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2N2222A Silicon NPN Transistor Small Signal General Purpose Amplifier & Switch TO-18 Type Package

Absolute Maximum Ratings:

Collector-Emitter Voltage, V_{CEO}	40V
Collector-Base Voltage, V_{CBO}	75V
Emitter-Base Voltage, V_{EBO}	6V
Continuous Collector Current, I_C	800mA
Total Device Dissipation ($T_A = +25^\circ\text{C}$), P_D	400mW
Derate Above $+25^\circ\text{C}$	2.28mW/ $^\circ\text{C}$
Total Device Dissipation ($T_C = +25^\circ\text{C}$), P_D	1.2W
Derate Above $+25^\circ\text{C}$	6.85mW/ $^\circ\text{C}$
Operating Temperature Range, T_J	-65° to $+200^\circ\text{C}$
Storage Temperature Range, T_{stg}	-65° to $+200^\circ\text{C}$
Thermal Resistance, Junction-to-Ambient, R_{thJA}	437.5 $^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Case, R_{thJC}	145.8 $^\circ\text{C}/\text{W}$

Electrical Characteristics: ($T_A = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
OFF Characteristics							
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\text{mA}$, $I_B = 0$	40	-	-	V	
Collector-Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 10\mu\text{A}$, $I_E = 0$	75	-	-	V	
Emitter-Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\mu\text{A}$, $I_C = 0$	6	-	-	V	
Collector Cutoff Current	I_{CEX}	$V_{CE} = 60\text{V}$, $V_{EB(off)} = 3\text{V}$	-	-	10	nA	
Collector Cutoff Current	I_{CBO}	$V_{CB} = 60\text{V}$, $I_E = 0$	-	-	0.01	μA	
		$V_{CB} = 60\text{V}$, $I_E = 0$, $T_A = +150^\circ\text{C}$	-	-	10	μA	
Emitter Cutoff Current	I_{EBO}	$V_{EB} = 3\text{V}$, $I_C = 0$	-	-	10	nA	
Base Cutoff Current	I_{BL}	$V_{CE} = 60\text{V}$, $V_{EB(off)} = 3\text{V}$	-	-	20	nA	
ON Characteristics							
DC Current Gain	h_{FE}	$V_{CE} = 10\text{V}$	$I_C = 0.1\text{mA}$	35	-	-	
			$I_C = 1\text{mA}$	50	-	-	
			$I_C = 10\text{mA}$, Note 1	75	-	-	
			$I_C = 10\text{mA}$, $T_A = +150^\circ\text{C}$, Note 1	35	-	-	
			$I_C = 150\text{mA}$, Note 1	100	-	300	
		$V_{CE} = 1\text{V}$, $I_C = 150\text{mA}$, Note 1	50	-	-		
		$V_{CE} = 10\text{V}$, $I_C = 500\text{mA}$, Note 1	40	-	-		

Note 1. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$.

Electrical Characteristics (Cont'd): ($T_A = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit	
ON Characteristics (Cont'd)							
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 150\text{mA}, I_B = 15\text{mA}, \text{Note 1}$	-	-	0.3	V	
		$I_C = 500\text{mA}, I_B = 50\text{mA}, \text{Note 1}$	-	-	1.0	V	
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 150\text{mA}, I_B = 15\text{mA}, \text{Note 1}$	0.6	-	1.2	V	
		$I_C = 500\text{mA}, I_B = 50\text{mA}, \text{Note 1}$	-	-	2.0	V	
Small-Signal Characteristics							
Current Gain – Bandwidth Product	f_T	$I_C = 20\text{mA}, V_{CE} = 20\text{V}, f = 100\text{MHz}, \text{Note 2}$	300	-	-	MHz	
Output Capacitance	C_{obo}	$V_{CB} = 10\text{V}, I_E = 0, f = 1\text{MHz}, \text{Note 3}$	-	-	8	pF	
Input Capacitance	C_{ibo}	$V_{EB} = 500\text{mV}, I_C = 0, f = 1\text{MHz}, \text{Note 3}$	-	-	25	pF	
Input Impedance	h_{je}	$I_C = 1\text{mA}$	$V_{CE} = 10\text{V}, f = 1\text{kHz}$	2.0	-	8.0	$k\Omega$
		$I_C = 10\text{mA}$		0.25	-	1.25	$k\Omega$
Voltage Feedback Ratio	h_{re}	$I_C = 1\text{mA}$	$V_{CE} = 10\text{V}, f = 1\text{kHz}$	-	-	8.0	$\times 10^4$
		$I_C = 10\text{mA}$		-	-	4.0	$\times 10^4$
Small-Signal Current Gain	h_{fe}	$I_C = 1\text{mA}$	$V_{CE} = 10\text{V}, f = 1\text{kHz}$	50	-	300	
		$I_C = 10\text{mA}$		75	-	375	
Output Admittance	h_{oe}	$I_C = 1\text{mA}$	$V_{CE} = 10\text{V}, f = 1\text{kHz}$	5	-	35	μmhos
		$I_C = 10\text{mA}$		15	-	200	μmhos
Collector-Base Time Constant	$rb'C_c$	$V_{CB} = 20\text{V}, I_E = 20\text{mA}, f = 31.8\text{MHz}$	-	-	150	ps	
Noise Figure	NF	$V_{CE} = 10\text{V}, I_C = 100\mu\text{A}, R_S = 1k\Omega, f = 1\text{kHz}$	-	-	4.0	dB	
Real Part of Common-Emitter High Frequency Input Impedance	$\text{Re}(h_{je})$	$V_{CE} = 20\text{V}, I_C = 20\text{mA}, f = 300\text{MHz}$	-	-	60	Ω	
Switching Characteristics							
Delay Time	t_d	$V_{CC} = 30\text{V}, V_{BE(off)} = -500\text{mV}, I_C = 150\text{mA}, I_{B1} = 15\text{mA}$	-	-	10	ns	
Rise Time	t_r		-	-	25	ns	
Storage Time	t_s	$V_{CC} = 30\text{V}, I_C = 150\text{mA}, I_{B1} = I_{B2} = 15\text{mA}$	-	-	225	ns	
Fall Time	t_f		-	-	60	ns	
Active Region Time Constant	T_A	$V_{CE} = 30\text{V}, I_C = 150\text{mA}$	-	-	2.5	ns	

Note 1. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$.

Note 2. f_T is defined as the frequency at which $|h_{fe}|$ extrapolates to unity.

Note 3. 2N5581 and 2N5582 are Listed C_{cb} and C_{ab} for these conditions and values.

