WCMA4008C1X

512K x 8 Static RAM

Features

- **Voltage Range**
  - **4.5V–5.5V**
- **Low active power**
  - **Typical active current: 2.5 mA @ f = 1 MHz**
  - **Typical active current: 12.5 mA @ f = f_{max}**
- **Low standby current**
- **Automatic power-down when deselected**
- **TTL-compatible inputs and outputs**
- **Easy memory expansion with $\overline{CE}$ and $\overline{OE}$ features**
- **CMOS for optimum speed/power**

Functional Description

The WCMA4008C1X is a high-performance CMOS static RAM organized as 512K words by 8 bits. Easy memory expansion is provided by an active LOW Chip Enable ($\overline{CE}$), an active LOW Output Enable ($\overline{OE}$), and three-state drivers. This device has an automatic power-down feature that reduces power consumption by more than 99% when deselected.

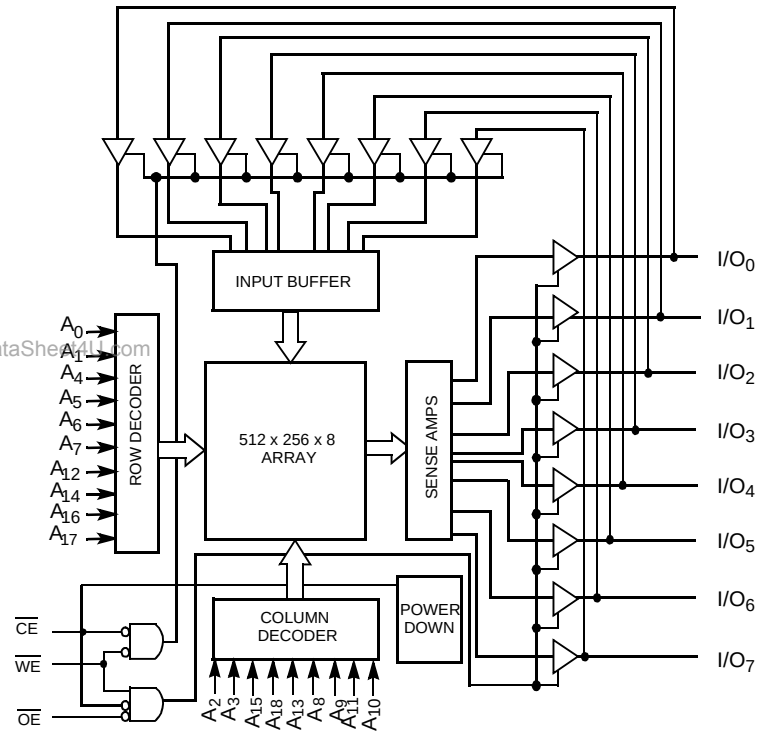
Writing to the device is accomplished by taking Chip Enable ($\overline{CE}$) and Write Enable ($\overline{WE}$) inputs LOW. Data on the eight I/O pins (I/O_0 through I/O_7) is then written into the location specified on the address pins (A_0 through A_{18}).

Reading from the device is accomplished by taking Chip Enable ($\overline{CE}$) and Output Enable ($\overline{OE}$) LOW while forcing Write Enable ($\overline{WE}$) HIGH for read. Under these conditions, the contents of the memory location specified by the address pins will appear on the I/O pins.

The eight input/output pins (I/O_0 through I/O_7) are placed in a high-impedance state when the device is deselected ($\overline{CE}$ HIGH), the outputs are disabled ($\overline{OE}$ HIGH), or during a write operation ($\overline{CE}$ LOW, and $\overline{WE}$ LOW).

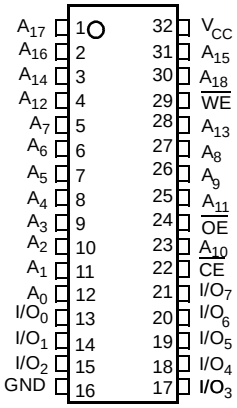
The WCMA4008C1X is available in a standard 32-pin 450-mil-wide body width SOIC.

Logic Block Diagram



Pin Configuration

Top View
SOIC



Maximum Ratings

(Above which the useful life may be impaired. For user guidelines, not tested.)

Storage Temperature ..... –65°C to +150°C

Ambient Temperature with Power Applied..... –55°C to +125°C

Supply Voltage on V_{CC} to Relative GND ..... –0.5V to +7.0V

DC Voltage Applied to Outputs in High Z State[1] ..... –0.5V to V_{CC} +0.5V

DC Input Voltage[1]..... –0.5V to V_{CC} +0.5V

Current into Outputs (LOW)..... 20 mA

Static Discharge Voltage..... 2001V (per MIL-STD-883, Method 3015)

Latch-Up Current ..... >200 mA

Product Portfolio

Product	V_{CC} Range			Speed	Temp.	Power Dissipation			
						Operating, Icc		Standby (I_{SB2})	
						f = f_{max}			
	Min.	Typ.	Max.			Typ.[3]	Max.	Typ.[2]	Max.
WCMA4008C1X	4.5 V	5.0V	5.5V	70 ns	Ind'l	12.5 mA	20 mA	4 µA	20 µA

Operating Range

Range	Ambient Temperature	V_{CC}
Industrial	–40°C to +85°C	4.5V–5.5V

Notes:

1. V_{IL} (min.) = –2.0V for pulse durations of less than 20 ns.
2. Typical values are measured at V_{CC} = 5V, T_A = 25°C, and are included for reference only and are not tested or guaranteed.

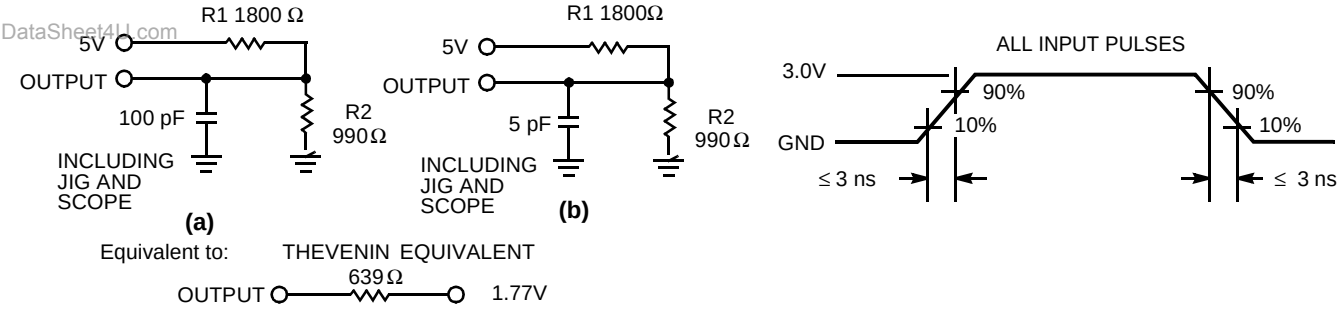
Electrical Characteristics Over the Operating Range

Parameter	Description	Test Conditions		WCMA4008C1X Min.	Typ.[2]	Max.	Unit
V_{OH}	Output HIGH Voltage	V_{CC} = Min., I_{OH} = – 1 mA		2.4			V
V_{OL}	Output LOW Voltage	V_{CC} = Min., I_{OL} = 2.1 mA				0.4	V
V_{IH}	Input HIGH Voltage			2.2		V_{CC}+0.3	V
V_{IL}	Input LOW Voltage			–0.3		0.8	V
I_{IX}	Input Leakage Current	GND ≤ V_I ≤ V_{CC}		–1		+1	µA
I_{OZ}	Output Leakage Current	GND ≤ V_I ≤ V_{CC}, Output Disabled		–1		+1	µA
I_{CC}	V_{CC} Operating Supply Current	f = f_{MAX} = 1/t_{RC}	I_{OUT} =0 mA V_{CC} = Max.,		12.5	20	mA
		f = 1 MHz			2.5		mA
I_{SB1}	Automatic CE Power-Down Current —TTL Inputs	Max. V_{CC}, $\overline{CE}$ ≥ V_{IH} V_{IN} ≥ V_{IH} or V_{IN} ≤ V_{IL}, f = f_{MAX}				1.5	mA
I_{SB2}	Automatic CE Power-Down Current —CMOS Inputs	Max. V_{CC}, $\overline{CE}$ ≥ V_{CC} – 0.3V, V_{IN} ≥ V_{CC} – 0.3V, or V_{IN} ≤ 0.3V, f =0			4	20	µA

Capacitance[3]

Parameter	Description	Test Conditions	Max.	Unit
C_{IN}	Input Capacitance	T_A = 25°C, f = 1 MHz, V_{CC} = 5.0V	6	pF
C_{OUT}	Output Capacitance		8	pF

AC Test Loads and Waveforms



Note:
3. Tested initially and after any design or process changes that may affect these parameters.

Switching Characteristics[4] Over the Operating Range

Parameter	Description	WCMA4008C1X		Unit
		Min.	Max.	
READ CYCLE				
t_{RC}	Read Cycle Time	70		ns
t_{AA}	Address to Data Valid		70	ns
t_{OHA}	Data Hold from Address Change	10		ns
t_{ACE}	$\overline{CE}$ LOW to Data Valid		70	ns
t_{DOE}	$\overline{OE}$ LOW to Data Valid		35	ns
t_{LZOE}	$\overline{OE}$ LOW to Low Z[5]	5		ns
t_{HZOE}	$\overline{OE}$ HIGH to High Z[5, 6]		25	ns
t_{LZCE}	$\overline{CE}$ LOW to Low Z[5]	10		ns
t_{HZCE}	$\overline{CE}$ HIGH to High Z[5, 6]		25	ns
t_{PU}	$\overline{CE}$ LOW to Power-Up	0		ns
t_{PD}	$\overline{CE}$ HIGH to Power-Down		70	ns
WRITE CYCLE[7]				
t_{WC}	Write Cycle Time	70		ns
t_{SCE}	$\overline{CE}$ LOW to Write End	60		ns
t_{AW}	Address Set-Up to Write End	60		ns
t_{HA}	Address Hold from Write End	0		ns
t_{SA}	Address Set-Up to Write Start	0		ns
t_{PWE}	$\overline{WE}$ Pulse Width	55		ns
t_{SD}	Data Set-Up to Write End	30		ns
t_{HD}	Data Hold from Write End	0		ns
t_{LZWE}	$\overline{WE}$ HIGH to Low Z[5]	5		ns
t_{HZWE}	$\overline{WE}$ LOW to High Z[5, 6]		25	ns

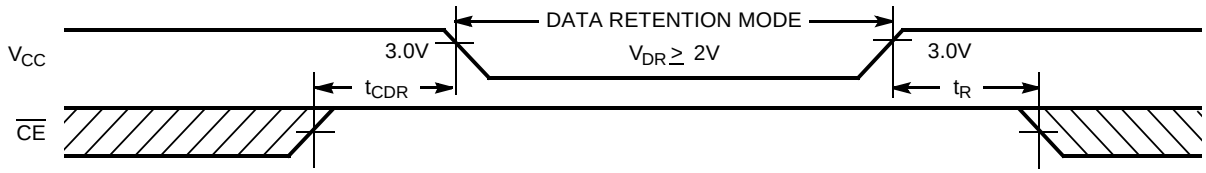
Notes:

4. Test conditions assume signal transition time of 5 ns or less, timing reference levels of 1.5V, input pulse levels of 0 to 3.0V, and output loading of the specified I_{OL}/I_{OH} and 100-pF load capacitance.
5. At any given temperature and voltage condition, t_{HZCE} is less than t_{LZCE}, t_{HZOE} is less than t_{LZOE}, and t_{HZWE} is less than t_{LZWE} for any given device.
6. t_{HZOE}, t_{HZCE}, and t_{HZWE} are specified with a load capacitance of 5 pF as in part (b) of AC Test Loads. Transition is measured ±500 mV from steady-state voltage.
7. The internal write time of the memory is defined by the overlap of $\overline{CE}$ LOW, and $\overline{WE}$ LOW. $\overline{CE}$ and $\overline{WE}$ must be LOW to initiate a write, and the transition of any of these signals can terminate the write. The input data set-up and hold timing should be referenced to the leading edge of the signal that terminates the write.

Data Retention Characteristics (Over the Operating Range)

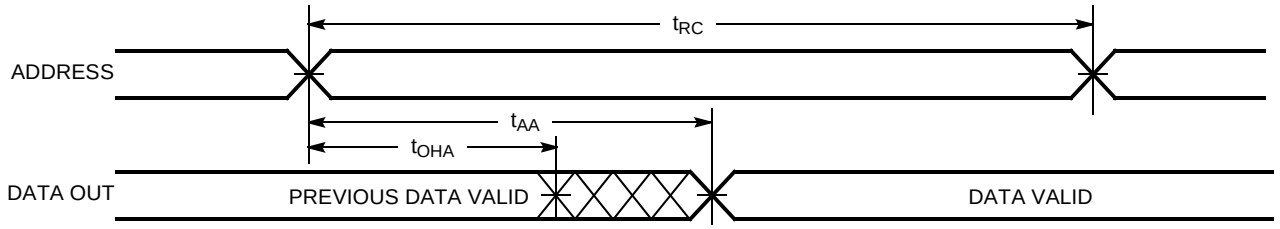
Parameter	Description	Conditions	Min.	Typ.[2]	Max.	Unit
V_{DR}	V_{CC} for Data Retention		2.0			V
I_{CCDR}	Data Retention Current	No input may exceed V_{CC} + 0.3V $\underline{V_{CC}} = V_{DR} = 3.0V$ $\overline{CE} > V_{CC} - 0.3V$ $V_{IN} > V_{CC} - 0.3V$ or $V_{IN} < 0.3V$			20	µA
t_{CDR}[3]	Chip Deselect to Data Retention Time		0			ns
t_R[8]	Operation Recovery Time		t_{RC}			ns

Data Retention Waveform

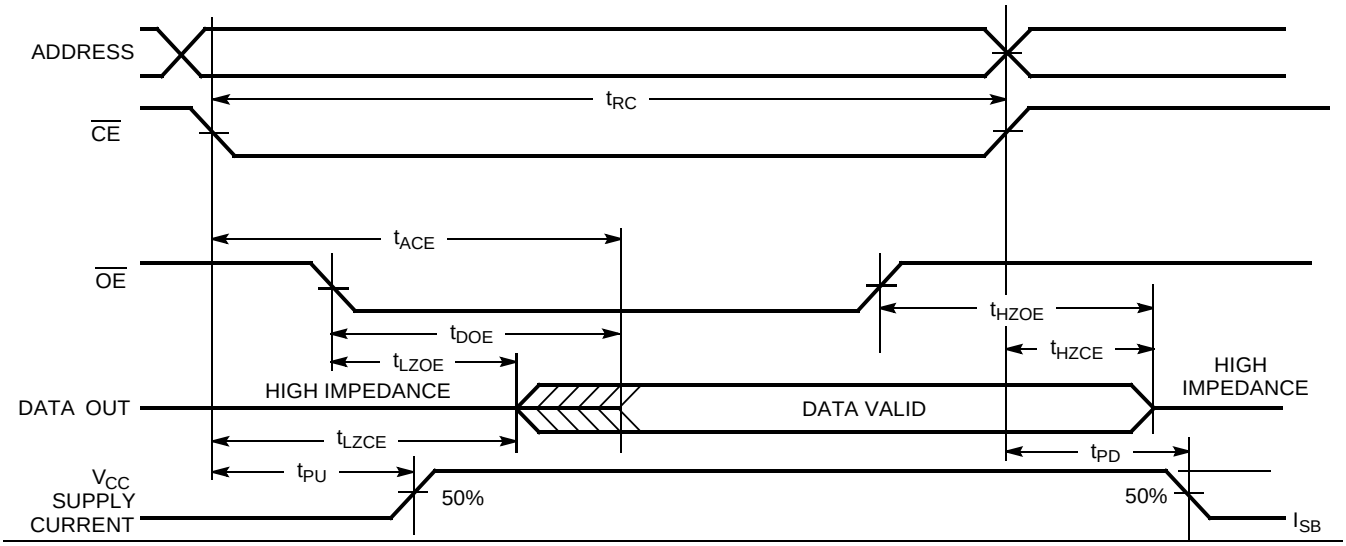


Switching Waveforms

Read Cycle No.1[9, 10]



Read Cycle No. 2 ($\overline{OE}$ Controlled)[10, 11]

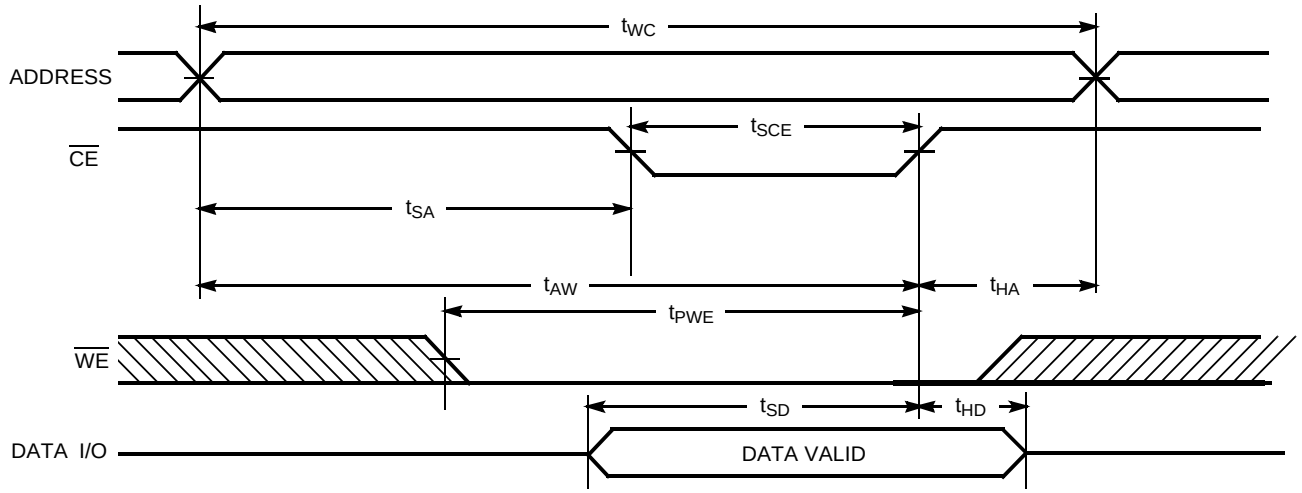


Notes:

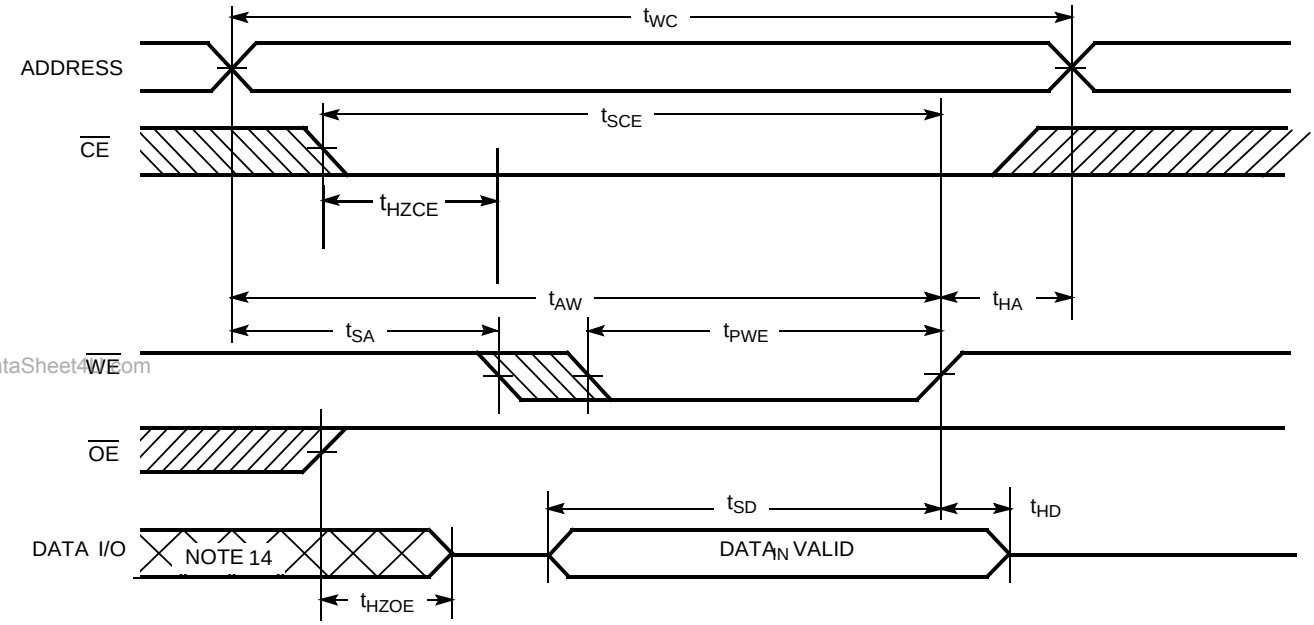
8. Full Device operatin requires linear V_{CC} ramp from V_{DR} to $V_{CC(min)} \geq 100$ µs or stable at $V_{cc(min)} \geq 100$ µs.
9. Device is continuously selected. $\overline{OE}$, $\overline{CE}$ = V_{IL}.
10. $\overline{WE}$ is HIGH for read cycle.
11. Address valid prior to or coincident with $\overline{CE}$ transition LOW.

Switching Waveforms (continued)

Write Cycle No. 1 ($\overline{CE}$ Controlled)[12]



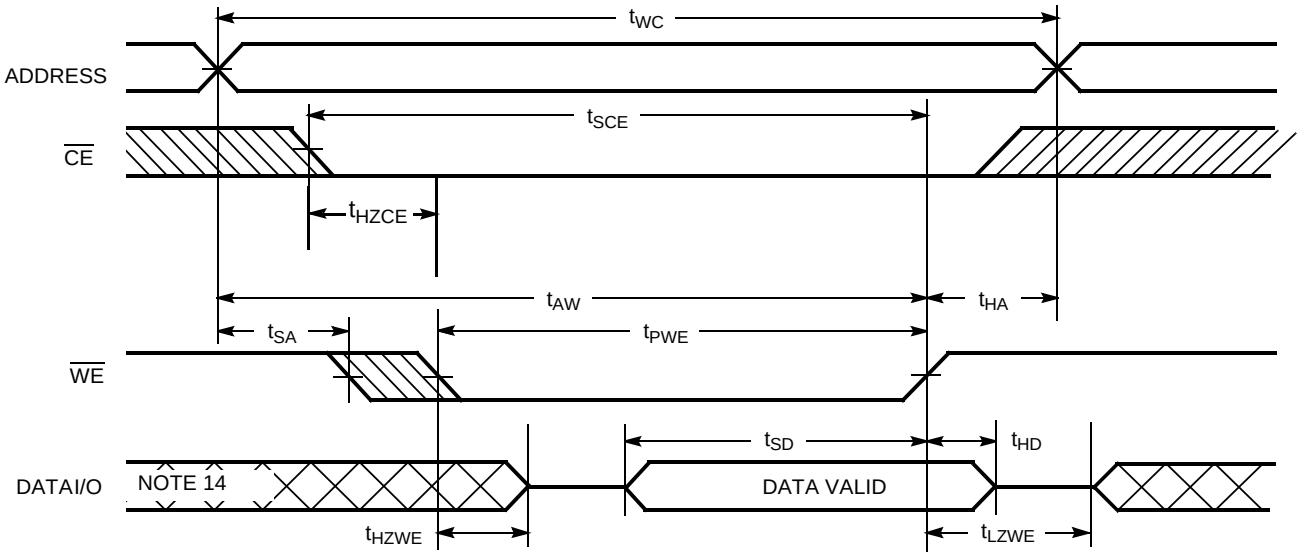
Write Cycle No. 2 ($\overline{WE}$ Controlled, $\overline{OE}$ HIGH During Write)[12, 13]



Notes:
12. If $\overline{CE}$ goes HIGH simultaneously with $\overline{WE}$ going HIGH, the output remains in a high-impedance state.
13. Data I/O is high-impedance if $\overline{OE}$ = V_{IH}.
14. During this period the I/Os are in the output state and input signals should not be applied.

Switching Waveforms (continued)

Write Cycle No.3 ($\overline{WE}$ Controlled, $\overline{OE}$ LOW)[12, 13]



Truth Table

$\overline{CE}$	$\overline{OE}$	$\overline{WE}$	$I/O_0 - I/O_7$	Mode	Power
H	X	X	High Z	Power-Down	Standby (I_{SB})
L	L	H	Data Out	Read	Active (I_{CC})
L	X	L	Data In	Write	Active (I_{CC})
L	H	H	High Z	Selected, Outputs Disabled	Active (I_{CC})

Ordering Information

Speed (ns)	Ordering Code	Package Name	Package Type	Operating Range
70	WCMA4008C1X-GF70	G32	32-Lead (450-Mil) Molded SOIC	Industrial

Package Diagrams

32-Lead (450 MIL) Molded SOIC, G32