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°C Derate above 25°C	P_D	2 16	W W/°C
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	80 640	W W/°C
Operating and Storage Junction Temperature Range	T_J, T_{stg}	−65 to +150	°C

THERMAL CHARACTERISTICS

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

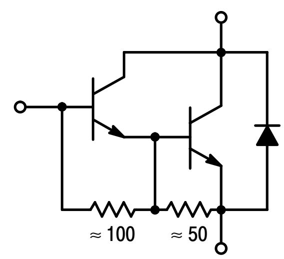
1. Pulse Test: Pulse Width = 5 ms, Duty Cycle ≤ 10%.

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

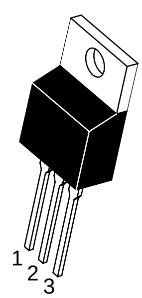
ON Semiconductor®

http://onsemi.com

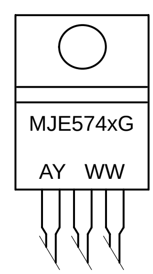
POWER DARLINGTON TRANSISTORS
8 AMPERES
300−400 VOLTS
80 WATTS



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.

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

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (Note 2)						
Collector−Emitter Sustaining Voltage (I_C = 50 mA, I_B = 0)	MJE5740 MJE5742	$V_{CEO(sus)}$	300 400	− −	− −	Vdc
Collector Cutoff Current (V_{CEV} = Rated Value, $V_{BE(off)}$ = 1.5 Vdc) (V_{CEV} = Rated Value, $V_{BE(off)}$ = 1.5 Vdc, T_C = 100°C)		I_{CEV}	− −	− −	1 5	mAdc
Emitter Cutoff Current (V_{EB} = 8 Vdc, I_C = 0)		I_{EBO}	−	−	75	mAdc
SECOND BREAKDOWN						
Second Breakdown Collector Current with Base Forward Biased		$I_{S/b}$	See Figure 6			
Clamped Inductive SOA with Base Reverse Biased		RBSOA	See Figure 7			
ON CHARACTERISTICS (Note 2)						
DC Current Gain (I_C = 0.5 Adc, V_{CE} = 5 Vdc) (I_C = 4 Adc, V_{CE} = 5 Vdc)		h_{FE}	50 200	100 400	− −	−
Collector−Emitter Saturation Voltage (I_C = 4 Adc, I_B = 0.2 Adc) (I_C = 8 Adc, I_B = 0.4 Adc) (I_C = 4 Adc, I_B = 0.2 Adc, T_C = 100°C)		$V_{CE(sat)}$	− − −	− − −	2 3 2.2	Vdc
Base−Emitter Saturation Voltage (I_C = 4 Adc, I_B = 0.2 Adc) (I_C = 8 Adc, I_B = 0.4 Adc) (I_C = 4 Adc, I_B = 0.2 Adc, T_C = 100°C)		$V_{BE(sat)}$	− − −	− − −	2.5 3.5 2.4	Vdc
Diode Forward Voltage (Note 3) (I_F = 5 Adc)		V_f	−	−	2.5	Vdc
SWITCHING CHARACTERISTICS						
Typical Resistive Load (Table 1)						
Delay Time	(V_{CC} = 250 Vdc, $I_{C(pk)}$ = 6 A I_{B1} = I_{B2} = 0.25 A, t_p = 25 μs, Duty Cycle ≤ 1%)	t_d	−	0.04	−	μs
Rise Time		t_r	−	0.5	−	μs
Storage Time		t_s	−	8	−	μs
Fall Time		t_f	−	2	−	μs
Inductive Load, Clamped (Table 1)						
Voltage Storage Time	($I_{C(pk)}$ = 6 A, $V_{CE(pk)}$ = 250 Vdc I_{B1} = 0.06 A, $V_{BE(off)}$ = 5 Vdc)	t_{sv}	−	4	−	μs
Crossover Time		t_c	−	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_f) 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)	

TYPICAL CHARACTERISTICS

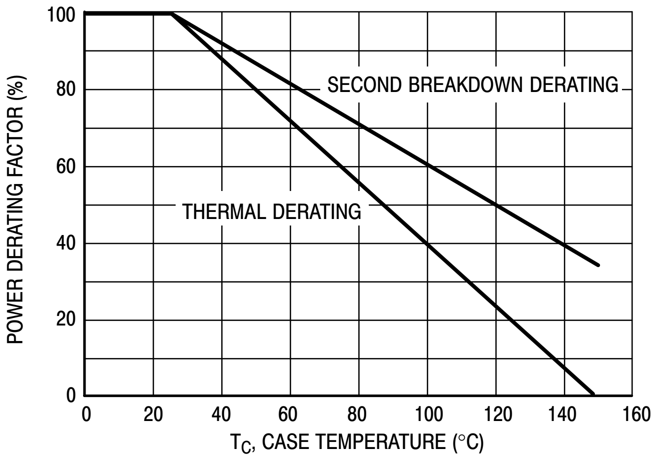


Figure 1. Power Derating

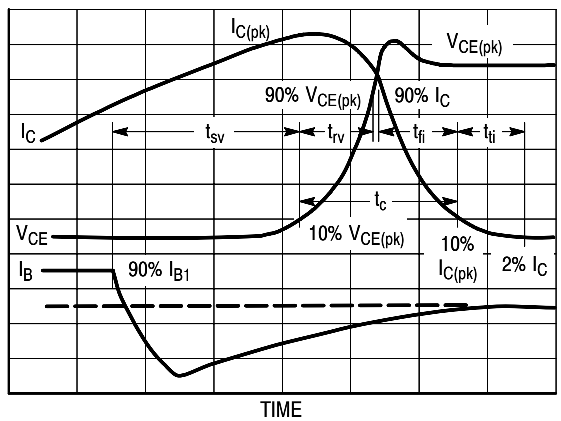


Figure 2. Inductive Switching Measurements

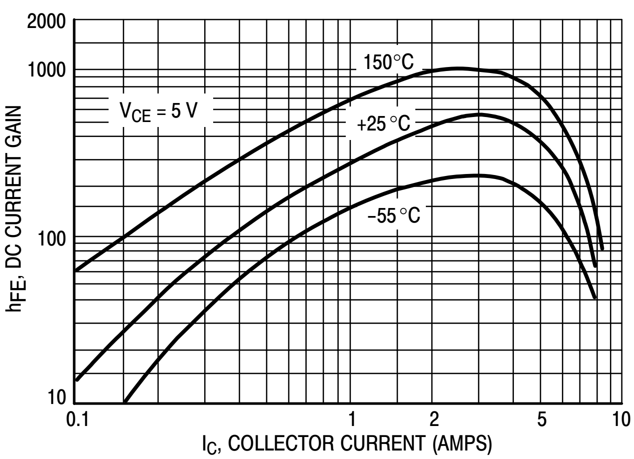


Figure 3. DC Current Gain

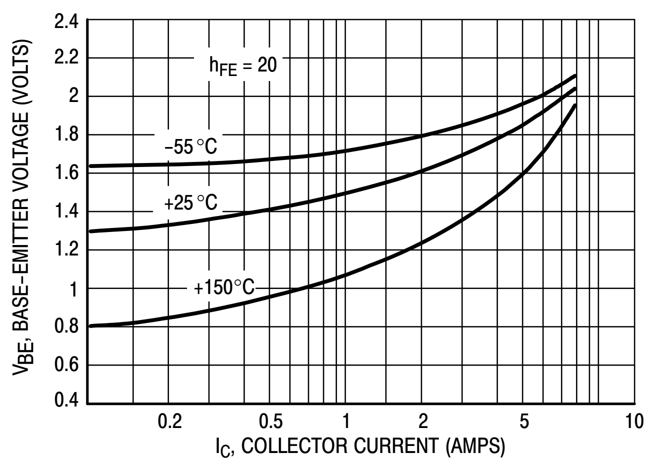
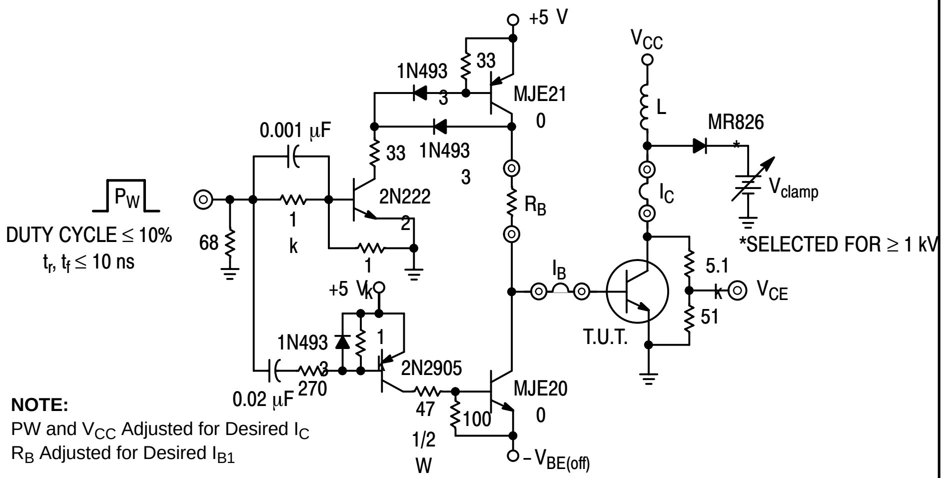
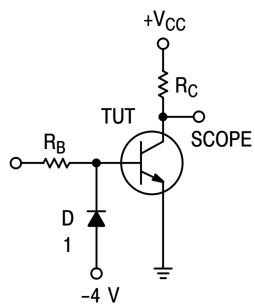
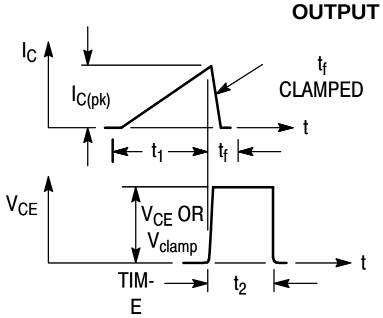
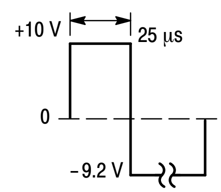


Figure 4. Base−Emitter Voltage

Table 1. Test Conditions for Dynamic Performance

	REVERSE BIAS SAFE OPERATING AREA AND INDUCTIVE SWITCHING	RESISTIVE SWITCHING
TEST CIRCUITS	 **NOTE:** PW and V_{CC} Adjusted for Desired I_C; R_B Adjusted for Desired I_{B1}	
CIRCUIT VALUES	COIL DATA: FERROXCUBE CORE #6656 FULL BOBBIN (~16 TURNS) #16; GAP FOR 200 μH/20 A L_{coil} = 200 μH; V_{CC} = 30 V, $V_{CE(pk)}$ = 250 Vdc, $I_{C(pk)}$ = 6 A	V_{CC} = 250 V; D1 = 1N5820 OR EQUIV.
TEST WAVEFORMS	**OUTPUT WAVEFORMS**  t_1 ADJUSTED TO OBTAIN I_C; $t_1 \approx \frac{L_{coil}\,(I_{C_{pk}})}{V_{CC}}$; $t_2 \approx \frac{L_{coil}\,(I_{C_{pk}})}{V_{clamp}}$; TEST EQUIPMENT SCOPE–TEKTRONICS 475 OR EQUIVALENT	 t_r, t_f < 10 ns; DUTY CYCLE = 1%; R_B AND R_C ADJUSTED FOR DESIRED I_B AND I_C

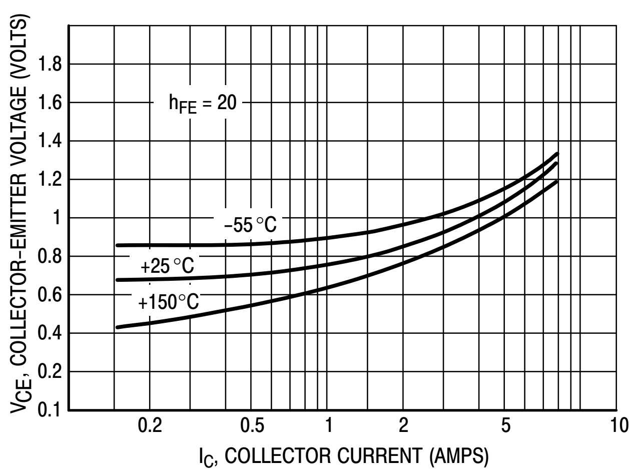


Figure 5. Inductive Switching Measurements

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 $T_C = 25°C$; $T_{J(pk)}$ is variable depending on power level. Second breakdown pulse limits are valid for duty cycles to 10% but must be derated when $T_C \geq 25°C$. 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.

REVERSE BIAS

For inductive loads, high voltage and high current must be sustained simultaneously during turn−off, in most cases, with the base to emitter junction reverse biased. Under these conditions the collector voltage must be held to a safe level at or below a specific value of collector current. This can be accomplished by several means such as active clamping, RC snubbing, load line shaping, etc. The safe level for these devices is specified as Reverse Bias Safe Operating Area and represents the voltage−current condition allowable during reverse biased turnoff. This rating is verified under clamped conditions so that the device is never subjected to an avalanche mode. Figure 7 gives the complete RBSOA characteristics.

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

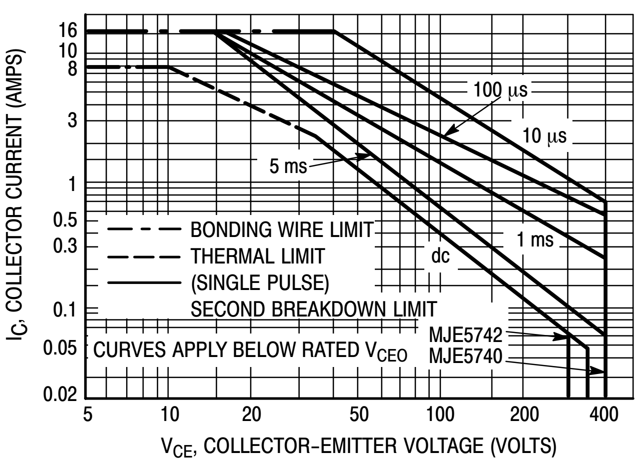


Figure 6. Forward Bias Safe Operating Area

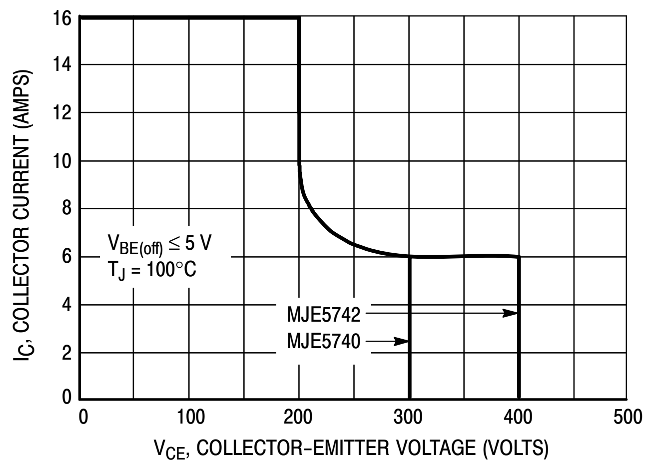


Figure 7. Reverse Bias Safe Operating Area

RESISTIVE SWITCHING PERFORMANCE

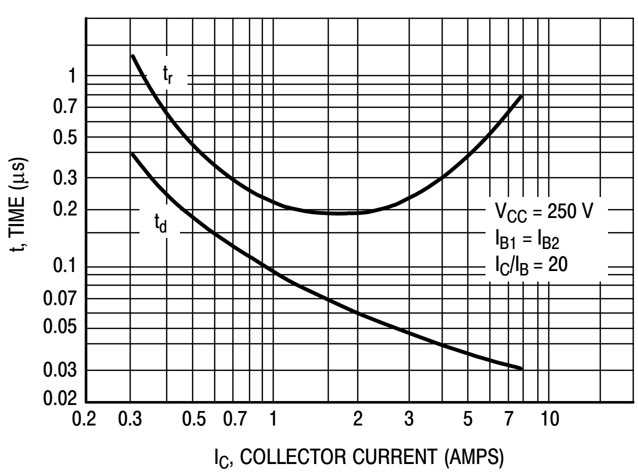


Figure 8. Turn−On Time

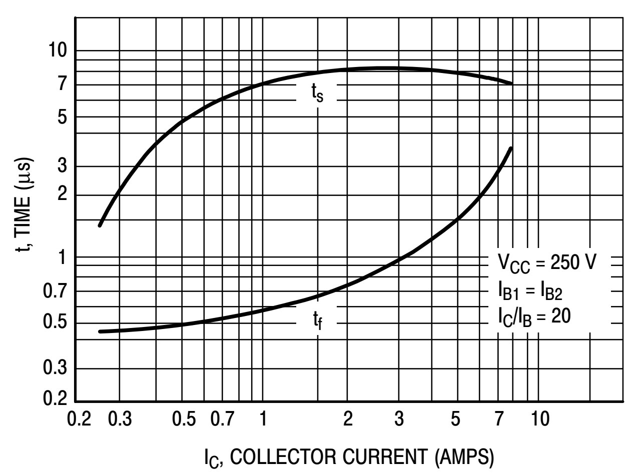
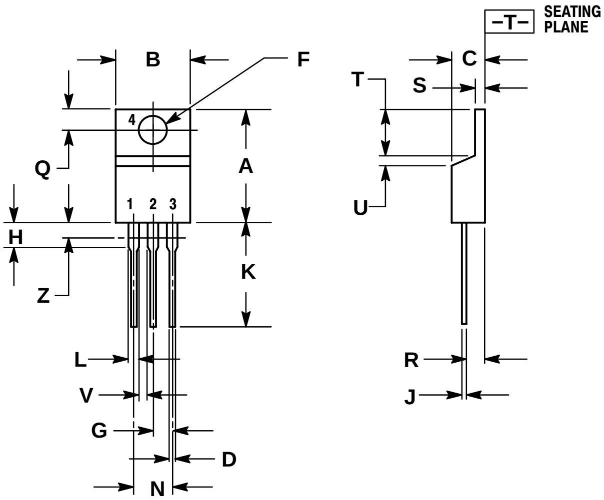


Figure 9. Turn−Off Time

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.

	INCHES		MILLIMETERS	
DIM	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:
PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
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