

Approval Sheet

Customer	
Product Number	M3DW-AGM16CN9-A
Module speed	PC3-10600
Pin	204 pin
Cl-tRCD-tRP	9-9-9
DRAM Operating Temp	0°C~85°C
Date	13 rd February 2017

The Total Solution For
Industrial Flash Storage

Rev 1.0

1. Features

Key Parameter

Industry Nomenclature	Speed Grade	Data Rate MT/s			tAA (ns)	tRCD (ns)	tRP (ns)
		CL=7	CL=9	CL=11			
PC3-10600	N	1066	1333	-	13.5	13.5	13.5

- JEDEC Standard 204-pin Dual In-Line Memory Module
- Intend for PC3-10600 applications
- Inputs and Outputs are SSTL-15 compatible
- VDD=VDDQ= 1.5 Volt (-0.075/+0.075V)
- Bi-directional Differential Data Strobe
- DLL aligns DQ and DQS transition with CK transition
- SDRAMs have 8 internal banks for concurrent operation
- Normal and Dynamic On-Die Termination support.
- SDRAMs are 78-ball BGA Package
- Golden Connector
- 8 bit pre-fetch
- Two different termination values (Rtt_Nom & Rtt_WR)
- Auto & self refresh 7.8 μ s ($T_A \leq +85^{\circ}\text{C}$)
- 16/11/2 Addressing (row/column/rank)-16GB
- SDRAM operating temperature range $0^{\circ}\text{C} \leq T_c \leq +85^{\circ}\text{C}$
- Programmable Device Operation:
 - Burst Type: Sequential or Interleave
 - Device CAS# Latency: 7, 9
 - Burst Length: switch on-the-fly: BL=8 or BC 4
- RoHS Compliant (*Section 12*)

2. Environmental Requirements

iDIMM are intended for use in standard office environments that have limited capacity for heating and air conditioning.

Symbol	Parameter	Rating	Units	Notes
TOPR	Operating Temperature (ambient)	0 to +65	°C	3
TSTG	Storage Temperature	-50 to +100	°C	
HOPR	Operating Humidity (relative)	10 to 90	%	
HSTG	Storage Humidity (without condensation)	5 to 95	%	
PBAR	Barometric Pressure (operating & storage)	105 to 69	K Pascal	1,2
1. The component maximum case temperature (Tcase) shall not exceed the value specified in the DDR DRAM component specification. 2. Up to 9850 ft. 3. The designer must meet the case temperature specifications for individual module components.				

3. DRAM Parameters by device density

RTT_Nom Setting	Parameter		8Gb	Units
tRFC	REF command ACT or REF command time		350	ns
tREFI	Average periodic refresh interval	0°C ≤ T _{CASE} ≤ 85°C	7.8	μs
		85°C ≤ T _{CASE} ≤ 95°C	3.9	μs

4. Ordering Information

DDR3 SODIMM w/ECC						
Part Number	Density	Speed	DIMM Organization	Number of DRAM	Number of rank	ECC
M3DW-AGM16CN9-A	16GB	PC3-10600	2Gx72	18	2	Y

5. Pin Configurations (Front side/Back side)

X72 SODIMM

Pin #	Front Side	Pin #	Back Side	Pin #	Front Side	Pin #	Back Side	Pin #	Front Side	Pin #	Back Side	Pin #	Front Side	Pin #	Back Side
1	VREFDQ	2	VSS	53	VSS	54	DQ28	103	A3	104	A4	155	VSS	156	DQS5_t
3	VSS	4	DQ4	55	DQ24	56	DQ29	105	A1	106	A2	157	DM5	158	VSS
5	DQ0	6	DQ5	57	DQ25	58	VSS	107	A0	108	BA1	159	DQ42	160	DQ46
7	DQ1	8	VSS	59	DM3	60	DQS3_c	109	VDD	110	VDD	161	DQ43	162	DQ47
9	VSS	10	DQS0_c	61	VSS	62	DQS3_t	111	CK0_t	112	Par_In, NC, CK1_t	163	VSS	164	VSS
11	DM0	12	DQS0_t	63	DQ26	64	VSS	113	CK0_c	114	Err_Out_n, NC, CK1_c	165	DQ48	166	DQ52
13	DQ2	14	VSS	65	DQ27	66	DQ30	115	VDD	116	VDD	167	DQ49	168	DQ53
15	DQ3	16	DQ6	67	VSS	68	DQ31	117	A10/AP	118	S3_n	169	VSS	170	VSS
17	VSS	18	DQ7	69	CB0	70	VSS	119	BA0	120	S2_n	171	DQS6_c	172	DM6
19	DQ8	20	VSS	71	CB1	72	CB4	121	WE_n	122	RAS_n	173	DQS6_t	174	DQ54
21	DQ9	22	DQ12	Key				123	VDD	124	VDD	175	VSS	176	DQ55
23	VSS	24	DQ13	73	VSS	74	CB5	125	CAS_n	126	ODT0	177	DQ50	178	VSS
25	DQS1_c	26	VSS	75	DQS8_c	76	DM8	127	S0_n	128	ODT1	179	DQ51	180	DQ60
27	DQS1_t	28	DM1	77	DQS8_t	78	VSS	129	S1_n	130	A13	181	VSS	182	DQ61
29	VSS	30	RESET_n	79	VSS	80	CB6	131	VDD	132	VDD	183	DQ56	184	VSS
31	DQ10	32	VSS	81	CB2	82	CB7	133	DQ32	134	DQ36	185	DQ57	186	DQS7_c
33	DQ11	34	DQ14	83	CB3	84	VREFCA	135	DQ33	136	DQ37	187	VSS	188	DQS7_t
35	VSS	36	DQ15	85	VDD	86	VDD	137	VSS	138	VSS	189	DM7	190	VSS
37	DQ16	38	VSS	87	CKE0	88	A15	139	DQS4_c	140	DM4	191	DQ58	192	DQ62
39	DQ17	40	DQ20	89	CKE1	90	A14	141	DQS4_t	142	DQ38	193	DQ59	194	DQ63
41	VSS	42	DQ21	91	BA2	92	A9	143	VSS	144	DQ39	195	VSS	196	VSS
43	DQS2_c	44	DM2	93	VDD	94	VDD	145	DQ34	146	VSS	197	SA0	198	EVENT_n
45	DQS2_t	46	VSS	95	A12/BC_n	96	A11	147	DQ35	148	DQ44	199	VDDSPD	200	SDA
47	VSS	48	DQ22	97	A8	98	A7	149	VSS	150	DQ45	201	SA1	202	SCL
49	DQ18	50	DQ23	99	A5	100	A6	151	DQ40	152	VSS	203	VTT	204	VTT
51	DQ19	52	VSS	101	VDD	102	VDD	153	DQ41	154	DQS5_c				

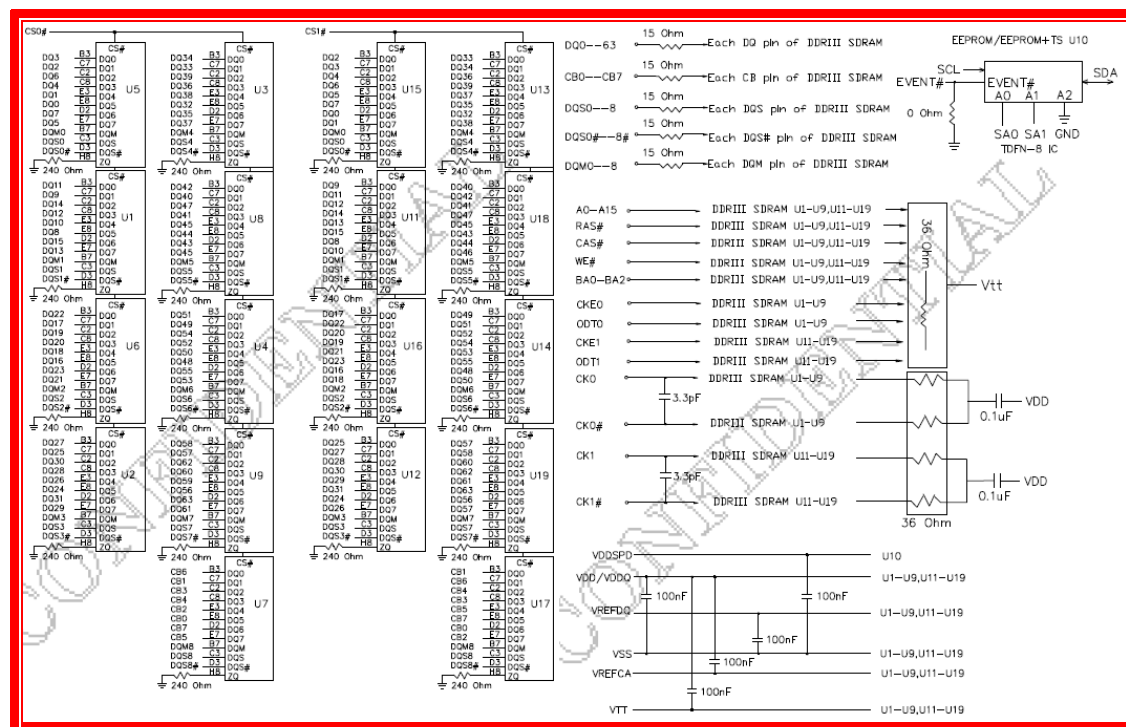
6. Architecture

Pin Definition

Pin Name	Description	Pin Name	Description
A0 - A13 (A14 or A15)	SDRAM address bus	SCL	Serial Presence Detect Clock Input
BA0 - BA1 (or BA2)	SDRAM Bank Address Inputs	SDA	Serial Presence Detect Data input/output
/RAS	SDRAM row address strobe	SA0 – SA2	Serial Presence Detect Address Inputs
/CAS	SDRAM column address strobe	V _{DD}	Power Supply
/WE	SDRAM write enable	V _{DDID}	V _{DD} Identification Flag
/S0 - /S1	DIMM Rank Select Lines	V _{DDQ}	SDRAM I/O Driver power supply
CK0 – CKE1	SDRAM clock enable lines	V _{REFDQ}	SDRAM I/O Reference supply
DQ0 – DQ63	DIMM memory data bus	V _{REFCA}	SDRAM Command/address reference supply.
CB0 – CB7	DIMM ECC check bit	V _{SS}	Ground
DQS0 – DQS8 /DQS0-/DQS8	SDRAM data strobes	V _{DDSPD}	Serial EEPROM positive power supply
DM0 – DM8	SDRAM data masks	NC	Spare Pin
ODT0-ODT1	Spare Pin	/Reset	Reset enable
CK0 – CK1 /CK0 - /CK1	Differential SDRAM Clocks	Event#	Reserved for optional temperature-sensing hardware
RSVD	Reserved for future use.	V _{TT}	SDRAM I/O termination supply.

7. Function Block Diagram:

- (16 GB, 2 Ranks, 1Gx8 DDR3 SDRAMs)



8. SDRAM Absolute Maximum Ratings

Symbol	Parameter		Rating	Units	Note
T _{OPER}	Operation Temperature	Normal Operating Temp.	0 to 85	°C	1,2
		Extended Temp.(optional)	85 to 95	°C	1,3
T _{STG}	Storage Temperature		-55 to 150	°C	4,5
V _{IN} , V _{OUT}	Voltage on any pins relative to Vss		-0.4 to +1.975	V	4
V _{DD}	Voltage on VDD supply relative to Vss		-0.4 to +1.975	V	4,6
V _{DDQ}	Voltage on VDDQ supply relative to Vss		-0.4 to +1.975	V	4,6

Note:

1. Operating Temperature T_{OPER} is the case surface temperature on the center / top side of the DRAM.

For measurement conditions, please refer to the JEDEC document JESD51-2.

2. The Normal Temperature Range specifies the temperatures where all DRAM specifications will be supported. During operation, the DRAM case temperature must be maintained between 0 to 85 °C under all operating conditions.

3. Some applications require operation of the DRAM in the Extended Temperature Range between 85 °C and 95 °C case temperature. Full specifications are supported in this range, but the following additional conditions apply:

- a) Refresh commands must be doubled in frequency, therefore reducing the Refresh interval tREFI to 3.9 μs. It is also possible to specify a component with 1X refresh (tREFI to 7.8μs) in the Extended Temperature Range. Please refer to supplier data sheet and/or the DIMM SPD for option availability.
- b) If Self-Refresh operation is required in the Extended Temperature Range, then it is mandatory to either use the Manual Self-Refresh mode with Extended Temperature Range capability (MR2 A6 =0b and MR2 A7 = 1b) or enable the optional Auto Self-Refresh mode (MR2 A6 = 1b and MR2 A7 =0b). Please refer to the supplier data sheet and/or the DIMM SPD for Auto Self-Refresh option availability, Extended Temperature Range support and tREFI requirements in the Extended Temperature Range.

4. Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is stress rating only, and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

5. Storage Temperature is the case surface temperature on the center/top side of the DRAM. For the measurement conditions, please refer to JESD51-2 standard.

6. VDD and VDDQ must be within 300 mV of each other at all times;and VREF must be not greater than 0.6 x VDDQ, When VDD and VDDQ are less than 500 mV; VREF may be equal to or less than 300 mV

9. DRAM AC & DC Operating

Symbol	Parameter	Min	Typ.	Max	Units	Notes
Recommended DC Operating Conditions						
V_{DD}	Supply Voltage	1.425	1.5	1.575	V	1,2
V_{DDQ}	Supply Voltage	1.425	1.5	1.575	V	1,2
Single Ended AC/DC Input Levels						
V_{IH} (DC)	DC Input High (Logic1) Voltage	$V_{REF} + 0.1$	-	V _{DD}	V	3
V_{IL} (DC)	DC Input Low (Logic 0) Voltage	V _{SS}	-	$V_{REF} - 0.1$	V	3
V_{IH} (AC)	AC Input High (Logic1) Voltage	$V_{REF} + 0.175$	-	-	V	3
V_{IL} (AC)	AC Input Low (Logic 0) Voltage	-	-	$V_{REF} - 0.175$	V	3
V_{REFDQ} (DC)	Reference Voltage for DQ, DM inputs	$0.49V_{DDQ}$	$0.5V_{DDQ}$	$0.51V_{DDQ}$	V	4,5
V_{REFCA} (DC)	Reference Voltage for ADD,CMD inputs	$0.49V_{DDQ}$	$0.5V_{DDQ}$	$0.51V_{DDQ}$	V	4,5
Single Ended AC/DC output Levels						
V_{OH} (DC)	DC output high measurement level (for IV curve linearity)	-	$0.8 \times V_{DDQ}$	-	V	
V_{OM} (DC)	DC output mid measurement level (for IV curve linearity)	-	$0.5 \times V_{DDQ}$	-	V	
V_{OL} (DC)	DC output low measurement level (for IV curve linearity)	-	$0.2 \times V_{DDQ}$	-	V	
V_{OH} (AC)	AC output high measurement level (for output SR)	-	$V_{TT} + 0.1 \times V_{DDQ}$	-	V	6
V_{OL} (AC)	AC output low measurement level (for output SR)		$V_{TT} - 0.1 \times V_{DDQ}$	-	V	6

Symbol	Parameter	Min	Typ.	Max	Units	Notes
Differential AC/DC Input Levels						
V_{IHdiff}	Differential Input high	+0.2	-	Note 9	V	7
V_{ILdiff}	Differential Input logic Low	Note 9	-	-0.2	V	7
V_{IHdiff}(ac)	Differential Input high ac	2* (V _{IH} (AC)- V _{REF})	-	Note 9	V	8
V_{ILdiff}(ac)	Differential Input logic Low ac	Note 9	-	2* (V _{REF} - V _{IL} (AC))	V	8
Differential AC and DC Output Levels						
V_{OHdiff}(AC)	AC differential output high measurement level (for output SR)	-	+ 0.2 x V _{DDQ}	-	V	10
V_{OLdiff}(AC)	AC differential output low measurement level (for output SR)	-	- 0.2 x V _{DDQ}	-	V	10
Note: - Under all conditions V_{DDQ} must be less than or equal to V_{DD}. - V_{DDQ} tracks with V_{DD}. AC parameters are measured with V_{DD} and V_{DDQ} tied together. - For DQ and DM, V_{ref} = V_{refDQ}. For input only pins except RESET#, V_{ref} = V_{refCA}. - The ac peak noise on V_{ref} may not allow V_{ref} to deviate from V_{ref}(DC) by more than +/-1% V_{DD} (for reference: approx. +/- 15 mV). - For reference: approx. V_{DD}/2 +/- 15 mV. - The swing of $\pm 0.1 \times V_{DDQ}$ is based on approximately 50% of the static single-ended output high or low swing with a driver impedance of 40 Ω and an effective test load of 25 Ω to V_{TT} = V_{DDQ}/2 - Used to define a differential signal slew-rate. - For CK - CK# use V_{IH}/V_{IL}(ac) of ADD/CMD and V_{REFCA}; for DQS - DQS#, DQSL, DQSL#, DQSU, DQSU# use V_{IH}/V_{IL}(ac) of DQs and V_{REFDQ}; if a reduced ac-high or ac-low level is used for a signal group, then the reduced level applies also here. - These values are not defined, however the single-ended signals CK, CK#, DQS, DQS#, DQSL, DQSL#, DQSU, DQSU# need to be within the respective limits (V_{IH}(dc) max, V_{IL}(dc)min) for single- ended signals as well as the limitations for overshoot and undershoot. - The swing of $\pm 0.2 \times V_{DDQ}$ is based on approximately 50% of the static single-ended output high or low swing with a driver impedance of 40 Ω and an effective test load of 25 Ω to V_{TT} = V_{DDQ}/2 at each of the differential outputs.						

10. Operating, Standby, and Refresh Currents

- 16GB SODIMM (2 Ranks, 1Gx8 DDR3 SDRAMs $T_{CASE} = 0^{\circ}C \sim 70^{\circ}C$)

Symbol	Parameter/Condition		PC3-10600 (MAX.)	Unit
I DD0	One bank; Active - Precharge		702	mA
I DD1	One bank; Active - Read - Precharge		801	mA
I DD2N	Precharge Standby Current		648	mA
IDD2NT	Precharge Standby ODT Current		459	mA
I DD2P	Precharge Power Down Current	Fast Mode	252	mA
	Precharge Power Down Current	Slow Mode	198	mA
I DD2Q	Precharge Quiet Standby Current		612	mA
I DD3N	Active Standby Current		918	mA
I DD3P	Active Power-Down Current		648	mA
I DD4R	Operating Current Burst Read		1224	mA
I DD4W	Operating Current Burst Write		1224	mA
I DD5B	Burst Refresh Current		2304	mA
I DD6	Self-Refresh Current: Normal Temperature Range		432	mA
I DD6ET	Self-Refresh Current: Extended Temperature Range		612	mA
I DD7	Operating Bank Interleave Read Current		1809	mA
IDD8	Reset Current		234	mA

11. Timing Parameters

Symbol	Parameter	PC3-10600		Unit
		Min.	Max.	
Clock Timing				
tCK (DLL-Off)	Minimum Clock Cycle Time	8	-	ns
tCK (avg)	Average Clock Period	1.5	3.3	ns
tCH (avg)	Average high pulse width	0.47	0.53	tCK (avg)
tCL (avg)	Average low pulse width	0.47	0.53	tCK (avg)
tCK (abs)	Absolute Clock Period	tCK(avg) min + tJIT(per) min	tCK(avg) max + tJIT(per) max -	Ps
tCH (abs)	Absolute high pulse width	0.43	-	tCK (avg)
tCL (abs)	Absolute low pulse width	0.43	-	tCK (avg)
JIT (per)	Clock Period Jitter	-80	80	Ps
TJIT (per, lck)	Clock Period Jitter during DLL locking period.	-70	70	Ps
JIT (CC)	Cycle to Cycle Period Jitter	160		Ps
TJIT (CC, lck)	Cycle to Cycle Period Jitter during DLL locking period.	140		Ps
TJIT (duty)		-	-	Ps
TERR (2per)	Cumulative error across 2 cycle	-118	118	Ps
TERR (3per)	Cumulative error across 3 cycle	-140	140	Ps
TERR (4per)	Cumulative error across 4 cycle	-155	155	Ps
TERR (5per)	Cumulative error across 5 cycle	-168	168	Ps
TERR (6per)	Cumulative error across 6 cycle	-177	177	Ps
TERR (7per)	Cumulative error across 7 cycle	-186	186	Ps
TERR (8per)	Cumulative error across 3 cycle	-193	193	Ps
TERR (9per)	Cumulative error across 4 cycle	-200	200	Ps
TERR (10per)	Cumulative error across 5 cycle	-205	205	Ps
TERR (11per)	Cumulative error across 6 cycle	-210	210	Ps

TERR (12per)	Cumulative error across 7 cycle	-215	215	Ps
TERR (nper)	Cumulative error across 13~50 cycle	$tERR(nper)_{min} = (1 + 0.68\ln(n)) * tJIT(per)_{min}$ $tERR(nper)_{max} = (1 + 0.68\ln(n)) * tJIT(per)_{max}$		Ps
Data Timing				
Symbol	Parameter	Min.	Max.	Unit
tDSQ	DQS, DQS# to DQ skew, per group, per access	-	125	Ps
tQH	DQ output hold time from DQS, DQS#	0.38	-	tCK(avg)
tLZ (DQ)	DQ low-impedance time from CK, CK#	-500	250	Ps
tHZ(DQ)	DQ high impedance time from CK, CK#	-	250	Ps
tDS(base) AC150	Data setup time to DQS, DQS# referenced to Vih(ac) / Vil(ac) levels	30	-	Ps
tDH(base) DC 100	Data hold time from DQS, DQS# referenced to Vih(dc) / Vil(dc) levels	65	-	Ps
Data Strobe Timing				
Symbol	Parameter	Min.	Max.	Unit
tRPRE	DQS,DQS# differential READ Preamble	0.9		tCK(avg)
tRPST	DQS, DQS# differential READ Postamble	0.3		tCK(avg)
tQSH	DQS, DQS# differential output high time	0.4		tCK(avg)
tQSL	DQS, DQS# differential output low time	0.4		tCK(avg)
tWPRE	DQS, DQS# differential WRITE Preamble	0.9		tCK(avg)
tWPST	DQS, DQS# differential WRITE Postamble	0.3		tCK(avg)
tDQSCK	DQS, DQS# rising edge output access time from rising CK, CK#	-225	225	Ps

tLZ(DQS)	DQS and DQS# low-impedance time (Referenced from RL - 1)	-450	225	Ps
tHZ(DQS)	DQS and DQS# high-impedance time (Referenced from RL + BL/2)	-	225	Ps
tDQSL	DQS, DQS# differential input low pulse width	0.4	0.6	tCK(avg)
tDQSH	DQS, DQS# differential input high pulse width	0.4	0.6	tCK(avg)
tDQSS	DQS, DQS# rising edge to CK, CK# rising edge	-0.25	0.25	tCK(avg)
tDSS	DQS, DQS# falling edge setup time to CK, CK# rising edge	0.2	-	tCK(avg)
tDSH	DQS, DQS# falling edge hold time from CK, CK# rising edge	0.2	-	tCK(avg)
Command and Address Timing				
Symbol	Parameter	Min.	Max.	Unit
tDLLK	DLL locking time	512	-	nCK
tRTP	Internal READ Command to PRECHARGE Command delay	max(4nCK, 7.5ns)	-	
tWTR	Delay from start of internal write transaction to Internal read command	max(4nCK, 7.5ns)	-	
tWR	WRITE recovery time	15	-	ns
tMRD	Mode Register Set command cycle time	4	-	nCK
tMOD	Mode Register Set command update delay	max(12nCK, 15ns)	-	
tRCD	Refer to Section 1 Feature			
tRP	Refer to Section 1 Feature			
tRC	Refer to Section 1 Feature			
tCCD		4	-	nCK

tDAL (min)	Auto precharge write recovery + precharge time	WR + roundup(tRP / tCK(avg))		nCK
tMPRR	Multi-Purpose Register Recovery Time	1	-	nCK
tRAS	ACTIVE to PRECHARGE command period	36	9 tREFI	ns
tRRD	ACTIVE to ACTIVE command period for 1KB page size	max(4nCK, 6ns)	-	
tRRD	ACTIVE to ACTIVE command period for 2KB page size	max(4nCK, 7.5ns)	-	
tFAW	Four activate window for 1KB page size	30	-	ns
tFAW	Four activate window for 2KB page size	45	-	ns
tIS (base)	Command and Address setup time to CK, CK#, referenced to Vih(ac) / Vil(ac) levels.	65		ns
tIH(base)	Command and Address hold time from CK, CK# referenced to Vih(dc) / Vil(dc) levels	140		ps
tIS(base) AC150	Command and Address setup time to CK, CK# referenced to Vih(ac) / Vil(ac) levels	65+125		ps
Calibration Timing				
Symbol	Parameter	Min.	Max.	Unit
tZQinit	Power-up and RESET calibration time	512	-	nCK
tZQoper	Normal operation Full calibration time	256	-	nCK
tZQCS	Normal operation Short calibration time	64	-	nCK
Reset Timing				
Symbol	Parameter	Min.	Max.	Unit
tXPR	Exit Reset from CKE HIGH to a valid command	max(5nCK, tRFC(min) + 10ns)	-	
Self Refresh Timings				

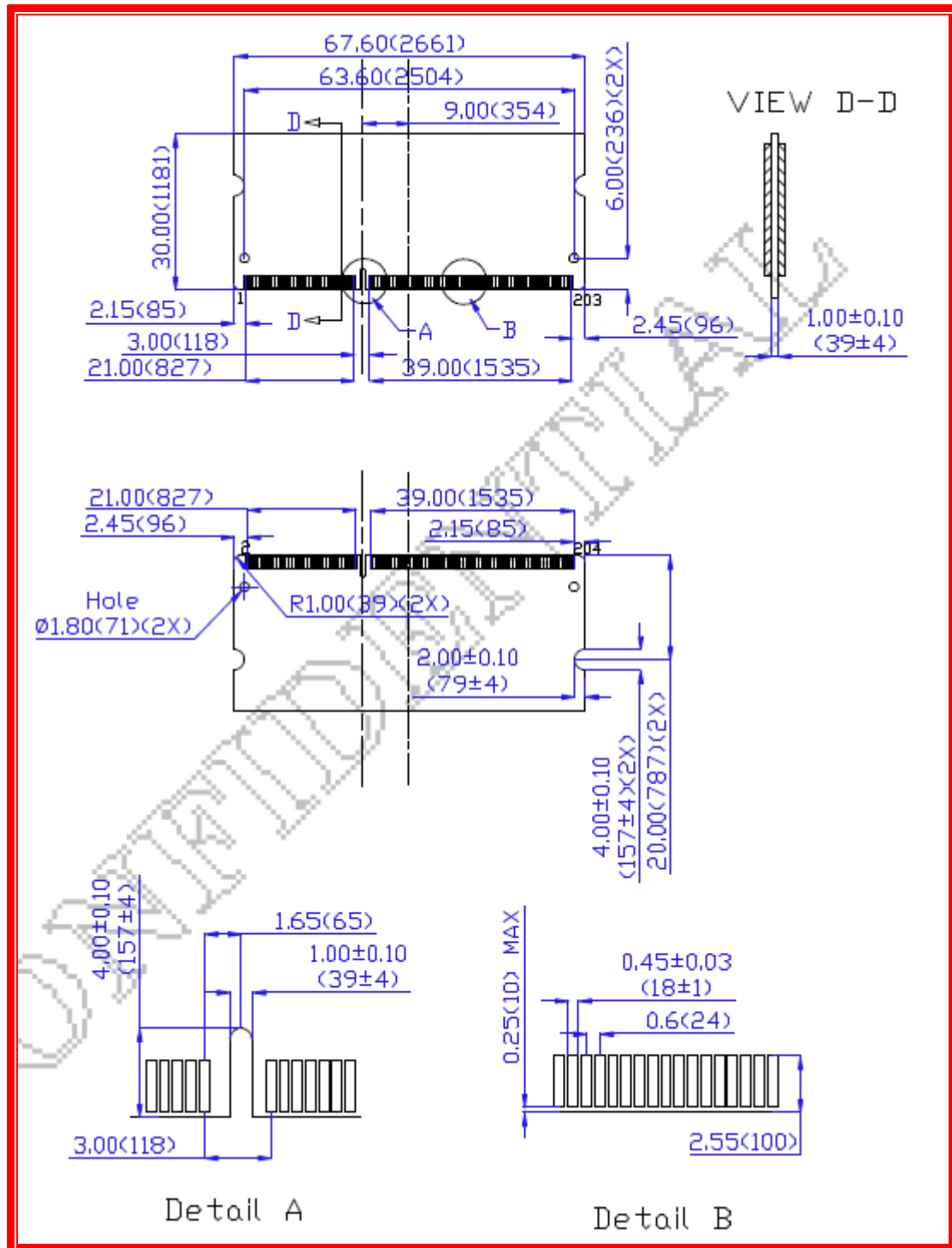
Symbol	Parameter	Min.	Max.	Unit
tXS	Exit Self Refresh to commands not requiring a locked DLL	Max(5nCK), tRFC(min) +10ns)		
tXSDLL	Exit Self Refresh to commands requiring a locked DLL.	tDLL(min)	-	nCK
tCKESR	Minimum CKE low width for Self Refresh entry to exit timing.	tCKE9min) +1nCK	-	
tCKSRE	Valid Clock Requirement after Self Refresh Entry (SRE) or Power-Down Entry (PDE)	Max(5nCK, 10ns)	-	
tCKSRX	Valid Clock Requirement before Self Refresh Exit (SRX) or Power-Down Exit (PDX) or Reset Exit	Max(5nCK, 10ns)	-	
Power Down Timings				
Symbol	Parameter	Min.	Max.	Unit
tXP	Exit Power Down with DLL on to any valid command; Exit Precharge Power Down with DLL frozen to commands not requiring a locked DLL	max(3nCK, 6ns)	-	
tXPDLL	Exit Precharge Power Down with DLL frozen to commands requiring a locked DLL	max(10nCK, 24ns)	-	
tCKE	CKE minimum pulse width	max(3nCK, 5ns)	-	
tCPDED	Command pass disable delay	1	-	nCK
tPD	Power Down Entry to Exit Timing	tCK(min)	9*tREFI	
tACTPDEN	Timing of ACT command to Power Down entry	1	-	nCK
tPRPDEN	Timing of PRE or PREA command to Power Down entry	1	-	nCK

tRDPDEN	Timing of RD/RDA command to Power Down entry	RL+4+1	-	nCK
tWRPDEN	Timing of WR command to Power Down entry (BL8OTF, BL8MRS, BC4OTF)	WL + 4 + (tWR / tCK(avg))	-	nCK
tWRAPDEN	Timing of WRA command to Power Down entry (BL8OTF, BL8MRS, BC4OTF)	WL + 4 + WR + 1	-	nCK
tWRPDEN	Timing of WR command to Power Down entry (BC4MRS)	WL + 2 + (tWR / tCK(avg))	-	nCK
tWRAPDEN	Timing of WRA command to Power Down entry (BC4MRS)	WL + 2 + WR + 1	-	nCK
tREFPDEN	Timing of REF command to Power Down entry	1	-	nCK
tMRSPDEN	Timing of MRS command to Power Down entry	tMOD(mi n)	-	nCK
ODT Timings				
Symbol	Parameter	Min.	Max.	Unit
ODTH4	ODT high time without write command or with write command and BC4	4	-	nCK
ODTH8	ODT high time with Write command and BL8	6	-	nCK
tAONPD	Asynchronous RTT turn-on delay (Power-Down with DLL frozen)	1	9	ns
tAOFPD	Asynchronous RTT turn-off delay (Power-Down with DLL frozen)	1	9	ns
tAON	RTT-turn-on	-250	250	ps
tAOF	RTT_Nom and RTT_WR turn-off time from ODTLoff reference	0.3	0.7	tCK(avg)
tADC	RTT dynamic change skew	0.3	0.7	tCK(avg)
Write Leveling Timing				

Symbol	Parameter	Min.	Max.	Unit
tWLMRD	First DQS/DQS# rising edge after write leveling mode is programmed	40	-	nCK
tWLDQSEN	DQS/DQS# delay after write leveling mode is programmed	25	-	nCK
tWLS	Write leveling setup time from rising CK, CK# crossing to rising DQS, DQS# crossing	195	-	ps
tWLH	Write leveling hold time from rising DQS, DQS# crossing to rising CK, CK# crossing	195	-	ps
tWLO	Write leveling output delay	0	9	ns
tWLOE	Write leveling output error	0	2	ns

12. PACKAGE DIMENSION

- (16GB, 2 Ranks, 1Gx8 DDR3 base SODIMM)



Note: All dimensions are in millimeters (mils) and should be kept within a tolerance of ± 0.15 (6), unless otherwise specified

13. RoHS Declaration

innodisk	宜鼎國際股份有限公司 Innodisk Corporation														
Tel: (02) 7703-3000 Fax: (02) 7703-3555 Internet: http://www.innodisk.com/															
RoHS 自我宣告書 (RoHS Declaration of Conformity)															
Manufacturer Product: All Innodisk EM Flash and Dram products															
一、 宜鼎國際股份有限公司（以下稱本公司）特此保證售予貴公司之所有產品，皆符合歐盟 2011/65/EU 關於 RoHS 之規範要求。 Innodisk Corporation declares that all products sold to the company, are complied with European Union RoHS Directive (2011/65/EU) requirement															
二、 本公司同意因本保證書或與本保證書相關事宜有所爭議時，雙方宜友好協商，達成協議。 Innodisk Corporation agrees that both parties shall settle any dispute arising from or in connection with this Declaration of Conformity by friendly negotiations.															
<table border="1"> <thead> <tr> <th>Name of hazardous substance</th> <th>Limited of RoHS ppm (mg/kg)</th> </tr> </thead> <tbody> <tr> <td>Cd</td> <td>< 100 ppm</td> </tr> <tr> <td>Pb</td> <td>< 1000 ppm</td> </tr> <tr> <td>Hg</td> <td>< 1000 ppm</td> </tr> <tr> <td>Chromium VI (Cr+6)</td> <td>< 1000 ppm</td> </tr> <tr> <td>Polybromodiphenyl ether (PBDE)</td> <td>< 1000 ppm</td> </tr> <tr> <td>Polybrominated Biphenyls (PBB)</td> <td>< 1000 ppm</td> </tr> </tbody> </table>	Name of hazardous substance	Limited of RoHS ppm (mg/kg)	Cd	< 100 ppm	Pb	< 1000 ppm	Hg	< 1000 ppm	Chromium VI (Cr+6)	< 1000 ppm	Polybromodiphenyl ether (PBDE)	< 1000 ppm	Polybrominated Biphenyls (PBB)	< 1000 ppm	
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Chromium VI (Cr+6)	< 1000 ppm														
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Polybrominated Biphenyls (PBB)	< 1000 ppm														
立 保 證 書 人 (Guarantor)															
Company name 公司名稱： <u>Innodisk Corporation 宜鼎國際股份有限公司</u>															
Company Representative 公司代表人： <u>Richard Lee 李鐘亮</u>															
Company Representative Title 公司代表人職稱： <u>CEO 執行長</u>															
Date 日期： <u>2014 / 07 / 29</u>															
 (Company Stamp/公司大小章)															

Revision Log

Rev	Date	Modification
0.1	13 rd February 2017	Preliminary Edition
1.0	13 rd February 2017	Official released.