

SEMICONDUCTOR TECHNICAL DATA

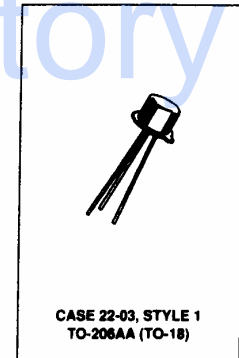
**2N2222,
2N2222A**

**NPN Silicon
Small-Signal Transistors**

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

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

MAXIMUM RATINGS				
Rating	Symbol	2N2221 2N2222	2N2221A 2N2222A	Unit
Collector-Emitter Voltage	V _{CEO}	30	50	Vdc
Collector-Base Voltage	V _{CBO}	60	75	Vdc
Emitter-Base Voltage	V _{EBO}	5.0	6.0	Vdc
Collector Current — Continuous	I _C	800		mAdc
Total Device Dissipation	P _T			W
@ T _A = 25°C		0.5		W
Derate above 25°C		2.85		mW/°C
@ T _C = 25°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°C unless otherwise noted.)					
Characteristic	Symbol	Min	Max	Unit	
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage ⁽¹⁾ (I _C = 10 mAdc, I _E = 0)	2N2221, 2N2222 2N2221A, 2N2222A	V _{(BR)CEO}	30 50	— —	Vdc
Collector-Base Breakdown Voltage (I _E = 10 μAdc)	2N2221, 2N2222 2N2221A, 2N2222A	V _{(BR)CBO}	60 75	— —	Vdc
Emitter-Base Breakdown Voltage (I _E = 10 μAdc)	2N2221, 2N2222 2N2221A, 2N2222A	V _{(BR)EBO}	5.0 6.0	— —	Vdc
Collector Cutoff Current (V _{CE} = 30 Vdc) (V _{CE} = 50 Vdc)	2N2221, 2N2222 2N2221A, 2N2222A	I _{CES}	— —	1.0 1.0	μAdc

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

(continued)

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

⁽¹⁾ Pulsed Pulse Width 250 to 350 μ s, 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	$t_{(on)}$	—	40	ns
	2N2221A, 2N2222A		—	35	
Turn-Off Time	2N2221, 2N2222	$t_{(off)}$	—	250	ns
	2N2221A, 2N2222A		—	300	

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

Delta from Pre-Burn-In Measured Values		Min	Max	Unit
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

⁽¹⁾ Pulsed Pulse Width 250 to 350 μ s, Duty Cycle 1.0 to 2.0%.

3

3