- **Organization:**
  - **TM8SR64JPU . . . 8 388 608 x 64 Bits**
  - **TM16SR64JPU . . . 16 777 216 x 64 Bits**
  - **TM8SR72JPU . . . 8 388 608 x 72 Bits**
  - **TM16SR72JPU . . . 16 777 216 x 72 Bits**
- **Designed for 66-MHz 4-Clock Systems**
- **JEDEC 168-Pin Dual-In-Line Memory Module (DIMM) Without Buffer for Use With Socket**
- **TM8SR64JPU — Uses Eight 64M-Bit Synchronous Dynamic RAMs (SDRAMs) (8M × 8-Bit) in Plastic Thin Small-Outline Packages (TSOPs)**
- **TM16SR64JPU — Uses Sixteen 64M-Bit SDRAMs (8M × 8-Bit) in Plastic TSOPs**
- **TM8SR72JPU — Uses Nine 64M-Bit SDRAMs (8M × 8-Bit) in Plastic TSOPs**
- **TM16SR72JPU — Uses Eighteen 64M-Bit SDRAMs (8M × 8-Bit) in Plastic TSOPs**
- **Performance Ranges:**
- **Single 3.3-V Power Supply (±10% Tolerance)**
- **Byte-Read/Write Capability**
- **High-Speed, Low-Noise Low-Voltage TTL (LVTTL) Interface**
- **Read Latencies 2 and 3 Supported**
- **Supports Burst-Interleave and Burst-Interrupt Operations**
- **Burst Length Programmable to 1, 2, 4, and 8**
- **Four Banks for On-Chip Interleaving (Gapless Access)**
- **Ambient Temperature Range 0°C to 70°C**
- **Gold-Plated Contacts**
- **Pipeline Architecture**
- **Serial Presence Detect (SPD) Using EEPROM**

	SYNCHRONOUS CLOCK CYCLE TIME		ACCESS TIME CLOCK TO OUTPUT		REFRESH INTERVAL
	t_{CK3}	t_{CK2}	t_{AC3}	t_{AC2}	t_{REF}
'xSRxxJPU-10	10 ns	15 ns	8 ns	9 ns	64 ms

description

The TM8SR64JPU is a 64M-byte, 168-pin dual-in-line memory module (DIMM). The DIMM is composed of eight TMS664814DGE, 8388608 x 8-bit SDRAMs, each in a 400-mil, 54-pin plastic thin small-outline package (TSOP) mounted on a substrate with decoupling capacitors. See the TMS664814 data sheet (literature number SMOS690).

The TM16SR64JPU is a 128M-byte, 168-pin DIMM. The DIMM is composed of sixteen TMS664814DGE, 8388608 x 8-bit SDRAMs, each in a 400-mil, 54-pin plastic TSOP mounted on a substrate with decoupling capacitors. See the TMS664814 data sheet (literature number SMOS690).

The TM8SR72JPU is a 64M-byte, 168-pin DIMM. The DIMM is composed of nine TMS664814DGE, 8388608 x 8-bit SDRAMs, each in a 400-mil, 54-pin plastic thin small-outline package (TSOP) mounted on a substrate with decoupling capacitors. See the TMS664814 data sheet (literature number SMOS690).

The TM16SR72JPU is a 128M-byte, 168-pin DIMM. The DIMM is composed of eighteen TMS664814DGE, 8388608 x 8-bit SDRAMs, each in a 400-mil, 54-pin plastic TSOP mounted on a substrate with decoupling capacitors. See the TMS664814 data sheet (literature number SMOS690).

Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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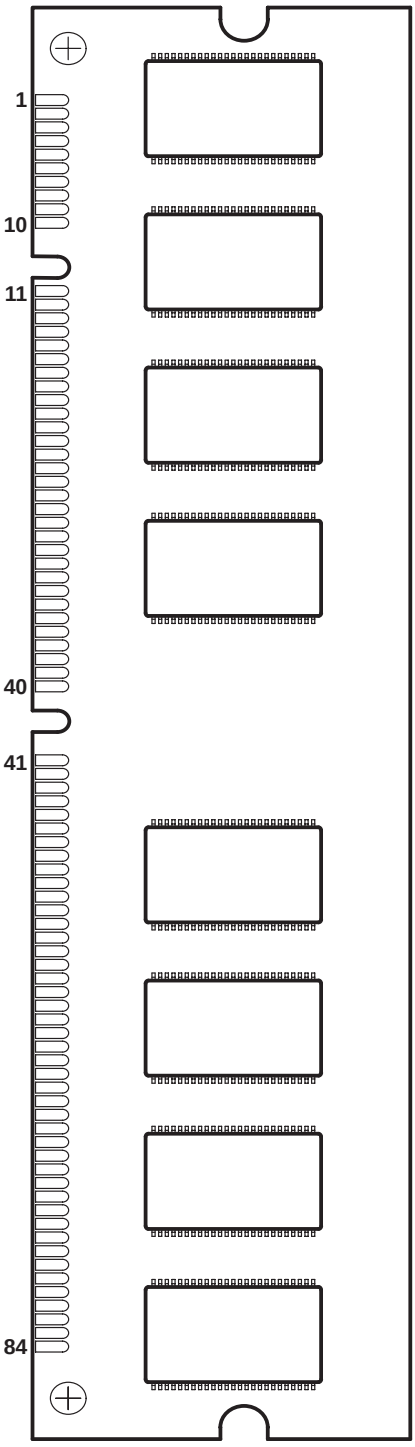
operation

The TM8SR64JPU operates as eight TMS664814DGE devices that are connected as shown in the TM8SR64JPU functional block diagram. The TM16SR64JPU operates as 16 TMS664814DGE devices connected as shown in the TM16SR64JPU functional block diagram. The TM8SR72JPU operates as nine TMS664814DGE devices that are connected as shown in the TM8SR72JPU functional block diagram. The TM16SR72JPU operates as 18 TMS664814DGE devices connected as shown in the TM16SR72JPU functional block diagram.

DUAL-IN-LINE MEMORY MODULE (TOP VIEW)



TM8SR64JPU (SIDE VIEW)

TM16SR64JPU (SIDE VIEW)

PIN NOMENCLATURE

A[0:11]	Row-Address Inputs
A[0:8]	Column-Address Inputs
A13/BA0	Bank-Select Zero
A12/BA1	Bank-Select One
$\overline{\text{CAS}}$	Column-Address Strobe
CB[0:7]	Check Bit In/Check Bit Out
CKE[0:1]	Clock Enable
CK[0:3]	System Clock
DQ[0:63]	Data-In/Data-Out
DQMB[0:7]	Data-In/Data-Out Mask Enable
NC	No Connect
$\overline{\text{RAS}}$	Row-Address Strobe
$\overline{\text{S}}$[0:3]	Chip-Select
SA[0:2]	Serial Presence Detect (SPD) Device Address Input
SCL	SPD Clock
SDA	SPD Address/Data
V_{DD}	3.3-V Supply
$V_{\overline{SS}}$	Ground
$\overline{\text{WE}}$	Write Enable

Pin Assignments

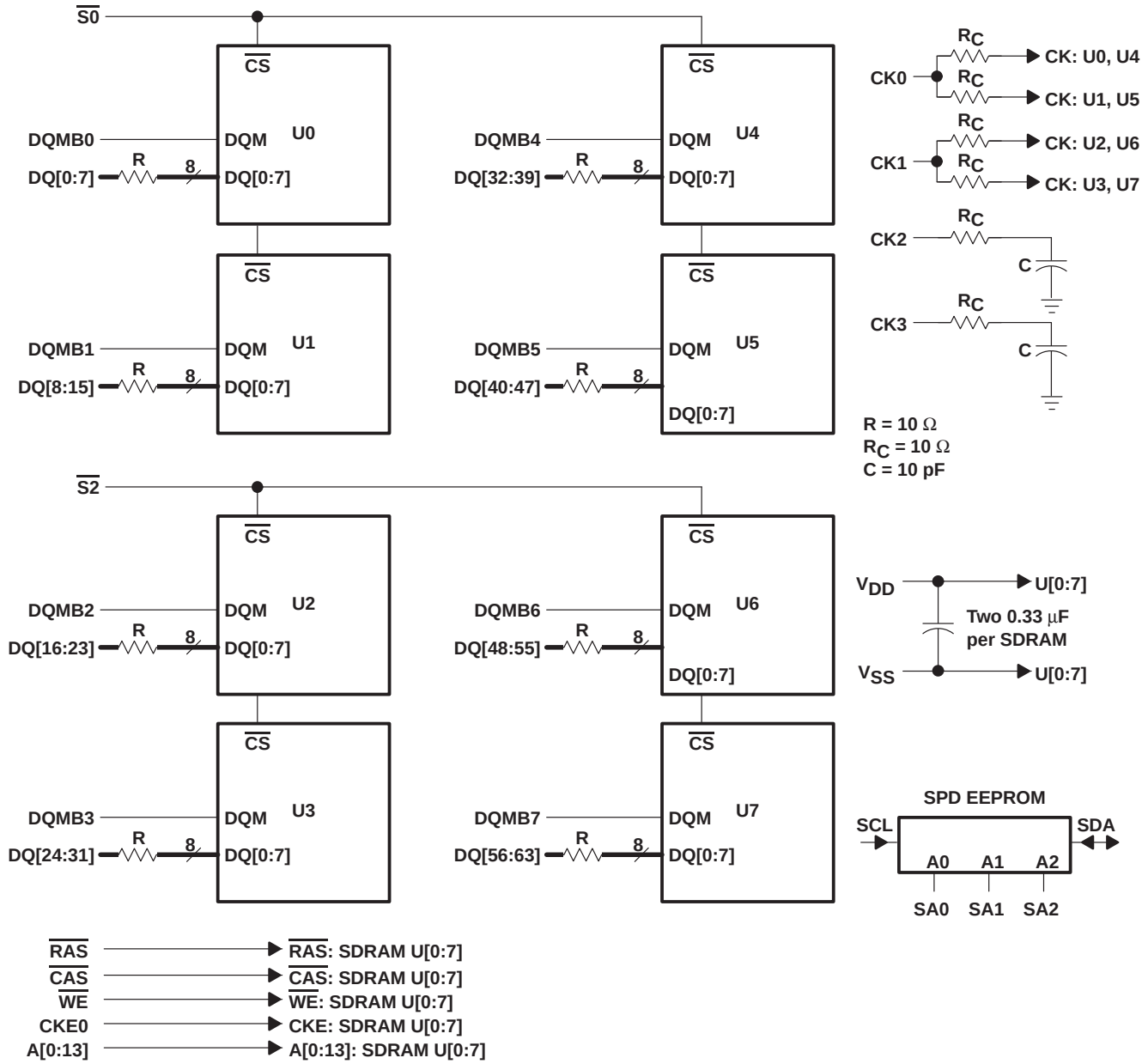
PIN NO.	PIN NAME	PIN NO.	PIN NAME	PIN NO.	PIN NAME	PIN NO.	PIN NAME
1	V_{SS}	43	V_{SS}	85	V_{SS}	127	V_{SS}
2	DQ0	44	NC	86	DQ32	128	CKE0
3	DQ1	45	$\overline{S2}$	87	DQ33	129	$\overline{S3}$
4	DQ2	46	DQMB2	88	DQ34	130	DQMB6
5	DQ3	47	DQMB3	89	DQ35	131	DQMB7
6	V_{DD}	48	NC	90	V_{DD}	132	NC
7	DQ4	49	V_{DD}	91	DQ36	133	V_{DD}
8	DQ5	50	NC	92	DQ37	134	NC
9	DQ6	51	NC	93	DQ38	135	NC
10	DQ7	52	CB2	94	DQ39	136	CB6
11	DQ8	53	CB3	95	DQ40	137	CB7
12	V_{SS}	54	V_{SS}	96	V_{SS}	138	V_{SS}
13	DQ9	55	DQ16	97	DQ41	139	DQ48
14	DQ10	56	DQ17	98	DQ42	140	DQ49
15	DQ11	57	DQ18	99	DQ43	141	DQ50
16	DQ12	58	DQ19	100	DQ44	142	DQ51
17	DQ13	59	V_{DD}	101	DQ45	143	V_{DD}
18	V_{DD}	60	DQ20	102	V_{DD}	144	DQ52
19	DQ14	61	NC	103	DQ46	145	NC
20	DQ15	62	NC	104	DQ47	146	NC
21	CB0	63	CKE1	105	CB4	147	NC
22	CB1	64	V_{SS}	106	CB5	148	V_{SS}
23	V_{SS}	65	DQ21	107	V_{SS}	149	DQ53
24	NC	66	DQ22	108	NC	150	DQ54
25	NC	67	DQ23	109	NC	151	DQ55
26	V_{DD}	68	V_{SS}	110	V_{DD}	152	V_{SS}
27	$\overline{WE}$	69	DQ24	111	$\overline{CAS}$	153	DQ56
28	DQMB0	70	DQ25	112	DQMB4	154	DQ57
29	DQMB1	71	DQ26	113	DQMB5	155	DQ58
30	$\overline{S0}$	72	DQ27	114	$\overline{S1}$	156	DQ59
31	NC	73	V_{DD}	115	$\overline{RAS}$	157	V_{DD}
32	V_{SS}	74	DQ28	116	V_{SS}	158	DQ60
33	A0	75	DQ29	117	A1	159	DQ61
34	A2	76	DQ30	118	A3	160	DQ62
35	A4	77	DQ31	119	A5	161	DQ63
36	A6	78	V_{SS}	120	A7	162	V_{SS}
37	A8	79	CK2	121	A9	163	CK3
38	A10	80	NC	122	A13/BA0	164	NC
39	A12/BA1	81	NC	123	A11	165	SA0
40	V_{DD}	82	SDA	124	V_{DD}	166	SA1
41	V_{DD}	83	SCL	125	CK1	167	SA2
42	CK0	84	V_{DD}	126	NC	168	V_{DD}

dual-in-line memory module and components

The dual-in-line memory module and components include:

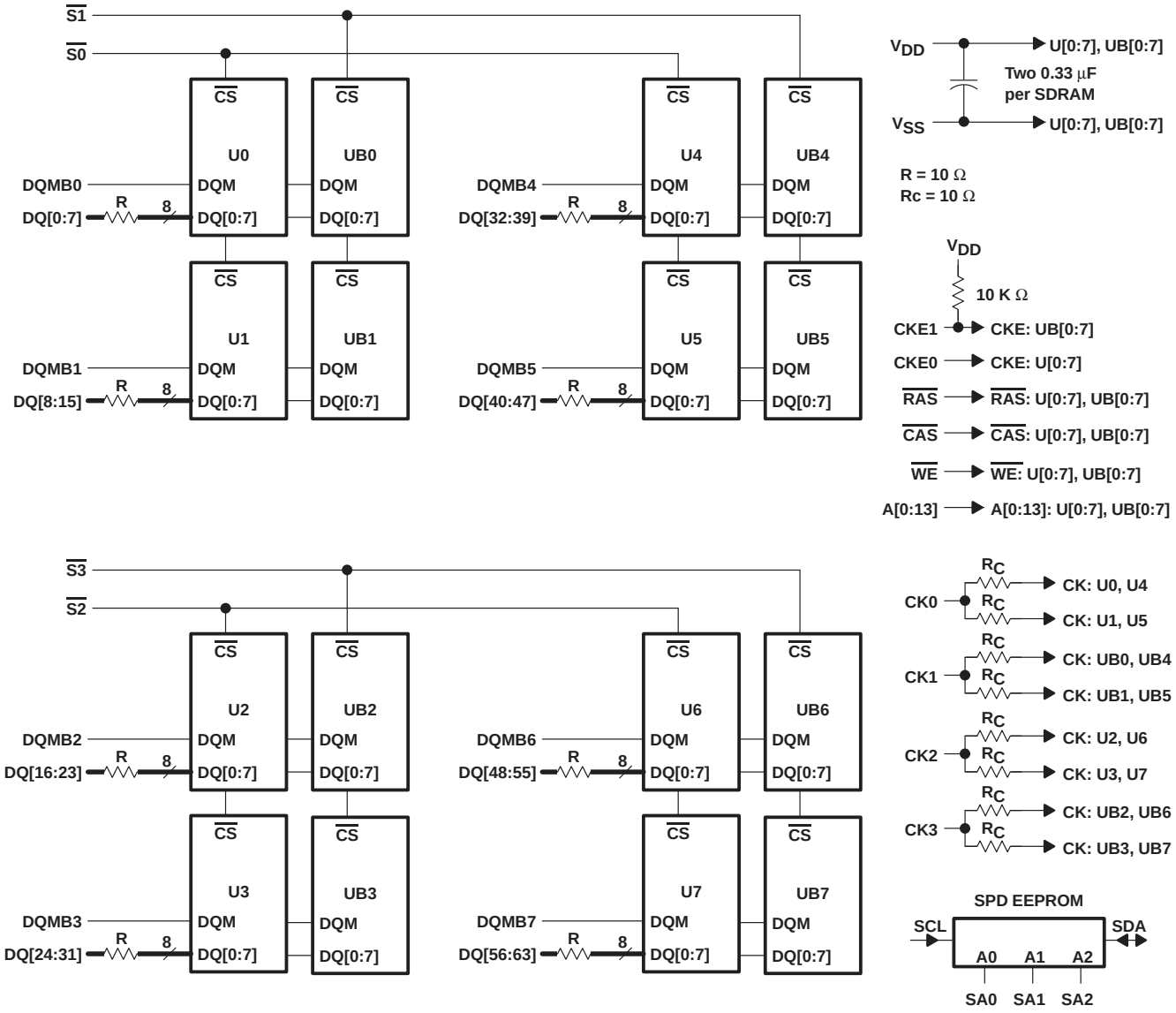
- PC substrate: 1,27 ± 0,1 mm (0.05 inch) nominal thickness; 0.005 inch/inch maximum warpage
- Bypass capacitors: Multilayer ceramic
- Contact area: Nickel plate and gold plate over copper

functional block diagram for the TM8SR64JPU

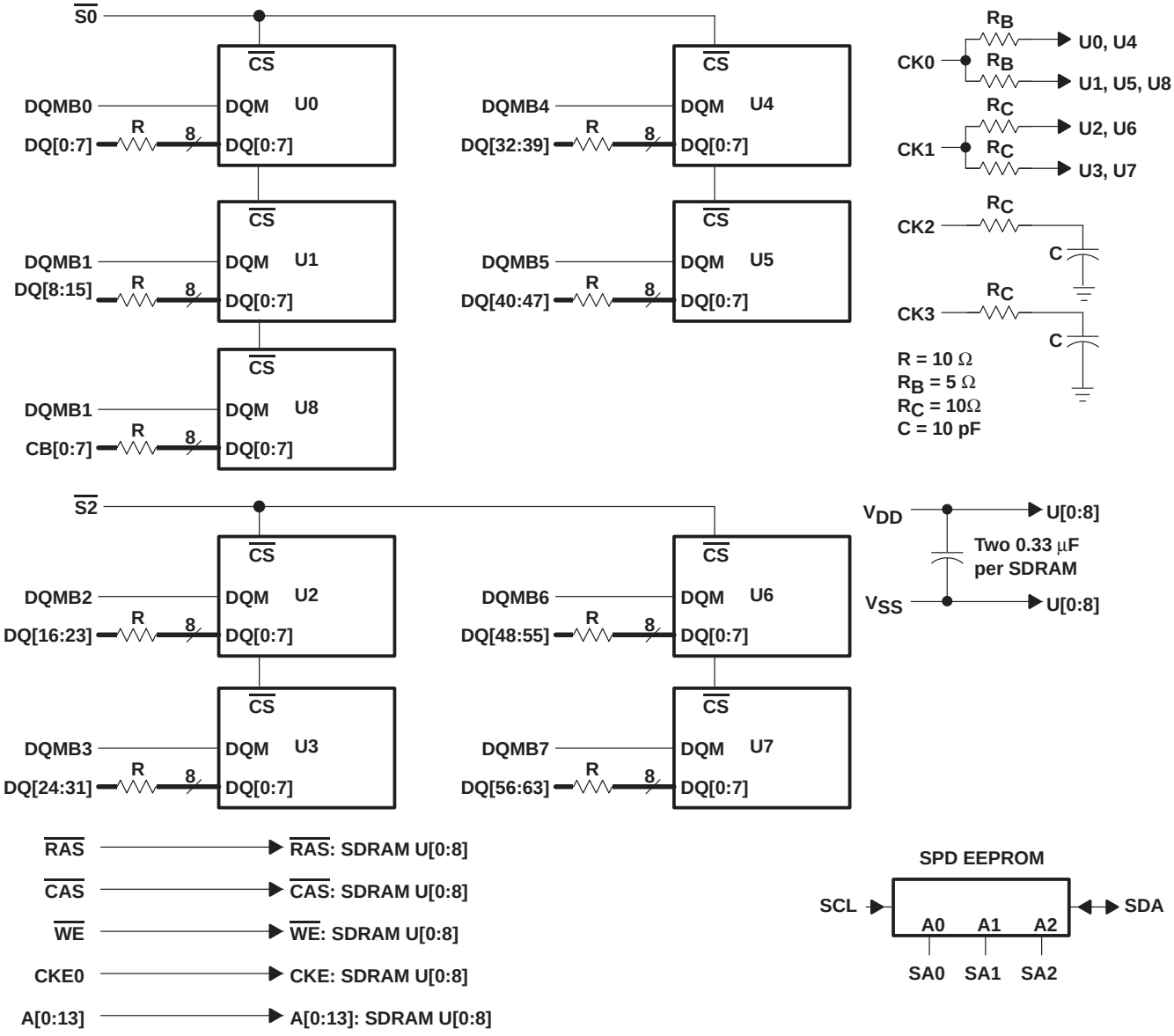


Legend:
CS = Chip select
SPD = Serial presence detect

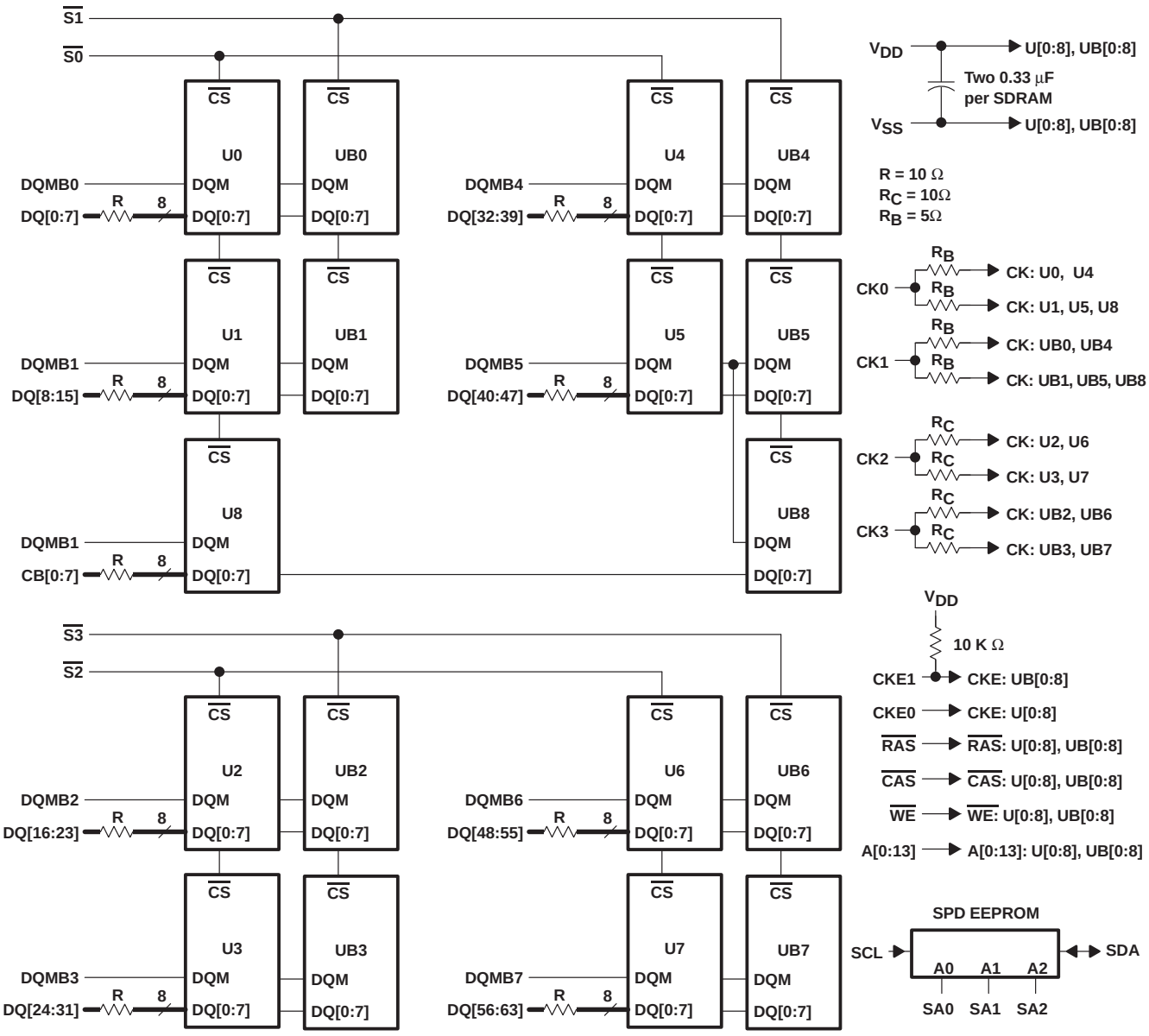
functional block diagram for the TM16SR64JPU



functional block diagram for the TM8SR72JPU



functional block diagram for the TM16SR72JPU



absolute maximum ratings over ambient temperature range (unless otherwise noted)†

Supply voltage range, V_{DD} . . . . . –0.5 V to 4.6 V
Voltage range on any pin (see Note 1) . . . . . – 0.5 V to 4.6 V
Short-circuit output current . . . . . 50 mA
Power dissipation: TM8SR64JPU . . . . . 8 W
TM16SR64JPU . . . . . 16 W
TM8SR72JPU . . . . . 9 W
TM16SR72JPU . . . . . 18 W
Ambient temperature range, T_A . . . . . 0°C to 70°C
Storage temperature range, T_{stg} . . . . . – 55°C to 125°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: All voltage values are with respect to V_{SS}.

recommended operating conditions

		MIN	NOM	MAX	UNIT
V_{DD}	Supply voltage	3	3.3	3.6	V
V_{SS}	Supply voltage		0		V
V_{IH}	High-level input voltage	2		V_{DD} + 0.3	V
V_{IH-SPD}	High-level input voltage for SPD device	2		5.5	V
V_{IL}	Low-level input voltage	–0.3		0.8	V
T_A	Ambient temperature	0		70	°C

capacitance over recommended ranges of supply voltage and ambient temperature, f = 1 MHz (see Note 2)‡

PARAMETER		TMxSRxxJPU		UNIT
		MIN	MAX	
$C_{i(CK)}$	Input capacitance, CK input		5	pF
$C_{i(AC)}$	Input capacitance, address and control inputs: A0–A13, $\overline{RAS}$, $\overline{CAS}$, $\overline{WE}$		5	pF
$C_{i(CKE)}$	Input capacitance, CKE input		5	pF
C_o	Output capacitance		7	pF
$C_{i(DQMBx)}$	Input capacitance, DQMBx input		5	pF
$C_{i(Sx)}$	Input capacitance, $\overline{Sx}$ input		5	pF
$C_{i/o(SDA)}$	SDA Input/output capacitance		9	pF
$C_{i(SPD)}$	Input capacitance, SA0, SA1, SA2, SCL inputs		7	pF

‡ Specifications in this table represent a single SDRAM device.

NOTE 2: V_{DD} = 3.3 V ± 0.3 V. Bias on pins under test is 0 V.

electrical characteristics over recommended ranges of supply voltage and ambient temperature (unless otherwise noted) (see Note 3)†

PARAMETER		TEST CONDITIONS		'xSRxxJPU-10 MIN	'xSRxxJPU-10 MAX	UNIT
V_{OH}	High-level output voltage	I_{OH} = – 2 mA		2.4		V
V_{OL}	Low-level output voltage	I_{OL} = 2 mA			0.4	V
I_I	Input current (leakage)	0 V < V_I < V_{DD} + 0.3 V, All other pins = 0 V to V_{DD}			±10	µA
I_O	Output current (leakage)	0 V < V_O < V_{DD} +0.3 V, Output disabled			±10	µA
I_{CC1}	Operating current	Burst length = 1, $t_{RC} \geq t_{RC}$ MIN, I_{OH}/I_{OL} = 0 mA, (see Notes 4, 5, and 6)	CAS latency = 2		105	mA
			CAS latency = 3		135	mA
I_{CC2P}	Precharge standby current in power-down mode	CKE ≤ V_{IL} MAX, t_{CK} = 15 ns (see Note 7)			2	mA
I_{CC2PS}		CKE and CK ≤ V_{IL} MAX, t_{CK} = ∞ (see Note 8)			2	mA
I_{CC2N}	Precharge standby current in non-power-down mode	CKE ≥ V_{IH} MIN, t_{CK} = 15 ns (see Note 7)			40	mA
I_{CC2NS}		t_{CK} = ∞ (see Note 8)			3	mA
I_{CC3P}	Active standby current in power-down mode	CKE ≤ V_{IL} MAX, t_{CK} = 15 ns (see Notes 4 and 7)			15	mA
I_{CC3PS}		CKE and CK ≤ V_{IL} MAX, t_{CK} = ∞ (see Notes 4 and 8)			15	mA
I_{CC3N}	Active standby current in non-power-down mode	CKE ≥ V_{IH} MIN, t_{CK} = 15 ns (see Notes 4 and 7)			70	mA
I_{CC3NS}		CKE ≥ V_{IH} MIN, CK ≤ V_{IL} MAX, t_{CK} = ∞ (see Notes 4 and 8)			20	mA
I_{CC4}	Burst current	Page burst, I_{OH}/I_{OL} = 0 mA All banks activated, n_{CCD} = one cycle (see Notes 9 and 10)	CAS latency = 2		130	mA
			CAS latency = 3		185	mA
I_{CC5}	Auto-refresh current	$t_{RC} \leq t_{RC}$ MIN (see Notes 5 and 8)	CAS latency = 2		165	mA
			CAS latency = 3		195	mA
I_{CC6}	Self-refresh current	CKE ≤ V_{IL} MAX			2	mA

† Specifications in this table represent a single SDRAM device.

NOTES: 3. All specifications apply to the device after power-up initialization. All control and address inputs must be stable and valid.
4. Only one bank is activated.
5. $t_{RC} \geq t_{RC}$MIN
6. Control and address inputs change state twice during t_{RC}.
7. Control and address inputs change state once every 30 ns.
8. Control and address inputs do not change state (stable).
9. Control and address inputs change once every cycle.
10. Continuous burst access, n_{CCD} = 1 cycle

ac timing requirements†

			’xxSRxxJPU-10		UNIT
			MIN	MAX	
t_{CK2}	Cycle time, CK	CAS latency = 2	15		ns
t_{CK3}	Cycle time, CK	CAS latency = 3	10		ns
t_{CH}	Pulse duration, CK high		3		ns
t_{CL}	Pulse duraction, CK low		3		ns
t_{AC2}	Access time, CK high to data out (see Note 11)	CAS latency = 2		9	ns
t_{AC3}	Access time, CK high to data out (see Note 11)	CAS latency = 3		8	ns
t_{OH}	Hold time, CK high to data out		3		ns
t_{LZ}	Delay time, CK high to DQ in low–impedance state (see Note 12)		1		ns
t_{HZ}	Delay time, CK high to DQ in high–impedance state (see Note 13)			8	ns
t_{IS}	Setup time, address, control, and data input		3		ns
t_{IH}	Hold time, address, control, and data input		1		ns
t_{CESP}	Power down/self–refresh exit time		10		ns
t_{RAS}	Delay time, ACTV command to DEAC or DCAB command		50	10000	ns
t_{RC}	Delay time, ACTV, MRS, REFR, or SLFR to ACTV, MRS, REFR, or SLFR command		80		ns
t_{RCD}	Delay time, ACTV command to READ, READ–P, WRT, or WRT–P command (see Note 14)		30		ns
t_{RP}	Delay time, DEAC or DCAB command to ACTV, MRS, REFR, or SLFR command		30		ns
t_{RRD}	Delay time, ACTV command in one bank to ACTV command in the other bank		20		ns
t_{RSA}	Delay time, MRS command to ACTV, MRS, REFR, or SLFR command		20		ns
t_{APR}	Final data out of READ–P operation to ACTV, MRS, SLFR, or REFR command		t_{RP} – (CL–1)* t_{CK}		ns
t_{APW}	Final data in of WRT–P operation to ACTV, MRS, SLFR, or REFR command		t_{RP} + 1 t_{CK}		ns
t_{WR}	Delay time, final data in of WRT operation to DEAC or DCAB command		10		ns
t_T	Transition time		1	5	ms

† All references are made to the rising transition of CK unless otherwise noted.

NOTES: 11. t_{AC} is referenced from the rising transition of CK that precedes the data-out cycle. For example, the first data out t_{AC} is referenced from the rising transition of CK that is read latency (one cycle after the READ command). Access time is measured at output reference level 1.4 V.

12. t_{LZ} is measured from the rising transition of CK that is read latency (one cycle after the READ command).
13. t_{HZ} (max) defines the time at which the outputs are no longer driven and is not referenced to output voltage levels.
14. For read or write operations with automatic deactivate, t_{RCD} must be set to satisfy minimum t_{RAS}.

clock timing requirements†

			’xxSRxxJPU-10		UNIT‡
			MIN	MAX	
t_{REF}	Refresh interval			64	ms
n_{CCD}	Delay time, READ or WRT command to an interrupting command		1		cycles
n_{CDD}	Delay time, CS low or high to input enabled or inhibited		0	0	cycles
n_{CLE}	Delay time, CKE high or low to CLK enabled or disabled		1	1	cycles
n_{CWL}	Delay time, final data in of WRT operation to READ, READ-P, WRT, or WRT-P		1		cycles
n_{DID}	Delay time, ENBL or MASK command to enabled or masked data in		0	0	cycles
n_{DOD}	Delay time, ENBL or MASK command to enabled or masked data out		2	2	cycles
n_{HZP2}	Delay time, DEAC or DCAB, command to DQ in high–impedance state	CAS latency = 2		2	cycles
n_{HZP3}	Delay time, DEAC or DCAB, command to DQ in high–impedance state	CAS latency = 3		3	cycles
n_{WCD}	Delay time, WRT command to first data in		0	0	cycles

† All references are made to the rising transition of CK unless otherwise noted.
‡ A CK cycle can be considered as contributing to a timing requirement for those parameters defined in cycle units only when not gated by CKE (those CK cycles occurring during the time when CKE is asserted low).

serial presence detect

The serial presence detect (SPD) is contained in a 2K-bit serial EEPROM located on the module. The SPD nonvolatile EEPROM contains various data such as module configuration, SDRAM organization, and timing parameters (see tables below). Only the first 128 bytes are programmed by Texas Instruments, while the remaining 128 bytes are available for customer use. Programming is done through an IIC bus using the clock (SCL) and data (SDA) signals. All Texas Instruments modules comply with the current JEDEC SPD Standard. See the *Texas Instruments Serial Presence Detect Technical Reference* (literature number SMMU001) for further details.

Tables in this section list the SPD contents as follows:

Table 1—TM8SR64JPU Table 2—TM16SR64JPU
Table 3—TM8SR72JPU Table 4—TM16SR72JPU

Table 1. Serial Presence Detect Data for the TM8SR64JPU

BYTE NO.	DESCRIPTION OF FUNCTION	TM8SR64JPU-10	
		ITEM	DATA
0	Defines number of bytes written into serial memory during module manufacturing	128 bytes	80h
1	Total number of bytes of SPD memory device	256 bytes	08h
2	Fundamental memory type (FPM, EDO, SDRAM, . . .)	SDRAM	04h
3	Number of row addresses on this assembly	12	0Ch
4	Number of column addresses on this assembly	9	09h
5	Number of module rows on this assembly	1 bank	01h
6	Data width of this assembly	64 bits	40h
7	Data width continuation		00h
8	Voltage interface standard of this assembly	LVTTL	01h
9	SDRAM cycle time at maximum supported CAS latency (CL), CL = X	t_{CK} = 10 ns	A0h
10	SDRAM access from clock at CL = X	t_{AC} = 8 ns	80h
11	DIMM configuration type (non-parity, parity, error correcting code [ECC])	Non-Parity	00h
12	Refresh rate/type	15.6 µs/ self-refresh	80h
13	SDRAM width, primary DRAM	x8	08h
14	Error-checking SDRAM data width	N/A	00h
15	Minimum clock delay, back-to-back random column addresses	1 CK cycle	01h
16	Burst lengths supported	1, 2, 4, 8	0Fh
17	Number of banks on each SDRAM device	4 banks	04h
18	CAS latencies supported	2, 3	06h
19	CS latency	0	01h
20	Write latency	0	01h
21	SDRAM module attributes	Non-buffered/ Non-registered	00h

serial presence detect (continued)

Table 1. Serial Presence Detect Data for the TM8SR64JPU (Continued)

BYTE NO.	DESCRIPTION OF FUNCTION	TM8SR64JPU-10	
		ITEM	DATA
22	SDRAM device attributes: general	V_{DD} tolerance = (±10%), Burst read/write, precharge all, auto precharge	0Eh
23	Minimum clock cycle time at CL = X – 1	t_{CK} = 15 ns	F0h
24	Maximum data-access time from clock at CL = X – 1	t_{AC} = 9 ns	90h
25	Minimum clock cycle time at CL = X – 2	N/A	00h
26	Maximum data-access time from clock at CL = X – 2	N/A	00h
27	Minimum row precharge time	t_{RP} = 30 ns	1Eh
28	Minimum row-active to row-active delay	t_{RRD} = 20 ns	14h
29	Minimum $\overline{RAS}$-to-$\overline{CAS}$ delay	t_{RCD} = 30 ns	1Eh
30	Minimum $\overline{RAS}$ pulse width	t_{RAS} = 50 ns	32h
31	Density of each bank on module	64M Bytes	10h
32	Command and address signal input setup time	t_{IS} = 3 ns	30h
33	Command and address signal input hold time	t_{IH} = 1 ns	10h
34	Data signal input setup time	t_{IS} = 3 ns	30h
35	Data signal input hold time	t_{IH} = 1 ns	10h
36 – 61	Superset features (may be used in the future)		
62	SPD revision	Rev. 2	02h
63	Checksum for byte 0 – 62	73	49h
64 – 71	Manufacturer's JEDEC ID code per JEP – 106E	97h	9700...00h
72	Manufacturing location†	TBD	
73 – 90	Manufacturer's part number†	TBD	
91	Die revision code†	TBD	
92	PCB revision code†	TBD	
93 – 94	Manufacturing date†	TBD	
95 – 98	Assembly serial number†	TBD	
99 – 125	Manufacturer specific data†	TBD	
126 – 127	Vendor specific data†	TBD	
128–166	System integrator's specific data‡	TBD	
167–255	Open		

† TBD indicates values are determined at manufacturing time and are module-dependent.
‡ These TBD values are determined and programmed by the customer (optional).

serial presence detect (continued)

Table 2. Serial Presence Detect Data for the TM16SR64JPU

BYTE NO.	DESCRIPTION OF FUNCTION	TM16SR64JPU-10	
		ITEM	DATA
0	Defines number of bytes written into serial memory during module manufacturing	128 bytes	80h
1	Total number of bytes of SPD memory device	256 bytes	08h
2	Fundamental memory type (FPM, EDO, SDRAM, . . .)	SDRAM	04h
3	Number of row addresses on this assembly	12	0Ch
4	Number of column addresses on this assembly	9	09h
5	Number of module rows on this assembly	2 banks	02h
6	Data width of this assembly	64 bits	40h
7	Data width continuation		00h
8	Voltage interface standard of this assembly	LVTTL	01h
9	SDRAM cycle time at maximum supported CAS latency (CL), CL = X	t_{CK} = 10 ns	A0h
10	SDRAM access from clock at CL = X	t_{AC} = 8 ns	80h
11	DIMM configuration type (non-parity, parity, error correcting code [ECC])	Non-Parity	00h
12	Refresh rate/type	15.6 µs/ self-refresh	80h
13	SDRAM width, primary DRAM	x8	08h
14	Error-checking SDRAM data width	N/A	00h
15	Minimum clock delay, back-to-back random column addresses	1 CK cycle	01h
16	Burst lengths supported	1, 2, 4, 8	0Fh
17	Number of banks on each SDRAM device	4 banks	04h
18	CAS latencies supported	2, 3	06h
19	CS latency	0	01h
20	Write latency	0	01h
21	SDRAM module attributes	Non-buffered/ Non-registered	00h
22	SDRAM device attributes: general	V_{DD} tolerance = (±10%). Burst read/write, precharge all, auto precharge	0Eh
23	Minimum clock cycle time at CL = X – 1	t_{CK} = 15 ns	F0h
24	Maximum data-access time from clock at CL = X – 1	t_{AC} = 9 ns	90h
25	Minimum clock cycle time at CL = X – 2	N/A	00h
26	Maximum data-access time from clock at CL = X – 2	N/A	00h

serial presence detect (continued)

Table 2. Serial Presence Detect Data for the TM16SR64JPU (Continued)

BYTE NO.	DESCRIPTION OF FUNCTION	TM16SR64JPU-10	
		ITEM	DATA
27	Minimum row precharge time	t_{RP} = 30 ns	1Eh
28	Minimum row-active to row-active delay	t_{RRD} = 20 ns	14h
29	Minimum $\overline{RAS}$-to-$\overline{CAS}$ delay	t_{RCD} = 30 ns	1Eh
30	Minimum $\overline{RAS}$ pulse width	t_{RAS} = 50 ns	32h
31	Density of each bank on module	64M Bytes	10h
32	Command and address signal input setup time	t_{IS} = 3 ns	30h
33	Command and address signal input hold time	t_{IH} = 1 ns	10h
34	Data signal input setup time	t_{IS} = 3 ns	30h
35	Data signal input hold time	t_{IH} = 1 ns	10h
36–61	Superset features (may be used in the future)		
62	SPD revision	Rev. 2	02h
63	Checksum for byte 0 – 62	74	4Ah
64 – 71	Manufacturer's JEDEC ID code per JEP – 106E	97h	9700...00h
72	Manufacturing location†	TBD	
73 – 90	Manufacturer's part number†	TBD	
91	Die revision code†	TBD	
92	PCB revision code†	TBD	
93 – 94	Manufacturing date†	TBD	
95 – 98	Assembly serial number†	TBD	
99 – 125	Manufacturer specific data†	TBD	
126 – 127	Vendor specific data†	TBD	
128–166	System integrator's specific data‡	TBD	
167–255	Open		

† TBD indicates values are determined at manufacturing time and are module-dependent.
‡ These TBD values are determined and programmed by the customer (optional).

serial presence detect (continued)

Table 3. Serial Presence Detect Data for the TM8SR72JPU

BYTE NO.	DESCRIPTION OF FUNCTION	TM8SR72JPU-10	
		ITEM	DATA CONTENTS
0	Defines number of bytes written into serial memory during module manufacturing	128 bytes	80h
1	Total number of bytes of SPD memory device	256 bytes	08h
2	Fundamental memory type (FPM, EDO, SDRAM, . . .)	SDRAM	04h
3	Number of row addresses on this assembly	12	0Ch
4	Number of column addresses on this assembly	9	09h
5	Number of module rows on this assembly	1 bank	01h
6	Data width of this assembly	72 bits	48h
7	Data width continuation		00h
8	Voltage interface standard of this assembly	LVTTL	01h
9	SDRAM cycle time at maximum supported CAS latency (CL), CL = X	t_{CK} = 10 ns	A0h
10	SDRAM access from clock at CL = X	t_{AC} = 8 ns	80h
11	DIMM configuration type (non-parity, parity, error correcting code [ECC])	ECC	02h
12	Refresh rate/type	15.6 µs/ self-refresh	80h
13	SDRAM width, primary DRAM	x8	08h
14	Error-checking SDRAM data width	x8	08h
15	Minimum clock delay, back-to-back random column addresses	1 CK cycle	01h
16	Burst lengths supported	1, 2, 4, 8	0Fh
17	Number of banks on each SDRAM device	4 banks	04h
18	CAS latencies supported	2, 3	06h
19	CS latency	0	01h
20	Write latency	0	01h
21	SDRAM module attributes	Non-buffered/ Non-registered	00h
22	SDRAM device attributes: general	V_{DD} tolerance = (±10%), Burst read/write, precharge all, auto precharge	0Eh
23	Minimum clock cycle time at CL = X – 1	t_{CK} = 15 ns	F0h
24	Maximum data-access time from clock at CL = X – 1	t_{AC} = 9 ns	90h
25	Minimum clock cycle time at CL = X – 2	N/A	00h
26	Maximum data-access time from clock at CL = X – 2	N/A	00h
27	Minimum row precharge time	t_{RP} = 30 ns	1Eh
28	Minimum row-active to row-active delay	t_{RRD} = 20 ns	14h
29	Minimum $\overline{RAS}$-to-$\overline{CAS}$ delay	t_{RCD} = 30 ns	1Eh
30	Minimum $\overline{RAS}$ pulse width	t_{RAS} = 50 ns	32h
31	Density of each bank on module	64M Bytes	10h

serial presence detect (continued)

Table 3. Serial Presence Detect Data for the TM8SR72JPU (Continued)

BYTE NO.	DESCRIPTION OF FUNCTION	TM8SR72JPU-10	
		ITEM	DATA CONTENTS
32	Command and address signal input setup time	t_{IS} = 3 ns	30h
33	Command and address signal input hold time	t_{IH} = 1 ns	10h
34	Data signal input setup time	t_{IS} = 3 ns	30h
35	Data signal input hold time	t_{IH} = 1 ns	10h
36–61	Superset features (may be used in the future)		
62	SPD revision	Rev. 2	02h
63	Checksum for byte 0–62	91	5Bh
64–71	Manufacturer's JEDEC ID code per JEP–106E	97h	9700...00h
72	Manufacturing location†	TBD	
73–90	Manufacturer's part number†	TBD	
91	Die revision code†	TBD	
92	PCB revision code†	TBD	
93–94	Manufacturing date†	TBD	
95–98	Assembly serial number†	TBD	
99–125	Manufacturer specific data†	TBD	
126–127	Vendor specific data†	TBD	
128–166	System integrator's specific data‡	TBD	
167–255	Open		

† TBD indicates values are determined at manufacturing time and are module-dependent.
‡ These TBD values are determined and programmed by the customer (optional).

serial presence detect (continued)

Table 4. Serial Presence Detect Data for the TM16SR72JPU

BYTE NO.	DESCRIPTION OF FUNCTION	TM16SR72JPU-10	
		ITEM	DATA
0	Defines number of bytes written into serial memory during module manufacturing	128 bytes	80h
1	Total number of bytes of SPD memory device	256 bytes	08h
2	Fundamental memory type (FPM, EDO, SDRAM, . . .)	SDRAM	04h
3	Number of row addresses on this assembly	12	0Ch
4	Number of column addresses on this assembly	9	09h
5	Number of module rows on this assembly	2 banks	02h
6	Data width of this assembly	72 bits	48h
7	Data width continuation		00h
8	Voltage interface standard of this assembly	LVTTL	01h
9	SDRAM cycle time at maximum supported CAS latency (CL), CL = X	t_{CK} = 10 ns	A0h
10	SDRAM access from clock at CL = X	t_{AC} = 8 ns	80h
11	DIMM configuration type (non-parity, parity, error correcting code [ECC])	ECC	02h
12	Refresh rate/type	15.6 µs/ self-refresh	80h
13	SDRAM width, primary DRAM	x8	08h
14	Error-checking SDRAM data width	x8	08h
15	Minimum clock delay, back-to-back random column addresses	1 CK cycle	01h
16	Burst lengths supported	1, 2, 4, 8	0Fh
17	Number of banks on each SDRAM device	4 banks	04h
18	CAS latencies supported	2, 3	06h
19	CS latency	0	01h
20	Write latency	0	01h
21	SDRAM module attributes	Non-buffered/ Non-registered	00h
22	SDRAM device attributes: general	V_{DD} tolerance = (±10%). Burst read/write, precharge all, auto precharge	0Eh
23	Minimum clock cycle time at CL = X – 1	t_{CK} = 15 ns	F0h
24	Maximum data-access time from clock at CL = X – 1	t_{AC} = 9 ns	90h
25	Minimum clock cycle time at CL = X – 2	N/A	00h
26	Maximum data-access time from clock at CL = X – 2	N/A	00h
27	Minimum row precharge time	t_{RP} = 30 ns	1Eh
28	Minimum row-active to row-active delay	t_{RRD} = 20 ns	14h
29	Minimum $\overline{RAS}$-to-$\overline{CAS}$ delay	t_{RCD} = 30 ns	1Eh
30	Minimum $\overline{RAS}$ pulse width	t_{RAS} = 50 ns	32h
31	Density of each bank on module	64M Bytes	10h

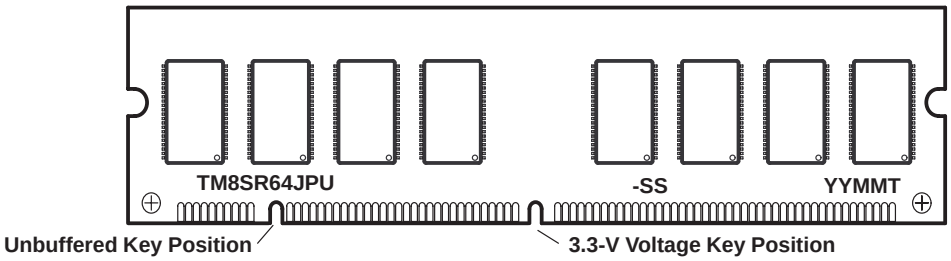
serial presence detect (continued)

Table 4. Serial Presence Detect Data for the TM16SR72JPU (Continued)

BYTE NO.	DESCRIPTION OF FUNCTION	TM16SR72JPU-10	
		ITEM	DATA
32	Command and address signal input setup time	t_{IS} = 3 ns	30h
33	Command and address signal input hold time	t_{IH} = 1 ns	10h
34	Data signal input setup time	t_{IS} = 3 ns	30h
35	Data signal input hold time	t_{IH} = 1 ns	10h
36–61	Superset features (may be used in the future)		
62	SPD revision	Rev. 2	02h
63	Checksum for byte 0 – 62	92	5Ch
64 – 71	Manufacturer's JEDEC ID code per JEP – 106E	97h	9700...00h
72	Manufacturing location†	TBD	
73 – 90	Manufacturer's part number†	TBD	
91	Die revision code†	TBD	
92	PCB revision code†	TBD	
93 – 94	Manufacturing date†	TBD	
95 – 98	Assembly serial number†	TBD	
99 – 125	Manufacturer specific data†	TBD	
126 – 127	Vendor specific data†	TBD	
128–166	System integrator's specific data‡	TBD	
167–255	Open		

† TBD indicates values are determined at manufacturing time and are module-dependent.
‡ These TBD values are determined and programmed by the customer (optional).

device symbolization (TM8SR64JPU)

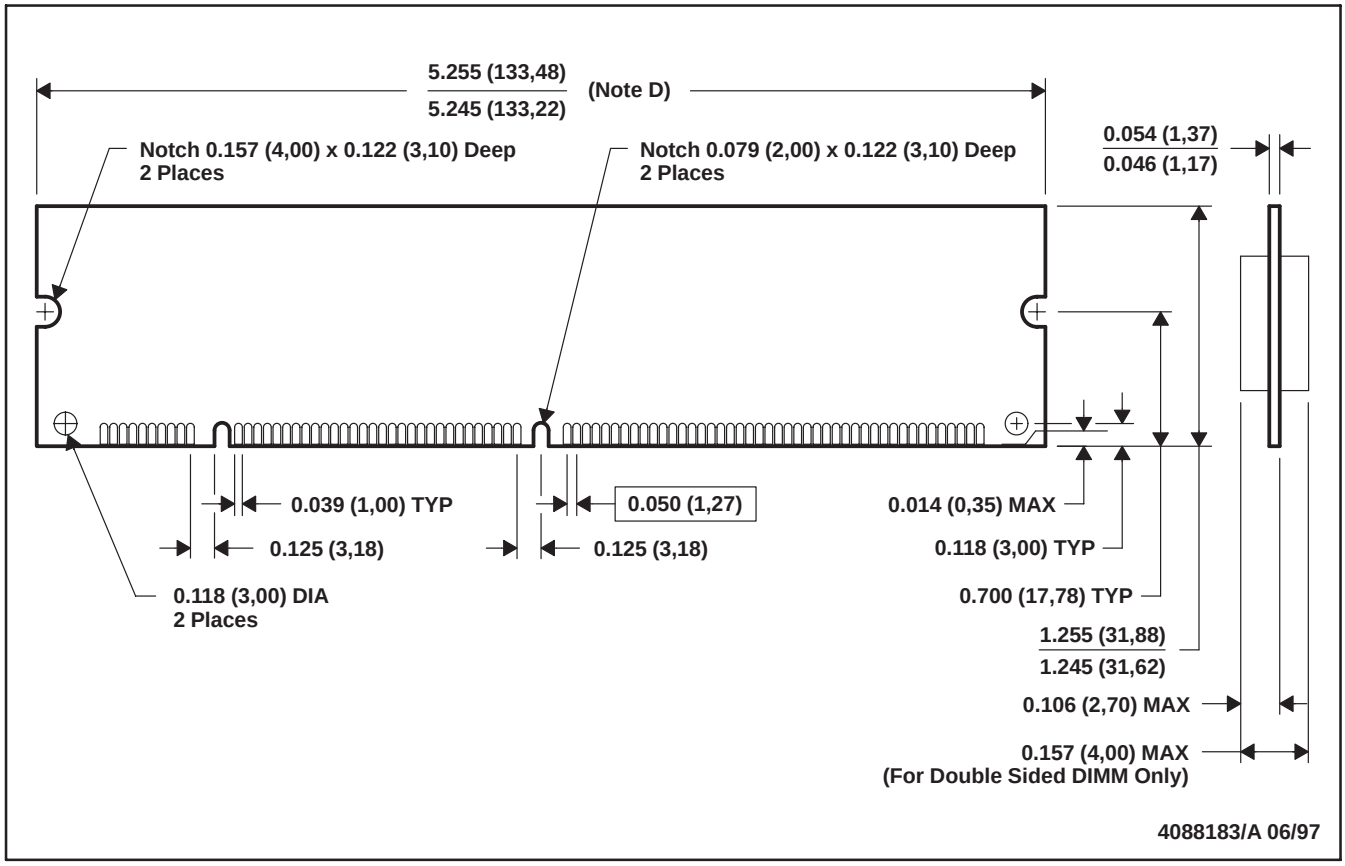


YY = Year Code
MM = Month Code
T = Assembly Site Code
-SS = Speed Code

NOTE A: Location of symbolization may vary.

MECHANICAL DATA

BU (R-PDIM-N168) **DUAL IN-LINE MEMORY MODULE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-161
D. Dimension includes de-panelization variations; applies between notch and tab edge.
E. Outline may vary above notches to allow router/panelization irregularities.

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