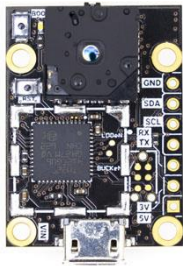
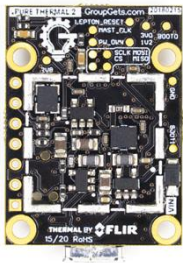


GroupGets PureThermal 2

FLIR Lepton® Smart I/O Module



The PureThermal 2 FLIR Lepton Smart I/O Module is a hackable thermal webcam module for the FLIR Lepton Longwave Infrared (LWIR) camera core. It ships pre-configured to operate as a plug-and-play UVC 1.0 USB thermal webcam that will work with standard webcam apps such as VLC Media Player on PC, Linux, Mac, and Android.



For developers, its reference firmware and hardware schematic are open source for customized applications. We have also created an open source software application, [GetThermal](#), to view Lepton data on x86 Linux and macOS platforms. For computers using a Microsoft Windows OS you can use the [FLIR Lepton User App](#) on the Lepton Getting Started page under the Downloads section. GetThermal as well as the FLIR Lepton User App with a PureThermal 2 (PT2) both support the *radiometric* mode of Lepton 2.5 & 3.5. Stay up to date with resources, video, and software for PT2 at its [resource page](#).

FEATURES

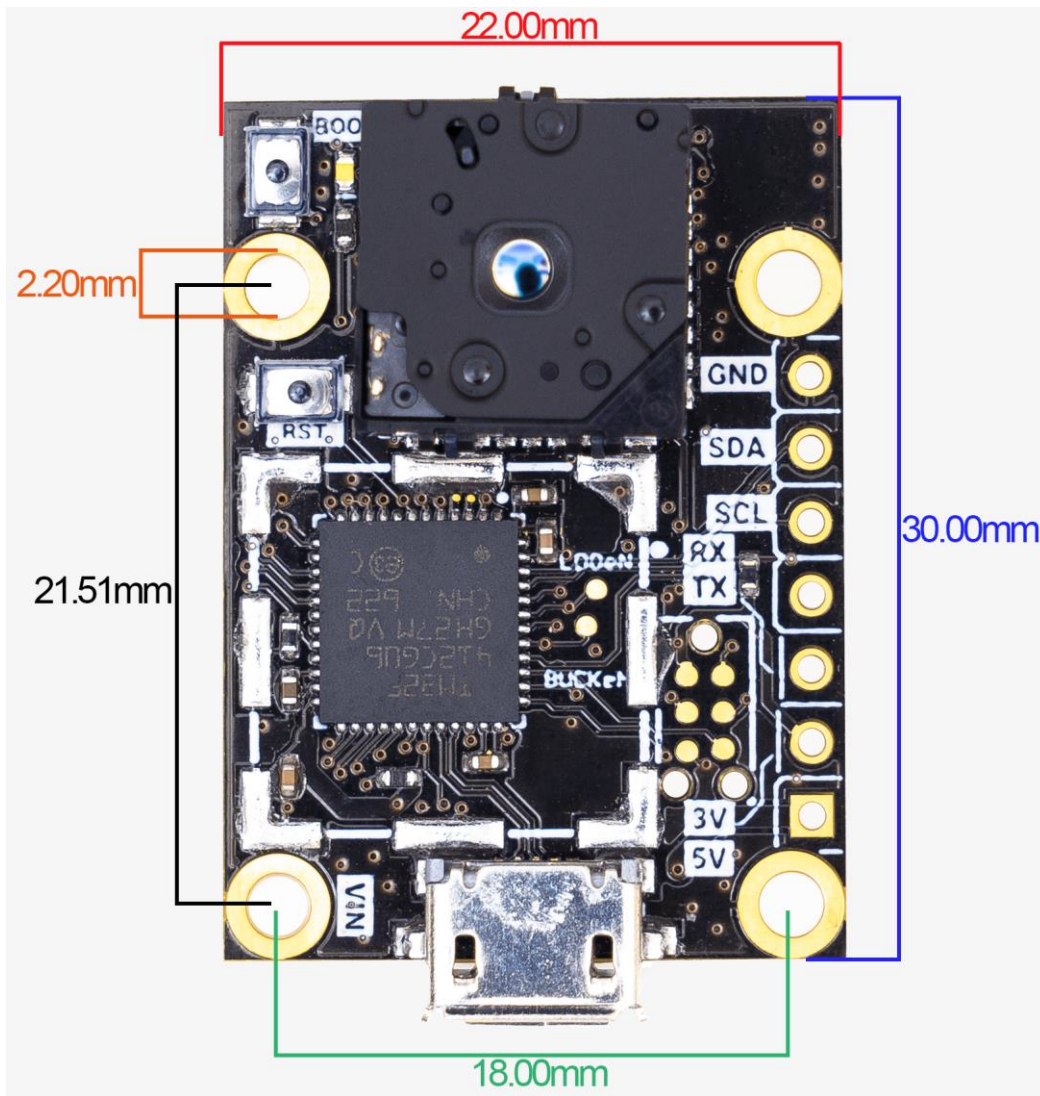
- Get Thermal video over USB right out of the box using freeware apps like VLC on Mac, Linux, Windows, or Android
- PT2 can do 9 Hz color video over usb using the [USB UVC class](#)
- STM32F412 ARM microprocessor. Execute on-board image processing without the need for an external system
- Through-holes for GPIO and peripheral breakouts to easily attach other devices
- Open source reference firmware is on the [GroupGets Github](#)
- Device Firmware Upgrade (DFU) the STM32 ARM MCU over USB
- Debug via JTAG through a 6-Pin plug-of-Nails port using a Tag-Connect TC2030-IDC-NL, an ARM20-CTX, & ST-Link V/2.
- Powered via USB
- UART, I2C, and GPIO Expansion via standard 0.1" holes
- Compatible with all current 2.x and 3.x Lepton cores
- Compact 30 x 18mm form-factor that can be embedded into other modules or inconspicuously housed as a standalone web, research, or security camera

APPLICATIONS

- Thermal Imaging
- Non-contact temperature measurements
- Motion Sensing
- Night Vision
- Gesture Recognition

PureThermal 2 Specifications

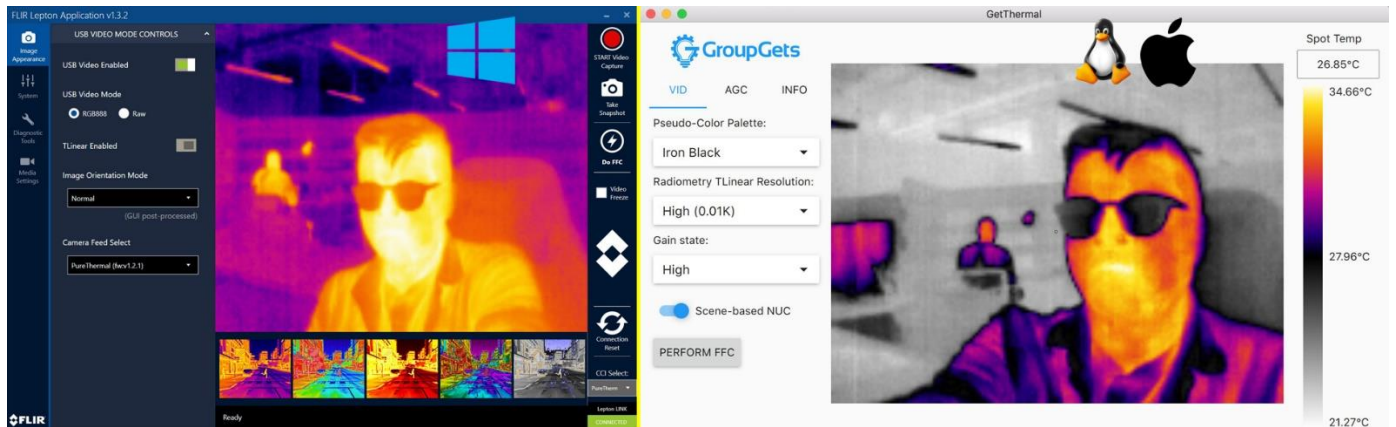
Power Inputs	Micro USB
Maximum Input Voltage (LiPo/H1)	5.5v
Lepton Core Support	Lepton 2.x and 3.x
Expansion	I2C, UART, GPIO, JTAG
Processor	STM32F412 (1M Flash, 512K RAM)
Thermal Video Outputs	UVC over USB
PureThermal 2 Part Number	PURETHERMAL-2
RoHS Compliant	Yes



Power Characteristics

	PureThermal 2		PureThermal Mini & Pro JST	
	No Lepton	W/ Lepton	No Lepton	W/ Lepton
	24.8	61.5	24	63
	24.5	60.7	23.9	62.5
	24.8	60.7	24	62.2
	24.4	61.5	23.8	62.7
Average	24.625	61.1	23.925	62.6
MIN	24.4	60.7	23.8	62.2
MAX	24.8	61.5	24	63
Shutter				
	Peak (mA)		Rise Time (μ S)	
	230 \pm 15mA		160	

Application Information



Compatible applications include:

- [FLIR Lepton Application](#) for Windows (above image on left).
- [GetThermal](#) for Mac OS and Linux (above image on right).
- VLC, and many other video players.

UVC-Capture Examples

The PureThermal FLIR Lepton development board by GroupGets supports the USB video class (UVC), and this makes it very easy to capture thermal imaging data from a host PC using standard tools and libraries. If you want to prototype quickly, your application demands increasing processing power, or you simply don't want to hack on the firmware, check out these examples to get started.

For more information see our purethermal1-uv-capture examples GitHub repository: <https://github.com/groupgets/purethermal1-uv-capture>

FLIR Lepton Windows SDK

SDK for Windows 10 is provided below. The FLIR Windows Lepton Software Development Kit (SDK) is a software package that you'll include in your project. It is a .NET library for communication over the UVC protocol. These commands allow you to execute commands, pull serial number information, and other useful functions of the camera component. Make sure to visit the Get Started Guide to learn to effectively use the SDK.

<https://lepton.flir.com/sdk/>

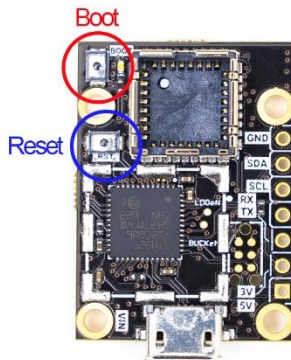
Programming PureThermal 2

You can program the PureThermal 2 over USB in DFU-Mode.

If you're not compiling from source you can download the firmware from [our PureThermal Firmware releases section here](#) and substitute the .bin file in the .tgz for main.bin in the commands below.

Entering bootloader (DFU) mode

1. Locate the buttons to press on your PureThermal board.



2. Press and hold the BOOT button
3. Without releasing BOOT, press and release RST
4. Release BOOT
5. When you successfully enter DFU mode, the indicator LED will stop blinking and dim to half brightness

Linux / MacOS Flashing

Install dfu-util:

```
sudo apt-get install dfu-util  
or
```

```
brew install dfu-util  
or your system's package manager.
```

Then run:

```
dfu-util -a 0 -D main.bin -s 0x08000000  
or use:
```

```
scripts/flash.sh
```

Windows Flashing

DfuSe USB

drivers. <http://www.st.com/web/en/catalog/tools/FM147/CL1794/SC961/SS1533/PF257916#>

win32 DFU tools https://files.groupgets.com/purethermal/win32_dfu.zip

To install DFU drivers, may need to use the device manager to select the st drivers

extract win32_dfu.zip to the current folder.

```
win32_dfu\bin2dfu --i main.bin --a 0x08000000 --o main.dfu  
win32_dfu\DfuSeCommand -c -d --fn main.dfu  
or use:
```

```
scripts/make_and_flash.bat
```

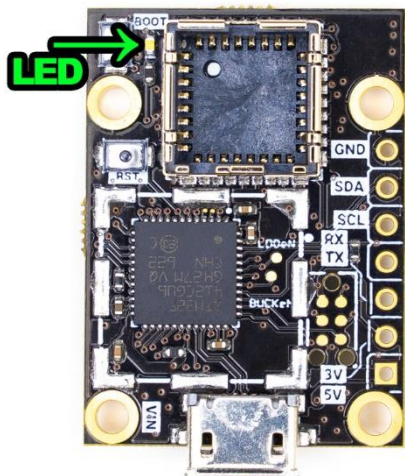
Alternate Flashing Method (not over usb)

Windows Flashing

Alternatively, you can Flash the PureThermal 2 using the hardware below a [ST-Link V2](#), [Tag-Connect TC2030-IDC-NL](#), & a [Tag-Connect ARM20-CTX 20-Pin to TC2030-IDC Adapter](#). You can download the latest release firmware on the [PureThermal github releases page](#).

1. [Download the STM32 ST-LINK Utility](#) (STSW-LINK004)
2. Install STM32 ST-Link Utility and then open the software.
3. Plug in the PureThermal 2 into USB and insert the [Tag-Connect TC2030-IDC-NL](#) connectors pins into the PureThermal 2's 6-Pin port with the front of the board facing towards you.
4. Select "Target" then "Connect" to connect the software to the PureThermal 2.
5. Next select "File" then "Open file...", now navigate to the folder which contains the PureThermal firmware and select the main.dfu file.
6. Finally click "Target" then "Program & Verify...", make sure that the "Reset after programming" box is selected then press the "Start" button.

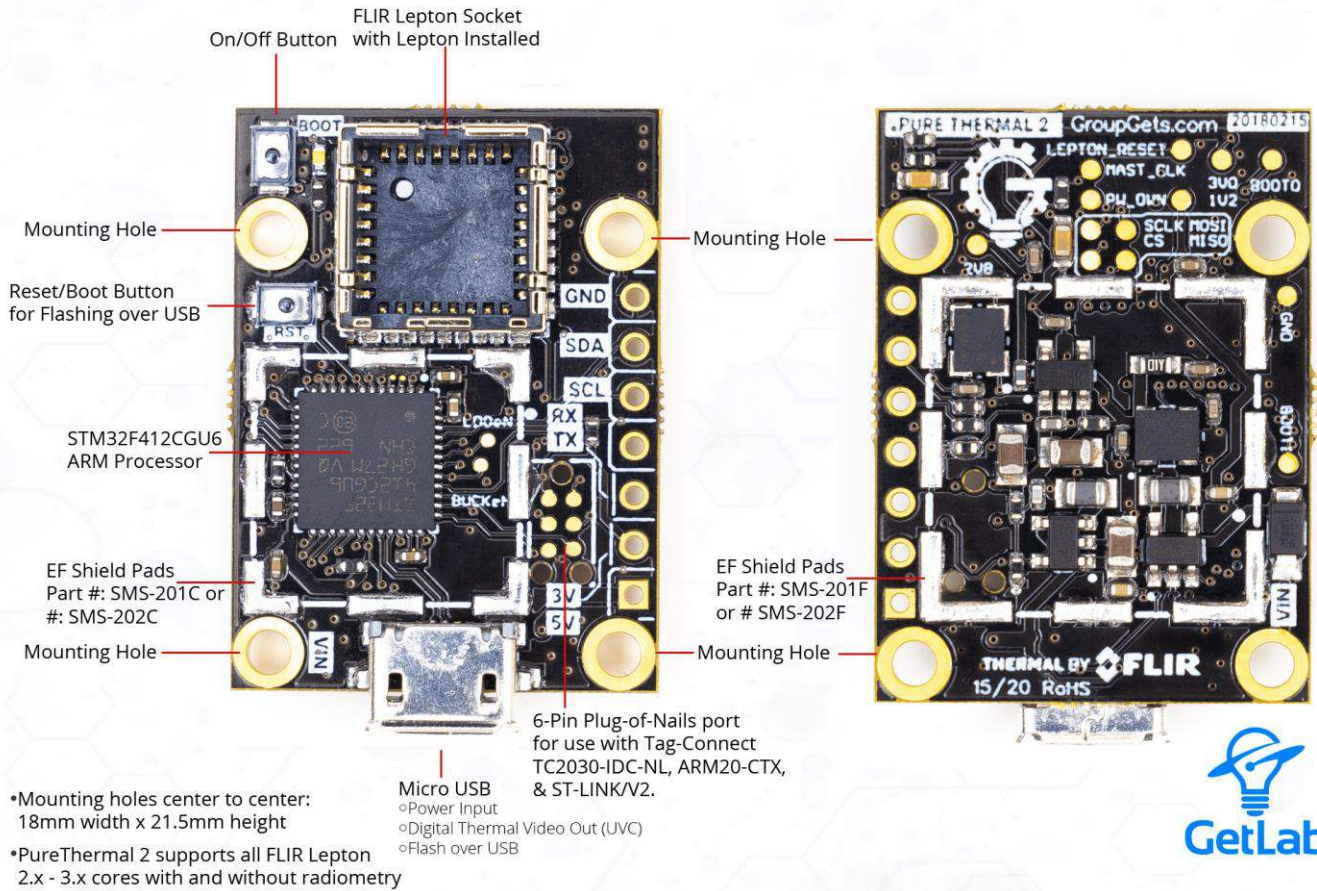
Functions



LED: When plugged in to micro-usb power and a Lepton is inserted in the socket LED will flash slowly. When video is being transmitted to the viewing program, LED will flash more rapidly.

PureThermal 2 Interface Diagram

PureThermal 2 Interface Diagram



Hardware Schematic

[Downloadable .pdf version available here.](#)

