Thermal Imaging HUD

Block Diagram

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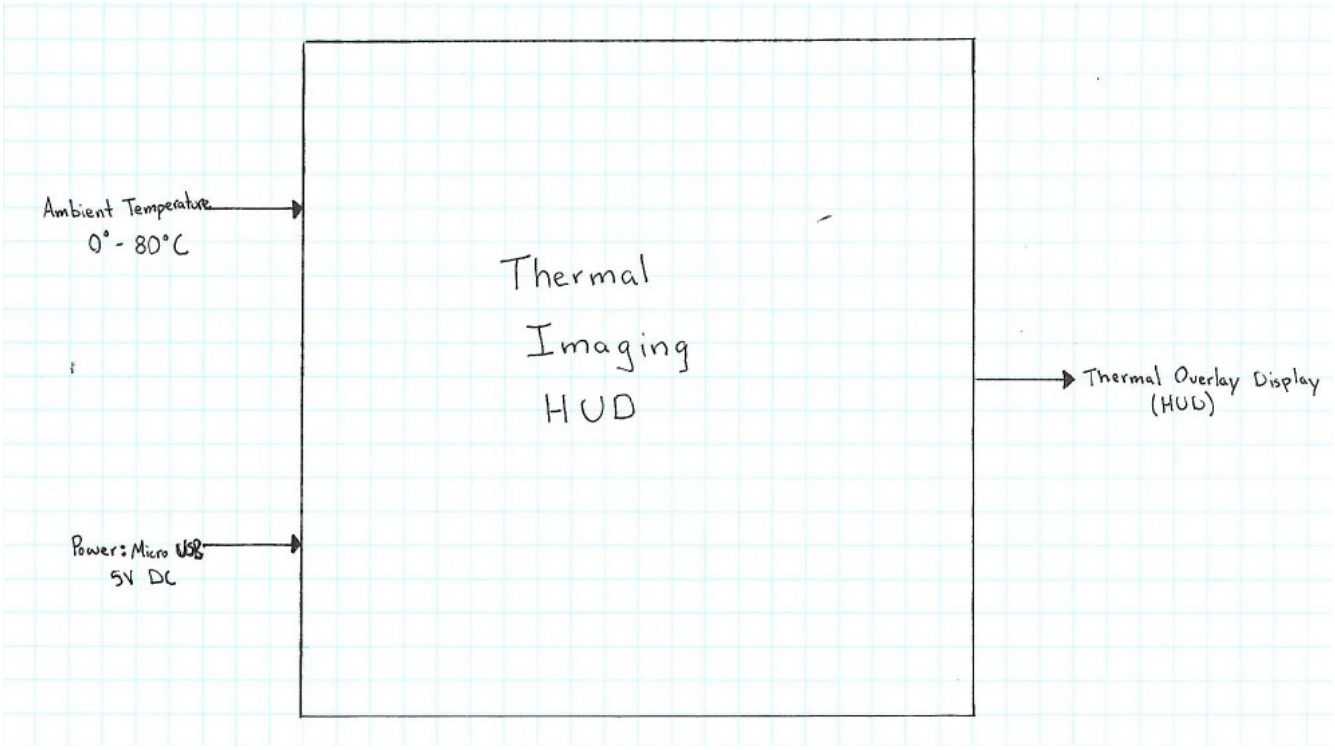
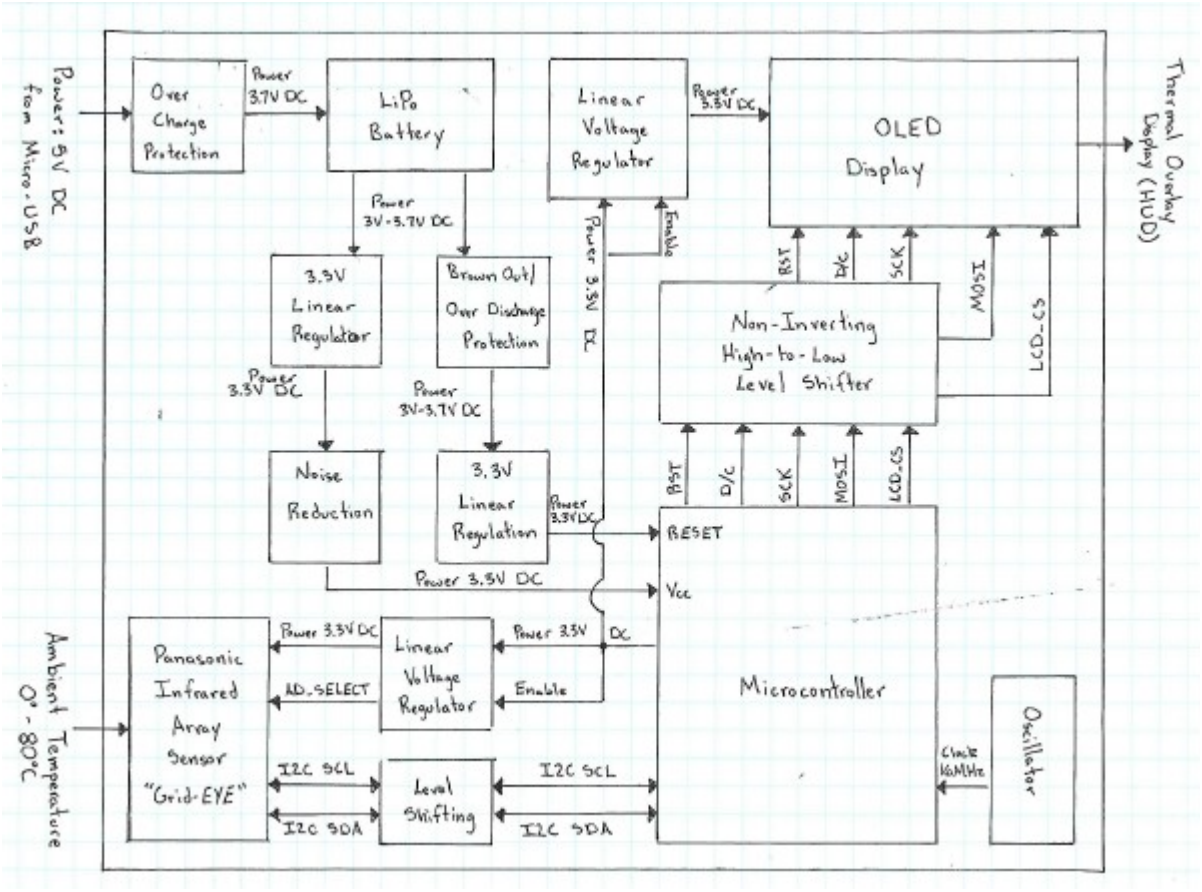
Thermal Imaging HUD: Level 0

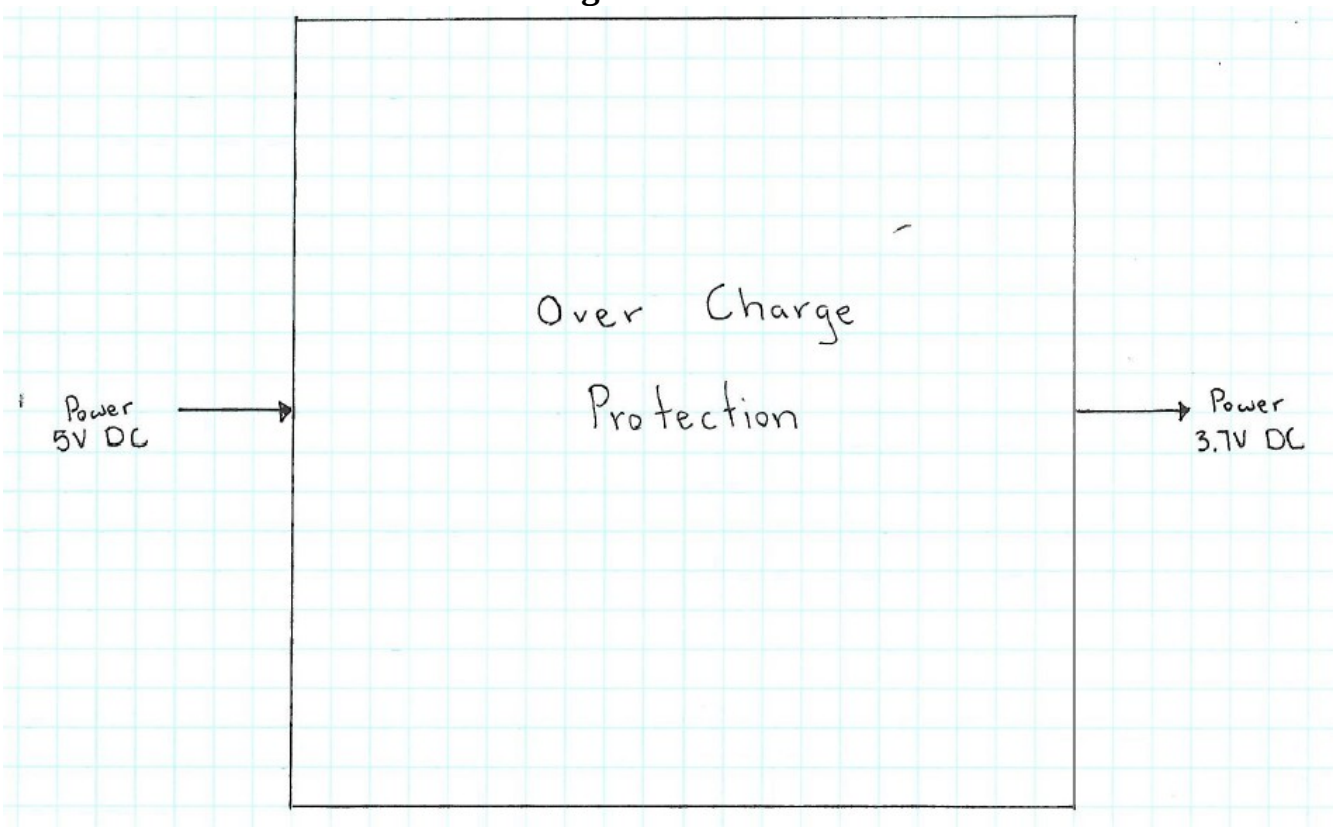


Module	Thermal Imaging HUD
Inputs	• Ambient temperature between 0º – 80ºC • Power: Micro-USB 5V DC
Outputs	• Thermal Overlay Displays (HUD)
Functionality	Measure a matrix of ambient temperature between 0º – 80ºC with an accuracy of +/-2.5ºC. Then process the ambient temperature data and transmit via I2C communication. The microcontroller executes an image processing algorithm to extrapolate to a large more displayable matrix. Then transfer the data via SPI communication to the OLED display. The image is then optically transmitted through a glass lenses to the heads up display.

Thermal Imaging HUD: Level 1

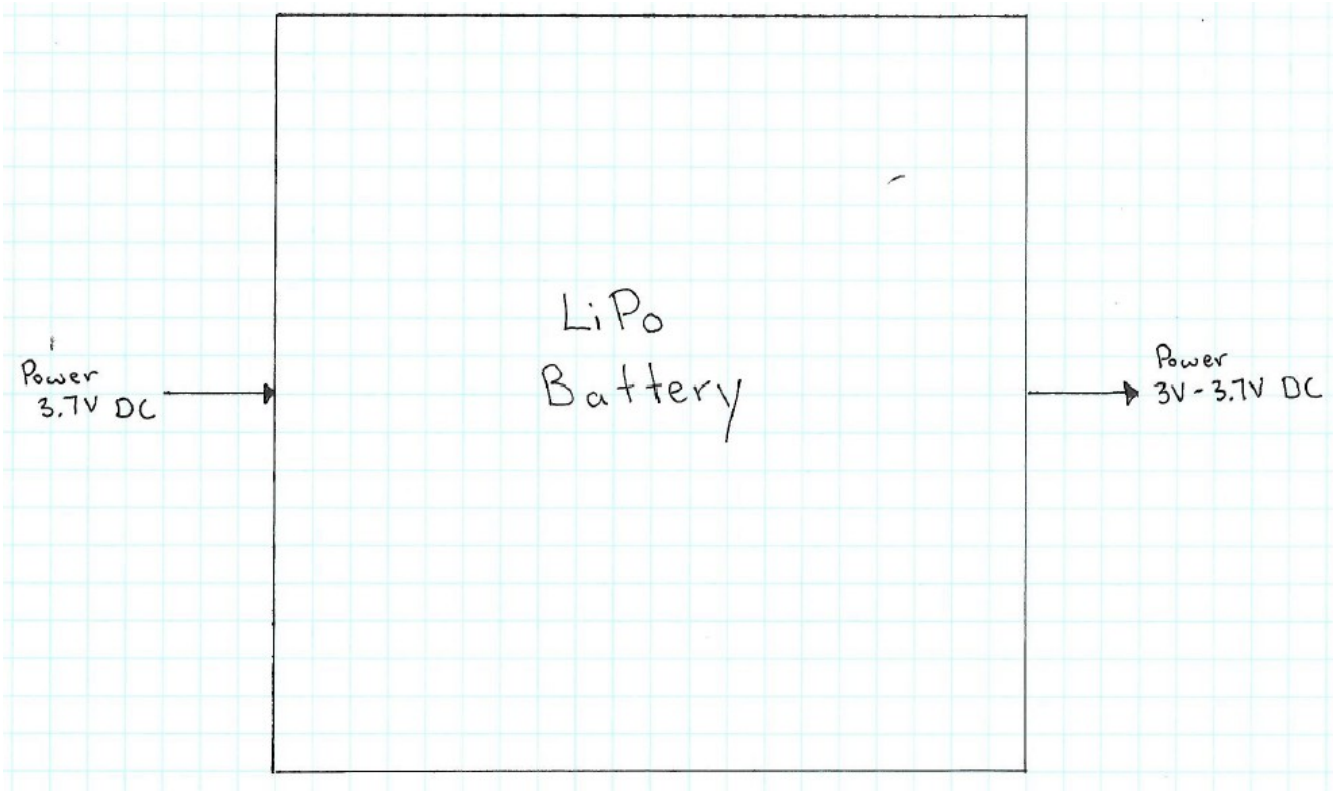


Over Charge Protection: Level 0



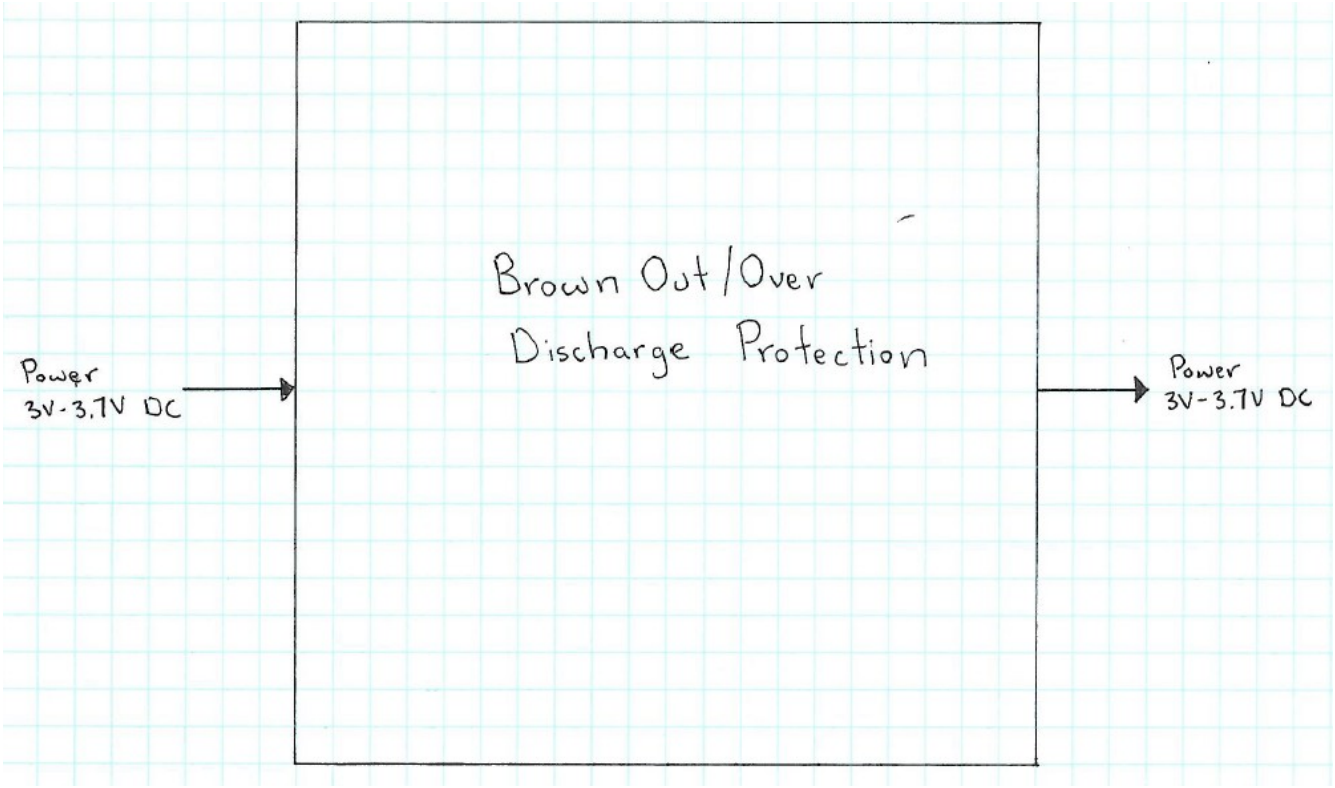
Module	Over Charge Protection
Inputs	• Power: 5V DC from the micro-USB
Outputs	• Power: 3.7V DC
Functionality	To prevent the LiPo battery from charging more than 3.7V DC. Prevent the explosion/damage of the LiPo battery.

LiPo Battery: Level 0



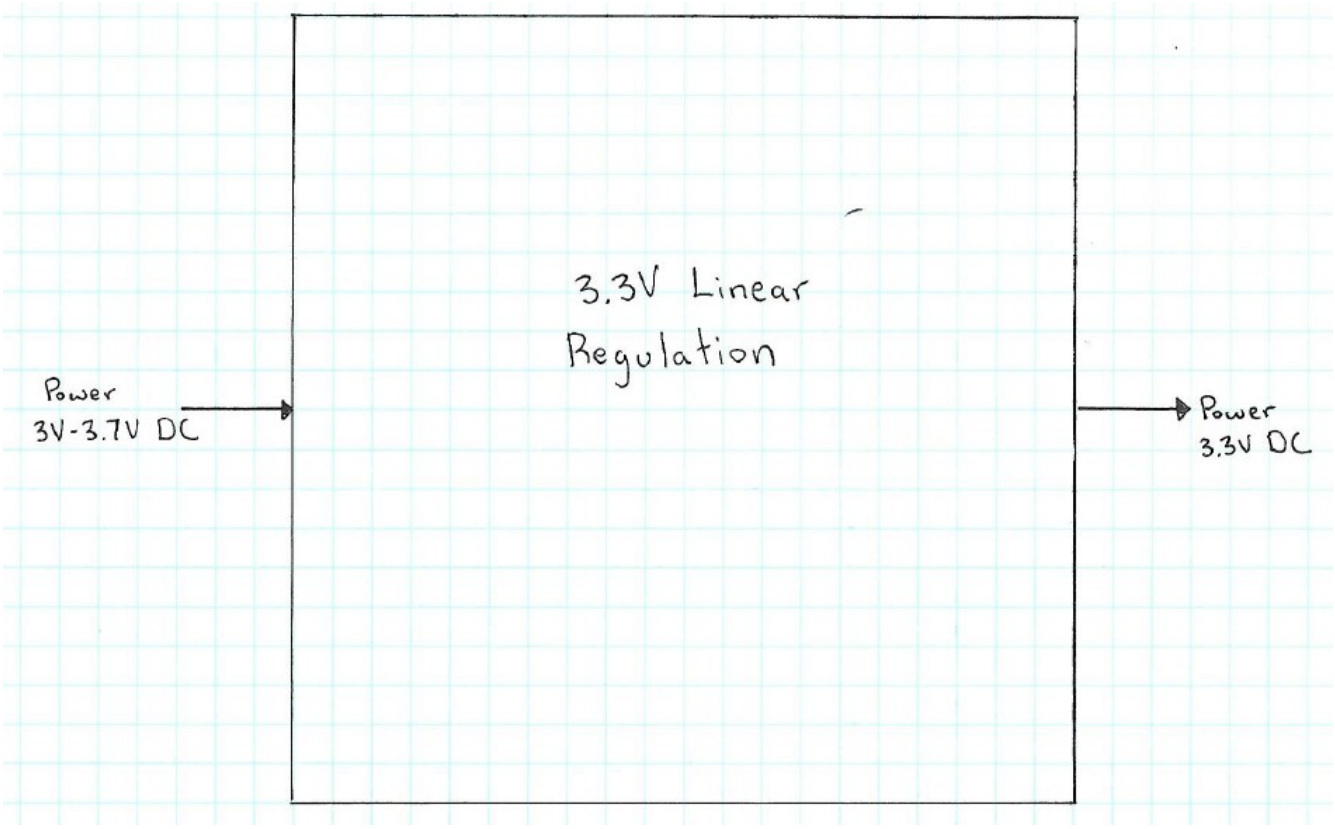
Module	LiPo Battery
Inputs	• Power: 3.7V DC from the over charge protection
Outputs	• Power: 3V – 3.7V DC
Functionality	To provide portable power to the circuit

Brown Out/Over Discharge Protection: Level 0



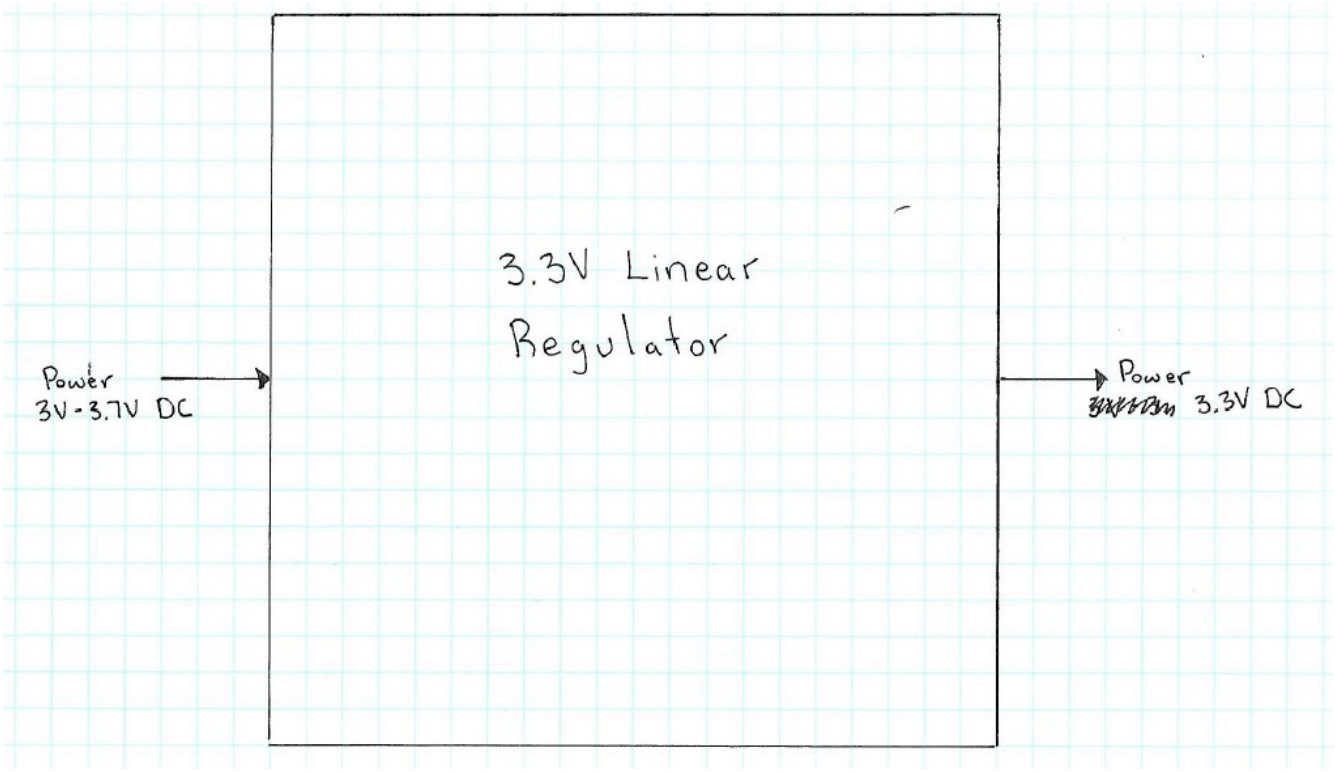
Module	Brown Out/Over Discharge Protection
Inputs	• Power: 3V – 3.7V DC from the LiPo battery
Outputs	• Power: 3V – 3.7V DC with undercurrent protection
Functionality	To protect the LiOp battery form over discharging.

3.3V Linear Regulation: Level 0



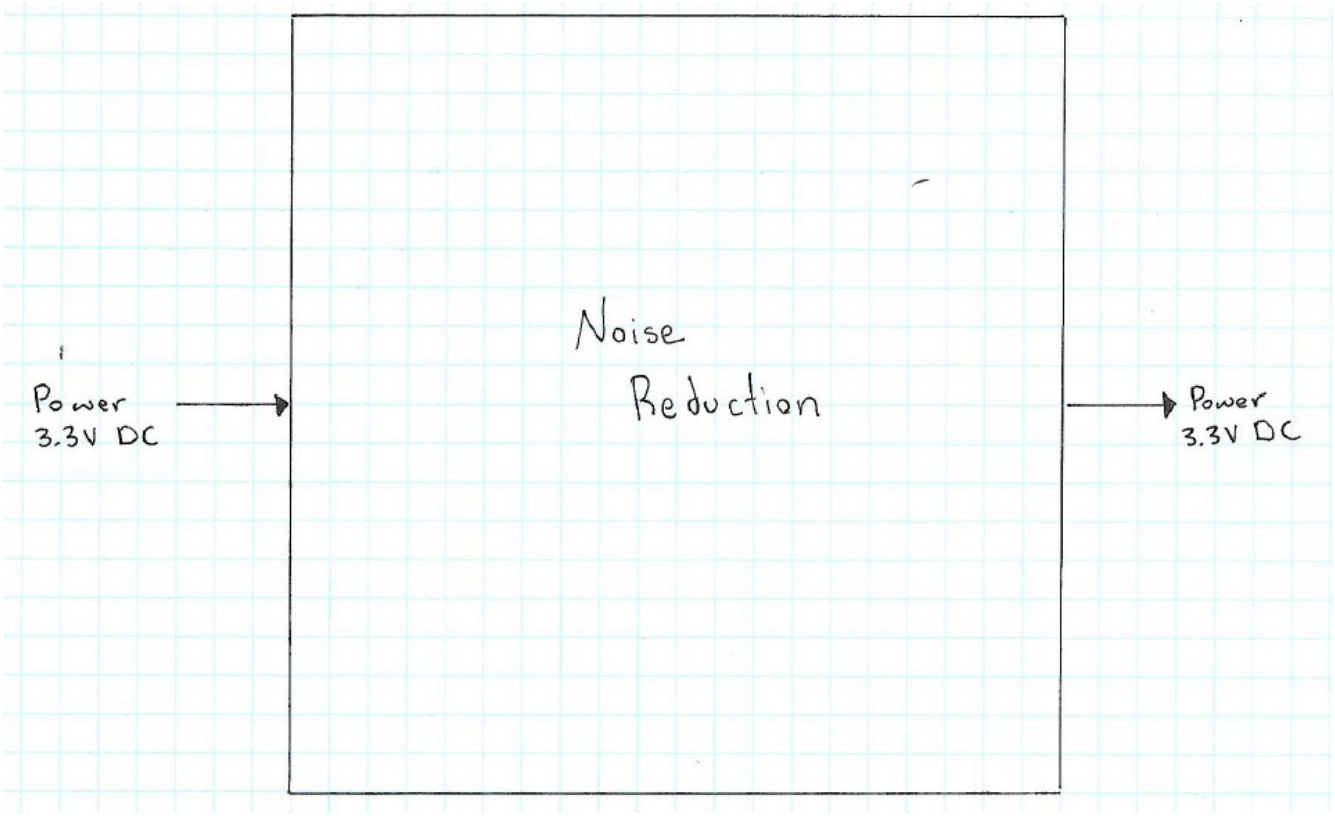
Module	3.3V Linear Regulation
Inputs	• Power: 3V – 3.7V DC from LiPo battery through the brown out/over discharge protection.
Outputs	• Power: 3.3V DC
Functionality	Takes the voltage provided by the LiPo battery to provide a 3.3V DC Reset logic of the mircocontroller.

3.3V Linear Regulator: Level 0



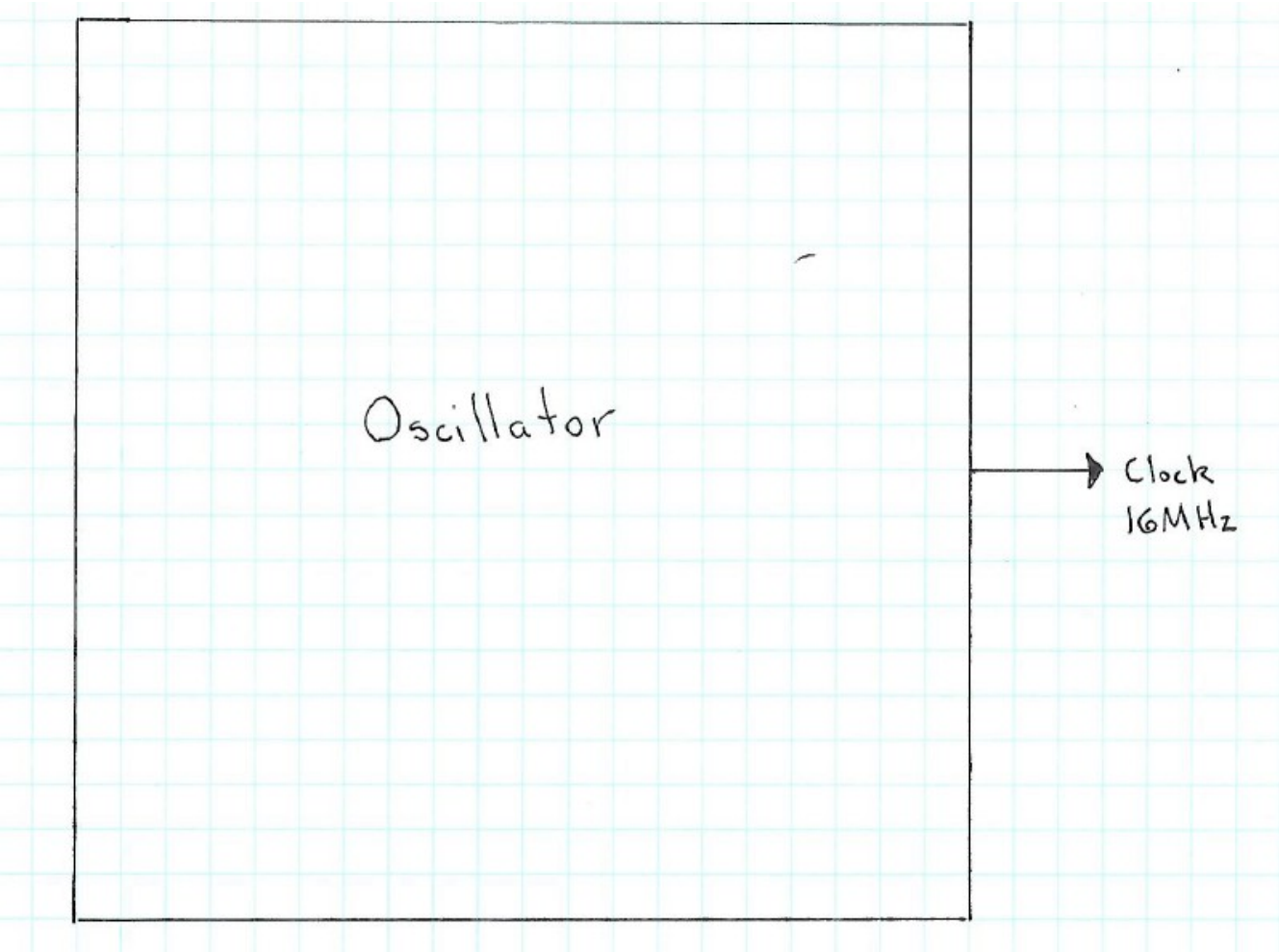
Module	3.3V Linear Regulator
Inputs	• Power: 3V – 3.7V DC from the LiPo battery
Outputs	• Power: 3.3V DC
Functionality	Takes the voltage provided by the LiPo battery to provide a 3.3V DC Vcc for the mircocontroller.

Noise Reduction: Level 0



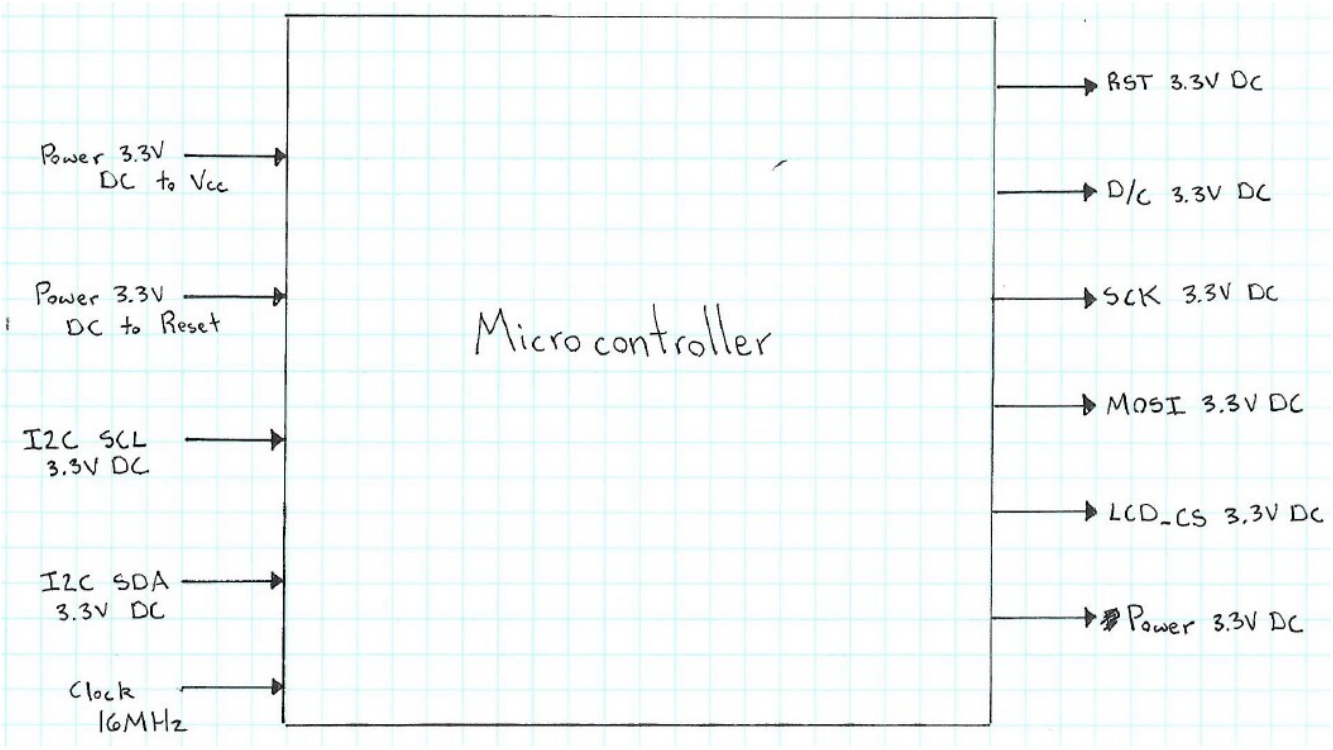
Module	Noise Reduction
Inputs	• Power: 3.3V DC from the voltage regulator
Outputs	• Power: 3.3V DC less noise
Functionality	Reducing electric noise from the ground plan using ferrite beads

Oscillator: Level 0



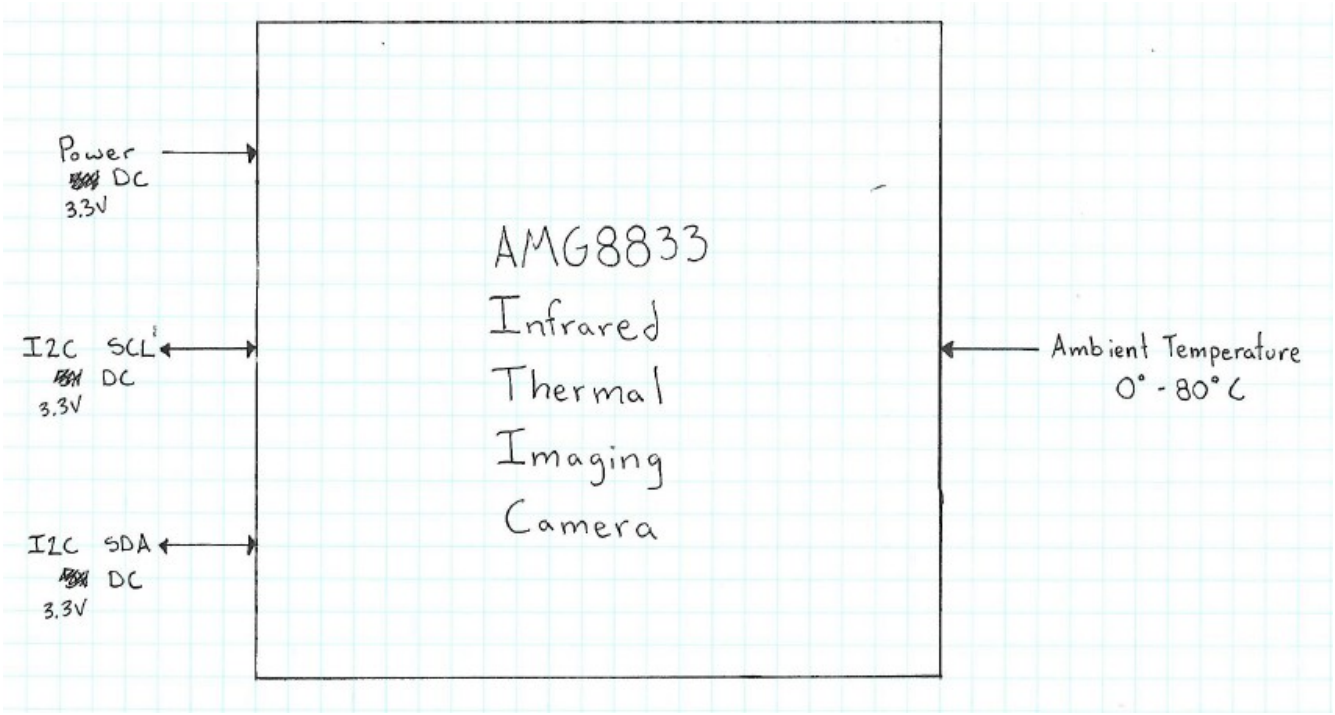
Module	Oscillator
Inputs	• None
Outputs	• Clock: 16MHz
Functionality	Sends the mircocontroller a 16MHz clock pulse.

Microcontroller: Level 0



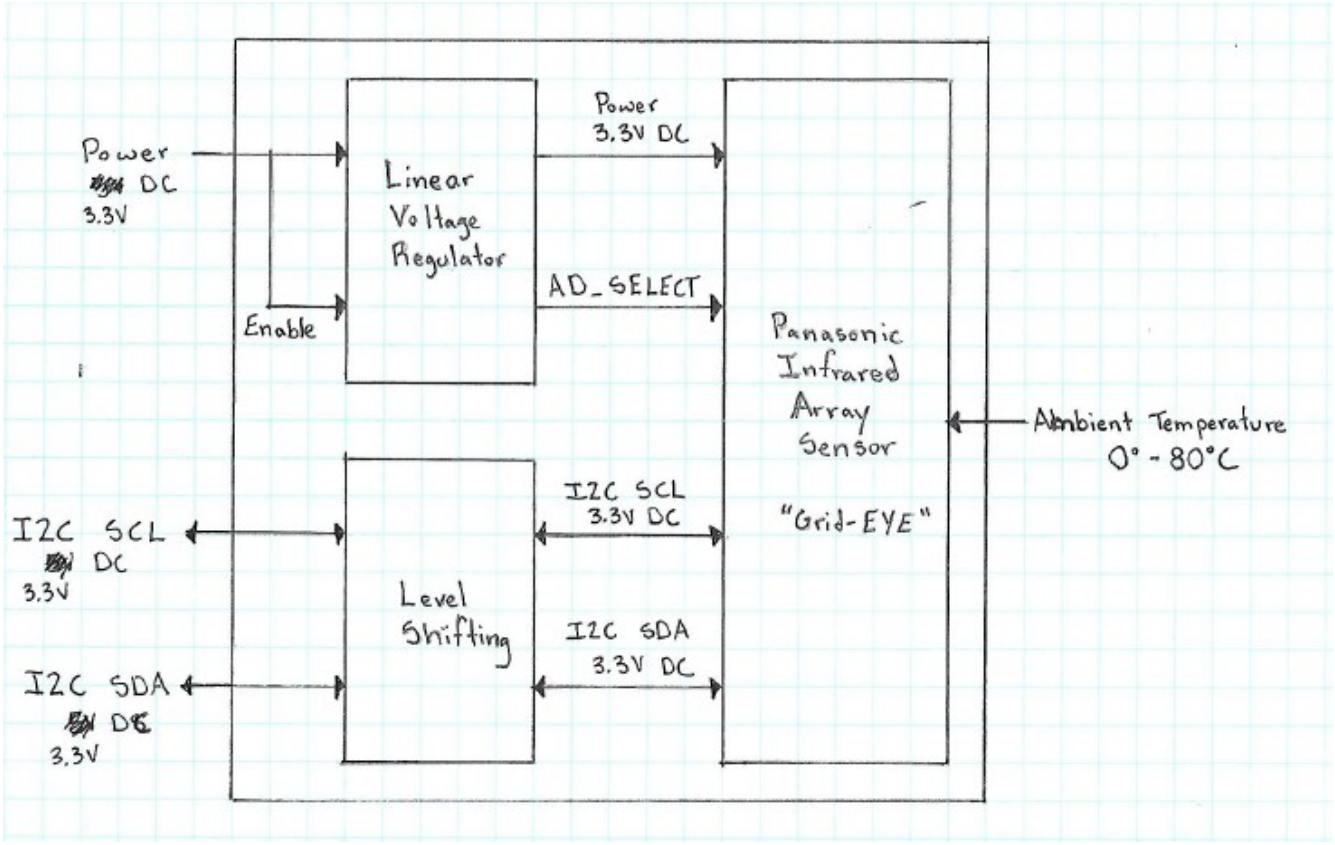
Module	Microcontroller
Inputs	• Power: 3.3V DC to Vcc and AVcc • Power: 3.3V DC to reset and once the voltage falls below 3.3V reset becomes active • I2C SCL: I2C serial clock line 3.3V DC bidirectional communication • I2C SDA: I2C serial data line 3.3V DC bidirectional communication • Clock: 16Mhz
Outputs	• Power: 3.3V DC • RST: 3.3V DC signal used to reset OLED display • D/C: 3.3V DC • SCK: 3.3V DC SPI clock line • MOSI: 3.3V DC SPI master out/slave in • LCD_CS: 3.3V DC signal to select the OLED display
Functionality	Translate the I2C data to SPI output data with an intermediate step of extrapolating the input 8x8 image matrix to a larger output image matrix.

AMG8833 Infrared Thermal Imaging Camera: Level 0

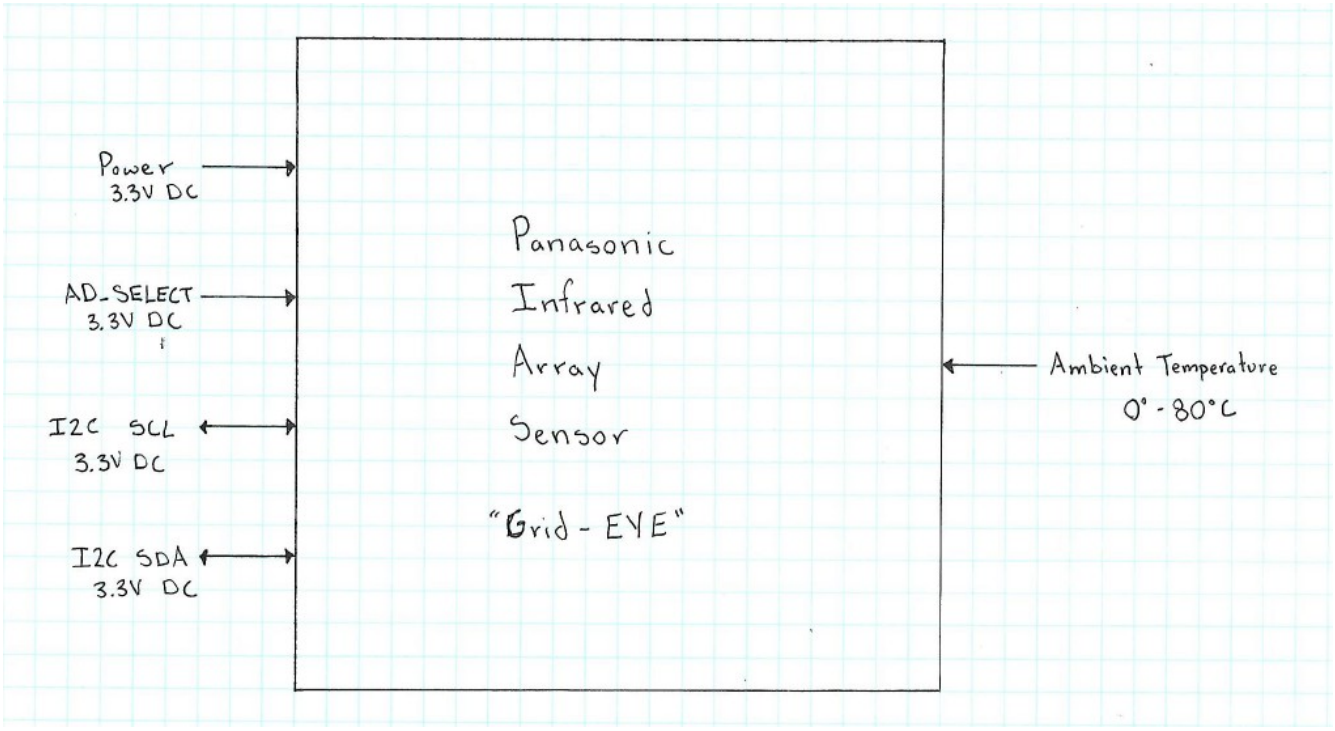


Module	AMG8833
Inputs	• Ambient temperature from 0º to 80ºC • I2C SCL: to receive master requests • I2C SDA: to receive master requests • Power: 3.3V DC
Outputs	• I2C SCL: to transmit ambient temperature to master • I2C SDA: to transmit ambient temperature to master
Functionality	Return an array of 64 (8x8) individual infrared temperature readings with an accuracy of +/- 2.5ºC via I2C when requested by master device.

AMG8833 Infrared Thermal Imaging Camera: Level 1

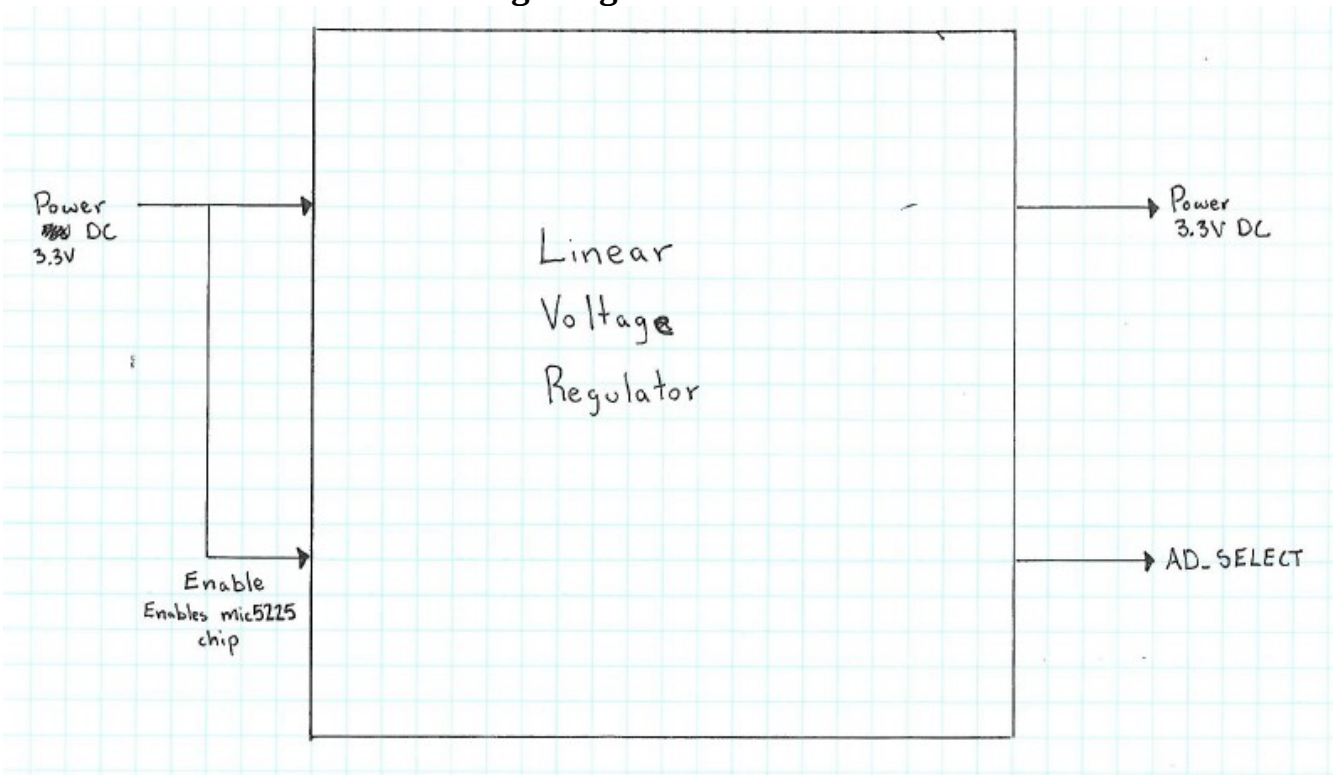


Panasonic Infrared Array Sensor: Level 0



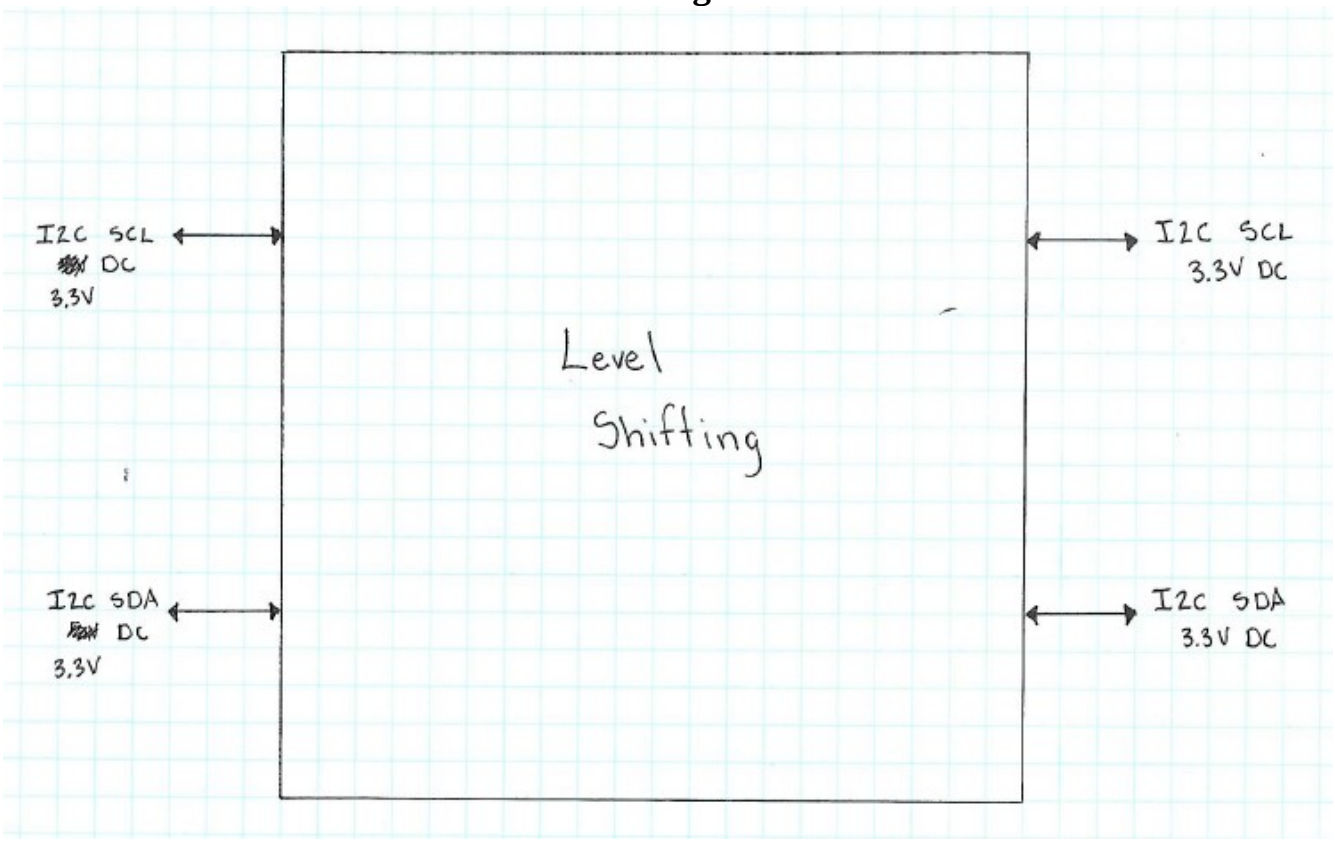
Module	Panasonic Infrared Array Sensor "Grid-EYE"
Inputs	• Ambient temperature from 0º to 80ºC • I2C SCL: 3.3V DC • I2C SDA 3.3V DC • AD_SELECT: configurable slave address of the device • Power: 3.3V DC
Outputs	• I2C SCL: 3.3V DC • I2C SDA: 3.3V DC
Functionality	Return an array of 64 (8x8) individual infrared temperature readings via I2C when requested by master device. Control registers can be programmed by the master.

Linear Voltage Regulator AMG8833: Level 0



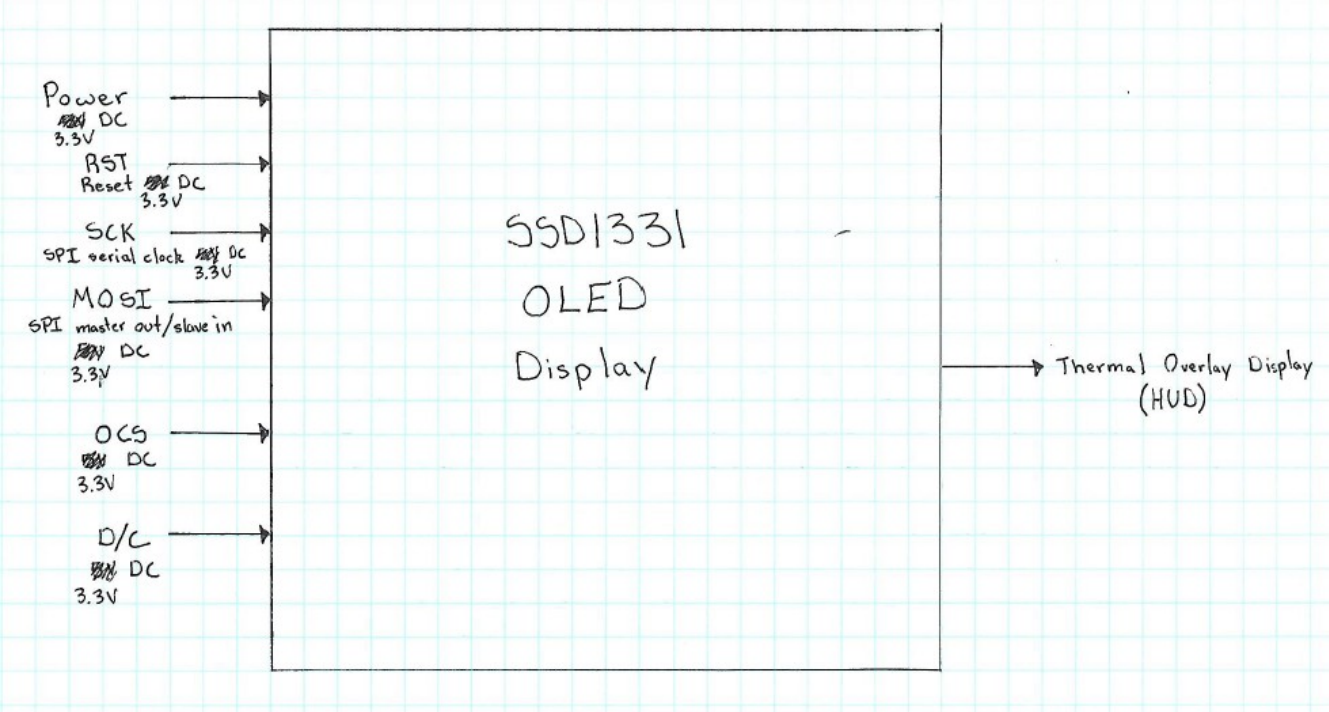
Module	Linear Voltage Regulator
Inputs	• Power: 3.3V DC • Enable: to enable the mic5225-3.3V chip (tied to power)
Outputs	• Power: 3.3V DC • AD_SELECT: configurable slave address of the device
Functionality	Regulated power supply that produces 3.3V DC using the mic5225-3.3V chip and an input voltage of 3.3V DC.

Level Shifting: Level 0



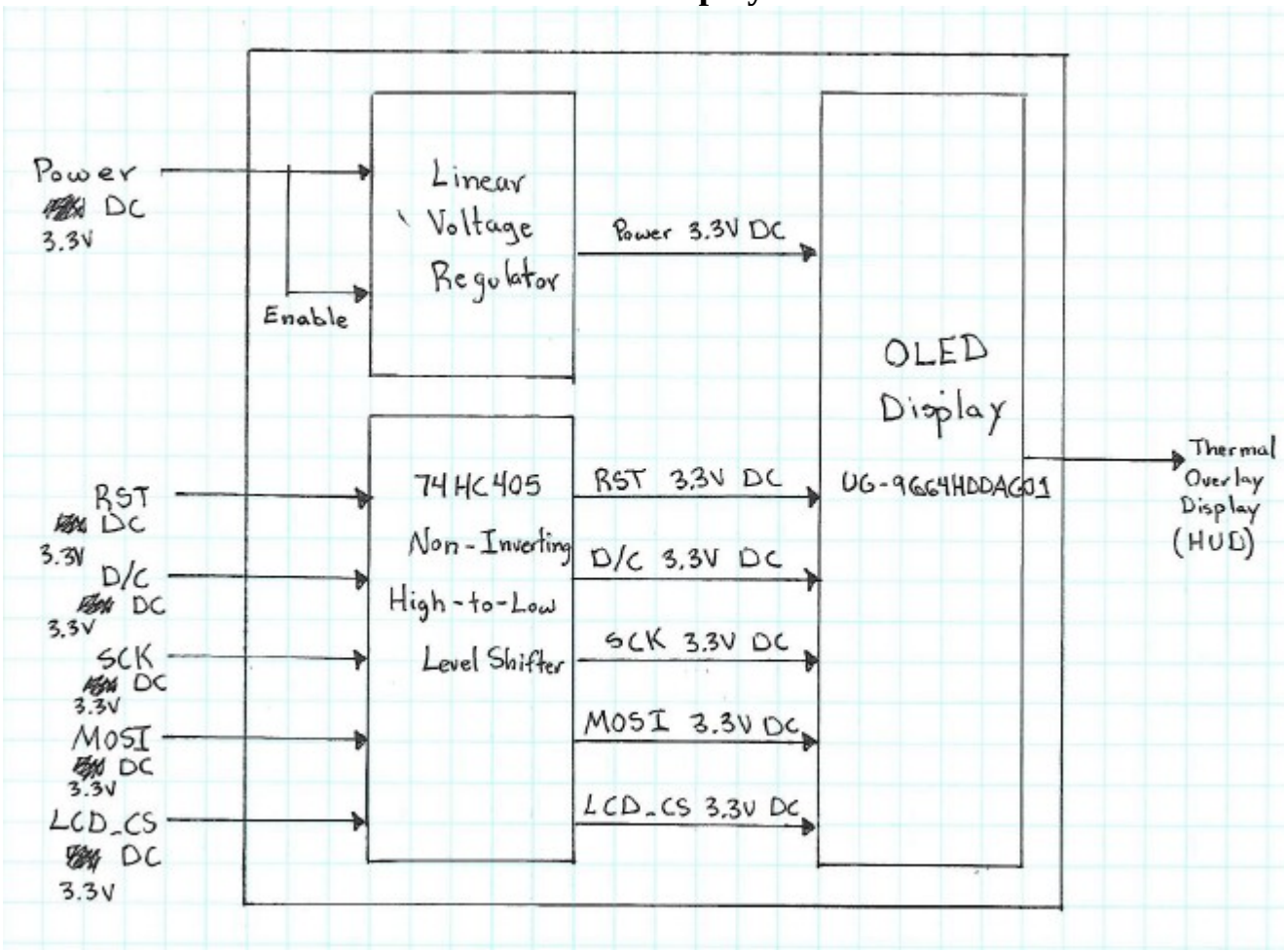
Module	Level Shifting
Inputs	• Power: 3.3V DC I2C SCL signal • Power: 3.3V DC I2C SDA signal
Outputs	• Power: 3.3 DC I2C SCL signal • Power: 3.3 DC I2C SDA signal
Functionality	Shifts the voltage level of the I2C communication signal form 3.3V DC to 3.3V DC using two BSS138 MOSEFTs.

SSD1331 OLED Display: Level 0

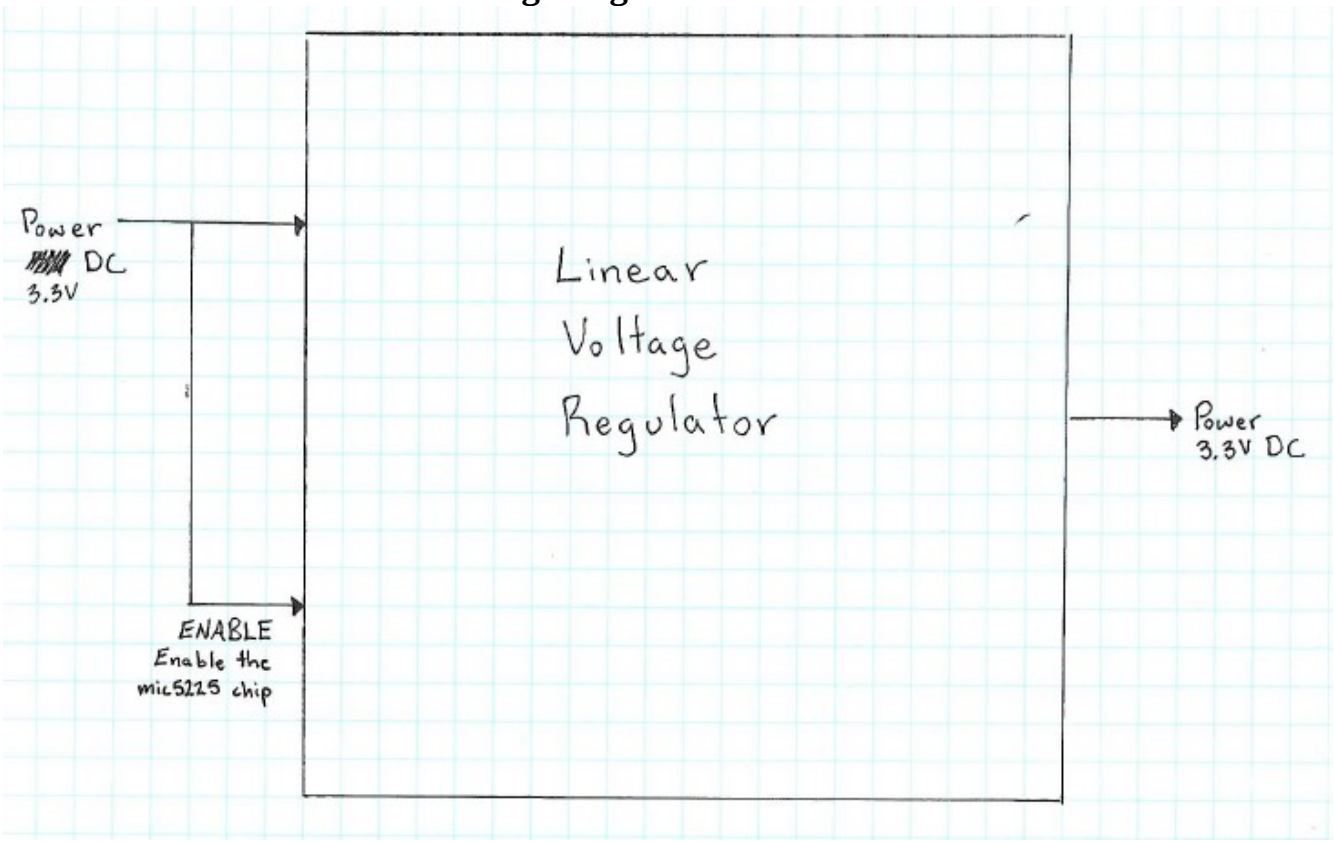


Module	SSD1331 OLED display
Inputs	• RST: Reset • SCK: SPI serial clock • MOSI: SPI master out/slave in • OCS: OLED chip select • D/C: Data command controll • Power: 3.3V DC
Outputs	• Display the array of individual ambient temperature in with colors to represent the temperature of the current pixel.
Functionality	Displays the transformed ambient temperature array of 64 individual pixels data to OLED display via SPI communication from the processor.

SSD1331 OLED Display: Level 1

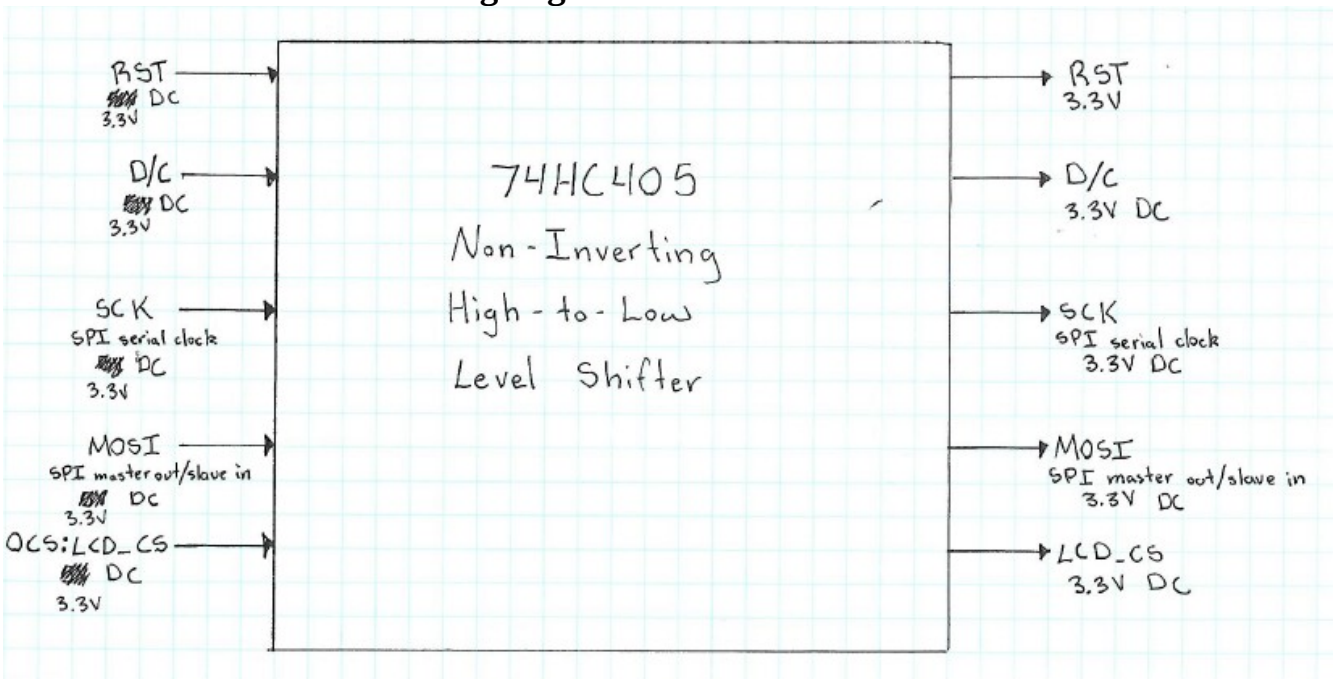


Linear Voltage Regulator SSD1331: Level 0



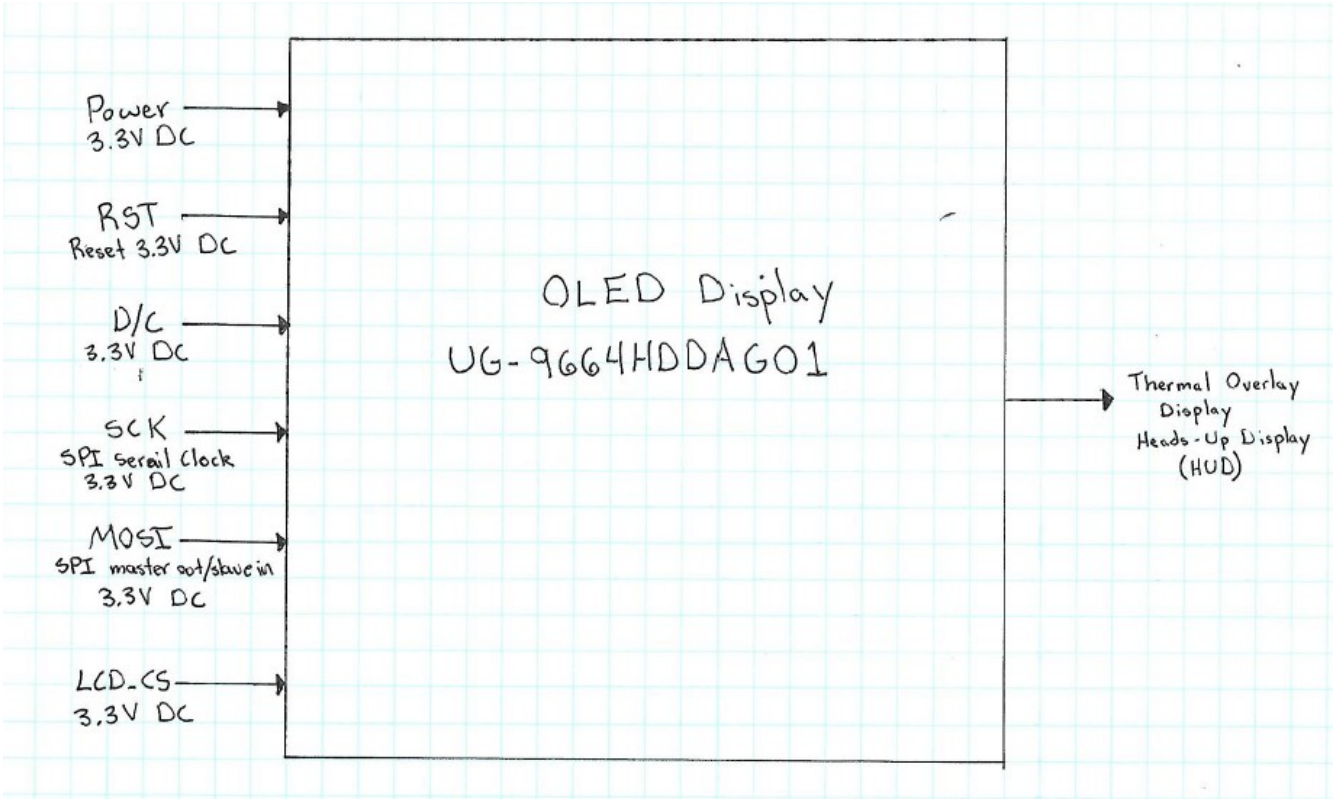
Module	Linear Voltage Regulator
Inputs	• Power: 3.3V DC • Enable: to enable the mic5225-3.3V chip (tied to power)
Outputs	• Power: 3.3V DC
Functionality	Regulated power supply that produces 3.3V DC using the mic5225-3.3V chip and an input voltage of 3.3V DC.

Non-Inverting High-to-Low Level Shifter: Level 0



Module	74HC4050 Non-Inverting High-to-Low Level Shifter
Inputs	• RST: reset 3.3V DC • SCK: SPI serial clock 3.3V DC • MOSI: SPI master out/slave in 3.3V DC • LCD_CS: OLED chip select 3.3V DC • DC: Data command control 3,3V DC
Outputs	• RST: reset 3.3V DC • SCK: SPI serial clock 3.3V DC • MOSI: SPI master out/slave in 3.3V DC • LCD_CS: OLED Chip select 3.3V DC • DC: Data command control 3.3V DC
Functionality	Shifts the voltage levels of the inputs from high voltage (3.3V DC) to low voltage (3.3V DC).

OLED LCD Display: Level 0



Module	OLED Display UG-9664HDDAG01
Inputs	• RST: reset 3.3V DC • SCK: SPI serial clock 3.3V DC • MOSI: SPI master out/slave in 3.3V DC • LCD_CS: OLED Chip select 3.3V DC • DC: Data command control 3.3V DC • Power: 3.3V DC
Outputs	• Thermal Overlay Display HUD
Functionality	Displays the transformed thermal imaging data to the OLED Display. The image is then propagated through the mirror to the HUD.