
GC230-TS20IP

8-bit Turbo Microcontroller

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1 GC230-TS20IP Overview

1.1 General Description

GC230-TS20IP is a high-speed 80C52 compatible Microcontroller. It executes all of the conventional 80C52 instructions.

GC230-TS20IP has three timer/counters, 18 programmable I/O ports, 1 Watchdog timer, POR (Power-On Reset), and 1 LVD (Low Voltage Detector), 1 channel 8bit PWM, 12 channels 10bit ADC as peripherals. In addition, it contains an internal precision oscillator, which can generate the 12 MHz system clock signal instead of a crystal oscillator.

GC230-TS20IP operates over the extended -40°C to +85°C 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: +2.4V to +5.5V
- ◆ Operating Frequency (F_{sys})
 - ✓ 3.68 MHz (Internal POSC Clock, Default)
 - ✓ Max. 12 / 11.06 MHz @2.4V ~ 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 @+2.4V to +5.5V (Typ. +/- 1%)
- ◆ **12-channel 10-bit ADC**
 - ✓ Max. 120k SPS @ $F_{ADC} = 12$ MHz ($F_{SYS} = 12$ MHz)
 - ✓ Programmable Input Clock Frequency
- ◆ **1-channel 8-bit High Speed PWM**
- ◆ **23-bit Programmable Watchdog Timer**
- ◆ **16-bit Stop Timer**
- ◆ **Two 16-bit Timer/Counters**
- ◆ **8 Interrupt Sources**
 - ✓ Timer0/1, WDT, ADC, PWM, LVD
 - ✓ 2 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 + 2 External Interrupt (Both Levels)
 - ✓ WDT Interrupt
- ◆ **Power Consumption**
 - ✓ Active Current: Max. 2mA @+3.0V, 2MHz
 - ✓ Idle Current: Max. 500uA @+3.0V 2MHz
 - ✓ Stop Current: Max. 1uA @+5.0V (All Clock OFF)
- ◆ **E.S.D. Protection up to 2,000 V**
- ◆ **Latch-up Protection Up to ± 200 mA**
- ◆ **Package**
 - ✓ 20-TSSOP

1.3 Applications

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

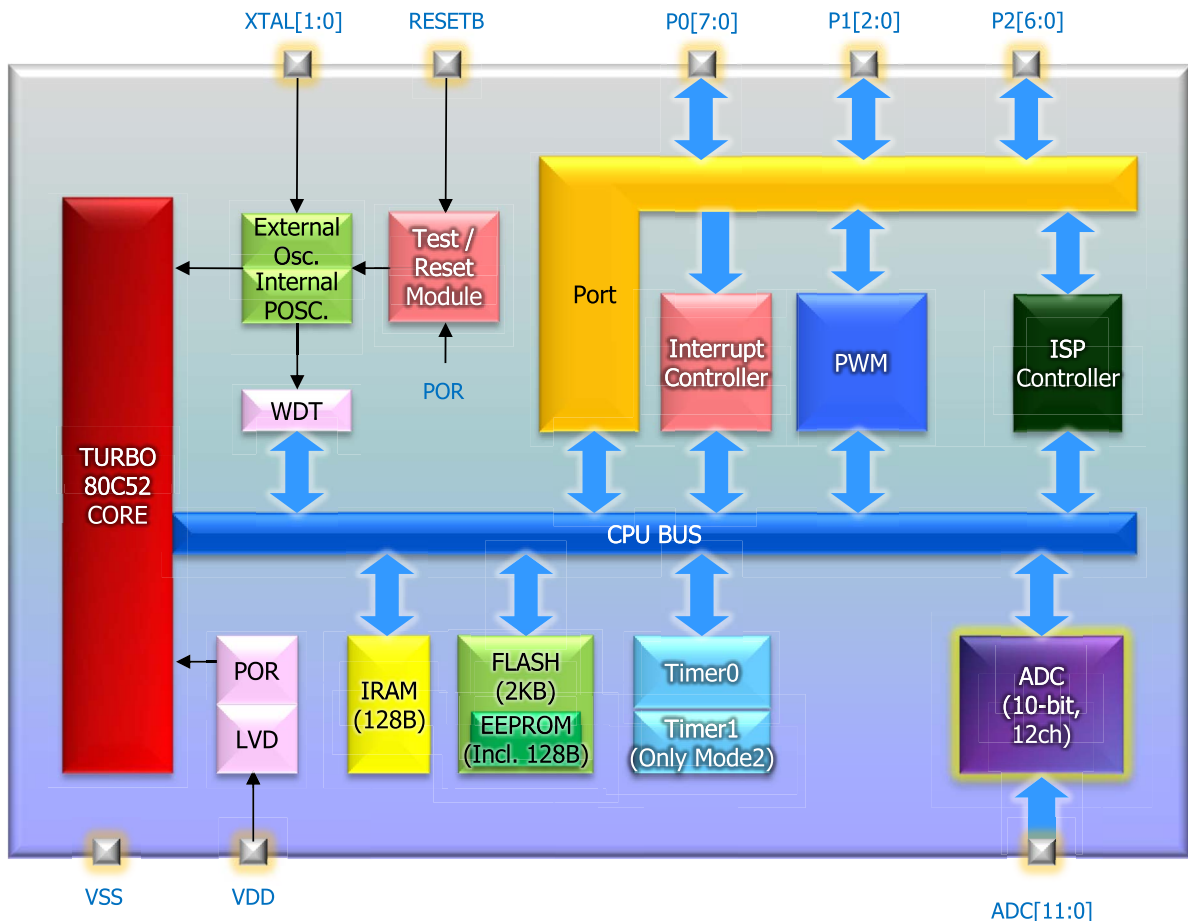
1.4 Product Family Guide

Product	Flash [Byte]	RAM [Byte]	Package	Programmable I/O	ADC (bit X Ch)	Other Peripherals
GC230-TS20I	2K	128	20-TSSOP	18	10 X12	2 Timer/Counters WDT IAP ISP EJTAG LVD POR Precision Oscillator 1-channel 8-bit PWM
GC230-SO20I	2K	128	20-SOP	18	10 X12	
GC230-TS16I	2K	128	16-TSSOP	14	10 X 8	
GC230-SO8I	2K	128	8-SOP	6	10 X 3	

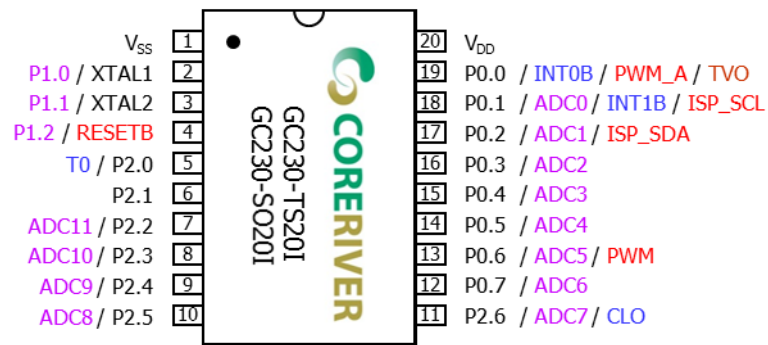
2 Block Diagram

Figure shows the block diagram of **GC230-TS20IP**. 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 **GC230-TS20IP** are configured as part of the on-chip RAM therefore, each register has an address. This is reasonable for **GC230-TS20-IP** 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
5	P2.0	I/O	General I/O	T0
6	P2.1	I/O	General I/O	
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 / CLO
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
15	P0.4	I/O	General I/O	ADC3
16	P0.3	I/O	General I/O	ADC2
17	P0.2	I/O	General I/O	ADC1 / ISP_SDA
18	P0.1	I/O	General I/O	ADC0 / INT1B / ISP_SCL
19	P0.0	I/O	General I/O	INT0B / TVO / PWM_A
20	VDD	PWR		

5 Absolute Maximum Ratings

Items	Conditions	Ranges
Voltage on any pin relative to Ground	-	-0.5 V to ($V_{DD}+0.5V$)
Voltage in V_{DD} relative to Ground	-	-0.5V to 6.5V
Output Voltage	-	-0.5 V 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	-	$\leq 40^{\circ}\text{C}$
Soldering Temperature	-	260 $^{\circ}\text{C}$, 10 seconds within 5 $^{\circ}\text{C}$ of actual peak temperature

6 Recommended Operating Conditions

Symbol	Parameter	Rating
V_{DD}	DC supply voltage	2.4V to 5.5V
T_A	Industrial temperature range	-40 $^{\circ}\text{C}$ to 85 $^{\circ}\text{C}$

7 DC Characteristics

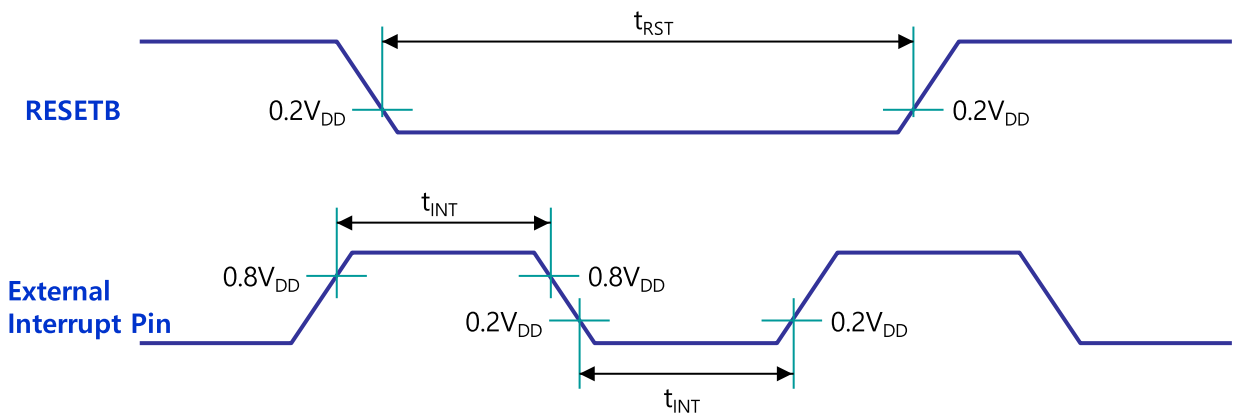
* $T_A = -40^{\circ}\text{C} \sim +85^{\circ}\text{C}$, $V_{DD} = 2.2\text{V} \sim 5.5\text{V}$ unless otherwise specified

Parameter	Symbol	Pin	Conditions	Value			Unit
				Min.	Typ.	Max.	
Input Low Voltage	V_{IL1}	RESETB, P0, P1, P2	$V_{DD} = 2.4\text{V} \sim 5.5\text{V}$	-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	$V_{DD} = 2.4\text{V} \sim 5.5\text{V}$	$0.2V_{DD} + 1.0$	-	$V_{DD} + 0.5$	V
	V_{IH2}	XTAL1, XTAL2		$0.7V_{DD}$	-	$V_{DD} + 0.5$	
Output Low Voltage	V_{OL}	All Pins	$I_{OL} = 17\text{mA} @ V_{DD} = 5\text{V}$ $I_{OL} = 7\text{mA} @ V_{DD} = 3\text{V}$ $I_{OL} = 4\text{mA} @ V_{DD} = 2.4\text{V}$	-	-	$0.3V_{DDIO}$	V
Output High Voltage	V_{OH}	All Pins	$I_{OH} = -18\text{mA} @ V_{DD} = 5\text{V}$ $I_{OH} = -6\text{mA} @ V_{DD} = 3\text{V}$ $I_{OH} = -3\text{mA} @ V_{DD} = 2.4\text{V}$	$0.7V_{DDIO}$	-	-	V
	V_{OHP}	ALL Pins (Pull-up Resistor Only)	$I_{OHP} = -49\mu\text{A} @ V_{DD} = 5\text{V}$ $I_{OHP} = -28\mu\text{A} @ V_{DD} = 3\text{V}$ $I_{OHP} = -22\mu\text{A} @ V_{DD} = 2.4\text{V}$	$0.7V_{DDIO}$	-	-	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	$V_{DD} = 5\text{V}$	-	10	-	pF

8 AC Characteristics

* $T_A = -40\text{ }^{\circ}\text{C} \sim +85\text{ }^{\circ}\text{C}$ unless otherwise specified

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

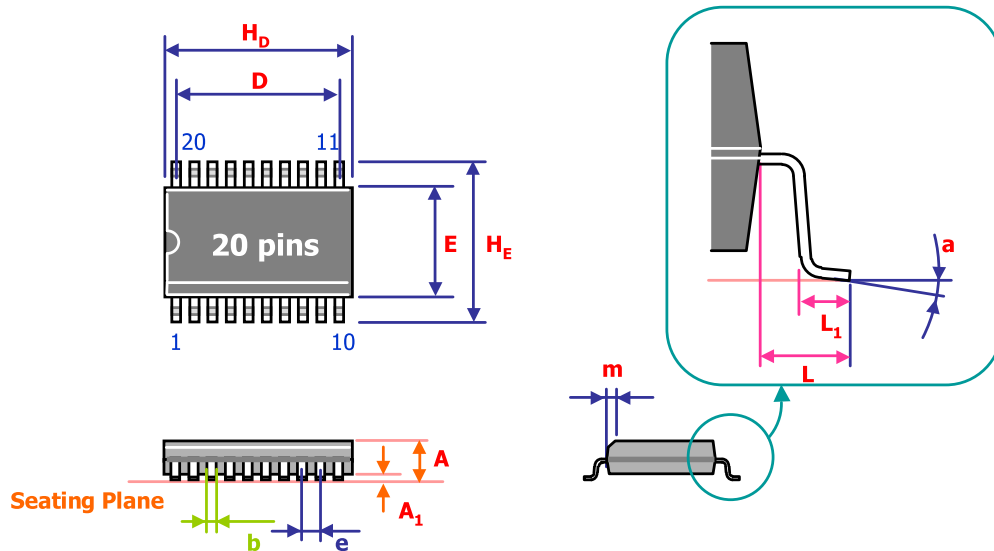


9 ADC Specifications

* TA = -40 °C ~ +85 °C 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}	$V_{DD} = 4.5V \sim 5.5V$ $V_{DD} = 2.4V \sim 3.3V$	-	-	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

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.