

# Approval Sheet

Customer	
Product Number	M3S0-8GMSDIN9
Module speed	PC3-10600
Pin	204 pin
CI-tRCD-tRP	9-9-9
SDRAM Operating Temp	-40°C~85°C
Date	23 <sup>rd</sup> April 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	P	1066	1333	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= 1.35V (1.28V~1.45V) or 1.5V
- 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 (Au:30u")
- 8 bit pre-fetch
- Two different termination values (Rtt\_Nom & Rtt\_WR)
- Auto & self refresh 7.8 $\mu$ s ( $T_A \leq +85^{\circ}\text{C}$ )
- 16/10/2 Addressing (row/column/rank)-8GB
- SDRAM IC operating temperature range  $-40^{\circ}\text{C} \leq T_A \leq +85^{\circ}\text{C}$
- 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 13*)

## 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)	-40 to +85	°C	1
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. DRAM Parameters by device density

RTT_Nom Setting	Parameter	4Gb	Units
tRFC	REF command ACT or REF command time	260	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

W/T DDR3L SODIMM						
Part Number	Density	Speed	DIMM Organization	Number of DRAM	Number of rank	ECC
<b>M3S0-8GMSDIN9</b>	8GB	PC3-10600	1Gx64	16	2	N

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

### X64 SODIMM

Pin	Front	Pin	Back	Pin	Front	Pin	Back	Pin	Front	Pin	Back
1	VREFDQ	2	V <sub>SS</sub>	69	DQ27	70	DQ31	137	DQS4	138	V <sub>SS</sub>
3	V <sub>SS</sub>	4	DQ4	71	V <sub>SS</sub>	72	V <sub>SS</sub>	139	V <sub>SS</sub>	140	DQ38
5	DQ0	6	DQ5	73	CKE0	74	CKE1	141	DQ34	142	DQ39
7	DQ1	8	V <sub>SS</sub>	75	V <sub>DD</sub>	76	V <sub>DD</sub>	143	DQ35	144	V <sub>SS</sub>
9	V <sub>SS</sub>	10	/DQS0	77	NC	78	A15 ***	145	V <sub>SS</sub>	146	DQ44
11	DM0	12	DQS0	79	BA2	80	A14 ***	147	DQ40	148	DQ45
13	V <sub>SS</sub>	14	V <sub>SS</sub>	81	V <sub>DD</sub>	82	V <sub>DD</sub>	149	DQ41	150	V <sub>SS</sub>
15	DQ2	16	DQ6	83	A12, /BC	84	A11	151	V <sub>SS</sub>	152	/DQS5
17	DQ3	18	DQ7	85	A9	86	A7	153	DM5	154	DQS5
19	V <sub>SS</sub>	20	V <sub>SS</sub>	87	V <sub>DD</sub>	88	V <sub>DD</sub>	155	V <sub>SS</sub>	156	V <sub>SS</sub>
21	DQ8	22	DQ12	89	A8	90	A6	157	DQ42	158	DQ46
23	DQ9	24	DQ13	91	A5	92	A4	159	DQ43	160	DQ47
25	V <sub>SS</sub>	26	V <sub>SS</sub>	93	V <sub>DD</sub>	94	V <sub>DD</sub>	161	V <sub>SS</sub>	162	V <sub>SS</sub>
27	/DQS1	28	DM1	95	A3	96	A2	163	DQ48	164	DQ52
29	DQS1	30	/Reset	97	A1	98	A0	165	DQ49	166	DQ53
31	V <sub>SS</sub>	32	V <sub>SS</sub>	99	V <sub>DD</sub>	100	V <sub>DD</sub>	167	V <sub>SS</sub>	168	V <sub>SS</sub>
33	DQ10	34	DQ14	101	CK0	102	CK1	169	/DQS6	170	DM6
35	DQ11	36	DQ15	103	/CK0	104	/CK1	171	DQS6	172	V <sub>SS</sub>
37	V <sub>SS</sub>	38	V <sub>SS</sub>	105	V <sub>DD</sub>	106	V <sub>DD</sub>	173	V <sub>SS</sub>	174	DQ54
39	DQ16	40	DQ20	107	A10, /AP	108	BA1	175	DQ50	176	DQ55
41	DQ17	42	DQ21	109	BA0	110	/RAS	177	DQ51	178	V <sub>SS</sub>
43	V <sub>SS</sub>	44	V <sub>SS</sub>	111	V <sub>DD</sub>	112	V <sub>DD</sub>	179	V <sub>SS</sub>	180	DQ60
45	/DQS2	46	DM2	113	/WE	114	/S0	181	DQ56	182	DQ61
47	DQS2	48	V <sub>SS</sub>	115	/CAS	116	ODT0	183	DQ57	184	V <sub>SS</sub>
49	V <sub>SS</sub>	50	DQ22	117	V <sub>DD</sub>	118	V <sub>DD</sub>	185	V <sub>SS</sub>	186	/DQS7
51	DQ18	52	DQ23	119	A13 ***	120	ODT1	187	DM7	188	DQS7
53	DQ19	54	V <sub>SS</sub>	121	/S1	122	NC +	189	V <sub>SS</sub>	190	V <sub>SS</sub>
55	V <sub>SS</sub>	56	DQ28	123	V <sub>DD</sub>	124	V <sub>DD</sub>	191	DQ58	192	DQ62
57	DQ24	58	DQ29	125	TEST/NC	126	VREFCA	193	DQ59	194	DQ63
59	DQ25	60	V <sub>SS</sub>	127	V <sub>SS</sub>	128	V <sub>SS</sub>	195	V <sub>SS</sub>	196	V <sub>SS</sub>
61	V <sub>SS</sub>	62	/DQS3	129	DQ32	130	DQ36	197	SA0	198	/EVENT
63	DM3	64	DQS3	131	DQ33	132	DQ37	199	VDDSPD	200	SDA
65	V <sub>SS</sub>	66	V <sub>SS</sub>	133	V <sub>SS</sub>	134	V <sub>SS</sub>	201	SA1	202	SCL
67	DQ26	68	DQ30	135	/DQS4	136	DM4	203	Vtt	204	Vtt

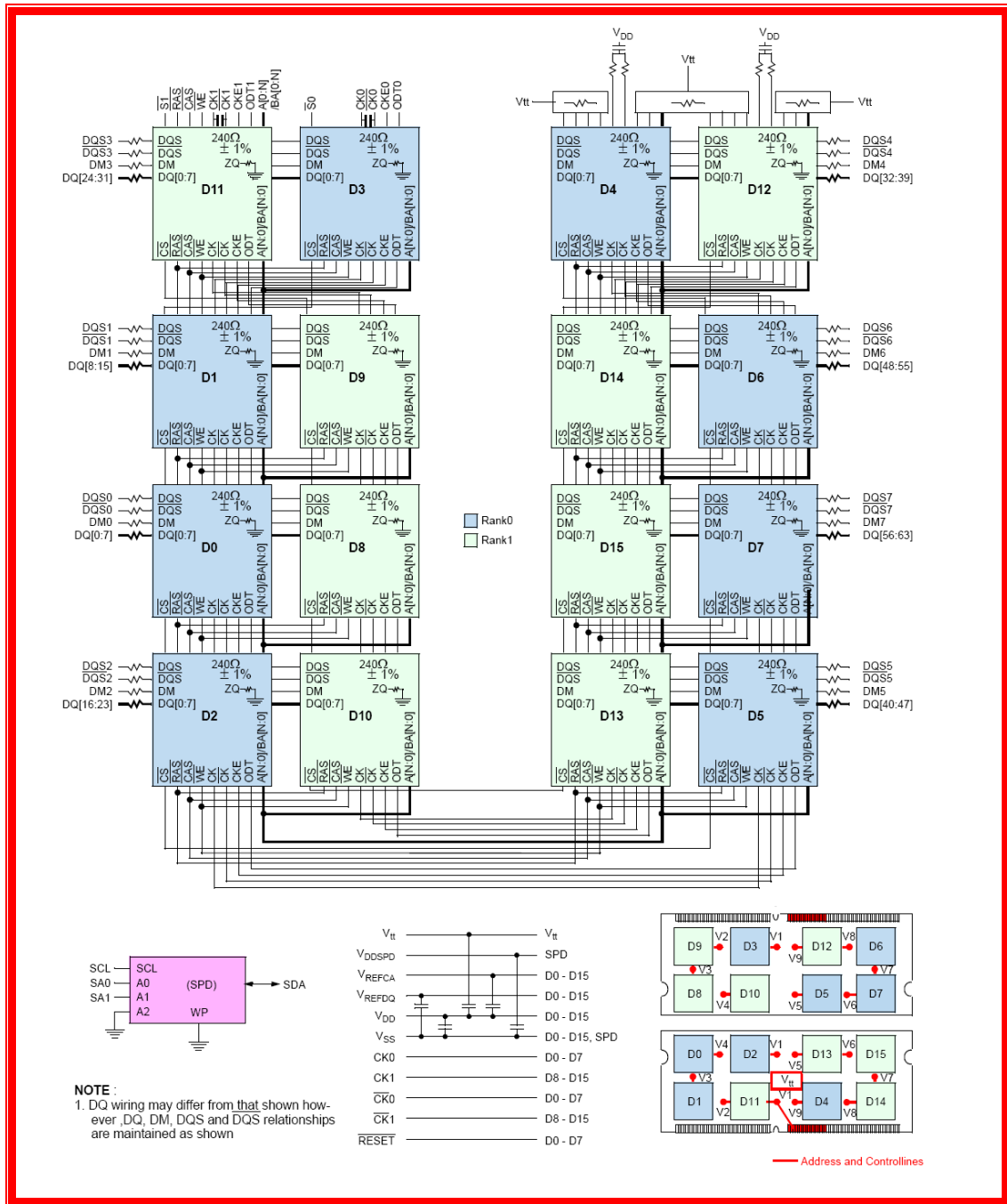
\* NC = No Connect  
\*\* TEST (PIN# 125) reserve for bus probing, is NC on normal modules.  
\*\*\* Pin might connected to NC ball od DRAMs (depending on density); alternatively may connect to termination resistor

## 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	VDD	Power Supply
/WE	SDRAM write enable	VDDID	VDD Identification Flag
/S0 - /S1	DIMM Rank Select Lines	VDDQ	SDRAM I/O Driver power supply
CK0 – CKE1	SDRAM clock enable lines	VREFDQ	SDRAM I/O Reference supply
DQ0 – DQ63	DIMM memory data bus	VREFCA	SDRAM Command/address reference supply.
CB0 – CB7	DIMM ECC check bit	VSS	Ground
DQS0 – DQS8 /DQS0-/DQS8	SDRAM data strobes	VDDSPD	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.	VTT	SDRAM I/O termination supply.

### 7. Function Block Diagram: - (8GB, 2 Ranks, 512Mx8 DDR3L SDRAMs)



## 8. DRAM Absolute Maximum Ratings

Symbol	Parameter	Rating	Units	Note	
T <sub>OPER</sub>	Operation Temperature	Normal Operating Temp.	-40 to 85	°C	1,2
		Extended Temp.(optional)	85 to 95	°C	1,3
T <sub>STG</sub>	Storage Temperature	-55 to 100	°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:**

1. 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.

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. V<sub>DD</sub> and V<sub>DDQ</sub> must be within 300 mV of each other at all times;and V<sub>REF</sub> 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; V<sub>REF</sub> 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>						
<b>V<sub>DD</sub></b>	Supply Voltage	1.283	1.35	1.45	V	1,2
<b>V<sub>DDQ</sub></b>	Supply Voltage	1.283	1.35	1.45	V	1,2
<b>Single Ended AC/DC Input Levels</b>						
<b>V<sub>IH</sub> (DC)</b>	DC Input High (Logic1) Voltage	$V_{REF} + 0.1$	-	V <sub>DD</sub>	V	3
<b>V<sub>IL</sub> (DC)</b>	DC Input Low (Logic 0) Voltage	V <sub>SS</sub>	-	$V_{REF} - 0.1$	V	3
<b>V<sub>IH</sub> (AC)</b>	AC Input High (Logic1) Voltage	$V_{REF} + 0.175$	-	-	V	3
<b>V<sub>IL</sub> (AC)</b>	AC Input Low (Logic 0) Voltage	-	-	$V_{REF} - 0.175$	V	3
<b>V<sub>REFDQ</sub> (DC)</b>	Reference Voltage for DQ, DM inputs	0.49V <sub>DDQ</sub>	0.5V <sub>DDQ</sub>	0.51V <sub>DDQ</sub>	V	4,5
<b>V<sub>REFCA</sub> (DC)</b>	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>						
<b>V<sub>OH</sub> (DC)</b>	DC output high measurement level (for IV curve linearity)	-	0.8 x V <sub>DDQ</sub>	-	V	
<b>V<sub>OM</sub> (DC)</b>	DC output mid measurement level (for IV curve linearity)	-	0.5 x V <sub>DDQ</sub>	-	V	
<b>V<sub>OL</sub> (DC)</b>	DC output low measurement level (for IV curve linearity)	-	0.2 x V <sub>DDQ</sub>	-	V	
<b>V<sub>OH</sub> (AC)</b>	AC output high measurement level (for output SR)	-	$V_{TT} + 0.1 \times V_{DDQ}$	-	V	6
<b>V<sub>OL</sub> (AC)</b>	AC output low measurement level (for output SR)	-	$V_{TT} - 0.1 \times V_{DDQ}$	-	V	6

Symbol	Parameter	Min	Typ.	Max	Units	Notes
<b>Differential AC/DC Input Levels</b>						
<b>V<sub>IHdiff</sub></b>	Differential Input high	+0.2	-	Note 9	V	7
<b>V<sub>ILdiff</sub></b>	Differential Input logic Low	Note 9	-	-0.2	V	7
<b>V<sub>IHdiff(ac)</sub></b>	Differential Input high ac	2* (V <sub>IH (AC)</sub> - V <sub>REF</sub> )	-	Note 9	V	8
<b>V<sub>ILdiff(ac)</sub></b>	Differential Input logic Low ac	Note 9	-	2* (V <sub>REF</sub> - V <sub>IL (AC)</sub> )	V	8
<b>Differential AC and DC Output Levels</b>						
<b>V<sub>OHdiff(AC)</sub></b>	AC differential output high measurement level (for output SR)	-	+ 0.2 x V <sub>DDQ</sub>	-	V	10
<b>V<sub>OLdiff(AC)</sub></b>	AC differential output low measurement level (for output SR)	-	- 0.2 x V <sub>DDQ</sub>	-	V	10
<b>Note:</b>						
<ol style="list-style-type: none"> <li>Under all conditions V<sub>DDQ</sub> must be less than or equal to V<sub>DD</sub>.</li> <li>V<sub>DDQ</sub> tracks with V<sub>DD</sub>. AC parameters are measured with V<sub>DD</sub> and V<sub>DDQ</sub> tied together.</li> <li>For DQ and DM, V<sub>ref</sub> = V<sub>refDQ</sub>. For input only pins except RESET#, V<sub>ref</sub> = V<sub>refCA</sub>.</li> <li>The ac peak noise on V<sub>Ref</sub> may not allow V<sub>Ref</sub> to deviate from V<sub>Ref(DC)</sub> by more than +/-1% V<sub>DD</sub> (for reference: approx. +/- 15 mV).</li> <li>For reference: approx. V<sub>DD</sub>/2 +/- 15 mV.</li> <li>The swing of ± 0.1 × V<sub>DDQ</sub> 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<sub>TT</sub> = V<sub>DDQ</sub>/2</li> <li>Used to define a differential signal slew-rate.</li> <li>For CK - CK# use V<sub>IH</sub>/V<sub>IL</sub>(ac) of ADD/CMD and V<sub>REFCA</sub>; for DQS - DQS#, DQSL, DQSL#, DQSU, DQSU# use V<sub>IH</sub>/V<sub>IL</sub>(ac) of DQs and V<sub>REFDQ</sub>; 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 (V<sub>IH</sub>(dc) max, V<sub>IL</sub>(dc)min) for single- ended signals as well as the limitations for overshoot and undershoot.</li> <li>The swing of ± 0.2 × V<sub>DDQ</sub> 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<sub>TT</sub> = V<sub>DDQ</sub>/2 at each of the differential outputs.</li> </ol>						

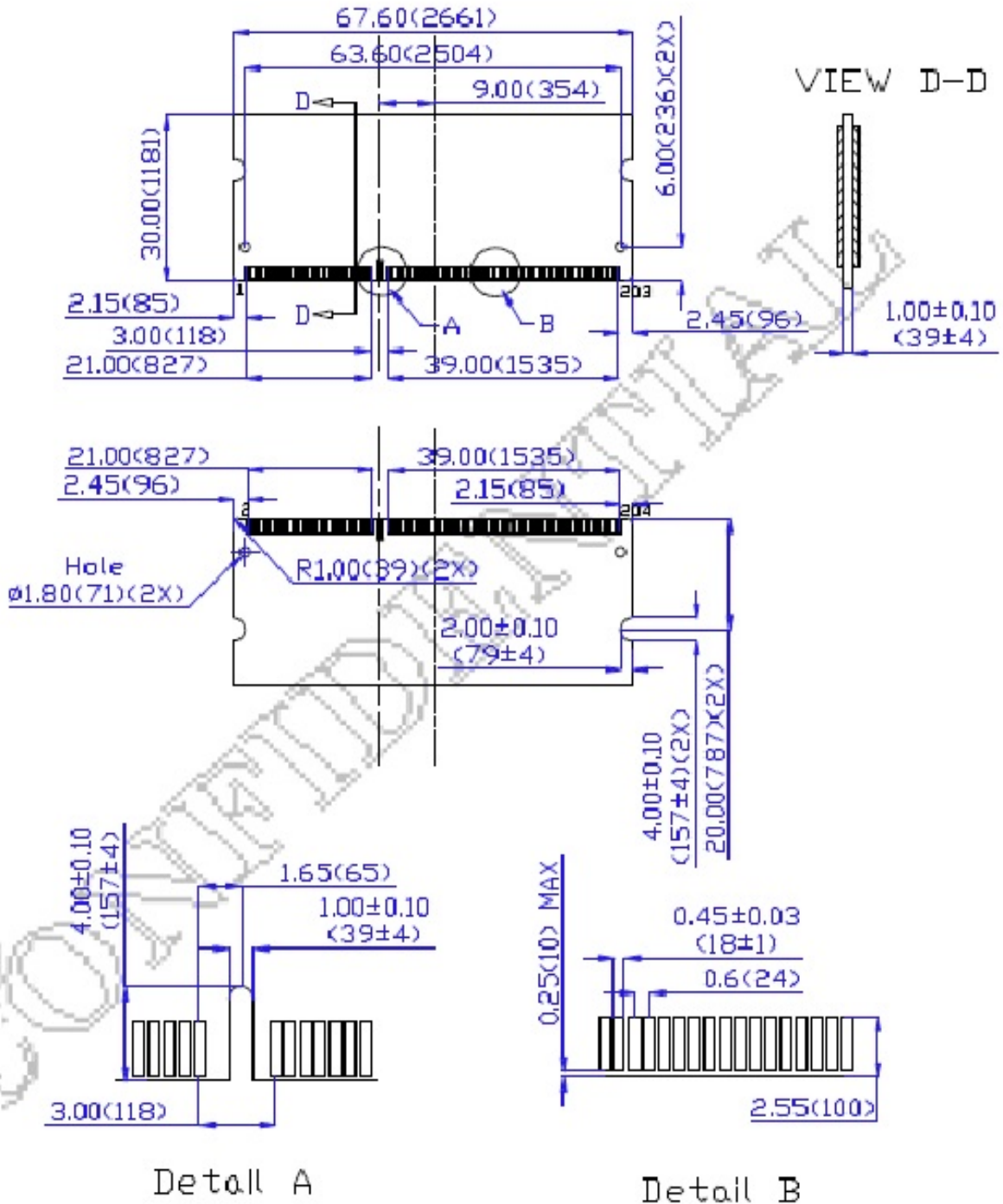
## 10. Operating, Standby, and Refresh Currents

- 8GB SODIMM (2 Ranks, 512Mx8 DDR3L SDRAMs  $T_{CASE} = -40^{\circ}C \sim 85^{\circ}C$ )

Symbol	Parameter/Condition	PC3-10600	Unit
I DD0	One bank; Active - Precharge	752	mA
I DD1	One bank; Active - Read - Precharge	992	mA
I DD2N	Precharge Standby Current	464	mA
I DD2NT	Precharge Standby ODT Current	560	mA
I DD2P	Precharge Power Down Current Fast Mode	448	mA
	Precharge Power Down Current Slow Mode	288	mA
I DD2Q	Precharge Quiet Standby Current	448	mA
I DD3N	Active Standby Current	560	mA
I DD3P	Active Power-Down Current	560	mA
I DD4R	Operating Current Burst Read	2240	mA
I DD4W	Operating Current Burst Write	1760	mA
I DD5B	Burst Refresh Current	3648	mA
I DD6	Self-Refresh Current: Normal Temperature Range	320	mA
I DD6ET	Self-Refresh Current: Extended Temperature Range	400	mA
I DD7	Operating Bank Interleave Read Current	3040	mA

**11. PACKAGE DIMENSION**

- (8GB, 2 Ranks, 512Mx8 W/T DDR3L base SODIMM)



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

## 12. RoHS Declaration



### Declaration of Conformity

We, InnoDisk Co., Ltd, here declare the product M3S0-8GMSDIN9 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.

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 : 2015/01/05

Manufacturer : InnoDisk Co., Ltd.

Address : 9F, No. 100, Sec.1 Xintai 5<sup>th</sup> Rd.,  
Xizhi City, Taipei 221, Taiwan

Authorized Signature :

QA Dept. Director - *Ryan Tsai*

## Revision Log

Rev	Date	Modification
0.1	23 <sup>rd</sup> April 2015	Preliminary Edition
1.0	23 <sup>rd</sup> April 2015	Official released.