MJF31C (NPN), MJF32C (PNP)

Preferred Device

Complementary Silicon Plastic Power Transistors for Isolated Package Applications

Designed for use in general purpose amplifier and switching applications.

Features

- Collector−Emitter Saturation Voltage −
  $V_{CE(sat)} = 1.2$ Vdc (Max) @ $I_C = 3.0$ Adc
- Collector−Emitter Sustaining Voltage −
  $V_{CEO(sus)} = 100$ Vdc (Min)
- High Current Gain − Bandwidth Product
  $f_T = 3.0$ MHz (Min) @ $I_C = 500$ mAdc
- UL Recognized, File #E69369, to 3500 V_{RMS} Isolation
- Pb−Free Packages are Available*

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector−Emitter Voltage	V_{CEO}	100	Vdc
Collector−Base Voltage	V_{CB}	100	Vdc
Emitter−Base Voltage	V_{EB}	5.0	Vdc
Collector CurrentUnclamped Inductive Load Energy (Note 1) – Continuous – Peak	I_C	3.0 5.0	Adc
Base Current	I_B	1.0	Adc
Total Power Dissipation @ $T_C = 25°C$ Derate above 25°C	P_D	28 0.22	W W/°C
Total Power Dissipation @ $T_A = 25°C$ Derate above 25°C	P_D	2.0 0.016	W W/°C
Unclamped Inductive Load Energy (Note 1)	E	32	mJ
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction−to−Ambient	$R_{\theta JC}$	62.5	°C/W
Thermal Resistance, Junction−to−Case	$R_{\theta JC}$	4.46	°C/W

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

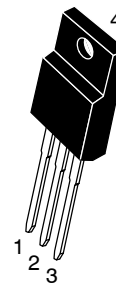1. $I_C = 1.8$ A, L = 20 mH, P.R.F. = 10 Hz, $V_{CC} = 10$ V, $R_{BE} = 100 \Omega$.

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.
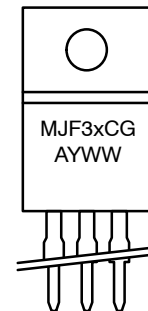
ON Semiconductor®

http://onsemi.com

**3.0 AMPERE
POWER TRANSISTORS
COMPLEMENTARY SILICON
100 VOLTS, 28 WATTS**

TO−220 FULLPAK
CASE 221D
STYLE 2

MARKING DIAGRAM

MJF3xCG
AYWW

x = 1 or 2
G = Pb−Free Package
A = Assembly Location
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping
MJF31C	TO−220 FULLPAK	50 Units/Rail
MJF31CG	TO−220 FULLPAK (Pb−Free)	50 Units/Rail
MJF32C	TO−220 FULLPAK	50 Units/Rail
MJF32CG	TO−220 FULLPAK (Pb−Free)	50 Units/Rail

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

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

Characteristic	Symbol	Min	Max	Unit
OFF CHARACTERISTICS				
Collector−Emitter Sustaining Voltage (Note 2) (I_C = 30 mAdc, I_B = 0)	$V_{CEO(sus)}$	100	–	Vdc
Collector Cutoff Current (I_C = 3.0 Adc, V_{CE} = 4.0 Vdc)	I_{CEO}	–	0.3	mAdc
Collector Cutoff Current	I_{CES}	–	200	μAdc
Emitter Cutoff Current (V_{BE} = 5.0 Vdc, I_C = 0)	I_{EBO}	–	1.0	mAdc
ON CHARACTERISTICS (Note 2)				
DC Current Gain (I_C = 1.0 Adc, V_{CE} = 4.0 Vdc) (I_C = 3.0 Adc, V_{CE} = 4.0 Vdc)	h_{FE}	25 10	– 50	–
Collector−Emitter Saturation Voltage (I_C = 3.0 Adc, I_B = 375 mAdc)	$V_{CE(sat)}$	–	1.2	Vdc
Base−Emitter On Voltage (I_C = 3.0 Adc, V_{CE} = 4.0 Vdc)	$V_{BE(on)}$	–	1.8	Vdc
DYNAMIC CHARACTERISTICS				
Current−Gain − Bandwidth Product (I_C = 500 mAdc, V_{CE} = 10 Vdc, f_{test} = 1.0 MHz)	f_T	3.0	–	MHz
Small−Signal Current Gain (I_C = 0.5 Adc, V_{CE} = 10 Vdc, f = 1.0 kHz)	h_{fe}	20	–	–

2. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.

Figure 1. Power Derating

t_1 ≤ 7.0 ns
100 < t_2 < 500 μs
t_3 < 15 ns

DUTY CYCLE ≈ 2.0%
APPROX − 9.0 V
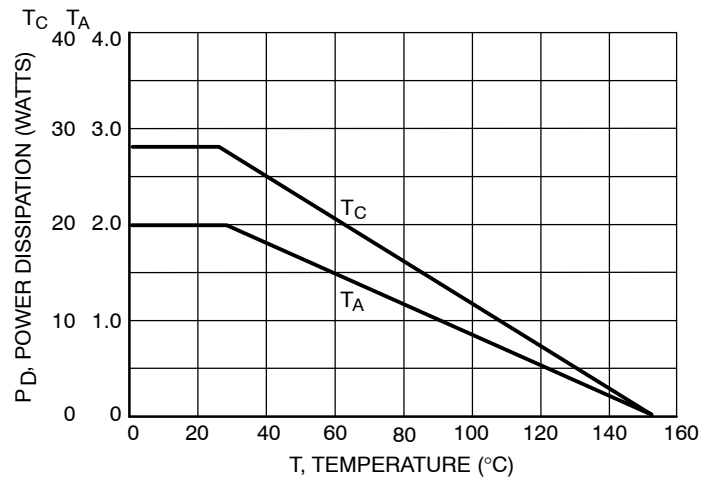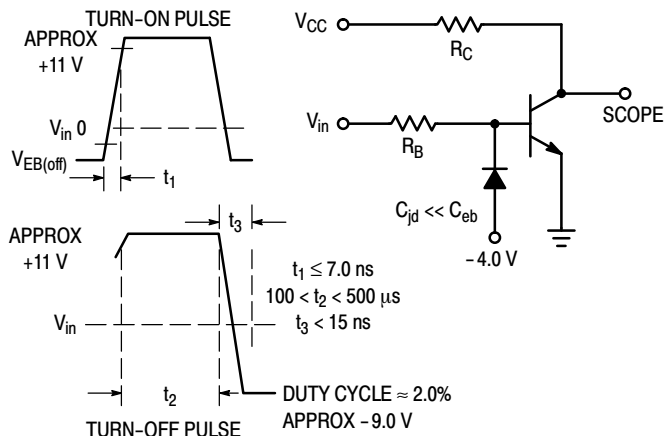
R_B and R_C VARIED TO OBTAIN DESIRED CURRENT LEVELS
Figure 2. Switching Time Equivalent Circuit
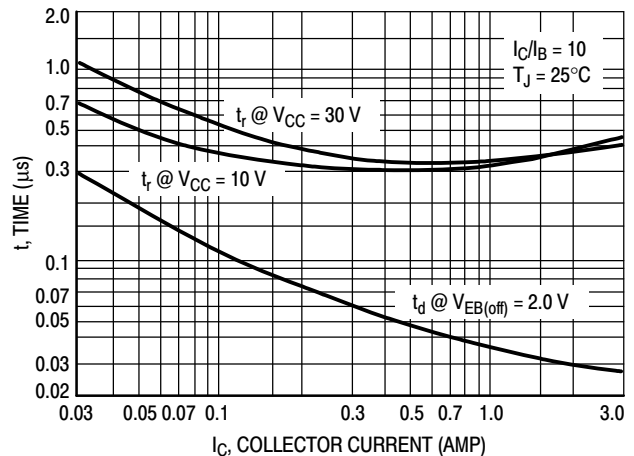
Figure 3. Turn−On Time
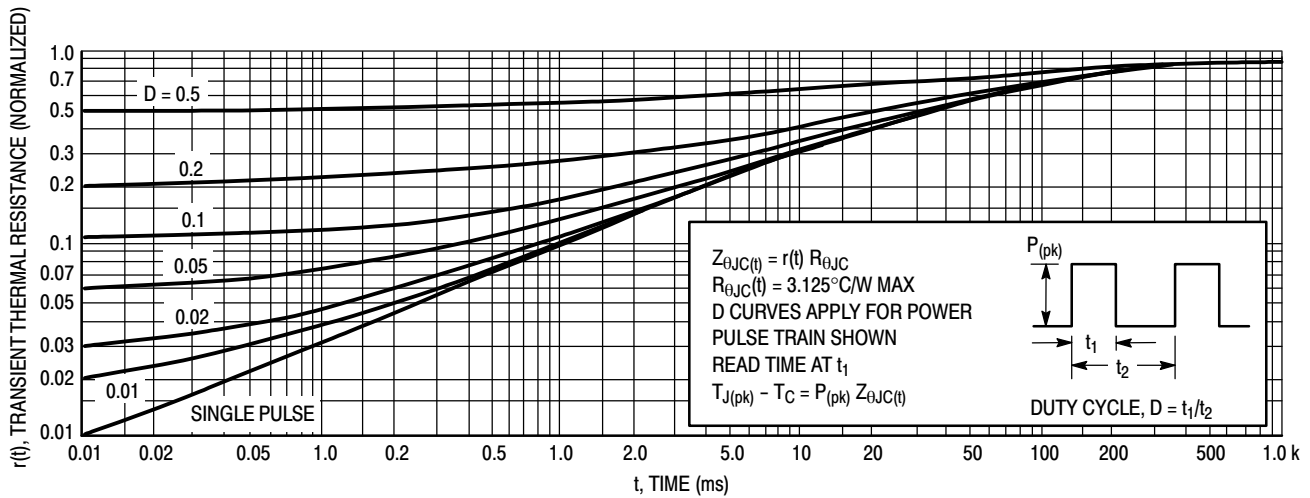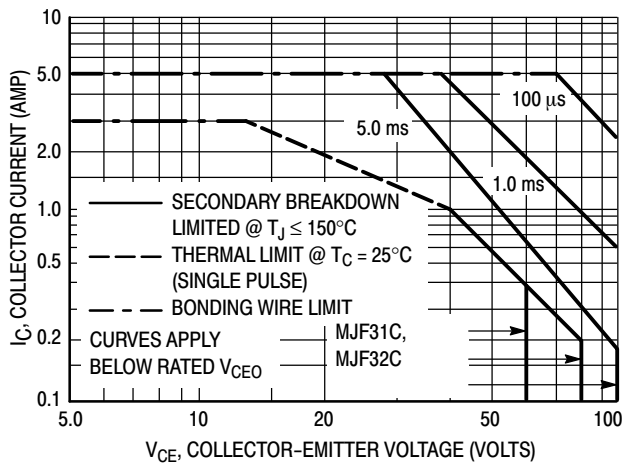
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$$Z_{\theta JC(t)} = r(t) \, R_{\theta JC}$$
$R_{\theta JC}(t) = 3.125°C/W \text{ MAX}$
D CURVES APPLY FOR POWER
PULSE TRAIN SHOWN
READ TIME AT t_1
$T_{J(pk)} - T_C = P_{(pk)} \, Z_{\theta JC(t)}$

DUTY CYCLE, $D = t_1/t_2$

Figure 4. Thermal Response

Figure 5. Active Region 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 $I_C - V_{CE}$ 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 5 is based on $T_{J(pk)} = 150°C$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 150°C$. $T_{J(pk)}$ may be calculated from the data in Figure 4. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

Figure 6. Turn−Off Time

Figure 7. Capacitance

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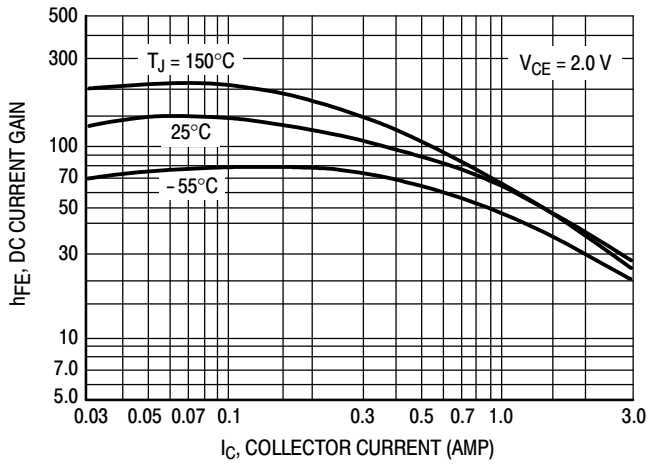
Figure 8. DC Current Gain
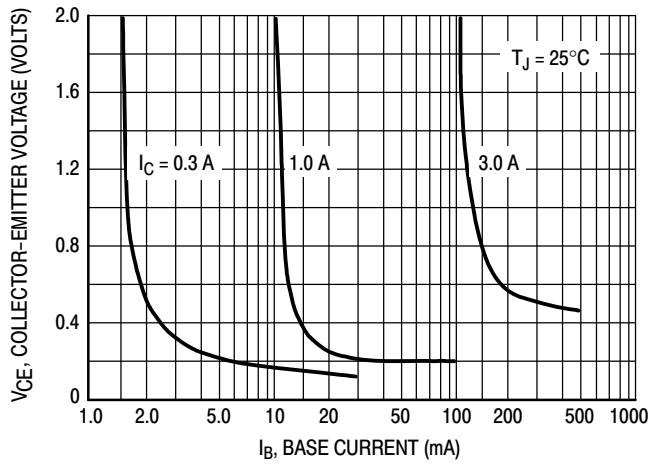
Figure 9. Collector Saturation Region
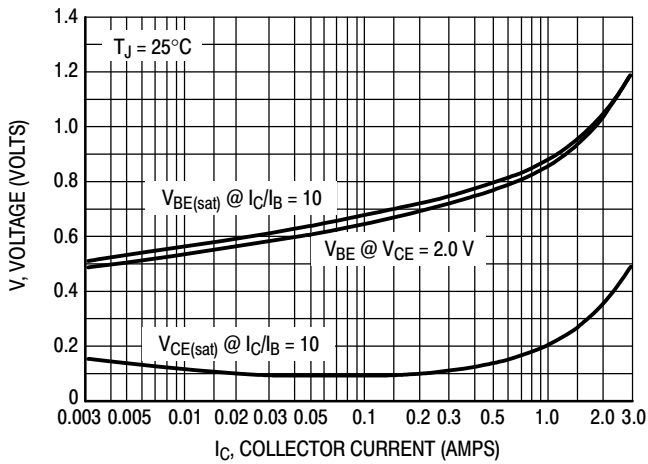
Figure 10. "On" Voltages
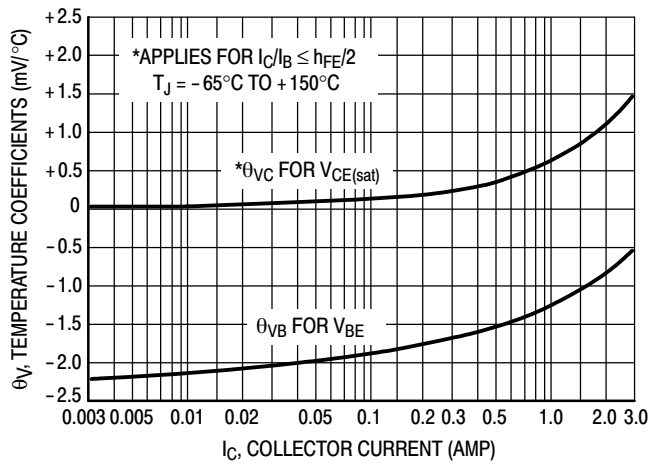
Figure 11. Temperature Coefficients
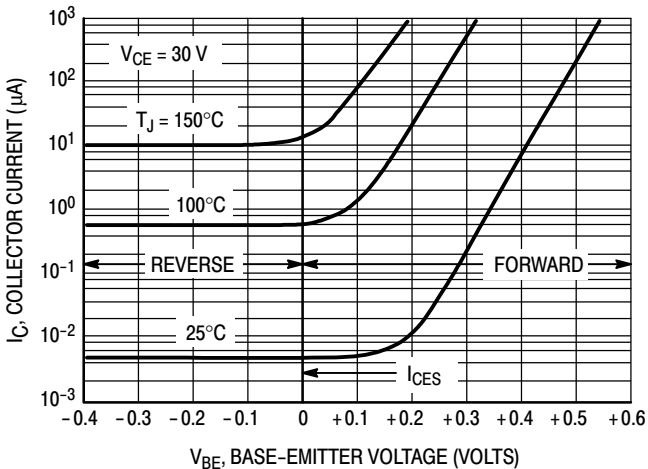
Figure 12. Collector Cut−Off Region
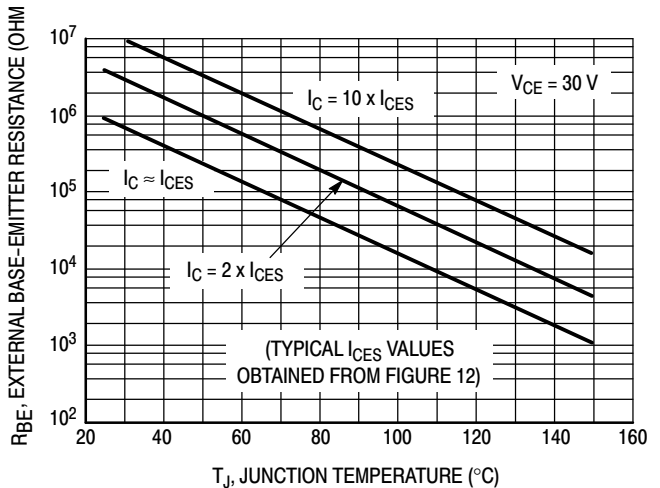
Figure 13. Effects of Base−Emitter Resistance
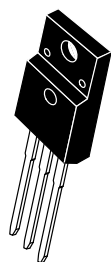
TO−220 FULLPAK
CASE 221D−03
ISSUE K

DATE 27 FEB 2009

SCALE 1:1

–T– **SEATING PLANE**
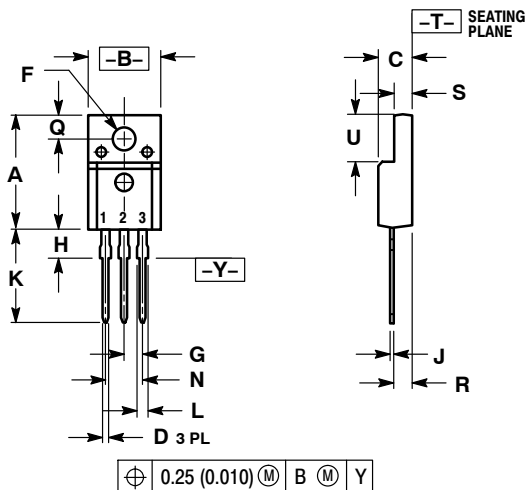
NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH
3. 221D−01 THRU 221D−02 OBSOLETE, NEW STANDARD 221D−03.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.617	0.635	15.67	16.12
B	0.392	0.419	9.96	10.63
C	0.177	0.193	4.50	4.90
D	0.024	0.039	0.60	1.00
F	0.116	0.129	2.95	3.28
G	0.100 BSC		2.54 BSC	
H	0.118	0.135	3.00	3.43
J	0.018	0.025	0.45	0.63
K	0.503	0.541	12.78	13.73
L	0.048	0.058	1.23	1.47
N	0.200 BSC		5.08 BSC	
Q	0.122	0.138	3.10	3.50
R	0.099	0.117	2.51	2.96
S	0.092	0.113	2.34	2.87
U	0.239	0.271	6.06	6.88

⊕ | 0.25 (0.010) Ⓜ | B Ⓜ | Y

STYLE 1:
PIN 1. GATE
2. DRAIN
3. SOURCE

STYLE 2:
PIN 1. BASE
2. COLLECTOR
3. EMITTER

STYLE 3:
PIN 1. ANODE
2. CATHODE
3. ANODE

STYLE 4:
PIN 1. CATHODE
2. ANODE
3. CATHODE

STYLE 5:
PIN 1. CATHODE
2. ANODE
3. GATE

STYLE 6:
PIN 1. MT 1
2. MT 2
3. GATE

MARKING DIAGRAMS

xxxxxxG
AYWW

Bipolar

AYWW
xxxxxxG
AKA
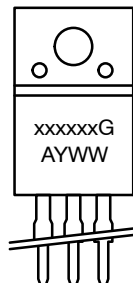
Rectifier

xxxxxx	= Specific Device Code
G	= Pb−Free Package
A	= Assembly Location
Y	= Year
WW	= Work Week

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Y	= Year
WW	= Work Week
xxxxxx	= Device Code
G	= Pb−Free Package
AKA	= Polarity Designator

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DESCRIPTION:	**TO−220 FULLPAK**		**PAGE 1 OF 1**

PUBLICATION ORDERING INFORMATION

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