

MANUFACTURING DESCRIPTION	
Module Manufacturer:	Samsung
Module Part Number:	M391A4G43MB1-CTD
DRAM Manufacturer:	Samsung
DRAM Components:	K4AAG085WM-BCTD
DRAM Die Revision / Process Node:	M / 18 nm
Module Manufacturing Date:	Week 08, 2020
Manufacturing Date Decoded:	February 17-21, 2020
Module Manufacturing Location:	Onyang, Korea
Module Serial Number:	03D010E3h
Manufacturing Identification Number:	W0ZP000
Module PCB Revision:	00h
PHYSICAL & LOGICAL ATTRIBUTES	
Fundamental Memory Class:	DDR4 SDRAM
Module Speed Grade:	DDR4-2666V downbin
Base Module Type:	UDIMM (133,35 mm)
Module Capacity:	32 GB
Reference Raw Card:	E1 (8 layers)
JEDEC Raw Card Designer:	Samsung
Module Nominal Height:	31 < H <= 32 mm
Module Thickness Maximum, Front:	1 < T <= 2 mm
Module Thickness Maximum, Back:	1 < T <= 2 mm
Number of DIMM Ranks:	2
Address Mapping from Edge Connector to DRAM:	Mirrored
DRAM Device Package:	Standard Monolithic
DRAM Device Package Type:	78-ball FBGA
DRAM Device Die Count:	Single die
Signal Loading:	Not specified
Number of Column Addresses:	10 bits
Number of Row Addresses:	17 bits
Number of Bank Addresses:	2 bits (4 banks)
Bank Group Addressing:	2 bits (4 groups)
DRAM Device Width:	8 bits
Programmed DRAM Density:	16 Gb
Calculated DRAM Density:	16 Gb
Number of DRAM components:	18
DRAM Page Size:	1 KB
Primary Memory Bus Width:	64 bits
Memory Bus Width Extension:	8 bits
DRAM Post Package Repair:	Supported
Soft Post Package Repair:	Supported
DRAM TIMING PARAMETERS	
Fine Timebase:	0,001 ns
Medium Timebase:	0,125 ns
CAS Latencies Supported:	10T, 11T, 12T, 13T, 14T, 15T, 16T, 17T, 18T, 19T, 20T
Minimum Clock Cycle Time (tCK min):	0,750 ns (1333,33 MHz)
Maximum Clock Cycle Time (tCK max):	1,600 ns (625,00 MHz)
CAS# Latency Time (tAA min):	13,750 ns
RAS# to CAS# Delay Time (tRCD min):	13,750 ns
Row Precharge Delay Time (tRP min):	13,750 ns
Active to Precharge Delay Time (tRAS min):	32,000 ns

Act to Act/Refresh Delay Time (tRC min):	45,750 ns
Normal Refresh Recovery Delay Time (tRFC1 min):	550,000 ns
2x mode Refresh Recovery Delay Time (tRFC2 min):	350,000 ns
4x mode Refresh Recovery Delay Time (tRFC4 min):	260,000 ns
Short Row Active to Row Active Delay (tRRD_S min):	3,000 ns
Long Row Active to Row Active Delay (tRRD_L min):	4,900 ns
Write Recovery Time (tWR min):	15,000 ns
Short Write to Read Command Delay (tWTR_S min):	2,500 ns
Long Write to Read Command Delay (tWTR_L min):	7,500 ns
Long CAS to CAS Delay Time (tCCD_L min):	5,000 ns
Four Active Windows Delay (tFAW min):	21,000 ns
Maximum Active Window (tMAW):	8192*tREFI
Maximum Activate Count (MAC):	Unlimited MAC
DRAM VDD 1,20 V operable/endurant:	Yes/Yes

THERMAL PARAMETERS	
Module Thermal Sensor:	Incorporated

INTEGRATED TEMPERATURE SENSOR	
Manufacturer:	STMicroelectronics
Model:	STTS2004
Revision:	01h
Temperature Monitor Status:	Active
Current Ambient Temperature:	38,000 °C
Sensor Resolution:	0,2500 °C (10-bit ADC)
Accuracy over the active range (75 °C to 95 °C):	±1 °C
Accuracy over the monitoring range (40 °C to 125 °C):	±2 °C
Open-drain Event Output:	Disabled
10V of VHV on A0 pin:	Supported
Negative Temperature Measurements:	Supported
Interrupt capabilities:	Supported

SPD PROTOCOL	
SPD Revision:	1.1
SPD Bytes Total:	512
SPD Bytes Used:	384
SPD Checksum (Bytes 00h-7Dh):	82FEh (OK)
SPD Checksum (Bytes 80h-FDh):	D6A6h (OK)

PART NUMBER DETAILS	
JEDEC DIMM Label:	32GB 2Rx8 PC4-2666V-UE1-11
Classification:	DDR4 SDRAM (1.2V VDD)
Module Type:	240-pin ECC Unbuffered DIMM
Module Speed:	Undefined
Module Revision:	1
Component Density:	16 Banks & POD-1.2V
Component Configuration:	x8
Memory Depth:	4G
Data Width:	72-bit
Die Generation:	M (1st Gen)
Package Type:	FBGA (Lead & Halogen Free)
AMB Vendor & Revision:	N/A
Power Consumption:	0°C-85°C / Normal Power

Frequency	CAS	RCD	RP	RAS	RC	RRDS	RRDL	WR	WTRS	WTRL	FAW
1333 MHz	20	19	19	43	61	4	7	20	4	10	28
1333 MHz	19	19	19	43	61	4	7	20	4	10	28

1200 MHz	18	17	17	39	55	4	6	18	3	9	26
1200 MHz	17	17	17	39	55	4	6	18	3	9	26
1067 MHz	16	15	15	35	49	4	6	16	3	8	23
1067 MHz	15	15	15	35	49	4	6	16	3	8	23
933 MHz	14	13	13	30	43	3	5	14	3	7	20
933 MHz	13	13	13	30	43	3	5	14	3	7	20
800 MHz	12	11	11	26	37	3	4	12	2	6	17
800 MHz	11	11	11	26	37	3	4	12	2	6	17
667 MHz	10	10	10	22	31	2	4	10	2	5	14