

**2N2221JAN, JTX, JTXV**  
**2N2221AJAN, JTX, JTXV**  
**2N2222JAN, JTX, JTXV**  
**2N2222AJAN, JTX, JTXV, JANS**  
Processed per MIL-S-19500/255  
**NPN Silicon**  
**Small-Signal Transistors**

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

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

MAXIMUM RATINGS				
Rating	Symbol	2N2221 2N2222	2N2221A 2N2222A	Unit
Collector-Emitter Voltage	$V_{CE0}$	30	50	Vdc
Collector-Base Voltage	$V_{CB0}$	60	75	Vdc
Emitter-Base Voltage	$V_{EB0}$	5.0	6.0	Vdc
Collector Current — Continuous	$I_C$	800		mAdc
Total Device Dissipation	$P_T$			W
@ $T_A = 25^\circ\text{C}$		0.5		W
Derate above 25°C		2.85		mW/°C
@ $T_C = 25^\circ\text{C}$		1.8		W
Derate above 25°C		10.3		mW/°C
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-65 to 200		°C



ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted)					
Characteristic	Symbol	Min	Max	Unit	
<b>OFF CHARACTERISTICS</b>					
Collector-Emitter Breakdown Voltage <sup>(1)</sup> ( $I_C = 10\text{ mAdc}, I_E = 0$ )	$V_{(BR)CEO}$	30 50	— —	Vdc	
Collector-Base Breakdown Voltage ( $I_E = 10\ \mu\text{Adc}$ )	$V_{(BR)CBO}$	60 75	— —	Vdc	
Emitter-Base Breakdown Voltage ( $I_E = 10\ \mu\text{Adc}$ )	$V_{(BR)EBO}$	5.0 6.0	— —	Vdc	
Collector Cutoff Current ( $V_{CE} = 30\text{ Vdc}$ ) ( $V_{CE} = 50\text{ Vdc}$ )	$I_{CES}$	— —	1.0 1.0	$\mu\text{Adc}$	

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

(1) Pulsed. Pulse Width 250 to 350  $\mu$ s. Duty Cycle 1.0 to 2.0%.

(continued)

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

<b>ASSURANCE TESTING (Pre Post Burn-In)</b>					
<b>Burn-In Conditions: <math>T_A = 25 \pm 3</math> °C, <math>V_{CB} = 24</math> Vdc 2N2221, 2N2222, 30 Vdc 2N2221A, 2N2222A, 10 Vdc JANS</b>					
<b><math>P_T = 400</math> mW</b>					
Characteristics Tested	Symbol	Initial and End Point Limits		Unit	
		Min	Max		
Collector Cutoff Current ( $V_{CB} = 50$ Vdc) ( $V_{CB} = 60$ Vdc)	2N2221, 2N2222 2N2221A, 2N2222A	$I_{CBO}$	— —	10 10	nAdc
DC Current Gain <sup>(1)</sup> ( $I_C = 150$ mA, $V_{CE} = 10$ Vdc)	2N2221, 2N2222 2N2221A, 2N2222A	$h_{FE}$	40 100	120 300	—
<b>Delta from Pre-Burn-In Measured Values</b>		Min	Max		
Delta Collector Cutoff Current	$\Delta I_{CBO}$	—	$\pm 100$ or $\pm 5.0$ whichever is greater	% of Initial Value nAdc	
Delta DC Current Gain <sup>(1)</sup>	$\Delta h_{FE}$	—	$\pm 15$	% of Initial Value	