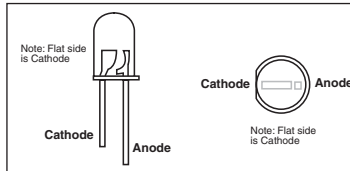


## LIGHT EMITTING DIODES

Light Emitting Diodes, or LEDs as they are known are a special type of diode which emits light when correctly powered. The average voltage required for an LED is about 2 volts and the typical current required is about 20mA.

**Colour:** Red Green Yellow Orange  
**Vf Typical:** 1.8V 2.2V 2.1V 2.0V

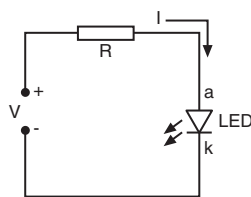
The LED's legs are called anode and cathode. The anode is the leg that needs to be connected to the positive of the power source. Normally a LED has different lead lengths to identify which is the positive lead.



Ohms Law dictates the following:

$$R = \frac{(V_S - V_{LED})}{I_{LED}}$$

Where:  $V_S$  = Voltage source  
 $V_{LED}$  = Volt drop of LED  
 $I_{LED}$  = Current draw of LED



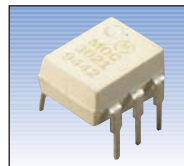
If  $I_{LED} = 20 \text{ mA @ } 2.0V$   
 If  $V_S = 3 \text{ Volts, } R_1 = 50\Omega$   
 If  $V_S = 6 \text{ Volts, } R_1 = 200\Omega$   
 If  $V_S = 9 \text{ Volts, } R_1 = 350\Omega$   
 If  $V_S = 12 \text{ Volts, } R_1 = 500\Omega$

These values can be substituted for the closest 5% resistor values.	
For 3 Volts	R = 56 Ohms
6 Volts	R = 220 Ohms
9 Volts	R = 390 Ohms
12 Volts	R = 560 Ohms

## AC OPTOCOUPLEDERS

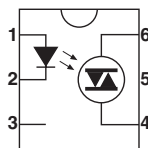
### TRIAC Driver MOC3021 and MOC3041

The MOC3041 is identical to the MOC3021 except that it triggers at the zero crossing point. This will only let full half wave cycles pass, thus giving a smoother turn ON curve. This means that it will not work as a wave chopper eg. when used in dimming a light by delaying the turn on time.



### Specifications Z 1642 & Z 1644:

**Package Dissipation:** .....300mW  
**Surge Isolation Voltage:** .....7500V Peak  
**Blocking Voltage:** .....400V LED  
**Trigger Current:** .....15mA LED  
**Forward Voltage (Max):** .....1.5

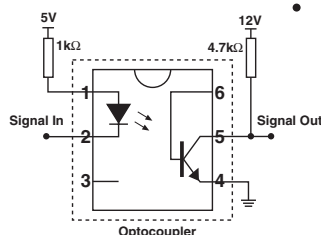


## DC OPTOCOUPLEDERS

Optocouplers are used where electrical isolation is required. An infra red link is used to provide isolation. This circuit can be used to interface a 5V switching source which needs to be isolated from another unit. It has been configured for 12V output which can be directly interfaced to other components.

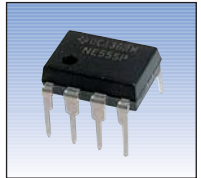
### Specifications Z 1645 (4N28):

**Diode Vr:** .....3V  
**If:** .....80mA cont, 3A peak  
**Vf @ 50mA:** .....1.5mA  
**Pd:** .....150mW  
**NPN Vce:** .....30V  
**Vcb:** .....70V  
**Pd:** .....150mW  
**Ice-Dark Current: (Vce 10V)** 50nA Max  
**Total Device rating Pd:** .....250mW  
**Isolation Voltage:** .....500V Min



## THE NE555 TIMER

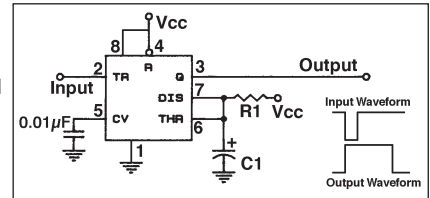
The 555 timer is one of the most versatile devices in electronics. There are many books devoted to it with thousands of application circuits published since its release. It can function in monostable (one shot) mode, or in astable mode, where it continues running at a user-set frequency. Power supply (Vcc) can be between 4.5V and 16V DC.



### Mono Stable Multivibrator

This simple circuit has a main use as a 'wave generator'. When a pulse is applied to pin 2, a pulse of T seconds is produced at pin 3.

$$T = 1.1 R_1 C_1$$

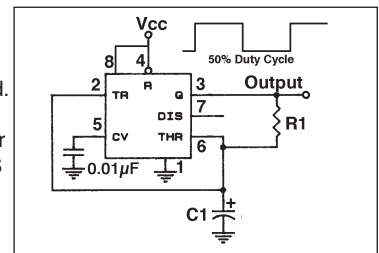


### Astable Multivibrators

#### Fixed Duty Cycle

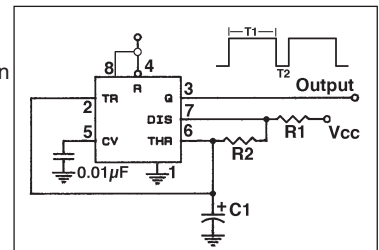
This is a great circuit for when a simple 50 / 50 oscillator is required. Once power is applied it is free running with a 50 % duty cycle. For more accurate timing use a CMOS type 7555 timer.

$$f = \frac{0.7}{R_1 C_1}$$



#### Adjustable Duty Cycle

This neat circuit will give output pulses of t1 seconds in length at an interval of t2. Shown are four formulas which will add the calculation of R1, R2 and C1 once the value of t1 and t2 have been chosen.



$$t_1 = 0.693 \times (R_1 + R_2) \times C_1$$

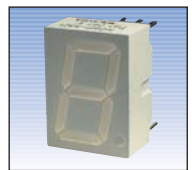
$$t_2 = 0.693 \times R_2 \times C_1 = \frac{1}{T}$$

$$f = \frac{1.44}{(R_1 + 2R_2) \times C_1}$$

$$\text{Period } T = 0.693 \times (R_1 + (2 \times R_2)) \times C_1$$

## SEVEN SEGMENT DISPLAYS

These displays, which are made out of seven LED segments, are commonly used to display numbers. These can be common cathode (needs negative voltage to drive the segments), or common anode (requires positive voltage to drive segments).



### Characteristics of FND500, FND507, BS-C536RW, BS-A536RW, HDSP5303, HDS5301, 5151, 5150

Digit size & colour: .....12.7 mm, Red  
 Average forward current / seg: .....25mA  
 Forward voltage: .....1.7 Volts  
 Min reverse breakdown voltage: .....3 Volts  
 Max reverse current per seg: .....100μA  
 Light intensity: .....600μcd  
 Max power dissipation: .....400mW

### Pin Assignments:

- 1: .....Seg E
- 2: .....Seg D
- 3: .....Common
- 4: .....Seg C
- 5: .....Dec Point
- 6: .....Seg B
- 7: .....Seg A
- 8: .....Common
- 9: .....Seg F
- 10: .....Seg G

