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Application Note

TDC-GP30

Operating TDC-GP30 with UART

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1 General Description

General description of the aspects which are covered in this Application Note.

IDLE - RAM Access

1.1 TDC-GP30 without Firmware

MCT=OFF, No Bootloader

- System Reset
- Watchdog Disable
- Transmit Configuration Registers (0xC0...0xCE)
- Transmit System Handling Registers (0xD0, 0xDA, 0xDB, 0xD8)
- Time conversion mode, self- or remote-controlled
 - Self-controlled, Measure Cycle Timer = ON
 - Remote-controlled, choose Measurement Task Request(s), e.g. Time of Flight Measurement
- Follow "Getting Measurement Results"-Steps

1.2 TDC-GP30 with Firmware

The TDC-GP30 starts the Time of Flight Measurement immediately after Power Supply was connected.

Interrupt Message (Acknowledge) will be received after clearing the Interrupt Flags.

Be sure the correct UART configuration is running.

Automatic UART Messaging Mode can be used to include data for messaging after clearing Interrupt. Available RAM start address (0x00 ... 0xF0) and length of data up to 15 (see data sheet, volume 4, section 6.1 Results in memory cells).

2 Preparations

2.1 UART Configuration (default)

Parameter	Description	Value
Baud	Baud Rate (bits per second)	4800
Data	Set number of data bits	8
Stop	Set number of stop bits	2
Parity	Set parity mode	None
CTS Flow control	Activate CTS flow control to regulate transmission via CTS signal	deactivated

2.2 CRC Configuration (default)

CRC-16/MCRF4XX	
Input reflected	YES
Result reflected	YES
Polynomial	0x1021
Initial Value	0xFFFF
Final Xor Value	0x0

Note: The differences to CRC-16/CCITT-FALSE are reflected input and reflected output.

3 Syntax's + CRC (default)

3.1 Received Data

Description	Received Data
Acknowledge	0xA8 0xC5 0x26

3.2 Resets and Inits

Description	Opcode + CRC	Acknowledge
System Reset	0x99 0xCF 0x06	0x99 0xCF 0x06 0xA8 0xC5 0x26
System Init	0x9A 0x54 0x34	0x9A 0x54 0x34 0xA8 0xC5 0x26
CPU Init	0x9B 0xDD 0x25	0x9B 0xDD 0x25
SV Init	0x9C 0x62 0x51	0x9C 0x62 0x51
FEP Init	0x9D 0xEB 0x40	0x9D 0xEB 0x40

3.3 Debug and System Commands

Description	Opcode + CRC	Acknowledge
Bus Master Release	0x87 0x30 0xFF	0x87 0x30 0xFF
Bus Master Request	0x88 0xC7 0x07	0x88 0xC7 0x07
Measure Cycle Timer OFF	0x8A 0xD5 0x24	0x8A 0xD5 0x24
Measure Cycle Timer ON	0x8B 0x5C 0x35	0x8B 0x5C 0x35
General Purpose Request	0x8C 0xE3 0x41	0x8C 0xE3 0x41
Interrupt Flags Clear	0x8D 0x6A 0x50	0x8D 0x6A 0x50
Communication Request	0x8E 0xF1 0x62	0x8E 0xF1 0x62

3.4 TDC-GP30 Configuration (default)

In case of transmitting the TDC-GP30 configuration, please consider that the WatchDog is disabled.

Description	Register Content + CRC (default)	Acknowledge
REG 0xC0, WatchDog Enable	0x5A 0xC0 0x01 0x99 0xA3 0xDB 0x47 0x17 0x9E	0x5A 0x58 0xF2
REG 0xC0, WatchDog Disable	0x5A 0xC0 0x01 0x99 0xA3 0xDB 0x48 0xE0 0x66	0x5A 0x58 0xF2
REG 0xC1	0x5A 0xC1 0x01 0x0A 0x31 0x34 0x00 0x15 0x31	0x5A 0x58 0xF2
REG 0xC2	0x5A 0xC2 0x01 0x44 0x11 0x11 0x81 0xAC 0x4E	0x5A 0x58 0xF2
REG 0xC3	0x5A 0xC3 0x01 0x00 0x50 0x21 0x10 0xD4 0x41	0x5A 0x58 0xF2
REG 0xC4	0x5A 0xC4 0x01 0xFF 0x03 0x1F 0x00 0x63 0xC8	0x5A 0x58 0xF2
REG 0xC5	0x5A 0xC5 0x01 0xE8 0xCA 0x4E 0x00 0x63 0x04	0x5A 0x58 0xF2
REG 0xC6	0x5A 0xC6 0x01 0x80 0xA0 0x11 0x00 0x2A 0x52	0x5A 0x58 0xF2
REG 0xC7	0x5A 0xC7 0x01 0x00 0x34 0x79 0x00 0xE2 0x3A	0x5A 0x58 0xF2
REG 0xC8	0x5A 0xC8 0x01 0x24 0x28 0x00 0x00 0x3E 0xFD	0x5A 0x58 0xF2
REG 0xC9	0x5A 0xC9 0x01 0x83 0x0C 0xE7 0x03 0x59 0xFA	0x5A 0x58 0xF2
REG 0xCA	0x5A 0xCA 0x01 0x10 0x2C 0x00 0x00 0x17 0xA8	0x5A 0x58 0xF2
REG 0xCB	0x5A 0xCB 0x01 0x81 0xD4 0x00 0x00 0xBE 0x14	0x5A 0x58 0xF2
REG 0xCC	0x5A 0xCC 0x01 0x7C 0xC4 0xA0 0x84 0x8D 0x1C	0x5A 0x58 0xF2
REG 0xCD	0x5A 0xCD 0x01 0xCF 0x25 0x17 0x40 0xC4 0xF8	0x5A 0x58 0xF2
REG 0xCE	0x5A 0xCE 0x01 0x08 0x08 0x27 0x00 0xA3 0x90	0x5A 0x58 0xF2
REG 0xD0	0x5A 0xD0 0x01 0x01 0x00 0x00 0x00 0x2B 0xBA	0x5A 0x58 0xF2
REG 0xDA	0x5A 0xDA 0x01 0x55 0x00 0x00 0x00 0xDF 0x34	0x5A 0x58 0xF2
REG 0xDB	0x5A 0xDB 0x01 0x55 0x00 0x00 0x00 0xF4 0x30	0x5A 0x58 0xF2
REG 0xD8	0x5A 0xD8 0x01 0x00 0x00 0x00 0x00 0xC8 0x87	0x5A 0x58 0xF2

3.5 Measurement Task Requests

In case the Interrupt Flag was cleared, additional Acknowledge is read 0x00 0xA8 0xC5 0x26 once.

Description	Opcode + CRC	Acknowledge
Vcc Voltage Measurement	0xDA 0x00 0xF3 0x52	0xDA 0x50 0x76
Time Of Flight Measurement	0xDA 0x04 0xD7 0x14	0xDA 0x50 0x76
Amplitude Measurement	0xDA 0x08 0xBB 0xDE	0xDA 0x50 0x76
Amplitude Measurement Calibration	0xDA 0x10 0x72 0x42	0xDA 0x50 0x76
Temperature Measurement	0xDA 0x20 0xF1 0x73	0xDA 0x50 0x76
High Speed Clock Calibration	0xDA 0x40 0xF7 0x10	0xDA 0x50 0x76

Description	Opcode + CRC	Acknowledge
Zero Cross Calibration	0xDA 0x80 0xFB 0xD6	0xDA 0x50 0x76

3.6 Getting Measurement Results

Description	Opcode + CRC	Acknowledge
Step 1 - Read SRR_IRQ_FLAG, 0xE0	0x7A 0xE0 0x01 0x81 0x32	0x7A 0x01 0x09 0x00 0x00 0x00 0x58 0x16
Step 1a - Read SRR_TS_TIME, 0xE9	0x7A 0xE9 0x01 0x99 0xE5	0x7A 0x01 0x04 0x00 0x00 0x00 0xD7 0x9D
Step 2 - Read SRR_ERR_FLAG, 0xE1	0x7A 0xE1 0x01 0x59 0x2B	0x7A 0x01 0x00 0x00 0x00 0x00 0x3B 0xEF
Step 3 - Read SRR_FEP_STF, 0xE2	0x7A 0xE2 0x01 0x31 0x01	0x7A 0x01 0x71 0x03 0x00 0x00 0xA1 0x46
Step 4 - Read data, 0x80	0x7A 0x80 0x01 0xD4 0x57	0x7A 0x01 0x8A 0x90 0x40 0x93 0xF6 0x77
Step 5 - Clear interrupt flag, 0xDD	0x5A 0xDD 0x01 0x07 0x00 0x00 0x00 0x6E 0xC4	0x5A 0x58 0xF2

4 UART Messaging Mode

TDC-GP30 sends messages by itself.

4.1 Baud Rate Change by Opcode

After receiving the Acknowledge with previous baud rate, the remote communication starts with new baud rate.

Description	Opcode + CRC	Acknowledge
LOW Baud Rate: 4800	0xA0 0x8D 0xAA	0xA0 0x8D 0xAA
HIGH Baud Rate: 19200	0xA4 0xA9 0xEC	0xA4 0xA9 0xEC
HIGH Baud Rate: 38400	0xA5 0x20 0xFD	0xA5 0x20 0xFD
HIGH Baud Rate: 57600	0xA6 0xBB 0xCF	0xA6 0xBB 0xCF
HIGH Baud Rate: 115200	0xA7 0x32 0xDE	0xA7 0x32 0xDE

4.2 Configuration of the UART Interface

Configuration Register CR_UART, 0x0C3

The following table shows the higher five nibbles in default: 0x10215 and describes only the lower three nibbles in details. For complete description please use TDC-GP30 data sheet, volume 1, section 7.

Parameter [bit range]	Description	Note
UART_CRC_POLY [31:16]	CRC Polynom = 0x1021	
UART_CRC_ORDER [15]	CRC in unresersed order	
UART_CRC_INIT_VAL [14]	CRC initial value = 0x1111	
UART_CRC_MODE [13]		
UART_WUP_EN [12]	Wake Up command enabled	
UART_HBR [11:10]	High Baud Rate If any High Baud Mode enabled: 00: 19200 Baud 01: 38400 Baud 10: 57600 Baud 11: 115200 Baud	
UART_HB_MODE [9]	High Baud Rate 0: High Baud Rate only controlled by remote controller 1: High Baud Rate enabled for UART Data Message	(1)
UART_IRQ_CLR_MODE [8]	Interrupt Clear Mode 0: Remote Interrupt has to be cleared by remote computer 1: Remote Interrupt automatically cleared by TDC-GP30	(2)
UART_DATA_MSG_ADR [7:4]	Address of automatic data message	(3)
UART_DATA_MSG_LEN [3:0]	0: Automatic Data Message is disabled 1-15: Length of automatic data message	(4)

Note 1, UART High Baud Mode. For any SPI communication, parameter UART_HB_MODE [bit 9] has to be zero.

Note 2, Interrupt Clear Mode. In case of clearing by remote controller the Acknowledge Message will receiving before the Data Message. In case of clearing automatically by TDC-GP30 the Data Message will be send instead through each configured interrupt source. Consider that not too many interrupts will occur and there is enough time for the UART communication.

Note 3, Address of automatic data message. In general the address range is from 0x00 to 0xFF, but only the high nibble is possible to configure as start address, e.g. address 0x00, 0x10, 0x20, ..., 0xE0, 0xF0. To reach the address in between, the length of automatic data message is needed. At least, length has to be one to send only the start address.

Note 4 Length of automatic data message

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7 Revision Information

Changes from previous version to current revision 1-02 (2017-May-12)	Page
Section 4.2 additional note	

Note: Page numbers for the previous version may differ from page numbers in the current revision.

Correction of typographical errors is not explicitly mentioned.