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|  | Foundation Activity 12 Transistor Nightlight |

Nightlight

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| In the last activity, we used a light dependent resistor (LDR) in a voltage divider to turn an LED on automatically when the room becomes dark. However, the LED was very **dim** because the current needed to flow through a **big resistance** to before going through the LED.  Instead, we can connect the LED to 5V using a 220Ω resistor and control it with a voltage controlled switch called a **transistor**. | C:\Users\Harryp\MEGA\Surface Pro 2\Nepal\Himalayan Makers Guild\Activities\Foundation Activities\FA12 - Transistor Nightlight\images\Eagle\nightlight_on_current.png |

BIpolar Junction Transistor (BJT)

BJTs can act like a switch, controlled by the voltage between the B and E pins. They have 3 pins:

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| Circuit Symbol | Part Image |
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| V\_BE less than 0.6V  BJT is off | V\_BE less than 0.6V  BJT is on | The current that can flow C to E is about 100x the current flowing from B to E |
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When the BJT is fully **ON**, V\_BE will stay constant at about 0.7V, like the voltage across a **diode**. Like an LED, too much current flowing from B to E can **damage** the BJT, so we need to make sure there is a resistor attached to B. However, if that resistor is too high we will get very little current flowing from B to E, limiting the current that can flow from C to E.

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| C:\Users\Harryp\MEGA\Surface Pro 2\Nepal\Himalayan Makers Guild\Activities\Foundation Activities\FA12 - Transistor Nightlight\images\Eagle\nightlight_bjt_off.png | [[2]](#footnote-2)  When there is light, the LSR has a small resistance.  The LSR becomes much **less than** 220kΩ, so Vout drops **below** 0.6 V, the transistor turns **OFF** and no current flows through the LED. |
| C:\Users\Harryp\MEGA\Surface Pro 2\Nepal\Himalayan Makers Guild\Activities\Foundation Activities\FA12 - Transistor Nightlight\images\Eagle\nightlight_bjt_on.png | When it is dark, the LSR has a big resistance.  The LSR much **greater than** 220kΩ, so Vout rises **above** 0.6 V, the transistor turns **ON** and current flows through the LED. |

1. Part image from Fritzing. [↑](#footnote-ref-1)
2. Sun and moon icons made by [Freepik](http://www.freepik.com) from [www.flaticon.com](https://www.flaticon.com/) [↑](#footnote-ref-2)