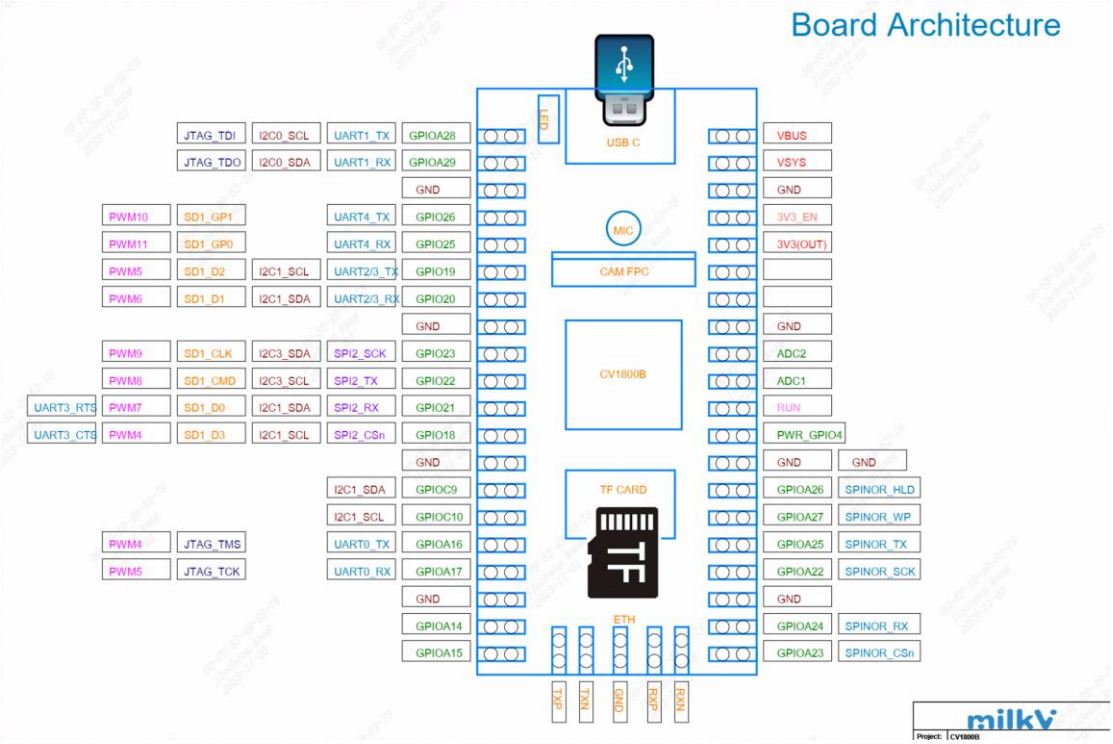
Milk-V Duo Loading DF9GMS Servo

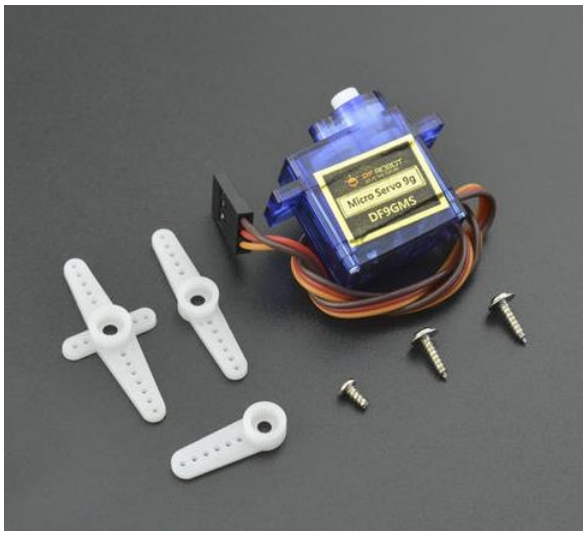
Hardware Information

Duo development board pin

GitHub：https://github.com/milkv-duo/duo-files/blob/master/duo-schematic-v1.1.pdf



DF9GMS



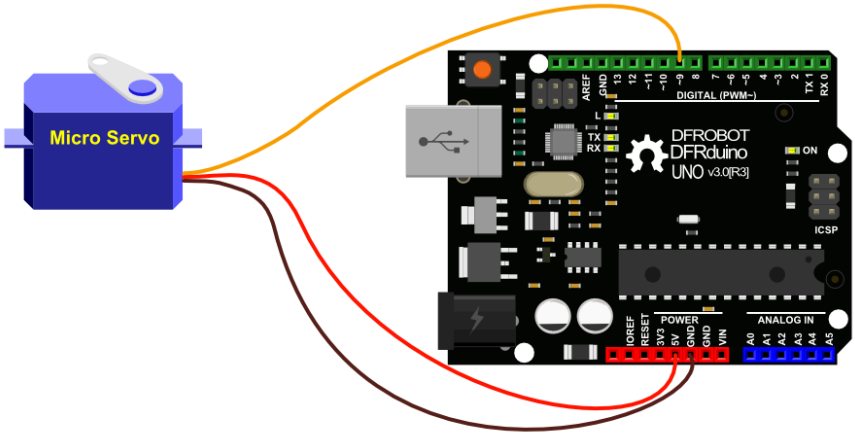
Micro Servo DF9GMS from DFRobot, this servo features a high-strength ABS transparent case with internal high-precision nylon gear set, precision control circuit and high-end lightweight hollow cup motor, resulting in a weight of only 9g for this mini servo, while the output torque reaches an amazing 1.6kg/cm.

Technical Specifications:
Operating Voltage: 4.8V
Torque: 1.6kg/cm (4.8V)
Speed: 0.14 seconds/60 degrees (4.8V)
Operating Temperature: -30 to +60 degrees Celsius
Deadband Width: 0.5 milliseconds
Physical Size: 23x12.2x29mm
Weight: 9g

Composition and Operating Principle of DF9GMS Micro Servo

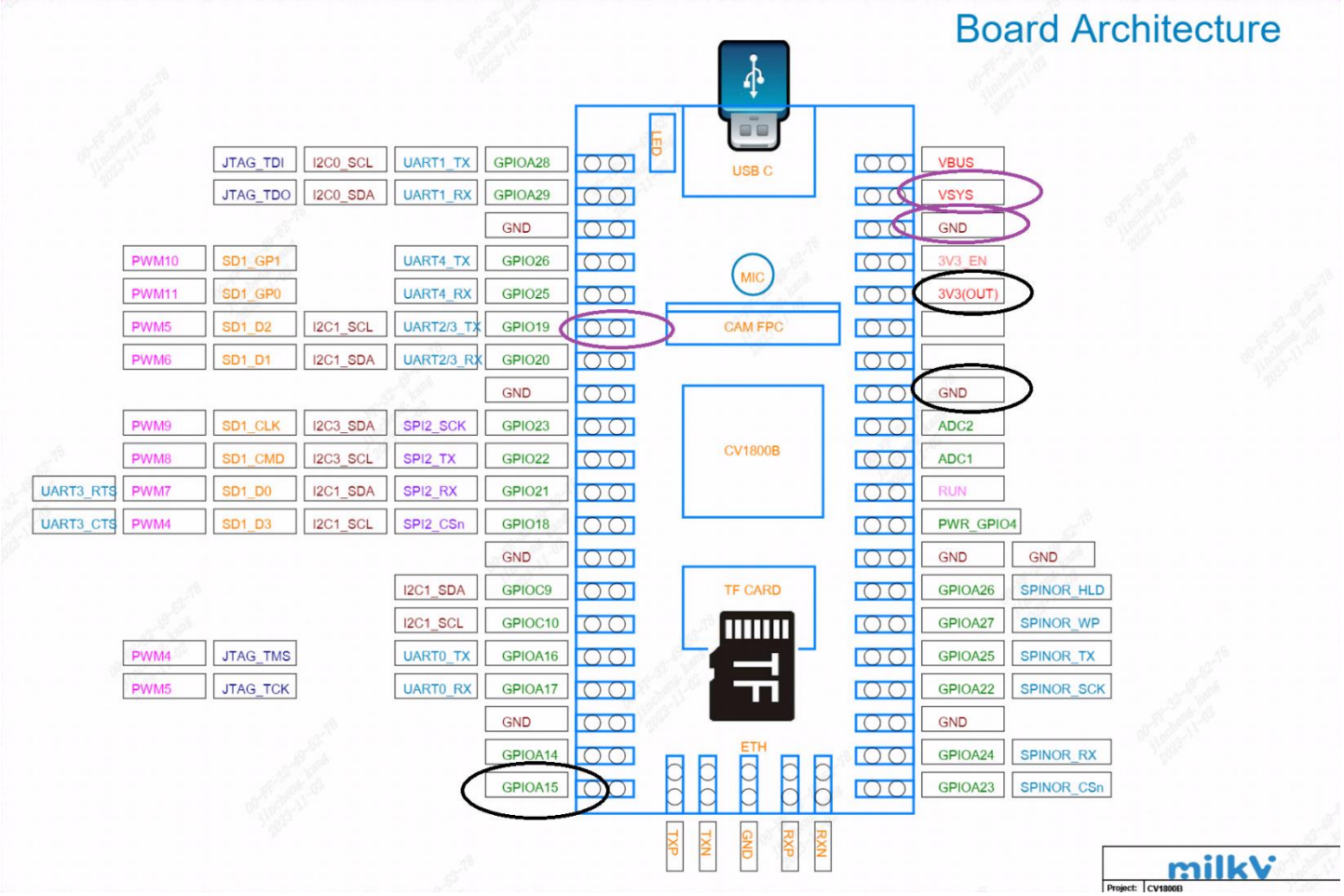
Connection Diagram:

• Hardware
o 1 x Arduino UNO control board
o 1 x DF9GMS micro servo
o Several Dupont wires
o Gray - GND, red - VCC, yellow - signal line

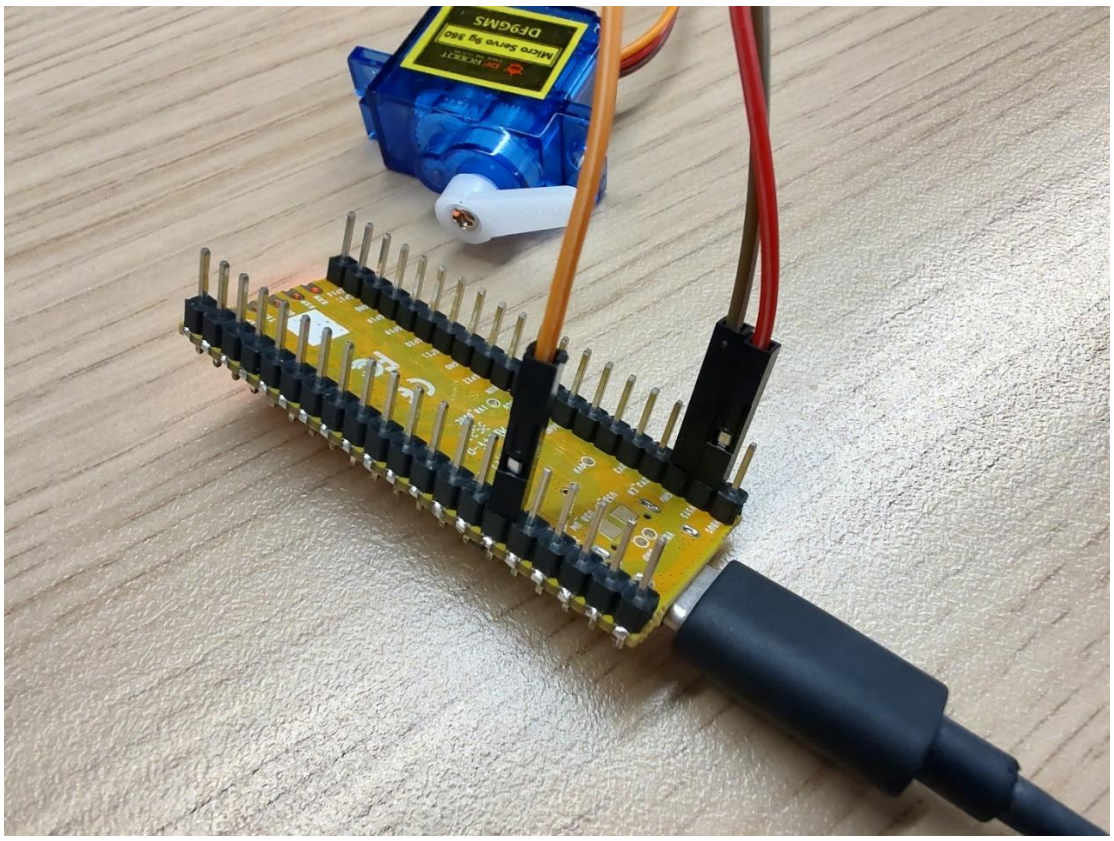


connected to the development board

DF9GMS: red wire connected to VSYS, brown wire connected to ground, orange wire connected to GPIO19.
Circuit diagram shown below: purple circle represents DF9GMS.



DF9GMS should be connected as follows:



Example Code:

GitHub link: https://github.com/milkv-duo/duo-examples

df9gms.c:

```
#include <stdio.h>
#include <unistd.h>
#include <wiringx.h>
	/*
	Duo
	-----------------------------------------
	PWM operation at a fixed frequency clock of 100MHz, writing Period in units of nanoseconds.
	 DF9GMS 360-degree PWM Duty Cycle
	 -----------------------------------------
	 0.4ms - 1.4ms CW deceleration
	 1.5ms Stop
	 1.6ms - 3ms CCW acceleration
	 */
static int PWM_PIN = 4; // PWM5@GP4

int main()
{
	long i;

	if(wiringXSetup("duo", NULL) == -1) {
		wiringXGC();
		return -1;
	}

	wiringXSetPWMPeriod(PWM_PIN, 20000000);	// 20ms
	wiringXSetPWMDuty(PWM_PIN, 1500000);		// 1.5ms stop
	wiringXSetPWMPolarity(PWM_PIN, 0);		// 0-normal, 1-inversed
	wiringXPWMEnable(PWM_PIN, 1);			// 1-enable, 0-disable

	delayMicroseconds(1000000); // 1s

	for (i = 10000; i< 3000000; i += 10000) // 10 us 步进
	{
		wiringXSetPWMDuty(PWM_PIN, i);
		printf("Duty: %ld\n", i);
		delayMicroseconds(50000); // 50ms
	}

	wiringXSetPWMDuty(PWM_PIN, 1500000);	// 1.5ms stop

	return 0;
}
```

Makefile：

```
TARGET=df9gms

ifeq (,$(TOOLCHAIN_PREFIX))
$(error TOOLCHAIN_PREFIX is not set)
endif

ifeq (,$(CFLAGS))
$(error CFLAGS is not set)
endif

ifeq (,$(LDFLAGS))
$(error LDFLAGS is not set)
endif

CC = $(TOOLCHAIN_PREFIX)gcc

CFLAGS += -I$(SYSROOT)/usr/include

LDFLAGS += -L$(SYSROOT)/lib
LDFLAGS += -L$(SYSROOT)/usr/lib
LDFLAGS += -lwiringx

SOURCE = $(wildcard *.c)
OBJS = $(patsubst %.c,%.o,$(SOURCE))

$(TARGET): $(OBJS)
	$(CC) -o $@ $(OBJS) $(LDFLAGS)

%.o: %.c
	$(CC) $(CFLAGS) -o $@ -c $<

.PHONY: clean
clean:
	@rm *.o -rf
	@rm $(OBJS) -rf
	@rm $(TARGET)
```

Build environment on Ubuntu20.04

You can also use Ubuntu installed in a virtual machine, Ubuntu installed via WSL on Windows, or Ubuntu-based systems using Docker.

- Install the tools that compile dependencies.

  sudo apt-get install wget git make

- Get example source code

  git clone https://github.com/milkv-duo/duo-examples.git

- Prepare compilation environment

  cd duo-examples
  source envsetup.sh

  The first time you source it, the required SDK package will be automatically downloaded, which is approximately 180MB in size. Once downloaded, it will be automatically extracted to the duo-examples directory with the name duo-sdk. When source it next time, if the directory already exists, it will not be downloaded again.

- Compile testing

  Take hello-world as an example, enter the hello-world directory and execute make

  cd hello-world
  make

  After the compilation is successful, send the generated helloworld executable program to the Duo device through the network port or the RNDIS network. For example, the RNDIS method

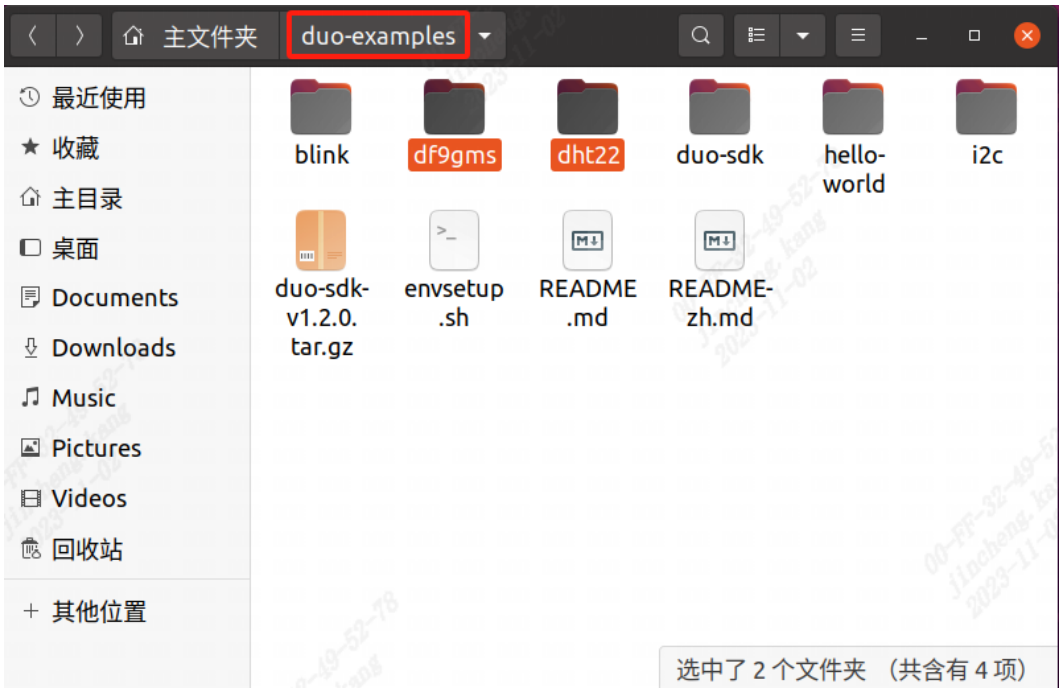
  supported by the `default firmware`, Duo's IP is 192.168.42.1, the user name is root, and the

  password is milkv
  scp helloworld root@192.168.42.1:/root/

  After sending successfully, run ./helloworld in the terminal logged in via ssh or serial port, and it will print Hello, World!
  [root@milkv]~# ./helloworld
  Hello, World!

  `At this point, our compilation and development environment is ready for use.`

Operation Procedure



Next, compile it. Taking df9gms as an example, enter the directory of the example and simply execute make

cd df9gms

make it

Make an error report and source it. After compiling successfully, you will get the df9gms executable program. As shown in the figure below.

```
kjc@ubuntu: ~/duo-examples/df9gms
kjc@ubuntu:~/duo-examples$ source envsetup.sh
SDK_DIR: /home/kjc/duo-examples
SDK environment is ready
kjc@ubuntu:~/duo-examples$ cd df9gms/
kjc@ubuntu:~/duo-examples/df9gms$ ls
df9gms.c  Makefile
kjc@ubuntu:~/duo-examples/df9gms$ make
/home/kjc/duo-examples/duo-sdk/riscv64-linux-musl-x86_64/bin/riscv64-unknown-lin
ux-musl-gcc -D_LARGEFILE_SOURCE -D_LARGEFILE64_SOURCE -D_FILE_OFFSET_BITS=64 -I/
home/kjc/duo-examples/duo-sdk/rootfs/usr/include -o df9gms.o -c df9gms.c
/home/kjc/duo-examples/duo-sdk/riscv64-linux-musl-x86_64/bin/riscv64-unknown-lin
ux-musl-gcc -o df9gms df9gms.o -mcpu=c906fdv -march=rv64imafdcv0p7xthead -mcmode
l=medany -mabi=lp64d -L/home/kjc/duo-examples/duo-sdk/rootfs/lib -L/home/kjc/duo
-examples/duo-sdk/rootfs/usr/lib -lwiringx
kjc@ubuntu:~/duo-examples/df9gms$ ls
df9gms  df9gms.c  df9gms.o  Makefile
kjc@ubuntu:~/duo-examples/df9gms$
```

Then upload df9gms to the root path of the development board, and enter ./df9gms to run it. The screenshot of successful running is shown below

```
[root@milkv-duo]~# ./df9gms
Duty: 10000
Duty: 20000
Duty: 30000
Duty: 40000
Duty: 50000
Duty: 60000
Duty: 70000
Duty: 80000
Duty: 90000
Duty: 100000
Duty: 110000
Duty: 120000
Duty: 130000
Duty: 140000
Duty: 150000
```