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APPENDIX A

DATA SHEETS

Courtesy of Motorola Semiconductor Products Inc.

2N2646 2N2647

SILICON ANNULAR¹ PN UNIJUNCTION TRANSISTORS

... designed for use in pulse and timing circuits, sensing circuits and thyristor trigger circuits. These devices feature:

- Low Peak Point Current — 2 μ A max
- Low Emitter Reverse Current — 200 nA max
- Passivated Surface for Reliability and Uniformity

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

Characteristic	Symbol	Rating	Unit
RMS Power Dissipation*	P_D	200*	mW
RMS Emitter Current	I_e	80	mA
Peak Pulse Emitter Current**	I_{epp}	2**	Amp
Emitter Reverse Voltage	V_{B2E}	30	Volts
Interbase Voltage	V_{B2B1}	36	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.

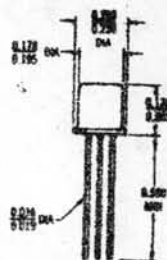
** Capacitor discharge — 10 μF or less, 50 volts or less.

¹ Annular Semiconductors Patented by Motorola Inc.

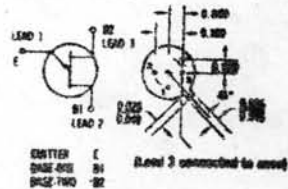
PN UNIJUNCTION TRANSISTORS

JANUARY 1967 — DS 2600

(Replaces DS 6514)



APPROX WEIGHT 015 G2



TO-18 PACKAGE (except for lead positions)

2N2646 2N2647

ELECTRICAL CHARACTERISTICS (V_E = 20 V unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Intrinsic Standoff Ratio (V _{BE21} = 10 V) (Note 1)	η	0.56 0.60	—	0.75 0.82	—
Interbase Resistance (V _{BE1} = 3 V, I _E = 0)	R _{DB}	4.7	7.0	9.1	K ohms
Interbase Resistance Temperature Coefficient (V _{BE1} = 3 V, I _E = 0, T _A = -55°C to +125°C)	αR_{DB}	0.1	—	0.9	%/°C
Emitter Saturation Voltage (V _{BE1} = 10 V, I _E = 50 mA) (Note 2)	V _{BE1(sat)}	—	2.5	—	Volts
Modulated Interbase Current (V _{BE1} = 10 V, I _E = 50 mA)	I _{DB(mod)}	—	15	—	mA
Emitter Reverse Current (V _{BE1} = 20 V, I _{B1} = 0)	I _{EO}	—	0.005 0.006	12 6.3	μA
Peak Point Emitter Current (V _{BE1} = 20 V)	I _p	—	1.0 1.0	5.0 5.0	μA
Valley Point Current (V _{BE1} = 20 V, R _{DB} = 100 ohms) (Note 2)	I _v	4.0 5.0	6.0 10	—	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,

η is defined by equation:

$$\eta = \frac{V_E - V_{BE1}}{V_{BE1}}$$

Where V_p = Peak Point Emitter Voltage

V_{BE1} = Interbase Voltage

V_{BE1} = Emitter to Base-One Junction Diode Drop
(-0.5 V @ 10 μA)

2. Use pulse techniques: PW ~ 300 μs duty cycle < 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

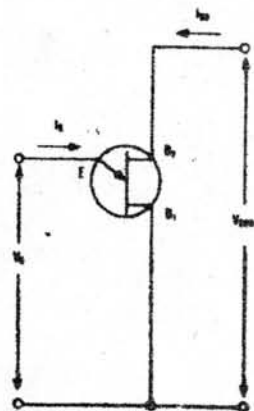


FIGURE 2 — STATIC EMITTER CHARACTERISTIC CURVES

(Exaggerated to Show Details)

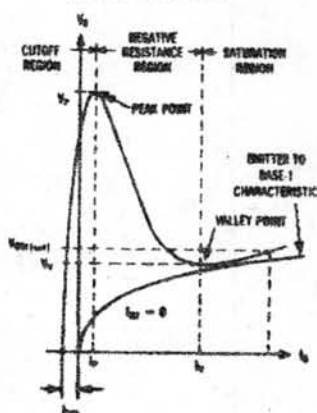
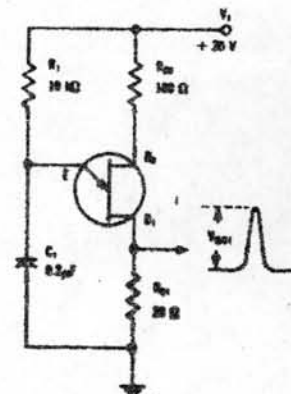


FIGURE 3 — V_{OB1} TEST CIRCUIT

(Typical Relaxation Oscillator)



APPENDIX B

RESISTOR AND CAPACITOR VALUES

B-1 Typical Standard Resistor Values

Ω	Ω	Ω	$k\Omega$	$k\Omega$	$k\Omega$	$M\Omega$	$M\Omega$
	10	100	1	10	100	1	10
	12	120	1.2	12	120	1.2	
	15	150	1.5	15	150	1.5	15
	18	180	1.8	18	180	1.8	
	22	220	2.2	22	220	2.2	22
2.7	27	270	2.7	27	270	2.7	
3.3	33	330	3.3	33	330	3.3	
3.9	39	390	3.9	39	390	3.9	
4.7	47	470	4.7	47	470	4.7	
5.6	56	560	5.6	56	560	5.6	
6.8	68	680	6.8	68	680	6.8	
	82	820	8.2	82	820		

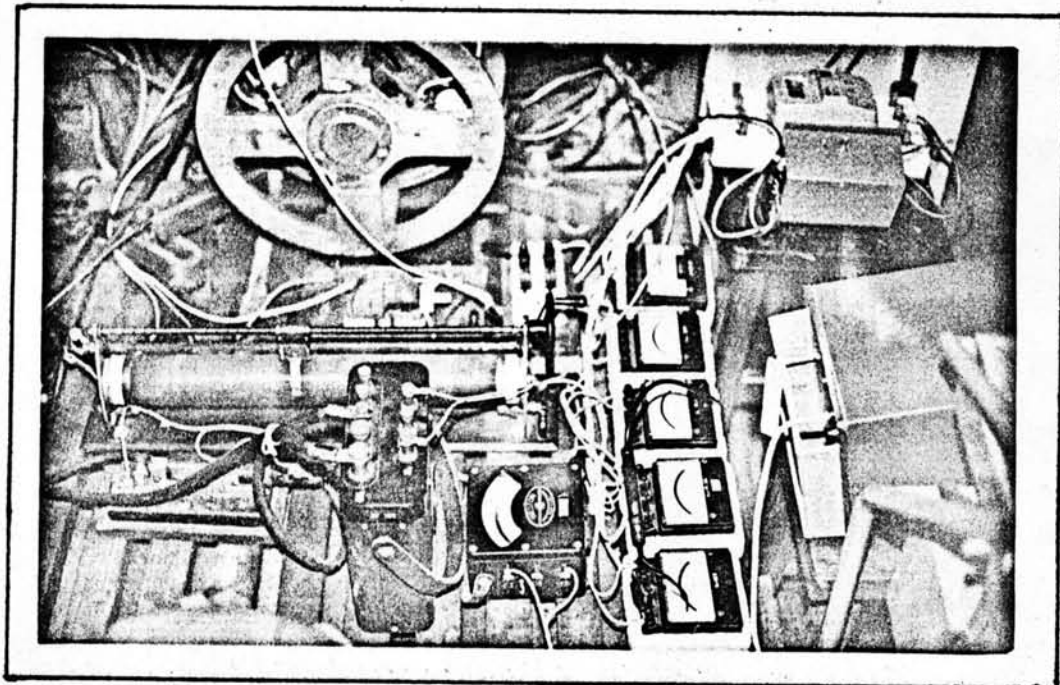
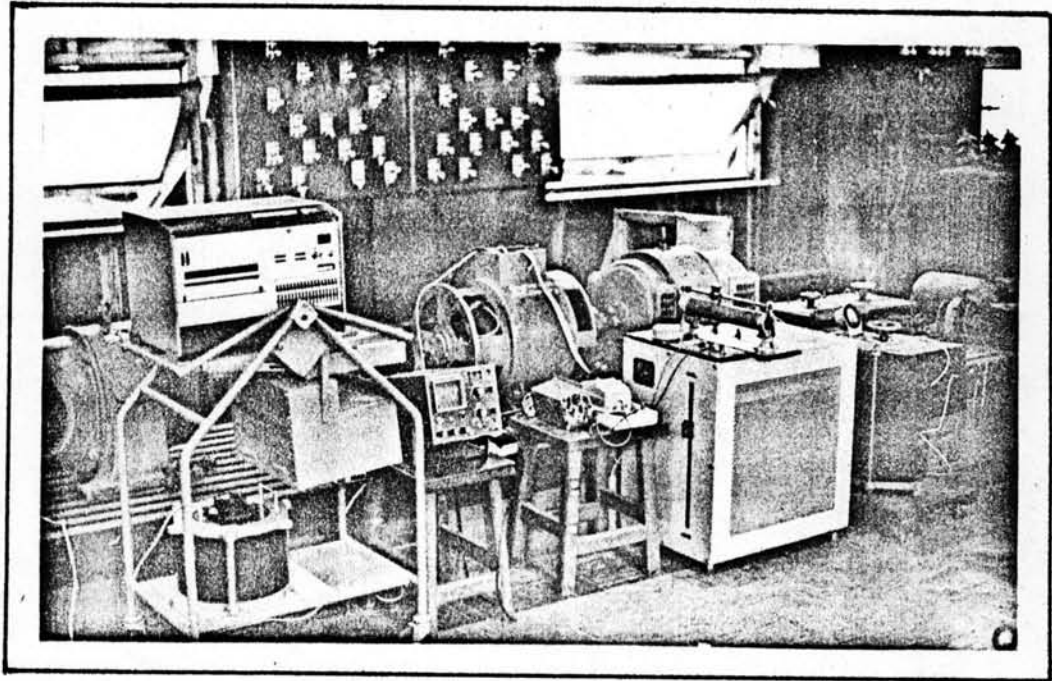
B-2 Typical Standard Capacitor Values

pF	pF	pF	pF	μF	μF	μF	μF	μF	μF	μF
5	50	500	5000		0.05	0.5	5	50	500	5000
	51	510	5100							
	56	560	5600		0.056	0.56	5.6	56		5600
			6000		0.06		6			6000
	62	620	6200							
	68	680	6800		0.068	0.68	6.8			
	75	750	7500					75		
			8000				8	80		
	82	820	8200		0.082	0.82	8.2	82		
	91	910	9100							
10	100	1000		0.01	0.1	1	10	100	1000	10000
	110	1100								
12	120	1200		0.012	0.12	1.2				
	130	1300								
15	150	1500		0.015	0.15	1.5	15	150	1500	
	160	1600								
18	180	1800		0.018	0.18	1.8	18	180		
20	200	2000		0.02	0.2	2	20	200	2000	
22	220	2200			0.22	2.2	22			
24	240	2400						240		
	250	2500			0.25		25	250	2500	
27	270	2700		0.027	0.27	2.7	27	270		
30	300	3000		0.03	0.3	3	30	300	3000	
33	330	3300		0.033	0.33	3.3	33	330	3300	
36	360	3600								
39	390	3900		0.039	0.39	3.9	39			
		4000		0.04		4		400		
43	430	4300								
47	470	4700		0.047	0.47	4.7	47			

APPENDIX C



TESTING INSTRUMENT AND APPARATUS



APPENDIX D

MATERIAL COST OF THE CONSTRUCTED REGULATOR

MATERIAL	QUANTITY	PURCHASE PRICE (Baht)	
		EACH	THE LOT
Potential transformer : Primary 0-380 V Secondary 30 V 100 mA	1	25.00	25.00
Filter choke : 3H 100 mA	1	25.00	25.00
Silicon rectifier diode : 1N4004	5	2.00	10.00
Silicon rectifier diode : 10 A 200 V	5	30.00	150.00
SCR : S4015L	2	64.00	128.00
Silicon PNP transistor : 2N4037	2	7.50	15.00
Unijunction transistor : 2N2646	1	28.00	28.00
Zener diode : BZX 83 C 6V2	1	6.00	6.00
Zener diode : 27 V 1W	1	10.00	10.00
Wire-wound variable resistors	2	16.00	32.00
Carbon variable resistor	1	5.00	5.00
Fixed resistors	18	-	9.75
Fixed capacitors	7	-	34.00
2-Contact 110 VAC relay	1	95.00	95.00
6-point screwed terminal	1	16.00	16.00
Printed circuit board	1	20.00	20.00
Regulator case	1	15.00	15.00
Nuts & Screws	-	-	1.75
TOTAL MATERIAL COST OF THE CONSTRUCTED REGULATOR			625.50

VITA

The author, Mr. Sakchai Talthip, was born on January 2, 1951 at Thonburi, Thailand. He received a Bachelor's Degree of Engineering (Second Class Honour) in Electrical Engineering from King Mongkut's Institute of Technology, Thonburi in 1974. He is currently as an Engineer in the Technical Section at the Thai-Yazaki Electric Wire Company.

