New Jersey Semi-Conductor Products, Inc.

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MJ8504
MJ8505

Designers Data Sheet

SWITCHMODE SERIES
NPN SILICON POWER TRANSISTORS

The MJ8504 and MJ8505 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 switch-mode applications such as:

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

Fast Turn-Off Times
- 75 ns Inductive Fall Time –25°C (typ)
- 150 ns Inductive Crossover Time –25°C (typ)
- 1.25 μs Inductive Storage Time –25°C (typ)

Operating Temperature Range –65 to + 200°C

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

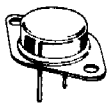
10 AMPERE

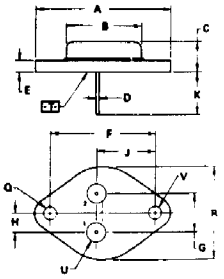
NPN SILICON POWER TRANSISTORS

700 and 800 VOLTS
175 WATTS

Designer's Data for "Worst Case" Conditions

The Designers Data Sheet permits the design of most circuits entirely from the information presented. Limit data – representing device characteristics boundaries are given to facilitate "worst case" design.





NOTES
1. DIMENSIONS Q AND V ARE DATUMS.
2. T IS SEATING PLANE AND DATUM.
3. POSITIONAL TOLERANCE FOR MOUNTING HOLE Q:
   ⌖ | ∅ 0.13 (0.005) M | T | V M |
   FOR LEADS:
   ⌖ | ∅ 0.13 (0.005) M T | V M | Q M |
4. DIMENSIONS AND TOLERANCES PER ANSI Y14.5, 1973.

STYLE 1
PIN 1. BASE
2. EMITTER
CASE COLLECTOR

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	–	39.37	–	1.550
B	–	21.08	–	0.830
C	6.35	7.62	0.250	0.300
D	0.97	1.09	0.038	0.043
E	–	3.43	–	0.135
F	30.15 BSC		1.187 BSC	
G	10.92 BSC		0.430 BSC	
H	5.46 BSC		0.215 BSC	
J	16.89 BSC		0.665 BSC	
K	11.18	12.19	0.440	0.480
Q	3.81	4.19	0.150	0.165
R	–	26.67	–	1.050
U	4.83	5.33	0.190	0.210
V	3.81	4.19	0.150	0.165

TO-3

MAXIMUM RATINGS

Rating	Symbol	MJ8504	MJ8505	Unit
Collector-Emitter Voltage	$V_{CEO(sus)}$	700	800	Vdc
Collector-Emitter Voltage	V_{CEV}	1200	1400	Vdc
Emitter Base Voltage	V_{EB}	8.0	8.0	Vdc
Collector Current – Continuous Peak (1)	I_C I_{CM}	10 15	10 15	Adc
Base Current – Continuous Peak (1)	I_B I_{BM}	8 12	8 12	Adc
Total Power Dissipation @ T_C = 25°C @ T_C = 100°C Derate above 25°C	P_D	175 100 1.0	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 ms, Duty Cycle ≤ 10%.

Quality Semi-Conductors

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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)	MJ8504 MJ8505	$V_{CEO(sus)}$	700 800	– –	– –	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} = 7.0 Vdc, I_C = 0)		I_{EBO}	–	–	1.0	mAdc
SECOND BREAKDOWN						
Second Breakdown Collector Current with base forward biased		$I_{S/b}$	See Figure 12			
Clamped Inductive SOA with Base Reverse Biased		RBSOA	See Figure 13			
ON CHARACTERISTICS (1)						
DC Current Gain (I_C = 1.5 Adc, V_{CE} = 5.0 Vdc)		h_{FE}	7.5	–	–	–
Collector-Emitter Saturation Voltage (I_C = 5.0 Adc, I_B = 2.0 Adc) (I_C = 10 Adc, I_B = 4.0 Adc) (I_C = 5.0 Adc, I_B = 2.0 Adc, T_C = 100°C)		$V_{CE(sat)}$	– – –	– – –	2.0 5.0 3.0	Vdc
Base-Emitter Saturation Voltage (I_C = 5.0 Adc, I_B = 2.0 Adc) (I_C = 5.0 Adc, I_B = 2.0 Adc, T_C = 100°C)		$V_{BE(sat)}$	– –	– –	1.5 1.5	Vdc
DYNAMIC CHARACTERISTICS						
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f_{test} = 1.0 kHz)		C_{ob}	90	–	450	pF
SWITCHING CHARACTERISTICS						
Resistive Load (Table 1)						
Delay Time	(V_{CC} = 500 Vdc, I_C = 5.0 A, I_{B1} = 2.0 A, $V_{BE(off)}$ = 5.0 Vdc, t_p = 50 μs, Duty Cycle ≤ 2.0%)	t_d	–	0.050	0.20	μs
Rise Time		t_r	–	0.175	2.0	μs
Storage Time		t_s	–	1.25	4.0	μs
Fall Time		t_f	–	0.60	2.0	μs
Inductive Load, Clamped (Table 1)						
Storage Time	(I_C = 5.0 A(pk), V_{clamp} = 500 Vdc, I_{B1} = 2.0 A, $V_{BE(off)}$ = 5 Vdc, T_C = 100°C	t_{sv}	–	1.75	5.5	μs
Crossover Time		t_c	–	0.400	2.0	μs
Storage Time	(I_C = 5.0 A(pk), V_{clamp} = 500 Vdc, I_{B1} = 2.0 A, $V_{BE(off)}$ = 5 Vdc, T_C = 25°C)	t_{sv}	–	1.25	–	μs
Crossover Time		t_c	–	0.150	–	μs
Fall Time		t_{fi}	–	0.075	–	μs

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