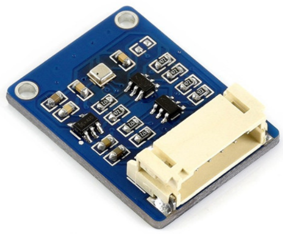

FUTEK QIA128 Digital Low Power Controller with SPI and UART User Guide

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FUTEK
ADVANCED SENSOR TECHNOLOGY, INC.

QIA128 Digital Low Power Controller with SPI and UART User Guide

Contents

General Description

The QIA128 is a single-channel ultra-low-power digital controller with UART and SPI outputs.

Pin Configurations and Function Descriptions

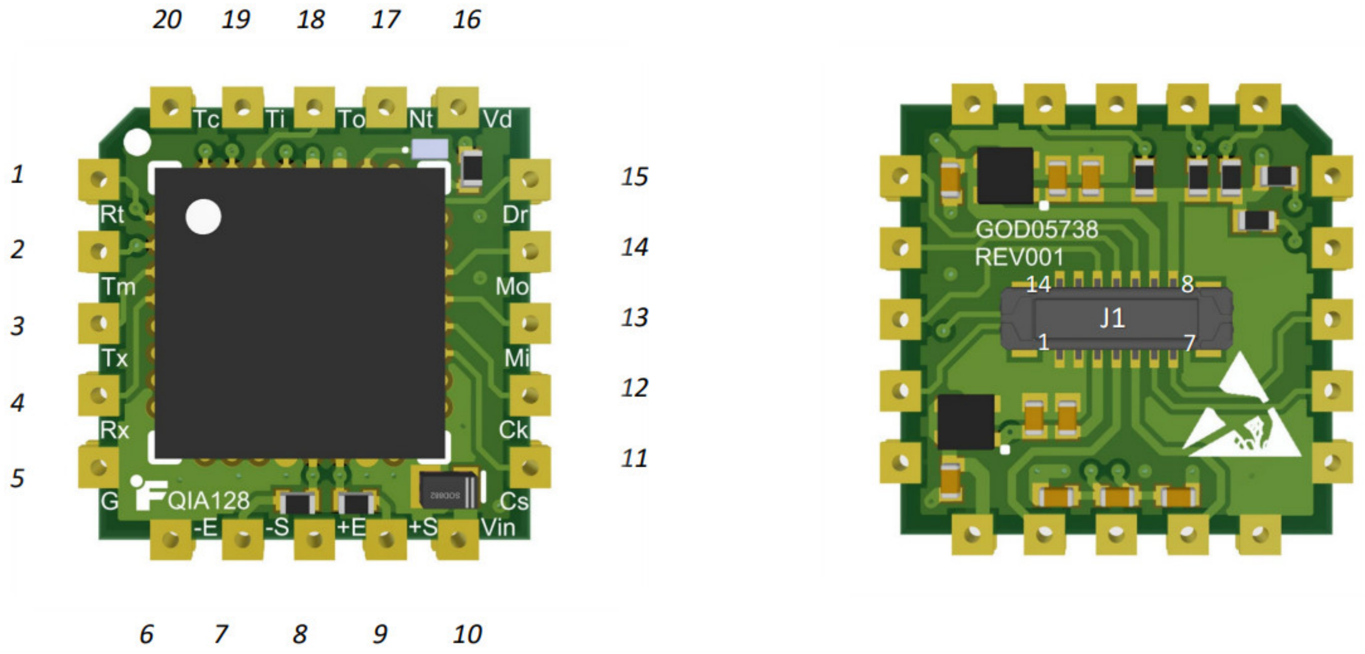

Figure 1.

Table 1.

#	Pin	Description	J1 #
		Active low reset pin.	–
2	**TMS**	JTAG TMS (Test Mode Select). Input pin used for debugging and download.	–
3	**TX**	Transmit Asynchronous Data output.	7
4	**RX**	Receive Asynchronous Data input.	6
5	**GND**	Ground pins are connected to each other internally.	1
6	**– Excitation**	Sensor excitation return (connected to Ground).	2

7	**– Signal**	Sensor negative Input.	5
8	**+Excitation**	Sensor excitation.	3
9	**+Signal**	Sensor Positive Input.	4
10	**VIN**	Voltage input 3 – 5	9
11		Active low chip-select. Do not drive the line low until the device has booted up completely. Also, ensure that the line is not driven low unless the is low.	14
12	**SCLK**	The serial clock is generated by the master.	13
13	**MISO**	Master-In-Slave-Out.	12
14	**MOSI**	Master-Out-Slave-In.	11
15		The active-low pin is used to keep all communication synchronized. It notifies the master device when new data from the sampling system is ready. This ensures that the master is always collecting the latest data. When the pin goes low, it indicates that the data is ready to be clocked out. This pin can be used to externally interrupt the master. The pin returns high when the system is in a conversion state and returns low once new data is ready. ***Note:** The pin does not return high once data is read—it will only return high once the system enters a conversion state.	–
16	**VDD**	Digital rail (2.5V).	–
17	**NTRST**	JTAG NTRST/BM Reset/Boot Mode. Input pin used for debugging and download only and boot mode ( ).	–
18	**TDO**	JTAG TDO (Data Out). Input pin used for debugging and download.	–
19	**TDI**	JTAG TDI (Data In). Input pin used for debugging and download.	–
20	**TCK**	JTAG TCK (Clock Pin). Input pin used for debugging and download.	–

QIA128 UART Configuration
Table 2.

Data	8-Bit
Operation Baud Rate:	320,000bps
Parity	None
Stop bits	1-Bit
Flow Control:	None

Pin Functionality

When the pin goes high, it means the device is in the process of A/D conversion. goes low as soon as the conversion is complete.
* **Note:** Since UART is asynchronous, the is provided to make the communication synchronous if required.
Period

Figure 2.

The following table shows the period of the pin for all sampling rates.
Table 3.

()	(µ)	Description
240	125	4 SPS
55		20 SPS
19		50 SPS
9		100 SPS
4.5		200 SPS
1.5		500 SPS
1.1		850 SPS
0.6		1300 SPS

"Stream" Mode

The Set System Stream State (SSSS) [with a payload of 1] command may be sent to activate the stream mode. The device will stop streaming as soon as the Set System Stream State command [with a payload of 0], or any other command is sent to QIA128.
***Note:** There may be no response from the QIA128 if an incorrect command is sent.
UART Packet Structure
The packet structure and length for every command may vary due to their type (GET and SET) and functionalities; refer to the **Command Set Table** for further information.
System Behavior
Start-up and Self-Calibration Mode
When the system powers ON, it starts reading the data from EEPROM and goes to the internal calibration mode.
***Note:** The first pulse could be used as an indicator for when the device is ready for communication.
Sampling Rate Change
When a sampling rate change is requested, it will take no more than 0.5 seconds (depending on the selected sampling rate) to see the change in the period.
Sampling Rates
Table 4.

Maximum Approximate data rate change timing ()	SR Code	Sampling Rate
≅ 250	0x00	4 SPS
	0x01	20 SPS
	0x02	50 SPS
	0x03	100 SPS
	0x04	200 SPS
	0x05	500 SPS
	0x06	850 SPS
	0x07	1300 SPS

Command-Set List

Table 6.

Type	Name	Description	TX Packet Structure	RX Packet Structure	Bytes in Payload
Get	GSAI	Get slave activity inquiry (Used to test communication)	00 05 00 01 0E	00 05 00 01 0E	N/A
*Get	GCCR	Get channel current reading	00 06 00 05 00 20	See Payload Example	4
Set	SSSS	Set system stream state OFF	00 06 00 0C 00 3C	00 05 00 0C 3A	N/A
*Set	SSSS	Set system stream state ON	00 06 00 0C 01 41	00 05 00 0C 3A … [Stream Bytes]	N/A … [4]
*Get	GDSN	Get the device serial number	00 05 01 00 0D	See Payload Example	4
*Get	GDMN	Get device model number	00 05 01 01 11	See Payload Example	10
*Get	GDIN	Get device item number	00 05 01 02 15	See Payload Example	10
*Get	GDHV	Get device hardware version	00 05 01 03 19	See Payload Example	1
*Get	GDFV	Get device firmware version	00 05 01 04 1D	See Payload Example	3
*Get	GDFD	Get device firmware date	00 05 01 05 21	See Payload Example	3
*Get	GPSSN	Get profile sensor serial number	00 06 03 00 00 15	See Payload Example	4

*Get	GPSPR	Get profile sampling rate	00 06 03 1E 00 8D	See Payload Example	1
Set	SPSPR	Set profile sampling rate 4SPS	00 07 04 1E 00 00 92	00 05 04 1E 8E	N/A
Set	SPSPR	Set profile sampling rate 20SPS	00 07 04 1E 00 01 98	00 05 04 1E 8E	N/A
Set	SPSPR	Set profile sampling rate 50SPS	00 07 04 1E 00 02 9E	00 05 04 1E 8E	N/A
Set	SPSPR	Set profile sampling rate 100SPS	00 07 04 1E 00 03 A4	00 05 04 1E 8E	N/A
Set	SPSPR	Set profile sampling rate 200SPS	00 07 04 1E 00 04 AA	00 05 04 1E 8E	N/A
Set	SPSPR	Set profile sampling rate 500SPS	00 07 04 1E 00 05 B0	00 05 04 1E 8E	N/A
Set	SPSPR	Set profile sampling rate 850SPS	00 07 04 1E 00 06 B6	00 05 04 1E 8E	N/A
Set	SPSPR	Set profile sampling rate 1300SPS	00 07 04 1E 00 07 BC	00 05 04 1E 8E	N/A
*Get	GPADP	Get profile analog-to-digital calibration value 0 (Direction 1)	00 07 03 19 00 00 7B	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 1 (Direction 1)	00 07 03 19 00 01 81	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 2 (Direction 1)	00 07 03 19 00 02 87	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 3 (Direction 1)	00 07 03 19 00 03 8D	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 4 (Direction 1)	00 07 03 19 00 04 93	See Payload Example	4

*Get	GPADP	Get profile analog-to-digital calibration value 5 (Direction 1)	00 07 03 19 00 05 99	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 6 (Direction 2)	00 07 03 19 00 06 9F	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 7 (Direction 2)	00 07 03 19 00 07 A5	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 8 (Direction 2)	00 07 03 19 00 08 AB	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 9 (Direction 2)	00 07 03 19 00 09 B1	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 10 (Direction 2)	00 07 03 19 00 0A B7	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 11 (Direction 2)	00 07 03 19 00 0B BD	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 12 (Direction 1)	00 07 03 19 00 0C C3	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 13 (Direction 1)	00 07 03 19 00 0D C9	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 14 (Direction 1)	00 07 03 19 00 0E CF	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 15 (Direction 1)	00 07 03 19 00 0F D5	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 16 (Direction 1)	00 07 03 19 00 10 DB	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 17 (Direction 1)	00 07 03 19 00 11 E1	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 18 (Direction 2)	00 07 03 19 00 12 E7	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 19 (Direction 2)	00 07 03 19 00 13 ED	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 20 (Direction 2)	00 07 03 19 00 14 F3	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 21 (Direction 2)	00 07 03 19 00 15 F9	See Payload Example	4
*Get	GPADP	Get profile analog-to-digital calibration value 22 (Direction 2)	00 07 03 19 00 16 FF	See Payload Example	4

***Note:** The Payload bytes are located directly before the last byte of the packet which is the Checksum.

Payload Example

The following transaction is the response to the GDSN command (Get device serial number). This command has

a payload of 4 bytes.
TX: 00 05 01 00 0D
RX: 00 09 01 00 00 01 E2 40 49
Hex to decimal: 0x0001E240 -> 123456

ADC Data Conversion

The following formula could be used to convert the raw ADC data:
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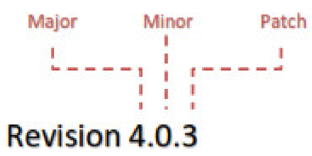
Here are the variables:
ADCValue = the most recent analog-to-digital conversion value.
Off-set Value = the analog-to-digital conversion value stored during calibration that corresponds to the offset (zero physical loads).
Full-Scale Value = the analog-to-digital conversion value stored during calibration that corresponds to the full scale (maximum physical load).
Full-Scale Load = the numeric value stored during calibration for the maximum physical load.

ADC Data Conversion Examples (Direction 1, 2-point Calibration)

Calibration Data
Get profile analog-to-digital calibration value 0 (Direction 1) [GPADP]:
Hex to decimal: **0x81B320** -> **000,500,8**
Get profile analog-to-digital calibration value 5 (Direction 1) [GPADP]:
Hex to decimal: **0xB71B00** -> **12,000,000**
Get channel current reading (GCCR):
Hex to decimal: **0x989680** -> **10,0000,00**
Calculation
OffsetValue = **8,500,000**
FullScaleValue = **12,000,000**
FullScaleLoad = **20g** (Available on the calibration certificate)

$$CalculatedReading = \frac{[10000000 - 8500000]}{[12000000 - 8500000]} \times 20g = 8.5714g$$

Firmware Revision



Firmware Notes
New Features
• N/A
Changes
• N/A
Fixes
• Changed the hardware revision from “0” to “1”.

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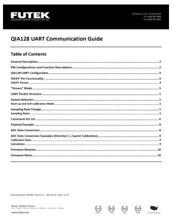
Documents / Resources

 FUTEK QIA128 UART Communication Guide Table of Contents	FUTEK QIA128 Digital Low Power Controller with SPI and UART [pdf] User Guide SPI, UART, Low Power Controller, QIA128