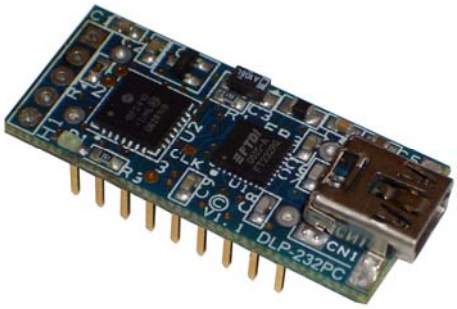
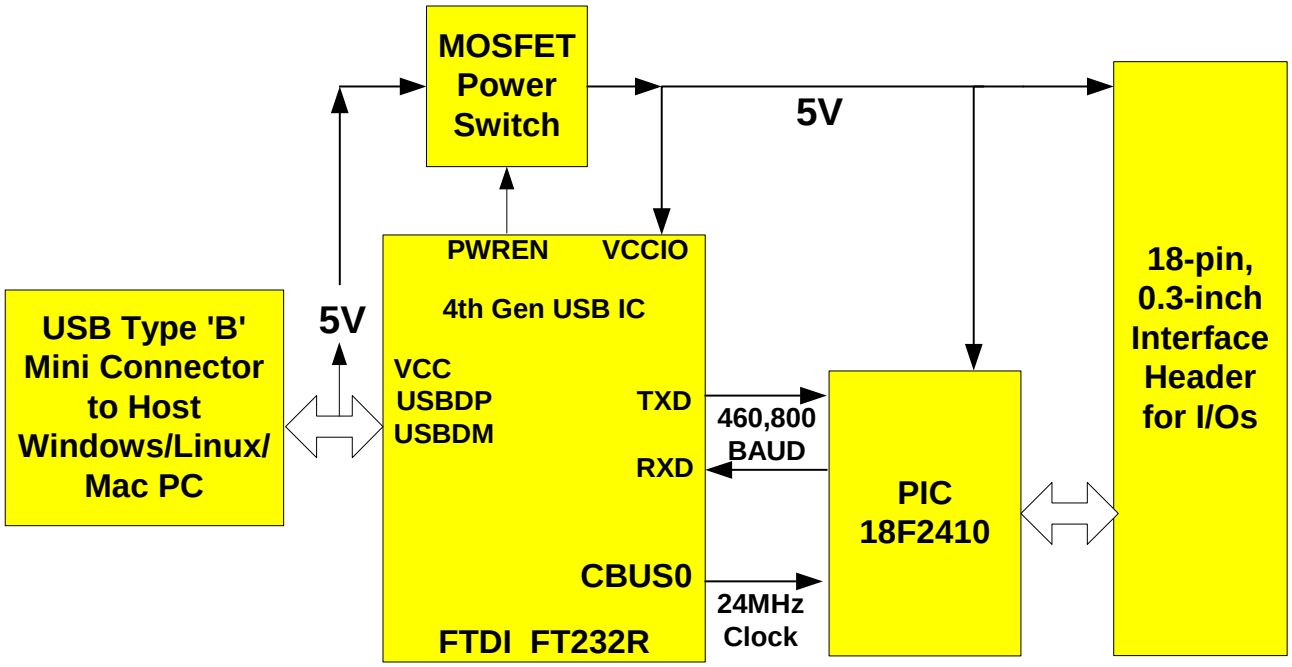


DLP-232PC

LEAD-FREE

MINIATURE USB - MICROCONTROLLER MODULE



Applications:

- Data Acquisition
- Industrial/Process Control
- Process Monitoring

Features:

- 14 Channels: Digital I/O, Temperature, 8 Configurable for Analog In (0-5 Volts)
- PIC18F2410 Microcontroller
- USB Port Powered
- USB 1.1 and 2.0 Compatible Interface
- Small Footprint: 1.375 x 0.6 Inch PCB
- Standard 18-Pin 0.3-Inch DIP Interface with 0.025 Square-Inch Posts
- Easy to Use with Single-Byte Commands; Can Utilize a Simple Terminal Emulator to Control All Functions

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1.0 INTRODUCTION

The DLP-232PC Data Acquisition Module is a low-cost, easy-to-use data acquisition module for measuring voltages, controlling and monitoring processes, and acquiring temperature data. Each of the 14 available channels can be configured for digital I/O or temperature modes via single-byte commands. Eight of the 14 channels can be configured to measure analog voltages in the range of 0-5 volts. All operational power is taken from the host PC via the USB port.

The mode of each I/O is automatically changed with each command sent. For example, if an I/O is set to Digital Output – High and then the Digital Input Mode is selected, the I/O is first changed to Input Mode and then the high/low state is read and returned to the host.

The programming interface (ICSP) is available for custom firmware development.

2.0 SPECIFICATIONS

The DLP-232PC is a 5-volt system that derives its power from the host USB port. Each channel has the following capabilities:

Digital Output: Set high, or clear to low. (The actual high/low voltage depends upon sink/source current.)

Digital Input: Read the high/low state.

Analog In: (Channels 1-8 only) read and return the voltage on each I/O pin using a 10-bit A/D (0-5 volt range, accuracy based on 5-volt USB Host supply voltage).

Temperature: Measure temperature using a digital temperature sensor (purchased separately) in the range of 67 to 257°F (-55 to 125°C).

3.0 ABSOLUTE MAXIMUM RATINGS

Stresses above those listed here may cause permanent damage to the DLP-232PC:

Operating Temperature: 0-70°C

Voltage on I/Os with Respect to Ground: -0.3V to +5.3V

Sink/Source Current on Any I/O: 25mA

4.0 WARNINGS

- Unplug the DLP-232PC from the host PC before making electrical connection to the module to avoid possible damage caused by electrical surge.
- Observe static precautions to prevent damage to the DLP-232PC module.

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5.0 USB DRIVERS

USB drivers for the following operating systems are available for download from the DLP Design website:

Windows XP x64	**Mac OSX**
Windows Server 2003	**Mac OS9**
Windows 2000	**Mac OS8**
Windows 98, ME	**Linux**

These drivers are available for download from the following page: http://www.dlpdesign.com/DNLD8/.

NOTE: If you are using the dual-mode drivers from FTDI (CDM2.00.00) and wish to use the Virtual COM Port (VCP) drivers instead, then it may be necessary to disable the D2XX drivers first via Device Manager. Right click on the entry under USB Controllers that appears when the DLP-232PC is connected, select Properties, select the Advanced tab, check the option for "Load VCP" and click OK. Once you unplug and then replug the DLP-232PC, a COM port should appear in Device Manager under Ports (COM & LPT).

6.0 ANALOG CHANNEL SETUP

Channels that are to be used as analog inputs to measure voltage must be properly configured for analog mode. There are 9 possible scenarios for the A/D Setup listed at the end of Table 1 ranging from no analog channels active to all 8 channels active.

Analog channels must be activated in order starting with Channel 1. For example, if a systems design requires a single analog channel and 13 digital I/O channels, then that analog channel must be Channel 1. (Refer to the end of Table 1 for additional detail.)

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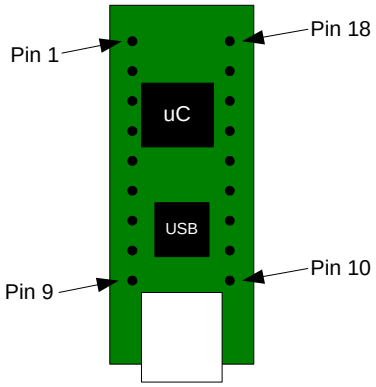
7.0 USING THE DLP-232PC

Simply connect the DLP-232PC to the PC to initiate the loading of drivers. Once the drivers are loaded, the DLP-232PC is ready for use. All commands are single-byte commands.

You can either utilize a simple terminal emulator program or write your own program in your language of choice. Begin by opening the COM port, set the baud rate to 460800 (1 start bit, No parity, 8 data bits, 1 stop bit), and send single-byte commands as shown in Table 1. The Ping command can be used to locate the correct COM port used for communicating with the DLP-232PC, or you can look in Device Manager to see which port Windows has assigned to the DLP-232PC.



Top View (Interface Headers on bottom of PCB)

TABLE 1

Channel 1 (Pin 5) Commands			
ASCII Character	**Hex Value**	**Description**	**Return / Comments**
1	0x31	Dig Out – High	Nothing returned
Q	0x51	Dig Out – Low	Nothing returned
A	0x41	Digital Input	Returns 0 or 1 (See Note 1)
Z	0x5A	Analog In	Returns measured voltage (See Note 1)
9	0x39	Temperature	Returns current temperature (See Notes 1 and 2)

Channel 2 (Pin 4) Commands			
2	0x32	Dig Out – High	
W	0x57	Dig Out – Low	
S	0x53	Digital Input	
X	0x58	Analog In	
0	0x30	Temperature	

Channel 3 (Pin 1) Commands			
3	0x33	Dig Out – High	
E	0x45	Dig Out – Low	
D	0x44	Digital Input	
C	0x43	Analog In	
-	0x2D	Temperature	

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Channel 4 (Pin 2) Commands			
4	0x34	Dig Out – High	
R	0x52	Dig Out – Low	
F	0x46	Digital Input	
V	0x56	Analog In	
=	0x3D	Temperature	

Channel 5 (Pin 3) Commands			
5	0x35	Dig Out – High	
T	0x54	Dig Out – Low	
G	0x47	Digital Input	
B	0x42	Analog In	
O	0x4F	Temperature	

Channel 6 (Pin 17) Commands			
6	0x36	Dig Out – High	
Y	0x59	Dig Out – Low	
H	0x48	Digital Input	
N	0x4E	Analog In	
P	0x50	Temperature	

Channel 7 (Pin 16) Commands			
7	0x37	Dig Out – High	
U	0x55	Dig Out – Low	
J	0x4A	Digital Input	
M	0x4D	Analog In	
[	0x5B	Temperature	

Channel 8 (Pin 15) Commands			
8	0x38	Dig Out – High	
I	0x49	Dig Out – Low	
K	0x4B	Digital Input	
, (Comma)	0x2C	Analog In	
]	0x5D	Temperature	

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Channel 9 (Pin 6) Commands			
/	0x2F	Dig Out – High	
a	0x61	Dig Out – Low	
b	0x62	Digital Input	
c	0x63	Temperature	

Channel 10 (Pin 8) Commands			
d	0x64	Dig Out – High	
e	0x65	Dig Out – Low	
f	0x66	Digital Input	
g	0x67	Temperature	

Channel 11 (Pin 11) Commands			
h	0x68	Dig Out – High	
i	0x69	Dig Out – Low	
j	0x6a	Digital Input	
k	0x6b	Temperature	

Channel 12 (Pin 12) Commands			
l	0x6c	Dig Out – High	
m	0x6d	Dig Out – Low	
n	0x6e	Digital Input	
o	0x6f	Temperature	

Channel 13 (Pin 13) Commands			
p	0x70	Dig Out – High	
q	0x71	Dig Out – Low	
r	0x72	Digital Input	
s	0x73	Temperature	

Channel 14 (Pin 14) Commands			
t	0x74	Dig Out – High	
&	0x26	Dig Out – Low	
*****	0x2A	Digital Input	
(	0x28	Temperature	

Setup Commands (Remembered Until Power is Cycled)			
`	0x60	Return ASCII	Default setting; nothing returned (Accent Grave character just left of the 1 key)
****	0x5C	Return Binary	Nothing returned
L	0x4C	Set °F	Default setting; nothing returned
;	0x3B	Set °C	Nothing returned

Ping Command			
‘	0x27	Issue Ping	Q (0x51) will be returned if the DLP-232PC is found on the selected port (Apostrophe character just right of the ; key)

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A/D Setup			
u	0x75	No Analogs	A/D Converter disabled
v	0x76	CH1 Only	A/D active on Channel 1 only
w	0x77	CH1 and CH2	A/D active on Channels 1 and 2
x	0x78	CH1,2,3	A/D active on Channels 1 through 3
y	0x79	CH1,2,3,4	A/D active on Channels 1 through 4
z	0x7A	CH1,2,3,4,5	A/D active on Channels 1 through 5
#	0x23	CH1,2,3,4,5,6	A/D active on Channels 1 through 6
$	0x24	CH1 – CH7	A/D active on Channels 1 through 7
%	0x25	CH1 – CH8	A/D active on Channels 1 through 8

LED Commands			
{	0x7B	LED Off	
}	0x7D	LED On	

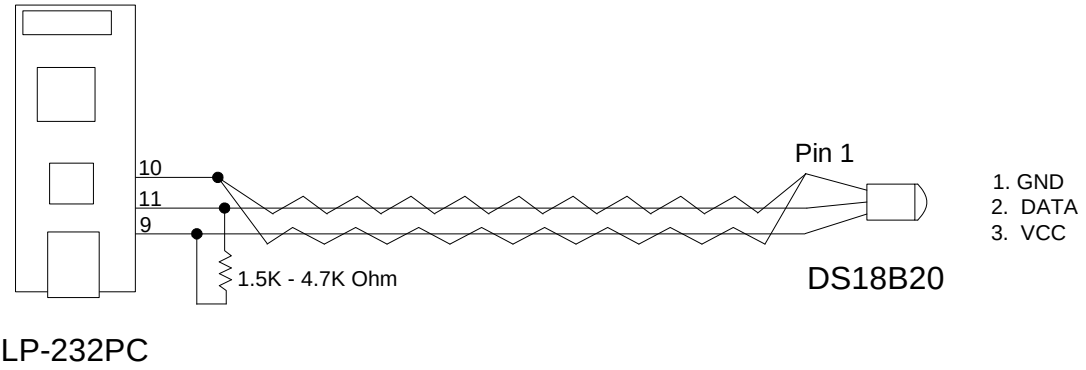
Note 1 – Data is returned in either the form of ASCII characters (ex: 1.25V, 78.2°F) or binary (raw data) depending upon the current mode. The power-up default mode is ASCII such that data is easily read using a terminal emulator program.

Note 2 – Requires DS18B20 digital temperature sensor (purchased separately). See Section 8.0 of this document for connection details.

8.0 TEMPERATURE

Up to 14 DS18B20 digital temperature sensors can be connected to the DLP-232PC. For best performance, use Category 5 type computer cable to connect the sensors to the DLP-232PC. Two pairs of wires in the Cat 5 cable are required for the connection. The first pair is for Power (5V) and Ground, and the second pair is designated as Data and Ground. In addition, a pull-up resistor is required for the data line in the range if 1.5K-4.7K Ohms. Figure 1 shows an example of this connection using I/O Channel 11:

FIGURE 1



The first time temperature data is requested, a value of 999.99° (0xFF x 2 if in Binary Mode) is returned. Subsequent reads will return valid temperature data if a temperature sensor is properly configured and connected to the specified I/O port. If no sensor is connected, a Temperature command will always return 999.99°. Please note that the PAR versions of the sensor (DS18B20+PAR) will not work with the 232PC firmware.

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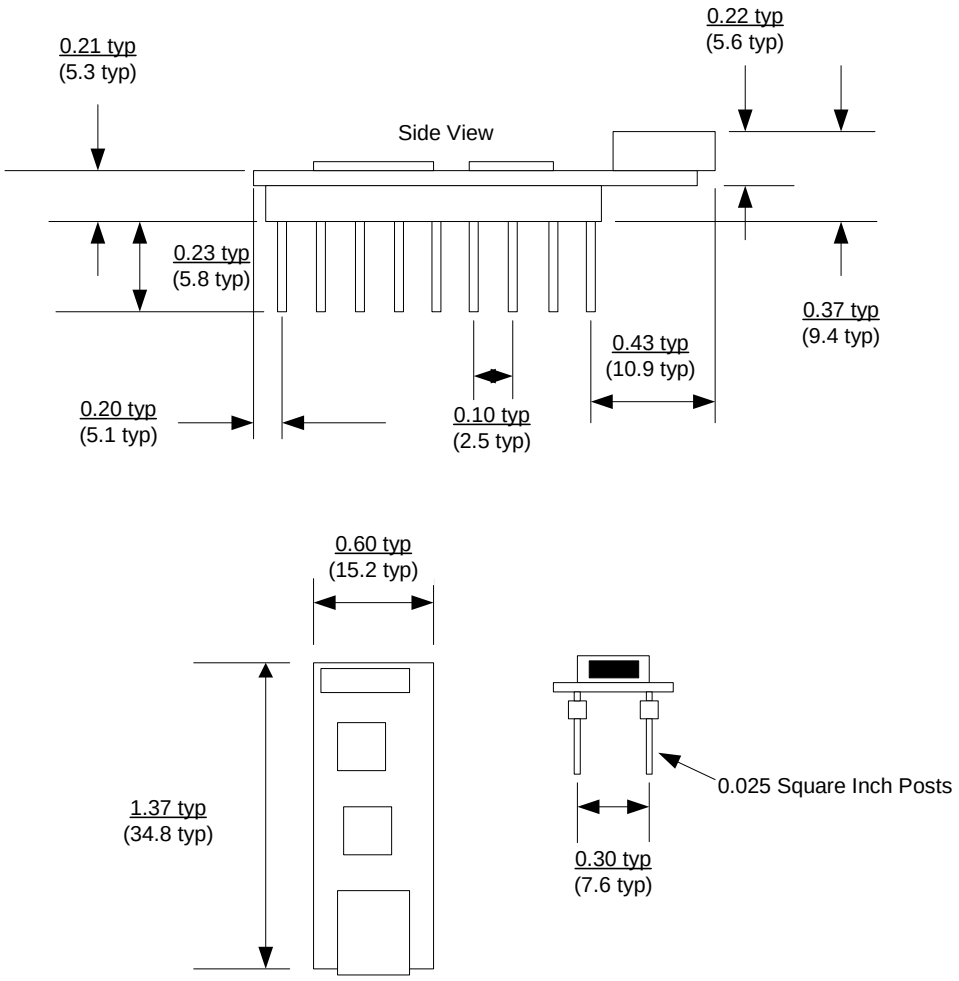
9.0 RETURN DATA TYPES

By default, the DLP-232PC returns data to the host PC in the form of ASCII text such that it can be easily displayed and read using a simple terminal emulator. Alternatively, data can be returned in binary form requiring the user's host app to calculate the voltage and temperature values. The commands used to set the return data types (0x60 and 0x5C) are shown at the end of Table 1.

10.0 MECHANICAL DIMENSIONS IN INCHES (MM) (PRELIMINARY)



11.0 DISCLAIMER

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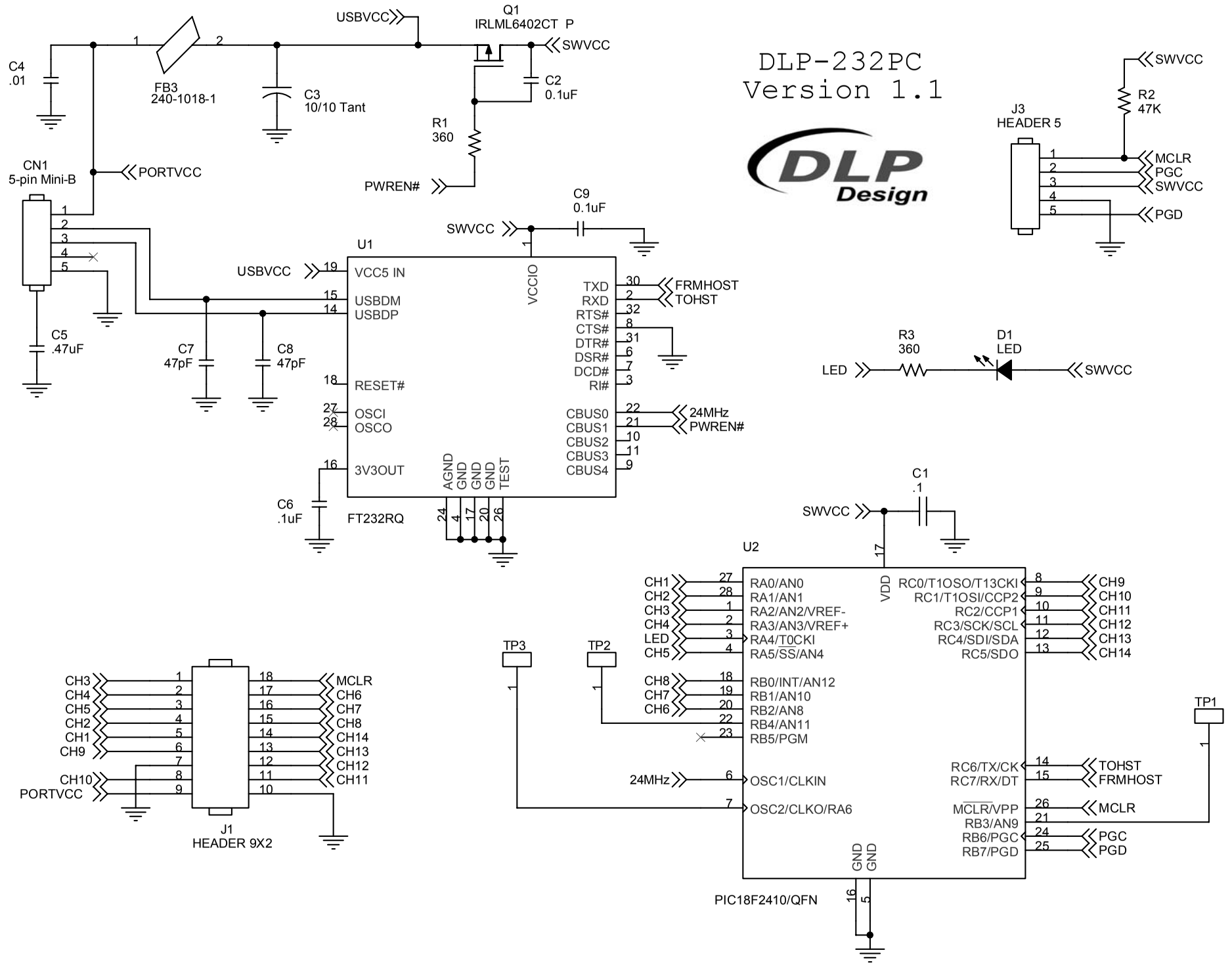
DLP-232PC
Version 1.1
DLP Design
USBVCC
Q1
IRLML6402CT P
SWVCC
C4
.01
FB3
240-1018-1
C3
10/10 Tant
C2
0.1uF
R1
360
PWREN#
CN1
5-pin Mini-B
PORTVCC
C9
0.1uF
U1
VCC5 IN
USBDM
USBDP
RESET#
OSCI
OSCO
3V3OUT
VCCIO
TXD
RXD
RTS#
CTS#
DTR#
DSR#
DCD#
RI#
CBUS0
CBUS1
CBUS2
CBUS3
CBUS4
AGND
GND
GND
GND
TEST
FRMHOST
TOHST
24MHz
C5
.47uF
C7
47pF
C8
47pF
C6
.1uF
FT232RQ
J3
HEADER 5
R2
47K
MCLR
PGC
PGD
R3
360
D1
LED
C1
.1
U2
RA0/AN0
RA1/AN1
RA2/AN2/VREF-
RA3/AN3/VREF+
RA4/T0CKI
RA5/SS/AN4
RB0/INT/AN12
RB1/AN10
RB2/AN8
RB4/AN11
RB5/PGM
OSC1/CLKIN
OSC2/CLKO/RA6
VDD
RC0/T1OSO/T13CKI
RC1/T1OSI/CCP2
RC2/CCP1
RC3/SCK/SCL
RC4/SDI/SDA
RC5/SDO
RC6/TX/CK
RC7/RX/DT
MCLR/VPP
RB3/AN9
RB6/PGC
RB7/PGD
GND
GND
PIC18F2410/QFN
TP1
TP2
TP3
CH1
CH2
CH3
CH4
CH5
CH6
CH7
CH8
CH9
CH10
CH11
CH12
CH13
CH14
LED
J1
HEADER 9X2
PORTVCC

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