

20 STERN AVE.
SPRINGFIELD, NEW JERSEY 07081
U.S.A.

SWITCHMODE Series NPN Silicon Power Transistors

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.

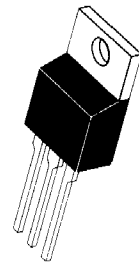
Typical Applications:

- 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

MJE16002*
MJE16004*

*Motorola Preferred Device

**5.0 AMPERE
NPN SILICON
POWER TRANSISTORS
450 VOLTS
80 WATTS**



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	I_C	5.0	Adc
— Peak (1)	I_{CM}	10	
Base Current — Continuous	I_B	4.0	Adc
— Peak (1)	I_{BM}	8.0	
Total Power Dissipation @ $T_C = 25^\circ\text{C}$	P_D	80	Watts
@ $T_C = 100^\circ\text{C}$		32	
Derate above $T_C = 25^\circ\text{C}$		0.64	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 \leq 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.



NJ Semi-Conductors reserves the right to change test conditions, parameter limits and package dimensions without notice. Information furnished by NJ Semi-Conductors is believed to be both accurate and reliable at the time of going to press. However, NJ Semi-Conductors assumes no responsibility for any errors or omissions discovered in its use. NJ Semi-Conductors encourages customers to verify that datasheets are current before placing orders.

MJE16002 MJE16004

ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (1)					
Collector-Emitter Sustaining Voltage (Table 2) ($I_C = 100\text{ mA}$, $I_B = 0$)	$V_{CEO(sus)}$	450	—	—	Vdc
Collector Cutoff Current ($V_{CEV} = 850\text{ Vdc}$, $V_{BE(off)} = 1.5\text{ Vdc}$) ($V_{CEV} = 850\text{ Vdc}$, $V_{BE(off)} = 1.5\text{ Vdc}$, $T_C = 100^\circ\text{C}$)	I_{CEV}	—	—	0.25 1.5	mAdc
Collector Cutoff Current ($V_{CE} = 850\text{ Vdc}$, $R_{BE} = 50\ \Omega$, $T_C = 100^\circ\text{C}$)	I_{CER}	—	—	2.5	mAdc
Emitter Cutoff Current ($V_{EB} = 6.0\text{ Vdc}$, $I_C = 0$)	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 ($I_C = 1.5\text{ Adc}$, $I_B = 0.2\text{ Adc}$) ($I_C = 1.5\text{ Adc}$, $I_B = 0.15\text{ Adc}$) ($I_C = 3.0\text{ Adc}$, $I_B = 0.4\text{ Adc}$) ($I_C = 3.0\text{ Adc}$, $I_B = 0.3\text{ Adc}$) ($I_C = 3.0\text{ Adc}$, $I_B = 0.4\text{ Adc}$, $T_C = 100^\circ\text{C}$) ($I_C = 3.0\text{ Adc}$, $I_B = 0.3\text{ Adc}$, $T_C = 100^\circ\text{C}$)	MJE16002 MJE16004 MJE16002 MJE16004 MJE16002 MJE16004	$V_{CE(sat)}$	— — — — — —	— — — — — —	1.0 1.0 2.5 2.5 2.5 2.5	Vdc
Base-Emitter Saturation Voltage ($I_C = 3.0\text{ Adc}$, $I_B = 0.4\text{ Adc}$) ($I_C = 3.0\text{ Adc}$, $I_B = 0.3\text{ Adc}$) ($I_C = 3.0\text{ Adc}$, $I_S = 0.4\text{ Adc}$, $T_C = 100^\circ\text{C}$) ($I_C = 3.0\text{ Adc}$, $I_B = 0.3\text{ Adc}$, $T_C = 100^\circ\text{C}$)	MJE16002 MJE16004 MJE16002 MJE16004	$V_{BE(sat)}$	— — — —	— — — —	1.5 1.5 1.5 1.5	Vdc
DC Current Gain ($I_C = 5.0\text{ Adc}$, $V_{CE} = 5.0\text{ Vdc}$)	MJE16002 MJE16004	h_{FE}	5.0 7.0	— —	— —	—

DYNAMIC CHARACTERISTICS

Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f_{test} = 1.0\text{ kHz}$)	C_{ob}	—	—	200	pF
--	----------	---	---	-----	----

SWITCHING CHARACTERISTICS

Resistive Load (Table 1) MJE16002/MJH10002								
Delay Time	$I_C = 3.0\text{ Adc}$, $V_{CC} = 250\text{ Vdc}$, $I_{B1} = 0.4\text{ Adc}$, $PW = 30\ \mu\text{s}$, Duty Cycle $\leq 2.0\%$	$(I_{B2} = 0.8\text{ Adc}$, $R_{B2} = 8.0\ \Omega)$	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			$(V_{BE(off)} = 5.0\text{ Vdc})$	t_s	—	400		—
Fall Time				t_f	—	130		—
Resistive Load (Table 1) MJE16004/MJH16004								
Delay Time	$I_C = 3.0\text{ Adc}$, $V_{CC} = 250\text{ Vdc}$, $I_{B1} = 0.3\text{ Adc}$, $PW = 30\ \mu\text{s}$, Duty Cycle $\leq 2.0\%$	$(I_{B2} = 0.6\text{ Adc}$, $R_{B2} = 8.0\ \Omega)$	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			$(V_{BE(off)} = 5.0\text{ Vdc})$	t_s	—	250		—
Fall Time				t_f	—	60		—

(1) Pulse Test: $PW = 300\ \mu\text{s}$, Duty Cycle $\leq 2\%$.

MJE16002 MJE16004

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 _{CCE(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 _{CCE(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%.