28LV64A

64K (8K x 8) Low Voltage CMOS EEPROM

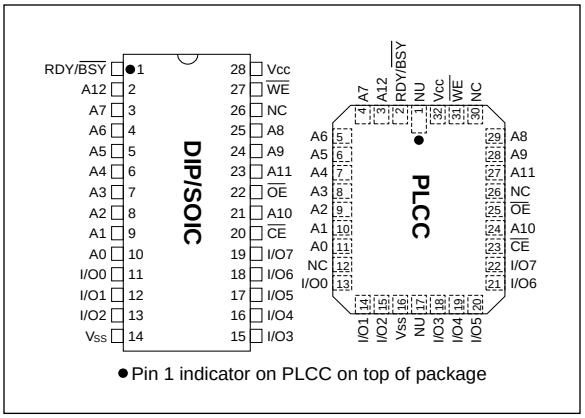
FEATURES

- 2.7V to 3.6V Supply
- Read Access Time—300 ns
- CMOS Technology for Low Power Dissipation
  - 8 mA Active
  - 50 µA CMOS Standby Current
- Byte Write Time—3 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
- $\overline{\text{Data}}$ Polling
- Ready/$\overline{\text{Busy}}$
- Chip Clear Operation
- Enhanced Data Protection
  - V_{CC} Detector
  - Pulse Filter
  - Write Inhibit
- Electronic Signature for Device Identification
- Organized 8Kx8 JEDEC Standard Pinout
  - 28-pin Dual-In-Line Package
  - 32-pin Chip Carrier (Leadless or Plastic)
- Available for Extended Temperature Ranges:
  - Commercial: 0˚C to +70˚C
  - Industrial: -40˚C to +85˚C

DESCRIPTION

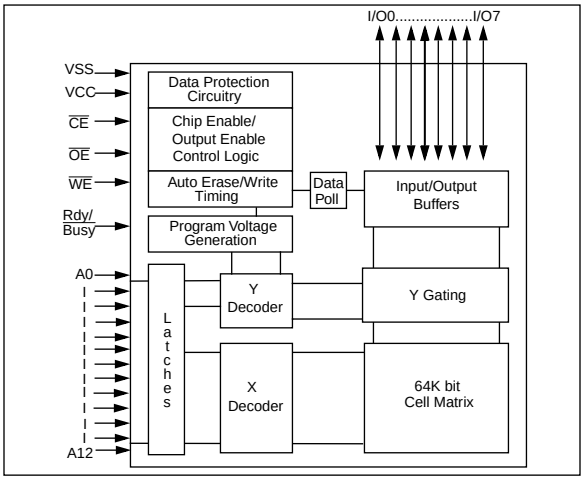
The Microchip Technology Inc. 28LV64A is a CMOS 64K non-volatile electrically Erasable PROM organized as 8K words by 8 bits. The 28LV64A is accessed like a static RAM for the read or write cycles without the need of external components. During a “byte write”, the address and data are latched internally, 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/$\overline{\text{Busy}}$ output or using $\overline{\text{Data}}$ polling. The Ready/$\overline{\text{Busy}}$ pin is an open drain output, which allows easy configuration in ‘wired-or’ systems. Alternatively, $\overline{\text{Data}}$ 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

MAXIMUM RATINGS*

VCC and input voltages w.r.t. VSS ..... -0.6V to + 6.25V

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

Voltage on A9 w.r.t. VSS ..... -0.6V to +13.5V

Output Voltage w.r.t. VSS ..... -0.6V to VCC+0.6V

Storage temperature ..... -65˚C to +150˚C

Ambient temp. with power applied ..... -55°C to +125°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 FUCTION 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/$\overline{Busy}$
VCC	+ Power Supply
VSS	Ground
NC	No Connect; No Internal Connection
NU	Not Used; No External Connection is Allowed

TABLE 1-2: READ/WRITE OPERATION DC CHARACTERISTICS

	VCC = 2.7 to 3.6V 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 “2”	VIH VIL	2.0	 0.6	V V	
Input Leakage	—	ILI	—	5	µA	VIN = 0V to VCC+1
Input Capacitance	—	CIN	—	6	pF	Vin = 0V; Tamb = 25°C; f = 1 MHz (Note 1)
Output Voltages	Logic “1” Logic “0”	VOH VOL	2.0	 0.3	V V	IOH = -100µA IOL = 1.0 mA I0L = 2.0 mA for RDY/$\overline{Busy}$
Output Leakage	—	ILO	—	5	µA	VOUT = 0V to VCC+0.1V
Output Capacitance	—	COUT	—	12	pF	VOUT = 0V; Tamb = 25°C; f = 1 MHz (Note 1)
Power Supply Current, Activity	TTL input	ICC	—	8	mA	f = 5 MHz (Note 2) IO = OmA VCC = 3.3 $\overline{CE}$ = VIL
Power Supply Current, Standby	TTL input TTL input CMOS input	ICC(S)TTL ICC(S)TTL ICC(S)CMOS	—	2 3 100	mA mA µA	$\overline{CE}$ = VIH (0°C to 70°C°) $\overline{CE}$ = VIH (-40°C to 85°C°) $\overline{CE}$ = VCC -3.0 to VCC+1 $\overline{OE}$ = $\overline{WE}$ = VCC All other inputs equal VCC or VSS
Note 1: Not 100% tested. 2: AC power supply current above 5 MHz: 2 mA/Mhz.						

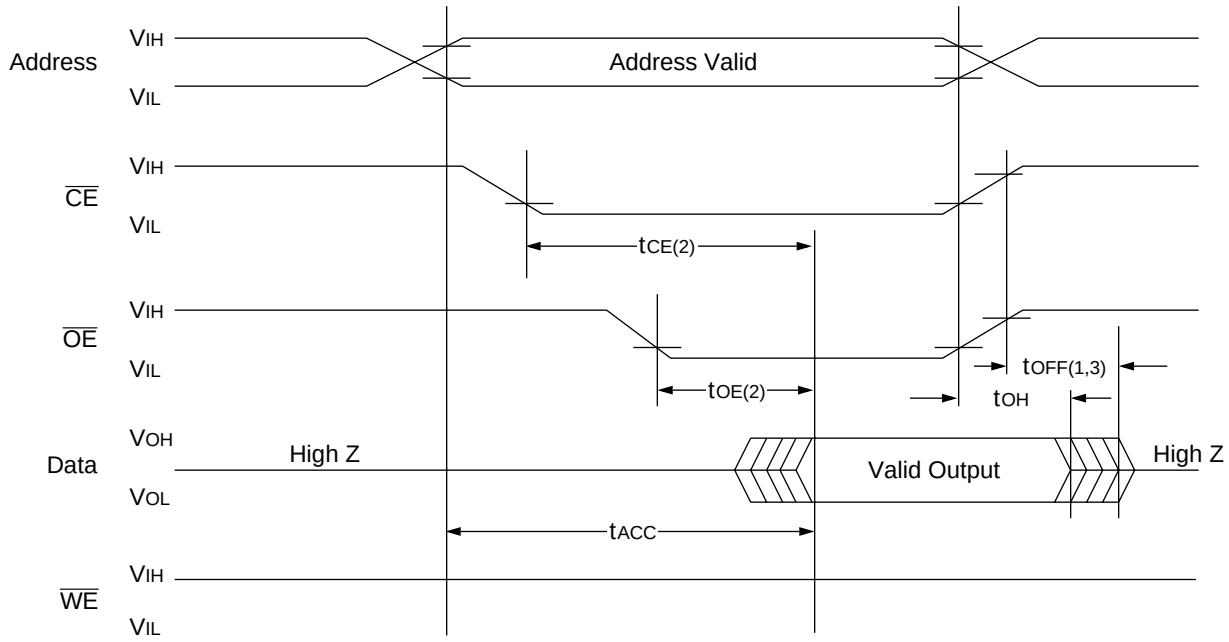
TABLE 1-3: READ OPERATION AC CHARACTERISTICS

	AC Testing Waveform:	V_{IH} = 2.0V; V_{IL} = 0.6V; V_{OH} = V_{OL} = V_{CC}/2			
	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	**Sym**	**28LV64-30**		**Units**	**Conditions**
		Min	**Max**		
Address to Output Delay	t_{ACC}	—	300	ns	$\overline{OE}$ = $\overline{CE}$ = V_{IL}
$\overline{CE}$ to Output Delay	t_{CE}	—	300	ns	$\overline{OE}$ = V_{IL}
$\overline{OE}$ to Output Delay	t_{OE}	—	150	ns	$\overline{CE}$ = V_{IL}
$\overline{CE}$ or $\overline{OE}$ High to Output Float	t_{OFF}	0	60	ns	(Note 1)
Output Hold from Address, $\overline{CE}$ or $\overline{OE}$, whichever occurs first.	t_{OH}	0	—	ns	(Note 1)
Endurance	—	10M	—	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_{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} = 2.0V; V_{IL} = 0.6V; V_{OH} = V_{OL} = V_{CC}/2			
	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	**Sym**	**Min**	**Max**	**Units**	**Remarks**
Address Set-Up Time	t_{AS}	10		ns	
Address Hold Time	t_{AH}	100		ns	
Data Set-Up Time	t_{DS}	120		ns	
Data Hold Time	t_{DH}	10		ns	
Write Pulse Width	t_{WPL}	150		ns	(Note 1)
$\overline{OE}$ 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}		50	ns	
Write Cycle Time (28LV64A)	t_{WC}		3	ms	1.5 ms 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 of $\overline{CE}$ or $\overline{WE}$, 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

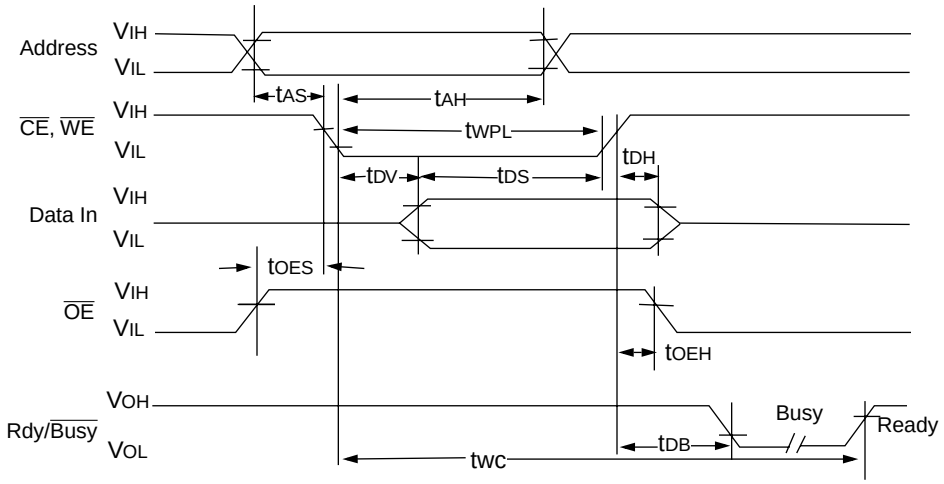


FIGURE 1-3: $\overline{DATA}$ POLLING WAVEFORMS

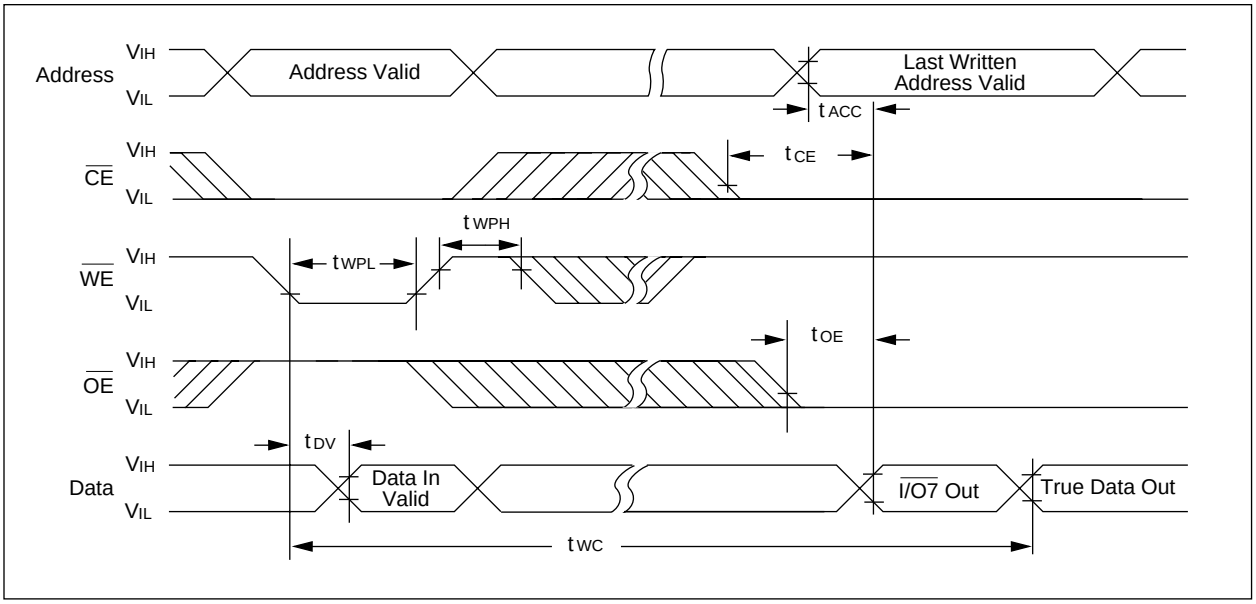


FIGURE 1-4: CHIP CLEAR WAVEFORMS

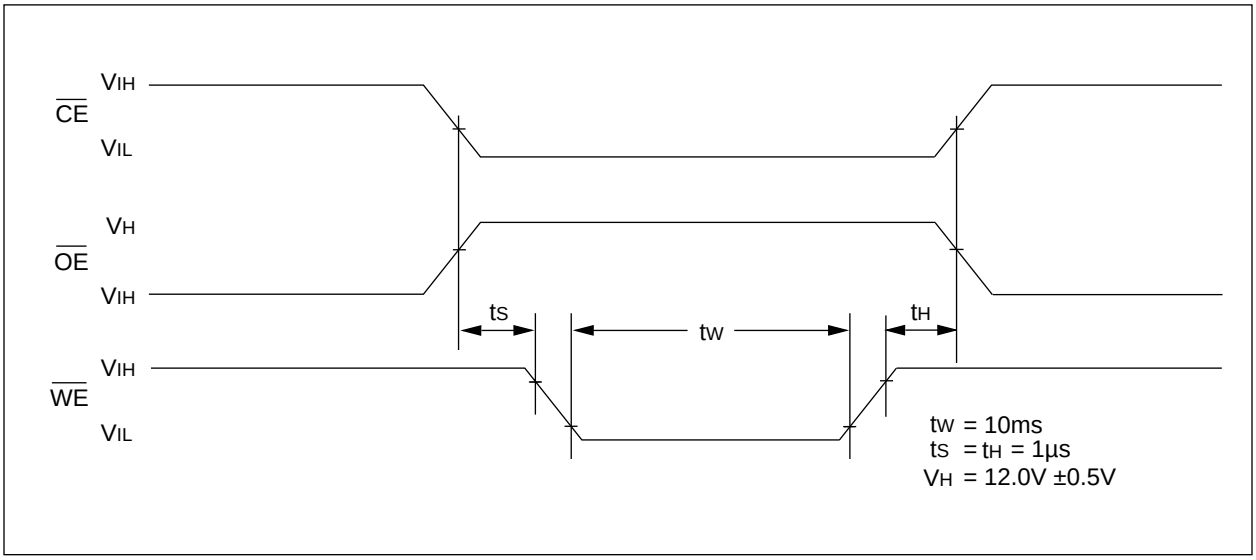


TABLE 1-5: SUPPLEMENTARY CONTROL

Mode	$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	AI	VCC	I/OI
Chip Clear	VIL	VH		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						

2.0 DEVICE OPERATION

The Microchip Technology Inc. 28LV64A 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.

2.1 Read Mode

The 28LV64A 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 (t_{ACC}) is equal to the delay from $\overline{CE}$ to output ($t_{\overline{CE}}$). Data is available at the output t_{OE} after the falling edge of $\overline{OE}$, assuming that $\overline{CE}$ has been low and addresses have been stable for at least t_{ACC}-t_{OE}.

2.2 Standby Mode

The 28LV64A 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 V_{CC} detect (2.0 volts typical) will inhibit the initiation of non-volatile programming operation when V_{CC} is less than the V_{CC} detect circuit trip.

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

2.4 Write Mode

The 28LV64A 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 28LV64A 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 28LV64A has completed writing and is ready to accept another cycle.

2.5 $\overline{Data}$ Polling

The 28LV64A 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 can not be determined). After completion of the write cycle, true data is available. 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

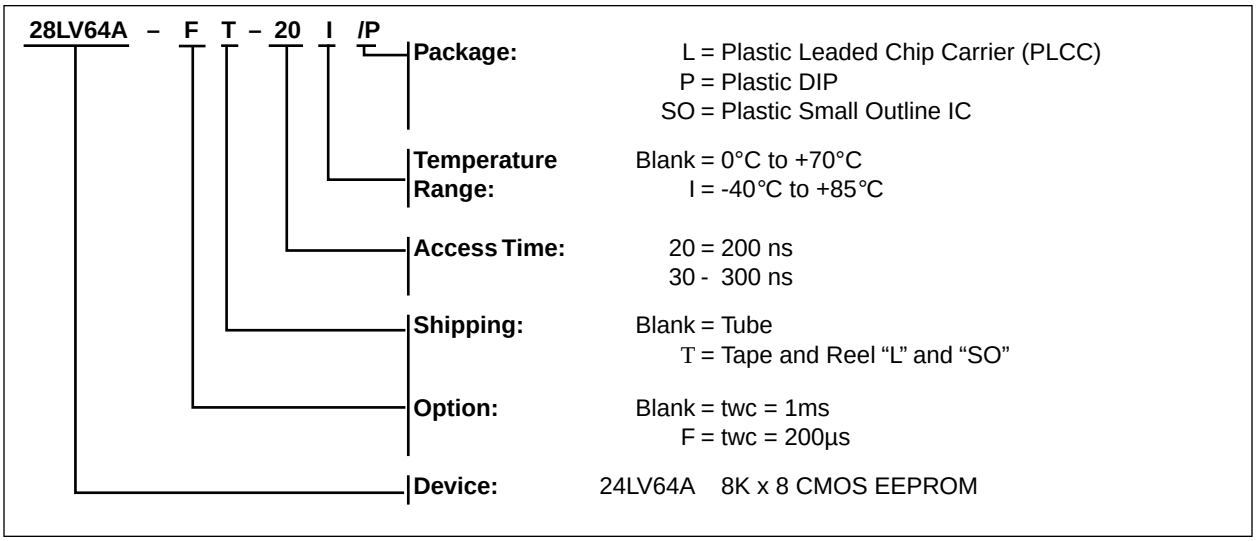
An extra row of 32 bytes of EEPROM memory is available to the user for device identification. By raising A9 to 12V ±0.5V and using address locations 1FEO to 1FFF, the additional bytes can be written to or read from in the same manner as the regular memory array.

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 CE low. This procedure clears all data, except for the extra row.

28LV64A 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.



Note the following details of the code protection feature on PICmicro® MCUs.

- The PICmicro family meets the specifications contained in the Microchip Data Sheet.
- Microchip believes that its family of PICmicro microcontrollers is one of the most secure products 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 PICmicro microcontroller in a manner outside the operating specifications contained in the data sheet. The person doing so may be 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 product.

If you have any further questions about this matter, please contact the local sales office nearest to you.

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Microchip received QS-9000 quality system certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona in July 1999. The Company’s quality system processes and procedures are QS-9000 compliant for its PICmicro® 8-bit MCUs, KEELOQ® code hopping devices, Serial EEPROMs and microperipheral products. In addition, Microchip’s quality system for the design and manufacture of development systems is ISO 9001 certified.

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