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## NTE99 Silicon NPN Transistor Darlington <sup>w</sup>/Base-Emitter Speed-up Diode TO-3 Type Package

**Description:**

The NTE99 is a silicon NPN Darlington 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 line-operated switchmode applications.

**Applications:**

- Switching Regulators
- Motor Controls
- Inverters
- Solenoid and Relay Drivers

**Features:**

- Fast Turn-Off Times:
  - 1.0µs (max) Inductive Crossover Time – 20 Amps
  - 2.5µs (max) Inductive Storage Time – 20 Amps
- Operating Temperature Range: -65° to +200°C

**Absolute Maximum Ratings:**

Collector-Emitter Voltage, $V_{CEO}$ .....	400V
Collector-Emitter Voltage, $V_{CEV}$ .....	600V
Emitter-Base Voltage, $V_{EB}$ .....	8V
Collector Current, $I_C$	
Continuous .....	50A
Peak (Note 1) .....	75A
Base Current, $I_B$	
Continuous .....	10A
Peak (Note 1) .....	15A
Total Power Dissipation, $P_D$	
$T_C = +25^\circ C$ .....	250W
Derate Above 25°C .....	1.43W/°C
$T_C = +100^\circ C$ .....	143W
Operating Junction Temperature Range, $T_J$ .....	-65° to +200°C
Storage Temperature Range, $T_{stg}$ .....	-65° to +200°C
Thermal Resistance, Junction-to-Case, $R_{thJC}$ .....	0.7°C/W
Maximum Lead Temperature (During Soldering, 1/8" from case for 5sec), $T_L$ .....	+275°C

Note 1. Pulse Test: Pulse Width = 5ms, Duty Cycle ≤ 10%.

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

Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
<b>OFF Characteristics</b> (Note 2)						
Collector–Emitter Sustaining Voltage	$V_{CEO(sus)}$	$I_C = 100\text{mA}, I_B = 0, V_{clamp} = 400\text{V}$	400	–	–	V
Collector Cutoff Current	$I_{CEV}$	$V_{CEV} = 600\text{V}, V_{BE(off)} = 1.5\text{V}$	–	–	0.25	mA
Emitter Cutoff Current	$I_{EBO}$	$V_{BE} = 2\text{V}, I_C = 0$	–	–	350	mA
<b>ON Characteristics</b> (Note 2)						
DC Current Gain	$h_{FE}$	$I_C = 20\text{A}, V_{CE} = 5\text{V}$	25	–	–	
		$I_C = 40\text{A}, V_{CE} = 5\text{V}$	10	–	–	
Collector–Emitter Saturation Voltage	$V_{CE(sat)}$	$I_C = 20\text{A}, I_B = 1\text{A}$	–	–	2.2	V
		$I_C = 50\text{A}, I_B = 10\text{A}$	–	–	5.0	V
Base–Emitter Saturation Voltage	$V_{BE(sat)}$	$I_C = 20\text{A}, I_B = 1\text{A}$	–	–	2.75	V
Diode Forward Voltage	$V_f$	$I_F = 20\text{A}, \text{Note 3}$	–	2.5	5.0	V
<b>Dynamic Characteristic</b>						
Output Capacitance	$C_{ob}$	$V_{CB} = 10\text{V}, I_E = 0, f_{test} = 100\text{kHz}$	–	–	750	pF
<b>Switching Characteristics</b>						
Resistive Load						
Delay Time	$t_d$	$V_{CC} = 250\text{V}, I_C = 20\text{A}, I_{B1} = 1\text{A}, V_{BE(off)} = 5\text{V}, t_p = 25\mu\text{s}, \text{Duty Cycle} \leq 2\%$	–	0.14	0.3	$\mu\text{s}$
Rise Time	$t_r$		–	0.3	1.0	$\mu\text{s}$
Storage Time	$t_s$		–	0.8	2.5	$\mu\text{s}$
Fall Time	$t_f$		–	0.3	1.0	$\mu\text{s}$
Inductive Load, Clamped						
Storage Time	$t_{sv}$	$I_C = 20\text{A(pk)}, V_{clamp} = 250\text{V}, I_{B1} = 1\text{A}, V_{BE(off)} = 5\text{V}$	–	1.0	2.5	$\mu\text{s}$
Crossover Time	$t_c$		–	0.36	1.0	$\mu\text{s}$

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

Note 3. The internal Collector–to–Emitter diode can eliminate the need for an external diode to clamp inductive loads. Tests have shown that the Forward Recovery Voltage ( $V_f$ ) of this diode is comparable to that of typical fast recovery rectifiers.



