

MJ16010, MJ16012, MJH16010, MJH16012

HARRIS SEMICONDUCTOR

27E D

4302271 0020450 4 HAS

T-33-15
T-33-135-A **SwitchMax II** Power Transistors

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

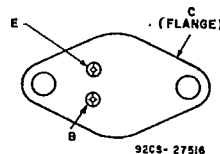
Features:

- Fast switching speed
- High-voltage ratings.
 $V_{CEV} = 850$ V
- Low $V_{CE(sat)}$ at $I_C = 10$ A

Applications:

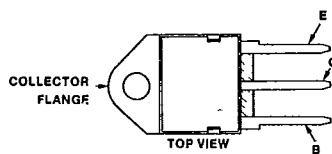
- Off-line power supplies
- High-voltage inverters
- Switching regulators

TERMINAL DESIGNATIONS

MJ16010
MJ16012

JEDEC TO-204AA

(200 mil diameter pin isolation)

MJH16010
MJH16012

JEDEC TO-218AC

92CS-40257

The MJ16010, MJ16012, MJH16010, and MJH16012 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, and saturation voltages are specified at 100°C to provide information necessary for worst-case design.

The MJ16010 and MJ16012 transistors are supplied in steel JEDEC TO-204AA hermetic packages. The MJH16010 and MJH16012 transistors are supplied in JEDEC TO-218AC plastic packages.

MAXIMUM RATINGS, Absolute-Maximum Values:

	MJ16010 MJ16012	MJH16010 MJH16012	
V_{CEV}			
$V_{BE} = -15$ V	850		V
V_{CEO}	450		V
V_{EBO}	6		V
$I_C(sat)$	10		A
I_C	15		A
I_{CM}	20		A
I_B	10		A
I_{BM}	15		A
P_T			
@ $T_C = 25^\circ\text{C}$	175	135	W
@ $T_C = 100^\circ\text{C}$	100	53.8	W
T_C above 25°C , derate linearly	1	1.08	W/ $^\circ\text{C}$
T_{stg}	-65 to 200	-65 to 150	$^\circ\text{C}$
T_L			
At distance $\geq 1/8$ " (3.17 mm) from seating plane for 10 s max		235	$^\circ\text{C}$
T_L			
At distance $\geq 1/16$ " (1.58 mm) from seating plane for 10 s max	235		$^\circ\text{C}$
$R_{\theta JC}$	1	0.93	$^\circ\text{C/W}$

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (1)					
Collector-Emitter Sustaining Voltage ($I_C = 100\text{ mA}$, $I_B = 0$)	$V_{CEO(sus)}$	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	mA
Collector Cutoff Current ($V_{CE} = 850\text{ Vdc}$, $R_{BE} = 50\ \Omega$, $T_C = 100^\circ\text{C}$)	I_{CER}	—	—	2.5	mA
Emitter Cutoff Current ($V_{EB} = 6.0\text{ Vdc}$, $I_C = 0$)	I_{EBO}	—	—	1.0	mA

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 ($I_C = 5.0\text{ Adc}$, $I_B = 0.7\text{ Adc}$) ($I_C = 10\text{ Adc}$, $I_B = 1.3\text{ Adc}$) ($I_C = 10\text{ Adc}$, $I_B = 1.3\text{ Adc}$, $T_C = 100^\circ\text{C}$)	$V_{CE(sat)}$	— — —	0.5 1.0 —	2.5 3.0 3.0	Vdc
Base-Emitter Saturation Voltage ($I_C = 10\text{ Adc}$, $I_B = 1.3\text{ Adc}$) ($I_C = 10\text{ Adc}$, $I_B = 1.3\text{ Adc}$, $T_C = 100^\circ\text{C}$)	$V_{BE(sat)}$	— —	1.0 —	1.5 1.5	Vdc
DC Current Gain ($I_C = 15\text{ Adc}$, $V_{CE} = 5.0\text{ Vdc}$)	h_{FE}	5.0	—	—	—

DYNAMIC CHARACTERISTICS

Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f_{test} = 1.0\text{ kHz}$)	C_{ob}	—	—	400	pF
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SWITCHING CHARACTERISTICS

Resistive Load							
Delay Time	$I_C = 10\text{ Adc}$, $V_{CC} = 250\text{ Vdc}$, $I_{B1} = 1.3\text{ Adc}$, $PW = 30\text{ }\mu\text{s}$, Duty Cycle $\leq 2.0\%$	$I_{B2} = 2.6\text{ Adc}$, $R_B = 1.6\text{ }\Omega$	t_d	—	40	—	ns
Rise Time			t_r	—	100	—	
Storage Time			t_s	—	1400	—	
Fall Time			t_f	—	140	—	
Storage Time			t_s	—	600	—	
Fall Time			t_f	—	100	—	
$(V_{BE(off)} = 5.0\text{ Vdc})$							
Inductive Load							
Storage Time	$I_C = 10\text{ Adc}$, $I_{B1} = 1.3\text{ Adc}$, $V_{BE(off)} = 5.0\text{ Vdc}$, $V_{CE(pk)} = 400\text{ Vdc}$	$(T_C = 100^\circ\text{C})$	t_{sv}	—	800	1800	ns
Fall Time			t_{fi}	—	50	200	
Crossover Time			t_c	—	100	250	
Storage Time		$(T_C = 150^\circ\text{C})$	t_{sv}	—	860	—	
Fall Time			t_{fi}	—	40	—	
Crossover Time			t_c	—	80	—	

(1) Pulse Test Pulse Width = $300\ \mu\text{s}$, Duty Cycle $\leq 2.0\%$

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

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS (1)

Collector-Emitter Sustaining Voltage ($I_C = 100\text{ mA}$, $I_B = 0$)	$V_{CE(sus)}$	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	mA _{dc}
Collector Cutoff Current ($V_{CE} = 850\text{ Vdc}$, $R_{BE} = 50\ \Omega$, $T_C = 100^\circ\text{C}$)	I_{CER}	—	—	2.5	mA _{dc}
Emitter Cutoff Current ($V_{EB} = 6.0\text{ Vdc}$, $I_C = 0$)	I_{EBO}	—	—	1.0	mA _{dc}

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 ($I_C = 5.0\text{ Adc}$, $I_B = 0.5\text{ Adc}$) ($I_C = 10\text{ Adc}$, $I_B = 1.0\text{ Adc}$) ($I_C = 10\text{ Adc}$, $I_B = 1.0\text{ Adc}$, $T_C = 100^\circ\text{C}$)	$V_{CE(sat)}$	— — —	— — —	2.5 3.0 3.0	Vdc
Base-Emitter Saturation Voltage ($I_C = 10\text{ Adc}$, $I_B = 1.0\text{ Adc}$) ($I_C = 10\text{ Adc}$, $I_B = 1.0\text{ Adc}$, $T_C = 100^\circ\text{C}$)	$V_{BE(sat)}$	— —	— —	1.5 1.5	Vdc
DC Current Gain ($I_C = 15\text{ Adc}$, $V_{CE} = 5.0\text{ Vdc}$)	h_{FE}	7.0	—	—	—

DYNAMIC CHARACTERISTICS

Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f_{test} = 1.0\text{ kHz}$)	C_{ob}	—	—	400	pF
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SWITCHING CHARACTERISTICS

Resistive Load							
Delay Time	(I _C = 10 Adc, V _{CC} = 250 Vdc, I _{B1} = 1 0 Adc, PW = 30 μs, Duty Cycle ≤2 0%)	(I _{B2} = 2 0 Adc, R _B = 1 6 Ω)	t _d	—	40	—	ns
Rise Time			t _r	—	100	—	
Storage Time			t _s	—	1400	—	
Fall Time			t _f	—	140	—	
Storage Time			t _s	—	600	—	
Fall Time			t _f	—	100	—	
Inductive Load							
Storage Time	(I _C = 10 Adc, I _{B1} = 1 0 Adc, V _{BE(off)} = 5 0 Vdc, V _{CE(pk)} = 400 Vdc)	(T _C = 100°C)	t _{sv}	—	800	1500	ns
Fall Time			t _{fi}	—	50	150	
Crossover Time			t _c	—	100	200	
Storage Time		(T _C = 150°C)	t _{sv}	—	860	—	
Fall Time			t _{fi}	—	40	—	
Crossover Time			t _c	—	80	—	

(1) Pulse Test Pulse Width = 300 μs , Duty Cycle $\leq 2.0\%$

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T-33-13

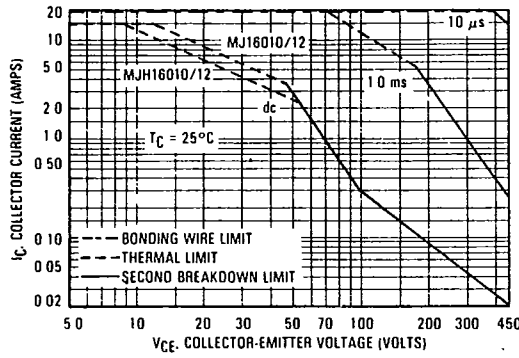


Fig. 1 — Maximum forward-bias safe-operating-areas for all types.

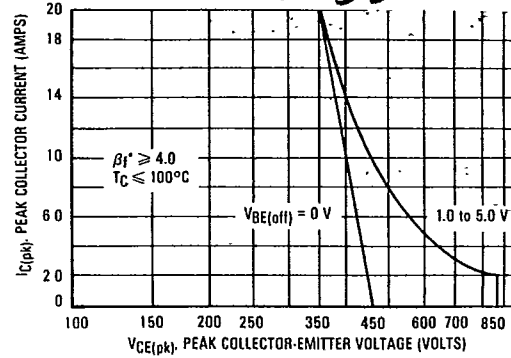


Fig. 2 — Maximum reverse-bias safe-operating-areas for all types.

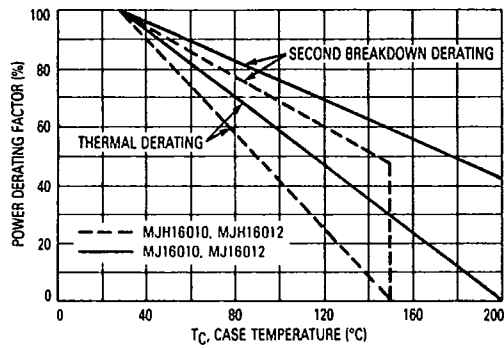
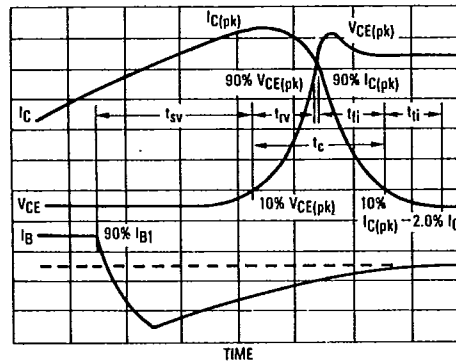
Fig. 3 — Dissipation and $I_{s, o}$ derating curves for all types.

Fig. 4 — Inductive switching measurements display.