1 Modified Electrical Specification Proposal

1.1 Electrical Specification

Table 1, Table 2, Table 3, Table 4, and **Error! Reference source not found.** define all D.C. Characteristics for the CompactFlash Storage Card and CF+ Card Series. Unless otherwise stated, conditions are:

Vcc = 5V ±10%

Vcc = 3.3V ± 5%

Ta = 0°C to 60°C

Table 1: Absolute Maximum Conditions

Parameter	Symbol	Conditions
Input Power	Vcc	-0.3V min. to 6.5V max.
Voltage on any pin except Vcc with respect to GND.	V	-0.5V min. to Vcc + 0.5V max.

Table 2: Input Power

Voltage	Maximum Average RMS Current			Measurement Method
	Power Level 0	Power Level 1	Power Level 2	
3.3V ± 5%	75 mA	500 mA	750 mA	3.3V at 25°C
5.0V ± 10%	100 mA	500 mA	750 mA	5.0V at 25°C

Note: 1) An additional current measurement method, Average Current, is defined below and is applicable to Power Level 2 only. Power Level 2 Average Current limit is 500mA.

CompactFlash and CF+ products shall operate correctly in both voltage ranges as shown in Table 2: Input Power above. To comply with this specification, current requirements shall not exceed the maximum limit.

The maximum average RMS current for CompactFlash cards after power up is 75 mA at 3.3V and 100 mA at 5V. For CF and CF+ cards, three power levels are defined. Power Level 0 has the same current specifications as CompactFlash cards after power up. Power Level 1 has an increased maximum current of 500 mA for both 3.3V and 5V and shall be supported by CF+and extended power CF cards, and Power level 2 may be supported by extended power CF and CF+ cards. It has a maximum Average RMS current of 750 mA and maximum Average Current of 500mA.

All cards shall operate within the specifications for Power Level 0 at power on and after reset. Cards shall also support CIS reads and (for ATA cards only) ATA Identify Device commands in Power Level 0. This requirement allows the host device to determine whether the card has commands, which require Power Level 1 or Power Level 2 (see *Sections* **Error! Reference source not found.** and **Error! Reference source not found.**). If the host cannot support the required Power Level, the host can either disable Power Level 1 or 2 commands in the card (see *Sections* **Error! Reference source not found.** and **Error! Reference source not found.** or reject the card).

A card supporting Power Level 2 shall also support Power Level 1.

An example of a CF+ card using both Power Level 0 and Power Level 1 is a disk drive. Typically, commands that require the spindle to rotate (e.g., read/write commands) are Power Level 1

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commands. CF+ disk drives shall make provisions to accommodate the execution of CIS reads and ATA Identify Device commands in Power Level 0; that is, without rotating the spindle.

Another class of CompactFlash card that can utilize Power Levels 1 and 2 is the Power Enhanced CF Storage Card. These cards allow enhanced operation in Power Level 1 or Power Level 2, but do not require Power Level 1 or Power Level 2 for any function. The cards report their current power level in ID Drive Word 160. They shall support all mandatory commands and all implemented commands and protocols at all Power Levels. These cards shall report identical supported features through the Identify Device command regardless of whether the command is issued in Power Level 0, Power Level 1, or Power Level 2. The cards power up in Power Level 0 and remain in Power Level 0 until the host uses the Set Features command (see section 6.2.1.29) to control Power Level 1 or Power Level 2 operation. Hosts shall use the Set Features command to enable and disable Power Level 1 and Power Level 2 in Power Enhanced CF Storage Cards.

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1.1.1 Current Measurement

For CompactFlash Storage Cards supporting Power Levels 0,1, or 2, current measurement is accomplished by connecting an amp meter (set to the 2 amp scale range) with a fast current probe with an RC filter with a time constant of 0.1 msec, in series with the Vcc supply to the CompactFlash Storage Card. Current measurements are to be taken while looping on a data transfer command with a sector count of 128. Current consumption values for both read and write commands are not to exceed the Maximum Average RMS Current specified in the above Table 2: Input Power.

For CF+ cards, a fast (>1 MHz) current probe monitors current on the Vcc supply to the CF+ card. The output of the current probe is filtered by an RC filter with a time constant of 0.1 msec. The output of the filter is monitored with a fast (>1 MHz) scope or other monitor. The filtered output measured in this way shall not exceed the specifications shown for Power Level 0 (for all CF+ cards) and for Power Levels 1 or 2 (for CF+ cards supporting Power Levels 1 or 2).

In addition, for cards supporting Power Level 2, an Average Current measurement shall be conducted. Current measurements are to be taken while looping on a data transfer command with a sector count of 128 at the highest transfer speed mode the card is capable of. Current consumption values shall be taken for both read and write commands. Measurements shall be averaged over a 100 msec moving window. The result shall not exceed 500 mA.

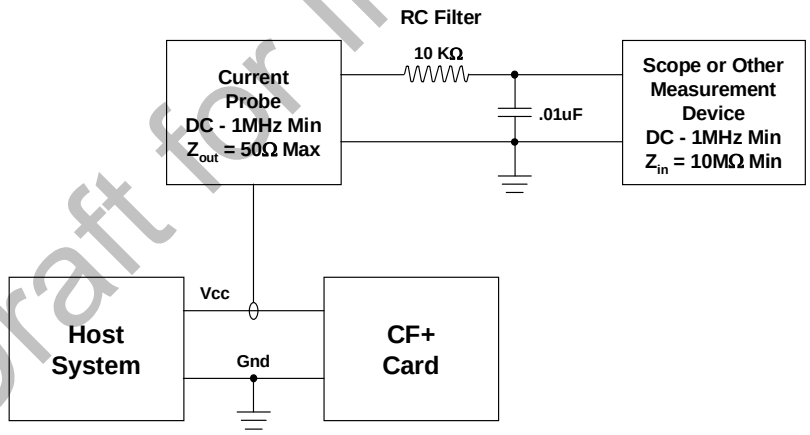

Figure 1: CF+ Power Supply Current Measurement Method

1.1.2 Input Leakage Current

Note: In Table 3 below, x refers to the characteristics described in *Section* 1.1.3. For example, I1U indicates a pull-up resistor with a type 1 input characteristic.

Table 3: Input Leakage Current

Type	Parameter	Symbol	Conditions	MIN	TYP	MAX	Units
IxZ	Input Leakage Current	IL	Vih = Vcc / Vil = Gnd	-1		1	µA
IxU	Pull-Up Resistor	RPU1	Vcc = 5.0V	50k		500k	Ohm
IxD	Pull-Down Resistor	RPD1	Vcc = 5.0V	50k		500k	Ohm

Note: The minimum pull-up resistor resistance meets the PCMCIA PC Card specification of 10k ohms but is intentionally higher in the CompactFlash Specification to reduce power use.

1.1.3 Input Characteristics

Table 4: Input Characteristics

Type	Parameter	Symbol	MIN	TYP	MAX	MIN	TYP	MAX	Units
			VCC = 3.3 V			VCC = 5.0 V			
1	Input Voltage CMOS	Vih Vil	2.0		0.8	2.0		0.8	Volts
2	Input Voltage CMOS	Vih Vil	2.0		0.8	2.0		0.8	Volts
3	Input Voltage CMOS Schmitt Trigger	Vt+(Vp)[1] Vt-(Vn)[2] Vh(ΔVt)[3]	0.9 0.7 0.2		2.1 1.9 1.4	0.9 0.7 0.2		2.1 1.9 1.4	Volts

Notes: 1) Vt+(Vp) is the positive going threshold voltage.
2) Vt-(Vn) is the negative going threshold voltage.
3) Vh(ΔVt) is the hysteresis voltage

In UDMA modes greater than 4, the following characteristics apply. Voltage output high and low values shall be met at the source connector to include the effect of series termination.

Table 5: Input Characteristics (UDMA Mode > 4)

Parameter	Symbol	MIN	MAX	Units
DC supply voltage to receivers	V_{DD3}	3.3 - 8%	3.3 + 8%	Volts
Low to high input threshold	V+	1.5	2.0	Volts
High to low input threshold	V–	1.0	1.5	Volts
Difference between input thresholds: $((V+_{current\ value}) - (V-_{current\ value}))$	V_{HYS}	320		mV
Average of thresholds: $((V+_{current\ value}) + (V-_{current\ value}))/2$	V_{THRAVG}	1.3	1.7	Volts

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Deleted: 1) Per PCMCIA PC Card Electrical Specification Signal Interface Table 4-18 note 1, the host provides a logic output high voltage for a CMOS load of .9 x VCC. For a 5 volt product, this translates to .9 x 4.5 = 4.05 volts minimum Voh.

1.1.4 Output Drive Type

Note: In Table 6 below, x refers to the characteristics described in *Section* **Error! Reference source not found.**. For example, OT3 refers to Totempole output with a type 3 output drive characteristic.

Table 6: Output Drive Type

Type	Output Type	Valid Conditions
OTx	Totempole	Ioh & Iol
OZx	Tri-State N-P Channel	Ioh & Iol
OPx	P-Channel Only	Ioh Only
ONx	N-Channel Only	Iol Only