 2N2221A 2N2222, 2N2222A		20 30	— —
( $I_C = 10 \text{ mAdc}$ , $V_{CE} = 10 \text{ Vdc}$ , $T_A = -55 \text{ C}$ )	2N2221, 2N2221A 2N2222, 2N2222A		15 35	— —
Collector-Emitter Saturation Voltage <sup>(1)</sup> ( $I_C = 150 \text{ mAdc}$ , $I_B = 15 \text{ mAdc}$ )	2N2221, 2N2222 2N2221A, 2N2222A	$V_{CE(sat)}$	— —	0.4 0.3
( $I_C = 500 \text{ mAdc}$ , $I_B = 50 \text{ mAdc}$ )	2N2221, 2N2222 2N2221A, 2N2222A		— —	1.6 1.0
Base-Emitter Saturation Voltage <sup>(1)</sup> ( $I_C = 150 \text{ mAdc}$ , $I_B = 15 \text{ mAdc}$ )	2N2221, 2N2222 2N2221A, 2N2222A	$V_{BE(sat)}$	0.6 0.6	1.3 1.2
( $I_C = 500 \text{ mAdc}$ , $I_B = 50 \text{ mAdc}$ )	2N2221, 2N2222 2N2221A, 2N2222A		— —	2.6 2.0
<b>SMALL-SIGNAL CHARACTERISTICS</b>				
Output Capacitance ( $V_{CB} = 10 \text{ Vdc}$ , $f = 0.1$ to $1.0 \text{ MHz}$ )		$C_{obo}$	—	8.0
Input Capacitance ( $V_{EB} = 0.5 \text{ Vdc}$ , $f = 0.1$ to $1.0 \text{ MHz}$ )		$C_{ibo}$	—	25
Current Gain ( $I_C = 1.0 \text{ mAdc}$ , $V_{CE} = 10 \text{ Vdc}$ , $f = 1.0 \text{ kHz}$ )	2N2221 2N2222 2N2221A 2N2222A	$h_{fe}$	25 50 30 50	— — — —
Small-Signal Current Transfer Ratio, Magnitude ( $I_C = 20 \text{ mAdc}$ , $V_{CE} = 20 \text{ Vdc}$ , $f = 100 \text{ MHz}$ )		$ h_{fe} $	2.5	—

<sup>(1)</sup> Pulsed Pulse Width 250 to 350  $\mu\text{s}$ , Duty Cycle 1.0 to 2.0%.

(continued)

<b>ELECTRICAL CHARACTERISTICS — continued</b> ( $T_A = 25^\circ\text{C}$ unless otherwise noted.)				
Characteristic	Symbol	Min	Max	Unit
<b>SWITCHING CHARACTERISTICS (See Figure 10)</b>				
Turn-On Time	2N2221, 2N2222 2N2221A, 2N2222A	$t_{(on)}$	— —	40 35
Turn-Off Time	2N2221, 2N2222 2N2221A, 2N2222A	$t_{(off)}$	— —	250 300

<b>ASSURANCE TESTING (Pre/Post Burn-In)</b>				
<b>Burn-In Conditions: <math>T_A = 25 \pm 3^\circ\text{C}</math>, <math>V_{CB} = 24 \text{ Vdc}</math> 2N2221, 2N2222, 30 Vdc 2N2221A, 2N2222A, 10 Vdc JANS</b>				
<b><math>P_T = 400 \text{ mW}</math></b>				
Characteristics Tested	Symbol	Initial and End Point Limits		Unit
		Min	Max	
Collector Cutoff Current ( $V_{CB} = 50 \text{ Vdc}$ ) ( $V_{CB} = 60 \text{ Vdc}$ )	2N2221, 2N2222 2N2221A, 2N2222A	$I_{CBO}$	— —	10 10
DC Current Gain <sup>(1)</sup> ( $I_C = 150 \text{ mAdc}$ , $V_{CE} = 10 \text{ Vdc}$ )	2N2221, 2N2222 2N2221A, 2N2222A	$h_{FE}$	40 100	120 300

Delta from Pre-Burn-In Measured Values		Min	Max	Unit
Delta Collector Cutoff Current	$\Delta I_{CBO}$	—	$\pm 100$ or $\pm 5.0$ whichever is greater	% of Initial Value $\mu\text{Adc}$
Delta DC Current Gain <sup>(1)</sup>	$\Delta h_{FE}$	—	$\pm 15$	% of Initial Value

<sup>(1)</sup> Pulsed Pulse Width 250 to 350  $\mu\text{s}$ , Duty Cycle 1.0 to 2.0%.