

# PCB Challenge - Documentation

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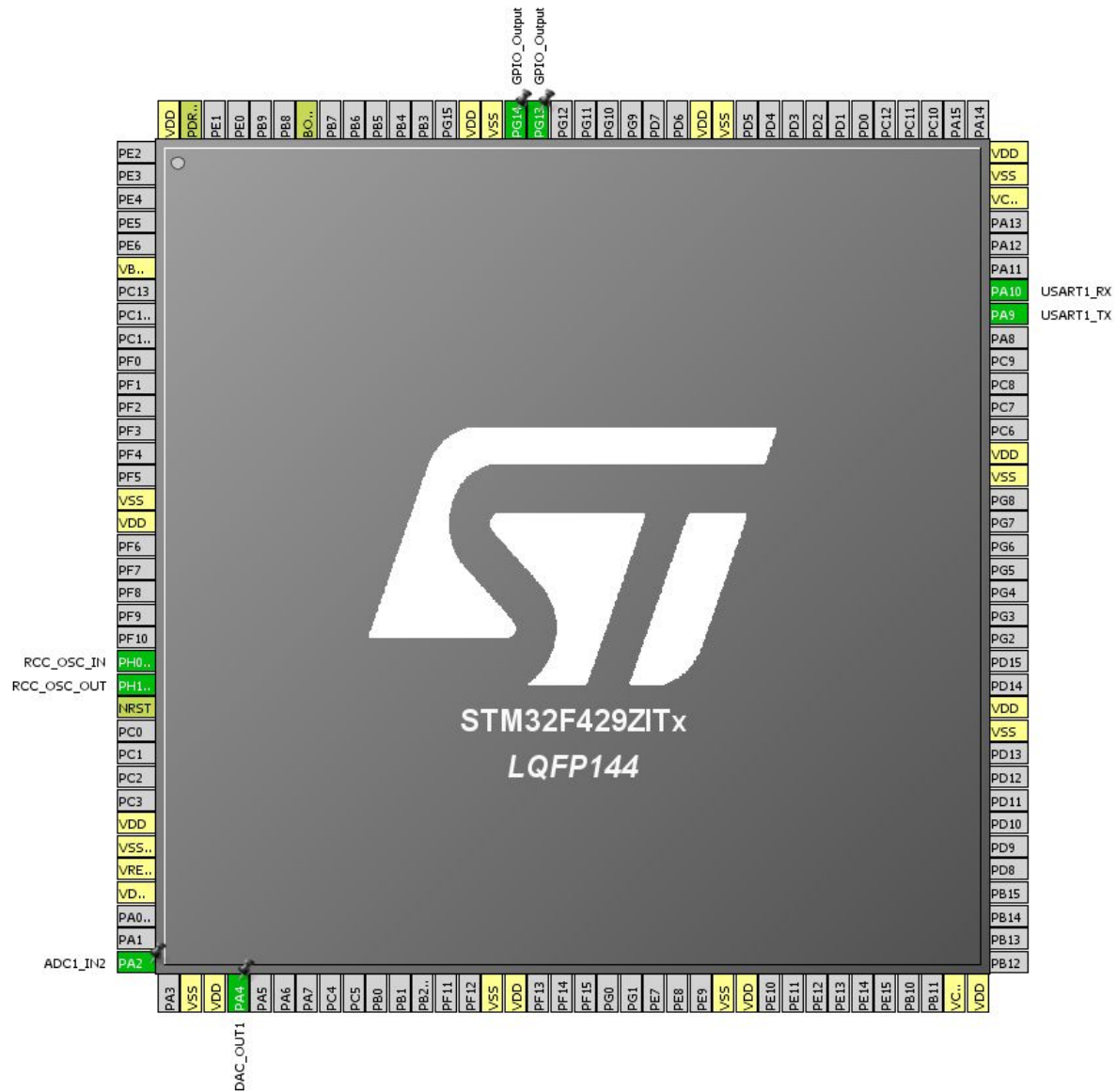
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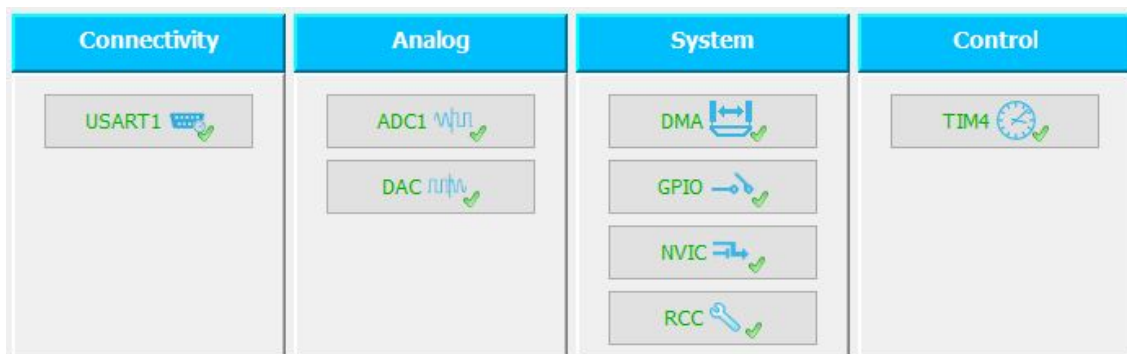
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## Pinout

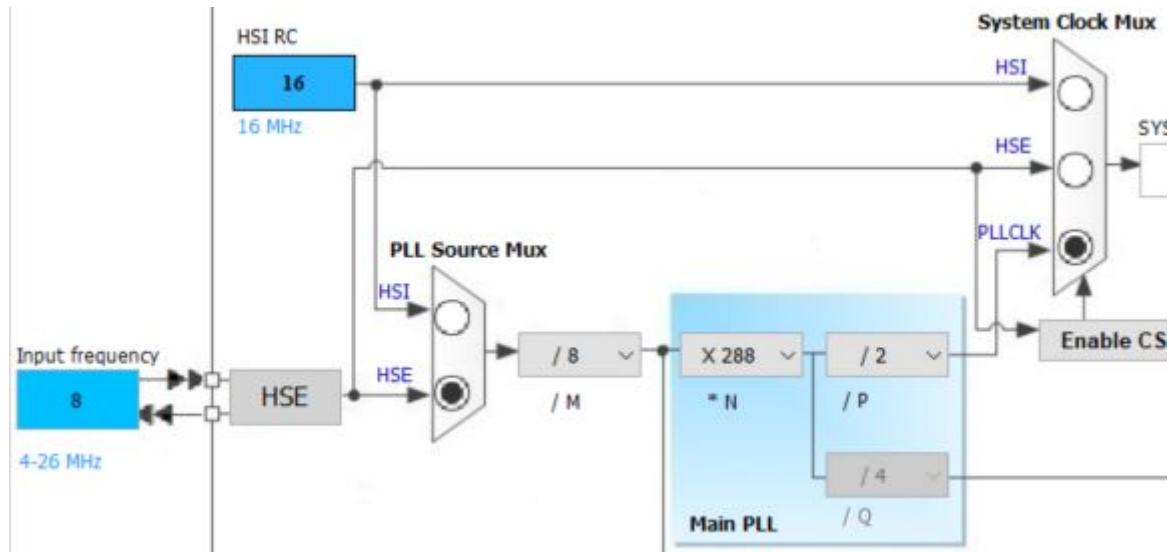


## Main modules

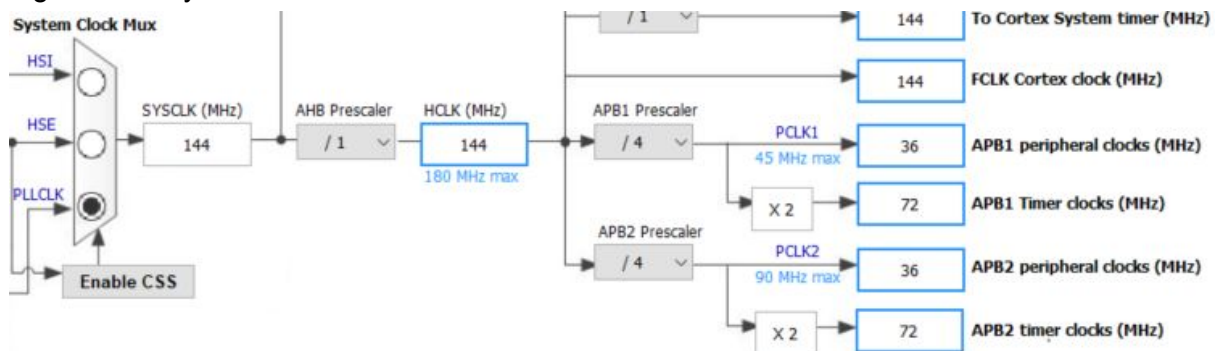


# Clock configuration

Left to the System Clock Mux:



Right to the System Clock Mux:



# Configuration of the USART

USART1 Configuration

✔ Parameter Settings

✔ User Constants

✔ NVIC Settings

✔ DMA Settings

✔ GPIO Settings

Configure the below parameters :

Search :

Basic Parameters

Baud Rate

115200 Bits/s

Word Length

8 Bits (including Parity)

Parity

None

Stop Bits

1

Advanced Parameters

Data Direction

Receive and Transmit

Over Sampling

16 Samples

DMA Request	Stream	Direction	Priority
USART1_TX	DMA2 Stream 7	Memory To Peripheral	Low

Add

Delete

DMA Request Settings

Mode

Circular

▼

Increment Address

☐

Peripheral

☐

Memory

☒

Use Fifo

☐

Threshold

▼

Data Width

Word

▼

Word

▼

# Configuration of the ADC

ADCs_Common_Settings	
Mode	Independent mode
ADC_Settings	
Clock Prescaler	PCLK2 divided by 2
Resolution	12 bits (15 ADC Clock cycles)
Data Alignment	Right alignment
Scan Conversion Mode	Disabled
Continuous Conversion Mode	Enabled
Discontinuous Conversion Mode	Disabled
DMA Continuous Requests	Enabled
End Of Conversion Selection	EOC flag at the end of single channel conversion

DMA Request	Stream	Direction	Priority
ADC1	DMA2 Stream 0	Peripheral To Memory	Low

Add

Delete

DMA Request Settings

		Peripheral	Memory
Mode	Circular	Increment Address	<input checked="" type="checkbox"/>
Use Fifo	<input type="checkbox"/> Threshold	Data Width	Word

## Configuration of the DAC

DAC Out1 Settings			
Output Buffer		Enable	
Trigger		Timer 4 Trigger Out event	
Wave generation mode		Disabled	

DMA Request	Stream	Direction	Priority
DAC1	DMA1 Stream 5	Memory To Peripheral	Low

AddDelete

DMA Request Settings

Mode		Increment Address		Peripheral	Memory
Circular				<input type="checkbox"/>	<input checked="" type="checkbox"/>
Use Fifo	Threshold	Data Width			
<input type="checkbox"/>		Word	Word		

## Configuration of Timer 4

Counter Settings	
Prescaler (PSC - 16 bits value)	0
Counter Mode	Up
Counter Period (AutoReload Register - 16 ...	1000
Internal Clock Division (CKD)	No Division
Trigger Output (TRGO) Parameters	
Master/Slave Mode (MSM bit)	Disable (Trigger input effect not delayed)
Trigger Event Selection	Update Event

# Software

## Some helpful variables

```
/* USER CODE BEGIN PV */
/* Private variables -----*/
#define BUFFER_LENGTH 256 // Size of buffer arrays
// Parameters of the sine wave:
#define SIN_AMP 36
#define SIN_PERIOD 256
#define SIN_OFFSET 90
uint16_t i, j;
uint32_t buffer_input[BUFFER_LENGTH]; // Data to DAC
uint32_t buffer_output[BUFFER_LENGTH]; // Data from ADC
/* USER CODE END PV */
```

## Main program

```
/* USER CODE BEGIN 2 */
for(i = 0; i < BUFFER_LENGTH; i++)
{
    buffer_input[i] = (int)(SIN_AMP * sin(2 * M_PI * i / SIN_PERIOD)) + SIN_OFFSET;
}
HAL_TIM_Base_Start(&htim4);
HAL_DAC_Start_DMA(&hdac, DAC_CHANNEL_1, (uint32_t *)buffer_input, BUFFER_LENGTH, DAC_ALIGN_12B_R);
HAL_ADC_Start_DMA(&hadc1, (uint32_t *)buffer_output, 32);
HAL_UART_Transmit_DMA(&huart1, (uint8_t *)buffer_output, 32);
/* USER CODE END 2 */

/* Infinite loop */
/* USER CODE BEGIN WHILE */
while (1)
{
    /* USER CODE END WHILE */

    /* USER CODE BEGIN 3 */

}
/* USER CODE END 3 */
```



## Data stream on PuTTY

```
COM3 - PuTTY
+*(&$$%$()+.14:>@DJMPTUXYZZZXVTRJFD@;730-)(&$$%$&)/269@AFHMPSUXYZZZXWURNJGD@;6
30,*(&$$%$'(+.24:=ADHMPTUXYZZZYVTRNKHD@;840-*'&$$%$&)+-14:=@DIMPSTXXWZZXWUSPKGC@
<830-*(&$$%$&(*.059=@DHLPRUWYY[YYWUSPKID@;841-*(&$$%$&()-037=@DHLPSUWYZZZYXUSPLH
D@=840.*(&$$%$&'*-047<@CHKPSTVYZZYZWUSPLHDA>950.+(&$$%$&(*,036<@DGKPRTVYYZZYXURP
KHEA=952.*(&$$%$&(*-036<@CFKPRTWYZZYZXUSPLHDA?951.+'&$$%$&'*,/36<@CGKNQTVYZZ[YWU
SPLHDA@9520+('&$$%$&'),046:@CGJNQTVYYZZYVWTPNIEA>962.,)&$$%$&),026:@BFJNRTUXZZZZ
WVSRNHEA@:52/,)'&$$%$&'),036:@BFJOQTVXZZYZZXVTQNIGB>963.,)'&$$%$&),/45:@BEINQTVXYZ
ZZXVTONJEB@:62/-)'&$$%$&)+.25:@AEINQTVXYZZYXVTRNJFB@;630,)&$$%$&'(+.259>ADHLPSWW
YZZYXVTONJFC@;720,('&$$%$&'(+.259=BEHLQSUXYYZZYVTRPJFD@<630-+(&$$%$&'(+.269>@DHLPT
TXYZZYXVTRNKG@<620,+(&$$%$&'*)*.159=@DIKPSUXZZYYXWUSOLGC?;740-*(&$$%$&(*.148<@DHK
PRUWYZZZYWTQOLHD@=740-+(&$$%$&()-058:@DHKPRTXZZZYWTSPMLHD@=941-*('&$$%$&(*-048;@D
HKPSUXXZ[ZYXURPLHE@<:50,*(&$$%$&'*-038<@CHKNRTWYZZZYWTSPMHEA>:40/+)&$$%$&()+047<
@DHKPRTWXZZZYXUSPMHDA=:51.+)&$$%$&(*,037;@CHJNRTWXXZZZYUTPMIDA>;51/,)'&$$%$&(*,03
6:@CGJNQTVXZZZYXVTPNJD@:51.+'&$$%$&(*,0379>CFKNQTVXZZZYVTPPJEA>;62.,)&$$%$&'),
036:>BGIMRTUXYYZZYVSQNKEB>;72.,+'&$$%$&'),036:>BFJNRTVXYZZZXWTRNKEB@;72/,*&$$%$&
)+.469=CFIMPVXYZZYXVTRNKG@;830,*'&$$%$&)+/249>BEILPTVWYZZYZXWTRNKEB@;840,*(&$$%$
&'')+269=BEHLPTWYZZZYXWTRNLGC@;720-*(&$$%$&'(*-158=AEILPTUWYZZZYXUQOKHD@;830-*(&
$$%$&'(*-169=@DHKPTUWYZZZYWTNKH@<930-*)&$$%$&'(*-159<@EHLPTUXYZZYXWTRPKHD@<850-+
)&$$%$&(*-148=@DHKPSVXYZZZXUROLHD@<950-*)&$$%$&(*-058<@EILNRUXYY[ZYXUSPLHD@=751.
+(&$$%$&(*-157;@DHLPTUWYZZZYXVTRNKG@;960.)*&$$%$&'*)-048;@DHLOQTVXZZZYXVSPMID@<96
1.+) '&$$%$&(*,/47;@DHKMQUVYZZYXVSPMIEA>;62/+)&$$%$&(*,036;@BGJOURUWXXZYXUSPMIE@>
:61/,)&$$%$&(*+.36:@AFJNQTVXZZZYXURPNJEA@:63-,)'&$$%$&'(+.37:@AFKNPUVYYYYYXVUPNIF
A>963.+) '&$$%$&)+.46:@AFJMPVXZZZZXWTRNKG@:84.+'&$$%$&'*),.16:@BFKNPSVYZZZYXWTRN
JHA@:63/,*'&$$%$&()+-15:>@FJMPVXWYZZZYXVTRNKG@;74/,*'&$$%$&'*)*.16:>
```

## Data in a file before processing

```
.chm  input.txt x
@@@DGKOSUWXX[ZYYVTRNJEB>;62/+) '&$$%$&'*,037;@CGKNQUWZZ[ZYYVTONKFB@;73.,*(&$$%$&')+046:DFJNR
+046:=BGJMQUWXX[[YXTRPLFC@;840,*(&$$%$&(*,/37>BFINRTWXXZZZYXUROLFCA<840.+(&$$%$&()),.26>BF
+-259<@DILRTTXY[[ZYXUTPLIC@<840-+('%%%'(*-169<@EIMPTVXZZZZZYVRPMHD@=951-+)&$$%$&'(+158<@E
(*.158<@EIMORVXZZZZXWTRNKG@=71.+'&$$%$&'(*-038<@EHKORUXXZ[ZYYVTONMIFA>;62.,)'&$$%$&'*,048;@
037;@CGJNRUXX[[ZZXWTRNKG@;73/,*&$$%$&(*.38;@AHKNQUVY[Z[YVWPNJGB@;74/,)'&$$%$&()),.46:@BFJ
.17>@AFJNQSWX[Z[ZYXURPKHD@;840**(&$$%$&'*),/16:>@FIMQSVXZZZZYURRLHD@;84/,+(&$$%$&'')+16:>@EJ
*/059>ADILPTVXYZ[ZYXVTRNKG@>951-+)&$$%$&'(+06:>@DILPSUYZ[[Z[YVSPMIEA>;62/+) '&$$%$&(*-048<@D
(*-048<@CIKORTXYZ[ZXXWTRPLJEB=:63-+)&$$%$&(*-048<@DGLNQWYZZZZXVUQMJB@>;63-*) '&$$%$&(*-049<@D
028;@BFJORUWXXZZZYWTRNJFB>9630,*(&$$%$&(*.26;@BEKORTVX[[ZYVWRNJFB@;631,*'&$$%$&')*/26:BEK
+.25>BDHNPVYVY[ZZYWURNKH@;840,*'&$$%$&'')+15:>@DHMPTUXZZ[ZXUSNLHE@;860-*) '&$$%$&'')+15:>@D
+-048=@EHLPTUXZZ[ZZYUSPLHE@<840/+(&$$%$&(+,048=@DILOSUWY[ZXXUTPLHFA>;52/+'&$$%$&(+037=@D
(*-047<@CHKPRUXY[ZXXWTPNIEB@:62/,(('&$$%$&()-037<?CGJOQUVYZ[ZYUTQNIEB@973/,)'&$$%$&'()-036<@
.36:@BFJNRTWXX[Z[XVTRNKG@<740,*'&$$%$&()),.26:@BFIPRTVXZZZYWURPJHC@;730-)'&$$%$&''),/26:@BEI
*/269@AEILQRVXYZZZXTRPLHD@<740-+('%%%'(+/158=BDIKPSUWY[ZXUSPLGE@=850-)&$$%$&)+.259@AE
.158<@EHLQSUXYZ[ZXXUTPMHEA>;51.+) '&$$%$&'(*.047<@DHLQTVX[[Z[XVSPMIDA>;51.+) '&$$%$&'(+048<@CH
137:@DGKORUWYZZZYVURNJEB?>53.,*(&$$%$&()+037;@CHJNRUXYZZYVTRNJFB@?>82.,*(&$$%$&(*,026:@CFJ
+026:=CFJNPTVXZZZZXWTRNLGB@;83/,*(&$$%$&)+/27>BFJMPVXZZZYWTRNKG@<830-*) '&$$%$&)+.36>BE
*.169=@EHLPTVXYZ[ZZWUSPKID@<840-+)&$$%$&'(+.26:=@EILQSVY[ZZYUSPLID@=850-+)'&$$%$&'(+,159<@E
(*.058<@EHLORVWY[ZZYVSPMJF@>;62.,)'&$$%$&'(+048<@EHLPRUWY[[ZXXVTONMIGA>;72/,*'&$$%$&'(*-048<@
038;@BHKPRVXZZ[ZVTONJFA@<74.,*'&$$%$&(*.47;@BGKNQUWXXZZZXWQNJGB@;74/,*(&$$%$&'*,46:@AFJ
.27>AGJNQSVYZZYXWURPKHD@;851**(&$$%$&()+.27>@FIMPSWXXZZZYXUSQLHD@<860-*) '&$$%$&()+.27>@EJ
+-169=@DIMPVXZZ[[ZXUTOMIFA=:51-+(&$$%$&)+.069=@EILQTVYZ[ZXXVTPMIE@=953.,(&$$%$&'')+049=@D
```



## C program to process the file

```
int main(int argc, char * agrv[])
{
    char ch;
    int counter = 0;
    FILE * file_output = fopen("output.txt", "wt");
    FILE * file_input = fopen("input.txt", "rt");
    if (file_input == NULL)
    {
        perror("Error while opening the file.\n");
        exit(EXIT_FAILURE);
    }
    while((ch = fgetc(file_input)) != EOF)
    {
        counter++;
        if(counter < 1000)
        {
            fprintf(file_output, "%u\n", ch);
        }
    }
    printf("counter: %d\n", counter);
    fclose(file_input);
    return 0;
}
```

## Sine wave (data from ADC) in Google Sheets

