CEC Continuing Education Center

DesignNews

BeagleBone Black Primer

Day 2:
BeagleBone Black GPIO

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Fred Eady

Visit ‘Lecturer Profile’ in your console for more details.

AGENDA

- Building an Ubuntu Dog House

do{

- Dog Food
- Let the Dog Out!

}while(Dog Food);

- BBB the Superdog

Install libgpiod to Cross Compile for BeagleBone Black on Ubuntu 20.04.1

Install Prerequisites:

```
sudo apt-get install autoconf autoconf-archive libtool libkmod-dev pkg-config
```

Download:

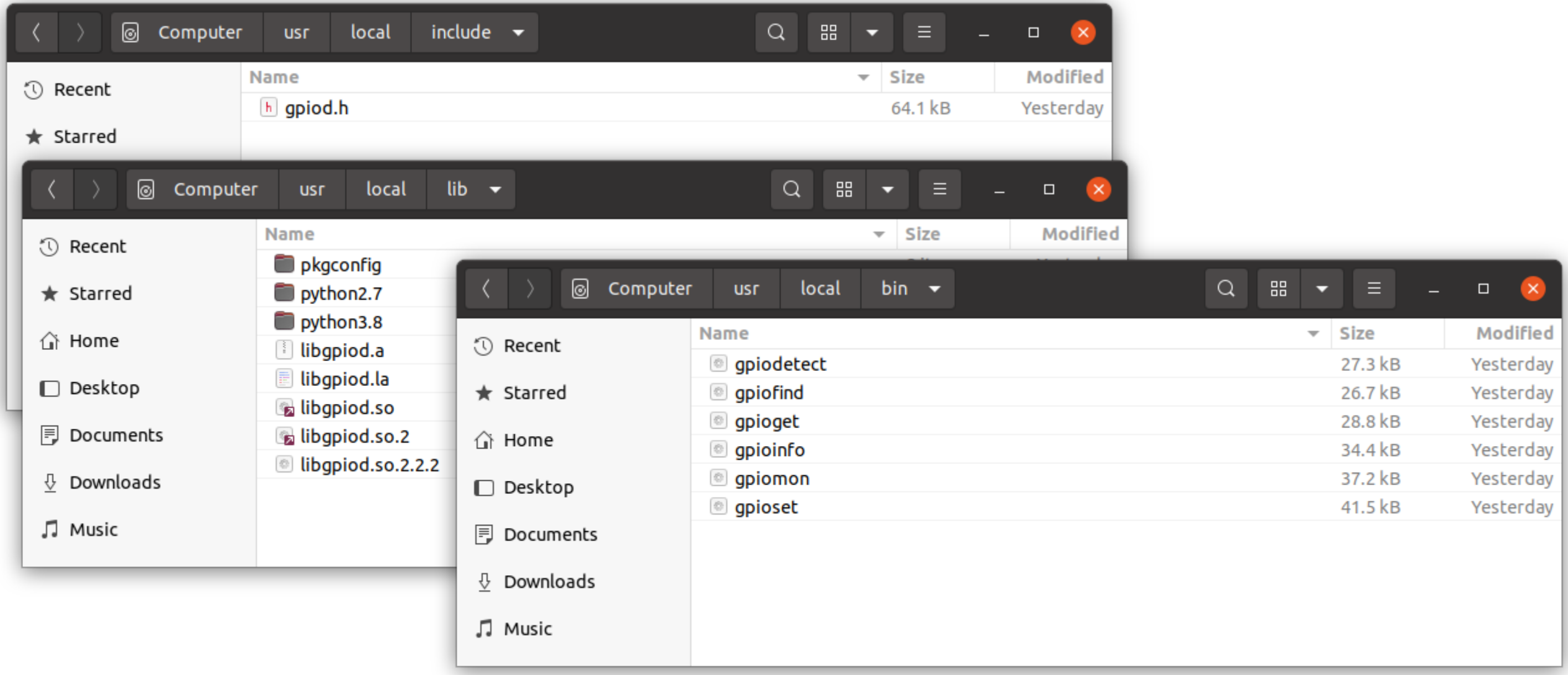
```
wget https://git.kernel.org/pub/scm/libs/libgpiod/libgpiod.git/snapshot/libgpiod-1.6.3.tar.gz

tar –xzf libgpiod-1.6.3.tar.gz
```

Cross Compile – Target host = arm-linux-gnueabihf:

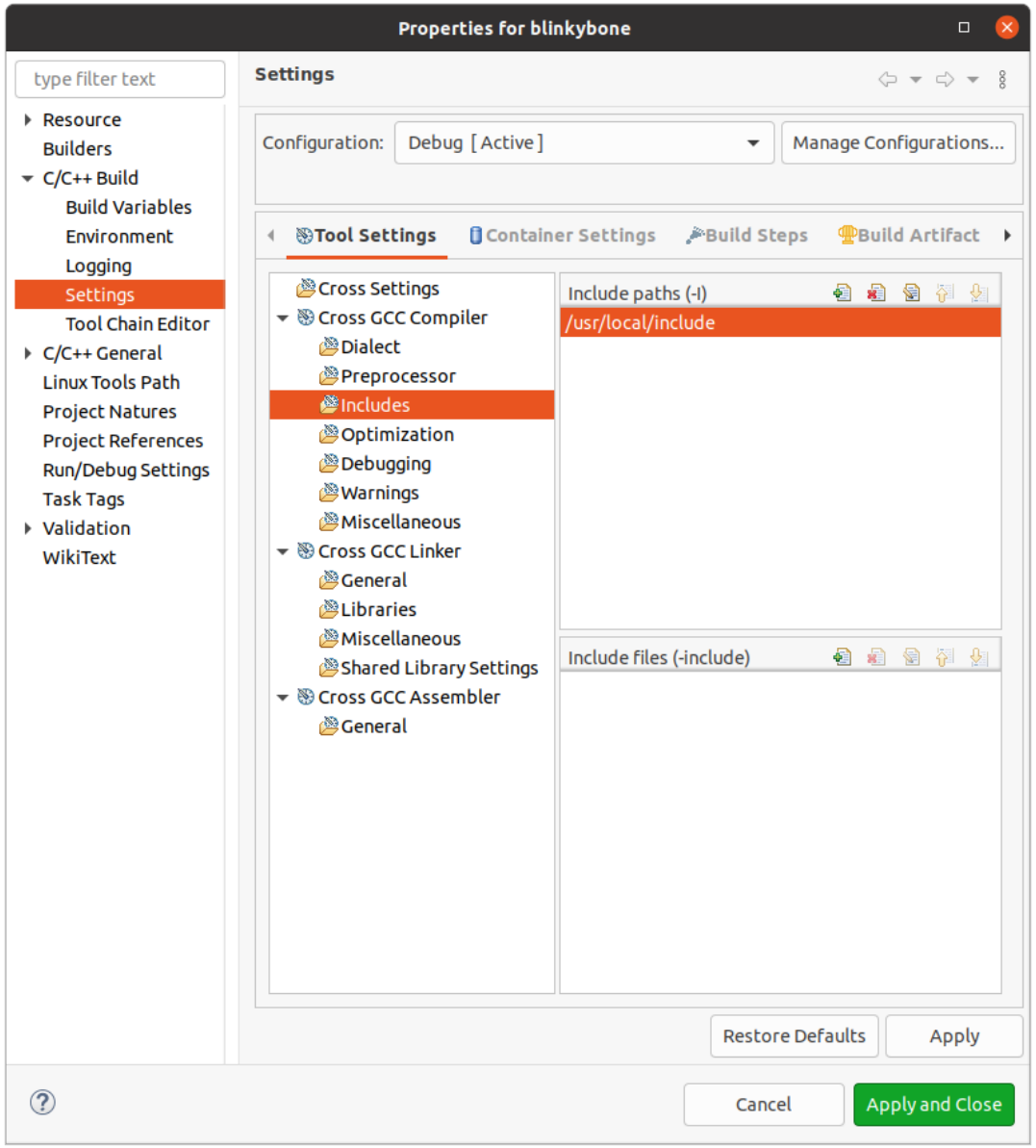
```
cd libgpiod-1.6.3

./autogen.sh - -enable-tools=yes - -host=arm-linux-gnueabihf - - prefix /usr/local
ac_cv_func_malloc_0_nonnull=yes

make

sudo make install
```

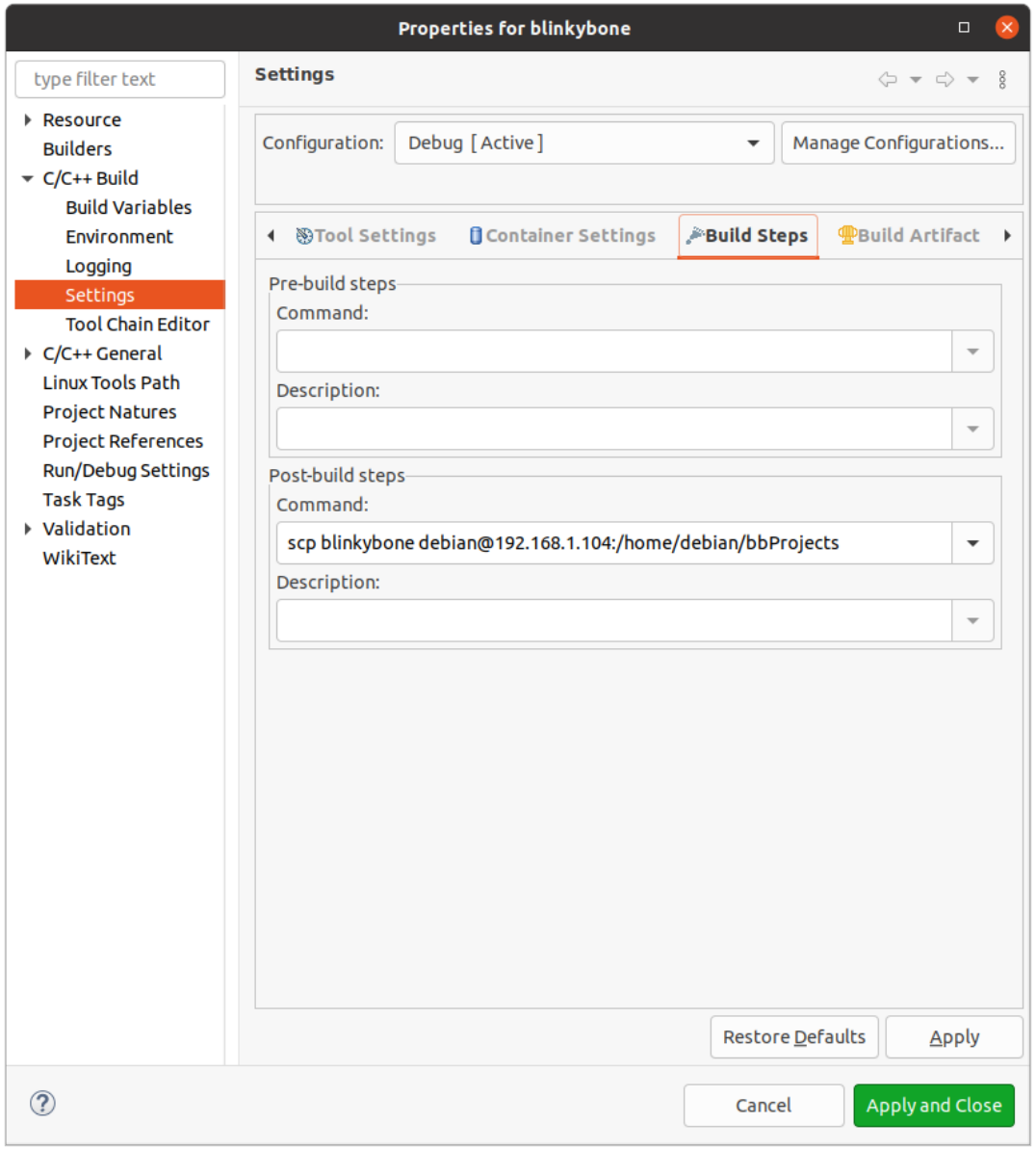
Building an Ubuntu Dog House

Install libgpiod to Cross Compile for BeagleBone Black on Ubuntu 20.04.1

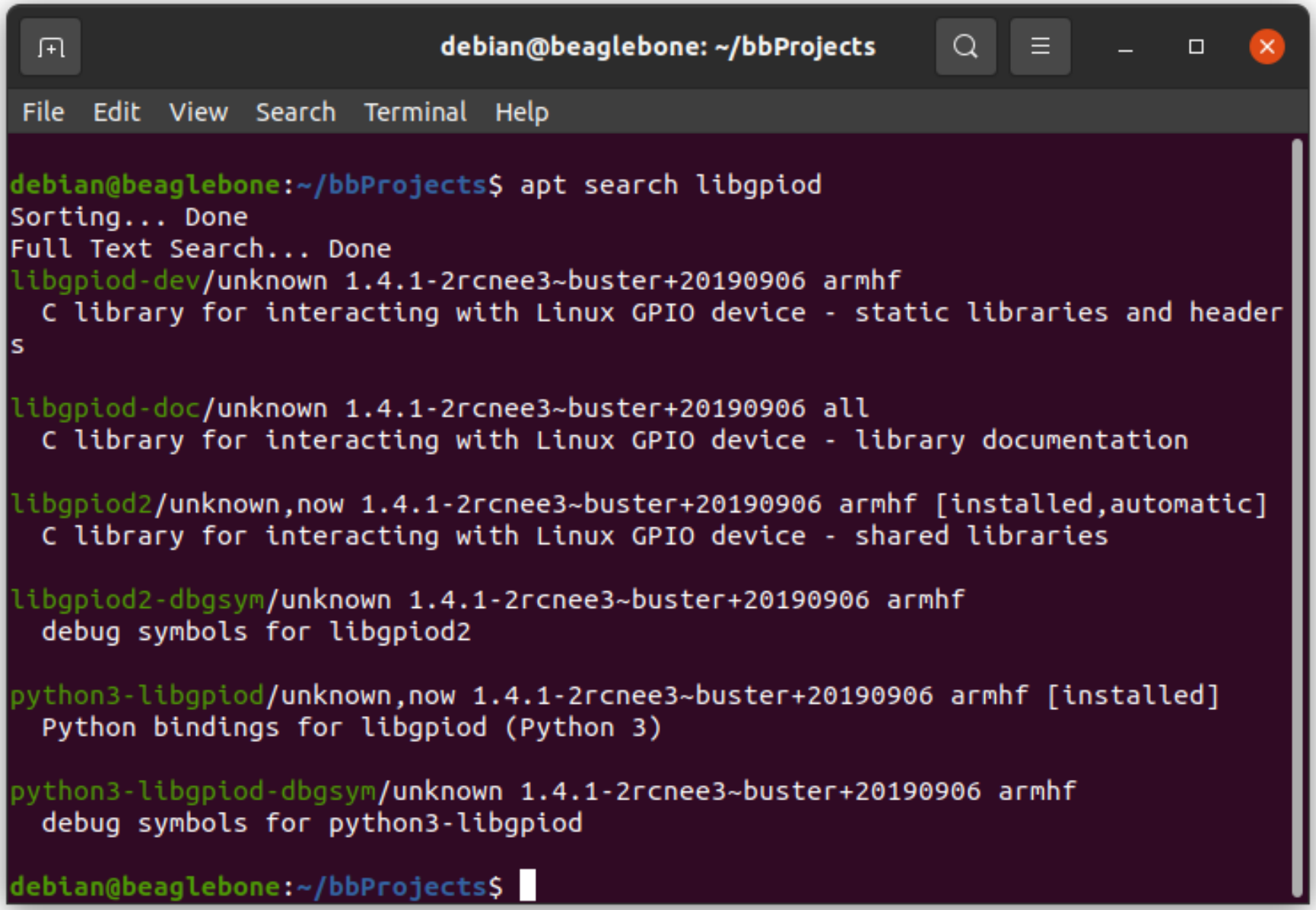


Building an Ubuntu Dog House
Configure Eclipse





Dog Food
The BBB Has Already Been Fed



Dog Food
BeagleBone Black versus Raspberry Pi 4B

In addition to supporting libgpiod, the Raspberry Pi 4B can also control its GPIO using the pigpio library.

Dog Food
Select Target GPIO Output Pin

P9

Function	Physical Pins		Function
DGND	1	2	DGND
VDD 3.3 V	3	4	VDD 3.3 V
VDD 5V	5	6	VDD 5V
SYS 5V	7	8	SYS 5V
PWR_BUT	9	10	SYS_RESET
UART4_RXD	11	12	GPIO_60
UART4_TXD	13	14	EHRPWM1A
GPIO_48	15	16	EHRPWM1B
SPIO_CSO	17	18	SPIO_D1
I2C2_SCL	19	20	I2C_SDA
SPIO_DO	21	22	SPIO_SLCK
GPIO_49	23	24	UART1_TXD
GPIO_117	25	26	UART1_RXD
GPIO_115	27	28	SP11_CSO
SP11_DO	29	30	GPIO_112
SP11_SCLK	31	32	VDD_ADC
AIN4	33	34	GND_ADC
AIN6	35	36	AIN5
AIN2	37	38	AIN3
AIN0	39	40	AIN1
GPIO_20	41	42	ECAPWMO
DGND	43	44	DGND
DGND	45	46	DGND

LEGEND
Power, Ground, Reset
Digital Pins
PWM Output
1.8 Volt Analog Inputs
Shared I2C Bus
Reconfigurable Digital

P8

Function	Physical Pins		Function
DGND	1	2	DGND
MMC1_DAT6	3	4	MMC1_DAT7
MMC1_DAT2	5	6	MMC1_DAT3
GPIO_66	7	8	GPIO_67
GPIO_69	9	10	GPIO_68
GPIO_45	11	12	GPIO_44
EHRPWM2B	13	14	GPIO_26
GPIO_47	15	16	GPIO_46
GPIO_27	17	18	GPIO_65
EHRPWM2A	19	20	MMC1_CMD
MMC1_CLK	21	22	MMC1_DAT5
MMC1_DAT4	23	24	MMC1_DAT1
MMC1_DATO	25	26	GPIO_61
LCD_VSYNC	27	28	LCD_PCLK
LCD_HSYNC	29	30	LCD_AC_BIAS
LCD_DATA14	31	32	LCD_DATA15
LCD_DATA13	33	34	LCD_DATA11
LCD_DATA12	35	36	LCD_DATA10
LCD_DATA8	37	38	LCD_DATA9
LCD_DATA6	39	40	LCD_DATA7
LCD_DATA4	41	42	LCD_DATA5
LCD_DATA2	43	44	LCD_DATA3
LCD_DATA0	45	46	LCD_DATA1

Dog Food
Select Target GPIO Output Pin


```
debian@beaglebone: ~
File  Edit  View  Search  Terminal  Help

debian@beaglebone:~$ sudo gpioinfo gpiochip0
gpiochip0 - 32 lines:
        line   0:   "MDIO_DATA"       unused   input  active-high
        line   1:    "MDIO_CLK"       unused   input  active-high
        line   2:   "SPI0_SCLK"      "P9_22"   input  active-high [used]
        line   3:     "SPI0_D0"      "P9_21"   input  active-high [used]
        line   4:     "SPI0_D1"      "P9_18"   input  active-high [used]
        line   5:    "SPI0_CS0"      "P9_17"   input  active-high [used]
        line   6:    "SPI0_CS1"        "cd"    input   active-low [used]
        line   7: "ECAP0_IN_PWM0_OUT" "P9_42" input active-high [used]
        line   8: "LCD_DATA12"       "P8_35"   input  active-high [used]
        line   9: "LCD_DATA13"       "P8_33"   input  active-high [used]
        line  10: "LCD_DATA14"       "P8_31"   input  active-high [used]
        line  11: "LCD_DATA15"       "P8_32"   input  active-high [used]
        line  12: "UART1_CTSN"       "P9_20"   input  active-high [used]
        line  13: "UART1_RTSN"       "P9_19"   input  active-high [used]
        line  14:  "UART1_RXD"       "P9_26"   input  active-high [used]
        line  15:  "UART1_TXD"       "P9_24"   input  active-high [used]
        line  16: "GMII1_TXD3"       unused    input  active-high
        line  17: "GMII1_TXD2"       unused    input  active-high
        line  18: "USB0_DRVVBUS" unused input active-high
        line  19: "XDMA_EVENT_INTR0" unused input active-high
        line  20: "XDMA_EVENT_INTR1" "P9_41" input active-high [used]
        line  21: "GMII1_TXD1"       unused    input  active-high
        line  22:   "GPMC_AD8"       "P8_19"   input  active-high [used]
        line  23:   "GPMC_AD9"       "P8_13"   input  active-high [used]
        line  24:         "NC"       unused    input  active-high
        line  25:         "NC"       unused    input  active-high
        line  26:  "GPMC_AD10"       "P8_14"   input  active-high [used]
        line  27:  "GPMC_AD11"       "P8_17"   input  active-high [used]
        line  28: "GMII1_TXD0"       unused    input  active-high
        line  29: "RMII1_REFCLK" unused input active-high
        line  30: "GPMC_WAIT0"       "P9_11"   input  active-high [used]
        line  31:   "GPMC_WPN"       "P9_13"   input  active-high [used]
debian@beaglebone:~$
```

P9			
Function	Physical Pins		Function
DGND	1	2	DGND
VDD 3.3 V	3	4	VDD 3.3 V
VDD 5V	5	6	VDD 5V
SYS 5V	7	8	SYS 5V
PWR_BUT	9	10	SYS_RESET
UART4_RXD	11	12	GPIO_60
UART4_TXD	13	14	EHRPWM1A
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SPIO_CSO	17	18	SPIO_D1
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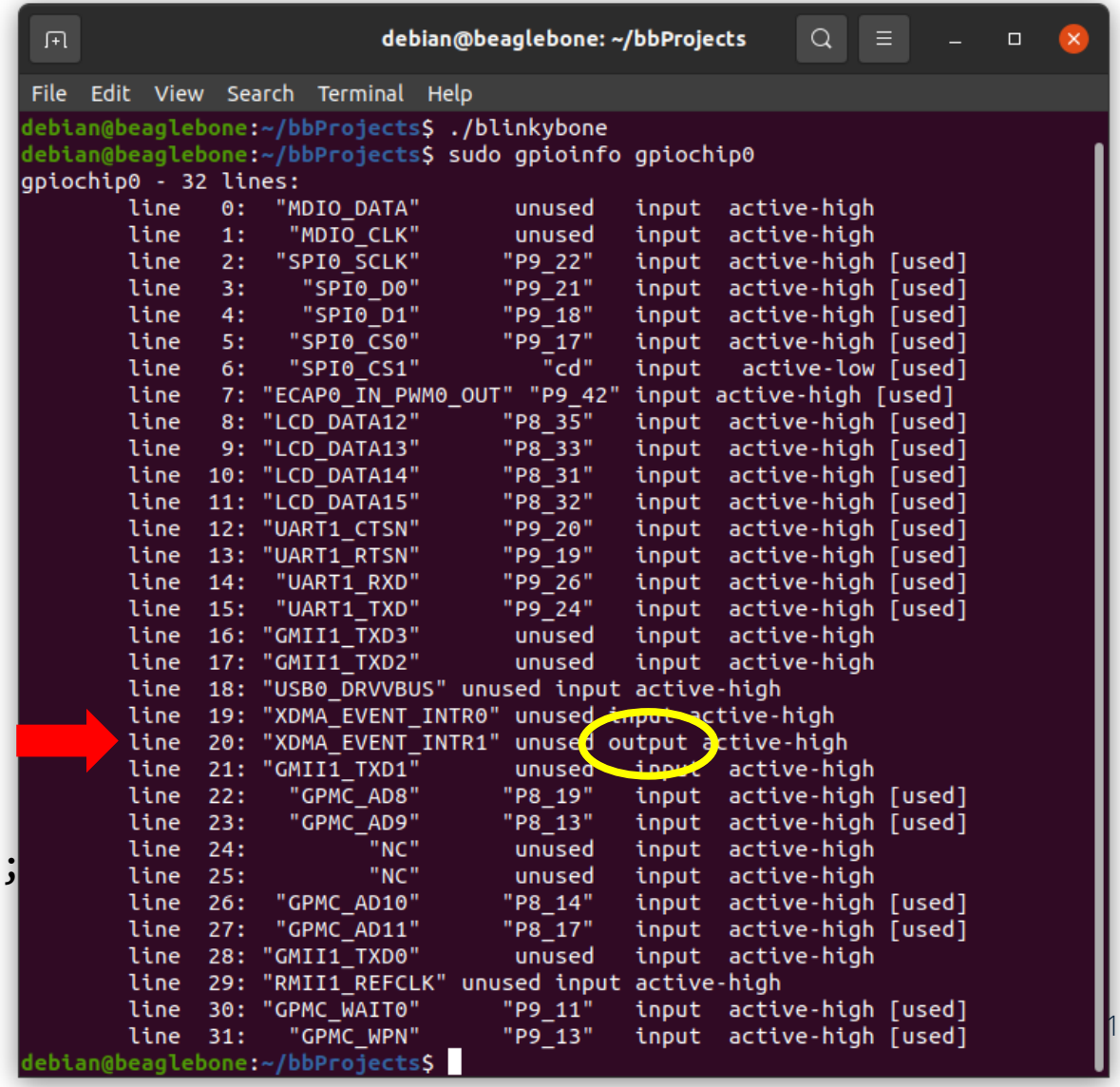
SPIO_DO	21	22	SPIO_SLCK
GPIO_49	23	24	UART1_TXD
GPIO_117	25	26	UART1_RXD
GPIO_115	27	28	SP11_CSO
SP11_DO	29	30	GPIO_112
SP11_SCLK	31	32	VDD_ADC
AIN4	33	34	GND_ADC
AIN6	35	36	AIN5
AIN2	37	38	AIN3
[illegible]	39	40	AIN1
GPIO_20	41	42	ECAPWMO
[illegible]	43	44	DGND
DGND	45	46	DGND

LEGEND
Power, Ground, Reset
Digital Pins
PWM Output
1.8 Volt Analog Inputs
Shared I2C Bus
Reconfigurable Digital

P8			
Function	Physical Pins		Function
DGND	1	2	DGND
MMC1_DAT6	3	4	MMC1_DAT7
MMC1_DAT2	5	6	MMC1_DAT3
GPIO_66	7	8	GPIO_67
GPIO_69	9	10	GPIO_68
GPIO_45	11	12	GPIO_44
EHRPWM2B	13	14	GPIO_26
GPIO_47	15	16	GPIO_46
GPIO_27	17	18	GPIO_65
EHRPWM2A	19	20	MMC1_CMD
MMC1_CLK	21	22	MMC1_DAT5
MMC1_DAT4	23	24	MMC1_DAT1
MMC1_DATO	25	26	GPIO_61
LCD_VSYNC	27	28	LCD_PCLK
LCD_HSYNC	29	30	LCD_AC_BIAS
LCD_DATA14	31	32	LCD_DATA15
LCD_DATA13	33	34	LCD_DATA11
LCD_DATA12	35	36	LCD_DATA10
LCD_DATA8	37	38	LCD_DATA9
LCD_DATA6	39	40	LCD_DATA7
LCD_DATA4	41	42	LCD_DATA5
LCD_DATA2	43	44	LCD_DATA3
LCD_DATA0	45	46	LCD_DATA1

Let the Dog Out!

```c
#include "gpiod.h"
#include <stdio.h>
#include <unistd.h>

const char *chipname = "gpiochip0";
struct gpiod_chip *chip;
struct gpiod_line *lineblinky;

int main(int argc, char **argv)
{
 // Open GPIO chip
 chip = gpiod_chip_open_by_name(chipname);

 // Open GPIO line
 lineblinky = gpiod_chip_get_line(chip, 20);

 // Open GPIO line for output
 gpiod_line_request_output(lineblinky, "blinky", 0);

 return 0;
}
```



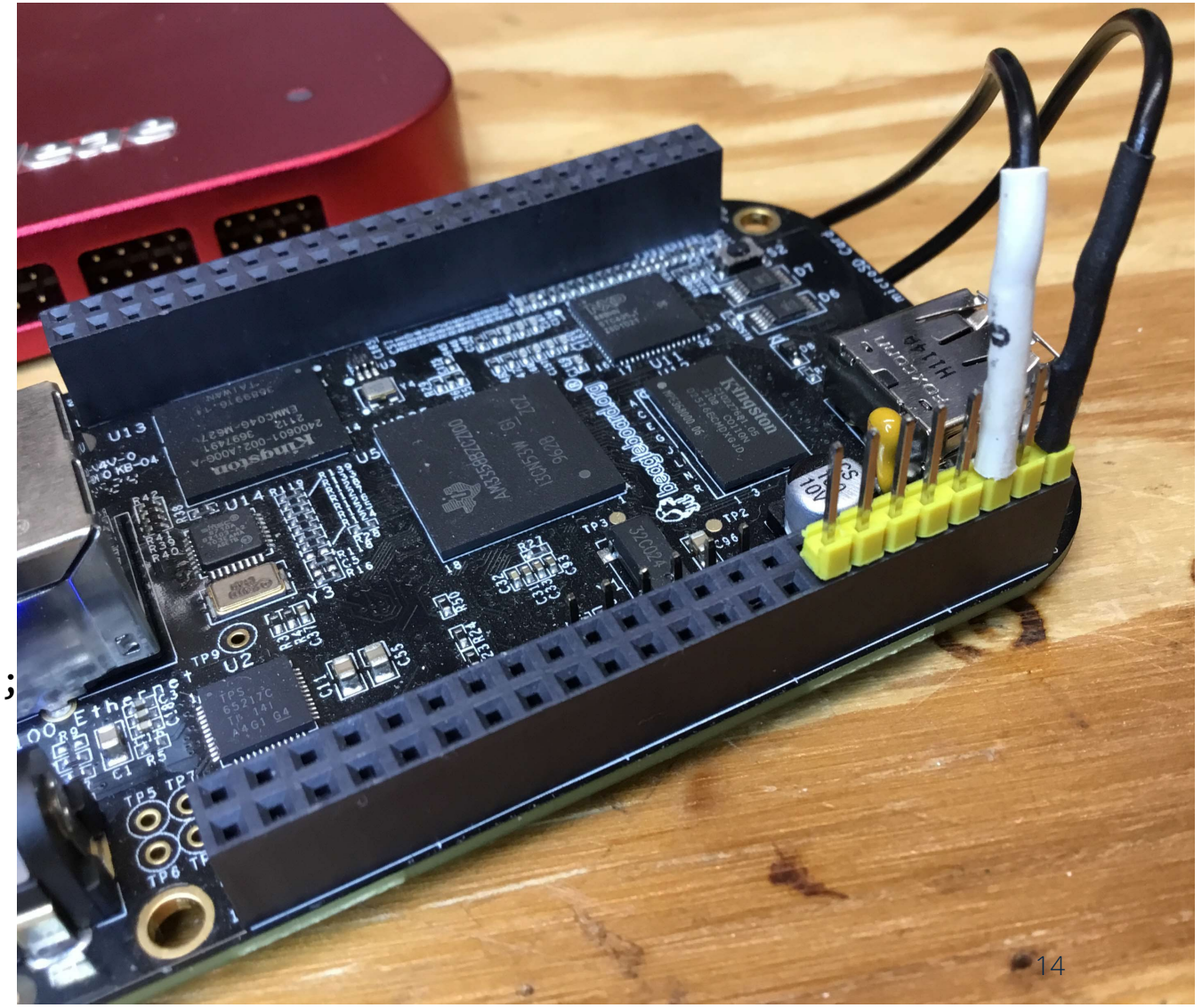
Let the Dog Out!

```c
#include "gpiod.h"
#include <stdio.h>
#include <unistd.h>

const char *chipname = "gpiochip0";
struct gpiod_chip *chip;
struct gpiod_line *lineblinky;

int main(int argc, char **argv)
{
 // Open GPIO chip
 chip = gpiod_chip_open_by_name(chipname);

 // Open GPIO line
 lineblinky = gpiod_chip_get_line(chip, 20);

 // Open GPIO line for input
 gpiod_line_request_input(lineblinky, "blinky");

 return 0;
}
```

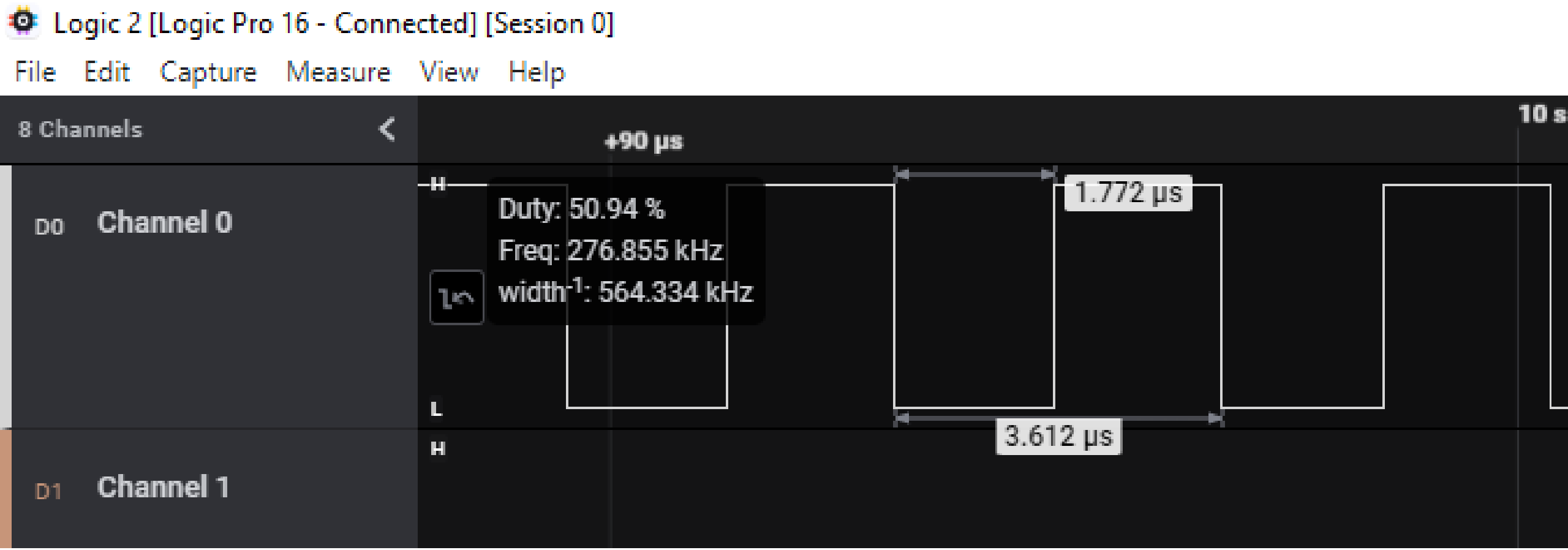
```
debian@beaglebone: ~/bbProjects
File  Edit  View  Search  Terminal  Help
debian@beaglebone:~/bbProjects$ sudo gpioinfo gpiochip0
[sudo] password for debian:
gpiochip0 - 32 lines:
        line   0:   "MDIO_DATA"       unused   input  active-high
        line   1:    "MDIO_CLK"       unused   input  active-high
        line   2:   "SPI0_SCLK"      "P9_22"   input  active-high [used]
        line   3:    "SPI0_D0"       "P9_21"   input  active-high [used]
        line   4:    "SPI0_D1"       "P9_18"   input  active-high [used]
        line   5:   "SPI0_CS0"       "P9_17"   input  active-high [used]
        line   6:   "SPI0_CS1"         "cd"    input   active-low [used]
        line   7: "ECAP0_IN_PWM0_OUT" "P9_42" input active-high [used]
        line   8: "LCD_DATA12"       "P8_35"   input  active-high [used]
        line   9: "LCD_DATA13"       "P8_33"   input  active-high [used]
        line  10: "LCD_DATA14"       "P8_31"   input  active-high [used]
        line  11: "LCD_DATA15"       "P8_32"   input  active-high [used]
        line  12: "UART1_CTSN"       "P9_20"   input  active-high [used]
        line  13: "UART1_RTSN"       "P9_19"   input  active-high [used]
        line  14:  "UART1_RXD"       "P9_26"   input  active-high [used]
        line  15:  "UART1_TXD"       "P9_24"   input  active-high [used]
        line  16: "GMII1_TXD3"       unused   input  active-high
        line  17: "GMII1_TXD2"       unused   input  active-high
        line  18: "USB0_DRVVBUS" unused input active-high
        line  19: "XDMA_EVENT_INTR0" unused input active-high
        line  20: "XDMA_EVENT_INTR1" unused input active-high
        line  21: "GMII1_TXD1"       unused   input  active-high
        line  22:   "GPMC_AD8"       "P8_19"   input  active-high [used]
        line  23:   "GPMC_AD9"       "P8_13"   input  active-high [used]
        line  24:         "NC"       unused   input  active-high
        line  25:         "NC"       unused   input  active-high
        line  26:  "GPMC_AD10"       "P8_14"   input  active-high [used]
        line  27:  "GPMC_AD11"       "P8_17"   input  active-high [used]
        line  28: "GMII1_TXD0"       unused   input  active-high
        line  29: "RMII1_REFCLK" unused input active-high
        line  30: "GPMC_WAIT0"       "P9_11"   input  active-high [used]
        line  31:   "GPMC_WPN"       "P9_13"   input  active-high [used]
debian@beaglebone:~/bbProjects$
```

Let the Dog Out!

```
#include "gpiod.h"
#include <stdio.h>
#include <unistd.h>

const char *chipname = "gpiochip0";
struct gpiod_chip *chip;
struct gpiod_line *lineblinky;

int main(int argc, char **argv)
{
 // Open GPIO chip
 chip = gpiod_chip_open_by_name(chipname);
 // Open GPIO line
 lineblinky = gpiod_chip_get_line(chip, 20);
 // Open GPIO line for output
 gpiod_line_request_output(lineblinky, "blinky", 0);
 // Toggle GPIO_20 as fast as we can
 while(1)
 {
  gpiod_line_set_value(lineblinky,1);
  gpiod_line_set_value(lineblinky,0);
 }
}
```



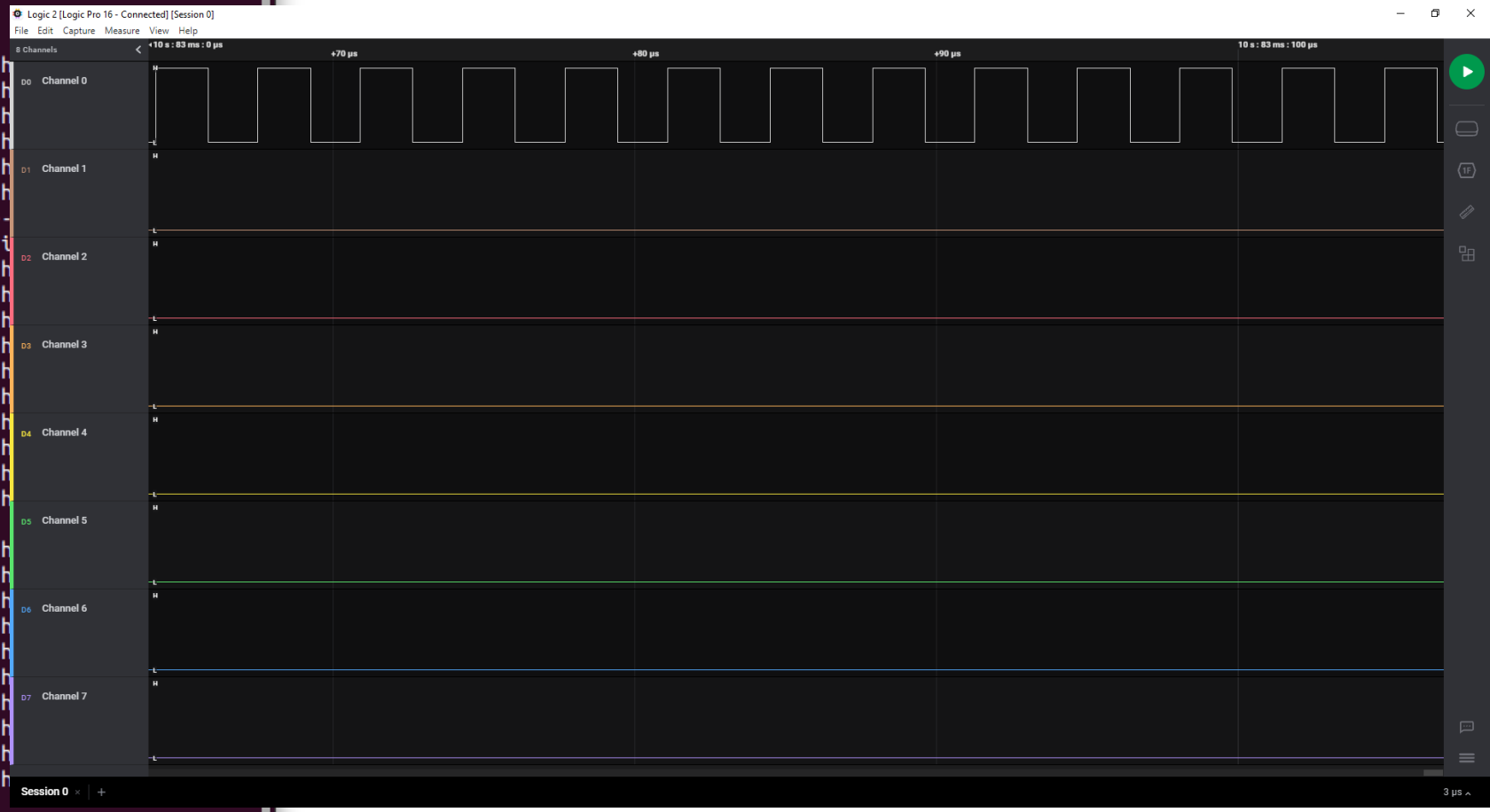
Let the Dog Out!



Let the Dog Out!

```
debian@beaglebone: ~
File  Edit  View  Search  Terminal  Help

debian@beaglebone:~$ sudo gpioinfo gpiochip0
gpiochip0 - 32 lines:
        line   0:  "MDIO_DATA"       unused   input  active-h
        line   1:   "MDIO_CLK"       unused   input  active-h
        line   2:  "SPI0_SCLK"      "P9_22"   input  active-h
        line   3:    "SPI0_D0"      "P9_21"   input  active-h
        line   4:    "SPI0_D1"      "P9_18"   input  active-h
        line   5:   "SPI0_CS0"      "P9_17"   input  active-h
        line   6:   "SPI0_CS1"         "cd"   input   active-
        line   7: "ECAP0_IN_PWM0_OUT" "P9_42" input active-hi
        line   8: "LCD_DATA12"      "P8_35"   input  active-h
        line   9: "LCD_DATA13"      "P8_33"   input  active-h
        line  10: "LCD_DATA14"      "P8_31"   input  active-h
        line  11: "LCD_DATA15"      "P8_32"   input  active-h
        line  12: "UART1_CTSN"      "P9_20"   input  active-h
        line  13: "UART1_RTSN"      "P9_19"   input  active-h
        line  14:  "UART1_RXD"      "P9_26"   input  active-h
        line  15:  "UART1_TXD"      "P9_24"   input  active-h
        line  16: "GMII1_TXD3"       unused   input  active-h
        line  17: "GMII1_TXD2"       unused   input  active-h
        line  18: "USB0_DRVVBUS" unused input active-high
        line  19: "XDMA_EVENT_INTR0" unused input active-high
        line  20: "XDMA_EVENT_INTR1"  "blinky"  output active-h
        line  21: "GMII1_TXD1"       unused   input  active-h
        line  22:   "GPMC_AD8"      "P8_19"   input  active-h
        line  23:   "GPMC_AD9"      "P8_13"   input  active-h
        line  24:         "NC"       unused   input  active-h
        line  25:         "NC"       unused   input  active-h
        line  26:  "GPMC_AD10"      "P8_14"   input  active-h
        line  27:  "GPMC_AD11"      "P8_17"   input  active-h
        line  28: "GMII1_TXD0"       unused   input  active-h
        line  29: "RMII1_REFCLK" unused input active-high
        line  30: "GPMC_WAIT0"      "P9_11"   input  active-high [used]
        line  31:   "GPMC_WPN"      "P9_13"   input  active-high [used]
debian@beaglebone:~$
```

```
// Open GPIO line for output
gpiod_line_request_output(lineblinky, "blinky", 0);
```



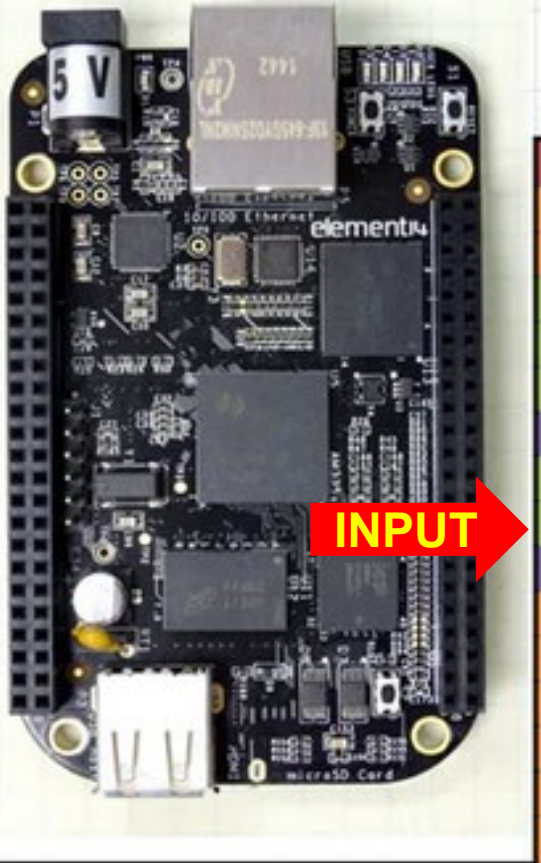
BBB the Superdog

BBB the Superdog

P9

Function	Physical Pins		Function
DGND	1	2	DGND
VDD 3.3 V	3	4	VDD 3.3 V
VDD 5V	5	6	VDD 5V
SYS 5V	7	8	SYS 5V
PWR_BUT	9	10	SYS_RESET
UART4_RXD	11	12	GPIO_60
UART4_TXD	13	14	EHRPWM1A
GPIO_48	15	16	EHRPWM1B
SPIO_CSO	17	18	SPIO_D1
I2C2_SCL	19	20	I2C_SDA
SPIO_DO	21	22	SPIO_SLCK
GPIO_49	23	24	UART1_TXD
GPIO_117	25	26	UART1_RXD
GPIO_115	27	28	SP11_CSO
SP11_DO	29	30	GPIO_112
SP11_SCLK	31	32	VDD_ADC
AIN4	33	34	GND_ADC
AIN6	35	36	AIN5
AIN2	37	38	AIN3
AIN0	39	40	AIN1
GPIO_20	41	42	ECAPWMO
DGND	43	44	DGND
DGND	45	46	DGND

OUTPUT



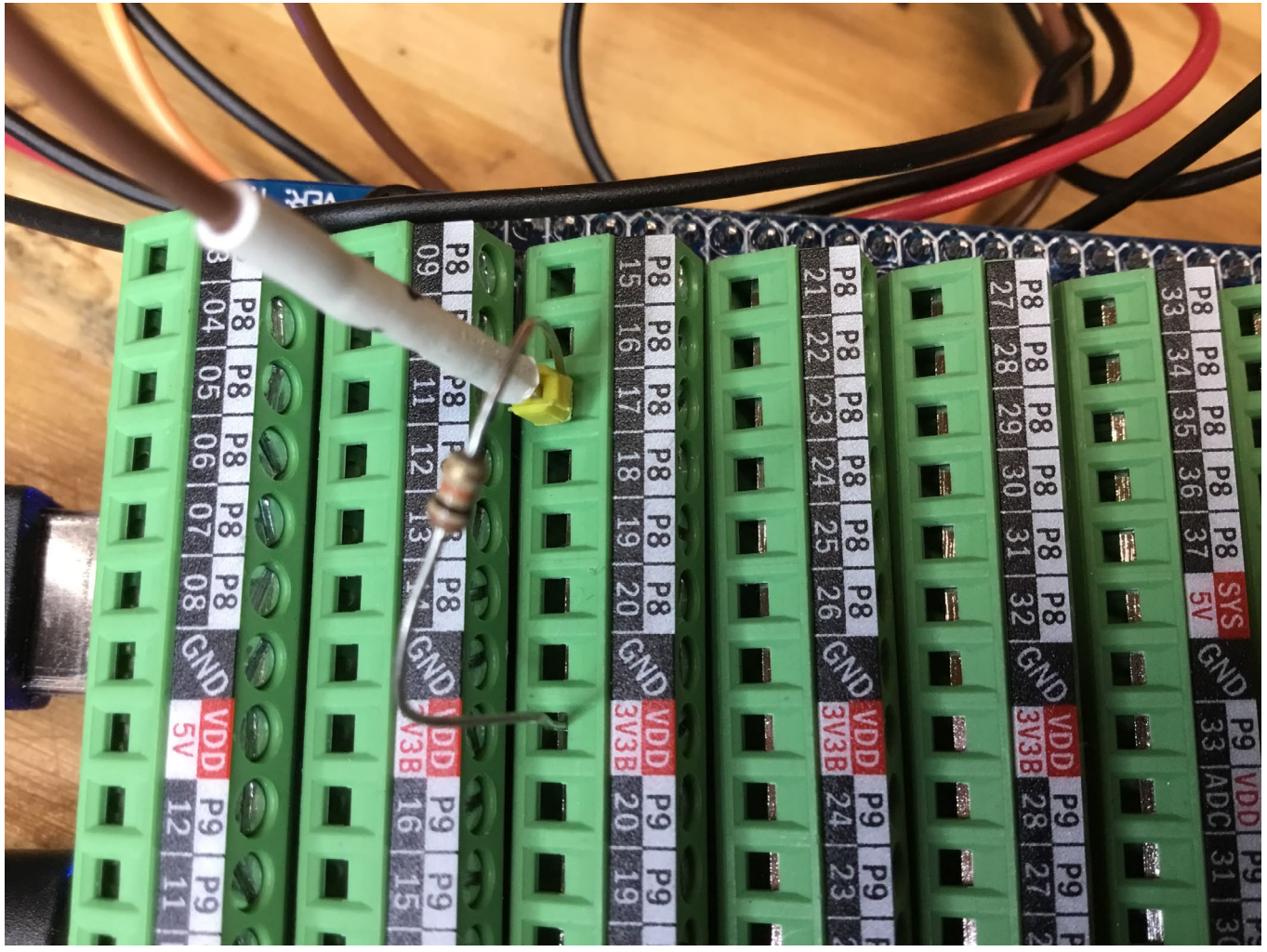
INPUT

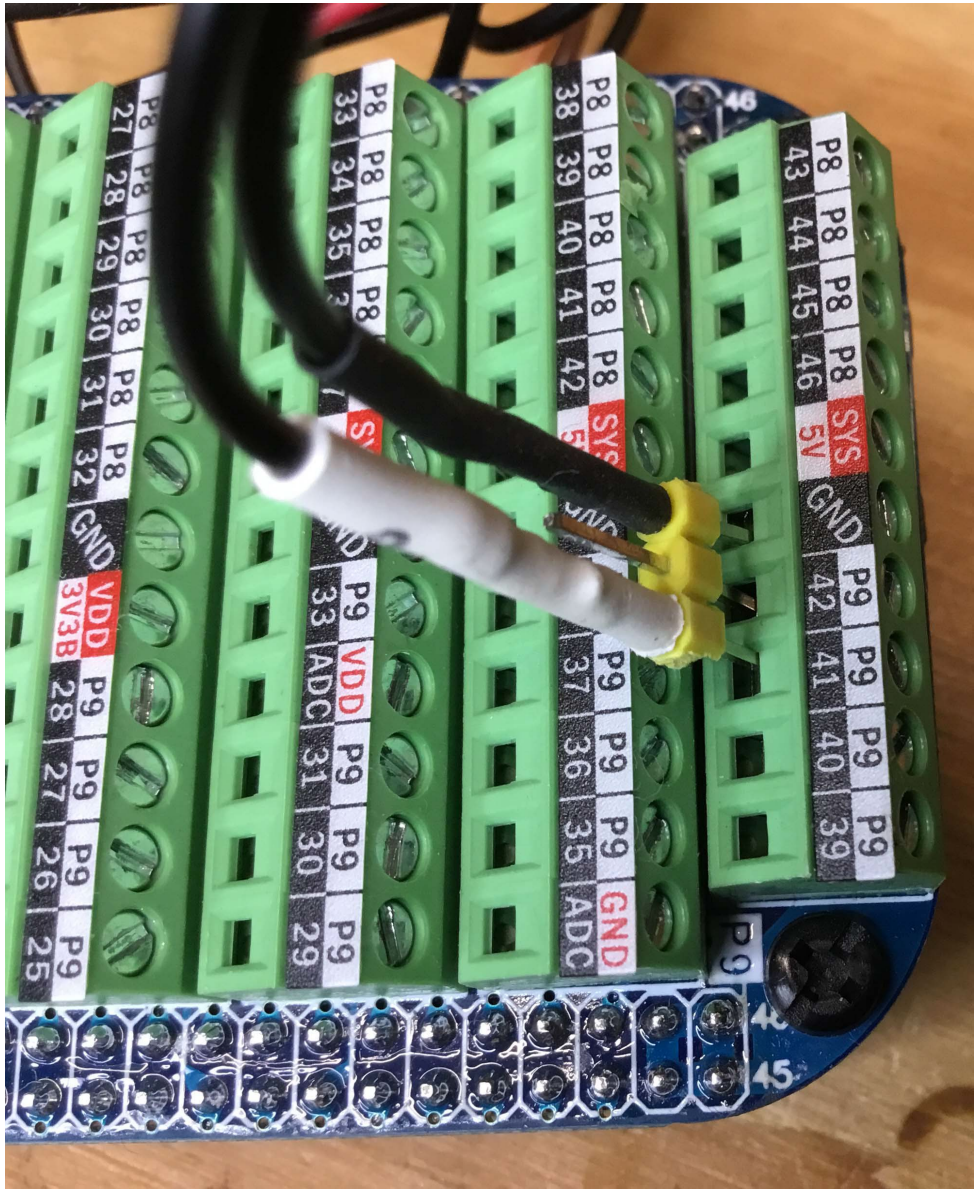
LEGEND
Power, Ground, Reset
Digital Pins
PWM Output
1.8 Volt Analog Inputs
Shared I2C Bus
Reconfigurable Digital

P8

Function	Physical Pins		Function
DGND	1	2	DGND
MMC1_DAT6	3	4	MMC1_DAT7
MMC1_DAT2	5	6	MMC1_DAT3
GPIO_66	7	8	GPIO_67
GPIO_69	9	10	GPIO_68
GPIO_45	11	12	GPIO_44
EHRPWM2B	13	14	GPIO_26
GPIO_47	15	16	GPIO_46
GPIO_27	17	18	GPIO_65
EHRPWM2A	19	20	MMC1_CMD
MMC1_CLK	21	22	MMC1_DAT5
MMC1_DAT4	23	24	MMC1_DAT1
MMC1_DATO	25	26	GPIO_61
LCD_VSYNC	27	28	LCD_PCLK
LCD_HSYNC	29	30	LCD_AC_BIAS
LCD_DATA14	31	32	LCD_DATA15
LCD_DATA13	33	34	LCD_DATA11
LCD_DATA12	35	36	LCD_DATA10
LCD_DATA8	37	38	LCD_DATA9
LCD_DATA6	39	40	LCD_DATA7
LCD_DATA4	41	42	LCD_DATA5
LCD_DATA2	43	44	LCD_DATA3
LCD_DATA0	45	46	LCD_DATA1

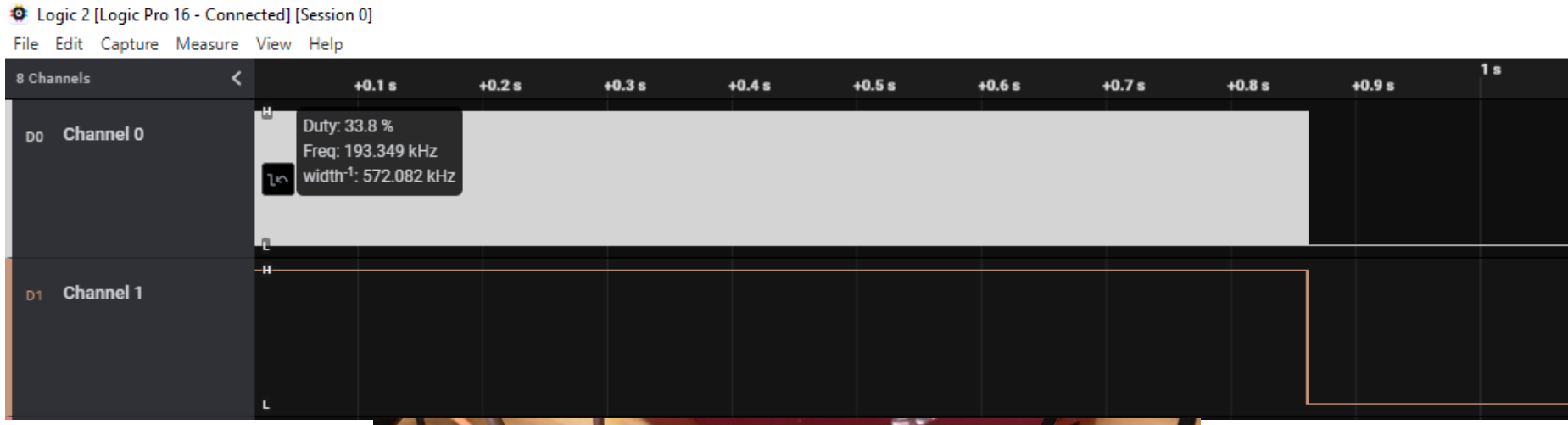
BBB the Superdog

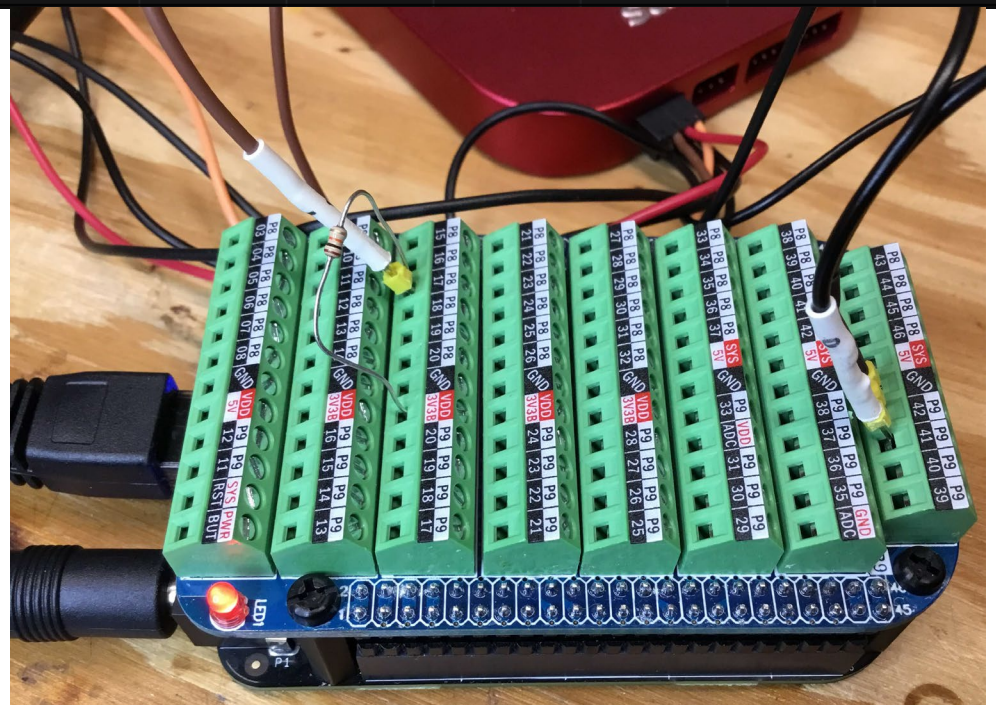




BBB the Superdog

```c
#include "gpiod.h"
#include <stdio.h>
#include <stdint.h>
#include <unistd.h>
const char *chipname = "gpiochip0";
struct gpiod_chip *chip;
struct gpiod_line *lineblinky;
struct gpiod_line *lineinput;
uint8_t val;

int main(int argc, char **argv)
{
  // Open GPIO chip
  chip = gpiod_chip_open_by_name(chipname);
  // Open GPIO line
  lineblinky = gpiod_chip_get_line(chip, 20);
  lineinput = gpiod_chip_get_line(chip, 27);
  // Open GPIO line for input
  gpiod_line_request_input(lineinput, "button");
  // Open GPIO line for output
  gpiod_line_request_output(lineblinky, "blinky", 0);
  // toggle GPIO_20 under control of “button”
  while(1)
  {
  if(gpiod_line_get_value(lineinput))
  {
   gpiod_line_set_value(lineblinky,1);
   gpiod_line_set_value(lineblinky,0);
  }
  else
  {
   gpiod_line_set_value(lineblinky,0);
  }
 }
}
```





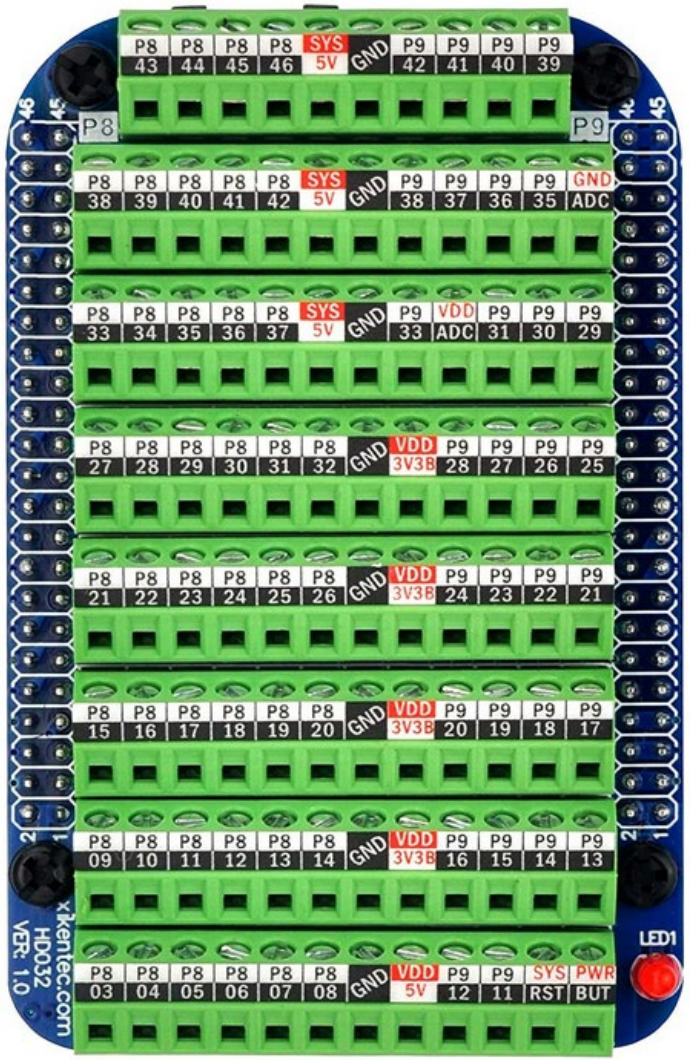
Thank you for attending!!!

Please consider the resources below:

- BeagleBone Black How-To PDF
- BeagleBone.org

No download package today.

MORE TO COME..



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