

MJ14001 (PNP), MJ14002* (NPN), MJ14003* (PNP)

*Preferred Devices

High-Current Complementary Silicon Power Transistors

Designed for use in high-power amplifier and switching circuit applications.

- High Current Capability –
 I_C Continuous = 60 Amperes
- DC Current Gain –
 $h_{FE} = 15-100$ @ $I_C = 50$ Adc
- Low Collector-Emitter Saturation Voltage –
 $V_{CE(sat)} = 2.5$ Vdc (Max) @ $I_C = 50$ Adc

MAXIMUM RATINGS

Rating	Symbol	MJ14001	MJ14002 MJ14003	Unit
Collector-Emitter Voltage	V_{CEO}	60	80	Vdc
Collector Base Voltage	V_{CBO}	60	80	Vdc
Emitter-Base Voltage	V_{EBO}		5.0	Vdc
Collector Current – Continuous	I_C		60	Adc
Base Current – Continuous	I_B		15	Adc
Emitter Current – Continuous	I_E		75	
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D		300	Watts
			1.71	W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}		-65 to +200	$^\circ\text{C}$

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	0.584	$^\circ\text{C/W}$

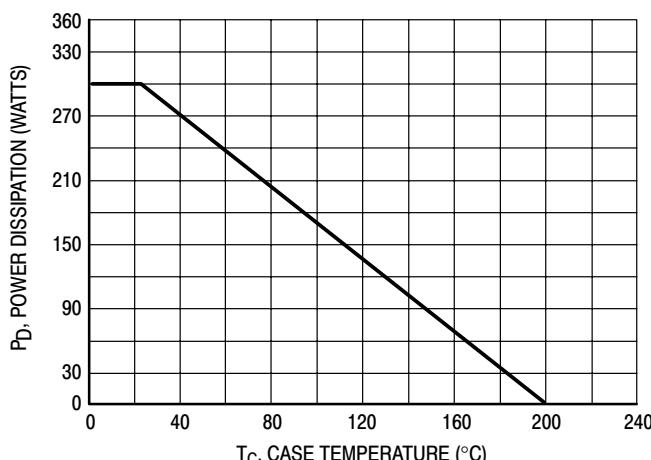


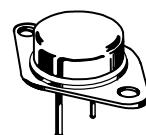
Figure 1. Power Derating



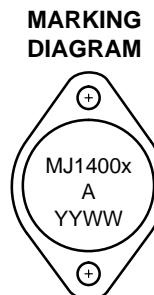
ON Semiconductor®

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COMPLEMENTARY SILICON
POWER TRANSISTORS
60 AMPERES
60-80 VOLTS
300 WATTS



TO-204 (TO-3)
STYLE 1
CASE 197A



MJ1400x = Device Code
A = Assembly Location
YY = Year
WW = Work Week
x = 1, 2, or 3

ORDERING INFORMATION

Device	Package	Shipping
MJ14001	TO-3	100 Units/Tray
MJ14002	TO-3	100 Units/Tray
MJ14003	TO-3	100 Units/Tray

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

MJ14001 (PNP), MJ14002* (NPN), MJ14003* (PNP)

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector-Emitter Sustaining Voltage (Note 1) ($I_C = 200 \text{ mA}_\text{dc}$, $I_B = 0$)	$V_{\text{CEO}(\text{sus})}$	60	—	Vdc
		80	—	
Collector Cutoff Current ($V_{\text{CE}} = 30 \text{ Vdc}$, $I_B = 0$) ($V_{\text{CE}} = 40 \text{ Vdc}$, $I_B = 0$)	I_{CEO}	—	1.0	mA
		—	1.0	
Collector Cutoff Current ($V_{\text{CE}} = 60 \text{ Vdc}$, $V_{\text{BE}(\text{off})} = 1.5 \text{ V}$) ($V_{\text{CE}} = 80 \text{ Vdc}$, $V_{\text{BE}(\text{off})} = 1.5 \text{ V}$)	I_{CEX}	—	1.0	mA
		—	1.0	
Collector Cutoff Current ($V_{\text{CB}} = 60 \text{ Vdc}$, $I_E = 0$) ($V_{\text{CB}} = 80 \text{ Vdc}$, $I_E = 0$)	I_{CBO}	—	1.0	mA
		—	1.0	
Emitter Cutoff Current ($V_{\text{BE}} = 5.0 \text{ Vdc}$, $I_C = 0$)	I_{EBO}	—	1.0	mA
ON CHARACTERISTICS				
DC Current Gain (Note 1) ($I_C = 25 \text{ Adc}$, $V_{\text{CE}} = 3.0 \text{ V}$) ($I_C = 50 \text{ Adc}$, $V_{\text{CE}} = 3.0 \text{ V}$) ($I_C = 60 \text{ Adc}$, $V_{\text{CE}} = 3.0 \text{ V}$)	h_{FE}	30	—	—
		15	100	
		5.0	—	
Collector-Emitter Saturation Voltage (Note 1) ($I_C = 25 \text{ Adc}$, $I_B = 2.5 \text{ Adc}$) ($I_C = 50 \text{ Adc}$, $I_B = 5.0 \text{ Adc}$) ($I_C = 60 \text{ Adc}$, $I_B = 12 \text{ Adc}$)	$V_{\text{CE}(\text{sat})}$	—	1.0	Vdc
		—	2.5	
		—	3.0	
Base-Emitter Saturation Voltage (Note 1) ($I_C = 25 \text{ Adc}$, $I_B = 2.5 \text{ Adc}$) ($I_C = 50 \text{ Adc}$, $I_B = 5.0 \text{ Adc}$) ($I_C = 60 \text{ Adc}$, $I_B = 12 \text{ Adc}$)	$V_{\text{BE}(\text{sat})}$	—	2.0	Vdc
		—	3.0	
		—	4.0	
DYNAMIC CHARACTERISTICS				
Output Capacitance ($V_{\text{CB}} = 10 \text{ Vdc}$, $I_E = 0$, $f = 0.1 \text{ MHz}$)	C_{ob}	—	2000	pF

1. Pulse Test: Pulse Width = 300 μs , Duty Cycle $\leq 2\%$.

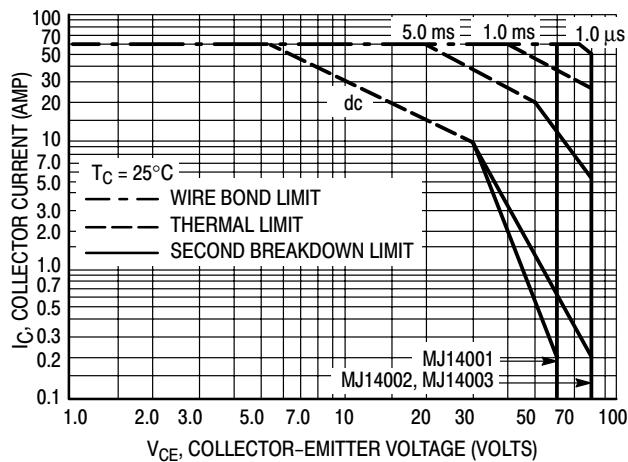


Figure 2. Maximum Rated Forward Biased Safe Operating Area

There are two limitations on the power handling ability of a transistor: average junction temperature and second breakdown. Safe operating area curves indicate $I_C - V_{\text{CE}}$ limits of the transistor that must be observed for reliable operation: i.e., the transistor must not be subjected to greater dissipation than the curves indicate.

The data of Figure 2 is based on $T_{\text{J}(\text{pk})} = 200^\circ\text{C}$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{\text{J}(\text{pk})} \leq 200^\circ\text{C}$. $T_{\text{J}(\text{pk})}$ may be calculated from the data in Figure 13. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

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TYPICAL ELECTRICAL CHARACTERISTICS

MJ14002 (NPN)

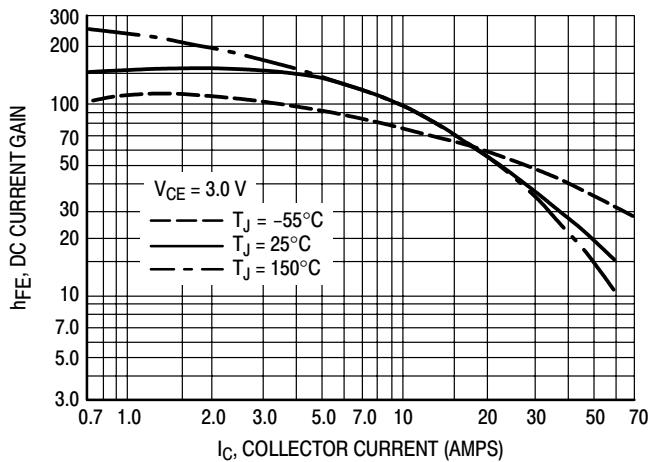


Figure 3. DC Current Gain

MJ14001, MJ14003 (PNP)

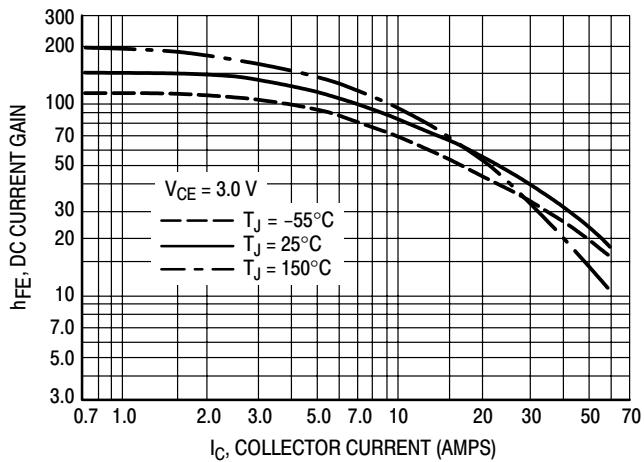


Figure 4. DC Current Gain

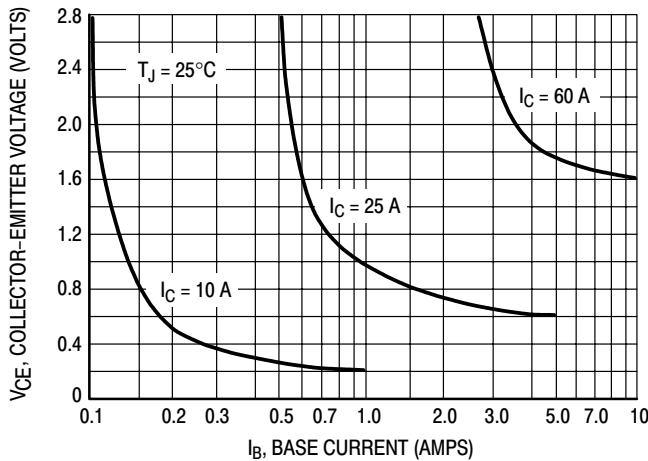


Figure 5. Collector Saturation Region

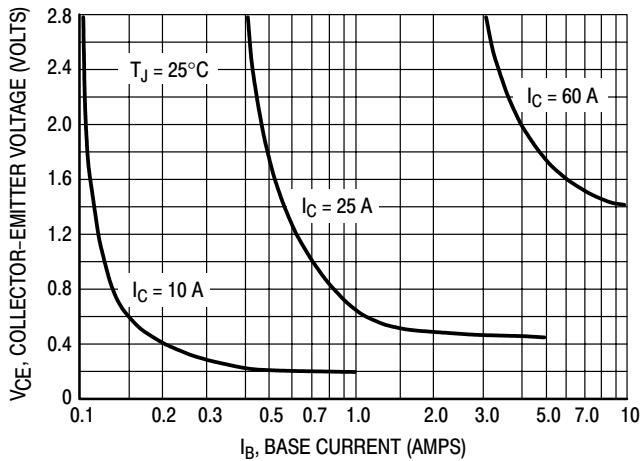


Figure 6. Collector Saturation Region

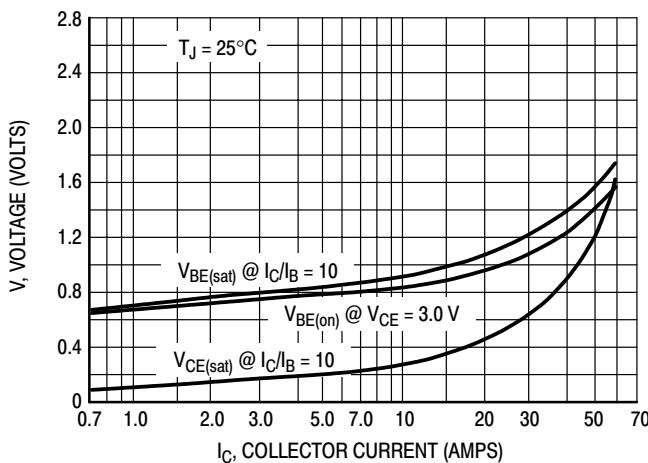


Figure 7. "On" Voltages

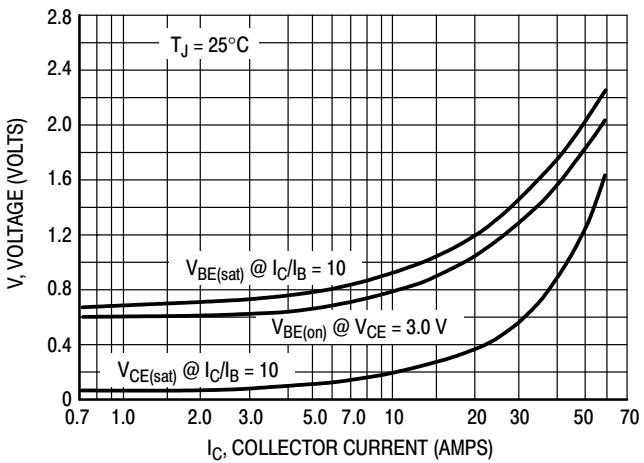


Figure 8. "On" Voltages

MJ14001 (PNP), MJ14002* (NPN), MJ14003* (PNP)

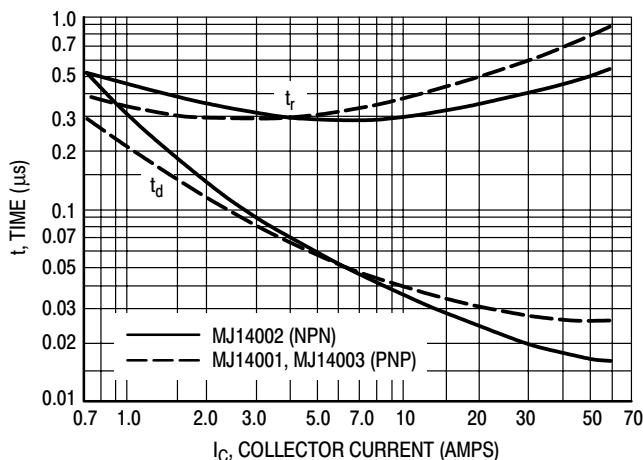


Figure 9. Turn-On Switching Times

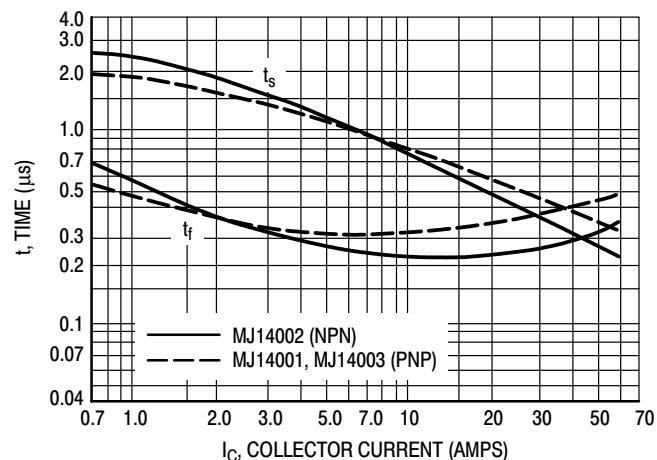


Figure 10. Turn-Off Switching Times

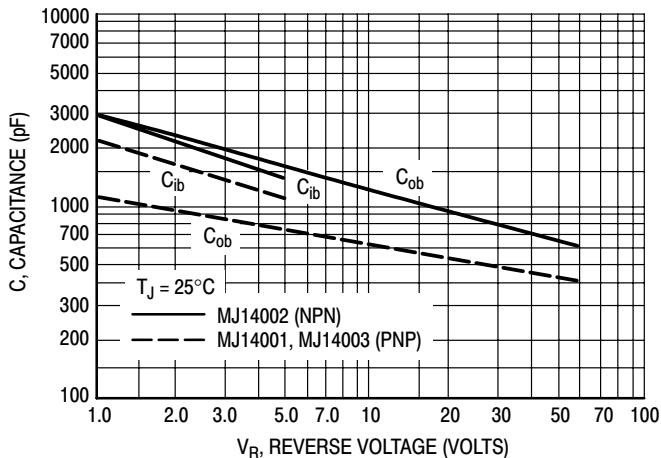
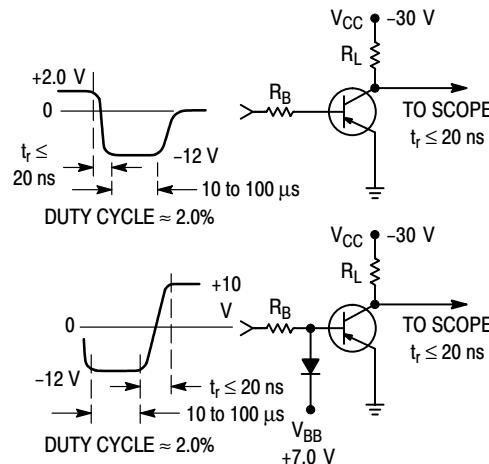


Figure 11. Capacitance Variation



FOR CURVES OF FIGURES 3 & 6, R_B & R_L ARE VARIED.
INPUT LEVELS ARE APPROXIMATELY AS SHOWN.
FOR NPN CIRCUITS, REVERSE ALL POLARITIES.

Figure 12. Switching Test Circuit

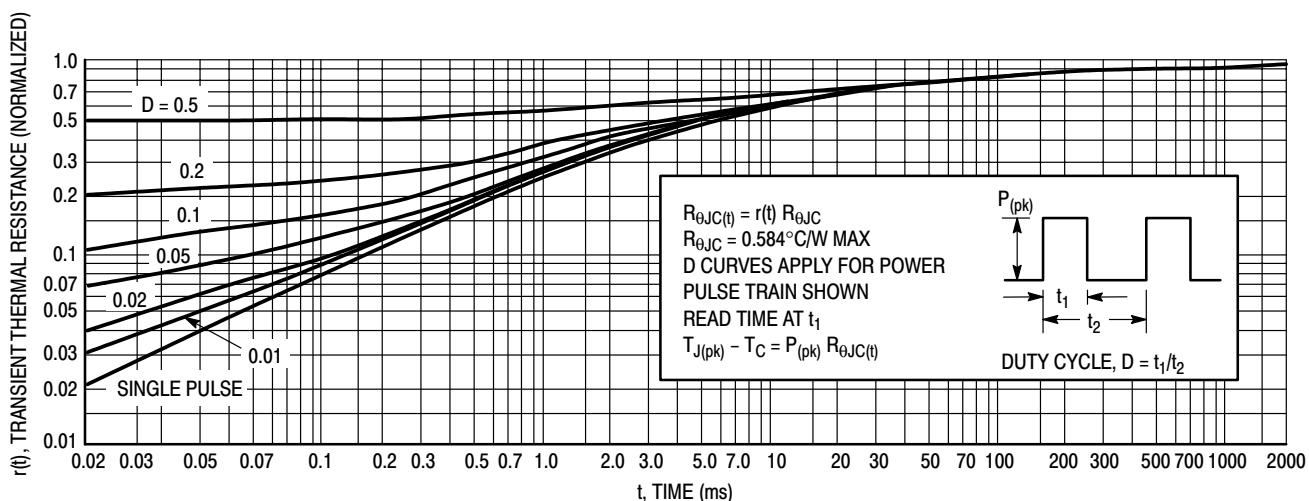
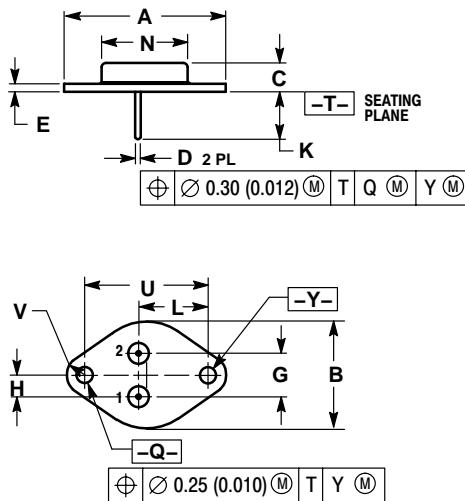


Figure 13. Thermal Response

PACKAGE DIMENSIONS

TO-204 (TO-3)
CASE 197A-05
ISSUE K



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	1.530	REF	38.86	REF
B	0.990	1.050	25.15	26.67
C	0.250	0.335	6.35	8.51
D	0.057	0.063	1.45	1.60
E	0.060	0.070	1.53	1.77
G	0.430	BSC	10.92	BSC
H	0.215	BSC	5.46	BSC
K	0.440	0.480	11.18	12.19
L	0.665	BSC	16.89	BSC
N	0.760	0.830	19.31	21.08
Q	0.151	0.165	3.84	4.19
U	1.187	BSC	30.15	BSC
V	0.131	0.188	3.33	4.77

STYLE 1:
 PIN 1. BASE
 2. Emitter
 CASE: COLLECTOR

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