New Jersey Semi-Conductor Products, Inc.

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SPRINGFIELD, NEW JERSEY 07081
U.S.A.

MJE16002*
MJE16004*

*Motorola Preferred Device

SWITCHMODE Series
NPN Silicon Power Transistors

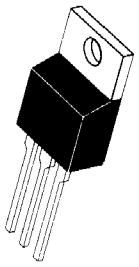
5.0 AMPERE
NPN SILICON
POWER TRANSISTORS
450 VOLTS
80 WATTS

These transistors are designed for high–voltage, high–speed switching of inductive circuits where fall time and RBSOA are critical. They are particularly well–suited for line–operated switchmode applications.

The MJE16004 is a high–gain version of the MJE16002 and MJH16002 for applications where drive current is limited.

Typical Applications:

- Switching Regulators
- High Resolution Deflection Circuits
- Inverters
- Motor Drives
- Fast Switching Speeds
  - 50 ns Inductive Fall Time @ 75°C (Typ)
  - 70 ns Crossover Time @ 75°C (Typ)
- 100°C Performance Specified for:
  - Reverse–Biased SOA
  - Inductive Switching Times
  - Saturation Voltages
  - Leakage Currents



TO–220AB

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	$V_{CEO(sus)}$	450	Vdc
Collector–Emitter Voltage	V_{CEV}	850	Vdc
Emitter–Base Voltage	V_{EB}	6.0	Vdc
Collector Current — Continuous — Peak (1)	I_C I_{CM}	5.0 10	Adc
Base Current — Continuous — Peak (1)	I_B I_{BM}	4.0 8.0	Adc
Total Power Dissipation @ T_C = 25°C @ T_C = 100°C Derate above T_C = 25°C	P_D	80 32 0.64	Watts W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.56	°C/W
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%.

Designer's Data for "Worst Case" Conditions — The Designer's Data Sheet permits the design of most circuits entirely from the information presented. SOA Limit curves — representing boundaries on device characteristics — are given to facilitate "worst case" design.

Preferred devices are Motorola recommended choices for future use and best overall value.

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

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (1)						
Collector–Emitter Sustaining Voltage (Table 2) (I_C = 100 mA, I_B = 0)		$V_{CEO(sus)}$	450	—	—	Vdc
Collector Cutoff Current (V_{CEV} = 850 Vdc, $V_{BE(off)}$ = 1.5 Vdc) (V_{CEV} = 850 Vdc, $V_{BE(off)}$ = 1.5 Vdc, T_C = 100°C)		I_{CEV}	— —	— —	0.25 1.5	mAdc
Collector Cutoff Current (V_{CE} = 850 Vdc, R_{BE} = 50 Ω, T_C = 100°C)		I_{CER}	—	—	2.5	mAdc
Emitter Cutoff Current (V_{EB} = 6.0 Vdc, I_C = 0)		I_{EBO}	—	—	1.0	mAdc
SECOND BREAKDOWN						
Second Breakdown Collector Current with Base Forward Biased		$I_{S/b}$	See Figure 17 or 18			
Clamped Inductive SOA with Base Reverse Biased		RBSOA	See Figure 19			
ON CHARACTERISTICS (1)						
Collector–Emitter Saturation Voltage		$V_{CE(sat)}$				Vdc
(I_C = 1.5 Adc, I_B = 0.2 Adc)	MJE16002		—	—	1.0	
(I_C = 1.5 Adc, I_B = 0.15 Adc)	MJE16004		—	—	1.0	
(I_C = 3.0 Adc, I_B = 0.4 Adc)	MJE16002		—	—	2.5	
(I_C = 3.0 Adc, I_B = 0.3 Adc)	MJE16004		—	—	2.5	
(I_C = 3.0 Adc, I_B = 0.4 Adc, T_C = 100°C)	MJE16002		—	—	2.5	
(I_C = 3.0 Adc, I_B = 0.3 Adc, T_C = 100°C)	MJE16004		—	—	2.5	
Base–Emitter Saturation Voltage		$V_{BE(sat)}$				Vdc
(I_C = 3.0 Adc, I_B = 0.4 Adc)	MJE16002		—	—	1.5	
(I_C = 3.0 Adc, I_B = 0.3 Adc)	MJE16004		—	—	1.5	
(I_C = 3.0 Adc, I_S = 0.4 Adc, T_C = 100°C)	MJE16002		—	—	1.5	
(I_C = 3.0 Adc, I_B = 0.3 Adc, T_C = 100°C)	MJE16004		—	—	1.5	
DC Current Gain		h_{FE}				—
(I_C = 5.0 Adc, V_{CE} = 5.0 Vdc)	MJE16002		5.0	—	—	
	MJE16004		7.0	—	—	
DYNAMIC CHARACTERISTICS						
Output Capacitance (V_{CB} = 10 Vdc, I_E = 0, f_{test} = 1.0 kHz)		C_{ob}	—	—	200	pF
SWITCHING CHARACTERISTICS						
Resistive Load (Table 1) **MJE16002/MJH10002**						
Delay Time	(I_C = 3.0 Adc, V_{CC} = 250 Vdc, I_{B1} = 0.4 Adc, PW = 30 µs, Duty Cycle ≤ 2.0%) (I_{B2} = 0.8 Adc, R_{B2} = 8.0 Ω)	t_d	—	30	100	ns
Rise Time		t_r	—	100	300	
Storage Time		t_s	—	1000	3000	
Fall Time		t_f	—	60	300	
Storage Time	($V_{BE(off)}$ = 5.0 Vdc)	t_s	—	400	—	
Fall Time		t_f	—	130	—	
Resistive Load (Table 1) **MJE16004/MJH16004**						
Delay Time	(I_C = 3.0 Adc, V_{CC} = 250 Vdc, I_{B1} = 0.3 Adc, PW = 30 µs, Duty Cycle ≤ 2.0%) (I_{B2} = 0.6 Adc, R_{B2} = 8.0 Ω)	t_d	—	30	100	ns
Rise Time		t_r	—	130	300	
Storage Time		t_s	—	800	2700	
Fall Time		t_f	—	80	350	
Storage Time	($V_{BE(off)}$ = 5.0 Vdc)	t_s	—	250	—	
Fall Time		t_f	—	60	—	

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

SWITCHING CHARACTERISTICS (continued)

Characteristics			Symbol	Min	Typ	Max	Unit
Inductive Load (Table 2) **MJE16002**							
Storage Time	(I_C = 3.0 Adc, I_{B1} = 0.4 Adc, $V_{BE(off)}$ = 5.0 Vdc, $V_{CE(pk)}$ = 400 Vdc)	(T_J = 100°C)	t_{sv}	—	500	1600	ns
Fall Time			t_{fi}	—	100	200	
Crossover Time			t_c	—	120	250	
Storage Time		(T_J = 150°C)	t_{sv}	—	600	—	
Fall Time			t_{fi}	—	120	—	
Crossover Time			t_c	—	160	—	
Inductive Load (Table 2) **MJE16004**							
Storage Time	(I_C = 3.0 Adc, I_{B1} = 0.3 Adc, $V_{BE(off)}$ = 5.0 Vdc, $V_{CE(pk)}$ = 400 Vdc)	(T_J = 100°C)	t_{sv}	—	400	1300	ns
Fall Time			t_{fi}	—	80	150	
Crossover Time			t_c	—	90	200	
Storage Time		(T_J = 150°C)	t_{sv}	—	450	—	
Fall Time			t_{fi}	—	100	—	
Crossover Time			t_c	—	110	—	

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