SCR Triggering Techniques
Scientech 2703

Learning Material
Ver 1.1

An ISO 9001:2008 company
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Certificate

Standard: **ISO 9001:2008**

Certificate Registr. No. **85 100 001 10182**

TÜV Rheinland India Pvt. Ltd.:

Certificate Holder: **Scientech Technologies Pvt. Ltd.**

Unit 1: 94 – 101, Electronics Complex, Pardeshi Pura,
Indore – 452 010, Madhya Pradesh, India

Unit 2: 90 – 91, Electronics Complex, Pardeshi Pura,
Indore – 452 010, Madhya Pradesh, India

Scope: **Design, Manufacture of Electronic Test & Measuring Instruments, Training Products for Electrical & Electronics Education and Providing Technology Training**

An audit was performed, Report No. 10182. Proof has been furnished that the requirements according to ISO 9001:2008 are fulfilled.

The due date for all future audits is 04-10 (dd.mm).

Validity: The certificate is valid from **2010-12-13 until 2013-12-12.**

Bangalore, 2010-12-20

The Certification Body of
TÜV Rheinland India Pvt. Ltd.

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The validity of this certificate is subject to timely completion of Surveillance audits as agreed in the Contract. The Validity of the Certificate can be verified under WWW.tuv.com with the Identification No. 9105027653

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Precisely Right.

SCR Triggering Techniques

Scientech 2703

Table of Contents

Safety Instructions

Read the following safety instructions carefully before operating the instrument. To avoid any personal injury or damage to the instrument or any product connected to the instrument.

Do not operate the instrument if you suspect any damage within.

The instrument should be serviced by qualified personnel only.

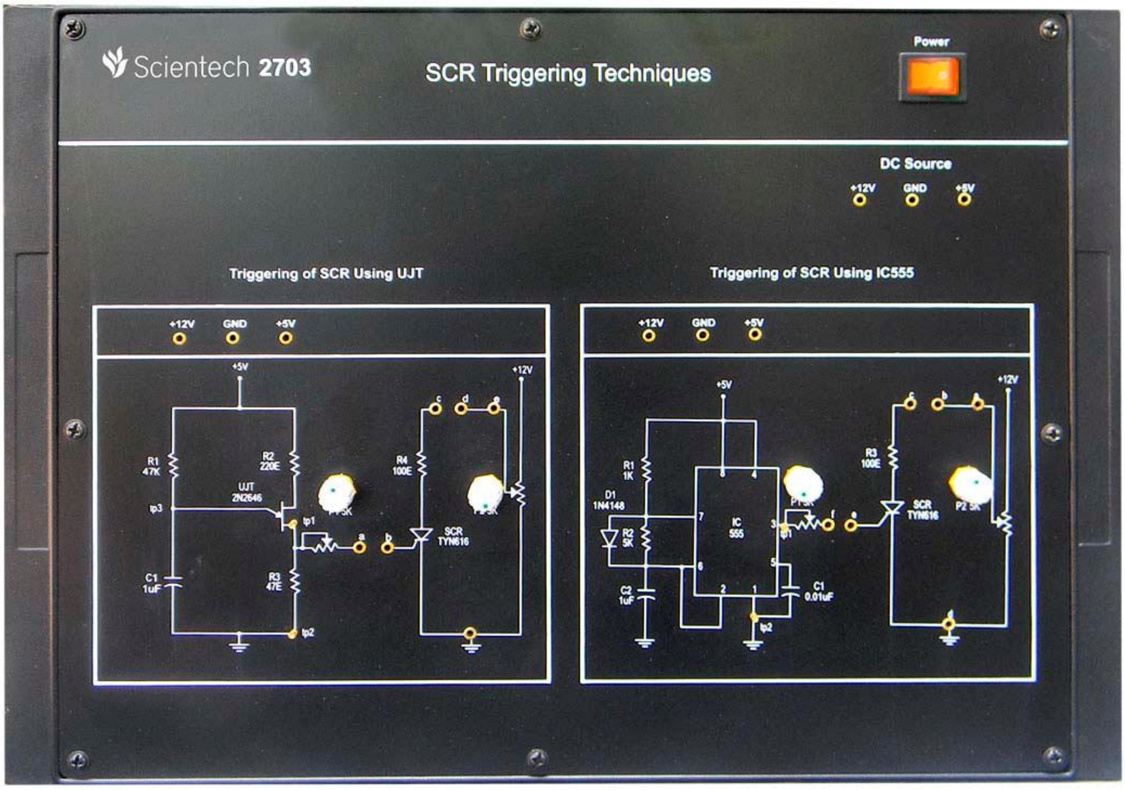
For your safety:

Use proper Mains cord	**:**	Use only the mains cord designed for this instrument. Ensure that the mains cord is suitable for your country.
Ground the Instrument	**:**	This instrument is grounded through the protective earth conductor of the mains cord. To avoid electric shock the grounding conductor must be connected to the earth ground. Before making connections to the input terminals, ensure that the instrument is properly grounded.
Observe Terminal Ratings	**:**	To avoid fire or shock hazards, observe all ratings and marks on the instrument.
Use only the proper Fuse	**:**	Use the fuse type and rating specified for this instrument.
Use in proper Atmosphere	**:**	Please refer to operating conditions given in the manual.

1. **Do not operate in wet / damp conditions.**
2. **Do not operate in an explosive atmosphere.**
3. **Keep the product dust free, clean and dry.**

Introduction

Scientech 2703 is a platform where Students can understand the various thyristor firing techniques by using IC 555 and UJT. This is very useful for understanding of pulse generation. 2703 is provided with in built power supplies, sockets for making interconnection in the circuit and exhaustive learning material.



Features

- **In built Power Supply**
- **Easy to operate and understand**
- **Two triggering circuits on single board**
- **Test points to observe output pulses**
- **Sockets to make different connections**
- **On board DC sources of 5 V and 12 V**

Technical Specifications

On board AC source	:	18 V - 0 V - 18 V
On board DC Supply	:	+5 V, +12 V
On board triggering circuits	:	
555 IC triggering circuit		
UJT triggering circuit		
Interconnection	:	2 mm socket (Gold plated)
SCR	:	SCRs TYN616, 600V/16 A
Test points	:	4 nos (Gold plated)
Dimensions (mm)	:	W 420 x D 255 x H 100
Power Supply	:	110V - 260V AC, 50/60Hz
Weight	:	1 Kg. (approximately)
Operating Conditions	:	0-40^0 C, 80% RH
Learning material	:	CD (Theory, procedure, reference results, etc), Online (optional)

Theory

Triggering of SCR using UJT

The UJT is often used as a trigger device for SCR's and TRIAC's. The most common UJT circuit in use today is the relaxation oscillator, which is shown in figure 1.

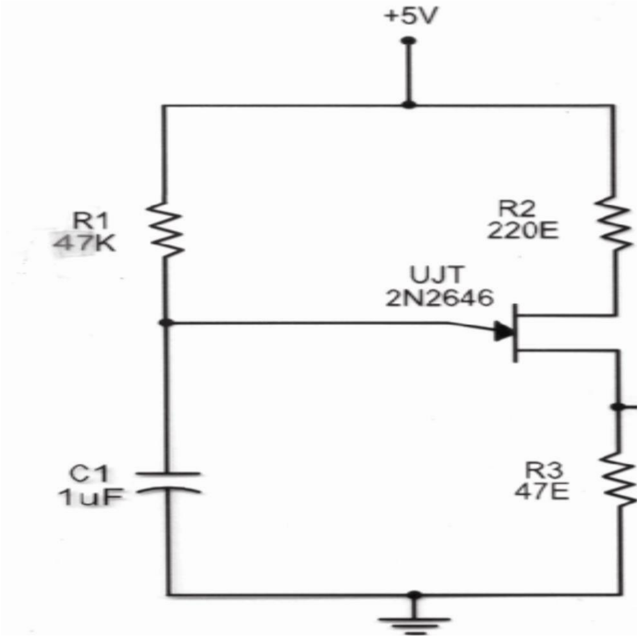


Figure 1

The diode-resistance, resistance, resistance-capacitance and the diode-resistance-capacitance circuit produce prolonged pulses, so power dissipation is more at the gate. The power loss can be limited by the use of this UJT in the firing circuit. Pulse triggering is preferred as it offers several merits over R and RC triggering. Gate characteristics wide spread; pulses can be adjusted easily to suit such a wide spectrum of gate characteristics. The power level in pulse triggering is low as the gate drive is discontinuous; pulse triggering is therefore more efficient. The above figure1 is called the relaxation oscillator. The resistor and capacitor connected to the emitter form an RC timing circuit. Normally, the value of capacitor is fixed and the value of resistor is of potentiometer type. The charging rate of the capacitor depends on the value of the resistor and since the resistor is variable the RC time constant can be controlled. When the voltage across the capacitor is equal to more than the peak voltage V_P of the UJT, it starts conducting. Since the UJT has a negative resistance, its voltage starts decreasing up to the valley voltage, and the capacitor discharges up to the valley voltage.

This repetitive process producing a train of pulses at its output is shown in figure 2. From the output voltage waveform it is clear that the output pulses has a very small width and that a long relaxation time exists between the two pulses. Therefore it is said that the device is relaxed in this duration and is called the relaxation oscillator.

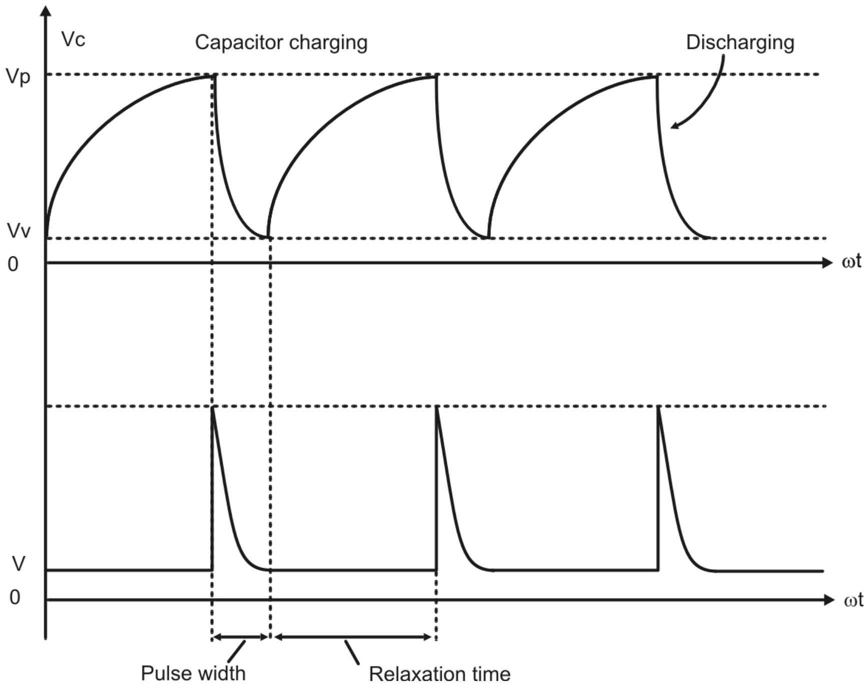


Figure 2

An important design consideration in this type of circuit concerns premature triggering of SCR. In the firing circuit $t_1=R_1C_1$ are time constant for charging circuit and $t_2=Ra_3C_1$are discharging time constant. Here t_2 is much smaller than t_1. Resistance R3 should be sufficiently small so that normal leakage current drop across R3, when UJT is off, is not able to trigger the SCR. In other words,

$$V_{BB}.R_3/R_{BB}+R_2+R_3<\text{SCR trigger voltage}$$

WHERE,

$$R_{BB}=R_{B1}+R_{B2} \text{ (INTERNAL RESISTANCE OF UJT BASES)}$$

THE OUTPUT PULSE FROM UJT IS CONNECTED TO THE GATE OF SCR. BY USING A POT THE GATE CURRENT CAN BE CONTROLLED AND MONITOR THE ANODE TO CATHODE CURRENT. IT WILL SHOW AT WHICH POINT THE SCR IS GETTING TRIGGERED.

Triggering of SCR using IC 555:

The Astable and Monostable circuits are so commonly required the special monolithic IC called IC timers, have been made available. The 555 IC has gained wide acceptance in terms of cost and versatility. Some typical applications are Monostable and Astable Multivibrators, dc-dc converters, digital logic probes, waveform generators, Analog frequency meters and tachometers, temperature measurement and control, infrared transmitters, burglar and toxic gas alarms, voltage regulators, etc. The device 555 is a monolithic timing circuit that can produce accurate and highly stable time delays or oscillations. The 555 IC is used for triggering of SCR in both dc and ac circuits. An Astable timer operation is achieved by adding resistor R_B to figure 3 and configuring as shown in figure 3. In the Astable operation, the trigger terminal and the threshold terminal are connected so that a self-trigger is formed, operating as a Multivibrator. When the timer output is high, its internal discharging Tr. turns off and the VC1 increases by exponential function with the time constant (RA+RB)*C. When the VC1, or the threshold voltage, reaches 2Vcc/3, the comparator output on the trigger terminal becomes high, resetting the F/F and causing the timer output to become low. This in turn turns on the discharging Tr. and the C1 discharges through the discharging channel formed by RB and the discharging Tr. When the VC1 falls below Vcc/3, the comparator output on the trigger terminal becomes high and the timer output becomes high again. The discharging Tr. turns off and theVC1 rises again.

In the above process, the section where the timer output is high is the time it takes for the VC1 to rise from Vcc/3 to 2Vcc/3, and the section where the timer output is low is the time it takes for the VC1 to drop from 2Vcc/3 to Vcc/3. When timer output is high, the equivalent circuit for charging capacitor C1 is as follows:

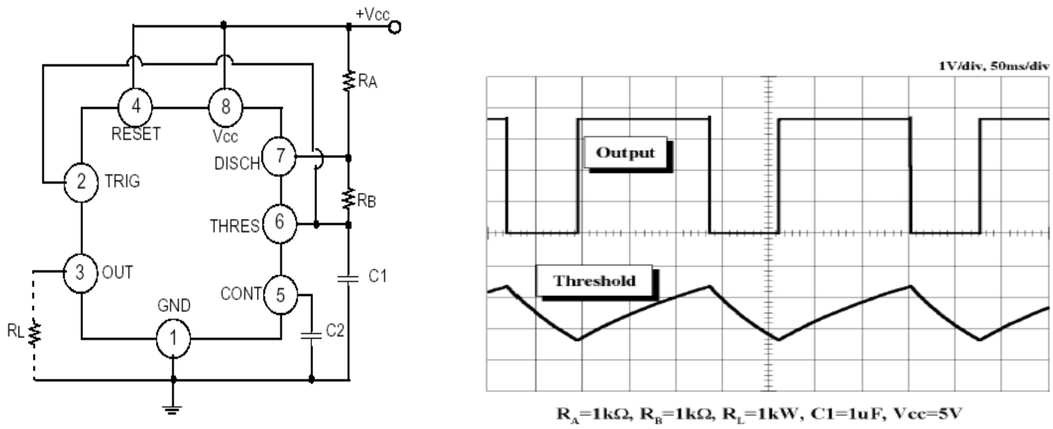


Figure 3

$$C_1\frac{dv_{c1}}{dt} = \frac{V_{cc} - V(0-)}{R_A + R_B} \qquad (1)$$

$$V_{C1}(0+) = V_{CC}/3 \qquad (2)$$

$$V_{C1}(t) = V_{CC}\left(1 - \frac{2}{3}e^{-\left(\frac{t}{(R_A+R_B)C1}\right)}\right) \qquad (3)$$

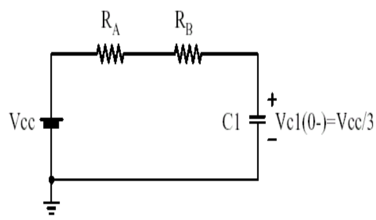


Figure 4

Since the duration of the timer output high state (t_H) is the amount of time it takes for the V_{C1} (t) to reach 2Vcc/3,

$$V_{C1}(t) = \frac{2}{3}V_{CC} = V_{CC}\left(1 - \frac{2}{3}e^{-\left(-\frac{t_H}{(R_A+R_B)C1}\right)}\right) \qquad (4)$$

$$t_H = C_1(R_A+R_B)\ln 2 = 0.693(R_A+R_B)C_1 \qquad (5)$$

The equivalent circuit for discharging capacitor C1, when timer output is low is, as follows:

$$C_1\frac{dv_{C1}}{dt} + \frac{1}{R_A+R_B}V_{C1} = 0 \qquad (6)$$

$$V_{C1}(t) = \frac{2}{3}V_{CC}e^{-\frac{t}{(R_A+R_D)C1}} \qquad (7)$$

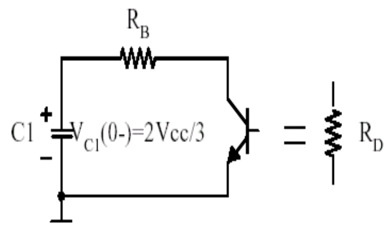


Figure 5

Since the duration of the timer output low state (t_L) is the amount of time it takes for the V_{C1}(t) to reach Vcc/3,

$$\frac{1}{3}V_{CC} = \frac{2}{3}V_{CC}e^{-\frac{t_L}{(R_A+R_D)C1}} \qquad (8)$$

$$t_L = C_1(R_B+R_D)\ln 2 = 0.693(R_B+R_D)C_1 \qquad (9)$$

Since RD is normally RB>>RD although related to the size of discharging Tr.,

$$t_L = 0.693RBC1 \qquad (10)$$

Consequently, if the timer operates in Astable mode, the period is the same with

'$T=t_H + t_L$= 0.693(RA+RB) C1+ 0.693RBC1= 0.693(RA+2RB) C1' because the period is the sum of the charge time and discharge time. And since frequency is the reciprocal of the period, the following applies.

$$\text{frequency,} \quad f = \frac{1}{T} = \frac{1.44}{(R_A+2R_B)C_1} \qquad (11)$$

THE OUTPUT PULSE FROM UJT IS CONNECTED TO THE GATE OF SCR. BY USING A POT THE GATE CURRENT CAN BE CONTROLLED AND MONITOR THE ANODE TO CATHODE CURRENT**. IT WILL SHOW AT WHICH POINT** THE SCR IS GETTING TRIGGERED.

Experiment 1

Objective:

To study the triggering of SCR using UJT

Equipments Needed:

1. Power Electronics Board **Scientech 2703**
2. Oscilloscope-Scientech 803/831, or equivalent
3. 2 mm patch cords.
4. Multi-meters

Circuit diagram:

The circuit diagram for Triggering of SCR using UJT is shown in figure 6

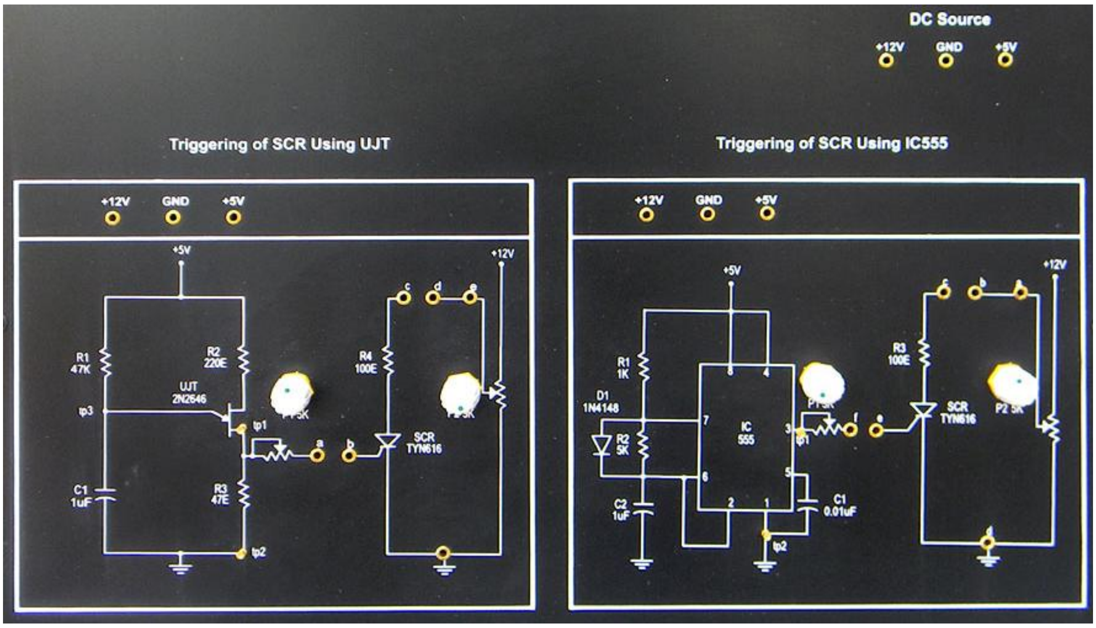


Figure 6

Procedure:

- Connect Ammeter between point‘d’ and ‘c’ to measure Anode-cathode current I_{AK} (mA).

1. Connect Ammeter between point ‘a’ and ‘b’ to measure the gate Current I_g (mA).
2. Connect voltmeter between point ‘e’ and ground to measure the anode-cathode voltage $V_{AK.}$
3. Rotate the potentiometer ‘P_1’ fully in clockwise direction and ‘P_2’ fully in counter clockwise direction.
4. Switch On the power supply.
5. Vary the potentiometer ‘P_2’ in clockwise direction so as to increase the anode to cathode voltage. Set this voltage above 11V.
6. Vary the potentiometer ‘P_1’ in counter clockwise direction so as to increase the value of gate current in step and measure the corresponding values of anode to cathode current I_{AK} in an Observation Table 1.
7. Initially there will not be any current flow across the SCR, while varying the gate current the ammeter connected at point ‘c’ and‘d’ suddenly increases and the voltmeter connected at point ‘e’ and ground will suddenly decrease. This shows that the SCR is triggered.
8. Now vary the ‘P_1’, there will not be any effect in the anode –cathode voltage and current of SCR.
9. To repeat the experiment switch off the power supply and follow the above procedure from step 4.

Observation Table:

Set V_{AK} = +12V

S.No	Gate current I_G(mA)	Anode to cathode current I_{AK}(mA)	Anode to cathode voltage V_{AK}(V)

Experiment 2

Objective:

To study the Triggering of SCR using 555 IC.

Equipments Needed:

1. Power Electronics Board **Scientech 2703**
2. Oscilloscope-Scientech 803/831, or equivalent
3. 2 mm patch cords.

Circuit diagram:

The circuit diagram for Triggering of SCR using 555 IC is shown in figure 7 as follows:

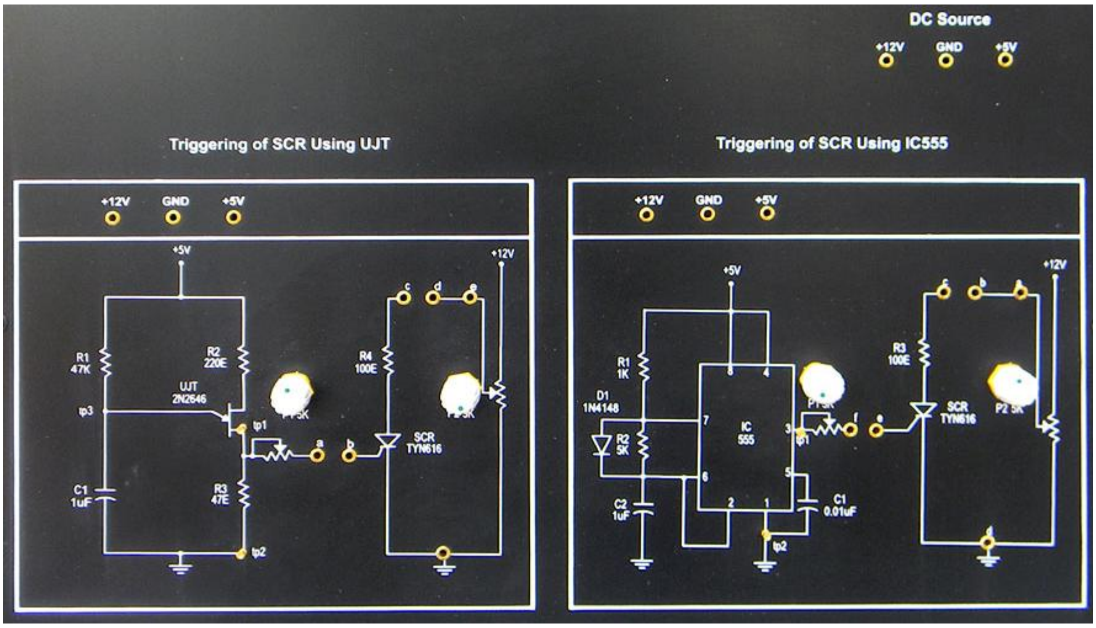


Figure 7

Procedure:

1. Connect Ammeter between point ‘c’ and ‘b’ to measure Anode-cathode current I_{AK} (mA).
2. Connect Ammeter between point ‘f’ and ‘e’ to measure the gate Current I_G (mA).
3. Connect voltmeter between point ‘a’ and ground to measure the anode-cathode voltage V_{AK}.
4. Rotate the potentiometer ‘P_1’ fully in clockwise direction and ‘P_2’ fully in counter clockwise direction.
5. Switch ‘On’ the power supply.
6. Vary the potentiometer ‘P_2’ in clockwise direction so as to increase the anode to cathode voltage. Set this voltage above 11V.
7. Vary the potentiometer ‘P_1’ in counterclockwise direction so as to increase the value of gate current in step and measure the corresponding values of anode to cathode current I_{AK} in an Observation Table 1.
8. Initially there will not be any current flow across the SCR while varying the gate current the ammeter connected at point ‘c’ and ‘d’ suddenly increases and the voltmeter connected at point ‘e’ and ground will suddenly decrease. This shows that the SCR is triggered.
9. Now vary the ‘P_1’, there will not be any effect in the anode-cathode voltage and current of SCR.

To repeat the experiment switch off the power supply and follow the procedure from step 4

Observation Table:

Set V_{AK} = +12V

S.No	Gate current I_G (mA)	Anode to cathode current I_{AK} (mA)	Anode to cathode current V_{AK} (V)

Datasheets

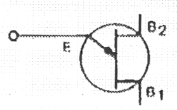
Boca Semiconductor Corp. (BSC)

PN Unijunction Transistors

Silicon PN Unijunction Transistors

2N2646
2N2647

PN UJTs



CASE 22A-01
STYLE 1

. . Designed for use In pulse and timing circuits, sensing circuits and thyristor trigger circuits. These devices feature:

1. Low Peak Point Current - 2 µA (Max)
2. Low Emitter Reverse Current - 200 nA (Max)
3. Passivated Surface for Reliability and Uniformity

Maximum Ratings (T_A = 25°C unless otherwise noted.)

Rating	Symbol	Value	Unit
Power Dissipation, Note 1	P_D	300	mW
RMS Emitter Current	$I_{E(RMS)}$	50	mA
Peak Pulse Emitter Current, Note 2	i_E	2	Amps
Emitter Reverse Voltage	V_{B2E}	30	Volts
Interbase Voltage	V_{B2B1}	35	Volts
Operating Junction Temperature Range	T_J	−65 to +125	°C
Storage Temperature Range	T_{stg}	−65 to +150	°C

"Indicates JEDEC Registered Date.

Notes:

Derate 3 mW/°C increase In ambient temperature. The total Power dissipation (available power to Emitter and Base-Two) must be limited by the external circuitry.

1. Capacitor discharge - 10µF or loss, 30 volts or loss.

Characteristic		Symbol	Min	Typ	Max	Unit
Intrinsic Standoff Ratio (V_{B2B1} = 10 V), Note 1	2N2646 2N2647	η	0.56 0.68	— —	0.75 0.82	—
Interbase Resistance (V_{B2B1} = 3 V, I_E = 0)		r_{BB}	4.7	7	9.1	k ohms
Interbase Resistance Temperature Coefficient (V_{B2B1} = 3 V, I_E = 0, T_A = −55°C to +125°C)		αr_{BB}	0.1	—	0.9	%/°C
Emitter Saturation Voltage (V_{B2B1} = 10 V, I_E = 50 mA), Note 2		$V_{EB1(sat)}$	—	3.5	—	Volts
Modulated Interbase Current (V_{B2B1} = 10 V, I_E = 50 mA)		$I_{B2(mod)}$	—	15	—	mA
Emitter Reverse Current (V_{B2E} = 30 V, I_{B1} = 0)	2N2646 2N2647	I_{EB2O}	— —	0.005 0.005	12 0.2	µA
Peak Point Emitter Current (V_{B2B1} = 25 V)	2N2646 2N2647	I_P	— —	1 1	5 2	µA
Valley Point Current (V_{B2B1} = 20 V, R_{B2} = 100 ohms), Note 2	2N2646 2N2647	I_V	4 8	6 10	— 18	mA
Base-One Peak Pulse Voltage (Note 3, Figure 3)	2N2646 2N2647	V_{OB1}	3 6	5 7	— —	Volts

*Indicates JEDEC Registered Data.

Notes:

1. Intrinsic standoff ratio, η, is defined by equation:

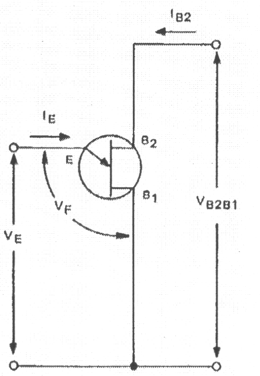
$$\eta = \frac{V_P - V_F}{V_{B2B1}}$$

Where V_P = Peak Point Emitter Voltage
V_{B2B1} = Interbase Voltage
V_F = Emitter to Base-One Junction Diode Drop (≈ 0.45 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.

UNIJUNCTION TRANSISTOR SYMBOL AND NOMENCLATURE



STATIC EMITTER CHARACTERISTIC CURVES
(Exaggerated to Show Details)

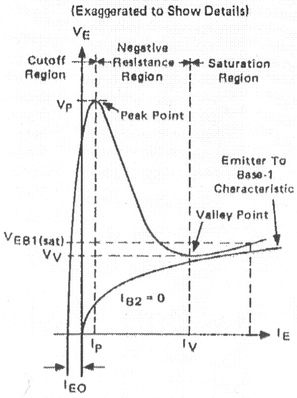
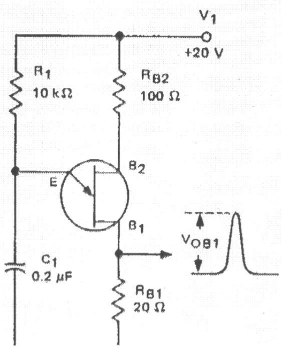


FIGURE 3 – V_{OB1} TEST CIRCUIT
(Typical Relaxation Oscillator)



LM555/NE555/SA555

Single Timer

Features

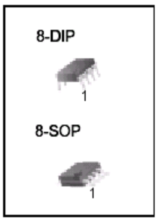
- High Current Drive Capability (200mA)
- Adjustable Duty Cycle
- Temperature Stability of 0.005%/°C
- Timing From µSec to Hours
- Turn off Time Less Than 2µSec

Applications

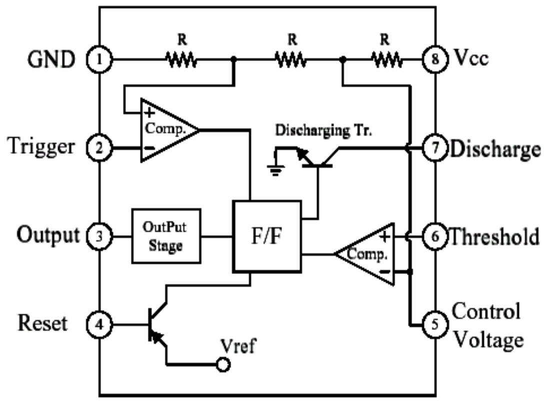
- Precision Timing
- Pulse Generation
- Time Delay Generation
- Sequential Timing

Description

The LM555/NE555/SA555 is a highly stable controller capable of producing accurate timing pulses. With a monostable operation, the time delay is controlled by one external resistor and one capacitor. With an astable operation, the frequency and duty cycle are accurately controlled by two external resistors and one capacitor.



Internal Block Diagram



Absolute Maximum Ratings (T_A = 25°C)

Parameter	Symbol	Value	Unit
Supply Voltage	V_{CC}	16	V
Lead Temperature (Soldering 10sec)	T_{LEAD}	300	°C
Power Dissipation	P_D	600	mW
Operating Temperature Range LM555/NE555 SA555	T_{OPR}	0 ~ +70 -40 ~ +85	°C
Storage Temperature Range	T_{STG}	-65 ~ +150	°C

Electrical Characteristics

(T_A = 25°C, V_{CC} = 5 ~ 15V, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply Voltage	V_{CC}	-	4.5	-	16	V
Supply Current (Low Stable) (Note1)	I_{CC}	V_{CC} = 5V, R_L = ∞	-	3	6	mA
		V_{CC} = 15V, R_L = ∞	-	7.5	15	mA
Timing Error (Monostable) Initial Accuracy (Note2) Drift with Temperature (Note4) Drift with Supply Voltage (Note4)	ACCUR Δt/ΔT Δt/ΔV_{CC}	R_A = 1kΩ to100kΩ C = 0.1μF	-	1.0 50 0.1	3.0 0.5	% ppm/°C %/V
Timing Error (Astable) Intial Accuracy (Note2) Drift with Temperature (Note4) Drift with Supply Voltage (Note4)	ACCUR Δt/ΔT Δt/ΔV_{CC}	R_A = 1kΩ to 100kΩ C = 0.1μF	-	2.25 150 0.3	-	% ppm/°C %/V
Control Voltage	V_C	V_{CC} = 15V	9.0	10.0	11.0	V
		V_{CC} = 5V	2.6	3.33	4.0	V
Threshold Voltage	V_{TH}	V_{CC} = 15V	-	10.0	-	V
		V_{CC} = 5V	-	3.33	-	V
Threshold Current (Note3)	I_{TH}	-	-	0.1	0.25	μA
Trigger Voltage	V_{TR}	V_{CC} = 5V	1.1	1.67	2.2	V
		V_{CC} = 15V	4.5	5	5.6	V
Trigger Current	I_{TR}	V_{TR} = 0V		0.01	2.0	μA
Reset Voltage	V_{RST}	-	0.4	0.7	1.0	V
Reset Current	I_{RST}	-		0.1	0.4	mA
Low Output Voltage	V_{OL}	V_{CC} = 15V I_{SINK} = 10mA I_{SINK} = 50mA	-	0.06 0.3	0.25 0.75	V V
		V_{CC} = 5V I_{SINK} = 5mA	-	0.05	0.35	V
High Output Voltage	V_{OH}	V_{CC} = 15V I_{SOURCE} = 200mA I_{SOURCE} = 100mA	12.75	12.5 13.3	-	V V
		V_{CC} = 5V I_{SOURCE} = 100mA	2.75	3.3	-	V
Rise Time of Output (Note4)	t_R	-	-	100	-	ns
Fall Time of Output (Note4)	t_F	-	-	100	-	ns
Discharge Leakage Current	I_{LKG}	-	-	20	100	nA

Notes:

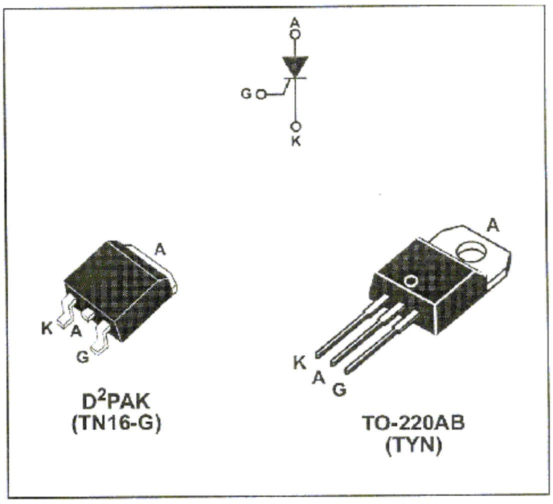
1. When the output is high, the supply current is typically 1mA less than at V_{CC} = 5V.
2. Tested at V_{CC} = 5.0V and V_{CC} = 15V.
3. This will determine the maximum value of R_A + R_B for 15V operation, the max. total R = 20MΩ, and for 5V operation, the max. total R = 6.7MΩ.
4. These parameters, although guaranteed, are not 100% tested in production.

TN16 and TYNx16 Series

STANDARD 16A SCRs

Main features:

Symbol	Value	Unit
$I_{T(RMS)}$	16	A
V_{DRM}/V_{RRM}	600 to 1000	V
I_{GT}	25	mA



Description

The TYN / TN16 SCR Series is suitable for general purpose applications.

Using clip assembly technology, they provide a superior performance in surge current capabilities.

Absolute Ratings (limiting values)

Symbol	Parameter			Value	Unit
$I_{T(RMS)}$	RMS on-state current (180° conduction angle)		Tc = 110°C	16	A
$T_{(AV)}$	Average on-state current (180° conduction angle)		Tc = 110°C	10	A
I_{TSM}	Non repetitive surge peak on-state current	tp = 8.3 ms	Tj = 25°C	200	A
		tp = 10 ms		190	
I^2t	I^2t Value for fusing	tp = 10 ms	Tj = 25°C	180	A^2s
dI/dt	Critical rate of rise of on-state current $I_G = 2 \times I_{GT}$, tr ≤ 100 ns	F = 60 Hz	Tj = 125°C	50	A/µs
I_{GM}	Peak gate current	tp = 20 µs	Tj = 125°C	4	A
$P_{G(AV)}$	Average gate power dissipation		Tj = 125°C	1	W
T_{stg} Tj	Storage junction temperature range Operating junction temperature range			- 40 to + 150 - 40 to + 125	°C
V_{RGM}	Maximum peak reverse gate voltage			5	V

TN16 and TYNx16 Series

Electrical Characteristics (Tj = 25°C, unless otherwise specified)

Symbol	Test Conditions			Value	Unit
I_{GT}	V_D = 12 V R_L = 33 Ω		MIN.	2	mA
			MAX.	25	
V_{GT}			MAX.	1.3	V
V_{GD}	$V_D = V_{DRM}$ R_L = 3.3 kΩ	Tj = 125°C	MIN.	0.2	V
I_H	I_T = 500 mA Gate open		MAX.	40	mA
I_L	$I_G = 1.2 \times I_{GT}$		MAX.	60	mA
dV/dt	V_D = 67 % V_{DRM} Gate open	Tj = 125°C	MIN.	500	V/µs
V_{TM}	I_{TM} = 32 A tp = 380 µs	Tj = 25°C	MAX.	1.6	V
V_{t0}	Threshold voltage	Tj = 125°C	MAX.	0.77	V
R_d	Dynamic resistance	Tj = 125°C	MAX.	23	mΩ
I_{DRM} I_{RRM}	$V_{DRM} = V_{RRM}$	Tj = 25°C	MAX.	5	µA
		Tj = 125°C		2	mA

Thermal Resistances

Symbol	Parameter		Value	Unit
$R_{th(j-c)}$	Junction to case (DC)		1.1	°C/W
$R_{th(j-a)}$	Junction to ambient (DC)	TO-220AB	60	°C/W
	S = 1 cm^2	D^2PAK	45	

s = Copper surface under tab

Product Selector

Part Number	Voltage (xxx)			Sensitivity	Package
	600 V	800 V	1000 V		
TN1625-xxxG	X	X	X	25 mA	D^2PAK
TYNx16	X	X	X	25 mA	TO-220AB

Warranty

1. We guarantee this product against all manufacturing defects for 24 months from the date of sale by us or through our dealers. Consumables like dry cell etc. are not covered under warranty.
2. The guarantee will become void, if
    a) The product is not operated as per the instruction given in the Learning Material.
    b) The agreed payment terms and other conditions of sale are not followed.
    c) The customer resells the instrument to another party.
    d) Any attempt is made to service and modify the instrument.
3. The non-working of the product is to be communicated to us immediately giving full details of the complaints and defects noticed specifically mentioning the type, serial number of the product and date of purchase etc.
4. The repair work will be carried out, provided the product is dispatched securely packed and insured. The transportation charges shall be borne by the customer.

List of Accessories

1. 2mm Patch cords 16” .... 4 Nos.

2. Mains Cord...1 No.

3. Learning Material (CD)..1 No.

List of other Trainers available from us are:

Model	Name
PE01	UJT Characteristics
PE02	MOSFET Characteristics
PE03	SCR Characteristics
PE04	TRIAC Characteristics
PE05	DIAC Characteristics
PE06	IGBT Characteristics
PE07	PUT Characteristics
PE10	SCR Triggering (R, RC Full wave, RC Half wave)
PE11	SCR Triggering (UJT)
PE12	SCR Triggering (IC555)
PE13	SCR Triggering (IC74121)
PE14	Ramp and Pedestal Triggering
PE15	SCR Triggering (IC741)
PE16	SCR Triggering (PUT)
PE21	Ramp Comparator Firing Circuit
PE22	Three Phase Firing Circuit
PE23	PWM Circuit
PE24	Cycloconverter Firing Circuit
PE25	Ramp Pedestal Firing Circuit
PE26	Cosine Firing Circuit
PE27	Microcontroller Base Firing Circuit
PE40	SCR Lamp Flasher
PE41	SCR Alarm Circuit
PE42	Series Inverter
PE43	UJT Relaxation Oscillator
PE44	Single Phase PWM Inverter
Scientech 2700	**High Voltage Power Electronic Lab**
Scientech 2701	IGBT Characteristics
Scientech 2702	SCR Triggering (R, RC Half wave, RC Full wave)
Scientech 2703	SCR Triggering Techniques
Scientech 2704	Triggering of SCR using 74121 IC
Scientech 2705	SCR Lamp Flasher
Scientech 2706	SCR Alarm Circuit
Scientech 2707	Series Inverter
Scientech 2708	Single Phase Controlled Rectifier (with Ramp Comparator Firing Scheme)
Scientech 2709	Single Phase Controlled Rectifier (Cosine Firing Scheme)
Scientech 2710	Single Phase Converter Firing Techniques (by TCA 785IC and Triangular Comparator)
Scientech 2711	Lamp Dimmer
Scientech 2712	Electronics Power Lab
Scientech 2713	Single Phase Cyclo-Converter
Scientech 2714	Speed Control of Universal Motor using SCR
Scientech 2715	Speed Control of AC Motor using TRIAC

Scientech 2716	Microcontroller Based Firing Circuit for Controlled Rectifier
Scientech 2717	SCR Commutation Circuits
Scientech 2718	Bedford & Parallel Inverter
Scientech 2719	Step-Up Chopper
Scientech 2720	Single Phase Bridge Inverter
Scientech 2722	Step-Down Chopper
Scientech 2723	AC Chopper
Scientech 2724	Step-Down Chopper (MOSFET,IGBT, Transistor & SCR Based)
Scientech 2725	Step-Up Chopper (MOSFET, IGBT, Transistor & SCR Based)
Scientech 2726	Buck Converter
Scientech 2727	Boost Converter
Scientech 2728	Flyback Converter
Scientech 2729	Flyback Converter
Scientech 2730	Buck Boost Converter

and many more……….