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MJ10009
Silicon NPN Transistor
HV Darlington Power Amp, Switch
TO−3 Type Package

Description:

The MJ10009 is a silicon NPN Darlington transistor in a TO−3 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°C), P_D 175W
  Derate Above +25°C . . . . . 1.0W/°C
Total Power Dissipation (T_C = +100°C), P_D 100W
Operating Junction Temperature Range, T_J . . . . . −65° to +200°C
Storage Temperature Range, T_{stg} . . . . . −65° to +200°C
Thermal Resistance, Junction−to−Case, R_{thJC} . . . . . 1.0°C/W
Lead Temperature (During Soldering, 1/8” from case, 5sec), T_L . . . . . +275°C

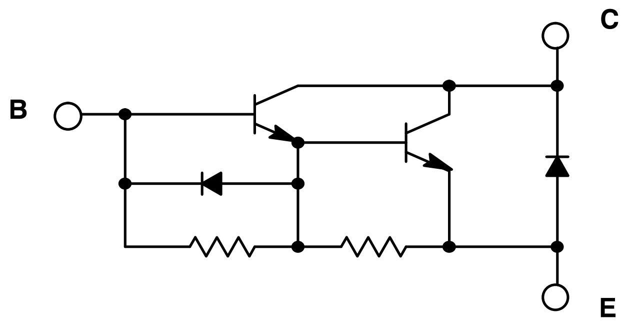
Note 1. Pulse test: Pulse Width = 5ms, Duty Cycle ≤ 10%.

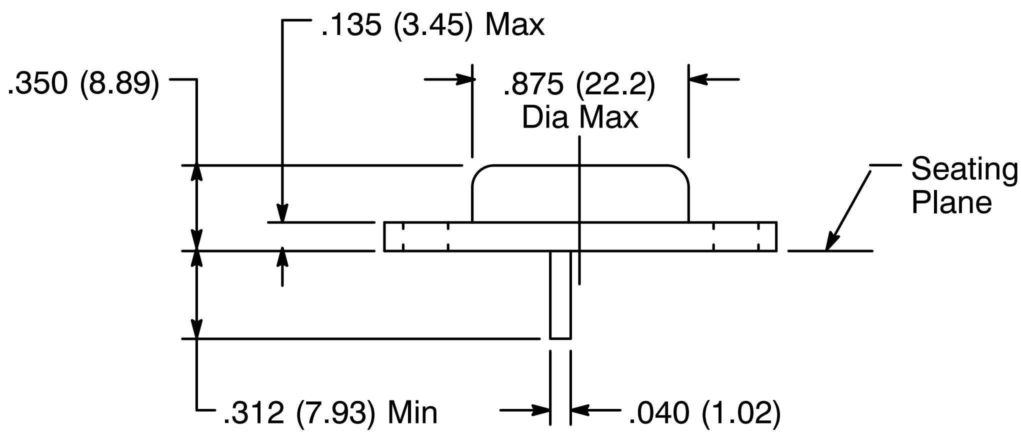
Electrical Characteristics: (T_C = +25°C unless otherwise specified)

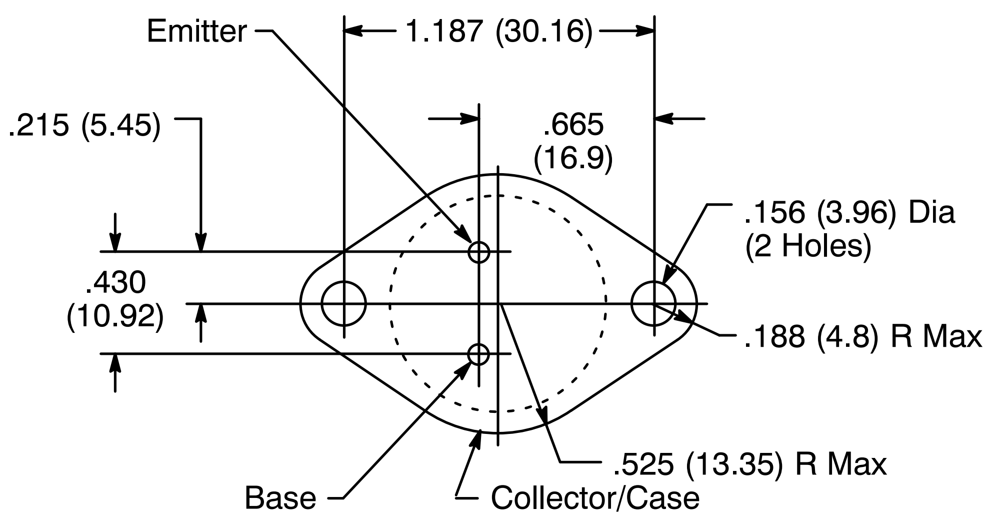
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
OFF Characteristics (Note 2)						
Collector–Emitter Sustaining Voltage	$V_{CEO(sus)}$	I_C = 100mA, I_B = 0, V_{clamp} = 500V	500	–	–	V
	$V_{CEX(sus)}$	I_C = 2A, V_{clamp} = 500V, T_C = +100°C	500	–	–	V
		I_C = 5A, V_{clamp} = 500V, T_C = +100°C	375	–	–	V
Collector Cutoff Current	I_{CEV}	V_{CEV} = 700V, $V_{BE(off)}$ = 1.5V	–	–	0.25	mA
		V_{CEV} = 700V, $V_{BE(off)}$ = 1.5V, T_C = +150°C	–	–	5.0	mA
	I_{CER}	V_{CE}= 700V, R_{BE}= 50Ω, T_C = +100°C	–	–	5.0	mA
Emitter Cutoff Current	I_{EBO}	V_{EB} = 2V, I_C = 0	–	–	175	mA
ON Characteristics (Note 3)						
DC Current Gain	h_{FE}	V_{CE} = 5V, I_C = 5A	40	–	400	
		V_{CE} = 5V, I_C = 10A	30	–	300	
Collector–Emitter Saturation Voltage	$V_{CE(sat)}$	I_C = 10A, I_B = 500mA	–	–	2.0	V
		I_C = 10A, I_B = 500mA, T_C = +100°C	–	–	2.5	V
		I_C = 20A, I_B = 2A	–	–	3.5	V
Base–Emitter Saturation Voltage	$V_{BE(sat)}$	I_C = 10A, I_B = 500mA	–	–	2.5	V
		I_C = 10A, I_B = 500mA, T_C = +100°C	–	–	2.5	V
Diode Forward Voltage	V_F	I_F = 5A, Note 3	–	3	5	V
Dynamic Characteristics						
Small–Signal Current Gain	h_{fe}	V_{CE} = 10V, I_C = 1A, f_{test} = 1MHz	8	–	–	
Output Capacitance	C_{ob}	V_{CB} = 50V, I_E = 0, f_{test} = 100kHz	100	–	325	pF
Switching Characteristics (Resistive Load)						
Delay Time	t_d	V_{CC} = 250V, I_C = 10A, I_{B1} = 500mA, $V_{BE(off)}$ = 5V, t_p = 50μs, Duty Cycle ≤ 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 = 10A Peak, V_{clamp} = 250V, I_{B1} = 500mA, $V_{BE(off)}$ = 5V, T_C = +100°C	–	1.5	3.5	μs
Crossover Time	t_c		–	0.36	1.6	μs
Storage Time	t_{sv}	I_C = 10A Peak, V_{clamp} = 250V, I_{B1} = 500mA, $V_{BE(off)}$ = 5V, T_C = +25°C	–	0.8	–	μs
Crossover Time	t_c		–	0.18	–	μs

Note 2. Pulse test: Pulse Width = 300μs, Duty Cycle ≤ 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.


C
B
E


.135 (3.45) Max
.350 (8.89)
.875 (22.2)
Dia Max
Seating
Plane
.312 (7.93) Min
.040 (1.02)


Emitter
1.187 (30.16)
.215 (5.45)
.665
(16.9)
.156 (3.96) Dia
(2 Holes)
.430
(10.92)
.188 (4.8) R Max
.525 (13.35) R Max
Base
Collector/Case