

# MJE5740, MJE5742

MJE5742 is a Preferred Device

## NPN Silicon Power Darlington Transistors

The MJE5740 and MJE5742 Darlington transistors are designed for high-voltage power switching in inductive circuits.

### Features

- Pb-Free Packages are Available\*

### Applications

- Small Engine Ignition
- Switching Regulators
- Inverters
- Solenoid and Relay Drivers
- Motor Controls

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage MJE5740 MJE5742	$V_{CEO(sus)}$	300 400	Vdc
Collector-Emitter Voltage MJE5740 MJE5742	$V_{CEV}$	600 800	Vdc
Emitter-Base Voltage	$V_{EB}$	8	Vdc
Collector Current – Continuous – Peak (Note 1)	$I_C$ $I_{CM}$	8 16	Adc
Base Current – Continuous – Peak (Note 1)	$I_B$ $I_{BM}$	2.5 5	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	2 16	W W/ $^\circ\text{C}$
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	80 640	W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +150	$^\circ\text{C}$

### THERMAL CHARACTERISTICS

Characteristics	Symbol	Max	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.25	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	62.5	$^\circ\text{C}/\text{W}$
Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 5 Seconds	$T_L$	275	$^\circ\text{C}$

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. Pulse Test: Pulse Width = 5 ms, Duty Cycle  $\leq 10\%$ .

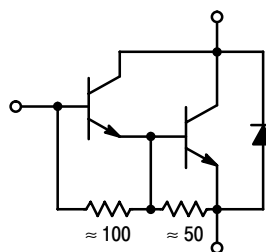
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



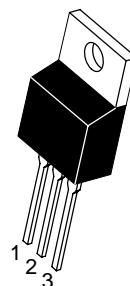
ON Semiconductor®

<http://onsemi.com>

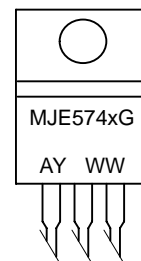
**POWER DARLINGTON  
TRANSISTORS  
8 AMPERES  
300-400 VOLTS  
80 WATTS**



### MARKING DIAGRAM



**TO-220AB  
CASE 221A-09  
STYLE 1**



MJE574x = Device Code  
          x = 0 or 2  
G = Pb-Free Package  
A = Assembly Location  
Y = Year  
WW = Work Week

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 2 of this data sheet.

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

# MJE5740, MJE5742

## ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS (Note 2)

Collector–Emitter Sustaining Voltage (I <sub>C</sub> = 50 mA, I <sub>B</sub> = 0)	MJE5740 MJE5742	V <sub>CEO(sus)</sub>	300 400	– –	– –	Vdc
Collector Cutoff Current (V <sub>CEV</sub> = Rated Value, V <sub>BE(off)</sub> = 1.5 Vdc) (V <sub>CEV</sub> = Rated Value, V <sub>BE(off)</sub> = 1.5 Vdc, T <sub>C</sub> = 100°C)		I <sub>CEV</sub>	– –	– –	1 5	mAdc
Emitter Cutoff Current (V <sub>EB</sub> = 8 Vdc, I <sub>C</sub> = 0)		I <sub>EBO</sub>	–	–	75	mAdc

### SECOND BREAKDOWN

Second Breakdown Collector Current with Base Forward Biased	I <sub>S/b</sub>	See Figure 6			
Clamped Inductive SOA with Base Reverse Biased	RBSOA	See Figure 7			

### ON CHARACTERISTICS (Note 2)

DC Current Gain (I <sub>C</sub> = 0.5 Adc, V <sub>CE</sub> = 5 Vdc) (I <sub>C</sub> = 4 Adc, V <sub>CE</sub> = 5 Vdc)	h <sub>FE</sub>	50 200	100 400	– –	–
Collector–Emitter Saturation Voltage (I <sub>C</sub> = 4 Adc, I <sub>B</sub> = 0.2 Adc) (I <sub>C</sub> = 8 Adc, I <sub>B</sub> = 0.4 Adc) (I <sub>C</sub> = 4 Adc, I <sub>B</sub> = 0.2 Adc, T <sub>C</sub> = 100°C)	V <sub>CE(sat)</sub>	– – –	– – –	2 3 2.2	Vdc
Base–Emitter Saturation Voltage (I <sub>C</sub> = 4 Adc, I <sub>B</sub> = 0.2 Adc) (I <sub>C</sub> = 8 Adc, I <sub>B</sub> = 0.4 Adc) (I <sub>C</sub> = 4 Adc, I <sub>B</sub> = 0.2 Adc, T <sub>C</sub> = 100°C)	V <sub>BE(sat)</sub>	– – –	– – –	2.5 3.5 2.4	Vdc
Diode Forward Voltage (Note 3) (I <sub>F</sub> = 5 Adc)	V <sub>f</sub>	–	–	2.5	Vdc

### SWITCHING CHARACTERISTICS

Typical Resistive Load (Table 1)						
Delay Time	(V <sub>CC</sub> = 250 Vdc, I <sub>C(pk)</sub> = 6 A I <sub>B1</sub> = I <sub>B2</sub> = 0.25 A, t <sub>p</sub> = 25 μs, Duty Cycle ≤ 1%)	t <sub>d</sub>	–	0.04	–	μs
Rise Time		t <sub>r</sub>	–	0.5	–	μs
Storage Time		t <sub>s</sub>	–	8	–	μs
Fall Time		t <sub>f</sub>	–	2	–	μs
Inductive Load, Clamped (Table 1)						
Voltage Storage Time	(I <sub>C(pk)</sub> = 6 A, V <sub>CE(pk)</sub> = 250 Vdc I <sub>B1</sub> = 0.06 A, V <sub>BE(off)</sub> = 5 Vdc)	t <sub>sv</sub>	–	4	–	μs
Crossover Time		t <sub>c</sub>	–	2	–	μs

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

3. The internal Collector–to–Emitter diode can eliminate the need for an external diode to clamp inductive loads. Tests have shown that the Forward Recovery Voltage (V<sub>f</sub>) of this diode is comparable to that of typical fast recovery rectifiers.

### ORDERING INFORMATION

Device	Package	Shipping
MJE5740	TO–220	50 Units / Rail
MJE5740G	TO–220 (Pb–Free)	
MJE5742	TO–220	
MJE5742G	TO–220 (Pb–Free)	

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## TYPICAL CHARACTERISTICS

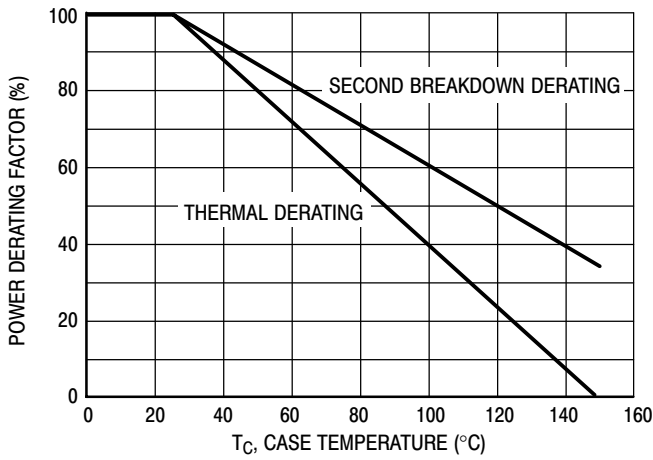


Figure 1. Power Derating

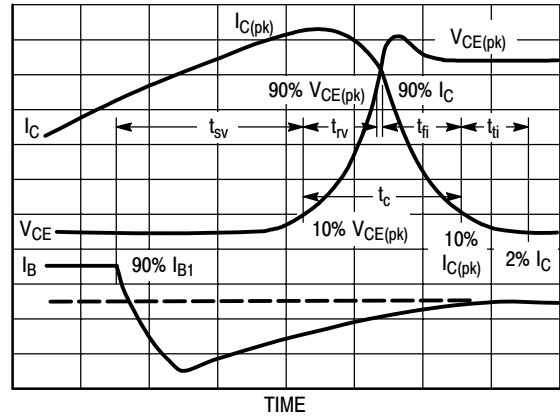


Figure 2. Inductive Switching Measurements

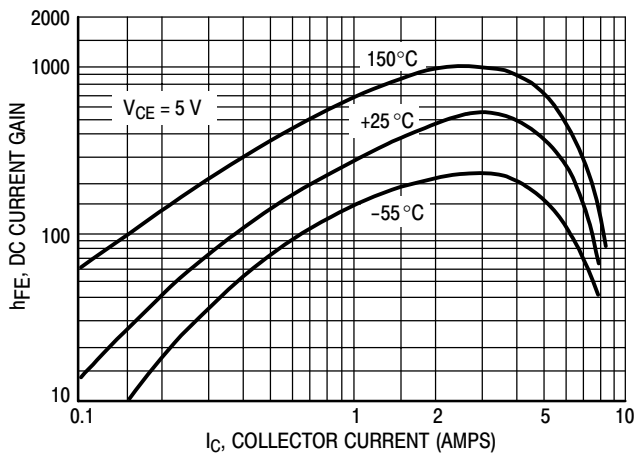


Figure 3. DC Current Gain

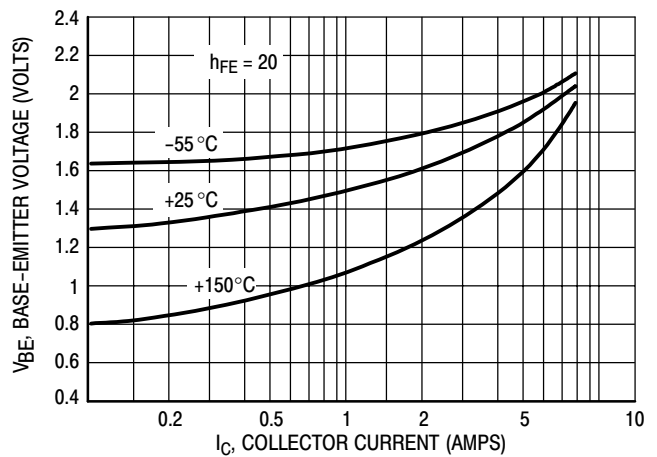


Figure 4. Base-Emitter Voltage

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Table 1. Test Conditions for Dynamic Performance

REVERSE BIAS SAFE OPERATING AREA AND INDUCTIVE SWITCHING		RESISTIVE SWITCHING
TEST CIRCUITS	<p>DUTY CYCLE <math>\leq 10\%</math>  <math>t_r, t_f \leq 10 \text{ ns}</math></p> <p>NOTE:            PW and <math>V_{CC}</math> Adjusted for Desired <math>I_C</math>  <math>R_B</math> Adjusted for Desired <math>I_{B1}</math></p>	<p>*SELECTED FOR <math>\geq 1 \text{ kV}</math></p>
CIRCUIT VALUES	COIL DATA: FERROXCUBE CORE #6656 FULL BOBBIN (~16 TURNS) #16 GAP FOR 200 $\mu\text{H}/20 \text{ A}$ $L_{\text{coil}} = 200 \mu\text{H}$	$V_{CC} = 30 \text{ V}$ $V_{CE(\text{pk})} = 250 \text{ Vdc}$ $I_{C(\text{pk})} = 6 \text{ A}$
TEST WAVEFORMS	<p>TEST EQUIPMENT            SCOPE-TEKTRONICS            475 OR EQUIVALENT</p> <p><math>t_1 \approx \frac{L_{\text{coil}} (I_{C(\text{pk})})}{V_{CC}}</math></p> <p><math>t_2 \approx \frac{L_{\text{coil}} (I_{C(\text{pk})})}{V_{\text{clamp}}}</math></p>	<p><math>t_r, t_f &lt; 10 \text{ ns}</math>            DUTY CYCLE = 1%  <math>R_B</math> AND <math>R_C</math> ADJUSTED            FOR DESIRED <math>I_B</math> AND <math>I_C</math></p>

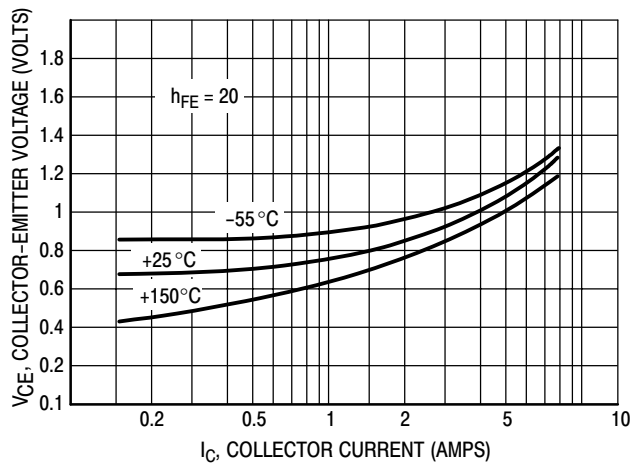


Figure 5. Inductive Switching Measurements

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## SAFE OPERATING AREA INFORMATION

### FORWARD BIAS

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 6 is based on  $T_C = 25^\circ\text{C}$ ;  $T_{J(pk)}$  is variable depending on power level. Second breakdown pulse limits are valid for duty cycles to 10% but must be derated when  $T_C \geq 25^\circ\text{C}$ . Second breakdown limitations do not derate the same as thermal limitations. Allowable current at the voltages shown on Figure 6 may be found at any case temperature by using the appropriate curve on Figure 1.

The Safe Operating Area figures shown in Figures 6 and 7 are specified ratings for these devices under the test conditions shown.

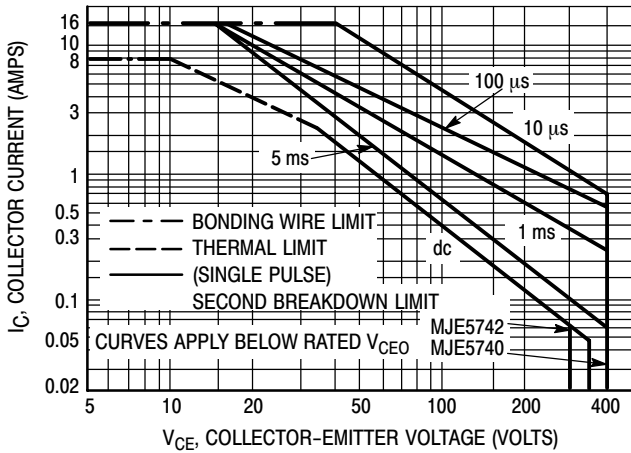


Figure 6. Forward Bias Safe Operating Area

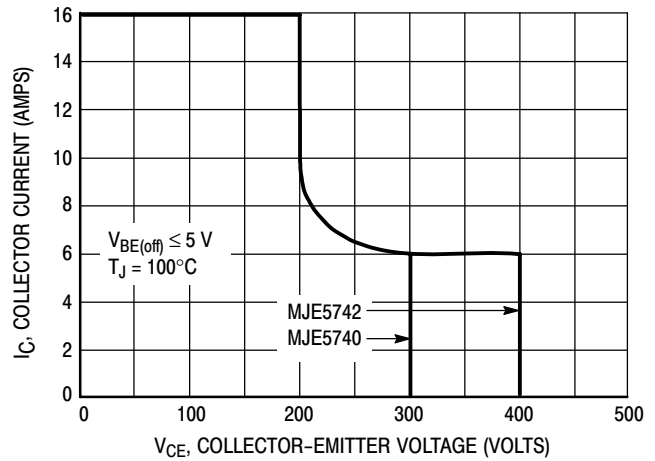


Figure 7. Reverse Bias Safe Operating Area

## RESISTIVE SWITCHING PERFORMANCE

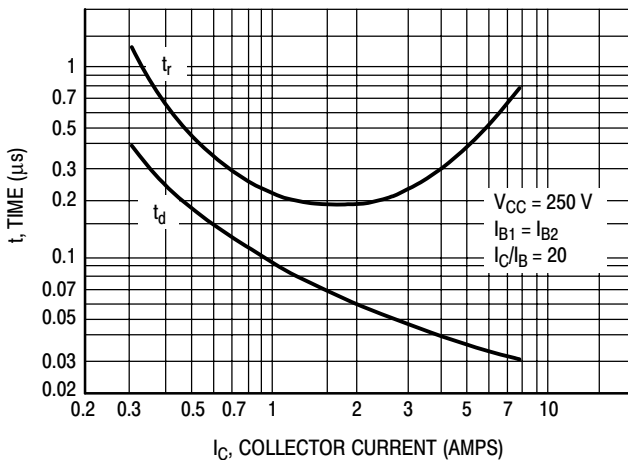


Figure 8. Turn-On Time

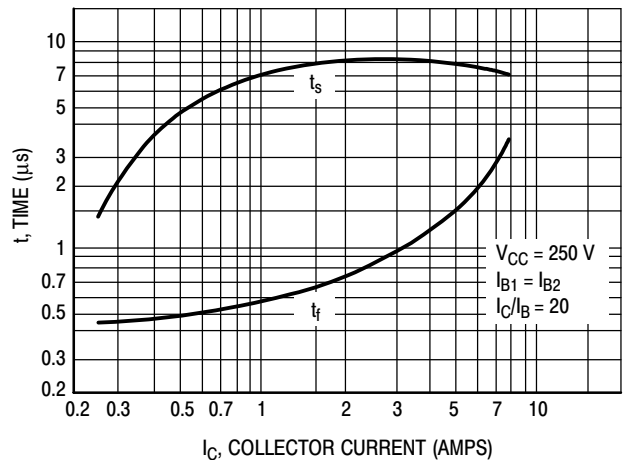
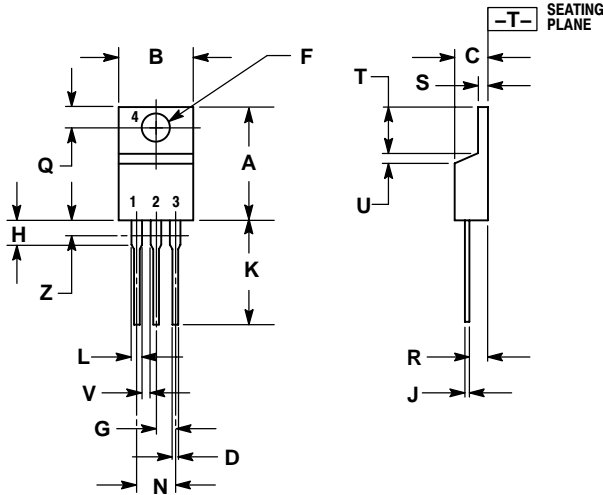


Figure 9. Turn-Off Time

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## PACKAGE DIMENSIONS

### TO-220AB CASE 221A-09 ISSUE AA



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.570	0.620	14.48	15.75
B	0.380	0.405	9.66	10.28
C	0.160	0.190	4.07	4.82
D	0.025	0.035	0.64	0.88
F	0.142	0.147	3.61	3.73
G	0.095	0.105	2.42	2.66
H	0.110	0.155	2.80	3.93
J	0.018	0.025	0.46	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.15	1.52
N	0.190	0.210	4.83	5.33
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.15	1.39
T	0.235	0.255	5.97	6.47
U	0.000	0.050	0.00	1.27
V	0.045	---	1.15	---
Z	---	0.080	---	2.04

#### STYLE 1:

1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

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