

1.	VENDOR	PART NUMBER	CATALOG REFERENCE
A	SGS-THOMSON MICROELECTRONICS	2N2222A	SMALL SIGNAL TRANSISTORS
B	MOTOROLA	2N2222A	DL126 REV 3
C			

2. DESCRIPTION.....**NPN TRANSISTOR**

3. VALUE..... $V_{CEO} = 40V$, $I_C = 0.8A$

4. SPECIFICATIONS NOT CALLED OUT IN VENDOR SPEC.....NONE


5. SPECIAL HANDLING REQUIREMENTS..... ESD PROTECTION: TO PROTECT AGAINST DAMAGE DUE TO ELECTROSTATIC DISCHARGE. THESE UNITS MUST BE PACKAGED AND SHIPPED IN ACCORDANCE WITH DOD-STD-1686.

6. FOR VENDOR'S MECHANICAL AND ELECTRICAL SPECIFICATION,SEE REVERSE SIDE OF THIS DOCUMENT OR ATTACHED SHEET(S).

7. SOLDERABILITY.....PARTS MUST MEET THE SOLDERABILITY REQUIREMENTS OF MIL-STD-202,METHOD 208.

8. THERMAL SHOCK..... PARTS MUST MEET THE THERMAL SHOCK REQUIREMENTS OF MIL-STD-750, METHOD 1051.2.

9. THE VENDOR HAS SUPPLIED A WRITTEN CONFIRMATION OF THIS SPECIFICATION CONTROL DOCUMENT.

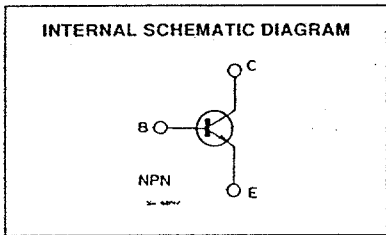
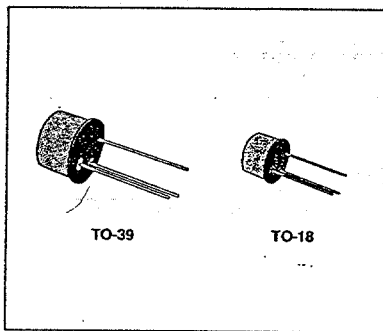
REVISIONS		APPROVALS			FIRST USED ON:	TITLE:	
REV.	DESCRIPTION	ENG	PUR	QUAL	ORIGINATED BY:	PK	NPN TRANSISTOR
R	ECO#A02568 10/28/88	JH			HANDLING:	ESD	
S	ECO#B13318 7/29/93	<i>(Signature)</i>	<i>(Signature)</i>	<i>(Signature)</i>	HAZARD:		 LAMBDA ELECTRONICS
					AGENCY:		
					DWG SIZE	UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND TOLERANCES ARE : DEC. ± .005 FRACTIONS: ±1/64 ,ANGLES : ±1/2°	FBN-L110
					A		REV. S

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.



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V _{CE0}	Collector-base Voltage (I _E = 0)	75	V
V _{CE0}	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} ≤ 25 °C for 2N2218A and 2N2219A for 2N2221A and 2N2222A at T _{case} ≤ 25 °C for 2N2218A and 2N2219A for 2N2221A and 2N2222A	0.8 0.5 3 1.8	W W W W
T _{stg}	Storage Temperature	- 65 to 200	°C
T _J	Junction Temperature	175	°C

THERMAL DATA

			2N2218A 2N2219A	2N2221A 2N2222A
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 °C unless otherwise specified)

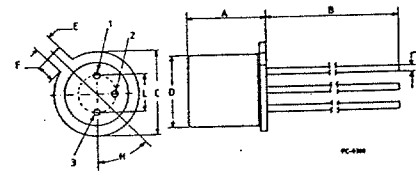
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I _{CBO}	Collector Cutoff Current (I _E = 0)	V _{CE} = 60 V V _{CB} = 60 V T _{amb} = 150 °C			10 10	nA µA
I _{CEX}	Collector Cutoff Current (V _{BE} = -3 V)	V _{CE} = 60 V			10	nA
I _{EBO}	Emitter Cutoff Current (I _C = 0)	V _{EB} = 3 V			10	nA
I _{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}	Emitter-base Breakdown Voltage (I _C = 0)	I _E = 10 µA	6			V
V _{CE(sat)}	Collector-emitter Saturation Voltage	I _C = 150 mA I _C = 500 mA I _B = 15 mA I _B = 50 mA			0.3 1	V V
V _{BE(sat)}	Base-emitter Saturation Voltage	I _C = 150 mA I _C = 500 mA I _B = 15 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	

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
h _{ie}	Small Signal Current Gain	I _C = 1 mA V _{CE} = 10 V f = 1 kHz for 2N2218A and 2N2221A for 2N2219A and 2N2222A I _C = 10 mA V _{CE} = 10 V f = 1 kHz for 2N2218A and 2N2221A for 2N2219A and 2N2222A	30 50		150 300	
f _T	Transition Frequency	I _C = 20 mA V _{CE} = 20 V f = 100 MHz for 2N2218A and 2N2221A for 2N2219A and 2N2222A	250 300			MHz MHz
C _{EBO}	Emitter-base Capacitance	I _C = 0 f = 100 kHz V _{EB} = 0.5 V			25	pF
C _{CBO}	Collector-base Capacitance	I _E = 0 f = 100 kHz V _{CB} = 10 V			8	pF
R _{e(ie)}	Real Part of Input Impedance	I _C = 20 mA f = 300 MHz V _{CE} = 20 V			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 for 2N2219A and 2N2222A I _C = 10 mA V _{CE} = 10 V for 2N2218A and 2N2221A for 2N2219A and 2N2222A	1 2 0.2 0.25		3.5 8 1 1.25	Ω Ω Ω Ω
h _{re} **	Reverse Voltage Ratio	I _C = 1 mA V _{CE} = 10 V for 2N2218A and 2N2221A for 2N2219A and 2N2222A I _C = 10 mA V _{CE} = 10 V for 2N2218A and 2N2221A for 2N2219A and 2N2222A			5x10 ⁻⁴ 8x10 ⁻⁴ 2.5x10 ⁻⁴ 4x10 ⁻⁴	
h _{oe} **	Output Admittance	I _C = 1 mA V _{CE} = 10 V for 2N2218A and 2N2221A for 2N2219A and 2N2222A I _C = 10 mA V _{CE} = 10 V for 2N2218A and 2N2221A for 2N2219A and 2N2222A	3 5 10 25		15 35 100 200	µS µS µS 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
τ _{eb-Cb/c}	Feedback Time Constant	I _C = 20 mA V _{CE} = 20 V f = 31.8 MHz			150	ps

* f = 1 kHz
** see test circuit.

MECHANICAL DATA



	DIMENSIONS			
	mm		inches	
	min	max	min	max
A	—	5.3	—	0.208
B	12.7	—	0.500	—
C	—	5.8	—	0.228
D	—	4.9	—	0.193
E	—	1.16	—	0.045
G	—	0.49	—	0.019
H	typ. 45°		typ. 45°	
L	typ. 2.54		typ. 0.100	

pin 1: Emitter - pin 2: Base - pin 3: Collector

MAXIMUM RATINGS

Rating	2N2218 2N2222	2N2219A 2N2222A	Unit
Collector-Emitter Voltage	30	40	Vdc
Collector-Base Voltage	60	76	Vdc
Emitter-Base Voltage	5.0	6.0	Vdc
Collector Current—Continuous	800	800	mAdc
Collector Current—Pulse	1.5	1.5	A
Power Dissipation @ TA = 25°C	0.8	0.4	Watt
Derate above 25°C	4.57	2.28	mW/°C
Power Dissipation @ TC = 25°C	3.0	1.2	Watts
Derate above 25°C	17.1	6.85	mW/°C
Operating and Storage Junction Temperature Range	-65 to +200		°C

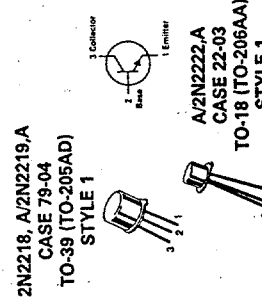
HERMAL CHARACTERISTICS

Characteristic	2N2218A 2N2219A	2N2222A	Unit
thermal Resistance, Junction to Ambient	RθJA	219	145.8
thermal Resistance, Junction to Case	RθJC	68	437.5

ELECTRICAL CHARACTERISTICS (TA = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
DC CHARACTERISTICS				
Collector-Emitter Breakdown Voltage (IC = 10 mA, IB = 0)	V(BR)CEO	30	—	Vdc
Collector-Base Breakdown Voltage (IC = 10 mA, IE = 0)	V(BR)CBO	60	—	Vdc
Emitter-Base Breakdown Voltage (IE = 10 mA, IC = 0)	V(BR)EBO	5.0	—	Vdc
Collector Cutoff Current (VCE = 80 Vdc, VEB(off) = 3.0 Vdc)	ICBO	—	10	nAdc
Collector Cutoff Current (VCE = 50 Vdc, IE = 0)	ICBO	—	0.01	μAdc
Collector Cutoff Current (VCE = 60 Vdc, IE = 0)	ICBO	—	0.01	μAdc
Collector Cutoff Current (VCE = 60 Vdc, IE = 0, TA = 150°C)	ICBO	—	10	μAdc
Collector Cutoff Current (VCE = 60 Vdc, IE = 0, TA = 150°C)	ICBO	—	10	μAdc
Emitter Cutoff Current (VBE = 3.0 Vdc, IC = 0)	IEBO	—	10	nAdc
Base Cutoff Current (VCE = 60 Vdc, VEB(off) = 3.0 Vdc)	IBL	—	20	nAdc
AC CHARACTERISTICS				
DC Current Gain (IC = 0.1 mA, VCE = 10 Vdc)	hFE	20	—	—
DC Current Gain (IC = 1.0 mA, VCE = 10 Vdc)	hFE	35	—	—
DC Current Gain (IC = 10 mA, VCE = 10 Vdc)	hFE	25	—	—
DC Current Gain (IC = 10 mA, VCE = 10 Vdc)	hFE	50	—	—
DC Current Gain (IC = 10 mA, VCE = 10 Vdc)	hFE	35	—	—
DC Current Gain (IC = 10 mA, VCE = 10 Vdc)	hFE	75	—	—
DC Current Gain (IC = 10 mA, VCE = 10 Vdc)	hFE	15	—	—
DC Current Gain (IC = 10 mA, VCE = 10 Vdc)	hFE	35	—	—
DC Current Gain (IC = 10 mA, VCE = 10 Vdc)	hFE	40	120	—
DC Current Gain (IC = 10 mA, VCE = 10 Vdc)	hFE	100	300	—

2N2218A, 2N2219A, 2N2222A



GENERAL PURPOSE TRANSISTORS
NPN SILICON
*2N2218A and 2N2222A are Motorola designated preferred devices.

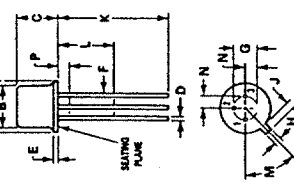
ELECTRICAL CHARACTERISTICS (continued) (TA = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Max	Unit
IC = 150 mA, VCE = 10 Vdc	hFE(1)	20	—	—
IC = 500 mA, VCE = 10 Vdc	hFE(1)	30	—	—
Collector-Emitter Saturation Voltage (IC = 150 mA, IB = 15 mA)	VCE(sat)	—	0.4	Vdc
Collector-Emitter Saturation Voltage (IC = 500 mA, IB = 50 mA)	VCE(sat)	—	0.3	Vdc
Base-Emitter Saturation Voltage (IC = 150 mA, IB = 15 mA)	VBE(sat)	—	1.6	Vdc
Base-Emitter Saturation Voltage (IC = 500 mA, IB = 50 mA)	VBE(sat)	—	1.0	Vdc
Current Gain — Bandwidth Product (IC = 20 mA, VCE = 20 Vdc, f = 100 MHz)	fT	250	—	MHz
Output Capacitance (VCE = 10 Vdc, IE = 0, f = 1.0 MHz)	Cobo	—	8.0	pF
Input Capacitance (VBE = 0.5 Vdc, IC = 0, f = 1.0 MHz)	Cibo	—	30	pF
Input Impedance (IC = 10 mA, VCE = 10 Vdc, f = 1.0 kHz)	hie	1.0	3.5	kohms
Input Impedance (IC = 10 mA, VCE = 10 Vdc, f = 1.0 kHz)	hie	2.0	8.0	kohms
Voltage Feedback Ratio (IC = 10 mA, VCE = 10 Vdc, f = 1.0 kHz)	hfe	0.2	1.0	—
Voltage Feedback Ratio (IC = 1.0 mA, VCE = 10 Vdc, f = 1.0 kHz)	hfe	0.25	1.25	X 10 ⁻⁴
Small-Signal Current Gain (IC = 1.0 mA, VCE = 10 Vdc, f = 1.0 kHz)	hfe	—	6.0	—
Small-Signal Current Gain (IC = 1.0 mA, VCE = 10 Vdc, f = 1.0 kHz)	hfe	—	6.0	—
Small-Signal Current Gain (IC = 1.0 mA, VCE = 10 Vdc, f = 1.0 kHz)	hfe	—	2.5	—
Small-Signal Current Gain (IC = 1.0 mA, VCE = 10 Vdc, f = 1.0 kHz)	hfe	—	4.0	—
Output Admittance (IC = 1.0 mA, VCE = 10 Vdc, f = 1.0 kHz)	hoe	3.0	15	μmhos
Output Admittance (IC = 1.0 mA, VCE = 10 Vdc, f = 1.0 kHz)	hoe	6.0	35	μmhos
Collector Base Time Constant (IE = 20 mA, VCB = 20 Vdc, f = 31.8 MHz)	tr/Cc	—	150	ps
Noise Figure (IC = 100 μA, VCE = 10 Vdc, RS = 1.0 kohm, f = 1.0 kHz)	NF	—	4.0	dB
Real Part of Common-Emitter High Frequency Input Impedance (IC = 20 mA, VCE = 20 Vdc, f = 300 MHz)	Re(hie)	—	60	Ohms

(1) Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2.0%.
(2) fT is defined as the frequency at which |hfe| extrapolates to unity.
(3) 2N5581 and 2N5582 are listed Ccb and Ccb for these conditions and values.

Package Outline Dimensions

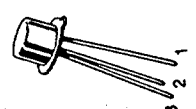
Dimensions are in inches unless otherwise noted.



CASE 22-03 TO-18 (TO-206AA) METAL

CASE 22 STYLES

- STYLE 1: EMITTER
- STYLE 2: BASE
- STYLE 3: COLLECTOR



MOTOROLA SMALL-SIGNAL TRANSISTORS, FETs AND DIODES

DIM	DIMENSIONS			MIN	MAX
	INCHES	MILLIMETERS	INCHES		
A	3.11	79.4	2.75	0.76	
B	4.18	106.5	117.0	0.10	
C	4.18	106.5	117.0	0.01	
D	0.66	16.8	0.15	0.00	
E	0.66	16.8	0.15	0.00	
F	0.66	16.8	0.15	0.00	
G	1.54	39.1	0.10	0.00	
H	0.11	2.8	0.05	0.04	
J	0.11	2.8	0.05	0.04	
K	0.11	2.8	0.05	0.04	
L	0.11	2.8	0.05	0.04	
M	0.11	2.8	0.05	0.04	
N	1.77	44.8	0.60	0.55	
P	—	—	1.77	—	0.50

All JEDEC notes and dimensions apply.