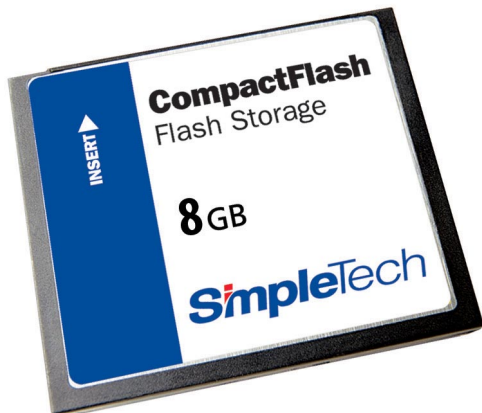


128 MB to 8 GB CompactFlash Cards



FEATURES

- CFA 2.0 and ATA-4 Compatibility
- Support for PCMCIA I/O, Memory and True-IDE Interfaces
- 128MB to 8GB Capacities
- Form Factors: CompactFlash Type I (SLCFxxxJ(I)) and CompactFlash Type II (SLCFxxxJT2(I))
- Endurance Guarantee of 2,000,000 Write/Erase Cycles
- CIS (Card Information Structure) Programmed into 256 Bytes of Internal Memory
- Compatible with PC Card and Socket Services (Release 2.1 or later)
- 5V or 3.3V Power Supply
- Completely Solid-State (No Moving Parts)
- Available in Commercial and Industrial Operating Temperature Ranges
- Standard ECC Engine
- 7 Year Warranty

ORDERING INFORMATION

CompactFlash

| Part Number* | CF Form Factor | Capacity |
|-----------------------|----------------|------------|
| • SLCF128J(I) | Type I..... | 128 MBytes |
| • SLCF256J(I) | Type I..... | 256 MBytes |
| • SLCF512J(I) | Type I..... | 512 MBytes |
| • SLCF1GBJ(I) | Type I..... | 1 GBytes |
| • SLCF2GBJ(I) | Type I..... | 2 GBytes |
| • SLCF3GBJ(I) | Type I..... | 3 GBytes |
| • SLCF4GBJ(I) | Type I..... | 4 GBytes |
| • SLCF5GBJ(I) | Type I..... | 5 GBytes |
| • SLCF6GBJT2(I) | Type II | 6 GBytes |
| • SLCF7GBJT2(I) | Type II | 7 GBytes |
| • SLCF8GBJT2(I) | Type II | 8 GBytesII |

GENERAL DESCRIPTION

The SimpleTech SLCFxxxJ(T2)(I) are CompactFlash Cards with 128MB to 8GB of nonvolatile storage. The SLCFxxxJ(I) cards are Type I CompactFlash Cards, and the SLCFxxxJT2(I) cards are Type II CompactFlash Cards. The cards use a flash memory controller that provides a fully compatible CompactFlash interface for the flash memory.

SimpleTech OEM CompactFlash cards are the product of choice in applications requiring high reliability and high tolerance to shock, vibration, humidity, altitude, and temperature. Because there are no moving parts to service or maintain, CompactFlash cards are reliable alternatives to mechanical hard disk drives for high availability and mission critical applications.

While the inherent ruggedness and reliability of solid state storage relative to rotating hard drives is intuitive, new applications for OEM CompactFlash cards are emerging due to the low cost per usable megabyte. Most applications using embedded operating systems such as VxWorks™, Windows XP/embedded™, and Linux™ don't have multi-gigabyte data storage requirements, and therefore a cost savings can be realized when using this robust media.

Adapters

- | Part Number | CF Form Factor | PC Card Form Factor |
|------------------|-------------------------|---------------------|
| • SLCFAD | Type I..... | Type II |
| • SLCFADII | Type I or Type II | Type |
- * Custom capacities available.

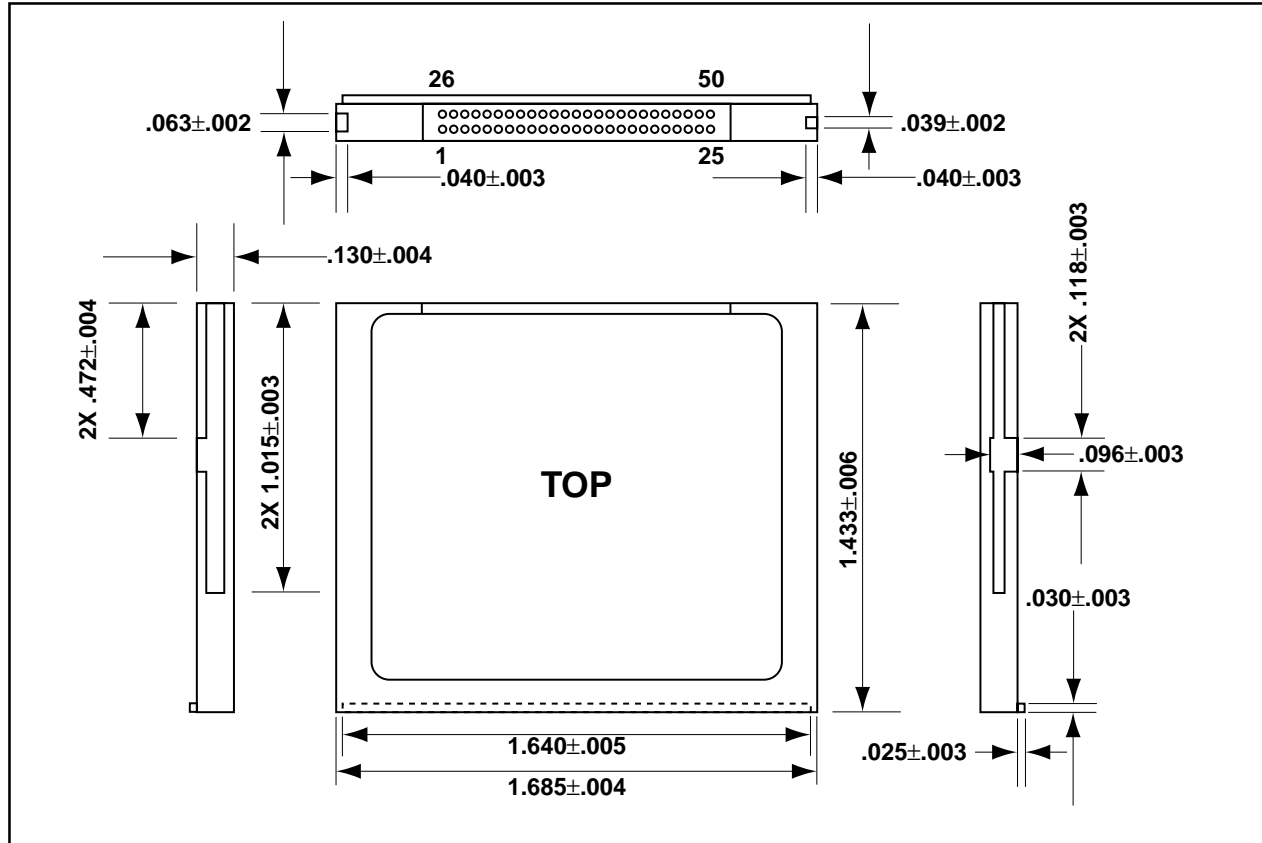
An "I" suffix added to the part number selects the Industrial Operating Temperature range option. A part number without the "I" suffix selects the Commercial Operating Temperature range option.

An "-F" suffix, that is SLCFxxxJ(T2)(I)-F, provides the media set to fixed storage for non-removable IDE applications. Some operating systems, such as Windows XP, require the storage media to be identified as a fixed drive before the storage media can be used as a bootable drive. SimpleTech offers the "-F" cards for these applications.

PACKAGE DIMENSIONS AND PIN LOCATIONS

CompactFlash Type I

| | |
|--------------------------|-------------------------------|
| Length | 1.433±.006 in (36.4±0.15 mm) |
| Width | 1.685±.004 in (42.80±0.10 mm) |
| Thickness (Type I) | .130±.004 in (3.3±0.10 mm) |
| (including Label Area) | |

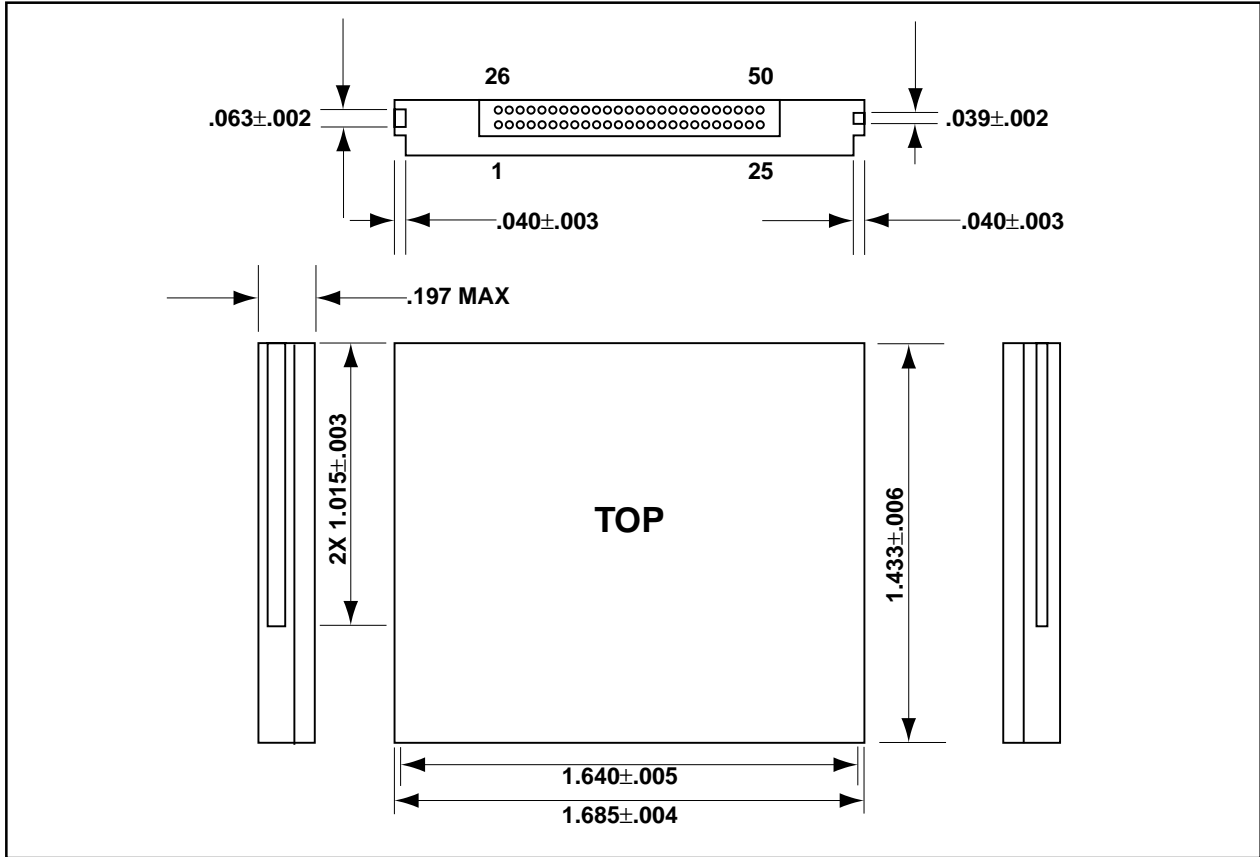


(continued)

PACKAGE DIMENSIONS AND PIN LOCATIONS (continued)

CompactFlash Type II

| | |
|---------------------------|---|
| Length | 1.433±.006 in (36.4±0.15 mm) |
| Width | 1.685±.004 in (42.80±0.10 mm) |
| Thickness (Type II) | .197 in (5.00 mm) max (including Label Area) |

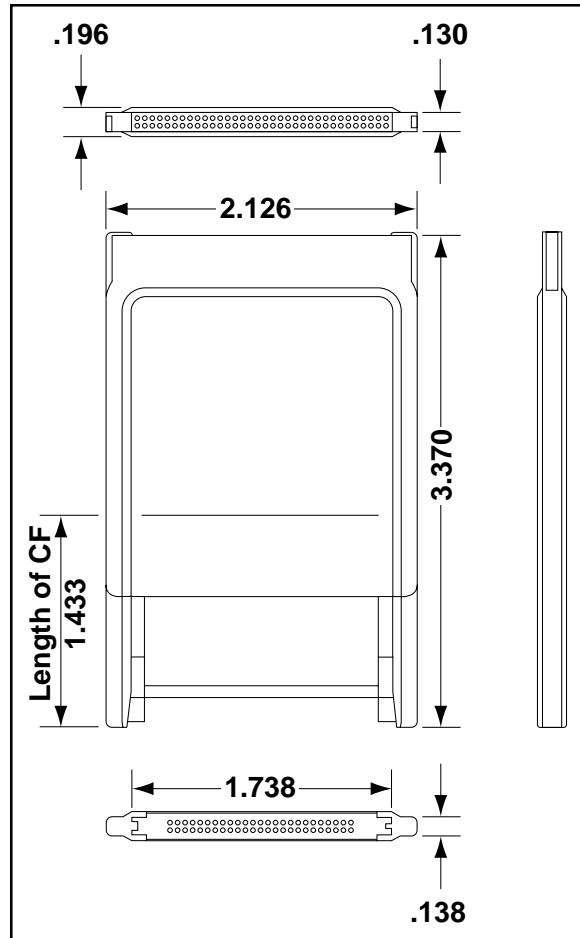


(continued)

PACKAGE DIMENSIONS AND PIN LOCATIONS *(continued)*

Adapter for CompactFlash Type I and II to PC Card Type II (Typical)

| | |
|-----------------|------------------------------|
| Length | 3.370±.008 in (85.6±0.20 mm) |
| Width | 2.126±.004 in (54.0±0.10 mm) |
| Thickness | .1968 in max. (5.0 mm max.) |



PIN ASSIGNMENTS

| PC Card Memory Mode | | | PC Card I/O Mode | | | True IDE Mode | | |
|---------------------|-------------|----------|------------------|-------------|----------|---------------|-------------|----------|
| Pin Num | Signal Name | Pin Type | Pin Num | Signal Name | Pin Type | Pin Num | Signal Name | Pin Type |
| 1 | GND | Ground | 1 | GND | Ground | 1 | GND | Ground |
| 2 | D03 | I/O | 2 | D03 | I/O | 2 | D03 | I/O |
| 3 | D04 | I/O | 3 | D04 | I/O | 3 | D04 | I/O |
| 4 | D05 | I/O | 4 | D05 | I/O | 4 | D05 | I/O |
| 5 | D06 | I/O | 5 | D06 | I/O | 5 | D06 | I/O |
| 6 | D07 | I/O | 6 | D07 | I/O | 6 | D07 | I/O |
| 7 | -CE1 | I | 7 | -CE1 | I | 7 | -CS0 | I |
| 8 | A10 | I | 8 | A10 | I | 8 | A10 | I |
| 9 | -OE | I | 9 | -OE | I | 9 | -SELATA | I |
| 10 | A09 | I | 10 | A09 | I | 10 | A09* | I |
| 11 | A08 | I | 11 | A08 | I | 11 | A08* | I |
| 12 | A07 | I | 12 | A07 | I | 12 | A07* | I |
| 13 | VCC | Power | 13 | VCC | Power | 13 | VCC | Power |
| 14 | A06 | I | 14 | A06 | I | 14 | A06* | I |
| 15 | A05 | I | 15 | A05 | I | 15 | A05* | I |
| 16 | A04 | I | 16 | A04 | I | 16 | A04* | I |
| 17 | A03 | I | 17 | A03 | I | 17 | A03* | I |
| 18 | A02 | I | 18 | A02 | I | 18 | A02 | I |
| 19 | A01 | I | 19 | A01 | I | 19 | A01 | I |
| 20 | A00 | I | 20 | A00 | I | 20 | A00 | I |
| 21 | D00 | I/O | 21 | D00 | I/O | 21 | D00 | I/O |
| 22 | D01 | I/O | 22 | D01 | I/O | 22 | D01 | I/O |
| 23 | D02 | I/O | 23 | D02 | I/O | 23 | D02 | I/O |
| 24 | WP | O | 24 | -IOIS16 | O | 24 | -IOCS16* | O |
| 25 | -CD2 | O | 25 | -CD2 | O | 25 | -CD2 | O |
| 26 | -CD1 | O | 26 | -CD1 | O | 26 | -CD1 | O |
| 27 | D11 | I/O | 27 | D11 | I/O | 27 | D11 | I/O |
| 28 | D12 | I/O | 28 | D12 | I/O | 28 | D12 | I/O |
| 29 | D13 | I/O | 29 | D13 | I/O | 29 | D13 | I/O |
| 30 | D14 | I/O | 30 | D14 | I/O | 30 | D14 | I/O |
| 31 | D15 | I/O | 31 | D15 | I/O | 31 | D15 | I/O |
| 32 | -CE2 | I | 32 | -CE2 | I | 32 | -CS1 | I |
| 33 | -VS1 | O | 33 | -VS1 | O | 33 | -VS1* | O |
| 34 | -IORD | I | 34 | -IORD | I | 34 | -IORD | I |
| 35 | -IOWR | I | 35 | -IOWR | I | 35 | -IOWR | I |
| 36 | -WE | I | 36 | -WE | I | 36 | -WE | I |
| 37 | RDY/-BSY | O | 37 | IREQ | O | 37 | INTRQ | O |
| 38 | VCC | Power | 38 | VCC | Power | 38 | VCC | Power |
| 39 | -CSEL | I | 39 | -CSEL | I | 39 | -CSEL | I |
| 40 | -VS2 | O | 40 | -VS2 | O | 40 | -VS2* | O |
| 41 | RESET | I | 41 | RESET | I | 41 | -RESET | I |
| 42 | -WAIT | O | 42 | -WAIT | O | 42 | IORDY | O |
| 43 | -INPACK | O | 43 | -INPACK | O | 43 | Not Used | O |
| 44 | -REG | I | 44 | -REG | I | 44 | Not Used | I |
| 45 | BVD2 | I/O | 45 | -SPKR | I/O | 45 | -DASP | I/O |
| 46 | BVD1 | I/O | 46 | -STSCHG | I/O | 46 | -PDIAG | I/O |
| 47 | D08 | I/O | 47 | D08 | I/O | 47 | D08 | I/O |
| 48 | D09 | I/O | 48 | D09 | I/O | 48 | D09 | I/O |
| 49 | D10 | I/O | 49 | D10 | I/O | 49 | D10 | I/O |
| 50 | GND | Ground | 50 | GND | Ground | 50 | GND | Ground |

* Signals marked with an asterisk are not used in IDE Mode.

PINOUT OF THE PC CARD TO CF ADAPTER

| Pin | PC Card | CF | Pin | PC Card | CF |
|-----|-----------------|------------|-----|---------|-----------------|
| 1 | GND | GND | 35 | GND | -IOWR |
| 2 | D03 | D03 | 36 | -CD1 | -WE |
| 3 | D04 | D04 | 37 | D11 | -RDY/-BSY/-IREQ |
| 4 | D05 | D05 | 38 | D12 | VCC |
| 5 | D06 | D06 | 39 | D13 | -CSEL |
| 6 | D07 | D07 | 40 | D14 | -VS2 |
| 7 | -CE1 | -CE1 | 41 | D15 | RESET |
| 8 | A10 | A10 | 42 | -CE2 | -WAIT |
| 9 | -OE | -OE | 43 | -VS1 | -INPACK |
| 10 | | A09 | 44 | -IORD | -REG |
| 11 | A09 | A08 | 45 | -IOWR | BVD2/DASP |
| 12 | A08 | A07 | 46 | | BVD1/-PDIAG |
| 13 | | VCC | 47 | | D08 |
| 14 | | A06 | 48 | | D09 |
| 15 | -WE | A05 | 49 | | D10 |
| 16 | -RDY/-BSY/-IREQ | A04 | 50 | | GND |
| 17 | VCC | A03 | 51 | VCC | |
| 18 | | A02 | 52 | | |
| 19 | | A01 | 53 | | |
| 20 | | A00 | 54 | | |
| 21 | | D00 | 55 | | |
| 22 | A07 | D01 | 56 | | |
| 23 | A06 | D02 | 57 | -VS2 | |
| 24 | A05 | WP/-IOIS16 | 58 | RESET | |
| 25 | A04 | -CD2 | 59 | -WAIT | |
| 26 | A03 | -CD1 | 60 | -INPACK | |
| 27 | A02 | D11 | 61 | -REG | |
| 28 | A01 | D12 | 62 | BVD2 | |
| 29 | A00 | D13 | 63 | -STSCHG | |
| 30 | D00 | D14 | 64 | D08 | |
| 31 | D01 | D15 | 65 | D09 | |
| 32 | D02 | -CE2 | 66 | D10 | |
| 33 | WP/-IOIS16 | -VS1 | 67 | -CD2 | |
| 34 | GND | -IORD | 68 | GND | |

SIGNAL DESCRIPTIONS

| Signal Name | Dir | Pin | Description |
|-------------------------------------|-----|--|--|
| BVD2 (PC Card Memory Mode) | I/O | 45 | This output line is always driven to a high state in Memory Mode since a battery is not required for this product. |
| -SPKR (PC Card I/O Mode) | | | This output line is always driven to a high state in I/O Mode since this product produces no audio. |
| -DASP (True IDE Mode) | | | In the True IDE Mode, this input/output is the Disk Active/Slave Present signal in the Master/Slave handshake protocol. |
| -CD1, -CD2 (PC Card Memory Mode) | O | 26, 25 | These Card Detect pins are connected to ground on the card. They are used by the host to determine that the card is fully inserted into the socket. |
| -CD1, -CD2 (PC Card I/O Mode) | | | This signal is the same as Memory Mode. |
| -CD1, -CD2 (True IDE Mode) | | | These signals are not used in IDE Mode. |
| D15-D00 (PC Card Memory Mode) | I/O | 31, 30, 29, 28, 27, 49, 48, 47, 6, 5, 4, 3, 2, 23, 22, 21 | These lines carry the data, commands, and status information between the host and the controller. D00 is the LSB of the Even Byte of the Word. D08 is the LSB of the Odd Byte of the Word. |
| D15-D00 (PC Card I/O Mode) | | | This signal is the same as the PC Card Memory Mode signal. |
| D15-D00 (True IDE Mode) | | | In True IDE Mode, all Task File operations occur in byte mode on the low order bus D00-D07 while all data transfers are 16 bit using D00-D15. |
| -IOWR (PC Card Memory Mode) | I | 35 | This signal is not used in this mode. |
| -IOWR (PC Card I/O Mode) | | | The I/O Write strobe pulse is used to clock I/O data onto the data bus and into the card controller registers. The clocking occurs on the negative to positive edge of the signal (trailing edge). |
| -IOWR (True IDE Mode) | | | In True IDE Mode, this signal has the same function as in PC Card I/O Mode. |
| -IORD (PC Card Memory Mode) | I | 34 | This signal is not used in this mode. |
| -IORD (PC Card I/O Mode) | | | This is an I/O Read strobe generated by the host. This signal gates I/O data onto the bus from the card. |
| -IORD (True IDE Mode) | | | In True IDE Mode, this signal has the same function as in PC Card I/O Mode. |
| -WE (PC Card Memory Mode) | I | 36 | This is a signal driven by the host and used for strobing memory write data into the registers. It is also used for writing the configuration registers. |
| -WE (PC Card I/O Mode) | | | In PC Card I/O Mode, this signal is used for writing the configuration registers. |
| -WE (True IDE Mode) | | | In True IDE Mode, this input signal is not used and should be connected to VCC. |

(continued)

SIGNAL DESCRIPTIONS *(continued)*

| Signal Name | Dir | Pin | Description |
|--|-----|---|---|
| -OE (PC Card Memory Mode) | I | 9 | This is an Output Enable strobe generated by the host interface. It is used to read data from the card in Memory Mode and to read the CIS and configuration registers. |
| -OE (PC Card I/O Mode) | | | In PC Card I/O Mode, this signal is used to read the CIS and configuration registers. |
| -OE (True IDE Mode) | | | To enable True IDE Mode, this input should be grounded by the host. |
| RDY/-BSY (PC Card Memory Mode) | O | 37 | In Memory Mode this signal is set high when the card is ready to accept a new data transfer operation and held low when the card is busy. The host memory card socket must provide a pull-up resistor. At power up and at reset, the RDY/-BSY signal is held low (busy) until the card has completed its power up or reset function. No access of any type should be made to the card during this time. The RDY/-BSY signal is held high (disabled from being busy) whenever the following condition is true: the card has been powered up with RESET continuously disconnected or asserted high. |
| -IREQ (PC Card I/O Mode) | | | After the card has been configured for I/O operation, this signal is used as the active low interrupt request. This line is strobed low to generate a pulse mode interrupt or held low for a level mode interrupt. |
| INTRQ (True IDE Mode) | | | In True IDE Mode, this signal is the active high interrupt request to the host. |
| A10-A0 (PC Card Memory Mode) | I | 8, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20 | These address lines along with the -REG signal are used to select the following: the I/O port address registers within the card, the memory mapped port address registers within the card, a byte in the card's information structure and the card's configuration control and status registers. |
| A10-A0 (PC Card I/O Mode) | | | This signal is the same as the PC Card Memory Mode signal. |
| A2-A0 (True IDE Mode) | | 27, 28, 29 | In True IDE Mode only, A2:A0 are used to select the one of eight registers in the Task File. The remaining address lines should be grounded. |
| -CE1, -CE2 (PC Card Memory Mode) Card Enable | I | 7, 32 | These input signals are used both to select the card and to indicate to the card whether a byte or a word operation is being performed. -CE2 always accesses the odd byte of the word. -CE1 accesses the even byte or the odd byte of the word depending on A0 and -CE2. A multiplexing scheme based on A0, -CE1, -CE2 allows 8 bit hosts to access all data on D0-D7. |
| -CE1, -CE2 (PC Card I/O Mode) Card Enable | | | This signal is the same as the PC Card Memory Mode signal. |
| -CS0, -CS1 (True IDE Mode) | | | In the True IDE Mode, -CS0 is the chip select for the task file registers while -CS2 is used to select the Alternate Status Register and the Device Control Register. |

(continued)

SIGNAL DESCRIPTIONS *(continued)*

| Signal Name | Dir | Pin | Description |
|--|-----|-----|--|
| -CSEL (PC Card Memory Mode) | I | 39 | This signal is not used for this mode. |
| -CSEL (PC Card I/O Mode) | | | This signal is not used for this mode. |
| -CSEL (True IDE Mode) | | | This internally pulled up signal is used to configure the card as a Master or a Slave. When the pin is grounded, the card is configured as a Master. When the pin is open, the card is configured as a Slave. |
| -REG (PC Card Memory Mode) Attribute Memory Select | I | 44 | This signal distinguishes between accesses to Common Memory (high) and Register Attribute Memory (low). |
| -REG (PC Card I/O Mode) | | | The signal must also be active (low) during I/O Cycles when the I/O address is on the bus. |
| Not Used (True IDE Mode) | | | This signal is not used in True IDE mode. |
| WP (PC Card Memory Mode) Write Protect | O | 24 | The card does not have a write protect switch; therefore, this signal is held low after the completion of the reset initialization sequence. |
| -IOIS16 (PC Card I/O Mode) | | | A low signal indicates that a 16 bit or odd byte only operation can be performed at the addressed port. |
| -IOIS16 (True IDE Mode) | | | Not defined in IDE Mode. |
| -INPACK (PC Card Memory Mode) | O | 43 | This signal is not used in this mode. |
| -INPACK (PC Card I/O Mode) Input Acknowledge | | | The Input Acknowledge signal is asserted by the card when it is selected and responding to an I/O read cycle at the address that is on the bus. The host uses this signal to control the enable of any input data buffers between the card and the host's CPU. |
| Not Used (True IDE Mode) | | | This signal is not used in True IDE mode. |
| BVD1 (PC Card Memory Mode) | I/O | 46 | This signal is asserted high as since a battery is not used with this product. |
| -STSCHG (PC Card I/O Mode) Status Changed | | | This signal is asserted low to alert the host to changes in the RDY/-BSY and Write Protect states. Its use is controlled by the Card Configuration and Status Register. |
| -PDIAG (True IDE Mode) | | | In True IDE Mode, this input/output signal is the Pass Diagnostic signal in the Master/Slave handshake protocol. |

(continued)

SIGNAL DESCRIPTIONS *(continued)*

| Signal Name | Dir | Pin | Description |
|---------------------------------------|-----|----------|---|
| -WAIT (PC Card Memory Mode) | O | 42 | This signal is not used by the card, and is pulled up to VCC through a 4.7K ohm resistor. |
| -WAIT (PC Card I/O Mode) | | | This signal is not used by the card, and is pulled up to VCC through a 4.7K ohm resistor. |
| IORDY (True IDE Mode) | | | This signal is not used by the card, and is pulled up to VCC through a 4.7K ohm resistor. |
| GND (PC Card Memory Mode) | — | 1, 50 | Ground |
| GND (PC Card I/O Mode) | | | Ground |
| GND (True IDE Mode) | | | Ground |
| VCC (PC Card Memory Mode) | — | 13, 38 | +5 V or 3.3V power |
| VCC (PC Card I/O Mode) | | | +5 V or 3.3V power |
| VCC (True IDE Mode) | | | +5 V or 3.3V power |
| RESET (PC Card Memory Mode) | I | 41 | When RESET is high, this signal resets the card. The card is reset only at power up if this signal is left high or open from power-up. The card can also be reset when the soft reset bit in the Card Configuration Option Register is set. |
| RESET (PC Card I/O Mode) | | | This signal is the same as the PC Card Memory Mode signal. |
| -RESET (True IDE Mode) | | | In the True IDE Mode this input pin is the active low hardware reset from the host. |
| -VS1 -VS2 (PC Card Memory Mode) | O | 33 40 | -VS1 is grounded, and -VS2 is not connected so that the card CIS can be read at either 3.3 volts or 5.0 volts. |
| -VS1 -VS2 (PC Card I/O Mode) | | | This signal is the same for all models. |
| -VS1 -VS2 (True IDE Mode) | | | This signal is not used in IDE Mode. |

ABSOLUTE MAXIMUM RATINGS

| Parameter | Symbol | Value | Unit |
|-------------------------------|-----------|-----------------|------|
| Voltage on any pin w.r.t. Vss | Vin, Vout | -0.5 to VCC+0.5 | V |
| Storage Temperature range | Tstg | -65 to +150 | °C |

RECOMMENDED OPERATING CONDITIONS

| Parameter | Symbol | Min | Typ | Max | Unit |
|----------------------------------|--------|--------------|------------|---------------|------|
| Commercial operating temperature | Ta | 0 | 25 | 70 | °C |
| Industrial operating temperature | Ta | -40 | — | 85 | °C |
| VCC voltage | VCC | 4.75 3.18 | 5.0 3.3 | 5.25 3.465 | V |

PERFORMANCE

| Item | Performance |
|---------------------------------|-----------------------|
| Data Transfer Rate To/From Host | 16.7 MBytes/s (burst) |
| Sustained Read | up to 5 MBytes/s |
| Sustained Write | up to 5 MBytes/s |

RELIABILITY

| Item | Value |
|----------------------------|----------------------------------|
| Data Write/Erase Endurance | 2 million cycles min. |
| Data reliability | 1 in 10 ¹⁴ bits, read |
| Data retention | 10 years |

ENVIRONMENTAL CHARACTERISTICS

| Item | Value |
|-----------|--|
| Shock | 2K G, half-sine, 0.330 ms to 0.750 ms (per MIL-STD-202G Method 213B, Condition A) |
| Vibration | 30 G 10Hz-2KHz (per MIL-STD-202G Method 204D 20 min/sweep, 12 sweeps/axis) |
| Humidity | 85°C 95% RH, 5.5V, 500 hrs |

CHS PARAMETERS

| Capacity | C | H | S |
|----------|-------|----|----|
| 128MB | 980 | 8 | 32 |
| 256MB | 980 | 16 | 32 |
| 512MB | 993 | 16 | 63 |
| 1GB | 1986 | 16 | 63 |
| 2GB | 3970 | 16 | 63 |
| 3GB | 6022 | 16 | 63 |
| 4GB | 7964 | 16 | 63 |
| 5GB | 10038 | 16 | 63 |
| 6GB | 12046 | 16 | 63 |
| 7GB | 14054 | 16 | 63 |
| 8GB | 16062 | 16 | 63 |

C=cylinders; H=heads; S=sectors/track

DC CHARACTERISTICS-1 (Ta=0 to 70°C for commercial temperature parts, -40 to 85°C for industrial temperature parts; VCC=3.3V +5% or -3.6%)

| Symbol | Parameter | Min | Max | Units | Notes |
|--------|--|------|-----------|----------|--------|
| VIL | Input LOW Voltage | -0.3 | +0.8 | V | |
| VIH | Input HIGH Voltage | 2.0 | VCC+0.3 | V | |
| VOL | Output LOW Voltage | | 0.45 | V | at 4mA |
| VOH | Output HIGH Voltage | 2.4 | | V | at 1mA |
| ICC | Operating Current Sleep mode Operating | | 800 30 | μA mA | |
| ILI | Input Leakage Current | | 10 | μA | |
| ILO | Output Leakage Current | | 1 | μA | |
| CI/O | Input/output Capacitance | | 25 | pF | |

DC CHARACTERISTICS-2 (Ta=0 to 70°C for commercial temperature parts, -40 to 85°C for industrial temperature parts; VCC=5V±5%)

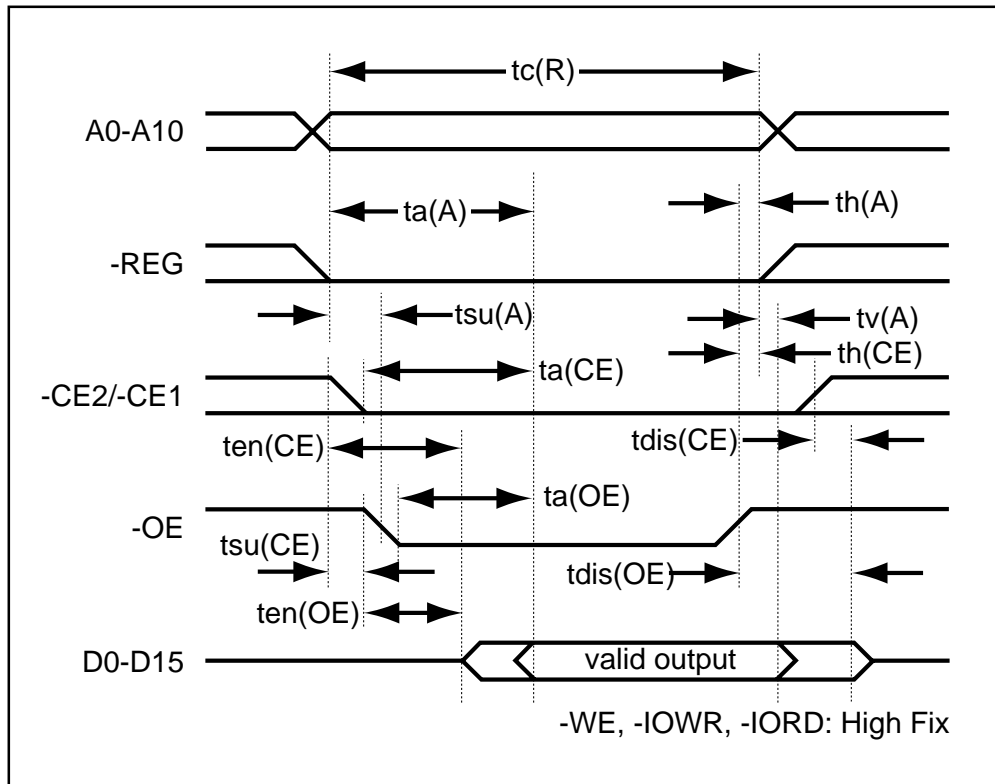
| Symbol | Parameter | Min | Max | Units | Notes |
|--------|--|------|---------|-------|--------|
| VIL | Input LOW Voltage | -0.3 | +0.8 | V | |
| VIH | Input HIGH Voltage | 2.0 | VCC+0.3 | V | |
| VOL | Output LOW Voltage | | 0.8 | V | at 4mA |
| VOH | Output HIGH Voltage | 4.0 | | V | at 1mA |
| ICC | Operating Current, VCC=5.0V Sleep mode Operating | | 1200 | μA | |
| | | | 30 | mA | |
| ILI | Input Leakage Current | | 10 | μA | |
| ILO | Output Leakage Current | | 2 | μA | |
| CI/O | Input/output Capacitance | | 25 | pF | |

AC CHARACTERISTICS (Ta=0 to 70°C for commercial temperature parts, -40 to 85°C for industrial temperature parts; VCC=5V±5% or VCC=3.3V +5% or -3.6%)

Attribute Memory Read AC Characteristics

| Item | Symbol | IEEE Symbol | Min. (ns) | Max. (ns) |
|--------------------------------|----------|-------------|-----------|-----------|
| Read Cycle Time | tc(R) | tAVAV | 250 | |
| Address Access Time | ta(A) | tAVQV | | 250 |
| Card Enable Access Time | ta(CE) | tELQV | | 250 |
| Output Enable Access Time | ta(OE) | tGLQV | | 125 |
| Output Disable Time from -CE | tdis(CE) | tEHQZ | | 100 |
| Output Disable Time from -OE | tdis(OE) | tGHQZ | | 100 |
| Address Setup Time | tsu(A) | tAVGL | 30 | |
| Output Enable Time from -CE | ten(CE) | tELQNZ | 5 | |
| Output Enable Time from -OE | ten(OE) | tGLQNZ | 5 | |
| Data Valid from Address Change | tv(A) | tAXQX | 0 | |
| Address Hold Time | th(A) | — | 20 | |
| -CE Setup Time | tsu(CE) | — | 0 | |
| -CE Hold Time | th(CE) | — | 20 | |

Attribute Memory Read Timings



(continued)

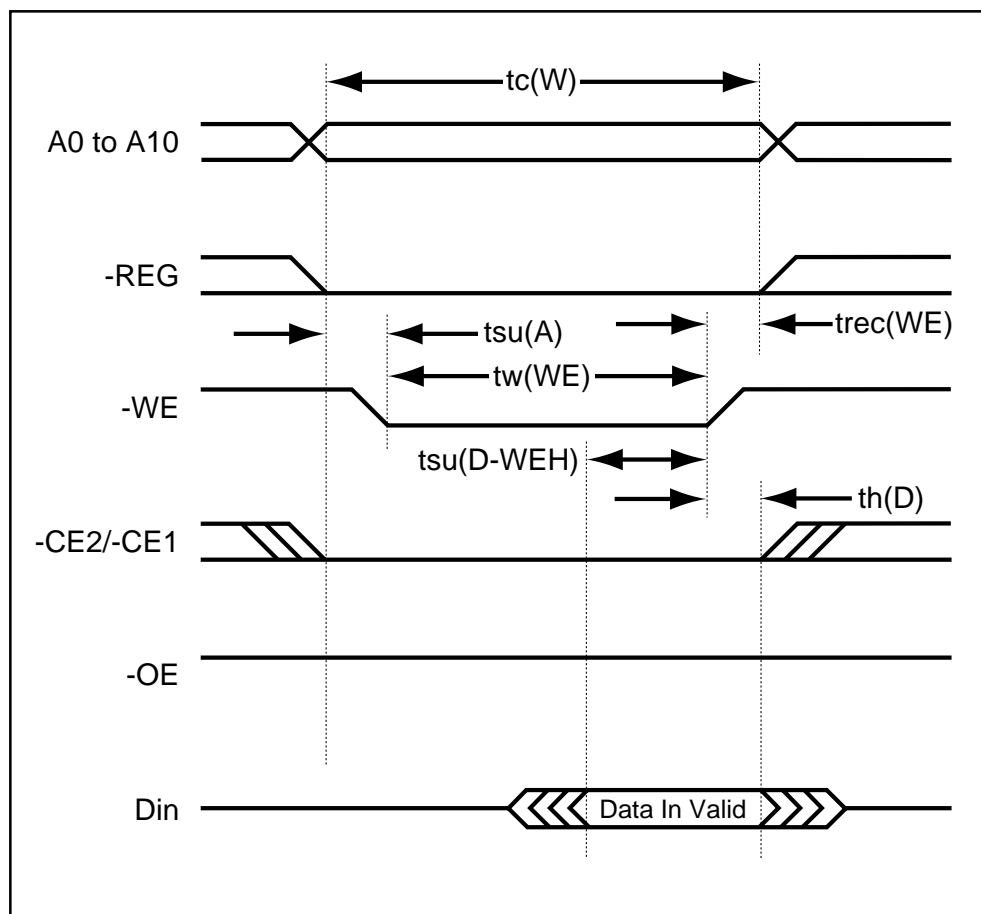
AC CHARACTERISTICS *(continued)***Attribute Memory Write AC Characteristics**

| Item | Symbol | IEEE Symbol | Min. (ns) | Max. (ns) |
|--------------------------------|-------------|-------------|-----------|-----------|
| Write Cycle Time | tc(W) | tAVAV | 250 | |
| Write Pulse Width | tw(WE) | tWLWH | 150 | |
| Address Setup Time | tsu(A) | tAVWL | 30 | |
| Address Setup Time (-WE) | tsu(A-WEH) | — | 180 | |
| -CE Setup Time (-WE) | tsu(CE-WEH) | — | 180 | |
| Data Setup Time (-WE) | tsu(D-WEH) | tDVWH | 80 | |
| Data Hold Time | th(D) | tWMDX | 30 | |
| Write Recovery Time | trec(WE) | tWMAX | 30 | |
| Output Disable Time (-WE) | tdis(WE) | — | | 100 |
| Output Disable Time (-OE) | tdis(OE) | — | | 100 |
| Output Enable Time (-WE) | ten(WE) | — | 5 | |
| Output Enable Time (-OE) | ten(OE) | — | 5 | |
| Output Enable Setup Time (-WE) | tsu(OE-WE) | — | 10 | |
| Output Enable Hold Time (-WE) | th(OE-WE) | — | 10 | |
| -CE Setup Time | tsu(CE) | — | 0 | |
| -CE Hold Time | th(CE) | — | 20 | |

(continued)

AC CHARACTERISTICS *(continued)*

Attribute Memory Write Timings

*(continued)*

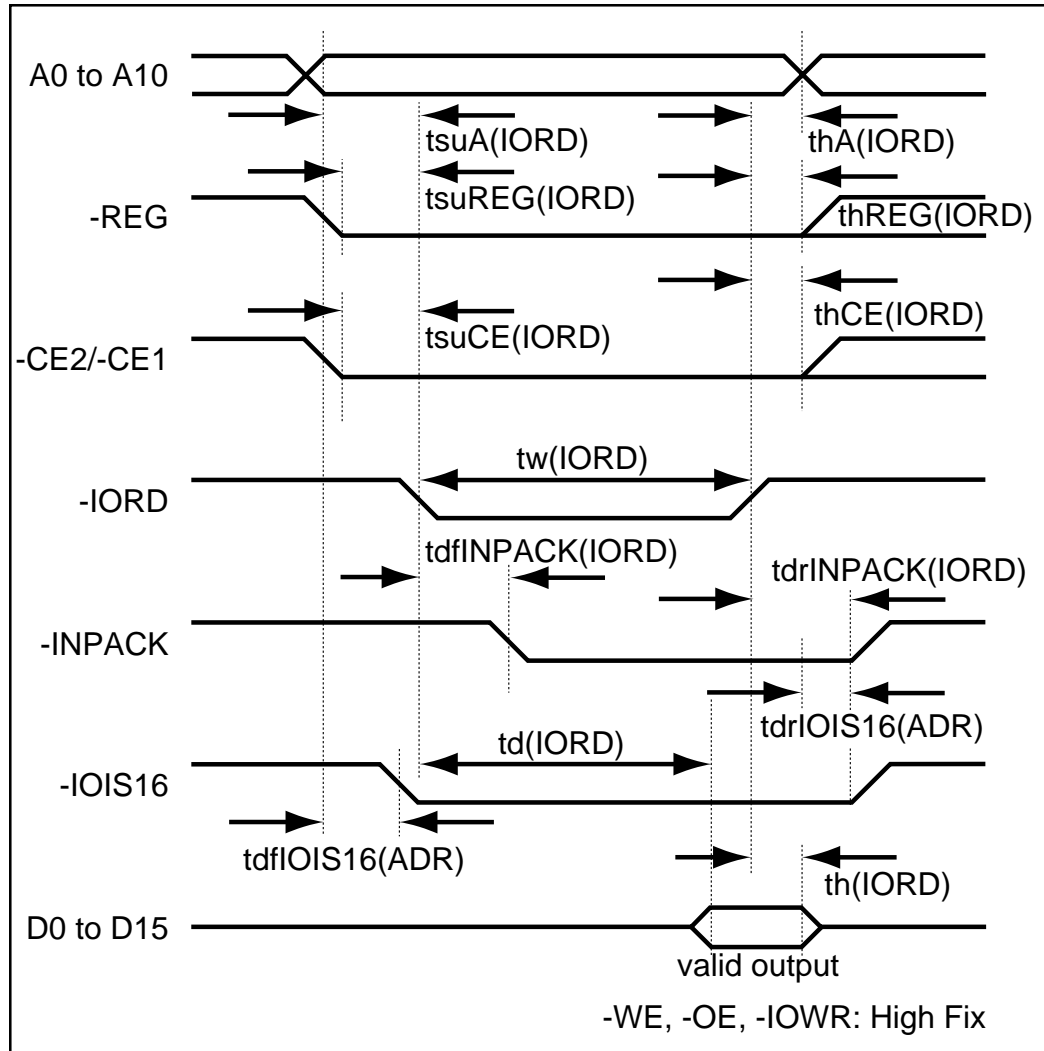
AC CHARACTERISTICS *(continued)***I/O Access Read AC Characteristics**

| Item | Symbol | IEEE Symbol | Min. (ns) | Max. (ns) |
|------------------------------------|-----------------|-------------|-----------|-----------|
| Data Delay after -IORD | td(IORD) | tIGLQV | | 100 |
| Data Hold following -IORD | th(IORD) | tIGHQX | 0 | |
| -IORD Width Time | tw(IORD) | tIGLIGH | 165 | |
| Address Setup before -IORD | tsuA(IORD) | tAVIGL | 70 | |
| Address Hold following -IORD | thA(IORD) | tIGHAX | 20 | |
| -CE Setup before -IORD | tsuCE(IORD) | tELIGL | 5 | |
| -CE Hold following -IORD | thCE(IORD) | tIGHEH | 20 | |
| -REG Setup before -IORD | tsuREG(IORD) | tRGLIGL | 5 | |
| -REG Hold following -IORD | thREG(IORD) | tIGHRGH | 0 | |
| -INPACK Delay Falling from -IORD | tdfINPACK(IORD) | tIGLIAL | 0 | 45 |
| -INPACK Delay Rising from -IORD | tdrINPACK(IORD) | tIGHIAH | | 45 |
| -IOIS16 Delay Falling from Address | tdfIOIS16(ADR) | tAVISL | | 35 |
| -IOIS16 Delay Rising from Address | tdrIOIS16(ADR) | tAVISH | | 35 |

(continued)

AC CHARACTERISTICS (continued)

I/O Access Read Timings



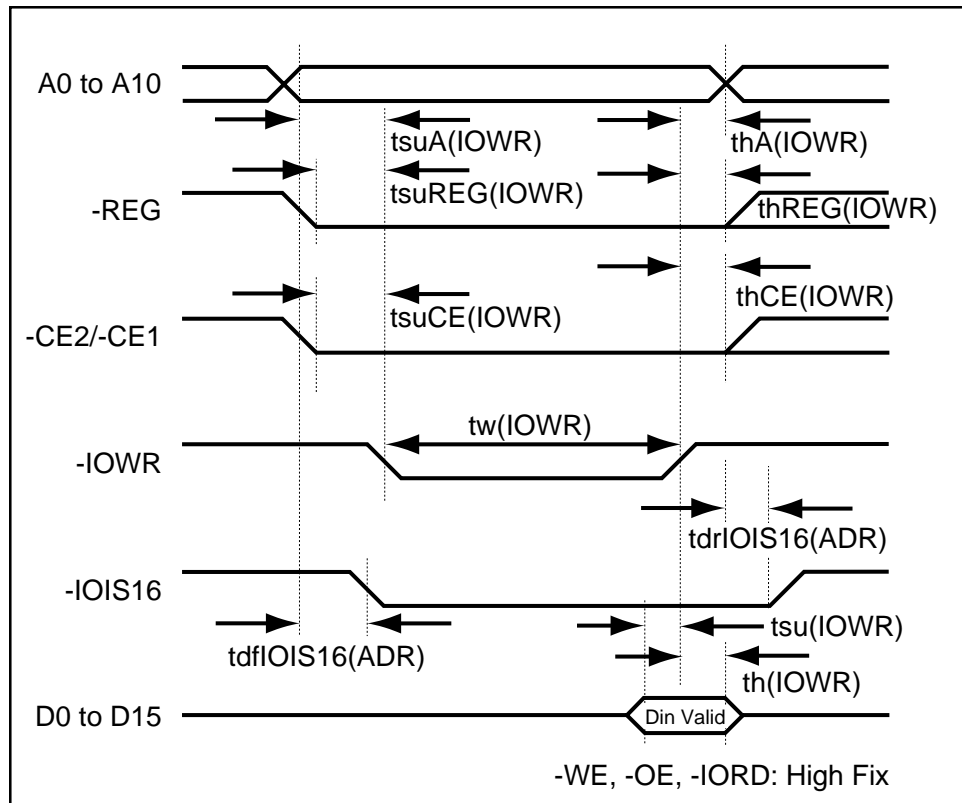
(continued)

AC CHARACTERISTICS *(continued)*

I/O Access Write AC Characteristics

| Item | Symbol | IEEE Symbol | Min. (ns) | Max. (ns) |
|------------------------------------|----------------|-------------|-----------|-----------|
| Data Setup before -IOWR | tsu(IOWR) | tDVIWH | 60 | |
| Data Hold following -IOWR | th(IOWR) | tIWHDX | 30 | |
| -IOWR Width Time | tw(IOWR) | tIWLWH | 165 | |
| Address Setup before -IOWR | tsuA(IOWR) | tAVIWL | 70 | |
| Address Hold following -IOWR | thA(IOWR) | tIWHAX | 20 | |
| -CE Setup before -IOWR | tsuCE(IOWR) | tELIWL | 5 | |
| -CE Hold following -IOWR | thCE(IOWR) | tIWHEH | 20 | |
| -REG Setup before -IOWR | tsuREG(IOWR) | tRGLIWL | 5 | |
| -REG Hold following -IOWR | thREG(IOWR) | tIWHRGH | 0 | |
| -IOIS16 Delay Falling from Address | tdfIOIS16(ADR) | tAVISL | | 35 |
| -IOIS16 Delay Rising from Address | tdrIOIS16(ADR) | tAVISH | | 35 |

I/O Access Write Timings



(continued)

AC CHARACTERISTICS *(continued)***Register Access AC Characteristics for True IDE**

| Parameter | Symbol | Mode0 | Mode1 | Mode2 | Mode3 | Mode4 | Unit |
|--|-----------------|-------|-------|-------|-------|-------|------|
| Cycle time (min) | t ₀ | 600 | 383 | 330 | 180 | 120 | ns |
| Address valid to -IORD/-IOWR setup (min) | t ₁ | 70 | 50 | 30 | 30 | 25 | ns |
| -IORD/-IOWR pulse width 8bit (min) | t ₂ | 290 | 290 | 290 | 80 | 70 | ns |
| -IORD/-IOWR recovery time (min) | t _{2i} | — | — | — | 70 | 25 | ns |
| -IOWR data setup (min) | t ₃ | 60 | 45 | 30 | 30 | 20 | ns |
| -IOWR data hold (min) | t ₄ | 30 | 20 | 15 | 10 | 10 | ns |
| -IORD data setup (min) | t ₅ | 50 | 35 | 20 | 20 | 20 | ns |
| -IORD data hold (min) | t ₆ | 5 | 5 | 5 | 5 | 5 | ns |
| -IORD data tristate (max) | t _{6z} | 30 | 30 | 30 | 30 | 30 | ns |
| Address valid to -IOCS16 assert. (max) | t ₇ | 90 | 50 | 40 | n/a | n/a | ns |
| Address valid to -IOCS16 release (max) | t ₈ | 60 | 45 | 30 | n/a | n/a | ns |
| -IORD/-IOWR to address valid hold | t ₉ | 20 | 15 | 10 | 10 | 10 | ns |

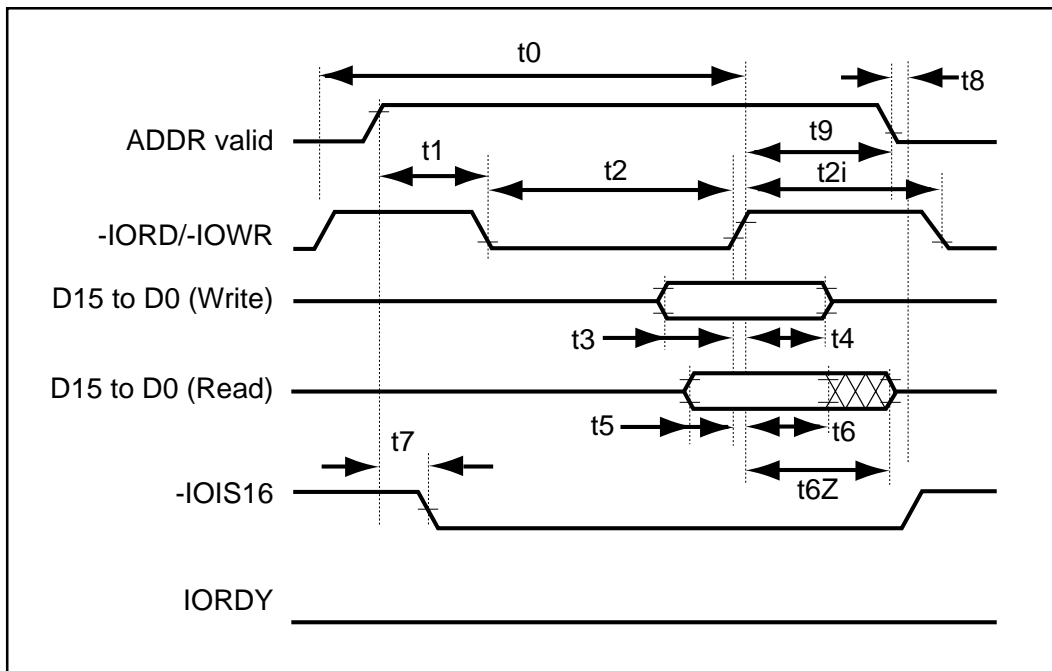
PIO Mode Access AC Characteristics for True IDE

| Parameter | Symbol | Mode0 | Mode1 | Mode2 | Mode3 | Mode4 | Unit |
|--|-----------------|-------|-------|-------|-------|-------|------|
| Cycle time (min) | t ₀ | 600 | 383 | 240 | 180 | 120 | ns |
| Address valid to -IORD/-IOWR setup (min) | t ₁ | 70 | 50 | 30 | 30 | 25 | ns |
| -IORD/-IOWR pulse width 16bit (min) | t ₂ | 165 | 125 | 100 | 80 | 70 | ns |
| -IORD/-IOWR recovery time (min) | t _{2i} | - | - | - | 70 | 25 | ns |
| -IOWR data setup (min) | t ₃ | 60 | 45 | 30 | 30 | 20 | ns |
| IOWR data hold (min) | t ₄ | 30 | 20 | 15 | 10 | 10 | ns |
| -IORD data setup (min) | t ₅ | 50 | 35 | 20 | 20 | 20 | ns |
| -IORD data hold (min) | t ₆ | 5 | 5 | 5 | 5 | 5 | ns |
| -IORD data tristate (max) | t _{6z} | 30 | 30 | 30 | 30 | 30 | ns |
| Address valid to -IOCS16 assert. (max) | t ₇ | 90 | 50 | 40 | n/a | n/a | ns |
| Address valid to -IOCS16 release (max) | t ₈ | 60 | 45 | 30 | n/a | n/a | ns |
| -IORD/-IOWR to address valid hold | t ₉ | 20 | 15 | 10 | 10 | 10 | ns |

(continued)

AC CHARACTERISTICS *(continued)*

True IDE Mode Access Read/Write Timings



HOST ACCESS SPECIFICATION

Attribute Access Specifications

The CIS can be accessed by Byte/Word/Odd-byte modes which are defined by CF card standard specifications. The -REG signal must be low when accessing the CIS.

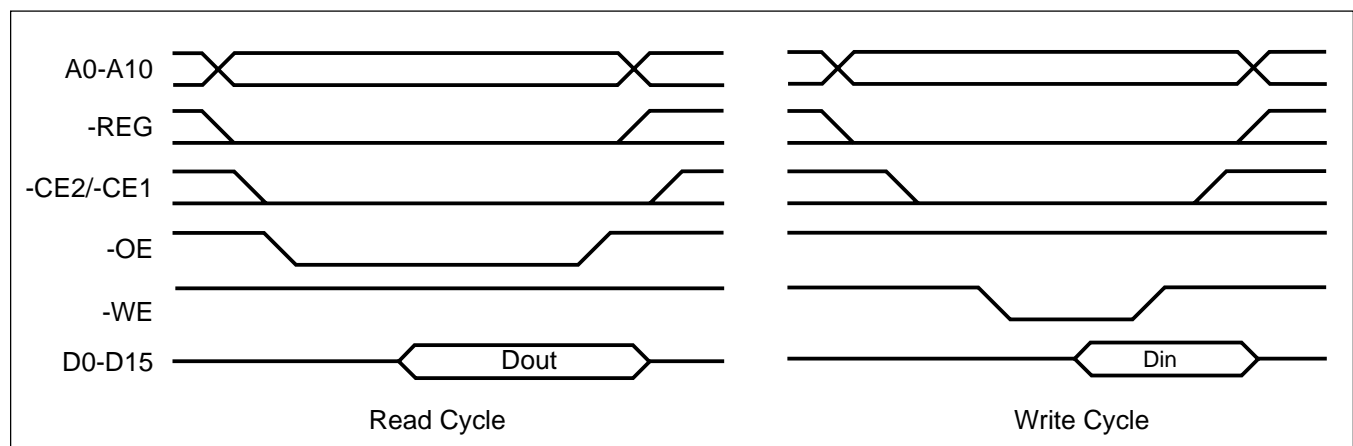
Attribute Read Access Mode

| Function Mode | -REG | -CE2 | -CE1 | A0 | -OE | -WE | D15-D8 | D7-D0 |
|-------------------------|--------|--------|--------|--------|--------|--------|------------------|----------------------|
| Standby Mode | X | H | H | X | X | X | High Z | High Z |
| Byte Access (8-bit) | L L | H H | L L | L H | L L | H H | High Z High Z | Even Byte Invalid |
| Word Access (16-bit) | L | L | L | x | L | H | Invalid | Even Byte |
| Odd Byte Access (8-bit) | L | L | H | x | L | H | Invalid | High Z |
| x: L or H | | | | | | | | |

Attribute Write Access Mode

| Function Mode | -REG | -CE2 | -CE1 | A0 | -OE | -WE | D15-D8 | D7-D0 |
|-------------------------|--------|--------|--------|--------|--------|--------|--------------------------|-------------------------|
| Standby Mode | X | H | H | X | X | X | Don't Care | Don't Care |
| Byte Access (8-bit) | L L | H H | L L | L H | H H | L L | Don't Care Don't Care | Even Byte Don't Care |
| Word Access (16-bit) | L | L | L | x | H | L | Don't Care | Even Byte |
| Odd Byte Access (8-bit) | L | L | H | x | H | L | Don't Care | Don't Care |
| x: L or H | | | | | | | | |

Attribute Access Timing Example



Task File Register Access Specifications

There are two cases of Task File register mapping, one is the mapped I/O address area, the other is mapped Memory address area. Task File register read and write operations are described in the charts below. The Task File register can be accessed by Byte/Word/Odd Byte mode which are defined by CF card standard specifications.

I/O Address Map

Task File Register Read Access Mode

| Mode | -REG | -CE2 | -CE1 | A0 | -IORD | -IOWR | -OE | -WE | D15-D8 | D7-D0 |
|-------------------------|--------|--------|--------|--------|--------|--------|--------|--------|------------------|-----------------------|
| Standby Mode | x | H | H | x | x | x | x | x | High Z | High Z |
| Byte Access (8 bit) | L L | H H | L L | L H | L L | H H | H H | H H | High Z High Z | Even-Byte Odd-Byte |
| Word Access (16-bit) | L | L | L | x | L | H | H | H | Odd-Byte | Even Byte |
| I/O Inhibit | H | x | x | x | L | H | H | H | High-Z | High-Z |
| Odd Byte Access (8-bit) | L | L | H | x | L | H | H | H | Odd-Byte | High-Z |

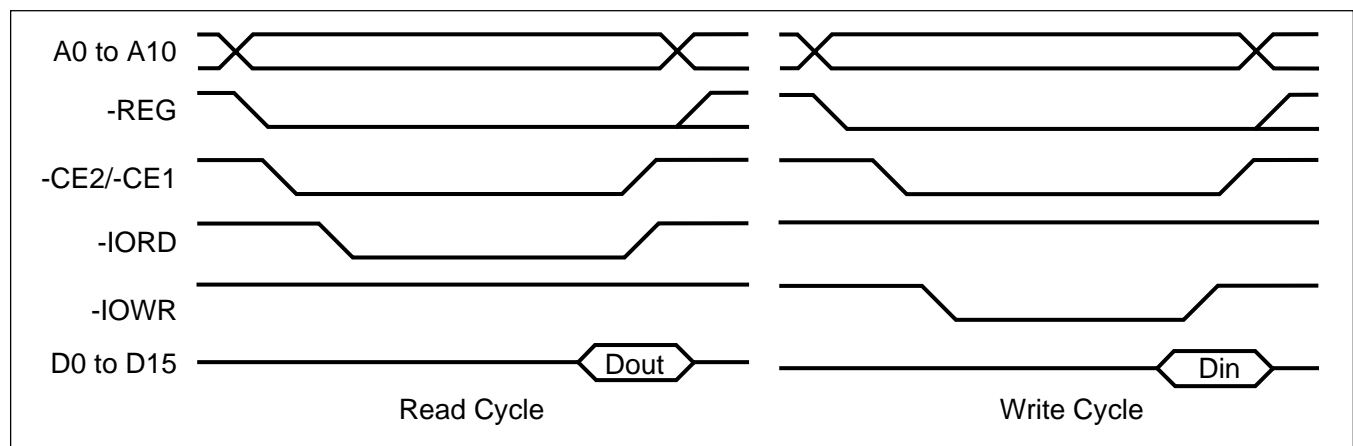
x: L or H

Task File Register Write Access Mode

| Mode | -REG | -CE2 | -CE1 | A0 | -IORD | -IOWR | -OE | -WE | D15-D8 | D7-D0 |
|-------------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------------------------|-----------------------|
| Standby Mode | x | H | H | x | x | x | x | x | Don't Care | Don't Care |
| Byte Access (8 bit) | L L | H H | L L | L H | H H | L L | H H | H H | Don't Care Don't Care | Even-Byte Odd-Byte |
| Word Access (16-bit) | L | L | L | x | H | L | H | H | Odd-Byte | Even Byte |
| I/O Inhibit | H | x | x | x | H | L | H | H | High-Z | High-Z |
| Odd Byte Access (8-bit) | L | L | H | x | H | L | H | H | Odd-Byte | Don't Care |

x: L or H

Task File Register Access Timing Example



Memory Address Map

Task File Register Read Access Mode

| Mode | -REG | -CE2 | -CE1 | A0 | -OE | -WE | -IORD | -IOWR | D15-D8 | D7-D0 |
|-------------------------|------|------|------|----|-----|-----|-------|-------|----------|-----------|
| Standby Mode | x | H | H | x | x | x | x | x | High Z | High Z |
| Byte Access (8 bit) | H | H | L | L | L | H | H | H | High Z | Even-Byte |
| | H | H | L | H | L | H | H | H | High Z | Odd-Byte |
| Word Access (16-bit) | H | L | L | x | L | H | H | H | Odd-Byte | Even Byte |
| Odd Byte Access (8-bit) | H | L | H | x | L | H | H | H | Odd-Byte | High-Z |

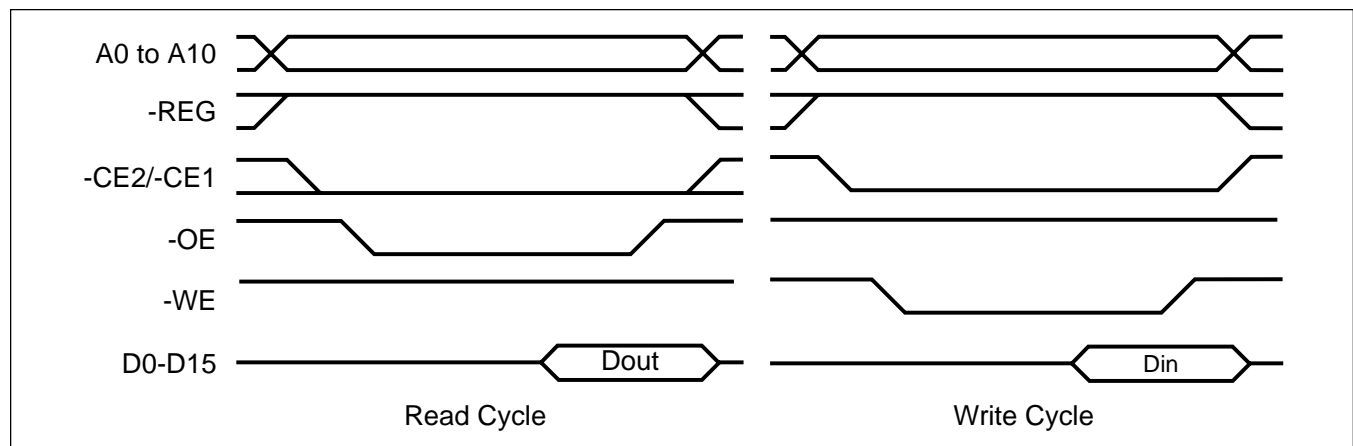
x: L or H

Task File Register Write Access Mode

| Mode | -REG | -CE2 | -CE1 | A0 | -OE | -WE | -IORD | -IOWR | D15-D8 | D7-D0 |
|-------------------------|------|------|------|----|-----|-----|-------|-------|------------|------------|
| Standby Mode | x | H | H | x | x | x | x | x | Don't Care | Don't Care |
| Byte Access (8 bit) | H | H | L | L | H | L | H | H | Don't Care | Even-Byte |
| | H | H | L | H | H | L | H | H | Don't Care | Odd-Byte |
| Word Access (16-bit) | H | L | L | x | H | L | H | H | Odd-Byte | Even Byte |
| Odd Byte Access (8-bit) | H | L | H | x | H | L | H | H | Odd-Byte | Don't Care |

x: L or H

Task File Register Access Timing Example



True IDE Mode

The card is configured in a True IDE mode of operation when the -OE input signal is asserted GND by the host at power up. In the True IDE mode, Attribute Registers are not accessible from the host. The data register is accessed in word (16-bit) mode at power up. The card permits 8-bit accesses if the host issues a Set Feature Command to put the device in 8-bit mode.

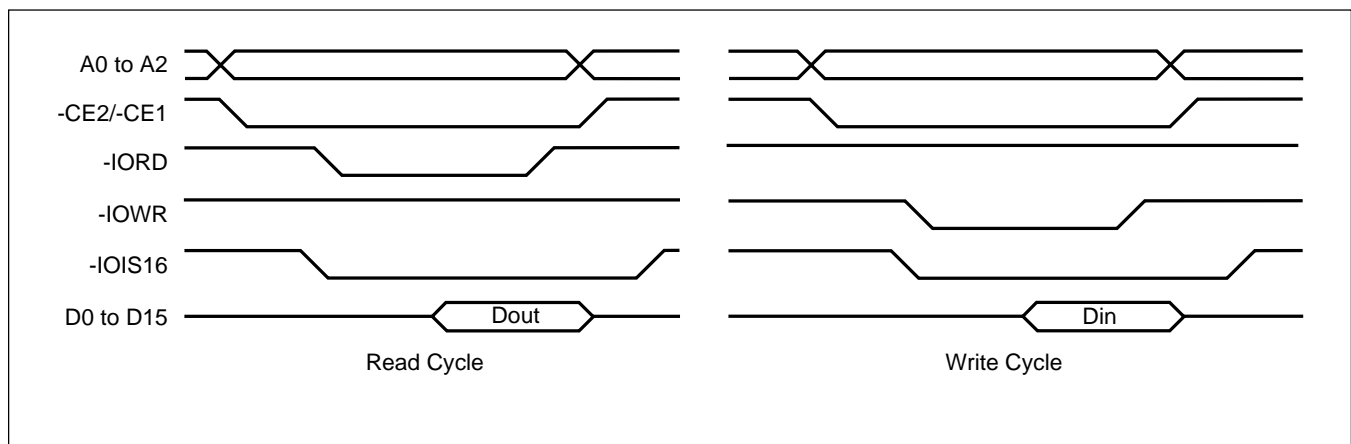
True IDE Mode Read I/O Function

| Mode | -CE2 | -CE1 | A0 to A2 | -IOR | -IOWR | D15-D8 | D7-D0 |
|-------------------------|------|------|----------|------|-------|----------|------------|
| Invalid Mode | L | L | x | x | x | High Z | High Z |
| Standby Mode | H | H | x | x | x | High Z | High Z |
| Data Register Access | H | L | 0 | L | H | Odd-Byte | Even-Byte |
| Alternate Status Access | L | H | 6h | L | H | High Z | Status Out |
| Other Task File Access | H | L | 1-7h | L | H | High Z | Data |
| x: L or H | | | | | | | |

True IDE Mode Write I/O Function

| Mode | -CE2 | -CE1 | A0 to A2 | -IOR | -IOWR | D15-D8 | D7-D0 |
|-------------------------|------|------|----------|------|-------|------------|------------|
| Invalid Mode | L | L | x | x | x | Don't Care | Don't Care |
| Standby Mode | H | H | x | x | x | Don't Care | Don't Care |
| Data Register Access | H | L | 0 | H | L | Odd-Byte | Even-Byte |
| Control Register Access | L | H | 6h | H | L | Don't Care | Control In |
| Other Task File Access | H | L | 1-7h | H | L | Don't Care | Data |
| x: L or H | | | | | | | |

True IDE Mode I/O Access Timing Example



CIS INFORMATION (TYPICAL)

| | |
|--|---|
| ----- | ----- |
| 0000: Code 01, link 03 | 0015: Code 15, link 13 |
| D9 01 FF | 04 01 53 54 49 00 46 6C 61 73 68 20 37 2E 30 2E |
| ----- | 30 00 FF |
| ----- | ----- |
| Tuple CISTPL_DEVICE (01), length 3 (03) at offset 0 | Tuple CISTPL_VERS_1 (15), length 19 (13) at offset 15 |
| Device type is FUNCSPEC | Major version 4, minor version 1 |
| Device speed is 250ns | Product Information: |
| Write protect switch is not in control | Manufacturer: "STI" |
| Device size is 2K bytes | Product name: "Flash X.Y.Z" |
| ----- | ----- |
| 0005: Code 1C, link 04 | 002A: Code 21, link 02 |
| 03 D9 01 FF | 04 01 |
| ----- | ----- |
| Tuple CISTPL_DEVICE_OC (1C), length 4 (04) at offset 5 | Tuple CISTPL_FUNCID (21), length 2 (02) at offset 2A |
| Device conditions: minimum cycle with WAIT at Vcc = 3.3V | Function code 04 (Fixed Disk), system init 01 |
| Device type is FUNCSPEC | ----- |
| Device speed is 250ns | 002E: Code 22, link 02 |
| Write protect switch is not in control | 01 01 |
| Device size is 2K bytes | ----- |
| ----- | Tuple CISTPL_FUNCE (22), length 2 (02) at offset 2E |
| 000B: Code 18, link 02 | This is an PC Card ATA Disk |
| DF 01 | ----- |
| ----- | 0032: Code 22, link 03 |
| Tuple CISTPL_JEDEC_C (18), length 2 (02) at offset B | 02 0C 0F |
| Device 0 JEDEC id: Manufacturer DF, ID 01 | ----- |
| ----- | Tuple CISTPL_FUNCE (22), length 3 (03) at offset 32 |
| 000F: Code 20, link 04 | Vpp is not required |
| 4D 01 00 01 | This is a silicon device |
| ----- | Identify Drive Model/Serial Number is guaranteed unique |
| Tuple CISTPL_MANFID (20), length 4 (04) at offset F | Low-Power Modes supported: Sleep Standby Idle |
| Manufacturer # 0x014D hardware rev 1.00 | Drive automatically minimizes power |
| | All modes include 3F7 or 377 |
| | Index bit is not supported |
| | -IOIS16 is unspecified in Twin configurations |

0037: Code 1A, link 05

01 03 00 02 0F

Tuple CISTPL_CONFIG (1A), length 5 (05) at offset 37

Last valid configuration index is 3

Configuration Register Base Address is 200

Configuration Registers Present:

Configuration Option Register at 200

Card Configuration and Status Register at 202

Pin Replacement Register at 204

Socket and Copy Register at 206

003E: Code 1B, link 08

C0 C0 A1 01 55 08 00 20

Tuple CISTPL_CFTABLE_ENTRY (1B), length 8 (08) at offset 3E

Configuration Table Index is 00 (default)

Interface type is Memory

BVDs not active, WP not active, RdyBsy active

Wait signal support required

Vcc Power Description:

Nom V = 5.0 V

map 2048 bytes of memory to card address 0

Miscellaneous Features:

Max Twins 0, -Audio, -ReadOnly, +PowerDown

0048: Code 1B, link 06

00 01 21 B5 1E 4D

Tuple CISTPL_CFTABLE_ENTRY (1B), length 6 (06) at offset 48

Configuration Table Index is 00

Vcc Power Description:

Nom V = 3.30 V

Peak I = 45.0 mA

0050: Code 1B, link 0A

C1 41 99 01 55 64 F0 FF FF 20

Tuple CISTPL_CFTABLE_ENTRY (1B), length 10 (0A) at offset 50

Configuration Table Index is 01 (default)

Interface type is I/O

BVDs not active, WP not active, RdyBsy active

Wait signal support not required

Vcc Power Description:

Nom V = 5.0 V

Decode 4 I/O lines, bus size 8 or 16

IRQ may be shared, pulse and level mode interrupts are supported

Interrupts in mask FFFF are supported

Miscellaneous Features:

Max Twins 0, -Audio, -ReadOnly, +PowerDown

005C: Code 1B, link 06

01 01 21 B5 1E 4D

Tuple CISTPL_CFTABLE_ENTRY (1B), length 6 (06) at offset 5C

Configuration Table Index is 01

Vcc Power Description:

Nom V = 3.30 V

Peak I = 45.0 mA

0064: Code 1B, link 0F

C2 41 99 01 55 EA 61 F0 01 07 F6 03 01 EE 20

Tuple CISTPL_CFTABLE_ENTRY (1B), length 15 (0F) at offset 64

Configuration Table Index is 02 (default)

Interface type is I/O

BVDs not active, WP not active, RdyBsy active

Wait signal support not required

Vcc Power Description:

Nom V = 5.0 V

Decode 10 I/O lines, bus size 8 or 16

I/O block at 01F0, length 8

I/O block at 03F6, length 2

IRQ may be shared, pulse and level mode interrupts are supported

Only IRQ14 is supported

Miscellaneous Features:

Max Twins 0, -Audio, -ReadOnly, +PowerDown

0075: Code 1B, link 06

02 01 21 B5 1E 4D

Tuple CISTPL_CFTABLE_ENTRY (1B), length 6 (06) at offset 75

Configuration Table Index is 02

Vcc Power Description:

Nom V = 3.30 V

Peak I = 45.0 mA

007D: Code 1B, link 0F

C3 41 99 01 55 EA 61 70 01 07 76 03 01 EE 20

Tuple CISTPL_CFTABLE_ENTRY (1B), length 15 (0F) at offset 7D

Configuration Table Index is 03 (default)

Interface type is I/O

BVDs not active, WP not active, RdyBsy active

Wait signal support not required

Vcc Power Description:

Nom V = 5.0 V

Decode 10 I/O lines, bus size 8 or 16

I/O block at 0170, length 8

I/O block at 0376, length 2

IRQ may be shared, pulse and level mode interrupts are supported

Only IRQ14 is supported

Miscellaneous Features:

Max Twins 0, -Audio, -ReadOnly, +PowerDown

008E: Code 1B, link 06

03 01 21 B5 1E 4D

Tuple CISTPL_CFTABLE_ENTRY (1B), length 6 (06) at offset 8E

Configuration Table Index is 03

Vcc Power Description:

Nom V = 3.30 V

Peak I = 45.0 mA

0096: Code 14, link 00

Tuple CISTPL_NO_LINK (14), length 0 (00) at offset 96

0098: Code FF

Tuple CISTPL_END (FF) at offset 98

CONFIGURATION REGISTER SPECIFICATION

This card supports four configuration registers for the purpose of the configuration and observation of the card. These registers can be used in memory card mode and I/O card mode. In True IDE mode, these registers can not be used.

Configuration Option Register (Address 200h)

This register is used to configure and observe the status of the card, and to issue soft resets to the card.

| | | | | | | | |
|--------------------|---------|------------------|------|------|------|------|------|
| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
| SRESET | LevIREQ | INDEX (bits 0-5) | | | | | |
| Initial Value: 00h | | | | | | | |

| Name | R/W | Function |
|------------------|-----|--|
| SRESET (HOST->) | R/W | Setting this bit to "1" places the card in the reset state. This operation is equal to a hard reset, except this bit is not cleared. |
| LevIREQ (HOST->) | R/W | This bit is set to "0" when pulse mode interrupt is selected, and to "1" when level mode interrupt is selected. |
| INDEX (HOST->) | R/W | These bits are used to select the operation mode of the card. (See table below.) At power on, hard reset, and soft reset, this data is "000000" for the purpose of Memory card interface recognition, and access to CIS. |

| INDEX bit | | | | | | Card Mode | Task File Register Address | Mapping Mode |
|-----------|---|---|---|---|---|-------------|----------------------------|-----------------------|
| 5 | 4 | 3 | 2 | 1 | 0 | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | Memory Card | 0h to Fh, 400h to 7FFh | Memory Mapped |
| 0 | 0 | 0 | 0 | 0 | 1 | I/O Card | xx0h to xxFh | Contiguous I/O Mapped |
| 0 | 0 | 0 | 0 | 1 | 0 | I/O Card | 1F0h to 1F7h, 3F6h to 3F7h | Primary I/O Mapped |
| 0 | 0 | 0 | 0 | 1 | 1 | I/O Card | 170h to 177h, 376h to 377h | Secondary I/O Mapped |

Configuration and Status Register (Address 202h)

This register is used for observing the card state.

| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
|--------------------|--------|-------|------|------|------|------|------|
| CHGED | SIGCHG | IOIS8 | 0 | 0 | PWD | INTR | 0 |
| Initial Value: 00h | | | | | | | |

| Name | R/W | Function |
|-----------------|-----|---|
| CHGED (CARD->) | R | This bit indicates that CRDY/-BSY bit on Pin Replacement register is set to "1". When the CHGED bit is set to "1", the -STSCHG pin is held low if the SIGCHG bit is also set to "1" and the card configured for the I/O interface. |
| SIGCHG (HOST->) | R/W | This bit is set or reset by the host for enabling and disabling the status change signal (-STSCHG pin). When the card is configured to I/O card interface and this bit is set to "1", -STSCHG pin is controlled by CHGED bit. If this bit is set to "0", -STSCHG pin is kept high when the card is configured for I/O. |
| IOIS8 (HOST->) | R/W | The host sets this field to "1" when it can provide I/O cycles only with an 8 bit data bus (D7 to D0). |
| PWD (HOST->) | R/W | When this bit is set to "1", the card enters sleep state (power down mode). When this bit is reset to "0", the card transfers to idle state (active mode). |
| INTR (CARD->) | R | This bit indicates the internal state of the interrupt request. The bit is available whether the I/O card interface has been configured or not. This signal remains true until the condition which caused the interrupt request has been serviced. If interrupts are disabled by the -IEN bit in the Device Control Register, this bit is a zero. |

Pin Replacement Register (Address 204h)

This register is used for providing the signal state of -IREQ when the card is configured as the I/O card interface.

| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
|--------------------|------|-----------|--------|------|------|-----------|--------|
| 0 | 0 | CRDY/-BSY | CWProt | 1 | 1 | RRDY/-BSY | RWProt |
| Initial Value: 0Ch | | | | | | | |

| Name | R/W | Function |
|--------------------|-----|---|
| CRDY/-BSY (HOST->) | R/W | This bit is set to "1" when the RRDY/-BSY bit changes state. This bit may also be written by the host. |
| CWProt (HOST->) | R | This bit is set to "1" when the RWProt changes state. This bit may also be written by the host. |
| RRDY/-BSY (HOST->) | R/W | This bit is used to determine the internal state of the RDY/BSY signal. This bit may be used to determine the state of the Ready/Busy as this pin has been reallocated for use as interrupt request on an I/O card. |
| RWProt (HOST->) | R | This bit indicates the write protect status. When set, indicates write protect. When cleared, indicates that write is enabled. |

Socket and Copy Register (Address 206h)

This read and write register is used to identify the card from other cards. This register should be set by the host before this card's Configuration Option register is set.

| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
|--------------------|------|------|------|------|------|------|------|
| 0 | 0 | 0 | DRV# | 1 | 1 | 0 | 0 |
| Initial Value: 00h | | | | | | | |

| Name | R/W | Function |
|---------------|-----|--|
| DRV# (HOST->) | R/W | These fields are used to configure multiple cards. When the host configures multiple cards, the card's copy number is written in this field. In this way, the host can perform the card's master/slave organization. |

TASK FILE REGISTER SPECIFICATION

These registers are used for reading and writing data to the card. These registers are mapped four types by the configuration of INDEX in Configuration Option register. A fifth mapping, True IDE, is configured at power up if -OE is held low.

Memory Map (INDEX=0)

| -REG | A10 | A9-A4 | A3 | A2 | A1 | A0 | Offset | -OE=L | -WE=L |
|------|-----|-------|----|----|----|----|--------|------------------------|------------------------|
| 1 | 0 | X | 0 | 0 | 0 | 0 | 0 | Data register | Data register |
| 1 | 0 | X | 0 | 0 | 0 | 1 | 1 | Error register | Feature register |
| 1 | 0 | X | 0 | 0 | 1 | 0 | 2 | Sector Count register | Sector Count register |
| 1 | 0 | X | 0 | 0 | 1 | 1 | 3 | Sector No. register | Sector No. register |
| 1 | 0 | X | 0 | 1 | 0 | 0 | 4 | Cylinder Low register | Cylinder Low register |
| 1 | 0 | X | 0 | 1 | 0 | 1 | 5 | Cylinder High register | Cylinder High register |
| 1 | 0 | X | 0 | 1 | 1 | 0 | 6 | Drive Head register | Drive Head register |
| 1 | 0 | X | 0 | 1 | 1 | 1 | 7 | Status register | Command register |
| 1 | 0 | X | 1 | 0 | 0 | 0 | 8 | Dup. Even RD Data reg. | Dup. Even WR Data reg. |
| 1 | 0 | X | 1 | 0 | 0 | 1 | 9 | Dup. Odd RD Data reg. | Dup. Odd WR Data reg. |
| 1 | 0 | X | 1 | 1 | 0 | 1 | D | Dup. Error register | Dup. Feature register |
| 1 | 0 | X | 1 | 1 | 1 | 0 | E | Alt Status register | Device Ctl register |
| 1 | 0 | X | 1 | 1 | 1 | 1 | F | Drive Address register | Reserved |
| 1 | 1 | X | X | X | X | 0 | 8 | Even Data register | Even Data register |
| 1 | 1 | X | X | X | X | 1 | 9 | Odd Data register | Odd Data register |

Contiguous I/O Map (INDEX=1)

| -REG | A10-A4 | A3 | A2 | A1 | A0 | Offset | -IORD=L | -IOWR=L |
|------|--------|----|----|----|----|--------|------------------------|------------------------|
| 0 | X | 0 | 0 | 0 | 0 | 0 | Data register | Data register |
| 0 | X | 0 | 0 | 0 | 1 | 1 | Error register | Feature register |
| 0 | X | 0 | 0 | 1 | 0 | 2 | Sector Count register | Sector Count register |
| 0 | X | 0 | 0 | 1 | 1 | 3 | Sector No. register | Sector No. register |
| 0 | X | 0 | 1 | 0 | 0 | 4 | Cylinder Low register | Cylinder Low register |
| 0 | X | 0 | 1 | 0 | 1 | 5 | Cylinder High register | Cylinder High register |
| 0 | X | 0 | 1 | 1 | 0 | 6 | Drive Head register | Drive Head register |
| 0 | X | 0 | 1 | 1 | 1 | 7 | Status register | Command register |
| 0 | X | 1 | 0 | 0 | 0 | 8 | Dup. Even RD Data reg. | Dup. Even WR Data reg. |
| 0 | X | 1 | 0 | 0 | 1 | 9 | Dup. Odd RD Data reg. | Dup. Odd WR Data reg. |
| 0 | X | 1 | 1 | 0 | 1 | D | Dup. Error register | Dup. Feature register |
| 0 | X | 1 | 1 | 1 | 0 | E | Alt Status register | Device Ctl register |
| 0 | X | 1 | 1 | 1 | 1 | F | Drive Address register | Reserved |

Primary I/O Map (INDEX=2)

| -REG | A10 | A9-A4 | A3 | A2 | A1 | A0 | -IORD=L | -IOWR=L |
|------|-----|-------|----|----|----|----|------------------------|------------------------|
| 0 | X | 1Fh | 0 | 0 | 0 | 0 | Data register | Data register |
| 0 | X | 1Fh | 0 | 0 | 0 | 1 | Error register | Feature register |
| 0 | X | 1Fh | 0 | 0 | 1 | 0 | Sector Count register | Sector Count register |
| 0 | X | 1Fh | 0 | 0 | 1 | 1 | Sector No. register | Sector No. register |
| 0 | X | 1Fh | 0 | 1 | 0 | 0 | Cylinder Low register | Cylinder Low register |
| 0 | X | 1Fh | 0 | 1 | 0 | 1 | Cylinder High register | Cylinder High register |
| 0 | X | 1Fh | 0 | 1 | 1 | 0 | Drive Head register | Drive Head register |
| 0 | X | 1Fh | 0 | 1 | 1 | 1 | Status register | Command register |
| 0 | X | 1Fh | 0 | 1 | 1 | 0 | Alt Status register | Device Ctl register |
| 0 | X | 1Fh | 0 | 1 | 1 | 1 | Drive Address register | Reserved |

Secondary I/O Map (INDEX=3)

| -REG | A10 | A9-A4 | A3 | A2 | A1 | A0 | -IORD=L | -IOWR=L |
|------|-----|-------|----|----|----|----|------------------------|------------------------|
| 0 | X | 17h | 0 | 0 | 0 | 0 | Data register | Data register |
| 0 | X | 17h | 0 | 0 | 0 | 1 | Error register | Feature register |
| 0 | X | 17h | 0 | 0 | 1 | 0 | Sector Count register | Sector Count register |
| 0 | X | 17h | 0 | 0 | 1 | 1 | Sector No. register | Sector No. register |
| 0 | X | 17h | 0 | 1 | 0 | 0 | Cylinder Low register | Cylinder Low register |
| 0 | X | 17h | 0 | 1 | 0 | 1 | Cylinder High register | Cylinder High register |
| 0 | X | 17h | 0 | 1 | 1 | 0 | Drive Head register | Drive Head register |
| 0 | X | 17h | 0 | 1 | 1 | 1 | Status register | Command register |
| 0 | X | 37h | 0 | 1 | 1 | 0 | Alt Status register | Device Ctl register |
| 0 | X | 37h | 0 | 1 | 1 | 1 | Drive Address register | Reserved |

True IDE Mode I/O Map (-OE held low at power up)

| -CE2 | -CE1 | A2 | A1 | A0 | -IORD=0 | -IOWR=0 |
|------|------|----|----|----|------------------------|-------------------------|
| 1 | 0 | 0 | 0 | 0 | Data register | Data register |
| 1 | 0 | 0 | 0 | 1 | Error register | Feature register |
| 1 | 0 | 0 | 1 | 0 | Sector Count register | Sector Count register |
| 1 | 0 | 0 | 1 | 1 | Sector No. register | Sector No. register |
| 1 | 0 | 1 | 0 | 0 | Cylinder Low register | Cylinder Low register |
| 1 | 0 | 1 | 0 | 1 | Cylinder High register | Cylinder High register |
| 1 | 0 | 1 | 1 | 0 | Drive Head register | Drive Head register |
| 1 | 0 | 1 | 1 | 1 | Status register | Command register |
| 0 | 1 | 1 | 1 | 0 | Alt Status register | Device Control register |
| 0 | 1 | 1 | 1 | 1 | Drive Address register | Reserved |

Data Register

The Data Register is a 16 bit read/write register used for transferring data between the card and the host. This register can be accessed in word mode and byte mode.

| | | | | | | | | | | | | | | | |
|-----------|-------|-------|-------|-------|-------|------|------|------|------|------|------|------|------|------|------|
| bit15 | bit14 | bit13 | bit12 | bit11 | bit10 | bit9 | bit8 | bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
| D0 to D15 | | | | | | | | | | | | | | | |

Error Register

This read only register is used for analyzing an error. This register is valid when the BSY bit in the Status register and Alternate Status register are set to "0" (Ready).

| | | | | | | | |
|------|------|------|------|------|------|------|------|
| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
| BBK | UNC | 0 | IDNF | 0 | ABRT | 0 | AMNF |

| bit | Name | Function |
|-----|-------------------------------|--|
| 7 | BBK (Bad Block Detected) | This bit is set when a Bad Block is detected in requested ID field—not supported |
| 6 | UNC (Data ECC Error) | This bit is set when an Uncorrectable error has occurred when reading the card. |
| 4 | IDNF (ID Not Found) | The requested sector ID is in error or cannot be found. |
| 2 | ABRT (ABoRTed Command) | Drive status error or Aborted invalid command |
| 0 | AMNF (Address Mark Not Found) | This bit is set in case of a general error. |

| Diagnostic Code | Description |
|-----------------|---------------------------|
| 01h | No error detected |
| 02h | Formatting error |
| 03h | Sector buffer error |
| 04h | ECC error |
| 05h | Microprocessor error |
| 8xh | Drive 1 failed (not used) |

Feature Register

This write only register provides information regarding the features of the card which the host wishes to utilize. See details under the SET FEATURE command.

| | | | | | | | |
|--------------|------|------|------|------|------|------|------|
| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
| Feature Byte | | | | | | | |

Sector Count Register

This register contains the numbers of sectors of data requested to be transferred on a read or write operation between the host and the card. If the value in the register is 0, a count of 256 sectors is indicated.

| | | | | | | | |
|-------------------|------|------|------|------|------|------|------|
| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
| Sector Count Byte | | | | | | | |

Sector Number Register

When the LBA bit in the Drive/Head register is 0, this register contains the starting sector number for any media access. When the LBA bit is set to 1, this register contains bits 7:0 of the LBA for any media access.

| | | | | | | | |
|---|------|------|------|------|------|------|------|
| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
| Sector Number Byte or bits 7:0 of the LBA | | | | | | | |

Cylinder Low Register

In CHS mode (LBA=0), this register contains the low order bits of the starting cylinder address. In LBA mode, it contains bits 15:8 of the LBA.

| | | | | | | | |
|---|------|------|------|------|------|------|------|
| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
| Cylinder Low Byte or bits 15:8 of the LBA | | | | | | | |

Cylinder High Register

In CHS mode (LBA=0), this register contains the high order bits of the starting cylinder address. In LBA mode, it contains bits 23:16 of the LBA.

| | | | | | | | |
|---|------|------|------|------|------|------|------|
| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
| Cylinder High Byte or bits 23:16 of the LBA | | | | | | | |

Drive/Head Register

This register select the device address translation (CHS or LBA) and provides head address (CHS) or high order address bits 27:24 for LBA.

| | | | | | | | |
|------|------|------|------|----------------------------|------|------|------|
| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
| 1 | LBA | 1 | DRV | Head No. or LBA bits 27:24 | | | |

| bit | Name | Function |
|-----|-----------------------|---|
| 7 | 1 | This bit is set to "1". |
| 6 | LBA | LBA is a flag to select either Cylinder/Head/Sector (CHS) or Logical Block Address (LBA) mode. When LBA=0, CHS mode is selected. When LBA=1, LBA mode is selected. In LBA mode, the Logical Block Address is interrupted as follows: LBA07-LBA00: Sector Number Register D7-D0 LBA15-LBA08: Cylinder Low Register D7-D0 LBA23-LBA16: Cylinder High Register D7-D0 LBA27-LBA24: Drive/Head Register bits HS3-HS0 |
| 5 | 1 | This bit is set to "1". |
| 4 | DRV (DRiVe select) | This bit is used for selecting the Master (Card 0) and Slave (Card 1) in Master/Slave organization. The card is set to be Card 0 or 1 by using DRV# of the Socket and Copy register. |
| 3-0 | Head Number (HS3-HS0) | These bits are used for selecting the Head number. Bit 3 is MSB. In LBA mode, these bits represent the LBA address 27:24. |

Status Register

This read only register indicates status of a command execution. When the BSY bit is “0”, the other bits are valid; when the BSY bit is “1”, the other bits are not valid. When the register is read, the interrupt (-IREQ pin) is cleared.

| | | | | | | | |
|------|------|------|------|------|------|------|------|
| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
| BSY | DRDY | DWF | DSC | DRQ | CORR | IDX | ERR |

| bit | Name | Function |
|-----|---------------------------|---|
| 7 | BSY (BuSY) | This bit is set when the card internal operation is executing. When this bit is set to “1”, other bits in this register are invalid. |
| 6 | DRDY (Drive ReaDY) | If this bit and DSC bit are set to “1”, the card is capable of receiving the read and write or seek requests. If this bit is set to “0”, the card prohibits these requests. On error, DRDY changes only after the host reads the Status Register. |
| 5 | DWF (Drive Write Fault) | This bit is set if a fault occurs during the write process. |
| 4 | DSC (Drive Seek Complete) | This bit is set when the requested sector was found. |
| 3 | DRQ (Data ReQuest) | This bit is set when information can be transferred between the host and data register. |
| 2 | CORR (CORRected data) | This bit is set when a correctable data error has occurred and the data has been corrected. |
| 1 | IDX (InDeX) | This bit is always set to “0”. |
| 0 | ERR (ERRor) | This bit is set when the previous command has ended in some type of error. The error information is set in the Error register. |

Alternate Status Register

This register is the same as the Status register except that -IREQ is not negated when data is read.

Command Register

This write only register is used for writing the command that executes the card’s operation. The command code is written in the command register after its parameters are written in the Task File during the card ready state. See details under the ATA COMMAND SPECIFICATIONS.

Device Control Register

This write only register is used for controlling the interrupt request and issuing an ATA soft reset to the card.

| | | | | | | | |
|------|------|------|------|------|------|------|------|
| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
| x | x | x | x | 1 | SRST | nIEN | 0 |

| bit | Name | Function |
|-----|-------------------------|--|
| 7-4 | x | Don't care. |
| 3 | 1 | This bit is set to "1". |
| 2 | SRST (Software ReSeT) | This bit is set to "1" in order to force the card to perform an AT disk control soft reset operation. |
| 1 | nIEN (Interrupt ENable) | When set to "0", it enables interrupts to the host (using the -IREQ tri-state pin). When inactive (set to "1") or drive is not selected, it disables all pending interrupts (-IREQ in high-Z). This bit is ignored in memory mode. |
| 0 | 0 | This bit is set to "0". |

Drive Address Register

This read only register is used for confirming the card's status. This register is provided for compatibility with the AT disk drive interface and it is not recommended that this register be mapped into the host's I/O space because of potential conflicts on bit 7.

| | | | | | | | |
|--------|------|------|------|------|------|------|------|
| bit7 | bit6 | bit5 | bit4 | bit3 | bit2 | bit1 | bit0 |
| High-Z | nWTG | nHS3 | nHS2 | nHS1 | nHS0 | nDS1 | nDS0 |

| bit | Name | Function |
|-----|--------------------------|---|
| 7 | x | This bit is unused. |
| 6 | nWTG (WriTing Gate) | This bit is unused. |
| 5-2 | nHS3-0 (Head Select 3-0) | These bits are the negative value of the Head Select bits (bit 3 to 0) in the Drive/Head register |
| 1 | nDS1 (Drive Select 1) | When set to "0", drive 1 is active and selected. |
| 0 | nDS0 (Drive Select 0) | When set to "0", drive 0 is active and selected. |

ATA COMMAND SPECIFICATIONS

This table with the following paragraphs summarizes the ATA command set.

| No. | Command set | Code | FR | SC | SN | CY | DR | HD | LBA |
|-----|-----------------------------|-------------|----|----|----|----|-----|----|-----|
| 1 | Check Power Mode | E5h or 98h | — | Y | — | — | Y | — | — |
| 2 | Execute Drive Diagnostic | 90h | — | — | — | — | Y** | — | — |
| 3 | Erase Sector(s) | C0h | — | Y | Y | Y | Y | Y | Y |
| 4 | Format Track | 50h | — | Y | — | Y | Y | Y | Y |
| 5 | Identify Drive | ECh | Y | — | — | — | Y | — | — |
| 6 | Idle | E3h or 97h | — | Y | — | — | Y | — | — |
| 7 | Idle Immediate | E1h or 95h | — | — | — | — | Y | — | — |
| 8 | Initialize Drive Parameters | 91h | — | Y | — | — | Y | Y | — |
| 9 | Read Buffer | E4h | — | — | — | — | Y | — | — |
| 10 | Read Multiple | C4h | — | Y | Y | Y | Y | Y | Y |
| 11 | Read Long Sector | 22h or 23h* | — | — | Y | Y | Y | Y | Y |
| 12 | Read Sector(s) | 20h or 21h* | — | Y | Y | Y | Y | Y | Y |
| 13 | Read Verify Sector(s) | 40h or 41h* | — | Y | Y | Y | Y | Y | Y |
| 14 | Recalibrate | 1Xh | — | — | — | — | Y | — | — |
| 15 | Request Sense | 03h | — | — | — | — | Y | — | — |
| 16 | Seek | 7Xh | — | — | Y | Y | Y | Y | Y |
| 17 | Set Features | EFh | — | Y | Y | Y | Y | Y | — |
| 18 | Set Multiple Mode | C6h | — | Y | — | — | Y | — | — |
| 19 | Set Sleep Mode | E6h or 99h | — | — | — | — | Y | — | — |
| 20 | Stand By | E2h or 96h | — | Y | — | — | Y | — | — |
| 21 | Stand By Immediate | E0h or 94h | — | — | — | — | Y | — | — |
| 22 | Translate Sector | 87h | — | Y | Y | Y | Y | Y | Y |
| 23 | Wear Level | F5h | — | — | — | — | Y | Y | — |
| 24 | Write Buffer | E8h | — | — | — | — | Y | — | — |
| 25 | Write Long Sector | 32h or 33h* | — | Y | Y | Y | Y | Y | Y |
| 26 | Write Multiple | C5h | — | Y | Y | Y | Y | Y | Y |
| 27 | Write Multiple w/o Erase | CDh | — | Y | Y | Y | Y | Y | Y |
| 28 | Write Sector(s) | 30h or 31h* | — | Y | Y | Y | Y | Y | Y |
| 29 | Write Sector(s) w/o Erase | 38h | — | Y | Y | Y | Y | Y | Y |
| 30 | Write Verify | 3Ch | — | Y | Y | Y | Y | Y | Y |

FR=Features Register, SC=Sector Count Register (00h to FFh), SN=Sector Number Register (01h to 20h), CY=Cylinder Registers, DR=Drive bit of Drive/Head Register, HD=Head no. (0 to 3) of Drive/Head Register, LBA=Logical Block Address Mode Supported.
Y—Set up.
“—” —Not set up.

* First command code=with retry, Second command code=without retry.
** Address to drive 0. Both drives execute command

Check Power Mode (code: E5h or 98h)

This command checks the power mode.

Execute Drive Diagnostic (code: 90h)

This command performs the internal diagnostic tests implemented by the card. See ERROR register for diagnostic codes.

Erase Sector(s) (code: C0h)

This command is used to pre-erase and condition data sectors in advance.

Format Track (code: 50h)

This command writes the desired head and cylinder of the selected drive with a vendor unique data pattern (typically 00h or FFh). This card accepts a sector buffer of data from the host to follow the command with the same protocol as the Write Sector Command although the information in the buffer is not used.

Identify Drive (code: ECh)

This command enables the host to receive parameter information from the card. (See table below.)

Identify Drive Information (Typical)

| Word Address | Data | Total Bytes | Description |
|--------------|-------|-------------|---|
| 0 | 848AH | 2 | Value fixed by CFA (value=044AH for versions with the -F suffix) |
| 1 | XXXXH | 2 | Default number of cylinders |
| 2 | 0000H | 2 | Reserved |
| 3 | 00XXH | 2 | Default number of heads |
| 4 | XXXXH | 2 | Do not use this word. Before retirement, was number of unformatted bytes per track |
| 5 | XXXXH | 2 | Do not use this word. Before retirement, was number of unformatted bytes per sector |
| 6 | XXXXH | 2 | Default number of sectors per track |
| 7-8 | XXXXH | 4 | Number of sectors per card (word7=MSW, word 8 = LSW) |
| 9 | 0000H | 2 | Reserved |
| 10-19 | XXXXH | 20 | Serial Number (see table next page for definition) |
| 20 | XXXXH | 2 | Do not use this word. Before retirement, was buffer type |
| 21 | XXXXH | 2 | Do not use this word. Before retirement, was buffer size in 512 byte increments |
| 22 | 0004H | 2 | # of ECC bytes passed on Read/Write Long commands |
| 23-46 | XXXXH | 48 | Firmware revision and model number in ASCII (see table next page for definition) |
| 47 | 0001H | 2 | Maximum of 1 sector on Read/Write Multiple command |
| 48 | 0000H | 2 | Double Word not supported |
| 49 | 0200H | 2 | DMA not supported, LBA supported |
| 50 | 0000H | 2 | Reserved |
| 51 | 0200H | 2 | PIO data transfer cycle timing mode |
| 52 | 0000H | 2 | Single word DMA data transfer cycle timing mode (not supported) |
| 53 | 0003h | 2 | Words 54 - 58 and 64 - 70 are valid |
| 54 | XXXXH | 2 | Number of Current Cylinders |
| 55 | XXXXH | 2 | Number of Current Heads |
| 56 | XXXXH | 2 | Number of Current Sectors Per Track |
| 57 | XXXXH | 2 | LSW of the Current Capacity in Sectors |
| 58 | XXXXH | 2 | MSW of the Current Capacity in Sectors |
| 59 | 010XH | 2 | Current Setting for Block Count=1 for R/W Multiple commands |
| 60-61 | XXXXH | 4 | Total number of sectors addressable in LBA Mode |
| 62 | 0000H | 2 | Single word DMA transfer not supported |
| 63 | 0000H | 2 | Multiword DMA modes not supported |
| 64 | 0003H | 2 | Advanced PIO modes supported (modes 3 and 4) |
| 65 | 0000H | 2 | Minimum multiword DMA transfer cycle time per word (ns) |
| 66 | 0000H | 2 | Recommended multiword DMA transfer cycle time per word (ns) |
| 67 | 0078H | 2 | Minimum PIO transfer without flow control |
| 68 | 0078H | 2 | Minimum PIO transfer with IORDY flow control |
| 69-255 | 0000H | 388 | Reserved |

XXXXH: These values are dependent upon the the specific card.

Identify Drive Information (continued)

(Serial Number, Firmware Revision, and Model Number)

| | | | | | |
|---|-----------|------------|-----------|-----------|-----------|
| Serial Number Format (typical): Words 10-19 | | | | | |
| SimpleTech Proprietary | Yr | Day | Hr | Min | Sec |
| <i>STI_J13C0</i> | <i>04</i> | <i>224</i> | <i>09</i> | <i>27</i> | <i>50</i> |
| Firmware Revision: Words 23-26 | | | | | |
| <i>mm/dd/yy</i> | | | | | |
| Model Number: Words 27-46 | | | | | |
| <i>STI Flash X.Y.Z</i> | | | | | |

Idle

(code: E3h or 97h)

This command causes the card to set BSY, enter the Idle mode, clear BSY, and generate an interrupt. If the sector count is non-zero, automatic power down mode is enabled. If the sector count is zero, the automatic power down mode is disabled.

Idle Immediate

(code: E1h or 95h)

This command causes the card to set BSY, enter the Idle (Read) mode, clear BSY, and generate an interrupt.

Initialize Drive Parameters

(code: 91h)

This command enables the host to set the number of sectors per track and the number of heads per cylinder.

Read Buffer

(code: E4h)

This command enables the host to read the current contents of the card's sector buffer.

Read Multiple

(code: C4h)

This command performs similarly to the Read Sectors command. Interrupts are not generated on each sector, but on the transfer of a block which contains the number of sectors defined by a Set Multiple command.

Read Long Sector

(code: 22h or 23h)

This command performs similarly to the Read Sector(s) command except that it returns 516 bytes of data instead of 512 bytes.

Read Sector(s)

(code: 20h or 21h)

This command reads from 1 to 256 sectors as specified in the Sector Count register. A sector count of 0 requests 256 sectors. The transfer begins at the sector specified in the Sector Number register.

Read Verify Sector(s)

(code: 40h or 41h)

This command verifies one or more sectors on the card by transferring data from the flash media to the data buffer in the card and verifying that the ECC is correct. This command is identical to the Read Sectors command, except that DRQ is never set and no data is transferred to the host. This

Recalibrate

(code: 1Xh)

The CompactFlash performs only the interface timing and register operations. When this command is issued, the CompactFlash sets BSY and waits for an appropriate length of time after which it clears BSY and issues an interrupt. When this command ends normally, the CompactFlash is initialized.

Request Sense

(code: 03h)

This command requests an extended error code after a command ends with an error. Refer to table below.

| Code | Description |
|-------------------------|--|
| 00H | No error detected |
| 01H | Self test OK (No error) |
| 09H | Miscellaneous Error - N/A |
| 20H | Invalid Command |
| 21H | Invalid Address (requested Head or Sector invalid) |
| 2FH | Address Overflow (address too large) |
| 35H, 36H | Supply or generate Voltage Out of Tolerance |
| 11H | Uncorrectable ECC Error |
| 18H | Correctable ECC Error - N/A |
| 05H, 30H-34H, 37H, 3EH | Self Test Diagnostic Failed |
| 10H, 14H | ID Not Found - N/A |
| 3AH | Spare Sectors Exhausted |
| 1FH | Data Transfer Error / Aborted Command |
| 0CH, 38H, 3BH, 3CH, 3FH | Corrupted Media Format - N/A |
| 03H | Write / Erase Failed - N/A |
| 22H | Power Level 1 Disabled |

Seek (code: 7Xh)

This command is effectively a NOP command to the Card although it does perform a range check.

Set Features (code: EFh)

This command is used by the host to establish or select certain features.

| Feature | Description |
|---------|--|
| 01H | Enable 8-bit data transfers |
| 55H | Disable Read Look Ahead |
| 66H | Disable Power on Reset (POR) establishment of defaults at Soft Reset |
| 81H | Disable 8-bit data transfers |
| BBH | 4bytes of data apply on Read/Write Long commands |
| CCH | Enable Power on Reset (POR) establishment of default at Soft Reset |

Set Multiple Mode (code: C6h)

This command enables the card to perform Read and Write Multiple operations and establishes the block count for these commands.

Set Sleep Mode (code: E6h or 99h)

This is the only command that allows the host to set the CompactFlash into Sleep mode. When the card is set to sleep mode, the CompactFlash clears the BSY line and issues an interrupt. The card enters sleep mode and the only method to make the card active again (back to normal operation) is by performing a hardware reset or a software reset.

Stand By (code: E2h or 96h)

This command is sets the CompactFlash in Standby mode. If the Sector Count Register is a value other than 0H, an Auto Power Down is enabled and when the card returns to the idle mode, the timer starts a countdown. The time is set in the Sector Count Register.

Stand By Immediate (code: E0h or 94h)

This command causes the card to set BSY, enter the Standby mode, clear BSY and return the interrupt immediately.

Translate Sector (code: 87h)

This command allows the host a method of determining the exact number of times a user sector has been erased and programmed. This command is not supported.

Wear Level (code: F5h)

This command is effectively a NOP command and only implemented for backward compatibility. The Sector Count Register will always be returned with an 00h indicating Wear Level is not needed.

Write Buffer (code: E8h)

This command enables the host to overwrite the contents of the card's sector buffer with any data pattern desired.

Write Long Sector (code: 32h or 33h)

This command is provided for compatibility purposes and is similar to the Write Sector(s) command except that it writes 516 bytes instead of 512 bytes.

Write Multiple (code: C5h)

This command is similar to the Write Sectors command. Interrupts are not presented on each sector, but on the transfer of a block which contains the number of sectors defined by Set Multiple command.

Write Multiple without Erase (code: CDh)

This command is similar to the Write Multiple command with the exception that an implied erase before the write operation is not performed. Note that before using this command, it is required to erase the respective sectors using the Erase Sectors command.

**Write Sector(s)
(code: 30h or 31h)**

This command writes from 1 to 256 sectors as specified in the Sector Count register. A sector count of zero requests 256 sectors. The transfer begins at the sector specified in the Sector Number register.

**Write Sector(s) without Erase
(code: 38h)**

This command is similar to the Write Sector(s) command with the exception that an implied erase before the write operation is not performed. Note that before using this command, it is required to erase the respective sectors using the Erase Sectors command.

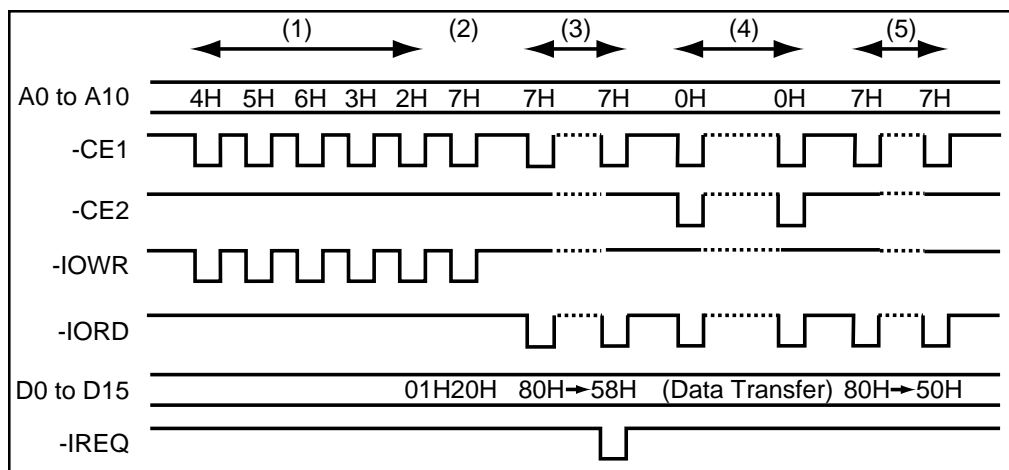
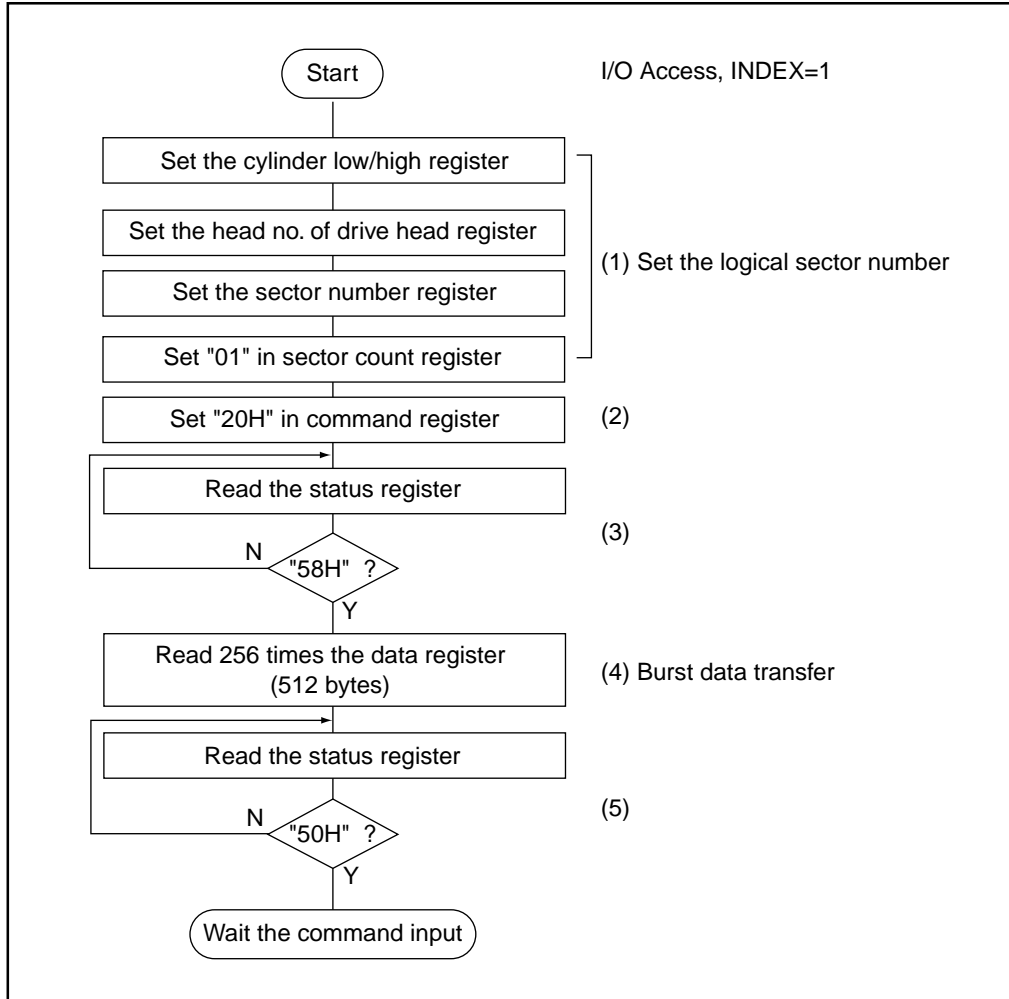
**Write Verify
(code: 3Ch)**

This command is similar to the Write Sector(s) command except each sector is verified immediately after being written.

SECTOR TRANSFER PROTOCOL

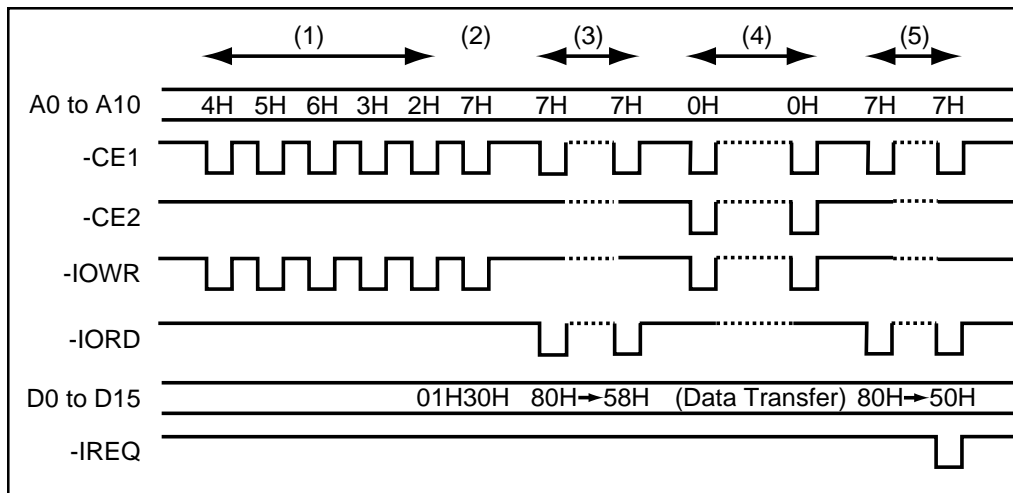
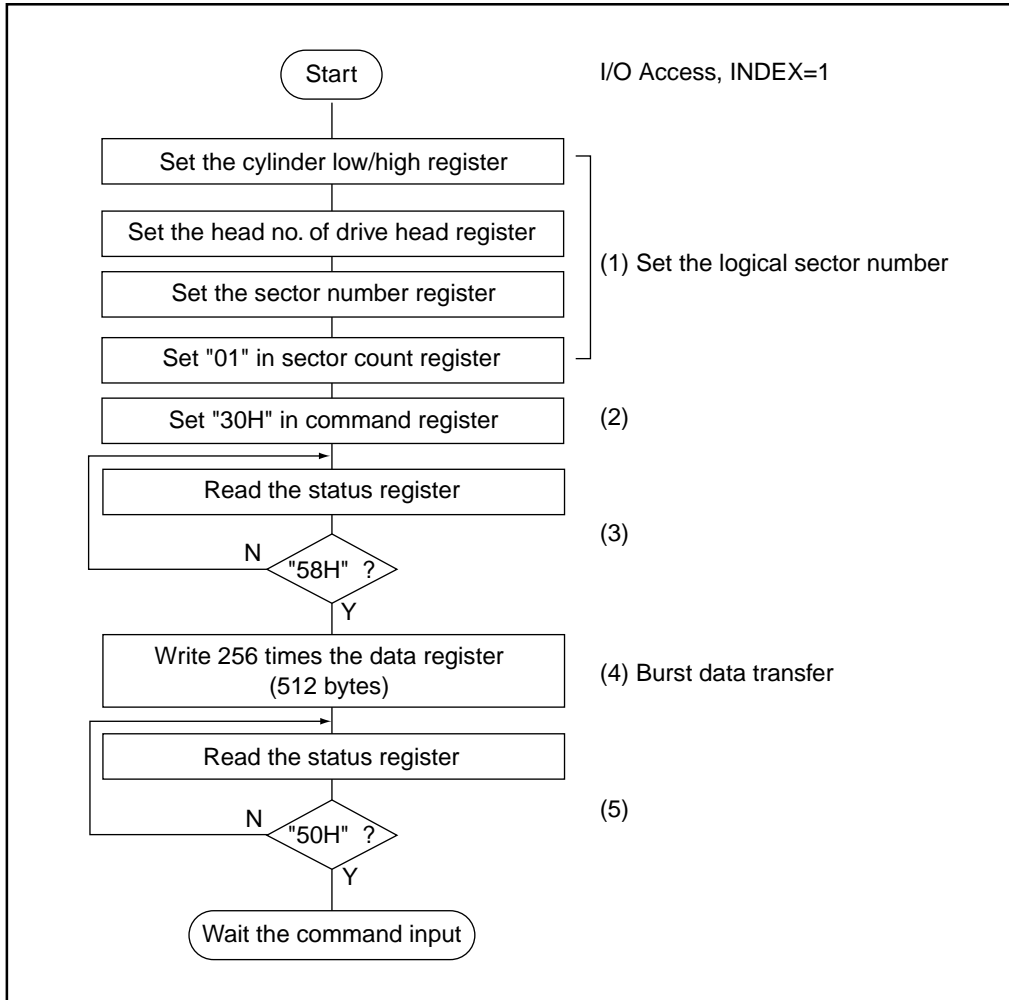
Sector Read

One sector read procedure after the card is configured to I/O interface is shown in the following charts.



Sector Write

One sector write procedure after the card is configured to I/O interface is shown in the following charts.



REVISION HISTORY

Rev. Change Description from Previous Revision

- 101 1/1/04. Initial Release.
- 102 2/23/04. Sleep mode current at 3.3V corrected to 80µA from 80mA. The operating current at 3.3V corrected to 30mA from 3mA.
- 103 2/23/04. IOL/IOH condition at 5.0V is removed.
- 104 3/16/04. Showpiece photo replaces Block Diagram. General Description updated with new marketing copy. R/W speeds updated from 5.4/5.5MB/s to 5/5MB/s. 64MB option removed.
- 105 5/26/04. CHS Parameter table added. VCC(min) changed to 3.18V from 3.135V. VCC 5V tolerance changed to 5% from 10%. Preliminary noticed removed. CIS Information corrected. Disclaimer notice added.
- 106 6/18/04. Features bullets on page 1 updated. Pin Assignments for IDE Mode corrected to indicate which pins are not used in IDE Mode. Pinout of the PC Card to CF Adapter corrected to call out DASP and -PDIAG. Pin Description changes: -CD1 and -CD2 not used in IDE mode; -IOIS16 not used in IDE mode; -WAIT description corrected to not used by card and pulled up by 4.7K ohm resistor. Performance rates for read and write described as sustained read and sustained write. AC Characteristics VCC 3.3V operating tolerances restated as +5% and -3.6% tolerances. Error register bit 0 Function "not supported" phrase removed. DMA commands removed (paper only error indicated that DMA was supported). Identify Drive Information table updated to reflect DMA not supported. "-F" p/n suffix selection added to notes of the Ordering Information. ATA-4 compatibility added to Features. DC Characteristics Sleep Mode values changed from 80uA to 800uA for 3.3V power supply, and 120uA to 1200uA for 5V power supply.
- 107 7/9/04. Endurance increased from 300,000 cycles min to 2 million cycles min.
- 108 7/22/04. "up to" added to sustained read and write data rate performance.
- 109 8/23/04. Definition for Serial #, Firmware Rev., and Model # in the Identify Drive Information table added in callout. Identify Drive Table words 20, 21, 49, and 63 corrected.
- 110 10/14/04. Standard ECC, Endurance, and Warranty bullets added to Features on page 1.
- 111 2/14/05. Shock parameter changed to 0.330ms to 0.750ms from 11ms. 3/8/05. Humidity parameter changed to 95% from 85%. 3/14/05. CHS values updated.

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