

**2N2369AJAN, JTX, JTXV, JANS  
2N3227JAN, JTX, JTXV  
2N4449JAN, JTX, JTXV**

Processed per MIL-S-19500/317

**NPN Silicon  
Small-Signal Transistors**

... designed for general-purpose switching applications.

MAXIMUM RATINGS					
Rating	Symbol	2N2369A	2N3227	2N4449	Unit
Collector-Emitter Voltage	$V_{CEO}$	15	20	15	Vdc
Collector-Emitter Voltage	$V_{CES}$	40	40	40	Vdc
Collector-Base Voltage	$V_{CBO}$	40	40	40	Vdc
Emitter-Base Voltage	$V_{EBO}$	4.5	6.0	4.5	Vdc
Total Device Dissipation	$P_T$				
@ $T_A = 25^\circ\text{C}$		360	360	300	mW
Derate above $25^\circ\text{C}$		2.06	2.06	1.71	mW/ $^\circ\text{C}$
@ $T_C = 25^\circ\text{C}$		1.2	1.2	1.5	Watts
Derate above $25^\circ\text{C}$		6.85	6.85	8.56	mW/ $^\circ\text{C}$
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	-65 to 200			$^\circ\text{C}$



ELECTRICAL CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ unless otherwise noted.)					
Characteristic	Symbol	Min	Max	Unit	
<b>OFF CHARACTERISTICS</b>					
Collector-Emitter Breakdown Voltage <sup>(1)</sup> ( $I_C = 10 \text{ mAdc}, I_E = 0$ )	2N2369A, 2N4449 2N3227	$V_{(BR)CEO}$	15 20	—	Vdc
Collector-Emitter Breakdown Voltage ( $I_C = 10 \text{ } \mu\text{Adc}, I_E = 0$ )		$V_{(BR)CES}$	40	—	Vdc
Collector-Base Breakdown Voltage ( $I_C = 10 \text{ } \mu\text{Adc}, I_E = 0$ )		$V_{(BR)CBO}$	40	—	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 10 \text{ } \mu\text{Adc}, I_C = 0$ )	2N2369A, 2N4449 2N3227	$V_{(BR)EBO}$	4.5 6.0	—	Vdc
Collector Cutoff Current ( $V_{CB} = 20 \text{ Vdc}, I_E = 0$ ) ( $V_{CB} = 20 \text{ Vdc}, I_E = 0, T_A = 150^\circ\text{C}$ )		$I_{CBO}$	— —	0.2 30	$\mu\text{Adc}$

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

(continued)

Datasheet Directory

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	120	—
(I <sub>C</sub> = 30 mAdc, V <sub>CE</sub> = 0.4 Vdc)			70	250	
(I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 1.0 Vdc)	2N2369A, 2N4449 2N3227	h <sub>FE</sub>	30	120	—
(I <sub>C</sub> = 100 mAdc, V <sub>CE</sub> = 1.0 Vdc)			40	250	
(I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 1.0 Vdc, T <sub>A</sub> = -55°C)	2N2369A, 2N4449 2N3227	h <sub>FE</sub>	40	120	—
(I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 1.0 Vdc, T <sub>A</sub> = -55°C)			100	300	
(I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 1.0 Vdc, T <sub>A</sub> = -55°C)	2N2369A, 2N4449 2N3227	h <sub>FE</sub>	20	120	—
(I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 1.0 Vdc, T <sub>A</sub> = -55°C)			30	150	
(I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 1.0 Vdc, T <sub>A</sub> = -55°C)	2N2369A, 2N4449 2N3227	h <sub>FE</sub>	20	—	—
(I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 1.0 Vdc, T <sub>A</sub> = -55°C)			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	Vdc	
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	0.85	Vdc
(I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc, T <sub>A</sub> = -55°C)			—	0.9	
(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>	0.8	1.2	—
(I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc, T <sub>A</sub> = -55°C)			0.59	—	
(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>	0.50	1.02	—
(I <sub>C</sub> = 10 mAdc, I <sub>B</sub> = 1.0 mAdc, T <sub>A</sub> = -55°C)			—	—	
<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	pF	
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	pF
(I <sub>C</sub> = 10 mAdc, V <sub>CE</sub> = 10 Vdc, f = 100 MHz)			—	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	ns
Turn-On Time		t <sub>(on)</sub>	—	12	ns
Turn-Off Time	2N2369A, 2N4449 2N3227	t <sub>(off)</sub>	—	18 25	ns

(1) Pulsed. Pulse Width 750 to 350 μs. Duty Cycle 1.0 to 2.0%.

2N2369AJAN, 2N3227JAN, 2N4449JAN SERIES

ASSURANCE TESTING (Pre/Post Burn-In)				
Burn-In Conditions: $T_A = 25 \pm 3^\circ\text{C}$ , $V_{CB} = 12 \text{ Vdc}$				
$P_T = 360 \text{ mW}$ 2N2369A, 2N3227, $300 \text{ mW}$ 2N4449				
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> ( $I_C = 10 \mu\text{Adc}$ , $V_{CE} = 1.0 \text{ Vdc}$ )	$h_{FE}$	40 100	120 300	—
	2N2369A, 2N4449 2N3227			

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

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



CRYSTALONCS  
 2805 Veterans Highway  
 Suite 14  
 Ronkonkoma, N.Y. 11779