2N2222, A, 2N5581, 2N5582 2n22185, AS, 2n22195, AS, 2n2221, A(SILICON)

NPN SILICON ANNULAR HERMETIC TRANSISTORS

widely used "Industry Standard" transistors for applications as medium-speed switches and as amplifiers from audio to VHF

- DC Current Gain Specified 1.0 to 500 mAdc
- Low Collector-Emitter Saturation Voltage --VCE(sat) @ IC = 500 mAdc
- = 1.6 Vdc (Max) Non-A Suffix = 1.0 Vdc (Max) A-Suffix
- High Current-Gain—Bandwidth Product —
- 250 MHz (Min) @ I_C = 20 mAdc All Types Except 300 MHz (Min) @ I_C = 20 mAdc 2N2219A, 2N2222A, 2N5582
- Complements to PNP 2N2904, A thru 2N2907, A
- JAN,JTX Available in all devices
- JTXV Available on 2N2222,A Series
- 2N2218 and 2N2219 available in TO-39 Package With 1/2" Leads (1)

SELECTION GUIDE

-i	10-18	4 0,	100/300		2N2222A
	,	25	40/120	à	2N2221A
	9	40	100/300	+	2N2219A
,		25	40/120	5	2N2218A
40	10.46	40	100/300	4	2N5582
;	1	25	40/120	à	2N5581
0.18	ō	30	100/300	ير	2N2222
5	1	20	40/120	3	2N2221
ن	10.5	30	100/300	20	2N2219
1	i)	20	40/120	3	2N2218
Package	Pac	Min	Min/Max	Volts	Туре
		1 _C = 500 mAdc	I _C = 150 mAdc	IC = 10 mAdc	Device
		han.		BVCEO	
			Characteristic		

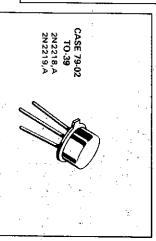
*MAXIMUM RATINGS

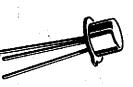
Rating	Symbol	2N2218 2N2219 2N2221 2N2221 2N2222	2N2218A 2N2219A 2N2221A 2N2222A	2N5581 2N5582
Collector-Emitter Voltage	VCEO	30	40	40
Collector-Base Voltage	۷св	60	75	75
Emitter-Base Voltage	٧єв	5.0	6.0	6.0
Collector Current - Continuous	lc	800	800	800
		2N2218,A 2N2219,A	2N2221,A 2N5581 2N2222,A 2N5582	2N5581 2N5582
Total Device Dissipation @ $T_A = 25^{\circ}C$ Derate above $25^{\circ}C$	PD	0.8 5.33	0.5 3.33	0.5 3.33
Total Device Dissipation @ T _C = 25°C	Po	3.0	1.8	2.0
Operating and Storage Junction Temperature Range	TJ,Tstg		-65 to +200	Ĭ
*Indicates JEDEC Registered Data			-	

Indicates JEDEC Registered Data.

Motorola Guarantees this Data in Addition to JEDEC Registered Data

NPN SILICON SWITCHING AND AMPLIFIER TRANSISTORS





CASE 22-03 TO-18 2N2221,A 2N2222,A





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	10 CA = 20 C CIII		
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	October Seattle Co. C.		
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	O (1 A = 20 C unless officer wise inc		
	(1) A = 20 C dilless office whise not		
	O (1 A = 20 C dilless officerwise note		
	Of the Personal Common Common Services		
	O (1 A = 25 C dilles office Anise moteur		

Characteristic	Symbol	Z.	Max	<u>₹</u>
OFF CHARACTERISTICS				
Collector-Emitter Breakdown Voltage	BVCEO			Vdc
(I _C = 10 mAdc, I _B = 0) Non-A Suffix A-Suffix, 2N5581,2N5582		40	ΙΙ	
Collector-Base Breakdown Voltage	вусво	}		Vdc
(I _C = 10 μAdc, I _E = 0) Non-A Suffix - A-Suffix, 2N5581,2N5582		60 75	: 	
Emítter-Base Breakdown Voltage	вуєво			. Vdc
$\{I_{\rm E} = 10 \mu {\rm Adc}, I_{\rm C} = 0\}$ Non-A Suffix A-Suffix, 2N5581,2N5582		5.0 6.0	1,1	
Collector Cutoff Current	ICEX			nAdc
(VCE = 60 Vdc, VEB(off) = 3.0 Vdc) A-Suffix, 2N5581,2N5582		1	ō	
Collector Cutoff Current	СВО			μAdc
(V _{CB} = 50 Vdc, I _E = 0) Non-A Suffix		ı	0.01	
(V _{CB} = 60 Vdc, _E = 0) A-Suffix, 2N5581,2N5582		ı	0.01	
(V _{CB} = 50 Vdc, I _E = 0, T _A = 150 ^o C) Non-A Suffix		í	ō	
(V _{CB} = 60 Vdc, I _E = 0, T _A = 150 ^o C) A.Suffix, 2N5581,2N5582		1.	ō	
Emitter Cutoff Current	l∈BO			nAdc
(VEB = 3.0 Vdc, IC = 0) A-Suffix, 2N5581,2N5582		1	10	
Base Cutoff Current	i _B L	-		nAdc
(VCE = 60 Vdc; VEB(off) = 3.0 Vdc) A-Suffix		. 1	20	
ON CUADACTEDICTICS			;	

ON CHANACIENISTICS					
DC Current Gain		ħFΕ	:		١
(i _C = 0.1 mAdc, V _{CE} = 10 Vdc)	2N2218,A,2N2221,A,2N5581(1)		20	ı	
	2N2219,A,2N2222,A,2N5582(1)		35	I	
$\{t_C = 1.0 \text{ mAde, } V_{CE} = 10 \text{ Vde}\}$	2N2218,A,2N2221,A,2N5581		25	1,	
	2N2219,A,2N2222,A,2N5582		₂ 0	1	
(IC = 10 mAdc, VCE = 10 Vdc)	2N2218,A,2N2221,A,2N5581(1)		35	ı	
	2N2219,A,2N2222,A,2N5582(1)		75	ţ	
$I_{C} = 10 \text{ mAdc}, V_{CE} = 10 \text{ Vdc}, T_{A} = -55^{\circ}\text{C}$	2N2218A,2N2221A,2N5581		55	<u>.</u> 1	•
	2N2219A,2N2222A,2N5582		ၾ	1	
$(I_C = 150 \text{ mAdc}, V_{CE} = 10 \text{ Vdc})(1)$	2N2218,A,2N2221,A;2N5581		8	120	4.
	2N2219,A,2N2222,A,2N5582		1 00	90	
(I _C = 150 mAde, V _{CE} = 1.0 Vdc)(1)	2N2218A,2N2221A,2N5581		20	1	
	2N2219A,2N2222A,2N5582		S	ļ	
$(I_C = 500 \text{ mAdc}, V_{CE} = 10 \text{ Vdc})(1)$	2N2218,2N2221		20	ι	
	2N2219,2N2222		30	!	
	2N2218A,2N2221A,2N5581		25	1.	
	2N2219A,2N2222A,2N5582		đ	-	
Collector-Emitter Saturation Voltage(1)		VCE (sat)			Vdc
(I _C = 150 mAdc, I _B = 15 mAdc)	Non-A Suffix		1	0.4	
	A-Suffix, 2N5581,2N5582	-	ı	۵.3	
(I _C = 500.mAdc, I _B = 50 mAdc)	Non-A Suffix		1	1.6	
	A-Suffix, 2N5581,2N5582		1	1.0	
Base-Emitter Saturation Voltage(1)		VBE (sat)			Vdc
(I _C = 150'mAdc; I _B = 15 mAdc)	Non-A Suffix		0.6	2.0	
	A-Suffix, 2N5581,2N5582		0.6	1.2	
(I _C = 500 mAdc, I _B = 50 mAdc)	Non-A Suffix		ı	2.6	_
	A-Suffix, 2N5581,2N5582		ı	2.0	

^{*} Indicates JEDEC Registered Data

*ELECTRICAL CHARACTERISTICS (Continued)

S All Types, Except 2N2219A,2N2222A,2N8582 P Non-A Suffix A-Suffix, 2N5581,2N5582 OkHz) Non-A Suffix, 2N5581,2N5582 Okhz) Okhz) Non-A Suffix, 2N5581,2N5582 Okhz) Okhz) Non-A Suffix, 2N5581,2N5582 Okhz) Ok	Characteristic	Symbol	X	Max	Gnit
in-Bandwidth Product(2) All Types, Except fT 250 — vAdc. VCE = 20 Vdc, f = 100 kHz) All Types, Except Cob — 300 — soltance(3) Non-A Suffix Cob — 8.0 s Vdc, IC = 0, f = 100 kHz) Non-A Suffix Cb — 30 s Vdc, IC = 0, f = 100 kHz) Non-A Suffix 2N2218A,2N2221A,2N5581 Cb — 30 s Vdc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 Pire 1.0 3.5 shade, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 Pire 0.2 1.0 shade, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5582 Pire — 5.0 shade, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5582 Pire — 5.0 chade, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5582 Pire — 5.0 chade, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5582 Pire — 4.0 current Gain 2N2218A,2N2221A,2N5582 Pire — 4.0 current Gain 2N2218A,2N2221A,2N5582 Pire 30 300 add, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 Pire 30 300 375 376 376 </th <th>SMALL-SIGNAL CHARACTERISTICS</th> <th></th> <th>1</th> <th></th> <th></th>	SMALL-SIGNAL CHARACTERISTICS		1		
actitance(3) Yodc, I _E = 0, f = 100 kHz) Non-A Suffix, 2N5581,2N5582 Act., V _{CE} = 10 Vdc, f = 1.0 kHz) Act. V _{CE} = 10 Vdc, f = 1.0 kHz) Act., V _{CE} = 10 Vdc, f = 1.0	100 MHz}	1	250		MHz
Sitance(3) Non-A Suffix, 2N5581,2N5582 Cib 30 5 Vdc, I _C = 0, f = 100 kHz) A-Suffix, 2N5581,2N5582 Cib - 35 Shance 2N2218A,2N2221A,2N5581 hie 1.0 3.5 Addc. V _{CE} = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 0.2 1.0 3.5 Addc. V _{CE} = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 hre 0.2 1.0 Addc. V _{CE} = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5582 hre - 5.0 Adc. V _{CE} = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5582 hre - 5.0 Current Gain 2N2218A,2N2221A,2N5582 hre - 2.5 Adc. V _{CE} = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5582 hre 30 2N2218A,2N2221A,2N5582 hre 30 150 Adc. V _{CE} = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5582 hre 30 150 2N2218A,2N2221A,2N5582 hre 30 150 300 300 2N2218A,2N2221A,2N5582 hre 30 300 300 2N2218A,2N2221A,2N5582 hre	0, f = 100 kHz)	Cob	t .	8.0	Þ
Jance Adc. VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 hie 1.0 3.5 Adc. VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 2.0 8.0 Adc. VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N222A,2N5581 0.2 1.0 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N222A,2N5582 hre - 5.0 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 hre - 8.0 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 hre - 8.0 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 hre - 2.5 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 hre 30 150 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5582 hre 30 300 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5582 hoe 3.0 35 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5582 hoe 3.0 35 Adc, VCE = 10 Vdc, f = 31.8 MHz) 2N2218A,2N2222A,2N5582 hoe 3.0 35 Adc,	= 0, f = 100 kHz}	Сів			Pr.
Adc, V _{CE} = 10 Vdc, f = 1.0 kHz). Add, V _{CE} = 10 Vdc, f = 1.0 kHz). Add, V _{CE} = 10 Vdc, f = 1.0 k	V _{CE} = 10 Vdc, f = 1.0 kHz)	nje	1.0	. ယ . ဟ	k ohms
dback Ratio 2N2218A,2N2221A,2N5581 hre 5.0 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5582 - 8.0 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 - 2.5 Current Gain 2N2218A,2N2221A,2N5582 hfe 30 150 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5582 hfe 30 150 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5582 hoe 30 300 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 hoe 30 35 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 hoe 30 15 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 hoe 30 15 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 hoe 30 15 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 hoe 30 15 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 hoe 30 15 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 hoe 30 10 Adc, VCB = 20 Vdc, f = 31.8 MHz) A-Suffix, 2N5581,2N5582 Pb Cc - 150 Add, VCB = 10 Vdc, f = 1.0 kHz) 2N2219A,2N2222A NF <td>•</td> <td>:_</td> <td>0.2</td> <td>1.0</td> <td></td>	•	:_	0.2	1.0	
Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 - 2.5 2Urrent Gain 2N2219A,2N2222A,2N5582 hfe 30 150 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 hfe 30 300 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 hoe 30 300 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 hoe 3.0 15 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 hoe 3.0 15 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 hoe 3.0 35 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 hoe 3.0 35 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 hoe 3.0 35 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 hoe 3.0 35 Adc, VCB = 20 Vdc, f = 31.8 kHz) A-Suffix, 2N5581,2N5582 hoe - 100 Adc, VCB = 10 Vdc, A-Suffix, 2N5581,2N5582 ne - 150 Add, VCB = 10 Vdc, A-Suffix, 2N5581,2N5582 ne - 150 A	10 Vdc, f = 1.0 kHz}	hre	i I	5.0 8.0	× 10 4
Current Gain Adc, V _{CE} = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 hfe 30 150 Adc, V _{CE} = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5582 50 300 Adc, V _{CE} = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 50 300 2N2218A,2N2222A,2N5582 hoe 3.0 15 Adc, V _{CE} = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 hoe 3.0 15 Adc, V _{CE} = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 hoe 3.0 35 Adc, V _{CE} = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2222A,2N5582 hoe 3.0 35 Adc, V _{CE} = 10 Vdc, f = 31.8 MHz) A-Suffix, 2N5581,2N5582 hoe 25 200 se Time Constant A-Suffix, 2N5581,2N5582 rb Cc - 150 Adc, V _{CE} = 20 Vdc, f = 31.8 MHz) A-Suffix, 2N5581,2N5582 NF - 150 Add, V _{CE} = 10 Vdc, 2N2219A,2N2222A NF - 4.0		<u>.</u>	1	4.0	
Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 50 300 2N2219A,2N2222A,2N5582 75 375 nittance 2N2218A,2N2222A,2N5582 hoe 3.0 15 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 5.0 35 Adc, VCE = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 10 100 2N2219A,2N2222A,2N5582 10 100 200 se Time Constant 2N2219A,2N5581,2N5582 rb °Cc — 150 dc, VCB = 20 Vdc, f = 31.8 MHz) A-Suffix, 2N5581,2N5582 NF — 150 Adc, VCE = 10 Vdc, f = 31.8 MHz) A-Suffix, 2N5581,2N5582 NF — 4.0	0 Vdc, f = 1.0 kHz)	h fe	5 3 5	300 300	I
ittrance Adc, V _{CE} = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 2N2219A,2N2221A,2N5581 2N2219A,2N2222A,2N5582 3.0. 35 2N2219A,2N2222A,2N5582 5.0 35 2N2218A,2N22221A,2N5581 2N2219A,2N2222A,2N5582 r _b ·C _c dc, V _{CB} = 20 Vdc, f = 31.8 MHz) A-Suffix, 2N5581,2N5582 NF Adc, V _{CB} = 10 Vdc, ohm, f = 1.0 kHz) 2N2219A,2N2222A NF			3 25	300 375	
Vac. V _{CE} = 10 Vdc, f = 1.0 kHz) 2N2218A,2N2221A,2N5581 10 100 2N2219A,2N2222A,2N5582 25 200 se Time Constant rb Cc - 150 dc. V _{CB} = 20 Vdc, f = 31.8 MHz) A-Suffix, 2N5581,2N5582 NF Adc, V _{CE} = 10 Vdc, NF - 4.0 ohm, f = 1.0 kHz) 2N2219A,2N2222A - 4.0)E = 10 Vdc, f = 1.0 kHz)	h _{oe}	3.0 5.0	აწ წ	μmhos
se Time Constant dc. V _{CB} = 20 Vdc, f = 31.8 MHz) A-Suffix, 2N5581,2N5582 NF Adc. V _{CE} = 10 Vdc, ohm, f = 1.0 kHz) 2N2219A,2N2222A - 4.0			25	2 3	
NF Adc, V _{CE} = 10 Vdc, ohm, f = 1.0 kHz) 2N2219A,2N2222A - 4.0	c, f = 31.8 MHz)	¹b'Ce	I .	150	B
	Adc, VCE = 10 Vdc, ohm, f = 1.0 kHz)	Z 7	1	4.0	d B

SWITCHING CHARACTERISTICS (A-Suffix, 2N5581 and 2N5582)

Delay Time	ፎ	Ι	10	su
(VCC = 30 Vdc, VBE (off) = 0.5 Vdc,				
(Figure 14)				
Rise Time	4.	1	25	ns.
Storage Time	t _s	'	225	ŋs.
$(V_{CC} = 30 \text{ Vdc}, I_C = 150 \text{ mAdc},$			# # <u></u>	
Fall Time	₹	1	68	3
Active Region Time Constant** (I _C = 150 mAdc, V _{CE} = 30 Vdc)	T _A		2.5	ns

^{*}Indicates JEDEC Registered Data.

**Motorola Guarantees this Data in Addition to JEDEC Registered Data.

(1)Pulse Test: Pulse Width < 300 \mus, Duty Cycle < 2.0%.

(2)f_T is defined as the frequency at which |hfe| extrapolates to unity.

(3)2N5581 and 2N5582 are Listed C_{cb} and C_{eb} for these conditions and values.