

**PCMCIA Flash Memory Card****8 MEGABYTE through 64 MEGABYTE (AMD based)****General Description**

WEDC's PCMCIA Flash memory cards offer the highest density, linear Flash solid state storage solutions for code and data storage, high performance disk emulation and execute in place (XIP) applications in mobile PC and dedicated (embedded) equipment.

Packaged in a PCMCIA type I housing, each card contains a connector, an array of Flash memories packaged in TSOP packages and card control logic. The card control logic provides the system interface and controls the internal Flash memories. Combined with file management software, such as Flash Translation Layer (FTL), WEDC Flash cards provide removable high-performance disk emulation.

The WEDC FLE series is based on AMD Flash memories. The FLE series offers byte wide and word wide operation, low power modes and Card Information Structure (CIS) for easy identification of card characteristics.

Note: Standard options include attribute memory. Cards without attribute memory are available. Cards are also available with or without a hardware write protect switch.

Architecture Overview

WEDC's FLE series is designed to support up to twenty (see Block diagram) 32Mb components, providing a wide range of density options. Cards are based on the Am29F032 (32Mb) device for 5V only applications. The device code for the Am29F032 is 41h and the manufacturer's ID is 01h. Systems should be able to recognize these codes. Cards utilizing 32Mb components provide densities ranging from 8MB to 64MB in 8MB increments.

In support of the PC Card (PCMCIA) standard for word wide access, devices are paired. Therefore, the Flash array is structured in 64K word blocks. Write, read and block erase operations can be performed as either a word or byte wide operation. By multiplexing A0, CE1# and CE2#, 8-bit hosts can access all data on data lines DQ0 - DQ7. The FLE series cards conform with the PC Card Standard (formerly PCMCIA) and supported JEIDA, providing electrical and physical compatibility. The PC Card form factor offers an industry standard pinout and mechanical outline, allowing density upgrades without system design changes.

WEDC's standard cards are shipped with WEDC's silkscreen design. Cards are also available with blank housings (no silkscreen). The blank housings are available in both a recessed (for label) and flat housing. Please contact your WEDC sales representative for further information on Custom artwork.

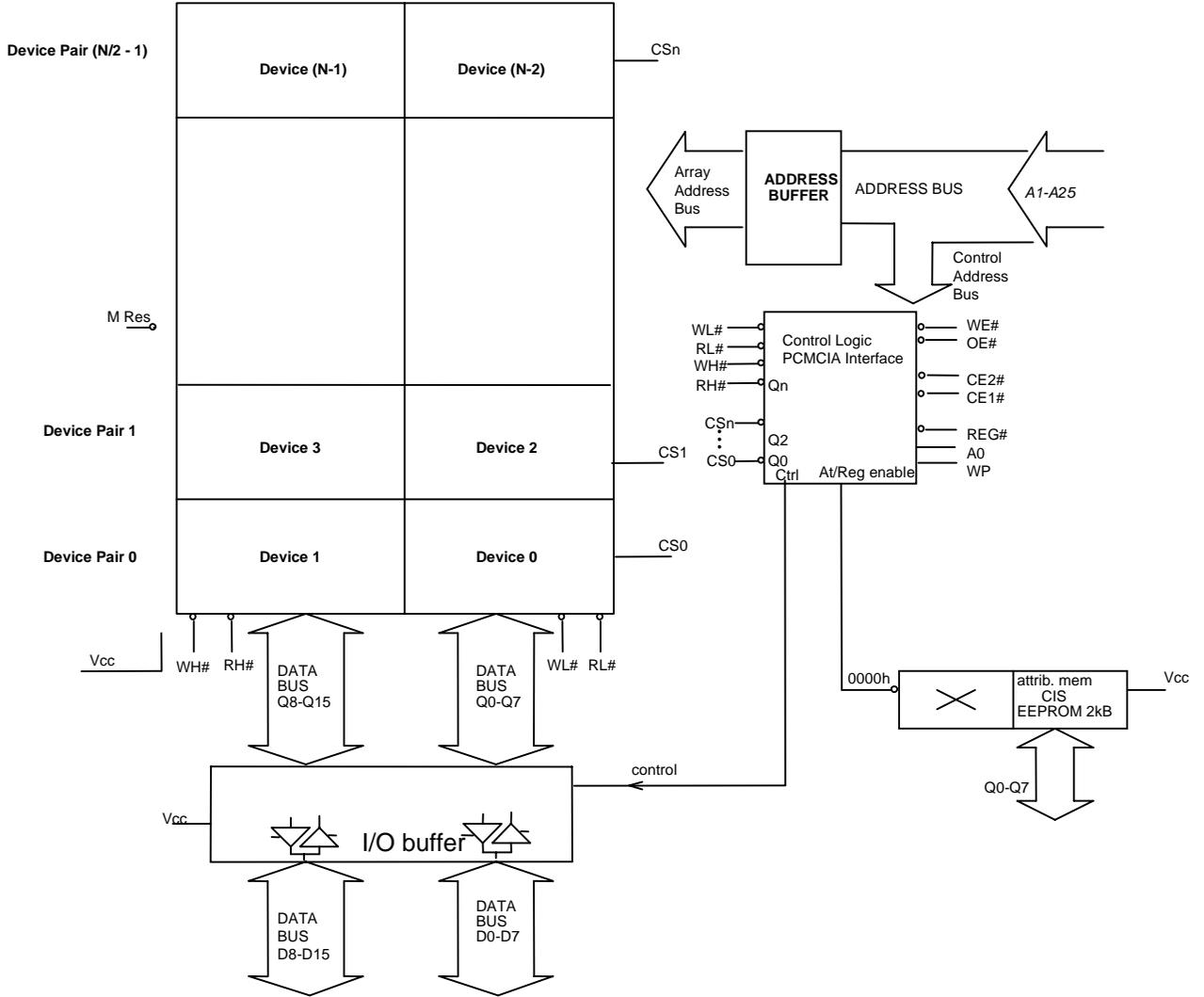
Features

- Very High Density Linear Flash Card
- Supports 5V only systems
- Based on AMD Flash Components
 - low standby power without entering reset mode
 - allows standard access from standby mode
- Fast Read Performance
 - 150ns Maximum Access Time
- x8/ x16 Data Interface
- High Performance Random Writes
 - 7µs Typical Word Write Time
- Automated Write and Erase Algorithms
 - AMD Command Set
- 1,000,000 Erase Cycles per Block
- 64K word (128kB) symmetrical Block Architecture
- PC Card Standard Type I Form Factor



Block Diagram

Device type	Manuf ID	Device ID
Am29F032	01 _H	41 _H





Pinout

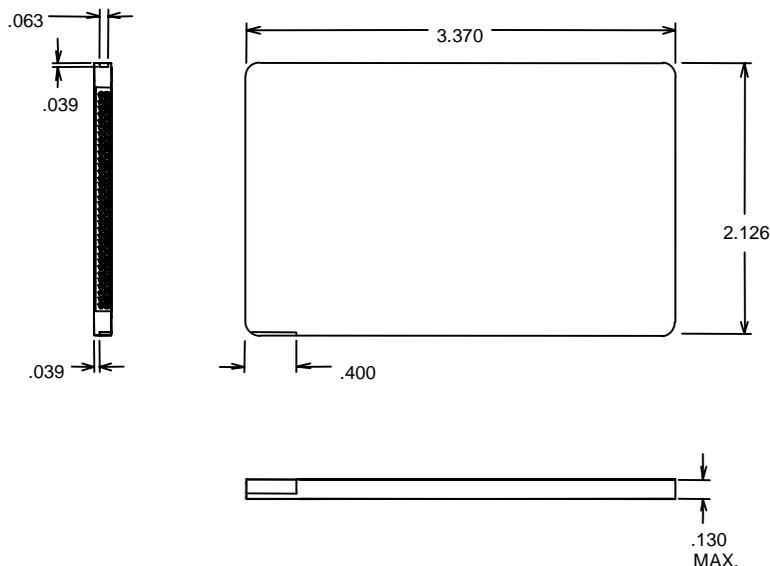
Pin	Signal name	I/O	Function	Active
1	GND		Ground	
2	DQ3	I/O	Data bit 3	
3	DQ4	I/O	Data bit 4	
4	DQ5	I/O	Data bit 5	
5	DQ6	I/O	Data bit 6	
6	DQ7	I/O	Data bit 7	
7	CE1#	I	Card enable 1	LOW
8	A10	I	Address bit 10	
9	OE#	I	Output enable	LOW
10	A11	I	Address bit 11	
11	A9	I	Address bit 9	
12	A8	I	Address bit 8	
13	A13	I	Address bit 13	
14	A14	I	Address bit 14	
15	WE#	I	Write Enable	LOW
16	RDY/BSY#	O	Ready/Busy	LOW
17	Vcc		Supply Voltage	
18	Vpp1		Prog. Voltage	N.C.
19	A16	I	Address bit 16	
20	A15	I	Address bit 15	
21	A12	I	Address bit 12	
22	A7	I	Address bit 7	
23	A6	I	Address bit 6	
24	A5	I	Address bit 5	
25	A4	I	Address bit 4	
26	A3	I	Address bit 3	
27	A2	I	Address bit 2	
28	A1	I	Address bit 1	
29	A0	I	Address bit 0	
30	DQ0	I/O	Data bit 0	
31	DQ1	I/O	Data bit 1	
32	DQ2	I/O	Data bit 2	
33	WP	O	Write Potect	HIGH
34	GND		Ground	

Pin	Signal name	I/O	Function	Active
35	GND		Ground	
36	CD1#	O	Card Detect 1	LOW
37	DQ11	I/O	Data bit 11	
38	DQ12	I/O	Data bit 12	
39	DQ13	I/O	Data bit 13	
40	DQ14	I/O	Data bit 14	
41	DQ15	I	Data bit 15	
42	CE2#	I	Card Enable 2	LOW
43	VS1	O	Voltage Sense 1	N.C.
44	RFU		Reserved	
45	RFU		Reserved	
46	A17	I	Address bit 17	
47	A18	I	Address bit 18	
48	A19	I	Address bit 19	
49	A20	I	Address bit 20	
50	A21	I	Address bit 21	
51	Vcc		Supply Voltage	
52	Vpp2		Prog. Voltage	N.C.
53	A22	I	Address bit 22	8MB(3)
54	A23	I	Address bit 23	16MB(3)
55	A24	I	Address bit 24	32MB(3)
56	A25	I	Address bit 25	64MB(3)
57	VS2	O	Voltage Sense 2	N.C.
58	RST	I	Card Reset	HIGH
59	Wait#	O	Extended Bus cycle	LOW(2)
60	RFU		Reserved	
61	REG#	I	Attrib Mem Select	
62	BVD2	O	Bat. Volt. Detect 2	(2)
63	BVD1	O	Bat. Volt. Detect 1	(2)
64	DQ8	I/O	Data bit 8	
65	DQ9	I/O	Data bit 9	
66	DQ10	O	Data bit 10	
67	CD2#	O	Card Detect 2	LOW
68	GND		Ground	

Notes:

1. RDY/BSY is an open drain output, external pull-up resistor is required.
2. Wait#, BVD1 and BVD2 are driven high for compatibility.
3. Shows density for which specified address bit is MSB. Higher order address bits are no connects (i.e., 16MB A23 is MSB A24, A25 are NC).

Mechanical





Card Signal Description

Symbol	Type	Name and Function
A0 - A25	INPUT	ADDRESS INPUTS: A0 through A25 enable direct addressing of up to 64MB of memory on the card. Signal A0 is not used in word access mode. A25 is the most significant bit
DQ0 - DQ15	INPUT/OUTPUT	DATA INPUT/OUTPUT: DQ0 THROUGH DQ15 constitute the bi-directional databus. DQ15 is the MSB.
CE1#, CE2#	INPUT	CARD ENABLE 1 AND 2: CE1# enables even byte accesses, CE2# enables odd byte accesses. Multiplexing A0, CE1# and CE2# allows 8-bit hosts to access all data on DQ0 - DQ7.
OE#	INPUT	OUTPUT ENABLE: Active low signal gating read data from the memory card.
WE#	INPUT	WRITE ENABLE: Active low signal gating write data to the memory card.
RDY/BSY#	OUTPUT	READY/BUSY OUTPUT: Indicates status of internally timed erase or program algorithms. A high output indicates that the card is ready to accept accesses. A low output indicates that one or more devices in the memory card are busy with internally timed erase or write activities.
CD1#, CD2#	OUTPUT	CARD DETECT 1 and 2: Provide card insertion detection. These signals are connected to ground internally on the memory card. The host socket interface circuitry shall supply 10K-ohm or larger pull-up resistors on these signal pins.
WP	OUTPUT	WRITE PROTECT: Write protect reflects the status of the Write Protect switch on the memory card. WP set to high = write protected, providing internal hardware write lockout to the Flash array. If card does not include optional write protect switch, this signal will be pulled low internally indicating write protect = "off".
VPP1, VPP2	N.C.	PROGRAM/ERASE POWER SUPPLY: Not connected for 5V only card.
VCC		CARD POWER SUPPLY: 5.0V for all internal circuitry.
GND		GROUND: for all internal circuitry.
REG#	INPUT	ATTRIBUTE MEMORY SELECT : provides access to Flash memory card registers and Card Information Structure in the Attribute Memory Plane.
RST	INPUT	RESET: Active high signal for placing card in Power-on default state. Reset can be used as a Power-Down signal for the memory array.
WAIT#	OUTPUT	WAIT: This signal is pulled high internally for compatibility. No wait states are generated.
BVD1, BVD2	OUTPUT	BATTERY VOLTAGE DETECT: These signals are pulled high to maintain SRAM card compatibility.
VS1, VS2	OUTPUT	VOLTAGE SENSE: Notifies the host socket of the card's VCC requirements. VS1 and VS2 are open to indicate a 5V card has been inserted.
RFU		RESERVED FOR FUTURE USE
N.C.		NO INTERNAL CONNECTION TO CARD: pin may be driven or left floating



Absolute Maximum Ratings ⁽²⁾

Operating Temperature TA (ambient)	
Commercial	0°C to +60°C
Industrial	-40°C to +85°C **
Storage Temperature	
Commercial	-30°C to +80°C
Industrial	-40°C to +85°C **
Voltage on any pin relative to V _{SS}	-0.5V to V _{CC} +0.5V (1)
V _{CC} supply Voltage relative to V _{SS}	-0.5V to +7.0V

** Advanced information

Notes:

(1) During transitions, inputs may undershoot to -2.0V or overshoot to V_{CC} +2.0V for periods less than 20ns.

(2) Stress greater than those listed under "Absolute Maximum ratings" may cause permanent damage to the device. This is a stress rating only and functional operation at these or any other conditions greater than those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

DC Characteristics ⁽¹⁾

Sym	Parameter	Density (Mbytes)	Notes	Typ ⁽⁴⁾	Max	Units	Test Conditions
I _{CCR}	V _{CC} Read Current	All		40(5)	75	mA	V _{CC} = V _{CC} max t _{cycle} = 150ns, CMOS levels
I _{CCW}	V _{CC} Program Current	All		30(6)	40(6)	mA	
I _{CC E}	V _{CC} Erase Current	All		30(6)	40(6)	mA	
I _{CCS} (CMOS)	V _{CC} Standby Current	8MB	2,3	50	200	μA	V _{CC} = V _{CC} max Control Signals = V _{CC} Reset = V _{SS} , CMOS levels
		64MB		100	400		

CMOS Test Conditions: V_{CC} = 5V ± 5%, V_{IL} = V_{SS} ± 0.2V, V_{IH} = V_{CC} ± 0.2V

Notes:

- All currents are RMS values unless otherwise specified. ICCR, ICCW and ICCE are based on Word wide operations.
- Control Signals: CE₁#, CE₂#, OE#, WE#, REG#.
- ICCS is specified for lowest density card (8MB for two, 32Mb components) This represents a single pair of devices.
- Typical: V_{CC} = 5V, T = +25°C.
- The I_{cc} current is typically less than 1mA/MHz per device, with OE not active.
- I_{cc} active while Embedded Program or Erase algorithm is in progress. Value based on one device active.

Symbol	Parameter	Notes	Min	Max	Units	Test Conditions
I _{LI}	Input Leakage Current	1		±20	μA	V _{CC} = V _{CC} MAX V _{in} = V _{CC} or V _{SS}
I _{LO}	Output Leakage Current	1		±20	μA	V _{CC} = V _{CC} MAX V _{out} = V _{CC} or V _{SS}
V _{IL}	Input Low Voltage	1	0	0.8	V	
V _{IH}	Input High Voltage	1	0.7V _{CC}	V _{CC} +0.5	V	
V _{OL}	Output Low Voltage	1		0.4	V	I _{OL} = 3.2mA
V _{OH}	Output High Voltage	1	V _{CC} -0.4	V _{CC}	V	I _{OH} = -2.0mA
V _{LKO}	V _{CC} Erase/Program Lock Voltage	1	2.0		V	

Notes:

- Values are the same for byte and word wide modes for all card densities.
- Exceptions: Leakage currents on CE₁#, CE₂#, OE#, REG# and WE# will be < 500 μA when V_{IN} = GND due to internal pull-up resistors. Leakage currents on RST will be <150μA when V_{IN}=V_{CC} due to internal pull-down resistor.



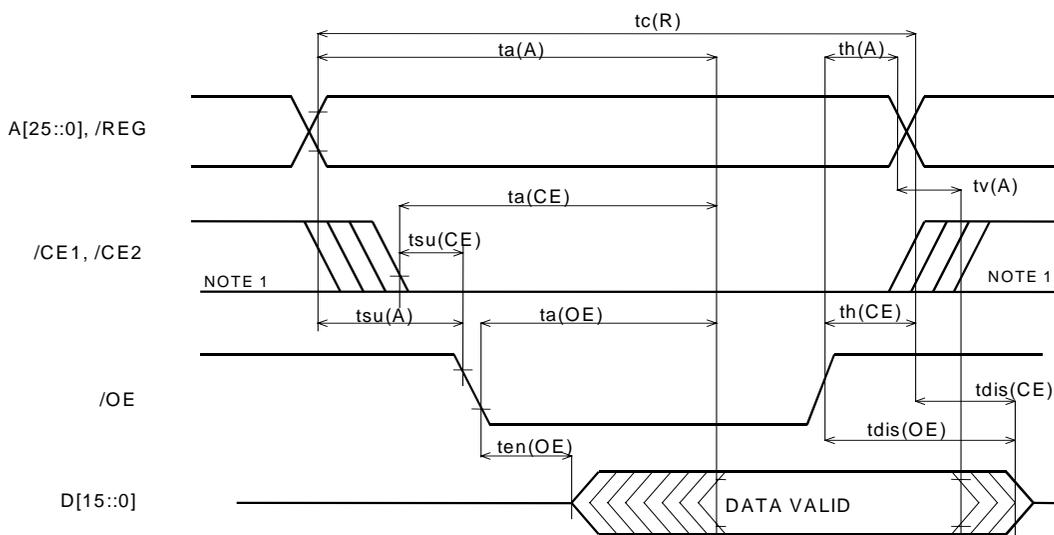
AC Characteristics

Read Timing Parameters

SYM (PCMCIA)	Parameter	150ns		Unit
		Min	Max	
$t_c(R)$	Read Cycle Time	150		ns
$t_a(A)$	Address Access Time		150	ns
$t_a(CE)$	Card Enable Access Time		150	ns
$t_a(OE)$	Output Enable Access Time		75	ns
$t_{su}(A)$	Address Setup Time	20		ns
$t_{su}(CE)$	Card Enable Setup Time	0		ns
$t_h(A)$	Address Hold Time	20		ns
$t_h(CE)$	Card Enable Hold Time	20		ns
$t_v(A)$	Output Hold from Address Change	0		ns
$t_{dis}(CE)$	Output Disable Time from CE#		75	ns
$t_{dis}(OE)$	Output Disable Time from OE#		75	ns
$t_{en}(CE)$	Output Enable Time from CE#	5		ns
$t_{en}(OE)$	Output Enable Time from OE#	5		ns

Note: AC timing diagrams and characteristics are guaranteed to meet or exceed PCMCIA 2.1 specifications.

Read Timing Diagram



Note: Signal may be high or low in this area.

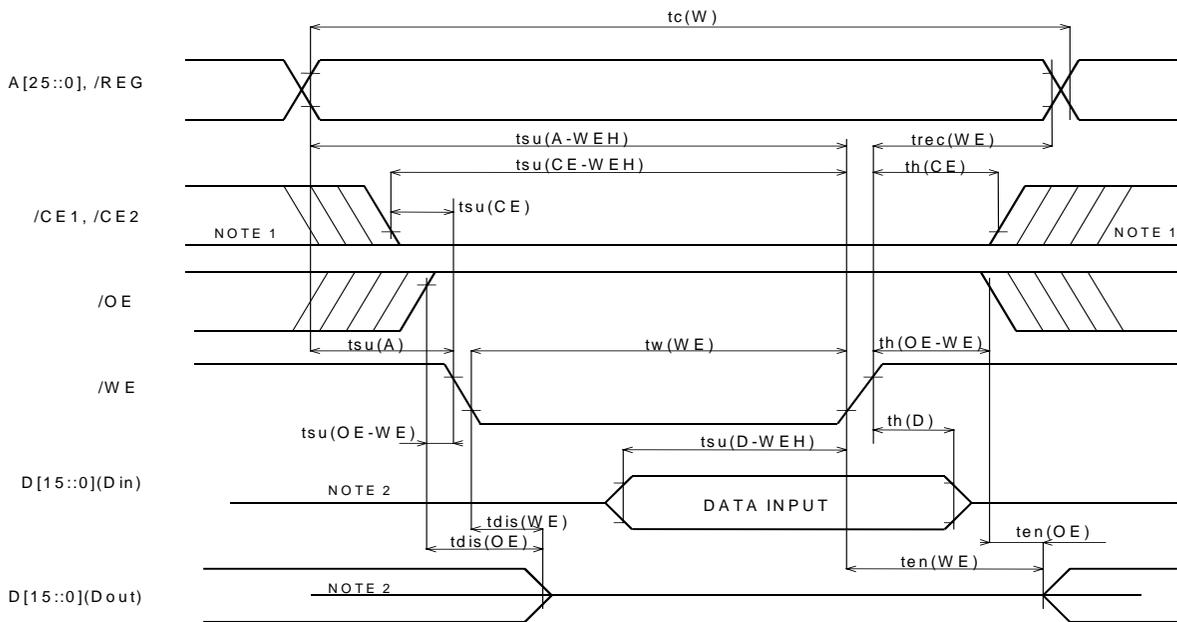


Write Timing Parameters

SYM (PCMCIA)	Parameter	150ns		Unit
		Min	Max	
$t_c(W)$	Write Cycle Time	150		ns
$t_w(WE)$	Write Pulse Width	80		ns
$t_{su}(A)$	Address Setup Time	20		ns
$t_{su}(A-WEH)$	Address Setup Time for WE#	100		ns
$t_{su}(CE-WEH)$	Card Enable Setup Time for WE#	100		ns
$t_{su}(D-WEH)$	Data Setup Time for WE#	50		ns
$t_h(D)$	Data Hold Time	20		ns
$t_{rec}(WE)$	Write Recover Time	20		ns
$t_{dis}(WE)$	Output Disable Time from WE#		75	ns
$t_{dis}(OE)$	Output Disable Time from OE#		75	ns
$t_{en}(WE)$	Output Enable Time from WE#	5		ns
$t_{en}(OE)$	Output Enable Time from OE#	5		ns
$t_{su}(OE-WE)$	Output Enable Setup from WE#	10		ns
$t_h(OE-WE)$	Output Enable Hold from WE#	10		ns
$t_{su}(CE)$	Card Enable Setup Time from OE#	0		ns
$t_h(CE)$	Card Enable Hold Time	20		ns

Note: AC timing diagrams and characteristics are guaranteed to meet or exceed PCMCIA 2.1 specifications.

Write Timing Diagram



Notes:

- Signal may be high or low in this area.
- When the data I/O pins are in the output state, no signals shall be applied to the data pins (D15 - D0) by the host system.



Data Write and Erase Performance ^(1,3)

$V_{CC} = 5V \pm 5\%$, $T_A = 0^{\circ}C$ to $+ 60^{\circ}C$

SYM	Parameter	Notes	Min	Typ ⁽¹⁾	Max	Units	Test Conditions
t_{WHQV1} t_{EHQV1}	Word/Byte Program time	2,4		7	300	μs	Excludes system-level overhead
t_{WHQV2} t_{EHQV2}	Block Program Time	2		0.5	2.0	sec	
	Block Erase Time	2		1	8	sec	Excludes 00h prog. prior to erasure

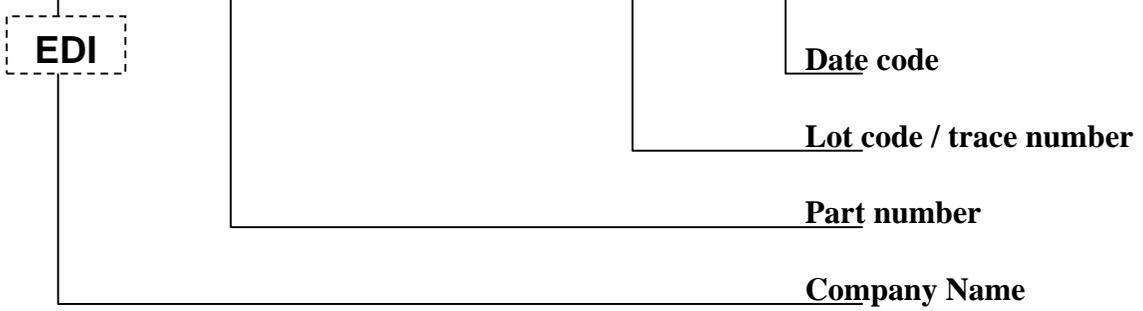
Notes:

1. Typical: Nominal voltages and $T_A = 25^{\circ}C$.
2. Excludes system overhead.
3. Valid for all speed options.
4. To maximize system performance RDY/BSY# signal should be polled.



PRODUCT MARKING

WED7P016FLE2200C15 C995 9915

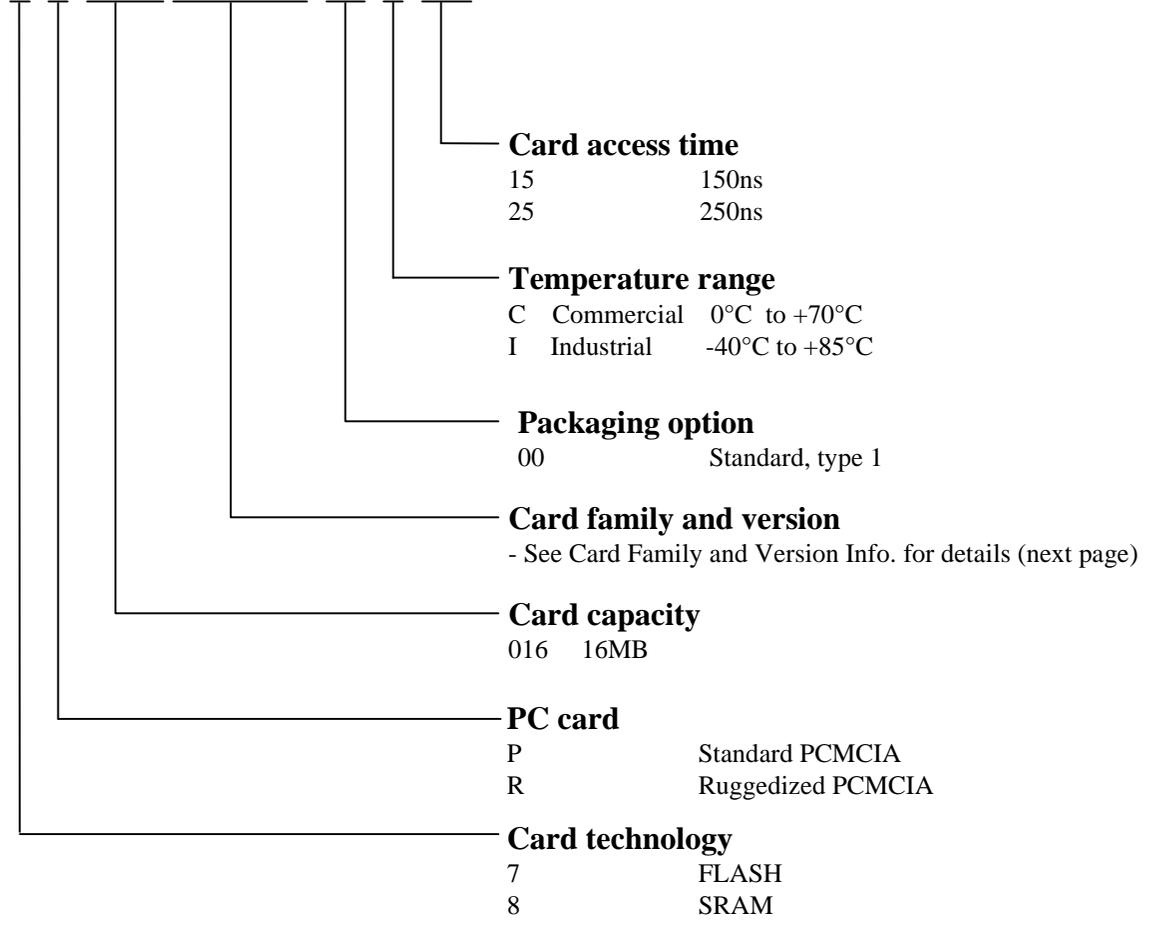


Note:

Some products are currently marked with our pre-merger company name/acronym (EDI). During our transition period, some products will also be marked with our new company name/acronym (WED). Starting October 2000 all PCMCIA products will be marked only with the WED prefix.

PART NUMBERING

7 P 016 FLE22 00 C 15





FLE Series

Ordering Information

EDI7P XXX FLE 22 SS T ZZ —————▶ Based on **Am29F032** for 5V only applications.

where

XXX:	008	8MB
	016	16MB
	024	24MB
	032	32MB
	040	40MB
	048	48MB
	056	56MB
	064	64MB
SS:	00	WEDC Silkscreen
	01	Blank Housing, Type I
	02	Blank Housing, Type I Recessed
T:	C	Commercial
	I	Industrial
ZZ:	15	150ns

Note: Options without attribute memory and with hardware write protect switch are available.

Card families:

FLE 21	- No Attribute memory, No WP switch
FLE 22	- With Attribute Memory, No WP switch
FLE 23	- No Attribute Memory, With WP switch
FLE 24	- With Attribute Memory, With WP switch



CIS Information for FLE Series Cards

CIS for FLE22, 150ns

Address	Value	Description	Address	Value	Description	Address	Value	Description
00H	01H	CISTPL_DEVICE	40H	45H	E	94H	45H	E
02H	03H	TPL_LINK	42H	44H	D	96H	53H	S
04H	53H	writable)	44H	49H	I	98H	49H	I
06H	1EH	CARD SIZE: 8MB	46H	37H	7	9AH	47H	G
	3EH	16MB	48H	50H	P	9CH	4EH	N
	5EH	24MB	4AH	30H	0	9EH	53H	S
	7EH	32MB	4CH	1)	x	A0H	20H	SPACE
	9EH	40MB	4EH	1)	x	A2H	49H	I
	BEH	48MB	50H	46H	F	A4H	4EH	N
	DEH	56MB	52H	4CH	L	A6H	43H	C
	FEH	64MB	54H	45H	E	A8H	4FH	O
08H	FFH	END OF DEVICE	56H	32H	2	AAH	52H	R
0AH	18H	CISTPL_JEDEC_C	58H	2)	x	ACH	50H	P
0CH	02H	TPL_LINK	5AH	2DH	-	AEH	4FH	O
0EH	01H	AMD - ID	5CH	2DH	-	B0H	52H	R
10H	41H	29F032 - ID	5EH	2DH	-	B2H	41H	A
12H	17H	CISTPL_DEVICE_A	60H	31H	1	B4H	54H	T
14H	03H	TPL_LINK	62H	35H	5	B6H	45H	E
16H	42H	EEPROM - 200ns	64H	20H	SPACE	B8H	44H	D
18H	01H	Device Size = 2KBytes	66H	00H	END TEXT	BAH	20H	SPACE
1AH	FFH	END OF TUPLE	68H	43H	C	BCH	00H	END TEXT
1CH	1EH	CISTPL_DEVICEGEO	6AH	4FH	O	BEH	31H	1
1EH	06H	TPL_LINK	6CH	50H	P	C0H	39H	9
20H	02H	DGTPL_BUS	6EH	59H	Y	C2H	39H	9
22H	11H	DGTPL_EBS	70H	52H	R	C4H	39H	9
24H	01H	DGTPL_RBS	72H	49H	I	C6H	00H	END TEXT
26H	01H	DGTPL_WBS	74H	47H	G	C8H	00H	END OF LIST
28H	01H	DGTPL_PART	76H	48H	H			
2AH	01H	FLASH DEVICE	78H	54H	T	1)		
		NON-INTERLEAVED	7AH	20H	SPACE	Address	Value	Description
2CH	20H	CISTPL_MANFID	7CH	45H	E	4CH	30	0
2EH	04H	TPL_LINK(04H)	7EH	4CH	L		31	1
30H	F6H	EDITPLMID_MANF: LSB	80H	45E	E		32	2
32H	01H	EDI PLMID_MANF: MSB	82H	43H	C		33	3
34H	00H	LSB: Number Not Assign.	84H	54H	T		34	4
		MSB: Number Not Assign.					36	6
36H	00H		86H	52H	R	4EH	30	0
38H	15H	CISTPL_VERS1	88H	4FH	O		32	2
3AH	47H	TPL_LINK	8AH	4EH	N		34	4
3CH	04H	TPLL1_MAJOR	8CH	49H	I		36	6
3EH	01H	TPLL1_MINOR	8EH	43H	C		38	8
			90H	20H	SPACE	2)		
			92H	44H	D	58H	32	2
							34	4



REVISION HISTORY

Date of revision	Version	Description
7-Feb-98	-001	Initial release
27-May-99	-002	Logo change
31-May-00	-003	Added page 9, Heading changed on all pgs
1-Aug-00	-004	Corrected Timing Errors, pgs. 6&7

White Electronic Designs Corporation

One Research Drive, Westborough, MA 01581, USA

tel: (508) 366 5151

fax: (508) 836 4850

www.whiteedc.com



WHITE ELECTRONIC DESIGNS