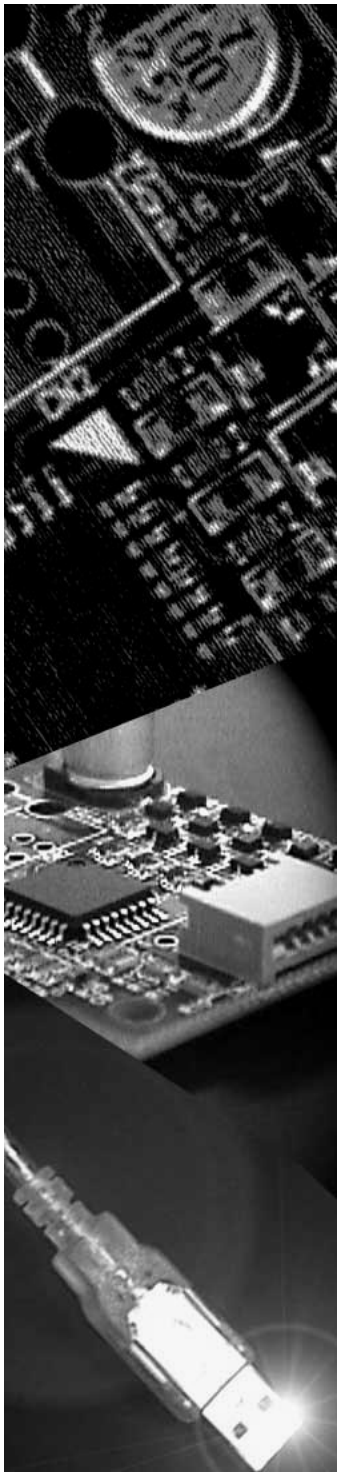


DMC Co., Ltd.

DUSx200 Series
I2C Interface Specifications

Table of Contents

1.Change History

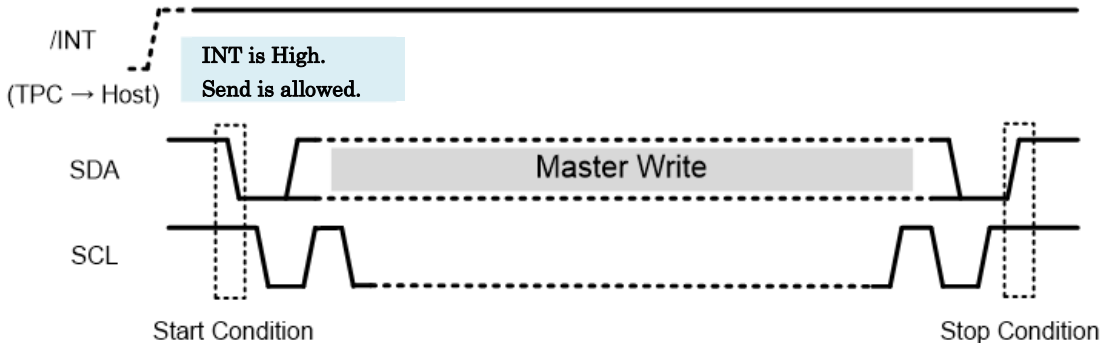
Version	Date	Note	Editor
1.0	2019/9/6	First Issue	Nagamori

2.Product Applicable

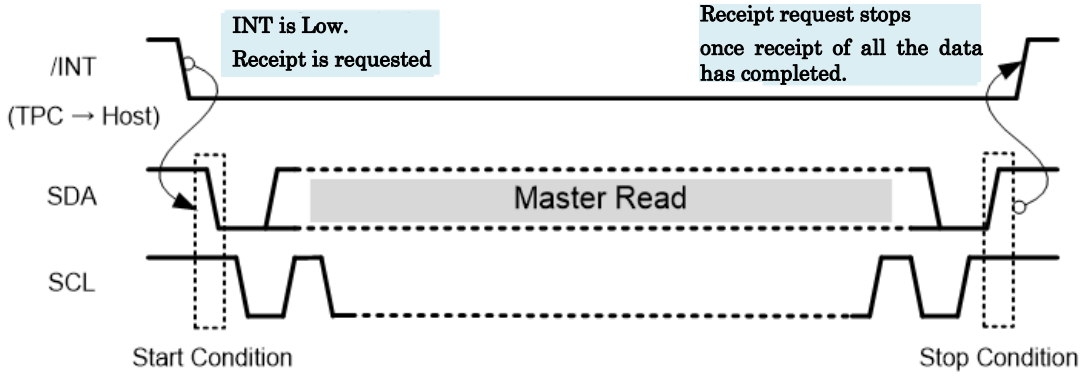
This specification sheet describes specifications for I2C interface of the projected capacitive touch screen controller boards, DUSx200 series (e.g. DUS1200/2200/3200/4200/7200).

3.Host Interface

3.1.Communication Timing



Send command (From Host to TouchPanelController)



Response or receipt of coordinate data (From TouchPanelController to Host)

3.2.Control signals

Name	Note
/INT	Open drain, Low active, input/output signals 1. When INT is High (TPC ready for receipt), commands can be sent from the host to TPC. 2. When there is data to be reported from TPC to the host, TPC will set INT to Low. Perform "Master Read" at Host so that it can receive data from TPC. Once the host has completed receipt of all the data, INT will become High. 3. To resume TPC from Sleep mode to Normal operation mode, host will set INT to Low (hold Low-pulse at 100μs or more, and then make sure to get it back to High).
SCL	I2C Clock signal, output by host (I2C Master).
SDA	I2C Data Signal, Read/Write is performed according to I2C protocols.

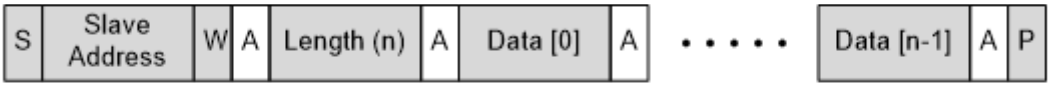
3.3.Communication Specification

Slave Address	0x5C
Transfer Rate	400Kbps [Fast mode]
Transfer Data Length	Maximum 255 bytes + Length 1 bytes
Master Connection	Single master (Multi-master is not supported)

3.4.Protocol Specification

Master Write

Host sends Data with the number of bytes (up to 255 bytes) specified in Length in single transaction.

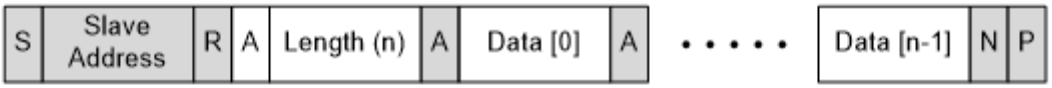


Note: When the controller receives data that exceeds the data length of Length (including Length 0 data), TPC will respond with NAK and discard the received data.

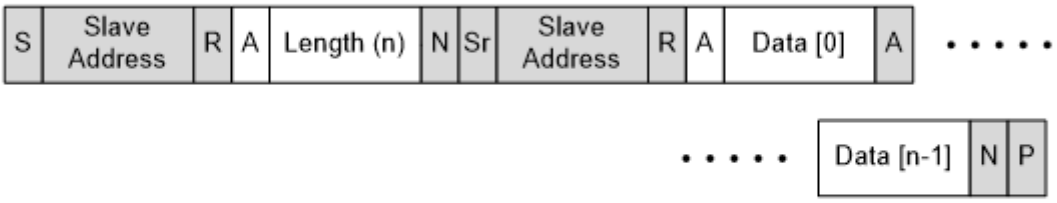
Master Read

Host acquires the Data (up to 255 bytes) with the number of bytes specified in the Length. TPC supports the following two methods:

[Method 1] acquiring Length and Data in single transaction



[Method 2] acquiring Length and Data in two successive transactions



Master (Host) -> Slave (TPC)

Slave (TPC) -> Master (Host)

S : Start Condition
Sr : Repeated Start Condition
P : Stop Condition

W (0) : Write
R (1) : Read
A (0) : Acknowledge
N (1) : Not Acknowledge

Length : Number of bytes (1 byte)
Data : Command, Response, Coordinate data(up to 255 byte)

4.Report Format

4.1.Touch Coordinate Data

Touch coordinate data is sent to host in the following format.

0	1	2	3	4	5	6
Report ID	Number of touch points	Touch 1 info				
		Flag	X coordinate		Y coordinate	
			Low	High	Low	High

.....

.....

p+2	p+3	p+4	p+5	p+6
Touch [n] info(Max. 10 points)				
Flag	X coordinate		Y coordinate	
	Low	High	Low	High

p : (Touch number – 1) * 5

Report ID: 0x04

Touch Points: Number of touch points when multiple points are touched (up to 10 points)

Touch Information: Coordinate information of each contact (number of touches)

Flag: [b7 - b6] 0 (fixed)

[b5 - b1] Finger ID (0 – 9)

[b0] Tip SW(1 : Down 0 : Up)

X、Y coordinate: Coordinate of touch contacts

- When I2C bus is transferred, Length (1 byte) is added before Report ID.

4.2.Water Detection

Water detection function is not supported by I2C I/F. (It is supported by USB only).

5.Maintenance Command

Maintenance commands can be used from the host via I2C.

5.1.Command/Response Format

0	1	2	3	4	…	4 + n
Header	Command	Byte to send	Argument	Data[0]	…	Data[n]

- When I2C bus is transferred, Length (1-byte) is added before Report ID.
- Header is 0x02 fixed.
- Byte to send = Argument + Data
- After the command is executed, the controller will send a response and report the processing result to the host.
- Make sure to acquire a response when issuing a command. (Refer to 3.1 Communication Timing and 3.2.Control signals for the timing of response acquisition.) If the next command is issued without response acquisition, operation of touch panel controller will not be guaranteed.

5.2.Command List

Command	Byte to Send	Argument	Data	Function
0x4C('L')	0x01	0x01	-	Offset Calibration
	0x02	0x04	0x00	Acquisition of version information
	0x02	0x06	0x00	Detail information of firmware
	0x02	0x08	Y/N	Coordinate Output Control
	0x02	0x09	Method	Self-diagnostic Test
	0x02	0x71	0x00	Sleep mode

- If any other command is issued, the operation of the touch panel controller will not be guaranteed.
- If a command code other than 0x4C is received from the touch panel controller, ignore (discard without processing) the data on the host side. The data other than 0x4C is optional data that is not supported by the I2C interface version of the touch panel controller. Ignoring it will not cause a problem in function.

5.2.1.Offset Calibration

This command is for performing calibration on the touch screen.

[Command]

Header	Command	Byte to Send	Argument	Data
0x02	0x4C ('L')	0x01	0x01	-

- Calibration takes a few seconds (the execution time depends on the number of electrodes on the panel).
- The calibration data will be saved in the Data Flash.

[Response]

Header	Command	Byte to Send	Argument	Processing Result
0x02	0x4C ('L')	0x02	0x01	0x01 Normal 0x00 Error

- After calibration is executed, the processing result will be notified by response.

5.2.2.Acquisition of Version Information

This command is for acquiring firmware version information.

[Command]

Header	Command	Byte to Send	Argument	Data
0x02	0x4C ('L')	0x02	0x04	0x00

[Response]

Header	Command	Byte to send	Argument	Version information [n]
0x02	0x4C ('L')	n + 1	0x04	ASCII

- Version information is acquired in ASCII codes. Bytes to send are variable according to products.

<Configuration of Version Information>

"nn…..n:PROG-pp…p DATA-dd…d"

nn…n Product Name

pp…p Program Version

dd…d Data Version

5.2.3.Firmware Details

This command is for acquiring details of firmware information.

[Command]

Header	Command	Byte to Send	Argument	Data
0x02	0x4C ('L')	0x02	0x06	0x00

[Response]

Header	Command	Byte to Send	Argument	Information Detail			
				0	1	2	3
0x02	0x4C ('L')	0x14	0x06	Number of electrodes		Resolution	
				X axis	Y axis	Low	High

Information Detail								
4	5	6	7	8	9	10	11	12
Number of touch points	Logical maximum value Width(X)		Logical maximum value Height(Y)		Physical maximum value Width(X)		Physical maximum value Height(Y)	
	Low	High	Low	High	Low	High	Low	High

Information Detail					
13	14	15	16	17	18
0x00	Function Flag	Data Flash version			
		LSB			MSB

Number of electrodes: Number of X-axis/Y-axis electrodes

Resolution: Logical coordinate factor

Number of touch points: Maximum number of multiple touches

Logical maximum value: Maximum value of logical coordinate of touch screen (maximum size)

Physical maximum value: Actual panel size of touch screen (unit:0.01[inch])

Function Flag: [b0] MCU type 0 : M48x 1 : M45x

[b1] TX/RX-axis 0 : TX / X-axis RX / Y-axis

1 : TX / Y-axis RX / X-axis

[b2 – 7] Unused(0)

Data Flash version: Control number of the Data Flash

5.2.4.Coordinate Output Control Command

This command is for starting and stopping coordinate output

[Command]

Header	Command	Byte to Send	Argument	Start/Stop
0x02	0x4C ('L')	0x02	0x08	0x00 Start (Default) 0x01 Stop

- If the controller is rebooted, the latest state before rebooting will not be kept, and it will start with the default state.

[Response]

Header	Command	Byte to Send	Argument	Processing Result
0x02	0x4C ('L')	0x02	0x08	0x01 Normal 0x00 Error

5.2.5.Self-diagnostic Test

This command is for acquiring result of self-diagnostic test.

[Command]

Header	Command	Byte to Send	Argument	Acquiring Method
0x02	0x4C ('L')	0x02	0x09	0x00 Latest 0x01 All

<Acquiring Method>

(1) 0x00 Error code detected most recently will be acquired.

(2) 0x01 All the error codes detected from power-on until issue of this command will be acquired.

[Response] (1) Acquiring Method: 0x00 (Latest)

Header	Command	Byte to Send	Argument	Processing Result	Diagnostic Result
0x02	0x4C ('L')	0x03 0x02	0x09	0x01 Normal 0x00 Error	0x00 Normal Not 0x00 Error

- If the processing result is 0x01 (Normal), the byte to send will be 3, and the diagnostic result will be enabled. The most recently detected error code or 0x00 (normal) will be set in the diagnostic result.
- If the processing result is 0x00 (Error), the byte to send will be 2 and the diagnostic result will not be added.

[Response] (1) Acquiring Method: 0x01 (All)

Header	Command	Byte to Send	Argument	Processing result	Diagnostic Result
					Data[0]~Data[n]
0x02	0x4C ('L')	Byte of Diagnostic result +2	0x09	0x01 Normal 0x00 Error	0x00 Normal Not 0x00 Error

- If the processing result is 0x01(Normal), all the error codes (up to 59 bytes) after power-on will be added to the diagnostic result. If the diagnostic result is normal, 0x00 (1 byte) will be added to the diagnostic result.
- If the processing result is 0x00 (Error), the byte to send will be 2, and the diagnostic result will not be added.

Error Code (for reference)

Error Code	Error Detail	Note
0x1x	Data Flash error (parameter area)	
0x2x	Data Flash error (calibration area)	
0x3x	AFE Error	

5.2.6.Sleep Mode

This command is for switching the controller to the low-power mode.

[Command]

Header	Command	Byte to Send	Argument	Data
0x02	0x4C ('L')	0x02	0x71	0x00

- Once switched into the sleep mode, the touch panel controller will stop all the processing such as coordinate detection and command processing. Its CPU will be switched to the low-power consumption mode, and be waiting for wake-up from the host (processing other than wake-up will not be accepted).
- When returning from the sleep mode to the normal operation mode, hold the INT signal Low for more than 100μs on the host side. (INT signal is an input/output signal with an open drain setting. Make sure to get it back to High in the normal state. For details of the INT signal, refer to 3.2 Control signals.)

[Response]

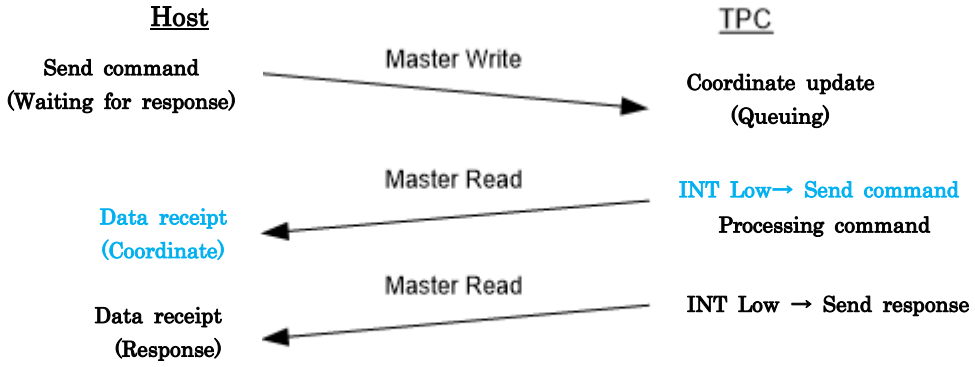
Header	Command	Byte to Send	Argument	Data
0x02	0x4C ('L')	0x02	0x71	0x01 Normal 0x00 Error

- If the processing result is normal, the controller will enter into sleep mode when the host has completed acquiring responses via Master Read.
- If the processing result is Error, the controller will not enter into sleep mode (the normal operation state will continue).

6.Precautions

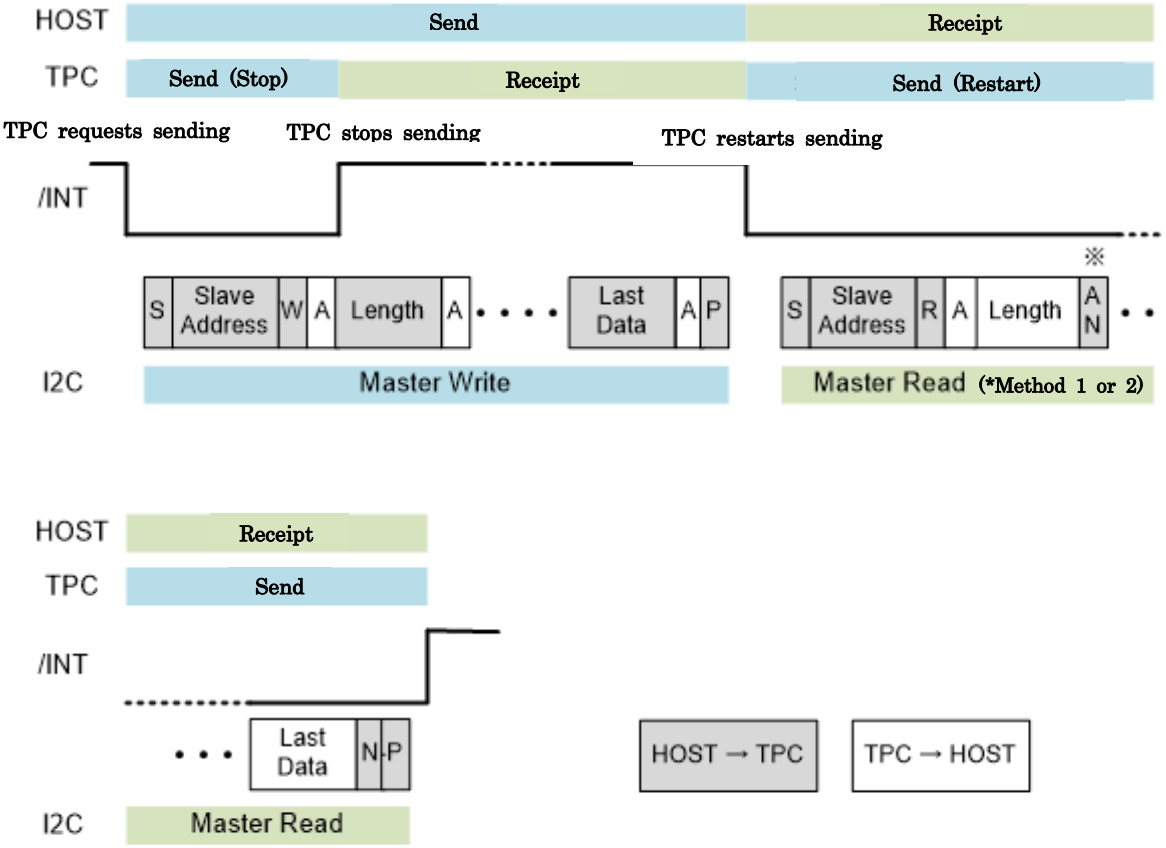
- When the receipt request (INT signal) to the host is active, make the host receive the data quickly. If the receipt request to the host (coordinate data or response) is pending inside the controller, the effects such as delay and stagnation for coordinate detection and command processing may occur.

- If a command is sent from the host when the controller is processing coordinate update, the coordinate data may be reported immediately before the command response. In this case, the controller will issue receipt requests to the host in a row, and the host must acquire all the data reported for each receipt requests.



Case: Command sending and coordinate update are executed at the same time.

If [send request] (INT Low) by the touch panel controller and [start send] (Master Write) by the host occur at the same time, the touch panel controller will stop the [send request] (INT L→H) when it recognizes Slave Address + W, and will receive the data sent from the host. Once sending from the host (Master Write) is completed, the touch panel controller will restart issuing [send request] (INT H→L). The host must perform Master Read and receive the data sent from the touch panel controller.



Case: Host and TPC started sending at the same time.

7.Precautions for Use

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§ The manufacturer or sales representatives will not be liable for any damages or loss arising from use of this product.

§ This product is intended for use in standard applications (computers, office automation, and other office equipment, industrial, communications, and measurement equipment, personal and household devices, etc.) Please avoid using this product for special applications where failure or abnormal operation may directly affect human lives, or cause physical injury or property damage, or where extremely high levels of reliability are required (such as aerospace systems, atomic energy controls, medical devices for life support, etc.).

§ Any semiconductor devices have inherently a certain rate of failure. The user must protect against injury, damage, or loss from such failures by incorporating safety design measures into the user's facility and equipment.

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