Introduction to TSC87C51/C52 OTP Microcontrollers

Introduction

The Microcontroller market is moving very fast, surprisingly the OTP market is even faster due to the following reasons:

- Time to market for new systems is the key answer to be on the leading edge and to continue to grow.

- Late orders coming from end customers or need for customized versions to better serve the market.

That's why the OTP market represents already more than 15% of the total volume.

Now TEMIC introduces brand new products –completing its existing offering– to better serve your needs. You can have access to the TSC87C51 and TSC87C52 One–Time–Programmable C51 microcontrollers and speed up your market penetration while preserving a low system cost.

These products have been qualified in order to be compatible with the Industry standard from Intel as TEMIC is one of the three major Intel licensed manufacturer.

TEMIC will continue to expand its global offering with also the compatible Mask ROM products which are still being supported with new improvements. These product always guarantee full compatibility with C51 Intel architecture. Therefore, it is easy qualify TEMIC products in your existing or new applications.

Thank you to get access to the TEMIC C51 OTP family through all the documentation and support like this design guide which is providing all the information on the products the way to implement them in the application and how to program them.

TEMIC Microcontrollers Overview

In the 8–bit microcontroller market, the 80C51 architecture has become an industry standard in embedded applications. Introduced in the early's 1980's by TEMIC/Matra MHS under Intel License, the 80C51 is still a market leader.

For over 15 years, TEMIC has been a leading provider of 80C51 microcontrollers to major embedded markets. Today, TEMIC is ranked number 3 in worldwide sales of 80C51 devices, representing over 20% market share. This unsurpassed experience is at the service of TEMIC customers in every application.

TEMIC now enlarges its product range by adding one time programmable (OTP) versions of standard products and the highly increased number of product derivatives for applications mainly targeted in the Communication and Computer area.

Also the market is in need for a more powerful solution to meet the requirements of increasingly sophisticated embedded applications. High growth markets, including applications in communication, automotive and personal computing are driving these requirements. Therefore TEMIC has introduced in 1996 the first two products of the Intel–licensed TSC80251 8–bit extended architecture.

C51 Standard Microcontrollers selection table

Device	ROM (byte)	RAM (byte)	Max Speed (MHz)	I/0	Serial Interfaces	16–bit Timers	WD	Other Features
General Purpose Microcontrollers – 5 Volt								
TSC80C31	–	128	44	32	UART	2		SR, ST
TSC80C51	4 K	128	44	32	UART	2		SR, ST
TSC87C51	4 K OTP	128	44	32	UART	2		SR, ST
80C32	–	256	44	32	UART	3		SR, ST
80C52	8 K	256	36	32	UART	3		SR, ST
TSC87C52	8 K OTP	256	36	32	UART	3		SR, ST
80C154	–	256	36	32	UART	3	●	SR, ST
83C154	16 K	256	36	32	UART	3	●	SR, ST
83C154D	32 K	256	36	32	UART	3	●	SR, ST
General Purpose – Low Voltage: 3 Volt, up to 20 MHz !								
TSC80C31–L	–	128	20	32	UART	2		SR, ST
TSC80C51–L	4 K	128	20	32	UART	2		SR, ST
TSC87C51–L	4 K OTP	128	16	32	UART	2		SR, ST
80C32–L	–	256	16	32	UART	3		SR, ST
80C52...–L	8 K	256	16	32	UART	3		SR, ST
TSC87C52–L	8 K OTP	256	16	32	UART	3		SR, ST
80C154–L	–	256	16	32	UART	3 (WD)	●	SR, ST
83C154...–L	16 K	256	16	32	UART	3 (WD)	●	SR, ST
83C154D...–L	32 K	256	16	32	UART	3 (WD)	●	SR, ST
General Purpose – Very Low Voltage: 1.8 Volt								
TSC80CL31	–	128	4	32	UART	2		SR, ST
TSC80CL51	4 K	128	4	32	UART	2		SR, ST

WD: Watchdog Timer
SR: Secret ROMencrypted ROM option to secure the ROM against piracy.
ST: Secret Tag a 64–Bit identifier can be customized in order to serialize each microcontroller with a unique number.

C51 OTP Product features by supplier

In this chapter you will find the benchmark between the TEMIC products and other suppliers on the market of C51 OTP microcontrollers.

This will help you to ensure the compatibility of the TEMIC product in your application after you have exactly listed the features which are being used.

You can note that the standard features are not listed in this table

87C51 OTP product features by supplier

Feature	TEMIC TSC80C51	TEMIC TSC87C51	INTEL 87C51	Philips 87C51	LG GMS80C7004	Atmel AT89C51	Windbond W87E51
Power off Flag	No	Yes	Yes	No	No	No	No
UART : Automatic Address Recognition	No	No	Yes	No	No	No	No
UART : Framing error Detection	No	Yes	Yes	No	No	No	No
Power–Down output using external interrupt	No	No	Yes	No	No	No	No
ALE disabling	Yes	Yes	Yes	No	No	No	No
ONCE mode	No	Yes	Yes	No	No	Yes	No
EPROM lock bits	NA	Yes[2]	Yes	Yes	Yes	Yes	Yes
Four levels priority interrupt	No	No	Yes	No	No	No	No
Full static design (Frequency down to 0 Mhz)	Yes	Yes	No	No	Yes	Yes	Yes
Supply voltage							
5 V	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3 V	Yes	Yes[2]	No	No	No	Yes	No
Speed							
12/16 MHz	Yes	Yes	Yes	Yes	Yes	Yes	Yes
24 MHz	Yes	Yes	Yes	Yes	Yes	Yes	Yes
33 MHz	Yes	Yes	Yes	No	No	No	Yes
40 MHz	Yes	Yes[2]	No	No	No	No	Yes
Range							
0°C to 70°C	Yes	Yes	Yes	Yes	Yes	Yes	Yes
–40°C to 85°C	Yes	Yes	Yes[3]	Yes	Yes	Yes	No
Package							
PDIL 40	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PLCC 44	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PQFP 44	Yes	Yes	Yes	No	No	Yes	No
TQFP 44	Yes	Yes	No	No	No	Yes	No
Power consumption (Max., 5V)	(at 16 MHz)	(at 16 MHz)	(at 16 MHz)	(at 16 MHz)	(at 12 MHz)	(at 12 MHz)	(at 20 MHz)
Active (mA)	25	25	38	32	21	25	50
Idle (mA)	6.5	8.5	9.5	5	18	6.5	7
PD (μA)	30	50	75	50	50	100	50

1 No clock out generation   2 Under study, no yet available.   3 except 33 Mhz   NA: Not Available

87C52 OTP product features by supplier

Feature	TEMIC 80C52	TEMIC TSC87C52	INTEL 87C52	Philips 87C52	Siemens C501–1E LG GMS80C701	Atmel AT89C52	Windbond W87E52
Power off Flag	No	Yes	Yes	No	No	No	No
Enhanced Timer 2	No	Yes	Yes	No	Yes[1]	Yes	No
UART : Automatic Address Recognition	No	No	Yes	No	No	No	No
UART : Framing error Detection	No	Yes	Yes	No	No	No	No
Power–Down output using external interrupt	No	No	Yes	No	No	No	No
ALE disabling	Yes	Yes	Yes	No	No	No	No
ONCE mode	No	Yes	Yes	No	No	Yes	No
EPROM lock bits	NA	Yes[2]	Yes	Yes	Yes	Yes	Yes
Full static design (Frequency down to 0 Mhz)	Yes	Yes	No	No	Yes	Yes	Yes
Supply voltage							
5 V	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3 V	Yes	Yes[2]	No	No	No	Yes	No
Speed							
12/16 MHz	Yes	Yes	Yes	Yes	Yes	Yes	Yes
24 MHz	Yes	Yes	Yes	Yes	Yes	Yes	Yes
33 MHz	Yes	Yes	Yes	No	No	No	Yes
40 MHz	Yes	Yes[2]	No	No	No	No	Yes
Range							
0°C to 70°C	Yes	Yes	Yes	Yes	Yes	Yes	Yes
–40°C to 85°C	Yes	Yes	Yes[3]	Yes	Yes	Yes	No
Package							
PDIL 40	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PLCC 44	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PQFP 44	Yes	Yes	Yes	No	No	Yes	No
TQFP 44	Yes	Yes	No	No	No	Yes	No
Power consumption (Max., 5V)	(at 16 MHz)	(at 16 MHz)	(at 16 MHz)	(at 16 MHz)	(at 12 MHz)	(at 12 MHz)	(at 20 MHz)
Active (mA)	25	25	38	32	21	25	50
Idle (mA)	8.5	8.5	9.5	5	18	6.5	7
PD (μA)	50	50	75	50	50	100	50

1 No clock out generation   2 Under study, no yet available.   3 except 33 MHz   NA: Not Available

Glossary

Power off Flag

This flag is used by the software to make the difference between a power on reset and a reset exiting from power down. In the power down mode, the crystal is stopped and the microcontroller power consumption is closed to zero. This flag is useful for low power application using the power down mode.

Enhanced Timer 2

Two new features are added to the timer 2 :

● Configuration as an up/down counter

● Clock out generation

UART : Automatic Address Recognition

Two new features are added to the UART. These features lower the software task during multi mode operation :

● Automatic Address Recognition ; in this mode the address recognition is done by hardware rather than by software.

● Framing error Detection; a new bit warn the software that one stop bit is missing.

Power–Down output using external interrupt

With this feature an external interrupt can cause a recover from power down mode ; otherwise, only a reset can restart the microcontroller. this feature provides more flexibility for low power systems.

ALE disabling

The "Address Latch Enable" is activated at a constant rate of 1/6 the oscillator frequency, except during an external data memory access at which one ALE pulse is skipped. When no external RAM and ROM access is required, the ALE is not necessary and can generated noise and EMI. With the ALE disable, this signal is only generated under software when it is required.

ONCE mode

The ON–Circuit Emulation (ONCE) mode facilitates testing and debugging of the system using the microcontroller without having to remove the device from the circuit. In this mode, the device is placed on an inactive state and an emulator or test CPU can be used to drive the circuit.

EPROM lock bits

The program lock bits protect the program memory from software piracy.

Four levels interrupt priority

The initial 8051 architecture has two levels interrupt priority. A second Interrupt Priority register has been added, increasing the number of priority levels to four. This feature provides more flexibility to real time systems.

Full Static Design

This allows to reduce the system power consumption by bringing the clock frequency down to any value, even 0 Mhz (DC), without loss of data.

Cross Reference List

H ere under is a short version of the Cross Reference list of the main products available.

Uptaded version with more references is available on our web site at

http://www.temic.de/semi

Part–numbers given for Commercial temperature Range (0° to 70° C)

	TEMIC	Intel	Philips	Atmel	Siemens	Freq (MHz)	Package
87C51	TSC87C51–12CA	P87C52BH	SC87C51CCN40	AT89C51–12PC	Not available	12	DIP40
	TSC87C51–12CB	S87C52BH	SC87C51CCA44	AT89C51–12JC	Not available	12	PLCC44
	TSC87C51–16CA	P87C52BH–1	SC87C51CGN40	AT89C51–16PC	Not available	16	DIP40
	TSC87C51–16CB	S87C52BH–1	SC87C51CGA44	AT89C51–16JC	Not available	16	PLCC44
87C52	TSC87C52–12CA	P87C52BH	SC87C52CCN40	AT89C52–12PC	SAB–C501G–1EP	12	DIP40
	TSC87C52–12CB	S87C52BH	SC87C52CCA44	AT89C52–12JC	SAB–C501G–1EN	12	PLCC44
	TSC87C52–16CA	P87C52BH–1	SC87C52CGN40	AT89C52–16PC	Not available	16	DIP40
	TSC87C52–16CB	S87C52BH–1	SC87C52CGA44	AT89C52–16JC	Not available	16	PLCC44