

## TOSHIBA MOS DIGITAL INTEGRATED CIRCUIT SILICON GATE CMOS

524,288-WORD BY 16-BIT FULL CMOS STATIC RAM

Lead-Free

### DESCRIPTION

The TC55VCM316B, TC55VEM316B, TC55YCM316B and TC55YEM316B is a 8,388,608-bit static random access memory (SRAM) organized as 524,288 words by 16 bits. Fabricated using Toshiba's CMOS Silicon gate process technology, this device operates from a single 2.3 to 3.6 V/1.65 to 2.2 V power supply. Advanced circuit technology provides both high speed and low power at an operating current of 2 mA/MHz and a minimum cycle time of 45 ns. It is automatically placed in low-power mode at 0.6  $\mu$ A standby current (at  $V_{DD} = 3$  V,  $T_a = 25^\circ\text{C}$ , typical) when chip enable ( $\overline{\text{CE1}}$ ) is asserted high or ( $\overline{\text{CE2}}$ ) is asserted low. There are three control inputs.  $\overline{\text{CE1}}$  and  $\overline{\text{CE2}}$  are used to select the device and for data retention control, and output enable ( $\overline{\text{OE}}$ ) provides fast memory access. Data byte control pin ( $\overline{\text{LB}}$ ,  $\overline{\text{UB}}$ ) provides lower and upper byte access. This device is well suited to various microprocessor system applications where high speed, low power and battery backup are required. And, with a guaranteed operating extreme temperature range of  $-40^\circ$  to  $85^\circ\text{C}$ , the TC55VCM316B, TC55VEM316B, TC55YCM316B and TC55YEM316B can be used in environments exhibiting extreme temperature conditions. The TC55VCM316BTGN/BSGN, TC55YCM316BTGN/BSGN is available in a plastic 48-pin thin-small-outline package (TSOP). The TC55VEM316BXGN, TC55YEM316BXGN is available in a plastic 48-ball BGA.

### FEATURES

- Low-power dissipation  
Operating: 6 mW/MHz (typical)
- Power down features using  $\overline{\text{CE1}}$  and  $\overline{\text{CE2}}$
- Wide operating temperature range of  $-40^\circ$  to  $85^\circ\text{C}$
- Lead-Free

Part Number	Operating Supply Voltage	Package	Access time (MAX)		Supply Current		At Data Retention
			Supply Voltage 2.7~3.6 V	Supply Voltage 2.3~3.6 V	At Operating (MAX)	At Standby (MAX)	
TC55VCM316BTGN45	2.3~3.6 V	48-pin Plastic TSOP(I) (12×20mm) (0.5mm pin pitch) (Normal bent)	45 ns	55 ns	20 mA	10 $\mu$ A	1.5~3.6 V
TC55VCM316BTGN55			55 ns	70 ns			
TC55VCM316BSGN45		48-pin Plastic TSOP(I) (12×14mm) (0.5mm pin pitch) (Normal bent)	45 ns	55 ns			
TC55VCM316BSGN55			55 ns	70 ns			
TC55VEM316BXGN45		48-ball BGA (6×7mm) (0.75mm ball pitch)	45 ns	55 ns			
TC55VEM316BXGN55			55 ns	70 ns			

Part Number	Operating Supply Voltage	Package	Access time (MAX)		Supply Current		At Data Retention
			Supply Voltage 1.8~2.2 V	Supply Voltage 1.65~2.2 V	At Operating (MAX)	At Standby (MAX)	
TC55YCM316BTGN55	1.65~2.2 V	48-pin Plastic TSOP(I) (12×20mm) (0.5mm pin pitch) (Normal bent)	55 ns	70 ns	12 mA	10 $\mu$ A	1.0~2.2 V
TC55YCM316BTGN70			70 ns	85 ns			
TC55YCM316BSGN55		48-pin Plastic TSOP(I) (12×14mm) (0.5mm pin pitch) (Normal bent)	55 ns	70 ns			
TC55YCM316BSGN70			70 ns	85 ns			
TC55YEM316BXGN55		48-ball BGA (6×7mm) (0.75mm ball pitch)	55 ns	70 ns			
TC55YEM316BXGN70			70 ns	85 ns			

## PIN ASSIGNMENT (TOP VIEW)

### 48-pin Plastic TSOP(I) (12×20mm) (0.5mm pin pitch) (Normal bent)

TC55VCM316BTGN  
 TC55YCM316BTGN

### 48-pin Plastic TSOP(I) (12×14mm) (0.5mm pin pitch) (Normal bent)

TC55VCM316BSGN  
 TC55YCM316BSGN



### 48-ball BGA (6×7mm) (0.75mm ball pitch)

TC55VEM316BXGN  
 TC55YEM316BXGN

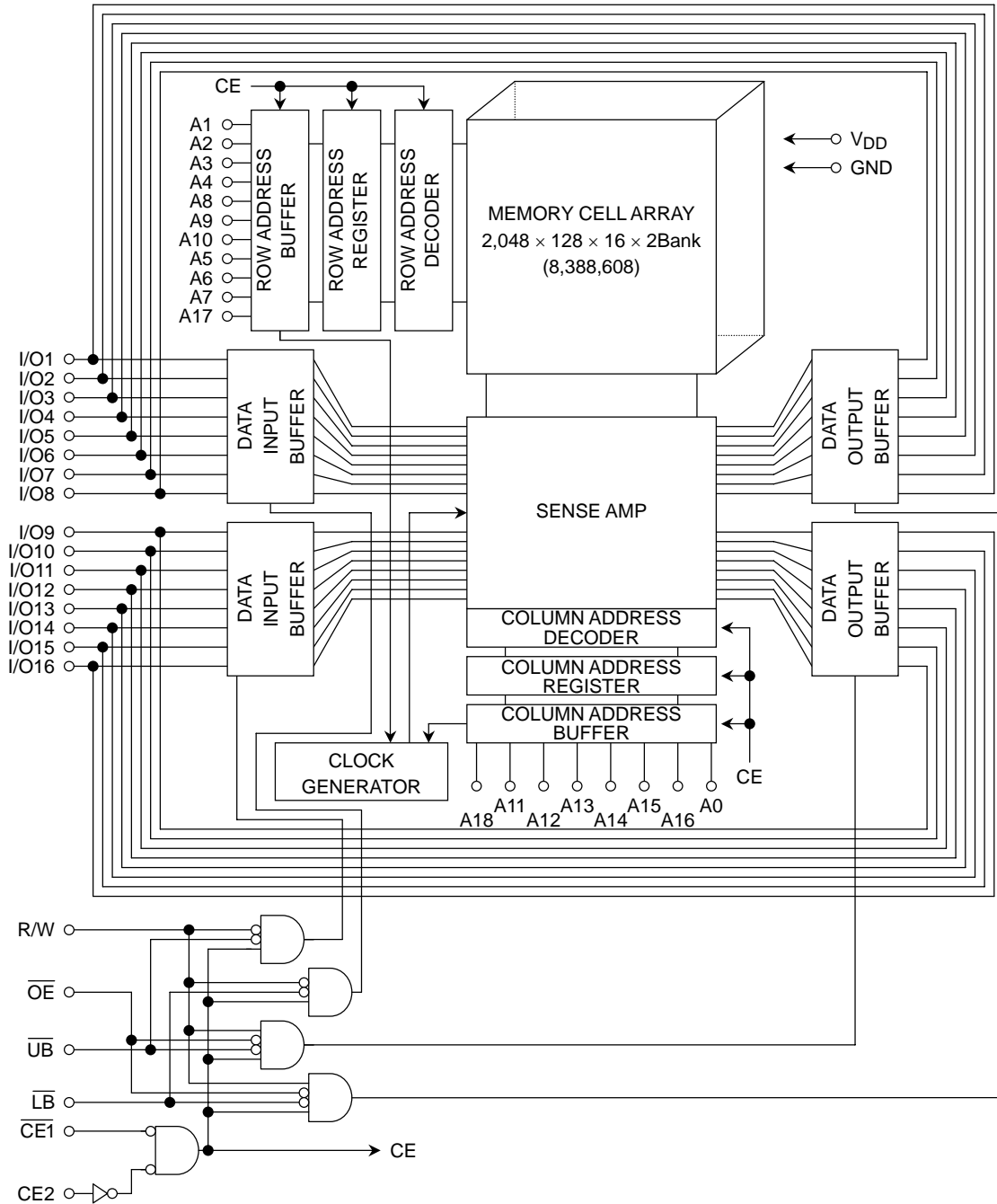
	1	2	3	4	5	6
A	LB	OE	A0	A1	A2	CE2
B	I/O9	UB	A3	A4	CE1	I/O1
C	I/O10	I/O11	A5	A6	I/O2	I/O3
D	GND	I/O12	A17	A7	I/O4	V <sub>DD</sub>
E	V <sub>DD</sub>	I/O13	OP	A16	I/O5	GND
F	I/O15	I/O14	A14	A15	I/O6	I/O7
G	I/O16	NC	A12	A13	R/W	I/O8
H	A18	A8	A9	A10	A11	NC

## PIN NAMES

A0~A18	Address Inputs
CE1, CE2	Chip Enable
R/W	Read/Write Control
OE	Output Enable
LB, UB	Data Byte Control
I/O1~I/O16	Data Inputs/Outputs
V <sub>DD</sub>	Power
GND	Ground
NC	No Connection
OP*	Option

\*: OP pin must be open or connected to GND.

**BLOCK DIAGRAM**



## OPERATING MODE

MODE	CE1	CE2	OE	R/W	LB	UB	I/O1~I/O8	I/O9~I/O16	POWER
Read	L	H	L	H	L	L	Output	Output	I <sub>DDO</sub>
	L	H	L	H	H	L	High-Z	Output	I <sub>DDO</sub>
	L	H	L	H	L	H	Output	High-Z	I <sub>DDO</sub>
Write	L	H	*	L	L	L	Input	Input	I <sub>DDO</sub>
	L	H	*	L	H	L	High-Z	Input	I <sub>DDO</sub>
	L	H	*	L	L	H	Input	High-Z	I <sub>DDO</sub>
Output Deselect	L	H	H	H	L	L	High-Z	High-Z	I <sub>DDO</sub>
	L	H	H	H	H	L	High-Z	High-Z	I <sub>DDO</sub>
	L	H	H	H	L	H	High-Z	High-Z	I <sub>DDO</sub>
Standby	H	*	*	*	*	*	High-Z	High-Z	I <sub>DDS</sub>
	*	L	*	*	*	*	High-Z	High-Z	I <sub>DDS</sub>

\* = don't care  
 H = logic high  
 L = logic low

## MAXIMUM RATINGS

SYMBOL	RATING	VALUE		UNIT
		TC55VCM316BTGN TC55VCM316BSGN TC55VEM316BXGN	TC55YCM316BTGN TC55YCM316BSGN TC55YEM316BXGN	
V <sub>DD</sub>	Power Supply Voltage	-0.3~4.2	-0.3~2.5	V
V <sub>IN</sub>	Input Voltage	-0.3 <sup>*1</sup> ~4.2	-0.3 <sup>*1</sup> ~2.5	V
V <sub>I/O</sub>	Input/Output Voltage	-0.5~V <sub>DD</sub> + 0.5	-0.5~V <sub>DD</sub> + 0.5	V
P <sub>D</sub>	Power Dissipation	0.6	0.6	W
T <sub>solder</sub>	Soldering Temperature (10s)	260	260	°C
T <sub>stg</sub>	Storage Temperature	TSOP type	-55~150	°C
		BGA type	-55~125	°C
T <sub>a</sub>	Operating Ambient Temperature	-40~85	-40~85	°C

\*1: -1.0 V when measured at a pulse width of 10ns

## DC RECOMMENDED OPERATING CONDITIONS (T<sub>a</sub> = -40° to 85°C)

SYMBOL	PARAMETER	TEST CONDITION	TC55VCM316BTGN TC55VCM316BSGN TC55VEM316BXGN		TC55YCM316BTGN TC55YCM316BSGN TC55YEM316BXGN		UNIT
			MIN	MAX	MIN	MAX	
V <sub>DD</sub>	Power Supply Voltage	—	2.3	3.6	1.65	2.2	V
V <sub>IH</sub>	Input High Voltage	2.3 V ≤ V <sub>DD</sub> < 2.7 V	2.0	V <sub>DD</sub> + 0.3	—	—	
		2.7 V ≤ V <sub>DD</sub> ≤ 3.6 V	2.2	V <sub>DD</sub> + 0.3	—	—	
		1.65 V ≤ V <sub>DD</sub> < 1.8 V	—	—	1.4	V <sub>DD</sub> + 0.3	
		1.8 V ≤ V <sub>DD</sub> ≤ 2.2 V	—	—	1.6	V <sub>DD</sub> + 0.3	
V <sub>IL</sub>	Input Low Voltage	—	-0.3 <sup>*2</sup>	V <sub>DD</sub> × 0.24	-0.3 <sup>*2</sup>	V <sub>DD</sub> × 0.22	
V <sub>DH</sub>	Data Retention Supply Voltage	—	1.5	3.6	1.0	2.2	

\*2: -1.0 V when measured at a pulse width of 10ns

## DC CHARACTERISTICS (Ta = -40° to 85°C, VDD = 2.3 to 3.6 V/1.65 to 2.2 V)

SYMBOL	PARAMETER	TEST CONDITION	TC55VCM316BTGN TC55VCM316BSGN TC55VEM316BXGN			TC55YCM316BTGN TC55YCM316BSGN TC55YEM316BXGN			UNIT		
			MIN	TYP	MAX	MIN	TYP	MAX			
I <sub>IL</sub>	Input Leakage Current	V <sub>IN</sub> = 0 V-V <sub>DD</sub>	—	—	±1.0	—	—	±1.0	μA		
I <sub>OH</sub>	Output High Current	V <sub>OH</sub> = V <sub>DD</sub> - 0.5 V	-0.5	—	—	-0.5	—	—	mA		
I <sub>OL</sub>	Output Low Current	V <sub>OL</sub> = 0.4 V	2.1	—	—	2.1	—	—	mA		
I <sub>LO</sub>	Output Leakage Current	$\overline{CE1} = V_{IH}$ or $CE2 = V_{IL}$ or $\overline{LB} = \overline{UB} = V_{IH}$ or $R/W = V_{IL}$ or $\overline{OE} = V_{IH}$ , V <sub>OUT</sub> = 0 V-V <sub>DD</sub>	—	—	±1.0	—	—	±1.0	μA		
I <sub>DDO1</sub>	Operating Current	$\overline{CE1} = V_{IL}$ and $CE2 = V_{IH}$ and $R/W = V_{IH}$ , I <sub>OUT</sub> = 0 mA, Other Input = V <sub>IH</sub> /V <sub>IL</sub>	t <sub>cycle</sub>	MIN	—	—	20	—	—	12	mA
				1 μs	—	—	7	—	—	3	
I <sub>DDO2</sub>	Operating Current	$\overline{CE1} = 0.2$ V and $CE2 = V_{DD} - 0.2$ V and $R/W = V_{DD} - 0.2$ V, I <sub>OUT</sub> = 0 mA, Other Input = V <sub>DD</sub> - 0.2 V/0.2 V	t <sub>cycle</sub>	MIN	—	—	20	—	—	12	mA
				1 μs	—	—	2	—	—	2	
I <sub>DDS1</sub>	Standby Current	$\overline{CE1} = V_{IH}$ or $CE2 = V_{IL}$		—	—	1	—	—	1	mA	
I <sub>DDS2</sub>		1) $\overline{CE1} = V_{DD} - 0.2$ V, $CE2 = V_{DD} - 0.2$ V	V <sub>DD</sub> = 2.3~3.6 V	Ta = -40~85°C	—	—	10	—	—	—	μA
				Ta = 25°C	—	0.6	0.9	—	—	—	
			V <sub>DD</sub> = 3.0 V	Ta = -40~40°C	—	—	2	—	—	—	
				Ta = 25°C	—	—	—	—	—	10	
I <sub>DDS2</sub>	2) CE2 = 0.2 V	V <sub>DD</sub> = 1.65~2.2 V	Ta = -40~85°C	—	—	—	—	—	10	μA	
			Ta = 25°C	—	—	—	—	0.6	0.9		

Note: In standby mode with  $\overline{CE1} \geq V_{DD} - 0.2$  V, these limits are assured for the condition  $CE2 \geq V_{DD} - 0.2$  V or  $CE2 \leq 0.2$  V. The other input pins are not restricted of input level.

## CAPACITANCE (Ta = 25°C, f = 1 MHz)

SYMBOL	PARAMETER	TEST CONDITION	MAX	UNIT
C <sub>IN</sub>	Input Capacitance	V <sub>IN</sub> = GND	10	pF
C <sub>OUT</sub>	Output Capacitance	V <sub>OUT</sub> = GND	10	pF

Note: This parameter is periodically sampled and is not 100% tested.

## AC CHARACTERISTICS AND OPERATING CONDITIONS (Ta = -40° to 85°C)

### READ CYCLE

SYMBOL	PARAMETER	TC55VCM316BTGN/BSGN TC55VEM316BXGN								UNIT
		V <sub>DD</sub> = 2.7~3.6 V				V <sub>DD</sub> = 2.3~3.6 V				
		45		55		45		55		
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>RC</sub>	Read Cycle Time	45	—	55	—	55	—	70	—	ns
t <sub>ACC</sub>	Address Access Time	—	45	—	55	—	55	—	70	
t <sub>CO1</sub>	Chip Enable( $\overline{CE1}$ ) Access Time	—	45	—	55	—	55	—	70	
t <sub>CO2</sub>	Chip Enable(CE2) Access Time	—	45	—	55	—	55	—	70	
t <sub>OE</sub>	Output Enable Access Time	—	25	—	30	—	30	—	35	
t <sub>BA</sub>	Data Byte Control Access Time	—	25	—	30	—	30	—	35	
t <sub>COE</sub>	Chip Enable Low to Output Active	5	—	5	—	5	—	5	—	
t <sub>OEE</sub>	Output Enable Low to Output Active	0	—	0	—	0	—	0	—	
t <sub>BE</sub>	Data Byte Control Low to Output Active	0	—	0	—	0	—	0	—	
t <sub>OD</sub>	Chip Enable High to Output High-Z	—	20	—	25	—	25	—	30	
t <sub>ODO</sub>	Output Enable High to Output High-Z	—	20	—	25	—	25	—	30	
t <sub>BD</sub>	Data Byte Control High to Output High-Z	—	20	—	25	—	25	—	30	
t <sub>OH</sub>	Output Data Hold Time	10	—	10	—	10	—	10	—	

### WRITE CYCLE

SYMBOL	PARAMETER	TC55VCM316BTGN/BSGN TC55VEM316BXGN								UNIT
		V <sub>DD</sub> = 2.7~3.6 V				V <sub>DD</sub> = 2.3~3.6 V				
		45		55		45		55		
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>WC</sub>	Write Cycle Time	45	—	55	—	55	—	70	—	ns
t <sub>WP</sub>	Write Pulse Width	30	—	40	—	40	—	50	—	
t <sub>CW</sub>	Chip Enable to End of Write	35	—	45	—	45	—	55	—	
t <sub>BW</sub>	Data Byte Control to End of Write	35	—	45	—	45	—	55	—	
t <sub>AS</sub>	Address Setup Time	0	—	0	—	0	—	0	—	
t <sub>WR</sub>	Write Recovery Time	0	—	0	—	0	—	0	—	
t <sub>ODW</sub>	R/W Low to Output High-Z	—	20	—	25	—	25	—	30	
t <sub>OEW</sub>	R/W High to Output Active	0	—	0	—	0	—	0	—	
t <sub>DS</sub>	Data Setup Time	20	—	25	—	25	—	30	—	
t <sub>DH</sub>	Data Hold Time	0	—	0	—	0	—	0	—	

Note: t<sub>OD</sub>, t<sub>ODO</sub>, t<sub>BD</sub> and t<sub>ODW</sub> are specified in time when an output becomes high impedance, and are not judged depending on an output voltage level.

## AC CHARACTERISTICS AND OPERATING CONDITIONS (Ta = -40° to 85°C)

### READ CYCLE

SYMBOL	PARAMETER	TC55YCM316BTGN/BSGN TC55YEM316BXGN								UNIT
		V <sub>DD</sub> = 1.8~2.2 V				V <sub>DD</sub> = 1.65~2.2 V				
		55		70		55		70		
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>RC</sub>	Read Cycle Time	55	—	70	—	70	—	85	—	ns
t <sub>ACC</sub>	Address Access Time	—	55	—	70	—	70	—	85	
t <sub>CO1</sub>	Chip Enable( $\overline{CE1}$ ) Access Time	—	55	—	70	—	70	—	85	
t <sub>CO2</sub>	Chip Enable(CE2) Access Time	—	55	—	70	—	70	—	85	
t <sub>OE</sub>	Output Enable Access Time	—	30	—	35	—	35	—	45	
t <sub>BA</sub>	Data Byte Control Access Time	—	30	—	35	—	35	—	45	
t <sub>COE</sub>	Chip Enable Low to Output Active	5	—	5	—	5	—	5	—	
t <sub>OEE</sub>	Output Enable Low to Output Active	0	—	0	—	0	—	0	—	
t <sub>BE</sub>	Data Byte Control Low to Output Active	0	—	0	—	0	—	0	—	
t <sub>OD</sub>	Chip Enable High to Output High-Z	—	25	—	30	—	30	—	35	
t <sub>ODO</sub>	Output Enable High to Output High-Z	—	25	—	30	—	30	—	35	
t <sub>BD</sub>	Data Byte Control High to Output High-Z	—	25	—	30	—	30	—	35	
t <sub>OH</sub>	Output Data Hold Time	10	—	10	—	10	—	10	—	

### WRITE CYCLE

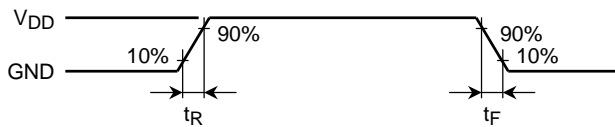
SYMBOL	PARAMETER	TC55YCM316BTGN/BSGN TC55YEM316BXGN								UNIT
		V <sub>DD</sub> = 1.8~2.2 V				V <sub>DD</sub> = 1.65~2.2 V				
		55		70		55		70		
		MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t <sub>WC</sub>	Write Cycle Time	55	—	70	—	70	—	85	—	ns
t <sub>WP</sub>	Write Pulse Width	40	—	50	—	50	—	60	—	
t <sub>CW</sub>	Chip Enable to End of Write	45	—	55	—	55	—	65	—	
t <sub>BW</sub>	Data Byte Control to End of Write	45	—	55	—	55	—	65	—	
t <sub>AS</sub>	Address Setup Time	0	—	0	—	0	—	0	—	
t <sub>WR</sub>	Write Recovery Time	0	—	0	—	0	—	0	—	
t <sub>ODW</sub>	R/W Low to Output High-Z	—	25	—	30	—	30	—	35	
t <sub>OEW</sub>	R/W High to Output Active	0	—	0	—	0	—	0	—	
t <sub>DS</sub>	Data Setup Time	25	—	30	—	30	—	35	—	
t <sub>DH</sub>	Data Hold Time	0	—	0	—	0	—	0	—	

Note: t<sub>OD</sub>, t<sub>ODO</sub>, t<sub>BD</sub> and t<sub>ODW</sub> are specified in time when an output becomes high impedance, and are not judged depending on an output voltage level.

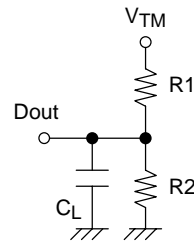
## AC TEST CONDITIONS (Ta = -40 to 85°C, VDD = 2.3 to 3.6 V/1.65 to 2.2 V)

PARAMETER		TEST CONDITION	
		TC55VCM316BTGN TC55VCM316BSGN TC55VEM316BXGN	TC55YCM316BTGN TC55YCM316BSGN TC55YEM316BXGN
Input pulse level	High	$V_{DD} \times 0.7 + 0.2 \text{ V}$	$V_{DD} - 0.2 \text{ V}$
	Low	0.2 V	0.2 V
Input rise and fall time (Fig.1)	t <sub>R</sub>	1 V/ns	1 V/ns
	t <sub>F</sub>	1 V/ns	1 V/ns
Timing measurements		$V_{DD} \times 0.5$	$V_{DD} \times 0.5$
Reference level		$V_{DD} \times 0.5$	$V_{DD} \times 0.5$
Output load (Fig.2)	V <sub>TM</sub>	2.3 V	1.65 V
	R1	810 Ω	470 Ω
	R2	1610 Ω	740 Ω
	C <sub>L</sub>	30 pF	30 pF

**Fig.1** : Input rise and fall time



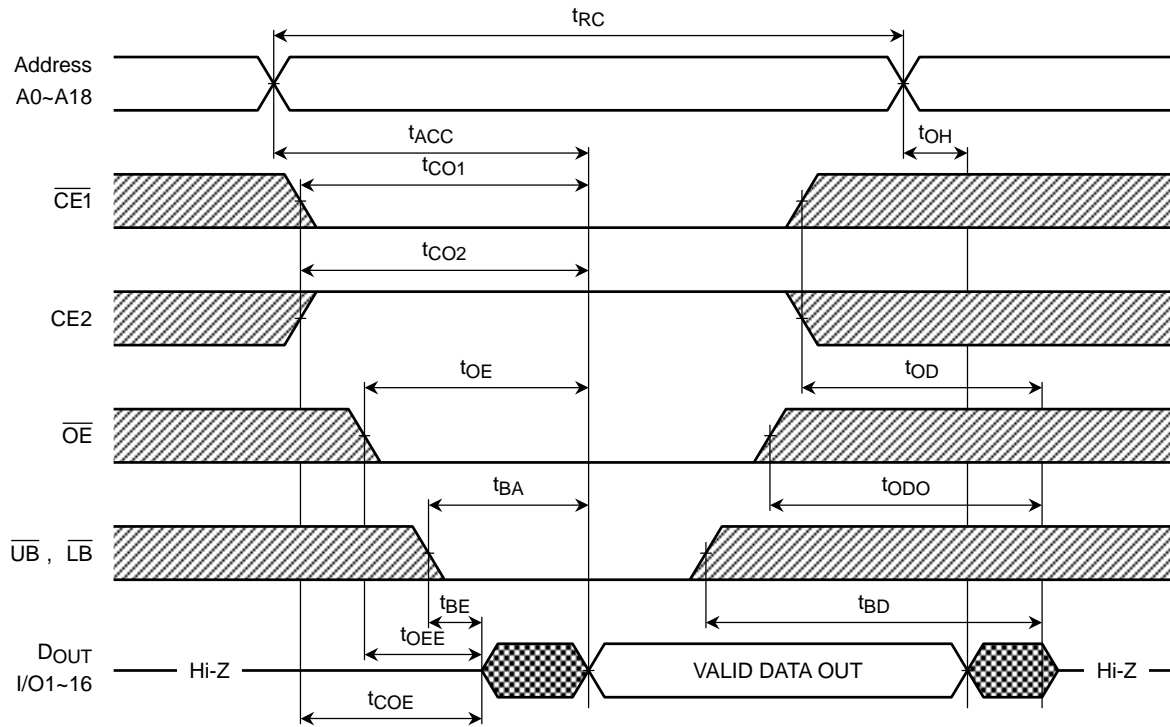
**Fig.2** : Output load



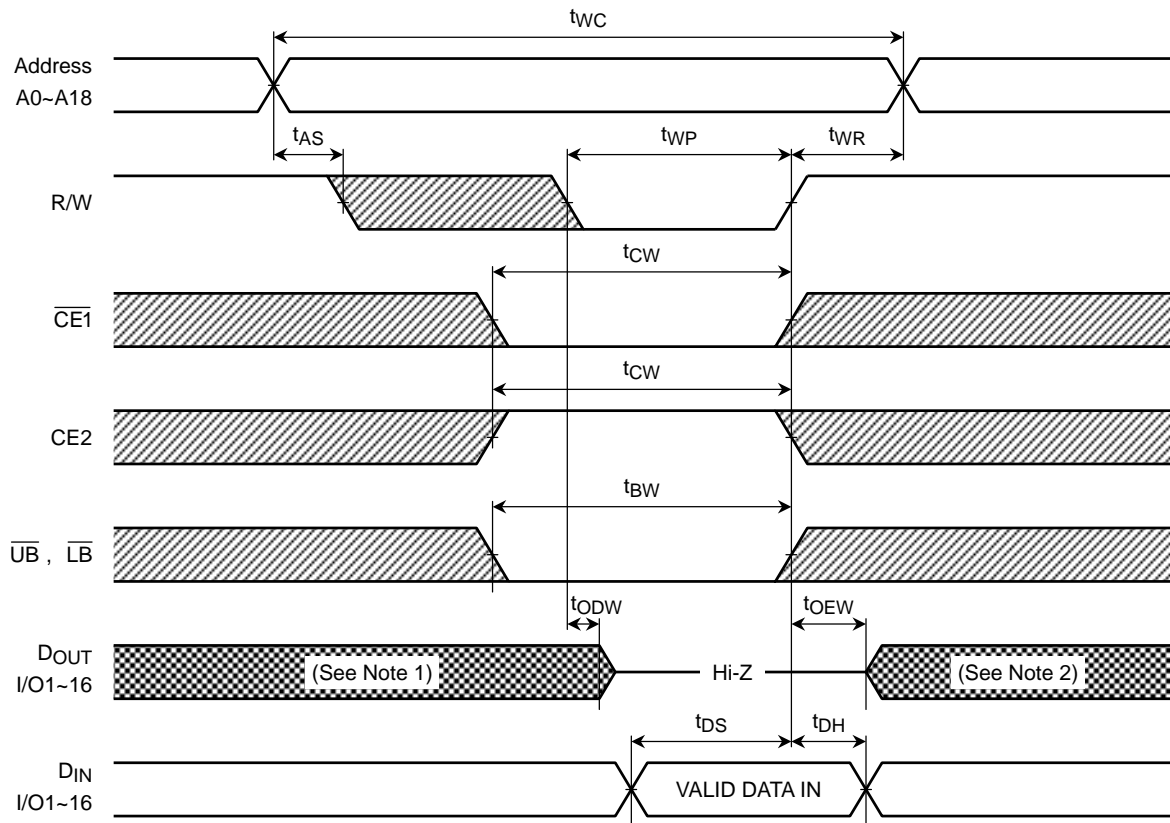


## TIMING DIAGRAMS

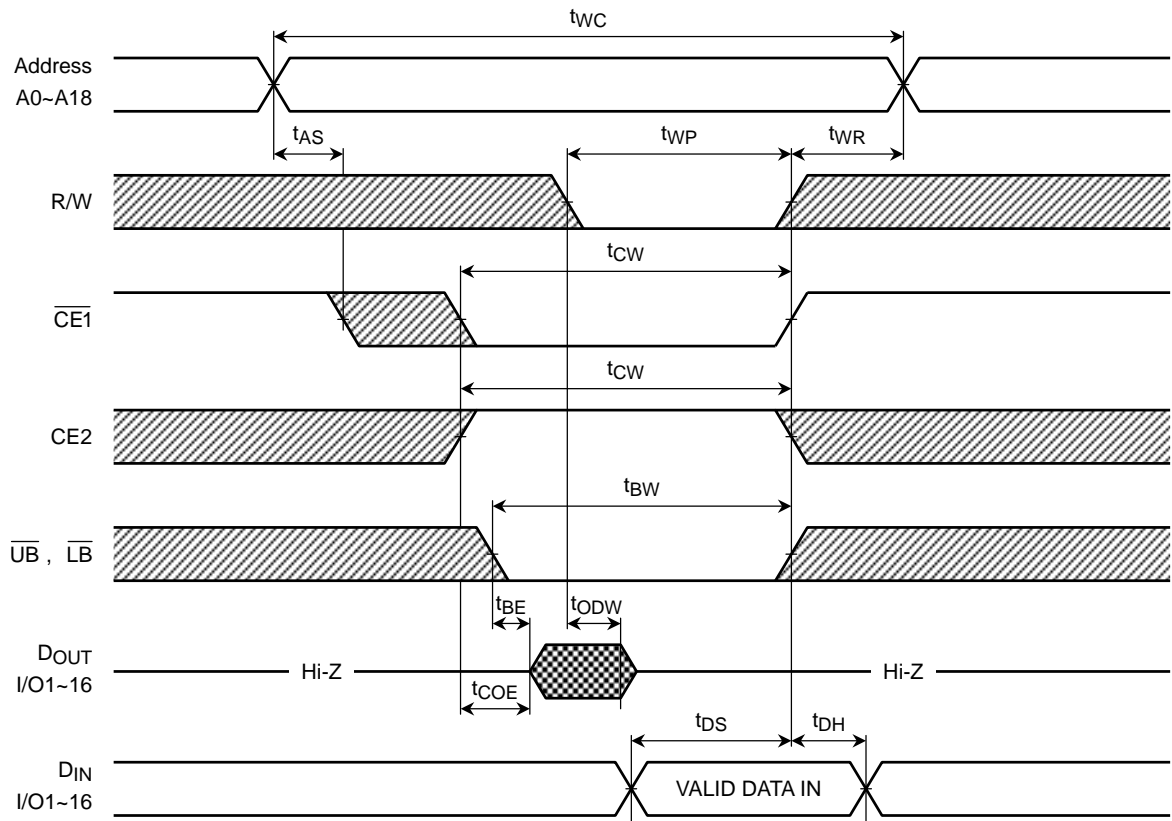
### READ CYCLE



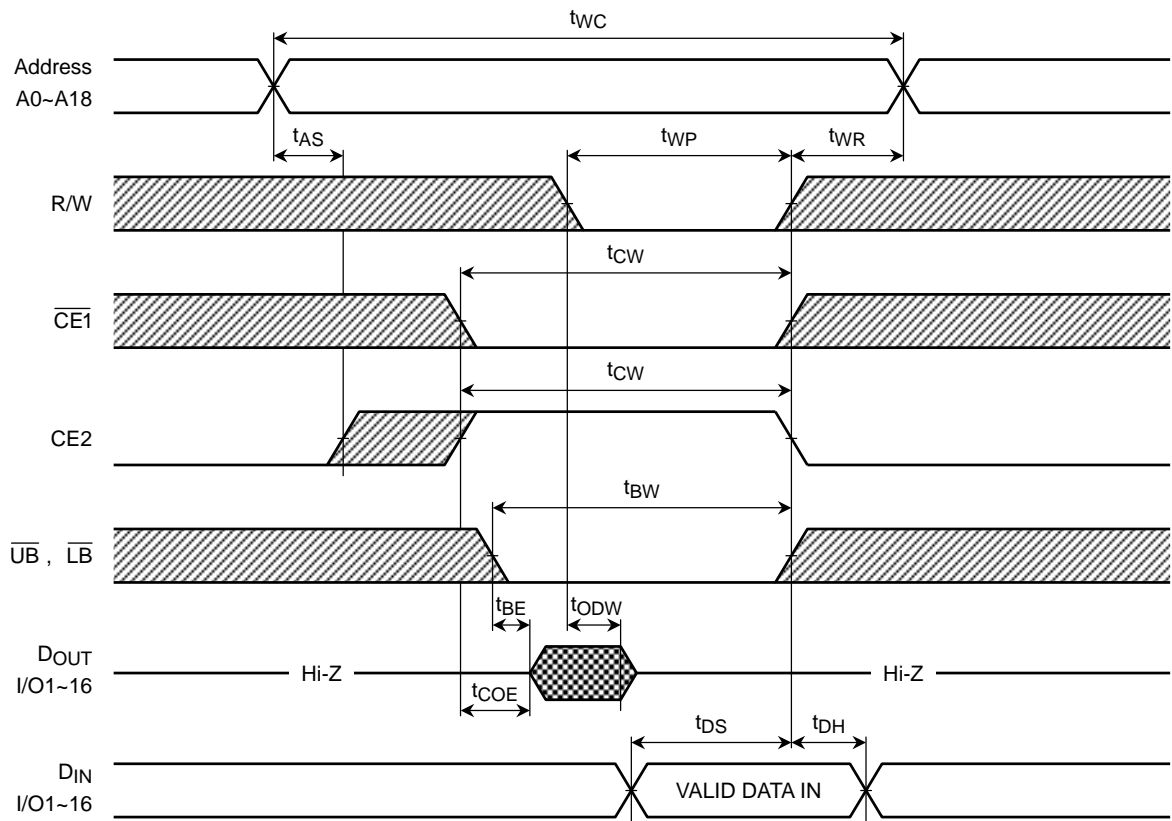
### WRITE CYCLE 1 (R/W CONTROLLED)



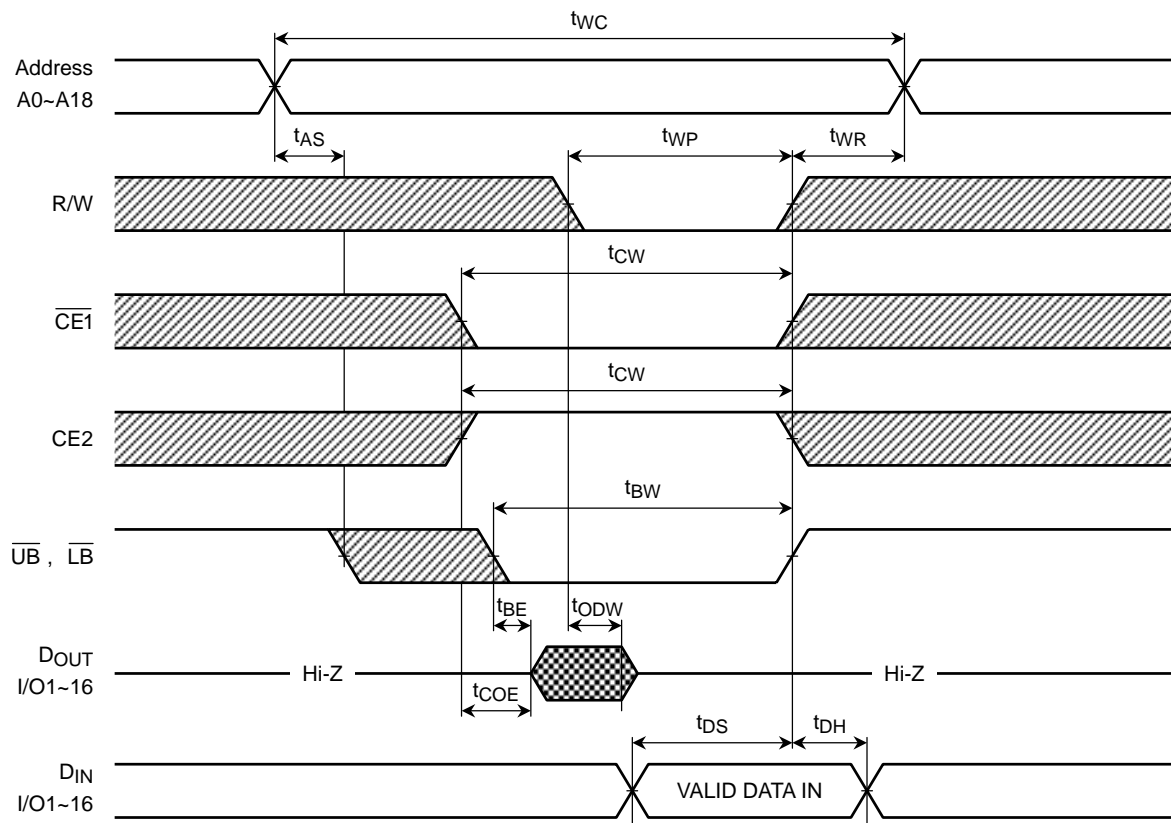
WRITE CYCLE 2 ( $\overline{CE1}$  CONTROLLED)



WRITE CYCLE 3 ( $\overline{CE2}$  CONTROLLED)



## WRITE CYCLE 4 ( $\overline{UB}$ , $\overline{LB}$ CONTROLLED)



Note:

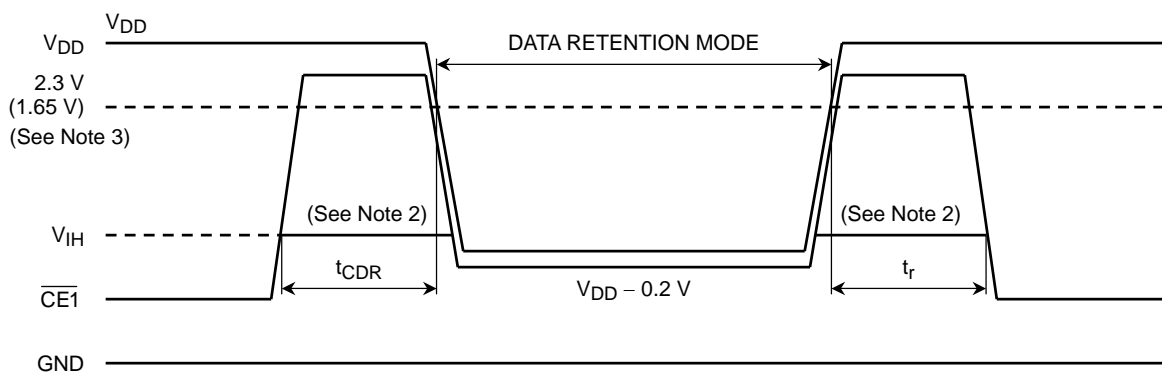
- Read cycle  
 R/W remains HIGH for the read cycle.
- Write cycle1
  - (1) If  $\overline{CE1}$  (or  $\overline{UB}$  or  $\overline{LB}$ ) goes LOW (or CE2 goes HIGH) coincident with or after R/W goes LOW, the outputs will remain at high impedance.
  - (2) If  $\overline{CE1}$  (or  $\overline{UB}$  or  $\overline{LB}$ ) goes HIGH (or CE2 goes LOW) coincident with or before R/W goes HIGH, the outputs will remain at high impedance.

Don't input the same polarity signal as a R/W signal into a  $\overline{OE}$  during the write cycle.
- Write cycle1 to 4  
 If  $\overline{OE}$  is HIGH during the write cycle, the outputs will remain at high impedance.  
 Because I/O signals may be in the output state at this time, input signals of reverse polarity must not be applied.

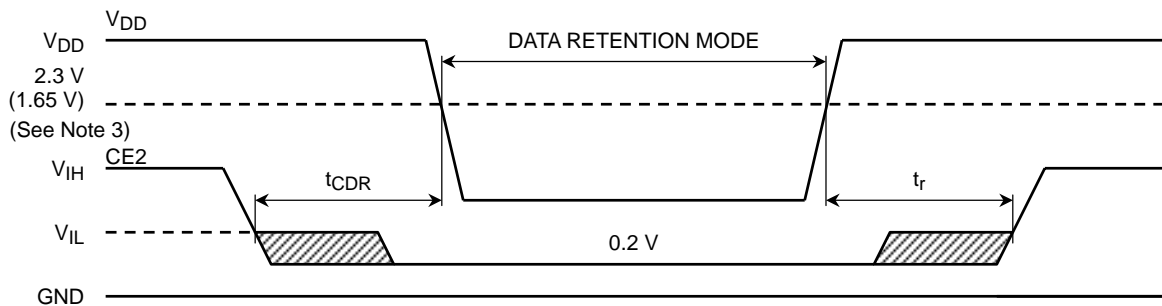
## DATA RETENTION CHARACTERISTICS (Ta = -40° to 85°C)

SYMBOL	PARAMETER		TC55VCM316BTGN TC55VCM316BSGN TC55VEM316BXGN		TC55YCM316BTGN TC55YCM316BSGN TC55YEM316BXGN		UNIT
			MIN	MAX	MIN	MAX	
V <sub>DH</sub>	Data Retention Supply Voltage		1.5	3.6	1.0	2.2	V
I <sub>DD</sub> S2	Standby Current	V <sub>DH</sub> = 3.6 V Ta = -40~85°C	—	10	—	—	μA
		V <sub>DH</sub> = 3.0 V Ta = -40~40°C	—	2	—	—	
		V <sub>DH</sub> = 2.2 V Ta = -40~85°C	—	—	—	10	
t <sub>CDR</sub>	Chip Deselect to Data Retention Mode Time		0	—	0	—	ns
t <sub>r</sub>	Recovery Time		5	—	5	—	ms

### CE1 CONTROLLED DATA RETENTION MODE (See Note 1)



### CE2 CONTROLLED DATA RETENTION MODE (See Note 4)

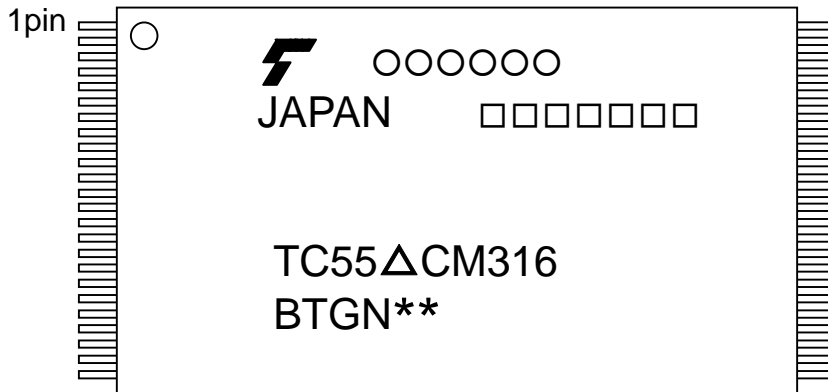


Note:

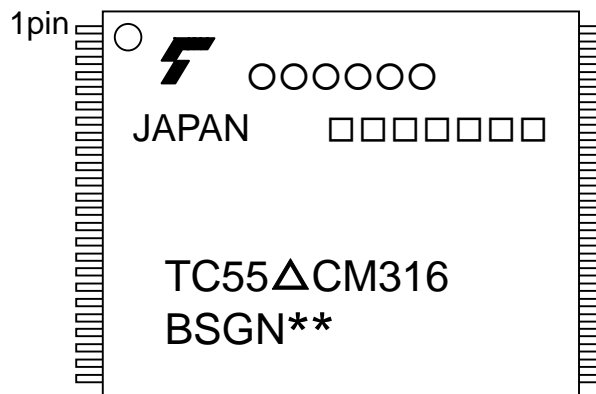
- (1) In  $\overline{\text{CE1}}$  controlled data retention mode, minimum standby current mode is entered when  $\text{CE2} \leq 0.2 \text{ V}$  or  $\text{CE2} \geq \text{V}_{\text{DD}} - 0.2 \text{ V}$ .
- (2) When  $\overline{\text{CE1}}$  is operating at the V<sub>IH</sub>(min.) level, the operating current is given by I<sub>DD</sub>S1 during the transition of V<sub>DD</sub> from 2.3(2.7) to 2.2 V(2.4 V). (TC55VCM316B, TC55VEM316B)
- (3) When  $\overline{\text{CE1}}$  is operating at the V<sub>IH</sub>(min.) level, the operating current is given by I<sub>DD</sub>S1 during the transition of V<sub>DD</sub> from 1.65 to 1.6 V. (TC55YCM316B, TC55YEM316B)
- (4) In CE2 controlled data retention mode, minimum standby current mode is entered when CE2 ≤ 0.2 V.

**MARKING (Example)**

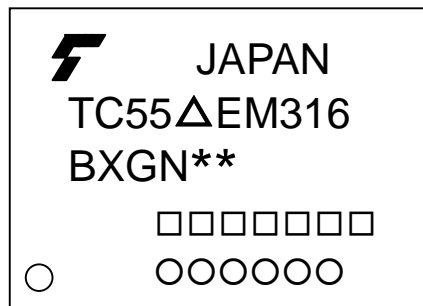
**TC55VCM316BTGN/TC55YCM316BTGN Family**



**TC55VCM316BSGN/TC55YCM316BSGN Family**



**TC55VEM316BXGN/TC55YEM316BXGN Family**



**EXPLANATION**

△ : Operating supply voltage (V:V<sub>DD</sub> = 2.3 to 3.6 V, Y: V<sub>DD</sub> = 1.65 to 2.2 V)

\*\* : Speed version

○ ○ ○ ○ ○ ○ : Key code

□ □ □ □ □ □ : Lot code

Control code

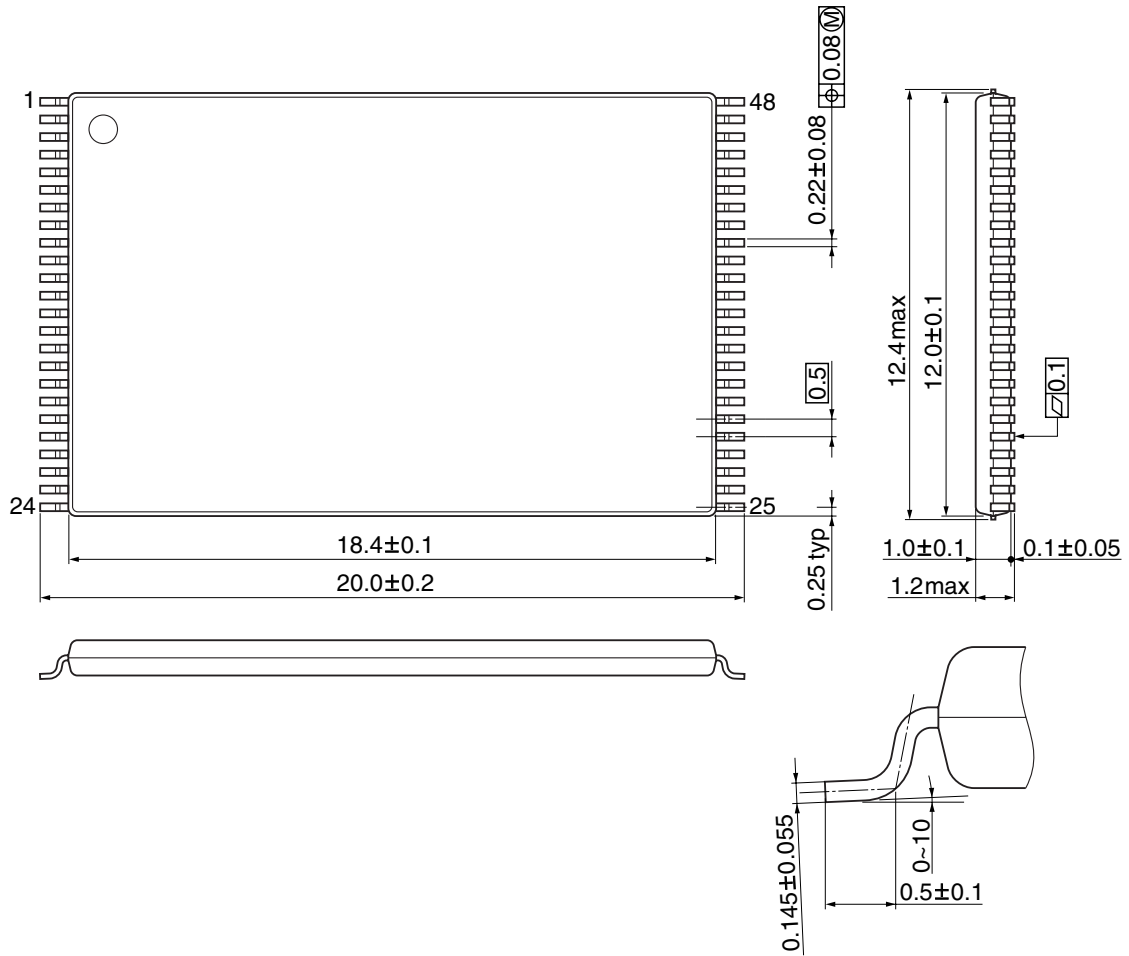
Week code

Year code

## PACKAGE DIMENSIONS

TSOP I 48-P-1220-0.50

Unit:mm

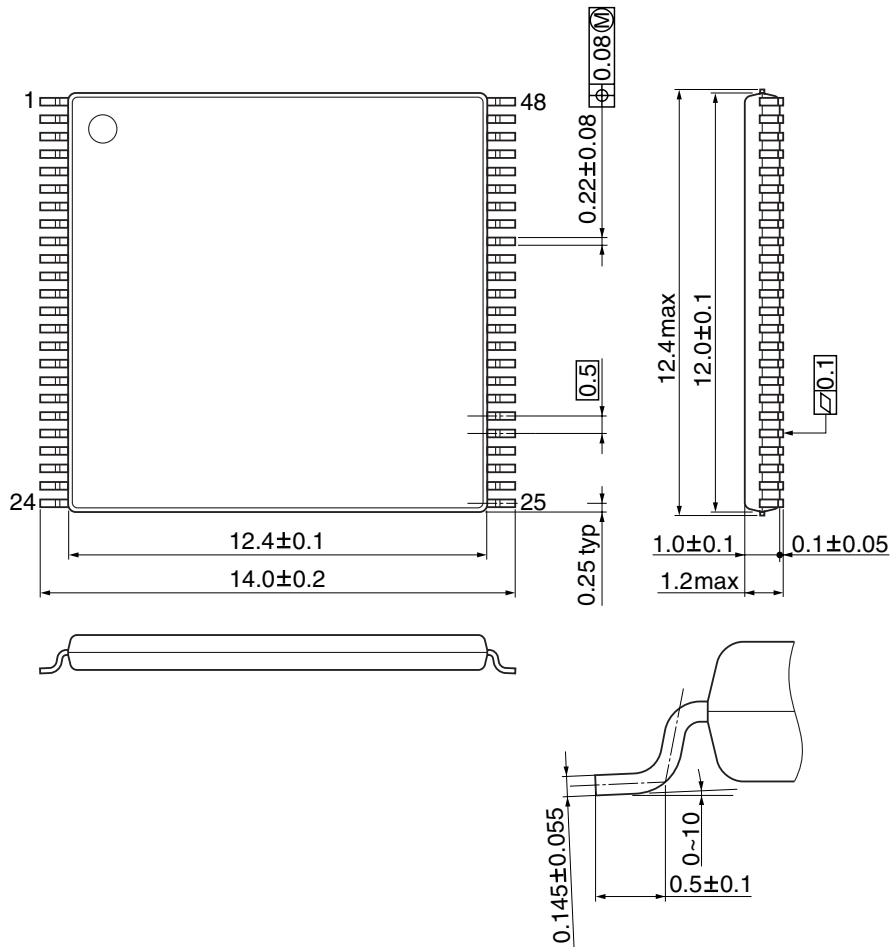


Weight:0.38 g (typ)

## PACKAGE DIMENSIONS

TSOP I 48-P-1214-0.50

Unit:mm

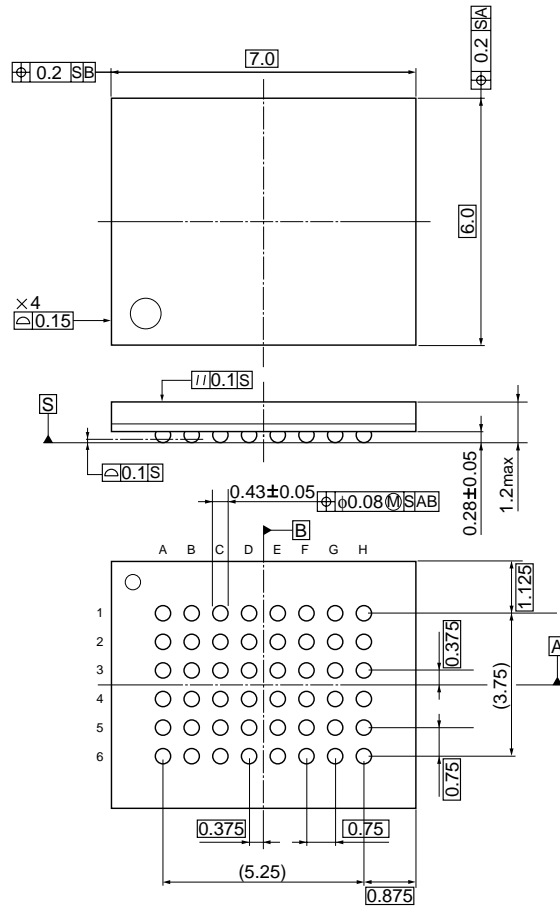


Weight:0.26 g (typ)

## PACKAGE DIMENSIONS

P-TFBGA48-0607-0.75AZ

Unit:mm



Weight:0.08 g (typ)



**REVISION HISTORY**

Draft Date	Revision Page		Type	Passage	Content
	After	Before			
V1.1a/2005-01-31	P.14,15,16	P.14,15,16		Weight	Described value of weight
V1.1b/2005-08-11	P.5,12	P.5,12		Deletion and addition of an item	Change of a IDDS2 temperature security definition
	P.1~18	P.1~18		Part number	Speed version change

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