

# MJE200 - NPN, MJE210 - PNP

Preferred Device

## Complementary Silicon Power Plastic Transistors

These devices are designed for low voltage, low-power, high-gain audio amplifier applications.

### Features

- Collector-Emitter Sustaining Voltage -  
 $V_{CEO(sus)} = 25 \text{ Vdc (Min) @ } I_C = 10 \text{ mAdc}$
- High DC Current Gain -  
 $h_{FE} = 70 \text{ (Min) @ } I_C = 500 \text{ mAdc}$   
 $= 45 \text{ (Min) @ } I_C = 2.0 \text{ Adc}$   
 $= 10 \text{ (Min) @ } I_C = 5.0 \text{ Adc}$
- 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 -  
 $I_{CBO} = 100 \text{ nAdc @ Rated } V_{CB}$
- Pb-Free Packages are Available\*

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	40	Vdc
Collector-Base Voltage	$V_{CB}$	25	Vdc
Emitter-Base Voltage	$V_{EB}$	8.0	Vdc
Collector Current - Continuous - Peak	$I_C$	5.0 10	Adc
Base Current	$I_B$	1.0	Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	15 0.12	W mW/ $^\circ\text{C}$
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	1.5 0.012	W mW/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	-65 to +150	$^\circ\text{C}$

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction-to-Case	$\theta_{JC}$	8.34	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient	$\theta_{JA}$	83.4	$^\circ\text{C/W}$

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

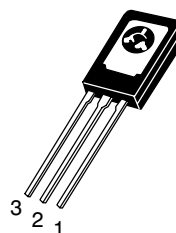
\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.



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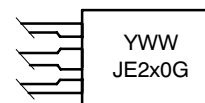
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**5.0 AMPERES  
POWER TRANSISTORS  
COMPLEMENTARY SILICON  
25 VOLTS, 15 WATTS**



TO-225  
CASE 77  
STYLE 1

### MARKING DIAGRAM



Y = Year  
WW = Work Week  
JE2x0 = Device Code  
x = 0 or 1  
G = Pb-Free Package

### ORDERING INFORMATION

Device	Package	Shipping
MJE200	TO-225	500 Units/Box
MJE200G	TO-225 (Pb-Free)	500 Units/Box
MJE210	TO-225	500 Units/Box
MJE210G	TO-225 (Pb-Free)	500 Units/Box
MJE210T	TO-225	50 Units/Rail
MJE210TG	TO-225 (Pb-Free)	50 Units/Rail

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

# MJE200 – NPN, MJE210 – PNP

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

Characteristic	Symbol	Min	Max	Unit
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### OFF CHARACTERISTICS

Collector-Emitter Sustaining Voltage (Note 1) (I <sub>C</sub> = 10 mA, I <sub>B</sub> = 0)	V <sub>CEO(sus)</sub>	25	-	Vdc
Collector Cutoff Current (V <sub>CB</sub> = 40 Vdc, I <sub>E</sub> = 0) (V <sub>CB</sub> = 40 Vdc, I <sub>E</sub> = 0, T <sub>J</sub> = 125°C)	I <sub>CBO</sub>	-	100	nAdc μAdc
Emitter Cutoff Current (V <sub>BE</sub> = 8.0 Vdc, I <sub>C</sub> = 0)	I <sub>EBO</sub>	-	100	nAdc

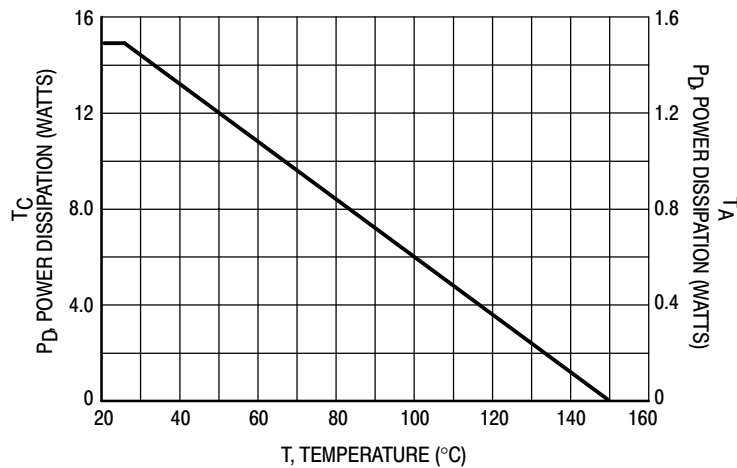
### ON CHARACTERISTICS

DC Current Gain (Note 1) (I <sub>C</sub> = 500 mA, V <sub>CE</sub> = 1.0 Vdc) (I <sub>C</sub> = 2.0 Adc, V <sub>CE</sub> = 1.0 Vdc) (I <sub>C</sub> = 5.0 Adc, V <sub>CE</sub> = 2.0 Vdc)	h <sub>FE</sub>	70 45 10	- 180 -	-
Collector-Emitter Saturation Voltage (Note 1) (I <sub>C</sub> = 500 mA, I <sub>B</sub> = 50 mA) (I <sub>C</sub> = 2.0 Adc, I <sub>B</sub> = 200 mA) (I <sub>C</sub> = 5.0 Adc, I <sub>B</sub> = 1.0 Adc)	V <sub>CE(sat)</sub>	- - -	0.3 0.75 1.8	Vdc
Base-Emitter Saturation Voltage (Note 1) (I <sub>C</sub> = 5.0 Adc, I <sub>B</sub> = 1.0 Adc)	V <sub>BE(sat)</sub>	-	2.5	Vdc
Base-Emitter On Voltage (Note 1) (I <sub>C</sub> = 2.0 Adc, V <sub>CE</sub> = 1.0 Vdc)	V <sub>BE(on)</sub>	-	1.6	Vdc

### DYNAMIC CHARACTERISTICS

Current-Gain – Bandwidth Product (Note 2) (I <sub>C</sub> = 100 mA, V <sub>CE</sub> = 10 Vdc, f <sub>test</sub> = 10 MHz)	f <sub>T</sub>	65	-	MHz
Output Capacitance (V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f = 0.1 MHz)	C <sub>ob</sub>	-	80 120	pF

1. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≈ 2.0%.
2. f<sub>T</sub> = |h<sub>fe</sub>| • f<sub>test</sub>.



**Figure 1. Power Derating**

MJE200 - NPN,

MJE210 - PNP

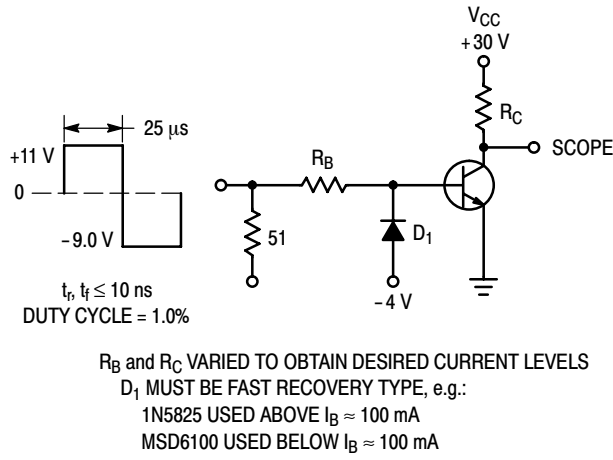


Figure 2. Switching Time Test Circuit

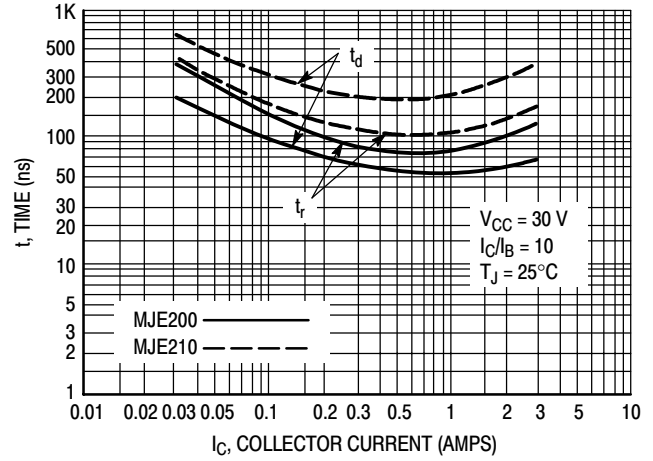


Figure 3. Turn-On Time

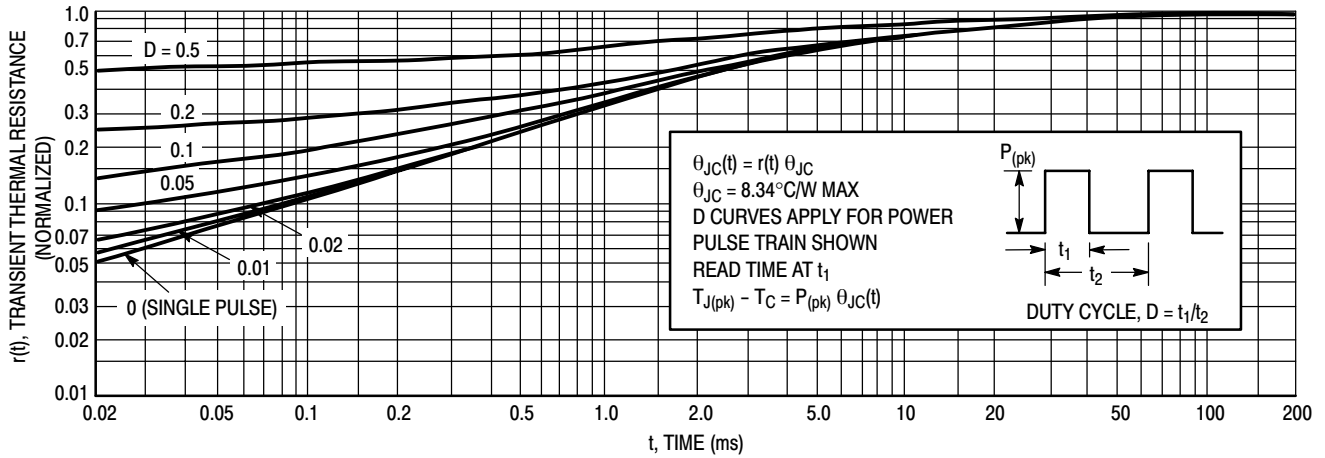


Figure 4. Thermal Response

## MJE200 - NPN,

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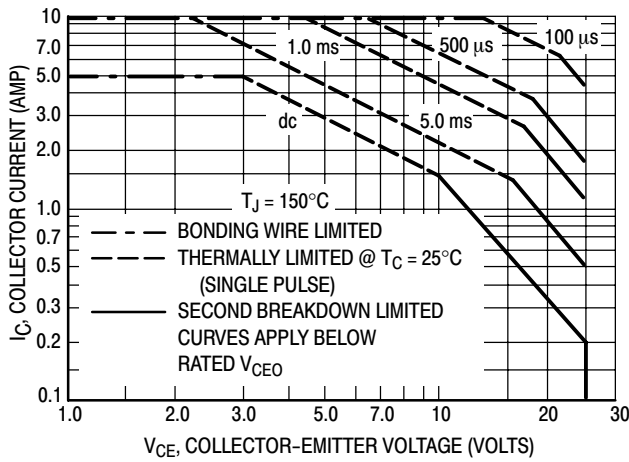


Figure 5. Active Region Safe Operating Area

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  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  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 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.

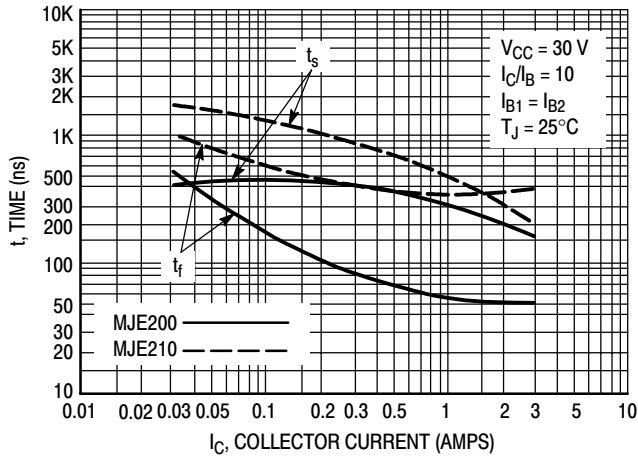


Figure 6. Turn-Off Time

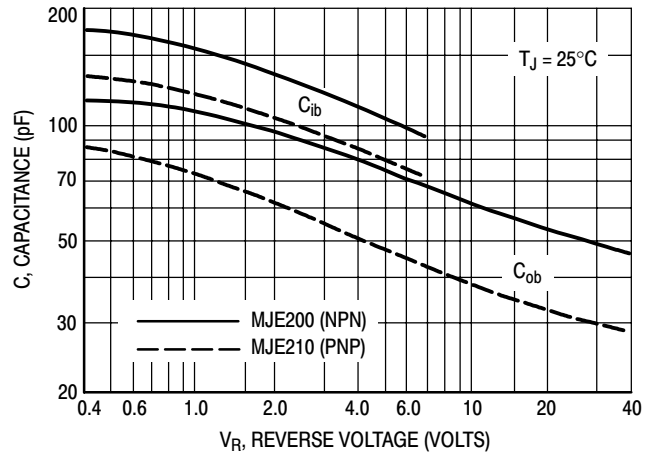


Figure 7. Capacitance

## MJE200 - NPN,

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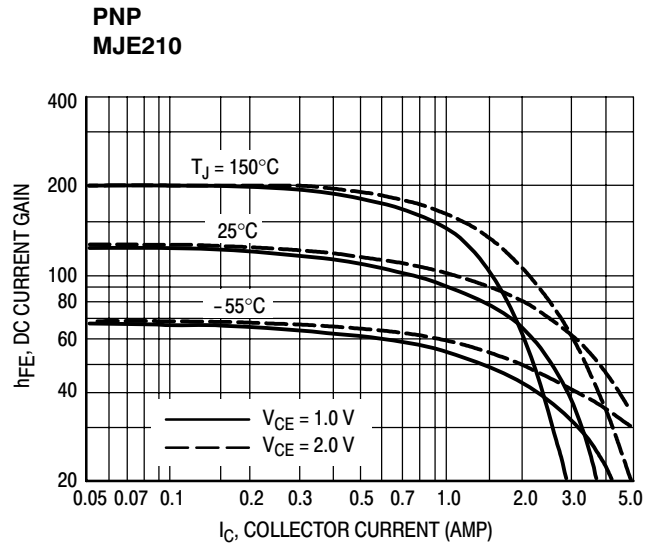
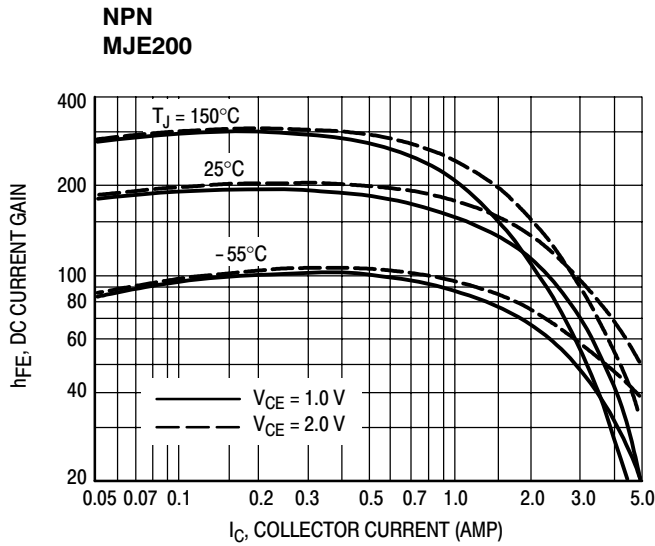


Figure 8. DC Current Gain

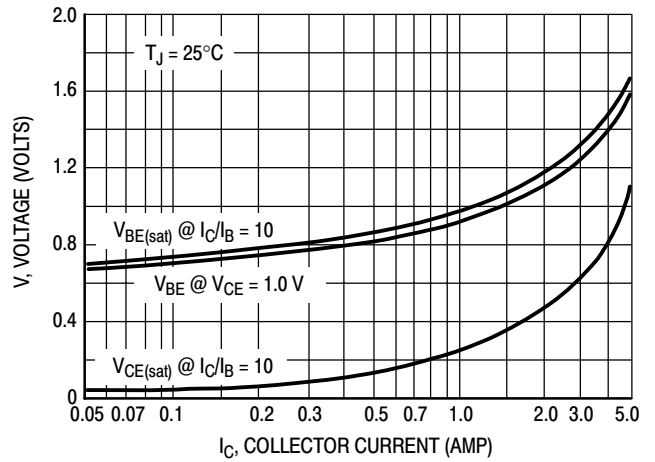
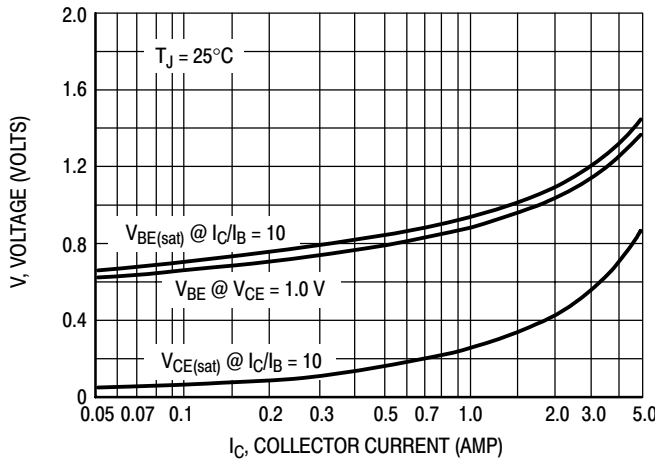


Figure 9. "On" Voltage

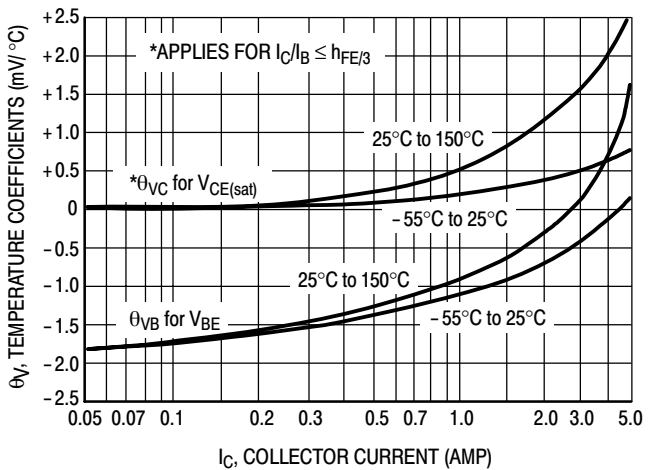
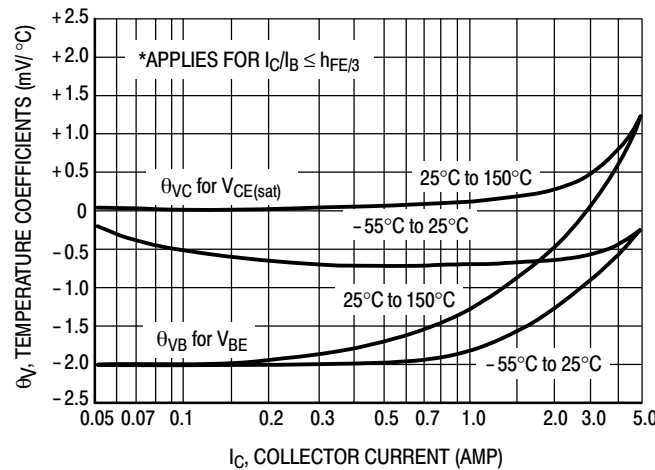
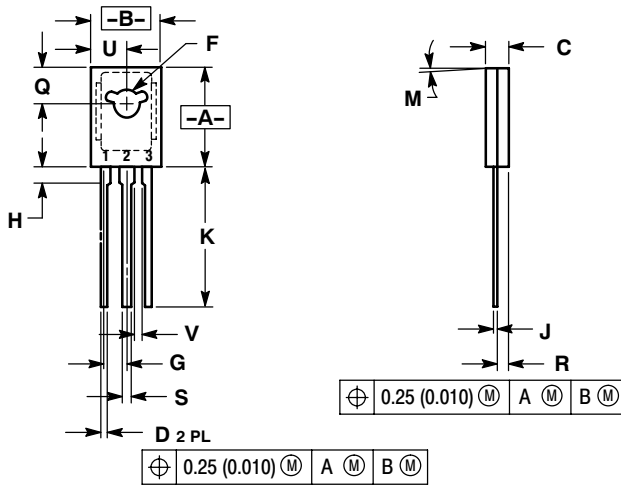


Figure 10. Temperature Coefficients

# MJE200 – NPN, MJE210 – PNP

## PACKAGE DIMENSIONS

TO-225  
CASE 77-09  
ISSUE Z



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. 077-01 THRU -08 OBSOLETE, NEW STANDARD 077-09.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.425	0.435	10.80	11.04
B	0.295	0.305	7.50	7.74
C	0.095	0.105	2.42	2.66
D	0.020	0.026	0.51	0.66
F	0.115	0.130	2.93	3.30
G	0.094 BSC		2.39 BSC	
H	0.050	0.095	1.27	2.41
J	0.015	0.025	0.39	0.63
K	0.575	0.655	14.61	16.63
M	5° TYP		5° TYP	
Q	0.148	0.158	3.76	4.01
R	0.045	0.065	1.15	1.65
S	0.025	0.035	0.64	0.88
U	0.145	0.155	3.69	3.93
V	0.040	---	1.02	---

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

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