

SEMICONDUCTOR TECHNICAL DATA

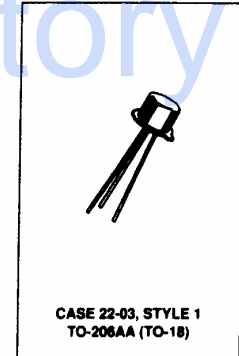
**2N2222,
2N2222A**

**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)

Symbol		Min	Max	Unit
OFF CHARACTERISTICS (continued)				
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 2N2221, 2N2222 2N2221A, 2N2222A	I_{CBO} — — — —	0.01 0.01 10 10	μ Adc
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 2N2222 2N2221A 2N2222A	h_{FE} 20 35 30 50	— — — —	—
($I_C = 1.0$ mAdc, $V_{CE} = 10$ Vdc)	2N2221 2N2222 2N2221A 2N2222A	25 50 35 75	150 325 150 325	
($I_C = 10$ mAdc, $V_{CE} = 10$ Vdc)	2N2221 2N2222 2N2221A 2N2222A	35 75 40 100	— — — —	
($I_C = 150$ mAdc, $V_{CE} = 10$ Vdc)	2N2221A 2N2222A	40 100	120 300	
($I_C = 500$ mAdc, $V_{CE} = 10$ Vdc) ⁽¹⁾	2N2221, 2N2221A 2N2222, 2N2222A	20 30	— —	
($I_C = 10$ mAdc, $V_{CE} = 10$ Vdc, $T_A = -55$ C)	2N2221, 2N2221A 2N2222, 2N2222A	15 35	— —	
Collector-Emitter Saturation Voltage ⁽¹⁾ ($I_C = 150$ mAdc, $I_B = 15$ mAdc)	2N2221, 2N2222 2N2221A, 2N2222A	$V_{CE(sat)}$ — —	0.4 0.3	Vdc
($I_C = 500$ mAdc, $I_B = 50$ mAdc)	2N2221, 2N2222 2N2221A, 2N2222A	— —	1.6 1.0	
Base-Emitter Saturation Voltage ⁽¹⁾ ($I_C = 150$ mAdc, $I_B = 15$ mAdc)	2N2221, 2N2222 2N2221A, 2N2222A	$V_{BE(sat)}$ 0.6 0.6	1.3 1.2	Vdc
($I_C = 500$ mAdc, $I_B = 50$ mAdc)	2N2221, 2N2222 2N2221A, 2N2222A	— —	2.6 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 2N2222 2N2221A 2N2222A	h_{fe} 25 50 30 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 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: $T_A = 25 \pm 3^\circ\text{C}$, $V_{CB} = 24$ 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 2N2221A, 2N2222A	I_{CBO}	— 10 10	nAdc
DC Current Gain ⁽¹⁾ ($I_C = 150$ mAdc, $V_{CE} = 10$ 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	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%.