imp006-breakout

Intro

The imp006-breakout design is intended to serve two purposes:

1. Provide a off-the-shelf hardware platform that allows a customer to evaluate the imp006 product & Twilio/Electric Imp platform

In order to evaluate the imp006, customers need to be able to connect it to sensors and actuators, build an application, integrate it with a cloud backend, and measure various parameters such as power consumption and latency to determine if they meet requirements. To satisfy these requirements, the imp006-breakout has various on-board peripherals, industry standard expansion connectors, and a configurable power supply to satisfy several common power scenarios.

2. Provide a reference design that customers can use to base their own imp006 products on

The schematics presented here are modular, with source provided for both schematics and PCB; a customer requiring only cellular connectivity can simply remove the entire WIFI/BLE page (and conversely, a customer needing only WIFI/BLE can remove the cellular page). At a more granular level within each schematic sheet, each functional area is boxed with a short description of the functionality it provides - for example, if GNSS is not required but cellular is, the GNSS parts of the cellular page can be removed without any side-effects.

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1: This page.

2: Core imp006: components on this page are all required in every customer design - the MCU, QSPI flash, blinkup and status LEDs.

3: Power: the power system is designed to work with both primary cells (or external power) and Li-Ion rechargeable cells; pick the power supply which suits your application, or omit this section and supply power to the components with your own power supplies.

4: Connectors/Peripherals: this page is really quite breakout-specific, but shows how various peripherals can be wired (eg sensors).

5: Cellular: parts required to support the Quectel BG96 Cat-M/2G/NB-IoT+GNSS radio. Can be omitted for WiFi/BLE only designs.

6: WiFi/BLE: parts required to support the Murata 1MW dual-band 802.11ac/a/b/g/n + BLE 4.1 radio. Can be omitted for cellular only designs.
Power selection jumpers

The imp006-breakout is designed for extreme power savings in multiple operating modes.

**JP-A: Force buck on**

JP-A is to force the primary buck ON regardless of whether the MCU wants either state to be present.

This is used when JB is set to 2-3: so that the primary buck will not be turned on to provide the MCU with power, or when power needs to be preserved in a shock to allow the GPS data to power through.

If the primary cell used is 18V (and JP-C is used normally), JB can still be used when required, selecting Q1.

**JP-B: VMOD select**

JP-B determines whether VMOD, the voltage mode supply, should be enabled or disabled, providing:

1. Power VMOD from VBUS, so the Li-Ion PMU can be enabled.
2. Power VMOD from the 3V3 back, which is used when a primary battery pack is in use.

**JP-C: 3V3 select**

JP-C determines if the 3V3 from VMOD power supply is enabled.

1. Power 3V3 from VMOD, which is used when a primary battery pack is in use.
2. Power 3V3 back from the primary cell, only used when the PRIMARY CELL MAX VOL GND is 3.3V.

**JP-D: USB Only power**

JP-D is used to bypass PMU U1 from VBUS to PRIMARY JN.

* Default factory state

### Primary battery 3V8 supply

#### Common configurations

- **Li-Ion rechargeable cell**
  - Primary cell, 4-10v
  - Primary cell, 10-17v

- **USB Only (no battery)**

* Default factory state

### Li-ion battery & gas gauge

8-bit 2G address: 0x0C

- Current sense
- Reverse-voltage protection

### Primary Battery Voltage Measurement

To use, short W12 and W9, then drive pinYG high to read scaled voltage on pinXD

### Li-ion PMU/battery charger & power path

8-bit 2G address: 0x0D

When J3 is used for power input, the USB DM/DP brick will not work, so short W1 to set 3A input current limit

Short W3 to enable PMU IRQ on pinXM

W10 is used for shipping modes

W10 enables pinYC control of S5V_PMU BOOST

### I2C bus isolator

This ensures an unpowered PMU & GG do not load the I2C bus when a primary cell power source is used. Applicable only to this breakout board

### Ultra-low Iq 3v3 supply

Hour range: ~3.5V to 4.5V

Used in all power configurations to power MCU and peripherals

### Alternative Ultra-low Iq 3v3 supply

Hour range: ~3.5V to 7V

Used in all power configurations to power MCU and peripherals
**Dual-band WiFi & BT module**
The Murata LBEE5HY1MW module is used to provide 2.4 & 5GHz WiFi ac/a/b/g/n and Bluetooth capabilities.
Please contact Electric Imp for guidance on using the Murata UDX module if only single-band WiFi & BT is required.
If you are not using WiFi or BT in your design, this entire page can be omitted.

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**Dual-band WiFi & BT antenna**
The relevant antenna is the Murata reference antenna, which was used for their FCC modular certification testing. Due to layout constraints, this antenna is not used in the best configuration on the imp006-breakout.
Please contact Murata for more details on correct 1MW antenna placement and usage.

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**WiFi / BT power gate**
In this design, because someone may be using the imp006 breakout just for cellular, WiFi / BT power is gated totally when WIFIBT_PWR_EN is low; this saves 1uA for designs that aren’t using WiFi or BT.
WIFI_VDDIO is gated by WIFI_BAT, ensuring that it comes up after WIFI_BAT as specified in the CYW43455 database.