

T-35-19

5-A *SwitchMax* II Power Transistors

High-Voltage N-P-N Types for Off-Line Power Supplies and Other High-Voltage Switching Applications

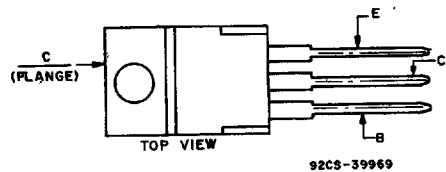
Features:

- Fast switching speed
- High-voltage ratings:
V_{CEV} = 850 V
- Low V_{CE(sat)} at I_c = 3A

Applications:

- Off-line power supplies
- High-voltage inverters
- Switching regulators

TERMINAL DESIGNATIONS



JEDEC TO-220AB

The MJE16002 and MJE16004 *SwitchMax* II series of silicon n-p-n power transistors feature high-voltage capability, fast switching speeds, and low saturation voltages, together with high safe-operating-area (SOA) ratings. They are specially designed for off-line power supplies, converter circuits, and pulse-width-modulated regulators. These high-voltage, high-speed transistors are tested for parameters

that are essential to the design of high-power switching circuits. Switching times, including inductive turn-off time, saturation voltages are specified at 100°C to provide information necessary for worst-case design.

These transistors are supplied in the JEDEC TO-220AB (VERSAWATT) plastic package.

MAXIMUM RATINGS, Absolute-Maximum Values:

V _{CEV}	850	V
V _{BE} = -1.5 V	450	V
V _{CEO}	6	V
V _{EBO}	3	A
I _{C(sat)}	5	A
I _C	10	A
I _{CM}	4	A
I _B	8	A
I _{BM}		
P _T	80	W
@ T _C = 25°C	32	W
@ T _C = 100°C	0.64	W/°C
T _C above 25°C, derate linearly	-65 to +150	°C
T _{stg} , T _J		
TL		
At distance ≥ 1/8" in. (3.17 mm) from seating plane for 10 s max	235	°C
R _{θJC}	1.56	°C/W

**MJE16002
MJE16004**

	850	V
	450	V
	6	V
	3	A
	5	A
	10	A
	4	A
	8	A
	80	W
	32	W
	0.64	W/°C
	-65 to +150	°C
	235	°C
	1.56	°C/W

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

T-35-19

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (1)					
Collector-Emitter Sustaining Voltage (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 1
Clamped Inductive SOA with Base Reverse Biased	RBSOA			See Figure 2

ON CHARACTERISTICS (1)

Collector-Emitter Saturation Voltage (I _C = 1.5 Adc, I _B = 0.2 Adc) MJE16002 (I _C = 1.5 Adc, I _B = 0.15 Adc) MJE16004 (I _C = 3.0 Adc, I _B = 0.4 Adc) MJE16002 (I _C = 3.0 Adc, I _B = 0.3 Adc) MJE16004 (I _C = 3.0 Adc, I _B = 0.4 Adc, T _C = 100°C) MJE16002 (I _C = 3.0 Adc, I _B = 0.3 Adc, T _C = 100°C) MJE16004	V _{CE(sat)}	—	0.5 0.5 1.2 1.2 — —	1.0 1.0 2.5 2.5 2.5 2.5	Vdc
Base-Emitter Saturation Voltage (I _C = 3.0 Adc, I _B = 0.4 Adc) MJE16002 (I _C = 3.0 Adc, I _B = 0.3 Adc) MJE16004 (I _C = 3.0 Adc, I _B = 0.4 Adc, T _C = 100°C) MJE16002 (I _C = 3.0 Adc, I _B = 0.3 Adc, T _C = 100°C) MJE16004	V _{BE(sat)}	—	1.0 1.0 — —	1.5 1.5 1.5 1.5	Vdc
DC Current Gain (I _C = 5.0 Adc, V _{CE} = 5.0 Vdc) MJE16002 MJE16004	h _{FE}	5.0 7.0	— —	— —	—

DYNAMIC CHARACTERISTICS

Output Capacitance (V _{CB} = 10 Vdc, I _E = 0, f _{test} = 1.0 kHz)	C _{ob}	—	—	200	pF
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SWITCHING CHARACTERISTICS

Resistive Load		MJE16002						
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	—	40	100	ns	
Rise Time			t _r	—	80	300		
Storage Time			t _s	—	900	3000		
Fall Time			t _f	—	20	300		
Storage Time			t _s	—	330	—		
Fall Time			t _f	—	100	—		
Resistive Load		MJE16004						
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	—	40	100	ns	
Rise Time			t _r	—	110	300		
Storage Time			t _s	—	750	2700		
Fall Time			t _f	—	150	350		
Storage Time			t _s	—	270	—		
Fall Time			t _f	—	90	—		

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

POWER TRANSISTORS

SWITCHING CHARACTERISTICS (continued)

Characteristics			Symbol	Min	Typ	Max	Unit
Inductive Load MJE16002							
Storage Time	$I_C = 3.0 \text{ Adc}$ $I_{B1} = 0.4 \text{ Adc}$	$(T_J = 100^\circ\text{C})$	t_{sv}	—	660	1600	ns
Fall Time			t_{fi}	—	50	200	
Crossover Time			t_c	—	80	250	
Storage Time	$V_{BE(off)} = 5.0 \text{ Vdc}$ $V_{CE(pk)} = 400 \text{ Vdc}$	$(T_J = 150^\circ\text{C})$	t_{sv}	—	690	—	
Fall Time			t_{fi}	—	50	—	
Crossover Time			t_c	—	90	—	
Inductive Load MJE16004							
Storage Time	$I_C = 3.0 \text{ Adc}$ $I_{B1} = 0.3 \text{ Adc}$	$(T_J = 100^\circ\text{C})$	t_{sv}	—	530	1300	ns
Fall Time			t_{fi}	—	40	150	
Crossover Time			t_c	—	80	200	
Storage Time	$V_{BE(off)} = 5.0 \text{ Vdc}$ $V_{CE(pk)} = 400 \text{ Vdc}$	$(T_J = 150^\circ\text{C})$	t_{sv}	—	600	—	
Fall Time			t_{fi}	—	40	—	
Crossover Time			t_c	—	80	—	

(1) Pulse Test PW - 300 μs . Duty Cycle $\leq 2\%$

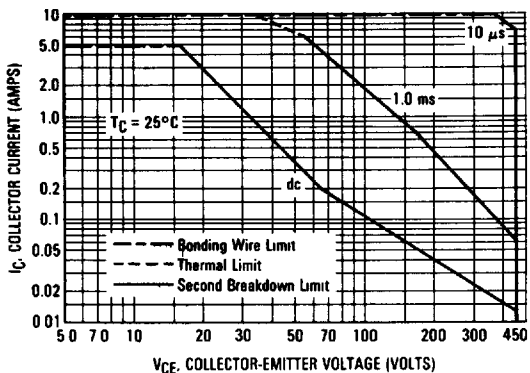


Fig. 1 — Maximum forward-bias safe-operating-areas for both types.

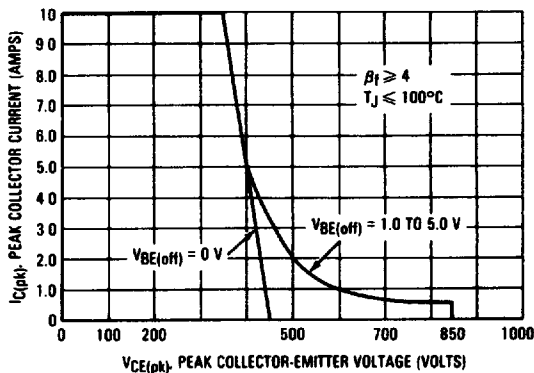


Fig. 2 — Maximum reverse-bias safe-operating-areas for both types.

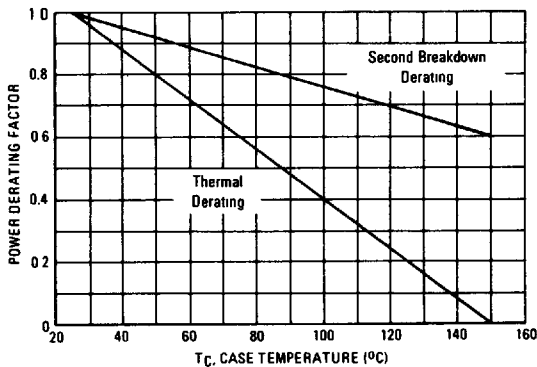


Fig. 3 — Dissipation and $I_{s,b}$ derating curves for both types.