UNIJUNCTIONS, TRIGGERS AND SWITCHES

Since the introduction of the commercial silicon unijunction transistor in 1956, General Electric has continued developing an extensive line of negative resistance threshold and four-layer switch devices. Each of these devices can be used as a power thyristor trigger, and each offers a special advantage for a particular trigger function. In addltion, each can be used for various non-trigger applications.

The features—both in design and characteristics—which you receive with these products are concisely defined for each series:

TYPES

CONVENTIONAL UNIJUNCTIONS 2N489-494—proved reliability, MIL spec version.
2N2646-47—low cost, proved hermetic sealed device.

PROGRAMMABLE UNIJUNCTION TRANSISTOR (PUT)—variable threshold, low cost, fast switching speed, and circuit adjustable electrical characteristics.

COMPLEMENTARY UNIJUNCTION TRANSISTOR—ultimate in temperature stability for timing and oscillator applications.

SILICON UNILATERAL SWITCH (SUS)—a stable fixed low voltage threshold, low cost, high performance "4-layer diode."

SILICON BILATERAL SWITCH (SBS)—low voltage triac trigger, two silicon unilateral switches connected back to back.

SILICON CONTROLLED SWITCH (SCS)—high triggering sensitivity, 4-lead capability for multiple loads or dv/dt suppression.

APPLICATIONS

Use	Device	Unijunctions				Triggers	
		Conventional		Complementary	Programmable		
		2N489-94, 2N1671, 2N2160	2N2646 2N2647	D5K1 D5K2	2N6027 2N6028	SUS 2N4983-90	SBS 2N4991-93
Trigger for SCR's	DC, Lo Cost	P	F	P	E	E	E
	DC, Hi Perf.	F	F	F	E	F	F
	DC, Volt Regulator	P	P	F	F	E	E
	DC, Inverter	F	F	E	E	F	F
	DC, Hi ΔI/ΔT	P	P	P	E[1]	P	P
	AC, ϕ, Hi Perf.	F	F	E	E[1]	F	F
	AC, ϕ, Hi f	F	F	F	E	P	P
	AC, Lo RFI	P	P	P	F	E	E
	AC, ϕ, Lo Cost	P	F	P	E	E	E
Timers	>1 hr.	F[1]	P	F[1]	E[1]	N	N
	>1 min, Lo Cost	P	F	P	E	N	N
	>1 min, Stable	F	P	E	P	N	N
	<1 min, Lo Cost	P	F	P	E	F	F
	<1 min, Stable	F	P	E	P	F	N
	<10V	P	P	F	E	N	N
	10V-25V	E	E	E	E	F	F
	>25V	P	P	P	E	F	F
Oscillators	Stability	F	F	E	F	N	N
	Cost	P	F	P	E	N	N
	Adjust, Range	E	E	F	F[1]	N	N
Markets	Military	E	P	F	F[2]	P	P
	Hi-Rel	E	P	E	F[2]	F	F
	Economy	P	F	P	E	E	E

E = Excellent, F = Fair, P = Poor, N = Not Applicable
[1] With additional circuitry
[2] Hermetic version 2N6116-18

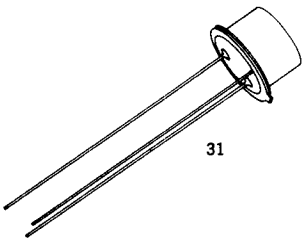
CONVENTIONAL UNIJUNCTIONS

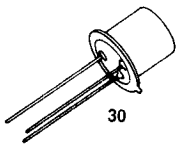
General Electric produces a very broad line of standard UJT's. The TO-5 ceramic disc bar structure device has been the workhorse of the unijunction industry for over 10 years. MIL versions are available on the 2N489-494 series.

The cube structure TO-18 series offers excellent value for those requiring proved, low cost units.

Applications

Oscillators
Timers
Sawtooth Generators
SCR Triggers
Frequency Divider
Stable Voltage Sensing





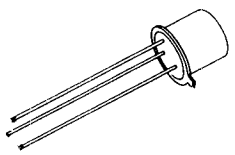
	GE Type	R_{BBO} Interbase Resistance @ V_{BB} = 3V I_E = 0 (KΩ)	η Intrinsic Standoff Ratio @ V_{BB} = 10V	I_V Valley Current Min. (mA)	I_P Peak Point Emitter Current Max. (μA)	I_{EO} Emitter Reverse Current Max. (μA)	I_{EO} Emitter Reverse Current T_J=25°C @ V_{B_2E}	V_{OB_1} Base One Peak Pulse Voltage Min. (V)	Comments	Package
TO-5 Bar Structure	2N489	4.7- 6.8	.51-.62	8	12	2	60	—	"A" versions are guaranteed in recommended circuit to trigger GE SCR's over range T_A = −55°C to 125°C. "B" versions in addition to SCR triggering guarantees lower I_{EO} and I_P for long timing periods with a smaller capacitor.	31
	2N489A *				12	2	60	3		
	2N489B				6	0.2	30	3		
	2N490	6.2- 9.1	.51-.62	8	12	2	60	—		
	2N490A *				12	2	60	3		
	2N490B				6	0.2	30	3		
	2N490C				2	.02	30	3		
	2N491	4.7- 6.8	.56-.68	8	12	2	60	—		31
	2N491A *				12	2	60	3		
	2N491B				6	0.2	30	3		
	2N492	6.2- 9.1	.56-.68	8	12	2	60	—		31
	2N492A *				12	2	60	3		
	2N492B				6	0.2	30	3		
	2N492C				2	.02	30	3		
	2N493	4.7- 6.8	.62-.75	8	12	2	60	—		31
	2N493A *				12	2	60	3		
	2N493B				6	0.2	30	3		
	2N494	6.2- 9.1	.62-.75	8	12	2	60	—		31
	2N494A *				12	2	60	3		
	2N494B				6	0.2	30	3		
	2N494C				2	.02	30	3		
	2N1671	4.7- 9.1	.47-.62	8	25	12	30	—	Industrial types.	31
	2N1671A				25	12	30	3		
	2N1671B				6	0.2	30	3		
	2N1671C				2	.02	30	3		
	2N2160	4.0-12.0	.47-.80	8	25	12	30	3	General purpose—low cost.	31
TO-18 Cube Structure	2N2646	4.7- 9.1	.56-.75	4	5	12	30	3	General purpose.	30
	2N2647	4.7- 9.1	.68-.82	8	2	0.2	30	6	For long timing periods and triggering high current SCR's.	30
	D5J-43	4.7- 9.1	.68-.82	6	2	1	30	5	General purpose.	30
	D5J-44	4.7- 9.1	.68-.82	4	5	12	30	4	General purpose—low cost.	30
	2N2840	4.7- 9.1 [2]	.62 Typical	.2	10	1	30	—	For 1.5 volt applications.	30

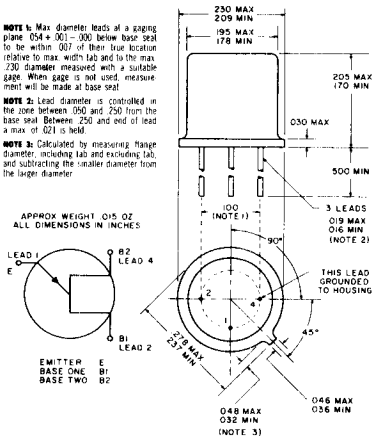
* JAN & JANTX types available
[2] V_{BB}=1.5V

Silicon Unijunction Transistors

2N2646,7

The General Electric 2N2646 and 2N2647 Silicon Unijunction Transistors have an entirely new structure resulting in lower saturation voltage, peak-point current and valley current as well as a much higher base-one peak pulse boltage. In addition, these devices are much faster switches.
The 2N2646 is intended for general purpose industrial applications where circuit economy is of primary importance, and is ideal for use in firing circuits for Silicon Controlled Rectifiers and other applications where a guaranteed minimum pulse amplitude is required. The 2N2647 is intended for applications where a low emitter leakage current and a low peak point emitter current (trigger current) are required (i.e. long timing applications), and also for triggering high power SCR's.





absolute maximum ratings: (25°C) (unless otherwise specified)

Power Dissipation (Note 1)	300 mw
RMS Emitter Current	50 ma
Peak Emitter Current (Note 2)	2 amperes
Emitter Reverse Voltage	30 volts
Interbase Voltage	35 volts
Operating Temperature Range	−65°C to +125°C
Storage Temperature Range	−65°C to +150°C

electrical characteristics: (25°C) (unless otherwise specified)

PARAMETER		2N2646			2N2647			
		Min.	Typ.	Max.	Min.	Typ.	Max.	
Intrinsic Standoff Ratio ($V_{BB} = 10V$)	η	0.56	0.69	0.75	0.68	0.77	0.82	
Interbase Resistance ($V_{BB} = 3V, I_E = 0$)	R_{BB0}	4.7	6.7	9.1	4.7	6.7	9.1	KΩ
Emitter Saturation Voltage ($V_{BB} = 10V, I_E = 50$ ma)	$V_{E(SAT)}$		2			2		volts
Modulated Interbase Current ($V_{BB} = 10V, I_E = 50$ ma)	$I_{B2(MOD)}$		24			27		ma
Emitter Reverse Current ($V_{B2E} = 30V, I_{B1} = 0$)	I_{EO}		.001	12		.001	.200	μa
Peak Point Emitter Current ($V_{BB} = 25V$)	I_P		0.8	5		1.0	2	μa
Valley Point Current ($V_{BB} = 20V, R_{B2} = 100\Omega$)	I_V	4	5		8	9	18	ma
Base-One Peak Pulse Voltage (Note 3)	V_{OB1}	3.0	8.5		6.0	9.5		volts
SCR Firing Conditions (See Figure 26, back page)								

1. Derate 3.0 MW/°C increase in ambient temperature. The total power dissipation (available power to Emitter and Base-Two) must be limited by the external circuitry.
2. Capacitor discharge—10μfd or less, 30 volts or less.
3. The Base-One Peak Pulse Voltage is measured in the circuit below. This specification on the 2N2646 and 2N2647 is used to ensure a minimum pulse amplitude for applications in SCR firing circuits and other types of pulse circuits.
4. The intrinsic standoff ratio, η, is essentially constant with temperature and interbase voltage. η is defined by the equation:

$$V_P = \eta V_{BB} + V_D$$

Where V_P = Peak Point Emitter Voltage
V_{BB} = Interbase Voltage
V_D = Junction Diode Drop (Approx. .5V)

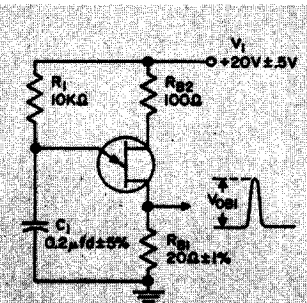


FIGURE 1

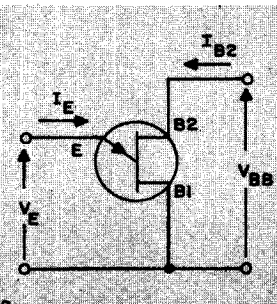


FIGURE 2
Unijunction Transistor Symbol with Nomenclature used for voltage and currents.

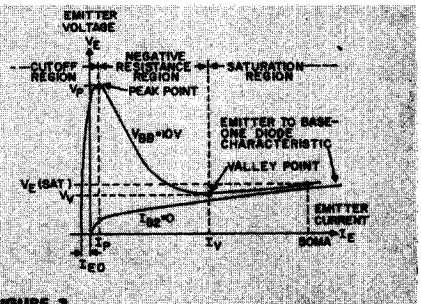


FIGURE 3
Static Emitter Characteristics curves showing important parameters and measurement points (exaggerated to show details).

$T_A = 125°C$

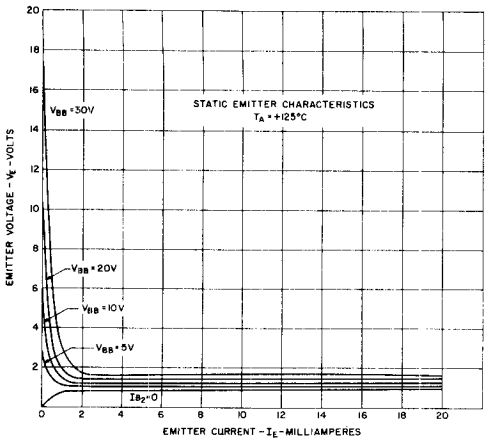


FIGURE 4

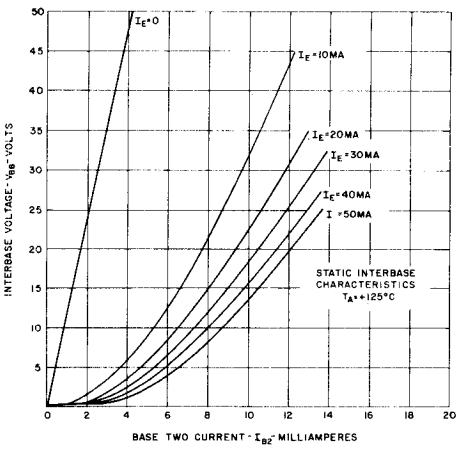


FIGURE 5

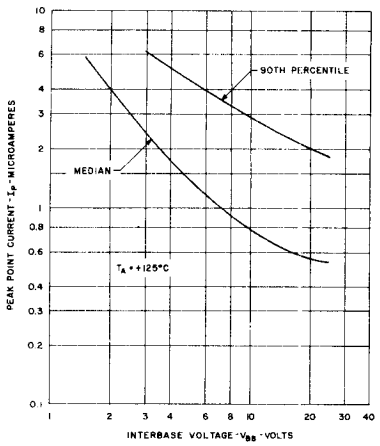


FIGURE 6

$T_A = 25°C$

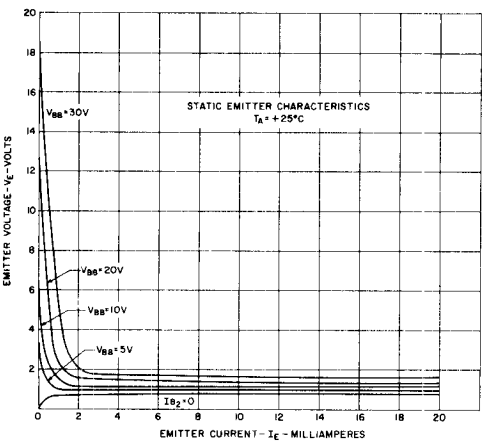


FIGURE 7

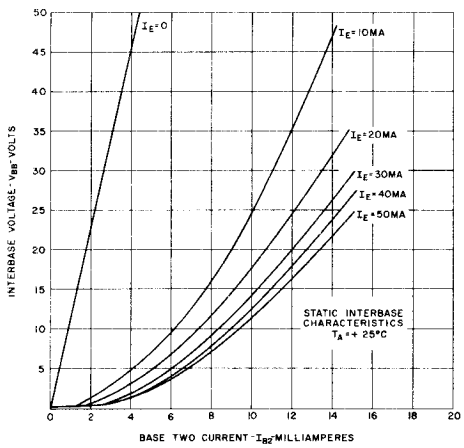


FIGURE 8

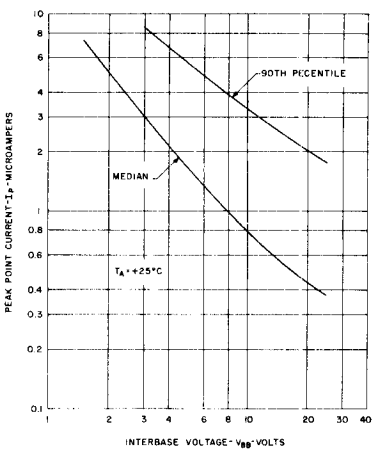


FIGURE 9

$T_A = -55°C$

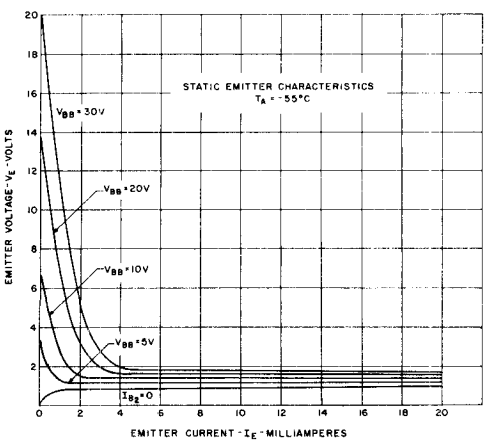


FIGURE 10

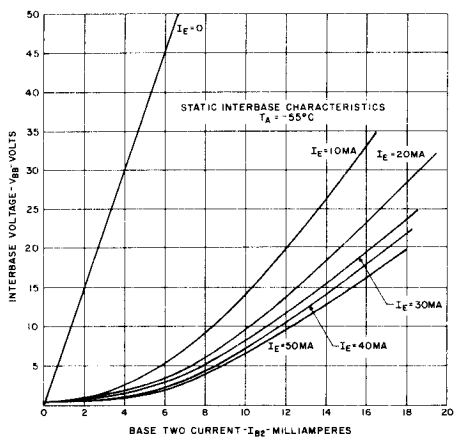


FIGURE 11

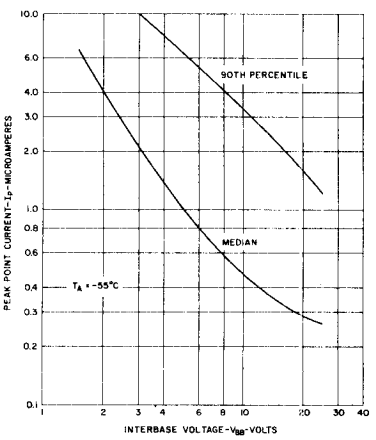


FIGURE 12

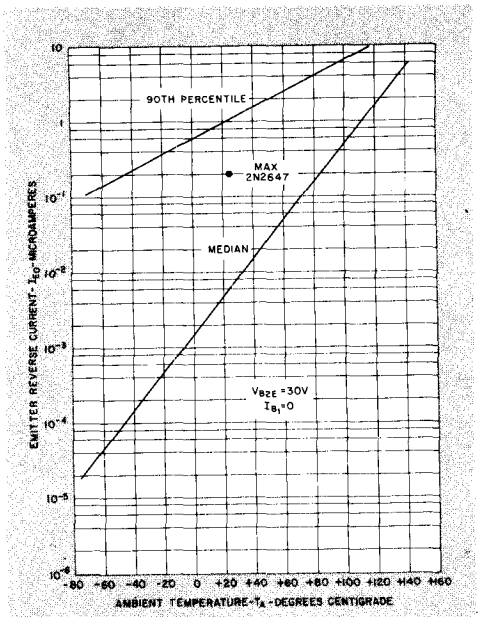


FIGURE 13

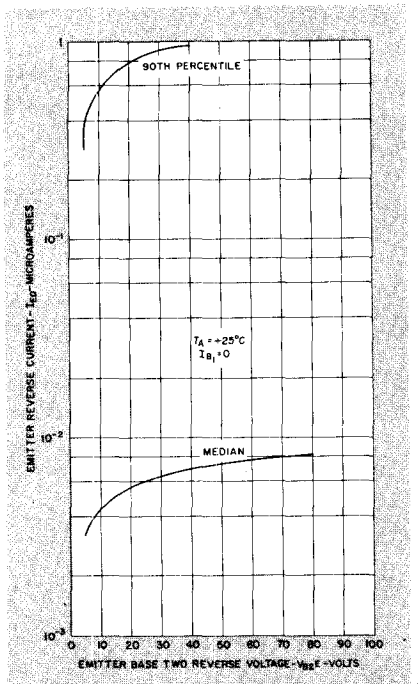


FIGURE 14

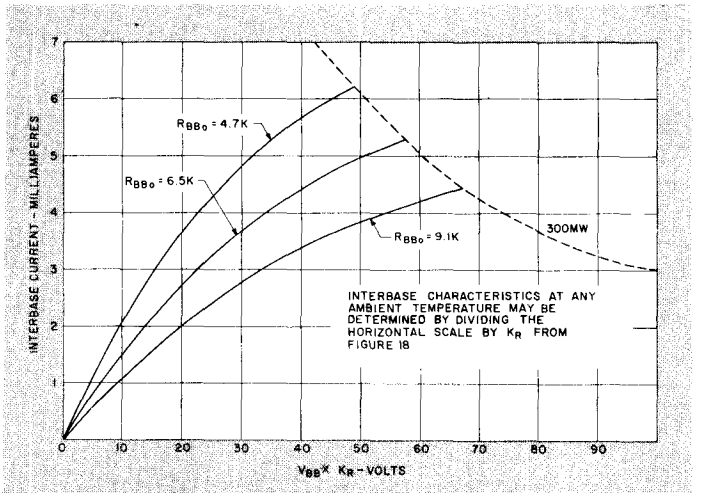


FIGURE 15

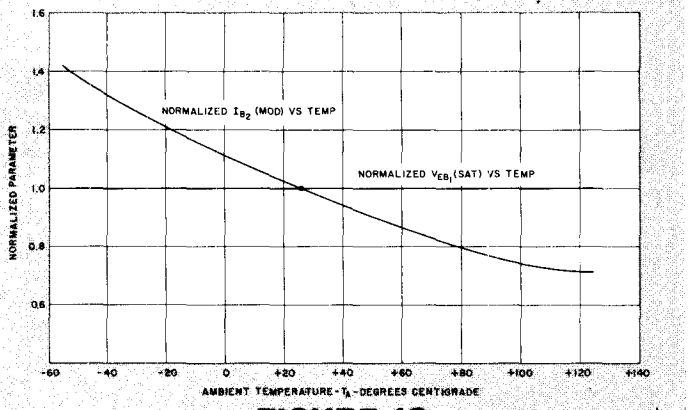


FIGURE 16

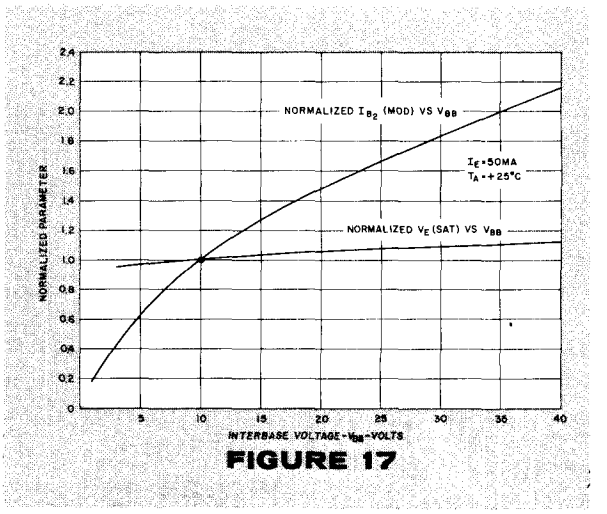


FIGURE 17

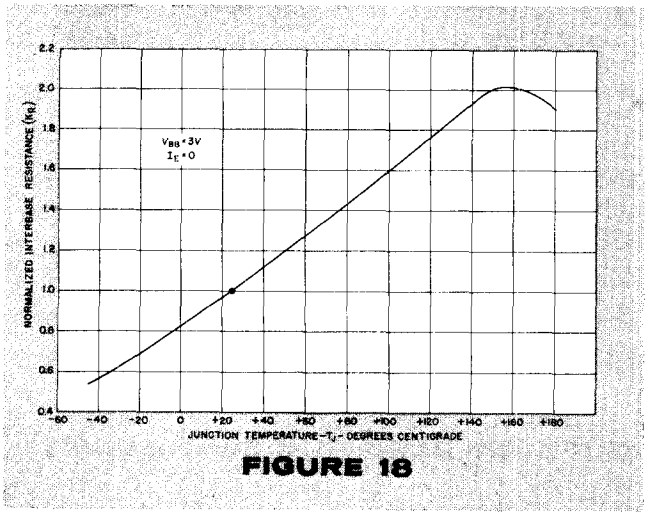


FIGURE 18

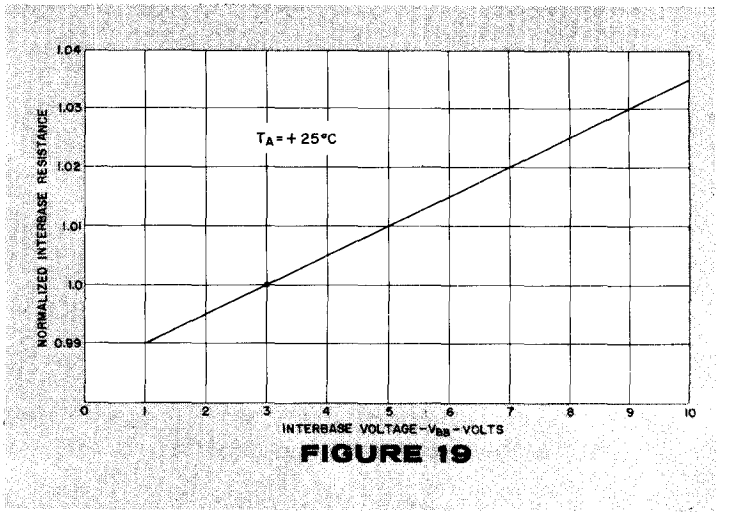


FIGURE 19

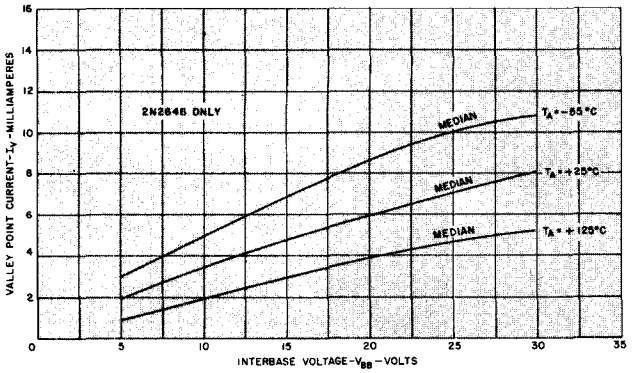


FIGURE 20

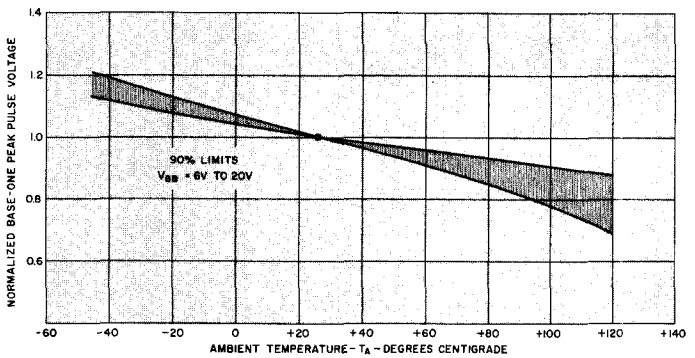


FIGURE 21

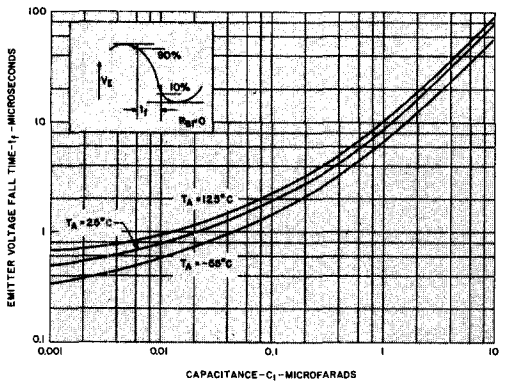


FIGURE 22

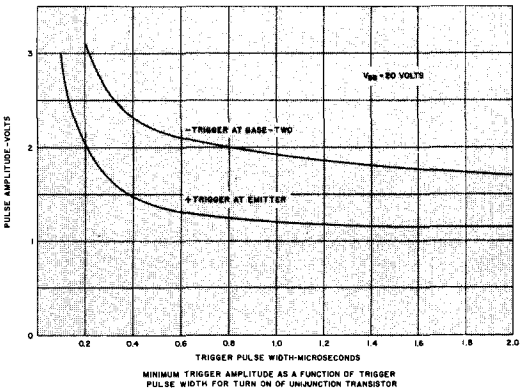


FIGURE 23

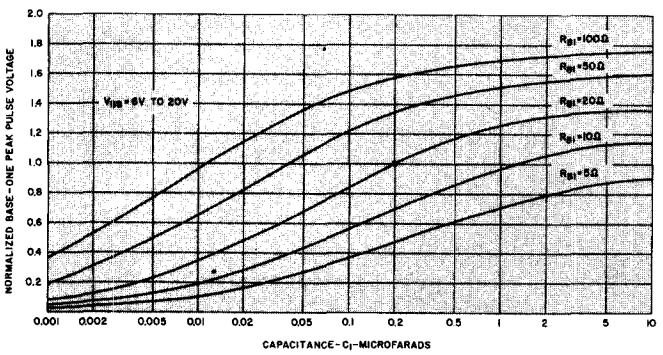


FIGURE 24

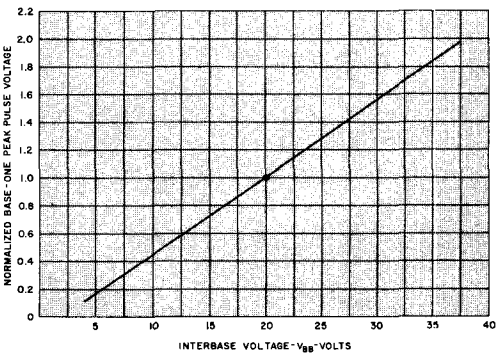


FIGURE 25

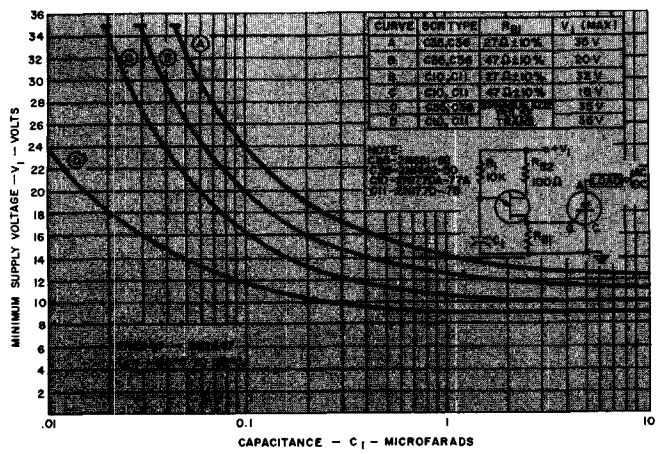


FIGURE 26A-Both types- Lo &Med. SCR's

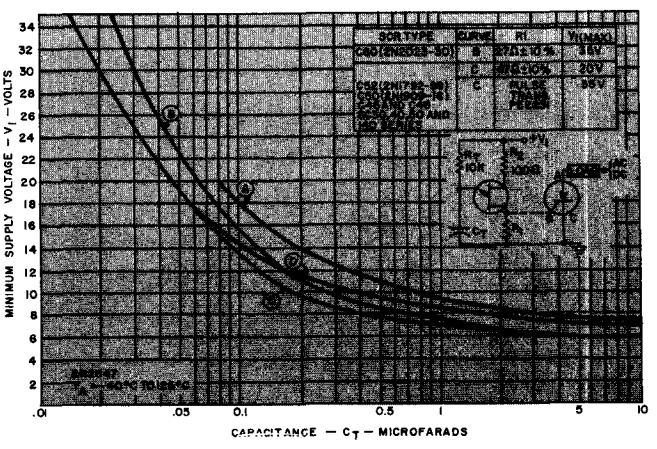


FIGURE 26B-2N2647-Hi Current SCR's