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## PN2222A

### Silicon NPN Transistor Audio Amplifier, Switch TO-92 Type Package

**Absolute Maximum Ratings:** ( $T_A = +25^\circ\text{C}$ , Note 1 unless otherwise specified)

Collector-Emitter Voltage, $V_{CE0}$ .....	40V
Collector-Base Voltage, $V_{CBO}$ .....	75V
Emitter-Base Voltage, $V_{EBO}$ .....	6V
Continuous Collector Current, $I_C$ .....	1A
Total Device Dissipation ( $T_A = +25^\circ\text{C}$ , Note 2), $P_D$ .....	625mW
Derate Above $25^\circ\text{C}$ .....	5.0mW/ $^\circ\text{C}$
Operating Junction Temperature Range, $T_J$ .....	$-55^\circ$ to $+150^\circ\text{C}$
Storage Temperature Range, $T_{stg}$ .....	$-55^\circ$ to $+150^\circ\text{C}$
Thermal Resistance, Junction to Case (Note 2), $R_{thJC}$ .....	83.3 $^\circ\text{C}/\text{W}$
Thermal Resistance, Junction to Ambient (Note 2), $R_{thJA}$ .....	200 $^\circ\text{C}/\text{W}$

Note 1. These ratings are based on a maximum junction temperature of  $+150^\circ\text{C}$ .

Note 2. PCB size: FR-4 76mm x 114mm x 1.57mm (3 inch x 4.5 inch x .062 inch) with minimum land pattern size.

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>OFF Characteristics</b>						
Collector-Emitter Breakdown Voltage	$V_{(BR)CEO}$	$I_C = 10\text{mA}$ , $I_B = 0$ , Note 3	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
		$V_{CE} = 60\text{V}$ , $I_E = 0$	-	-	0.01	$\mu\text{A}$
		$V_{CE} = 60\text{V}$ , $I_E = 0$ , $T_A = +25^\circ\text{C}$	-	-	10	$\mu\text{A}$
Emitter Cutoff Current	$I_{BEV}$	$V_{EB} = 3\text{V}$ , $I_C = 0$	-	-	10	nA
Base Cutoff Current	$I_{BL}$	$V_{CE} = 60\text{V}$ , $V_{EB(off)} = 3\text{V}$	-	-	20	nA

Note 3. 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
<b>ON Characteristics</b>						
DC Current Gain	$h_{FE}$	$V_{CE} = 1\text{V}, I_C = 0.1\text{mA}$	20	-	-	
		$V_{CE} = 10\text{V}, I_C = 0.1\text{mA}$	35	-	-	
		$V_{CE} = 10\text{V}, I_C = 1\text{mA}$	50	-	-	
		$V_{CE} = 10\text{V}, I_C = 10\text{mA}$	75	-	-	
		$V_{CE} = 10\text{V}, I_C = 10\text{mA}, T_A = -55^\circ\text{C}$	35	-	-	
		$V_{CE} = 10\text{V}, I_C = 150\text{mA}, \text{Note 3}$	100	-	300	
		$V_{CE} = 1\text{V}, I_C = 150\text{mA}, \text{Note 3}$	50	-	-	
		$V_{CE} = 10\text{V}, I_C = 500\text{mA}, \text{Note 3}$	40	-	-	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 150\text{mA}, I_B = 15\text{mA}, \text{Note 3}$	-	-	0.3	V
		$I_C = 500\text{mA}, I_B = 50\text{mA}, \text{Note 3}$	-	-	1.0	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 150\text{mA}, I_B = 15\text{mA}, \text{Note 3}$	0.6	-	1.2	V
		$I_C = 500\text{mA}, I_B = 50\text{mA}, \text{Note 3}$	-	-	2.0	V
<b>Small-Signal Characteristics</b>						
Current Gain-Bandwidth Product	$f_T$	$I_C = 20\text{mA}, V_{CE} = 20\text{V}, f = 100\text{MHz}$	300	-	-	MHz
Output Capacitance	$C_{obo}$	$V_{CB} = 10\text{V}, I_E = 0, f = 1\text{MHz}$	-	-	8	pF
Input Capacitance	$C_{ibo}$	$V_{EB} = 0.5\text{V}, I_C = 0, f = 1\text{MHz}$	-	-	25	pF
Collector-Base Time Constant	$r_b'C_c$	$I_C = 20\text{mA}, V_{CB} = 20\text{V}, f = 31.8\text{MHz}$	-	-	150	pS
Noise Figure	NF	$I_C = 100\mu\text{A}, V_{CE} = 10\text{V}, R_S = 1\text{k}\Omega, f = 1\text{kHz}$	-	-	4	dB
Real Part of Common-Emitter High Frequency Input Impedance	$\text{Re}(h_{ie})$	$I_C = 20\text{mA}, V_{CE} = 20\text{V}, f = 300\text{MHz}$	-	-	60	$\Omega$
<b>Switching Characteristics</b>						
Delay Time	$t_d$	$V_{CC} = 30\text{V}, V_{EB(off)} = 0.5\text{V}, I_C = 150\text{mA}, I_{B1} = 15\text{mA}$	-	-	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

Note 3. Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2\%$ .

