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**SCC16GX03H4F1C-32AA**  
**SCC32GX13H4F1C-32AA**

**260-Pin DDR4 Unbuffered ECC SODIMM (X72, ECC)**  
**EU RoHS Compliant**

**Data Sheet**

**Rev. B**

Revision History		
Date	Revision	Subjects (major changes since last revision)
2022-09	A	Initial Release
2024-11	B	Add Module description

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# 1 Overview

This chapter gives an overview of the 260-pin DDR4 Unbuffered ECC SODIMM product family and describes its main characteristics.

## 1.1 Features

- 260-Pin PC4-3200 DDR4 Unbuffered ECC SODIMM
- Frequency/CAS latency  
0.625ns @ CL = 22 (DDR4-3200)
- VDD = 1.2V ±60mV
- VPP = 2.5V (2.375V~2.75V)
- VDDSPD = 2.5V(NOM)
- Programmable CAS latency 9,10, 11, 12, 13, 14, 15 and 16, 17, 18,19, 20, 21, 22, and 24 supported
- Programmable additive latency 0, CL-1, and CL-2 supported (x4/x8 only)
- Programmable CAS Write latency (CWL) = 9, 10, 11, 12, 14, 16,18, 20
- Programmable burst length 4/8 with both nibble sequential and interleave mode
- BL switch on the fly
- Nominal and dynamic on-die termination (ODT) for strobe, and mask signals
- Low-power auto self refresh (LPASR)
- Data bus inversion (DBI) for data bus
- On-die VREFDQ generation and calibration
- 16 internal banks; 4 groups of 4 banks each
- Fixed burst chop (BC) of 4 and burst length (BL) of 8 via the mode register set (MRS)
- Gold edge contacts
- Halogen-free
- Fly-by topology
- Terminated control command and address bus
- Average Refresh Cycle (Tcase of 0 °C ~ 95 °C)
  - 7.8 μs at 0 °C ~ 85 °C
  - 3.9 μs at 85 °C ~ 95 °C
- Anti-Sulfurated Option

**Table 1 - Module Performance Table**

UnilC Speed Code		-3200AA	Unit	Note
DRAM Speed Grade	DDR4	-3200	MT/s	
CAS-RCD-RP latencies		22-22-22	t <sub>CK</sub>	
Min. RAS-CAS-Delay	13.75	13.75	ns	
Min. Row Precharge Time	13.75	13.75	ns	
Min. Row Active Time	32	32	ns	
Min. Row Cycle Time	45.75	45.75	ns	

## 1.2 Description

The UnilC 16GB/32GB module family is Unbuffered ECC SODIMM with 30mm height based on DDR4 technology. DIMMs are intended for mounting into 260-pin connector sockets.

The memory array is designed with 16 Gbit Double-Data- Rate-Four (DDR4) Synchronous DRAMs. Decoupling capacitors are mounted on the PCB board. The DIMMs feature serial presence detect based on a serial E<sup>2</sup>PROM device using the 2-pin I<sup>2</sup>C protocol.



**Table 2 - Ordering Information**

Product Type	Compliance Code <sup>1)</sup>	Description	SDRAM Technology
SCC16GX03H4F1C-32AA	16GB 1R×8 PC4-3200S-22-22-22	1 Rank	16Gbit (×8)
SCC32GX13H4F1C-32AA	32GB 2R×8 PC4-3200S-22-22-22	2 Ranks	16Gbit (×8)

- 1) This describes the speed grade, for example "PC4-3200S-22-22-22" where 3200 means DIMM modules with 3200MT/s data rate and "22-22-22" means Column Address Strobe (CAS) latency=22, Row Column Delay (RCD) latency = 22 and Row Precharge (RP) latency = 22.

**Table 3 - Address Format**

DIMM Density	16GB(1R×8,X72)	32GB(2R×8,X72)
Row address	128K A[16:0]	128K A[16:0]
Column address	1K A[9:0]	1K A[9:0]
Device bank group address	4 BG[1:0]	4 BG[1:0]
Device bank address per group	4 BA[1:0]	4 BA[1:0]
Device configuration	16Gb(2G×8)	16Gb(2G×8)
Module rank address	1 CS_n[0]	2CS_n[1:0]
Device Quantity	9	18

## 2 Pin Configurations

### 2.1 Pin Configurations

The pin configuration of the 260-Pin DDR4 Unbuffered ECC SODIMM is listed by function in [Table 4](#) (260 pins).

**Table 4 - Pin Configuration SODIMM (260 pin)**

Pin	Front	Pin	Back	Pin	Front	Pin	Back	Pin	Front	Pin	Back
1	VSS	2	VSS	97	DQS8_t	98	VSS	193	VSS	194	DQ41
3	DQ5	4	DQ4	99	VSS	100	CB6	195	DQ40	196	VSS
5	VSS	6	VSS	101	CB2	102	VSS	197	VSS	198	DQS5_c
7	DQ1	8	DQ0	103	VSS	104	CB7	199	DM5_n /DBI5_n	200	DQS5_t
9	VSS	10	VSS	105	CB3	106	VSS	201	VSS	202	VSS
11	DQS0_c	12	DM0_n /DBI0_n	107	VSS	108	RESET_n	203	DQ46	204	DQ47
13	DQS0_t	14	VSS	109	CKE0	110	CKE1	205	VSS	206	VSS
15	VSS	16	DQ6	111	VDD	112	VDD	207	DQ42	208	DQ43
17	DQ7	18	VSS	113	BG1	114	ACT_n	209	VSS	210	VSS
19	VSS	20	DQ2	115	BG0	116	ALERT_n	211	DQ52	212	DQ53
21	DQ3	22	VSS	117	VDD	118	VDD	213	VSS	214	VSS
23	VSS	24	DQ12	119	A12	120	A11	215	DQ49	216	DQ48
25	DQ13	26	VSS	121	A9	122	A7	217	VSS	218	VSS
27	VSS	28	DQ8	123	VDD	124	VDD	219	DQS6_c	220	DM6_n /DBI6_n
29	DQ9	30	VSS	125	A8	126	A5	221	DQS6_t	222	VSS
31	VSS	32	DQS1_c	127	A6	128	A4	223	VSS	224	DQ54
33	DM1_n /DBI1_n	34	DQS1_t	129	VDD	130	VDD	225	DQ55	226	VSS
35	VSS	36	VSS	131	A3	132	A2	227	VSS	228	DQ50
37	DQ15	38	DQ14	133	A1	134	EVENT_n	229	DQ51	230	VSS
39	VSS	40	VSS	135	VDD	136	VDD	231	VSS	232	DQ60
41	DQ10	42	DQ11	137	CK0_t	138	CK1_t	233	DQ61	234	VSS
43	VSS	44	VSS	139	CK0_c	140	CK1_c	235	VSS	236	DQ57
45	DQ21	46	DQ20	141	VDD	142	VDD	237	DQ56	238	VSS
47	VSS	48	VSS	143	Parity	144	A0	239	VSS	240	DQS7_c
49	DQ17	50	DQ16	145	BA1	146	A10/AP	241	DM7_n /DBI7_n	242	DQS7_t
51	VSS	52	VSS	147	VDD	148	VDD	243	VSS	244	VSS
53	DQS2_c	54	DM2_n /DBI2_n	149	CS0_n	150	BA0	245	DQ62	246	DQ63
55	DQS2_t	56	VSS	151	A14 /WE_n	152	A16 /RAS_n	247	VSS	248	VSS
57	VSS	58	DQ22	153	VDD	154	VDD	249	DQ58	250	DQ59
59	DQ23	60	VSS	155	ODT0	156	A15 CAS_n/	251	VSS	252	VSS

Pin	Front	Pin	Back	Pin	Front	Pin	Back	Pin	Front	Pin	Back
61	VSS	62	DQ18	157	CS1_n	158	A13	253	SCL	254	SDA
63	DQ19	64	VSS	159	VDD	160	VDD	255	VDDSPD	256	SA0
65	VSS	66	DQ28	161	ODT1	162	C0 /CS2_n /NC	257	VPP	258	Vtt
67	DQ29	68	VSS	163	VDD	164	VREFCA	259	VPP	260	SA1
69	VSS	70	DQ24	165	C1 /CS3_n /NC	166	SA2				
71	DQ25	72	VSS	167	VSS	168	VSS				
73	VSS	74	DQS3_c	169	DQ37	170	DQ36				
75	DM3_n /DBI3_n	76	DQS3_t	171	VSS	172	VSS				
77	VSS	78	VSS	173	DQ33	174	DQ32				
79	DQ30	80	DQ31	175	VSS	176	VSS				
81	VSS	82	VSS	177	DQS4_c	178	DM4_n /DBI4_n				
83	DQ26	84	DQ27	179	DQS4_t	180	VSS				
85	VSS	86	VSS	181	VSS	182	DQ39				
87	CB5	88	CB4	183	DQ38	184	VSS				
89	VSS	90	VSS	185	VSS	186	DQ35				
91	CB1	92	CB0	187	DQ34	188	VSS				
93	VSS	94	VSS	189	VSS	190	DQ45				
95	DQS8_c	96	DM8_n /DBI8_n	191	DQ44	192	VSS				

## 2.2 Pin Descriptions

**Table 5 - Pin Descriptions**

Symbol	Type	Function
CKx_t, CKx_c,	Input	Clock: CK_t and CK_c are differential clock inputs. All address and control input signals are sampled on the crossing of the positive edge of CK_t and negative edge of CK_c.
CKEx	Input	Clock Enable: CKE HIGH activates and CKE LOW deactivates internal clock signals and device input buffers and output drivers. Taking CKE LOW provides Precharge Power-Down and Self-Refresh operation (all banks idle), or Active Power-Down (row Active in any bank). CKE is synchronous for Self-Refresh exit. After VREFCA and Internal DQ Vref have become stable during the power on and initialization sequence, they must be maintained during all operations (including Self-Refresh). CKE must be maintained high throughout read and write accesses. Input buffers, excluding CK_t, CK_c, ODT and CKE, are disabled during power-down. Input buffers, excluding CKE, are disabled during Self-Refresh.
CSx_n	Input	Chip Select: All commands are masked when CS-n is registered HIGH. CS_n provides for external Rank selection. CS_n is considered part of the command code.
Cx	Input	Chip ID : Chip ID is only used for 3DS for 2,4,8 high stack via TSV to select each slice of stacked component. Chip ID is considered part of the command code.
ODTx	Input	On Die Termination: ODT (registered HIGH) enables RTT_NOM termination resistance internal to the DDR4 SDRAM. When enabled, ODT is only applied to each DQ, DQS_t, DQS_c, TDQS_t and TDQS_c signal. The ODT pin will be ignored if MR1 is programmed to disable RTT_NOM.
ACT_n	Input	Activation Command Input: ACT_n defines the Activation command being entered along with CS_n. The input into RAS_n/A16, CAS_n/A15 and WE_n/A14 will be considered as Row Address A16, A15 and A14
RAS_n/A16. CAS_n/A15. WE_n/A14	Input	Command Inputs: RAS_n/A16, CAS_n/A15 and WE_n/A14 (along with CS_n) define the command being entered. Those pins have multi function. For example, for activation with ACT_n Low, these are Addresses like A16, A15 and A14 but for non-activation command with ACT_n High, these are Command pins for Read, Write and other command defined in command truth table
BGx	Input	Bank Group Inputs: BG0 - BG1 define which bank group an Active, Read, Write or Precharge command is being applied. BG0 also determines which mode register is to be accessed during a MRS cycle.
BAx	Input	Bank Address Inputs: BA0 - BA1 define to which bank an Active, Read, Write or Precharge command is being applied. Bank address also determines which mode register is to be accessed during a MRS cycle.
Ax	Input	Address Inputs: Provide the row address for ACTIVATE Commands and the column address for Read/Write commands to select one location out of the memory array in the respective bank. A10/AP, A12/BC_n, RAS_n/A16, CAS_n/A15 and WE_n/A14 have additional functions. See other rows. The address inputs also provide the op-code during Mode Register Set commands. A17 is only defined for 16 Gb x4 SDRAM configurations.
A10 / AP	Input	Auto-precharge: A10 is sampled during Read/Write commands to determine whether Autoprecharge should be performed to the accessed bank after the Read/Write operation. (HIGH: Autoprecharge; LOW: no Autoprecharge). A10 is sampled during a Precharge command to determine whether the Precharge applies to one bank (A10 LOW) or all banks (A10 HIGH). If only one bank is to be precharged, the bank is selected by bank addresses.



Symbol	Type	Function
A12/BC_n	Input	Burst Chop: A12/BC_n is sampled during Read and Write commands to determine if burst chop (on-the-fly) will be performed. (HIGH, no burst chop; LOW: burst chopped). See command truth table for details.
Parity	Input	Command and Address Parity Input: DDR4 Supports Even Parity check in SDRAMs with MR setting. Once it's enabled via Register in MR5, then SDRAM calculates Parity with ACT_n, RAS_n/A16, CAS_n/A15, WE_n/A14, BG0-BG1, BA0-BA1, A17-A0. Input parity should be maintained at the rising edge of the clock and at the same time with command & address with CS_n LOW
SAX	Input	Serial address inputs: Used to configure the temperature sensor/SPD EEPROM address range on the I2C bus.
SCL	Input	Serial clock for temperature sensor/SPD EEPROM: Used to synchronize communication to and from the temperature sensor/SPD EEPROM on the I2C bus.
RESET_n	CMOS Input	Active Low Asynchronous Reset: Reset is active when RESET_n is LOW, and inactive when RESET_n is HIGH. RESET_n must be HIGH during normal operation.
DQx, CBx	I/O	Data Input/ Output: Bi-directional data bus. If CRC is enabled via Mode register then CRC code is added at the end of Data Burst. Any DQ from DQ0-DQ3 may indicate the internal Vref level during test via Mode Register Setting MR4 A4=High. Refer to vendor specific data sheets to determine which DQ is used.
DQSx_t-DQSx_c	I/O	Data Strobe: output with read data, input with write data. Edge-aligned with read data, centered in write data. The data strobe DQS_t is paired with differential signals DQS_c, respectively, to provide differential pair signaling to the system during reads and writes. DDR4 SDRAM supports differential data strobe only and does not support single-ended.
DM_n/DBI_n/ TDQS_t (DMU_n, DBIU_n), (DML_n/ DBIL_n)	I/O	Input data mask and data bus inversion: DM_n is an input mask signal for write data. Input data is masked when DM_n is sampled LOW coincident with that input data during a write access. DM_n is sampled on both edges of DQS. DM is multiplexed with the DBI function by the mode register A10, A11, and A12 settings in MR5. For a x8 device, the function of DM or TDQS is enabled by the mode register A11 setting in MR1. DBI_n is an input/output identifying whether to store/output the true or inverted data. If DBI_n is LOW, the data will be stored/ output after inversion inside the DDR4 device and not inverted if DBI_n is HIGH. TDQS is only supported in x8 SDRAM configurations (TDQS is not valid for UDIMMs).
SDA	I/O	Serial Data: Bidirectional signal used to transfer data in or out of the EEPROM or EEPROM/TS combo device.
ALERT_n	Output	Alert: It has multi functions such as CRC error flag, Command and Address Parity error flag as Output signal. If there is error in CRC, then ALERT_n goes LOW for the period time interval and goes back HIGH. If there is error in Command Address Parity Check, then ALERT_n goes LOW for relatively long period until ongoing SDRAM internal recovery transaction is complete. During Connectivity Test mode this pin functions as an input.
EVENT_n	Output	Temperature event: The EVENT_n pin is asserted by the temperature sensor when critical temperature thresholds have been exceeded. This pin has no function (NF) on modules without temperature sensors.

Symbol	Type	Function
TDQS_t TDQS_c (x8 DRAM-based RDIMM only)	Output	Termination data strobe: When enabled via the mode register, the DRAM device enables the same RTT termination resistance on TDQS_t and TDQS_c that is applied to DQS_t and DQS_c. When the TDQS function is disabled via the mode register, the DM/TDQS_t pin provides the data mask (DM) function, and the TDQS_c pin is not used. The TDQS function must be disabled in the mode register for both the x4 and x16 configurations. The DM function is supported only in x8 and x16 configurations. DM, DBI, and TDQS are a shared pin and are enabled/disabled by mode register settings. For more information about TDQS, see the DDR4 DRAM component datasheet (TDQS_t and TDQS_c are not valid for UDIMMs).
VDD	Supply	Module power supply: 1.2V (TYP).
VPP	Supply	DRAM activating power supply: 2.5V -0.125V / +0.250V.
VREFCA	Supply	Reference voltage for control, command, and address pins.
VSS	Supply	Ground.
VTT	Supply	Power supply for termination of address, command, and control VDD/2.
VDDSPD	Supply	Power supply used to power the I2C bus for SPD.
RFU	-	Reserved for Future Use: No on DIMM electrical connection is present
NC	-	No Connect: No on DIMM electrical connection is present

## 3 General Description

### 3.1 General Description

High-speed DDR4 SDRAM modules use DDR4 SDRAM devices with 2 or 4 internal memory bank groups. DDR4 SDRAM modules utilizing 4- and 8-bit-wide DDR4 SDRAM have 4 internal bank groups consisting of 4 memory banks each, providing a total of 16 banks. Sixteen-bit-wide DDR4 SDRAM has 2 internal bank groups consisting of 4 memory banks each, providing a total of 8 banks. DDR4 SDRAM modules benefit from DDR4 SDRAM's use of an 8n-prefetch architecture with an interface designed to transfer two data words per clock cycle at the I/O pins. A single READ or WRITE operation for the DDR4 SDRAM effectively consists of a single 8n-bit-wide, four-clock data transfer at the internal DRAM core and eight corresponding n-bit wide, one-half-clock-cycle data transfers at the I/O pins.

DDR4 modules use two sets of differential signals: DQS, DQS# to capture data and CK and CK# to capture commands, addresses, and control signals. Differential clocks and data strobes ensure exceptional noise immunity for these signals and provide precise crossing points to capture input signals.

### 3.2 Serial Presence-Detect EEPROM Operation

DDR4 SDRAM modules incorporate serial presence-detect. The SPD data is stored in a 512-byte EEPROM. System READ/WRITE operations between the master (system logic) and the slave EEPROM device occur via a standard I2C bus using the DIMM's SCL (clock) SDA (data), and SA (address) pins. Write protect (WP) is connected to VSS, permanently disabling hardware write protection.

### 3.3 Function Block Diagram

Figure 1 - Function Block Diagram\_SCC16GX03H4F1C-32AA

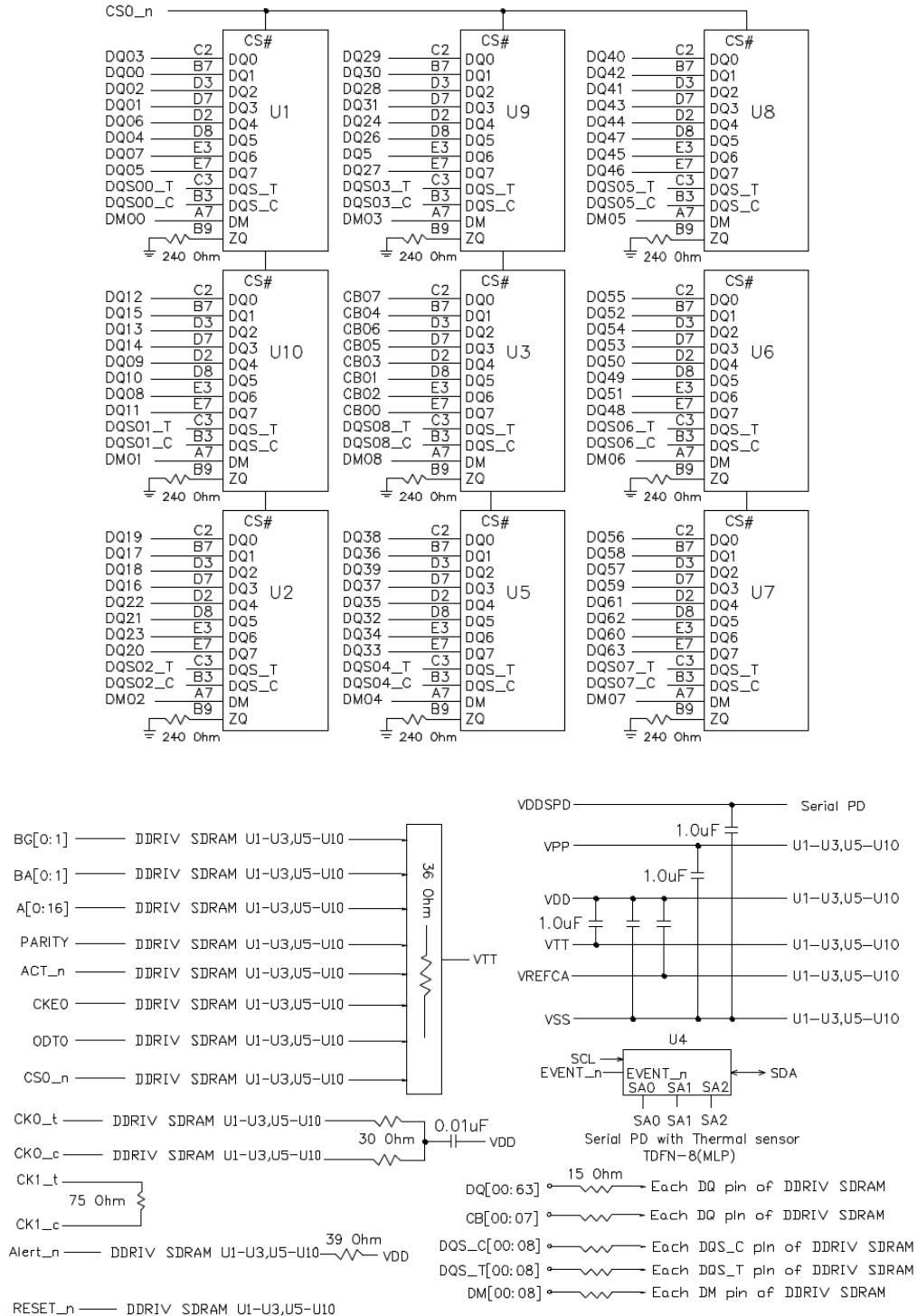
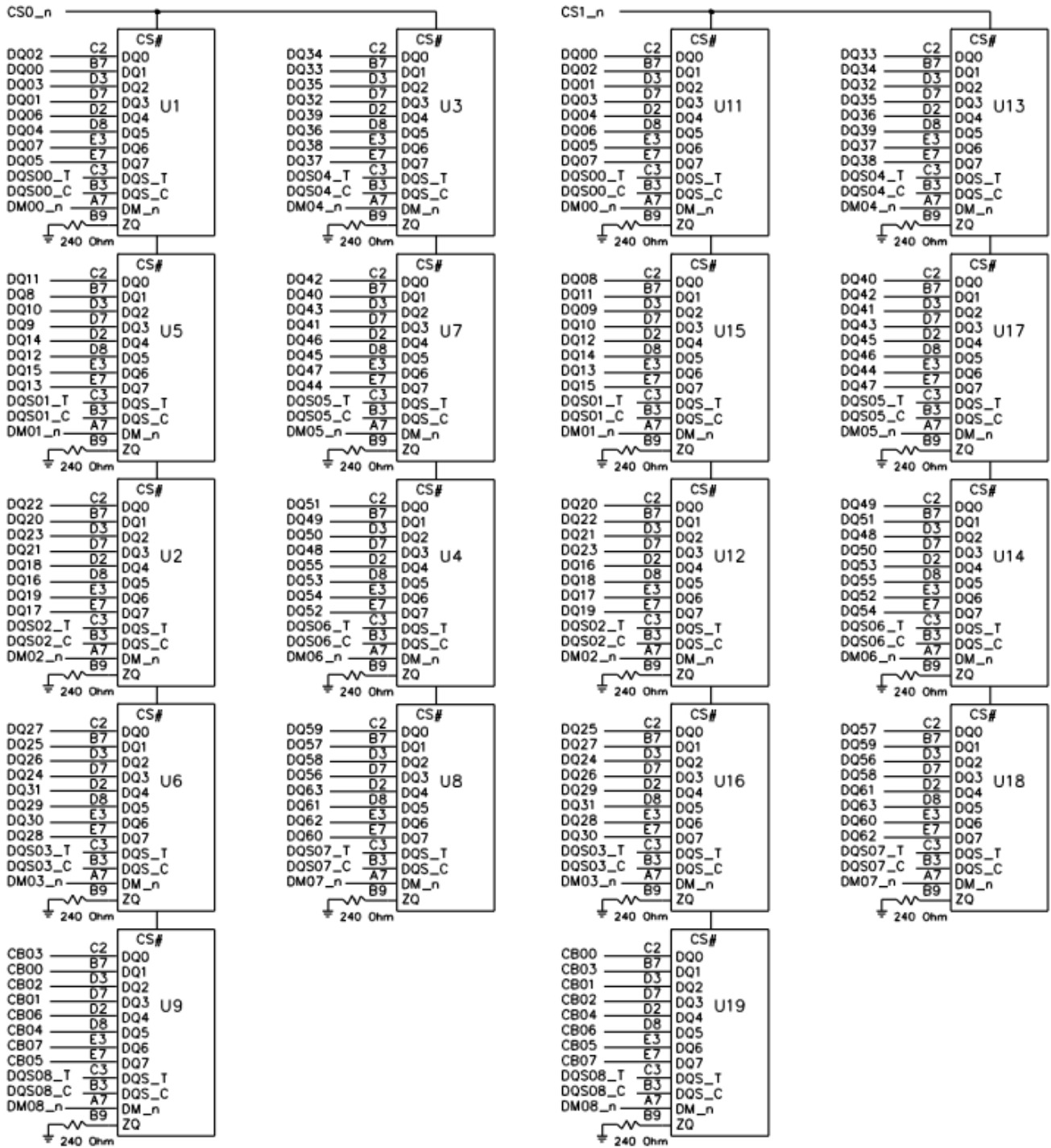
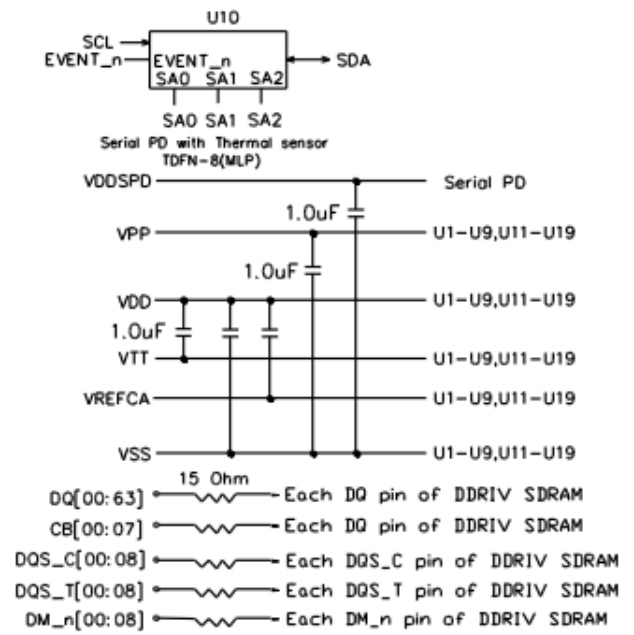
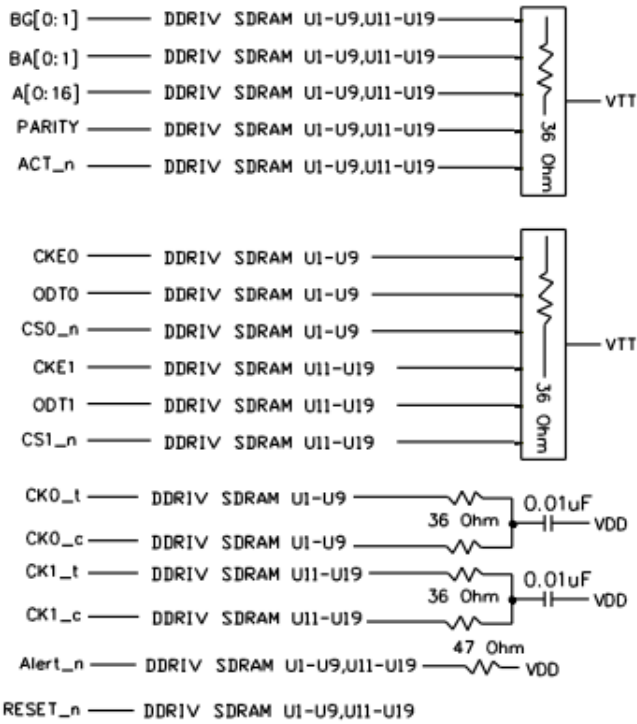


Figure 2 - Function Block Diagram\_SCC32GX13H4F1C-32AA





### 3.4 DQ Map

Table 6 - DQ Map\_ SCC16GX03H4F1C-32AA

Module Pin No.	Module DQ	Damping RES.	IC NO.	IC DQ	Module Pin No.	Module DQ	Damping RES.	IC NO.	IC DQ
8	0	R112	U1	1	28	8	R107	U10	6
7	1	R7		3	29	9	R13		4
20	2	R109		2	41	10	R16		5
21	3	R11		0	42	11	R103		7
4	4	R113		5	24	12	R18		0
3	5	R6		7	25	13	R12		2
16	6	R110		4	38	14	R104		3
17	7	R10		6	37	15	R15		1
50	16	R101	U2	3	70	24	R96	U9	4
49	17	R18		1	71	25	R24		6
62	18	R98		2	83	26	R27		5
63	19	R22		0	84	27	R92		7
46	20	R102		7	66	28	R97		2
45	21	R17		5	67	29	R23		0
58	22	R99		4	79	30	R26		1
59	23	R21		6	80	31	R93		3
92	CB0	R90	U3	7	174	32	R84	U5	5
91	CB1	R29		5	173	33	R35		7
101	CB2	R32		6	187	34	R39		6
105	CB3	R33		4	186	35	R81		4
88	CB4	R91		1	170	36	R85		1
87	CB5	R28		3	169	37	R34		3
100	CB6	R88		2	183	38	R38		0
104	CB7	R87		0	182	39	R82		2
195	40	R41	U8	0	216	48	R73	U6	7
194	41	R79		2	215	49	R46		5
207	42	R44		1	228	50	R70		4
208	43	R75		3	229	51	R50		6
191	44	R40		4	211	52	R45		1
190	45	R80		6	212	53	R74		3
203	46	R43		7	224	54	R71		2
204	47	R76		5	225	55	R49		0
237	56	R52	U7	0					
236	57	R68		2					
249	58	R55		1					
250	59	R64		3					
232	60	R69		6					
233	61	R51		4					
245	62	R54		5					
246	63	R65		7					



Table 7 - DQ Map\_ SCC32GX13H4F1C-32AA

Module Pin NO.	Module DQ NO.	Damping RES.	R0 IC NO.	R0 IC DQ	R1 IC NO.	R1 IC DQ	Module Pin NO.	Module DQ NO.	Damping RES.	R0 IC NO.	R0 IC DQ	R1 IC NO.	R1 IC DQ
8	0	AR27(1-4)	U1	1	U11	0	28	8	AR40(1-4)	U5	1	U15	0
7	1	AR17(2-3)		3		2	29	9	AR39(2-3)		3		2
20	2	AR38(1-4)		0		1	41	10	AR20(2-3)		2		3
21	3	AR37(2-3)		2		3	42	11	AR30(1-4)		0		1
4	4	AR27(2-3)		5		4	24	12	AR40(2-3)		5		4
3	5	AR17(1-4)		7		6	25	13	AR39(1-4)		7		6
16	6	AR38(2-3)		4		5	38	14	JAR30(2-3)		4		5
17	7	AR37(1-4)		6		7	37	15	AR20(1-4)		6		7
50	16	AR32(2-3)	U2	5	U12	4	70	24	AR44(1-4)	U6	3	U16	2
49	17	AR21(2-3)		7		6	71	25	AR43(2-3)		1		0
62	18	AR42(1-4)		4		5	83	26	AR2(2-3)		2		3
63	19	AR41(2-3)		6		7	84	27	AR4(1-4)		0		1
46	20	AR31(2-3)		1		0	66	28	AR44(2-3)		7		6
45	21	AR21(1-4)		3		2	67	29	AR43(1-4)		5		4
58	22	AR42(2-3)		0		1	79	30	AR2(1-4)		6		7
59	23	AR41(1-4)		2		3	80	31	AR4(2-3)		4		5
92	CB0	AR54(1-4)	U9	1	U19	0	174	32	AR33(1-4)	U3	3	U13	2
91	CB1	AR53(2-3)		3		2	173	33	AR23(2-3)		1		0
101	CB2	AR6(1-4)		2		3	187	34	AR51(2-3)		0		1
105	CB3	AR6(2-3)		0		1	186	35	AR52(1-4)		2		3
88	CB4	AR54(2-3)		5		4	170	36	AR33(2-3)		5		4
87	CB5	AR53(1-4)		7		6	169	37	AR23(1-4)		7		6
100	CB6	AR8(2-3)		4		5	183	38	AR51(1-4)		6		7
104	CB7	AR8(1-4)		6		7	182	39	AR52(2-3)		4		5
195	40	AR49(2-3)	U7	1	U17	0	216	48	AR11(1-4)	U4	3	U14	2
194	41	AR50(1-4)		3		2	215	49	AR9(2-3)		1		0
207	42	AR26(2-3)		0		1	228	50	AR48(1-4)		2		3
208	43	AR36(1-4)		2		3	229	51	AR47(2-3)		0		1
191	44	AR49(1-4)		7		6	211	52	AR9(1-4)		7		6
190	45	AR50(2-3)		5		4	212	53	AR11(2-3)		5		4
203	46	AR26(1-4)		4		5	224	54	AR48(2-3)		6		7
204	47	AR36(2-3)		6		7	225	55	AR47(1-4)		4		5
237	56	AR13(2-3)	U8	3	U18	2							
236	57	AR15(1-4)		1		0							
249	58	AR45(2-3)		2		3							
250	59	AR46(1-4)		0		1							
232	60	AR15(2-3)		7		6							
233	61	AR13(1-4)		5		4							
245	62	AR45(1-4)		6		7							
246	63	AR46(2-3)		4		5							



## 4 Electrical Characteristics

This chapter contains speed grade definition, AC timing parameter and ODT tables.

### 4.1 Absolute Maximum Ratings

**Attention: Stresses greater than those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a 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.**

**Table 8 - Absolute Maximum Ratings**

Symbol	Parameter	Rating		Unit	Note
		Min.	Max.		
$V_{DD}$	Voltage on $V_{DD}$ pin relative to $V_{SS}$	-0.4	+1.5	V	
$V_{DDQ}$	Voltage on $V_{DDQ}$ pin relative to $V_{SS}$	-0.4	+1.5	V	
$V_{PP}$	Voltage on $V_{PP}$ pin relative to $V_{SS}$	-0.4	3.0	V	
$V_{IN}, V_{OUT}$	Voltage on any pin relative to $V_{SS}$	-0.4	+1.5	V	
$T_{STG}$ Temperature	Storage Temperature	- 50	+100	°C	

Attention: Stresses above the max. values listed here may cause permanent damage to the device. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Maximum ratings are absolute ratings; exceeding only one of these values may cause irreversible damage to integrated circuit.

**Table 9 - DRAM Component Operating Temperature Range**

Symbol	Parameter	Rating		Unit	Note
		Min.	Max.		
$T_{CASE}$	Operating Temperature	0	95	°C	1)2)3)4)

- 1) Operating Temperature is the case surface temperature on the center / top side of the DRAM.
- 2) The operating temperature ranges are the temperatures where all DRAM specification will be supported. During operation, the DRAM case temperature must be maintained between 0 - 95 °C under all other specification parameters.
- 3) Above 85 °C the Auto-Refresh command interval has to be reduced to  $t_{REFI} = 3.9 \mu s$
- 4) When operating this product in the 85 °C to 95 °C  $T_{CASE}$  temperature range, the High Temperature Self Refresh has to be enabled by setting EMR(2) bit A7 to “1”.

## 4.2 Operating Conditions

**Table 10 - Supply Voltage Levels and AC / DC Operating Conditions**

Parameter	Symbol	Values			Unit	Note
		Min.	Typ.	Max.		
Device Supply Voltage	$V_{DD}$	1.14	1.2	1.26	V	1),2),3)
Output Supply Voltage	$V_{DDQ}$	1.14	1.2	1.26	V	1),2),3)
Peak-to-Peak Voltage	$V_{PP}$	2.375	2.5	2.75	V	3)
Input Reference Voltage	$V_{REF}$	$0.49 \times V_{DD}$	$0.5 \times V_{DDQ}$	$0.51 \times V_{DD}$	V	
DC Input Logic High	$V_{IH,CA}(DC65)$	$V_{REFCA} + 0.065$	—	$V_{DD}$	V	
DC Input Logic Low	$V_{IL,CA}(DC65)$	Vss	—	$V_{REFCA} - 0.065$	V	
AC Input Logic High	$V_{IH,CA}(AC90)$	$V_{REF} + 0.09$	—		V	
AC Input Logic Low	$V_{IL,CA}(AC90)$		—	$V_{REF} - 0.09$	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.
- 3) DC bandwidth is limited to 20MHz.

### 4.3 Module and Component Speed Grades

DDR4 components may exceed the listed module speed grades; module may not be available in all listed speed grades

**Table 11 - Module and Component Speed Grades**

Module Speed Grade	Component Speed Grade
-32AA	3200-22-22-22

## 4.4 $I_{DD}/I_{PP}$ Specifications and Conditions

List of tables defining  $I_{DD}/I_{PP}$  Specifications and Conditions.

**Table 12 -  $I_{DD}/I_{PP}$  Measurement Conditions**

Symbol	Description
IDD0 IPP0	Operating One Bank Active-Precharge Current (AL=0)  CKE: High; External clock: On; tCK, nRC, nRAS, CL: Refer to Component Datasheet for detail pattern; BL: 8 <sup>1</sup> ; AL: 0; CS_n: High between ACT and PRE; Command, Address, Bank Group Address, Bank Address Inputs: partially toggling; Data IO: VDDQ; DM_n: stable at 1; Bank Activity: Cycling with one bank active at a time: 0,0,1,1,2,2,... ; Output Buffer and RTT: Enabled in Mode Registers <sup>2</sup> ; ODT Signal: stable at 0; Pattern Details: Refer to Component Datasheet for detail pattern
IDD1 IPP1	Operating One Bank Active-Read-Precharge Current (AL=0)  CKE: High; External clock: On; tCK, nRC, nRAS, nRCD, CL: Refer to Component Datasheet for detail pattern; BL: 8 <sup>1</sup> ; AL: 0; CS_n: High between ACT, RD and PRE; Command, Address, Bank Group Address, Bank Address Inputs, Data IO: partially toggling; DM_n: stable at 1; Bank Activity: Cycling with one bank active at a time: 0,0,1,1,2,2,... ; Output Buffer and RTT: Enabled in Mode Registers <sup>2</sup> ; ODT Signal: stable at 0; Pattern Details: Refer to Component Datasheet for detail pattern
IDD2N IPP2N	Precharge Standby Current (AL=0)  CKE: High; External clock: On; tCK, CL: Refer to Component Datasheet for detail pattern; BL: 8 <sup>1</sup> ; AL: 0; CS_n: stable at 1; Command, Address, Bank Group Address, Bank Address Inputs: partially toggling ; Data IO: VDDQ; DM_n: stable at 1; Bank Activity: all banks closed; Output Buffer and RTT: Enabled in Mode Registers <sup>2</sup> ; ODT Signal: stable at 0; Pattern Details: Refer to Component Datasheet for detail pattern
IDD2NT	Precharge Standby ODT Current  CKE: High; External clock: On; tCK, CL: Refer to Component Datasheet for detail pattern; BL: 8 <sup>1</sup> ; AL: 0; CS_n: stable at 1; Command, Address, Bank Group Address, Bank Address Inputs: partially toggling ; Data IO: VSSQ; DM_n: stable at 1; Bank Activity: all banks closed; Output Buffer and RTT: Enabled in Mode Registers <sup>2</sup> ; ODT Signal: toggling according ; Pattern Details: Refer to Component Datasheet for detail pattern
IDD2P IPP2P	Precharge Power-Down Current CKE: Low; External clock: On; tCK, CL: Refer to Component Datasheet for detail pattern; BL: 8 <sup>1</sup> ; AL: 0; CS_n: stable at 1; Command, Address, Bank Group Address, Bank Address Inputs: stable at 0; Data IO: VDDQ; DM_n: stable at 1; Bank Activity: all banks closed; Output Buffer and RTT: Enabled in Mode Registers <sup>2</sup> ; ODT Signal: stable at 0
IDD2Q	Precharge Quiet Standby Current  CKE: High; External clock: On; tCK, CL: Refer to Component Datasheet for detail pattern; BL: 8 <sup>1</sup> ; AL: 0; CS_n: stable at 1; Command, Address, Bank Group Address, Bank Address Inputs: stable at 0; Data IO: VDDQ; DM_n: stable at 1; Bank Activity: all banks closed; Output Buffer and RTT: Enabled in Mode Registers <sup>2</sup> ; ODT Signal: stable at 0

Symbol	Description
IDD3N IPP3N	Active Standby Current  CKE: High; External clock: On; tCK, CL: Refer to Component Datasheet for detail pattern; BL: 8 <sup>1</sup> ; AL: 0; CS <sub>n</sub> : stable at 1; Command, Address, Bank Group Address, Bank Address Inputs: partially toggling Data IO: VDDQ; DM <sub>n</sub> : stable at 1; Bank Activity: all banks open; Output Buffer and RTT: Enabled in Mode Registers <sup>2</sup> ; ODT Signal: stable at 0; Pattern Details: Refer to Component Datasheet for detail pattern
IDD3P IPP3P	Active Power-Down Current  CKE: Low; External clock: On; tCK, CL: Refer to Component Datasheet for detail pattern; BL: 8 <sup>1</sup> ; AL: 0; CS <sub>n</sub> : stable at 1; Command, Address, Bank Group Address, Bank Address Inputs: stable at 0; Data IO: VDDQ; DM <sub>n</sub> : stable at 1; Bank Activity: all banks open; Output Buffer and RTT: Enabled in Mode Registers <sup>2</sup> ; ODT Signal: stable at 0
IDD4R IPP4R	Operating Burst Read Current  CKE: High; External clock: On; tCK, CL: Refer to Component Datasheet for detail pattern; BL: 8 <sup>2</sup> ; AL: 0; CS <sub>n</sub> : High between RD; Command, Address, Bank Group Address, Bank Address Inputs: partially toggling ; Data IO: seamless read data burst with different data between one burst and the next one according ; DM <sub>n</sub> : stable at 1; Bank Activity: all banks open, RD commands cycling through banks: 0,0,1,1,2,2,... ; Output Buffer and RTT: Enabled in Mode Registers <sup>2</sup> ; ODT Signal: stable at 0; Pattern Details: Refer to Component Datasheet for detail pattern
IDD4W IPP4W	Operating Burst Write Current  CKE: High; External clock: On; tCK, CL: Refer to Component Datasheet for detail pattern; BL: 8 <sup>1</sup> ; AL: 0; CS <sub>n</sub> : High between WR; Command, Address, Bank Group Address, Bank Address Inputs: partially toggling ; Data IO: seamless write data burst with different data between one burst and the next one ; DM <sub>n</sub> : stable at 1; Bank Activity: all banks open, WR commands cycling through banks: 0,0,1,1,2,2,... ; Output Buffer and RTT: Enabled in Mode Registers <sup>2</sup> ; ODT Signal: stable at HIGH; Pattern Details: Refer to Component Datasheet for detail pattern
IDD5B IPP5B	Burst Refresh Current (1X REF)  CKE: High; External clock: On; tCK, CL, nRFC: Refer to Component Datasheet for detail pattern; BL: 8 <sup>1</sup> ; AL: 0; CS <sub>n</sub> : High between REF; Command, Address, Bank Group Address, Bank Address Inputs: partially toggling ; Data IO: VDDQ; DM <sub>n</sub> : stable at 1; Bank Activity: REF command every nRFC ; Output Buffer and RTT: Enabled in Mode Registers <sup>2</sup> ; ODT Signal: stable at 0; Pattern Details: Refer to Component Datasheet for detail pattern
IDD5F2 IPP5F2	Burst Refresh Current (2X REF) tRFC=tRFC <sub>x2</sub> ,
IDD5F4 IPP5F4	Burst Refresh Current (4X REF) tRFC=tRFC <sub>x4</sub> ,
IDD6N IPP6N	Self Refresh Current: Normal Temperature Range  Tcase: 0 - 85°C; Low Power Array Self Refresh (LP ASR) : Normal <sup>4</sup> ; CKE: Low; External clock: Off; CK <sub>t</sub> and CK <sub>c</sub> : LOW; CL: Refer to Component Datasheet for detail pattern; BL: 8 <sup>1</sup> ; AL: 0; CS <sub>n</sub> #, Command, Address, Bank Group Address, Bank Address, Data IO: High; DM <sub>n</sub> : stable at 1; Bank Activity: Self-Refresh operation; Output Buffer and RTT: Enabled in Mode Registers <sup>2</sup> ; ODT Signal: MIDDLELEVEL
IDD6E IPP6E	Self-Refresh Current: Extended Temperature Range)  TCase: 0 - 95°C; Low Power Array Self Refresh (LP ASR) : Extended <sup>4</sup> ; CKE: Low; External clock: Off; CK <sub>t</sub> and CK <sub>c</sub> : LOW; CL: Refer to Component Datasheet for detail pattern; BL: 8 <sup>1</sup> ; AL: 0; CS <sub>n</sub> , Command, Address, Bank Group Address, Bank Address, Data IO: High; DM <sub>n</sub> : stable at 1; Bank Activity: Extended Temperature Self-Refresh operation; Output Buffer and RTT: Enabled in Mode Registers <sup>2</sup> ; ODT Signal: MID-LEVEL

Symbol	Description
IDD6R IPP6R	Self-Refresh Current: Reduced Temperature Range  TCASE: 0 - 45°C; Low Power Array Self Refresh (LP ASR) : Reduced <sup>4</sup> ; CKE: Low; External clock: Off; CK_t and CK_c#: LOW; CL: Refer to Component Datasheet for detail pattern; BL: 8 <sup>1</sup> ; AL: 0; CS_n#, Command, Address, Bank Group Address, Bank Address, Data IO: High; DM_n:stable at 1; Bank Activity: Extended Temperature Self-Refresh operation; Output Buffer and RTT: Enabled in Mode Registers <sup>2</sup> ; ODT Signal: MID-LEVEL
IDD6A IPP6A	Auto Self-Refresh Current  TCASE: 0 - 95°C; Low Power Array Self Refresh (LP ASR) : Auto <sup>4</sup> ; CKE: Low; External clock: Off; CK_t and CK_c#: LOW; CL: Refer to Component Datasheet for detail pattern; BL: 8 <sup>1</sup> ; AL: 0; CS_n#, Command, Address, Bank Group Address, Bank Address, Data IO: High; DM_n:stable at 1; Bank Activity: Auto Self-Refresh operation; Output Buffer and RTT: Enabled in Mode Registers <sup>2</sup> ; ODT Signal: MID-LEVEL
IDD7 IPP7	Operating Bank Interleave Read Current  CKE: High; External clock: On; tCK, nRC, nRAS, nRCD, nRRD, nFAW, CL: Refer to Component Datasheet for detail pattern; BL: 8 <sup>1</sup> ; AL: CL-1; CS_n: High between ACT and RDA; Command, Address, Bank Group Address, Bank Address Inputs: partially toggling ; Data IO: read data bursts with different data between one burst and the next one ; DM_n: stable at 1; Bank Activity: two times interleaved cycling through banks (0, 1, ...7) with different addressing; Output Buffer and RTT: Enabled in Mode Registers <sup>2</sup> ; ODT Signal: stable at 0; Pattern Details: Refer to Component Datasheet for detail pattern
IDD8 IPP8	Maximum Power Down Current TBD

**Notes :**

1. Burst Length: BL8 fixed by MRS: set MR0 [A1:0=00].
2. Output Buffer Enable - set MR1 [A12 = 0] : Qoff = Output buffer enabled - set MR1 [A2:1 = 00] : Output Driver Impedance Control = RZQ/7  
 RTT\_Nom enable - set MR1 [A10:8 = 011] : RTT\_NOM = RZQ/6 RTT\_WR enable - set MR2 [A10:9 = 01] : RTT\_WR = RZQ/2 RTT\_PARK disable - set MR5 [A8:6 = 000]
3. CAL enabled : set MR4 [A8:6 = 001] : 1600MT/s 010] : 1866MT/s, 2133MT/s 011] : 2400MT/s Gear Down mode enabled :set MR3 [A3 = 1] : 1/4 Rate DLL disabled : set MR1 [A0 = 0] CA parity enabled :set MR5 [A2:0 = 001] : 1600MT/s,1866MT/s, 2133MT/s 010] : 2400MT/s Read DBI enabled : set MR5 [A12 = 1] Write DBI enabled : set :MR5 [A11 = 1]
4. Low Power Array Self Refresh (LP ASR) : set MR2 [A7:6 = 00] : Normal 01] : Reduced Temperature range 10] : Extended Temperature range 11] : Auto Self Refresh

**Table 13 - IDD Specification for SCC16GX03H4F1C-32AA and SCC32GX13H4F1C-32AA**

Product Type	SCC16GX03H4F1C-32AA	SCC32GX13H4F1C-32AA	Unit	Note
Organization	16GB	32GB		
	1 Rank (x8)	2 Rank (x8)		
	x72	x72		
	-32AA	-32AA		
Symbol	Current	Current		
IDD0	414	648	mA	2)
IDD1	486	720	mA	2)
IDD2N	324	648	mA	3)
IDD2NT	360	594	mA	2)
IDD2P	234	468	mA	3)
IDD2Q	306	612	mA	3)
IDD3N	666	1332	mA	3)
IDD3P	585	1170	mA	3)
IDD4R	1341	1575	mA	2)
IDD4W	1287	1521	mA	2)
IDD5B	5211	5445	mA	2)
IDD5F2	3591	3825	mA	2)
IDD5F4	2979	3213	mA	2)
IDD6N	423	846	mA	3)
IDD6E	630	1260	mA	3)
IDD6R	198	396	mA	3)
IDD6A	693	1386	mA	3)
IDD7	1440	1674	mA	2)
IDD8	135	270	mA	3)

- 1) Calculated values from Device data.
- 2) One module rank in the active IDD/IPP, the other rank in IDD2P/IPP3N.
- 3) All ranks in this IDD/IPP condition

**Table 14 - I<sub>PP</sub> Specification for SCC16GX03H4F1C-32AA and SCC32GX13H4F1C-32AA**

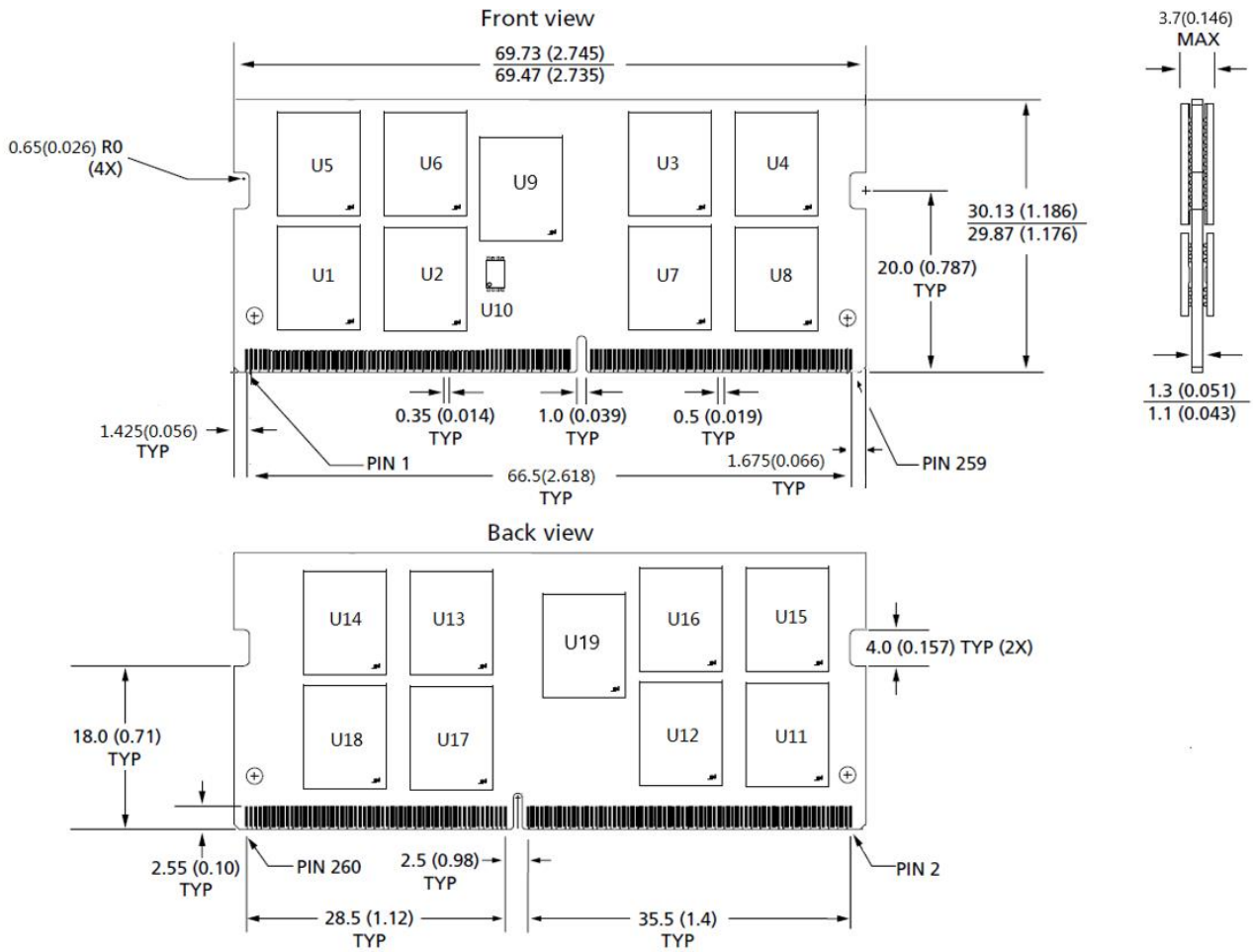
Product Type	SCC16GX03H4F1C-32AA	SCC32GX13H4F1C-32AA	Unit	Note
Organization	16GB	32GB		
	1 Rank (x8)	2 Rank (x8)		
	x72	x72		
	-32AA	-32AA		
Symbol	Current	Current		
IPP0	28.8	48.6	mA	2)
IPP1	31.5	51.3	mA	2)
IPP2N	17.1	34.2	mA	3)
IPP2P	17.1	34.2	mA	3)
IPP3N	19.8	39.6	mA	3)
IPP3P	19.8	39.6	mA	3)
IPP4R	46.8	66.6	mA	2)
IPP4W	46.8	66.6	mA	2)
IPP5B	513	532.8	mA	2)
IPP6N	360	379.8	mA	3)
IPP6E	297	316.8	mA	3)
IPP6R	43.2	86.4	mA	3)
IPP6A	68.4	136.8	mA	3)
IPP7	26.1	52.2	mA	2)
IPP8	60.3	120.6	mA	3)

- 1) Calculated values from Device data.
- 2) One module rank in the active IDD/IPP, the other rank in IDD2P/IPP3N.
- 3) All ranks in this IDD/IPP condition





Figure 4 - Package Dimensions\_SCC32GX13H4F1C-32AA



- Notes: 1. All dimensions are in millimeters (inches); MAX/MIN or typical (TYP) where noted.  
 2. The dimensional diagram is for reference only.

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