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MJ10000

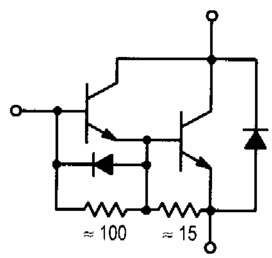
Designer's™ Data Sheet
SWITCHMODE Series NPN Silicon Power Darlington Transistor

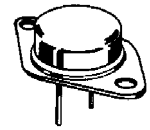
20 AMPERE NPN SILICON POWER DARLINGTON TRANSISTORS 350 VOLTS 175 WATTS

The MJ10000 Darlington transistor is designed for high–voltage, high–speed, power switching in inductive circuits where fall time is critical. It is particularly suited for line operated switchmode applications such as:

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

100°C Performance Specified for:
- Reversed Biased SOA with Inductive Loads
- Switching Times With Inductive Loads — 210 ns Inductive Fall Time (Typ)
- Saturation Voltages
- Leakage Currents





(TO–3)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	V_{CEO}	350	Vdc
Collector–Emitter Voltage	V_{CEX}	400	Vdc
Collector–Emitter Voltage	V_{CEV}	450	Vdc
Emitter Base Voltage	V_{EB}	8	Vdc
Collector Current — Continuous — Peak (1)	I_C I_{CM}	20 30	Adc
Base Current — Continuous — Peak (1)	I_B I_{BM}	2.5 5	Adc
Total Power Dissipation @ T_C = 25°C @ T_C =100°C Derate above 25°C	P_D	175 100 1	Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	–65 to +200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1	°C/W
Maximum Lead Temperature for Soldering Purposes: 1/8″ from Case for 5 Seconds	T_L	275	°C

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

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (2)					
Collector–Emitter Sustaining Voltage (Table 1) (I_C = 250 mA, I_B = 0, V_{clamp} = Rated V_{CEO}) MJ10000	$V_{CEO(sus)}$	350	—	—	Vdc
Collector–Emitter Sustaining Voltage (Table 1, Figure 12) I_C = 2 A, V_{clamp} = Rated V_{CEX}, T_C = 100°C MJ10000 I_C = 10 A, V_{clamp} = Rated V_{CEX}, T_C = 100°C MJ10000	$V_{CEX(sus)}$	 400 275	 — —	 — —	Vdc
Collector Cutoff Current (V_{CEV} = Rated Value, $V_{BE(off)}$ = 1.5 Vdc) (V_{CEV} = Rated Value, $V_{BE(off)}$ = 1.5 Vdc, T_C = 150°C)	I_{CEV}	 — —	 — —	 0.25 5	mAdc
Collector Cutoff Current (V_{CE} = Rated V_{CEV}, R_{BE} = 50 Ω, T_C = 100°C)	I_{CER}	—	—	5	mAdc
Emitter Cutoff Current (V_{EB} = 8 Vdc, I_C = 0)	I_{EBO}	—	—	150	mAdc
SECOND BREAKDOWN					
Second Breakdown Collector Current with base forward biased	$I_{S/b}$	See Figure 11			Adc
ON CHARACTERISTICS (2)					
DC Current Gain (I_C = 5 Adc, V_{CE} = 5 Vdc) (I_C = 10 Adc, V_{CE} = 5 Vdc)	h_{FE}	 50 40	 — —	 600 400	—
Collector–Emitter Saturation Voltage (I_C = 10 Adc, I_B = 400 mAdc) (I_C = 20 Adc, I_B = 1 Adc) (I_C = 10 Adc, I_B = 400 mAdc, T_C = 100°C)	$V_{CE(sat)}$	 — — —	 — — —	 1.9 3 2	Vdc
Base–Emitter Saturation Voltage (I_C = 10 Adc, I_B = 400 mAdc) (I_C = 10 Adc, I_B = 400 mAdc, T_C = 100°C)	$V_{BE(sat)}$	 — —	 — —	 2.5 2.5	Vdc
Diode Forward Voltage (1) (I_F = 10 Adc)	V_f	—	3	5	Vdc
DYNAMIC CHARACTERISTICS					
Small–Signal Current Gain (I_C = 1.0 Adc, V_{CE} = 10 Vdc, f_{test} = 1 MHz)	h_{fe}	10		—	—
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f_{test} = 100 kHz)	C_{ob}	100		325	pF
SWITCHING CHARACTERISTICS					
Resistive Load (Table 1)					
Delay Time (V_{CC} = 250 Vdc, I_C = 10 A, Rise Time I_{B1} = 400 mA, $V_{BE(off)}$ = 5 Vdc, t_p = 50 μs, Storage Time Duty Cycle ≤ 2%) Fall Time	t_d t_r t_s t_f	— — — —	0.12 0.20 1.5 1.1	0.2 0.6 3.5 2.4	μs μs μs μs
Inductive Load, Clamped (Table 1)					
Storage Time (I_C = 10 A(pk), V_{clamp} = Rated V_{CEX}, I_{B1} = 400 mA, Crossover Time $V_{BE(off)}$ = 5 Vdc, T_C = 100°C)	t_{sv} t_c	— —	3.5 1.5	5.5 3.7	μs μs
Storage Time (I_C = 10 A(pk), V_{clamp} = Rated V_{CEX}, I_{B1} = 400 mA, Crossover Time $V_{BE(off)}$ = 5 Vdc, T_C = 25°C)	t_{sv} t_c	— —	1.0 0.7	— —	μs μs