

Wide Temperature Industrial SD Card Product Specification

Version 1.0

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C-ONE Technology Corp.

Document Version

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1. Introduction

1.1 General Description

Wide Temperature Industrial Grade SD (Secure Digital) Cards are specifically designed, manufactured and tested to withstand extreme environmental conditions and to improve system reliability and endurance. At the heart of each card there is an advanced microcontroller that performs elaborate Flash modules management including 5 Bytes on-the-fly Error Detection and 4-Bytes Error Correction (EDC/ECC), bad block management (BBM) and extensive wear leveling. selects the highest reliability Single Level Cell (SLC) Flash for its superior endurance. This combination allows achieving 2,000,000 hours for 256MB, 512MB, 1GB, 2GB, 4GB and 8GB capacities.

manufacturing process and test methodology makes the card more robust and capable to perform at the extreme temperature conditions. To assure that each card shipped meets the rigorous threshold set by the OEM customers, each card is extensively tested at manufacturing facility to guarantee perfect functionality in extreme conditions. provides rigorous bill of material control as an additional guarantee for the customer, ensuring long term product stability and support.

1.2 Features

- Fully compliant with SD 1.0/2.0 standard. (only 4GB and above support SDHC standard)
- Bulid-in15-bit ECC (Error Correction Code) functionality and wear - leveling algorithm
- Two alternative communication protocols: SD/SPI Mode
- Write Protection Mechanism - Complies with highest security of SDMI (Secure Digital Music Initiative) standard
- Card Detection (Insertion/Removal)
- Compatible with SD and MMC standard
- Voltage range: 2.7V ~ 3.6V
- Temperature range qualified -40°C to +85°C
- Resistant to humidity, salt spray, bending force, drop test and plug cycle

1.3 Ordering Information

Part Number	Capacity	Description
SDS256MSBHP	256MB	256MB Wide-temp Industrial SD Card, SD1.0
SDS512MSBHP	512MB	512MB Wide-temp Industrial SD Card, SD1.0
SDS001GSBHP	1GB	1GB Wide-temp Industrial SD Card, SD1.0
SDS002GSCHP	2GB	2GB Wide-temp Industrial SD Card, SD1.0
SDS004GSCHP	4GB	4GB Wide-temp Industrial SD Card, SD1.0
SHS004GSCHP	4GB	4GB Wide-temp Industrial SD Card, SD2.0 (SDHC)
SHS008GSCHP	8GB	8GB Wide-temp Industrial SD Card, SD2.0 (SDHC)

Notes:

1. Please note that only 4GB Industrial SD Card is available in both SD1.0 and SD2.0 (SDHC) format for ordering.

2. Product Specification

2.1 Package Dimensions

Refer to the Table 1, Figure 1 and 2 for package dimensions of the card. Units are in millimeters, and tolerances are $\pm 0.15\text{mm}$ unless otherwise specified.

Table 1: Wide Temperature Industrial SD Card Mechanical Dimensions

Parameter	Value
Length	32.00mm \pm 0.10mm
Width	24.00mm \pm 0.10mm
Height	2.10mm \pm 0.15mm

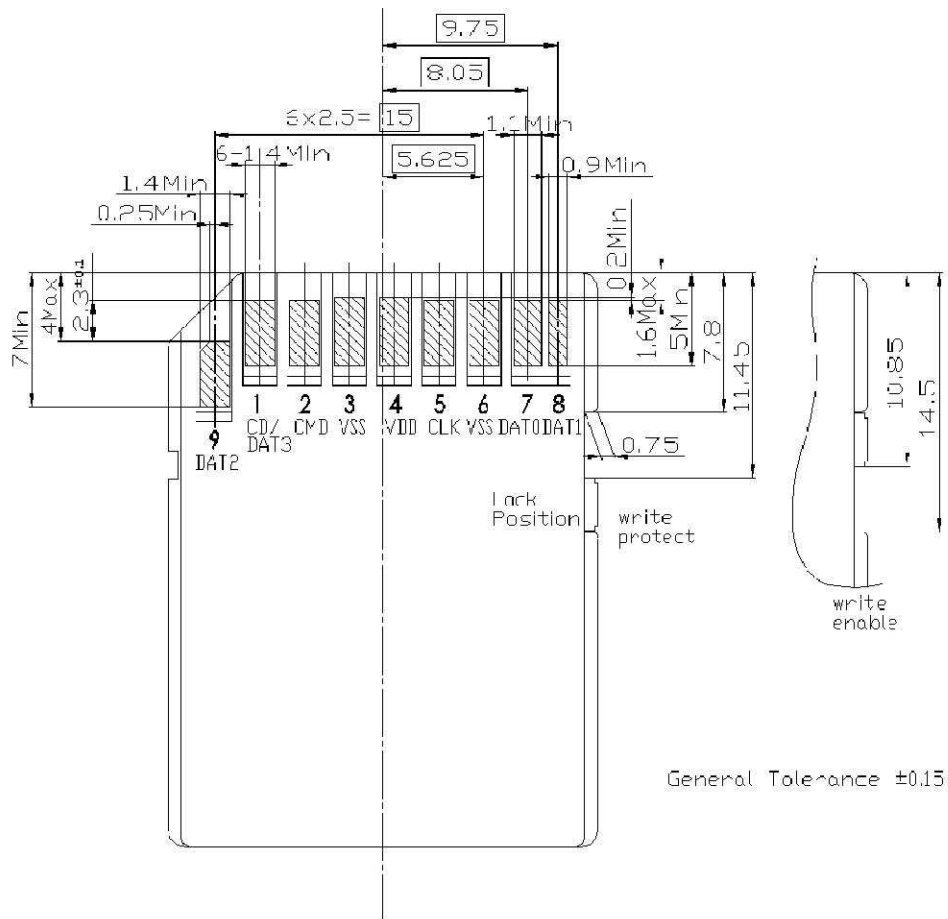


Figure 1: Wide Temperature Industrial SD Card Mechanical Dimensions

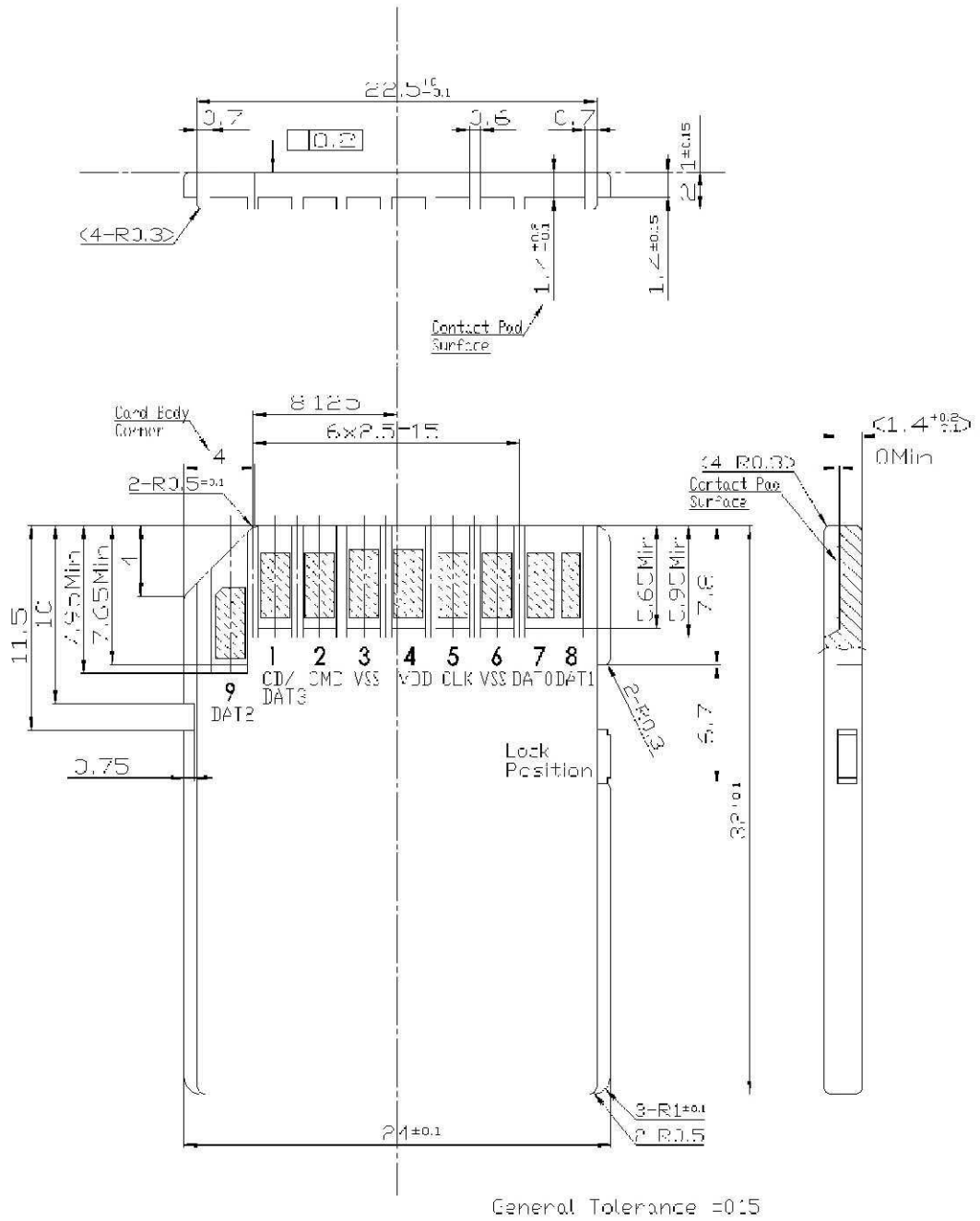


Figure 2: Wide Temperature Industrial SD Card Mechanical Dimensions (continued)

2.2 Pin Assignment and Signal Description

Table 2: SD Mode Pin Assignment and Signal Description

Pin	Signal Name	Pin Type	Description
1	CD, DAT3	I/O, Push-Pull Drivers	Card Detect, Data line bit 3. See Notes 1 and 2.
2	CMD	Push-Pull Drivers	Command/Response
3	VSS1	Supply	Supply voltage ground
4	VDD	Supply	Supply voltage
5	CLK	Input	Clock
6	VSS2	Supply	Supply voltage ground
7	DAT0	I/O, Push-Pull Drivers	Data line bit 0. For read only cards, DAT0 is output only.
8	DAT1	I/O, Push-Pull Drivers	Data line bit 1. For read only cards, DAT1 is output only.
9	DAT2	I/O, Push-Pull Drivers	Data line bit 2. For read only cards, DAT2 is output only.

Table 3: SPI Mode Pin Assignment and Signal Description

Pin	Signal Name	Pin Type	Description
1	/CS	Input	Chip select ("/" indicates low active)
2	DI	Input	Data in
3	VSS1	Supply	Supply voltage ground
4	VDD	Supply	Supply voltage
5	SCLK	Input	Clock
6	VSS2	Supply	Supply voltage ground
7	DO	Output; Push Pull Drivers	Data out
8	-	-	Reserved for future use. Host should pull up with 10 to 100K ohm resistance.
9	-	-	Reserved for future use. Host should pull up with 10 to 100K ohm resistance.

Notes:

1. The extended DAT lines (DAT1-DAT3) are input on power up. They start to operate as DAT lines after SET_BUS_WIDTH command. The Host shall keep its own DAT1-DAT3 lines in input mode, as well, while they are not used. It is defined so, in order to keep compatibility to MultiMediaCards.
2. After power up the CD line is input with 50KOhm pull-up (can be used for card detection or SPI mode selection). The pull-up should be disconnected by the user, during regular data transfer, with SET_CLR_CARD_DETECT (ACMD42) command.

2.3 Performance

Table 4: Wide Temperature Industrial SD Card Read/Write Performance

Capacity: 1GB

Benchmark	Read	Write
ATTO BENCH	24.1 MB/s	17.8 MB/s

Capacity: 2GB

Benchmark	Read	Write
ATTO BENCH	24.3 MB/s	17.8 MB/s

Capacity: 4GB

Benchmark	Read	Write
ATTO BENCH	24.7 MB/s	17.8 MB/s

Capacity: 8GB

Benchmark	Read	Write
ATTO BENCH	24.7 MB/s	19.2 MB/s

3. Environmental Specifications

3.1 Recommended Operating Conditions

Table 5: Wide Temperature Industrial SD Card Recommended Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
Ta1	Commercial Operating Temperature	0	25	70	°C
Ta2	Industrial Operating Temperature	-40	-	85	°C
VDD1	Supply Voltage: Normal Operating Status	2.7	-	3.6	V
VDD2	Supply Voltage: Basic Communication (CMD0, CMD15, CMD55, ACMD41)	2.0	3.3	3.6	V
VSS1 VSS2	Supply Voltage Differentials	-0.5	-	0.5	V
-	Power Up Time (from 0V to VDD min)	-	-	250	ms

3.2 Reliability

Table 6: Wide Temperature Industrial SD Card Endurance, Power Consumption and Data Retention

Parameter	Value
Data retention	10 years
MTBF	2 Million Hours
Endurance	2 Million read/write cycles
Power Consumption	Read Mode: 0.2 μ A
	Write Mode: 0.3 μ A
	Normal Mode: 0.1 μ A

3.3 Durability

Table 7: Duration of Wide Temperature Industrial SD Card

Parameter	Value
Durability	10,000 insertion
Drop Test	1.5m free fall
Bending	20N middle of the card and 20N border of the card
Torque	0.15N or +/-2.5 deg
Bump	25G; 6ms; +/- 3 x 4000 shocks
Shock	1000 G max.
Minimum moving force of WP switch	40gf
WP switch cycles	1000 cycles at slide force 0.4N to 5N
Operating Vibration	15G peak-to-peak
Storage Vibration	15G peak-to-peak

3.4 Humidity and ESD

Table 8: Wide Temperature Industrial SD Card Humidity and ESD

Parameter	Value
Operating Humidity	40°C/95% RH
Storage Humidity	40°C/93% RH 500 hours
ESD: Contact Pad, Human Body Model IEC61000-4-2: Charge C=100pF; Discharge R=1.5 K ohm IEC61000-4-2: Charge C=150pF; Discharge R=0 ohm	>±10KV >±10KV
ESD Contact Pad, Machine Model IEC61000-4-2: Charge C=200pF; Discharge R=0 ohm	±0.25KV

4. Electrical Specifications

4.1 DC Characteristics

Table 9: Wide Temperature Industrial SD Card DC Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Notes
-	Peak Voltage on all Lines	-0.6	-	3.6	V	-
VIL	Input LOW Voltage	-	-	+0.8	V	VCC=3.3V
VIH	Input HIGH Voltage	2.0	-	-	V	VCC=3.3V
VOL	Output LOW Voltage	-	-	0.4	V	VCC=3.3V
VOH	Output HIGH Voltage	2.4	-	-	V	VCC=3.3V
IDD	Operating Current	-	25	50	mA	VCC=3.3V
IDDSB1	Pre-initialization Standby Current	-	-	3	mA	VCC=3.3V
IDDSB2	Post-initialization Standby Current	-	80	150	μA	VCC=3.3V
ILI	Input Leakage Current	-1	-	1	μA	without pull up R
ILO	Output Leakage Current	1	-	1	μA	without pull up R

Note:

1. Measurements are at recommended operating conditions unless otherwise specified.

4.2 Signal Loading

The total capacitance CL is the sum of the bus master capacitance C_{HOST}, the bus capacitance C_{BUS}, and the capacitance C_{CARD} of the card connected to the line:

$$CL = C_{HOST} + C_{BUS} + C_{CARD}$$

To allow the sum of the host and bus capacitances to be up to 20pF for the card, the following conditions in Table 10 are met by the card.

Table 10: Wide Temperature Industrial SD Card Signal Loading

Parameter	Symbol	Min.	Max.	Unit	Notes
Pull up resistance	R _{CMD}	4.7	100	K ohms	To prevent bus floating
Pull up resistance	R _{DAT}	50	100	K ohms	To prevent bus floating
Bus signal line capacitance	CL	-	30	pF	Single card
Signal card capacitance	C _{card}	-	7	pF	Single card
Signal line inductance	-	-	16	nH	-

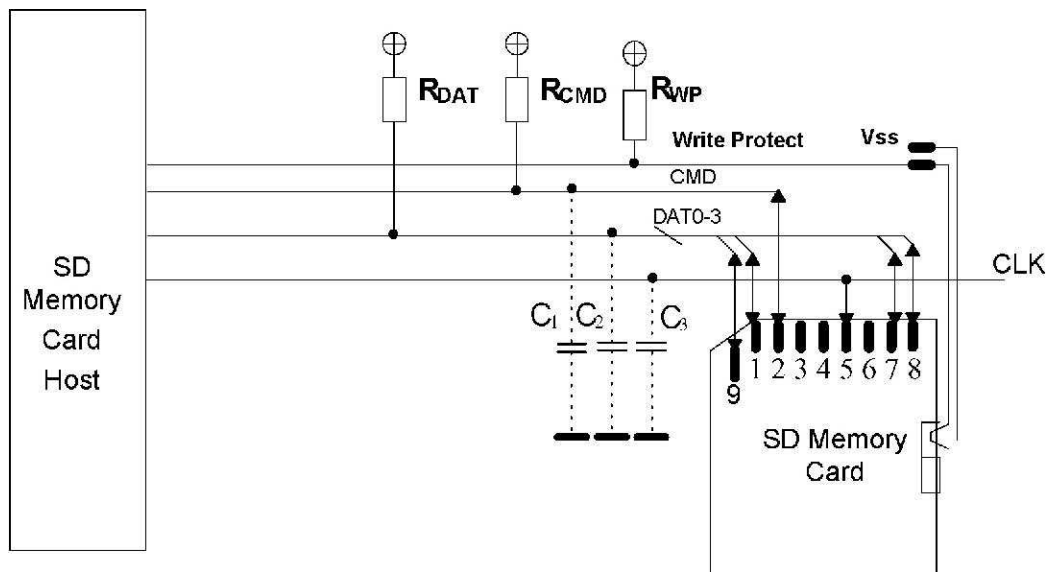


Figure 3: Wide Temperature Industrial SD Card Signal Loading

4.3 AC Characteristics

Table 11: Characteristics Low Speed Mode

Parameter	Symbol	Min.	Max.	Unit
Clock frequency in data transfer mode	fPP	0	25	MHz
Clock frequency in card id mode	fOD	0	400	KHz
Clock low time	tWL	10	-	ns
Clock high time	tWH	10	-	ns
Clock rise time	tTLH	-	10	ns
Clock fall time	tTHL	-	10	ns
CMD, DAT input setup time	tISU	5	-	ns
CMD, DAT input hold time	tIH	5	-	ns
CMD, DAT output delay time	tODLY	0	14	ns

Notes:

1. Rise and fall times are measured from 10% to 90% of voltage level.
2. CLK referenced to VIH min and VIL max.
3. CMD and DAT inputs and outputs referenced to CLK.
4. 0Hz means to stop the clock. The given minimum frequency range is for cases where a continuous clock is required.
5. Specified for one card. $C_L \leq 30\text{pF}$.

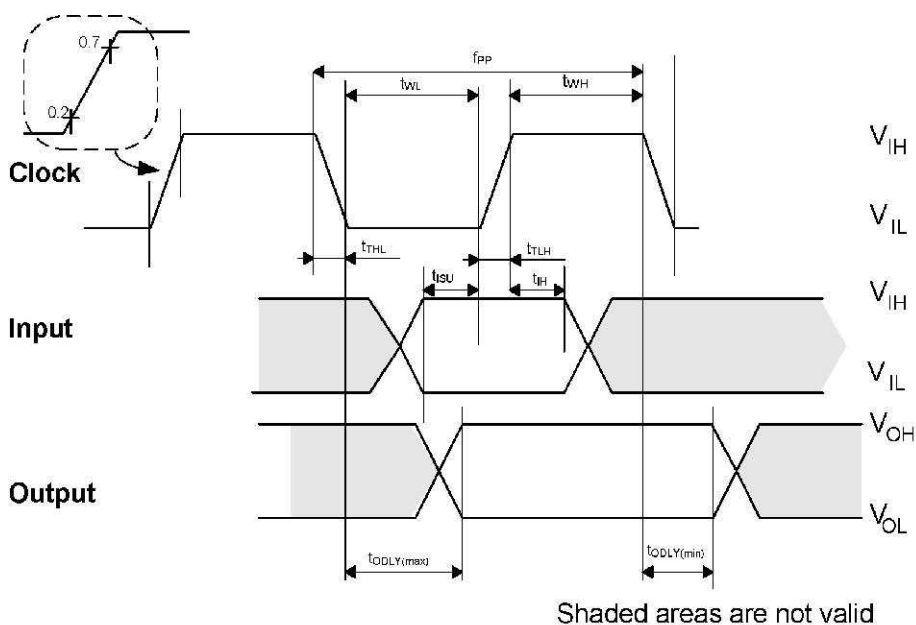


Figure 4: AC Characteristics Low Speed Mode

Table 12: AC Characteristics High Speed Mode

Parameter	Symbol	Min.	Max.	Unit
Clock frequency in data transfer mode	fPP	26	50	MHz
Clock low time	tWL	7.0	-	ns
Clock high time	tWH	7.0	-	ns
Clock rise time	tTLH	-	3	ns
Clock fall time	tTHL	-	3	ns
CMD, DAT input setup time	tISU	6	-	ns
CMD, DAT input hold time	tIH	2	-	ns
CMD, DAT output delay time during data transfer mode	tODLY	-	14	ns
CMD, DAT output hold time	tOHU	2.5	-	ns

Notes:

1. Rise and fall times are measured from 10% to 90% of voltage level.
2. CLK referenced to VIH min and VIL max.
3. CMD and DAT inputs and outputs referenced to CLK.
4. 0Hz means to stop the clock. The given minimum frequency range is for cases where a continuous clock is required.
5. In order to satisfy severe timing, the host shall drive only one card. $C_L \leq 30\text{pF}$.

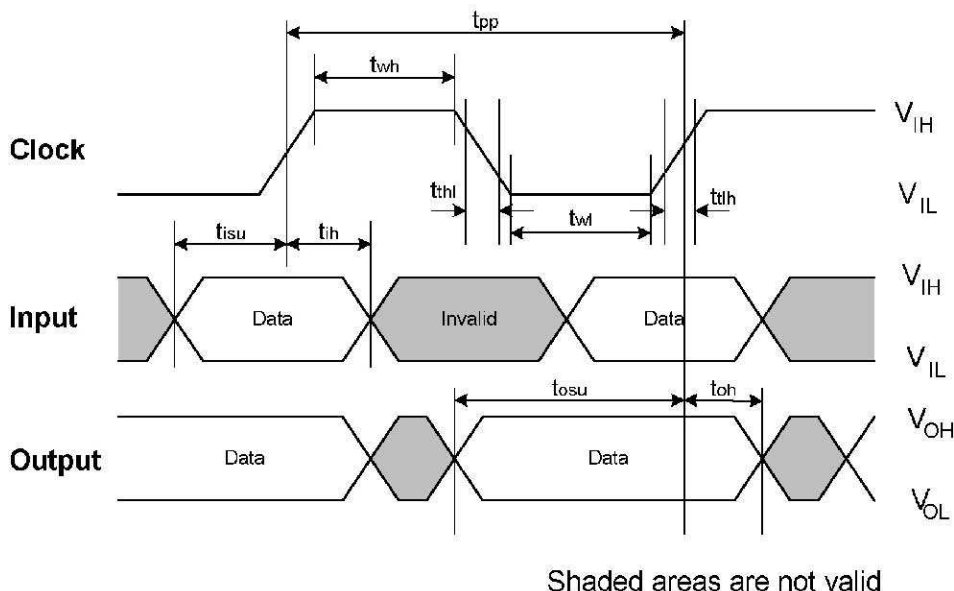


Figure 5: AC Characteristics High Speed Mode

5. Functional Block Diagram

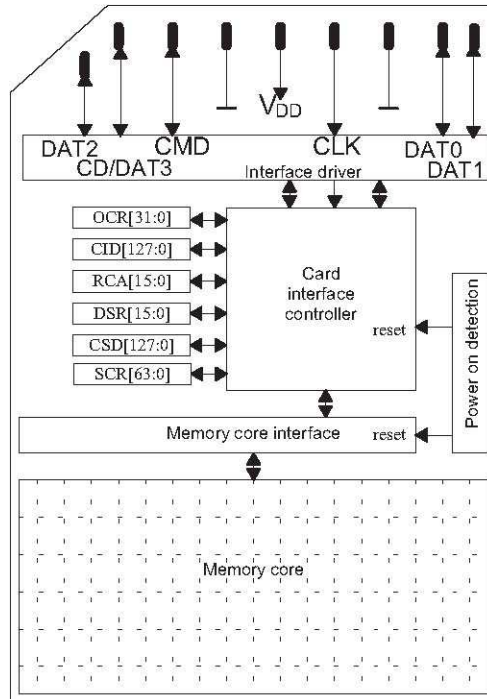


Figure 6: Wide Temperature Industrial SD Card Function Block Diagram

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