

# NJL3281D (NPN) NJL1302D (PNP)

## Product Preview Complementary ThermalTrak™ Transistors

The ThermalTrak family of devices has been designed to eliminate thermal equilibrium lag time and bias trimming in audio amplifier applications. They can also be used in other applications as transistor die protection devices.

### Features

- Thermally Matched Bias Diode
- Instant Thermal Bias Tracking
- Absolute Thermal Integrity
- High Safe Operating Area

### Benefits

- Eliminates Thermal Equilibrium Lag Time and Bias Trimming
- Superior Sound Quality Through Improved Dynamic Temperature Response
- Significantly Improved Bias Stability
- Simplified Assembly
  - ◆ Reduced Labor Costs
  - ◆ Reduced Component Count
- High Reliability

### Applications

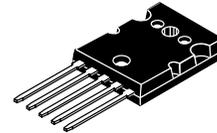
- High-End Consumer Audio Products
  - ◆ Home Amplifiers
  - ◆ Home Receivers
- Professional Audio Amplifiers
  - ◆ Theater and Stadium Sound Systems
  - ◆ Public Address Systems (PAs)



ON Semiconductor®

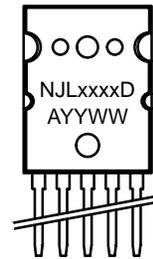
<http://onsemi.com>

**BIPOLAR POWER  
TRANSISTORS**  
**15 A, 230 V, 200 W**

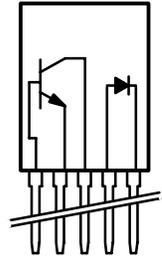


TO-264, 5 LEAD  
CASE 340AA  
STYLE 1

### MARKING DIAGRAM



### SCHEMATIC



xxxx = Specific Device Code  
A = Assembly Location  
YY = Year  
WW = Work Week

### ORDERING INFORMATION

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

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

## NJL3281D (NPN) NJL1302D (PNP)

### MAXIMUM RATINGS ( $T_J = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	$V_{CEO}$	230	Vdc
Collector–Base Voltage	$V_{CBO}$	230	Vdc
Emitter–Base Voltage	$V_{EBO}$	5	Vdc
Collector–Emitter Voltage – 1.5 V	$V_{CEX}$	230	Vdc
Collector Current – Continuous – Peak (Note 1)	$I_C$	15 25	Adc
Base Current – Continuous	$I_B$	1.5	Adc
Total Power Dissipation @ $T_C = 25^\circ\text{C}$ Derate Above $25^\circ\text{C}$	$P_D$	200 1.43	W W/ $^\circ\text{C}$
Operating and Storage Junction Temperature Range	$T_J, T_{stg}$	– 65 to +150	$^\circ\text{C}$
DC Blocking Voltage	$V_R$	200	V
Average Rectified Forward Current	$I_{F(AV)}$	1.0	A

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction–to–Case	$R_{\theta JC}$	0.625	$^\circ\text{C/W}$

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%.

### ATTRIBUTES

Characteristic	Value
ESD Protection Human Body Model Machine Model	>8000 V > 400 V
Flammability Rating	UL 94 V–0 @ 0.125 in

### ORDERING INFORMATION

Device	Package	Shipping
NJL3281D	TO–264	25 Units / Rail
NJL1302D	TO–264	25 Units / Rail

## NJL3281D (NPN) NJL1302D (PNP)

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

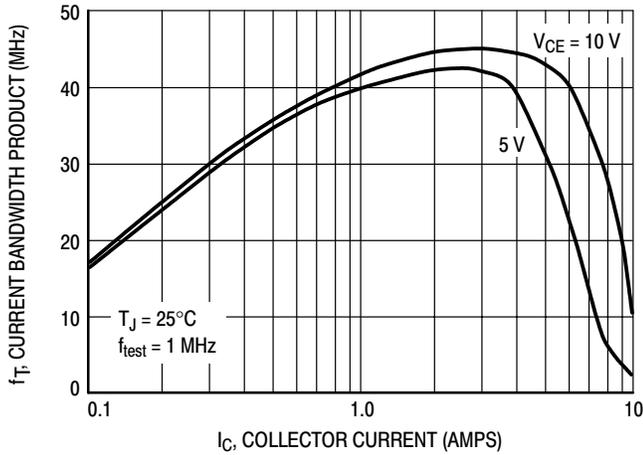
Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS</b>				
Collector–Emitter Sustaining Voltage (I <sub>C</sub> = 100 mAdc, I <sub>B</sub> = 0)	V <sub>CEO(sus)</sub>	230	–	Vdc
Collector Cutoff Current (V <sub>CB</sub> = 230 Vdc, I <sub>E</sub> = 0)	I <sub>CB0</sub>	–	50	μAdc
Emitter Cutoff Current (V <sub>EB</sub> = 5 Vdc, I <sub>C</sub> = 0)	I <sub>EBO</sub>	–	5	μAdc
<b>ON CHARACTERISTICS</b>				
DC Current Gain (I <sub>C</sub> = 100 mAdc, V <sub>CE</sub> = 5 Vdc) (I <sub>C</sub> = 1 Adc, V <sub>CE</sub> = 5 Vdc) (I <sub>C</sub> = 3 Adc, V <sub>CE</sub> = 5 Vdc) (I <sub>C</sub> = 5 Adc, V <sub>CE</sub> = 5 Vdc) (I <sub>C</sub> = 7 Adc, V <sub>CE</sub> = 5 Vdc) (I <sub>C</sub> = 8 Adc, V <sub>CE</sub> = 5 Vdc) (I <sub>C</sub> = 15 Adc, V <sub>CE</sub> = 5 Vdc)	h <sub>FE</sub>	60 60 60 60 60 45 12	175 175 175 175 175 – –	
Collector–Emitter Saturation Voltage (I <sub>C</sub> = 10 Adc, I <sub>B</sub> = 1 Adc)	V <sub>CE(sat)</sub>	–	3	Vdc
<b>DYNAMIC CHARACTERISTICS</b>				
Current–Gain – Bandwidth Product (I <sub>C</sub> = 1 Adc, V <sub>CE</sub> = 5 Vdc, f <sub>test</sub> = 1 MHz)	f <sub>T</sub>	30	–	MHz
Output Capacitance (V <sub>CB</sub> = 10 Vdc, I <sub>E</sub> = 0, f <sub>test</sub> = 1 MHz)	C <sub>ob</sub>	–	600	pF
Maximum Instantaneous Forward Voltage (Note 2) (i <sub>F</sub> = 1.0 A, T <sub>J</sub> = 25°C) (i <sub>F</sub> = 1.0 A, T <sub>J</sub> = 150°C)	V <sub>F</sub>		1.0 0.83	V
Maximum Instantaneous Reverse Current (Note 2) (Rated dc Voltage, T <sub>J</sub> = 25°C) (Rated dc Voltage, T <sub>J</sub> = 150°C)	i <sub>R</sub>		10 100	μA
Maximum Reverse Recovery Time (i <sub>F</sub> = 1.0 A, di/dt = 50 A/μs)	t <sub>rr</sub>		100	ns

2. Pulse Test: Pulse Width = 300 μs, Duty Cycle ≤ 2.0%.

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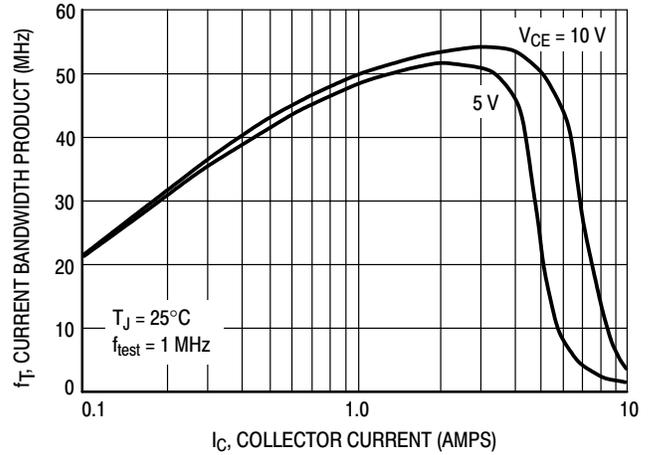
## TYPICAL CHARACTERISTICS

**PNP NJL1302D**



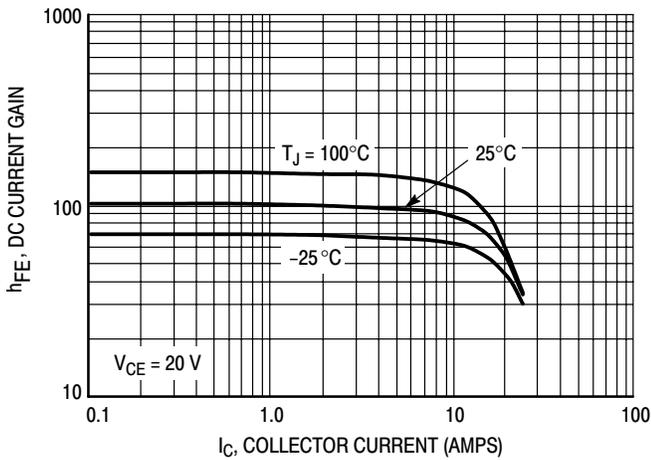
**Figure 1. Typical Current Gain Bandwidth Product**

**NPN NJL3281D**



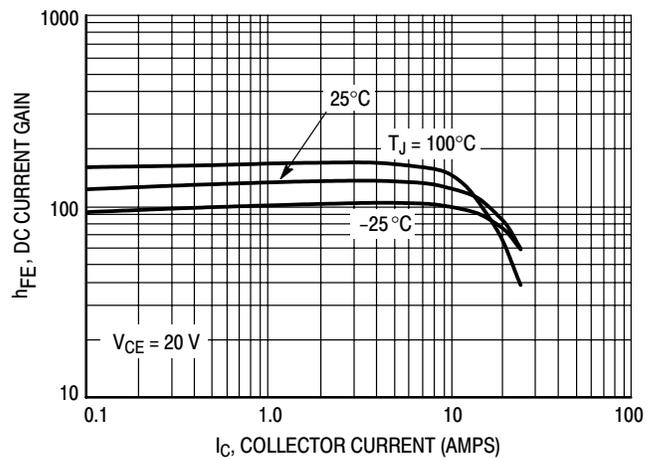
**Figure 2. Typical Current Gain Bandwidth Product**

**PNP NJL1302D**



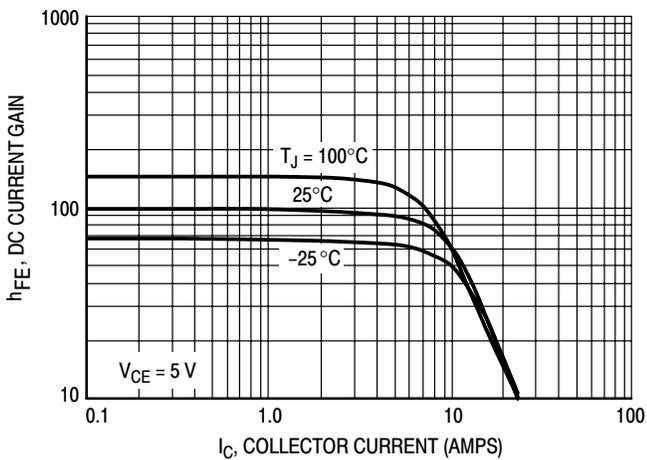
**Figure 3. DC Current Gain,  $V_{CE} = 20\text{ V}$**

**NPN NJL3281D**



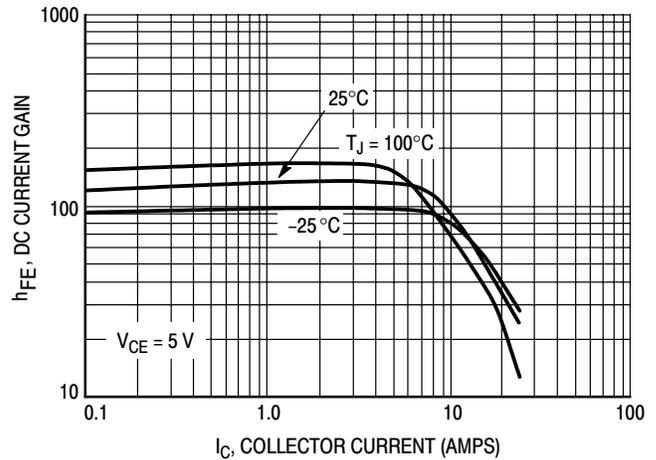
**Figure 4. DC Current Gain,  $V_{CE} = 20\text{ V}$**

**PNP NJL1302D**



**Figure 5. DC Current Gain,  $V_{CE} = 5\text{ V}$**

**NPN NJL3281D**



**Figure 6. DC Current Gain,  $V_{CE} = 5\text{ V}$**

# NJL3281D (NPN) NJL1302D (PNP)

## TYPICAL CHARACTERISTICS

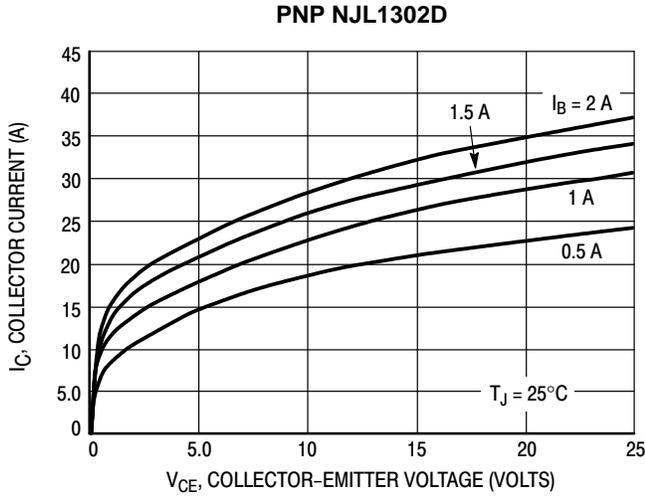


Figure 7. Typical Output Characteristics

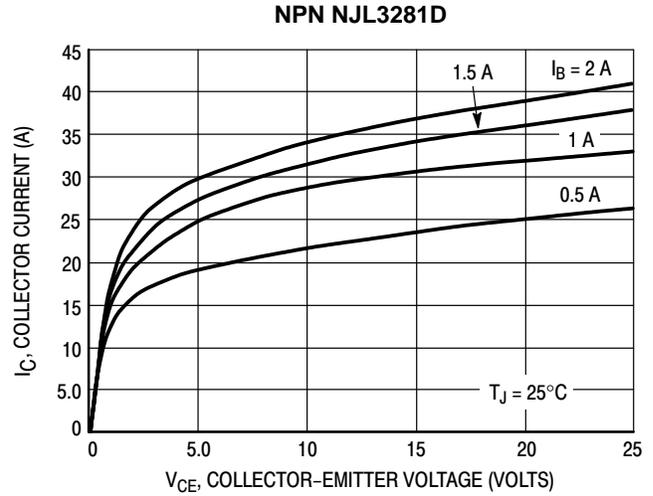


Figure 8. Typical Output Characteristics

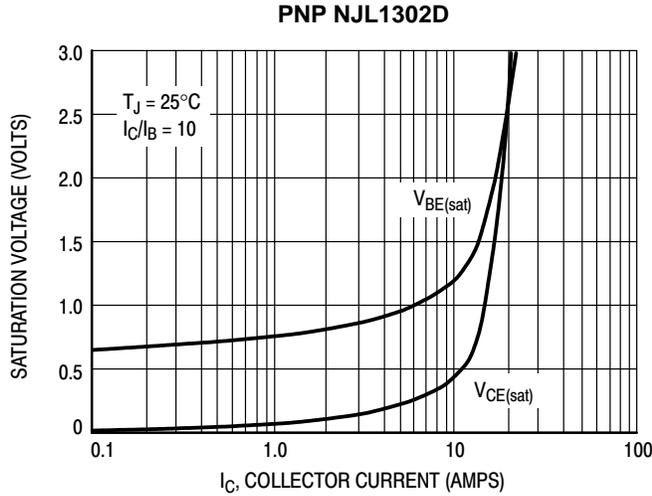


Figure 9. Typical Saturation Voltages

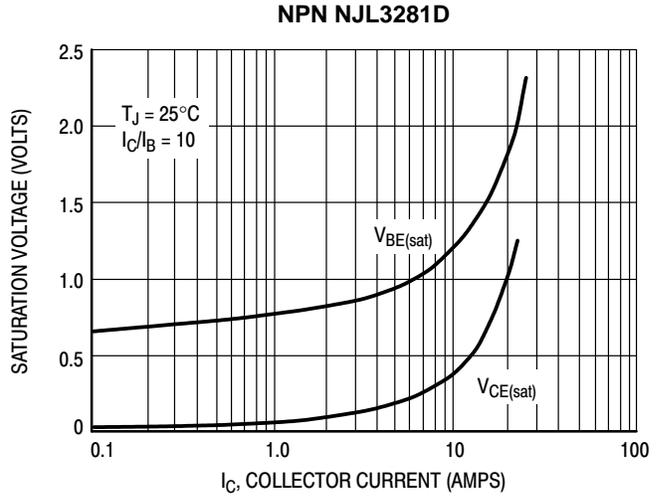


Figure 10. Typical Saturation Voltages

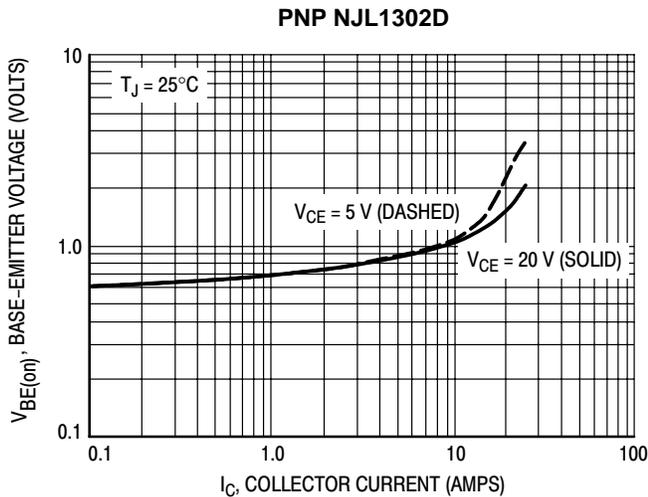


Figure 11. Typical Base-Emitter Voltage

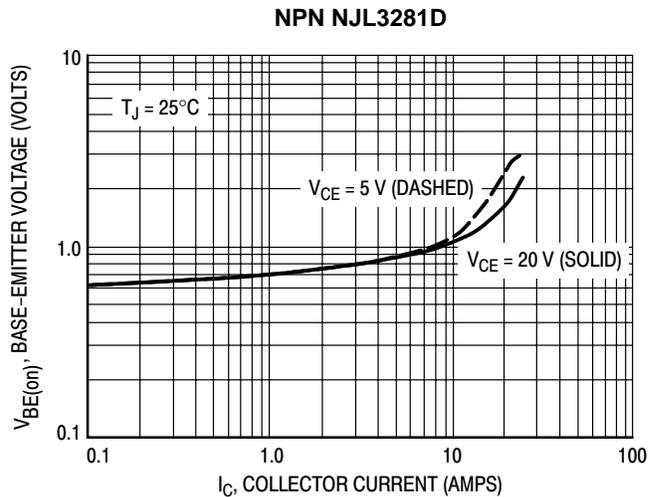


Figure 12. Typical Base-Emitter Voltage

# NJL3281D (NPN) NJL1302D (PNP)

## TYPICAL CHARACTERISTICS

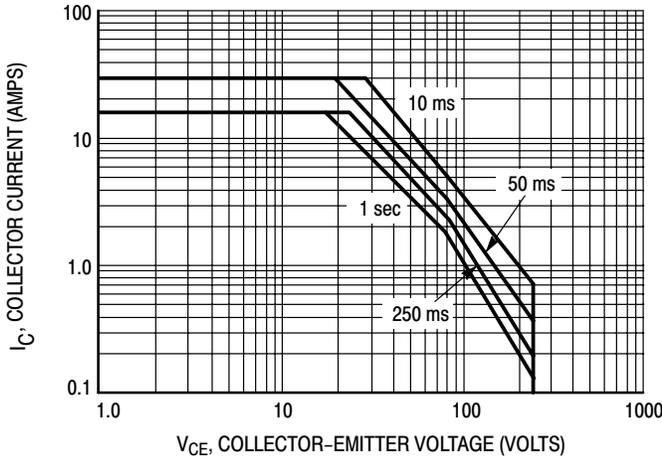


Figure 13. Active Region Safe Operating Area

There are two limitations on the power handling ability of a transistor; average junction temperature and secondary 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 13 is based on  $T_{J(pk)} = 150^\circ\text{C}$ ;  $T_C$  is variable depending on conditions. At high case temperatures, thermal limitations will reduce the power than can be handled to values less than the limitations imposed by second breakdown.

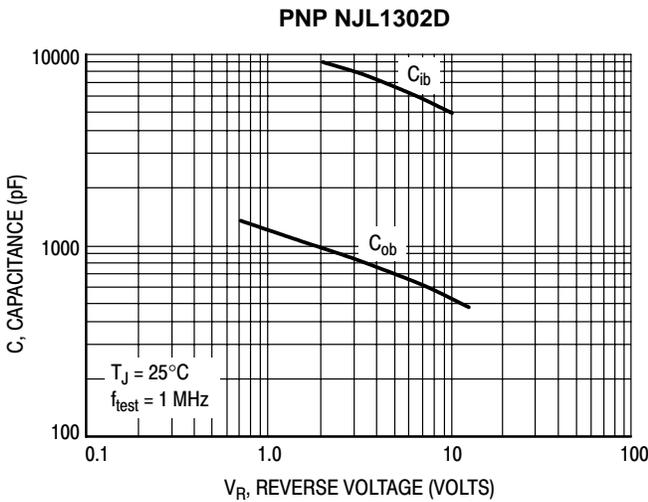


Figure 14. NJL1302D Typical Capacitance

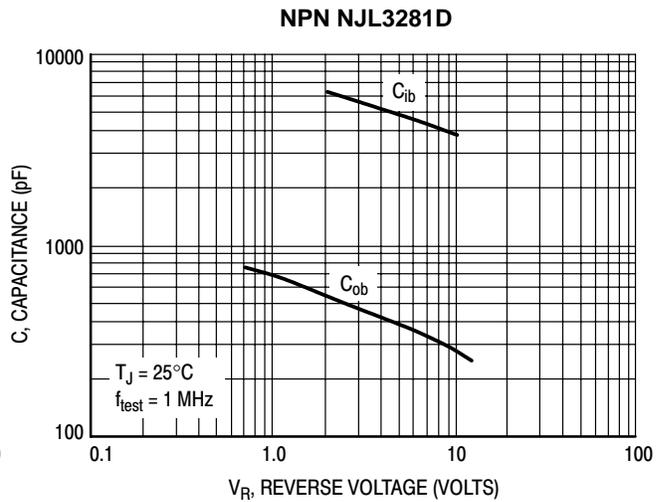


Figure 15. NJL3281D Typical Capacitance

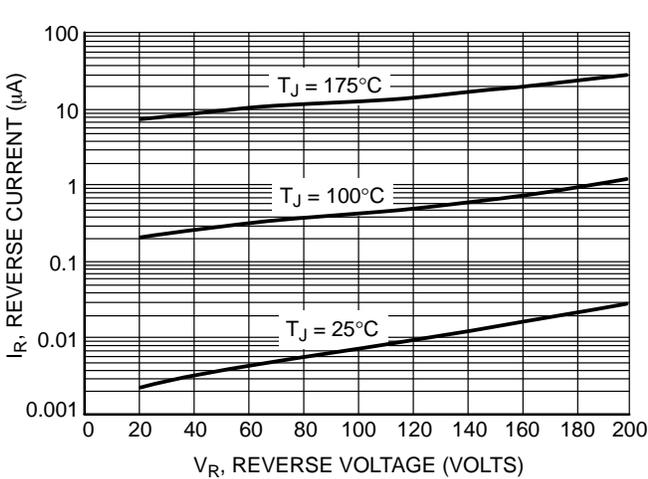


Figure 16. Typical Reverse Current

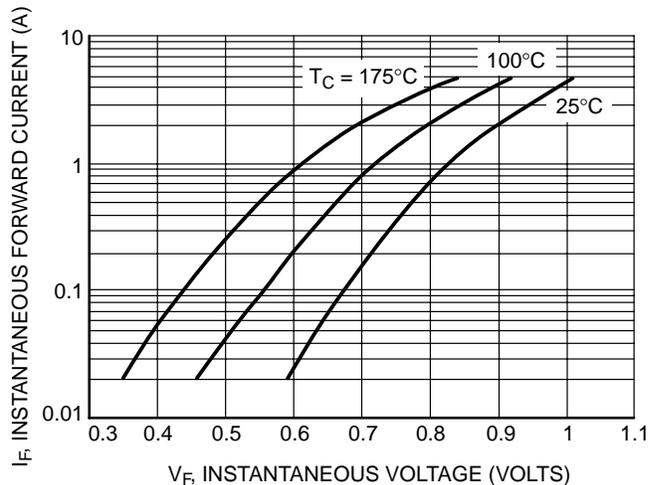
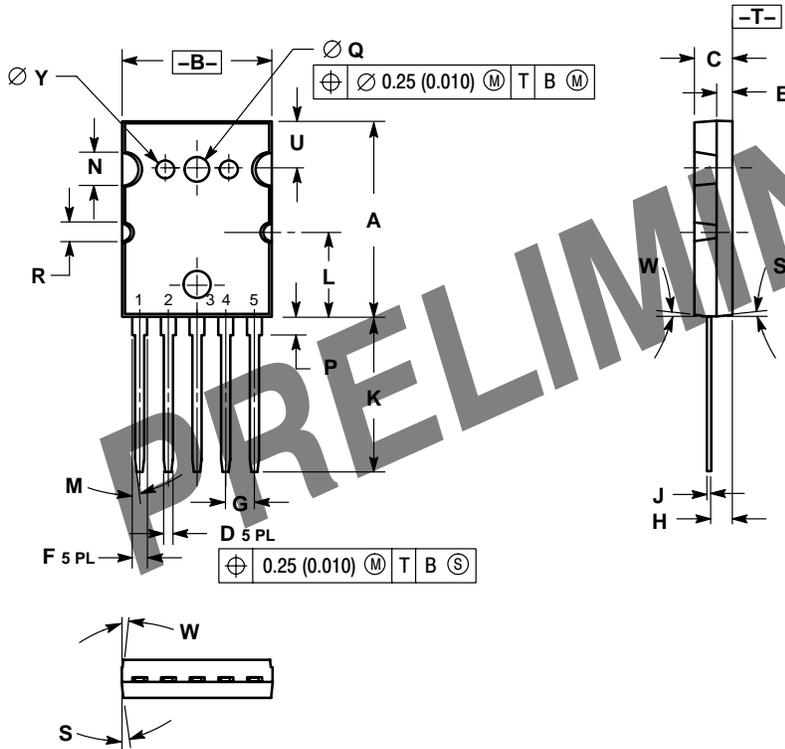


Figure 17. Typical Forward Voltage

# NJL3281D (NPN) NJL1302D (PNP)

## PACKAGE DIMENSIONS

TO-264, 5 LEAD  
CASE 340AA-01  
ISSUE O



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

DIM	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	25.857	25.984	26.111	1.018	1.023	1.028
B	19.761	19.888	20.015	0.778	0.783	0.788
C	4.928	5.055	5.182	0.194	0.199	0.204
D	1.219 BSC			0.0480 BSC		
E	2.032	2.108	2.184	0.0800	0.0830	0.0860
F	1.981 BSC			0.0780 BSC		
G	3.81 BSC			0.150 BSC		
H	2.667	2.718	2.769	0.1050	0.1070	0.1090
J	0.584 BSC			0.0230 BSC		
K	20.422	20.549	20.676	0.804	0.809	0.814
L	11.28 REF			0.444 REF		
M	0°	---	7°	0°	---	7°
N	4.57 REF			0.180 REF		
P	2.259	2.386	2.513	0.0889	0.0939	0.0989
Q	3.480 BSC			0.1370 BSC		
R	2.54 REF			0.100 REF		
S	0°	---	8°	0°	---	8°
U	6.17 REF			0.243 REF		
W	0°	---	6°	0°	---	6°
Y	2.388 BSC			0.0940 BSC		

STYLE 1:  
PIN 1. BASE  
2. EMITTER  
3. COLLECTOR  
4. ANODE  
5. CATHODE

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