

TYPE	MATERIAL	POLARITY	REPLACE- MENT	PAGE NUMBER	USE	MAXIMUM RATINGS					ELECTRICAL CHARACTERISTICS													
						P <sub>D</sub> @ 25°C	T <sub>J</sub> °C	V <sub>CB</sub> (volts)	V <sub>CE</sub> - (volts)	Subscript	h <sub>FE</sub> @ I <sub>C</sub> (min) (max)	V <sub>CE(SAT)</sub> @ I <sub>C</sub> (volts)	h <sub>FE</sub>	f <sub>T</sub>	Subscript	f <sub>T</sub> Units	Subscript							
2N2618	S	N			VID	0.6W	A	200	60	40	0	25												
2N2619	Thyristor, see Table on Page 1-154																							
2N2620	Field Effect Transistor, see Table on Page 1-166																							
2N2621	G	P			RFC	150M	J	100	15	15	S	15		1.0M										
2N2622	G	P			RFC	150M	J	100	24	24	S	15		1.0M										
2N2623	G	P			RFC	150M	J	100	32	32	S	20		1.0M										
2N2624	G	P			RFC	150M	J	100	15	15	S	20		1.0M										
2N2625	G	P			RFC	150M	J	100	24	24	S	15		1.0M										
2N2626	G	P			RFC	150M	J	100	32	32	S	20		1.0M										
2N2627	G	P			RFC	150M	J	100	15	15	S	15		1.0M										
2N2628	G	P			RFC	150M	J	100	24	24	S	15		1.0M										
2N2629	G	P			RFC	150M	J	100	32	32	S	15		1.0M										
2N2630	G	P			HSS	300M	A	100	18	10	0	25		100M	0.45	100M	3.0	E						
2N2631	S	N			AFA	8.75W	C	200	80	80	V	8.0		200M										
2N2632	S	N	2N3487	7-115	LPA	40W	C	175	90	60	0	40	120	1.0A	0.25	1.0A	40	E		20M	T			
2N2633	S	N	2N3488	7-115	LPA	40W	C	175	120	80	0	40	120	1.0A	0.25	1.0A	40	E		20M	T			
2N2634	S	N	2N3489	7-115	LPA	40W	C	175	150	100	0	40	120	1.0A	0.25	1.0A	40	E		20M	T			
2N2635	G	P		8-153	HSS	150M	A	100	30	12	0	45	300	50M	0.2	10M					150M	T		
2N2636	G	P			PMS	100W	C	110	100	60	0	20	80	25A	0.65	25A					0.6M	T		
2N2637	G	P			PMS	100W	C	110	100	60	0	20	80	25A	0.65	25A					0.6M	T		
2N2638	G	P			PMS	100W	C	110	100	60	0	20	80	25A	0.65	25A					0.6M	T		
2N2639	S	N		11-11	DFA	300M	A	200	45	45	0	50	300	10*	1.0	10M	65	E		35M	T			
2N2640	S	N		11-11	DFA	300M	A	200	45	45	0	50	300	10*	1.0	10M	65	E		35M	T			
2N2641	S	N		11-11	DFA	300M	A	200	45	45	0	50	300	10*	1.0	10M	65	E		35M	T			
2N2642	S	N		11-11	DFA	300M	A	200	45	45	0	100	300	10*	1.0	10M	130	E		35M	T			
2N2643	S	N		11-11	DFA	300M	A	200	45	45	0	100	300	10*	1.0	10M	130	E		35M	T			
2N2644	S	N		11-11	DFA	300M	A	200	45	45	0	100	300	10*	1.0	10M	130	E		35M	T			
2N2645	S	N			DFA	500M	A	200	75	50	R	100	300	150M	0.4	10M	75	E		50M	T			
2N2646	Unijunction Transistors, see Table on Page 1-174																							
2N2647	G	P			MSA	5.0W	C	100	35	10	0	80	500	1.0A	0.4	1.0A					10M	T		
2N2648	G	P			HPA	8.7W	C	200	65	65	0	10		0.5A							100M	T		
2N2649	S	N			HPA	8.7W	C	200	140	140	0	10		0.5A							100M	T		
2N2650	S	N	2N2501	8-148	HSS	360M	A	200	40	20	0	25		10M	0.25	10M					350M	T		
2N2651	S	N		11-13	DFA	0.3W	A	200	100	60	0	50	200	1.0M	1.2	50M	50	E		60M	T			
2N2652	S	N		11-13	DFA	0.3W	A	200	100	60	0	50	200	1.0M	1.2	50M	50	E		60M	T			
2N2652A	S	N			DFA	0.3W	A	200	100	60	0	50	200	1.0M	1.2	50M	50	E		60M	T			
2N2653	Thyristor, see Table on Page 1-154																							
2N2654	G	P			RFC	0.1W	A	75	25	0	0	25		1.0M										
2N2655	G	P			LPA	15W	C	200	100	100	0	30	90	0.2A	2.0	0.2A	30	E		0.25M	E			
2N2656	S	N			RFA	0.36W	A	200	25	15	0	40	160	0.1M	0.5	10M					250M	T		
2N2657	S	N			PMS	1.25W	A	200	80	60	0	40	120	1.0A	0.5	1.0A					20M	T		
2N2658	S	N			PMS	1.25W	A	200	100	80	0	40	120	1.0A	0.5	1.0A					20M	T		
2N2659	G	P			LPA	15W	C	100	50	50	V	30	90	500M	0.2	500M	30	E		280K	T			
2N2660	G	P			LPA	15W	C	100	70	70	V	30	90	500M	0.2	500M	30	E		280K	T			
2N2661	G	P			LPA	15W	C	100	90	90	V	30	90	500M	0.2	500M	30	E		280K	T			
2N2662	G	P			LPA	15W	C	100	50	50	V	30	90	500M	0.2	500M	30	E		280K	T			
2N2663	G	P			LPA	15W	C	100	70	70	V	30	90	500M	0.2	500M	30	E		280K	T			
2N2664	G	P			LPA	15W	C	100	90	90	V	30	90	500M	0.2	500M	30	E		280K	T			
2N2665	G	P			LPA	15W	C	100	50	50	V	50	150	500M	0.2	500M	50	E		300K	T			
2N2666	G	P			LPA	15W	C	100	70	70	V	50	150	500M	0.2	500M	50	E		300K	T			
2N2667	G	P			LPA	15W	C	100	90	90	V	50	150	500M	0.2	500M	50	E		300K	T			
2N2668	G	P			LPA	15W	C	100	50	50	V	50	150	500M	0.2	500M	50	E		300K	T			
2N2669	G	P			LPA	15W	C	100	70	70	V	50	150	500M	0.2	500M	50	E		300K	T			
2N2670	G	P			LPA	15W	C	100	70	70	V	50	150	500M	0.2	500M	50	E		300K	T			
2N2671	G	P			RFC	0.1W	A	75	25	0	0	40		1.0M										
2N2672	G	P			RFC	0.1W	A	90	25	0	0	40		1.0M										
2N2672A	G	P			RFC	0.1W	A	90	32	0	0	40		1.0M										
2N2673	S	N			AFA	250M	A	200	60	45	0	8.0		1.0M	1.5	5.0M	9.0	E		2.5M	B			
2N2674	S	N			AFA	250M	A	200	60	45	0	12		1.0M	1.5	5.0M	18	E		5.0M	B			
2N2675	S	N			AFA	250M	A	200	60	45	0	22		1.0M	1.5	5.0M	37	E		10M	B			
2N2676	S	N			AFA	250M	A	200	60	45	0	45		1.0M	1.5	5.0M	76	E		10M	B			
2N2677	S	N			AFA	250M	A	200	45	35	0	20	55	1.0M	1.5	5.0M	19	E		10M	B			
2N2678	S	N			AFA	250M	A	200	45	35	0	45	150	1.0M	1.5	5.0M	39	E		20M	B			
2N2679	Thyristors, see Table on Page 1-154																							
2N2690	Thru																							
2N2691	G	P			PMS	100W	C	110	100	80	0	30	100	20A	0.65	20A					6.0M	T		
2N2691A	G	P			PMS	170W	C	125	120	80	0	50	100	20M										
2N2692	S	N			HSS	300M	A	175	45	30	0	90	360	100*	0.12	100*								

— Numerical Index —




UNIUNION TRANSISTORS INDEX

2N489-2N4949


TYPE	REPLACEMENT	PAGE NUMBER	P <sub>D</sub> (mW)	R <sub>BB</sub> (kΩ)	η	I <sub>V</sub> (min) (mA)	I <sub>P</sub> (max) (μA)	I <sub>EO</sub> @V <sub>EB2</sub> (μA @ V max)	V <sub>E(SAT)</sub> I <sub>E</sub> @50 mA
2N489			450	6.8	0.62	8.0	20	12 @ 60	5.0
2N489A			450	6.8	0.62	8.0	15	12 @ 60	4.0
2N489B			450	6.8	0.62	8.0	6.0	0.2 @ 60	4.0
2N490			450	9.1	0.62	8.0	20	12 @ 60	5.0
2N490A			450	9.1	0.62	8.0	15	12 @ 60	4.0
2N490B			450	9.1	0.62	8.0	6.0	0.2 @ 60	4.0
2N490C			450	9.1	0.51				
2N491			450	6.8	0.68	8.0	20	12 @ 60	5.0
2N491A			450	6.8	0.68	8.0	15	12 @ 60	4.3
2N491B			450	6.8	0.68	8.0	6.0	0.2 @ 60	4.3
2N492			450	9.1	0.68	8.0	20	12 @ 60	5.0
2N492A			450	9.1	0.68	8.0	15	12 @ 60	4.3
2N492B			450	9.1	0.68	8.0	6.0	0.2 @ 60	4.3
2N492C			450	9.1	0.56				
2N493			450	6.8	0.75	8.0	20	12 @ 60	5.0
2N493A			450	6.8	0.75	8.0	15		
2N493B			450	6.8	0.75	8.0	6.0	0.2 @ 60	5.0
2N494			450	9.1	0.75	8.0	20	12 @ 60	5.0
2N494A			450	9.1	0.75	8.0	15	12 @ 60	4.6
2N494B			450	9.1	0.75	8.0	6.0	0.2 @ 60	4.6
2N494C			450	9.1	0.62	8.0	2.0	0.02 @ 60	4.6
2N1671			450	9.1	0.62	8.0	25	12 @ 30	5.0
2N1671A			450	9.1	0.62	8.0	25	12 @ 30	5.0
2N1671B			450	9.1	0.62	8.0	6.0	0.2 @ 30	5.0
2N1671C			450	4.1 -9.1					
2N2160			450	4.0 -12	0.47 -0.80	8.0	25	12 @ 30	
2N2417			390	0.68	0.62	8.0	20	12 @ 60	5.0
2N2417A			390	0.68	0.62	8.0	20	12 @ 60	4.0
2N2417B			300	6.8	0.51 -0.62	8.0	6.0	0.2 @ 30	4.0
2N2418			390	0.68	0.62	8.0	20	12 @ 60	5.0
2N2418A			390	9.1	0.62	8.0	20	12 @ 60	4.0
2N2418B			300	9.1	0.51 - 0.62	8.0	6.0	0.2 @ 60	4.0
2N2419			390	4.7 -6.8	0.68	8.0	20	12 @ 60	5.0
2N2419A			390	6.8	0.68	8.0	20	12 @ 60	4.3
2N2419B			300	6.8	0.56 -0.68	8.0	6.0	0.2 @ 30	4.3
2N2420			390	9.1	0.68	8.0	20	12 @ 60	5.0
2N2420A			390	9.1	0.68	8.0	20	12 @ 60	4.3
2N2420B			300	9.1	0.56 -0.68	8.0	6.0	0.2 @ 30	4.3
2N2421			390	6.8	0.75	8.0	20	12 @ 60	5.0
2N2421A			390	6.8	0.75	8.0	20	12 @ 60	4.6
2N2421B			300	6.8	4.7 -6.8	8.0	6.0	0.2 @ 30	4.6
2N2422			390	9.1	0.75	8.0	20	12 @ 60	5.0
2N2422A			390	9.1	0.75	8.0	20	12 @ 60	4.6
2N2422B			300	9.1	0.62 -0.75	8.0	6.0	0.2 @ 30	
2N2646		4-70	300	4.7 (min)	0.56	4.0	25	12 @ 30	2.0
2N2647		4-70	300	4.7 (min)	0.68	8.0	2.0	0.2 @ 30	2.0
2N2840			300	4.7 -9.1	1.3 -1.5	0.70	10	1.0 @ 30	
2N3406			450			8.0			
2N3479			400	4.7 -9.1	0.47 -0.62	6.0	20	12 @ 30	5.0
2N3480			400	9.1	0.75	4.0	15	12 @ 30	5.0
2N3481			400	9.1	0.85	6.0	15	12 @ 30	5.0
2N3482			400	4.7 -6.8	0.51 -0.62	8.0	2.0	0.02 @ 30	5.0
2N3483			400	9.1	0.72	8.0	2.0	1.0 @ 30	5.0
2N3484			400	9.1	0.85	8.0	2.0	0.2 @ 30	5.0
2N3679			250	9.1	0.80	4.2			
2N3980		4-72	360	8.0					
2N4851		4-74	300	4.7 (min)	0.56 (min)	2.0	2.0	0.1 @ 30	2.5
2N4852		4-74	300	4.7 (min)	0.70 (min)	4.0	2.0	0.1 @ 30	2.5
2N4853		4-74	300	4.7 (min)	0.70 (min)	6.0	0.4	0.05 @ 30	2.5
2N4870		4-78	300	4.0 (min)	0.56 (min)	2.0	5.0	0.05 @ 30	2.5
2N4871		4-78	300	4.0 (min)	0.70 (min)	4.0	5.0	0.05 @ 30	2.5
2N4891			300	4.0 (min)	0.55 (min)	2.0	5.0	0.01 @ 30	4.0
2N4892			300	4.0 (min)	0.51 (min)	4.0	2.0	0.01 @ 30	4.0
2N4893			300	4.0 (min)	0.55 (min)	2.0	2.0	0.01 @ 30	4.0
2N4894			300	4.0 (min)	0.74 (min)	2.0	1.0	0.01 @ 30	4.0
2N4948		4-82	360	4.0 (min)	0.55 (min)	2.0	2.0	0.01 @ 30	2.5
2N4949		4-82	360	4.0 (min)	0.74 (min)	2.0	1.0	0.01 @ 30	2.5

## THYRISTOR SELECTOR GUIDE (continued)



### BIDIRECTIONAL THYRISTORS — TRIACS (8.0 AMP RMS)

V <sub>BO</sub> M Peak Blocking Voltage	50 V	MAC1-2		MAC2-2		MAC3-2		
	200 V	MAC1-4		MAC2-4		MAC3-4		
	400 V	MAC1-6		MAC2-6		MAC3-6		
		Case 85			Case 86		Case 87L	


### BILATERAL TRIGGER DIODES (3-layer diodes)


	Type	V <sub>BR</sub>	I <sub>pk</sub>	I <sub>BR</sub>	ΔV
		Breakover Voltage (Both Directions)	Peak Pulse Current @ 30 μs, 120 Hz	Breakover Current (Both Directions)	Switchback Voltage (Both Directions)
		Volts (Nom)	Amp (Max)	μA (Max)	Volts (Min)
Case 29B	MPT28	28	2.0	50	7.0
	MPT32	32	2.0	50	7.0

### UNIUNCTION TRANSISTORS

	Type	I <sub>p</sub>	I <sub>EB20</sub>	η		I <sub>v</sub>	P <sub>D</sub>	V <sub>B2B1</sub>
		Peak Point Emitter Current	Emitter Reverse Current	Intrinsic Standoff Ratio		Valley Point Current	Power Dissipation	Interbase Voltage
		μA (Max)	μA (Max)	Min	Max	mA (Min)	mW	Volts
Case 29 (9)	2N4870	5.0	1.0	0.56	0.75	2.0	300	35
	2N4871	5.0	1.0	0.70	0.85	4.0	300	35
	2N2646	5.0	12.0	0.56	0.75	4.0	300	35
	2N2647	2.0	0.2	0.68	0.82	8.0	300	
	2N3980	2.0	0.01	0.68	0.82	1.0	360	
	2N4851	2.0	0.1	0.56	0.75	2.0	300	
	2N4852	2.0	0.1	0.70	0.85	4.0	300	
	2N4853	0.4	0.05	0.70	0.85	6.0	300	
								35

### 4-LAYER DIODES (Peak Pulse Current = 10 Amp @ PW = 50 μs Max)

	Type*	V <sub>BR(F)</sub>	I <sub>H</sub>
		Forward Breakover Voltage @ T <sub>A</sub> = 25°C Volts	Holding Current @ T <sub>A</sub> = 25°C mA
		Min/Max	Min/Max
	I <sub>F</sub> = 150 mA (Max)		
	1N5158(M4L3052)	8/10	1/20
	1N5159(M4L3053)	9/11	1/20
	1N5160(M4L3054)	10/12	1/20
	I <sub>F</sub> = 180 mA (Max)		
	M4L20-3	16/24	1/6
	M4L20M-3	16/24	1/6
M4L20-8	16/24	1/15	
M4L20M-8	16/24	1/15	
M4L20-28	16/24	14/45	
M4L20M-28	16/24	14/45	
M4L20A	14/26	0.5/60	
M4L30-3	26/34	1/6	
M4L30M-3	26/34	1/6	
M4L30-8	26/34	1/15	
M4L30M-8	26/34	1/15	
M4L30-28	26/34	14/45	
M4L30M-28	26/34	14/45	
M4L30A	24/36	0.5/60	

	Type*	V <sub>BR(F)</sub>	I <sub>H</sub>
		Forward Breakover Voltage @ T <sub>A</sub> = 25°C Volts	Holding Current @ T <sub>A</sub> = 25°C mA
		Min/Max	Min/Max
	I <sub>F</sub> = 180 mA (Max)		
	M4L40-3	36/44	1/6
	M4L40M-3	36/44	1/6
	M4L40-8	36/44	1/15
	M4L40M-8	36/44	1/15
	M4L40-28	36/44	14/45
	M4L40M-28	36/44	14/45
M4L40A	34/46	0.5/60	
M4L50-3	46/54	1/6	
M4L50M-3	46/54	1/6	
M4L50-8	46/54	1/15	
M4L50M-8	46/54	1/15	
M4L50-28	46/54	14/45	
M4L50M-28	46/54	14/45	
M4L50A	44/56	0.5/60	

\*Suffix "M" designates guaranteed V<sub>BR(F)</sub> unit over the temperature range, T<sub>A</sub> = -60 to +125°C.

**2N2646** (SILICON)  
**2N2647**

$V_{BB} = 35 \text{ V}$   
 $I_e = 50 \text{ mA}$   
 $P_D = 300 \text{ mW}$



Silicon annular PN unijunction transistors designed for use in pulse and timing circuits, sensing circuits and thyristor trigger circuits.

**CASE 22A**

(Lead 3 connected to case)

**MAXIMUM RATINGS** ( $T_A = 25^\circ\text{C}$  unless otherwise noted)

Rating	Symbol	Value	Unit
RMS Power Dissipation*	$P_D$	300*	mW
RMS Emitter Current	$I_e$	50	mA
Peak Pulse Emitter Current**	$i_e$	2**	Amp
Emitter Reverse Voltage	$V_{B2E}$	30	Volts
Interbase Voltage	$V_{B2B1}$	35	Volts
Operating Junction Temperature Range	$T_J$	-65 to +125	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-65 to +150	$^\circ\text{C}$

\* Derate 3.0 mW/ $^\circ\text{C}$  increase in ambient temperature. The total power dissipation (available power to Emitter and Base-Two) must be limited by the external circuitry.

\*\* Capacitor discharge — 10  $\mu\text{F}$  or less, 30 volts or less.

**2N2646, 2N2647 (continued)**

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

Characteristic	Symbol	Min	Typ	Max	Unit
Intrinsic Standoff Ratio ( $V_{B2B1} = 10\text{ V}$ ) (Note 1)	$\eta$	0.56 0.68	— —	0.75 0.82	—
Interbase Resistance ( $V_{B2B1} = 3\text{ V}$ , $I_E = 0$ )	$R_{BB}$	4.7	7.0	9.1	K ohms
Interbase Resistance Temperature Coefficient ( $V_{B2B1} = 3\text{ V}$ , $I_E = 0$ , $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$ )	$\alpha R_{BB}$	0.1	—	0.9	$\%/^\circ\text{C}$
Emitter Saturation Voltage ( $V_{B2B1} = 10\text{ V}$ , $I_E = 50\text{ mA}$ ) (Note 2)	$V_{EB1(sat)}$	—	3.5	—	Volts
Modulated Interbase Current ( $V_{B2B1} = 10\text{ V}$ , $I_E = 50\text{ mA}$ )	$I_{B2(mod)}$	—	15	—	mA
Emitter Reverse Current ( $V_{B2E} = 30\text{ V}$ , $I_{B1} = 0$ )	$I_{EO}$	— —	0.005 0.005	12 0.2	$\mu\text{A}$
Peak Point Emitter Current ( $V_{B2B1} = 25\text{ V}$ )	$I_P$	— —	1.0 1.0	5.0 2.0	$\mu\text{A}$
Valley Point Current ( $V_{B2B1} = 20\text{ V}$ , $R_{B2} = 100\text{ ohms}$ ) (Note 2)	$I_V$	4.0 8.0	6.0 10	— 18	mA
Base-One Peak Pulse Voltage (Note 3, Figure 3)	$V_{OB1}$	3.0 6.0	5.0 7.0	— —	Volts

**NOTES**

1. Intrinsic standoff ratio,

$\eta$ , is defined by equation:

$$\eta = \frac{V_P - V_{(EB1)}}{V_{B2B1}}$$

Where  $V_P$  = Peak Point Emitter Voltage

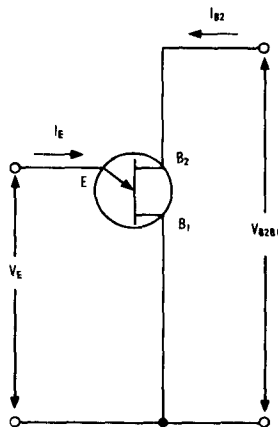
$V_{B2B1}$  = Interbase Voltage

$V_{(EB1)}$  = Emitter to Base-One Junction Diode Drop  
( $\approx 0.5\text{ V}$  @  $10\ \mu\text{A}$ )

2. Use pulse techniques:  $PW \approx 300\ \mu\text{s}$  duty cycle  $\leq 2\%$  to avoid internal heating due to interbase modulation which may result in erroneous readings.

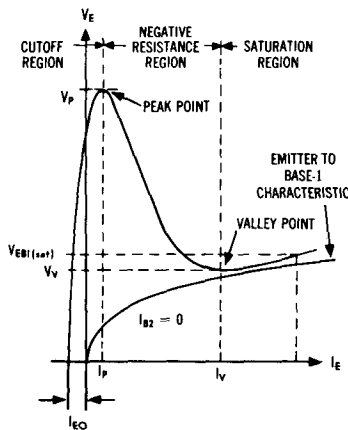
3. Base-One Peak Pulse Voltage is measured in circuit of Figure 3. This specification is used to ensure minimum pulse amplitude for applications in SCR firing circuits and other types of pulse circuits.

**FIGURE 1 — UNIJUNCTION TRANSISTOR SYMBOL AND NOMENCLATURE**



**FIGURE 2 — STATIC EMITTER CHARACTERISTIC CURVES**

(Exaggerated to Show Details)



**FIGURE 3 —  $V_{OB1}$  TEST CIRCUIT**

(Typical Relaxation Oscillator)

