

PayRange BluKey Module

User Manual

Introduction

The turnkey PayRange payment system includes several BluKey hardware devices for making payments with a mobile app. Consumers maintain a prepaid balance on their smartphones and use it to make payments at a variety of machines that can include vending, amusement, parking, transit ticketing, and laundry equipment.

BluKey Module (BK Module) provides BluKey in a form factor suitable for easy integration into latest generation of controller boards of vending and other kinds of machines that accept payments. It provides a low-cost additional BOM for controller board and easy future upgrade path without redesign of the controller board.

BK Module is implemented in a form factor and complies with mini PCI Express board standard (half-size), so existing low-cost connectors and holders can be used, though it does not use PCI bus and instead uses lower-end interfaces for easier software integration. Typically there is no change to the software needed (if integration is performed using UART lines for MDB).

Usage

Usage selection requires software support from Payrange application. See Payrange.com for details.

I2C

The Blukey Module can control numerous I/Os through the I2C interface. Connect one or more port expander circuits.

UART

The Blukey Module can communicate with a host over USB or UART using the Payrange Host Protocol Version 1.0

Logic

The Blukey module can use its own internal GPIO to control payment devices such to imitate a coin switch.

Specification

Electrical Characteristics

Absolute Maximum Ratings

Symbol	Description	Min	Max	Unit	Notes
T _{STG}	Storage temperature	-40	85	°C	1
V _{DD}	+3.3V supply	-0.3	3.8	V	
V _{DIO}	Digital input voltage	-0.3	V _{DD} + 0.3	V	

1. Determined according to JEDEC Standard JESD22-A103, High Temperature Storage Life.

Operating Conditions

Symbol	Description	Min	Typ	Max	Unit
T _O	Operating temperature range	-30	-	85	°C
V _{DD}	+3.3V supply voltage	3.0	3.3	3.6	V
I _{DD}	+3.3V supply current		-	200	mA
V _{IL}	input logic level low	-0.4	-	0.35 x V _{DD}	V
V _{IH}	input logic level high	0.7 x V _{DD}	-	V _{DD} + 0.4	V
V _{OH}	Output high voltage	V _{DD} - 0.5	-	-	V
V _{OL}	Output low voltage	-	-	0.5	V

ESD handling ratings

Symbol	Description	Min.	Max.	Unit	Notes
V _{HBM}	Electrostatic discharge voltage, human body model	-2000	+2000	V	1
V _{CDM}	Electrostatic discharge voltage, charged-device model	-500	+500	V	2
I _{LAT}	Latch-up current at ambient temperature of 105°C	-100	+100	mA	3

1. Determined according to JEDEC Standard JESD22-A114, Electrostatic Discharge (ESD) Sensitivity Testing Human Body Model (HBM).
2. Determined according to JEDEC Standard JESD22-C101, Field-Induced Charged-Device Model Test Method for Electrostatic-Discharge-Withstand Thresholds of Microelectronic Components.
3. Determined according to JEDEC Standard JESD78, IC Latch-Up Test.

Connector Pinout

BK Module connector is standard 52-pin mini PCI Express edge connector.

Pin	Name	Type	Pin	Name	Type
51	SATA Presence Detection	output, NC	52	+3.3V	power
49	Button	Input	50	GND	power
47	GPIO2	in/out	48	+1.5V	power
45	GPIO1	in/out	46	LED_Blue	output, open drain
43	PCIe Presence Detection	output, NC	44	LED_Red	output, open drain
41	+3.3V	power	42	LED_Option	output, open drain
39	+3.3V	power	40	GND	power
37	GND	power	38	USB_D+	in/out
35	GND	power	36	USB_D-	in/out
33	Reserved	NC	34	GND	power
31	Reserved	NC	32	I2C_SDA	in/out
29	GND	power	30	I2C_SCL	output, open drain
27	GND	power	28	+1.5V	power
25	Reserved	NC	26	GND	power
23	Reserved	NC	24	+3.3V	power

21	GND	power	22	[PERST#]	input
19	UART_AUX_TxD	output	20	[W_DISABLE#]	input
17	UART_AUX_RxD	input	18	GND	power
Mechanical Key					
15	GND	power	16	Reserved	NC
13	Reserved	NC	14	Reserved	NC
11	Reserved	NC	12	Reserved	NC
9	GND	power	10	Reserved	NC
7	[CLKREQ#]	output, open drain	8	Reserved	NC
5	UART_TxD	output	6	+1.5V	power
3	UART_RxD	input	4	GND	power
1	[WAKE#]	output, open drain	2	+3.3V	power

Host Device Design Requirements

All signals are in +3.3V domain.

The following table lists requirements for each pin.

Pin	Notes	Pin	Notes
51	NC, detect mSATA if GND	52	+3.3V
49	Optional, connect to a button dedicated to BK function (other end to GND), mSATA: DA/DSS	50	GND
47	NC, Vendor (mSATA)	48	+1.5V
45	NC, Vendor (mSATA)	46	Optional, Blue LED for BK status, max 9mA, Vol 400mV
43	NC, detect mini PCIe if GND	44	Optional, Red LED for BK status, max 9mA, Vol 400mV
41	+3.3V	42	Optional, LED 3 for BK status, max 9mA, Vol 400mV
39	+3.3V	40	GND
37	GND	38	USB_D+ master / hub
35	GND	36	USB_D- master / hub
33	NC, PETp0 (PCIe), +A (mSATA)	34	GND
31	NC, PETn0 (PCIe), -A (mSATA)	32	Optional, I2C_SDA (slaves only), provide pullup*
29	GND	30	Optional, I2C_SCL (slaves only), provide pullup*
27	GND	28	+1.5V
25	NC, PERp0 (PCIe), -B (mSATA)	26	GND
23	NC, PERn0 (PCIe), +B (mSATA)	24	+3.3V
21	GND	22	Optional, PERST# (PCIe), NC (mSATA)
19	NC or 2nd MDB, UIM_IC_DP (PCIe)	20	Optional, W_DISABLE1# (PCIe), NC (mSATA)
17	NC or 2nd MDB, UIM_IC_DM (PCIe)	18	GND

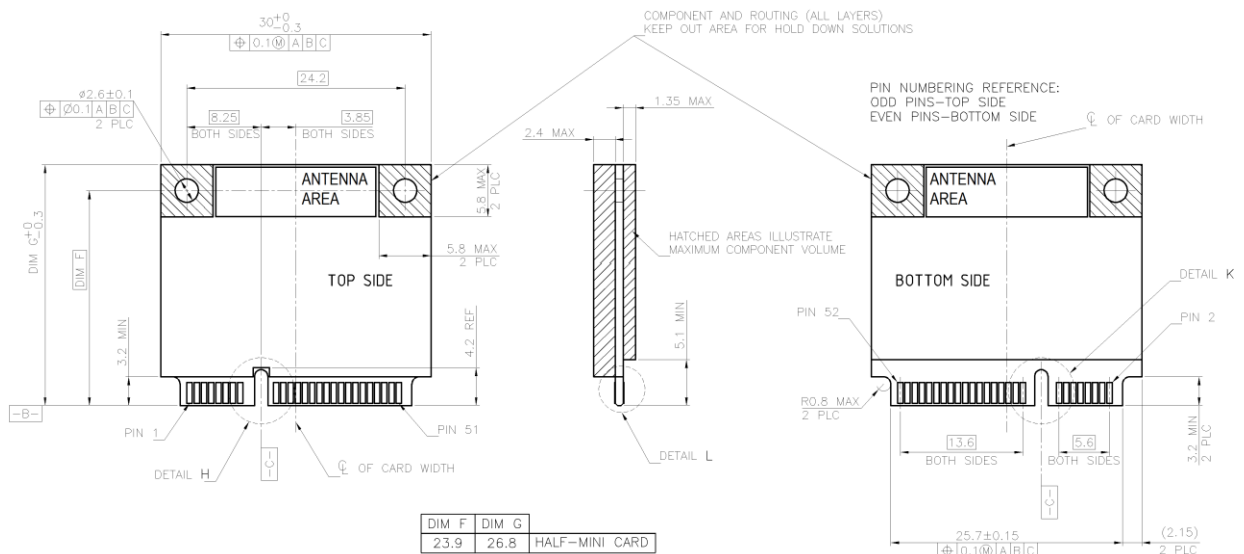
Mechanical Key			
15	GND	16	NC, UIM_SPU/C6 (PCIe)
13	NC, REFCLK+ (PCIe)	14	NC, UIM_RESET/C2 (PCIe)
11	NC, REFCLK- (PCIe)	12	NC, UIM_CLK/C3 (PCIe)
9	GND	10	NC, UIM_DATA (PCIe)
7	Optional, CLKREQ# (PCIe, handshake for PERST#), NC (mSATA)	8	NC, UIM_PWR/C1 (PCIe)
5	MDB master RxD/input	6	+1.5V
3	MDB master TxD/output	4	GND
1	WAKE# (BK, PCIe), NC (mSATA)	2	+3.3V

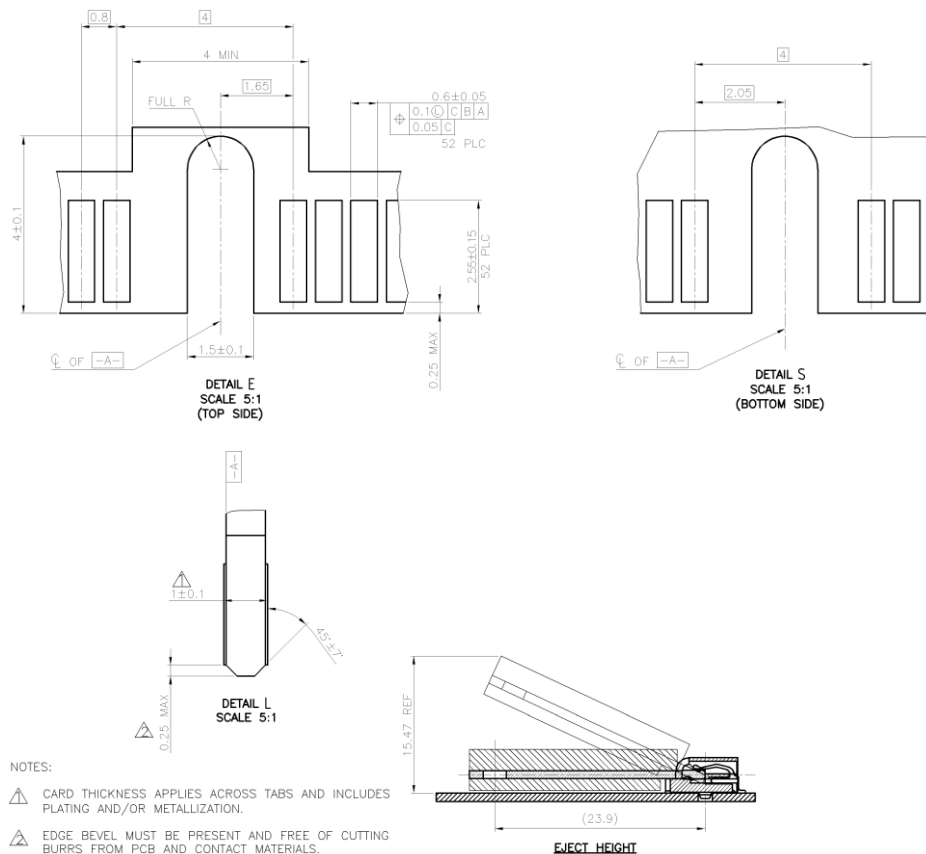
Notes:

- Host should provide +3.3V power in low power / stand-by / suspend state.
- Host may not provide +1.5V power in the low power state. BK Module does not use +1.5V.
- Host must provide I2C pullups (can be to +3.3V or 5V). BK Module is a master, but it is capable of 5V I/O on I2C Bus.
- Blue and Red LEDs, if implemented, should be co-located (preferably in a single device), as BK Module may use the combination color (Magenta).

Mechanical

BK Module dimensions are the same as standard mini PCI Express half-size card, see below (RF connector and antenna are not shown).





System Integration

BK Module should be placed optimally with regard to RF performance of its antenna. BK Module should be placed so that its antenna area is near the edge of the controller board and is not obstructed by metal and conductive parts, shields and cables.

BK Module connector requires connection to GND and 3.3V power supply and logical connection to CPU on the controller board.

There are few ways to connect BK Module to the CPU on the controller board, with #1 being the recommended method:

1. Use UART (3.3V domain signals)
2. Use SMB Bus (or I2C bus). This method requires special BK Module firmware.
3. Use USB bus. This method requires BK Module with USB option.

The above connections are sufficient to fully enable BK Module for operation in PayRange system. Few other options are provided for further level of integration:

- A. BK Module RF Interface – Internal Bluetooth antenna. The RF connector is only intended for manufacturing test.
- B. BK Module User interface – LEDs and button. If mechanical integration blocks service access to BK Module LEDs and / or button, controller board may provide LEDs and/or button to mirror BK Module indication and replacement button control.

- C. Aux UART – BK Module with slave port option can support secondary devices (e.g. credit card reader interface).
- D. BK Module reset. If controller board should be able to reset its peripherals (e.g. for entering service mode without power cycle), BK Module reset should be connected to controller board reset line.
- E. BK Module radio disable. If controller board should be able to disable all RF transmissions, BK Module radio disable should be connected to corresponding controller board line. An alternative soft command could be defined in customized BK Module firmware.
- F. GPIO lines – for custom functionality (e.g. mechanical controls, or coin collector counter), BK Module can support additional functions with customized firmware.
- G. I2C interface – additional peripherals can be accessed by BK Module with customized firmware.

Please inquire with PayRange support for custom options.

United States FCC Requirements

Labeling

The BK Module has been labeled with its own FCC ID number, and if the FCC ID is not visible when the module is installed inside another device, then the outside of the finished product into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording as follows:

Contains Transmitter Module FCC ID: 2AF78-00370 or Contains FCC ID: 2AF78-00370

User Manual

The User Manual must contain the following:

This device complies with Part 15 of the FCC Rules.

Operation is subject to the following two conditions:

- (1) this device may not cause harmful interference, and
- (2) this device must accept any interference received, including interference that may cause undesired operation This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules.

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.

- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CAUTION: Per FCC 15.21, changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

RF EXPOSURE

The BluKey Module is certified as a modular transmitter device for integration into fixed products under the following conditions:

1. The antenna(s) must be installed such that a minimum separation distance of 20cm is maintained between the radiator (antenna) and all persons at all times.
2. The transmitter module must not be co-located or operating in conjunction with any other antenna or transmitter.

As long as the two conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.). IMPORTANT NOTE: In the event that these conditions cannot be met (for certain configurations or co-location with another transmitter), then the FCC and Industry Canada authorizations are no longer considered valid and the FCC ID and IC Certification Number cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC and Industry Canada authorization.

HELPFUL WEB SITES

Federal Communications Commission (FCC):

<http://www.fcc.gov>

FCC Office of Engineering and Technology (OET) Laboratory Division Knowledge Database (KDB):

<http://apps.fcc.gov/oetcf/kdb/index.cfm>

Canada IC Requirements

The Blukey Module has been certified for use in Canada under Industry Canada (IC) Radio Standards Specification (RSS) RSS-247 and RSP-100. Modular approval permits the installation of a module in a host device without the need to recertify the device.

LABELING AND USER INFORMATION REQUIREMENTS

Labeling Requirements for the Host Device (from Section 3.2, RSP-100, Issue 11, January 2016): The host device shall be properly labeled to identify the module within the host device.

Per section 3.2

The Host Marketing Name (HMN) must be displayed (according to e-labelling requirements) or indicated at any location on the exterior of the host product or product packaging or product literature, which shall be available with the host product or online.

The host product shall be properly labeled to identify the modules within the host product.

The Innovation, Science and Economic Development Canada certification label of a module shall be clearly visible at all times when installed in the host product; otherwise, the host product must be labeled to display the Innovation, Science and Economic Development Canada certification number for the module, preceded by the word “Contains” or similar wording expressing the same meaning, as follows:

Contains IC: XXXXXX-YYYYYYYYYY

where: XXXXXX-YYYYYYYYYY is the module’s certification number.

User Manual Notice

User manuals shall contain the following text, or an equivalent notice that shall be displayed in a conspicuous location, either in the user manual or on the device, or both:

This device complies with Industry Canada’s license-exempt RSSs. Operation is subject to the following two conditions:

- (1) This device may not cause interference; and*
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.*

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

The above notice may be affixed to the device instead or displayed in the user manual.

RF EXPOSURE

All transmitters regulated by IC must comply with RF exposure requirements listed in RSS-102 - Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands).

This module is certified for integration into fixed products and must not be collocated or operating in conjunction with any other antenna or transmitter except in accordance with Industry Canada's multi-transmitter guidelines. The antenna used for this transmitter must be installed >20 cm from all persons, or it will separate approval.

APPROVED EXTERNAL ANTENNA TYPES

Transmitter Antenna: The Blukey module can only be sold or operated with internal antenna with which it was approved.

HELPFUL WEB SITES

Industry Canada: <http://www.ic.gc.ca/>