128Kx32 5V FLASH MODULE, SMD 5962-94716

FEATURES

- Access Times of 60, 70, 90, 120 and 150ns
- Packaging
  - 66 pin, PGA Type, 1.075 inch square, Hermetic Ceramic HIP (Package 400)
  - 68 lead, 40mm, Low Profile 3.5mm (0.140"), CQFP (Package 502)
  - 68 lead, Hermetic CQFP (G2), 22mm (0.880 inch) square (Package 500). Designed to fit JEDEC 68 lead 0.990" CQFJ footprint (Fig. 3)
- Sector Architecture
  - 8 equal size sectors of 16K bytes each
  - Any combination of sectors can be concurrently erased. Also supports full chip erase
- 100,000 Erase/Program Cycles Typical, 0°C to +70°C
- Organized as 128Kx32
- Commercial, Industrial and Military Temperature Ranges
- 5 Volt Programming. 5V ± 10% Supply
- Low Power CMOS, 1mA Standby Typical
- Embedded Erase and Program Algorithms
- TTL Compatible Inputs and CMOS Outputs
- Built in Decoupling Caps and Multiple Ground Pins for Low Noise Operation
- Page Program Operation and Internal Program Control Time
- Weight
  WF128K32-XG2X5 - 8 grams typical
  WF128K32-XH1X5 - 13 grams typical
  WF128K32-XG4X5 - 20 grams typical

Note: See programming information 1M5 in programming section for algorithms.

FIG. 1 PIN CONFIGURATION FOR WF128K32N-XH1X5, SMD 5962-94716

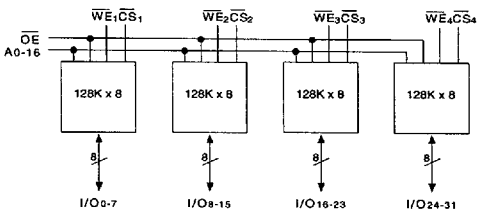
TOP VIEW

1	12	23		34	45	56
I/O8	$\overline{WE}_2$	I/O15		I/O24	Vcc	I/O31
I/O9	$\overline{CS}_2$	I/O14		I/O25	$\overline{CS}_4$	I/O30
I/O10	GND	I/O13		I/O26	$\overline{WE}_4$	I/O29
A14	I/O11	I/O12		A7	I/O27	I/O28
A16	A10	$\overline{OE}$		A12	A4	A1
A11	A9	NC		NC	A5	A2
A0	A15	$\overline{WE}_1$		A13	A6	A3
NC	Vcc	I/O7		A8	$\overline{WE}_3$	I/O23
I/O0	$\overline{CS}_1$	I/O6		I/O16	$\overline{CS}_3$	I/O22
I/O1	NC	I/O5		I/O17	GND	I/O21
I/O2	I/O3	I/O4		I/O18	I/O19	I/O20
11	22	33		44	55	66

PIN DESCRIPTION

I/O0-31	Data Inputs/Outputs
A0-16	Address Inputs
$\overline{WE}_{1-4}$	Write Enables
$\overline{CS}_{1-4}$	Chip Selects
$\overline{OE}$	Output Enable
Vcc	Power Supply
GND	Ground
NC	Not Connected

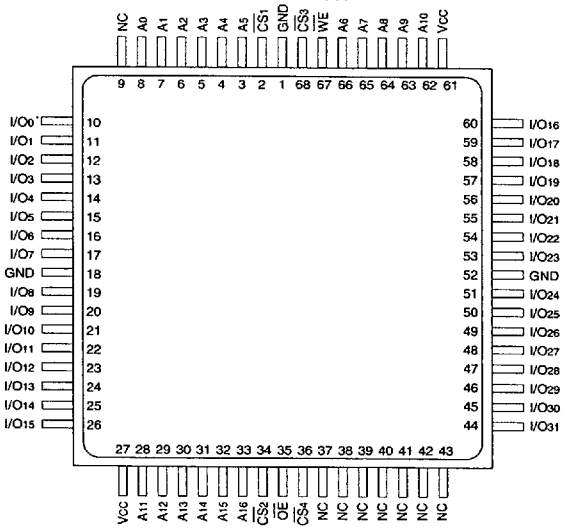
BLOCK DIAGRAM



FLASH MODULES

FIG. 2 PIN CONFIGURATION FOR WF128K32-XG4TX5

TOP VIEW



PIN DESCRIPTION

I/O0-31	Data Inputs/Outputs
A0-16	Address Inputs
$\overline{WE}$	Write Enable
$\overline{CS}_{1-4}$	Chip Selects
$\overline{OE}$	Output Enable
Vcc	Power Supply
GND	Ground
NC	Not Connected

BLOCK DIAGRAM

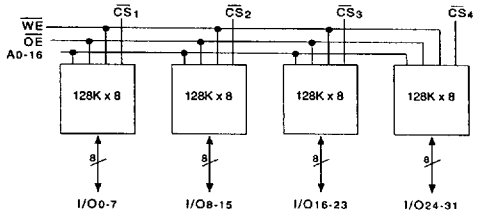
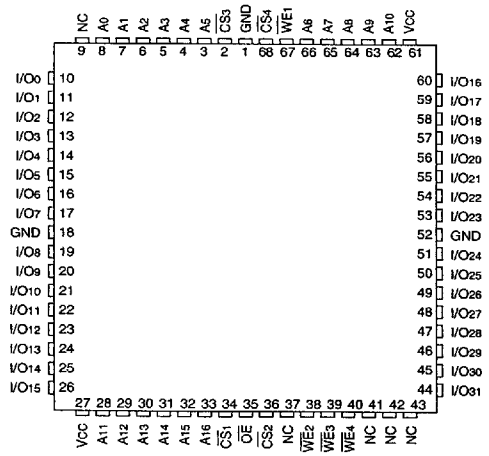
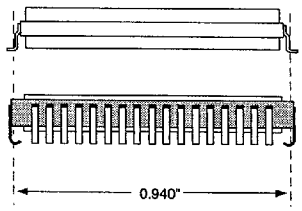


FIG. 3 PIN CONFIGURATION FOR WF128K32-XG2X5

TOP VIEW



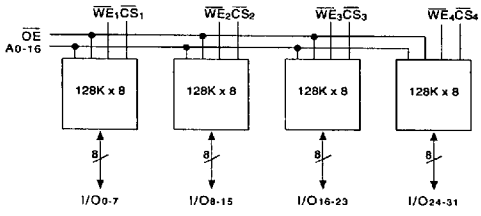


The White 68 lead G2 CQFP fills the same fit and function as the JEDEC 68 lead CQFJ or 68 PLCC. But the G2 has the TCE and lead inspection advantage of the CQFP form.

PIN DESCRIPTION

I/O0-31	Data Inputs/Outputs
A0-16	Address Inputs
$\overline{WE}_{1-4}$	Write Enables
$\overline{CS}_{1-4}$	Chip Selects
$\overline{OE}$	Output Enable
Vcc	Power Supply
GND	Ground
NC	Not Connected

BLOCK DIAGRAM



FLASH MODULES

ABSOLUTE MAXIMUM RATINGS (1)

Parameter		Unit
Operating Temperature	-55 to +125	°C
Supply Voltage Range (V_{CC})	-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_9 Voltage for sector protect (V_{ID}) (3)	-2.0 to +14.0	V

NOTES:
1. 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.
2. Minimum DC voltage on input or I/O pins is -0.5V. During voltage transitions, inputs may overshoot V_{SS} to -2.0 V for periods of up to 20ns. Maximum DC voltage on output and I/O pins is V_{CC} + 0.5V. During voltage transitions, outputs may overshoot to V_{CC} + 2.0 V for periods of up to 20ns.
3. Minimum DC input voltage on A_9 pin is -0.5V. During voltage transitions, A_9 may overshoot Vss to -2V for periods of up to 20ns. Maximum DC input voltage on A_9 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_{CC}	4.5	5.5	V
Input High Voltage	V_{IH}	2.0	V_{CC} + 0.3	V
Input Low Voltage	V_{IL}	-0.5	+0.8	V
Operating Temp. (Mil.)	T_A	-55	+125	°C
A_9 Voltage for Sector Protect	V_{ID}	11.5	12.5	V

CAPACITANCE

(T_A = +25°C)

Parameter	Symbol	Conditions	Max	Unit
$\overline{OE}$ capacitance	C_{OE}	V_{IN} = 0 V, f = 1.0 MHz	50	pF
$\overline{WE}_{1-4}$ capacitance	C_{WE}	V_{IN} = 0 V, f = 1.0 MHz		pF
HIP (PGA)			20	
CQFP G4T			50	
CQFP G2			20	
$\overline{CS}_{1-4}$ capacitance	C_{CS}	V_{IN} = 0 V, f = 1.0 MHz	20	pF
Data I/O capacitance	$C_{I/O}$	$V_{I/O}$ = 0 V, f = 1.0 MHz	20	pF
Address input capacitance	C_{AD}	V_{IN} = 0 V, f = 1.0 MHz	50	pF

This parameter is guaranteed by design but not tested.

DC CHARACTERISTICS - CMOS COMPATIBLE

(V_{CC} = 5.0V, V_{SS} = 0V, T_A = -55°C to +125°C)

Parameter	Symbol	Conditions	-60		-70		-90		-120		-150		Unit
			Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
Input Leakage Current	I_{LI}	V_{CC} = 5.5, V_{IN} = GND to V_{CC}		10		10		10		10		10	µA
Output Leakage Current	I_{LOx32}	V_{CC} = 5.5, V_{IN} = GND to V_{CC}		10		10		10		10		10	µA
V_{CC} Active Current for Read (1)	I_{CC1}	$\overline{CS}$ = V_{IL}, $\overline{OE}$ = V_{IH}		140		140		140		140		140	mA
V_{CC} Active Current for Program or Erase (2)	I_{CC2}	$\overline{CS}$ = V_{IL}, $\overline{OE}$ = V_{IH}		200		200		200		200		200	mA
V_{CC} Standby Current	I_{CC3}	V_{CC} = 5.5, $\overline{CS}$ = V_{IH}, f = 5MHz		6.5		6.5		6.5		6.5		6.5	mA
V_{CC} Static Current	I_{CC4}	V_{CC} = 5.5, $\overline{CS}$ = V_{IH}		0.6		0.6		0.6		0.6		0.6	mA
Output Low Voltage	V_{OL}	I_{OL} = 12.0 mA, V_{CC} = 4.5		0.45		0.45		0.45		0.45		0.45	V
Output High Voltage	V_{OH1}	I_{OH} = -2.5 mA, V_{CC} = 4.5	0.85 x V_{CC}		0.85 x V_{CC}		0.85 x V_{CC}		0.85 x V_{CC}		0.85 x V_{CC}		V
Output High Voltage	V_{OH2}	I_{OH} = -100 µA, V_{CC} = 4.5	V_{CC} -0.4		V_{CC} -0.4		V_{CC} -0.4		V_{CC} -0.4		V_{CC} -0.4		V
Low V_{CC} Lock Out Voltage	V_{LKO}		3.2		3.2		3.2		3.2		3.2		V

NOTES:
1. The I_{CC} 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_{IH}.
2. I_{CC} active while Embedded Algorithm (program or erase) is in progress.
3. DC test conditions: V_{IL} = 0.3V, V_{IH} = V_{CC} - 0.3V

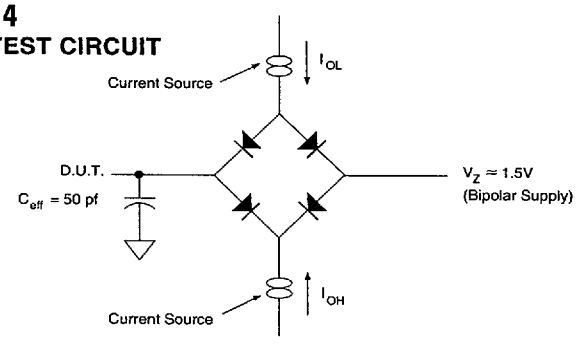
AC CHARACTERISTICS – WRITE/ERASE/PROGRAM OPERATIONS, $\overline{CS}$ CONTROLLED

(Vcc = 5.0V, Vss = 0V, TA = -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 AVAV	tWC	60		70		90		120		150		ns
$\overline{WE}$ Setup Time	t WLEL	tWS	0		0		0		0		0		ns
$\overline{CS}$ Pulse Width	t ELEH	tCP	30		35		45		50		50		ns
Address Setup Time	t AVEL	tAS	0		0		0		0		0		ns
Data Setup Time	t DVEH	tDS	30		30		45		50		50		ns
Data Hold Time	t EHDX	tDH	0		0		0		0		0		ns
Address Hold Time	t ELAX	tAH	45		45		45		50		50		ns
$\overline{WE}$ Hold from $\overline{WE}$ High	t EHWH	tWH	0		0		0		0		0		ns
$\overline{CS}$ Pulse Width High	t EHEL	tCPH	20		20		20		20		20		ns
Duration of Programming Operation	t WHWH1		14		14		14		14		14		µs
Duration of Erase Operation	t WHWH2		2.2	60	2.2	60	2.2	60	2.2	60	2.2	60	sec
Read Recovery before Write	t GHEL		0		0		0		0		0		ns
Chip Programming Time				12.5		12.5		12.5		12.5		12.5	sec

FLASH MODULES

FIG. 4
AC TEST CIRCUIT



AC TEST CONDITIONS

Parameter	Typ	Unit
Input Pulse Levels	VIL = 0, VIH = 3.0	V
Input Rise and Fall	5	ns
Input and Output Reference Level	1.5	V
Output Timing Reference Level	1.5	V

NOTES:
VZ is programmable from -2V to +7V.
IOL & IOH programmable from 0 to 16mA.
Tester Impedance ZO = 75 Ω.
VZ is typically the midpoint of VOH and VOL.
IOL & IOH are adjusted to simulate a typical resistive load circuit.
ATE tester includes jig capacitance.

AC CHARACTERISTICS – WRITE/ERASE/PROGRAM OPERATIONS, $\overline{WE}$ CONTROLLED

(V_{CC} = 5.0V, V_{SS} = 0V, T_A = -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_{AVAV}	t_{WC}	60		70		90		120		150		ns
Chip Select Setup Time	t_{ELWL}	t_{CS}	0		0		0		0		0		ns
Write Enable Pulse Width	t_{WLWH}	t_{WP}	30		35		45		50		50		ns
Address Setup Time	t_{AVWL}	t_{AS}	0		0		0		0		0		ns
Data Setup Time	t_{DVWH}	t_{DS}	30		30		45		50		50		ns
Data Hold Time	t_{WHDX}	t_{DH}	0		0		0		0		0		ns
Address Hold Time	t_{WLAX}	t_{AH}	45		45		45		50		50		ns
Chip Select Hold Time	t_{WHEH}	t_{CH}	0		0		0		0		0		ns
Write Enable Pulse Width High	t_{WHWL}	t_{WPH}	20		20		20		20		20		ns
Duration of Byte Programming Operation (min)	t_{WHWH1}		14		14		14		14		14		µs
Sector Erase Time	t_{WHWH2}		2.2	60	2.2	60	2.2	60	2.2	60	2.2	60	sec
Read Recovery Time Before Write	t_{GHWL}		0		0		0		0		0		ns
Vcc Setup Time		t_{VCS}	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_{OES}	0		0		0		0		0		ns
Output Enable Hold Time (1)		t_{OEH}	10		10		10		10		10		ns

1. For Toggle and $\overline{Data}$ Polling.

AC CHARACTERISTICS – READ ONLY OPERATIONS

(V_{CC} = 5.0V, V_{SS} = 0V, T_A = -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_{AVAV}	t_{RC}	60		70		90		120		150		ns
Address Access Time	t_{AVQV}	t_{ACC}		60		70		90		120		150	ns
Chip Select Access Time	t_{ELQV}	t_{CE}		60		70		90		120		150	ns
$\overline{OE}$ to Output Valid	t_{GLQV}	t_{OE}		30		35		40		50		55	ns
Chip Select to Output High Z (1)	t_{EHQZ}	t_{DF}		20		20		25		30		35	ns
$\overline{OE}$ High to Output High Z (1)	t_{GHQZ}	t_{DF}		20		20		25		30		35	ns
Output Hold from Address, $\overline{CS}$ or $\overline{OE}$ Change, whichever is first	t_{AXQX}	t_{OH}	0		0		0		0		0		ns

1. Guaranteed by design, not tested.

FLASH MODULES

FIG. 5
AC WAVEFORMS FOR READ OPERATIONS

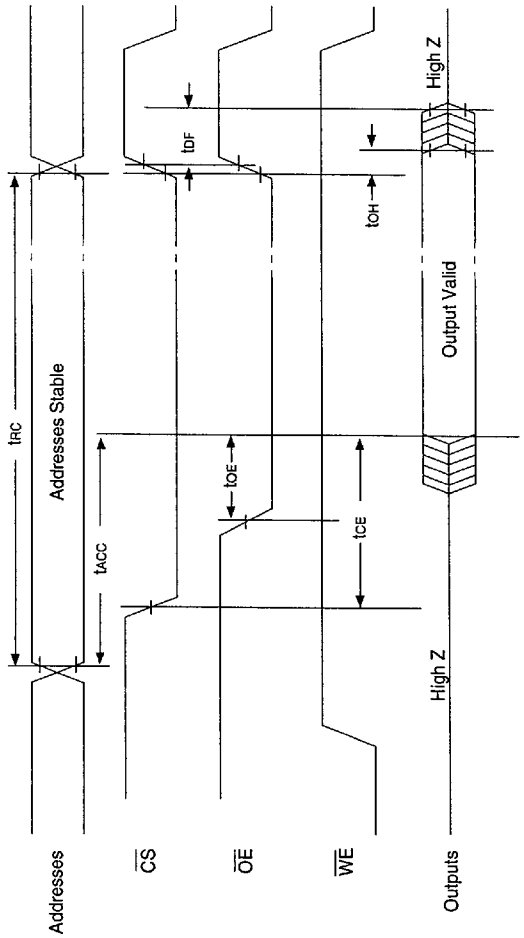
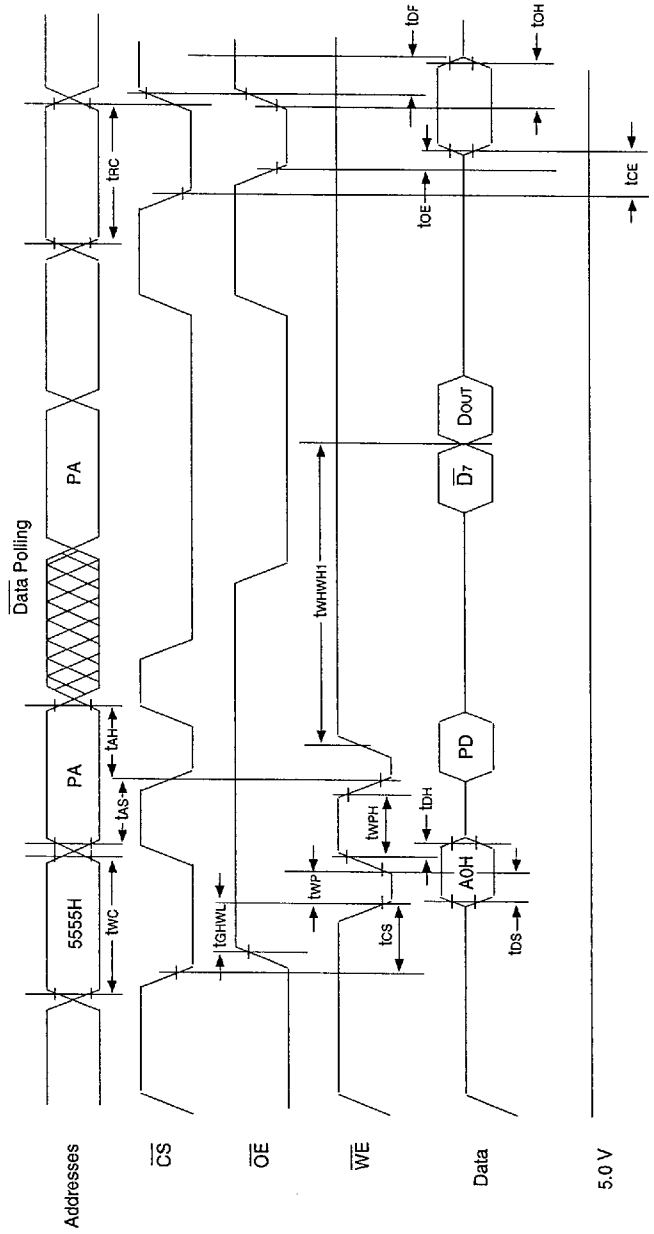
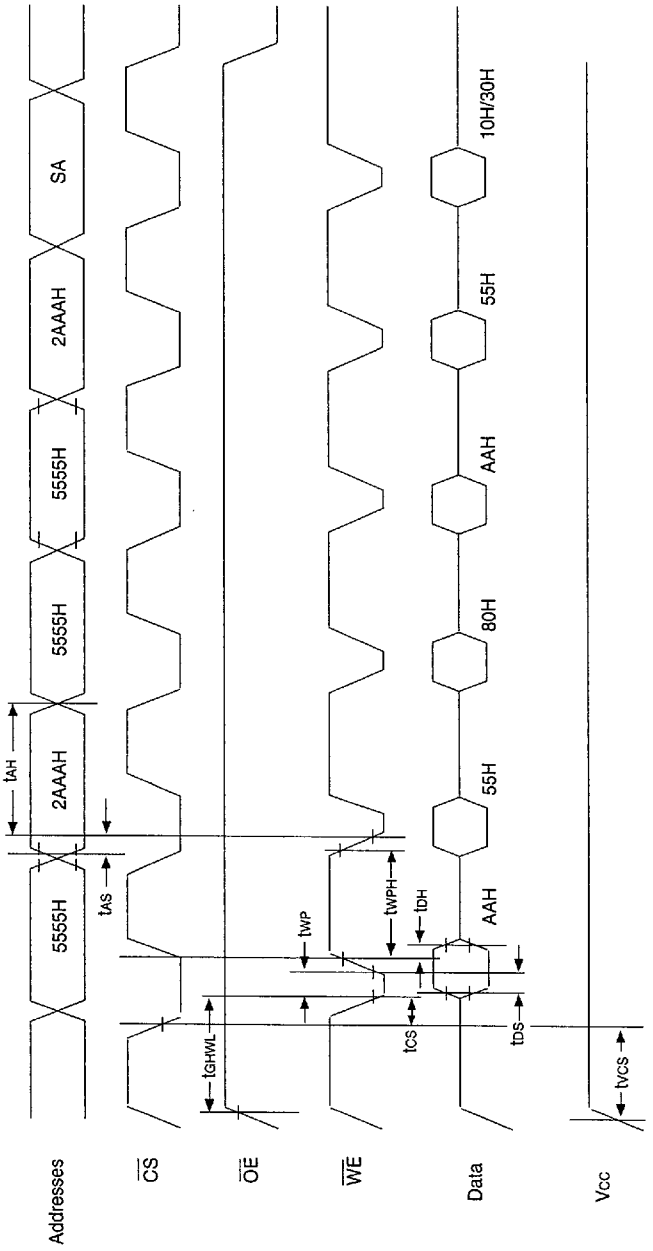


FIG. 6
WRITE/ERASE/PROGRAM OPERATION, $\overline{WE}$ CONTROLLED



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

FIG. 7
AC WAVEFORMS CHIP/SECTOR ERASE OPERATIONS



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

FLASH MODULES

FIG. 8
AC WAVEFORMS FOR $\overline{\text{DATA}}$ POLLING DURING EMBEDDED ALGORITHM OPERATIONS

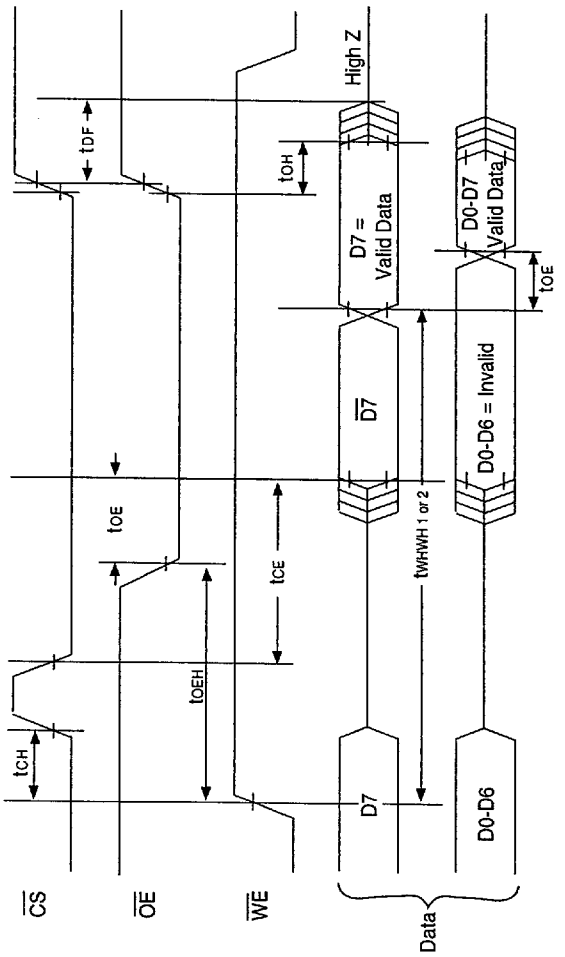
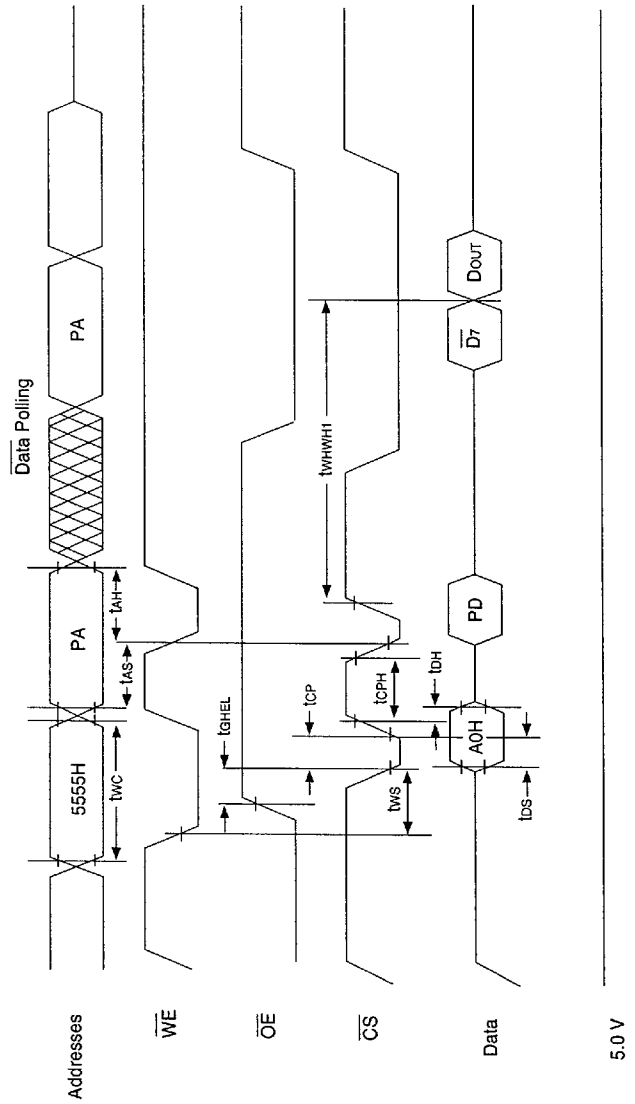


FIG. 9
WRITE/ERASE/PROGRAM OPERATION, $\overline{CS}$ CONTROLLED



NOTES:
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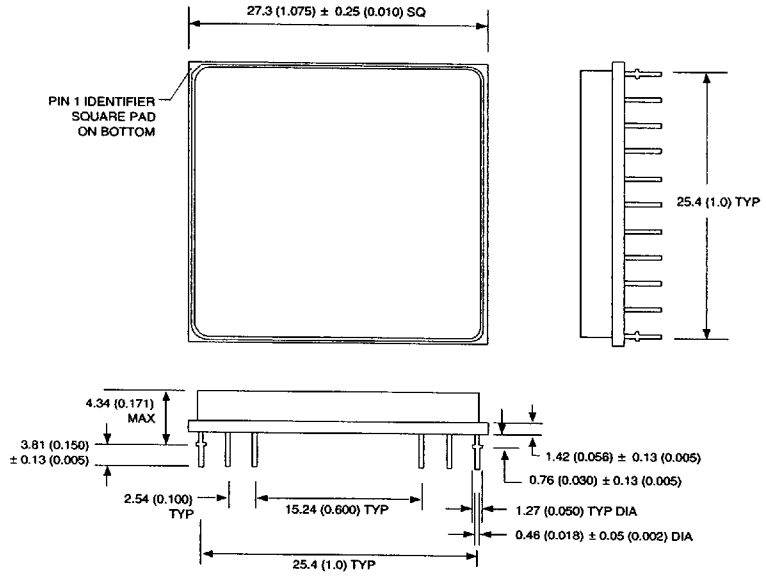
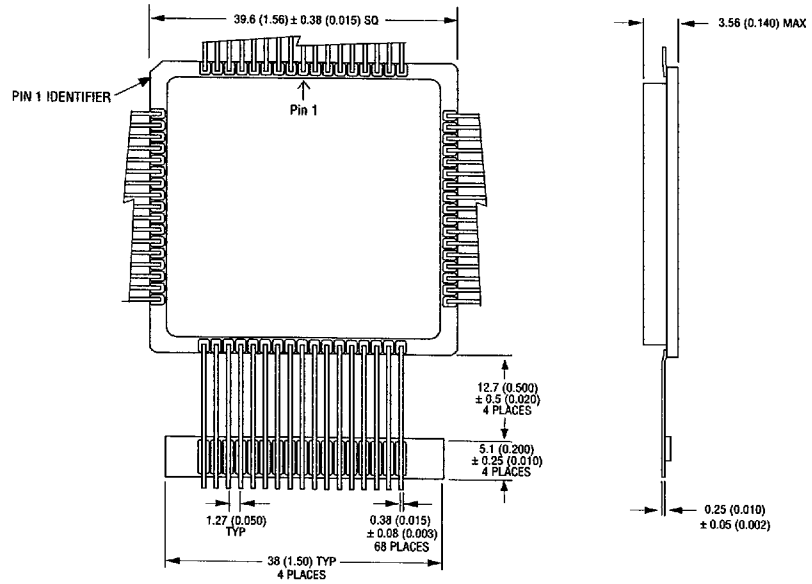
3. $\overline{D7}$ is the output of the complement of the data written to the device (for each chip).
4. DOUT is the output of the data written to the device.
5. Figure indicates the last two bus cycles of a four bus cycle sequence.

PACKAGE 400: 66 PIN, PGA TYPE, CERAMIC HEX-IN-LINE PACKAGE, HIP (H1)



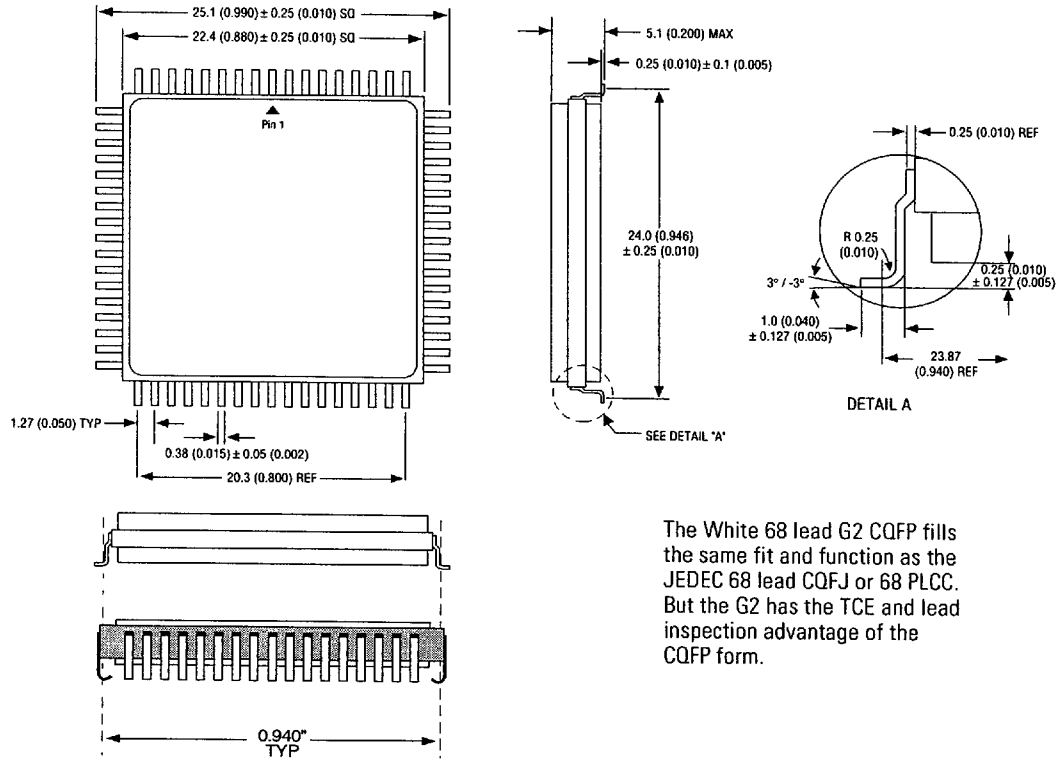
ALL LINEAR DIMENSIONS ARE MILLIMETERS AND PARENTHETICALLY IN INCHES

PACKAGE 502: 68 LEAD, CERAMIC QUAD FLAT PACK, LOW PROFILE CQFP (G4T)



ALL LINEAR DIMENSIONS ARE MILLIMETERS AND PARENTHETICALLY IN INCHES

PACKAGE 500: 68 LEAD, CERAMIC QUAD FLAT PACK, CQFP (G2)



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ALL LINEAR DIMENSIONS ARE MILLIMETERS AND PARENTHETICALLY IN INCHES

FLASH MODULES

ORDERING INFORMATION

W F 128K32 X - XXX X X 5

VPP 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:
H1 = 1.075" sq. Ceramic Hex In-line Package, HIP (Package 400)
G2 = 22mm Ceramic Quad Flat Pack, CQFP (Package 500)
G4T = 40mm Ceramic Low Profile, CQFP (Package 502)

ACCESS TIME in ns

IMPROVEMENT MARK
N = No Connect at pin 8, 21, 28 and 39 in HIP for Upgrade

ORGANIZATION, 128K x 32
User configurable as 256K x 16 or 512K x 8

Flash PROM

WHITE MICROELECTRONICS

DEVICE TYPE	SPEED	PACKAGE	SMD NO.
128K x 32 Flash	150ns	66 pin HIP (H1)	5962-94716 01H8X
128K x 32 Flash	120ns	66 pin HIP (H1)	5962-94716 02H8X
128K x 32 Flash	90ns	66 pin HIP (H1)	5962-94716 03H8X
128K x 32 Flash	70ns	66 pin HIP (H1)	5962-94716 04H8X
128K x 32 Flash	60ns	66 pin HIP (H1)	5962-94716 05H8X
128K x 32 Flash	150ns	68 lead CQFP/J (G2)	5962-94716 01HMX
128K x 32 Flash	120ns	68 lead CQFP/J (G2)	5962-94716 02HMX
128K x 32 Flash	90ns	68 lead CQFP/J (G2)	5962-94716 03HMX
128K x 32 Flash	70ns	68 lead CQFP/J (G2)	5962-94716 04HMX
128K x 32 Flash	60ns	68 lead CQFP/J (G2)	5962-94716 05HMX
128K x 32 Flash	150ns	68 lead CQFP Low Profile (G4T)	5962-94716 01H4X
128K x 32 Flash	120ns	68 lead CQFP Low Profile (G4T)	5962-94716 02H4X
128K x 32 Flash	90ns	68 lead CQFP Low Profile (G4T)	5962-94716 03H4X
128K x 32 Flash	70ns	68 lead CQFP Low Profile (G4T)	5962-94716 04H4X
128K x 32 Flash	60ns	68 lead CQFP Low Profile (G4T)	5962-94716 05H4X