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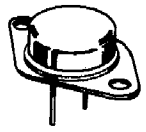
MJ10005

SWITCHMODE Series NPN Silicon Power Darlington Transistor with Base-Emitter Speedup Diode

20 AMPERE
NPN SILICON
POWER DARLINGTON
TRANSISTORS
400 VOLTS
175 WATTS



TO-3

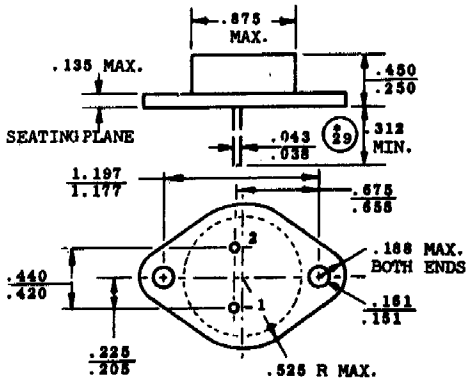
The MJ10005 Darlington transistor is designed for high–voltage, high–speed, power switching in inductive circuits where fall time is critical. It is particularly suited for line operated switchmode applications such as:

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

Fast Turn–Off Times
- 40 ns Inductive Fall Time — 25°C (Typ)
- 650 ns Inductive Storage Time — 25°C (Typ)

Operating Temperature Range –65 to +200°C

100°C Performance Specified for:
- Reversed Biased SOA with Inductive Loads
- Switching Times with Inductive Loads
- Saturation Voltages
- Leakage Currents



MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	V_{CEO}	400	Vdc
Collector–Emitter Voltage	V_{CEX}	450	Vdc
Collector–Emitter Voltage	V_{CEV}	500	Vdc
Emitter Base Voltage	V_{EB}	8.0	Vdc
Collector Current — Continuous — Peak (1)	I_C I_{CM}	20 30	Adc
Base Current — Continuous — Peak (1)	I_B I_{BM}	2.5 5.0	Adc
Total Power Dissipation @ T_C = 25°C @ T_C = 100°C Derate above 25°C	P_D	175 100 1.0	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	$R_{\theta JC}$	1.0	°C/W
Maximum Lead Temperature for Soldering Purposes 1/8″ from Case for 5 Seconds	T_L	275	°C

(1) Pulse Test: Pulse Width = 5.0 ms, Duty Cycle ≤ 10%.

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector–Emitter Sustaining Voltage (Table 1) (I_C = 250 mA, I_B = 0, V_{clamp} = Rated V_{CEO})	$V_{CEO(sus)}$	400	—	—	Vdc
Collector Emitter Sustaining Voltage (Table 1, Figure 12) (I_C = 2.0 A, V_{clamp} = Rated V_{CEX}, T_C = 100°C) (I_C = 10 A, V_{clamp} = Rated V_{CEX}, T_C = 100°C)	$V_{CEX(sus)}$	 450 325	 — —	 — —	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 5.0	mAdc
Collector Cutoff Current (V_{CE} = Rated V_{CEV}, R_{BE} = 50 Ω, T_C = 100°C)	I_{CER}	—	—	5.0	mAdc
Emitter Cutoff Current (V_{EB} = 2.0 Vdc, I_C = 0)	I_{EBO}	—	—	175	mAdc
SECOND BREAKDOWN					
Second Breakdown Collector Current with base forward biased	$I_{S/b}$	See Figure 11			
ON CHARACTERISTICS (2)					
DC Current Gain (I_C = 5.0 Adc, V_{CE} = 5.0 Vdc) (I_C = 10 Adc, V_{CE} = 5.0 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 = 2.0 Adc) (I_C = 10 Adc, I_B = 400 mAdc, T_C = 100°C)	$V_{CE(sat)}$	 — — —	 — — —	 1.9 3.0 2.0	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	—	3.0	5.0	Vdc
DYNAMIC CHARACTERISTICS					
Small–Signal Current Gain (I_C = 1.0 Adc, V_{CE} = 10 Vdc, f_{test} = 1.0 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, I_{B1} = 400 mA, $V_{BE(off)}$ = 5.0 Vdc, t_p = 50 μs, Duty Cycle ≤ 2%).	t_d	—	0.12	0.2	μs
Rise Time		t_r	—	0.2	0.6	μs
Storage Time		t_s	—	0.6	1.5	μs
Fall Time		t_f	—	0.15	0.5	μs
Inductive Load Clamped (Table 1)						
Storage Time	(I_C = 10 A(pk), V_{clamp} = Rated V_{CEX}, I_{B1} = 400 mA, $V_{BE(off)}$ = 5.0 Vdc, T_C = 100°C)	t_{sv}	—	1.0	2.5	μs
Crossover Time		t_c	—	0.4	1.5	μs
Storage Time	(I_C = 10 A(pk), V_{clamp} = Rated V_{CEX}, I_{B1} = 400 mA, $V_{BE(off)}$ = 5.0 Vdc, T_C = 25°C)	t_{sv}	—	0.65	—	μs
Crossover Time		t_c	—	0.2	—	μs