

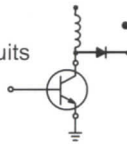
Designer's™ Data Sheet

SWITCHMODE Series

NPN Silicon Power Transistors

These 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 switchmode applications. The MJ16012 and MJW16012 are selected high gain versions of the MJ16010 and MJW16010 for applications where drive current is limited.

- Switching Regulators
- Inverters
- Solenoids
- Relay Drivers
- Motor Controls
- Deflection Circuits
- Fast Turn-Off Times — $T_C = 100^\circ\text{C}$
 - 50 ns Inductive Fall Time (Typ)
 - 90 ns Inductive Crossover Time (Typ)
 - 800 ns Inductive Storage Time (Typ)
- 100°C Performance Specified for:
 - Reverse-Biased SOA with Inductive Loads
 - Switching Times with Inductive Loads
 - Saturation Voltages
 - Leakage Currents



MJ16010
MJW16010
MJ16012*
MJW16012*

15 AMPERE
NPN SILICON
POWER TRANSISTORS
450 VOLTS
135 AND 175 WATTS

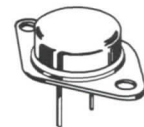
MAXIMUM RATINGS

Rating	Symbol	MJ16010 MJ16012	MJW16010 MJW16012	Unit
Collector-Emitter Voltage	V_{CEO}	450		Vdc
Collector-Emitter Voltage	V_{CEV}	850		Vdc
Emitter-Base Voltage	V_{EB}	6.0		Vdc
Collector Current — Continuous	I_C	15		Adc
— Peak (1)	I_{CM}	20		
Base Current — Continuous	I_B	10		Adc
— Peak (1)	I_{BM}	15		
Total Device Dissipation	P_D			Watts
@ $T_C = 25^\circ\text{C}$		1.75	1.35	
@ $T_C = 100^\circ\text{C}$		100	53.8	
Derate above 25°C		1.0	1.11	W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to 200	-55 to 150	$^\circ\text{C}$

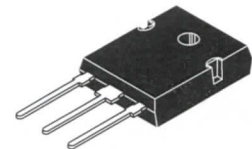
THERMAL CHARACTERISTICS

Characteristic	Symbol	Max		Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.0	0.93	$^\circ\text{C}/\text{W}$
Lead Temperature for Soldering Purposes, 1/8" from Case for 5 Seconds	T_L	275		$^\circ\text{C}$

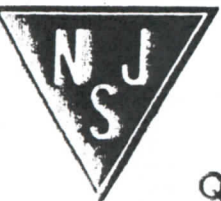
(1) Pulse Test: Pulse Width $\leq 50 \mu\text{s}$, Duty Cycle $\geq 10\%$



(TO-3)
MJ16010
MJ16012



TO-247AE
MJW16010
MJW16012



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MJ16010 MJW16010 MJ16012 MJW16012

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
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}	—	—	10	mAdc

SECOND BREAKDOWN

Second Breakdown Collector Current with Base Forward Biased	$I_{S/b}$	See Figure 15			
Clamped Inductive SOA with Base Reverse Biased	RBSOA	See Figure 16			

ON CHARACTERISTICS (1)

Collector-Emitter Saturation Voltage ($I_C = 5.0\text{ Adc}$, $I_B = 0.7\text{ Adc}$) ($I_C = 10\text{ Adc}$, $I_B = 1.3\text{ Adc}$) ($I_C = 10\text{ Adc}$, $I_B = 1.3\text{ Adc}$, $T_C = 100^\circ\text{C}$)	$V_{CE(sat)}$	—	—	2.5 3.0 3.0	Vdc
Base-Emitter Saturation Voltage ($I_C = 10\text{ Adc}$, $I_B = 1.3\text{ Adc}$) ($I_C = 10\text{ Adc}$, $I_B = 1.3\text{ Adc}$, $T_C = 100^\circ\text{C}$)	$V_{BE(sat)}$	—	—	1.5 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 (Table 1)							
Delay Time	$(I_C = 10\text{ Adc}$, $V_{CC} = 250\text{ Vdc}$, $I_{B1} = 1.3\text{ Adc}$, $PW = 30\ \mu\text{s}$, Duty Cycle $\leq 2.0\%$)	$(I_{B2} = 2.6\text{ Adc}$, $R_{B2} = 1.6\ \Omega)$	t_d	—	20	—	ns
Rise Time			t_r	—	200	—	
Storage Time			t_s	—	1200	—	
Fall Time			t_f	—	200	—	
Storage Time		$(V_{BE(off)} = 5.0\text{ Vdc})$	t_s	—	650	—	
Fall Time			t_f	—	80	—	
Inductive Load (Table 2)							
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	—	90	250	
Storage Time		$(T_C = 150^\circ\text{C})$	t_{sv}	—	1050	—	
Fall Time			t_{fi}	—	70	—	
Crossover Time			t_c	—	120	—	

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

MJ16010 MJW16010 MJ16012 MJW16012

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

Characteristic	Symbol	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

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}	—	—	10	mAdc

SECOND BREAKDOWN

Second Breakdown Collector Current with Base Forward Biased	$I_{S/b}$	See Figure 15			
Clamped Inductive SOA with Base Reverse Biased	RBSOA	See Figure 16			

ON CHARACTERISTICS (1)

Collector–Emitter Saturation Voltage ($I_C = 5.0\text{ Adc}$, $I_B = 0.7\text{ Adc}$) ($I_C = 10\text{ Adc}$, $I_B = 1.0\text{ Adc}$) ($I_C = 10\text{ Adc}$, $I_B = 1.0\text{ Adc}$, $T_C = 100^\circ\text{C}$)	$V_{CE(sat)}$	—	—	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 (Table 1)							
Delay Time	$(I_C = 10\text{ Adc}$, $V_{CC} = 250\text{ Vdc}$, $I_{B1} = 1.0\text{ Adc}$, $PW = 30\ \mu\text{s}$, Duty Cycle $\leq 2.0\%$)	$(I_{B2} = 2.0\text{ Adc}$, $R_{B2} = 1.6\ \Omega)$	t_d	—	20	—	ns
Rise Time			t_r	—	200	—	
Storage Time			t_s	—	900	—	
Fall Time		t_f	—	150	—		
Storage Time		$(V_{BE(off)} = 5.0\text{ Vdc})$	t_s	—	500	—	
Fall Time			t_f	—	40	—	
Inductive Load (Table 2)							
Storage Time	$(I_C = 10\text{ Adc}$, $I_{B1} = 1.0\text{ Adc}$, $V_{BE(off)} = 5.0\text{ Vdc}$, $V_{CE(pk)} = 400\text{ Vdc}$)	$(T_C = 100^\circ\text{C})$	t_{sv}	—	650	1500	ns
Fall Time			t_{fi}	—	30	150	
Crossover Time			t_c	—	50	200	
Storage Time		$(T_C = 150^\circ\text{C})$	t_{sv}	—	850	—	
Fall Time			t_{fi}	—	30	—	
Crossover Time			t_c	—	70	—	

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