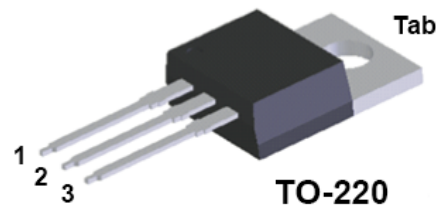# MOSFET Worksheet

MOSFETs are a great transistor to use in most circuits.  They can be a little bit complicated to design in.  Use this worksheet to find the critical information in the datasheet and to help determine if it can be used in your circuit.

## Step 1:  Pin-Out

| Function | Pin Number |
|---|---|
| Gate | |
| Drain | |
| Source | |
| Tab (Which pin) | |

The tab of the transistor is connected to one of the pins, make sure you note that.  Also, verify the orientation of this picture is the same as your datasheet.

## Step 2:  Threshold Voltage ($V_{GS}$ or $V_{TH}$) and Max $V_{DS}$

| Function | Value | Comment |
|---|---|---|
| $V_{GS}$ | | The voltage range necessary to "turn on" the MOSFET |
| $V_{CC}$ | | Voltage of the I/O pin used ($V_{GS}$ must be *less*) |
| $V_{DS}$ | | The maximum operational voltage for the load side |
| $V_{LOAD}$ | | Voltage of whatever you are trying to control ($V_{DS}$ must be *more*). |

$V_{CC}$ is whatever voltage your circuit I/O runs at, which is probably 3.3V or 5.0V.  Make sure this number is bigger than the minimum threshold voltage $V_{GS}$.

If you're using a battery or external supply for the load, make sure $V_{DS}$ is bigger than that power source.

## Step 3: Drain to Source Resistance (R$_{DS}$-On)

| Function | Value | Comment |
|---|---|---|
| **Max R$_{DS}$** | | Rated limit of R$_{DS}$.  (Will vary with V$_{GS}$.) |
| **Actual R$_{DS}$** | | Expected resistance *at your V$_{GS}$* |

Look for the R$_{DS}$.  Keep in mind that R$_{DS}$ will vary with V$_{GS}$.  So the limit (or Max) stated in the description of the MOSFET, may not apply to your circuit.

$$P = Current^2 * R_{DS}$$

Once you know the on-resistance, you can use your load's current to calculate how many watts the MOSFET will dissipate.

## Step 4: Calculate Max MOSFET Power

| Function | Value | Comment |
|---|---|---|
| **Max Junction Temp** | | Should be in the range of 125°C to 175°C. If not stated clearly, use 150°C. |
| **R$_{ØJA}$** | | Thermal Resistance: Junction-to-Ambient Units should be °C/W |

Sometimes the Maximum Junction Temperature isn't clearly stated.  If that is the case, just assume 150°C for TJ$_{Max}$.

$$P_D = \frac{TJ_{Max} - T_{Ambient}}{R_{\Theta JA}}$$

T$_{Ambient}$ is the "air temperature".  Room temperature is usually around 25°C.

Make sure that number calculated in Step 4 is less than Step 3.  If Step 3 is bigger, you need a heatsink.