RoHS Compliant

2GB DDR2 SDRAM VLP DIMM

Product Specifications

December 22, 2015

Version 1.1

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General Description

Apacer **78.A1G9O.40M0C** is a 256M x 64 DDR2 SDRAM (Synchronous DRAM) DIMM. This high-density memory module consists of 16 pieces 128M x 8 bit with 8banks Double Data Rate SDRAMs in FBGA packages mounted on a 240pin glass-epoxy substrate. Decoupling capacitors are mounted on the printed circuit board in parallel for each DDR2 SDRAM.

Ordering Information

Part Number	Bandwidth	Speed Grade	Max Frequency	CAS Latency
78.A1G9O.40M0C	5.3 GB/sec	667 Mbps	333 MHz	CL5

Density	Organization	Component	Rank
2GB	256M x 64	128M x8*16	2

Key Parameters

MT/s	DDR2-667	DDR2-800	DDR2-800	Unit
Grade	-CL5	-CL5	-CL6	
tCK (min)	3	2.5	2.5	ns
CAS latency	5	5	6	tCK
tRCD (min)	15	12.5	15	ns
tRP (min)	15	12.5	15	ns
tRAS (min)	45	45	45	ns
tRC (min)	60	57.5	60	ns
CL-tRCD-tRP	5-5-5	5-5-5	6-6-6	tCK

Specifications:

- JEDEC standard 1.8V ± 0.1V
- Power Supply VDDQ = 1.8V± 0.1V
- Interface: SSTL_18
- Posted CAS
- Programmable CAS Latency: 3, 4, 5
- OCD (Off-Chip Driver Impedance Adjustment) and ODT (On-Die Termination)
- Fully differential clock operations (CK & /CK)
- Programmable Burst Length 4 / 8 with both sequential and interleave mode
- Auto refresh and self refresh supported
- On Die Termination
- 8192 refresh cycles / 64ms
- Serial presence detect with EEPROM
- Compliance with RoHS
- Compliance with CE
- Supports auto-refresh/self-refresh
- Operating Temperature Range:
  Commercial 0°C≦TC≦85°C
- Average refresh period
  7.8us at 0°C ≦ TC ≦ 85°C
  3.9us at 85°C ≦ TC ≦ 95°C

Pin Assignments

Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name
1	VREF	61	A4	121	VSS	181	VDDQ
2	VSS	62	VDDQ	122	DQ4	182	A3
3	DQ0	63	A2	123	DQ5	183	A1
4	DQ1	64	VDD	124	VSS	184	VDD
5	VSS	65	VSS	125	DM0	185	CK0
6	/DQS0	66	VSS	126	NC	186	/CK0
7	DQS0	67	VDD	127	VSS	187	VDD
8	VSS	68	NC	128	DQ6	188	A0
9	DQ2	69	VDD	129	DQ7	189	VDD
10	DQ3	70	A10(AP)	130	VSS	190	BA1
11	VSS	71	BA0	131	DQ12	191	VDDQ
12	DQ8	72	VDDQ	132	DQ13	192	/RAS
13	DQ9	73	/WE	133	VSS	193	/S0
14	VSS	74	/CAS	134	DM1	194	VDDQ
15	/DQS1	75	VDDQ	135	NC	195	ODT0
16	DQS1	76	/S1	136	VSS	196	A13
17	VSS	77	ODT1	137	CK1	197	VDD
18	NC	78	VDDQ	138	/CK1	198	VSS
19	NC	79	VSS	139	VSS	199	DQ36
20	VSS	80	DQ32	140	DQ14	200	DQ37
21	DQ10	81	DQ33	141	DQ15	201	VSS
22	DQ11	82	VSS	142	VSS	202	DM4
23	VSS	83	/DQS4	143	DQ20	203	NC
24	DQ16	84	DQS4	144	DQ21	204	VSS
25	DQ17	85	VSS	145	VSS	205	DQ38
26	VSS	86	DQ34	146	DM2	206	DQ39
27	/DQS2	87	DQ35	147	NC	207	VSS
28	DQS2	88	VSS	148	VSS	208	DQ44
29	VSS	89	DQ40	149	DQ22	209	DQ45
30	DQ18	90	DQ41	150	DQ23	210	VSS

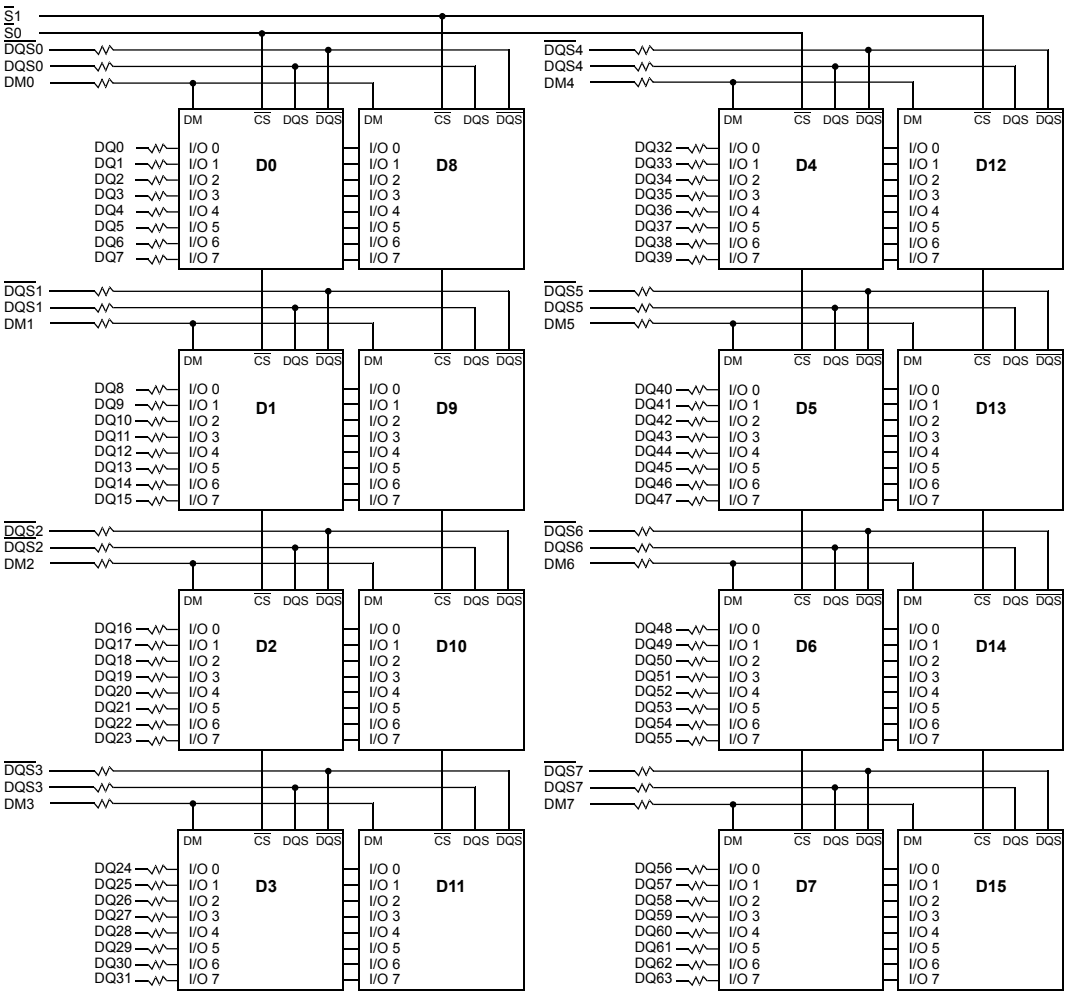
Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name	Pin No.	Pin name
31	DQ19	91	VSS	151	VSS	211	DM5
32	VSS	92	/DQS5	152	DQ28	212	NC
33	DQ24	93	DQS5	153	DQ29	213	VSS
34	DQ25	94	VSS	154	VSS	214	DQ46
35	VSS	95	DQ42	155	DM3	215	DQ47
36	/DQS3	96	DQ43	156	NC	216	VSS
37	DQS3	97	VSS	157	VSS	217	DQ52
38	VSS	98	DQ48	158	DQ30	218	DQ53
39	DQ26	99	DQ49	159	DQ31	219	VSS
40	DQ27	100	VSS	160	VSS	220	CK2
41	VSS	101	SA2	161	NC(CB4)*	221	/CK2
42	NC(CB0)*	102	NC(TEST)	162	NC(CB5)*	222	VSS
43	NC(CB1)*	103	VSS	163	VSS	223	DM6
44	VSS	104	/DQS6	164	NC(DM8)*	224	NC
45	NC(DQS8)*	105	DQS6	165	NC	225	VSS
46	NC(DQS8)*	106	VSS	166	VSS	226	DQ54
47	VSS	107	DQ50	167	NC(CB6)*	227	DQ55
48	NC(CB2)*	108	DQ51	168	NC(CB7)*	228	VSS
49	NC(CB3)*	109	VSS	169	VSS	229	DQ60
50	VSS	110	DQ56	170	VDDQ	230	DQ61
51	VDDQ	111	DQ57	171	CKE1	231	VSS
52	CKE0	112	VSS	172	VDD	232	DM7
53	VDD	113	/DQS7	173	NC(A15)*	233	NC
54	NC(BA2)*	114	DQS7	174	NC(A14)*	234	VSS
55	NC	115	VSS	175	VDDQ	235	DQ62
56	VDDQ	116	DQ58	176	A12	236	DQ63
57	A11	117	DQ59	177	A9	237	VSS
58	A7	118	VSS	178	VDD	238	VDDSPD
59	VDD	119	SDA	179	A8	239	SA0
60	A5	120	SCL	180	A6	240	SA1

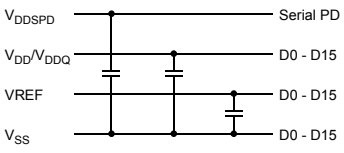
1. Pin173 Pin174 are reserved for 2Gb / 4Gb comp. base Unbuffered DIMM.
2. The * pin is not connected on this un-buffer memory module products

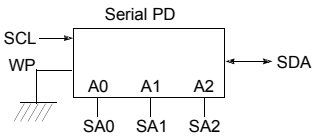
Pin Descriptions

Pin Name	Description
Ax	SDRAM address bus
BAx	SDRAM bank select
/RAS	SDRAM row address strobe
/CAS	SDRAM column address strobe
/WE	SDRAM write enable
/Sx	DIMM Rank Select Lines
CKEx	SDRAM clock enable lines
ODTx	On-die termination control lines
DQx	DIMM memory data bus
CBx	DIMM ECC check bits
DQSx	SDRAM data strobes(positive line of differential pair)
/DQSx	SDRAM data strobes(negative line of differential pair)
DMx	SDRAM data masks high data strobes(x8-based X72 DIMMs)
CKx	SDRAM clocks(positive line of differential pair)
/CKx	SDRAM clocks(negative line of differential pair)
SCL	I2C serial bus clock for EEPROM
SDA	I2C serial bus data line for EEPROM
SAx	I2C slave address select for EEPROM
VDD	SDRAM core power supply
VDDQ	SDRAM I/0 Driver power supply
VREF	SDRAM I/O reference supply
VSS	Power supply return(ground)
VDDSPD	Serial EEPROM positive power supply
NC	Spare pins(no connect)
TEST	Used by memory bus analysis tools(unused on memory DIMMS)
RESET	Set DRAMs to Known State

Functional Block Diagram







BA0 - BA2	BA0-BA2 : DDR2 SDRAMs D0 - D15
A0 - A13	A0-A13 : DDR2 SDRAMs D0 - D15
CKE0	CKE : DDR2 SDRAMs D0 - D7
CKE1	CKE : DDR2 SDRAMs D8 - D15
$\overline{RAS}$	$\overline{RAS}$: DDR2 SDRAMs D0 - D15
$\overline{CAS}$	$\overline{CAS}$: DDR2 SDRAMs D0 - D15
$\overline{WE}$	$\overline{WE}$: DDR2 SDRAMs D0 - D15
ODT0	ODT : DDR2 SDRAMs D0 - D7
ODT1	ODT : DDR2 SDRAMs D8 - D15

* Clock Wiring	
Clock Input	DDR2 SDRAMs
*CK0/$\overline{CK0}$	4 DDR2 SDRAMs
*CK1/$\overline{CK1}$	6 DDR2 SDRAMs
*CK2/CK2	6 DDR2 SDRAMs

*Wire per Clock Loading Table/Wiring Diagrams

Notes :
1. DQ,DM, DQS/$\overline{DQS}$ resistors : 22 Ohms ± 5%.
2. BAx, Ax, $\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$ resistors : 3 Ohms ± 5%.

Absolute Maximum Ratings

Parameter	Symbol	Description	Units
Voltage on VDD pin relative to Vss	V_{DD}	- 1.0 V ~ 2.3 V	V
Voltage on VDDQ pin relative to Vss	V_{DDQ}	- 0.5 V ~ 2.3 V	V
Voltage on any pin relative to Vss	V_{IN}, V_{OUT}	- 0.5 V ~ 2.3 V	V
Storage Temperature	TSTG	-55 to +100	℃

Notes:

1. Stress greater than those listed may cause permanent damage to the device. This is a stress rating only and device functional operation at or above the conditions indicated is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability. .

DRAM Component Operating Temperature Range

Symbol	Parameter	Rating	Units	Notes
TOPER	Normal Operating Temperature Range	0 to 85	℃	1,2
	Extended Temperature Range	85 to 95	℃	1,3

Notes:

1. Operating Temperature TOPER 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℃ - 85℃ under all operating Conditions.
3. Some applications require operation of the DRAM in the Extended Temperature Range between 85℃ and 95℃ case temperature. Full specifications are guaranteed 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.
   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), in this case IDD6 current can be increased around 10~20% than normal Temperature range.

Operating Conditions

Recommended DC Operating Conditions – DDR2 (1.8V) operation

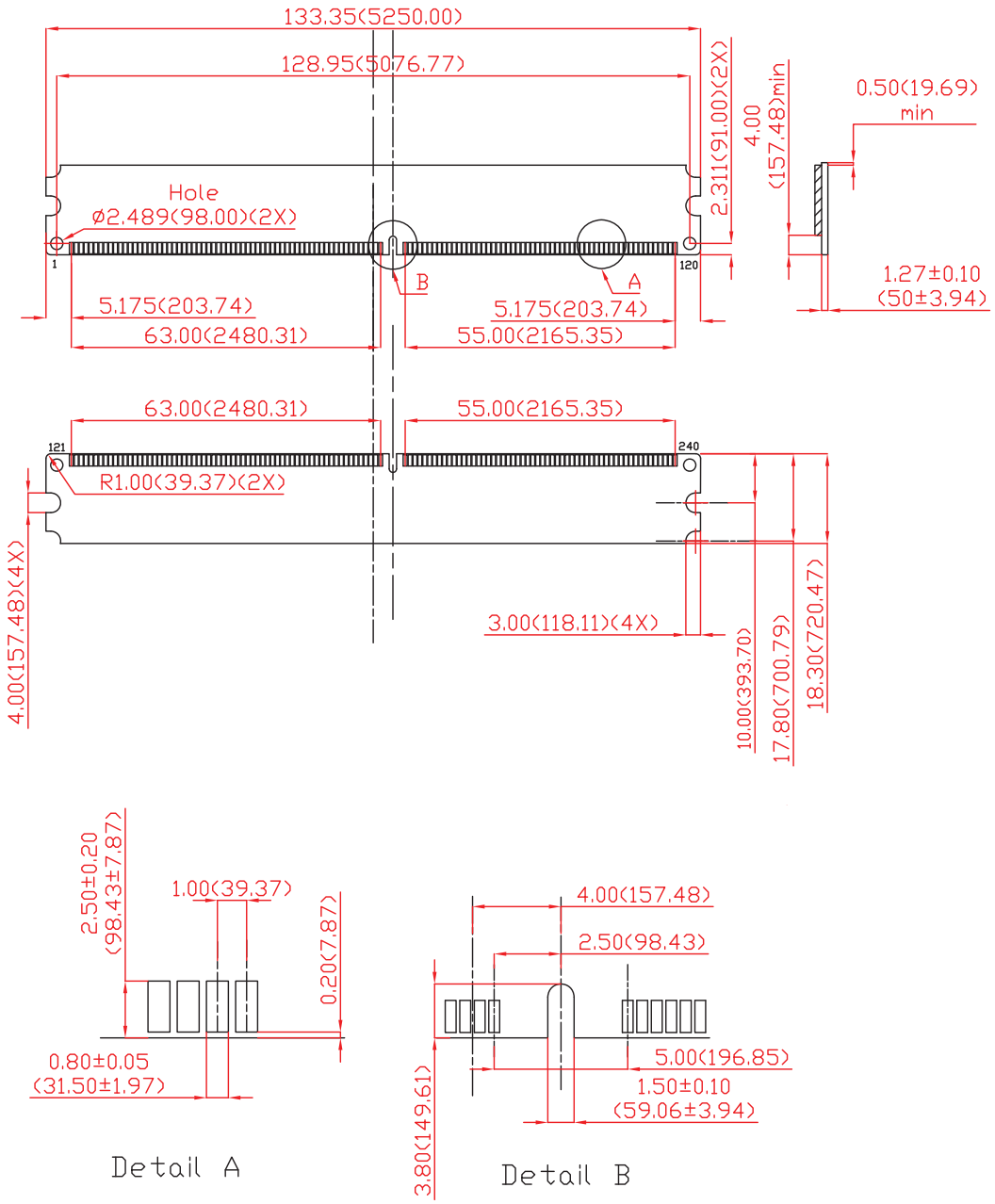
Symbol	Parameter	Rating			Units
		Min.	Typ.	Max.	
VDD	Supply Voltage	1.7	1.8	1.9	V
VDDQ	Supply Voltage for Output	1.7	1.8	1.9	V

Notes:

1. Under all conditions VDDQ must be less than or equal to VDD..
2. VDDQ tracks with VDD. AC parameters are measured with VDD and VDDQ tied together.

Mechanical Drawing

Unit: mm / (Mils)



Tolerances:+-0.15mm unless otherwise specified

Revision History

Revision	Date	Description	Remark
0.9	08/28/2012	Official release	
1.0	08/29/2012	release	
1.1	07/23/2013	Changed headquarters address	

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