

MJD200 (NPN) MJD210 (PNP)

Complementary Plastic Power Transistors

NPN/PNP Silicon DPAK For Surface Mount Applications

Designed for low voltage, low-power, high-gain audio amplifier applications.

Features

- Collector-Emitter Sustaining Voltage –
 $V_{CE(sus)} = 25 \text{ Vdc (Min) @ } I_C = 10 \text{ mAdc}$
- High DC Current Gain – $h_{FE} = 70 \text{ (Min) @ } I_C = 500 \text{ mAdc}$
 $= 45 \text{ (Min) @ } I_C = 2 \text{ Adc}$
 $= 10 \text{ (Min) @ } I_C = 5 \text{ Adc}$
- Lead Formed for Surface Mount Applications in Plastic Sleeves (No Suffix)
- Lead Formed Version in 16 mm Tape and Reel (“T4” Suffix)
- Low Collector-Emitter Saturation Voltage –
 $V_{CE(sat)} = 0.3 \text{ Vdc (Max) @ } I_C = 500 \text{ mAdc}$
 $= 0.75 \text{ Vdc (Max) @ } I_C = 2.0 \text{ Adc}$
- High Current-Gain – Bandwidth Product –
 $f_T = 65 \text{ MHz (Min) @ } I_C = 100 \text{ mAdc}$
- Annular Construction for Low Leakage –
 $I_{CBO} = 100 \text{ nAdc @ Rated } V_{CB}$
- Epoxy Meets UL 94, V-0 @ 0.125 in.
- ESD Ratings: Human Body Model, 3B > 8000 V
Machine Model, C > 400 V
- Pb-Free Packages are Available

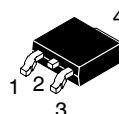


ON Semiconductor®

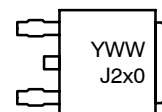
<http://onsemi.com>

**SILICON
POWER TRANSISTORS
5 AMPERES
25 VOLTS
12.5 WATTS**

MARKING DIAGRAM



**DPAK
CASE 369C
STYLE 1**



Y = Year
WW = Work Week
x = 1 or 0

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 6 of this data sheet.

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MAXIMUM RATINGS

Rating	Symbol	Max	Unit
Collector-Base Voltage	V_{CB}	40	Vdc
Collector-Emitter Voltage	V_{CEO}	25	Vdc
Emitter-Base Voltage	V_{EB}	8	Vdc
Collector Current – Continuous Peak	I_C	5 10	Adc
Base Current	I_B	1	mAdc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above 25°C	P_D	12.5 0.1	W W/ $^\circ\text{C}$
Total Power Dissipation* @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	1.4 0.011	W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	T_J, T_{stg}	-65 to +150	$^\circ\text{C}$

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.

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	10	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient*	$R_{\theta JA}$	89.3	$^\circ\text{C/W}$

*These ratings are applicable when surface mounted on the minimum pad sizes recommended.

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

Characteristic	Symbol	Min	Max	Unit
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OFF CHARACTERISTICS

Collector-Emitter Sustaining Voltage (Note 1), ($I_C = 10 \text{ mAdc}$, $I_B = 0$)	$V_{CEO(sus)}$	25	-	Vdc
Collector Cutoff Current ($V_{CB} = 40 \text{ Vdc}$, $I_E = 0$) ($V_{CB} = 40 \text{ Vdc}$, $I_E = 0$, $T_J = 125^\circ\text{C}$)	I_{CBO}	-	100	nAdc μAdc
Emitter Cutoff Current ($V_{BE} = 8 \text{ Vdc}$, $I_C = 0$)	I_{EBO}	-	100	nAdc

ON CHARACTERISTICS

DC Current Gain (Note 1), ($I_C = 500 \text{ mAdc}$, $V_{CE} = 1 \text{ Vdc}$) ($I_C = 2 \text{ Adc}$, $V_{CE} = 1 \text{ Vdc}$) ($I_C = 5 \text{ Adc}$, $V_{CE} = 2 \text{ Vdc}$)	h_{FE}	70 45 10	- 180 -	-
Collector-Emitter Saturation Voltage (Note 1) ($I_C = 500 \text{ mAdc}$, $I_B = 50 \text{ mAdc}$) ($I_C = 2 \text{ Adc}$, $I_B = 200 \text{ mAdc}$) ($I_C = 5 \text{ Adc}$, $I_B = 1 \text{ Adc}$)	$V_{CE(sat)}$	-	0.3 0.75 1.8	Vdc
Base-Emitter Saturation Voltage (Note 1), ($I_C = 5 \text{ Adc}$, $I_B = 1 \text{ Adc}$)	$V_{BE(sat)}$	-	2.5	Vdc
Base-Emitter On Voltage (Note 1), ($I_C = 2 \text{ Adc}$, $V_{CE} = 1 \text{ Vdc}$)	$V_{BE(on)}$	-	1.6	Vdc

DYNAMIC CHARACTERISTICS

Current-Gain – Bandwidth Product (Note 2) ($I_C = 100 \text{ mAdc}$, $V_{CE} = 10 \text{ Vdc}$, $f_{test} = 10 \text{ MHz}$)	f_T	65	-	MHz
Output Capacitance ($V_{CB} = 10 \text{ Vdc}$, $I_E = 0$, $f = 0.1 \text{ MHz}$)	MJD200 MJD210 C_{ob}	-	80 120	pF

1. Pulse Test: Pulse Width = 300 μs , Duty Cycle $\approx 2\%$.
2. $f_T = |h_{fe}| \cdot f_{test}$.

MJD200 (NPN) MJD210 (PNP)

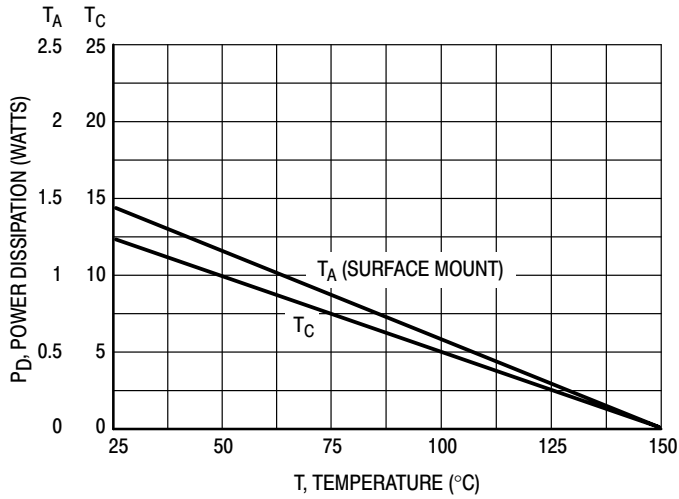
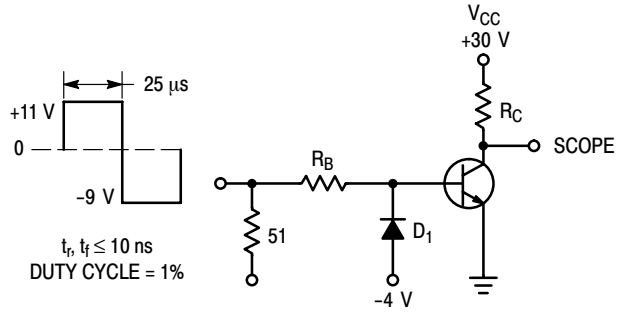


Figure 1. Power Derating



R_B and R_C VARIED TO OBTAIN DESIRED CURRENT LEVELS
 D_1 MUST BE FAST RECOVERY TYPE, e.g.:
 1N5825 USED ABOVE $I_B \approx 100$ mA FOR PNP TEST CIRCUIT,
 MSD6100 USED BELOW $I_B \approx 100$ mA REVERSE ALL POLARITIES

Figure 2. Switching Time Test Circuit

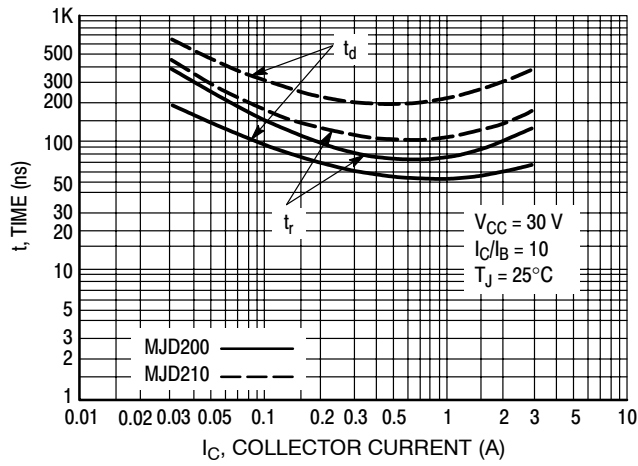


Figure 3. Turn-On Time

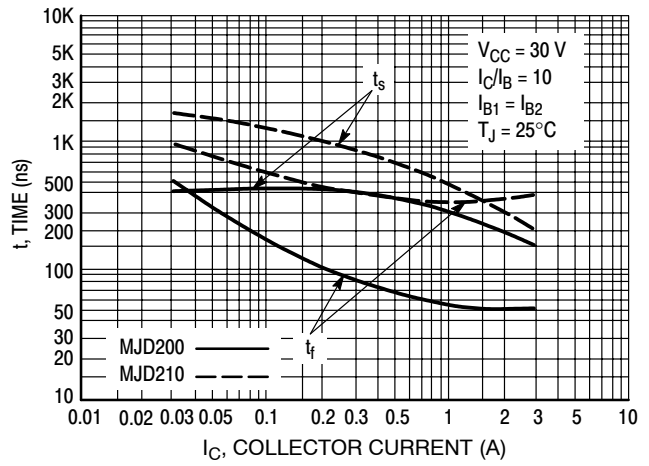
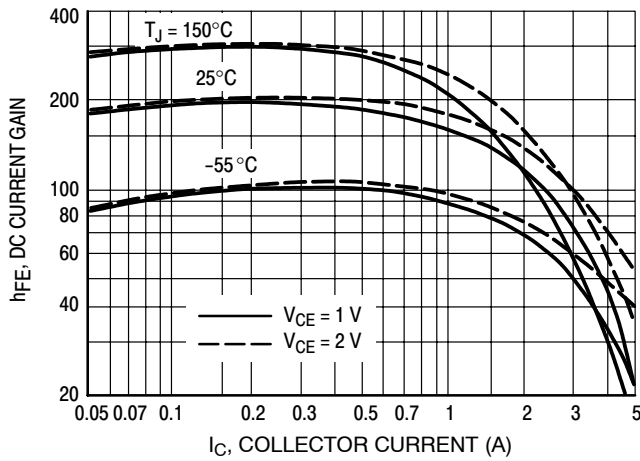


Figure 4. Turn-Off Time

MJD200 (NPN) MJD210 (PNP)

**NPN
MJD200**



**PNP
MJD210**

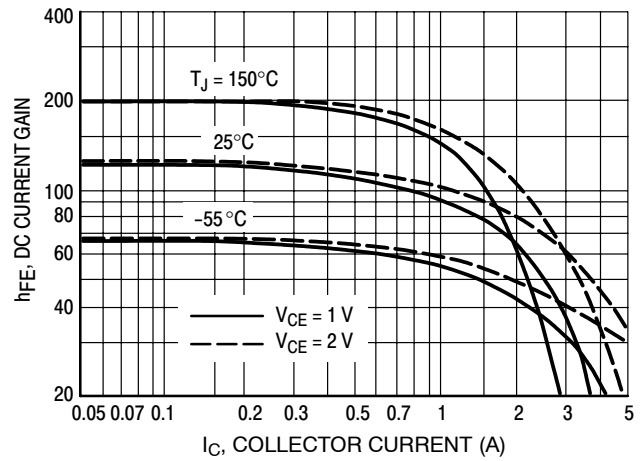


Figure 5. DC Current Gain

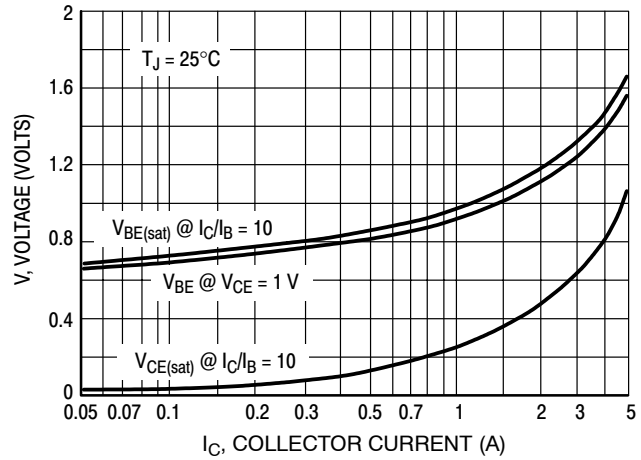
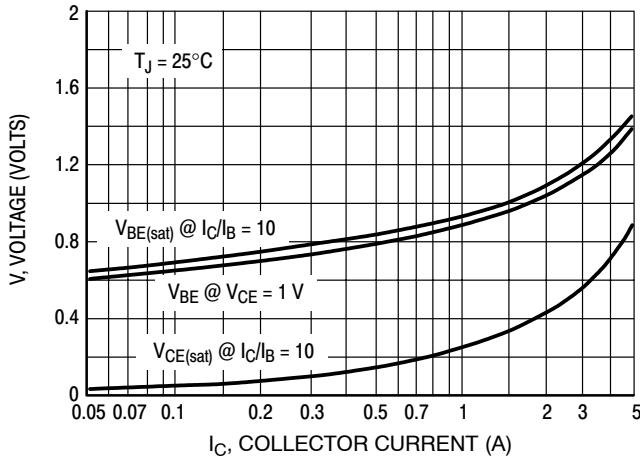


Figure 6. "On" Voltage

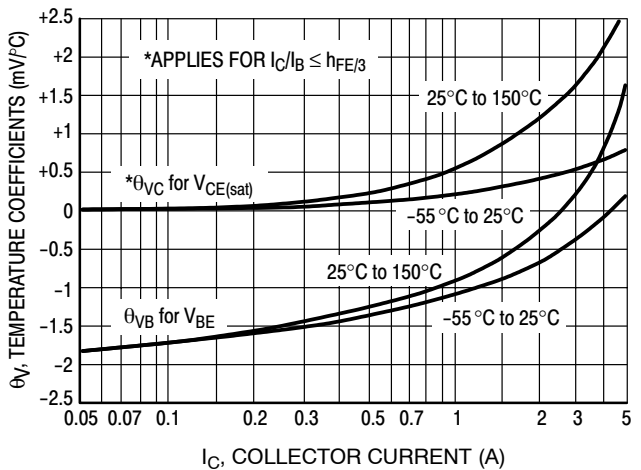
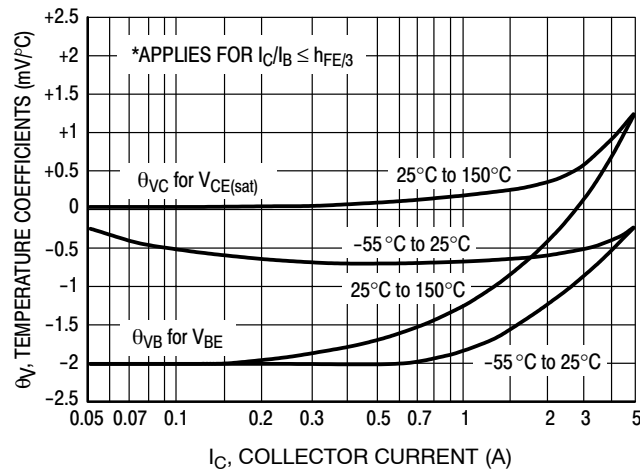


Figure 7. Temperature Coefficients

MJD200 (NPN) MJD210 (PNP)

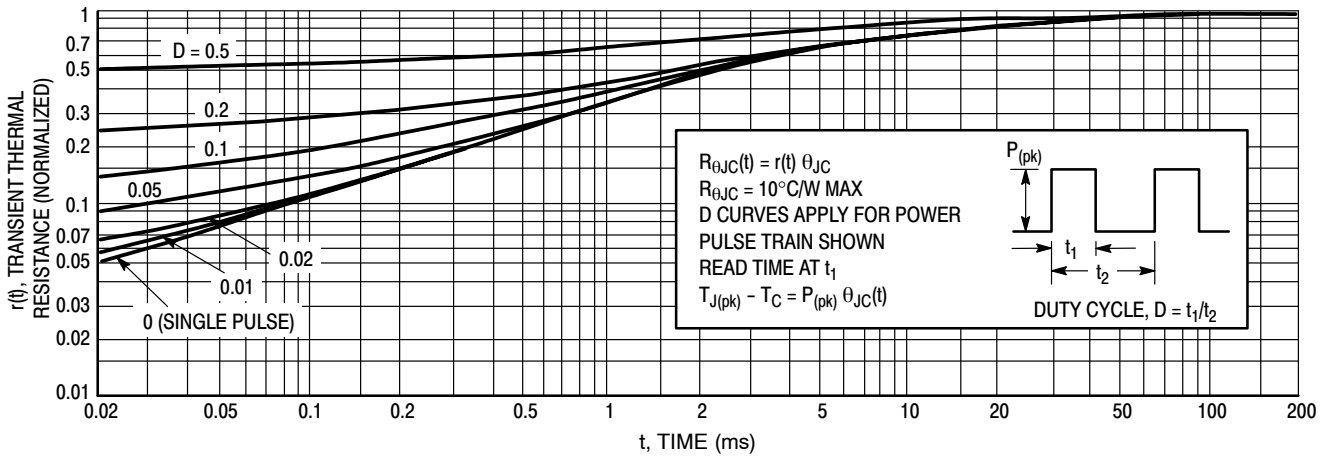


Figure 8. Thermal Response

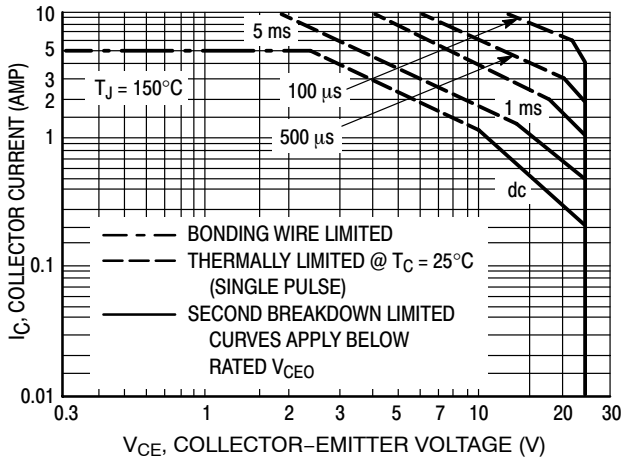


Figure 9. Active Region Safe Operating Area

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 9 is based on $T_{J(pk)} = 150^{\circ}\text{C}$; T_C is variable depending on conditions. Second breakdown pulse limits are valid for duty cycles to 10% provided $T_{J(pk)} \leq 150^{\circ}\text{C}$. $T_{J(pk)}$ may be calculated from the data in Figure 8. At high case temperatures, thermal limitations will reduce the power that can be handled to values less than the limitations imposed by second breakdown.

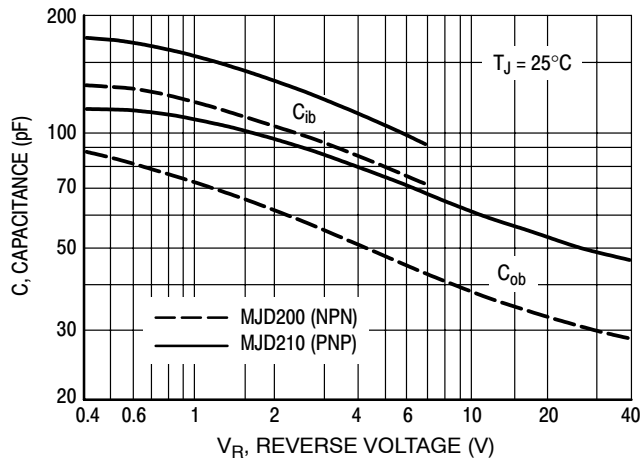


Figure 10. Capacitance

MJD200 (NPN) MJD210 (PNP)

ORDERING INFORMATION

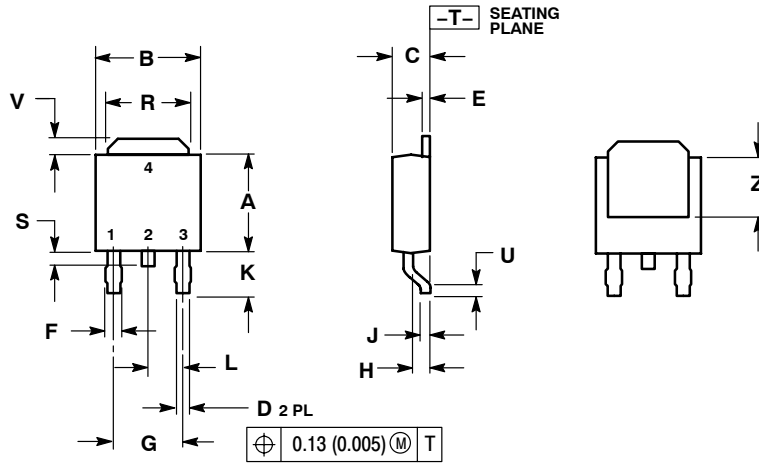
Device	Package Type	Shipping†
MJD200	DPAK	75 Units / Rail
MJD200G	DPAK (Pb-Free)	75 Units / Rail
MJD200RL	DPAK	1800 Tape & Reel
MJD200RLG	DPAK (Pb-Free)	1800 Tape & Reel
MJD200T4	DPAK	2500 Tape & Reel
MJD200T4G	DPAK (Pb-Free)	2500 Tape & Reel
MJD210	DPAK	75 Units / Rail
MJD210RL	DPAK	1800 Tape & Reel
MJD210T4	DPAK	2500 Tape & Reel
MJD210T4G	DPAK (Pb-Free)	2500 Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

MJD200 (NPN) MJD210 (PNP)

PACKAGE DIMENSIONS

DPAK
CASE 369C
ISSUE O

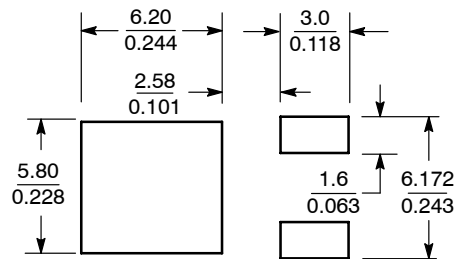


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.235	0.245	5.97	6.22
B	0.250	0.265	6.35	6.73
C	0.086	0.094	2.19	2.38
D	0.027	0.035	0.69	0.88
E	0.018	0.023	0.46	0.58
F	0.037	0.045	0.94	1.14
G	0.180 BSC		4.58 BSC	
H	0.034	0.040	0.87	1.01
J	0.018	0.023	0.46	0.58
K	0.102	0.114	2.60	2.89
L	0.090 BSC		2.29 BSC	
R	0.180	0.215	4.57	5.45
S	0.025	0.040	0.63	1.01
U	0.020	---	0.51	---
V	0.035	0.050	0.89	1.27
Z	0.155	---	3.93	---

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


SOLDERING FOOTPRINT*



SCALE 3:1 $\left(\frac{\text{mm}}{\text{inches}}\right)$

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

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