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## **NTE2320** **Silicon NPN/PNP Transistor** **Quad, General Purpose Switch, Amp** **(Complementary Pair)**

### **Absolute Maximum Ratings:**

Collector–Emitter Voltage, $V_{CEO}$ .....	30V
Collector–Base Voltage, $V_{CBO}$ .....	60V
Emitter–Base Voltage, $V_{EBO}$ .....	5V
Continuous Collector Current, $I_C$ .....	500mA
Total Device Dissipation ( $T_A = +25^\circ\text{C}$ , Each Die, Note 1), $P_D$ .....	0.65W
Derate Above $25^\circ\text{C}$ .....	5.18mW/ $^\circ\text{C}$
Total Device Dissipation ( $T_A = +25^\circ\text{C}$ , Four Die Equal Power, Note 1), $P_D$ .....	1.25W
Derate Above $25^\circ\text{C}$ .....	10mW/ $^\circ\text{C}$
Total Device Dissipation ( $T_C = +25^\circ\text{C}$ , Each Die, Note 1), $P_D$ .....	1.0W
Derate Above $25^\circ\text{C}$ .....	8.0mW/ $^\circ\text{C}$
Total Device Dissipation ( $T_C = +25^\circ\text{C}$ , Four Die Equal Power, Note 1), $P_D$ .....	3.0W
Derate Above $25^\circ\text{C}$ .....	24mW/ $^\circ\text{C}$
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–Ambient, $R_{thJA}$	
Each Die .....	193 $^\circ\text{C}/\text{W}$
Effective, 4 Die .....	100 $^\circ\text{C}/\text{W}$
Thermal Resistance, Junction–to–Case, $R_{thJC}$	
Each Die .....	125 $^\circ\text{C}/\text{W}$
Effective, 4 Die .....	41.6 $^\circ\text{C}/\text{W}$
Coupling Factors, Junction–to–Ambient	
Q1–Q4 or Q2–Q3 .....	60%
Q1–Q2 or Q3–Q4 .....	24%
Coupling Factors, Junction–to–Case	
Q1–Q4 or Q2–Q3 .....	30%
Q1–Q2 or Q3–Q4 .....	20%

Note 1. Voltage and current are negative for PNP transistors.

**Electrical Characteristics:** ( $T_A = +25^\circ\text{C}$ , Note 1 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 2	30	–	–	V
Collector–Base Breakdown Voltage	$V_{(BR)CBO}$	$I_C = 10\mu\text{A}$ , $I_E = 0$	60	–	–	V
Emitter–Base Breakdown Voltage	$V_{(BR)EBO}$	$I_E = 10\mu\text{A}$ , $I_C = 0$	5	–	–	V
Collector Cutoff Current	$I_{CBO}$	$V_{CB} = 50\text{V}$ , $I_E = 0$	–	–	30	nA
Emitter Cutoff Current	$I_{EBO}$	$V_{EB} = 3\text{V}$ , $I_C = 0$	–	–	30	nA
<b>ON Characteristics (Note 3)</b>						
DC Current Gain	$h_{FE}$	$V_{CE} = 10\text{V}$ , $I_C = 1\text{mA}$	50	–	–	
		$V_{CE} = 10\text{V}$ , $I_C = 10\text{mA}$	75	–	–	
		$V_{CE} = 10\text{V}$ , $I_C = 150\text{mA}$	100	–	–	
		$V_{CE} = 10\text{V}$ , $I_C = 300\text{mA}$	20	–	–	
Collector–Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 150\text{mA}$ , $I_B = 15\text{mA}$	–	–	0.4	V
		$I_C = 300\text{mA}$ , $I_B = 30\text{mA}$	–	–	0.4	V
Base–Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 150\text{mA}$ , $I_B = 15\text{mA}$	–	–	1.3	V
		$I_C = 300\text{mA}$ , $I_B = 30\text{mA}$	–	–	2.0	V
<b>Small–Signal Characteristics</b>						
Current Gain–Bandwidth Product	$f_T$	$V_{CE} = 20\text{V}$ , $I_C = 50\text{mA}$ , $f = 100\text{MHz}$ , Note 3	200	350	–	MHz
Output Capacitance NPN PNP	$C_{obo}$	$V_{CB} = 10\text{V}$ , $I_E = 0$ , $f = 1\text{MHz}$	–	6.0	8.0	pF
			–	4.5	8.0	pF
Input Capacitance NPN PNP	$C_{ibo}$	$V_{EB} = 2\text{V}$ , $I_C = 0$ , $f = 1\text{MHz}$	–	20	30	pF
			–	17	30	pF
<b>Switching Characteristics</b>						
Turn–On Time	$t_{on}$	$V_{CC} = 30\text{V}$ , $V_{EB} = 0.5\text{V}$ , $I_C = 150\text{mA}$ , $I_{B1} = 15\text{mA}$	–	30	–	ns
Turn–Off Time	$t_{off}$	$V_{CC} = 30\text{V}$ , $I_C = 150\text{mA}$ , $I_{B1} = I_{B2} = 15\text{mA}$	–	225	–	ns

Note 1. Voltage and current are negative for PNP transistors.

Note 2. Second Breakdown occurs at power levels greater than 3 times the power dissipation rating.

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

### Pin Connection Diagram

