

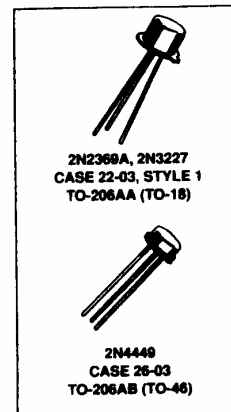
**SEMICONDUCTOR  
TECHNICAL DATA**

**2N2369A  
2N3227  
2N4449**

**NPN Silicon  
Small-Signal Transistors**

...designed for general-purpose switching applications.

MAXIMUM RATINGS					
Rating	Symbol	2N2369A	2N3227	2N4449	Unit
Collector-Emitter Voltage	V <sub>CEO</sub>	15	20	15	V <sub>dc</sub>
Collector-Emitter Voltage	V <sub>CES</sub>	40	40	40	V <sub>dc</sub>
Collector-Base Voltage	V <sub>CBO</sub>	40	40	40	V <sub>dc</sub>
Emitter-Base Voltage	V <sub>EBO</sub>	4.5	6.0	4.5	V <sub>dc</sub>
Total Device Dissipation @ T <sub>A</sub> = 25°C	P <sub>T</sub>	360	360	300	mW
Derate above 25°C		2.06	2.06	1.71	mW/°C
@ T <sub>C</sub> = 25°C		1.2	1.2	1.5	Watts
Derate above 25°C		6.85	6.85	8.56	mW/°C
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	-65 to 200			°C



ELECTRICAL CHARACTERISTICS (T <sub>A</sub> = 25°C unless otherwise noted.)					
Characteristic	Symbol	Min	Max	Unit	
<b>OFF CHARACTERISTICS</b>					
Collector-Emitter Breakdown Voltage <sup>(1)</sup> (I <sub>C</sub> = 10 mA <sub>dc</sub> , I <sub>B</sub> = 0)	2N2369A, 2N4449 2N3227	V <sub>(BR)CEO</sub>	15 20	—	V <sub>dc</sub>
Collector-Emitter Breakdown Voltage (I <sub>C</sub> = 10 μA <sub>dc</sub> , I <sub>E</sub> = 0)		V <sub>(BR)CES</sub>	40	—	V <sub>dc</sub>
Collector-Base Breakdown Voltage (I <sub>C</sub> = 10 μA <sub>dc</sub> , I <sub>E</sub> = 0)		V <sub>(BR)CBO</sub>	40	—	V <sub>dc</sub>
Emitter-Base Breakdown Voltage (I <sub>E</sub> = 10 μA <sub>dc</sub> , I <sub>C</sub> = 0)	2N2369A, 2N4449 2N3227	V <sub>(BR)EBO</sub>	4.5 6.0	—	V <sub>dc</sub>
Collector Cutoff Current (V <sub>CB</sub> = 20 V <sub>dc</sub> , I <sub>E</sub> = 0) (V <sub>CB</sub> = 20 V <sub>dc</sub> , I <sub>E</sub> = 0, T <sub>A</sub> = 150°C)		I <sub>CBO</sub>	— —	0.2 30	μA <sub>dc</sub>

(1) Pulsed. Pulse Width 250 to 350 μs. Duty Cycle 10 to 2.0%.

(continued)

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ELECTRICAL CHARACTERISTICS — continued (T <sub>A</sub> = 25°C unless otherwise noted.)				
Characteristic	Symbol	Min	Max	Unit
<b>OFF CHARACTERISTICS (continued)</b>				
Collector Cutoff Current (V <sub>CE</sub> = 10 Vdc, V <sub>BE</sub> = 0.25 Vdc) (V <sub>CE</sub> = 10 Vdc, V <sub>BE</sub> = 0.25 Vdc, T <sub>A</sub> = 125°C)	I <sub>CEX</sub>	—	0.3 30	μAdc
Collector Cutoff Current (V <sub>CE</sub> = 20 Vdc, I <sub>E</sub> = 0)	I <sub>CES</sub>	—	0.4	μAdc
Emitter Cutoff Current (V <sub>BE</sub> = 4.0 Vdc, I <sub>C</sub> = 0)	I <sub>EBO</sub>	—	0.25	μAdc
<b>ON CHARACTERISTICS</b>				
DC Current Gain <sup>(1)</sup> (I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 0.35 Vdc)	2N2369A, 2N4449 2N3227	h <sub>FE</sub>	40 70	120 250
(I <sub>C</sub> = 30 mAdc, V <sub>CE</sub> = 0.4 Vdc)	2N2369A, 2N4449 2N3227		30 40	120 250
(I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 1.0 Vdc)	2N2369A, 2N4449 2N3227		40 100	120 300
(I <sub>C</sub> = 100 mAdc, V <sub>CE</sub> = 1.0 Vdc)	2N2369A, 2N4449 2N3227		20 30	120 150
(I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 1.0 Vdc, T <sub>A</sub> = -55°C)	2N2369A, 2N4449 2N3227		20 40	— —
Collector-Emitter Saturation Voltage (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc) (I <sub>C</sub> = 30 mAdc, I <sub>B</sub> = 3.0 mAdc) (I <sub>C</sub> = 100 mAdc, I <sub>B</sub> = 10 mAdc) (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc, T <sub>A</sub> = 125°C)		V <sub>CE(sat)</sub>	— — — —	0.2 0.25 0.45 0.3
Base-Emitter Saturation Voltage (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc) (I <sub>C</sub> = 30 mAdc, I <sub>B</sub> = 3.0 mAdc) (I <sub>C</sub> = 100 mAdc, I <sub>B</sub> = 10 mAdc) (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc, T <sub>A</sub> = 125°C) (I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc, T <sub>A</sub> = -55°C)	2N2369A, 2N4449 2N3227	V <sub>BE(sat)</sub>	0.7 — 0.8 0.59 0.50	0.85 0.9 1.2 — 1.02
<b>SMALL-SIGNAL CHARACTERISTICS</b>				
Collector-Base Capacitance (V <sub>CB</sub> = 5.0 Vdc, I <sub>E</sub> = 0, f = 0.1 to 1.0 MHz)		C <sub>obo</sub>	—	4.0
Input Capacitance (V <sub>BE</sub> = 0.5 Vdc, I <sub>C</sub> = 0, f = 0.1 to 1.0 MHz)	2N2369A, 2N4449 2N3227	C <sub>ibo</sub>	— —	5.0 4.0
Small-Signal Current Transfer Ratio, Magnitude (I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 10 Vdc, f = 100 MHz)		h <sub>fe</sub>	5.0	10
<b>SWITCHING CHARACTERISTICS (See Figures 12 and 13)</b>				
Storage Time	2N2369A, 2N4449 2N3227	t <sub>s</sub>	—	13 18
Turn On Time		t <sub>(on)</sub>	—	12
Turn Off Time	2N2369A, 2N4449 2N3227	t <sub>(off)</sub>	—	18 25

<sup>(1)</sup> Pulsed. Pulse Width 750 to 100 μs. Duty Cycle 1.0 to 2.0%.

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<b>ASSURANCE TESTING (Pre/Post Burn-in)</b>				
<b>Burn-in Conditions: <math>T_A = 25 \pm 3^\circ\text{C}</math>, <math>V_{CB} = 12 \text{ Vdc}</math></b>				
<b><math>P_T = 360 \text{ mW}</math> 2N2369A, 2N3227, <math>300 \text{ mW}</math> 2N4449</b>				
Characteristics Tested	Symbol	Initial and End Point Limits		Unit
		Min	Max	
Collector Cutoff Current ( $V_{CE} = 20 \text{ Vdc}$ )	$I_{CES}$	—	0.4	$\mu\text{Adc}$
DC Current Gain <sup>(1)</sup> ( $I_C = 10 \mu\text{Adc}$ , $V_{CE} = 1.0 \text{ Vdc}$ )	$h_{FE}$ 2N2369A, 2N4449 2N3227	40 100	120 300	—

Delta from Pre-Burn-in Measured Values		Min	Max	
Delta Collector Cutoff Current	$\Delta I_{CES}$	—	$\pm 100$ or $\pm 25$ whichever is greater	% of Initial Value $\mu\text{Adc}$
Delta DC Current Gain <sup>(1)</sup>	$\Delta h_{FE}$	—	$\pm 15$	% of Initial Value

<sup>(1)</sup> Pulsed. Pulse Width 250 to 350  $\mu\text{s}$ . Duty Cycle 1.0 to 2.0%



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