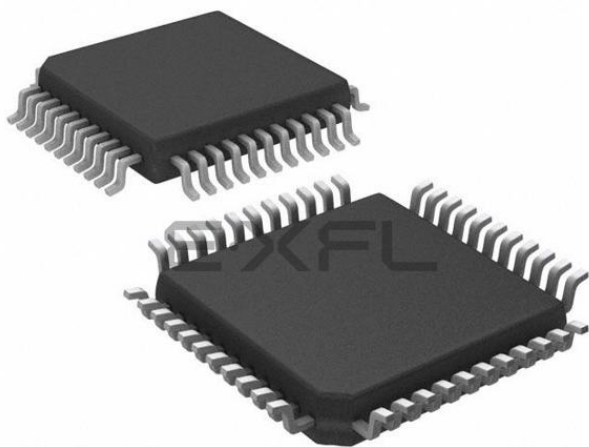




Welcome to [E-XFL.COM](https://www.e-xfl.com)

What is "[Embedded - Microcontrollers](#)"?

"[Embedded - Microcontrollers](#)" refer to small, integrated circuits designed to perform specific tasks within larger systems. These microcontrollers are essentially compact computers on a single chip, containing a processor core, memory, and programmable input/output peripherals. They are called "embedded" because they are embedded within electronic devices to control various functions, rather than serving as standalone computers. Microcontrollers are crucial in modern electronics, providing the intelligence and control needed for a wide range of applications.

Applications of "[Embedded - Microcontrollers](#)"

Details

Product Status	Obsolete
Core Processor	80C51
Core Size	8-Bit
Speed	40/20MHz
Connectivity	UART/USART
Peripherals	POR, PWM, WDT
Number of I/O	32
Program Memory Size	-
Program Memory Type	ROMless
EEPROM Size	-
RAM Size	256 x 8
Voltage - Supply (Vcc/Vdd)	4.5V ~ 5.5V
Data Converters	-
Oscillator Type	Internal
Operating Temperature	-40°C ~ 85°C (TA)
Mounting Type	Surface Mount
Package / Case	44-QFP
Supplier Device Package	44-VQFP
Purchase URL	https://www.e-xfl.com/product-detail/microchip-technology/ts80c51ra2-mie

facilitates multiprocessor communication (EUSART) and an X2 speed improvement mechanism.

The fully static design of the TS80C51Rx2 allows to reduce system power consumption by bringing the clock frequency down to any value, even DC, without loss of data.

The TS80C51Rx2 has 2 software-selectable modes of reduced activity for further reduction in power consumption. In the idle mode the CPU is frozen while the timers, the serial port and the interrupt system are still operating. In the power-down mode the RAM is saved and all other functions are inoperative.

PDIL40 PLCC44 VQFP44 1.4	ROM (bytes)	EPROM (bytes)	XRAM (bytes)	TOTAL RAM (bytes)	I/O
TS80C51RA2	0	0	256	512	32
TS80C51RD2	0	0	768	1024	32
TS83C51RB2	16k	0	256	512	32
TS83C51RC2	32k	0	256	512	32
TS83C51RD2	64k	0	768	1024	32
TS87C51RB2	0	16k	256	512	32
TS87C51RC2	0	32k	256	512	32
TS87C51RD2	0	64k	768	1024	32

PLCC68 VQFP64 1.4	ROM (bytes)	EPROM (bytes)	XRAM (bytes)	TOTAL RAM (bytes)	I/O
TS80C51RD2	0	0	768	1024	48
TS83C51RD2	64k	0	768	1024	48
TS87C51RD2	0	64k	768	1024	48

PSEN	67	55
$\overline{EA}/VPP$	2	58
XTAL1	49	38
XTAL2	48	37
P4.0	20	11
P4.1	24	15
P4.2	26	17
P4.3	44	33
P4.4	46	35
P4.5	50	39
P4.6	53	42
P4.7	57	46
P5.0	60	49
P5.1	62	51
P5.2	63	52
P5.3	7	62
P5.4	8	63
P5.5	10	1
P5.6	13	4
P5.7	16	7

5.4 Dual Data Pointer Register

The additional data pointer can be used to speed up code execution and reduce code size in a number of ways.

The dual DPTR structure is a way by which the chip will specify the address of an external data memory location. There are two 16-bit DPTR registers that address the external memory, and a single bit called DPS = AUXR1/bit0 (Table 5-3) that allows the program code to switch between them (Refer to Figure 5-3).

Figure 5-3. Use of Dual Pointer

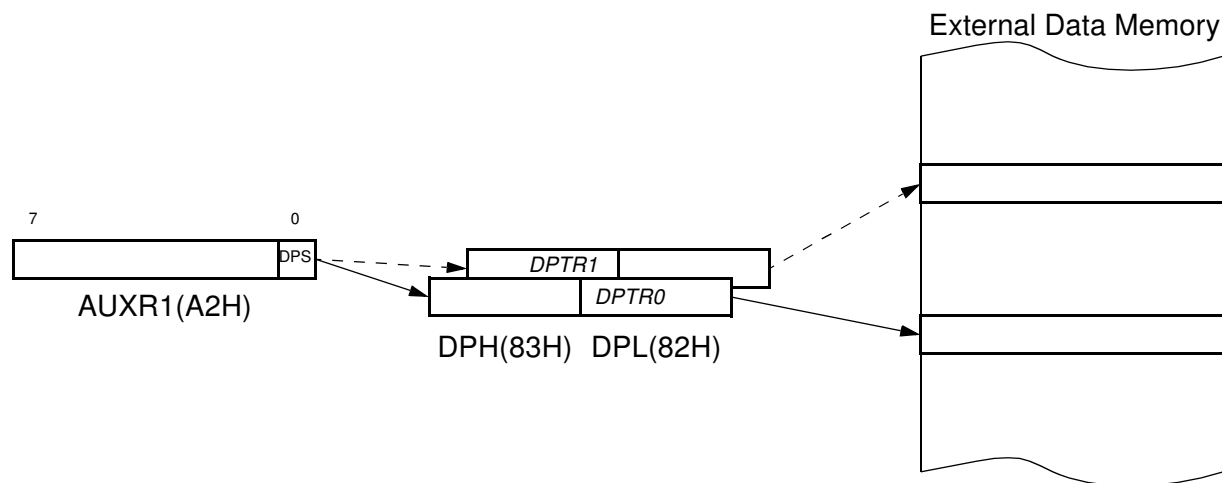


Table 5-3. AUXR1: Auxiliary Register 1

AUXR1 Address 0A2H		-	-	-	-	GF3	-	-	DPS
	Reset value	X	X	X	X	0	X	X	0
Symbol	Function								
-	Not implemented, reserved for future use ⁽¹⁾								
DPS	Data Pointer Selection.								
	DPS	Operating Mode							
	0	DPTR0 Selected							
	1	DPTR1 Selected							
GF3	This bit is a general purpose user flag ⁽²⁾ .								

1. User software should not write 1s to reserved bits. These bits may be used in future 8051 family products to invoke new feature. In that case, the reset value of the new bit will be 0, and its active value will be 1. The value read from a reserved bit is indeterminate.

GF3 will not be available on first version of the RC devices.

6. Application

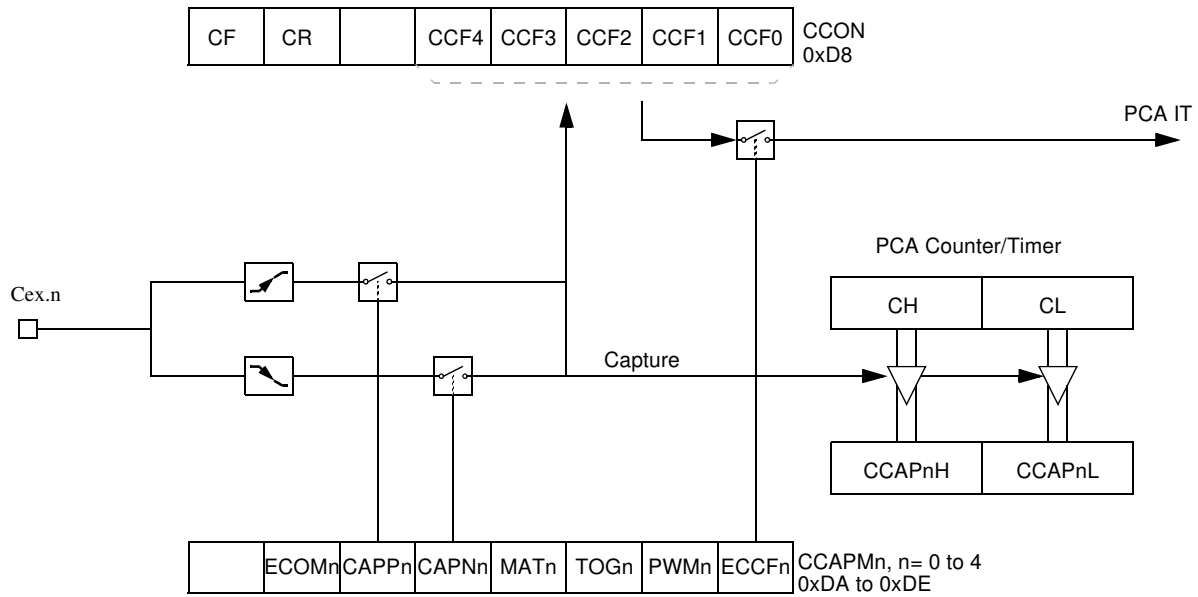
Software can take advantage of the additional data pointers to both increase speed and reduce code size, for example, block operations (copy, compare, search ...) are well served by using one data pointer as a 'source' pointer and the other one as a "destination" pointer.

ASSEMBLY LANGUAGE

```
; Block move using dual data pointers
; Destroys DPTR0, DPTR1, A and PSW
; note: DPS exits opposite of entry state
; unless an extra INC AUXR1 is added
;
00A2  AUXR1 EQU 0A2H
;
0000 909000MOV DPTR,#SOURCE ; address of SOURCE
0003 05A2 INC AUXR1 ; switch data pointers
0005 90A000 MOV DPTR,#DEST ; address of DEST
0008 LOOP:
0008 05A2 INC AUXR1 ; switch data pointers
000A E0 MOVX A,@DPTR ; get a byte from SOURCE
000B A3 INC DPTR ; increment SOURCE address
000C 05A2 INC AUXR1 ; switch data pointers
000E F0 MOVX @DPTR,A ; write the byte to DEST
000F A3 INC DPTR ; increment DEST address
0010 70F6JNZ LOOP ; check for 0 terminator
0012 05A2 INC AUXR1 ; (optional) restore DPS
```

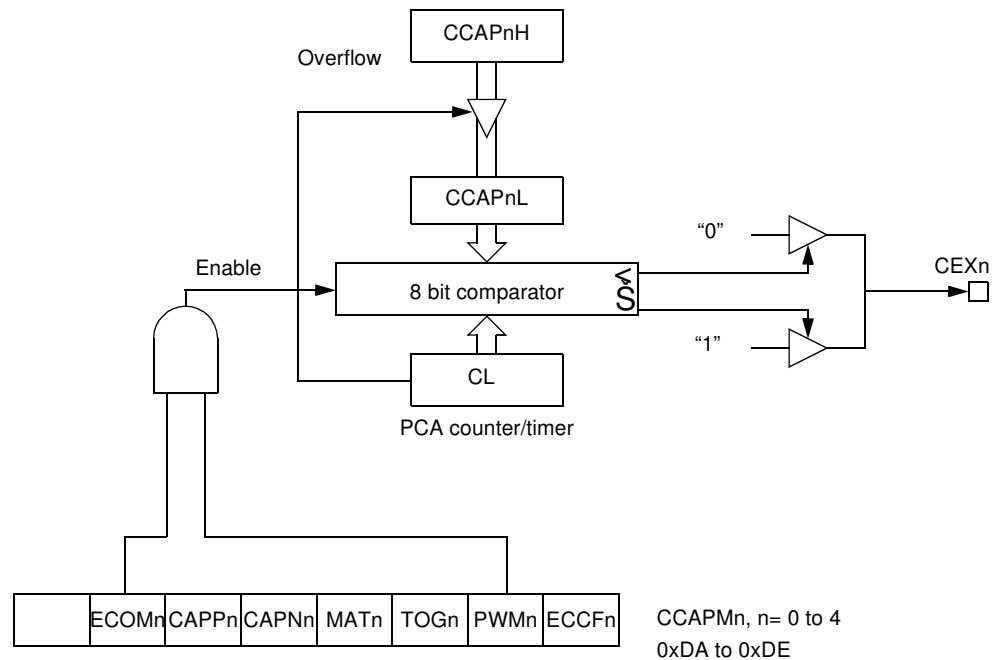
INC is a short (2 bytes) and fast (12 clocks) way to manipulate the DPS bit in the AUXR1 SFR. However, note that the INC instruction does not directly force the DPS bit to a particular state, but simply toggles it. In simple routines, such as the block move example, only the fact that DPS is toggled in the proper sequence matters, not its actual value. In other words, the block move routine works the same whether DPS is '0' or '1' on entry. Observe that without the last instruction (INC AUXR1), the routine will exit with DPS in the opposite state.

Figure 6-6. PCA Capture Mode



6.3.2 16-bit Software Timer/ Compare Mode

The PCA modules can be used as software timers by setting both the **ECOM** and **MAT** bits in the modules **CCAPMn** register. The PCA timer will be compared to the module's capture registers and when a match occurs an interrupt will occur if the **CCFn** (**CCON** SFR) and the **ECCFn** (**CCAPMn** SFR) bits for the module are both set (See Figure 6-7).

Figure 6-9. PCA PWM Mode

6.3.5 PCA Watchdog Timer

An on-board watchdog timer is available with the PCA to improve the reliability of the system without increasing chip count. Watchdog timers are useful for systems that are susceptible to noise, power glitches, or electrostatic discharge. Module 4 is the only PCA module that can be programmed as a watchdog. However, this module can still be used for other modes if the watchdog is not needed. Figure 6-7 shows a diagram of how the watchdog works. The user pre-loads a 16-bit value in the compare registers. Just like the other compare modes, this 16-bit value is compared to the PCA timer value. If a match is allowed to occur, an internal reset will be generated. This will not cause the RST pin to be driven high.

In order to hold off the reset, the user has three options:

- 1. Periodically change the compare value so it will never match the PCA timer,
- 2. periodically change the PCA timer value so it will never match the compare values, or
- 3. Disable the watchdog by clearing the WDTE bit before a match occurs and then re-enable it.

The first two options are more reliable because the watchdog timer is never disabled as in option #3. If the program counter ever goes astray, a match will eventually occur and cause an internal reset. The second option is also not recommended if other PCA modules are being used. Remember, the PCA timer is the time base for all modules; changing the time base for other modules would not be a good idea. Thus, in most applications the first solution is the best option.

This watchdog timer won't generate a reset out on the reset pin.

Bit Number	Bit Mnemonic	Description												
7	FE	Framing Error bit (SMOD0=1) Clear to reset the error state, not cleared by a valid stop bit. Set by hardware when an invalid stop bit is detected. SMOD0 must be set to enable access to the FE bit												
	SM0	Serial port Mode bit 0 Refer to SM1 for serial port mode selection. SMOD0 must be cleared to enable access to the SM0 bit												
6	SM1	Serial port Mode bit 1 <u>SM0 SM1 Mode Description Baud Rate</u> <table> <tr> <td>0</td><td>0</td><td>0Shift Register $F_{XTAL}/12$ (/6 in X2 mode)</td></tr> <tr> <td>0</td><td>1</td><td>18-bit UART Variable</td></tr> <tr> <td>1</td><td>0</td><td>29-bit UART $F_{XTAL}/64$ or $F_{XTAL}/32$ (/32, /16 in X2 mode)</td></tr> <tr> <td>1</td><td>1</td><td>39-bit UART Variable</td></tr> </table>	0	0	0Shift Register $F_{XTAL}/12$ (/6 in X2 mode)	0	1	18-bit UART Variable	1	0	29-bit UART $F_{XTAL}/64$ or $F_{XTAL}/32$ (/32, /16 in X2 mode)	1	1	39-bit UART Variable
0	0	0Shift Register $F_{XTAL}/12$ (/6 in X2 mode)												
0	1	18-bit UART Variable												
1	0	29-bit UART $F_{XTAL}/64$ or $F_{XTAL}/32$ (/32, /16 in X2 mode)												
1	1	39-bit UART Variable												
5	SM2	Serial port Mode 2 bit / Multiprocessor Communication Enable bit Clear to disable multiprocessor communication feature. Set to enable multiprocessor communication feature in mode 2 and 3, and eventually mode 1. This bit should be cleared in mode 0.												
4	REN	Reception Enable bit Clear to disable serial reception. Set to enable serial reception.												
3	TB8	Transmitter Bit 8 / Ninth bit to transmit in modes 2 and 3 Clear to transmit a logic 0 in the 9th bit. Set to transmit a logic 1 in the 9th bit.												
2	RB8	Receiver Bit 8 / Ninth bit received in modes 2 and 3 Cleared by hardware if 9th bit received is a logic 0. Set by hardware if 9th bit received is a logic 1. In mode 1, if SM2 = 0, RB8 is the received stop bit. In mode 0 RB8 is not used.												
1	TI	Transmit Interrupt flag Clear to acknowledge interrupt. Set by hardware at the end of the 8th bit time in mode 0 or at the beginning of the stop bit in the other modes.												
0	RI	Receive Interrupt flag Clear to acknowledge interrupt. Set by hardware at the end of the 8th bit time in mode 0, see Figure 6-11. and Figure 6-12. in the other modes.												

Reset Value = 0000 0000b

Bit addressable

Table 6-15. PCON Register
PCON - Power Control Register (87h)

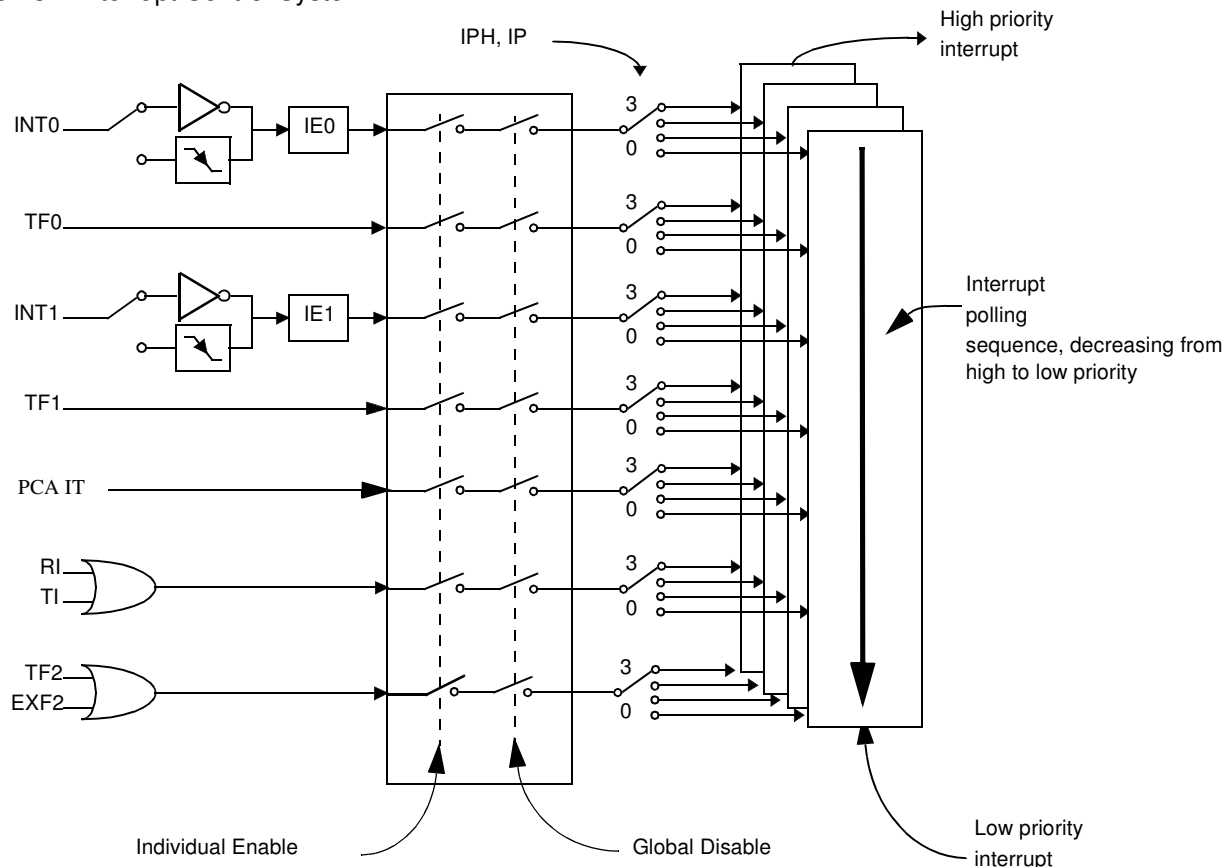
7	6	5	4	3	2	1	0
SMOD1	SMOD0	-	POF	GF1	GF0	PD	IDL

6.5 Interrupt System

The TS80C51Rx2 has a total of 7 interrupt vectors: two external interrupts ($\overline{\text{INT0}}$ and $\overline{\text{INT1}}$), three timer interrupts (timers 0, 1 and 2), the serial port interrupt and the PCA global interrupt. These interrupts are shown in Figure 6-13.

WARNING: Note that in the first version of RC devices, the PCA interrupt is in the lowest priority. Thus the order in $\overline{\text{INT0}}$, TF0, INT1, TF1, RI or TI, TF2 or EXF2, PCA.

Figure 6-13. Interrupt Control System

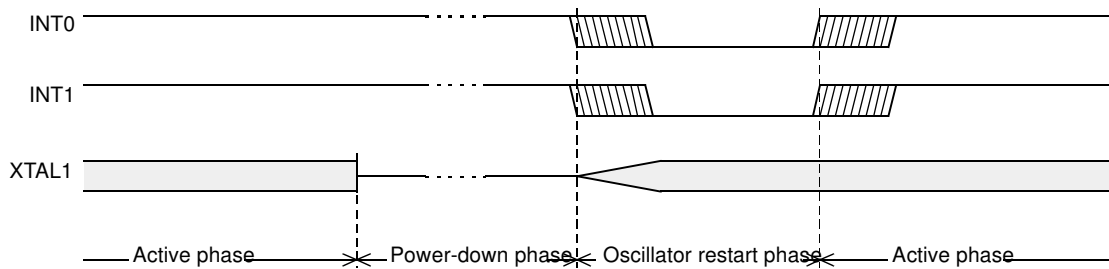


Each of the interrupt sources can be individually enabled or disabled by setting or clearing a bit in the Interrupt Enable register (See Table 6-17. Table 6-18.). This register also contains a global disable bit, which must be cleared to disable all interrupts at once.

Each interrupt source can also be individually programmed to one out of four priority levels by setting or clearing a bit in the Interrupt Priority register (See Table 6-18.) and in the Interrupt Priority High register (See Table 6-19.). shows the bit values and priority levels associated with each combination.

The PCA interrupt vector is located at address 0033H. All other vector addresses are the same as standard C52 devices.

Figure 6-14. Power-Down Exit Waveform



Exit from power-down by reset redefines all the SFRs, exit from power-down by external interrupt does not affect the SFRs.

Exit from power-down by either reset or external interrupt does not affect the internal RAM content.

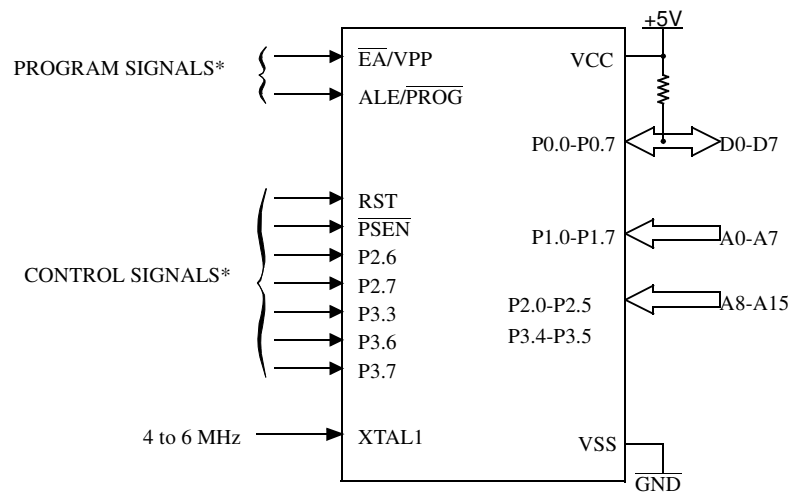
Note: If idle mode is activated with power-down mode (IDL and PD bits set), the exit sequence is unchanged, when execution is vectored to interrupt, PD and IDL bits are cleared and idle mode is not entered.

Table 6-20. The state of ports during idle and power-down mode

Mode	Program Memory	ALE	PSEN	PORT0	PORT1	PORT2	PORT3
Idle	Internal	1	1	Port Data*	Port Data	Port Data	Port Data
Idle	External	1	1	Floating	Port Data	Address	Port Data
Power-down	Internal	0	0	Port Data*	Port Data	Port Data	Port Data
Power-down	External	0	0	Floating	Port Data	Port Data	Port Data

* Port 0 can force a "zero" level. A "one" will leave port floating.

Figure 9-1. Set-Up Modes Configuration



* See Table 31, for proper value on these inputs

9.3.3 Programming Algorithm

The Improved Quick Pulse algorithm is based on the Quick Pulse algorithm and decreases the number of pulses applied during byte programming from 25 to 1.

To program the TS87C51RB2/RC2/RD2 the following sequence must be exercised:

- Step 1: Activate the combination of control signals.
- Step 2: Input the valid address on the address lines.
- Step 3: Input the appropriate data on the data lines.
- Step 4: Raise $\overline{EA}/VPP$ from VCC to VPP (typical 12.75V).
- Step 5: Pulse ALE/ $\overline{PROG}$ once.
- Step 6: Lower $\overline{EA}/VPP$ from VPP to VCC

Repeat step 2 through 6 changing the address and data for the entire array or until the end of the object file is reached (See [Figure 9-2](#)).

9.3.4 Verify algorithm

Code array verify must be done after each byte or block of bytes is programmed. In either case, a complete verify of the programmed array will ensure reliable programming of the TS87C51RB2/RC2/RD2.

P 2.7 is used to enable data output.

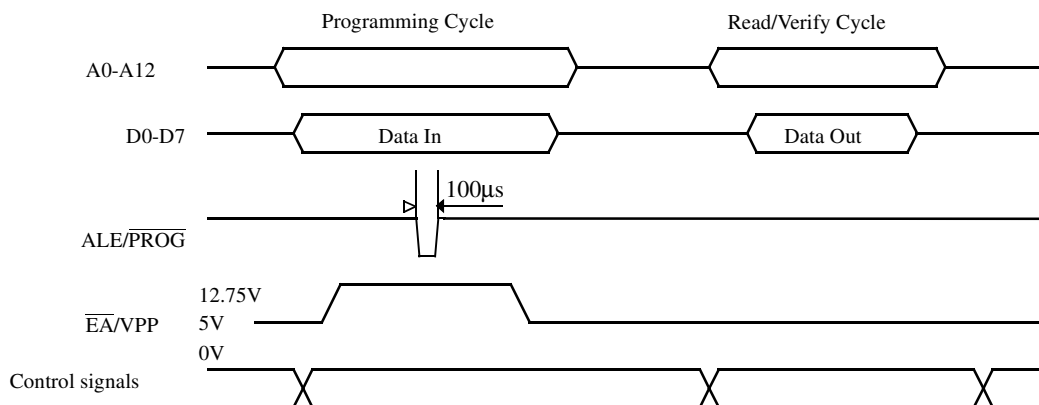
To verify the TS87C51RB2/RC2/RD2 code the following sequence must be exercised:

- Step 1: Activate the combination of program and control signals.
- Step 2: Input the valid address on the address lines.
- Step 3: Read data on the data lines.

Repeat step 2 through 3 changing the address for the entire array verification (See [Figure 9-2](#)).

The encryption array cannot be directly verified. Verification of the encryption array is done by observing that the code array is well encrypted.

Figure 9-2. Programming and Verification Signal's Waveform



9.4 EPROM Erasure (Windowed Packages Only)

Erasing the EPROM erases the code array, the encryption array and the lock bits returning the parts to full functionality.

Erasure leaves all the EPROM cells in a 1's state (FF).

9.4.1 Erasure Characteristics

The recommended erasure procedure is exposure to ultraviolet light (at 2537 Å) to an integrated dose at least 15 W-sec/cm². Exposing the EPROM to an ultraviolet lamp of 12,000 μW/cm² rating for 30 minutes, at a distance of about 25 mm, should be sufficient. An exposure of 1 hour is recommended with most of standard erasers.

Erasure of the EPROM begins to occur when the chip is exposed to light with wavelength shorter than approximately 4,000 Å. Since sunlight and fluorescent lighting have wavelengths in this range, exposure to these light sources over an extended time (about 1 week in sunlight, or 3 years in room-level fluorescent lighting) could cause inadvertent erasure. If an application subjects the device to this type of exposure, it is suggested that an opaque label be placed over the window.

10. Signature Bytes

The TS83/87C51RB2/RC2/RD2 has four signature bytes in location 30h, 31h, 60h and 61h. To read these bytes follow the procedure for EPROM verify but activate the control lines provided in Table 31. for Read Signature Bytes. Table 10-1. shows the content of the signature byte for the TS87C51RB2/RC2/RD2.

Table 10-1. Signature Bytes Content

Location	Contents	Comment
30h	58h	Manufacturer Code: Atmel
31h	57h	Family Code: C51 X2
60h	7Ch	Product name: TS83C51RD2

Figure 11-3. I_{CC} Test Condition, Idle Mode

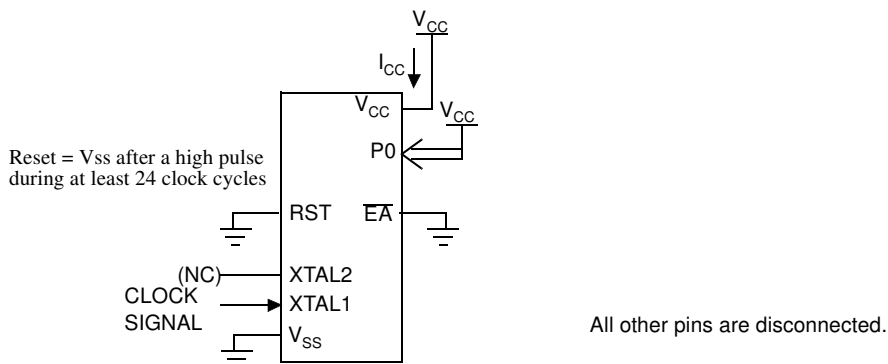


Figure 11-4. I_{CC} Test Condition, Power-Down Mode

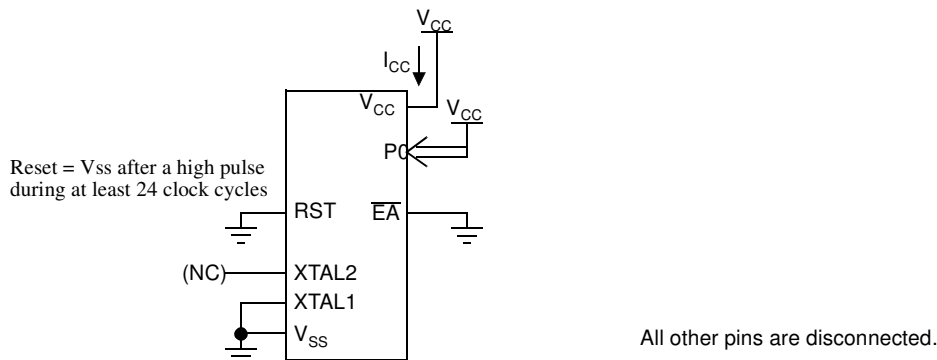
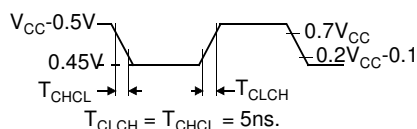


Figure 11-5. Clock Signal Waveform for I_{CC} Tests in Active and Idle Modes



11.5 AC Parameters

11.5.1 Explanation of the AC Symbols

Each timing symbol has 5 characters. The first character is always a “T” (stands for time). The other characters, depending on their positions, stand for the name of a signal or the logical status of that signal. The following is a list of all the characters and what they stand for.

Example: T_{AVLL} = Time for Address Valid to ALE Low.

T_{LLPL} = Time for ALE Low to $\overline{PSEN}$ Low.

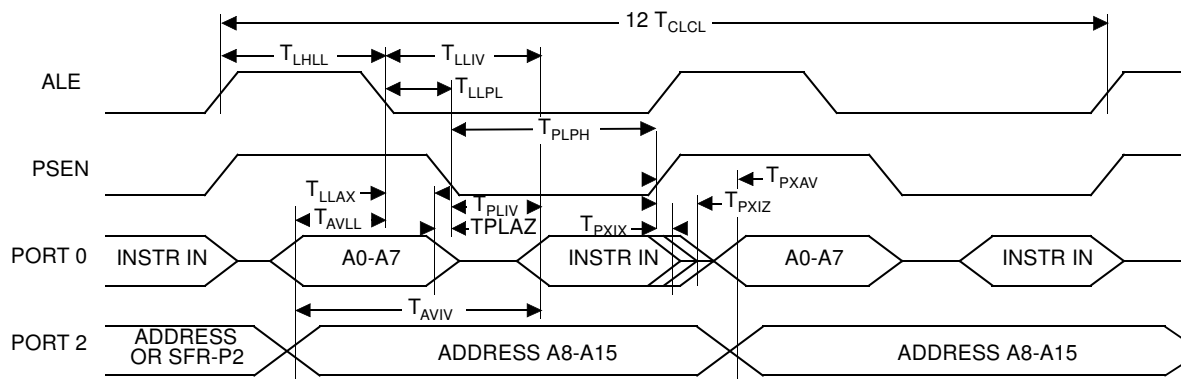
$T_A = 0$ to $+70^\circ C$ (commercial temperature range); $V_{SS} = 0 V$; $V_{CC} = 5 V \pm 10\%$; -M and -V ranges.
 $T_A = -40^\circ C$ to $+85^\circ C$ (industrial temperature range); $V_{SS} = 0 V$; $V_{CC} = 5 V \pm 10\%$; -M and -V ranges.

Table 11-7. AC Parameters for a Variable Clock: derating formula

Symbol	Type	Standard Clock	X2 Clock	-M	-V	-L	Units
T_{LHLL}	Min	$2 T - x$	$T - x$	10	8	15	ns
T_{AVLL}	Min	$T - x$	$0.5 T - x$	15	13	20	ns
T_{LLAX}	Min	$T - x$	$0.5 T - x$	15	13	20	ns
T_{LLIV}	Max	$4 T - x$	$2 T - x$	30	22	35	ns
T_{LLPL}	Min	$T - x$	$0.5 T - x$	10	8	15	ns
T_{PLPH}	Min	$3 T - x$	$1.5 T - x$	20	15	25	ns
T_{PLIV}	Max	$3 T - x$	$1.5 T - x$	40	25	45	ns
T_{PXIX}	Min	x	x	0	0	0	ns
T_{PXIZ}	Max	$T - x$	$0.5 T - x$	7	5	15	ns
T_{AVIV}	Max	$5 T - x$	$2.5 T - x$	40	30	45	ns
T_{PLAZ}	Max	x	x	10	10	10	ns

11.5.3 External Program Memory Read Cycle

Figure 11-6. External Program Memory Read Cycle



11.5.4 External Data Memory Characteristics

Symbol	Parameter
T_{RLRH}	$\overline{RD}$ Pulse Width
T_{WLWH}	$\overline{WR}$ Pulse Width
T_{RLDV}	$\overline{RD}$ to Valid Data In
T_{RHDx}	Data Hold After $\overline{RD}$
T_{RHDZ}	Data Float After $\overline{RD}$
T_{LLDV}	ALE to Valid Data In
T_{AVDV}	Address to Valid Data In
T_{LLWL}	ALE to $\overline{WR}$ or $\overline{RD}$
T_{AVWL}	Address to $\overline{WR}$ or $\overline{RD}$
T_{QVWX}	Data Valid to $\overline{WR}$ Transition
T_{QVWH}	Data set-up to $\overline{WR}$ High
T_{WHQX}	Data Hold After $\overline{WR}$
T_{RLAZ}	$\overline{RD}$ Low to Address Float
T_{WHLH}	$\overline{RD}$ or $\overline{WR}$ High to ALE high

Table 11-8. AC Parameters for a Fix Clock

Speed	-M 40 MHz		-V X2 mode 30 MHz 60 MHz equiv.		-V standard mode 40 MHz		-L X2 mode 20 MHz 40 MHz equiv.		-L standard mode 30 MHz		Units
			Min	Max	Min	Max	Min	Max	Min	Max	
T_{RLRH}	130		85		135		125		175		ns
T_{WLWH}	130		85		135		125		175		ns
T_{RLDV}		100		60		102		95		137	ns
T_{RHDx}	0		0		0		0		0		ns
T_{RHDZ}		30		18		35		25		42	ns
T_{LLDV}		160		98		165		155		222	ns
T_{AVDV}		165		100		175		160		235	ns
T_{LLWL}	50	100	30	70	55	95	45	105	70	130	ns
T_{AVWL}	75		47		80		70		103		ns
T_{QVWX}	10		7		15		5		13		ns
T_{QVWH}	160		107		165		155		213		ns
T_{WHQX}	15		9		17		10		18		ns
T_{RLAZ}		0		0		0		0		0	ns
T_{WHLH}	10	40	7	27	15	35	5	45	13	53	ns

11.5.9 EPROM Programming and Verification Characteristics

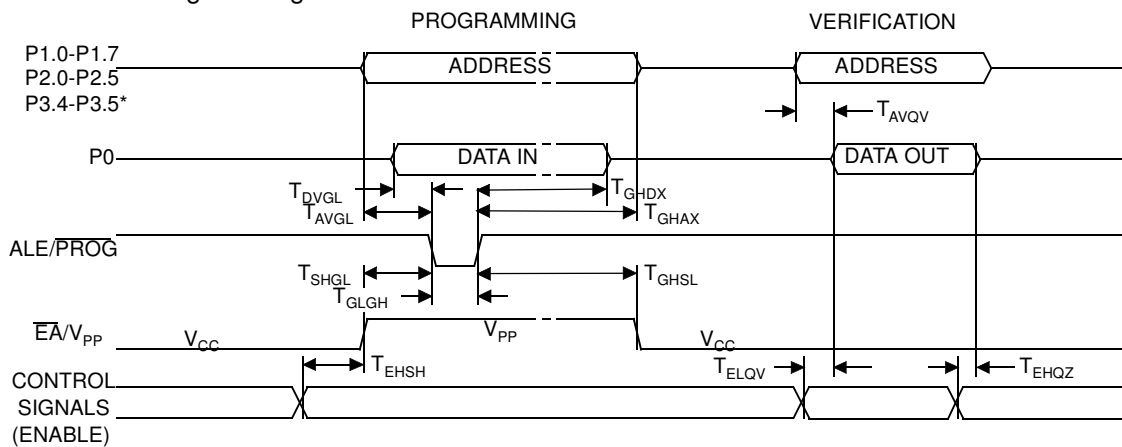
$T_A = 21^\circ\text{C}$ to 27°C ; $V_{SS} = 0\text{V}$; $V_{CC} = 5\text{V} \pm 10\%$ while programming. V_{CC} = operating range while

Symbol	Parameter	Min	Max	Units
V_{PP}	Programming Supply Voltage	12.5	13	V
I_{PP}	Programming Supply Current		75	mA
$1/T_{CLCL}$	Oscillator Frequency	4	6	MHz
T_{AVGL}	Address Setup to $\overline{\text{PROG}}$ Low	$48 T_{CLCL}$		
T_{GHAX}	Address Hold after $\overline{\text{PROG}}$	$48 T_{CLCL}$		
T_{DVGL}	Data Setup to $\overline{\text{PROG}}$ Low	$48 T_{CLCL}$		
T_{GHDX}	Data Hold after $\overline{\text{PROG}}$	$48 T_{CLCL}$		
T_{EHS}	(Enable) High to V_{PP}	$48 T_{CLCL}$		
T_{SHGL}	V_{PP} Setup to $\overline{\text{PROG}}$ Low	10		μs
T_{GHSL}	V_{PP} Hold after $\overline{\text{PROG}}$	10		μs
T_{GLGH}	$\overline{\text{PROG}}$ Width	90	110	μs
T_{AVQV}	Address to Valid Data		$48 T_{CLCL}$	
T_{ELQV}	ENABLE Low to Data Valid		$48 T_{CLCL}$	
T_{EHQZ}	Data Float after ENABLE	0	$48 T_{CLCL}$	

verifying

11.5.10 EPROM Programming and Verification Waveforms

Figure 11-10. EPROM Programming and Verification Waveforms

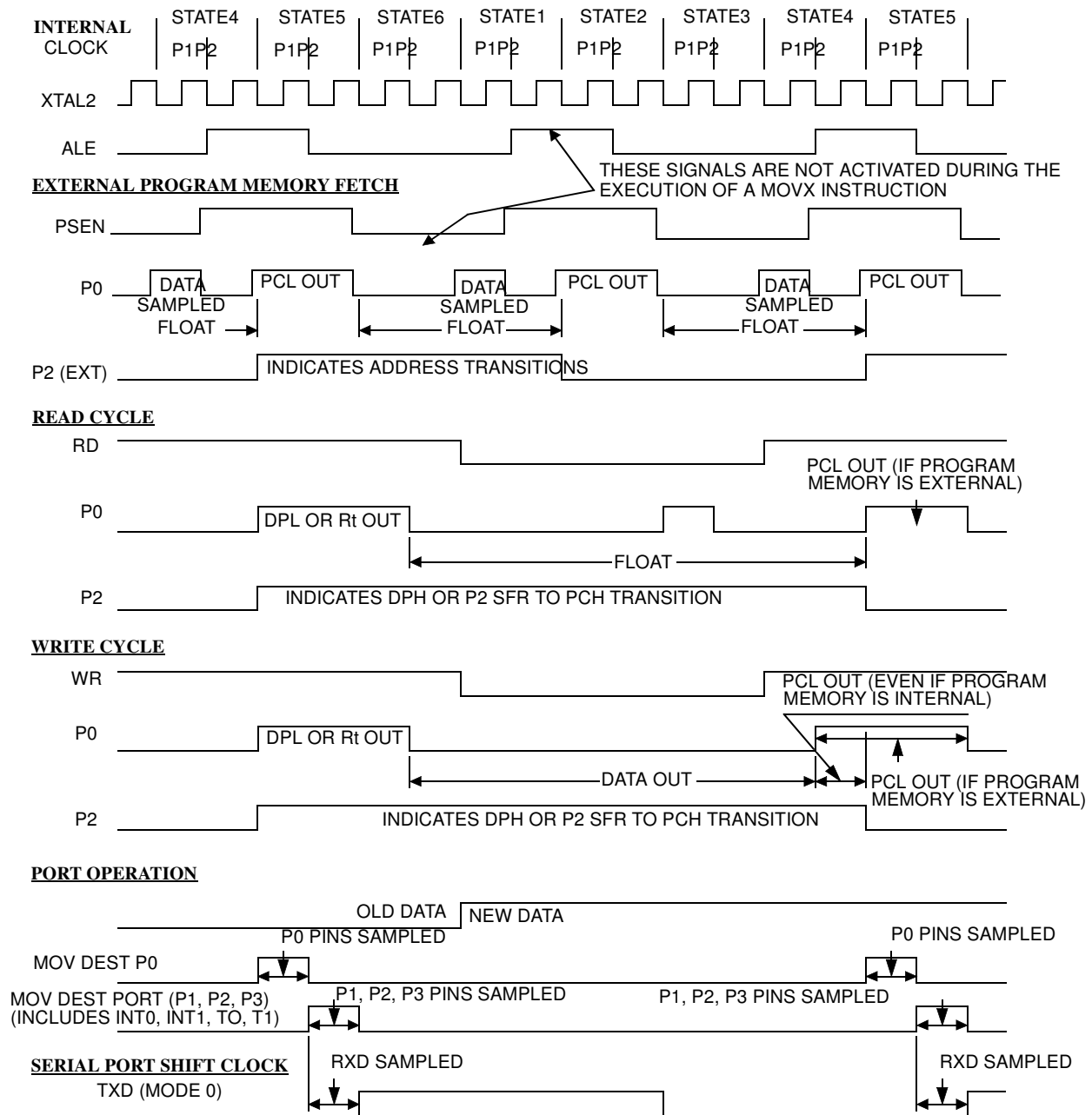


* 8KB: up to P2.4, 16KB: up to P2.5, 32KB: up to P3.4, 64KB: up to P3.5

11.5.15 Clock Waveforms

Valid in normal clock mode. In X2 mode XTAL2 signal must be changed to XTAL2 divided by two.

Figure 11-14. Clock Waveforms

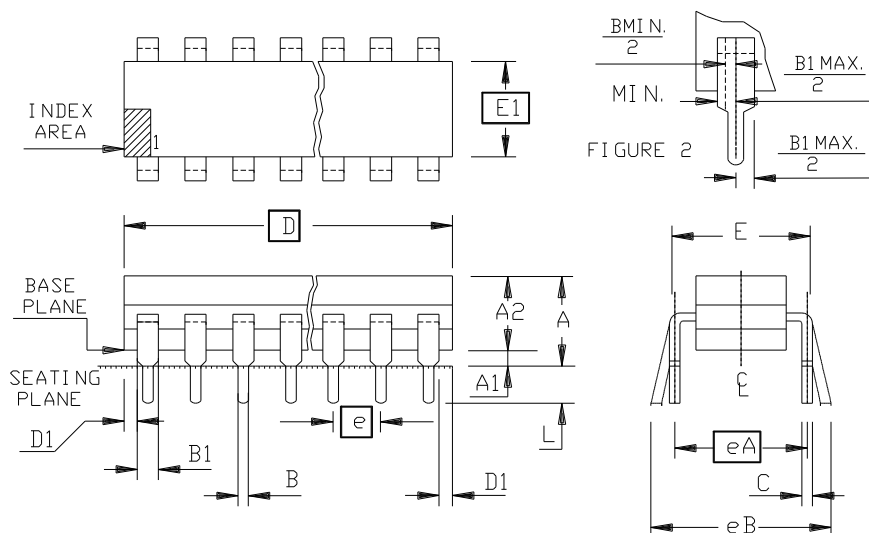


This diagram indicates when signals are clocked internally. The time it takes the signals to propagate to the pins, however, ranges from 25 to 125 ns. This propagation delay is dependent on variables such as temperature and pin loading. Propagation also varies from output to output and component. Typically though ($T_A=25^{\circ}\text{C}$ fully loaded) $\overline{\text{RD}}$ and $\overline{\text{WR}}$ propagation delays are approximately 50ns. The other signals are typically 85 ns. Propagation delays are incorporated in the AC specifications.

Part Number	Memory size	Supply Voltage	Temperature Range	Max Frequency	Package	Packing
AT80C51RA2-3CSCV	OBSOLETE					
AT80C51RA2-SLSCV						
AT80C51RA2-RLTCV						
AT80C51RA2-3CSIV						
AT80C51RA2-SLSIV						
AT80C51RA2-RLSIV						
TS80C51RD2-MCA	Not recommended use AT87C51RD2					
TS80C51RD2-MCB	Not recommended use AT87C51RD2					
TS80C51RD2-MCE	Not recommended use AT87C51RD2					
TS80C51RD2-MIA	Not recommended use AT87C51RD2					
TS80C51RD2-MIB	Not recommended use AT87C51RD2					
TS80C51RD2-MIE	Not recommended use AT87C51RD2					
TS80C51RD2-LCA	Not recommended use AT87C51RD2					
TS80C51RD2-LCB	Not recommended use AT87C51RD2					
TS80C51RD2-LCE	Not recommended use AT87C51RD2					
TS80C51RD2-LIA	Not recommended use AT87C51RD2					
TS80C51RD2-LIB	Not recommended use AT87C51RD2					
TS80C51RD2-LIE	Not recommended use AT87C51RD2					
TS80C51RD2-VCA	Not recommended use AT87C51RD2					
TS80C51RD2-VCB	Not recommended use AT87C51RD2					
TS80C51RD2-VCE	Not recommended use AT87C51RD2					
TS80C51RD2-VIA	Not recommended use AT87C51RD2					
TS80C51RD2-VIB	Not recommended use AT87C51RD2					
TS80C51RD2-VIE	Not recommended use AT87C51RD2					
AT80C51RD2-3CSUM	Not recommended use AT87C51RD2					
AT80C51RD2-SLSUM	Not recommended use AT87C51RD2					
AT80C51RD2-RLTUM	Not recommended use AT87C51RD2					
AT80C51RD2-3CSUL	Not recommended use AT87C51RD2					
AT80C51RD2-SLSUL	Not recommended use AT87C51RD2					
AT80C51RD2-RLTUL	Not recommended use AT87C51RD2					

Part Number	Memory size	Supply Voltage	Temperature Range	Max Frequency	Package	Packing
TS87C51RB2-MCA	OBSOLETE					
TS87C51RB2-MCB						
TS87C51RB2-MCE						
TS87C51RB2-MIA						
TS87C51RB2-MIB						
TS87C51RB2-MIE						
TS87C51RB2-LCA						
TS87C51RB2-LCB						
TS87C51RB2-LCE						
TS87C51RB2-LIA						
TS87C51RB2-LIB						
TS87C51RB2-LIE						
TS87C51RB2-VCA						
TS87C51RB2-VCB						
TS87C51RB2-VCE						
TS87C51RB2-VIA						
TS87C51RB2-VIB						
TS87C51RB2-VIE						
AT87C51RB2-3CSUM	OTP 16k Bytes	5V	Industrial & Green	40 MHz (20 MHz X2)	PDIL40	Stick
AT87C51RB2-SLSUM	OTP 16k Bytes	5V	Industrial & Green	40 MHz (20 MHz X2)	PLCC44	Stick
AT87C51RB2-RLTUM	OTP 16k Bytes	5V	Industrial & Green	40 MHz (20 MHz X2)	VQFP44	Tray
AT87C51RB2-3CSUL	OTP 16k Bytes	3-5V	Industrial & Green	30 MHz (20 MHz X2)	PDIL40	Stick
AT87C51RB2-SLSUL	OTP 16k Bytes	3-5V	Industrial & Green	30 MHz (20 MHz X2)	PLCC44	Stick
AT87C51RB2-RLTUL	OTP 16k Bytes	3-5V	Industrial & Green	30 MHz (20 MHz X2)	VQFP44	Tray

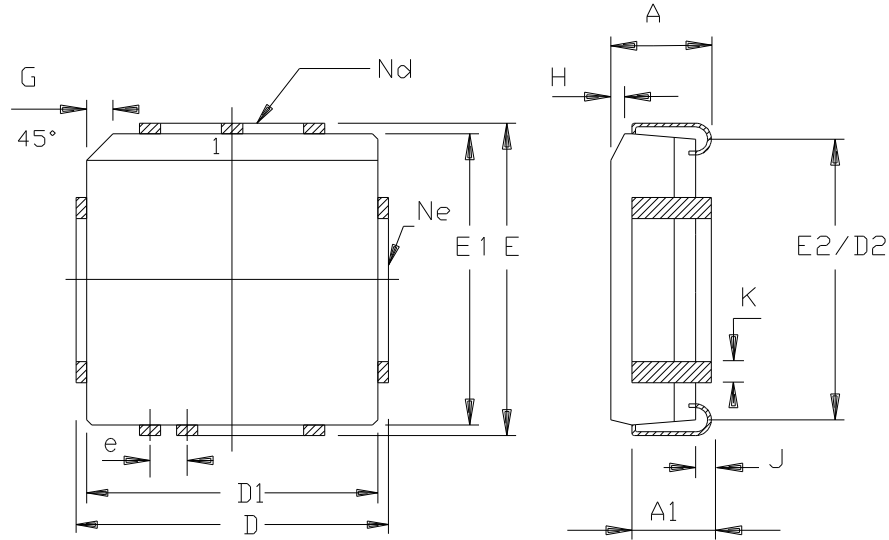
13.2 PDIL40



	MM		INCH	
A	-	5.08	-	.200
A1	0.38	-	.015	-
A2	3.18	4.95	.125	.195
B	0.36	0.56	.014	.022
B1	0.76	1.78	.030	.070
C	0.20	0.38	.008	.015
D	50.29	53.21	1.980	2.095
E	15.24	15.87	.600	.625
E1	12.32	14.73	.485	.580
e	2.54	B. S. C	.100	B. S. C
eA	15.24	B. S. C	.600	B. S. C
eB	-	17.78	-	.700
L	2.93	3.81	.115	.150
D1	0.13	-	.005	-
PKG STD		02		

13.5 PLCC68

68 PINS PLCC



	MM		INCH	
A	4.20	5.08	.165	.200
A1	2.29	3.30	.090	.130
D	25.02	25.27	.985	.995
D1	24.13	24.33	.950	.958
D2	22.61	23.62	.890	.930
E	25.02	25.27	.985	.995
E1	24.13	24.33	.950	.958
E2	22.61	23.62	.890	.930
e	1.27	BSC	.050	BSC
G	1.07	1.22	.042	.048
H	1.07	1.42	.042	.056
J	0.51	-	.020	-
K	0.33	0.53	.013	.021
Nd	17		17	
Ne	17		17	
PKG STD	00			

14. Datasheet Revision History

14.1 Changes from 4188E to 4188F

1. Removed TS80C51RD2 and AT80C51RD2 from “Ordering Information” on page 73.
2. Removed non-green part numbers from ordering information.