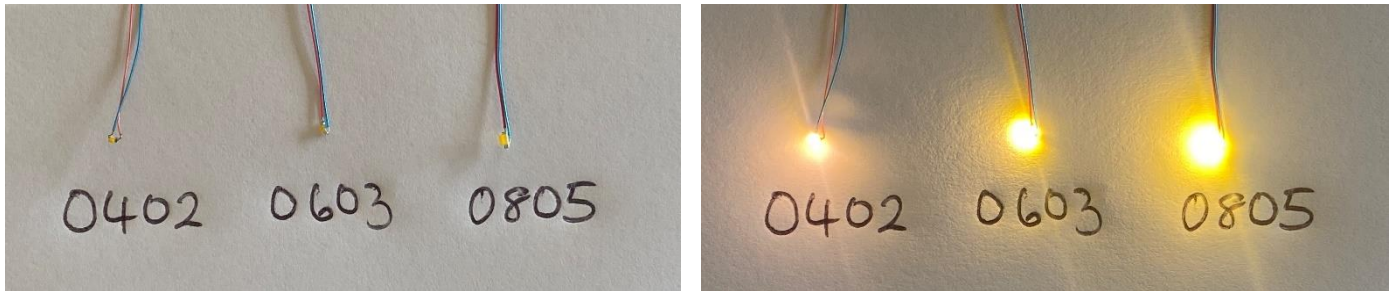


JTElectronics

Various LEDs

Model: JTE0402, JTE0603, JTE0805



This datasheet covers usage of the various LEDs we stock and much of the technical information applies to all LEDs.

CURRENT: Before a light emitting diode can “emit” any form of light it needs a current to flow through it, as it is a current dependant device with light output intensity being directly proportional to the current flowing through the LED. LEDs have a maximum operating current that must not be exceeded, or the LED will have a very short lifetime. The operating current is often limited to a safe level by just connecting an appropriate resistor in series with the LED but as the voltage to the LED circuit increases, so will the LED current increase and vice versa. If the applied voltage is likely to vary a lot, special external circuitry may be employed to limit the current through the LED which also keeps a steady current through the LED regardless of the voltage applied to the circuit – known as a “Constant Current” circuit.

See “**SETTING LED CURRENT**” section later in this document for information on how to limit the LED current.

VOLTAGE: LEDs will not allow significant current to flow through them until a voltage threshold is reached – called the “Forward Voltage” and is typically in the 1.8-to-3.5-volt range, dependent on LED light colour (what elements were used to make the LED). Once the Forward Voltage threshold is reached the current increases quickly, and exponentially, which is why it is necessary to limit the current through the LED. The Forward Voltage threshold of all LEDs is slightly different and can vary as much as ± 0.5 Volt, even for the same colour LED, so if you need to connect two (or more) LEDs in parallel, even the same colour LEDs, each LED still requires its own individual current limiting resistor so the LEDs share the available current evenly between them. LEDs required a DC supply voltage, don’t supply them from an AC voltage! (unless you add a series diode to the block reverse voltage).

POLARITY: Like all other “diode” type devices, LEDs have a positive wire (often called the Anode, or “A”) and a negative wire (often called the Cathode, or “K”). LEDs must always be connected with the correct voltage polarity, or they will not work and may be damaged, so always pay careful attention when wiring them into a circuit.

LED TYPES:

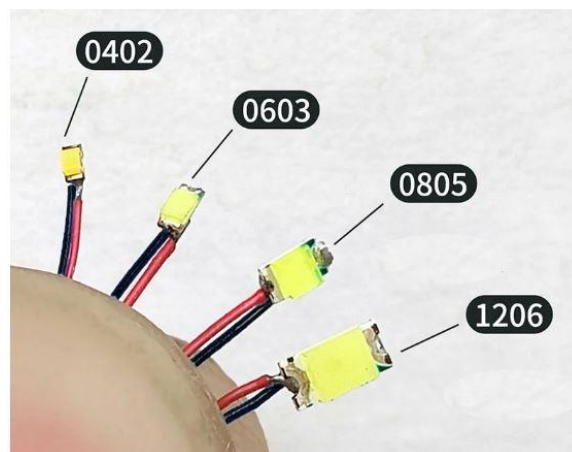
We stock prewired “surface mount” LEDs in a variety of sizes and colours. The wires have already been soldered to each end of the LED, so they emit light out one side rather than directly from one end like an incandescent lamp. You may want to carefully rotate the LED so the light emitting face of the LED faces “outwards” from your enclosure – there is a high risk of detaching one of the wires doing this! In practice when you install these LEDs in some sort of housing, the light bounces off everything and comes out where you expect to see it. Some sizes of these prewired LEDs are tiny so you need to be very careful when handling and wiring them because the wires will eventually detach from the LED with excessive movement.

LED brightness is related to operating current so, generally speaking as a guide, larger size LEDs can operate at higher current and therefore give higher brightness. Below is a table of common LED sizes and specifications. All specifications are typical and vary between different manufacturers due to different materials and processes. “Size” is the size of the LED with no wires, actual size is bigger due to wires and solder attached to each end.

| MODEL | SIZE (imp) | SIZE (mm) | COLOUR | CURRENT | FORWARD VOLTAGE |
|--------------|-------------------|------------------|---------------|----------------|------------------------|
| JTE0402GRN | 0402 | 1 x 0.5 | Green | 5mA | 2.2V |
| JTE0402ORA | 0402 | 1 x 0.5 | Orange | 5mA | 2.1V |
| JTE0402RED | 0402 | 1 x 0.5 | Red | 5mA | 2.0V |
| JTE0402WW | 0402 | 1 x 0.5 | Warm White | 5mA | 3.3V |
| JTE0603GRN | 0603 | 1.6 x 0.8 | Green | 10mA | 2.2V |
| JTE0603ORA | 0603 | 1.6 x 0.8 | Orange | 10mA | 2.1V |
| JTE0603RED | 0603 | 1.6 x 0.8 | Red | 10mA | 2.0V |
| JTE0603WW | 0603 | 1.6 x 0.8 | Warm White | 10mA | 3.3V |
| JTE0805GRN | 0805 | 2 x 1.2 | Green | 15mA | 2.2V |
| JTE0805ORA | 0805 | 2 x 1.2 | Orange | 15mA | 2.1V |
| JTE0805RED | 0805 | 2 x 1.2 | Red | 15mA | 2.0V |
| JTE0805WW | 0805 | 2 x 1.2 | Warm White | 15mA | 3.3V |

Below is an indication of how the wires are soldered to the LEDs.

The main surface emitting light is facing outwards,
but from a small distance the light appears to come out in all directions...



SETTING LED CURRENT:

As mentioned earlier the current used by a LED must be limited to a safe level, or the LED will have a very short lifetime. If the voltage fed to the LED circuit is fairly constant (maybe varies $\pm 10\%$), you can simply use a resistor in series with the LED to limit the current to a safe level.

As with most electronic design calculations they are usually done with “worst case” values to cover any possible operating conditions. Often there is also a compromise involved because we can’t obtain components of exact calculated values, or that we have a lot of existing components of a particular value, which will still operate the circuitry at safe conditions.

To calculate the series resistor required use the formula: $R = \frac{V_s - V_f}{I_f}$

Where V_s is the DC supply voltage, V_f is the LED forward voltage, and I_f is the LED current.

Amongst many others, DigiKey have a nice online series resistor calculator:

<https://www.digikey.co.nz/en/resources/conversion-calculators/conversion-calculator-led-series-resistor>

You may not be able to obtain the exact resistor value so a value either side of the calculated resistor value will be fine. For example, if your resistor is about 5% away from the calculated value, the LED current will be about 5% over or under the desired value which is not a major problem. It is ideal to select the resistor value higher than the calculated value to ensure the LED current will be slightly lower than the desired value to prolong the life of the LED.

Below is a chart of recommended series current limiting resistors for a few types of LEDs when powered from a 12 to 15 volt DC power supply – commonly used on HO and N scale model railroads.

| LED TYPE | CURRENT | SERIES RESISTOR |
|-----------------|----------------|------------------------|
| 0403 | 5mA | 2200 ohms (2k2) |
| 0603 | 10mA | 1000 ohms (1k) |
| 0805 | 15mA | 620 ohms (620R) |
| 3mm Round | 15mA | 620 ohms (620R) |