

Modern Voltage Regulators

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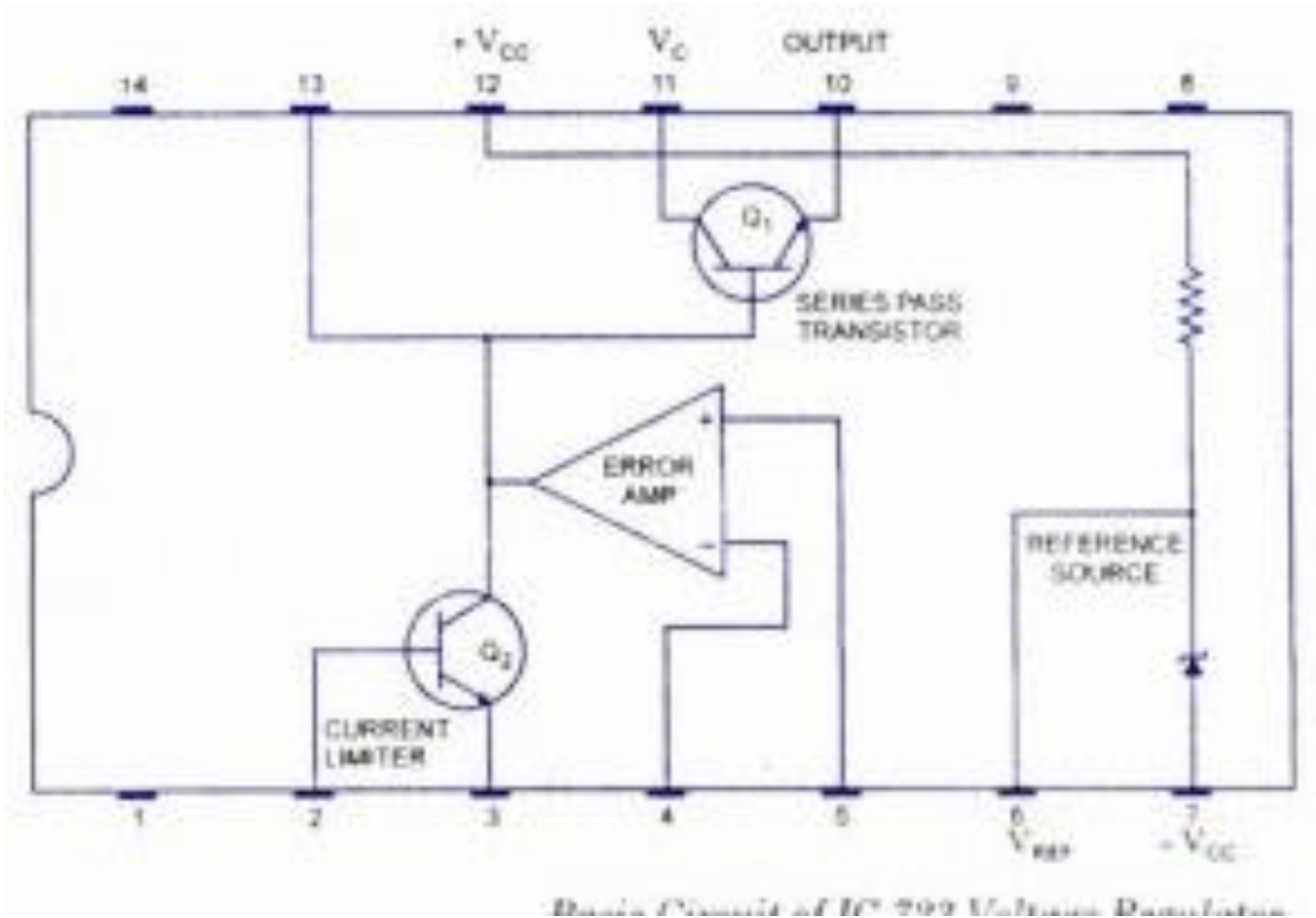
History

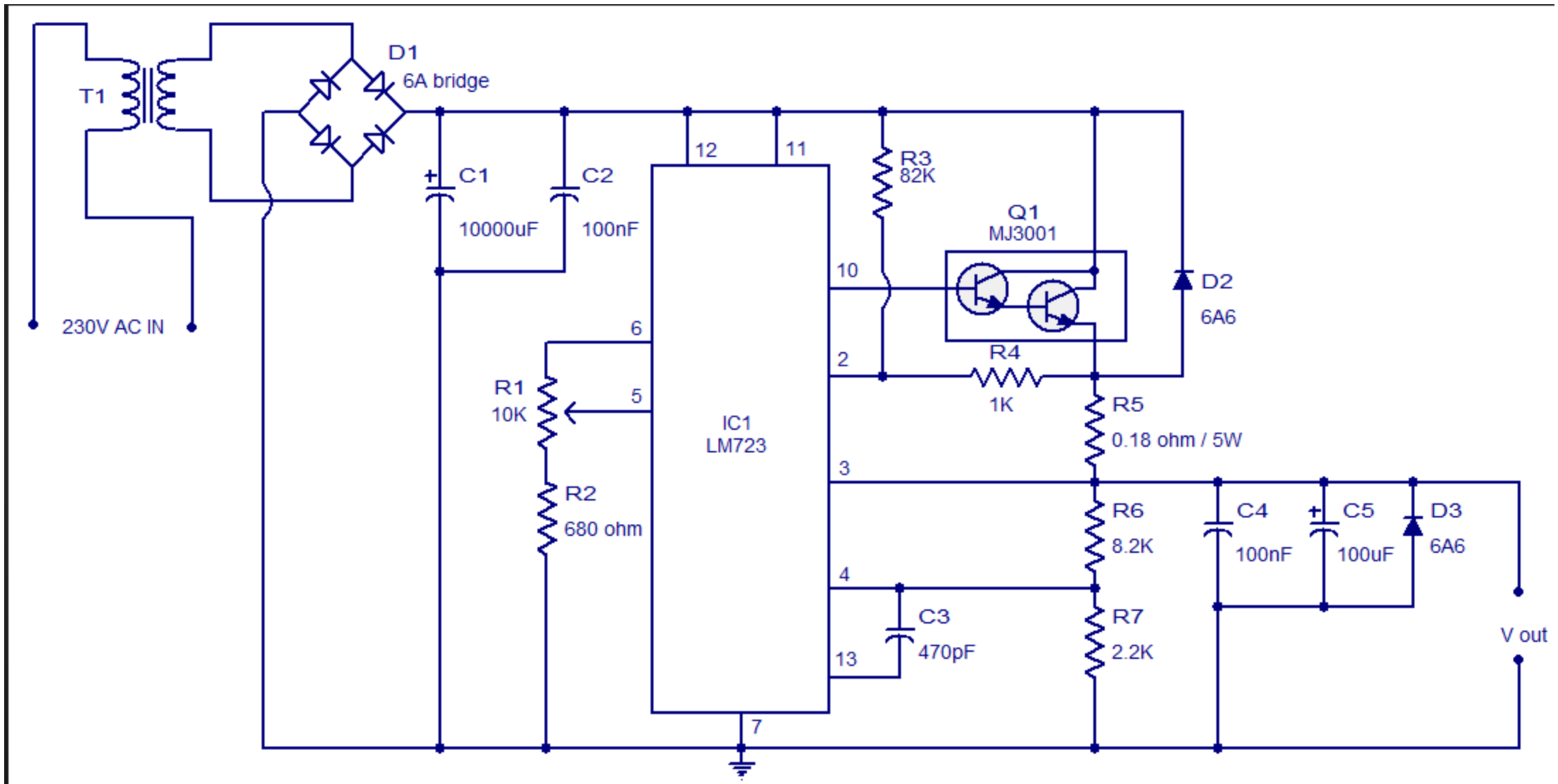
- 723 regulators with external pass transistors.
 - The 723 was one of the first analog IC's
 - Still popular and being manufactured.
 - High dropout voltage.
- 78xx
 - Integrated version of 723 with pass transistor.
 - Three terminal regulator.
 - High dropout voltage.
 - Fails without reverse diode when zero load.
 - High noise $.003\%V_{out}$ 317
 - 7805

More Recent

- LT1763 and similar
 - Low dropout voltage, 0.3-0.5 volts
 - Much lower noise. 20uV RMS
 - Precision \$4.69
- LT3081
 - Low noise 27uV RMS
 - Low dropout voltage
 - More stable, less output capacitance required
 - Temperature, current, power good monitors
 - Parallel devices for higher current.
 - Set with a single resistor
 - Reverse Input Voltage Protection
 - Reverse Output Voltage Protection
 - Reverse Output to Input Protection
- LT3086
 - 40 uV RMS
- ADM7150
 - Ultra Low Noise 1uV RMS
 - \$8.75

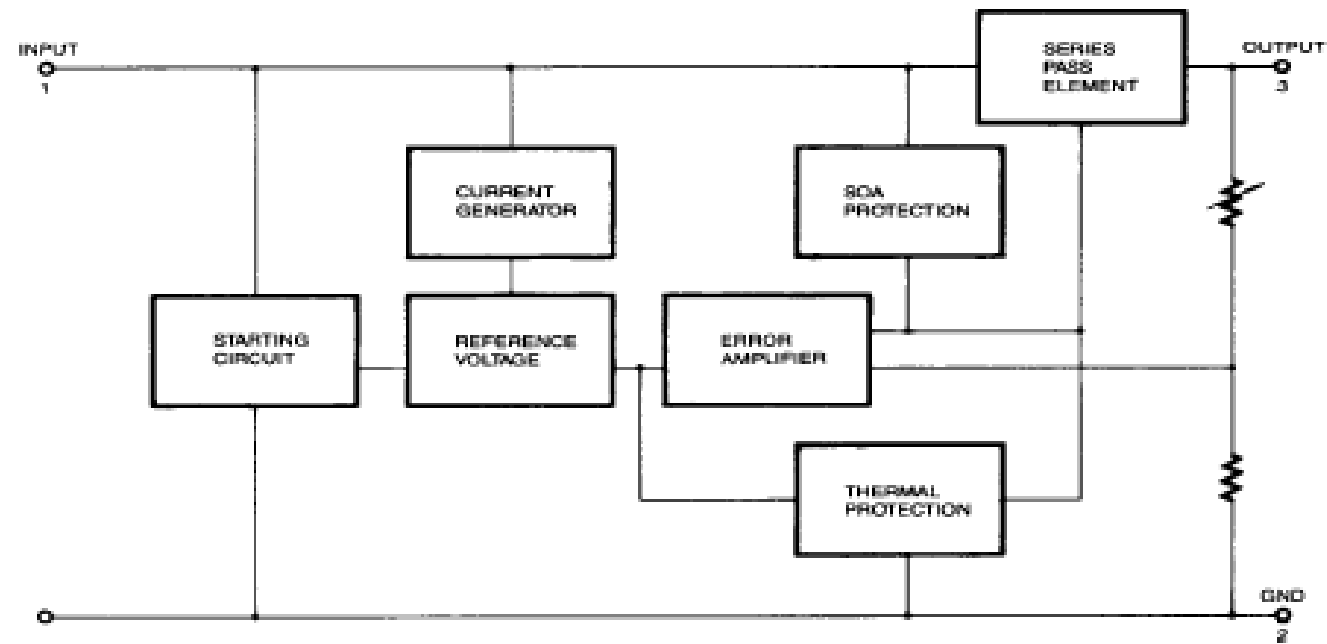
723 Regulator





78xx

Internal Block Diagram



Rev. 1.0.0

Manufacturers Example Circuit

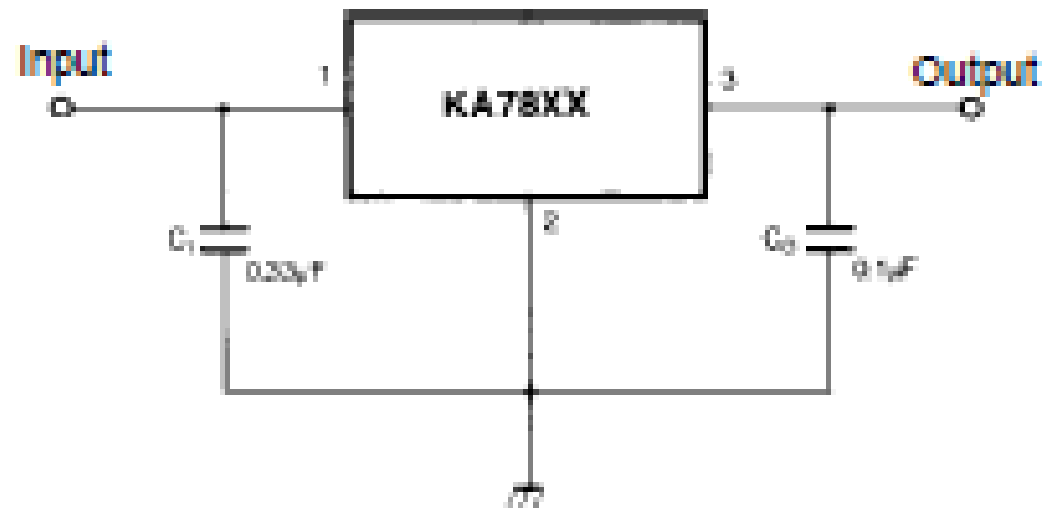
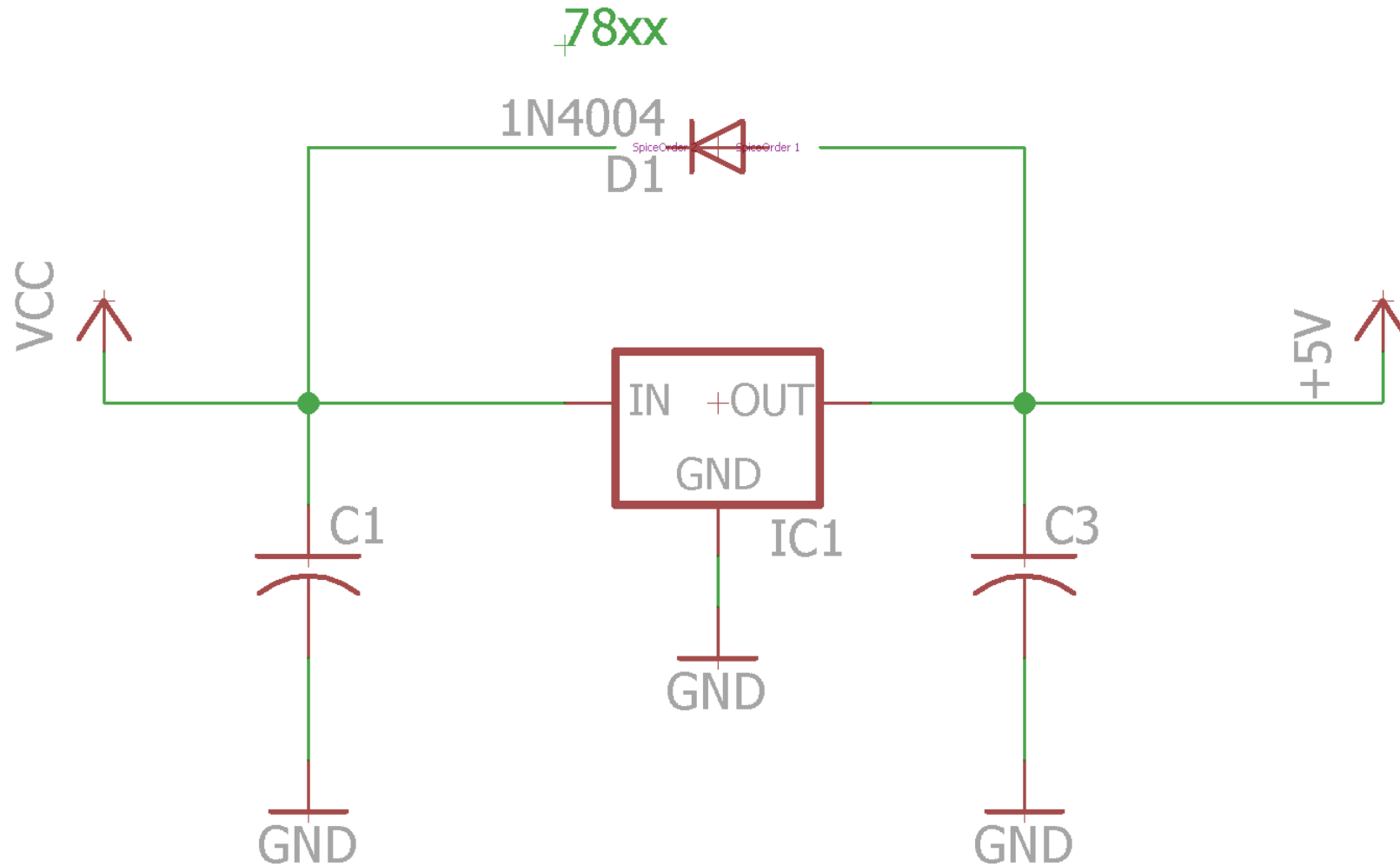


Figure 8. Fixed Output Regulator

What will actually keep working!



LT3086

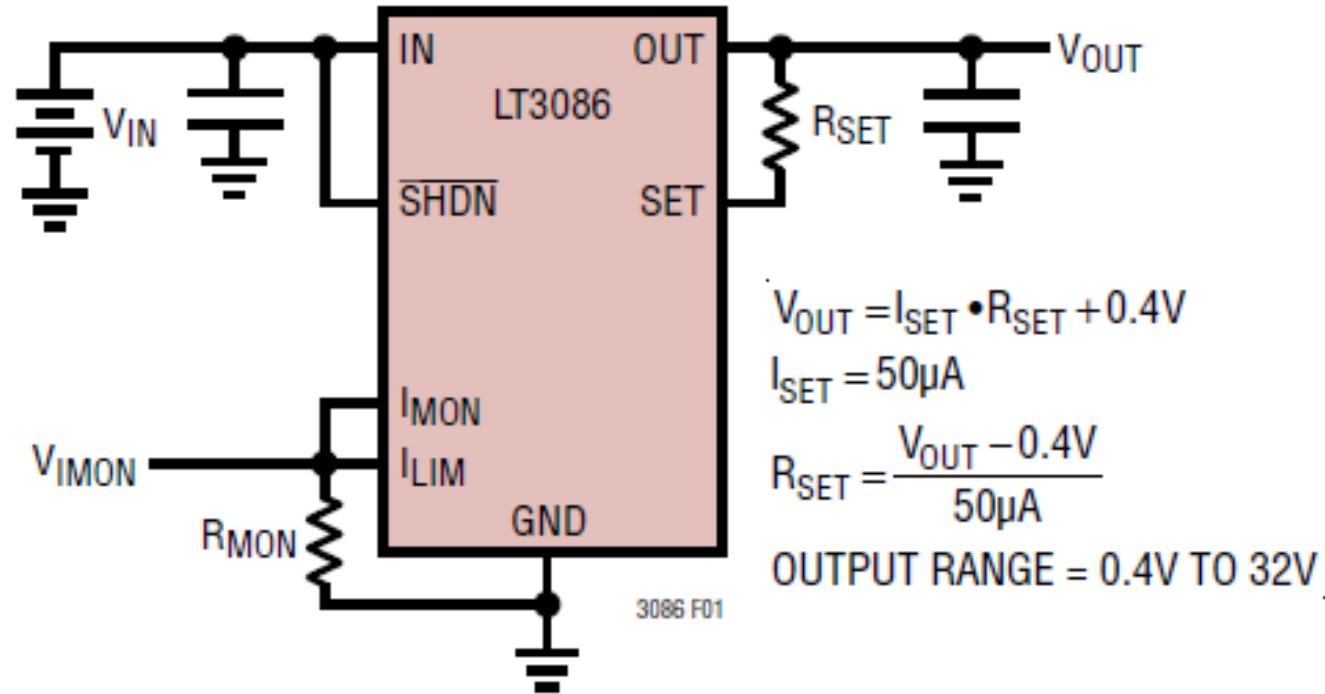
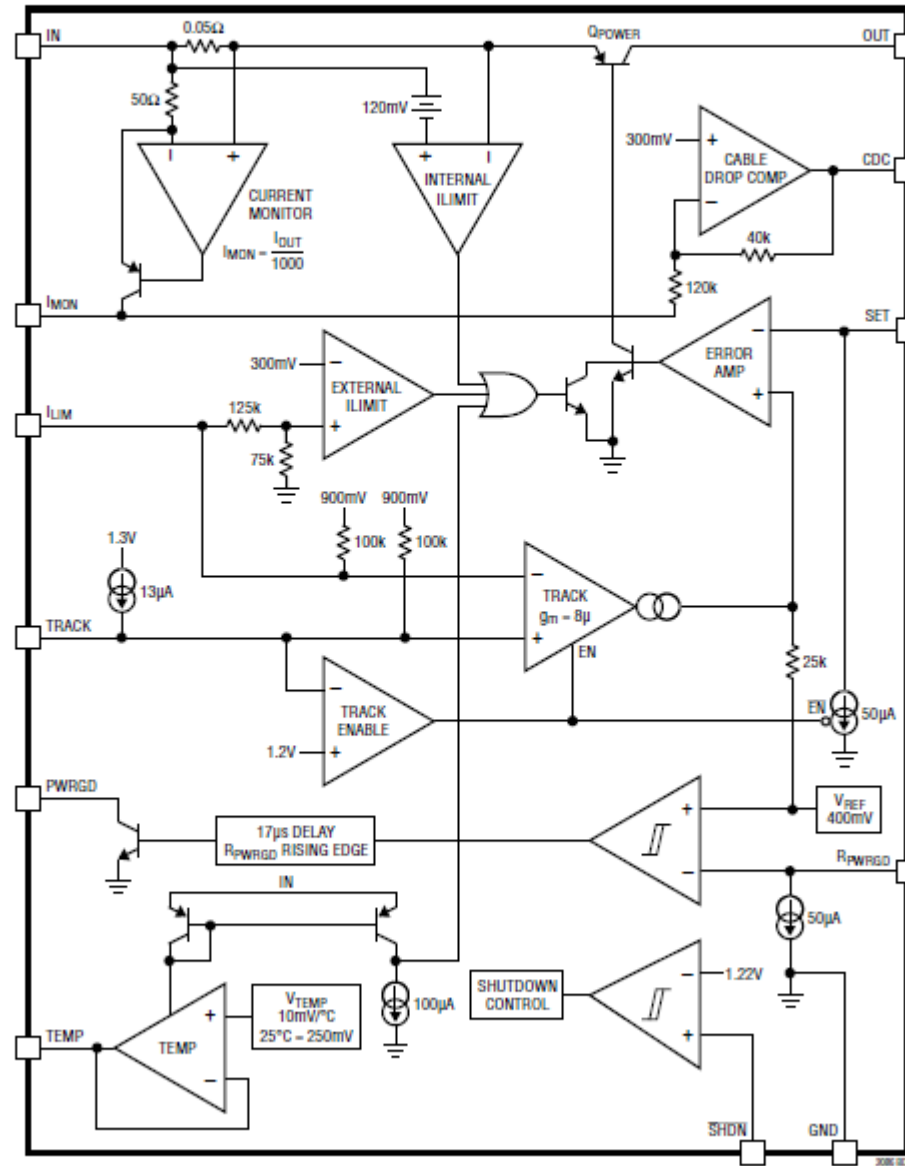


Figure 1. Programming Output Voltage

BLOCK DIAGRAM

LT3086



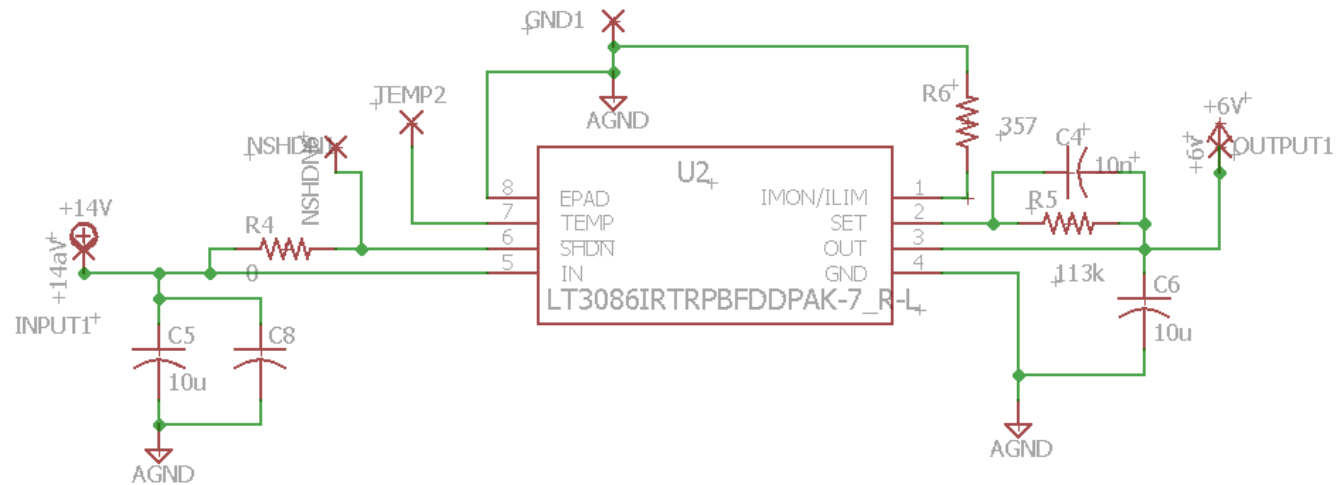
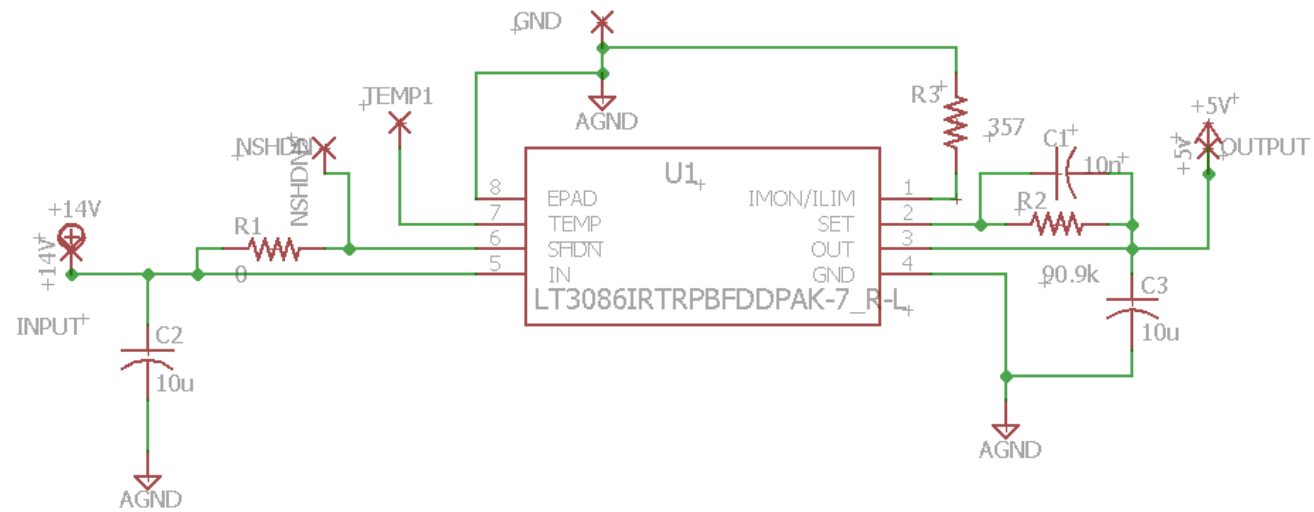
Need +5 and +6Volt Regulators

- Need +5 for PiZero
 - Programs ADF5355 in Python
- Need +6 for ADF5355 Frequency Synthesizer
- Layout the PCB in Eagle
 - No footprint or schematic part...
- Enter Ultra Librarian
 - Generates footprints for many layout tools, including Eagle and Kicad

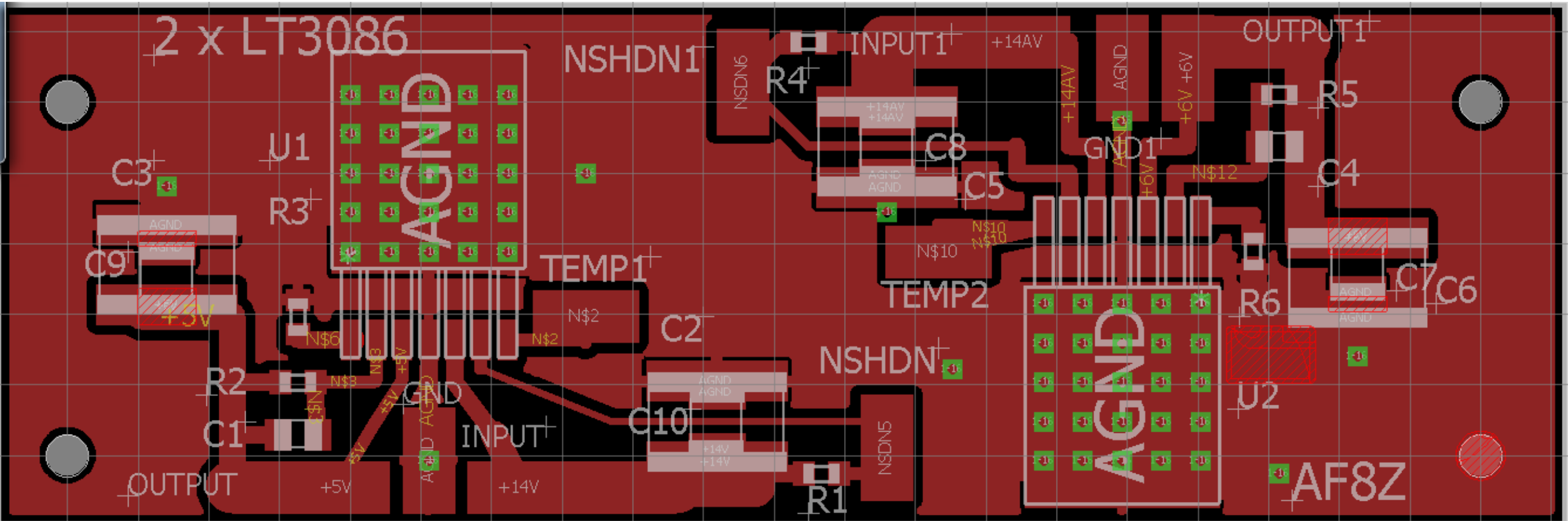
Ultra Librarian

- Installed the local file.
 - While you can make choices, if you do it may not work.
 - Creates a .scr file that Eagle can open. HIDES it in a directory with an undecipherable name. So you can't search for it.
 - Try `c:\UltraLibrarian\Library\Exported\gibberish.scr`
- Eagle then forces you to put it into its own library.
 - <Like you want a library for one part with one footprint.>s
- But I did get a part eventually!

Power Supplies



Board Layout



Design Notes

- Vias under LT3086 are for thermal conductivity.
- NSHDN are the not shutdown pins, to avoid using insert R4 and R1 which may be between 0 and 1K. Solder bridge would work.
- The input caps, C5,C8, C2,C10 need to be high enough voltage however only 1 is required. The layout works for 1206, 1210 or 3225. Suggest using X7R or Tantalum up to 50 V. 2x whatever you input voltage will be.
- C6, C7, C3, C9 are the same. A ceramic may give superior noise performance due to lower ESR.
- Output current will be limited by dissipation, this part will shut down if it gets too hot!
- No reverse protection diode needed up to 40 V.

Why the Thermal Vias?

- Copper Thermal Conductivity 401 W/(m*K)

- Solder SN63

SN63 50.9 W/(m*K)

SAC 96.5% Sn 57.26 W/(m*K)

FR4 1.7 W/(m*K)

FR408 0.4 W/(m*K)

Aluminum 240 W/(m*K) High strength alloys much worse.

Boards

- \$5/ sq inch from OshPark for 3 boards.
 - Dual layer
 - Purple Solder Mask
 - Takes Eagle Files directly
- They also do 4 layer boards.
 - \$10/sq inch.
- \$1/sq inch 2 layers, 100 sq inches
- <https://oshpark.com>