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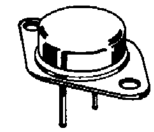
MJ10020
MJ10021

Designer's™ Data Sheet

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

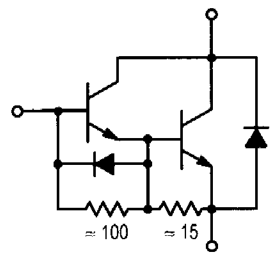
60 AMPERE
NPN SILICON
POWER DARLINGTON
TRANSISTORS
200 AND 250 VOLTS
250 WATTS



TO–204AE (TO–3)

The MJ10020 and MJ10021 Darlington transistors are designed for high–voltage, high–speed, power switching in inductive circuits where fall time is critical. They are particularly suited for line operated switchmode applications such as:

- AC and DC Motor Controls
- Switching Regulators
- Inverters
- Solenoid and Relay Drivers
- Fast Turn–Off Times
  - 150 ns Inductive Fall Time at 25°C (Typ)
  - 750 ns Inductive Storage Time at 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	MJ10020	MJ10021	Unit
Collector–Emitter Voltage	V_{CEO}	200	250	Vdc
Collector–Emitter Voltage	V_{CEV}	300	350	Vdc
Emitter Base Voltage	V_{EB}	8.0		Vdc
Collector Current — Continuous — Peak (1)	I_C I_{CM}	60 100		Adc
Base Current — Continuous — Peak (1)	I_B I_{BM}	20 30		Adc
Total Power Dissipation @ T_C = 25°C @ T_C = 100°C Derate above 25°C	P_D	250 143 1.43		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	$R_{\theta JC}$	0.7	°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						
Collector–Emitter Sustaining Voltage (Table 1) (I_C = 100 mA, I_B = 0)	MJ10020 MJ10021	$V_{CEO(sus)}$	200 250	— —	— —	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 V, I_C = 0)		I_{EBO}	—	—	175	mAdc
SECOND BREAKDOWN						
Second Breakdown Collector Current with base forward biased		$I_{S/b}$		See Figure 13		
Clamped Inductive SOA with Base Reverse Biased		RBSOA		See Figure 14		
ON CHARACTERISTICS (1)						
DC Current Gain (I_C = 15 Adc, V_{CE} = 5.0 V)		h_{FE}	75	—	1000	—
Collector–Emitter Saturation Voltage (I_C = 30 Adc, I_B = 1.2 Adc) (I_C = 60 Adc, I_B = 4.0 Adc) (I_C = 30 Adc, I_B = 1.2 Adc, T_C = 100°C)		$V_{CE(sat)}$	— — —	— — —	2.2 4.0 2.4	Vdc
Base–Emitter Saturation Voltage (I_C = 30 Adc, I_B = 1.2 Adc) (I_C = 30 Adc, I_B = 1.2 Adc, T_C = 100°C)		$V_{BE(sat)}$	— —	— —	3.0 3.5	Vdc
Diode Forward Voltage (I_F = 30 Adc)		V_f	—	2.5	5.0	Vdc
DYNAMIC CHARACTERISTICS						
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f_{test} = 1.0 kHz)		C_{ob}	175	—	700	pF
SWITCHING CHARACTERISTICS						
Resistive Load (Table 1)						
Delay Time	(V_{CC} = 175 Vdc, I_C = 30 A, I_{B1} = Adc, $V_{BE(off)}$ = 5.0 V, t_p = 25 µs Duty Cycle ≤ 2.0%).	t_d	—	0.02	0.2	µs
Rise Time		t_r	—	0.30	1.0	µs
Storage Time		t_s	—	1.0	3.5	µs
Fall Time		t_f	—	0.07	0.5	µs
Inductive Load, Clamped (Table 1)						
Storage Time	I_{CM} = 30 A(pk), V_{CEM} = 200 V, I_{B1} = 1.2 A, $V_{BE(off)}$ = 5 V, T_C = 100°C)	t_{sv}	—	1.2	3.5	µs
Crossover Time		t_c	—	0.45	2.0	µs
Storage Time	(I_{CM} = 30 A(pk), V_{CEM} = 200 V, I_{B1} = 1.2 A, $V_{BE(off)}$ = 5 V, T_C = 25°C)	t_{sv}	—	0.75	—	µs
Crossover Time		t_c	—	0.25	—	µs
Fall Time		t_{fi}	—	0.15	—	µs

(1) Pulse Test: PW = 300 µs, Duty Cycle ≤ 2%.