Microchip Technology Jumps to Number One in Worldwide 8-bit Microcontroller Shipments!

PIC® microcontroller shipments grow 30 percent despite industry downturn

Thanks to more than 40,000 worldwide customers, Microchip has achieved the number one position in worldwide 8-bit microcontroller unit shipments, according to industry analyst Gartner Dataquest’s recently released 2002 Microcontroller Market Share and Unit Shipments report††. From 2001 to 2002, unit sales for Microchip’s PIC microcontrollers grew 30 percent, despite challenging business conditions, to attain the number one ranking.

This announcement demonstrates the dramatic growth and market acceptance Microchip’s proprietary PIC microcontroller architecture has achieved since the company’s inception in 1989. According to the yearly Gartner Dataquest rankings, Microchip placed 20th in worldwide unit shipments in 1990, rising steadily to eighth in 1993, fifth in 1996, second in 1997 through 2001 and now number one in 2002.

Achieving these milestones illustrates that Microchip’s PIC microcontrollers deliver a compelling solution for embedded designers worldwide. Today Microchip serves more than 40,000 customers in the consumer, automotive, industrial control, office automation and communications market.

The PIC microcontroller architecture is driven by a modified Harvard RISC (Reduced Instruction Set Computing) instruction set that provides an easy migration path from 8- to 84-pins and from 1k byte to 128k bytes of program data memory. Today, Microchip offers more than 180 PIC devices in reprogrammable (Flash), one-time-programmable (OTP), and read-only memory (ROM) program memory configurations, featuring numerous on-chip peripherals.

“Microchip became number one by pioneering the field programmable segment of the 8-bit microcontroller market with one-time-programmable (OTP) and Flash microcontrollers leadership,” said Microchip’s CEO and President, Steve Sanghi. “Leading engineers worldwide continue to use the PIC microcontroller architecture because we provide a competitive advantage to their own businesses with faster time to market, lower total system cost and low-risk product development.”

Mitch Little, vice president of Worldwide Sales at Microchip Technology said, “Our deepest gratitude to our worldwide customers and distribution partners for enabling this number one ranking to occur.”

Microchip provides world-class easy-to-use development tools, allowing engineers to design quickly and efficiently with PIC microcontrollers. Microchip features a broad portfolio of easy-to-learn development tools to support its PIC microcontrollers: programmers, in-circuit emulators, C compilers, in-circuit debuggers, assemblers, editors, linkers, simulators, librarians and more. Engineers can manage all related Microchip development tools from the single MPLAB® Integrated Development Environment (IDE) platform. With a common core of development tools, Microchip customers can easily transition to new microcontrollers without having to purchase and learn new development tools.

For more information go to: www.microchip.com/one


For the detailed results of the MCU market, contact Gartner Dataquest at (480) 468-8000 or www.gartner.com for the report 2002 Microcontroller Market Share and Unit Shipments. For more information on how Microchip’s PICmicro® microcontrollers provide high performance solutions for leading embedded systems designers, contact any authorized Microchip distributor or sales representative around the world for more information, or visit www.microchip.com/one.
Microchip Technology Introduces New, High Performance, 150 mA CMOS LDO

Microchip has introduced the TC1017, high-accuracy (typically ±0.5%) CMOS upgrade for bipolar low dropout regulators (LDO). The TC1017 is offered in a SC-70 package, which represents a 50% reduced footprint vs. the popular SOT-23 package.

The TC1017 offers better overall performance than competing devices: better load/line transient response, higher output voltage accuracy and supports higher output current requirements.

Key performance parameters for the TC1017 are:

- **150 mA output current**
  Can be used for lower I\(_{\text{OUT}}\), such as, 80 mA, 100 mA, 120 mA

- **Smallest standard SC-70 package in the industry**
  50% smaller footprint than a SOT-23 package. Saves board space.

- **Very low supply (53 µA) and shutdown current (0.05 µA)**
  Extends battery life.

- **Low dropout voltage (285 mV at 150 mA)**
  Maximizes useable battery life.

- **Stability with small, 1 µF ceramic capacitors**
  Saves board space and reduces cost.

- **Excellent dynamic performance**
  Responds faster to line and load changes.

- **High output voltage accuracy (±0.5%)**
  Provides high-precision supply voltages.

The TC1017's features make it ideal for a variety of applications:

- Cellular and Cordless Phones
- Pagers
- PDAs & Laptops
- Digital Cameras & Camcorders
- Bar Code Scanners
- Flash, PC & PCMCIA Cards
- Modems, WLAN Cards/Devices
- Consumer Electronics
- Battery-operated Applications

For more information, contact any authorized Microchip sales representative or authorized distributor, or visit;

[www.microchip.com/solutionstc1017](http://www.microchip.com/solutionstc1017)
PICmicro® Power Managed Tips n' Tricks

Input / Output Multiplexing

Individual diodes and or a combination of diodes can be enabled by driving I/Os high and low or switching to inputs (Z). The number of diodes (D) that can be controlled depends on the number of I/Os (GP) used.

The equation is: \( D = GP \times (GP - 1) \).

Example – Six LEDs on three I/O pins

<table>
<thead>
<tr>
<th>GPx</th>
<th>LEDs</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0 0 0 0 0 0 0 0 0</td>
</tr>
<tr>
<td>1</td>
<td>1 Z 1 0 0 0 0 0</td>
</tr>
<tr>
<td>2</td>
<td>0 1 Z 0 1 0 0 0 0</td>
</tr>
<tr>
<td>3</td>
<td>Z 0 1 0 0 1 0 0 0</td>
</tr>
<tr>
<td>4</td>
<td>Z 1 0 0 0 0 1 0 0</td>
</tr>
<tr>
<td>5</td>
<td>0 Z 1 0 0 0 0 1 0</td>
</tr>
<tr>
<td>6</td>
<td>1 Z 0 0 0 0 0 0 1</td>
</tr>
</tbody>
</table>

For more information, contact any authorized Microchip sales representative or authorized distributor, or visit

[www.microchip.com/solutionstipstricksjuly](http://www.microchip.com/solutionstipstricksjuly)
Implementing a simple voltage follower using a digital potentiometer
By Frank Rossini, Solutions-Cubed

The following technical article is the second in a series of “Hints” reprinted by permission from the Agilent Technologies’ Test & Measurement Group’s publication, “5 Hints for Debugging Microcontroller-based Designs.”

Digital potentiometers or pots have many uses in today’s embedded systems. In this example, we will implement an embedded “voltage follower” using a PIC16F873 microcontroller and a MCP41010 digital pot, both from Microchip Technology, Inc. Basically, the PIC® microcontroller (MCU) will read the analog voltage and instruct the digital pot to reproduce the input voltage. Because we are interested in analyzing the analog input and output and the smart plug-in interface (SPI™) to the digital pot, the mixed-signal analysis capabilities of the Agilent 54642D mixed signal oscilloscope (MSO) will come in handy.

Designing the Voltage Follower

Figure 1 shows the simplified system used for testing, which consists of a filtered analog input to a PIC16F873, three digital lines connecting the PIC MCU to the MCP41010 pot, and the output of the pot. Two analog and three digital lines on the oscilloscope monitor the system.

Analyzing the Analog Input and Digital Output

The top analog trace in Figure 2a represents the input voltage, the analog voltage reading at the bottom of the figure represents the digital output for the SPI. Notice how the output voltage changes after the /CS line is un-asserted on the SPI bus. It is also worth noting that the 54642D MSO has built-in SPI triggering. You can select the lines to use for CS, Clock, and Data, pick between rising and falling edge clocked data, and even select the value of the data byte to trigger on.

Figure 1. Simplified system diagram showing the filtered analog input to a PIC16F873, three digital lines connecting the PIC MCU to the MCP41010 digital pot, and the output of the pot. Two analog lines and three digital lines on the 54642D mixed signal oscilloscope monitor the system.

Figure 2a. Measurement of the test system showing the input voltage (analog trace on top) and the digital output (analog voltage on the bottom).

Figure 2b. Another view of the test system with two transitions.
int8 Get_Voltage(int8 Channel, int8 Count)
{
    set_adc_channel(Channel);
    delay_us(200);
    Vavg = 0;
    for(x=0;x<Count;x++) // Take "Count" Samples{
        delay_us(50); // Sample & Hold Time
        Vavg = Vavg + (read_adc() >> 2); // Use only 8 bits out of 10
    }
    Vavg = Vavg / Count; // Get Averagereturn (int8)(Vavg);
}

void Digital_Pot_Control (int8 Pot_Output)
{
    output_high(CS_41010); //Start with CS line high
    output_low(DAT_41010); //Start with control lines low
    output_low(CLK_41010); //delay_cycles(2); //Small Delay
    output_low(CS_41010); //Assert Chip Select

    //Control Byte Loop - 8 bit constant
    Pot_Temp = 0x11; //Value = 00010001 (Write to Pot0)
    for(x=1;x<9;x++) // Send 8 bits{
        if( bit_test(Pot_Temp,7) == 1 ) //Test for one or zero
            output_high(DAT_41010);
        else
            output_low(DAT_41010);
        shift_left(&Pot_Temp,1,0); //Clock in Data
        delay_cycles(2); //Small Delay
        output_high(CLK_41010); //Small Delay
        delay_cycles(2);
    }

    //Data Byte Loop - 8 bit constant
    Pot_Temp = Pot_Output;
    for(x=1;x<9;x++) //Send 8 bits{
        if( bit_test(Pot_Temp,7) == 1 ) //Test for one or zero
            output_high(DAT_41010);
        else
            output_low(DAT_41010);
        shift_left(&Pot_Temp,1,0); //Clock in Data
        delay_cycles(2); //Small Delay
        output_high(CLK_41010); //Small Delay
        delay_cycles(2);
    }
    output_low(DAT_41010); //Unassert CS line
}

main()
{
    while(TRUE) //Main Program Loop Begin
    {
        restart_wdt(); //Reset Watchdog Timer
        delay_ms(1); //Take 1 Sample
        Simulated_TPS = Get_Voltage(Channel0, 1);
        Digital_Pot_Control(Simulated_TPS);
    }
}

The following abbreviated C code reads the input voltage on the Channel 0 A/D of the PIC MCU, converts it to an 8-bit value, and sends the result directly to the digital pot via the SPI. This allows the designer to input various voltages and easily test the potentiometer output. The format of the data sent to the pot is beyond the scope of this document and is available from Microchip if desired.

Click here for additional information on the Agilent 54642D or information on the MCP41010.
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Microchip now offers online buying and sampling capability.

Microchip now features the ability to purchase products online through its new buy.Microchip site at http://buy.microchip.com or you can link to the site through www.microchip.com. This site allows you to place orders via credit card within the United States at this time. Microchip intends to expand the scope of buy.Microchip to international locations soon. See Figure 1.

With buy.Microchip, you can purchase from the full scope of Microchip devices, including our high-performance PIC® microcontrollers, stand-alone analog and interface products, serial EEPROMs, development tools and many other solutions. You can also obtain Microchip devices through our distribution partners; Arrow, Digi-Key, Future, and Newark who offer many outstanding value-added services to support your design needs.

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