555 DEMONSTRATOR

This Contents screen lists Help topics available for the **555 DEMONSTRATOR** application.
Use the scroll bar to see entries not currently visible in the Help window.
To learn how to use Help, press F1 or choose How to Use Help from the Help menu.

OVERVIEW

The intent of the program is to be a tool to supplement the user in understanding the 555 integrated circuit. **555 DEMONSTRATOR** will provide basic information on the operation that the user can use alone or with additional material.

This application uses standard resistor values and standard capacitor values. The resistor values are for carbon, 5% tolerance, resistors. The capacitor values are for various voltage ratings and various materials. Not all values are available for all ratings. Additional information is found in this Help File.

All of the information contained in the application **555 Demonstrator**, 555.exe and it's Help File, 555.hlp, is assumed to be accurate by the author. However, the author assumes no liability for any use of the application or it's Help File.

This application also requires the following -

CMDIALOG.VBX	the common dialog control
COMMDLG.DLL	the cmdialog dll
THREED.VBX	3-D panel control
VBRUN300.DLL	

Background

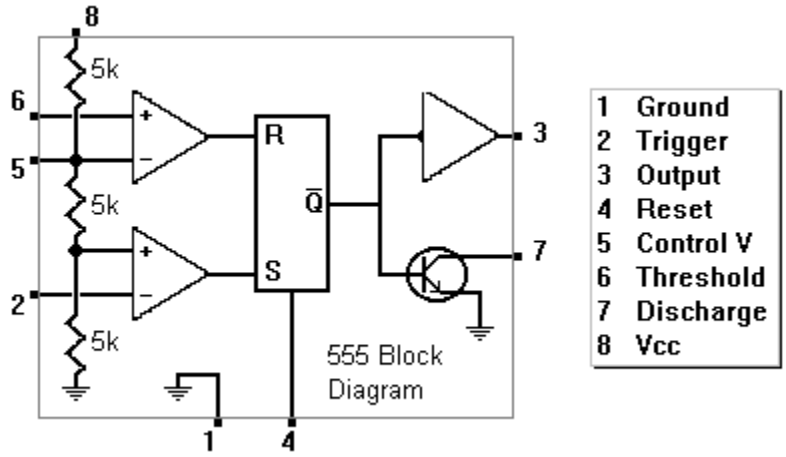
The 555 integrated circuit was developed in an 8 pin dip by Signetics in the1970's as the NE555. Today it can now be found in a wide variety of packages, including 8 pin dip, 14 pin dip (dual 555's) and surface mount (SMT). The chips can be of be standard, C-Mos or low-power technology.

The 555 can be operated in either of two modes: Astable or Monostable. Astable or 'free-running' mode produces an repeatable output pulse of an interval determined by external resistors and capacitors. Monostable or 'on-shot' mode produces a triggered output pulse of duration determined by an external resistor and an external capacitor.

Related Topics-

Operation
Pinouts
Specifications

Operation



Click on a block for a description of its function.

There are basically two modes of operation for the 555:

- Astable
- Monstable

Related Topics-

- Pinout
- Specifications

Buffer Amplifier-
Allows for driving of loads drawing up to 200 mA.
The output from the Flip-Flop is amplified and bufferred.

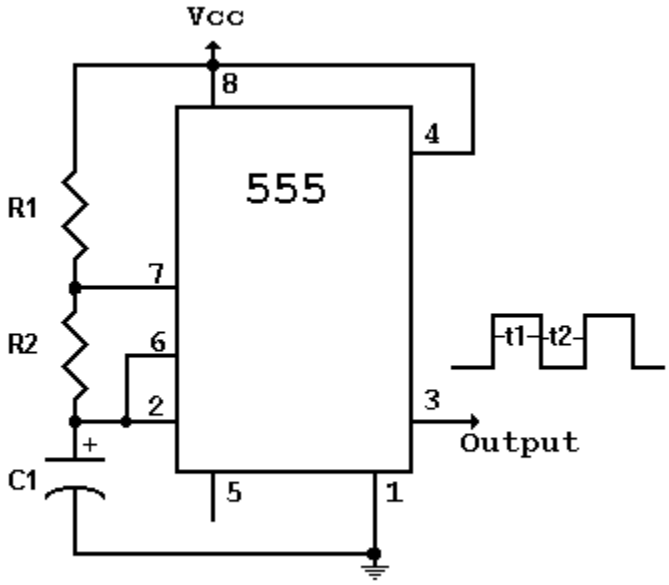
Voltage Divider-
Provides voltages to comparator stage.
1/3 Vcc to the lower comparator.
2/3 Vcc to the upper comparator.

Flip Flop-
This R/S flipflop switches the discharge transistor and drives the buffer amplifier. It's output is controlled by voltages from the comparator circuit.

Op-Amp Comparator-
Compares the threshold input and the trigger input voltages.
Output from the comparators drive the R/S Flip-Flop.

Discharge Transistor-
This transistor discharges the timing capacitor, C1, when the transistor is 'turned on' by a voltage on it's input (base).

ASTABLE MODE



The astable or 'free-running' mode produces continuous output pulses. The frequency of the pulses (number of pulses per second) is determined by the components R1, R2 and C1. The formula used for calculating this is

The duration of the 'on state' of the pulses is determined by the timing components R1, R2 and C1. The formula used is .

The duration of the 'off state' of the low is determined by R2 and C1. The formula used is .

The total time for one pulse cycle (on and off) is **T = t1 + t2.** The relationship between the on-state time t1 and the total time is known as the **duty cycle**. This is basically the percentage of the total time that the pulse is high. This relationship can be expressed as .

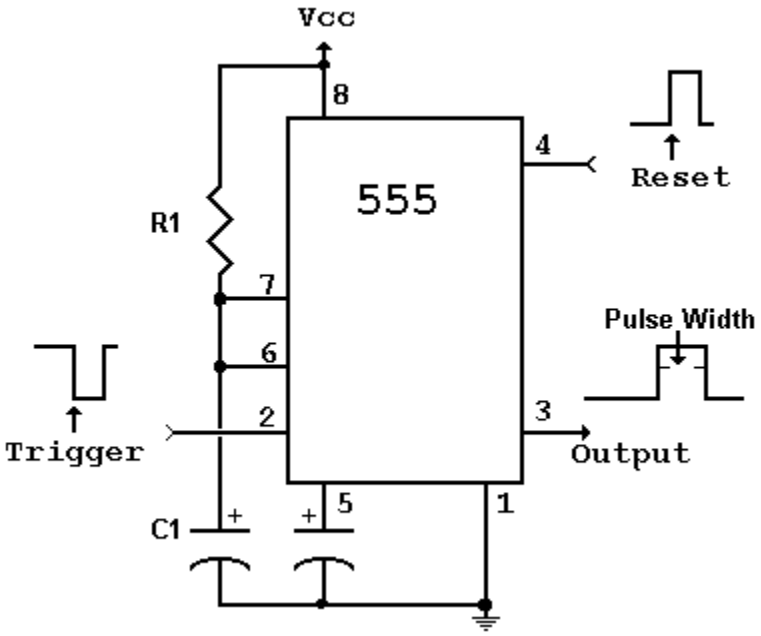
The 'on state' has a voltage value of approximately **2/3 of Vcc**. The 'off-state' has a voltage value of approximately 1/3 Vcc.

The astable mode 555 is mainly used as an oscillator. Circuits include flashers, tone generators and pulse generators.

Related Topics-

Operation
Monostable Mode

MONOSTABLE MODE



The monostable or 'one-shot' mode produces an output pulse for each negative going trigger pulse. The duration of the output pulse is determined by the timing components R1 and C1. The formula used is **t = R1 x C1**. The voltage value of the pulse is approximately **2/3 Vcc**.

The 555 in monostable mode is used in timers, switch de-bounce circuits and other applications requiring one pulse of a known duration.

There have been many articles and several good books written about the 555. They can provide additional background information and application circuits that you can use in your own projects.

Related Topics-

Operation
Astable Mode

Resistance

Electrical resistance is a property of an electrical circuit that opposes the flow of current. The electrical component most commonly used to implement this property is the resistor. The resistor's resistance depends on the resistor material's composition and the amount of that material. The unit of resistance is the ohm, named for Georg Simon Ohm, and is usually indicated by Ω, the Greek letter Omega. The ohm is also the unit of reactance and impedance.

In 1827 Ohm stated that the current **I** in a wire increases in direct proportion to the voltage **V** and inversely proportion to the resistance of the wire **R**. Ohm's law is expressed as **I = V/R**. This equation is usually in the form of **V = (I x R)**

A British physicist James Prescott Joule stated in a 1840 publication that the amount of heat produced by an electric current is equal to the product of the resistance of the wire and the square of the current. That equation became known as Joule's Law and is expressed as the power (P) dissipated in a resistor is given by P = (I x I x R). The Power Law is a restatement of Joule's Law and is expressed as P = (I X (I x R)) = (I x V)

Resistor 

A resistor is an electrical component that has the property of resistance, which enables it to oppose the flow of current in a circuit. Below is a table detailing the different types of resistors.

RESISTOR TYPES

Resistor	Resistance	Power Rating	Material / Coating	Tolerances
Carbon	1Ω to 30MΩ	1/8 to 2 watts	carbon / ceramic	5%, 10%
Metal Film	10Ω to 1MΩ	1/10, 1/8, 1/4	metal film / ceramic	1%
Metal Oxide	.47Ω to 1.0MΩ	to 2 watts	metal oxide / ceramic	5%
Wirewound	1Ω to 50kΩ	to 200 watts	metal wire / enamel	1% to 5%

Wirewound resistors normally have their value stamped on their case. The Carbon and the Metal resistors normally have their values coded on their bodies using a color code.

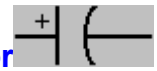
There are variable type resistors that are of carbon composition or wirewound types. They can be either a potentiometer, which is a three terminal, low-power device, or a rheostat, which is a 2 contact, high-power device. They have a contact that slides across the resistor material, so that the amount of resistance can be varied.

Capacitance

Electrical capacitance, or capacity, is the ability of passive circuit elements to store electric charges. Devices that have this property are called capacitors. These capacitors are used in circuits to store and control electric charges. By controlling the charges the circuit current is also controlled. The impedance Z of a capacitor is inversely proportional to the frequency of the current passing through it.

The capacitance C is defined as the ratio of the charge on one of the conductors to the voltage between them: C = q / V. However, the value of C depends on two plates and on the dielectric between them and is independent of the charge q, since as q increases, V increases proportionally. If the charge is given in coulombs and the voltage in volts, the capacitance will be in farads.

The farad is the unit of capacitance and is named after Michael Faraday. Most of the capacitors used in electronics have capacitances measured in microfarads or picofarads since the farad is such a large amount of capacitance

Capacitor 

A capacitor is an electrical component that consists of two conductors separated by an insulator. A capacitor is said to have the property of capacitance and so opposes any change in the voltage across its terminals. The capacitor is the only device other than a battery that can store electrical energy. This stored energy enables the capacitor to resist changes of voltage. The farad (F) is the unit of measure is farads for capacitance.

The simplest capacitor consists of two metal plates separated by an insulator, or dielectric. The characteristics of a capacitor depend on the plate size, distance between the plates and upon the dielectric used. Common dielectrics include paper, mica, ceramic, plastic, electrolytes and air.

Because the dielectric is an insulator, a capacitor will not permit a direct current to flow through it, but its continuous charging and discharging action will allow alternating current (AC) to pass.

Capacitors are described in terms of their capacitance, their maximum DC (direct current) working voltage (DCWV), the type of dielectric, and whether the value of the capacitance is fixed or variable. Capacitors normally have their values stamped on their bodies

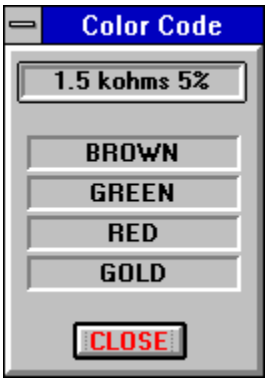
Below is a table detailing various capacitor types.

CAPACITOR TYPES

Capacitor	Dielectric	Range	DCWV
Ceramic	ceramic	1pf to 1uf	up to 1000vv
Electrolytic	* electrolyte	.1uf to 15000uf	6.3v to 500v
Metal Film	dielectric film	.01uf to 1.0uf	to 100v
Mica	mica	pf to .1uf	up to 35,000v
Paper	waxed paper	pf to .1uf	up to 500v
Plastic Film	polystyrene	5pf to .47uf	up to 50v
Tantalum	tantalum	4.7uf to 220uf	6.3v to 50v

* various types of electrolytes used in electrolytic capacitors

Color Code Screen



This screen pops-up when the user clicks on one of the resistor identifiers- R1, R2, ect. The value that is assigned to that designator at that time will have its resistor color code determined and displayed on this form.

In the example above, the resistor chosen has a value of 1.5 kohms or 1500 ohms. The first band color is Brown, for the first digit of the value, 1. The next band is Green for the next digit 5. The third color stands for the number of zeros that follows, in this case Red, for 2 zeros. The forth band is the tolerance designator. Since it is assumed in this application that 5% tolerance resistors are used, the fourth band is Gold. If the tolerance was 10% then the band would be Silver. No fourth band designates 20% tolerance.

Related Topics-

Resistor Color Code

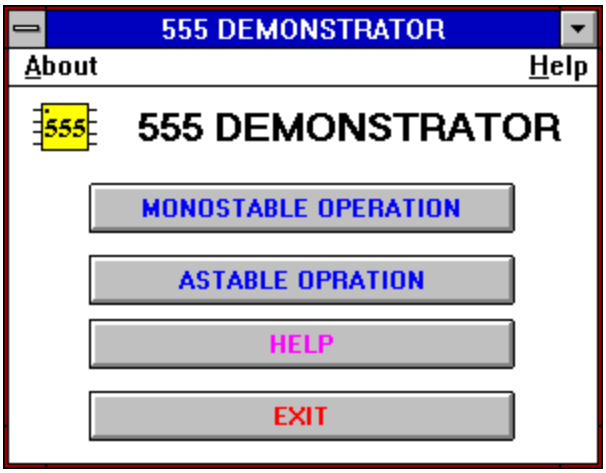
Glossary of Terms

Terms with (discussion) have an additional information screen

Term	Definition
Astable (discussion)	Continuously pulsing mode also known as 'free-running'. Oscillator.
Capacitance (discussion)	The property of circuit elements or circuit device to store electric charges.
Capacitor (discussion)	Electrical device for adding capacitance property to an electrical circuit
Duty-cycle	The ratio of pulsewidth to the period of the output. The formula is-
Farads	The unit of measure defining capacitance. Normally has prefix micro (u) or pico (p). Symbol is **F**
flip-flop	An electronic circuit designed so that it can be of one of two possible states- on or off. These circuits change state in response to an external trigger signal.
Frequency	The number of cycles or pulses per second. Measured in Hertz or Hz. the astable mode frequency formula is-
Kilo	Prefix denoting a multiplier of x . Symbol is **k**
Mega	Prefix denoting multiplier of x . Symbol is **M**
Micro	Prefix denoting multiplier of x . Symbol is **µ**
Milli	Prefix denoting multiplier of x . Symbol is **m**
Monostable (discussion)	Mode that produces one output pulse of a known duration. Also known as 'one-shot' operation.
Pico	Prefix denoting multiplier of x . Symbol is **p**
Pulse width	The period of the output pulse. Also known as **t1**. In the astable mode the formula used is
Ohms	The unit of measure defining resistance. Can also have prefix kilo (K) or Meg (M). Symbol is **Ω**
Op-Amp	Operation Amplifier. Amplifier circuit that has a very linear output and whose gain is

	determined by the amount of output signal is fedback to the input. Has a large variety of uses.
Resistance (discussion)	The property of an electrical circuit that opposes the flow of current.
Resistor (discussion)	Electrical device for adding resistance to an electrical circuit

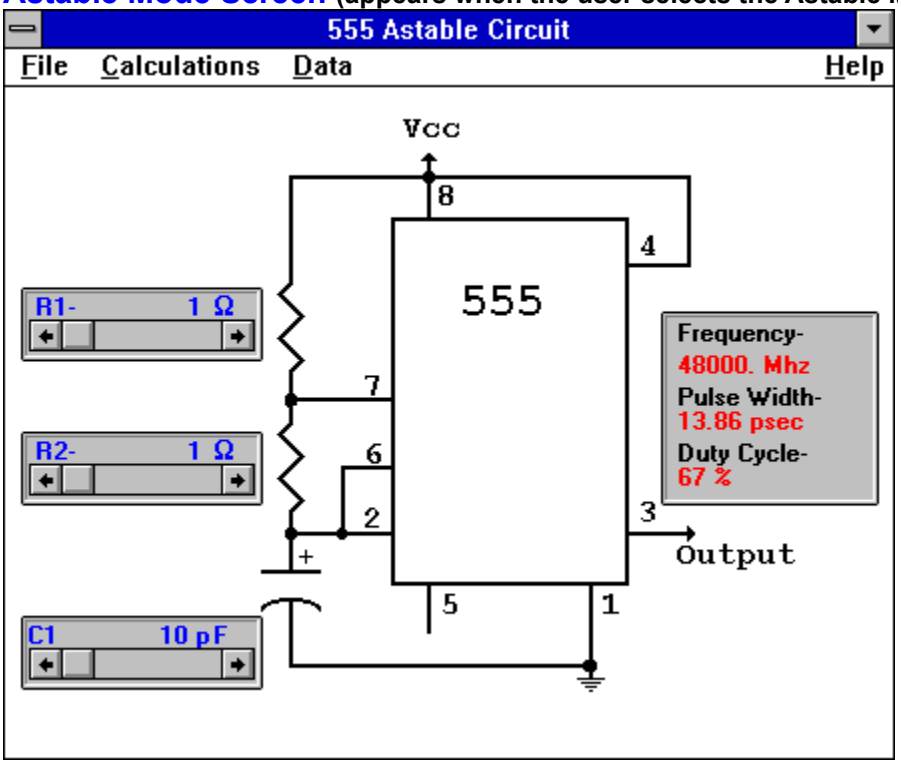
Home Screen



This is the screen that appears when the application first begins or when one of the mode screens is closed.

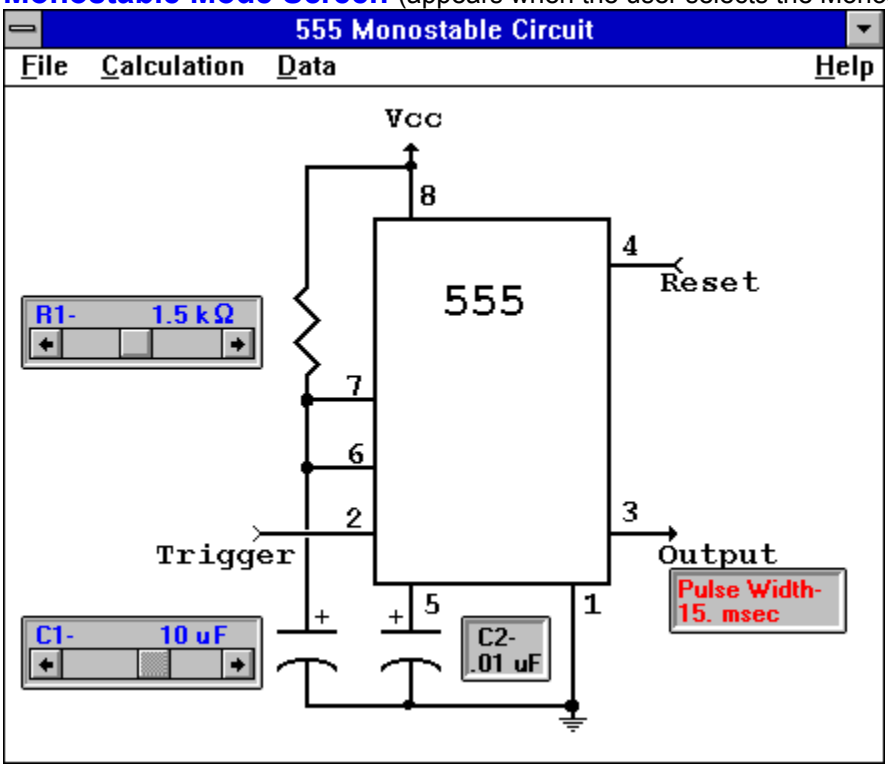
Click on a button or menu item for additional information.

Astable Mode Screen (appears when the user selects the Astable Mode)



Click on an item for additional information.

Monostable Mode Screen (appears when the user selects the Monostable Mode)



Click on an item for additional information.

Screen Function
Click on this button to select the ASTABLE MODE screen.
Keyboard- use tab key to set focus, then select by typing <Enter>

Screen Function

Click on this button to select the MONOSTABLE MODE screen.
Keyboard- use tab key to set focus, then select by typing <Enter>

Screen Function

Click on this button to select the HELP file for this program

Keyboard- use tab key to set focus, then select by typing <Enter>

Screen Function

Click on this button to EXIT the application.
You can also double-click the control box in the upper-left corner
Keyboard- use tab key to set focus, then select by typing <Enter>

Screen Function

Click on this button to see the ABOUT BOX screen.
This will provide some system and program information.
Keyboard- use ALT key to set focus, then select by typing <Enter>.

Screen Function

Click on this menu item to-

- See the About box
- Close this mode window
- EXIT the application

Keyboard- use ALT key to set focus, then use cursor to focus, then type <Enter>.

Screen Function

Click on this menu item to see-

- the 555 Pinouts
- the 555 Specifications
- the Standard Resistor Values
- the Standard Capacitor Values

Keyboard- use ALT key to set focus, then use cursor to focus, then type <Enter>.

Screen Function

Click on this menu item to-

See the Calculation for Pulse Width

Keyboard- use ALT key to set focus, then use cursor to focus, then type <Enter>.

Screen Function

Click on this menu item to see-

- the calculation of the Duty Cycle
- the calculation of the Output Frequency
- the calculation of the Pulse Width(t1)

Keyboard- use ALT key to set focus, then use cursor to focus, then type <Enter>.

Screen Functions

The **Component Box**(grey box) has several functions-

Displays the component designator (C1)

Displays the current selected Standard Capacitor Value
(Cursor will change to a box when over the value)

Clicking on the displayed value brings up the Cap Code box

Clicking on the scrollbar **arrows** selects the next higher
or lower Standard Capacitor Value

Clicking on the scrollbar **tab bar** increments or decrements the value
by a power of ten

Drag and drop the **thumb box** to the desired value

Screen Function

The **Component Box**(grey box) has several functions-

- Displays the component designator (R1, R2)
- Displays the current selected Standard Resistor Value
- Clicking on the displayed value brings up the Color Code box
  (Cursor will change to a box when over the value)
- Clicking on the scrollbar **arrows** selects the next higher
  or lower Standard Resistor Value
- Clicking on the scrollbar **tab bar** increments or decrements the value
  by a power of ten
- Drag and drop the **thumb box** to the desired value

Screen Function

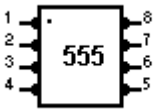
This grey box displays the

Frequency of the output. This value is displayed in Hz, kHz or MHz.
Pulse Width (t1) of the output in seconds or seconds with a prefix.
Duty Cycle of the output. This value is displayed as a percentage.

Screen Function

This grey box displays the Pulse Width of the output.
This value is displayed in seconds or seconds with a prefix.

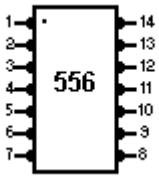
Pinouts



555 Pinout

Pin #	Name	Function
1	Ground	power ground
2	Trigger	astable: normally connected to timing capacitor monostable: it initiates one-shot operation when pulsed low
3	Output	output pulse or pulses at this pin
4	Reset	normally held high by connecting to Vcc, it can be pulsed low to reset the operation of 555
5	Control	in normal astable or monostable operation, this pin is connected to a de-coupling capacitor
6	Threshold	in astable mode pin 6 is connected to pin 2, in monostable mode it is connected to pin 7
7	Discharge	the timing capacitor discharges thru this pin depending upon the operation state of pin 2
8	Vcc	+ power supply 4.5 v to 15 v

Related Topics-
Operation



556 Pinout

Pin#	Name	Pin#	Name
1	Discharge (1)	8	Trigger (2)
2	Threshold (1)	9	Output (2)
3	Control (1)	10	Reset (2)
4	Reset (1)	11	Control (2)
5	Output (1)	12	Threshold (2)
6	Trigger (1)	13	Discharge (2)
7	Ground	14	Vcc

*** functions same as 555 pinout above**

555 Specifications

Supply Voltage Vcc		+ 4.5v to 15v
Supply Current Ic	@+5v	3 mA to 6 mA
	@ +15v	10 mA to 15 mA
Reset Voltage Vr		.4 v to 1.0 v
Reset Current Ir		.1 mA to .3 mA
Rise or Fall Time tr or tf		100 ns
Output Current		200 mA maximum
Power Dissipation		600 mW
Operating Temperature		0 to 70 degrees Centigrade

NOTE- these are the specifications for the standard 555 (NE555) or 556 Specifications may vary for the C-MOS or low-power versions

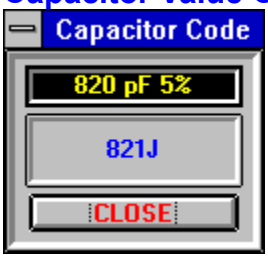
Resistor Color Code

	BANDS		
COLOR	**1**	**2**	**3(multiplier)**
Black	0	0	x 1
Brown	1	1	X 10
Red	2	2	x 100
Orange	3	3	x 1000 (1k)
Yellow	4	4	x 10000 (10k)
Green	5	5	x 100000 (100k)
Blue	6	6	x 1000000 (1m)
Violet	7	7	--------
Gray	8	8	--------
White	9	9	--------
Gold	----	----	x 0.1
Silver	----	----	x 0.01

Band 4 denotes the tolerance

Gold band = 5 % Silver band = 10 % No 4th Band = 20 %

Capacitor Value Code Screen



This screen pops-up when the user clicks on the capacitor identifier- C1. The value that is assigned to that designator at that time will have its capacitor value code determined and displayed on this form.

Related Topics-

Capacitor Value Code
Standard Capacitor Values

Capacitor Value Code

Many years ago, capacitors used to be identified with color dots on their bodies. This is technique is no longer in practice. Capacitors were also identified with the value printed on the body. While larger capacitors still have the value printed on the case, most have a coded value for identification.

The modern capacitor value code is different from the Resistor Color Code in that the value is alphanumerically coded on the body of the capacitor instead of using color bands as on resistors.

The first two numbers of the code stand for the two significant digits of the value. The third number stands for the number of zeros in the multiplier factor that indicates the capacitor value in picofarads. The letter stands for the tolerance. Values of 1 uF and above are normally stamped on the case.

Example- a capacitor with a value of 820 pf at 5% tolerance.

the first two digits are 8 & 2
the next digit is 1 (for x10 or 10 E+1)
the tolerance is J for 5%
8 + 2 + 1 + J the code is 821J

Multiplier Code (3rd digit)

Value	Multiplier Code
1pf - 99pf	0
100pf - 820pf	1
.001 uf - 0082uf	2
.01 uf - .082uf	3
.1uf - .82uf	4

Capacitor Tolerance Code

Tolerance	Code
5%	J
10%	K
20%	M
+80 / -20 %	Z

Related Topics-

Standard Capacitor Values

Standard Resistor Values

The values shown are in ohms, kilohms (k) or megohms (M)
low wattage carbon resistors 5% tolerance

1.0	1.1	1.2	1.3	1.5	1.6	1.8	2.0	2.2	2.4	2.7	3.0
3.3	3.6	3.9	4.3	4.7	5.1	5.6	6.2	6.8	7.5	8.2	9.1
10	11	12	13	15	16	18	20	22	24	27	30
33	36	39	43	47	51	56	62	68	75	82	91
100	110	120	130	150	160	180	200	220	240	270	300
330	360	390	430	470	510	560	620	680	750	820	910
1k	1.1k	1.2k	1.3k	1.5k	1.6k	1.8k	2.0k	2.2k	2.4k	2.7k	3k
3.3k	3.6k	3.9k	4.3k	4.7k	5.1k	5.6k	6.2k	6.8k	7.5k	8.2k	9.1k
10k	11k	12k	13k	15k	16k	18k	20k	22k	24k	27k	30k
33k	36k	39k	43k	47k	51k	56k	62k	68k	75k	82k	91k
100k	110k	120k	130k	150k	160k	180k	200k	220k	240k	270k	300k
330k	360k	390k	430k	470k	510k	560k	620k	680k	750k	820k	910k
1M	1.1M	1.2M	1.3M	1.5M	1.6M	1.8M	2.0M	2.2M	2.4M	2.7M	3.0M
3.3M	3.6M	3.9M	4.3M	4.7M	5.1M	5.6M	6.2M	6.8M	7.5M	8.2M	9.1M
						10M					

Related Topics-
Color Code

Standard Capacitor Values

NOTE: Not all values available for all capacitor working voltages
The Working Voltage can range from 6 volts to several hundreds

10 p	12p	15p	18p	22p	27p	33p	39p	47p	56p	68p	82p
100p	120p	150p	180p	220p	270p	330p	390p	470p	560p	680p	820p
1000p	1200p	1500p	1800p	2200p	2700p	3300p	3900p	4700p	5600p	6800p	8200p
.01u	.012u	.015u	.018u	.022u	.027u	.033u	.039u	.047u	.056u	.068u	.082u
.1u	.12u	.15u	.18u	.22u	.27u	.33u	.39u	.47u	.56u	.68u	.82u
1u	1.2u	1.5u	1.8u	2.2u	2.7u	3.3u	3.9u	4.7u	5.6u	6.8u	8.2u
10u	12u	15u	18u	22u	27u	33u	39u	47u	56u	68u	82u
100u	120u	150u	180u	220u	270u	330u	390u	470u	560u	680u	820u
1000u	1200u	1500u	1800u	2200u	2700u	3300u	3900u	4700u	5600u	6800u	8200u
					10000u						

Legend-

p - picofarads (X .000000000001 farads)
u - microfarads (X .000001 farads)

Registration

The application and this Help File was the result of many hours of work. I have presented it uncrippled so that is may be evaluated completely and without "nags". Feel free to evaluate for 30 days at no risk. It is however, intended to be **SHAREWARE**.

If you feel that it is of value to you, please take the time to register it with the author. The registration fee is a mere $7.50 and registration will enable you to receive any upgrades for just the cost of a disk (3.5 ") plus postage.

Feel free to pass the program on to others with the following restriction-
It must be accompanied by the Help File and the document files:

555.exe
555.hlp
555.txt

The application also requires the following -

CMDIALOG.VBX	the common dialog control
COMMDLG.DLL	the cmdialog dll
THREED.VBX	3-D panel control
VBRUN300.DLL	

If you have any questions or suggestions for making this application better contact me at the registration address below or on:
Compuserve at 71320,3246 or
America Online at RobertJ85

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555 Demonstrator Registration

Name_____
Address_____
City_____ State_____ Zip_____

Mail this form and payment to:

Robert Johnson
Sagamore Software
P.O. Box 4082
Lafayette, IN 47903-4082