

# カメレオンIC PSoCの研究 PSoC 4 Pioneer KitでPmodモジュールを制御する

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Cypress Semiconductor Corporation (以下Cypress社) が提供しているPSoC (Programmable System on Chip) シリーズの評価キットPSoC 4 Pioneer Kitは、Pmod (ピーモッドと発音) と呼ばれる拡張モジュールに対応しています。今回はPSoC 4 Pioneer Kitに、そのPmodモジュールを接続したI/O機能の拡張例を紹介します。

## 1 Pmodインターフェースとモジュール

### ● Pmodとは

Pmodとは、Digilent社が規定した低周波数・少I/Oのペリフェラル・ボードを接続するための規格です。電源ピン ( $V_{CC}/GND$ ) も含めて6ピン (6ピン×1列)、8ピン (4ピン×2列)、および12ピン (6ピン×2列) の3種類があり、全てピン間隔は2.54mmピッチとなっています。図1にPmodの仕様書を、写真1に12ピン (6ピン×2列) のPmodコネクタを示します。

電源は5.0Vと3.3Vの2通りですが、信号レベルはLVCMOS 3.3VもしくはLVTTL 3.3Vです。ホスト側からPmodモジュールへ供給する最大電流は明記されていませんが、おおむね100mAとしています。インターフェースは汎用I/Oとして接続するものもありますが、主にシリアル通信を前提としているようです。

Pmodコネクタを搭載したホスト・ボードは、今回使用するPSoC 4 Pioneer Kit以外に、FPGAベンダのXilinx社やLattice Semiconductor社からも提供されています。

### Digilent Pmod™ Interface Specification

Revision: November 20, 2011



#### Introduction

The Digilent Pmod interface is used to connect low frequency, low I/O pin count peripheral modules to host controller boards. There are six-pin and twelve-pin versions of the interface defined. The six-pin version provides four digital I/O signal pins, one power pin and one ground pin. The twelve-pin version provides eight I/O signal pins, two power pins and two ground pins. The signals of the twelve-pin version are arranged so that it provides two of the six-pin interfaces stacked.

In general, Pmod peripheral modules can plug directly into connectors on the host controller board, or be connected to the controller board via six-pin or twelve-pin cables. Two six-pin peripheral modules can be connected to a single twelve-pin host connector via a twelve-pin to dual six-pin splitter cable. Similarly, a single twelve-pin peripheral module can be connected to two six-pin host connectors via the same twelve-pin to dual six-pin splitter cable.

Pmod peripheral modules are powered by the host via the interface's power and ground pins.

The Pmod interface is not intended for high frequency operation, however, using RJ45 connectors and twisted pair Ethernet cable, signals have been sent reliably at 24Mhz and distances of up to 4 meters.

In addition to the six and twelve pin interfaces, the Pmod peripheral module interface also encompasses a variant using the I<sup>2</sup>C interface, and two or four wire MTE cables. In some cases, an I<sup>2</sup>C connected module can be connected directly to a Pmod connector on a system board, but generally the connection will be via MTE cables. The Pmod I<sup>2</sup>C interface provides the two I<sup>2</sup>C signals, SDA and SCL, plus power and ground.

#### Electrical Specifications

The digital signal characteristics are not specified. However, the general expectation is that a 3.3V logic power supply will be used and the signals will conform to LVCMOS 3.3V or LVTTL 3.3V logic conventions.

The driver current source/sink capability isn't specified and depends on the capabilities of the specific system board or module. The I/O pins on Xilinx FPGAs generally have symmetrical 24mA source/sink capability. The drive capability of microcontrollers is generally less and some of them are not symmetrical. The drive strength for microcontroller pins is generally in the range +/-5mA to +/-10mA.

The I/O pins on system board Pmod connectors generally have ESD protection diodes and 200ohm series resistors. The resistors are to limit short circuit currents if pins are inadvertently shorted, or to protect against driver conflicts if outputs are inadvertently connected together.

Peripheral modules may be connected to the host via cables of up to 18" in length. The drivers on the host or peripheral module should have sufficient drive strength to drive this length of cable at

Doc: 510-002

page 1 of 11

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図1 Pmodの詳細仕様書

[http://www.digilentinc.com/Pmods/Digilent-Pmod\\_20\\_Interface\\_Specification.pdf](http://www.digilentinc.com/Pmods/Digilent-Pmod_20_Interface_Specification.pdf)

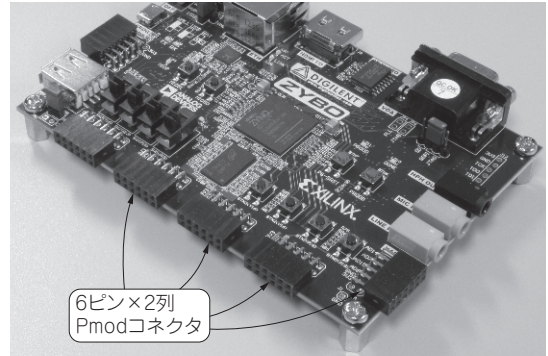


写真1 Pmodコネクタの例 (6ピン×2列)

表1 Pmod仕様書で定義しているインターフェース

分類	インターフェース	ピン数
I <sup>2</sup> C		8
Type1	GPIO	6
Type2	SPI	6
Type2A	expanded SPI	12
Type3	UART	6
Type4	UART	6
Type4A	expanded UART	12
Type5	H-Bridge	6
Type6	dual H-Bridge	6