

NPN Silicon Power Darlington Transistors

MJE5740, MJE5742

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

Features

- These Devices are Pb-Free and are RoHS Compliant*

Applications

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

MAXIMUM RATINGS

Symbol	Rating	Value	Unit
$V_{CE(sus)}$	Collector-Emitter Voltage MJE5740 MJE5742	300 400	Vdc
V_{CEV}	Collector-Emitter Voltage MJE5740 MJE5742	600 800	Vdc
V_{EB}	Emitter-Base Voltage	8	Vdc
I_C I_{CM}	Collector Current – Continuous – Peak (Note 1)	8 16	Adc
I_B I_{BM}	Base Current – Continuous – Peak (Note 1)	2.5 5	Adc
P_D	Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	2 0.016	W W/ $^\circ\text{C}$
P_D	Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	100 0.8	W W/ $^\circ\text{C}$
T_J, T_{stg}	Operating and Storage Junction Temperature Range	-65 to +150	$^\circ\text{C}$

THERMAL CHARACTERISTICS

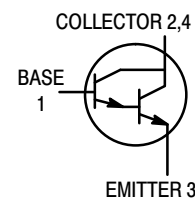
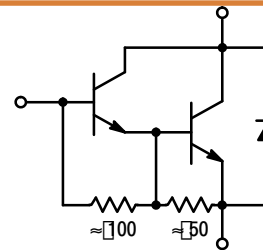
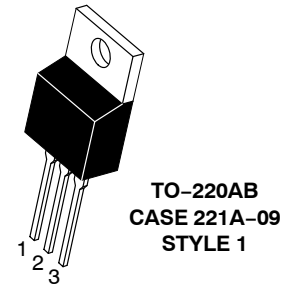
Symbol	Characteristics	Max	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.25	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	62.5	$^\circ\text{C}/\text{W}$
T_L	Maximum Lead Temperature for Soldering Purposes 1/8" from Case for 5 Seconds	275	$^\circ\text{C}$

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, 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 [onsemi Soldering and Mounting Techniques Reference Manual, SOLDERRM/D](#).

POWER DARLINGTON TRANSISTORS 8 AMPERES 300–400 VOLTS 80 WATTS



MARKING DIAGRAM



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 6 of this data sheet.

NOTE: Some of the devices on this data sheet have been **DISCONTINUED**. Please refer to the table on page 6.

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

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

V _{CEO(sus)}	Collector–Emitter Sustaining Voltage (I _C = 50 mA, I _B = 0)	MJE5740 300 MJE5742 400	– –	– –	Vdc
I _{CEV}	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)	– –	– –	1 5	mAdc
I _{EBO}	Emitter Cutoff Current (V _{EB} = 8 Vdc, I _C = 0)	–	–	75	mAdc

SECOND BREAKDOWN

I _{S/b}	Second Breakdown Collector Current with Base Forward Biased	See Figure 6			
RBSOA	Clamped Inductive SOA with Base Reverse Biased	See Figure 7			

ON CHARACTERISTICS (Note 2)

h _{FE}	DC Current Gain (I _C = 0.5 Adc, V _{CE} = 5 Vdc) (I _C = 4 Adc, V _{CE} = 5 Vdc)	50 200	100 400	– –	–
V _{CE(sat)}	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)	– – –	– – –	2 3 2.2	Vdc
V _{BE(sat)}	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)	– – –	– – –	2.5 3.5 2.4	Vdc
V _f	Diode Forward Voltage (Note 3) (I _F = 5 Adc)	–	–	2.5	Vdc

SWITCHING CHARACTERISTICS

Typical Resistive Load (Table 1)

t _d	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%)	–	0.04	–	μs
t _r	Rise Time		–	0.5	–	μs
t _s	Storage Time		–	8	–	μs
t _f	Fall Time		–	2	–	μs

Inductive Load, Clamped (Table 1)

t _{sv}	Voltage Storage Time	(I _{C(pk)} = 6 A, V _{CE(pk)} = 250 Vdc I _{B1} = 0.06 A, V _{BE(off)} = 5 Vdc)	–	4	–	μs
t _c	Crossover Time		–	2	–	μs

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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.

TYPICAL CHARACTERISTICS

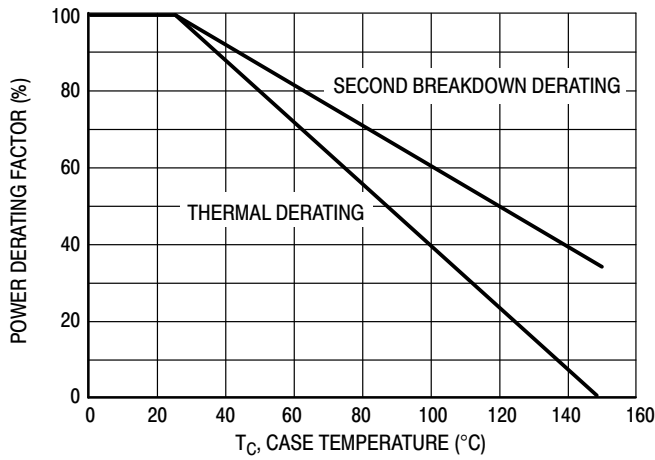


Figure 1. Power Derating

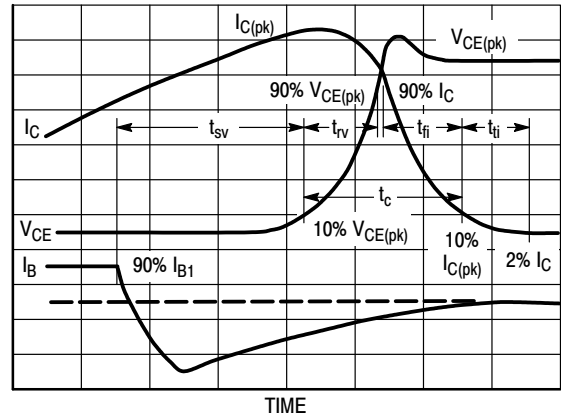


Figure 2. Inductive Switching Measurements

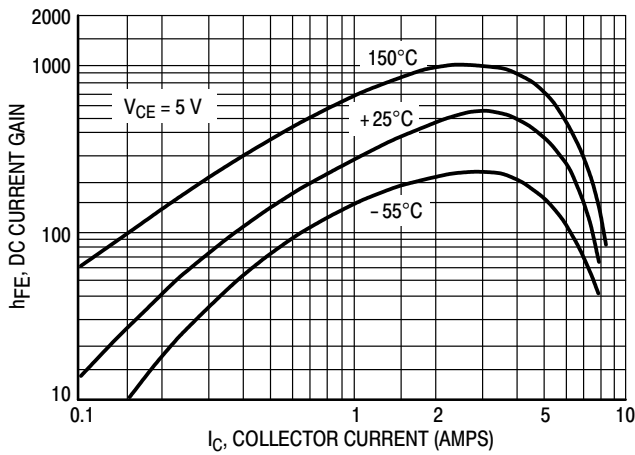


Figure 3. DC Current Gain

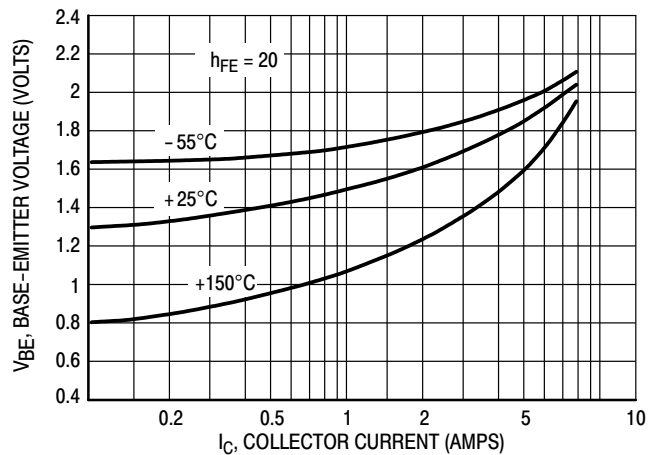


Figure 4. Base-Emitter Voltage

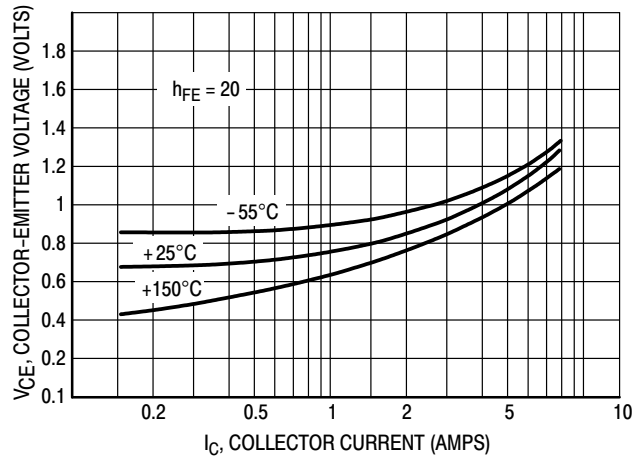


Figure 5. Collector-Emitter Saturation Voltage

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Table 1. Test Conditions for Dynamic Performance

REVERSE BIAS SAFE OPERATING AREA AND INDUCTIVE SWITCHING		RESISTIVE SWITCHING
TEST CIRCUITS	DUTY CYCLE $\leq 10\%$ $t_r, t_f \leq 10 \text{ ns}$ NOTE: PW and V_{CC} Adjusted for Desired I_C R_B Adjusted for Desired I_{B1}	*SELECTED FOR $\geq 1 \text{ kV}$
CIRCUIT VALUES	COIL DATA: FERROXCUBE CORE #6656 FULL BOBBIN (~16 TURNS) #16 GAP FOR 200 $\mu\text{H}/20 \text{ A}$ $L_{\text{coil}} = 200 \mu\text{H}$ $V_{CC} = 30 \text{ V}$ $V_{CE(\text{pk})} = 250 \text{ Vdc}$ $I_{C(\text{pk})} = 6 \text{ A}$	$V_{CC} = 250 \text{ V}$ $D1 = 1\text{N}5820 \text{ OR EQUIV.}$
TEST WAVEFORMS	OUTPUT WAVEFORMS t_1 ADJUSTED TO OBTAIN I_C $t_1 \approx \frac{L_{\text{coil}} (I_{C(\text{pk})})}{V_{CC}}$ $t_2 \approx \frac{L_{\text{coil}} (I_{C(\text{pk})})}{V_{\text{clamp}}}$ TEST EQUIPMENT SCOPE-TEKTRONICS 475 OR EQUIVALENT	$t_r, t_f < 10 \text{ ns}$ DUTY CYCLE = 1% R_B AND R_C ADJUSTED FOR DESIRED I_B AND I_C

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.

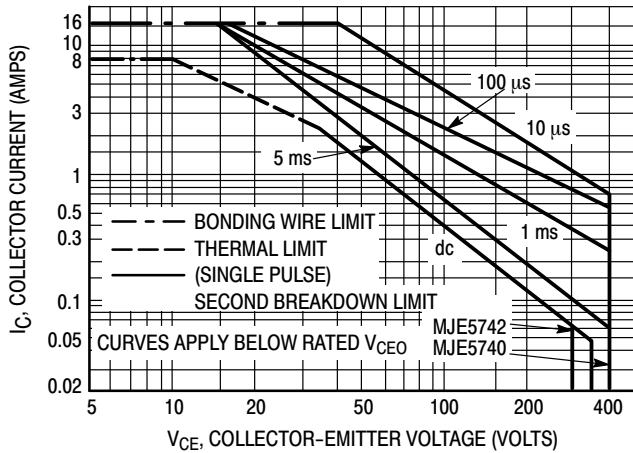


Figure 6. Forward Bias Safe Operating Area

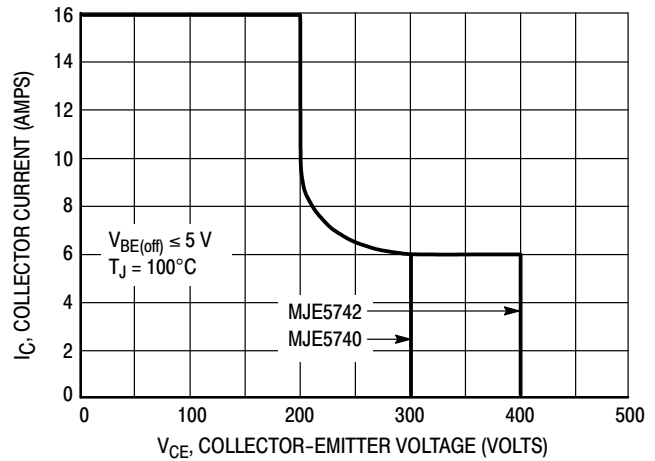


Figure 7. Reverse Bias Safe Operating Area

RESISTIVE SWITCHING PERFORMANCE

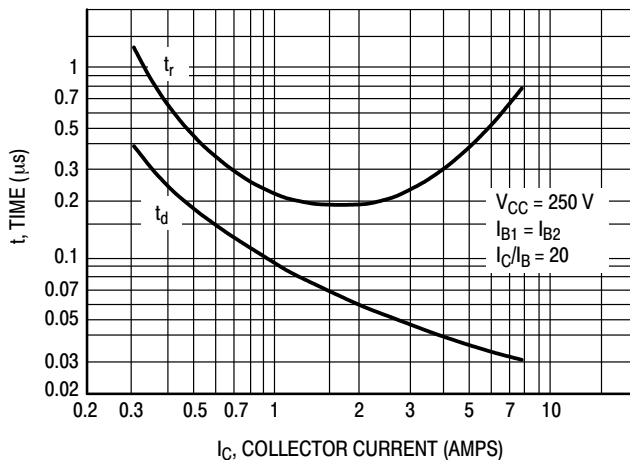


Figure 8. Turn-On Time

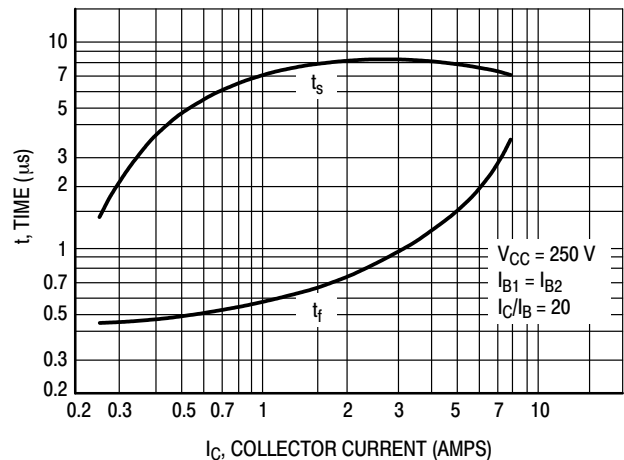


Figure 9. Turn-Off Time

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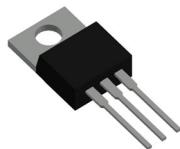
ORDERING INFORMATION

Device	Package	Shipping
MJE5742G	TO-220 (Pb-Free)	50 Units / Rail

DISCONTINUED (Note 4)

MJE5740G	TO-220 (Pb-Free)	50 Units / Rail
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4. **DISCONTINUED:** This device is not recommended for new design. Please contact your **onsemi** representative for information. The most current information on this device may be available on www.onsemi.com.

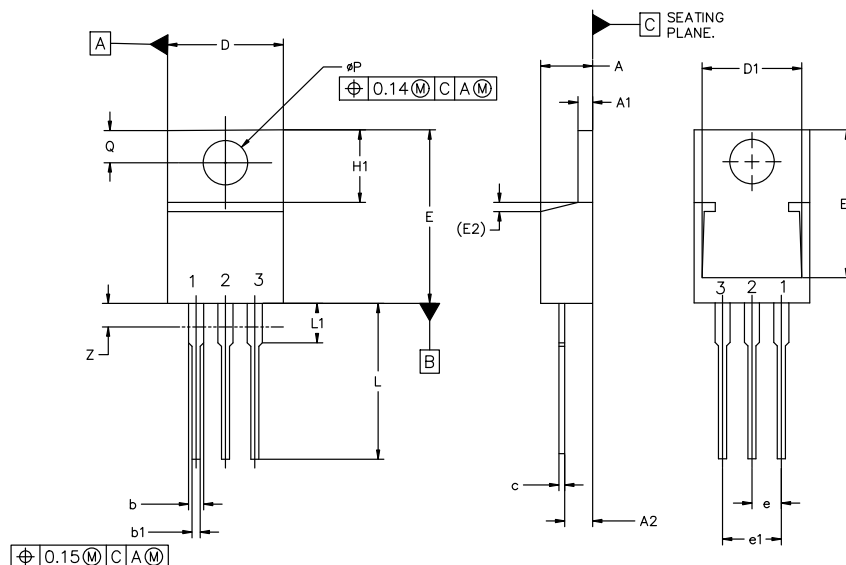


TO-220-3 10.10x15.12x4.45, 2.54P

CASE 221A

ISSUE AL

DATE 05 FEB 2025



MILLIMETERS			
DIM	MIN	NOM	MAX
A	4.07	4.45	4.83
A1	1.15	1.28	1.41
A2	2.04	2.42	2.79
b	1.15	1.34	1.52
b1	0.64	0.80	0.96
c	0.36	0.49	0.61
D	9.66	10.10	10.53
D1	8.43	8.63	8.83
E	14.48	15.12	15.75
E1	12.58	12.78	12.98
E2	1.27 REF		

MILLIMETERS			
DIM	MIN	NOM	MAX
e	2.42	2.54	2.66
e1	4.83	5.08	5.33
H1	5.97	6.22	6.47
L	12.70	13.49	14.27
L1	2.80	3.45	4.10
Q	2.54	2.79	3.04
øP	3.60	3.85	4.09
Z	---	---	3.48

NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 2018.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED.

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

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

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

STYLE 4:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. MAIN TERMINAL 2

STYLE 5:
PIN 1. GATE
2. DRAIN
3. SOURCE
4. DRAIN

STYLE 6:
PIN 1. ANODE
2. CATHODE
3. ANODE
4. CATHODE

STYLE 7:
PIN 1. CATHODE
2. ANODE
3. CATHODE
4. ANODE

STYLE 8:
PIN 1. CATHODE
2. ANODE
3. EXTERNAL TRIP/DELAY
4. ANODE

STYLE 9:
PIN 1. GATE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

STYLE 10:
PIN 1. GATE
2. SOURCE
3. DRAIN
4. SOURCE

STYLE 11:
PIN 1. DRAIN
2. SOURCE
3. GATE
4. SOURCE

STYLE 12:
PIN 1. MAIN TERMINAL 1
2. MAIN TERMINAL 2
3. GATE
4. NOT CONNECTED

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