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MJ10022
MJ10023

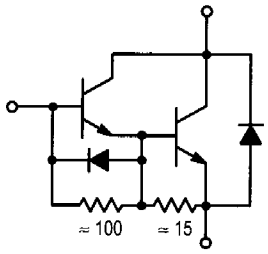
Designer's™ Data Sheet

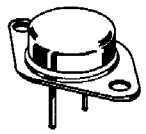
SWITCHMODE Series NPN Silicon Power Darlington Transistors with Base-Emitter Speedup Diode

40 AMPERE
NPN SILICON
POWER DARLINGTON
TRANSISTORS
350 AND 400 VOLTS
250 WATTS

The MJ10022 and MJ10023 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 @ 25°C (Typ)
  - 300 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





(TO–3)

MAXIMUM RATINGS

Rating	Symbol	MJ10022	MJ10023	Unit
Collector–Emitter Voltage	V_{CEO}	350	400	Vdc
Collector–Emitter Voltage	V_{CEV}	450	600	Vdc
Emitter Base Voltage	V_{EB}	80		Vdc
Collector Current — Continuous — Peak (1)	I_C I_{CM}	40 80		Adc
Base Current — Continuous — Peak (1)	I_B I_{BM}	20 40		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)	MJ10022 MJ10023	$V_{CEO(sus)}$	350 400	— —	— —	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 = O)		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 = 10 Adc, V_{CE} = 5.0 V)		h_{FE}	50	—	600	—
Collector–Emitter Saturation Voltage (I_C = 20 Adc, I_B = 1.0 Adc) (I_C = 40 Adc, I_B = 5.0 Adc) (I_C = 20 Adc, I_B = 10 Adc, T_C = 100°C)		$V_{CE(sat)}$	— — —	— — —	2.2 5.0 2.5	Vdc
Base–Emitter Saturation Voltage (I_C = 20 Adc, I_B = 1.2 Adc) (I_C = 20 Adc, I_B = 1.2 Adc, T_C = 100°C)		$V_{BE(sat)}$	— —	— —	2.5 2.5	Vdc
Diode Forward Voltage (I_F = 20 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}	150	—	600	pF
SWITCHING CHARACTERISTICS						
Resistive Load (Table 1)						
Delay Time	(V_{CC} = 250 Vdc, I_C = 20 A, I_{B1} = 1.0 Adc, $V_{BE(off)}$ = 5.0 V, t_p = 50 μs, Duty Cycle ≤ 2.0%)	t_d	—	0.03	0.2	μs
Rise Time		t_r	—	0.4	1.2	μs
Storage Time		t_s	—	0.9	2.5	μs
Fall Time		t_f	—	0.3	0.9	μs
Inductive Load, Clamped (Table 1)						
Storage Time	(I_{CM} = 20 A, V_{CEM} = 250 V, I_{B1} = 1.0 A, $V_{BE(off)}$ = 5 V, T_C = 100°C)	t_{sv}	—	1.9	4.4	μs
Crossover Time		t_c	—	0.6	2.0	μs
Fall Time		t_{fi}	—	0.3	—	μs
Storage Time	(I_{CM} = 20 A, V_{CEM} = 250 V, I_{B1} = 1.0 A, $V_{BE(off)}$ = 5 V, T_C = 25°C)	t_{sv}	—	1.0	—	μs
Crossover Time		t_c	—	0.3	—	μs
Fall Time		t_{fi}	—	0.15	—	μs

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