TouchCore Family

SS-TouchCore1.0-V1.9

Spec. Sheet of **TouchCore1.0** Family

Digital-type / Capacitive Touch Sensor Engine

V1.9

June 2008

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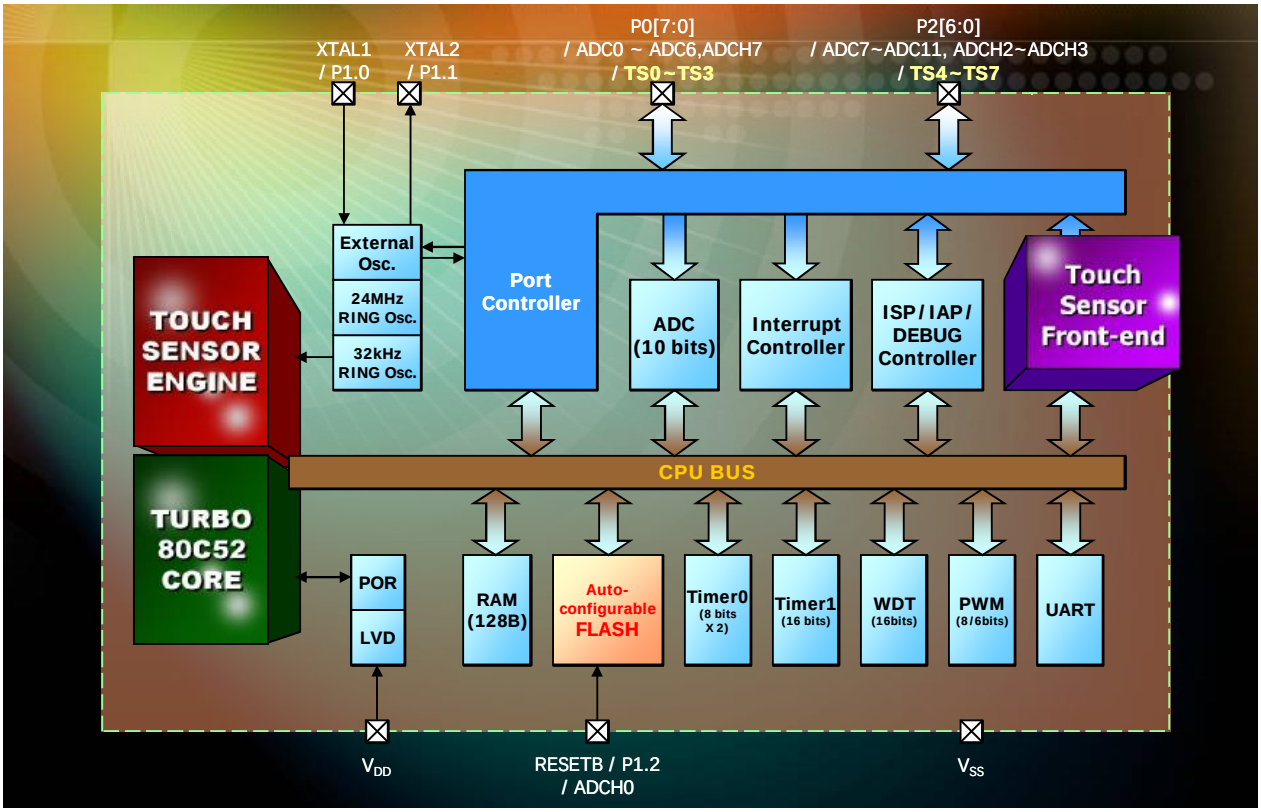
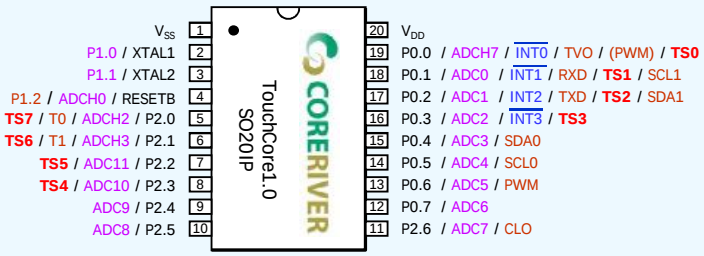
2. Block Diagram



3. Features

- **Digital-type Touch Sensor Engine**
  - Capacitive Touch Sensor Engine with Auto-configurable Flash Memory
- 4kB FLASH (Including 256B EEPROM)
- Operating Voltage : 1.8V ~ 5.5V
- Operating Temperature : -20℃ ~ +85℃
- Operating Frequency
  - Max. 23MHz @ V_{DD} = 5.0V
  - Max. 12MHz @ V_{DD} = 3.3V
- Max. Programmable 18 Output Pins
  - Push-Pull Output
- LVD (Low Voltage Detector)
- Internal RING Oscillator
  - Max. 12MHz @ 5.0V
  - 4MHz @2.7V ~ 5.0V (+/-3%)
  - 32KHz @2.7V (+/-10%) (Low power 32KHz OSC)
- Supporting ISP & IAP
- Latch-up Protection Up to ±200mA
- E.S.D. Protection Up to
  - 6000V for Touch Sensor Pad
  - 2000V for normal I/O
- Max. 8-channel TS (Touch Sensors)
- 2-channel I2C Slave (I2C Master/Slave, I2C Slave)
- 16-bit Programmable Watchdog Timer
- UART / PWM / Timer / I2C
- 16-channel 10-bit ADC
  - Max 100KSPS (@F_{ADC} = 8 MHz)
  - Programmable input clock frequency
- 14 Interrupt Sources
  - Timer0/1, WDT, LVD, ADC, UART, 2-I2C, ,PWM, TS
  - 4 External sources : both edge/level
  - Two-level interrupt priority
- Reset Sources
  - On-chip POR (Power-On-Reset)
  - LVD (Low Voltage Detector) Reset
  - WDT (Watchdog Timer) Reset
- Power Consumption
  - Typ. 6uA @ V_{DD}=2.0V (SNAP Mode)
  - Typ. 1uA @ V_{DD}=5.0V (All Clock OFF) (Changeable)
- Packages
  - 20-pin Packages : Wide-SOIC / QFN
  - 8-pin Package : SOIC

4. Pin Configurations (1 of 2)

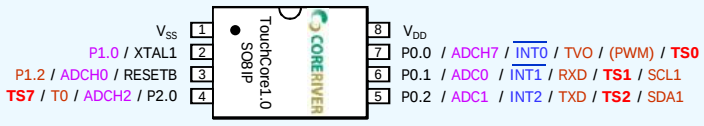


[20-pin SOIC]

[ISP Pin Configuration]

[Ordering Information]

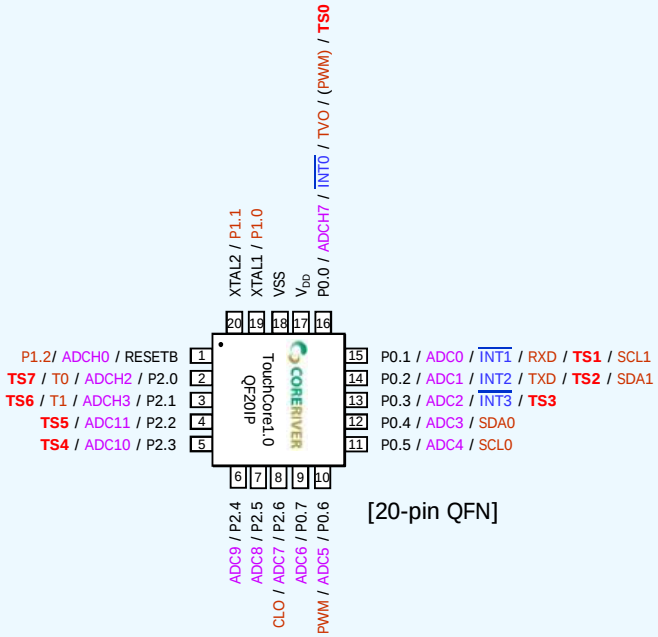
- 20-SOIC (Wide) : TC10-SO20IP
- 8-SOIC : TC10-SO8IP



[8-SOIC]

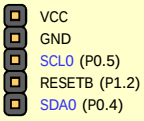
[ISP Pin Configuration]

4. Pin Configurations (2 of 2)



[20-pin QFN]

[ISP Pin Configuration]



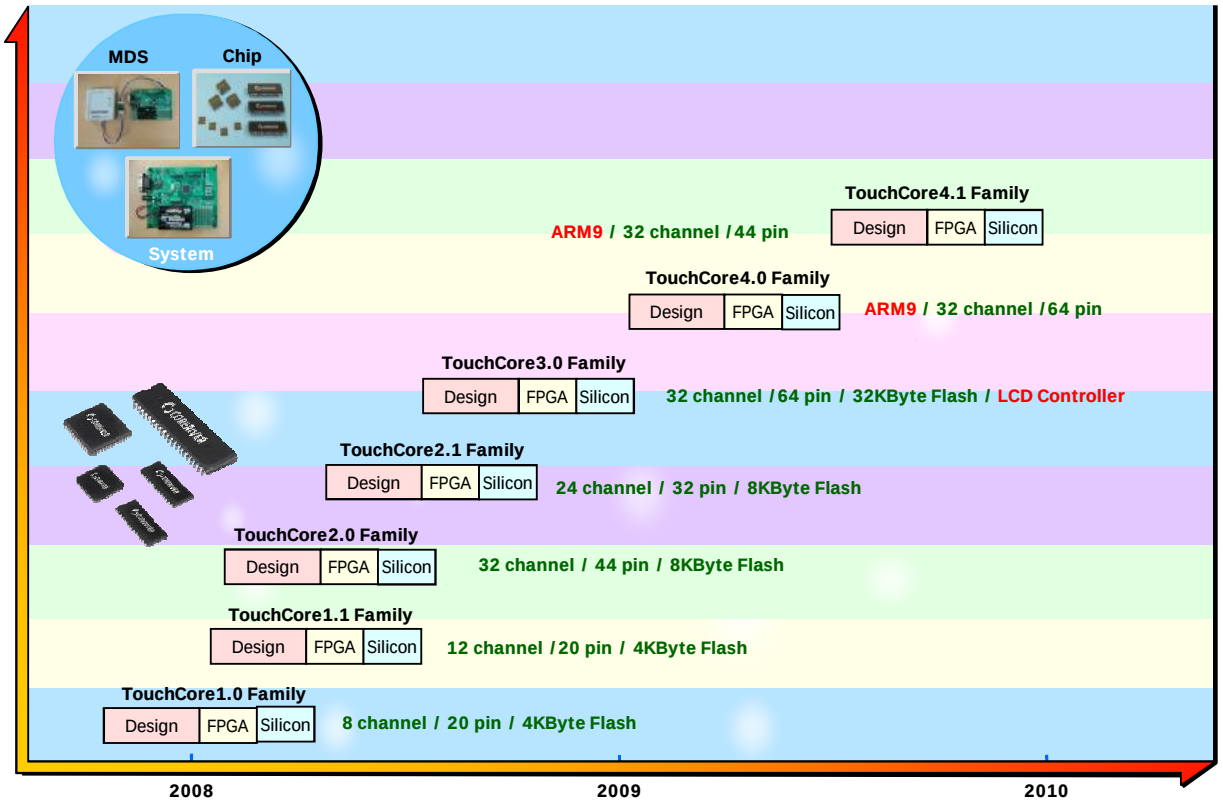
[Ordering Information]

- 20-QFN : TC10-QF20IP

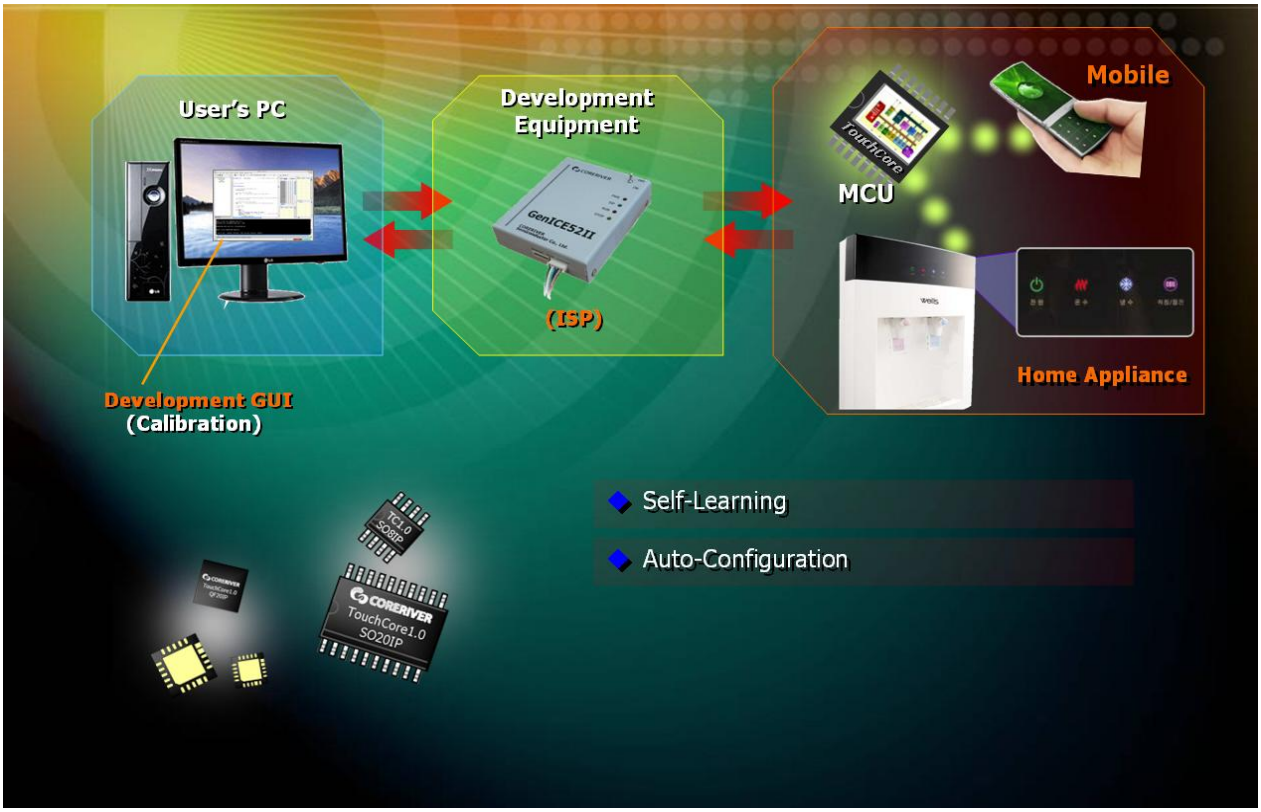
5. Pin Descriptions

Symbol	Direction	Description	Share Pins
V_{DD}	Input	Power Supply	-
V_{SS}	Input	Ground	-
XTAL1 / P1.0	Input/Output	§ Crystal Input/Output (Default) § Bit Programmable with Schmitt Trigger - Optional Pull-up Control Enable - Open-drain Output - Push-pull Output	XTAL1 / P1.0 (Crystal Input)
XTAL2 / P1.1			XTAL2 / P1.1 (Crystal Output)
RESETB / P1.2	Input/Output	§ External Reset Input Signal (Default) § Bit Programmable - Optional Pull-up Control Enable - Open-drain Output - Push-pull Output	RESETB / P1.2 / ADCH0
P0[7:0]	Input/Output	§ Bit Programmable with Schmitt Trigger - Optional Pull-up Control Enable - Open-drain Output - Push-pull Output (Default)	P0.0 / ADCH7 / $\overline{INT0}$ / TVO / (PWM) / TS0 P0.1 / ADC0 / $\overline{INT1}$ / RXD / TS1 / SCL1 P0.2 / ADC1 / $\overline{INT2}$ / TXD / TS2 / SDA1 P0.3 / ADC2 / $\overline{INT3}$ / TS3 P0.4 / ADC3 / SDA0 P0.5 / ADC4 / SCL0 P0.6 / ADC5 / PWM P0.7 / ADC6
P2[6:0]	Input/Output	§ Bit Programmable with Schmitt Trigger - Optional Pull-up Control Enable - Open-drain Output - Push-pull Output (Default)	P2.0 / ADCH2 / T0 / TS7 P2.1 / ADCH3 / T1 / TS6 P2.2 / ADC11 / TS5 P2.3 / ADC10 / TS4 P2.4 / ADC9 P2.5 / ADC8 P2.6 / ADC7 / CLO

6. Roadmap of Touch Solution



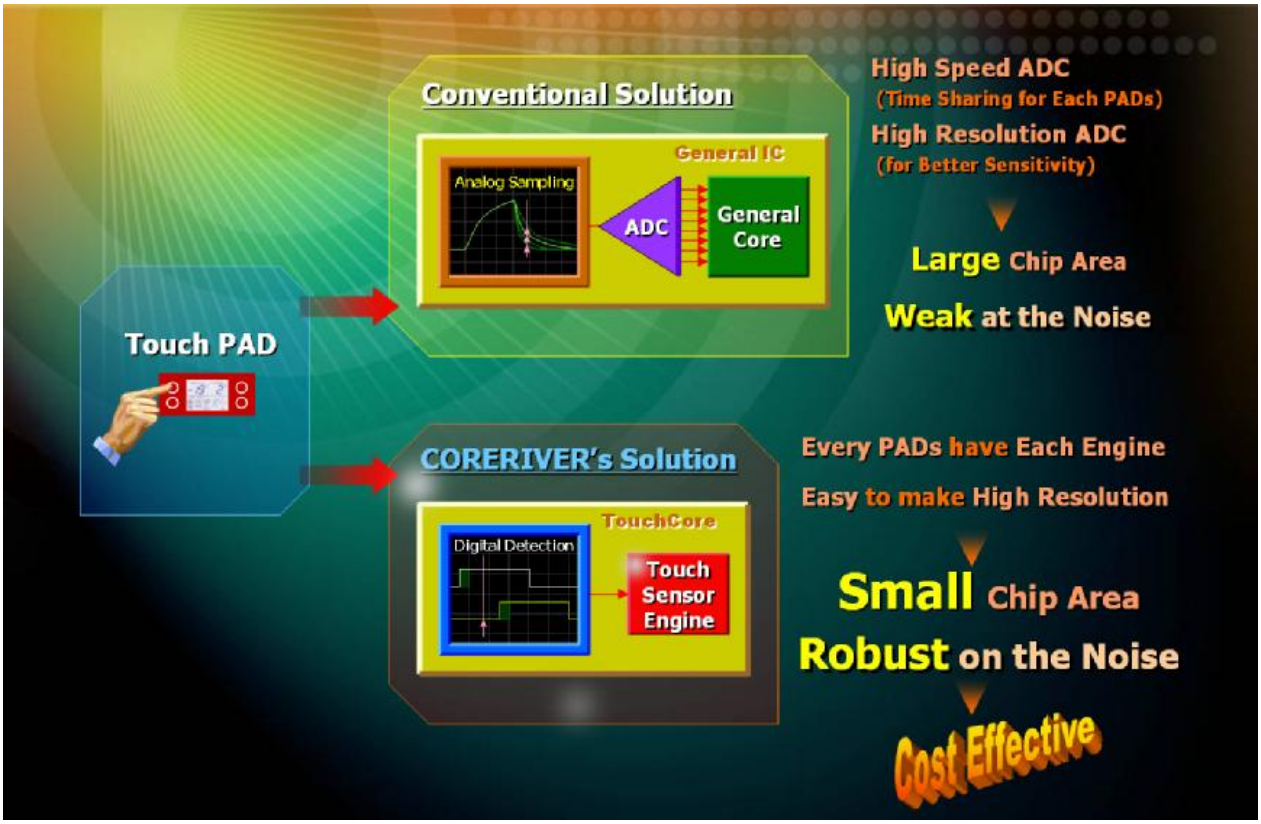
7. Development Tool Environment



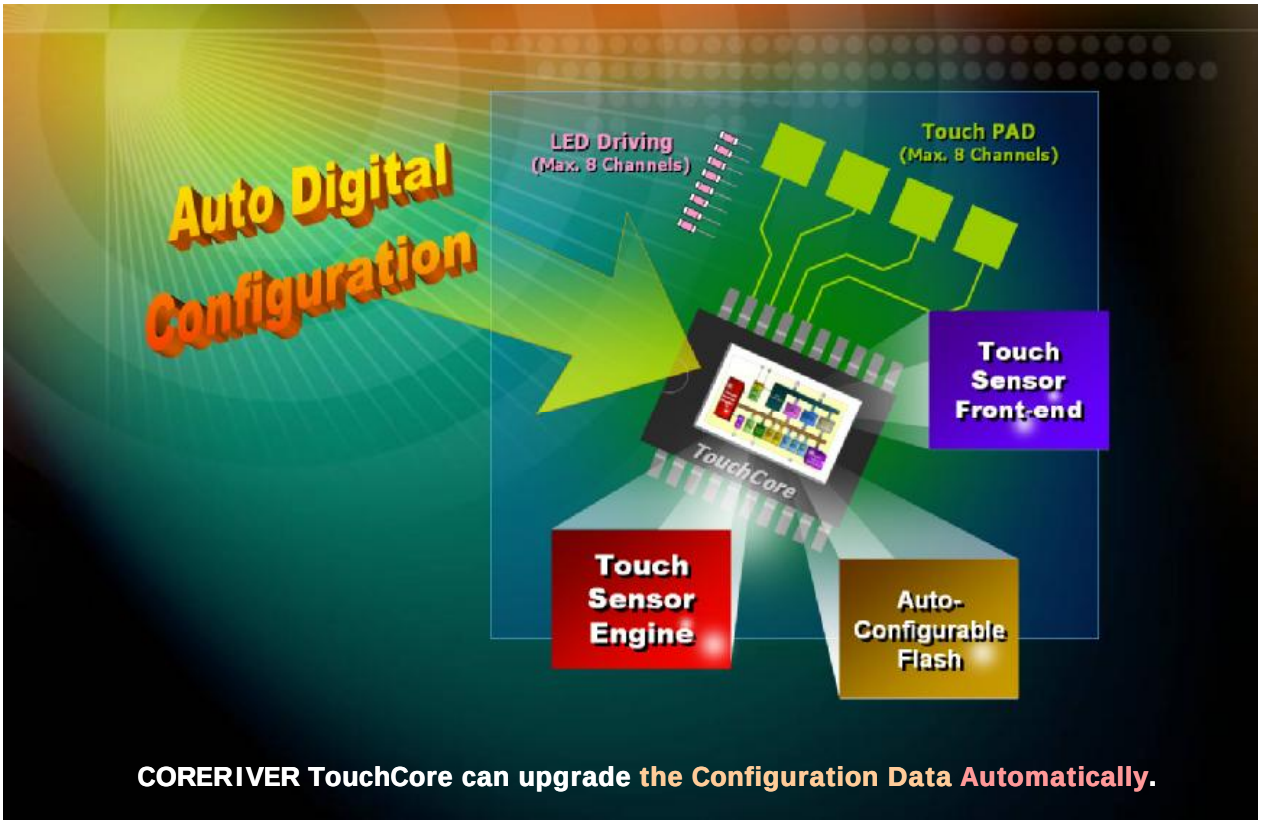
8. Comparison Table

	Conventional Devices	CORERIVER's TouchCore
Detection Type	Analog Detection	Digital Detection
Environmental Noise (Power, Humidity, Light, & Etc)	Weak at the Noise	Robust on the Noise
Cost	High	Low
External Component	R or C	Needless
Area Overhead	Large	Small
Touch Resolution	ON/OFF	Max. 256 level
Detection Speed	Slow	Fast
Available Touch PAD Type	Single	Single, Matrix, Complex
Power Consumption	Typ. 100uA	SNAP Mode Support (Typ. 6uA)

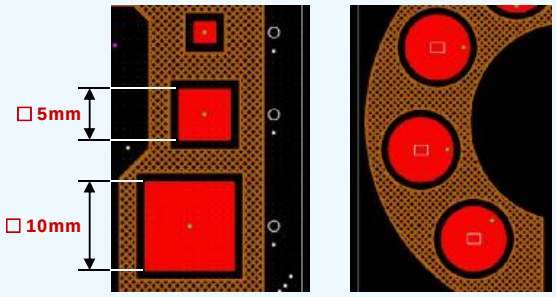
9. Strong Points : I. Digital Scheme



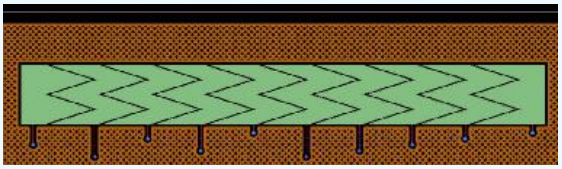
9. Strong Points : II. Flexibility



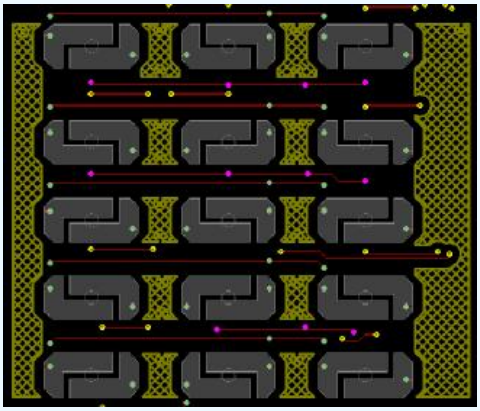
9. Strong Points : III. Various Touch PAD Types



[Button Type]

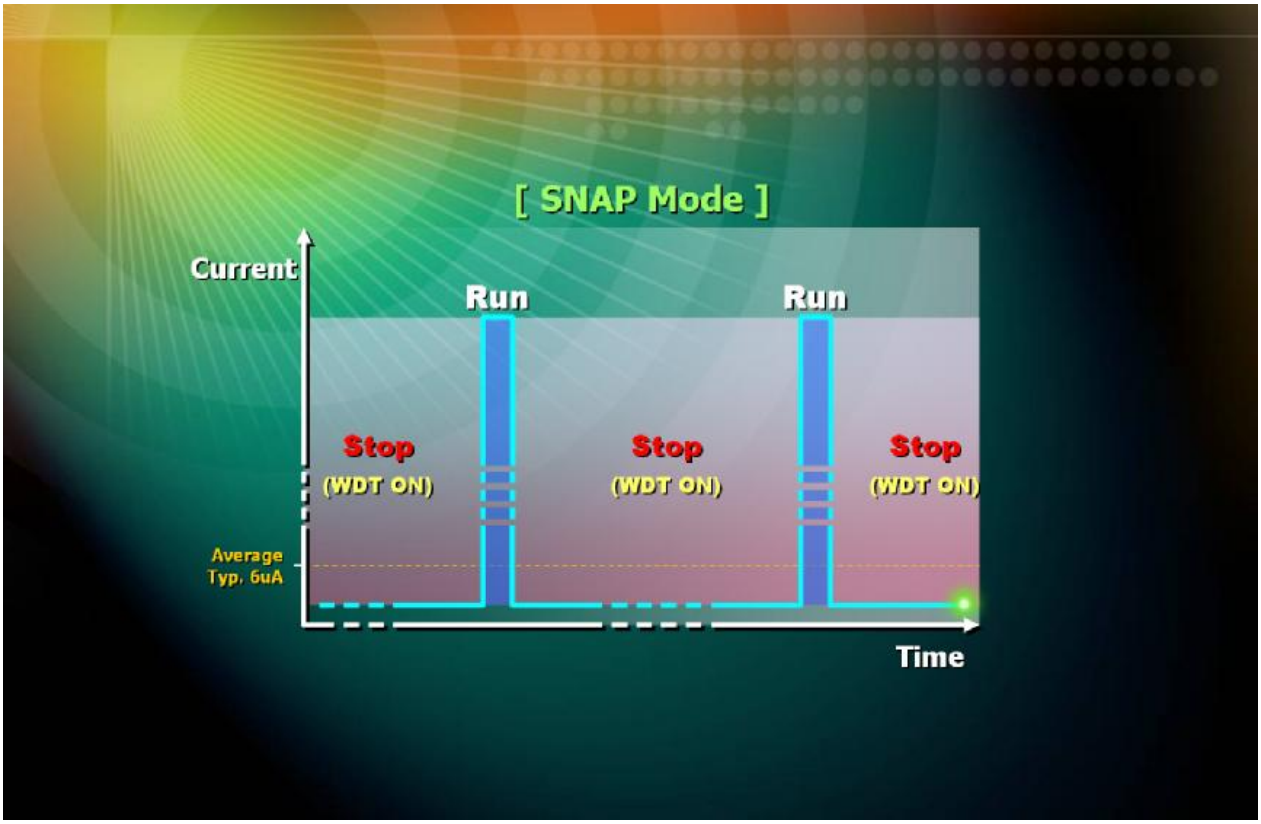


[Scroll Bar Type]



[Matrix Button Type]

9. Strong Points : IV. Low Power



10. Absolute Maximum Ratings

Items	Conditions	Ranges
Voltage on any pin relative to Ground	-	-0.5V to (V_{DD}+0.5V)
Voltage in V_{DD} relative to Ground	-	-0.5V to 6.5V
Output Voltage	-	-0.5V to (V_{DD}+0.5V)
Output Current High	One I/O pin active	-25mA
	All I/O pin active	-100mA
Output Current Low	One I/O pin active	+30mA
	All I/O pin active	+150mA
Storage Temperature	-	-65 ºC to +150 ºC
Soldering Temperature	-	Peak 260℃, 20 seconds within 5℃ of actual peak temperature

11. DC Characteristics

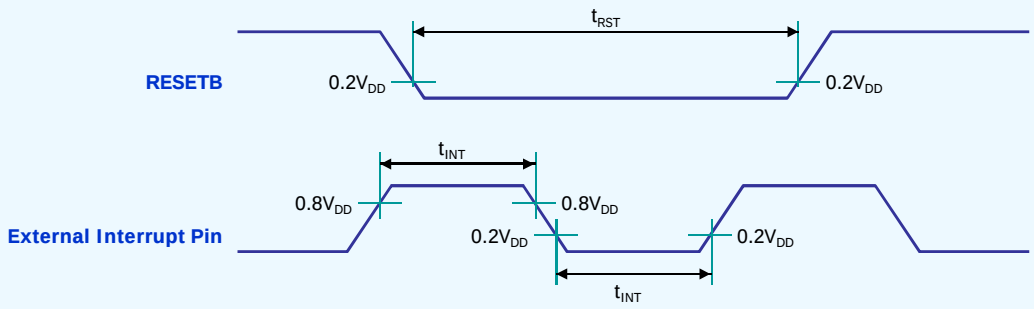
*** TA = = -20 ºC ~ +85 ºC, V_{DD} = 1.8V ~ 5.5V unless otherwise specified.**

Parameter	Symbol	Pin	Conditions	Value			Unit
				Min.	Typ.	Max.	
Input Low Voltage	V_{IL1}	RESETB, P0, P1, P2	V_{DD} = 1.8V ~ 5.5V	-0.5	-	$0.2V_{DD}$-0.1	V
	V_{IL2}	XTAL1, XTAL2		-0.5	-	$0.3V_{DD}$	
Input High Voltage	V_{IH1}	RESETB, P0, P1 ,P2	V_{DD} = 1.8V ~ 5.5V	$0.2V_{DD}$+1.0	-	V_{DD}+0.5	V
	V_{IH2}	XTAL1, XTAL2		$0.7V_{DD}$	-	V_{DD}+0.5	
Output Low Voltage	V_{OL}	All Pins	I_{OL} = 20mA @V_{DD}=5V (I_{OL} = 3mA @V_{DD}=2.2V)	-	-	$0.3V_{DD}$	V
Output High Voltage	V_{OH}	All Pins	I_{OH} = -15mA @V_{DD}=5V (I_{OH}= -2mA @V_{DD}=2.2V)	$0.7V_{DD}$	-	-	V
	V_{OHP}	All Pins (Pull-up)	I_{OHP}= -40uA @V_{DD}=5V (I_{OHP} = -15uA @V_{DD}=2.2V)	$0.7V_{DD}$	-	-	V
Input Leakage Current	I_{IL}	All Pins except XTAL1 & XTAL2	V_{IN} = V_{IH} or V_{IL}	-	-	±1	µA
Pin Capacitance	C_{IO}	All Pins	V_{DD} = 5V	-	10	-	pF

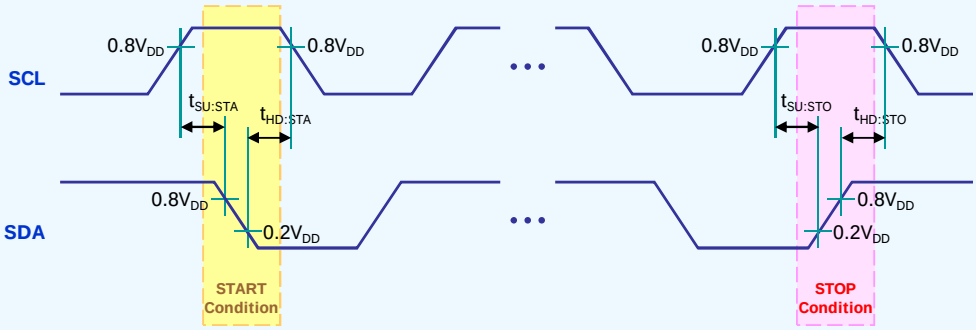
12. AC Characteristics

*** TA = -20 ºC ~ +85 ºC unless otherwise specified.**

Parameter	Symbol	Pin	Conditions	Value			Unit
				Min.	Typ.	Max.	
Operating Frequency	F_{OSC}	XTAL1, XTAL2	V_{DD} = 5V ± 10%	1	-	24	MHz
			V_{DD} = 3V ± 10%	1	-	12	
RESETB Input Width	t_{RST}	RESETB	V_{DD} = 5V ± 10%	24	-	-	F_{OSC}
			V_{DD} = 3V ± 10%	24	-	-	
External Interrupt Input Width	t_{INT}	External Interrupt	V_{DD} = 5V ± 10%	4	-	-	F_{OSC}
			V_{DD} = 3V ± 10%	4	-	-	

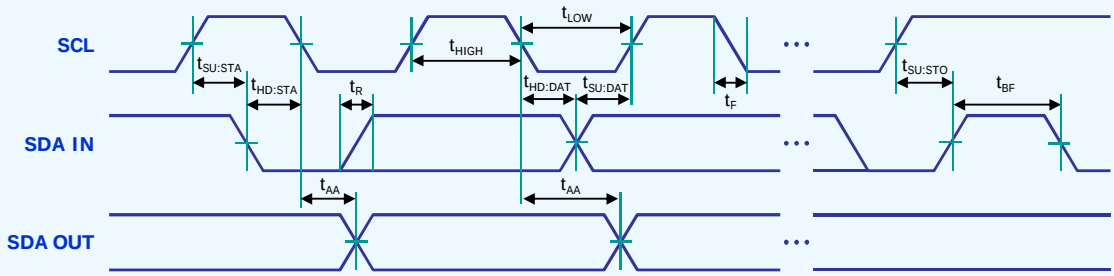


13. I2C Characteristics (1 of 2)



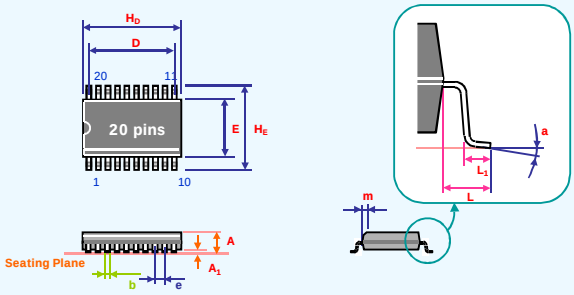
Symbol	Characteristic		Min	Max	Unit	Conditions
$t_{SU:STA}$	Start condition setup time	100KHz mode	4,700	-	ns	Only relevant for repeated START condition
		400KHz mode	600	-		
$t_{HD:STA}$	Start condition hold time	100KHz mode	4,000	-	ns	After this period, the first clock pulse is generated
		400KHz mode	600	-		
$t_{SU:STO}$	Stop condition setup time	100KHz mode	4,700	-	ns	
		400KHz mode	600	-		
$t_{HD:STO}$	Stop condition hold time	100KHz mode	4,000	-	ns	
		400KHz mode	600	-		

13. I2C Characteristics (2 of 2)



Symbol	Characteristic		Min	Max	Units	Conditions
t_{HIGH}	Clock high time	100KHz mode	4,000	-	ns	Minimum frequency : 1MHz
		400KHz mode	600	-		Minimum frequency : 5MHz
t_{LOW}	Clock low time	100KHz mode	4,700	-	ns	Minimum frequency : 1MHz
		400KHz mode	1,300	-		Minimum frequency : 5MHz
$t_{SU:DAT}$	Data Input setup time	100KHz mode	250	-	ns	
		400KHz mode	100	-		
$t_{HD:DAT}$	Data Input hold time	100KHz mode	0	-	ns	
		400KHz mode	0	900		
t_{AA}	Output valid from clock	100KHz mode	-	3,500	ns	
		400KHz mode	-	-		
t_{BF}	Bus free time	100KHz mode	4,700	-	ns	
		400KHz mode	1,300	-		
t_R	SDA and SCL rising time	100KHz mode	-	1,000	ns	The range of Cb is from 10pF to 400pF.
		400KHz mode	20 + 0.1Cb	300		
t_F	SDA and SCL falling time	100KHz mode	-	300	ns	The range of Cb is from 10pF to 400pF.
		400KHz mode	20 + 0.1Cb	300		

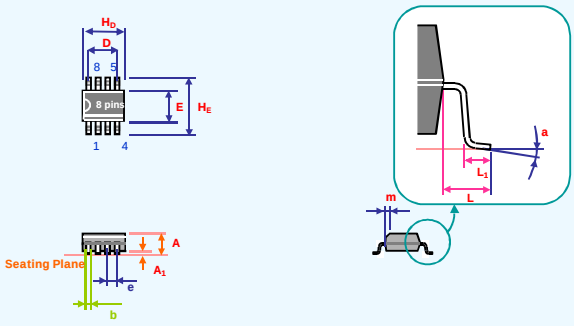
14. Package Dimensions : 20/8-SOIC



[20-SOIC]

Symbol	Dimension in Inches			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.093	0.099	0.104	2.35	2.45	2.65
A_1	0.004	0.008	0.012	0.10	0.20	0.30
b	0.014	0.016	0.019	0.35	0.42	0.49
D	-	0.450	-	-	11.43	-
E	0.291	0.295	0.299	7.40	7.50	7.60
H_D	0.496	0.504	0.512	12.60	12.80	13.00
H_E	0.404	0.411	0.419	10.26	10.45	10.65
L	0.057	0.058	0.060	1.43	1.48	1.53
L_1	0.034	0.038	0.042	0.86	0.96	1.07
a	0°	-	8°	0°	-	8°
e	0.050 BSC			1.27 BSC		
m	0.020	0.025	0.030	0.50	0.62	0.75

Notes:
1. Dimension D Max. & S include mold flash or tie bar Burns.
2. Dimension E_1 dose not include interlead flash.
3. Dimension D & E_1 include mold mismatch and are determined at the mold parting line.
4. Dimension B_1 does not include dambar protrusion/intrusion.
5. General appearance spec. should be based on final visual inspection spec.

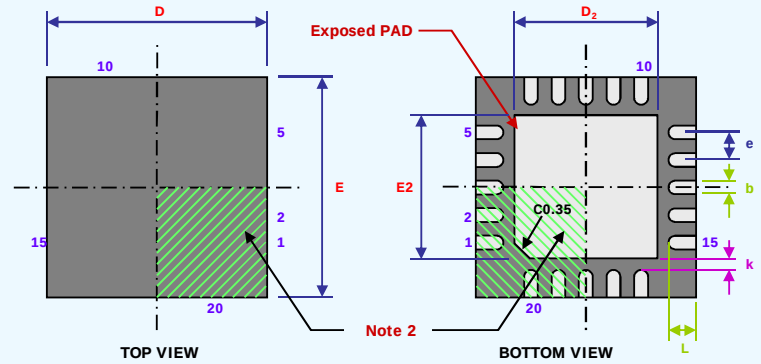


[8-SOIC]

Symbol	Dimension in Inches			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.093	0.099	0.104	2.35	2.45	2.65
A_1	0.004	0.008	0.012	0.10	0.20	0.30
b	0.014	0.016	0.019	0.35	0.42	0.49
D	-	0.150	-	-	3.81	-
E	0.150	0.153	0.157	3.80	3.90	4.00
H_D	0.189	0.193	0.197	4.80	4.90	5.00
H_E	0.234	0.239	0.244	5.95	6.07	6.20
L	0.038	0.043	0.048	0.97	1.08	1.2
L_1	0.022	0.027	0.032	0.58	0.70	0.82
a	0°	-	8°	0°	-	8°
e	0.050 BSC			1.27 BSC		
m	0.010	0.015	0.020	0.25	0.37	0.50

Notes:
1. Dimension D & E include mold mismatch and are determined at the mold parting line.
2. General appearance spec. should be based on final visual inspection spec.

14. Package Dimensions : 20-QFN



[20-QFN]

Symbol	Dimension in mm		
	Min.	Nom.	Max.
A	0.80	0.85	0.90
A_1	0.00	0.02	0.05
A_3		0.20 REF	
D		4.00 BSC	
E		4.00 BSC	
D_2	2.70	2.80	2.90
E_2	2.70	2.80	2.90
b	0.20	0.25	0.30
e		0.50 REF	
L	0.30	0.40	0.50
K	0.20	-	-

Notes:

1. All Dimension are in mm. Angles in Degrees.
2. Pin 1 visual index feature may vary, but must be located within the hatched area.
4. Package is saw singulated.
5. Refer JEDEC MO-220.
6. BSC : Basic Dimension. Theoretically exact value shown without tolerances.
   REF : Reference Dimension, Usually without tolerance, for information purpose only.