

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

SILICON PLANAR NPN

HIGH-SPEED SWITCHES

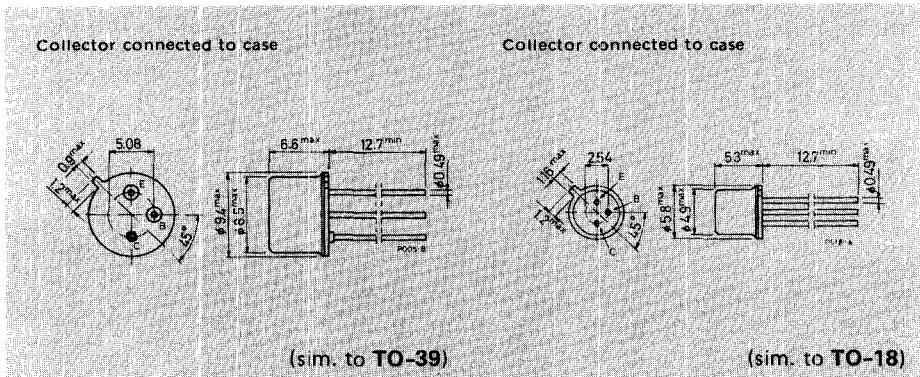
The 2N 2218A, 2N 2219A, 2N 2221A and 2N 2222A are silicon planar epitaxial NPN transistors in Jedec TO-39 (for 2N 2218A and 2N 2219A) and in Jedec TO-18 (for 2N 2221A and 2N 2222A) metal cases. They are designed for high-speed switching applications at collector currents up to 500 mA, and feature useful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

ABSOLUTE MAXIMUM RATINGS

V_{CBO}	Collector-base voltage ($I_E = 0$)	70	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 $T_{amb} \leq 25^\circ C$ for 2N 2218A and 2N 2219A for 2N 2221A and 2N 2222A at $T_{case} \leq 25^\circ C$ for 2N 2218A and 2N 2219A for 2N 2221A and 2N 2222A	0.8	W
		0.5	W
		3	W
		1.8	W
T_{stg}	Storage temperature	-65 to 200	°C
T_j	Junction temperature	175	°C

MECHANICAL DATA

Dimensions in mm



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THERMAL DATA

			2N 2218A	2N 2221A
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$R_{th\ j-case}$	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 ($I_E = 0$) $V_{CB} = 60V$ $V_{CB} = 60V \quad T_{amb} = 150^\circ C$		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 ($I_E = 0$) $I_C = 10 \mu A$	70			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 $I_C = 150 mA \quad I_B = 15 mA$ $I_C = 500 mA \quad I_B = 50 mA$		0.3	1	V V
$V_{BE(sat)}^*$	Base-emitter saturation voltage $I_C = 150 mA \quad I_B = 15 mA$ $I_C = 500 mA \quad I_B = 50 mA$	0.6	1.2	2	V V
h_{FE}	DC current gain for 2N 2218A and 2N 2221A $I_C = 0.1 mA \quad V_{CE} = 10V$ $I_C = 1 mA \quad V_{CE} = 10V$ $I_C = 10 mA \quad V_{CE} = 10V$ $I_C = 150 mA \quad V_{CE} = 10V$ $I_C = 500 mA \quad V_{CE} = 10V$ $I_C = 150 mA \quad V_{CE} = 1V$ $I_C = 10 mA \quad V_{CE} = 10V$ $T_{amb} = -55^\circ C$	20			—
		25			—
		35			—
		40	120		—
		25			—
		20			—
		15			—

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ELECTRICAL CHARACTERISTICS (continued)

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

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ELECTRICAL CHARACTERISTICS (continued)

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

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

** f = 1 kHz