

## True Multi-Touch Capacitive Touch Panel Controller

### INTRODUCTION

The FT5X26 is single-chip capacitive touch panel controllers with built-in enhanced Micro-controller unit (MCU). It provides the benefits of full screen common mode scan technology, fast response time and high level of accuracy. It can drive capacitive type touch panel with up to 42 driving and 30 sensing lines.

### FEATURES

- Mutual Capacitive Sensing Techniques
- Full Screen Common Mode Scan Techniques
- True Multi-touch up to 10 Points of absolute X and Y Coordinates
- High immunity to RF and power Interferences
- 5626NEm Supports up to 40TX + 27 RX
- 5726NEi Supports up to 42TX + 30 RX
- Full Programmable Scan Sequences to Support Various TX/RX Configurations
- High Report Rate: Over 100Hz
- Touch Resolution of 325 Dots per Inch (dpi) or above
- Auto-calibration
- Support Interfaces: I2C
- Built-in 64KB Flash
- 2.7 to 3.6V Operating Voltage
- IOVCC (Ext. or Int.) supports from 1.8V to 3.6V
- Single Channel(TX/RX)resistance: Up to 100K  $\Omega$
- Single Channel (transmit/receive) Capacitance: 40pF
- Optimal Sensing Mutual Capacitance: 0.5pF~4pF
- 12-Bit ADC Accuracy
- 3 Operating Modes
  - Active
  - Monitor
  - Hibernation
- Operating Temperature Range: -40°C to +85°C
- Package:
  - QFN88L 10x10x0.8mm, 0.4mm/pitch

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## 1 OVERVIEW

### 1.1 Typical Applications

FT5X26 accommodates a wide range of applications with a set of buttons up to a 2D touch sensing device; their typical applications are listed below.

- Tablet
- Navigation systems, GPS
- Game consoles
- POS (Point of Sales) devices

FT5X26 support Touch Panel, the spec is listed in the following table,

Part Number	Package	TX	RX	Total Channels	Recommended for Smart Phone TP Size (16:9)
FT5626NEm	QFN 88L 10x10x0.8mm Pitch =0.4mm	40	27	67	≤ 10.1", Sensor Pitch:6mm
FT5726NEi	QFN 88L 10x10x0.8mm Pitch =0.4mm	42	30	72	≤ 11.6", Sensor Pitch:6mm

## 2 FUNCTIONAL DESCRIPTION

### 2.1 Architectural Overview

Figure2-1 shows the overall architecture for the FT5X26.

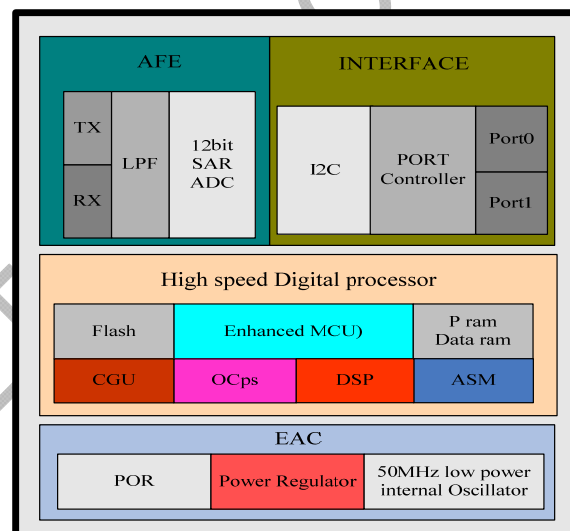


Figure 2-1 System Architecture Diagram

The FT5X26 is comprised of five main functional parts listed below,

- Touch Panel Interface Circuits

The main function for the AFE and AFE controller is to interface with the touch panel. It scans the panel by sending AC signals to the panel and processes the received signals from the panel. It includes both Transmit (TX) and Receive (RX) functions. Key parameters to configure this circuit can be sent via serial interfaces.

- Enhanced MCU with DSP accelerator

For the Enhanced MCU, larger program and data memories are supported. Furthermore, a Flash memory is implemented to store programs and some key parameters.

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Complex signal processing algorithms are implemented by MCU and DSP accelerator to detect the touches reliably and efficiently. Communication protocol software is also implemented in this MCU to exchange data and control information with the host processor.

- External Interface
  - I2C: an interface for data exchange with host
  - INT: an interrupt signal to inform the host processor that touch data is ready for read
  - RSTN: an external low signal reset the chip. The port is also use to wake up the FT5X26 from the Hibernate mode.
- A watch dog timer is implemented to ensure the robustness of the chip.
- A voltage regulator to generate 1.8V for digital circuits from the input VDD3 supply
- Power On Reset (POR) is active until VDDD is higher than some level and hold decades of  $\mu$ s.

## 2.2 MCU

This section describes some critical features and operations supported by the enhanced MCU.

Figure 2-2 shows the overall structure of the MCU block. In addition to the enhanced MCU core, we have added the following circuits,

- A DSP accelerator cooperates with MCU to process the complex algorithms
- Timer: A number of timers are available to generate different clocks
- Clock Manager: To control various clocks under different operation conditions of the system

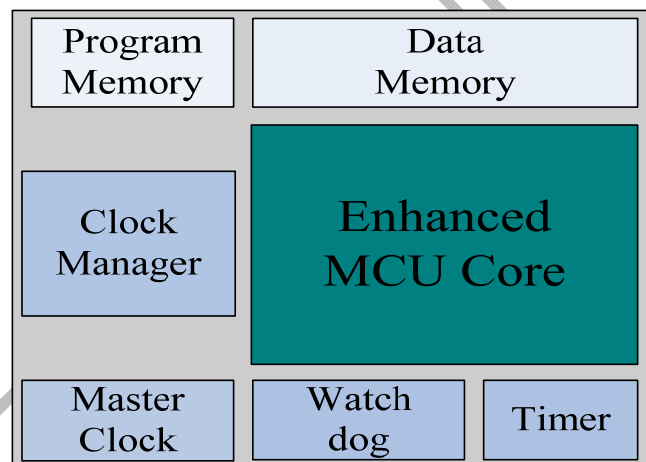


Figure 2-2 MCU Block Diagram

## 2.3 Operation Modes

FT5X26 offers following three modes:

- **Active Mode**

When in this mode, FT5X26 actively scans the panel. The default scan rate is 100 frames per second. The host processor can configure it to speed up or to slow down.

- **Monitor Mode**

In this mode, FT5X26 scans the panel at a reduced speed. The default scan rate is 25 frames per second and the host processor can increase or decrease this rate. In this mode, most algorithms are stopped. A simpler algorithm is being executed to determine if there is a touch or not. When a touch is detected, FT5X26 shall enter the Active mode immediately to acquire the touch information quickly. During this mode, the serial port is closed and no data shall be transferred with the host processor.

- **Hibernate Mode**

In this mode, the chip is set in a power down mode. It shall only respond to the "RESET" signal from the host processor. The chip therefore consumes very little current, which help prolong the standby time for the portable devices.

## 2.4 Host Interface

**Figure 2-3** shows the interface between a host processor and FT5X26. This interface consists of the following three sets of signals:

- Serial Interface
- Interrupt from FT5X26 to the Host
- Reset Signal from the Host to FT5X26

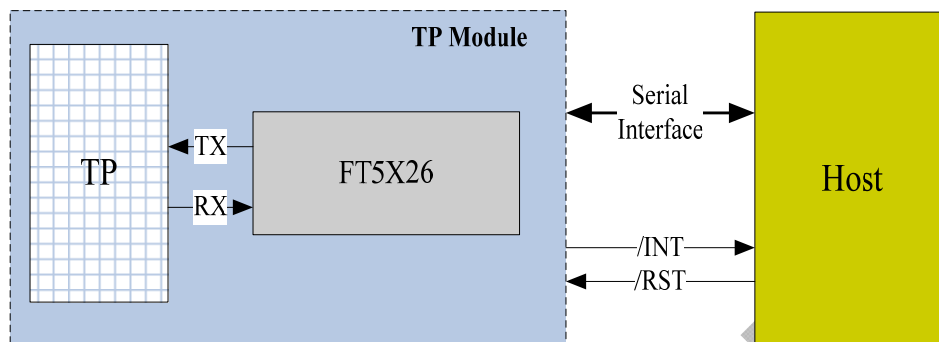


Figure 2-3 Host Interface Diagram

The serial interface of FT5X26 is I2C. The detail of the interface is described in detail in Section 2.5. The interrupt signal (/INT) is used for FT5X26 to inform the host that data are ready for the host to receive. The /RST signal is used for the host to wake up FT5X26 from the Hibernate mode. After resetting, FT5X26 shall enter the Active mode.

## 2.5 Serial Interface

FT5X26 supports the I2C interfaces, which can be used by a host processor or other devices.

The I2C is always configured in the Slave mode. The data transfer format is shown in **Figure 2-4**.

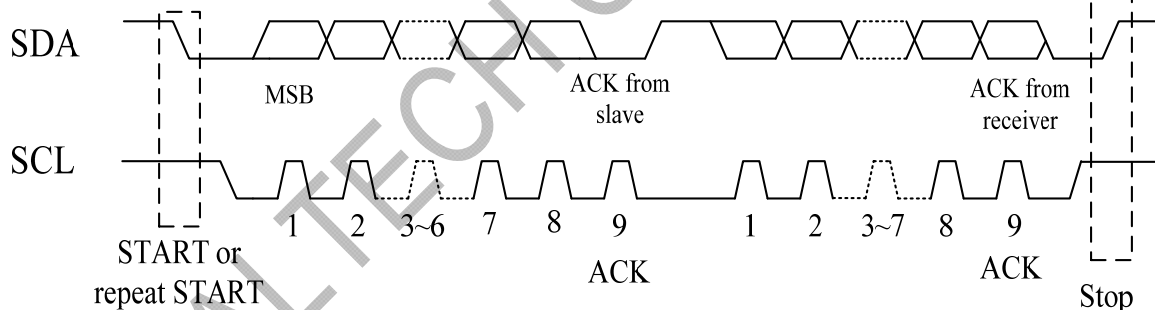


Figure 2-4 I2C Serial Data Transfer Format

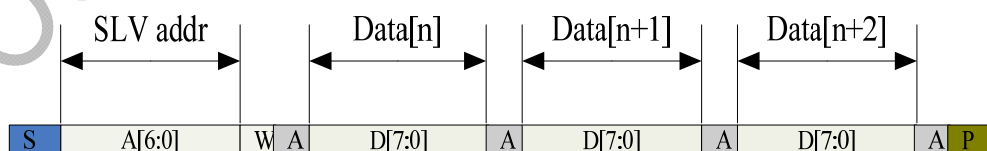


Figure 2-5 I2C master write, slave read

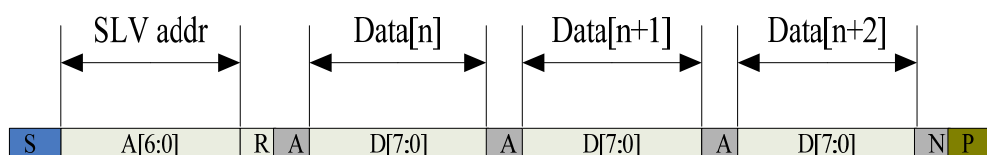


Figure 2-6 I2C master read, slave write

Table 2-1 lists the meanings of the mnemonics used in the above figures.

**Table 2-1 Mnemonics Description**

Mnemonics	Description
S	I2C Start or I2C Restart
A[6:0]	Slave address
R/ W	READ/WRITE bit, '1' for read, '0' for write
A(N)	ACK(NACK) bit
P	STOP: the indication of the end of a packet (if this bit is missing, S will indicate the end of the current packet and the beginning of the next packet)

I2C Interface Timing Characteristics is shown in Table 2-2.

**Table 2-2 I2C Timing Characteristics**

Parameter	Min	Max	Unit
SCL frequency	0	400	KHz
Bus free time between a STOP and START condition	1.3		us
Hold time (repeated) START condition	0.6		us
Data setup time	100		ns
Setup time for a repeated START condition	0.6		us
Setup Time for STOP condition	0.6		us

### 3 ELECTRICAL SPECIFICATIONS

#### 3.1 Absolute Maximum Ratings

**Table 3-1 Absolute Maximum Ratings**

Item	Symbol	Value	Unit	Note
Power Supply Voltage	VDD3 – VSS	-0.3 ~ +3.6	V	1, 3
I/O Digital Voltage	IOVCC	1.8~3.6	V	1
Operating Temperature	Topr	-40 ~ +85	℃	1
Storage Temperature	Tstg	-55 ~ +150	℃	1

#### Notes

1. If used beyond the absolute maximum ratings, FT5X26 may be permanently damaged. It is strongly recommended that the device be used within the electrical characteristics in normal operations. If exposed to the condition not within the electrical characteristics, it may affect the reliability of the device.
2. Make sure VDD (high) ≥ VSS (low)

### 3.2 DC Characteristics

**Table 3-2 DC Characteristics**

Item	Symbol	Unit	Test Condition	Min.	Typ.	Max.	Note
Input high-level voltage	VIH	V		0.7 x IOVCC	--	IOVCC	
Input low -level voltage	VIL	V		-0.3	--	0.3 x IOVCC	
Output high -level voltage	VOH	V	IOH=-0.1mA	0.7 x IOVCC	--	--	
Output low -level voltage	VOL	V	IOH=0.1mA	--	--	0.3 x IOVCC	
I/O leakage current	ILI	uA	Vin=0~VDD3	-1	--	1	
Current consumption ( Normal operation mode )	Iopr	mA	VDD3 = 3V Ta=25°C MCLK=24MHz	--		--	
Current consumption ( Monitor mode )	Imon	mA	VDD3 = 3V Ta=25°C MCLK=24MHz	--		--	
Current consumption ( Sleep mode )	Islp	uA	VDD3 = 3V Ta=25°C MCLK=24MHz	--		--	
Step-up output voltage	VDD5	V	VDD3= 2.8V				
Step-up output voltage	VDD10	V	VDD3= 2.8V				
Power Supply voltage	VDD3	V		2.7	--	3.6	

Notes: This sample data is intended for design guidance only. Values shown are typical for a 42Tx × 30Rx sensor configured at 80 Hz report rate. Actual current will depend on the particular sensor design and firmware options.

### 3.3 AC Characteristics

**AC Characteristics of Oscillators**

Item	Symbol	Unit	Test Condition	Min.	Typ.	Max.	Note
OSC clock 1	fosc1	MHz	VDD3 = 2.8V; Ta=25°C	49	50	51	

**Table 3-3 AC Characteristics of TX & RX**

Item	Symbol	Test Condition	Min	Typ	Max	Unit	Note
TX acceptable clock	ftx		50	150	400	KHz	
TX output rise time	Ttxr		--	210	--	nS	
TX output fall time	Ttxf		--	210	--	nS	
RX input voltage	Trxi		1.2	--	1.6	V	

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### 3.4 I/O Ports Circuits

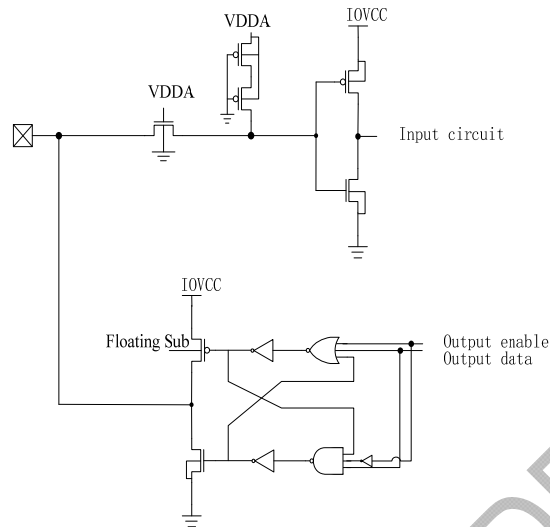


Figure 3-1 General Purpose In/Out Port Circuit.

The input/output property can be configured via firmware setting. The firmware can also control its output behavior as push-pull or as open-drain that SDA of I2C interface is required.

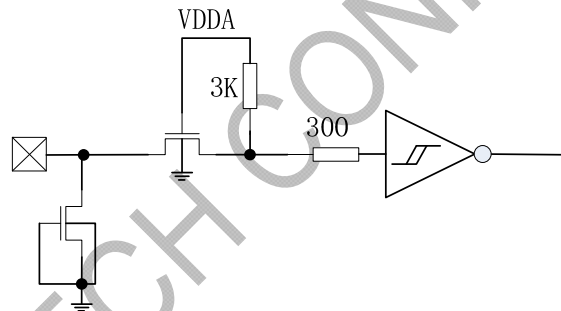


Figure 3-2 Reset Input Port Circuits

### 3.5 POWER ON/Reset Sequence

Reset should be pulled down to be low before powering on and powering down. I2C shouldn't be used by other devices during Reset time after VDD powering on ( $T_{rtp}$ ). INT signal will be sent to the host after initializing all parameters and then start to report points to the host. If Power is down, the voltage of supply must be below 0.3V and  $T_{pdt}$  is more than 1ms.

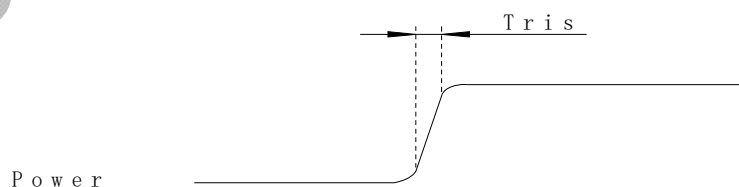


Figure 3-3 Power on time



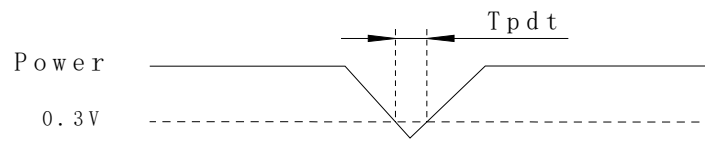


Figure 3-4 Power Cycle requirement

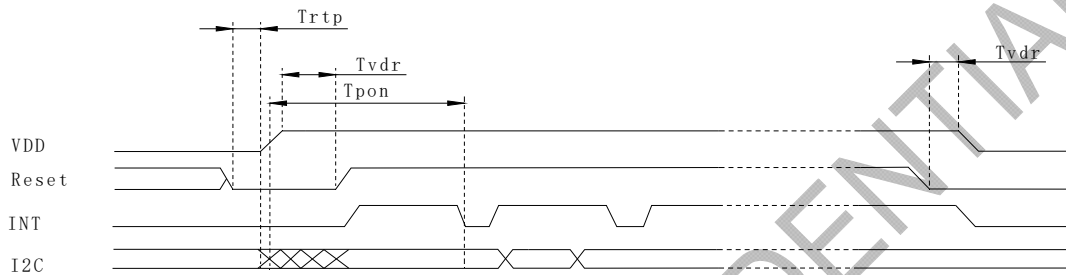


Figure 3-5 Power on Sequence

Reset time must be enough to guarantee reliable reset, the time of starting to report point after resetting approach to the time of starting to report point after powering on.

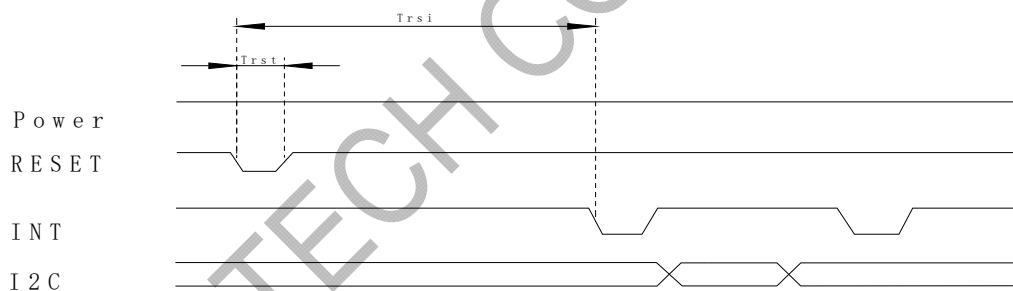


Figure 3-6 Reset Sequence

**Table 3-5 Power on/Reset Sequence Parameters**

Parameter	Description	Min	Max	Units
Tris	Rise time from 0.1VDD to 0.9VDD	--	5	ms
Tpdt	Time of the voltage of supply being below 0.3V	5	--	ms
Trtp	Time of resetting to be low before powering on	100	--	$\mu$ S
Tpon	Time of starting to report point after powering on	--	200	ms
Tvdr	Reset time after VDD powering on	1	--	ms
Trsi	Time of starting to report point after resetting	--	200	ms
Trst	Reset time	1	--	ms

## 4 PIN CONFIGURATIONS

Pin List of FT5X26

**Table 4-1 Pin Definition**

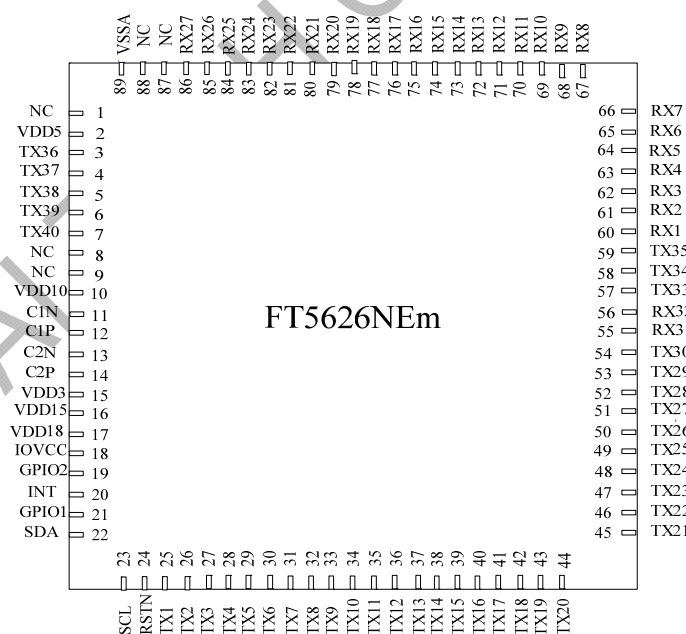
Name	Pin No.		Type	Description
	5626NEm	5726NEi		
RX30		1	I	Receiver input pins
RX29		88	I	Receiver input pins
RX28		87	I	Receiver input pins
RX27	86	86	I	Receiver input pins
RX26	85	85	I	Receiver input pins
RX25	84	84	I	Receiver input pins
RX24	83	83	I	Receiver input pins
RX23	82	82	I	Receiver input pins
RX22	81	81	I	Receiver input pins
RX21	80	80	I	Receiver input pins
RX20	79	79	I	Receiver input pins
RX19	78	78	I	Receiver input pins
RX18	77	77	I	Receiver input pins
RX17	76	76	I	Receiver input pins
RX16	75	75	I	Receiver input pins
RX15	74	74	I	Receiver input pins
RX14	73	73	I	Receiver input pins
RX13	72	72	I	Receiver input pins
RX12	71	71	I	Receiver input pins
RX11	70	70	I	Receiver input pins
RX10	69	69	I	Receiver input pins
RX9	68	68	I	Receiver input pins
RX8	67	67	I	Receiver input pins
RX7	66	66	I	Receiver input pins
RX6	65	65	I	Receiver input pins
RX5	64	64	I	Receiver input pins
RX4	63	63	I	Receiver input pins
RX3	62	62	I	Receiver input pins
RX2	61	61	I	Receiver input pins
RX1	60	60	I	Receiver input pins
TX35	59	59	O	Transmit output pin
TX34	58	58	O	Transmit output pin
TX33	57	57	O	Transmit output pin
TX32	56	56	O	Transmit output pin
TX31	55	55	O	Transmit output pin
TX30	54	54	O	Transmit output pin
TX29	53	53	O	Transmit output pin
TX28	52	52	O	Transmit output pin
TX27	51	51	O	Transmit output pin

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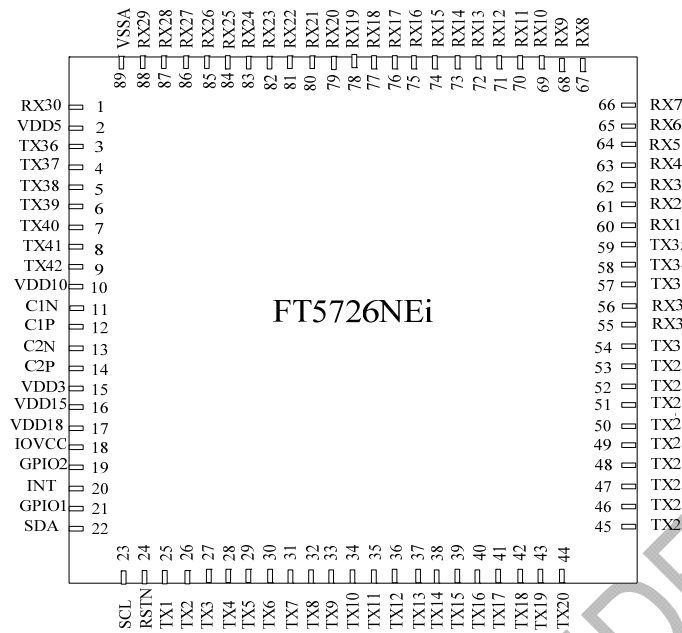
TX26	50	50	O	Transmit output pin
TX25	49	49	O	Transmit output pin
TX24	48	48	O	Transmit output pin
TX23	47	47	O	Transmit output pin
TX22	46	46	O	Transmit output pin
TX21	45	45	O	Transmit output pin
TX20	44	44	O	Transmit output pin
TX19	43	43	O	Transmit output pin
TX18	42	42	O	Transmit output pin
TX17	41	41	O	Transmit output pin
TX16	40	40	O	Transmit output pin
TX15	39	39	O	Transmit output pin
TX14	38	38	O	Transmit output pin
TX13	37	37	O	Transmit output pin
TX12	36	36	O	Transmit output pin
TX11	35	35	O	Transmit output pin
TX10	34	34	O	Transmit output pin
TX9	33	33	O	Transmit output pin
TX8	32	32	O	Transmit output pin
TX7	31	31	O	Transmit output pin
TX6	30	30	O	Transmit output pin
TX5	29	29	O	Transmit output pin
TX4	28	28	O	Transmit output pin
TX3	27	27	O	Transmit output pin
TX2	26	26	O	Transmit output pin
TX1	25	25	O	Transmit output pin
RSTN	24	24	I	External Reset, Low is active
SCL	23	23	I/O	I2C clock input
SDA	22	22	I/O	I2C data input and output
GPIO1	21	21	I/O	General Purpose Input/Output port
INT	20	20	I/O	Interrupt request to the host, or Wakeup request from the host.
GPIO2	19	19	I/O	General Purpose Input/Output port
IOVCC	18	18	PWR	I/O power supply
VDD18	17	17	PWR	digital power supply, A 1μF ceramic capacitor to ground is required.
VDD15	16	16	PWR	digital power supply, A 1μF ceramic capacitor to ground is required.
VDD3	15	15	PWR	digital power supply, A 1μF ceramic capacitor to ground is required.
C2P	14	14		
C2N	13	13		
C1P	12	12		
C1N	11	11		
VDD10	10	10	PWR	digital power supply, A 1μF ceramic capacitor to ground is required.
NC	9	9	NC	
NC	8	8	NC	

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TX40	7	7	O	Transmit output pin
TX39	6	6	O	Transmit output pin
TX38	5	5	O	Transmit output pin
TX37	4	4	O	Transmit output pin
TX36	3	3	O	Transmit output pin
VDD5	2	2	PWR	digital power supply, A 1 $\mu$ F ceramic capacitor to ground is required.
NC	1		NC	
VSS	89	89	PWR	Analog ground
NC	88		NC	
NC	87		NC	



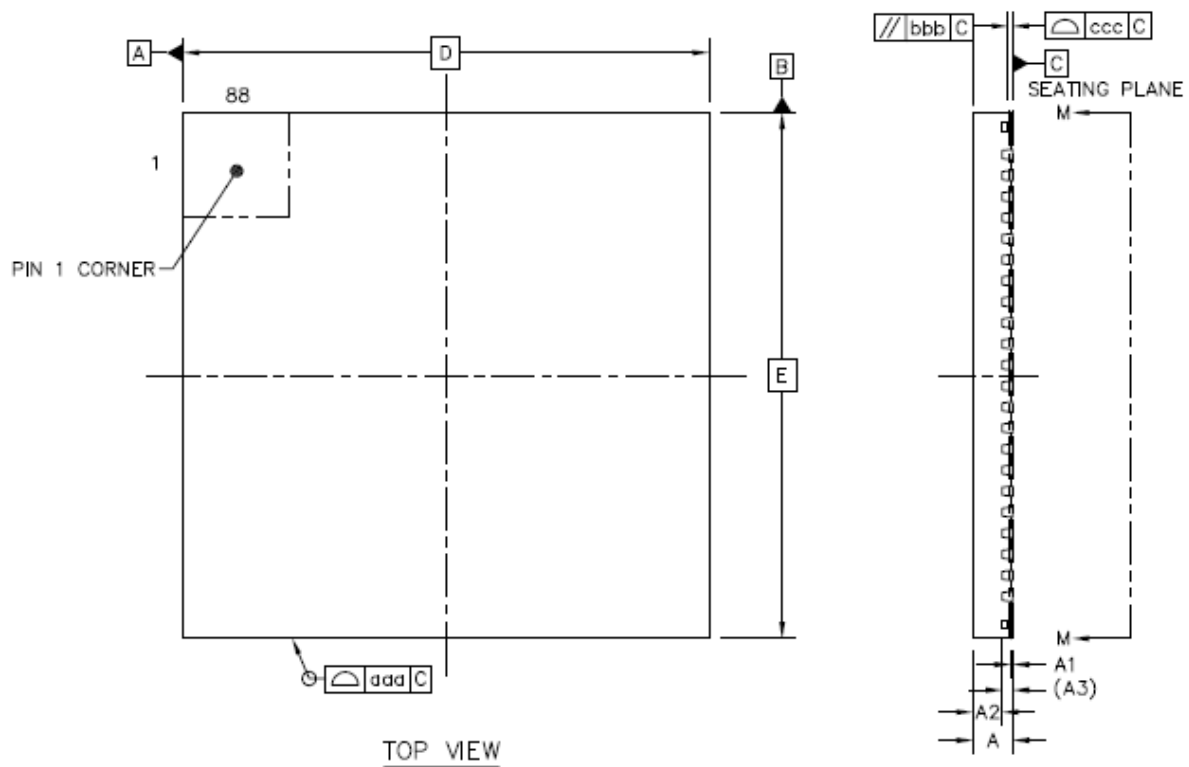
FT5626NEm Package Diagram

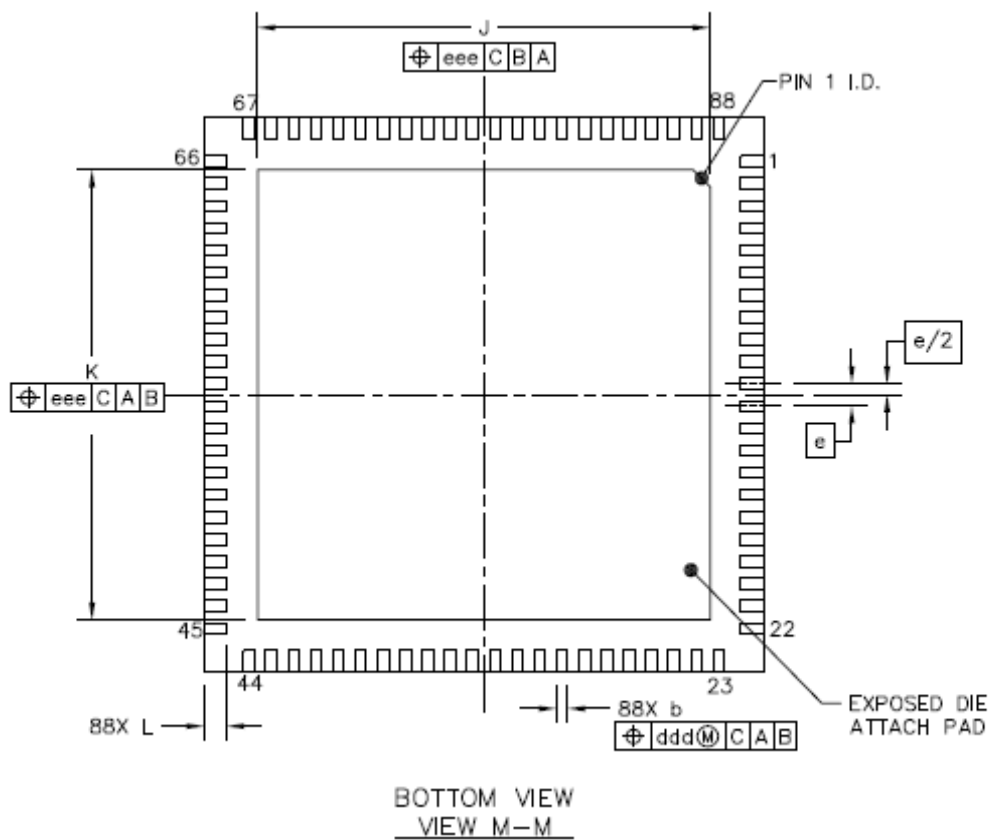


FT5726NEi Package Diagram

## 5 PACKAGE INFORMATION

### 5.1 Package Information of QFN-10x10-88L Package



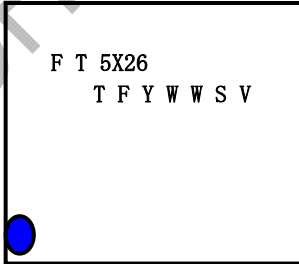


Item	Symbol	Millimeter		
		Min	Type	Max
Total Thickness	A	0.7	0.75	0.8
Stand Off	A1	0	0.035	0.05
Mold Thickness	A2	----	0.55	----
L/F Thickness	A3	0.203 REF		
Lead Width	b	0.15	0.2	0.25
Body Size	X	10 BSC		
	Y	10 BSC		
Lead Pitch	e	0.4 BSC		
EP Size	X	8	8.1	8.2
	Y	8	8.1	8.2
Lead Length	L	0.35	0.4	0.45
Package Edge Tolerance	aaa	0.1		
Mold Flatness	bbb	0.1		
Co Planarity	ccc	0.08		
Lead Offset	ddd	0.1		
Exposed Pad Offset	eee	0.1		

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## 5.2 Order Information

Package Type	QFN
	88Pin(10 * 10 )
	88Pin(0.8 - P0.4)
Product Name	FT5X26
<p>Note:</p> <ol style="list-style-type: none"> <li>1). The last three letters in the product name indicate the package type , lead pitch and thickness and numbers of TX and RX.</li> <li>2). The third last letter indicates the package type . N: QFN-10*10</li> <li>3). The second last letter indicates the lead pitch and thickness. E : 0.8 - P0.4</li> <li>4). The last letter indicates the numbers of TX and RX. m: 40TX-27RX i: 42TX-30RX</li> </ol>	

<p>T: Track Code</p> <p>F/R:" F" for Lead Free process, " R" for Halogen Free process</p> <p>Y: Year Code</p> <p>WW: Week Code</p> <p>S: Lot Code</p>	
---	---

Product Name	Package Type	# TX Pins	# RX Pins
FT5626NEm	QFN-88L	40	27
FT5726NEi	QFN-88L	42	30

END OF DATASHEET

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