Driving DC Motors
DC motors are usually driven by microcontrollers through motor drivers. There are many motor drivers in the market with a wide range of voltage and current specifications. The particular DC motor driver discussed in this section is Toshiba’s TB6612FNG dual motor driver, which is very easy to use and is available in a carrier board. The motor driver can independently control two bidirectional DC motors. The operating voltage range is from 4.5 to 13.5 V. The peak current output is 3 A per channel with 1 A continuous. It is useful for driving low-power motors. Pictures, ordering information and web link of the datasheet for the motor driver are shown below.

<table>
<thead>
<tr>
<th>Vendor</th>
<th>Part Number</th>
<th>Weblink for the part</th>
<th>Description</th>
<th>Unit Price</th>
</tr>
</thead>
</table>

Hardware interfacing to the Freescale 9S12C32 MCU
The wiring diagram below shows how to connect the Pololu motor driver carrier board to the microcontroller.

The motor direction control chart shows how to drive a motor in clockwise and counterclockwise
directions and braking.

**Motor Direction Control Chart**

<table>
<thead>
<tr>
<th>Input</th>
<th>Output</th>
<th>Node</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN1</td>
<td>IN2</td>
<td>PWMA</td>
</tr>
<tr>
<td>H</td>
<td>H</td>
<td>H/L</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
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</tr>
</tbody>
</table>

**Software development**

In the wiring diagram above, the PW0 pin of the microcontroller drives the PWMA pin of the motor driver. A C-function for initializing PW0 as a pulse width modulator is shown below. In the code the duty cycle is set to be 80%. To increase the speed, increase the duty cycle.

```c
Void init_PWM(void) {
    PWMPRCLK=0x06;   //SET CLOCK A TO 125 Khz
    //PWMSCLA=0x06;   // clock SA not used
    PWMCLK=0x00;     // choose CLOCK A as the clock source for PWM channel 0
    PWMCTL=0x00;     // 8 bit pwm signal at channel 0
    PWMPOL=0x01;     // CHANNEL 0 IS ACTIVE HIGH
    PWMCAE=0x00;     // channel 0 is left aligned
    PWMPER0=250;     // PERIOD=250*ONE PERIOD OF CLK A=2ms
    PWMDTY0=200;     // DUTY CYCLE SET TO 80% INITIALLY
    //PWMCNT0=0;
    PWME=0x01;       // ENABLE CHANNEL 0
}
```

To drive the motor moving in the clockwise direction, a C-function for that is shown below. Note that PT1 and PT2 are used as GPIO for driving AIN1 and AIN2 respectively. It is assume that PW0 is outputting.

```c
Void clockwise(void) {
    PTT_PTT1 = 1;
    PTT_PTT2 = 0;
}
```

To drive the motor moving in the counterclockwise direction, a C-function for that is shown below. It is assumed that PT1 and PT2 are used as GPIO for driving AIN1 and AIN2 respectively.

```c
Void counterclockwise(void) {
```
PTT_PTT1 = 0;
PTT_PTT2 = 1;
}

A C-function for braking is shown below.
Void counterclockwise(void) {
    PTT_PTT1 = 1;
    PTT_PTT2 = 1;
}

To stop the motor abruptly, a C-function for that is shown below.
Void counterclockwise(void) {
    PTT_PTT1 = 0;
    PTT_PTT2 = 0;
}