Obsolete Device

28C64A

64K (8K x 8) CMOS EEPROM

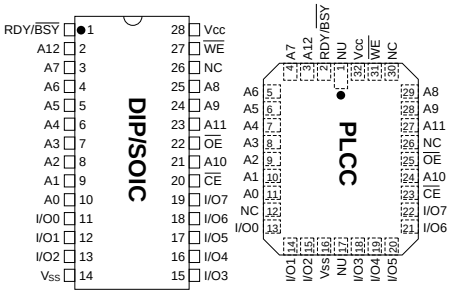
FEATURES

- Fast Read Access Time—150 ns
- CMOS Technology for Low Power Dissipation
  - 30 mA Active
  - 100 µA Standby
- Fast Byte Write Time—200 µs or 1 ms
- Data Retention >200 years
- High Endurance - Minimum 100,000 Erase/Write Cycles
- Automatic Write Operation
  - Internal Control Timer
  - Auto-Clear Before Write Operation
  - On-Chip Address and Data Latches
- Data Polling
- Ready/Busy
- Chip Clear Operation
- Enhanced Data Protection
  - VCC Detector
  - Pulse Filter
  - Write Inhibit
- Electronic Signature for Device Identification
- 5-Volt-Only Operation
- Organized 8Kx8 JEDEC Standard Pinout
  - 28-pin Dual-In-Line Package
  - 32-pin PLCC Package
  - 28-pin SOIC Package
- Available for Extended Temperature Ranges:
  - Commercial: 0°C to +70°C
  - Industrial: -40°C to +85°C

DESCRIPTION

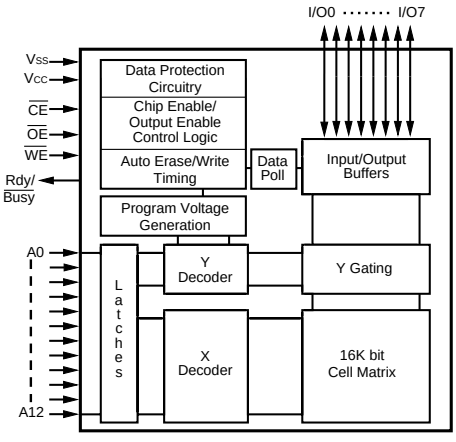
The Microchip Technology Inc. 28C64A is a CMOS 64K non-volatile electrically Erasable PROM. The 28C64A is accessed like a static RAM for the read or write cycles without the need of external components. During a “byte write”, the address and data are latched internally, freeing the microprocessor address and data bus for other operations. Following the initiation of write cycle, the device will go to a busy state and automatically clear and write the latched data using an internal control timer. To determine when the write cycle is complete, the user has a choice of monitoring the Ready/Busy output or using Data polling. The Ready/Busy pin is an open drain output, which allows easy configuration in wired-or systems. Alternatively, Data polling allows the user to read the location last written to when the write operation is complete. CMOS design and processing enables this part to be used in systems where reduced power consumption and reliability are required. A complete family of packages is offered to provide the utmost flexibility in applications.

PACKAGE TYPES



● Pin 1 indicator on PLCC on top of package

BLOCK DIAGRAM



1.0 ELECTRICAL CHARACTERISTICS

1.1 MAXIMUM RATINGS*

V_{CC} and input voltages w.r.t. V_{SS} ..... -0.6V to + 6.25V

Voltage on $\overline{OE}$ w.r.t. V_{SS} ..... -0.6V to +13.5V

Voltage on A9 w.r.t. V_{SS} ..... -0.6V to +13.5V

Output Voltage w.r.t. V_{SS} ..... -0.6V to V_{CC}+0.6V

Storage temperature ..... -65°C to +125°C

Ambient temp. with power applied ..... -50°C to +95°C

***Notice:** Stresses above those listed under "Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

TABLE 1-1: PIN FUNCTION TABLE

Name	Function
A0 - A12	Address Inputs
$\overline{CE}$	Chip Enable
$\overline{OE}$	Output Enable
$\overline{WE}$	Write Enable
I/O0 - I/O7	Data Inputs/Outputs
RDY/$\overline{Busy}$	Ready/$\overline{Busy}$
V_{CC}	+5V Power Supply
V_{SS}	Ground
NC	No Connect; No Internal Connection
NU	Not Used; No External Connection is Allowed

TABLE 1-2: READ/WRITE OPERATION DC CHARACTERISTIC

				V_{CC} = +5V ±10% Commercial (C): Tamb = 0°C to +70°C Industrial (I): Tamb = -40°C to +85°C		
Parameter	**Status**	**Symbol**	**Min**	**Max**	**Units**	**Conditions**
Input Voltages	Logic '1' Logic '0'	V_{IH} V_{IL}	2.0 -0.1	Vcc+1 0.8	V V	
Input Leakage	—	I_{LI}	-10	10	µA	V_{IN} = -0.1V to Vcc +1
Input Capacitance	—	C_{IN}	—	10	pF	V_{IN} = 0V; Tamb = 25°C; f = 1 MHz (Note 2)
Output Voltages	Logic '1' Logic '0'	V_{OH} V_{OL}	2.4	 0.45	V V	I_{OH} = -400 µA I_{OL} = 2.1 mA
Output Leakage	—	I_{LO}	-10	10	µA	V_{OUT} = -0.1V to Vcc +0.1V
Output Capacitance	—	C_{OUT}	—	12	pF	V_{IN} = 0V; Tamb = 25°C; f = 1 MHz (Note 2)
Power Supply Current, Active	TTL input	I_{CC}	—	30	mA	f = 5 MHz (Note 1) V_{CC} = 5.5V
Power Supply Current, Standby	TTL input TTL input CMOS input	$I_{CC(S)TTL}$ $I_{CC(S)TTL}$ $I_{CC(S)CMOS}$	—	2 3 100	mA mA µA	$\overline{CE}$ = V_{IH} (0°C to +70°C) $\overline{CE}$ = V_{IH} (-40°C to +85°C) $\overline{CE}$ = V_{CC}-0.3 to Vcc +1 $\overline{OE}$ = $\overline{WE}$ = Vcc All other inputs equal V_{CC} or V_{SS}

Note 1: AC power supply current above 5MHz: 2mA/MHz.

2: Not 100% tested.

TABLE 1-3: READ OPERATION AC CHARACTERISTICS

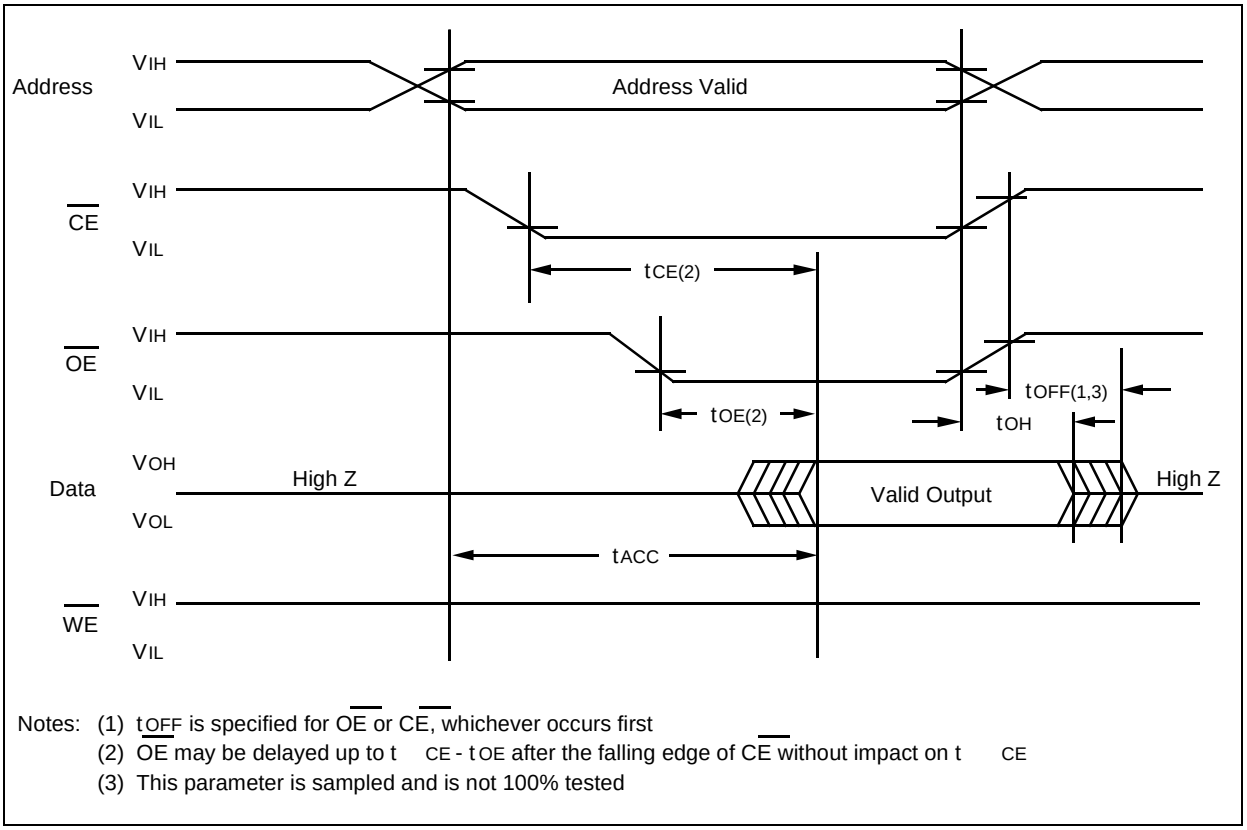
AC Testing Waveform:	V_{IH} = 2.4V; V_{IL} = 0.45V; V_{OH} = 2.0V; V_{OL} = 0.8V	
Output Load:	1 TTL Load + 100 pF	
Input Rise and Fall Times:	20 ns	
Ambient Temperature:	Commercial (C):	Tamb = 0°C to +70°C
	Industrial (I):	Tamb = -40°C to +85°C

Parameter	Symbol	28C64A-15		28C64A-20		28C64A-25		Units	Conditions
		Min	Max	Min	Max	Min	Max		
Address to Output Delay	t_{ACC}	—	150	—	200	—	250	ns	$\overline{OE}$ = $\overline{CE}$ = V_{IL}
$\overline{CE}$ to Output Delay	t_{CE}	—	150	—	200	—	250	ns	$\overline{OE}$ = V_{IL}
$\overline{OE}$ to Output Delay	t_{OE}	—	70	—	80	—	100	ns	$\overline{CE}$ = V_{IL}
$\overline{CE}$ or $\overline{OE}$ High to Output Float	t_{OFF}	0	50	0	55	0	70	ns	(Note 1)
Output Hold from Address, $\overline{CE}$ or $\overline{OE}$, whichever occurs first.	t_{OH}	0	—	0	—	0	—	ns	(Note 1)
Endurance	—	1M	—	1M	—	1M	—	cycles	25°C, Vcc = 5.0V, Block Mode (Note 2)

Note 1: Not 100% tested.

2: This parameter is not tested but guaranteed by characterization. For endurance estimates in a specific application, please consult the Total Endurance Model which can be obtained on our BBS or website.

FIGURE 1-1: READ WAVEFORMS



Notes: (1) $t_{\overline{OFF}}$ is specified for $\overline{OE}$ or $\overline{CE}$, whichever occurs first

(2) $\overline{OE}$ may be delayed up to $t_{CE} - t_{OE}$ after the falling edge of $\overline{CE}$ without impact on t_{CE}

(3) This parameter is sampled and is not 100% tested

TABLE 1-4: BYTE WRITE AC CHARACTERISTICS

	AC Testing Waveform:	V_{IH} = 2.4V; V_{IL} = 0.45V; V_{OH} = 2.0V; V_{OL} = 0.8V			
	Output Load:	1 TTL Load + 100 pF			
	Input Rise/Fall Times:	20 ns			
	Ambient Temperature:	Commercial (C): Tamb = 0°C to +70°C Industrial (I): Tamb = -40°C to +85°C			
Parameter	**Symbol**	**Min**	**Max**	**Units**	**Remarks**
Address Set-Up Time	t_{AS}	10	—	ns	
Address Hold Time	t_{AH}	50	—	ns	
Data Set-Up Time	t_{DS}	50	—	ns	
Data Hold Time	t_{DH}	10	—	ns	
Write Pulse Width	t_{WPL}	100	—	ns	Note 1
Write Pulse High Time	t_{WPH}	50	—	ns	
$\overline{OE}$ Hold Time	t_{OEH}	10	—	ns	
$\overline{OE}$ Set-Up Time	t_{OES}	10	—	ns	
Data Valid Time	t_{DV}	—	1000	ns	Note 2
Time to Device Busy	t_{DB}	2	50	ns	
Write Cycle Time (28C64A)	t_{WC}	—	1	ms	0.5 ms typical
Write Cycle Time (28C64AF)	t_{WC}	—	200	µs	100 µs typical

Note 1: A write cycle can be initiated be $\overline{CE}$ or $\overline{WE}$ going low, whichever occurs last. The data is latched on the positive edge $\overline{WE}$, whichever occurs first.

2: Data must be valid within 1000ns max. after a write cycle is initiated and must be stable at least until t_{DH} after the positive edge of $\overline{WE}$ or $\overline{CE}$, whichever occurs first.

FIGURE 1-2: PROGRAMMING WAVEFORMS

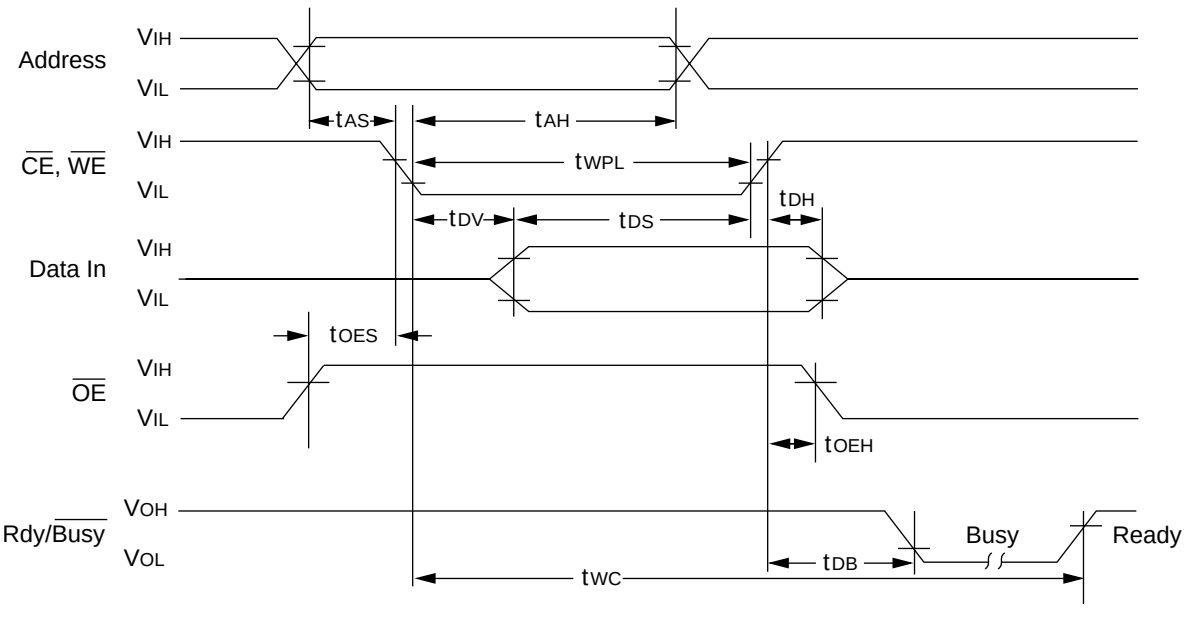


FIGURE 1-3: $\overline{\text{DATA}}$ POLLING WAVEFORMS

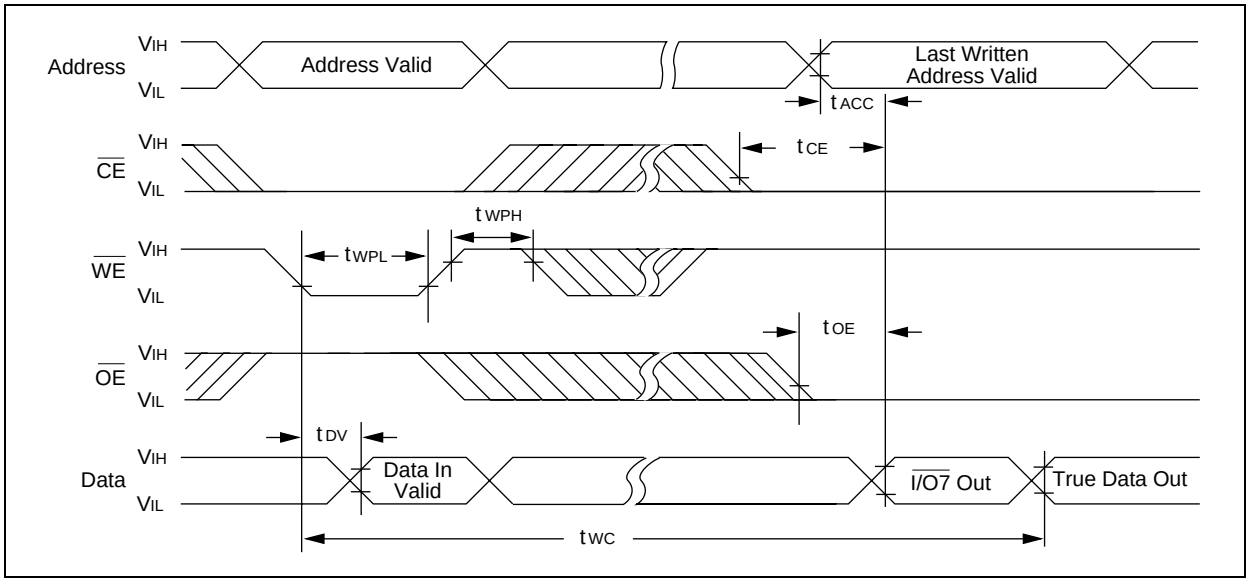


FIGURE 1-4: CHIP CLEAR WAVEFORMS

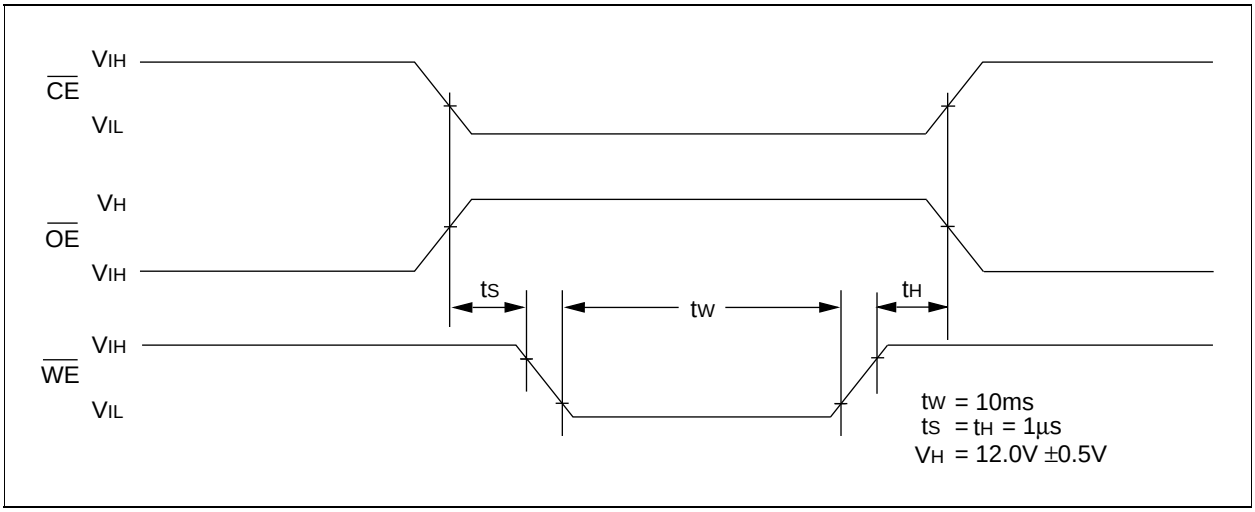


TABLE 1-5: SUPPLEMENTARY CONTROL

Mode	$\overline{\text{CE}}$	$\overline{\text{OE}}$	$\overline{\text{WE}}$	A9	Vcc	I/Oi
Chip Clear	VIL	VIH	VIL	X	Vcc	
Extra Row Read	VIL	VIL	VIH	A9 = VH	Vcc	Data Out
Extra Row Write	*	VIH	*	A9 = VH	Vcc	Data In

Note: VH = 12.0V±0.5V. *Pulsed per programming waveforms.

2.0 DEVICE OPERATION

The Microchip Technology Inc. 28C64A has four basic modes of operation—read, standby, write inhibit, and byte write—as outlined in the following table.

Operation Mode	$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	I/O	Rdy/$\overline{Busy}$ (1)
Read	L	L	H	DOUT	H
Standby	H	X	X	High Z	H
Write Inhibit	H	X	X	High Z	H
Write Inhibit	X	L	X	High Z	H
Write Inhibit	X	X	H	High Z	H
Byte Write	L	H	L	DIN	L
Byte Clear	Automatic Before Each “Write”				

Note 1: Open drain output.
2: X = Any TTL level.

2.1 Read Mode

The 28C64A has two control functions, both of which must be logically satisfied in order to obtain data at the outputs. Chip enable ($\overline{CE}$) is the power control and should be used for device selection. Output Enable ($\overline{OE}$) is the output control and is used to gate data to the output pins independent of device selection. Assuming that addresses are stable, address access time (tACC) is equal to the delay from $\overline{CE}$ to output (tCE). Data is available at the output tOE after the falling edge of $\overline{OE}$, assuming that $\overline{CE}$ has been low and addresses have been stable for at least tACC-tOE.

2.2 Standby Mode

The 28C64A is placed in the standby mode by applying a high signal to the $\overline{CE}$ input. When in the standby mode, the outputs are in a high impedance state, independent of the $\overline{OE}$ input.

2.3 Data Protection

In order to ensure data integrity, especially during critical power-up and power-down transitions, the following enhanced data protection circuits are incorporated:

First, an internal VCC detect (3.3 volts typical) will inhibit the initiation of non-volatile programming operation when VCC is less than the VCC detect circuit trip.

Second, there is a $\overline{WE}$ filtering circuit that prevents $\overline{WE}$ pulses of less than 10 ns duration from initiating a write cycle.

Third, holding $\overline{WE}$ or $\overline{CE}$ high or $\overline{OE}$ low, inhibits a write cycle during power-on and power-off (VCC).

2.4 Write Mode

The 28C64A has a write cycle similar to that of a Static RAM. The write cycle is completely self-timed and initiated by a low going pulse on the $\overline{WE}$ pin. On the falling edge of $\overline{WE}$, the address information is latched. On rising edge, the data and the control pins ($\overline{CE}$ and $\overline{OE}$) are latched. The Ready/$\overline{Busy}$ pin goes to a logic low level indicating that the 28C64A is in a write cycle which signals the microprocessor host that the system bus is free for other activity. When Ready/$\overline{Busy}$ goes back to a high, the 28C64A has completed writing and is ready to accept another cycle.

2.5 $\overline{Data}$ Polling

The 28C64A features $\overline{Data}$ polling to signal the completion of a byte write cycle. During a write cycle, an attempted read of the last byte written results in the data complement of I/O7 (I/O0 to I/O6 are indeterminable). After completion of the write cycle, true data is available. $\overline{Data}$ polling allows a simple read/compare operation to determine the status of the chip eliminating the need for external hardware.

2.6 Electronic Signature for Device Identification

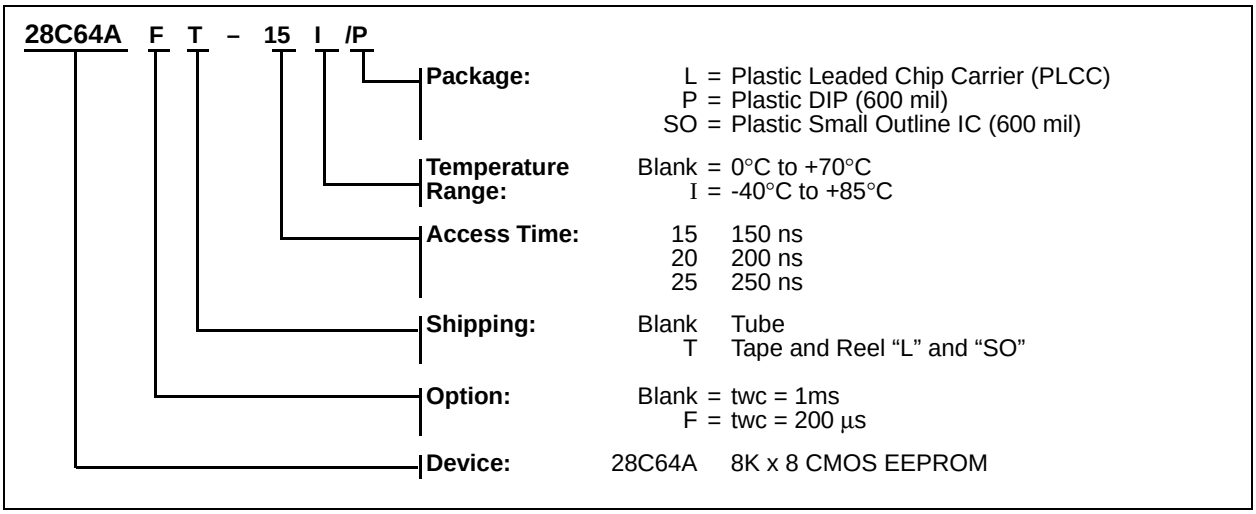
An extra row of 32 bytes of EEPROM memory is available to the user for device identification. By raising A9 to 12V ±0.5V and using address locations 1FEO to 1FFF, the additional bytes can be written to or read from in the same manner as the regular memory array.

2.7 Chip Clear

All data may be cleared to 1's in a chip clear cycle by raising $\overline{OE}$ to 12 volts and bringing the $\overline{WE}$ and $\overline{CE}$ low. This procedure clears all data, except for the extra row.

28C64A Product Identification System

To order or to obtain information, e.g., on pricing or delivery, please use the listed part numbers, and refer to the factory or the listed sales offices.



NOTES:

Note the following details of the code protection feature on Microchip devices:

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break Microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

QUALITY MANAGEMENT SYSTEM
CERTIFIED BY DNV
ISO/TS 16949:2002

Microchip received ISO/TS-16949:2002 quality system certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona and Mountain View, California in October 2003. The Company's quality system processes and procedures are for its PICmicro® 8-bit MCUs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 certified.

WORLDWIDE SALES AND SERVICE

AMERICAS

Corporate Office
2355 West Chandler Blvd.
Chandler, AZ 85224-6199
Tel: 480-792-7200
Fax: 480-792-7277
Technical Support: 480-792-7627
Web Address: www.microchip.com

Atlanta
3780 Mansell Road, Suite 130
Alpharetta, GA 30022
Tel: 770-640-0034
Fax: 770-640-0307

Boston
2 Lan Drive, Suite 120
Westford, MA 01886
Tel: 978-692-3848
Fax: 978-692-3821

Chicago
333 Pierce Road, Suite 180
Itasca, IL 60143
Tel: 630-285-0071
Fax: 630-285-0075

Dallas
16200 Addison Road, Suite 255
Addison Plaza
Addison, TX 75001
Tel: 972-818-7423
Fax: 972-818-2924

Detroit
Tri-Atria Office Building
32255 Northwestern Highway, Suite 190
Farmington Hills, MI 48334
Tel: 248-538-2250
Fax: 248-538-2260

Kokomo
2767 S. Albright Road
Kokomo, IN 46902
Tel: 765-864-8360
Fax: 765-864-8387

Los Angeles
25950 Acero St., Suite 200
Mission Viejo, CA 92691
Tel: 949-462-9523
Fax: 949-462-9608

San Jose
1300 Terra Bella Avenue
Mountain View, CA 94043
Tel: 650-215-1444
Fax: 650-961-0286

Toronto
6285 Northam Drive, Suite 108
Mississauga, Ontario L4V 1X5, Canada
Tel: 905-673-0699
Fax: 905-673-6509

ASIA/PACIFIC

Australia
Microchip Technology Australia Pty Ltd
Unit 32 41 Rawson Street
Epping 2121, NSW
Sydney, Australia
Tel: 61-2-9868-6733
Fax: 61-2-9868-6755

China - Beijing
Unit 706B
Wan Tai Bei Hai Bldg.
No. 6 Chaoyangmen Bei Str.
Beijing, 100027, China
Tel: 86-10-85282100
Fax: 86-10-85282104

China - Chengdu
Rm. 2401-2402, 24th Floor,
Ming Xing Financial Tower
No. 88 TIDU Street
Chengdu 610016, China
Tel: 86-28-86766200
Fax: 86-28-86766599

China - Fuzhou
Unit 28F, World Trade Plaza
No. 71 Wusi Road
Fuzhou 350001, China
Tel: 86-591-7503506
Fax: 86-591-7503521

China - Hong Kong SAR
Unit 901-6, Tower 2, Metroplaza
223 Hing Fong Road
Kwai Fong, N.T., Hong Kong
Tel: 852-2401-1200
Fax: 852-2401-3431

China - Shanghai
Room 701, Bldg. B
Far East International Plaza
No. 317 Xian Xia Road
Shanghai, 200051
Tel: 86-21-6275-5700
Fax: 86-21-6275-5060

China - Shenzhen
Rm. 1812, 18/F, Building A, United Plaza
No. 5022 Binhe Road, Futian District
Shenzhen 518033, China
Tel: 86-755-82901380
Fax: 86-755-8295-1393

China - Shunde
Room 401, Hongjian Building, No. 2
Fengxiangnan Road, Ronggui Town, Shunde
District, Foshan City, Guangdong 528303, China
Tel: 86-757-28395507 Fax: 86-757-28395571

China - Qingdao
Rm. B505A, Fullhope Plaza,
No. 12 Hong Kong Central Rd.
Qingdao 266071, China
Tel: 86-532-5027355 Fax: 86-532-5027205

India
Divyasree Chambers
1 Floor, Wing A (A3/A4)
No. 11, O'Shaugnessey Road
Bangalore, 560 025, India
Tel: 91-80-22290061 Fax: 91-80-22290062

Japan
Yusen Shin Yokohama Building 10F
3-17-2, Shin Yokohama, Kohoku-ku,
Yokohama, Kanagawa, 222-0033, Japan
Tel: 81-45-471- 6166 Fax: 81-45-471-6122

Korea
168-1, Youngbo Bldg. 3 Floor
Samsung-Dong, Kangnam-Ku
Seoul, Korea 135-882
Tel: 82-2-554-7200 Fax: 82-2-558-5932 or
82-2-558-5934

Singapore
200 Middle Road
#07-02 Prime Centre
Singapore, 188980
Tel: 65-6334-8870 Fax: 65-6334-8850

Taiwan
Kaohsiung Branch
30F - 1 No. 8
Min Chuan 2nd Road
Kaohsiung 806, Taiwan
Tel: 886-7-536-4816
Fax: 886-7-536-4817

Taiwan
Taiwan Branch
11F-3, No. 207
Tung Hua North Road
Taipei, 105, Taiwan
Tel: 886-2-2717-7175 Fax: 886-2-2545-0139

Taiwan
Taiwan Branch
13F-3, No. 295, Sec. 2, Kung Fu Road
Hsinchu City 300, Taiwan
Tel: 886-3-572-9526
Fax: 886-3-572-6459

EUROPE

Austria
Durisolstrasse 2
A-4600 Wels
Austria
Tel: 43-7242-2244-399
Fax: 43-7242-2244-393

Denmark
Regus Business Centre
Lautrup hoj 1-3
Ballerup DK-2750 Denmark
Tel: 45-4420-9895 Fax: 45-4420-9910

France
Parc d'Activite du Moulin de Massy
43 Rue du Saule Trapu
Batiment A - ler Etage
91300 Massy, France
Tel: 33-1-69-53-63-20
Fax: 33-1-69-30-90-79

Germany
Steinheilstrasse 10
D-85737 Ismaning, Germany
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Italy
Via Salvatore Quasimodo, 12
20025 Legnano (MI)
Milan, Italy
Tel: 39-0331-742611
Fax: 39-0331-466781

Netherlands
Waegenburghtplein 4
NL-5152 JR, Drunen, Netherlands
Tel: 31-416-690399
Fax: 31-416-690340

United Kingdom
505 Eskdale Road
Winnersh Triangle
Wokingham
Berkshire, England RG41 5TU
Tel: 44-118-921-5869
Fax: 44-118-921-5820

07/12/04