

## NTE53 Silicon NPN Transistor High Voltage, High Speed Switch

### **Description:**

The NTE53 is a silicon NPN transistor in a TO3 type package designed for high voltage, high-speed power switching in inductive circuits where fall time is critical. This device is particularly suited for 115V and 220V line-operated switch-mode applications.

### **Applications:**

- Switching Regulators
- PWM Inverters and Motor Controls
- Deflection Circuits
- Solenoid and Relay Drivers

### **Absolute Maximum Ratings:**

Collector-Emitter Voltage, $V_{CEO(sus)}$ .....	400V
Collector-Emitter Voltage, $V_{CEX(sus)}$ .....	450V
Collector-Emitter Voltage, $V_{CEV}$ .....	850V
Emitter-Base Voltage, $V_{EB}$ .....	9V
Collector Current, $I_C$	
Continuous .....	15A
Peak (Note 1) .....	30A
Base Current, $I_B$	
Continuous .....	10A
Peak (Note 1) .....	20A
Total Device Dissipation ( $T_C = +25^\circ\text{C}$ ), $P_D$ .....	175W
Derate Above $25^\circ\text{C}$ .....	1.0W/ $^\circ\text{C}$
Total Device Dissipation ( $T_C = +100^\circ\text{C}$ ), $P_D$ .....	100W
Operating Junction Temperature Range, $T_J$ .....	$-65^\circ$ to $+200^\circ\text{C}$
Storage Temperature Range, $T_{stg}$ .....	$-65^\circ$ to $+200^\circ\text{C}$
Thermal Resistance, Junction-to-Case, $R_{thJC}$ .....	1.0 $^\circ\text{C}/\text{W}$
Maximum Lead temperature (During Soldering, 1/8" from case, 5sec), $T_L$ .....	$+275^\circ\text{C}$

Note 1. Pulse test: Pulse Width = 5ms, Duty Cycle  $\leq$  10%.

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>OFF Characteristics (Note 2)</b>						
Collector-Emitter Sustaining Voltage	$V_{CEO(sus)}$	$I_C = 100\text{mA}, I_B = 0$	400	-	-	V
	$V_{CEX(sus)}$	$I_C = 8\text{A}, V_{clamp} = 450\text{V}, T_C = +100^\circ\text{C}$	450	-	-	V
		$I_C = 15\text{A}, V_{clamp} = 300\text{V}, T_C = +100^\circ\text{C}$	300	-	-	V
Collector Cutoff Current	$I_{CEV}$	$V_{CEV} = 850\text{V}, V_{BE(off)} = 1.5\text{V}$	-	-	1.0	mA
		$V_{CEV} = 850\text{V}, V_{BE(off)} = 1.5\text{V}, T_C = +100^\circ\text{C}$	-	-	4.0	mA
	$I_{CER}$	$V_{CE} = 850\text{V}, R_{BE} = 50\Omega, T_C = +100^\circ\text{C}$	-	-	5.0	mA
Emitter Cutoff Current	$I_{EBO}$	$V_{EB} = 9\text{V}, I_C = 0$	-	-	1.0	mA
<b>Second Breakdown</b>						
Second Breakdown Collector Current with Base Forward Bias	$I_{S/b}$	$V_{CE} = 100\text{V}, t = 1.0\text{s}$ (non-repetitive)	0.2	-	-	A
<b>ON Characteristics (Note 2)</b>						
DC Current Gain	$h_{FE}$	$V_{CE} = 2\text{V}, I_C = 5\text{A}$	12	-	60	
		$V_{CE} = 2\text{V}, I_C = 10\text{A}$	6	-	30	
Collector-Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 10\text{A}, I_B = 2\text{A}$	-	-	1.5	V
		$I_C = 10\text{A}, I_B = 2\text{A}, T_C = +100^\circ\text{C}$	-	-	2.5	V
		$I_C = 15\text{A}, I_B = 3\text{A}$	-	-	5.0	V
Base-Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 10\text{A}, I_B = 2\text{A}$	-	-	1.6	V
		$I_C = 10\text{A}, I_B = 2\text{A}, T_C = +100^\circ\text{C}$	-	-	1.6	V
<b>Dynamic Characteristics</b>						
Current Gain-Bandwidth Product	$f_T$	$V_{CE} = 10\text{V}, I_C = 500\text{mA}, f = 1\text{MHz}$	6	-	28	MHz
Output Capacitance	$C_{ob}$	$V_{CB} = 10\text{V}, I_E = 0, f = 1\text{MHz}$	125	-	500	pF
<b>Switching Characteristics (Resistive Load)</b>						
Delay Time	$t_d$	$V_{CC} = 250\text{V}, I_C = 10\text{A}, I_{B1} = I_{B2} = 2\text{A}, t_p = 300\mu\text{s}, \text{Duty Cycle} \leq 2\%$	-	-	0.05	$\mu\text{s}$
Rise Time	$t_r$		-	-	1.0	$\mu\text{s}$
Storage Time	$t_s$		-	-	4.0	$\mu\text{s}$
Fall Time	$t_f$		-	-	0.7	$\mu\text{s}$
<b>Switching Characteristics (Inductive Load, Clamped)</b>						
Storage Time	$t_{sv}$	$I_C = 10\text{A peak}, V_{clamp} = 450\text{V}, I_{B1} = 2\text{A}, V_{BE(off)} = 5\text{V}$	-	2.0	-	$\mu\text{s}$
Fall Time	$t_{fi}$		0.09	-	-	$\mu\text{s}$
Storage Time	$t_{sv}$	$I_C = 10\text{A peak}, V_{clamp} = 450\text{V}, I_{B1} = 2\text{A}, V_{BE(off)} = 5\text{V}, T_J = +100^\circ\text{C}$	-	-	5.0	$\mu\text{s}$
Fall Time	$t_{fi}$		-	-	1.5	$\mu\text{s}$

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

