

# Approval Sheet

Customer	
Product Number	M3CW-AGM13LN9-A
Module speed	PC3-10600
Pin	240 pin
Cl-tRCD-tRP	9-9-9
DRAM Operating Temp	0°C~85°C
Date	20 <sup>th</sup> May 2015

Approval by Customer

P/N:

Signature:

Date:

Sales: \_\_\_\_\_

Sr. Technical Manager: John Hsieh

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	1333	13.5	13.5	13.5

- JEDEC Standard 240-pin Dual In-Line Memory Module
- Intend for PC3-10600 applications
- Inputs and Outputs are SSTL-15 compatible
- VDD=VDDQ= 1.35 Volt (-0.067/+0.1V) or 1.5 Volt (-0.075/+0.075)
- 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 $\mu$ s ( $T_A \leq +85^{\circ}\text{C}$ )
- 16/11/2 Addressing (row/column/rank)-16GB
- SDRAM operating temperature range  $0^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$
- Programmable Device Operation:
  - Burst Type: Sequential or Interleave
  - Device CAS# Latency: 7, 9, 11
  - 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	$0^{\circ}\text{C} \leq \text{T}_{\text{CASE}} \leq 85^{\circ}\text{C}$	7.8	$\mu\text{s}$
		$85^{\circ}\text{C} \leq \text{T}_{\text{CASE}} \leq 95^{\circ}\text{C}$	3.9	$\mu\text{s}$

#### 4. Ordering Information

DDR3L UDIMM w/ECC						
Part Number	Density	Speed	DIMM Organization	Number of DRAM	Number of rank	ECC
<b>M3CW-AGM13LN9-A</b>	16GB	PC3-10600	2Gx72	18	2	Y

## 5. Pin Configurations (Front side/Back side)

### X72 UDIMM

Pin	Front	Pin	Back	Pin	Front	Pin	Back	Pin	Front	Pin	Back	Pin	Front	Pin	Back
1	V <sub>REFDQ</sub>	121	V <sub>SS</sub>	31	DQ25	151	V <sub>SS</sub>	61	A2	181	A1	91	DQ41	211	V <sub>SS</sub>
2	V <sub>SS</sub>	122	DQ4	32	V <sub>SS</sub>	152	DM3, DQS12, TDQS12	62	V <sub>DD</sub>	182	V <sub>DD</sub>	92	V <sub>SS</sub>	212	DM5, DQS14, TDQS14
3	DQ0	123	DQ5	33	DQS3#	153	NC, DQS12#, TDQS12#	63	NC, CK1	183	V <sub>DD</sub>	93	DQS5#	213	NC, DQS14#, TDQS14#
4	DQ1	124	V <sub>SS</sub>	34	DQS3	154	V <sub>SS</sub>	64	NC, CK1#	184	CK0	94	DQS5	214	V <sub>SS</sub>
5	V <sub>SS</sub>	125	DM0, DQS9, TDQS9	35	V <sub>SS</sub>	155	DQ30	65	V <sub>DD</sub>	185	CK#0	95	V <sub>SS</sub>	215	DQ46
6	DQS0#	126	NC, DQS9#, TDQS9#	36	DQ26	156	DQ31	66	V <sub>DD</sub>	186	V <sub>DD</sub>	96	DQ42	216	DQ47
7	DQS0	127	V <sub>SS</sub>	37	DQ27	157	V <sub>SS</sub>	67	V <sub>REFCA</sub>	187	EVENT#, NC	97	DQ43	217	V <sub>SS</sub>
8	V <sub>SS</sub>	128	DQ6	38	V <sub>SS</sub>	158	CB4,NC	68	PAR_IN,NC	188	A0	98	V <sub>SS</sub>	218	DQ52
9	DQ2	129	DQ7	39	CB0,NC	159	CB5,NC	69	V <sub>DD</sub>	189	V <sub>DD</sub>	99	DQ48	219	DQ53
10	DQ3	130	V <sub>SS</sub>	40	CB1,NC	160	V <sub>SS</sub>	70	A10/AP	190	BA1	100	DQ49	220	V <sub>SS</sub>
11	V <sub>SS</sub>	131	DQ12	41	V <sub>SS</sub>	161	DM8, DQS17, TDQS17	71	BA0	191	V <sub>DD</sub>	101	V <sub>SS</sub>	221	DM6, DQS15, TDQS15
12	DQ8	132	DQ13	42	DQS8#	162	NC, DQS17#, TDQS17#	72	V <sub>DD</sub>	192	RAS#	102	DQS6#	222	NC, DQS15#, TDQS15#
13	DQ9	133	V <sub>SS</sub>	43	DQS8	163	V <sub>SS</sub>	73	WE#	193	S0#	103	DQS6	223	V <sub>SS</sub>
14	V <sub>SS</sub>	134	DM1, DQS10, TDQS10	44	V <sub>SS</sub>	164	CB6,NC	74	CAS#	194	V <sub>DD</sub>	104	V <sub>SS</sub>	224	DQ54
15	DQS1#	135	NC, DQS10#, TDQS10#	45	CB2,NC	165	CB7,NC	75	V <sub>DD</sub>	195	ODT0	105	DQ50	225	DQ55
16	DQS1	136	V <sub>SS</sub>	46	CB3,NC	166	V <sub>SS</sub>	76	S1#,NC	196	A13	106	DQ51	226	V <sub>SS</sub>
17	V <sub>SS</sub>	137	DQ14	47	V <sub>SS</sub>	167	NC	77	ODT1,NC	197	V <sub>DD</sub>	107	V <sub>SS</sub>	227	DQ60
18	DQ10	138	DQ15	48	V <sub>TT</sub> ,NC	168	RESET#	78	V <sub>DD</sub>	198	S3#,NC	108	DQ56	228	DQ61
19	DQ11	139	V <sub>SS</sub>	49	V <sub>TT</sub> ,NC	169	CKE1,NC	79	S2#,NC	199	V <sub>SS</sub>	109	DQ57	229	V <sub>SS</sub>
20	V <sub>SS</sub>	140	DQ20	50	CKE0	170	V <sub>DD</sub>	80	V <sub>SS</sub>	200	DQ36	110	V <sub>SS</sub>	230	DM7, DQS16, TDQS16
21	DQ16	141	DQ21	51	V <sub>DD</sub>	171	A15,NC	81	DQ32	201	DQ37	111	DQS7#	231	NC, DQS16#, TDQS16#
22	DQ17	142	V <sub>SS</sub>	52	BA2	172	A14	82	DQ33	202	V <sub>SS</sub>	112	DQS7	232	V <sub>SS</sub>
23	V <sub>SS</sub>	143	DM2, DQS11, TDQS11	53	ERR_Out#, NC	173	V <sub>DD</sub>	83	V <sub>SS</sub>	203	DM4, DQS13, TDQS13	113	V <sub>SS</sub>	233	DQ62
24	DQS2#	144	NC, DQS11#, TDQS11#	54		174	A12/BC#	84	DQS4#	204	NC, DQS13#, TDQS13#	114	DQ58	234	DQ63
25	DQS2	145	V <sub>SS</sub>	55	A11	175	A9	85	DQS4	205	V <sub>SS</sub>	115	DQ59	235	V <sub>SS</sub>
26	V <sub>SS</sub>	146	DQ22	56	A7	176	V <sub>DD</sub>	86	V <sub>SS</sub>	206	DQ38	116	V <sub>SS</sub>	236	V <sub>DDSPD</sub>
27	DQ18	147	DQ23	57	V <sub>DD</sub>	177	A8	87	DQ34	207	DQ39	117	SA0	237	SA0
28	DQ19	148	V <sub>SS</sub>	58	A5	178	A6	88	DQ35	208	V <sub>SS</sub>	118	SCL	238	SA1
29	V <sub>SS</sub>	149	DQ28	59	A4	179	V <sub>DD</sub>	89	V <sub>SS</sub>	209	DQ44	119	SA2	239	V <sub>SS</sub>
30	DQ24	150	DQ29	60	V <sub>DD</sub>	180	A3	90	DQ40	210	DQ45	120	V <sub>TT</sub>	240	V <sub>TT</sub>

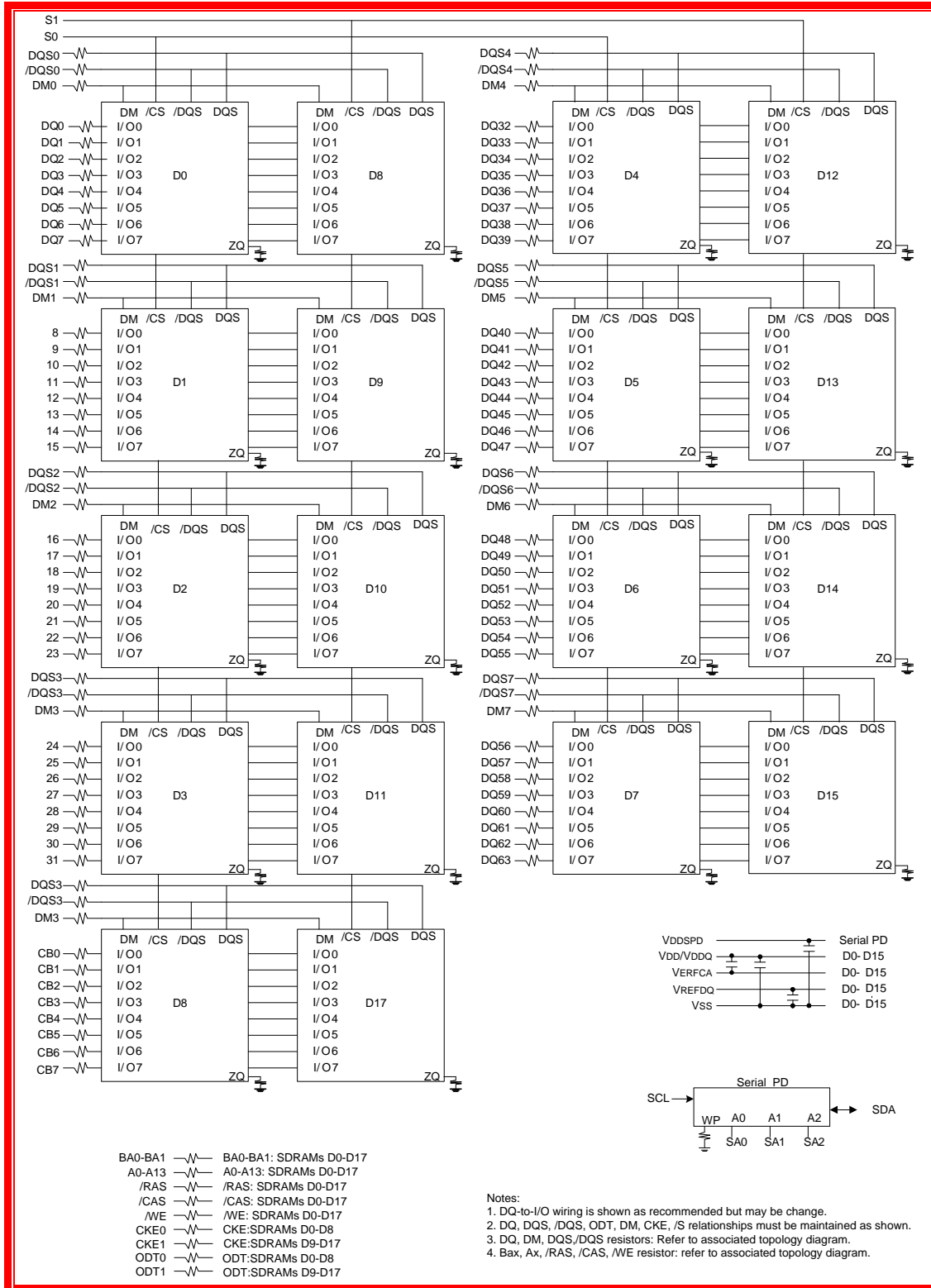
NC = No Connect, RFU = Reserved for Future Use

## 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 <sub>DD</sub>	Power Supply
/WE	SDRAM write enable	V <sub>DDID</sub>	V <sub>DD</sub> Identification Flag
/S0 - /S1	DIMM Rank Select Lines	V <sub>DDQ</sub>	SDRAM I/O Driver power supply
CK0 – CK1	SDRAM clock enable lines	V <sub>REFDQ</sub>	SDRAM I/O Reference supply
DQ0 – DQ63	DIMM memory data bus	V <sub>REFCA</sub>	SDRAM Command/address reference supply.
CB0 – CB7	DIMM ECC check bit	V <sub>SS</sub>	Ground
DQS0 – DQS8 /DQS0-/DQS8	SDRAM data strobes	V <sub>DDSPD</sub>	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 <sub>TT</sub>	SDRAM I/O termination supply.

### 7. Function Block Diagram: - (16GB, 2 Ranks, 1Gx8 DDR3L SDRAMs)



## 8. SDRAM Absolute Maximum Ratings

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

**Note:**

- Operating Temperature T<sub>OPER</sub> is the case surface temperature on the center / top side of the DRAM. For measurement conditions, please refer to the JEDEC document JESD51-2.
- 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.
- 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:
  - 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.
  - 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.
- 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.
- 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.
- V<sub>DD</sub> and V<sub>DDQ</sub> must be within 300 mV of each other at all times;and VREF must be not greater than 0.6 x V<sub>DDQ</sub>, When V<sub>DD</sub> and V<sub>DDQ</sub> 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
<b>Recommended DC Operating Conditions</b>						
V <sub>DD</sub>	Supply Voltage	1.283	1.35	1.45	V	1,2
V <sub>DDQ</sub>	Supply Voltage	1.283	1.35	1.45	V	1,2
<b>Single Ended AC/DC Input Levels</b>						
V <sub>IH</sub> (DC)	DC Input High (Logic1) Voltage	V <sub>REF</sub> + 0.1	-	V <sub>DD</sub>	V	3
V <sub>IL</sub> (DC)	DC Input Low (Logic 0) Voltage	V <sub>SS</sub>	-	V <sub>REF</sub> - 0.1	V	3
V <sub>IH</sub> (AC)	AC Input High (Logic1) Voltage	V <sub>REF</sub> + 0.175	-	-	V	3
V <sub>IL</sub> (AC)	AC Input Low (Logic 0) Voltage	-	-	V <sub>REF</sub> - 0.175	V	3
V <sub>REFDQ</sub> (DC)	Reference Voltage for DQ, DM inputs	0.49V <sub>DDQ</sub>	0.5V <sub>DDQ</sub>	0.51V <sub>DDQ</sub>	V	4,5
V <sub>REFCA</sub> (DC)	Reference Voltage for ADD,CMD inputs	0.49V <sub>DDQ</sub>	0.5V <sub>DDQ</sub>	0.51V <sub>DDQ</sub>	V	4,5
<b>Single Ended AC/DC output Levels</b>						
V <sub>OH</sub> (DC)	DC output high measurement level (for IV curve linearity)	-	0.8 x V <sub>DDQ</sub>	-	V	
V <sub>OM</sub> (DC)	DC output mid measurement level (for IV curve linearity)	-	0.5 x V <sub>DDQ</sub>	-	V	
V <sub>OL</sub> (DC)	DC output low measurement level (for IV curve linearity)	-	0.2 x V <sub>DDQ</sub>	-	V	
V <sub>OH</sub> (AC)	AC output high measurement level (for output SR)	-	V <sub>TT</sub> + 0.1 x V <sub>DDQ</sub>	-	V	6
V <sub>OL</sub> (AC)	AC output low measurement level (for output SR)		V <sub>TT</sub> - 0.1 x V <sub>DDQ</sub>	-	V	6

Symbol	Parameter	Min	Typ.	Max	Units	Notes
<b>Differential AC/DC Input Levels</b>						
<b>VIHdiff</b>	Differential Input high	+0.2	-	Note 9	V	7
<b>VILdiff</b>	Differential Input logic Low	Note 9	-	-0.2	V	7
<b>VIHdiff(ac)</b>	Differential Input high ac	2* (VIH (AC)- VREF)	-	Note 9	V	8
<b>VILdiff(ac)</b>	Differential Input logic Low ac	Note 9	-	2* (VREF- VIL (AC) )	V	8
<b>Differential AC and DC Output Levels</b>						
<b>VOHdiff(AC)</b>	AC differential output high measurement level (for output SR)	-	+ 0.2 x VDDQ	-	V	10
<b>VOLdiff(AC)</b>	AC differential output low measurement level (for output SR)	-	- 0.2 x VDDQ	-	V	10
<b>Note:</b>						
<ol style="list-style-type: none"> <li>Under all conditions VDDQ must be less than or equal to VDD.</li> <li>VDDQ tracks with VDD. AC parameters are measured with VDD and VDDQ tied together.</li> <li>For DQ and DM, Vref = VrefDQ. For input only pins except RESET#, Vref = VrefCA.</li> <li>The ac peak noise on VRef may not allow VRef to deviate from VRef(DC) by more than +/-1% VDD (for reference: approx. +/- 15 mV).</li> <li>For reference: approx. VDD/2 +/- 15 mV.</li> <li>The swing of <math>\pm 0.1 \times VDDQ</math> is based on approximately 50% of the static single-ended output high or low swing with a driver impedance of <math>40 \Omega</math> and an effective test load of <math>25 \Omega</math> to <math>V_{TT} = VDDQ/2</math></li> <li>Used to define a differential signal slew-rate.</li> <li>For CK - CK# use VIH/VIL(ac) of ADD/CMD and VREFCA; for DQS - DQS#, DQSL, DQSL#, DQSU, DQSU# use VIH/VIL(ac) of DQs and VREFDQ; if a reduced ac-high or ac-low level is used for a signal group, then the reduced level applies also here.</li> <li>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 (VIH(dc) max, VIL(dc)min) for single- ended signals as well as the limitations for overshoot and undershoot.</li> <li>The swing of <math>\pm 0.2 \times VDDQ</math> is based on approximately 50% of the static single-ended output high or low swing with a driver impedance of <math>40 \Omega</math> and an effective test load of <math>25 \Omega</math> to <math>V_{TT} = VDDQ/2</math> at each of the differential outputs.</li> </ol>						

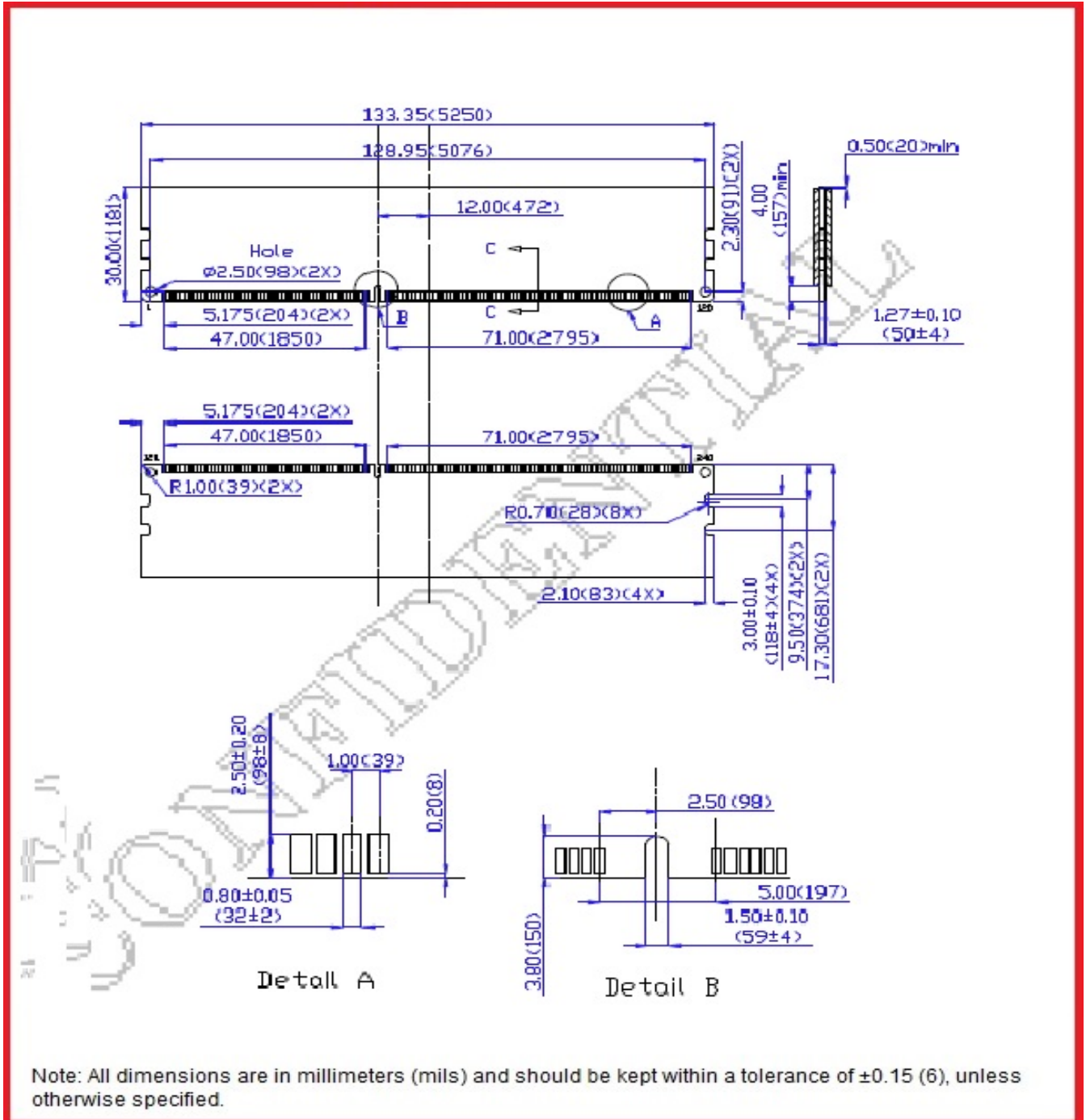
## 10. Operating, Standby, and Refresh Currents

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


Symbol	Parameter/Condition	PC3-10600	Unit	
I DD0	One bank; Active - Precharge	1196	mA	
I DD1	One bank; Active - Read - Precharge	1396	mA	
I DD2N	Precharge Standby Current	638	mA	
IDD2NT	Precharge Standby ODT Current	710	mA	
I DD2P	Precharge Power Down Current	Fast Mode	242	mA
	Precharge Power Down Current	Slow Mode	188	mA
I DD2Q	Precharge Quiet Standby Current	602	mA	
I DD3N	Active Standby Current	908	mA	
I DD3P	Active Power-Down Current	638	mA	
I DD4R	Operating Current Burst Read	2202	mA	
I DD4W	Operating Current Burst Write	2202	mA	
I DD5B	Burst Refresh Current	4390	mA	
I DD6	Self-Refresh Current: Normal Temperature Range	422	mA	
I DD6ET	Self-Refresh Current: Extended Temperature Range	602	mA	
I DD7	Operating Bank Interleave Read Current	3390	mA	
IDD8	Reset Current	IDD2P + 2mA	mA	

**11. PACKAGE DIMENSION**

- (16GB, 2 Ranks, 1Gx8 DDR3L base ECC Unbuffered DIMM)



## 12. RoHS Declaration



### Declaration of Conformity

We, InnoDisk Co., Ltd, here declare the product M3CW-AGM13LN9-(X) complies with the requirement of RoHS directives 2002/95/EC and 2006/122/EC.

Innodisk ensures the above product meets RoHS requirements of six restricted substances. This declaration is based on vendor supplied analysis/MSDS, material certifications, and/ or 3<sup>rd</sup> party test reports of the component/ raw materials used in the manufacture of products.

✦ RoHS Exemptions Applied Of 7(C)-I for Resist.

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
Perfluorooctane Sulfonate (PFOS)	Not Contained

Date issued : 2015/05/10

Manufacturer : Innodisk Co., Ltd.  
 Address : 221 5F, No. 237, Sec.1 Datong Rd., Xizhi City, New Taipei City, Taiwan

Authorized Signature :

QA Dept. Director – *Ryan Tsai*

## Revision Log

Rev	Date	Modification
0.1	20 <sup>th</sup> May 2015	Preliminary Edition
1.0	20 <sup>th</sup> May 2015	Official released.