# Application Note for FT7511 CTPM

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| Project name | Touch panel |
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Revision History

| Date | Version | List of changes | Author | Approved by |
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## Terminology

CTP – Capacitive touch panel

CTPM – Capacitive touch panel module

TX – Transmitter

RX – Receiver

# 1 CTPM interface to Host

Figure 1-1 shows how CTPM communicates with host device. I²C interface supported by FT7511that is two-wire serial bus consisting of data line SDA and clock line SCL, used for serial data transferring between host and slave device.

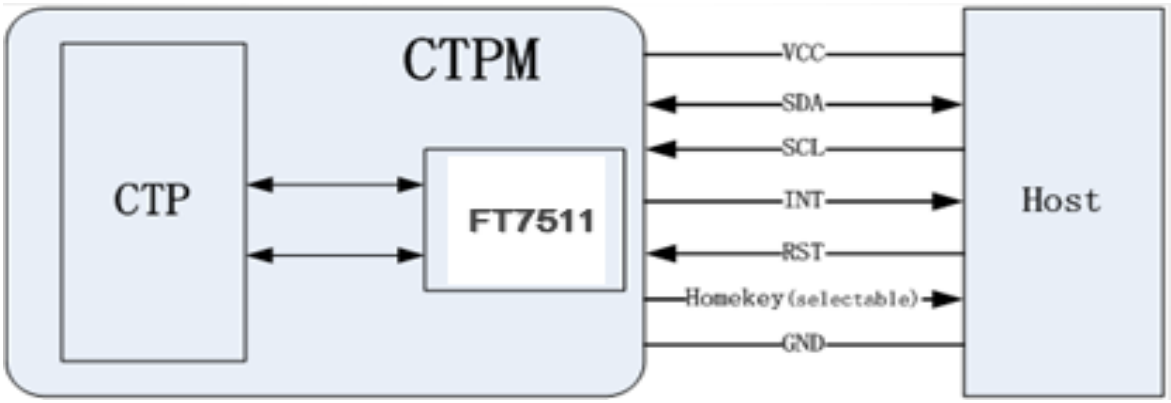



**Figure 1-1 CTPM and Host connection**

INT port and RST port form the control interface. The INT port is controlled by FT7511, it will send out an interrupt request signal to the host when there is a valid touch on CTPM. Host can send the reset signal to CTPM via RST port to reset the FT7511 if needed. The Power Supply voltage of CTPM ranges from 2.7V to 3.6V. For details, please refer to Table 1-1.

**Table 1-1 Description for CTPM and Host interface**

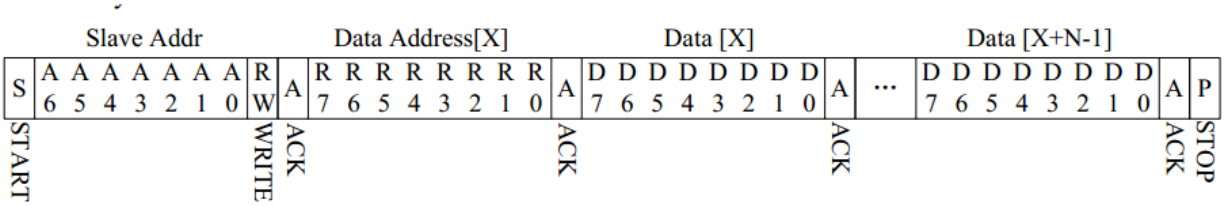
| Port Name | Description |
|---|---|
| VCC | CTPM power supply, ranges from 2.7V to 3.6V. |
| SDA | I²C data input and output. |
| SCL | I²C clock input. |
| INT | The interrupt request signal from CTPM to Host. |
| RST | The reset signal from host to CTPM, active low, and the low pulse width should be more than 1ms. |
| Homekey(selectable) | For win8 Homekey only. |
| GND | Power ground. |

The CTPM default address is 0x70, this also applies to the HID and bootload.

## 1.1 I2C Read/Write Interface description

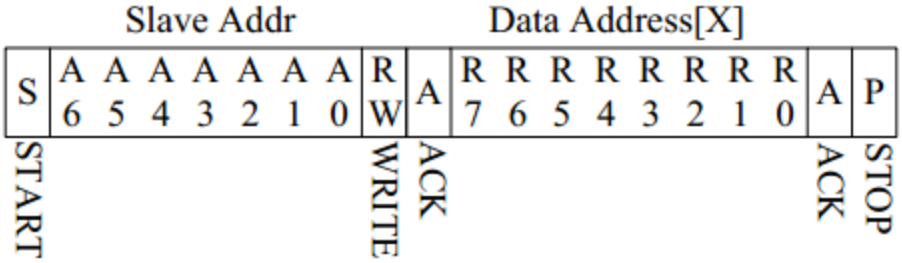
It is important to note that the SDA and SCL must connect with a pull-high resistor respectively before you read/write I²C data.

### 1.1.1 Host write data to slave

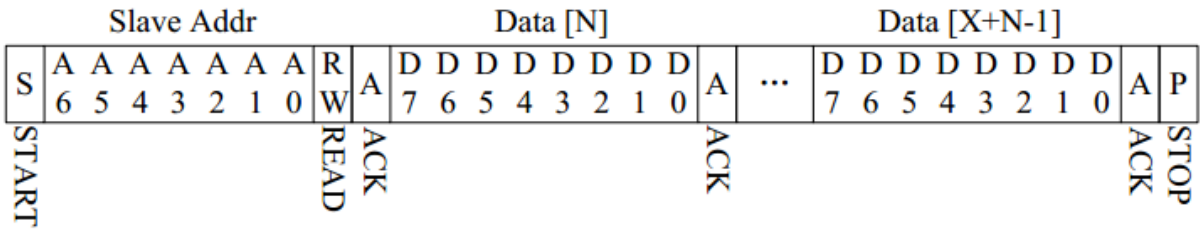


### 1.1.2 Host read data from slave

Step1: write data address




Step2: read data




## 1.2 Interrupt signal from CTPM to Host

As for standard CTPM, host needs to use both interrupt signal and I2C interface to get the touch data. CTPM will output an interrupt request signal to the host when there is a valid touch. Then host can get the touch data via I2C interface. If there is no valid touch detected, the INT will output high level, and the host does not need to read the touch data. There are two kinds of method to use interrupt: interrupt trigger and interrupt polling.

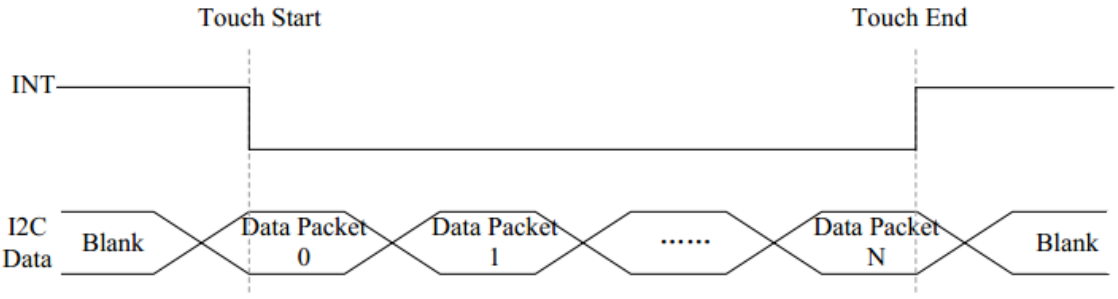



Figure 1-2 Interrupt polling mode

As for interrupt polling mode, INT will always be pulled to low level when there is a valid touch point, and be high level when a touch finished.

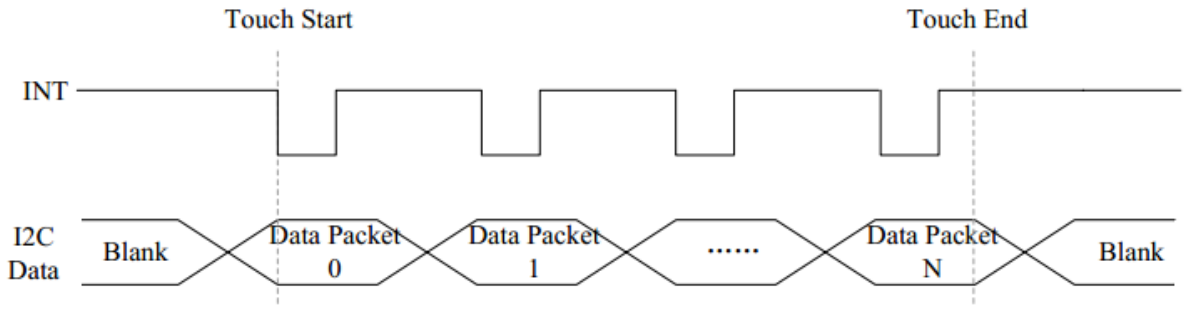



Figure 1-3 Interrupt trigger mode

While for interrupt trigger mode, INT signal will be set to low if there is a touch detected. But whenever an update of valid touch data, CTPM will produce a valid pulse on INT port for INT signal, and host can read the touch data periodically according to the frequency of this pulse. In this mode, the pulse frequency is the touch data updating rate

## 1.3 Reset signal from Host to CTPM.

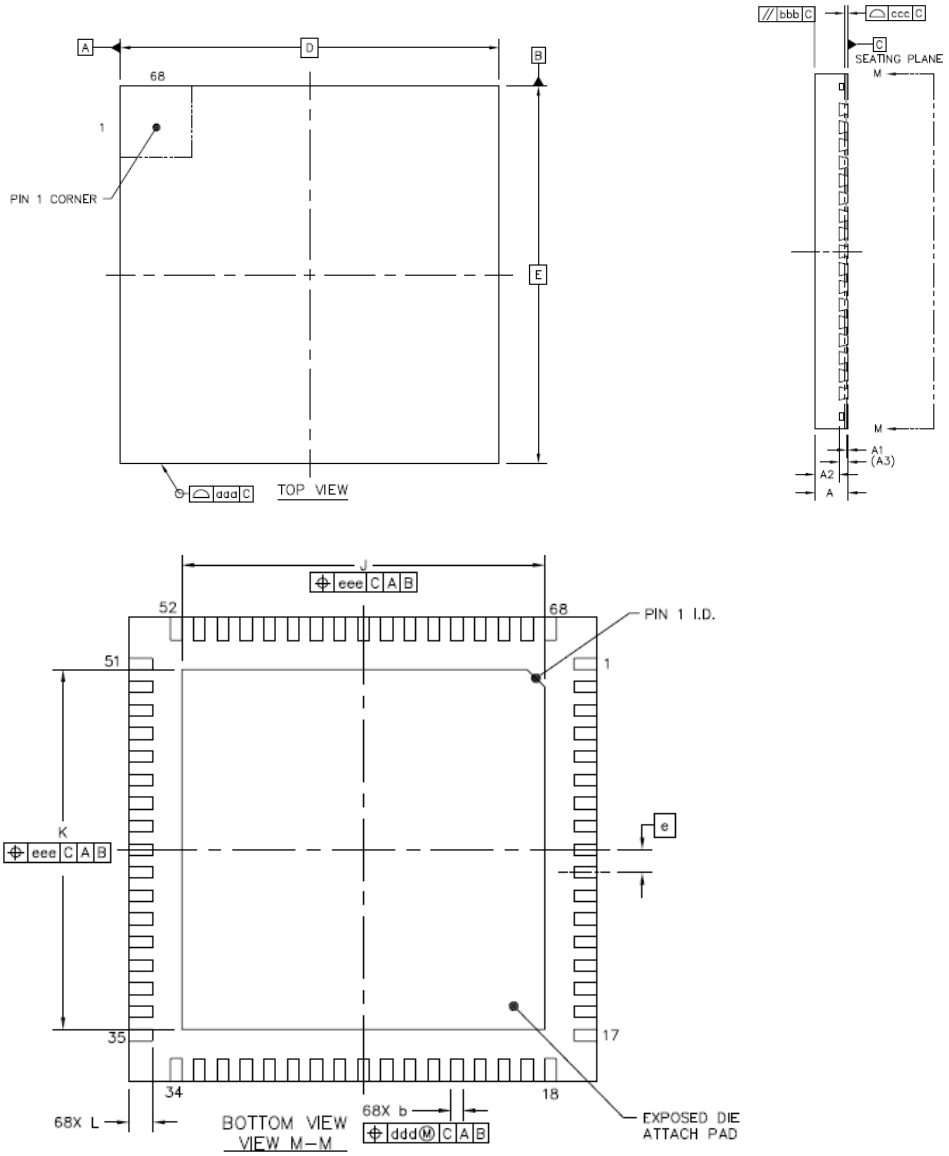
Host can send the reset signal via RST port to reset FT7511. The reset signal should not be set to low while in normal working mode. The RST port can also be used to active the CTPM in hibernate mode. Note that the reset pulse width should be more than 1ms.

# 2 Standard Application Circuit

Table 2-1 is a brief summary of the FT7511 application features.

**Table 2-1 Brief features of FT7511**

| IC Type | FT7511 |
|---|---|
| **Operating Voltage(V)** | 2.7 ~ 3.6 |
| **Channel** | 35 TX + 21 RX |
| **Panel Size** | ≤10.1” |
| **Touch points** | 10 |
| **Interface** | $I^2C$ |
| **Report rate** | >100Hz |
| **Package (mm)** | QFN 68L 8x8x0.8mm<br>Pitch =0.4mm |



# 3 CTPM Register Mapping

This chapter describes the standard CTPM communication registers in address order for working mode.

## 3.1 Working Mode

The CTP is fully functional as a touch screen controller in working mode. The access address to read and write is just logical address which is not enforced by hardware. Here is the working mode register map.

Register Map [Working Mode]

| ADDR | RW | Name | b7 | b6 | b5 | b4 | b3 | b2 | b1 | b0 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0x00 | RW | Mode_Switch | | Device Mode[2:0] | | | | | | |
| 0x01 | RO | Guesture | Gesture ID [7:0] | | | | | | | |
| 0x02 | RO | Cur Point | Number of touch points[7:0] | | | | | | | |
| 0x03 | RO | TOUCH1_XH | 1st Event Flag | | | | 1st Touch X Position[11:8] | | | |
| 0x04 | RO | TOUCH1_XL | 1st Touch X Position[7:0] | | | | | | | |
| 0x05 | RO | TOUCH1_YH | 1st Touch ID[3:0] | | | | 1st Touch Y Position[11:8] | | | |
| 0x06 | RO | TOUCH1_YL | 1st Touch Y Position[7:0] | | | | | | | |
| 0x07 | RO | TOUCH1_WEIGHT | 1st Touch Weight[7:0] | | | | | | | |
| 0x08 | RO | TOUCH1_MISC | 1st Touch Area[3:0] | | | | | | | |
| 0x09 | RO | TOUCH2_XH | 2nd Event Flag | | | | 2nd Touch X Position[11:8] | | | |
| 0x0A | RO | TOUCH2_XL | 2nd Touch X Position[7:0] | | | | | | | |
| 0x0B | RO | TOUCH2_YH | 2nd Touch ID[3:0] | | | | 2nd Touch Y Position[11:8] | | | |
| 0x0C | RO | TOUCH2_YL | 2nd Touch Y Position[7:0] | | | | | | | |
| 0x0D | RO | TOUCH2_WEIGHT | 2nd Touch Weight[7:0] | | | | | | | |
| 0x0E | RO | TOUCH2_MISC | 2nd Touch Area[3:0] | | | | | | | |
| 0x0F | RO | TOUCH3_XH | 3rd Event Flag | | | | 3rd Touch X Position[11:8] | | | |
| 0x10 | RO | TOUCH3_XL | 3rd Touch X Position[7:0] | | | | | | | |
| 0x11 | RO | TOUCH3_YH | 3rd Touch ID[3:0] | | | | 3rd Touch Y Position[11:8] | | | |
| 0x12 | RO | TOUCH3_YL | 3rd Touch Y Position[7:0] | | | | | | | |
| 0x13 | RO | TOUCH3_WEIGHT | 3rd Touch Weight[7:0] | | | | | | | |
| 0x14 | RO | TOUCH3_MISC | 3rd Touch Area[3:0] | | | | | | | |
| 0x15 | RO | TOUCH4_XH | 4th Event Flag | | | | 4th Touch X Position[11:8] | | | |
| 0x16 | RO | TOUCH4_XL | 4th Touch X Position[7:0] | | | | | | | |
| 0x17 | RO | TOUCH4_YH | 4th Touch ID[3:0] | | | | 4th Touch Y Position[11:8] | | | |
| 0x18 | RO | TOUCH4_YL | 4th Touch Y Position[7:0] | | | | | | | |
| 0x19 | RO | TOUCH4_WEIGHT | 4th Touch Weight[7:0] | | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 0x1A | RO | TOUCH4_MISC | 4th Touch Area[3:0] | | | |
| 0x1B | RO | TOUCH5_XH | 5th Event Flag | | 5th Touch X Position[11:8] | |
| 0x1C | RO | TOUCH5_XL | 5th Touch X Position[7:0] | | | |
| 0x1D | RO | TOUCH5_YH | 5th Touch ID[3:0] | | 5th Touch Y Position[11:8] | |
| 0x1E | RO | TOUCH5_YL | 5th Touch Y Position[7:0] | | | |
| 0x1F | RO | TOUCH5_WEIGHT | 5th Touch Weight[7:0] | | | |
| 0x20 | RO | TOUCH5_MISC | 5th Touch Area[3:0] | | | |
| 0x21 | RO | TOUCH6_XH | 6th Event Flag | | 6th Touch X Position[11:8] | |
| 0x22 | RO | TOUCH6_XL | 6st Touch X Position[7:0] | | | |
| 0x23 | RO | TOUCH6_YH | 6st Touch ID[3:0] | | 6st Touch Y Position[11:8] | |
| 0x24 | RO | TOUCH6_YL | 6st Touch Y Position[7:0] | | | |
| 0x25 | RO | TOUCH6_WEIGHT | 6st Touch Weight[7:0] | | | |
| 0x26 | RO | TOUCH6_MISC | 6st Touch Area[3:0] | | | |
| 0x27 | RO | TOUCH7_XH | 7th Event Flag | | 7th Touch X Position[11:8] | |
| 0x28 | RO | TOUCH7_XL | 7st Touch X Position[7:0] | | | |
| 0x29 | RO | TOUCH7_YH | 7st Touch ID[3:0] | | 7st Touch Y Position[11:8] | |
| 0x2A | RO | TOUCH7_YL | 7st Touch Y Position[7:0] | | | |
| 0x2B | RO | TOUCH7_WEIGHT | 7st Touch Weight[7:0] | | | |
| 0x2C | RO | TOUCH7_MISC | 7st Touch Area[3:0] | | | |
| 0x2D | RO | TOUCH8_XH | 8th Event Flag | | 8st Touch X Position[11:8] | |
| 0x2E | RO | TOUCH8_XL | 8st Touch X Position[7:0] | | | |
| 0x2F | RO | TOUCH8_YH | 8st Touch ID[3:0] | | 8st Touch Y Position[11:8] | |
| 0x30 | RO | TOUCH8_YL | 8st Touch Y Position[7:0] | | | |
| 0x31 | RO | TOUCH8_WEIGHT | 8st Touch Weight[7:0] | | | |
| 0x32 | RO | TOUCH8_MISC | 8st Touch Area[3:0] | | | |
| 0x33 | RO | TOUCH9_XH | 9th Event Flag | | 9st Touch X Position[11:8] | |
| 0x34 | RO | TOUCH9_XL | 9st Touch X Position[7:0] | | | |
| 0x35 | RO | TOUCH9_YH | 9st Touch ID[3:0] | | 9st Touch Y Position[11:8] | |
| 0x36 | RO | TOUCH9_YL | 9st Touch Y Position[7:0] | | | |
| 0x37 | RO | TOUCH9_WEIGHT | 9st Touch Weight[7:0] | | | |
| 0x38 | RO | TOUCH9_MISC | 9st Touch Area[3:0] | | | |
| 0x39 | RO | TOUCH10_XH | 10th Event Flag | | 10st Touch X Position[11:8] | |

| | | | | | |
|---|---|---|---|---|---|
| **0x3A** | RO | **TOUCH10_XL** | **10st Touch X Position[7:0]** | | |
| **0x3B** | RO | **TOUCH10_YH** | **10st Touch ID[3:0]** | **10st Touch Y Position[11:8]** | |
| **0x3C** | RO | **TOUCH10_YL** | **10st Touch Y Position[7:0]** | | |
| **0x3D** | RO | **TOUCH10_WEIGHT** | **10st Touch Weight[7:0]** | | |
| **0x3E** | RO | **TOUCH10_MISC** | **10st Touch Area[3:0]** | | |

## 3.2 DEVICE_MODE

This is the device mode register, which is configured to determine the current mode of the chip.

| Address | Bit Address | Register Name | Description |
|---|---|---|---|
| 0x00 | 6:4 | [2:0]Device Mode | 000b WORKING Mode<br>100b TEST Mode |

## 3.3 GEST_ID

This register describes the gesture of a valid touch.

| Address | Bit Address | Register Name | Description |
|---|---|---|---|
| 0x01 | 7:0 | Gesture ID[7:0] | Gesture ID<br>0x10 Move Up<br>0x14 Move Right<br>0x18 Move Down<br>0x1C Move Left<br>0x48 Zoom In<br>0x49 Zoom Out<br>0x00 No Gesture |

## 3.4 TD_STATUS

This register is the Touch Data status register.

| Address | Bit Address | Register Name | Description |
|---|---|---|---|
| 0x02 | 7:0 | Number of touch points [7:0] | The detected point number, max. 10 |

## 3.5 Pn_XH (n:1-5)

This register describes MSB of the X coordinate of the nth touch point and the corresponding event flag.

| Address | Bit Address | Register Name | Description |
|---|---|---|---|
| 0x03<br>0x09<br>0x0F<br>0x15<br>0x1B | 7:6 | Event Flag | 00b: Press Down<br>01b: Lift Up<br>10b: Contact<br>11b: No event |
| | 5:4 | Reserved | |

| | | | |
|---|---|---|---|
| 0x21<br>0x27<br>0x2D<br>0x33<br>0x39 | 3:0 | Touch X Position [11:8] | MSB of Touch X Position in pixels |

## 3.6 Pn_XL (n:1-5)

This register describes LSB of the X coordinate of the nth touch point.

| Address | Bit Address | Register Name | Description |
|---|---|---|---|
| 0x04<br>0x0A<br>0x10<br>0x16<br>0x1C<br>0x22<br>0x28<br>0x2E<br>0x34<br>0x3A | 7:0 | Touch X Position [7:0] | LSB of the Touch X Position in pixels |

## 3.7 Pn_YH (n:1-5)

This register describes MSB of the Y coordinate of the nth touch point and corresponding touch ID.

| Address | Bit Address | Register Name | Description |
|---|---|---|---|
| 0x05<br>0x0B | 7:4 | Touch ID[3:0] | Touch ID of Touch Point, this value is 0x0F when the ID is invalid |
| 0x11<br>0x17<br>0x1D<br>0x23<br>0x29<br>0x2F<br>0x35<br>0x3B | 3:0 | Touch Y Position [11:8] | MSB of Touch Y Position in pixels |

## 3.8 Pn_YL (n:1-2)

This register describes LSB of the Y coordinate of the nth touch point.

| Address | Bit Address | Register Name | Description |
|---|---|---|---|
| 0x06<br>0x0C<br>0x12<br>0x18<br>0x1E | 7:0 | Touch Y Position [7:0] | LSB of the Touch Y Position in pixels |

| | | | |
|---|---|---|---|
| 0x24<br>0x2A<br>0x30<br>0x36<br>0x3C | | | |

## 3.9 Pn_WEIGHT (n:1-5)

This register describes weight of the nth touch point.

| Address | Bit Address | Register Name | Description |
|---|---|---|---|
| 0x07<br>0x0D<br>0x13<br>0x19<br>0x1F<br>0x25<br>0x2B<br>0x31<br>0x37<br>0x3D | 7:0 | Touch Weight[7:0] | Touch pressure value |

## 3.10 Pn_MISC (n:1-5)

This register describes the miscellaneous information of the nth touch point.

| Address | Bit Address | Register Name | Description |
|---|---|---|---|
| 0x08<br>0x0E<br>0x14<br>0x1A | 7:4 | Touch Area[3:0] | Touch area value |
| 0x20<br>0x26<br>0x2C<br>0x32<br>0x38<br>0x3E | 3:0 | Reserved | |

# 4 Communication between host and CTPM

## 4.1 Communication Contents

The data Host received from the CTPM through I2C interface are different depend on the configuration in Device Mode Register of the CTPM. Please refer to Section 2---CTPM Register Mapping.

## 4.2 I2C Example Code

The code is only for reference, if you want to learn more, please contact our FAE staff.

```
//////////////////////////////////////////////////////////////////
// I2C write bytes to device.
// Arguments: ucSlaveAdr - slave address
//                        ucSubAdr - sub address
//                        pBuf - pointer of buffer
//                        ucBufLen - length of buffer
//////////////////////////////////////////////////////////////////
void i2cBurstWriteBytes(BYTE ucSlaveAdr, BYTE ucSubAdr, BYTE *pBuf, BYTE ucBufLen)
{
    BYTE ucDummy; // loop dummy
    ucDummy = I2C_ACCESS_DUMMY_TIME;
    while(ucDummy--)
    {
        if (i2c_AccessStart(ucSlaveAdr, I2C_WRITE) == FALSE)
            continue;
        if (i2c_SendByte(ucSubAdr) == I2C_NON_ACKNOWLEDGE) // check non-acknowledge
            continue;
        while(ucBufLen--) // loop of writting data
        {
            i2c_SendByte(*pBuf); // send byte
            pBuf++; // next byte pointer
        } // while
        break;
    } // while
     i2c_Stop();
}

//////////////////////////////////////////////////////////////////
// I2C read bytes from device.
//
// Arguments: ucSlaveAdr - slave address
//                        ucSubAdr - sub address
//                        pBuf - pointer of buffer
//                        ucBufLen - length of buffer
//////////////////////////////////////////////////////////////////
void i2cBurstReadBytes(BYTE ucSlaveAdr, BYTE ucSubAdr, BYTE *pBuf, BYTE ucBufLen)
{
    BYTE ucDummy; // loop dummy

    ucDummy = I2C_ACCESS_DUMMY_TIME;
    while(ucDummy--)
    {
        if (i2c_AccessStart(ucSlaveAdr, I2C_WRITE) == FALSE)
```

```
            continue;
        if (i2c_SendByte(ucSubAdr) == I2C_NON_ACKNOWLEDGE) // check non-acknowledge
            continue;
        if (i2c_AccessStart(ucSlaveAdr, I2C_READ) == FALSE)
            continue;
        while(ucBufLen--) // loop to burst read
        {
            *pBuf = i2c_ReceiveByte(ucBufLen); // receive byte
            pBuf++; // next byte pointer
        } // while
        break;
    } // while
```