

Introduction

This is a practical guide that will help you to find the polarity and pin configuration of any small bipolar transistor. There is an element of trial and error involved. But since we're dealing with a limited number of variables - the task is not too daunting. There are only three leads - collector - base - and emitter. If your meter has a transistor tester - you could simply try all of the six possible pin configurations - in both polarities.

Transistor Pin Configuration

b c e

Bipolar Transistors - With Three Pins - Have Six Possible Pin Configurations.

e b c

However - The Top Three Combinations Are By Far The Most Common.

c b e

e c b

If Your Meter Has A Transistor Tester - Connect The Three Pins - In The Following Order - To Both The NPN And PNP Inputs.

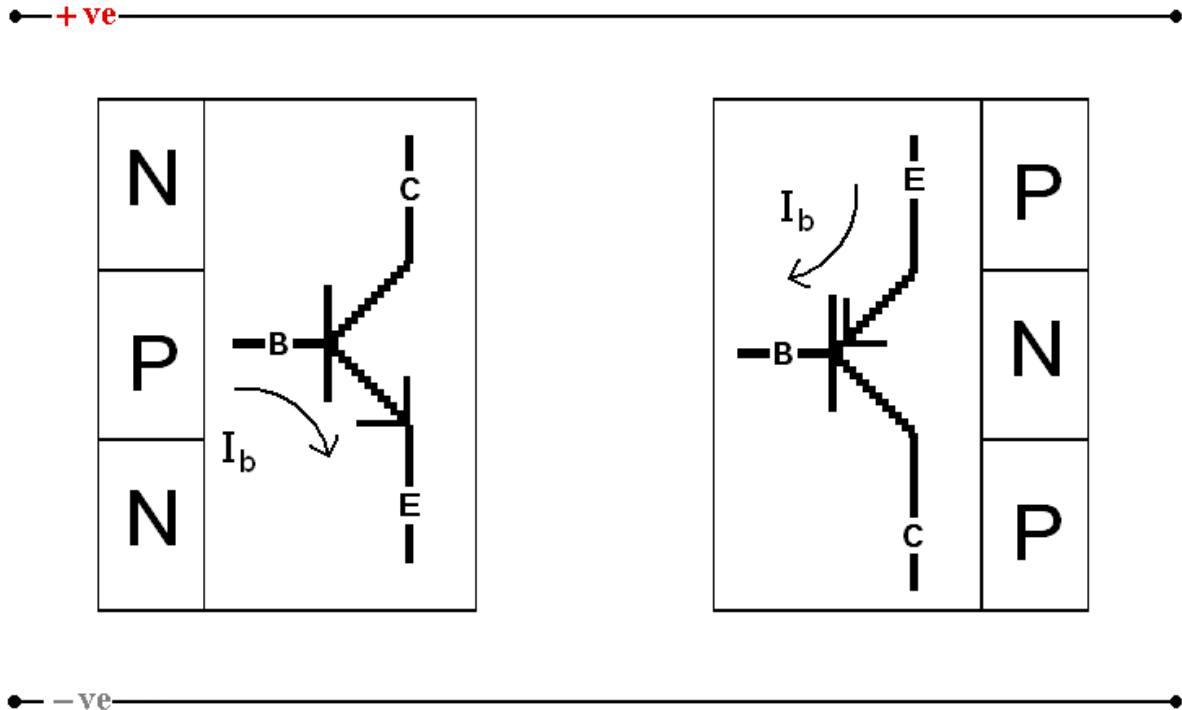
c e b

b e c

Look For The Highest Gain Figure. It Will Normally Be Between About 100 And 500

Comparing NPN and PNP Transistors

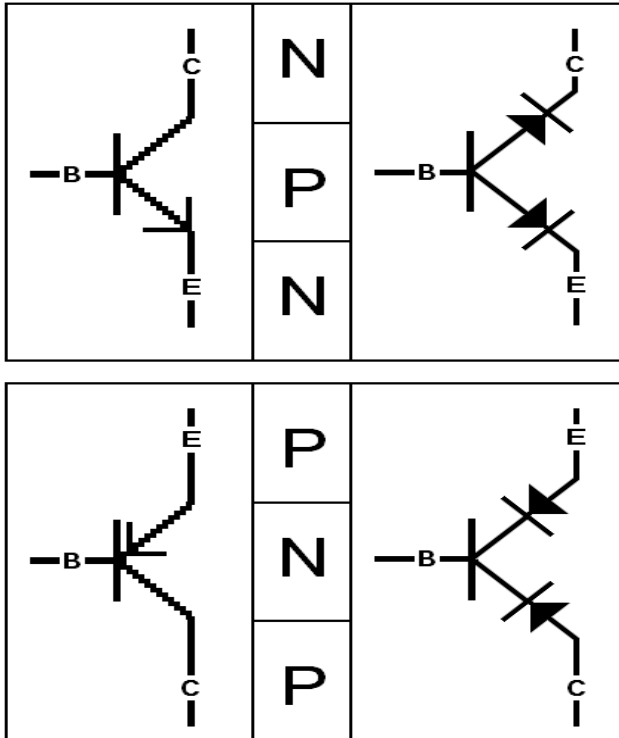
Small bipolar transistors fall into two groups - NPN and PNP. The emitter of an NPN transistor is connected to - or towards - the negative line. And its collector is connected to - or towards - the positive line. An NPN transistor switches on - when current flows INTO its base pin. And it switches off when this base current ceases. The small arrowhead - in the symbol - indicates the direction of the base current.



Compared with NPN transistors - PNP transistors are connected upside down - and operate back to front. The collector of a PNP transistor is connected to - or towards - the negative line. And its emitter is connected to - or towards - the positive line. A PNP transistor switches on when current flows OUT OF its base pin. And it switches off when this base current ceases. The small arrowhead - in the symbol - indicates the direction of the base current.

Identifying A Transistor's Polarity

If you have a moving coil meter - or your digital meter has a diode tester - you should begin by identifying the polarity of the transistor. Since we're going to use the meter to identify the polarity of the transistor - the polarity of the meter leads is crucial. Before you start - make absolutely certain that your leads are connected the right way round. Then begin by finding the collector and emitter diodes. These diodes will conduct - when the red meter lead is connected to a "P" terminal.



Inside Every Bipolar Transistor - There Are Two Diodes. One Is Connected Between The Base And Emitter. And The Other Is Connected Between The Base And Collector.

These Internal Diodes Behave Like Regular Diodes. They Allow Current To Flow In One Direction Only.

The Arrowheads Indicate The Direction Of Current Flow Through The Diodes. They Always Point - Towards The N Material - And Away From The P Material.

The Top Drawing Represents An NPN Transistor - With The Two Diodes Pointing Away From The Positive Base.

The Bottom Drawing Represents A PNP Transistor With The Two Diodes Pointing Towards The Negative Base.

We Can Use This Information To Identify Both The Polarity Of An Unknown Transistor - And Its Base Pin.

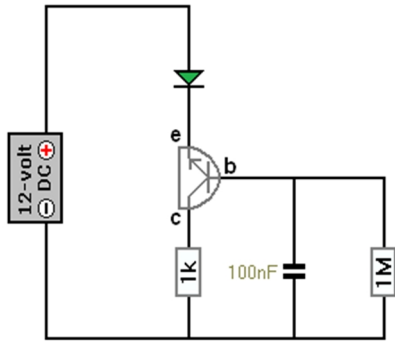
And Since The Other Two Pins Must Be Collector And Emitter - All That Remains Is To Identify Which Is Which.

When you've identified the polarity of the transistor - and its base pin - one of the following small circuits will help you identify the collector and emitter. Build the circuit on your breadboard. And plug in your transistor. You already know where the base pin should go. Use trial and error to position the other two pins. If the LED glows - even dimly - the collector and emitter are connected the wrong way round. If the collector and emitter are connected correctly - the LED will not light.

Next - wet the tip of your finger with the tip of your tongue. And use your wet fingertip to join the collector to the base. If your transistor is working properly - and connected correctly - the moisture will supply sufficient base current to switch the transistor on. And the LED will light.

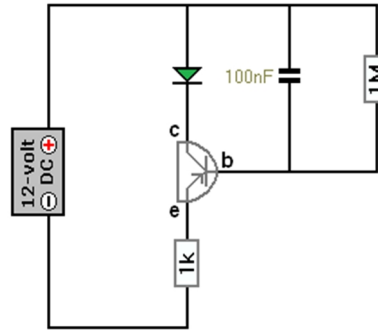
NPN Transistor

If The Emitter And Collector Are Connected The Wrong Way Round - The LED Is Likely To Glow All The Time



PNP Transistor

If The Emitter And Collector Are Connected The Wrong Way Round - The LED Is Likely To Glow All The Time



If you don't have a moving coil meter - or a diode tester.

You can still use these two circuits to identify the polarity of your transistor - and its pin configuration. Just use the "Transistor Tester" technique described above. Try all six possible pin configurations. The first three are the most likely. When you can light the LED with a moist fingertip - the transistor is connected correctly.