





## ABSOLUTE MAXIMUM RATINGS (1)

Parameter		Unit
Operating Temperature	-55 to +125	°C
Supply Voltage Range (V <sub>CC</sub> )	-2.0 to +7.0	V
Signal voltage range (any pin except A9) (2)	-2.0 to +7.0	V
Storage Temperature Range	-65 to +150	°C
Lead Temperature (soldering, 10 seconds)	+300	°C
Data Retention Mil Temp	10 years	
Endurance (write/erase cycles) Mil Temp	10,000 cycles min.	
A <sub>9</sub> Voltage for sector protect (V <sub>IO</sub> ) (3)	-2.0 to +14.0	V

### NOTES:

- Stresses above the absolute maximum rating may cause permanent damage to the device. Extended operation at the maximum levels may degrade performance and affect reliability.
- Minimum DC voltage on input or I/O pins is -0.5V. During voltage transitions, inputs may overshoot V<sub>SS</sub> to -2.0 V for periods of up to 20ns. Maximum DC voltage on output and I/O pins is V<sub>CC</sub> + 0.5V. During voltage transitions, outputs may overshoot to V<sub>CC</sub> + 2.0 V for periods of up to 20ns.
- Minimum DC input voltage on A<sub>9</sub> pin is -0.5V. During voltage transitions, A<sub>9</sub> may overshoot V<sub>SS</sub> to -2V for periods of up to 20ns. Maximum DC input voltage on A<sub>9</sub> is +13.5V which may overshoot to 14.0 V for periods up to 20ns.

## RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Max	Unit
Supply Voltage	V <sub>CC</sub>	4.5	5.5	V
Input High Voltage	V <sub>IH</sub>	2.0	V <sub>CC</sub> + 0.3	V
Input Low Voltage	V <sub>IL</sub>	-0.5	+0.8	V
Operating Temp. (Mil.)	T <sub>A</sub>	-55	+125	°C
A <sub>9</sub> Voltage for Sector Protect	V <sub>IO</sub>	11.5	12.5	V

## CAPACITANCE

(T<sub>A</sub> = +25°C)

Parameter	Symbol	Conditions	Max	Unit
OE capacitance	C <sub>OE</sub>	V <sub>IN</sub> = 0 V, f = 1.0 MHz	100	pF
WE capacitance	C <sub>WE</sub>	V <sub>IN</sub> = 0 V, f = 1.0 MHz	20	pF
CS capacitance	C <sub>CS</sub>	V <sub>IN</sub> = 0 V, f = 1.0 MHz	20	pF
Data I/O capacitance	C <sub>I/O</sub>	V <sub>I/O</sub> = 0 V, f = 1.0 MHz	20	pF
Address input capacitance	C <sub>AD</sub>	V <sub>IN</sub> = 0 V, f = 1.0 MHz	100	pF

This parameter is guaranteed by design but not tested.

## DC CHARACTERISTICS - CMOS COMPATIBLE

(V<sub>CC</sub> = 5.0V, V<sub>SS</sub> = 0V, T<sub>A</sub> = -55°C to +125°C)

Parameter	Symbol	Conditions	Min	Max	Unit
Input Leakage Current	I <sub>LI</sub>	V <sub>CC</sub> = 5.5, V <sub>IN</sub> = GND to V <sub>CC</sub>		10	μA
Output Leakage Current	I <sub>LOx32</sub>	V <sub>CC</sub> = 5.5, V <sub>IN</sub> = GND to V <sub>CC</sub>		10	μA
V <sub>CC</sub> Active Current for Read (1)	I <sub>CC1</sub>	$\overline{CS} = V_{IL}, \overline{OE} = V_{IH}$		280	mA
V <sub>CC</sub> Active Current for Program or Erase (2)	I <sub>CC2</sub>	$\overline{CS} = V_{IL}, \overline{OE} = V_{IH}$		400	mA
V <sub>CC</sub> Standby Current	I <sub>CC3</sub>	V <sub>CC</sub> = 5.5, $\overline{CS} = V_{IH}, f = 5\text{MHz}$		13	mA
V <sub>CC</sub> Static Current	I <sub>CC4</sub>	V <sub>CC</sub> = 5.5, $\overline{CS} = V_{IH}$		1.2	mA
Output Low Voltage	V <sub>OL</sub>	I <sub>OL</sub> = 12.0 mA, V <sub>CC</sub> = 4.5		0.45	V
Output High Voltage	V <sub>OH1</sub>	I <sub>OH</sub> = -2.5 mA, V <sub>CC</sub> = 4.5	0.85 x V <sub>CC</sub>		V
Output High Voltage	V <sub>OH2</sub>	I <sub>OH</sub> = -100 μA, V <sub>CC</sub> = 4.5	V <sub>CC</sub> - 0.4		V
Low V <sub>CC</sub> Lock Out Voltage	V <sub>LKO</sub>		3.2		V

### NOTES:

- The I<sub>CC</sub> current listed includes both the DC operating current and the frequency dependent component (at 5 MHz). The frequency component typically is less than 2 mA/MHz, with  $\overline{OE}$  at V<sub>IH</sub>.
- I<sub>CC</sub> active while Embedded Algorithm (program or erase) is in progress.
- DC test conditions: V<sub>IL</sub> = 0.3V, V<sub>IH</sub> = V<sub>CC</sub> - 0.3V

**AC CHARACTERISTICS – WRITE/ERASE/PROGRAM OPERATIONS,  $\overline{WE}$  CONTROLLED**(V<sub>CC</sub> = 5.0V, V<sub>SS</sub> = 0V, T<sub>A</sub> = -55°C to +125°C)

Parameter	Symbol		-60		-70		-90		-120		-150		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
Write Cycle Time	t <sub>AVAV</sub>	t <sub>WC</sub>	60		70		90		120		150		ns
Chip Select Setup Time	t <sub>ELWL</sub>	t <sub>CS</sub>	0		0		0		0		0		ns
Write Enable Pulse Width	t <sub>WLWH</sub>	t <sub>WP</sub>	30		35		45		50		50		ns
Address Setup Time	t <sub>AVWL</sub>	t <sub>AS</sub>	0		0		0		0		0		ns
Data Setup Time	t <sub>DVWH</sub>	t <sub>DS</sub>	30		30		45		50		50		ns
Data Hold Time	t <sub>WHDX</sub>	t <sub>DH</sub>	0		0		0		0		0		ns
Address Hold Time	t <sub>WLAX</sub>	t <sub>AH</sub>	45		45		45		50		50		ns
Chip Select Hold Time	t <sub>WHEH</sub>	t <sub>CH</sub>	0		0		0		0		0		ns
Write Enable Pulse Width High	t <sub>WHWL</sub>	t <sub>WPH</sub>	20		20		20		20		20		ns
Duration of Byte Programming Operation (min)	t <sub>WHWH1</sub>		14		14		14		14		14		μs
Chip and Sector Erase Time	t <sub>WHWH2</sub>		2.2	60	2.2	60	2.2	60	2.2	60	2.2	60	sec
Read Recovery Time Before Write	t <sub>GHWL</sub>		0		0		0		0		0		ns
V <sub>CC</sub> Setup Time		t <sub>VCS</sub>	50		50		50		50		50		μs
Chip Programming Time				12.5		12.5		12.5		12.5		12.5	sec
Output Enable Setup Time		t <sub>OES</sub>	0		0		0		0		0		ns
Output Enable Hold Time (1)		t <sub>OEH</sub>	10		10		10		10		10		ns

1. For Toggle and Data Polling.

**AC CHARACTERISTICS – READ ONLY OPERATIONS**(V<sub>CC</sub> = 5.0V, V<sub>SS</sub> = 0V, T<sub>A</sub> = -55°C to +125°C)

Parameter	Symbol		-60		-70		-90		-120		-150		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
Read Cycle Time	t <sub>AVAV</sub>	t <sub>RC</sub>	60		70		90		120		150		ns
Address Access Time	t <sub>AVQV</sub>	t <sub>ACC</sub>		60		70		90		120		150	ns
Chip Select Access Time	t <sub>ELQV</sub>	t <sub>CE</sub>		60		70		90		120		150	ns
$\overline{OE}$ to Output Valid	t <sub>GLQV</sub>	t <sub>OE</sub>		30		35		40		50		55	ns
Chip Select to Output High Z (1)	t <sub>EHQZ</sub>	t <sub>DF</sub>		20		20		25		30		35	ns
$\overline{OE}$ High to Output High Z (1)	t <sub>GHQZ</sub>	t <sub>DF</sub>		20		20		25		30		35	ns
Output Hold from Address, $\overline{CS}$ or $\overline{OE}$ Change, whichever is first	t <sub>AXQX</sub>	t <sub>OH</sub>	0		0		0		0		0		ns

1. Guaranteed by design, not tested.

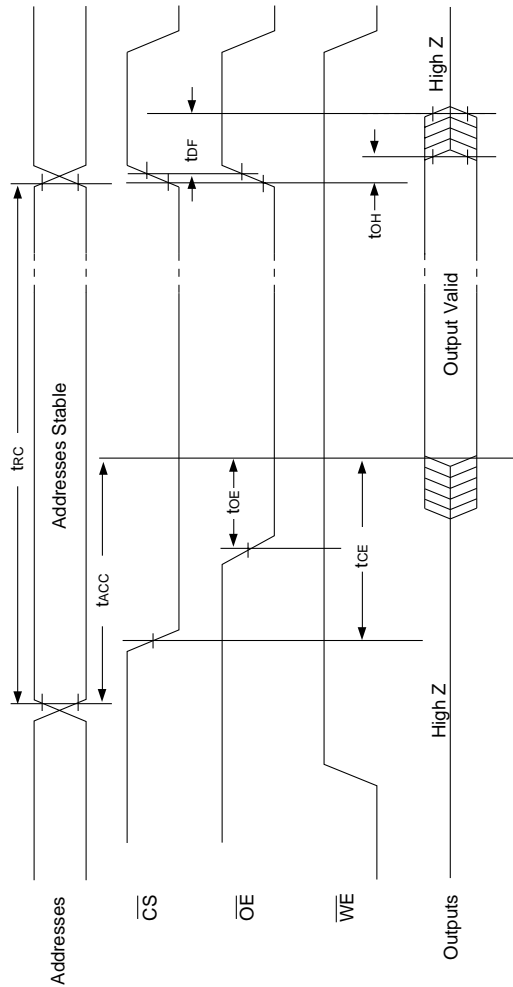


**AC CHARACTERISTICS – WRITE/ERASE/PROGRAM OPERATIONS,  $\overline{CS}$  CONTROLLED**  
 (V<sub>CC</sub> = 5.0V, V<sub>SS</sub> = 0V, T<sub>A</sub> = -55°C to +125°C)

Parameter	Symbol		-60		-70		-90		-120		-150		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
Write Cycle Time	t <sub>AVAV</sub>	t <sub>WC</sub>	60		70		90		120		150		ns
$\overline{WE}$ Setup Time	t <sub>WLLEL</sub>	t <sub>WS</sub>	0		0		0		0		0		ns
$\overline{CS}$ Pulse Width	t <sub>ELEH</sub>	t <sub>CP</sub>	30		35		45		50		50		ns
Address Setup Time	t <sub>AVEL</sub>	t <sub>AS</sub>	0		0		0		0		0		ns
Data Setup Time	t <sub>DVEH</sub>	t <sub>DS</sub>	30		30		45		50		50		ns
Data Hold Time	t <sub>EHDX</sub>	t <sub>DH</sub>	0		0		0		0		0		ns
Address Hold Time	t <sub>ELAX</sub>	t <sub>AH</sub>	45		45		45		50		50		ns
$\overline{WE}$ Hold from $\overline{WE}$ High	t <sub>EHWH</sub>	t <sub>WH</sub>	0		0		0		0		0		ns
$\overline{CS}$ Pulse Width High	t <sub>EHEL</sub>	t <sub>CPH</sub>	20		20		20		20		20		ns
Duration of Programming Operation	t <sub>WHWH1</sub>		14		14		14		14		14		μs
Duration of Erase Operation	t <sub>WHWH2</sub>		2.2	60	2.2	60	2.2	60	2.2	60	2.2	60	sec
Read Recovery before Write	t <sub>GHLEL</sub>		0		0		0		0		0		ns
Chip Programming Time				12.5		12.5		12.5		12.5		12.5	sec



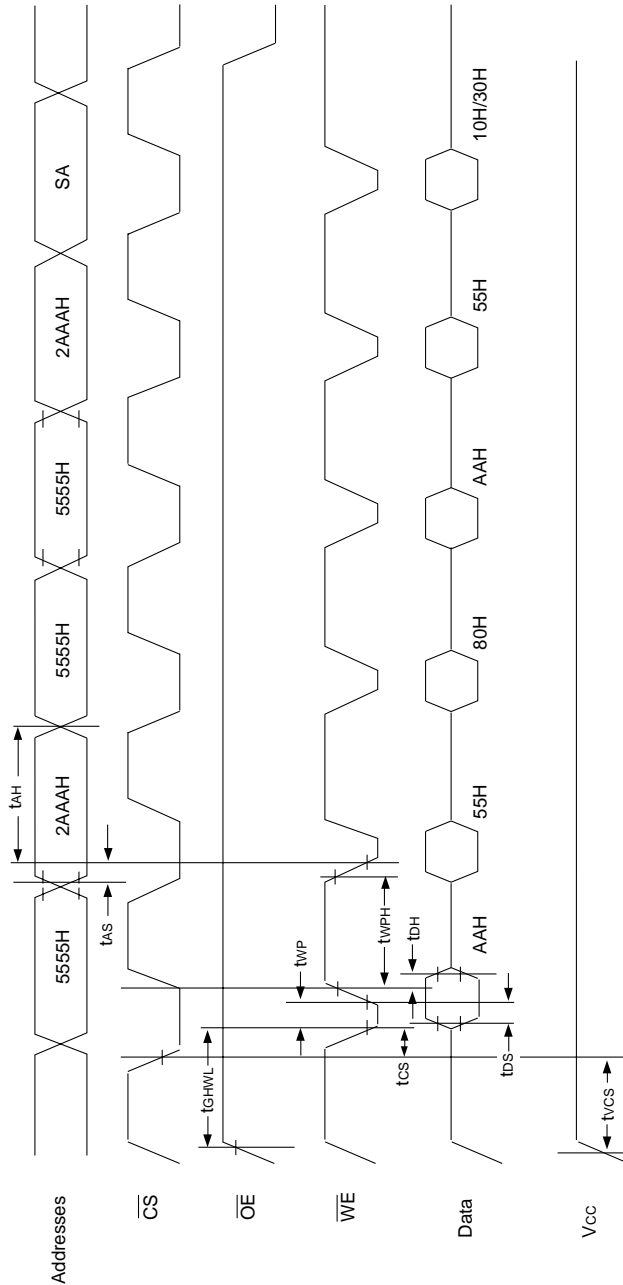
**FIG. 2**  
AC WAVEFORMS FOR READ OPERATIONS







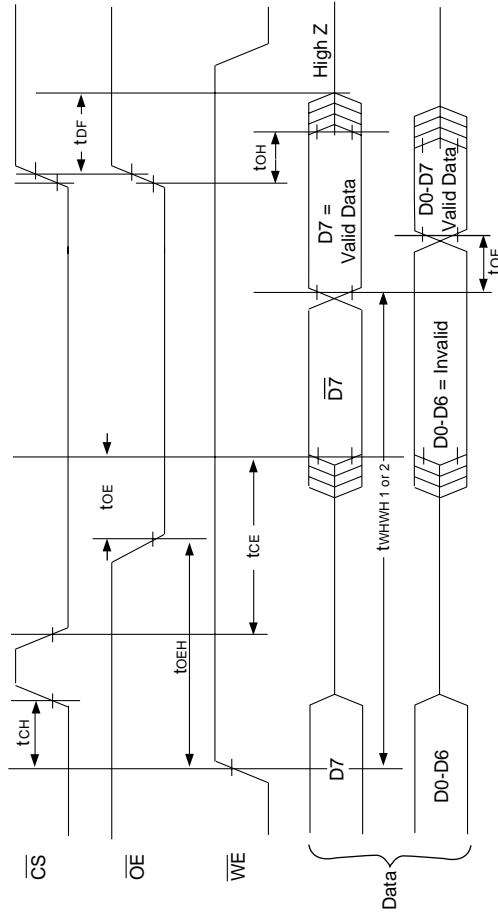
**FIG. 4**  
**AC WAVEFORMS CHIP/SECTOR ERASE OPERATIONS**



- NOTES:**
1. SA is the sector address for Sector Erase.



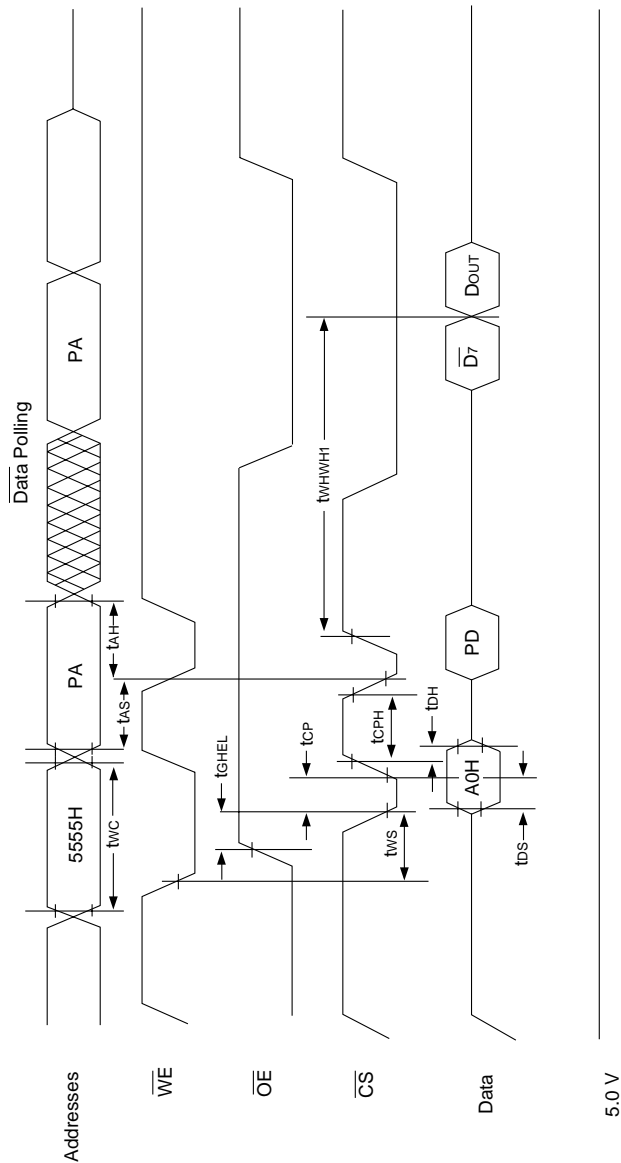
**FIG. 5**  
AC WAVEFORMS FOR DATA POLLING DURING  
EMBEDDED ALGORITHM OPERATIONS







**FIG. 6**  
**WRITE/ERASE/PROGRAM OPERATION,  $\overline{CS}$  CONTROLLED**

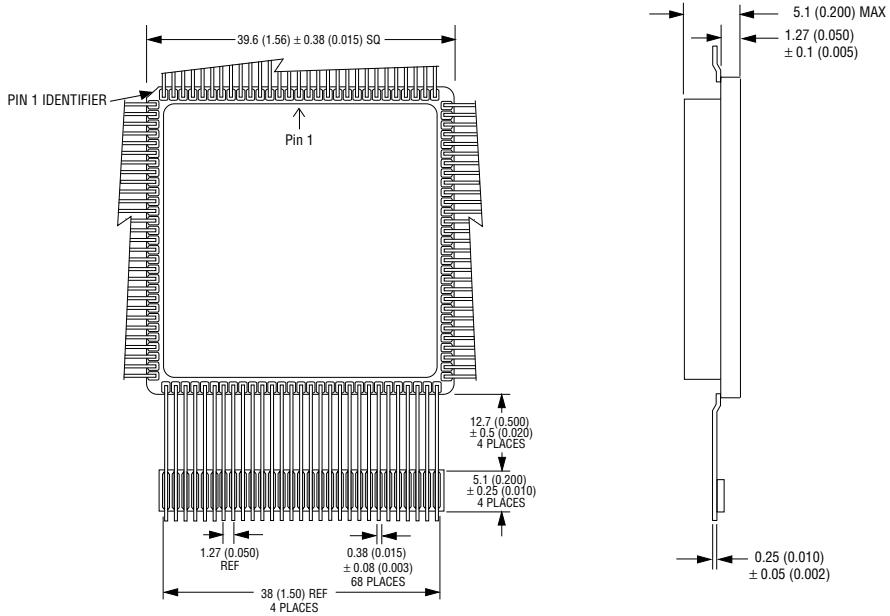


**NOTES:**

1. PA represents the address of the memory location to be programmed.
2. PD represents the data to be programmed at byte address.
3.  $\overline{D7}$  is the output of the complement of the data written to each chip.
4. Dout is the output of the data written to the device.
5. Figure indicates the last two bus cycles of a four bus cycle sequence.



**PACKAGE 504: 116 LEAD, CERAMIC QUAD FLAT PACK, CQFP (G4W)**



ALL LINEAR DIMENSIONS ARE MILLIMETERS AND PARENTHETICALLY IN INCHES

**ORDERING INFORMATION**

**W F 128K64 - XXX G4W X 5**

**V<sub>PP</sub> PROGRAMMING VOLTAGE**  
5 = 5V

**DEVICE GRADE:**  
M = Military Screened -55°C to +125°C  
I = Industrial -40°C to +85°C  
C = Commercial 0 to +70°C

**PACKAGE TYPE:**  
G4W = 116 Lead 40mm Ceramic Quad Flat Pack, CQFP (Package 504)

**ACCESS TIME (ns)**

**ORGANIZATION, 128K x 64**  
User configurable as 256K x 32, 512K x 16, or 1M x 8

**Flash PROM**

**WHITE MICROELECTRONICS**