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NTE98 Silicon NPN Transistor HV Darlington Power Amp, Switch

Description:

The NTE98 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. They are particularly suited for line operated switch-mode applications.

Applications:

- Switching Regulators
- Inverters
- Solenoid and Relay Drivers

Absolute Maximum Ratings:

| | |
|------------------------------------------------------------------------|-------------------------------|
| Collector–Emitter Voltage, $V_{CEO(sus)}$ | 500V |
| Collector–Emitter Voltage, $V_{CEX(sus)}$ | 500V |
| Collector–Emitter Voltage, V_{CEV} | 700V |
| Emitter–Base Voltage, V_{EB} | 8V |
| Collector Current, I_C | |
| Continuous | 20A |
| Peak (Note 1) | 30A |
| Base Current, I_B | |
| Continuous | 2.5A |
| Peak (Note 1) | 5.0A |
| Total Power Dissipation ($T_C = +25^\circ C$), P_D | 175W |
| Derate Above $+25^\circ C$ | 1.0W/ $^\circ C$ |
| Total Power Dissipation ($T_C = +100^\circ C$), P_D | 100W |
| Operating Junction Temperature Range, T_J | -65° to $+200^\circ C$ |
| Storage Temperature Range, T_{stg} | -65° to $+200^\circ C$ |
| Thermal Resistance, Junction–to–Case, R_{thJC} | 1.0 $^\circ C/W$ |
| Lead Temperature (During Soldering, 1/8" from case, 5sec), T_L | $+275^\circ C$ |

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 |
|------------------------------------------------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|------|------|---------------|
| OFF Characteristics (Note 2) | | | | | | |
| Collector–Emitter Sustaining Voltage | $V_{\text{CEO(sus)}}$ | $I_C = 100\text{mA}, I_B = 0, V_{\text{clamp}} = 500\text{V}$ | 500 | – | – | V |
| | $V_{\text{CEX(sus)}}$ | $I_C = 2\text{A}, V_{\text{clamp}} = 500\text{V}, T_C = +100^\circ\text{C}$ | 500 | – | – | V |
| | | $I_C = 5\text{A}, V_{\text{clamp}} = 500\text{V}, T_C = +100^\circ\text{C}$ | 375 | – | – | V |
| Collector Cutoff Current | I_{CEV} | $V_{\text{CEV}} = 700\text{V}, V_{\text{BE(off)}} = 1.5\text{V}$ | – | – | 0.25 | mA |
| | | $V_{\text{CEV}} = 700\text{V}, V_{\text{BE(off)}} = 1.5\text{V}, T_C = +150^\circ\text{C}$ | – | – | 5.0 | mA |
| | I_{CER} | $V_{\text{CE}} = 700\text{V}, R_{\text{BE}} = 50\Omega, T_C = +100^\circ\text{C}$ | – | – | 5.0 | mA |
| Emitter Cutoff Current | I_{EBO} | $V_{\text{EB}} = 2\text{V}, I_C = 0$ | – | – | 175 | mA |
| ON Characteristics (Note 3) | | | | | | |
| DC Current Gain | h_{FE} | $V_{\text{CE}} = 5\text{V}, I_C = 5\text{A}$ | 40 | – | 400 | |
| | | $V_{\text{CE}} = 5\text{V}, I_C = 10\text{A}$ | 30 | – | 300 | |
| Collector–Emitter Saturation Voltage | $V_{\text{CE(sat)}}$ | $I_C = 10\text{A}, I_B = 500\text{mA}$ | – | – | 2.0 | V |
| | | $I_C = 10\text{A}, I_B = 500\text{mA}, T_C = +100^\circ\text{C}$ | – | – | 2.5 | V |
| | | $I_C = 20\text{A}, I_B = 2\text{A}$ | – | – | 3.5 | V |
| Base–Emitter Saturation Voltage | $V_{\text{BE(sat)}}$ | $I_C = 10\text{A}, I_B = 500\text{mA}$ | – | – | 2.5 | V |
| | | $I_C = 10\text{A}, I_B = 500\text{mA}, T_C = +100^\circ\text{C}$ | – | – | 2.5 | V |
| Diode Forward Voltage | V_{F} | $I_{\text{F}} = 5\text{A}, \text{Note 3}$ | – | 3 | 5 | V |
| Dynamic Characteristics | | | | | | |
| Small–Signal Current Gain | h_{fe} | $V_{\text{CE}} = 10\text{V}, I_C = 1\text{A}, f_{\text{test}} = 1\text{MHz}$ | 8 | – | – | |
| Output Capacitance | C_{ob} | $V_{\text{CB}} = 50\text{V}, I_{\text{E}} = 0, f_{\text{test}} = 100\text{kHz}$ | 100 | – | 325 | pF |
| Switching Characteristics (Resistive Load) | | | | | | |
| Delay Time | t_{d} | $V_{\text{CC}} = 250\text{V}, I_C = 10\text{A}, I_{\text{B1}} = 500\text{mA}, V_{\text{BE(off)}} = 5\text{V}, t_{\text{p}} = 50\mu\text{s}, \text{Duty Cycle} \leq 2\%$ | – | 0.12 | 0.25 | μs |
| Rise Time | t_{r} | | – | 0.5 | 1.5 | μs |
| Storage Time | t_{s} | | – | 0.8 | 2.0 | μs |
| Fall Time | t_{f} | | – | 0.2 | 0.6 | μs |
| Switching Characteristics (Inductive Load, Clamped) | | | | | | |
| Storage Time | t_{sv} | $I_C = 10\text{A Peak}, V_{\text{clamp}} = 250\text{V}, I_{\text{B1}} = 500\text{mA}, V_{\text{BE(off)}} = 5\text{V}, T_C = +100^\circ\text{C}$ | – | 1.5 | 3.5 | μs |
| Crossover Time | t_{c} | | – | 0.36 | 1.6 | μs |
| Storage Time | t_{sv} | $I_C = 10\text{A Peak}, V_{\text{clamp}} = 250\text{V}, I_{\text{B1}} = 500\text{mA}, V_{\text{BE(off)}} = 5\text{V}, T_C = +25^\circ\text{C}$ | – | 0.8 | – | μs |
| Crossover Time | t_{c} | | – | 0.18 | – | μs |

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

Note 3. The internal Collector–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.

