

2N 2218 A
2N 2219 A
2N 2221 A
2N 2222 A

SILICON PLANAR NPN

HIGH-SPEED SWITCHES

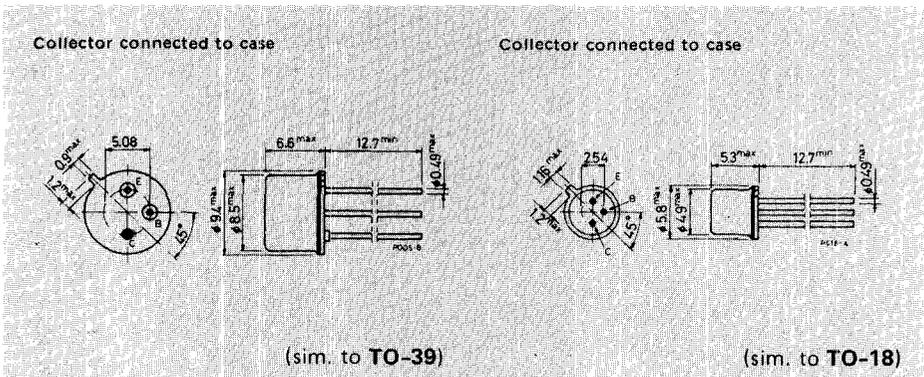
The 2N 2218A, 2N 2219A, 2N 2221A and 2N 2222A are silicon planar epitaxial NPN transistors in Jedec TO-39 (for 2N 2218A and 2N 2219A) and in Jedec TO-18 (for 2N 2221A and 2N 2222A) metal cases. They are designed for high-speed switching applications at collector currents up to 500 mA, and feature useful current gain over a wide range of collector current, low leakage currents and low saturation voltages.

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	75	V
V_{CEO}	Collector-emitter voltage ($I_B = 0$)	40	V
V_{EBO}	Emitter-base voltage ($I_C = 0$)	6	V
I_C	Collector current	0.8	A
P_{tot}	Total power dissipation at $T_{amb} \leq 25^\circ\text{C}$		
	for 2N 2218A and 2N 2219A	0.8	W
	for 2N 2221A and 2N 2222A	0.5	W
	at $T_{case} \leq 25^\circ\text{C}$		
T_{stg}	Storage temperature	3	W
		1.8	W
T_j	Junction temperature	-65 to 200	$^\circ\text{C}$
		175	$^\circ\text{C}$

MECHANICAL DATA

Dimensions in mm



2N 2218 A
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2N 2222A

THERMAL DATA

			2N 2218A 2N 2219A	2N 2221A 2N 2222A
$R_{th\ j-case}$	Thermal resistance junction-case	max	50 °C/W	83.3 °C/W
$R_{th\ j-amb}$	Thermal resistance junction-ambient	max	187.5 °C/W	300 °C/W

ELECTRICAL CHARACTERISTICS ($T_{amb} = 25^{\circ}C$ unless otherwise specified)

Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector cutoff current ($I_E = 0$) $V_{CB} = 60V$ $V_{CB} = 60V$ $T_{amb} = 150^{\circ}C$			10 10	nA μA
I_{CEX}	Collector cutoff current ($V_{BE} = -3V$) $V_{CE} = 60V$			10	nA
I_{EBO}	Emitter cutoff current ($I_C = 0$) $V_{EB} = 3V$			10	nA
I_{BEX}	Base cutoff current ($V_{BE} = -3V$) $V_{CE} = 60V$			20	nA
$V_{(BR)CBO}$	Collector-base breakdown voltage ($I_E = 0$) $I_C = 10 \mu A$	75			V
$V_{(BR)CEO}$	Collector-emitter breakdown voltage ($I_B = 0$) $I_C = 10 mA$	40			V
$V_{(BR)EBO}$	Emitter-base breakdown voltage ($I_C = 0$) $I_E = 10 \mu A$	6			V
$V_{CE(sat)}^*$	Collector-emitter saturation voltage $I_C = 150 mA$ $I_B = 15 mA$ $I_C = 500 mA$ $I_B = 50 mA$			0.3 1	V V
$V_{BE(sat)}^*$	Base-emitter saturation voltage $I_C = 150 mA$ $I_B = 15 mA$ $I_C = 500 mA$ $I_B = 50 mA$	0.6		1.2 2	V V
h_{FE}	DC current gain for 2N 2218A and 2N 2221A $I_C = 0.1 mA$ $V_{CE} = 10V$ $I_C = 1 mA$ $V_{CE} = 10V$ $I_C = 10 mA$ $V_{CE} = 10V$ $I_C = 150 mA$ $V_{CE} = 10V$ $I_C = 500 mA$ $V_{CE} = 10V$ $I_C = 150 mA$ $V_{CE} = 1V$ $I_C = 10 mA$ $V_{CE} = 10V$ $T_{amb} = -55^{\circ}C$	20 25 35 40 25 20 15		120	— — — — — — —

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2N 2222A

ELECTRICAL CHARACTERISTICS (continued)

Parameter	Test conditions	Min.	Typ.	Max.	Unit
h_{FE} DC current gain	for 2N 2219A and 2N 2222A $I_C = 0.1 \text{ mA}$ $V_{CE} = 10\text{V}$ $I_C = 1 \text{ mA}$ $V_{CE} = 10\text{V}$ * $I_C = 10 \text{ mA}$ $V_{CE} = 10\text{V}$ * $I_C = 150 \text{ mA}$ $V_{CE} = 10\text{V}$ * $I_C = 500 \text{ mA}$ $V_{CE} = 10\text{V}$ * $I_C = 150 \text{ mA}$ $V_{CE} = 1\text{V}$ * $I_C = 10 \text{ mA}$ $V_{CE} = 10\text{V}$ $T_{amb} = -55^\circ\text{C}$	35 50 75 100 40 50 35		300	— — — — — — —
h_{fe} Small signal current gain	$I_C = 1 \text{ mA}$ $V_{CE} = 10\text{V}$ $f = 1 \text{ kHz}$ for 2N 2218A and 2N 2221A for 2N 2219A and 2N 2222A $I_C = 10 \text{ mA}$ $V_{CE} = 10\text{V}$ $f = 1\text{kHz}$ for 2N 2218A and 2N 2221A for 2N 2219A and 2N 2222A	30 50 50 75		150 300 300 375	— — — —
f_T Transition frequency	$I_C = 20 \text{ mA}$ $V_{CE} = 20\text{V}$ $f = 100 \text{ MHz}$ for 2N 2218A and 2N 2221A for 2N 2219A and 2N 2222A	250 300			MHz MHz
C_{EBO} Emitter-base capacitance	$I_C = 0$ $V_{EB} = 0.5\text{V}$ $f = 100 \text{ kHz}$			25	pF
C_{CBO} Collector-base capacitance	$I_E = 0$ $V_{CB} = 10\text{V}$ $f = 100 \text{ kHz}$			8	pF
$R_{e(h_{ie})}$ Real part of input impedance	$I_C = 20 \text{ mA}$ $V_{CE} = 20\text{V}$ $f = 300 \text{ MHz}$			60	Ω
NF Noise figure	$I_C = 100 \mu\text{A}$ $V_{CE} = 0\text{V}$ $R_g = 1 \text{ k}\Omega$ $f = 1 \text{ kHz}$			4	dB
h_{ie}^{**} Input impedance	$I_C = 1 \text{ mA}$ $V_{CE} = 10\text{V}$ for 2N 2218A and 2N 2221A for 2N 2219A and 2N 2222A $I_C = 10 \text{ mA}$ $V_{CE} = 10\text{V}$ for 2N 2218A and 2N 2221A for 2N 2219A and 2N 2222A	1 2 0.2 0.25		3.5 8 1 1.25	Ω Ω Ω Ω

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ELECTRICAL CHARACTERISTICS (continued)

Parameter	Test conditions	Min.	Typ.	Max.	Unit
h_{re}^{**} Reverse voltage ratio	$I_C = 1 \text{ mA}$ $V_{CE} = 10\text{V}$ for 2N 2218A and 2N 2221A for 2N 2219A and 2N 2222A $I_C = 10 \text{ mA}$ $V_{CE} = 10\text{V}$ for 2N 2218A and 2N 2221A for 2N 2219A and 2N 2222A			5×10^{-4} 8×10^{-4} 2.5×10^{-4} 4×10^{-4}	— — — —
h_{oe}^{**} Output admittance	$I_C = 1 \text{ mA}$ $V_{CE} = 10\text{V}$ for 2N 2218A and 2N 2221A for 2N 2219A and 2N 2222A $I_C = 10 \text{ mA}$ $V_{CE} = 10\text{V}$ for 2N 2218A and 2N 2221A for 2N 2219A and 2N 2222A	3 5 10 25		15 35 100 200	μS μS μS μS
t_d Delay time	$I_C = 150 \text{ mA}$ $V_{CC} = 30\text{V}$ $I_{B1} = 15 \text{ mA}$ $V_{BE} = -0.5\text{V}$			10	ns
t_r Rise time	$I_C = 150 \text{ mA}$ $V_{CC} = 30\text{V}$ $I_{B1} = 15 \text{ mA}$ $V_{BE} = -0.5\text{V}$			25	ns
t_s Storage time	$I_C = 150 \text{ mA}$ $V_{CC} = 30\text{V}$ $I_{B1} = -I_{B2} = 15 \text{ mA}$			225	ns
t_f Fall time	$I_C = 150 \text{ mA}$ $V_{CC} = 30\text{V}$ $I_{B1} = -I_{B2} = 15 \text{ mA}$			60	ns
$r_{bb}'C_{bc}$ Feedback time constant	$I_C = 20 \text{ mA}$ $V_{CE} = 20\text{V}$ $f = 31.8 \text{ MHz}$			150	ps

* Pulsed: pulse duration = 300 μs , duty cycle = 1%

** $f = 1 \text{ kHz}$