

**HIGH-FREQUENCY INTERMEDIATE-POWER TRANSISTORS**

- 15 Watts at 100°C Case Temperature
- Typ  $V_{CE(sat)}$  of 0.2 V at 200 mA
- Typ  $V_{BE}$  of 0.8 V at 200 mA
- Typ  $f_T$  of 50 MHz at 10 V, 100 mA

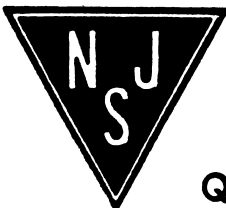
\* mechanical data

<p><b>2N2987</b> THRU <b>2N2990</b></p> <p>DETAILS OF OUTLINE IN THIS ZONE OPTIONAL</p> <p>CASE TEMPERATURE IS MEASURED 0.144 INCH ± 0.010 INCH DOWN FROM TOP OF CAN</p>	<p>THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE CASE</p> <p>ALL JEDEC TO-5 DIMENSIONS AND NOTES ARE APPLICABLE</p> <p>ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED</p>	
<p><b>2N2991</b> THRU <b>2N2994</b></p>	<p>THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE CASE</p> <p>POSITION OF THE LEADS IN RELATION TO THE HEX IS NOT CONTROLLED</p> <p>MAXIMUM RECOMMENDED MOUNTING TORQUE: 15 IN.-LB.</p> <p>ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED</p>	

absolute maximum ratings at 25°C case temperature (unless otherwise noted)

	2N2987	2N2988	2N2991	2N2992
	2N2989	2N2990	2N2993	2N2994
* Collector-Base Voltage	95 V	155 V	95 V	155 V
* Collector-Emitter Voltage (See Note 1)	80 V	100 V	80 V	100 V
* Emitter-Base Voltage	← 7 V →			
* Continuous Collector Current	← 1 A →			
Peak Collector Current (See Note 2)	← 1.5 A →			
* Continuous Base Current	← 0.2 A →			
Safe Operating Region at (or below) 100°C Case Temperature	See Figure 10			
* Continuous Device Dissipation at (or below) 100°C Case Temperature (See Note 3)	← 15 W →			
* Continuous Device Dissipation at (or below) 25°C Free-Air Temperature (See Note 4)	← 1 W →		← 2 W →	
* Operating Case Temperature Range	← -65°C to 200°C →			
* Storage Temperature Range	← -65°C to 200°C →			
* Lead Temperature 1/16 Inch from Case for 10 Seconds	← 230°C →			

- NOTES: 1. This value applies between 1 mA and 30 mA collector current when the base-emitter diode is open-circuited.  
 2. This value applies for  $t_p \leq 0.3$  ms, duty cycle  $\leq 10\%$ .  
 3. Derate linearly to 200°C case temperature at the rate of 150 mW/deg.  
 4. Derate linearly to 200°C free-air temperature at the rate of 5.7 mW/deg for the 2N2987 through 2N2990 and 11.4 mW/deg for the 2N2991 through 2N2994.



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\*electrical characteristics at 25°C case temperature (unless otherwise noted)

PARAMETER	TEST CONDITIONS	2N2987	2N2988	2N2989	2N2990	UNIT	
		2N2991	2N2992	2N2993	2N2994		
		MIN	MAX	MIN	MAX	MIN	MAX
$V_{(BR)CEO}$ Collector-Emitter Breakdown Voltage	$I_C = 30 \text{ mA}$ , $I_B = 0$ , See Note 5	80	100	80	100	V	
$I_{CEO}$ Collector Cutoff Current	$V_{CE} = 50 \text{ V}$ , $I_B = 0$	0.1		0.1		μA	
	$V_{CE} = 90 \text{ V}$ , $I_B = 0$			0.1		0.1	
$I_{CEV}$ Collector Cutoff Current	$V_{CE} = 90 \text{ V}$ , $V_{BE} = -1.5 \text{ V}$	25		25		nA	
	$V_{CE} = 150 \text{ V}$ , $V_{BE} = -1.5 \text{ V}$			25		25	
	$V_{CE} = 90 \text{ V}$ , $V_{BE} = -1.5 \text{ V}$ , $T_C = 175^\circ\text{C}$	15		15		μA	
	$V_{CE} = 150 \text{ V}$ , $V_{BE} = -1.5 \text{ V}$ , $T_C = 175^\circ\text{C}$			15		15	
$I_{EBO}$ Emitter Cutoff Current	$V_{EB} = 7 \text{ V}$ , $I_C = 0$	25		25		nA	
$h_{FE}$ Static Forward Current Transfer Ratio	$V_{CE} = 5 \text{ V}$ , $I_C = 1 \text{ mA}$	20		20		40	
	$V_{CE} = 5 \text{ V}$ , $I_C = 200 \text{ mA}$ , See Notes 5 and 6	25 75		25 75		60 120	
	$V_{CE} = 5 \text{ V}$ , $I_C = 500 \text{ mA}$ , See Notes 5 and 6	20		20		40	
	$V_{CE} = 10 \text{ V}$ , $I_C = 100 \text{ mA}$ , See Notes 5 and 6	25		25		50	
	$V_{CE} = 5 \text{ V}$ , $I_C = 200 \text{ mA}$ , $T_C = -55^\circ\text{C}$ , See Notes 5 and 6	10		10		20	
$V_{BE}$ Base-Emitter Voltage	$V_{CE} = 5 \text{ V}$ , $I_C = 200 \text{ mA}$ , See Notes 5 and 6	0.9		0.9		0.9	
	$I_B = 20 \text{ mA}$ , $I_C = 200 \text{ mA}$ , See Notes 5 and 6	1		1		1	
	$I_B = 50 \text{ mA}$ , $I_C = 500 \text{ mA}$ , See Notes 5 and 6	1.4		1.4		1.4	
$V_{CE(sat)}$ Collector-Emitter Saturation Voltage	$I_B = 20 \text{ mA}$ , $I_C = 200 \text{ mA}$ , See Notes 5 and 6	0.8		0.8		0.8	
	$I_B = 50 \text{ mA}$ , $I_C = 500 \text{ mA}$ , See Notes 5 and 6	3		3		3	
$h_{fe}$ Small-Signal Common-Emitter Forward Current Transfer Ratio	$V_{CE} = 10 \text{ V}$ , $I_C = 100 \text{ mA}$ , $f = 1 \text{ kHz}$	25	85	25	85	50	170
$ h_{fe} $ Small-Signal Common-Emitter Forward Current Transfer Ratio	$V_{CE} = 10 \text{ V}$ , $I_C = 100 \text{ mA}$ , $f = 30 \text{ MHz}$	1		1		1	
$C_{obo}$ Common-Base Open-Circuit Output Capacitance	$V_{CB} = 10 \text{ V}$ , $I_E = 0$ , $f = 1 \text{ MHz}$	50		50		50	

NOTES: 5. These parameters must be measured using pulse techniques.  $t_p = 300 \mu\text{s}$ , duty cycle  $\leq 2\%$ .

6. These parameters are measured with voltage-sensing contacts separate from the current-carrying contacts.

\*Indicates JEDEC registered data

thermal characteristics

PARAMETER	2N2987 THRU 2N2990	2N2991 THRU 2N2994	UNIT
	MAX	MAX	
$\theta_{J-C}$ Junction-to-Case Thermal Resistance	6.67	6.67	deg/W
$\theta_{J-A}$ Junction-to-Free-Air Thermal Resistance	175	87.5	

switching characteristics at 25°C case temperature

PARAMETER	TEST CONDITIONS†	TYP	UNIT
$t_{on}$ Turn-On Time	$I_C = 200 \text{ mA}$ , $I_{B(1)} = 20 \text{ mA}$ , $I_{B(2)} = -20 \text{ mA}$ , $V_{BE(off)} = -3.4 \text{ V}$ , $R_L = 150 \Omega$ , See Figure 1	0.14	μs
$t_{off}$ Turn-Off Time		2.6	

†Voltage and current values shown are nominal; exact values vary slightly with transistor parameters.