

# ATP Industrial Grade microSD/microSDHC Card Specification

Revision 2.4



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**Revision History**

<b>Date</b>	<b>Version</b>	<b>Changes compared to previous issue</b>
Sep.21 <sup>th</sup> , 2007	1.0	- Base version.
Jan.20 <sup>th</sup> , 2009	2.0	- Add table of contents and main features - Compliant with SD specification 2.0
Nov.27 <sup>th</sup> , 2009	2.1	- Add 4GB Capacity product
Apr.02 <sup>nd</sup> , 2010	2.2	- Update the product performance - Add Bend,Torque, Salt Spray,Solar Radiation certification - Add ESD ,Water,Dust proof certification - Update MTBF
Feb.11 <sup>th</sup> , 2011	2.3	- Update P/N
May.11 <sup>th</sup> , 2011	2.4	- Update the product performance

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## **Introduction**

ATP Industrial Grade microSD/microSDHC cards are designed for demanding industrial applications, such as military/aerospace, automotive, marine navigation, embedded, communication equipment or networking, medical equipment, and manufacturing, where mission-critical data requires the highest level of reliability, durability, and data integrity.

## **Main Features**

- Compliant with SD Specification version 2.00
- Supports SD and SPI mode
- High reliability, operating at -40°C to 85°C
- Top level Single Level Cell (SLC) NAND flash memory
- Water proof, Dust proof and ESD proof
- SIP (System In Package) process
- Enhanced endurance by internal dynamic/static wear-leveling
- Hardware BCH ECC engine up to 28bit/1KB
- Supports CPRM
- RoHS compliant
- CE & FCC certification
- Compact form factor : 15mm x 11mm x 1.0mm

## Card Images



## Capacities

ATP P/N	CAPACITY
AF128UDI-2AAXX	128MB
AF256UDI-2ABXX	256MB
AF512UDI-2ABXX	512MB
AF1GUDI-2ABXX	1GB
AF2GUDI-2ABXX	2GB
AF4GUDI-2AAXX	4GB
AF8GUDI-2AAXX	8GB

## microSD/microSDHC Card Pad Assignment

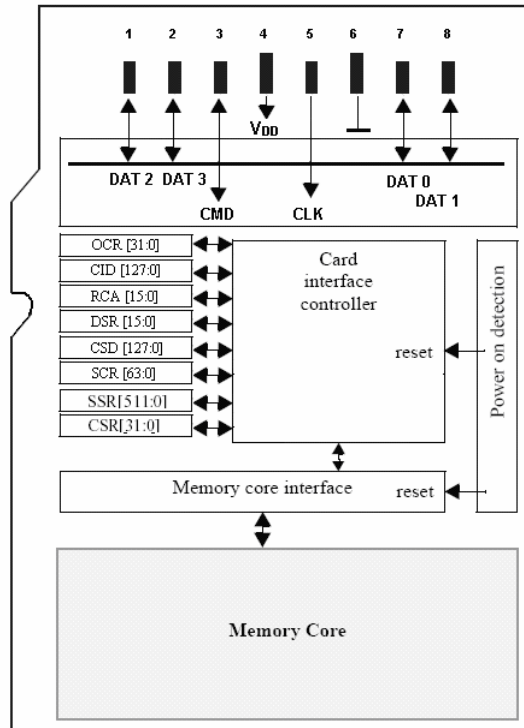
Pin #	SD Interface			SPI Interface		
	Name	Type <sup>1</sup>	Description	Name	Type <sup>1</sup>	Description
1	DAT2	I/O/PP	Data Line [Bit 2]	RSV		
2	CD/DAT3 <sup>2</sup>	I/O/PP <sup>3</sup>	Card Detect / Data Line [Bit 3]	CS	I <sup>3</sup>	Chip Select (Active Low)
3	CMD	PP	Command/ Response	DI	I	Data In
4	V <sub>DD</sub>	S	Supply Voltage	V <sub>DD</sub>	S	Supply Voltage
5	CLK	I	Clock	SCLK	I	Clock
6	V <sub>SS</sub>	S	Supply Voltage Ground	V <sub>SS</sub>	S	Supply Voltage ground
7	DAT0	I/O/PP	Data Line [Bit 0]	DO	O/PP	Data Out
8	DAT1	I/O/PP	Data Line [Bit 1]	RSV		

1) S:power supply; I: input; O; output using push-pull drivers; PP: I/O using push-pull drivers;

2) 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.

3) After power up this line is input with 50Kohm pull-up (can be used for card detection or SPI mode selection). The pull-up should be disconnected by user, during regular data transfer, with SET\_CLR\_CARD\_DETECT (ACMD42) command.

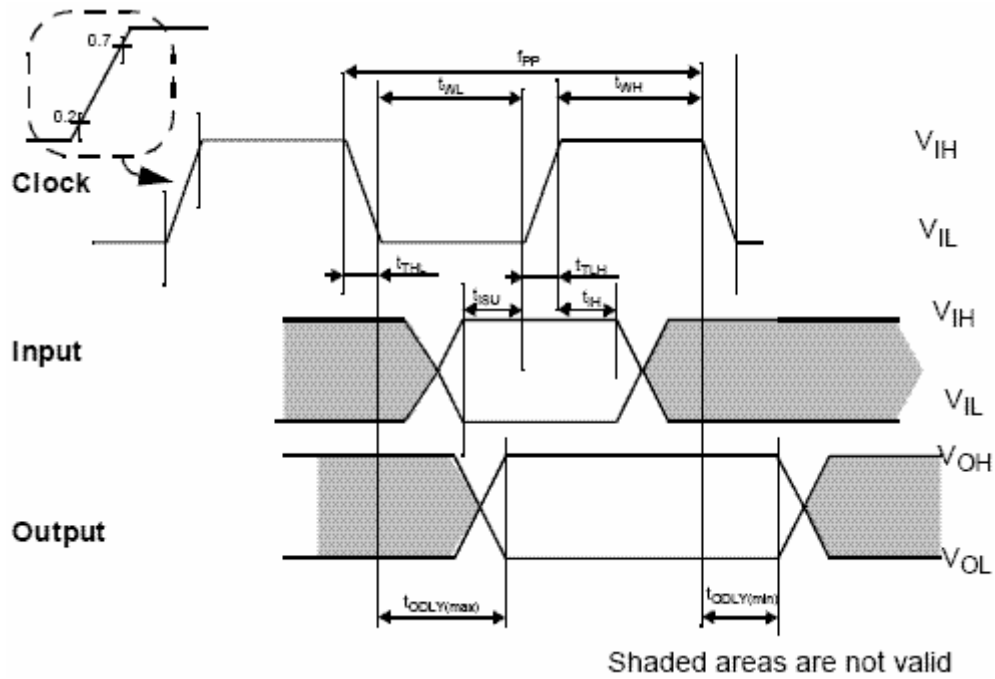
### Functional Block Diagram



### Bus Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit	Remark
Supply voltage	$V_{DD}$	2.7	3.3	3.6	V	
Operating Current	$I_{CC}$	$\leq 2GB$	-	40	mA	RMS
		$> 2GB$		120	mA	RMS
Standby Current	$I_{SB}$	$\leq 2GB$	-	120	$\mu A$	RMS
		$> 2GB$		60	$\mu A$	RMS
Input Leakage Current	$I_{LI}$	-10	-	10	$\mu A$	
Output Leakage Current	$I_{LO}$	-10	-	10	$\mu A$	
Input High Voltage	$V_{IH}$	$0.625 \times V_{DD}$	-	$V_{DD} + 0.3$	V	
Input Low Voltage	$V_{IL}$	$V_{SS} - 0.3$	-	$0.25 \times V_{DD}$	V	
Output High Voltage	$V_{OH}$	$0.75 \times V_{DD}$	-	-	V	
Output Low Voltage	$V_{OL}$	-	-	$0.125 \times V_{DD}$	V	

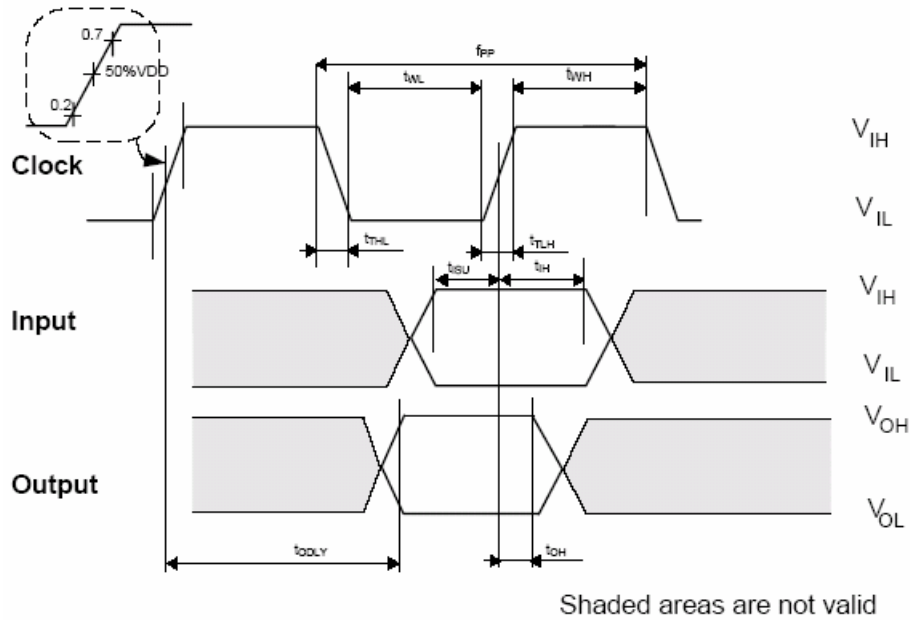
### Default Bus Timing



Parameter	Symbol	Min	Max	Unit	Remark
Clock CLK (All values are referred to min ( $V_{IH}$ ) and max ( $V_{IL}$ ))					
Clock frequency Data Transfer Modez	$f_{PP}$	0	25	MHz	$C_L \leq 10$ pF(1 card)
Clock frequency Identification Mode	$f_{OD}$	0/100	400	KHz	$C_L \leq 10$ pF(1 card)
Clock low time	$t_{WL}$	10	-	ns	$C_L \leq 10$ pF(1 card)
Clock high time	$t_{WH}$	10	-	ns	$C_L \leq 10$ pF(1 card)
Clock rise time	$t_{TLH}$	-	10	ns	$C_L \leq 10$ pF(1 card)
Clock fall time	$t_{TFL}$	-	10	ns	$C_L \leq 10$ pF(1 card)
Inputs CMD, DAT (referenced to CLK)					
Input set-up time	$t_{ISU}$	3	-	ns	$C_L \leq 10$ pF(1 card)
Input hold time	$t_{IH}$	3	-	ns	$C_L \leq 10$ pF(1 card)
Outputs CMD, DAT (referenced to CLK)					
Output Delay time during Data Transfer Mode	$t_{ODLY}$	0	14	ns	$C_L \leq 40$ pF(1 card)
Output Delay time during Identification Mode	$t_{ODLY}$	0	50	ns	$C_L \leq 40$ pF(1 card)



### High Speed Mode Bus Timing



Parameter	Symbol	Min	Max	Unit	Remark
Clock CLK (All values are referred to min ( $V_{IH}$ ) and max ( $V_{IL}$ ))					
Clock frequency Data Transfer Mode	$f_{PP}$	0	50	MHz	$C_L \leq 10$ pF(1 card)
Clock low time	$t_{WL}$	7	-	ns	$C_L \leq 10$ pF(1 card)
Clock high time	$t_{WH}$	7	-	ns	$C_L \leq 10$ pF(1 card)
Clock rise time	$t_{TLH}$	-	3	ns	$C_L \leq 10$ pF(1 card)
Clock fall time	$t_{THL}$	-	3	ns	$C_L \leq 10$ pF(1 card)
Inputs CMD, DAT (referenced to CLK)					
Input set-up time	$t_{ISU}$	6	-	ns	$C_L \leq 10$ pF(1 card)
Input hold time	$t_{IH}$	2	-	ns	$C_L \leq 10$ pF(1 card)
Outputs CMD, DAT (referenced to CLK)					
Output Delay time during Data Transfer Mode	$t_{ODLY}$	-	14	ns	$C_L \leq 40$ pF(1 card)

## Electrical Characteristics

Type	Measurement
Card supported Voltage	2.7~3.6V
Card supported Frequency	0~50 MHz
Data Bus Width Supported	1 or 4 bits

## Performance

Type	Measurement
SD Speed Class	Class 6 (128MB~512MB) Class 10 (1GB~8GB)
Data Transfer Rate	Up to 18MByte/s (120X)

\* The performance may vary according to different product capacity

## Environment Specifications

Type		Standard
Temperature	Operating	-40°C to 85°C
	Non-Operating	-40°C to 85°C
Humidity	Operating	8% to 95%, noncondensing
	Non-Operating	8% to 95%, noncondensing
Vibration	Operating	15G peak-to-peak Max.
	Non-Operating	15G peak-to-peak Max.
Shock	Operating	1,000G Max.
	Non-Operating	1,000G Max.
Altitude	Operating	80,000 feet Max.
	Non-Operating	80,000 feet Max.
Bend	Non-Operating	10N center of the card
Torque	Non-Operating	0.15N-m or +/-2.5°
Salt Spray	Non-Operating	35 °C, Over 85% RH,5% Salt Concentration
Solar Radiation	Non-Operating	40 °C, Irradiation 1000W/m <sup>2</sup>

**Reliability**

Type	Measurement
Number of insertions	10,000 minimum
Data Retention	10 years
Endurance	>2,000,000 cycles (program/erase, in normal applications)
MTBF (@ 25°C)	>5,000,000 hours

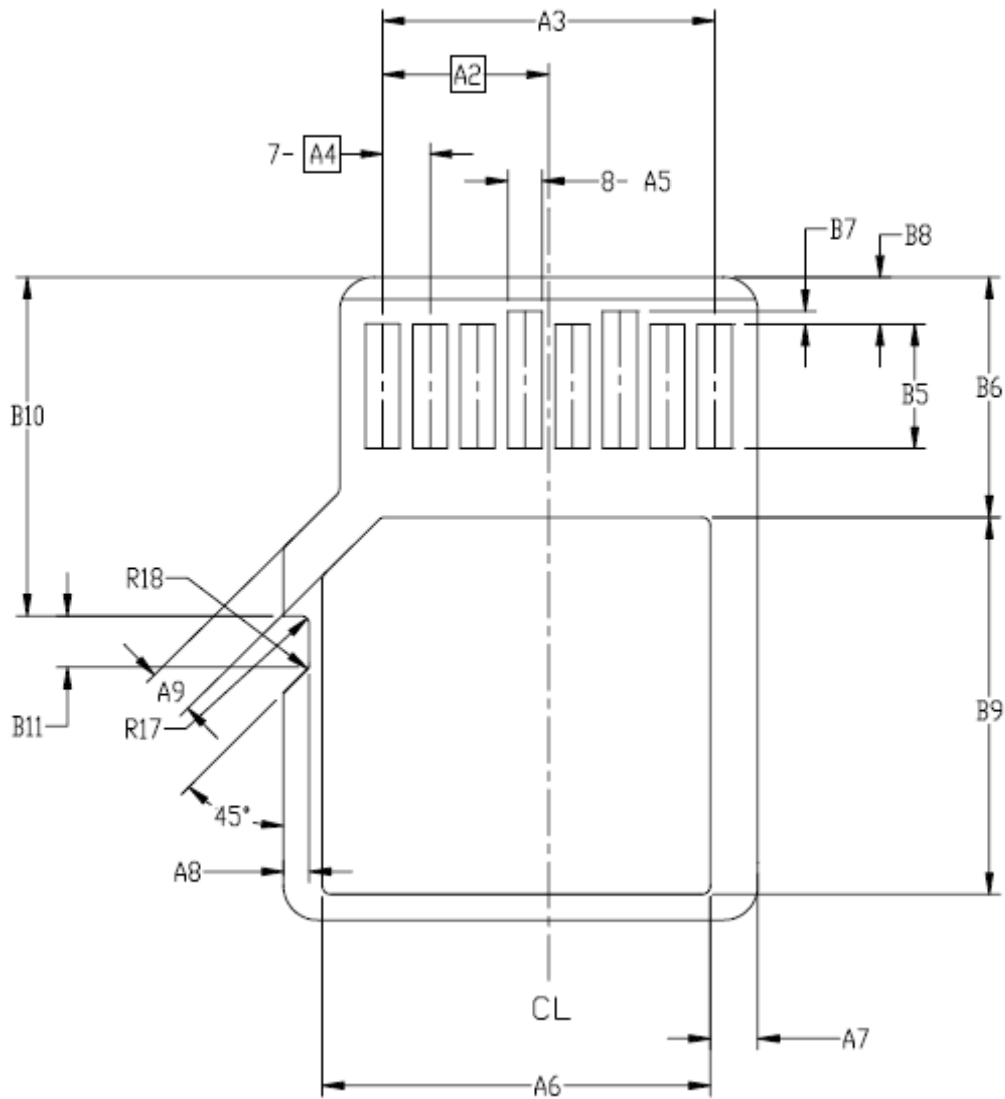
**Extra Features**

Type	Measurement
Water Proof	IEC 60529 Edition 2.1: 2001-02—IPX7, below 1000mm water, 30min
Dust Proof	IEC 60529 Edition 2.1: 2001-02—IP6X
ESD Proof	IEC 61000-4-2: contact pad +/- 4KV, non-contact pad (Coupling plane discharge) +/- 8KV, non-contact pad (Air discharge) +/- 15KV
RoHS Compliant	Yes

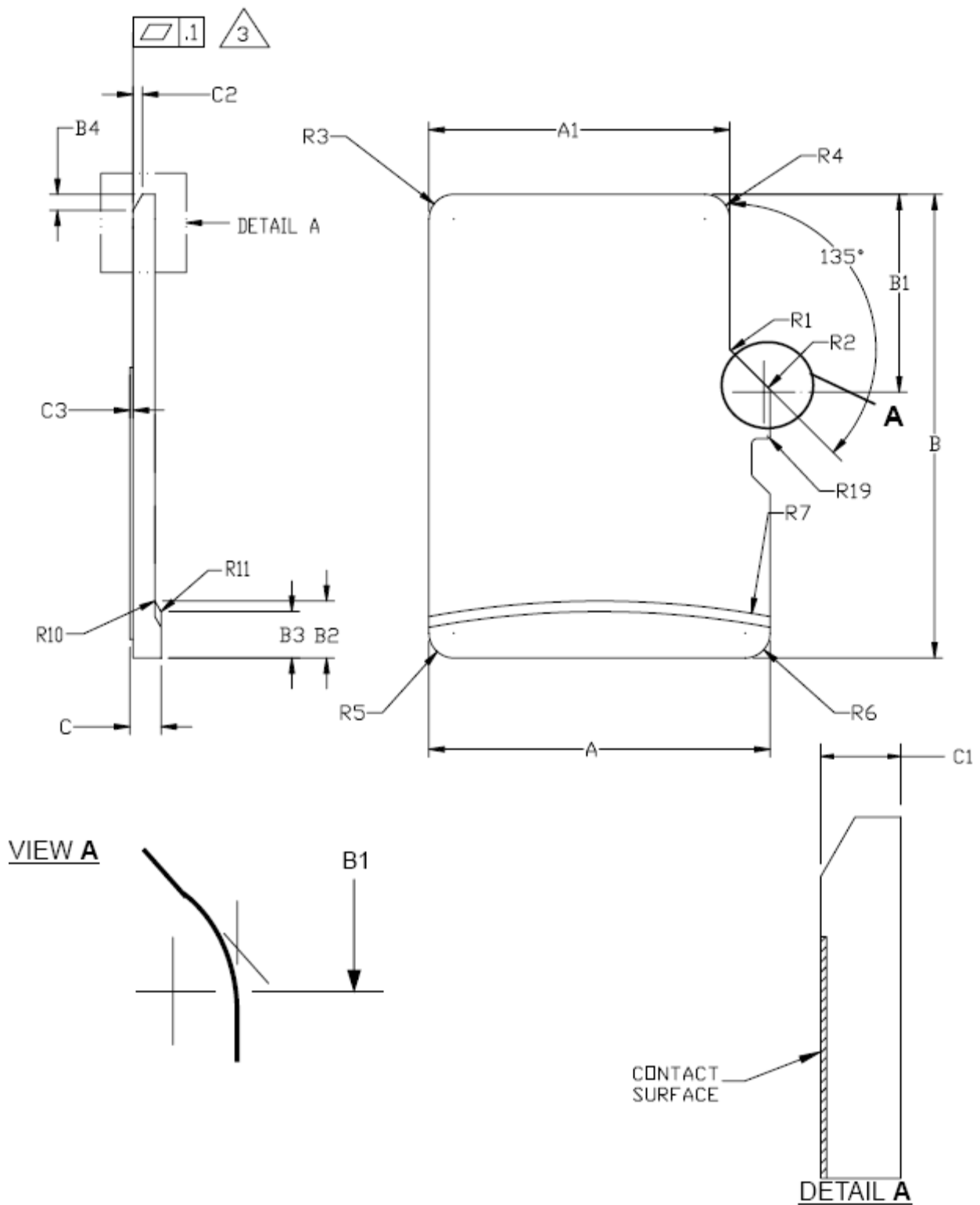
**Physical Dimension Specifications**

Type	Measurement
Length	15mm +/- 0.1mm
Width	11mm +/- 0.1mm
Thickness	1.0mm +/- 0.1mm
Weight	0.4 g Max.

### **Mechanical Form Factor (Unit in mm)**



**Dimensions of microSD (Bottom View)**



Dimensions Of microSD (Top View)

SYMBOL	COMMON DIMENSIONS			NOTE
	MIN	NOM	MAX	
A	10.90	11.00	11.10	
A1	9.60	9.70	9.80	
A2	-	3.85	-	BASIC
A3	7.60	7.70	7.80	
A4	-	1.10	-	BASIC
A5	0.75	0.80	0.85	
A6	-	-	8.50	
A7	0.90	-	-	
A8	0.60	0.70	0.80	
A9	0.80	-	-	
B	14.90	15.00	15.10	
B1	6.30	6.40	6.50	
B2	1.64	1.84	2.04	
B3	1.30	1.50	1.70	
B4	0.42	0.52	0.62	
B5	2.80	2.90	3.00	
B6	5.50	-	-	
B7	0.20	0.30	0.40	
B8	1.00	1.10	1.20	
B9	-	-	9.00	
B10	7.80	7.90	8.00	
B11	1.10	1.20	1.30	
C	0.90	1.00	1.10	
C1	0.60	0.70	0.80	
C2	0.20	0.30	0.40	
C3	0.00	-	0.15	

R1	0.20	0.40	0.60	
R2	0.20	0.40	0.60	
R3	0.70	0.80	0.90	
R4	0.70	0.80	0.90	
R5	0.70	0.80	0.90	
R6	0.70	0.80	0.90	
R7	29.50	30.00	30.50	
R10	-	0.20	-	
R11	-	0.20	-	
R17	0.10	0.20	0.30	
R18	0.20	0.40	0.60	
R19	0.05	-	0.20	