CORERIVER
Total Solution of MCU

GC222

8-bit Turbo Microcontroller

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Revised Nov 29, 2023

1 GC222 Overview

1.1 General Description

GC222 is a high-speed 80C52 compatible Microcontroller. It executes all of the conventional 80C52 instructions.

GC222 has three timer/counters, 18 programmable I/O ports, 1 Watchdog timer, Stop timer, POR (Power-On Reset), UARTs, I^2Cs, and 1 LVD (Low Voltage Detector) as peripherals. In addition, it contains an internal precision oscillator, which can generate the 12 MHz system clock signal instead of a crystal oscillator.

GC222 operates over the extended -40℃ to +85℃ temperature range and is available in the 20-pin TSSOP package.

1.2 Features

- **CPU**
  - ✓ 8-bit turbo 80C52 architecture
  - ✓ 4 cycles/1 machine cycle
  - ✓ instruction level compatible with Intel 80C52
- **2 KB FLASH (Including 128B User EEPROM)**
- **Supporting ISP/IAP/MDS**
- **128B Internal RAM**
- **Operating Voltage: +2.2V to +5.5V**
- **Operating Frequency (F_{SYS})**
  - ✓ 3.68 MHz (Internal POSC Clock, Default)
  - ✓ Max. 12 / 11.06 MHz @2.2V ~ 3.3V (External/Internal POSC Clock)
  - ✓ Max. 24 MHz @4.5V ~ 5.5V (External Clock)
- **Operating temperature: -40 °C ~ 85 °C**
- **18 Programmable I/O Pins**
  - ✓ Pull-up control, Open drain, & Push-Pull output
  - ✓ TTL and CMOS compatible logic levels

- **Configurable Low Voltage Detector (LVD)**
- **Internal Precision OSC with Calibration function**
  - ✓ 11.06 MHz @+2.2V to +5.5V (Typ. +/- 1%)
  - ✓ 32kHz @+2.7V (+/- 10%): Low Power OSC.
- **16-channel 10-bit ADC**
  - ✓ Max. 120k SPS @F_{ADC} = 12 MHz (F_{SYS} = 12 MHz)
  - ✓ Programmable Input Clock Frequency
- **23-bit Programmable Watchdog Timer**
- **16-bit Stop Timer**
- **Two 16-bit Timer/Counters**
- **Full-Duplex 1-channel UART Comm.**
- **1-channel I2C Comm. (I2C Slave)**
- **1-channel 10-bit high speed PWM**
- **12 Interrupt Sources**
  - ✓ Timer0/1, WDT, LVD, ADC, UART, PWM, I2C1
  - ✓ 4 External Interrupt Sources: Both Edge/Level
  - ✓ Two-level Interrupt Priority
- **Reset Sources**
  - ✓ On-chip Power-On-Reset (POR/LVR)
  - ✓ External Reset
  - ✓ Configurable Low Voltage Detector Reset
  - ✓ Watchdog Timer Reset
- **Power Down Wake-up Sources**
  - ✓ Reset Sources + 4 External Interrupt (Both Levels)
  - ✓ I2C Interrupt or WDT Interrupt
  - ✓ Stop Timer wake-up
- **Power Consumption**
  - ✓ Active Current: Max. 2mA @+3.0V, 2MHz
  - ✓ Stop Current1: Max. 1uA @+5.0V (All Clock OFF)
  - ✓ Stop Current2: Max. 450uA @+3.0V, 461kHz (Only WDT is on)
  - ✓ Stop Current3: Max. 5uA @+3.0V (Only ST is ON)
- **E.S.D. Protection up to 2,000 V**
- **Latch-up Protection Up to ±200mA**
- **Package**
  - ✓ 20-TSSOP

1.3 Applications

- Mobile Devices
- Multimedia
- Navigation Systems
- Home Appliance
- Other Electronic Devices

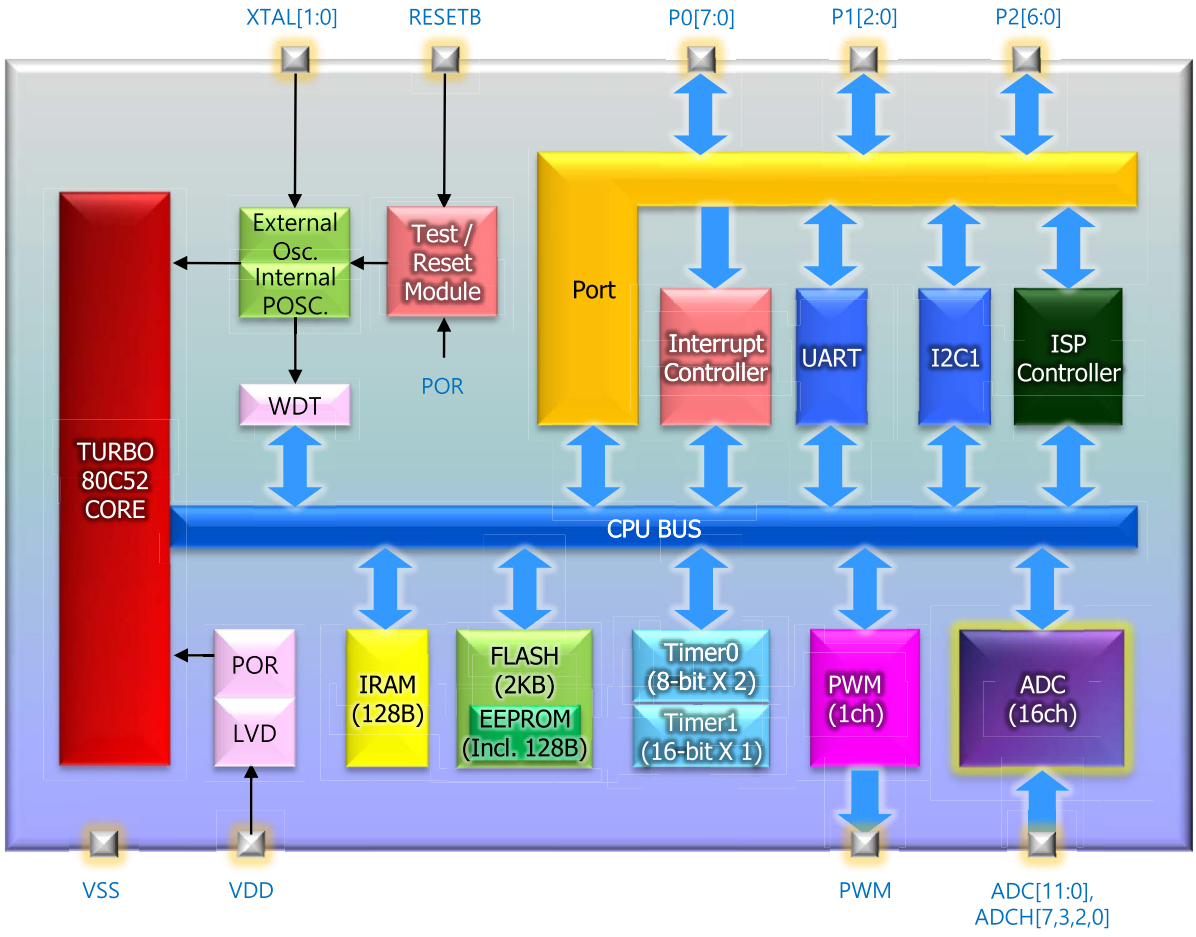
1.4 Product Family Guide

Product	Flash [Byte]	RAM [Byte]	Package	Programmable I/O	Other Peripherals
GC220	**8K**	**128**	**20-TSSOP**	**18**	3 Timer/Counters UART I2C WDT IAP ISP EJTAG LVD POR Precision Oscillator Stop Timer 16-channel 10-bit ADC 1-channel 10-bit PWM
GC221	4K	128	20-TSSOP 16-SOP 8-SOP	18 14 6	
GC222	2K	128	20-TSSOP	18	

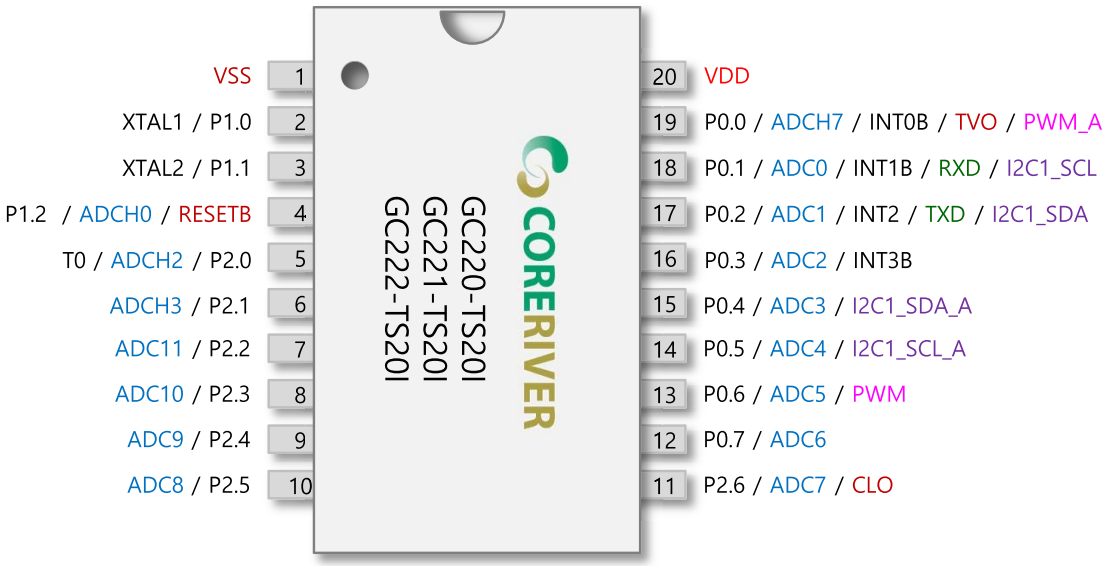
2 Block Diagram

Figure shows the block diagram of ***GC222***. Programs reside in the internal program memory (Embedded Flash Memory). Data are read from or written to data memory (SRAM) or special function registers (SFRs).

The internal registers of ***GC222*** are configured as part of the on-chip RAM: therefore, each register has an address. This is reasonable for ***GC222***, since it has so many registers.



3 Pin Configuration



20-pin TSSOP Package Diagram

4 Pin Description

Pin No.	Name	Type	Description	Share Pins
1	VSS	GND		
2	XTAL1	I/O	Crystal Input	P1.0
3	XTAL2	I/O	Crystal Output	P1.1
4	RESETB	I/O	External Reset Input	P1.2 / ADCH0
5	P2.0	I/O	General I/O	T0 / ADCH2
6	P2.1	I/O	General I/O	ADCH3
7	P2.2	I/O	General I/O	ADC11
8	P2.3	I/O	General I/O	ADC10
9	P2.4	I/O	General I/O	ADC9
10	P2.5	I/O	General I/O	ADC8
11	P2.6	I/O	General I/O	ADC7
12	P0.7	I/O	General I/O	ADC6
13	P0.6	I/O	General I/O	ADC5 / PWM
14	P0.5	I/O	General I/O	ADC4 / I2C1_SCL_A
15	P0.4	I/O	General I/O	ADC3 / I2C1_SDA_A
16	P0.3	I/O	General I/O	ADC2 / INT3B
17	P0.2	I/O	General I/O	ADC1 / INT2 / TXD / I2C1_SDA
18	P0.1	I/O	General I/O	ADC0 / INT1B / RXD / I2C1_SCL
19	P0.0	I/O	General I/O	ADCH7 / INT0B / TVO / PWM_A
20	VDD	PWR		

5 Absolute Maximum Ratings

Item	Conditions	Range
Voltage on any pin relative to Ground	-	-0.5 V to (V_{DDIO}+0.5V)
Voltage in V_{DD} relative to Ground	-	-0.5V to 6.5V
Output Voltage	-	-0.5 V to (V_{DDIO}+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	-	< 40℃
Soldering Temperature	-	260℃, 10 seconds within 5℃ of actual peak temperature

6 DC Characteristics

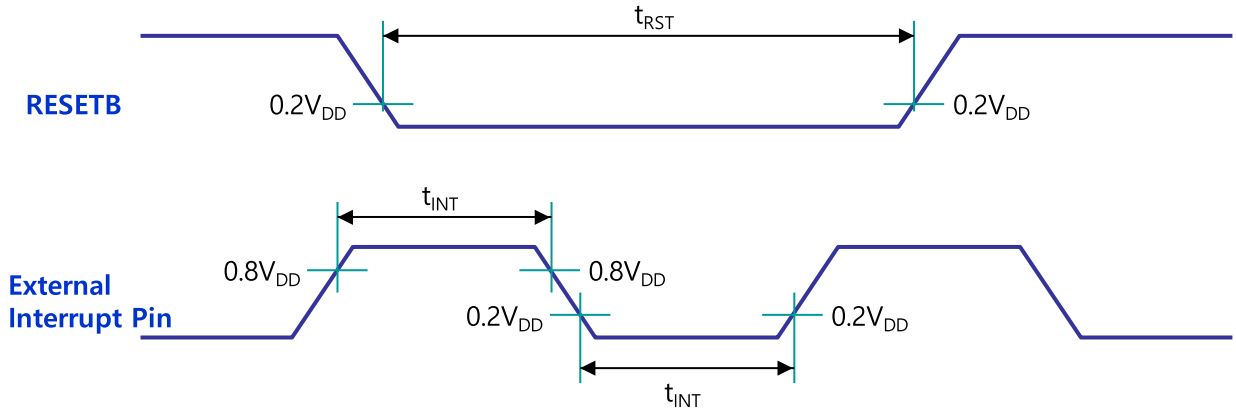
* T_A= -40°C ~ +85°C, V_{DD}=2.2V ~ 5.5V unless otherwise specified

Parameter	Symbol	Pin	Conditions	Value			Unit
				Min.	Typ.	Max.	
Input Low Voltage	V_{IL1}	RESETB ,P0, P1, P2	V_{DD} = 2.2V~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} = 2.2V~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} = 17mA @V_{DD}=5V I_{OL} = 7mA @V_{DD}=3V I_{OL} = 4mA @V_{DD}=2.4V	-	-	$0.3V_{DDIO}$	V
	V_{OL2}	P0[3:0] when high drive is enabled.	I_{OL} = 50mA @V_{DD}=5V I_{OL} = 20mA @V_{DD}=3V I_{OL} = 12mA @V_{DD}=2.4V	-	-	$0.3V_{DDIO}$	V
Output High Voltage	V_{OH}	All Pins	I_{OH}= -18mA @V_{DD}=5V I_{OH} = -6mA @V_{DD}=3V I_{OH}=-3mA @V_{DD}=2.4V	$0.7V_{DDIO}$	-	-	V
	V_{OH2}	P0[3:0] when high drive is enabled.	I_{OH} = -26mA @V_{DD}=5V I_{OH} = -8mA @V_{DD}=3V I_{OH} = -4mA @V_{DD}=2.4V	$0.7V_{DDIO}$	-	-	V
	V_{OHP}	ALL Pins (Pull-up Resistor Only)	I_{OHP}= -49uA @V_{DD}=5V I_{OHP}= -28uA @V_{DD}=3V I_{OHP}=-22uA@V_{DD}=2.4V	$0.7V_{DDIO}$	-	-	V
Input Leakage Current	I_{IL}	All Pins Except of XTAL1, XTAL2	V_{IN} = V_{IH} or V_{IL}	-	-	±1	μA
Pin Capacitance	C_{IO}	All Pins	V_{DD} = 5V	-	10	-	pF

7 AC Characteristics

* T_A = -40 °C ~ +85 °C unless otherwise specified

Parameter	Symbol	Pin	Conditions	Value			Unit
				Min.	Typ.	Max.	
Operating Frequency	F_{SYS}	Internal Oscillator XTAL1, XTAL2	V_{DD} = 5V ± 10%	-	-	24	MHz
			V_{DD} = 3V ± 10%	-	-	12	
RESETB Input Width	t_{RST}	RESETB	V_{DD} = 5V ± 10%	20	-	-	F_{SYS}
			V_{DD} = 3V ± 10%	20	-	-	
External Interrupt Input Width	t_{INT}	External Interrupt	V_{DD} = 5V ± 10%	4	-	-	F_{SYS}
			V_{DD} = 3V ± 10%	4	-	-	

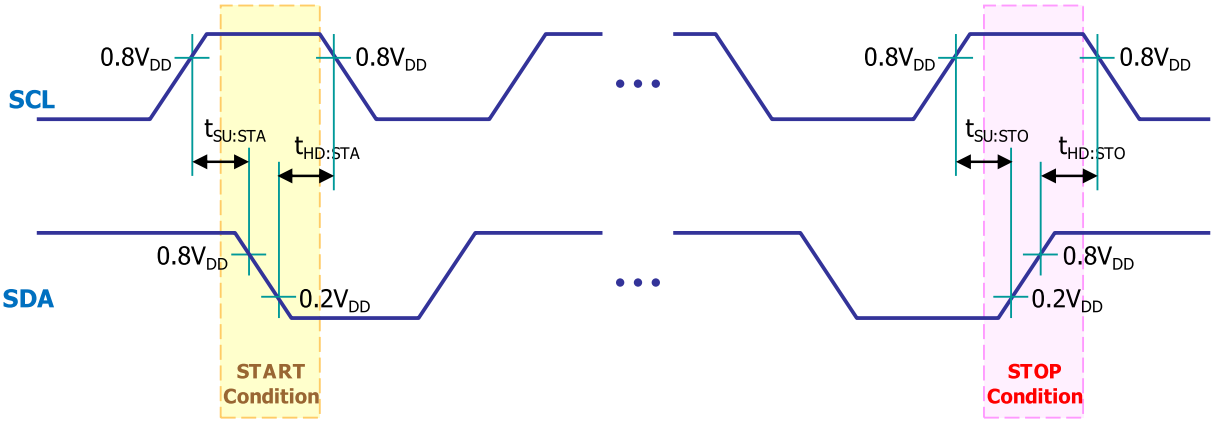


8 ADC Specifications

* T_A= -40°C ~ +85°C, V_{DD}=2.2V ~ 5.5V unless otherwise specified

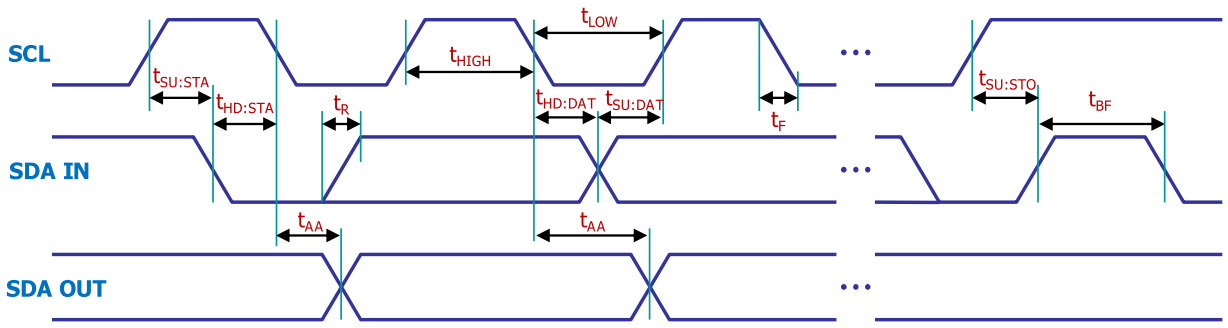
Parameter		Symbol	Conditions	Value			Unit
				Min.	Typ.	Max.	
Supply Voltage		V_{DDADC}	V_{DDADC} = V_{DD}	2.4	-	5.5	V
Input Voltage		V_{INADC}	-	V_{SS}	-	V_{DD}	V
Resolution		RES_{ADC}	-	-	10	-	bit
Operating Frequency		F_{ADC}	V_{DD} = 4.5V ~ 5.5V V_{DD} = 2.4V ~ 3.3V	-	-	10 5	MHz
Conversion Time		t_{ADC}	-	-	96 / F_{ADC}	-	s
Overall Accuracy		OA_{ADC}	V_{DD} =5V, F_{ADC}=10MHz V_{DD} =3V, F_{ADC}=5MHz	-	±2	±4	LSB
Integral Nonlinearity		INL_{ADC}	V_{DD} =5V, F_{ADC}=10MHz V_{DD} =3V, F_{ADC}=5MHz	-	±2	±4	LSB
Differential Nonlinearity		DNL_{ADC}	V_{DD} =5V, F_{ADC}=10MHz V_{DD} =3V, F_{ADC}=5MHz	-	±0.5	±1	LSB
Zero Input Error		ZIE_{ADC}	V_{DD} =5V, F_{ADC}=10MHz V_{DD} =3V, F_{ADC}=5MHz	-	±2	±4	LSB
Full Scale Error		FSE_{ADC}	V_{DD} =5V, F_{ADC}=10MHz V_{DD} =3V, F_{ADC}=5MHz	-	±2	±4	LSB
Analog Input Capacitance		C_{INADC}	-	-	10	15	pF
ADC Current	Active	I_{ADC}	V_{DD} = 5V, F_{ADC}=10MHz	-	1	2	mA
			V_{DD} = 3V, F_{ADC}=5MHz	-	0.3	0.6	
	Power-down		V_{DD} = 5V	-	-	100	nA

9 I2C Timing Characteristics



* T_A= -40°C ~ +85°C, V_{DD}=2.2V ~ 5.5V unless otherwise specified

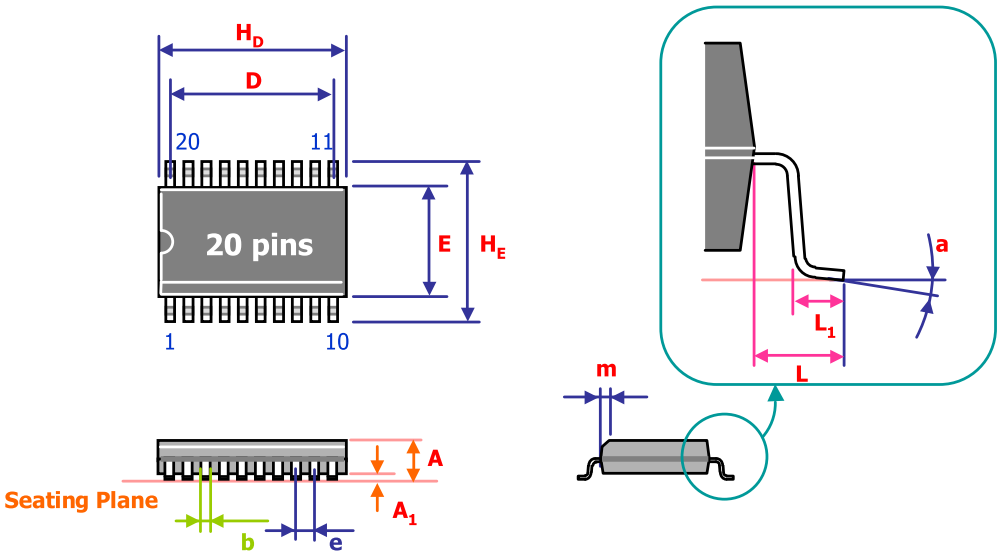
Symbol	Characteristics		Min. [ns]	Max. [ns]	Conditions
$t_{SU:STA}$	START Condition Setup Time	100kHz Mode	4,700	-	Only relevant for repeated START condition
		400kHz Mode	600	-	
$t_{HD:STA}$	START Condition Hold Time	100kHz Mode	4,700	-	After this period, the first clock pulse is generated
		400kHz Mode	600	-	
$t_{SU:STO}$	STOP Condition Setup Time	100kHz Mode	4,700	-	
		400kHz Mode	600	-	
$t_{HD:STO}$	STOP Condition Hold Time	100kHz Mode	4,700	-	
		400kHz Mode	600	-	



* T_A= -40°C ~ +85°C, V_{DD}=2.2V ~ 5.5V unless otherwise specified

Symbol	Characteristics		Min. [ns]	Max. [ns]	Conditions
t_{HIGH}	Clock High Time	100kHz Mode	4,000	-	Minimum Frequency : 1MHz
		400kHz Mode	600	-	Minimum Frequency : 5MHz
t_{LOW}	Clock Low Time	100kHz Mode	4,700	-	Minimum Frequency : 1MHz
		400kHz Mode	1,300	-	Minimum Frequency : 5MHz
$t_{SU:DAT}$	Data Input Setup Time	100kHz Mode	250	-	
		400kHz Mode	100	-	
$t_{HD:DAT}$	Data Input Hold Time	100kHz Mode	0	-	
		400kHz Mode	0	900	
t_{AA}	Data Valid from Clock	100kHz Mode	-	3,500	
		400kHz Mode	-	-	
t_{BF}	BUS Free Time	100kHz Mode	4,700	-	
		400kHz Mode	1,300	-	
t_R	SDA & SCL Rising Time	100kHz Mode	-	1,000	The Range of Cb is from 10pF to 400pF
		400kHz Mode	2.0 + 0.1Cb	300	
t_F	SDA & SCL Falling Time	100kHz Mode	-	300	The Range of Cb is from 10pF to 400pF
		400kHz Mode	2.0 + 0.1Cb	300	

10 20-pin TSSOP Package Dimension



Symbol	Dimension in Inches			Dimension in mm		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A			0.043			1.1
A_1	0.001		0.006	0.020		0.150
b	0.007		0.012	0.190		0.300
D		0.234			5.850	
E	0.169	0.174	0.177	4.300	4.400	4.500
H_D	0.252	0.254	0.259	6.400	6.500	6.600
H_E	0.246	0.252	0.258	6.250	6.400	6.550
L	0.038	0.039	0.040	0.975	1.000	1.025
L_1	0.020	0.024	0.028	0.500	0.600	0.700
a	1°	-	7°	1°	-	7°
e	0.026 BSC			0.65 BSC		

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.**