

2N2156-2N2229

TYPE	MATERIAL	POLARITY	REPLACE- MENT	PAGE NUMBER	USE	MAXIMUM RATINGS						ELECTRICAL CHARACTERISTICS									
						P _D	Ref Point	T _J	V _{CB}	V _{CE}	Subscript	h _{FE} @ I _C		V _{CE(SAT)} @ I _C	h _{FE}	Subscript	f _T	Subscript			
						@ 25°C	°C	(volts)	(volts)	(min)		(max)	Units						Units	Units	Units
2N2156	G	P		7-82	LPA	170W	C	110	45	45	S	80	160	5.0A	0.1	5.0A				2.0K	E
2N2156A	G	P		7-82	LPA	170W	C	110	45	30	O	80	160	5.0A	0.1	5.0A				2.0K	E
2N2157	G	P		7-82	LPA	170W	C	110	60	60	O	80	160	5.0A	0.1	5.0A				2.0K	E
2N2157A	G	P		7-82	LPA	170W	C	110	60	45	O	80	160	5.0A	0.1	5.0A				2.0K	E
2N2158	G	P		7-82	LPA	170W	C	110	75	75	S	80	160	5.0A	0.1	5.0A				2.0K	E
2N2158A	G	P		7-82	LPA	170W	C	110	75	60	O	80	160	5.0A	0.1	5.0A				2.0K	E
2N2159	G	P		7-82	LPA	170W	C	110	90	90	S	80	160	5.0A	0.1	5.0A				2.0K	E
2N2159A	G	P		7-82	LPA	170W	C	110	90	65	O	80	160	5.0A	0.1	5.0A				2.0K	E
2N2160	Unijunction Transistor, see Table on Page 1-174																				
2N2161	S	N			HSS	200M	A	150	55	35	O	60	160	10M	1.5	10M	75	E			
2N2162	S	P			CHP	150M	A	140	30	30	O									14M	T
2N2163	S	P			CHP	150M	A	140	15	15	O									14M	T
2N2164	S	P			CHP	150M	A	140	12	8.0	O									24M	T
2N2165	S	P			CHP	150M	A	140	30	30	O									10M	T
2N2166	S	P			CHP	150M	A	140	15	15	O									10M	T
2N2167	S	P			CHP	150M	A	140	12	8.0	O									16M	T
2N2168	G	P			HSS	60M	A	100	20	15	O	50		10M	0.125	10M					
2N2169	G	P			HSS	60M	A	100	15	15	O	40		10M	0.15	10M					
2N2170	G	P			HSS	60M	A	100	15	10	O	20		10M	0.18	10M					
2N2171	G	P		6-10	AFA	0.2W	A	100	50	25	R	110	250	20M			120	E		5.0M	B
2N2172	G	P			MSS	200M	A	85	20	15	O	30	150	10M	0.2	10M	0.97	E			
2N2173	G	P			HSS	240M	A	100	25	15	O	30		200M	0.4	200M					
2N2175	S	P			AFA	0.1W	A	175	6.0	6.0	O	30		20*						10M	T
2N2176	S	P			AFA	0.1W	A	175	6.0	6.0	O	30		20*						10M	T
2N2177	S	P			AFA	0.1W	A	160	6.0	6.0	O	15		5.0*			50	E		8.0M	B
2N2178	S	P			AFA	0.1W	A	160	6.0	6.0	O	15		5.0*			50	E		8.0M	B
2N2180	G	P			HSS	50M	A	100	15	6.0	O	100		10M	0.08	10M	120	E		60M	T
2N2181	S	P			CHP	150M	A	140	25	25	O	10		5.0M						6.0M	T
2N2182	S	P			CHP	150M	A	140	25	25	O	10		5.0M						6.0M	T
2N2183	S	P			CHP	150M	A	140	15	10	O	10		5.0M						6.0M	T
2N2184	S	P			CHP	150M	A	140	15	10	O	10		5.0M						6.0M	T
2N2185	S	P			CHP	150M	A	140	30	30	O									6.5M	T
2N2186	S	P			CHP	150M	A	140	30	30	O									6.5M	T
2N2187	S	P			CHP	150M	A	140	30	30	O									6.5M	T
2N2188	G	P	2N3323	9-71	RFA	125M	A	85	40	25	O	40	160	1.5M			40	E		60M	T
2N2189	G	P	2N3323	9-71	RFA	125M	A	85	40	25	O	60	180	1.5M			40	E		102M	T
2N2190	G	P	2N3323	9-71	RFA	125M	A	85	60	25	O	40	160	1.5M			40	E		60M	T
2N2191	G	P	2N3323	9-71	RFA	125M	A	85	60	25	O	60	180	1.5M			60	E		102M	T
2N2192	S	N		8-106	HSA	800M	A	200	60	40	O	100	300	150M	0.35	150M					
2N2192A	S	N		8-106	HSA	800M	A	200	60	40	O	100	300	150M	0.25	150M					
2N2192B	S	N		8-106	HSA	800M	A	200	60	40	O	100	300	150M	0.18	150M					
2N2193	S	N		8-106	HSA	800M	A	200	80	50	O	40	120	150M	0.35	150M					
2N2193A	S	N		8-106	HSA	800M	A	200	80	50	O	40	120	150M	0.25	150M					
2N2193B	S	N		8-106	HSA	800M	A	200	80	50	O	40	120	150M	0.18	150M					
2N2194	S	N		8-106	HSA	800M	A	200	60	40	O	20	60	150M	0.35	150M					
2N2194A	S	N		8-106	HSA	800M	A	200	60	40	O	20	60	150M	0.25	150M					
2N2194B	S	N		8-106	HSA	800M	A	200	60	40	O	20	60	150M	0.18	150M					
2N2195	S	N		8-106	HSA	800M	A	200	45	25	O	20		150M	0.35	150M					
2N2195A	S	N		8-106	HSA	800M	A	200	45	25	O	20		150M	0.25	150M					
2N2195B	S	N		8-106	HSA	800M	A	200	45	25	O	20		150M	0.18	150M					
2N2196	S	N			LPA	2.0W	A	175	80	60	R	30	90	0.2A	2.0	0.2A	30	E			
2N2197	S	N			LPA	2.0W	A	175	80	60	R	75	200	0.2A	2.0	0.2A	30	E			
2N2198	G	P			RFA	5.5M	A	200	80	80	O	35	55	0.1A	6.0	0.2A				4.0M	T
2N2199	G	P			RFA	75M	A	100	15	10	O	9.0		3.0M						120M	T
2N2200	G	P			RFA	75M	A	100	15	10	O	9.0		3.0M						120M	T
2N2201	S	N	2N3738	7-133	AFA	1.0W	C	175	120	100	O	25	90	200M	1.7	200M	30	E			
2N2202	S	N	2N3738	7-133	AFA	1.0W	C	175	120	100	O	25	90	200M	1.7	200M	30	E			
2N2203	S	N	2N3738	7-133	AFA	1.0W	C	175	120	100	O	25	90	200M	1.7	200M	30	E			
2N2204	S	N	2N3738	7-133	AFA	1.0W	C	175	120	100	O	25	90	200M	1.7	200M	30	E			
2N2205	S	N	2N835	8-54	HSS	1.0W	C	175	25	12	O	20		10M	0.22	10M	2.0	E			
2N2206	S	N	2N835	8-54	HSS	1.0W	C	175	25	12	O	40	120	10M	0.22	10M	2.0	E			
2N2207	G	P			VID	0.26W	A	75	70	50	R	36	370	10M						140M	B
2N2208	G	P			RFC	120M	A	85	40	10	O	15		1.5M			30	E			
2N2209	G	P			MSS	150M	A	85	30	12	O	50		24M	0.15	12M				6.0M	B
2N2210	G	P	2N2075	7-75	LPA	75W	C	100	100	65	S	25	50	5.0A	0.6	12A				5.0K	E
2N2211	G	P			LPA	90W	C	100	80	60	S	60	140	1.0A	0.8	2.0A				5.0K	E
2N2212	G	P			HPA	100W	C	110	120	120	R	50	120	5.0A	1.0	5.0A	30	E		0.45M	T
2N2214	S	N	2N3498	8-232	HSS	0.25W	C	150	25	15	O	25		10M	0.2	10M				200M	T
2N2216	S	N	2N2218	8-108	HSA	3.0W	A	200	150	100	O	25	120	50M	5.0	50M				50M	T
2N2217	S	N		8-108	HSA	0.8W	A	175	60	30	O	20	60	150M	0.4	150M				250M	T
2N2218	S	N		8-108	HSA	0.8W	A	175	60	30	O	40	120	150M	0.4	150M				250M	T
2N2218A	S	N		8-114	HSS	0.8W	A	175	75	40	O	40	120	0.15A	0.3	0.15A	30	E		250M	T
2N2219	S	N		8-108	HSA	0.8W	A	175	60	30	O	100	300	150M	0.4	150M				250M	T
2N2219A	S	N		8-114	HSS	0.8W	A	175	75	40	O	100	200	0.15A	0.3	0.15A	50	E		300M	T
2N2220	S	N	2N2222	8-108	HSA	0.5W	A	175	60	30	O	20	60	150M	9.4	150M				250M	

GENERAL PURPOSE SWITCHING AND AMPLIFIER TRANSISTORS (SILICON)

Current versus Voltage

BV _{CEO} Min Volts	OPTIMUM COLLECTOR CURRENT									
	0 to 10 mA		10 mA to 100 mA		100 mA to 500 mA		500 mA to 1.0 A		1.0 A to 3.0 A	
	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP	NPN	PNP
15 ↓ 29	2N916 2N2330 2N2331		2N916 2N1983 2N1984		2N696 2N697 2N718 2N1420 2N2195	2N1991				
30 ↓ 39			2N2218 2N2219 2N2221 2N2222	2N3133 2N3134 2N3135 2N3136	2N2218 2N2219 2N2221 2N2222 2N3299 2N3300 2N3301 2N3302	2N2800 2N2801 2N2837 2N2838 2N3133 2N3134 2N3135 2N3136				
49 ↓ 59	2N758 2N795 2N760 2N915 2N929 2N930 2N3946 2N3947	2N3250 2N3251 MM4048	2N2218A 2N2219A 2N2221A 2N2222A 2N2224 2N3946 2N3947	2N3250 2N3251	2N2194 2N2218A 2N2219A 2N2221A 2N2222A	2N2904 2N2905 2N2906 2N2907 2N3485 2N3486 2N4890	2N2192 2N2193	2N3244 2N3245	2N3506 2N3507	
60 ↓ 79	2N758A 2N759A 2N760A 2N929A 2N930A MM2483 MM2484	2N3798 2N3799 2N3250A 2N3251A	2N910 2N911 2N1990	2N3250A 2N3251A	2N656 2N699	2N2904A 2N2905A 2N2906A 2N2907A 2N3485A 2N3486A				
80 ↓ 99	2N739 2N740	2N3494 2N3496	2N720A 2N1893 2N2405	2N3494 2N3496	2N720A 2N3019 2N3020		2N3019 2N3020			
100 ↓ 149	2N4924	2N3495 2N3497 2N4928	2N3498 2N3499 2N4924	2N3495 2N3497 2N3634 2N3635 2N4928	2N3498 2N3499 2N4924	2N3634 2N3635				
150 ↓ 249	2N3114 2N4925 2N4926	2N4929 2N4930	2N3500 2N3501 2N4925 2N4926	2N3635 2N3637 2N4929 2N4930	2N3500 2N3501 2N4925	2N3636 2N3637				
250 UP	2N3742 2N4927	2N3743 2N4931	2N3742 2N4927	2N3743 2N4931						

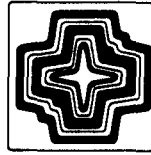
2N2218 (SILICON)

2N2219

2N2221

2N2222

2N2904 thru 2N2907

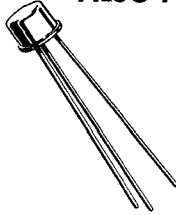


$V_{CEO} = 30-40\text{ V}$
 $f_T = 400\text{ MHz Typ}$

ALSO AVAILABLE AS JAN AND HI-REL UNITS



CASE 22
(TO-18)



CASE 31
(TO-5)

2N2221

2N2222

2N2906

2N2907

2N2218, 2N2219,

2N2904, 2N2905

Silicon annular star transistors for high-speed switching and DC to UHF amplifier applications. NPN types 2N2218 thru 2N2222 are complementary to PNP types 2N2904 thru 2N2907.

Collector connected to case

MAXIMUM RATINGS

Rating	Symbol	NPN	PNP	Unit
Collector - Base Voltage	V_{CB}	60	60	Vdc
Collector - Emitter Voltage	V_{CEO}	30	40	Vdc
Emitter - Base Voltage	V_{EB}	5	5	Vdc
Collector Current	I_C	800	600	mA dc
Total Device Dissipation @ 25°C Case Temperature To - 5: 2N2218, 2N2219 Derate Above 25°C 2N2904, 2N2905 Derate Above 25°C To - 18: 2N2221, 2N2222 Derate Above 25°C 2N2906, 2N2907 Derate Above 25°C	P_D	3		W
		20		mW/°C
			3	W
			17.2	mW/°C
Total Device Dissipation @ 25°C Ambient Temperature To - 5: 2N2218, 2N2219 Derate Above 25°C 2N2904, 2N2905 Derate Above 25°C To - 18: 2N2221, 2N2222 Derate Above 25°C 2N2906, 2N2907 Derate Above 25°C	P_D	1.8		W
		12		mW/°C
			1.8	W
			10.3	mW/°C
Total Device Dissipation @ 25°C Ambient Temperature To - 5: 2N2218, 2N2219 Derate Above 25°C 2N2904, 2N2905 Derate Above 25°C To - 18: 2N2221, 2N2222 Derate Above 25°C 2N2906, 2N2907 Derate Above 25°C	P_D	0.8		W
		5.33		mW/°C
			0.6	W
			3.43	mW/°C
Total Device Dissipation @ 25°C Ambient Temperature To - 5: 2N2218, 2N2219 Derate Above 25°C 2N2904, 2N2905 Derate Above 25°C To - 18: 2N2221, 2N2222 Derate Above 25°C 2N2906, 2N2907 Derate Above 25°C	P_D	0.5		W
		3.33		mW/°C
			0.4	W
			2.28	mW/°C
Operating Junction Temperature	T_J	-65 to +175	-65 to +200	°C
Storage Temperature	T_{stg}	-65 to +200	-65 to +200	°C

2N2218 SERIES, 2N2904 SERIES (continued)

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Static Characteristic	Fig. No.	Symbol	Min	Max	Unit
Collector-Base Breakdown Voltage ($I_C = 10\text{ }\mu\text{A}$, $I_E = 0$)	---	BV_{CBO}	60	---	Vdc
Collector-Emitter Breakdown Voltage* ($I_C = 10\text{ mA}$, $I_B = 0$)	9	BV_{CEO}^*	30 40	---	Vdc
Emitter-Base Breakdown Voltage ($I_E = 10\text{ }\mu\text{A}$, $I_C = 0$)	---	BV_{EBO}	5	---	Vdc
Collector Cutoff Current ($V_{CB} = 50\text{ Vdc}$, $I_E = 0$) ($V_{CB} = 50\text{ Vdc}$, $I_E = 0$, $T_A = 150^\circ\text{C}$)	---	I_{CBO}	---	.01 .02 10 20	μA
Collector Cutoff Current ($V_{CE} = 30\text{ Vdc}$, $V_{BE} = 0.5\text{ Vdc}$)	---	I_{CEX}	---	50	nA
Base Cutoff Current ($V_{CE} = 30\text{ Vdc}$, $V_{BE} = 0.5\text{ Vdc}$)	---	I_{BL}	---	50	nA
Collector-Emitter Saturation Voltage* ($I_C = 150\text{ mA}$, $I_B = 15\text{ mA}$) ($I_C = 500\text{ mA}$, $I_B = 50\text{ mA}$)	12, 15	$V_{CE(sat)}^*$	---	0.4 1.6	Vdc
Base-Emitter Saturation Voltage* ($I_C = 150\text{ mA}$, $I_B = 15\text{ mA}$) ($I_C = 500\text{ mA}$, $I_B = 50\text{ mA}$)	13, 16	$V_{BE(sat)}^*$	---	1.3 2.6	Vdc
DC Forward Current Transfer Ratio ($I_C = 0.1\text{ mA}$, $V_{CE} = 10\text{ Vdc}$)	10	h_{FE}	20	---	---
	11		35	---	---
($I_C = 1.0\text{ mA}$, $V_{CE} = 10\text{ Vdc}$)			25	---	---
			50	---	---
($I_C = 10\text{ mA}$, $V_{CE} = 10\text{ Vdc}$)			35	---	---
			75	---	---
($I_C = 150\text{ mA}$, $V_{CE} = 10\text{ Vdc}$)*			40	120	---
			100	300	---
($I_C = 500\text{ mA}$, $V_{CE} = 10\text{ Vdc}$)*			20	---	---
			30	---	---

Dynamic Characteristic	Fig. No.	Symbol	Min	Typ	Max	Unit
Output Capacitance ($V_{CB} = 10\text{ Vdc}$, $I_E = 0$, $f = 100\text{ kHz}$)	4	C_{ob}	---	---	8	pF
Input Capacitance ($V_{BE} = 0.5\text{ Vdc}$, $I_C = 0$, $f = 100\text{ kHz}$) ($V_{BE} = 2\text{ Vdc}$, $I_C = 0$, $f = 100\text{ kHz}$)	4	C_{ib}	---	---	30 30	pF
Current Gain - Bandwidth Product ($I_C = 20\text{ mA}$, $V_{CE} = 20\text{ Vdc}$, $f = 100\text{ MHz}$) ($I_C = 50\text{ mA}$, $V_{CE} = 20\text{ Vdc}$, $f = 100\text{ MHz}$)	8	f_T	250 200	---	---	MHz
Delay Time	1	t_d	---	6	10	ns
Rise Time	1	t_r	---	20	40	ns
Turn-On Time	1	t_{on}	---	26	45	ns
Storage Time	2	t_s	---	50	80	ns
Fall Time	2	t_f	---	20	30	ns
Turn-Off Time	2	t_{off}	---	70	100	ns
Total Switching Time	3	t_{total}	---	12	---	ns

*Pulse Test, Pulse Width $\leq 300\text{ }\mu\text{s}$ Duty Cycle $\leq 2\%$

PNP SWITCHING-TIME CIRCUITS

For NPN Switching Tests, reverse diodes, polarities, and input pulses.

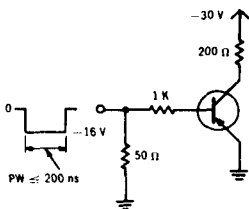


FIGURE 1 — SATURATED TURN-ON SWITCHING-TIME TEST CIRCUIT

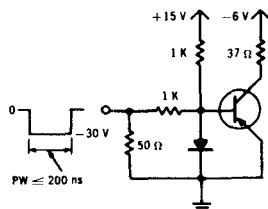


FIGURE 2 — SATURATED TURN-OFF SWITCHING-TIME TEST CIRCUIT

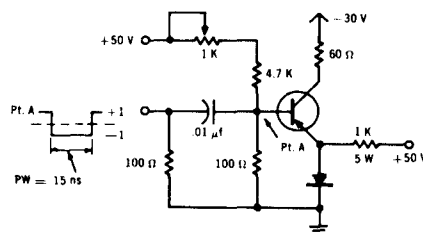


FIGURE 3 — NON-SATURATED SWITCHING-TIME TEST CIRCUIT