SGS-THOMSON MICROELECTRONICS

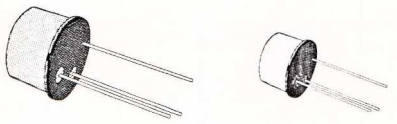
2N2218A-2N2219A 2N2221A-2N2222A

HIGH SPEED SWITCHES

DESCRIPTION

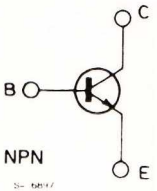
The 2N2218A, 2N2219A, 2N2221A and 2N2222A are silicon planar epitaxial NPN transistors in Jedec TO-39 (for 2N2218A and 2N2219A) and in Jedec TO-18 (for 2N2221A and 2N2222A) metal cases. They are designed for high-speed switching applications at collector currents up to 500 mA, and feature useful current gain over a wide range of collector current, low leakage currents and low saturation voltages.

2N2218A/2N2219A approved to CECC 50002-100, 2N2221A/2N2222A approved to CECC 50002-101 available on request.



TO-39 TO-18

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
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 $T_{amb} \leq 25$ °C		
	for **2N2218A** and **2N2219A**	0.8	W
	for **2N2221A** and **2N2222A**	0.5	W
	at $T_{case} \leq 25$ °C		
	for **2N2218A** and **2N2219A**	3	W
	for **2N2221A** and **2N2222A**	1.8	W
T_{stg}	Storage Temperature	– 65 to 200	°C
T_j	Junction Temperature	175	°C

THERMAL DATA

			2N2218A 2N2219A	2N2221A 2N2222A
$R_{th\ j\text{-}case}$	Thermal Resistance Junction-case	Max	50 °C/W	83.3 °C/W
$R_{th\ j\text{-}amb}$	Thermal Resistance Junction-ambient	Max	187.5 °C/W	300 °C/W

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C unless otherwise specified)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{CBO}	Collector Cutoff Current (I_E = 0)	V_{CB} = 60 V V_{CB} = 60 V T_{amb} = 150 °C			10 10	nA μA
I_{CEX}	Collector Cutoff Current (V_{BE} = − 3 V)	V_{CE} = 60 V			10	nA
I_{EBO}	Emitter Cutoff Current (I_C = 0)	V_{EB} = 3 V			10	nA
I_{BEX}	Base Cutoff Current (V_{BE} = − 3 V)	V_{CE} = 60 V			20	nA
$V_{(BR)\ CBO}$	Collector-base Breakdown Voltage (I_E = 0)	I_C = 10 μA	75			V
$V_{(BR)\ CEO}$*	Collector-emitter Breakdown Voltage (I_B = 0)	I_C = 10 mA	40			V
$V_{(BR)\ EBO}$	Emittter-base Breakdown Voltage (I_C = 0)	I_E = 10 μA	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 **2N2218A** and **2N2221A** I_C = 0.1 mA V_{CE} = 10 V I_C = 1 mA V_{CE} = 10 V I_C = 10 mA V_{CE} = 10 V I_C = 150 mA V_{CE} = 10 V I_C = 500 mA V_{CE} = 10 V I_C = 150 mA V_{CE} = 1 V I_C = 10 mA V_{CE} = 10 V T_{amb} = − 55 °C	 20 25 35 40 25 20 15		 120	
h_{FE}*	DC Current Gain	for **2N2219A** and **2N2222A** I_C = 0.1 mA V_{CE} = 10 V I_C = 1 mA V_{CE} = 10 V I_C = 10 mA V_{CE} = 10 V I_C = 150 mA V_{CE} = 10 V I_C = 500 mA V_{CE} = 10 V I_C = 150 mA V_{CE} = 1 V I_C = 10 mA V_{CE} = 10 V T_{amb} = − 55 °C	 35 50 75 100 40 50 35		 300	

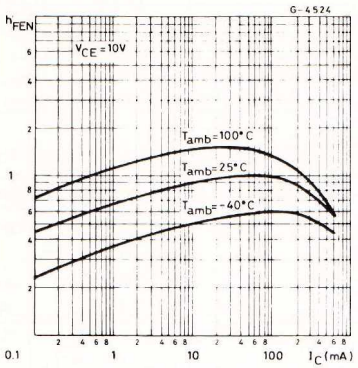
* Pulsed : pulse duration = 300 μs, duty cycle = 1 %.

ELECTRICAL CHARACTERISTICS (continued)

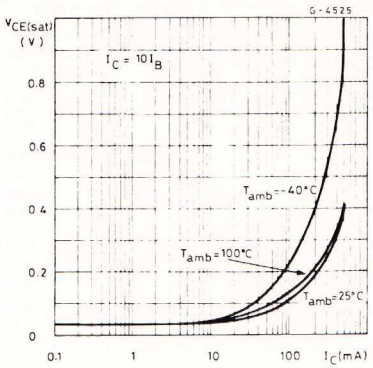
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
h_{fe}	Small Signal Current Gain	I_C = 1 mA V_{CE} = 10 V f = 1 kHz				
		for **2N2218A** and **2N2221A**	30		150	
		for **2N2219A** and **2N2222A**	50		300	
		I_C = 10 mA V_{CE} = 10 V f = 1 kHz				
		for **2N2218A** and **2N2221A**	50		300	
		for **2N2219A** and **2N2222A**	75		375	
f_T	Transition Frequency	I_C = 20 mA V_{CE} = 20 V f = 100 MHz				
		for **2N2218A** and **2N2221A**	250			MHz
		for **2N2219A** and **2N2222A**	300			MHz
C_{EBO}	Emitter-base Capacitance	I_C = 0 V_{EB} = 0.5 V f = 100 kHz			25	pF
C_{CBO}	Collector-base Capacitance	I_E = 0 V_{CB} = 10 V f = 100 kHz			8	pF
$R_{e(hie)}$	Real Part of Input Impedance	I_C = 20 mA V_{CE} = 20 V f = 300 MHz			60	Ω
NF	Noise Figure	I_C = 100 µA V_{CE} = 10 V R_g = 1 kΩ f = 1 kHz		4		dB
h_{ie}**	Input Impedance	I_C = 1 mA V_{CE} = 10 V				
		for **2N2218A** and **2N2221A**	1		3.5	Ω
		for **2N2219A** and **2N2222A**	2		8	Ω
		I_C = 10 mA V_{CE} = 10 V				
		for **2N2218A** and **2N2221A**	0.2		1	Ω
		for **2N2219A** and **2N2222A**	0.25		1.25	Ω
h_{re}**	Reverse Voltage Ratio	I_C = 1 mA V_{CE} = 10 V				
		for **2N2218A** and **2N2221A**			$5x10^{-4}$	
		for **2N2219A** and **2N2222A**			$8x10^{-4}$	
		I_C = 10 mA V_{CE} = 10 V				
		for **2N2218A** and **2N2221A**			$2.5x10^{-4}$	
		for **2N2219A** and **2N2222A**			$4x10^{-4}$	
h_{oe}**	Output Admittance	I_C = 1 mA V_{CE} = 10 V				
		for **2N2218A** and **2N2221A**	3		15	µS
		for **2N2219A** and **2N2222A**	5		35	µS
		I_C = 10 mA V_{CE} = 10 V				
		for **2N2218A** and **2N2221A**	10		100	µS
		for **2N2219A** and **2N2222A**	25		200	µS
t_d***	Delay Time	I_C = 150 mA V_{CC} = 30 V I_{B1} = 15 mA V_{BB} = − 0.5 V			10	ns
t_r***	Rise Time	I_C = 150 mA V_{CC} = 30 V I_{B1} = 15 mA V_{BB} = − 0.5 V			25	ns
t_s***	Storage Time	I_C = 150 mA V_{CC} = 30 V I_{B1} = − I_{B2} = 15 mA			225	ns
t_f***	Fall Time	I_C = 150 mA V_{CC} = 30 V I_{B1} = − I_{B2} = 15 mA			60	ns
$r_{bb'}C_{b'c}$	Feedback Time Constant	I_C = 20 mA V_{CE} = 20 V f = 31.8 MHz			150	ps

** f = 1 kHz
*** see test circuit.

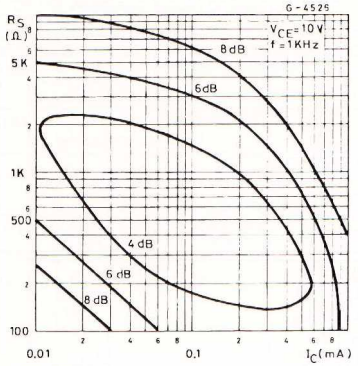
Normalized DC Current Gain.



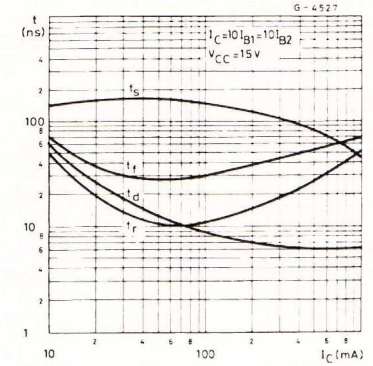
Collector-emitter Saturation Voltage.



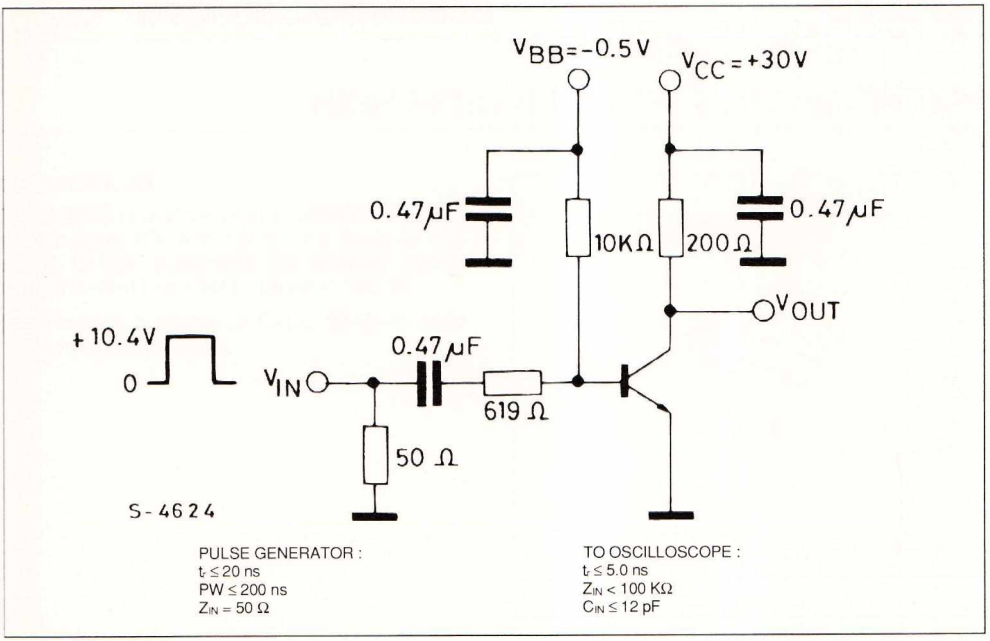
Contours of Constant Narrow Band Noise Figure.



Switching Time vs. Collector Current.



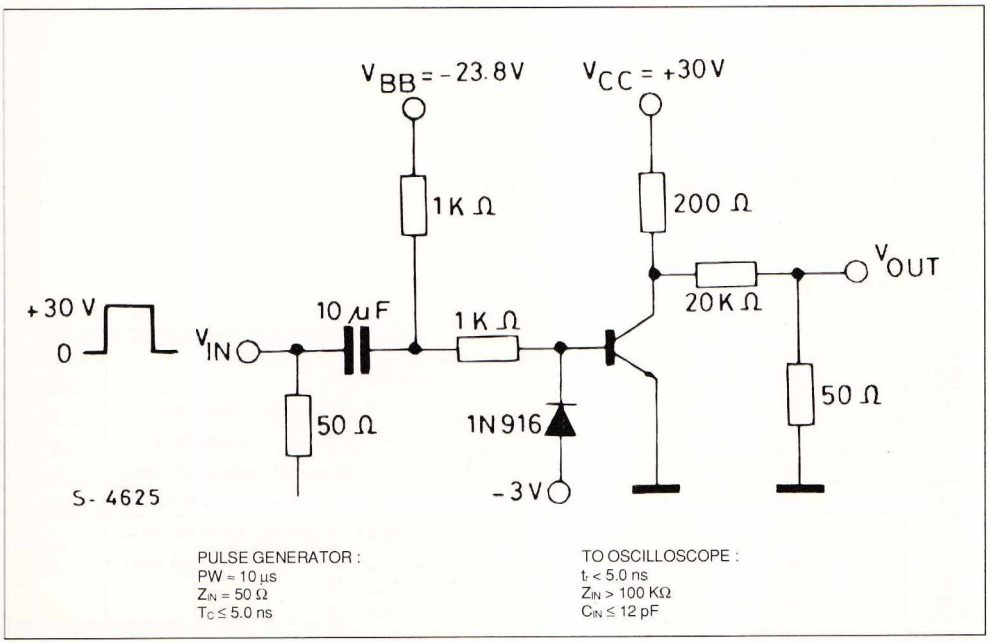
Test Circuit fot t_d, t_r.



PULSE GENERATOR :
$t_r \leq 20$ ns
PW ≤ 200 ns
$Z_{IN} = 50\ \Omega$

TO OSCILLOSCOPE :
$t_r \leq 5.0$ ns
$Z_{IN} < 100$ KΩ
$C_{IN} \leq 12$ pF

Test Circuit fot t_d, t_r.



PULSE GENERATOR :
PW = 10 µs
$Z_{IN} = 50\ \Omega$
$T_C \leq 5.0$ ns

TO OSCILLOSCOPE :
$t_r < 5.0$ ns
$Z_{IN} > 100$ KΩ
$C_{IN} \leq 12$ pF