

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	
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage ⁽¹⁾ ($I_C = 10\text{ mAdc}, I_E = 0$)	$V_{(BR)CEO}$	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	μAdc	

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

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

(continued)

ELECTRICAL CHARACTERISTICS — continued ($T_A = 25^\circ\text{C}$ unless otherwise noted.)					
Characteristic	Symbol	Min	Max	Unit	
SWITCHING CHARACTERISTICS (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

ASSURANCE TESTING (Pre Post Burn-In)					
Burn-In Conditions: $T_A = 25 \pm 3^\circ\text{C}$, $V_{CB} = 24 \text{ Vdc}$ 2N2221, 2N2222, 30 Vdc 2N2221A, 2N2222A, 10 Vdc JANS					
$P_T = 400 \text{ mW}$					
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	nAdc
DC Current Gain ⁽¹⁾ ($I_C = 150 \text{ mA}$, $V_{CE} = 10 \text{ Vdc}$)	2N2221, 2N2222 2N2221A, 2N2222A	h_{FE}	40 100	120 300	—
Delta from Pre-Burn-In Measured Values		Min	Max		
Delta Collector Cutoff Current	ΔI_{CBO}	—	± 100 or ± 5.0 whichever is greater	% of Initial Value nAdc	
Delta DC Current Gain ⁽¹⁾	Δh_{FE}	—	± 15	% of Initial Value	