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HM628128D Series

1 M SRAM (128-kword $\times$ 8-bit)

HITACHI

ADE-203-996 (Z)
Preliminary, Rev. 0.0
Jan. 20, 1999

Description

The Hitachi HM628128D Series is 1-Mbit static RAM organized 131,072-kword $\times$ 8-bit. HM628128D Series has realized higher density, higher performance and low power consumption by employing Hi-CMOS process technology. The HM628128D Series offers low power standby power dissipation; therefore, it is suitable for battery backup systems. It has package variations of standard 32-pin plastic DIP, standard 32-pin plastic SOP and standard 32-pin plastic TSOPI.

Features

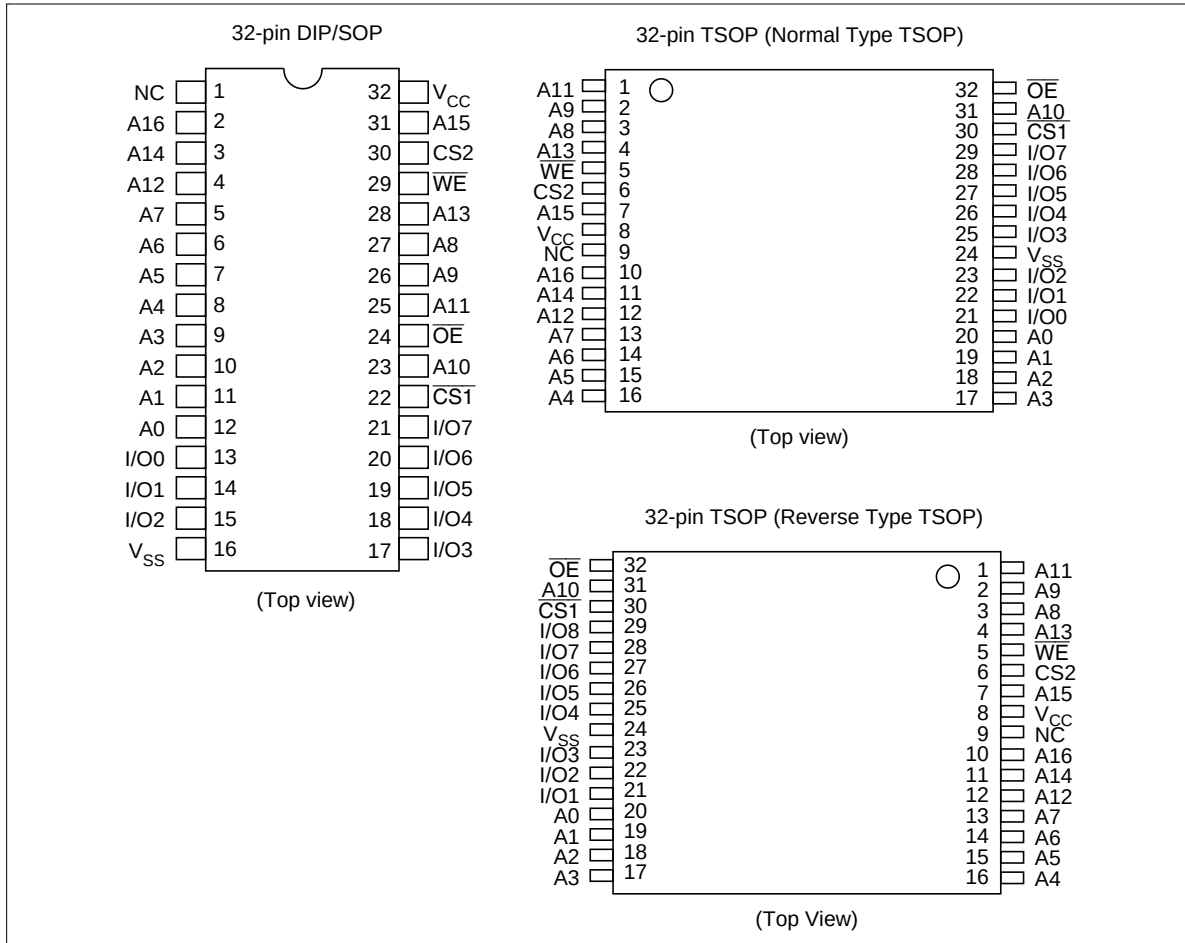
- Single 5 V supply: 5 V $\pm$ 10%
- Access time: 55 ns/70 ns (max)
- Power dissipation
 - Active: 30 mW/MHz (typ)
 - Standby: 10 μ W (typ)
- Completely static memory.
 - No clock or timing strobe required
- Equal access and cycle times
- Common data input and output
 - Three state output
- Directly TTL compatible all inputs
- Battery backup operation
 - 2 chip selection for battery backup

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Ordering Information

Type No.	Access time	Package
HM628128DLP-5	55 ns	600-mil 32-pin plastic DIP (DP-32)
HM628128DLP-7	70 ns	
HM628128DLP-5SL	55 ns	
HM628128DLP-7SL	70 ns	
HM628128DLP-5UL	55 ns	
HM628128DLP-7UL	70 ns	
HM628128DLFP-5	55 ns	525-mil 32-pin plastic SOP (FP-32D)
HM628128DLFP-7	70 ns	
HM628128DLFP-5SL	55 ns	
HM628128DLFP-7SL	70 ns	
HM628128DLFP-5UL	55 ns	
HM628128DLFP-7UL	70 ns	
HM628128DLTS-5	55 ns	8 × 13.4 mm 32-pin plastic TSOP I (TFP-32DC)
HM628128DLTS-7	70 ns	
HM628128DLTS-5SL	55 ns	
HM628128DLTS-7SL	70 ns	
HM628128DLTS-5UL	55 ns	
HM628128DLTS-7UL	70 ns	
HM628128DLT-5	55 ns	Normal-bend type 8 × 20 mm 32-pin plastic TSOP I (TFP-32D)
HM628128DLT-7	70 ns	
HM628128DLT-5SL	55 ns	
HM628128DLT-7SL	70 ns	
HM628128DLT-5UL	55 ns	
HM628128DLT-7UL	70 ns	
HM628128DLR-5	55 ns	Reverse-bend type 8 × 20 mm 32-pin plastic TSOP I (TFP-32DR)
HM628128DLR-7	70 ns	
HM628128DLR-5SL	55 ns	
HM628128DLR-7SL	70 ns	
HM628128DLR-5UL	55 ns	
HM628128DLR-7UL	70 ns	

Pin Arrangement

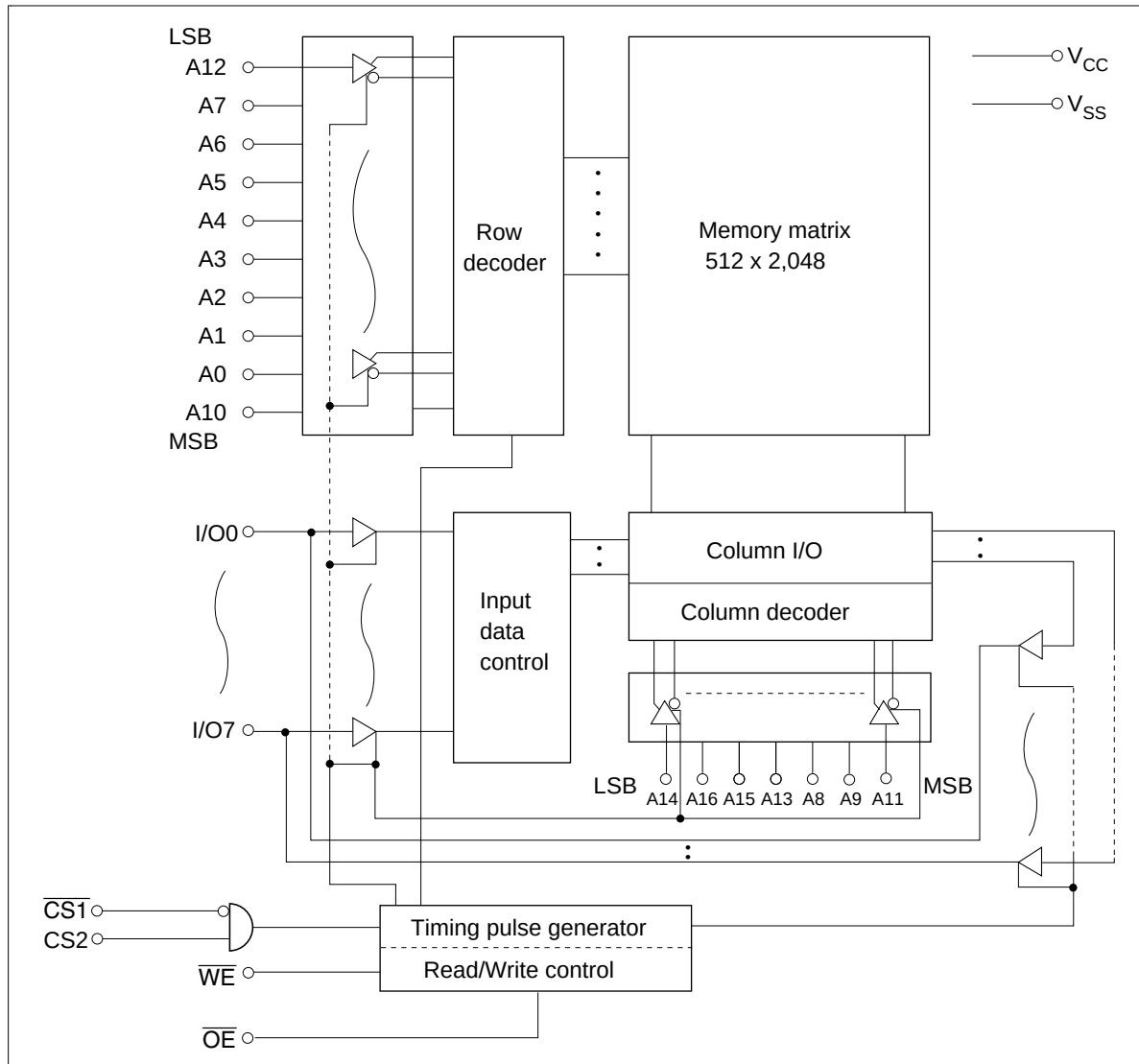


Pin Description

Pin name	Function
A0 to A16	Address input
I/O0 to I/O7	Data input/output
CS1	Chip select 1
CS2	Chip select 2
WE	Write enable
OE	Output enable
V _{CC}	Power supply
V _{SS}	Ground
NC	No connection

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Block Diagram



Operation Table

$\overline{\text{CS1}}$	CS2	$\overline{\text{WE}}$	$\overline{\text{OE}}$	I/O	Operation
H	H	×	×	High-Z	Standby
L	L	×	×	High-Z	Standby
L	L	×	×	High-Z	Standby
L	H	H	L	Dout	Read
L	H	L	H	Din	Write
L	H	L	L	Din	Write
L	H	H	H	High-Z	Output disable

Note: H: V_{IH} , L: V_{IL} , ×: V_{IH} or V_{IL}

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Power supply voltage relative to V_{SS}	V_{CC}	−0.5 to +7.0	V
Terminal voltage on any pin relative to V_{SS}	V_{T}	−0.5* ¹ to $V_{\text{CC}} + 0.3$ * ²	V
Power dissipation	P_{T}	1.0	W
Storage temperature range	Tstg	−55 to +125	°C
Storage temperature range under bias	Tbias	−20 to +85	°C

Notes: 1. V_{T} min: −1.5 V for pulse half-width ≤ 30 ns

2. Maximum voltage is +7.0 V

DC Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit	Note
Supply voltage	V_{CC}	4.5	5.0	5.5	V	
	V_{SS}	0	0	0	V	
Input high voltage	V_{IH}	2.2	—	$V_{\text{CC}} + 0.3$	V	
Input low voltage	V_{IL}	−0.3	—	0.8	V	1
Ambient temperature range	Ta	−20	—	+70	°C	

Note: 1. V_{IL} min: −1.5 V for pulse half-width ≤ 30 ns

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DC Characteristics

Parameter	Symbol	Min	Typ* ¹	Max	Unit	Test conditions
Input leakage current	$ I_{Li} $	—	—	1	μA	$V_{in} = V_{SS} \text{ to } V_{CC}$
Output leakage current	$ I_{Lo} $	—	—	1	μA	$\overline{CS1} = V_{IH}$ or $CS2 = V_{IL}$ or $OE = V_{IH}$ or $\overline{WE} = V_{IL}$, $V_{I/O} = V_{SS} \text{ to } V_{CC}$
Operating current	I_{CC}	—	—	15	mA	$\overline{CS1} = V_{IL}$, $CS2 = V_{IH}$, others = V_{IH}/V_{IL} , $I_{I/O} = 0$ mA
Average operating current	I_{CC1}	—	—	60	mA	Min cycle, duty = 100% $I_{I/O} = 0$ mA, $\overline{CS1} = V_{IL}$, $CS2 = V_{IH}$, Others = V_{IH}/V_{IL}
	I_{CC2}	—	6	20	mA	Cycle time = 1 μs , duty = 100%, $I_{I/O} = 0$ mA, $\overline{CS1} \leq 0.2$ V, $CS2 \geq V_{CC} - 0.2$ V, $V_{IH} \geq V_{CC} - 0.2$ V, $V_{IL} \leq 0.2$ V
Standby current	I_{SB}	—	—	2	mA	(1) $\overline{CS1} = V_{IH}$, $CS2 = V_{IH}$, or (2) $CS2 = V_{IL}$
	I_{SB1}^{*2}	—	2	100	μA	0 V $\leq V_{in}$ (1) 0 V $\leq CS2 \leq 0.2$ V or (2) $\overline{CS1} \geq V_{CC} - 0.2$ V, $CS2 \geq V_{CC} - 0.2$ V
	I_{SB1}^{*3}	—	2	50	μA	
	I_{SB1}^{*4}	—	1	20	μA	
Output high voltage	V_{OH}	2.4	—	—	V	$I_{OH} = -1$ mA
Output low voltage	V_{OL}	—	—	0.4	V	$I_{OL} = 2.1$ mA

Notes: 1. Typical values are at $V_{CC} = 5.0$ V, $T_a = +25^\circ C$ and specified loading, and not guaranteed.
2. This characteristics is guaranteed only for L version.
3. This characteristics is guaranteed only for L-SL version.
4. This characteristics is guaranteed only for L-UL version.

Capacitance ($T_a = +25^\circ C$, $f = 1$ MHz)

Parameter	Symbol	Typ	Max	Unit	Test conditions	Note
Input capacitance	C_{in}	—	8	pF	$V_{in} = 0$ V	1
Input/output capacitance	$C_{I/O}$	—	10	pF	$V_{I/O} = 0$ V	1

Note: 1. This parameter is sampled and not 100% tested.

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AC Characteristics ($T_a = -20$ to $+70^\circ\text{C}$, $V_{CC} = 5.0\text{ V} \pm 10\%$, unless otherwise noted.)

Test Conditions

- Input pulse levels: $V_{IL} = 0.8\text{ V}$, $V_{IH} = 2.4\text{ V}$
- Input rise and fall time: 5 ns
- Input timing reference levels: 1.5 V
- Output timing reference level: 1.5 V
- Output load: 1 TTL Gate+ CL (100 pF) (HM628128D-7)
1 TTL Gate+ CL (50 pF) (HM628128D-5)
(Including scope and jig)

Read Cycle

HM628128D							
		-5		-7			
Parameter	Symbol	Min	Max	Min	Max	Unit	Notes
Read cycle time	t_{RC}	55	—	70	—	ns	
Address access time	t_{AA}	—	55	—	70	ns	
Chip select access time	t_{ACS1}	—	55	—	70	ns	
	t_{ACS2}	—	55	—	70	ns	
Output enable to output valid	t_{OE}	—	30	—	35	ns	
Output hold from address change	t_{OH}	10	—	10	—	ns	
Chip selection to output in low-Z	t_{CLZ1}	10	—	10	—	ns	2, 3
	t_{CLZ2}	10	—	10	—	ns	2, 3
Output enable to output in low-Z	t_{OLZ}	5	—	5	—	ns	2, 3
Chip deselection to output in high-Z	t_{CHZ1}	0	20	0	25	ns	1, 2, 3
	t_{CHZ2}	0	20	0	25	ns	1, 2, 3
Output disable to output in high-Z	t_{OHZ}	0	20	0	25	ns	1, 2, 3

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Write Cycle

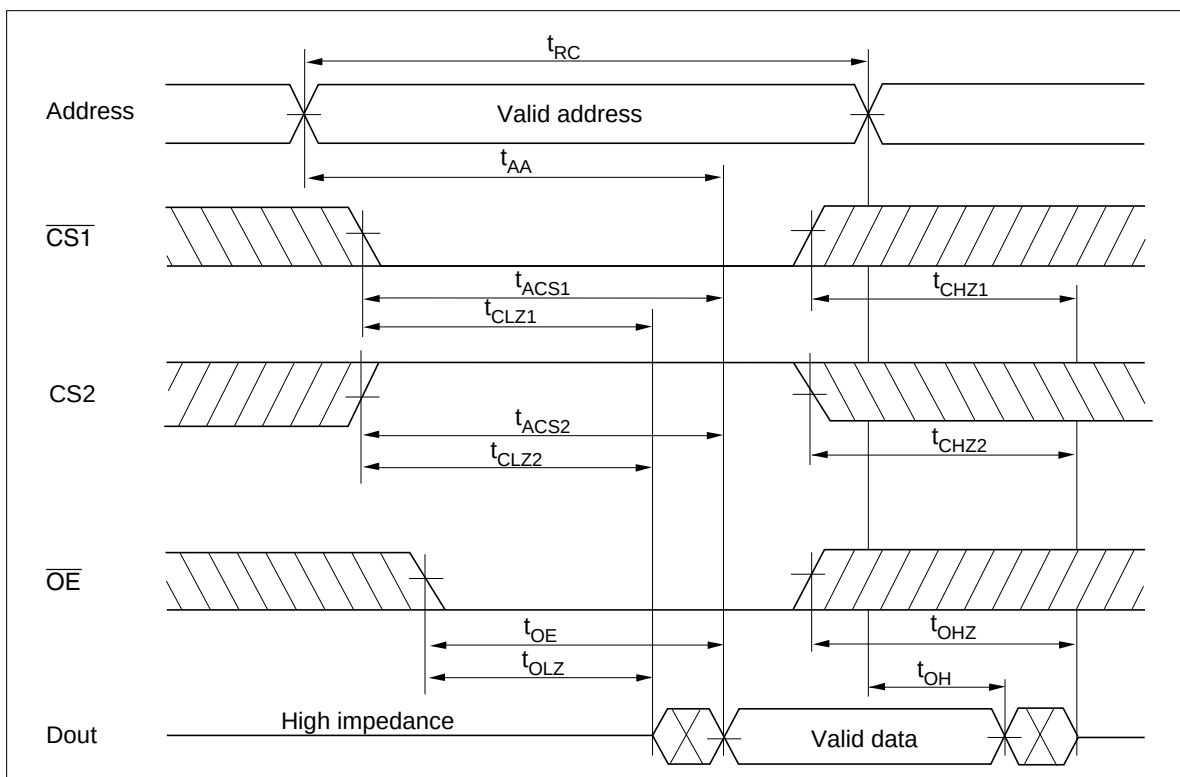
HM628128D							
		-5		-7			
Parameter	Symbol	Min	Max	Min	Max	Unit	Notes
Write cycle time	t_{WC}	55	—	70	—	ns	
Address valid to end of write	t_{AW}	50	—	60	—	ns	
Chip selection to end of write	t_{CW}	50	—	60	—	ns	5
Write pulse width	t_{WP}	40	—	50	—	ns	4, 13
Address setup time	t_{AS}	0	—	0	—	ns	6
Write recovery time	t_{WR}	0	—	0	—	ns	7
Data to write time overlap	t_{DW}	20	—	25	—	ns	
Data hold from write time	t_{DH}	0	—	0	—	ns	
Output active from output in high-Z	t_{OW}	5	—	5	—	ns	2
Output disable to output in high-Z	t_{OHZ}	0	20	0	25	ns	1, 2, 8
$\overline{WE}$ to output in high-Z	t_{WHZ}	0	20	0	25	ns	1, 2, 8

Notes: 1. t_{CHZ} , t_{OHZ} and t_{WHZ} are defined as the time at which the outputs achieve the open circuit conditions and are not referred to output voltage levels.

2. This parameter is sampled and not 100% tested.
3. At any given temperature and voltage condition, t_{HZ} max is less than t_{LZ} min both for a given device and from device to device.
4. A write occurs during the overlap (t_{WP}) of a low $\overline{CS1}$, a high $CS2$, and a low $\overline{WE}$. A write begins at the later transition of $\overline{CS1}$ going low, $CS2$ going high, or $\overline{WE}$ going low. A write ends at the earlier transition of $\overline{CS1}$ going high, $CS2$ going low, or $\overline{WE}$ going high. t_{WP} is measured from the beginning of write to the end of write.
5. t_{CW} is measured from $\overline{CS1}$ going low or $CS2$ going high to the end of write.
6. t_{AS} is measured from the address valid to the beginning of write.
7. t_{WR} is measured from the earlier of $\overline{WE}$ or $\overline{CS1}$ going high or $CS2$ going low to the end of write cycle.
8. During this period, I/O pins are in the output state; therefore, the input signals of the opposite phase to the outputs must not be applied.
9. If the $\overline{CS1}$ goes low or $CS2$ going high simultaneously with $\overline{WE}$ going low or after $\overline{WE}$ going low, the output remain in a high impedance state.
10. Dout is the same phase of the write data of this write cycle.
11. Dout is the read data of next address.
12. If $\overline{CS1}$ is low and $CS2$ high during this period, I/O pins are in the output state. Therefore, the input signals of the opposite phase to the outputs must not be applied to them.
13. In the write cycle with $\overline{OE}$ low fixed, t_{WP} must satisfy the following equation to avoid a problem of data bus contention. $t_{WP} \geq t_{DW} \text{ min} + t_{WHZ} \text{ max}$

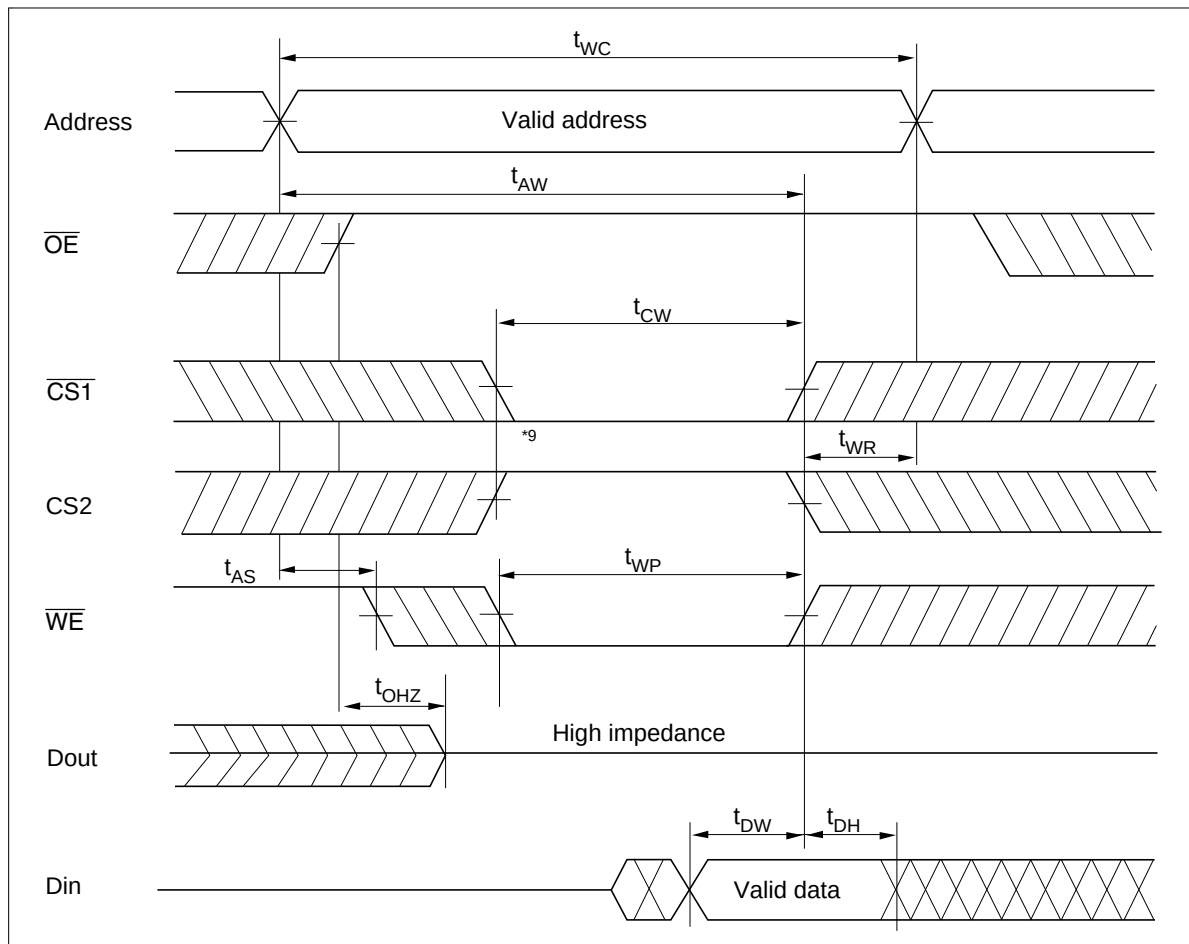
Timing Waveforms

Read Cycle ($\overline{WE} = V_{IH}$)

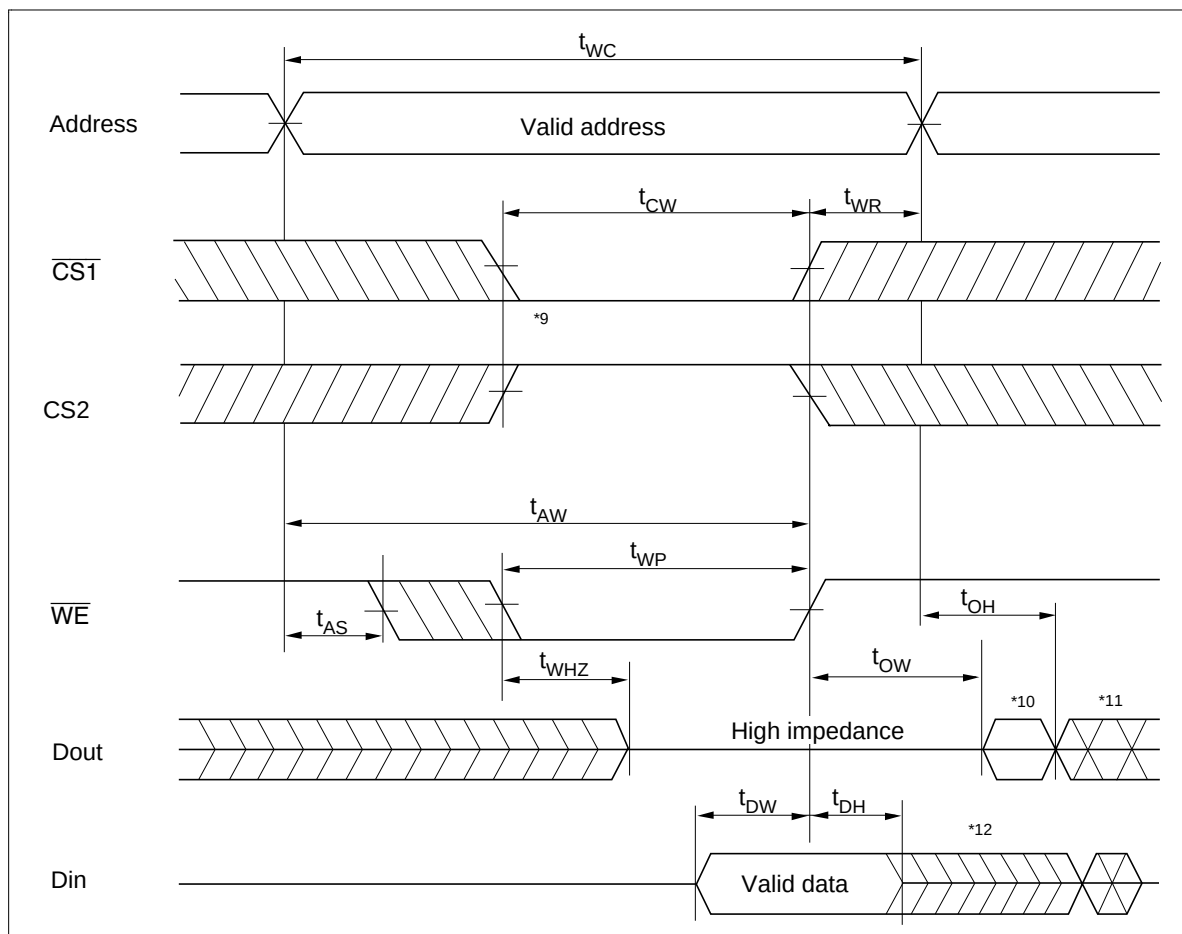


HM628128D Series

Write Cycle (1) ($\overline{\text{OE}}$ Clock)



Write Cycle (2) ($\overline{OE} = V_{IL}$)



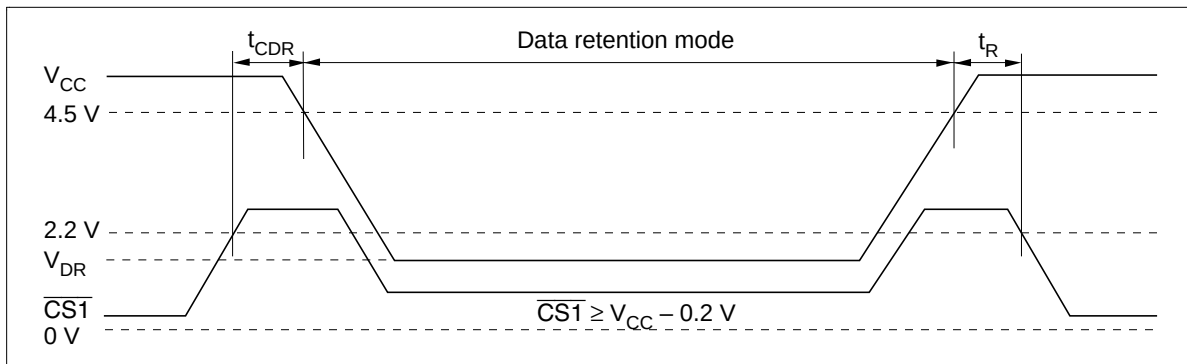
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Low V_{CC} Data Retention Characteristics ($T_a = -20$ to $+70^\circ\text{C}$)

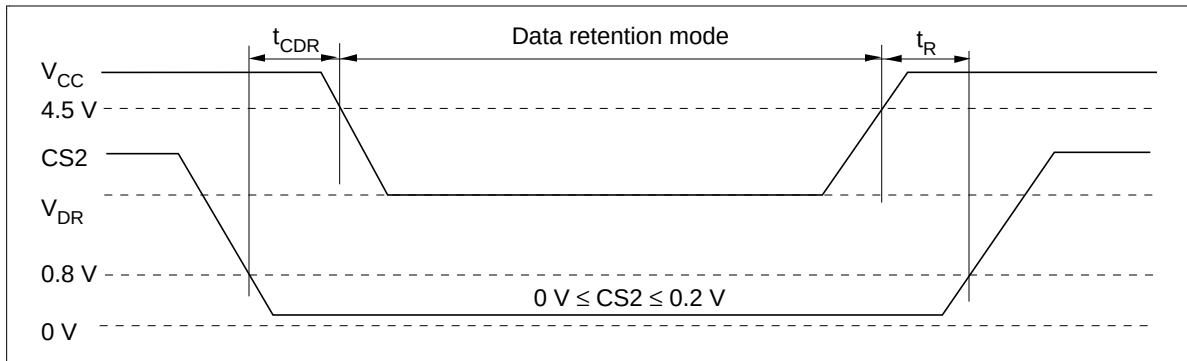
Parameter	Symbol	Min	Typ ^{*5}	Max	Unit	Test conditions ^{*4}
V_{CC} for data retention	V_{DR}	2.0	—	—	V	$V_{in} \geq 0\text{V}$ (1) $0\text{V} \leq \overline{CS2} \leq 0.2\text{V}$ or (2) $\overline{CS2} \geq V_{CC} - 0.2\text{V}$ $\overline{CS1} \geq V_{CC} - 0.2\text{V}$
Data retention current	I_{CCDR}^{*1}	—	1.0	50	μA	$V_{CC} = 3.0\text{V}$, $V_{in} \geq 0\text{V}$ (1) $0\text{V} \leq \overline{CS2} \leq 0.2\text{V}$ or (2) $\overline{CS2} \geq V_{CC} - 0.2\text{V}$, $\overline{CS1} \geq V_{CC} - 0.2\text{V}$
	I_{CCDR}^{*2}	—	1.0	15	μA	
	I_{CCDR}^{*3}	—	0.5	10	μA	
Chip deselect to data retention time	t_{CDR}	0	—	—	ns	See retention waveform
Operation recovery time	t_R	t_{RC}^{*6}	—	—	ns	

- Notes: 1. This characteristic is guaranteed only for L-version, 20 μA max. at $T_a = -20$ to $+40^\circ\text{C}$.
2. This characteristic is guaranteed only for L-SL-version, 3 μA max. at $T_a = -20$ to $+40^\circ\text{C}$.
3. This characteristic is guaranteed only for L-UL-version, 1 μA max. at $T_a = -20$ to $+40^\circ\text{C}$.
4. $\overline{CS2}$ controls address buffer, $\overline{WE}$ buffer, $\overline{CS1}$ buffer, $\overline{OE}$ buffer, and D_{in} buffer. If $\overline{CS2}$ controls data retention mode, V_{in} levels (address, $\overline{WE}$, $\overline{OE}$, $\overline{CS1}$, I/O) can be in the high impedance state. If $\overline{CS1}$ controls data retention mode, $\overline{CS2}$ must be $\overline{CS2} \geq V_{CC} - 0.2\text{V}$ or $0\text{V} \leq \overline{CS2} \leq 0.2\text{V}$. The other input levels (address, $\overline{WE}$, $\overline{OE}$, I/O) can be in the high impedance state.
5. Typical values are at $V_{CC} = 3.0\text{V}$, $T_a = +25^\circ\text{C}$ and specified loading, and not guaranteed.
6. t_{RC} = read cycle time.

Low V_{CC} Data Retention Timing Waveform (1) ($\overline{CS1}$ Controlled)



Low V_{CC} Data Retention Timing Waveform (2) (CS2 Controlled)

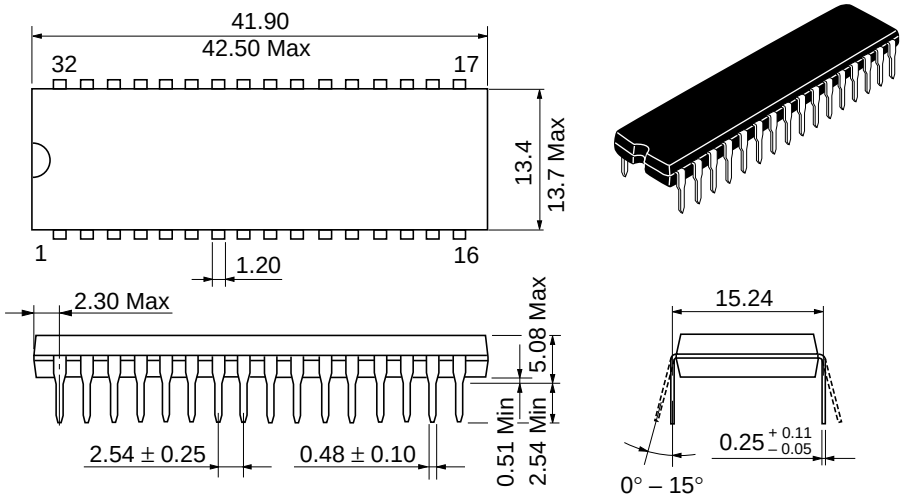


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Package Dimensions

HM628128DLP Series (DP-32)

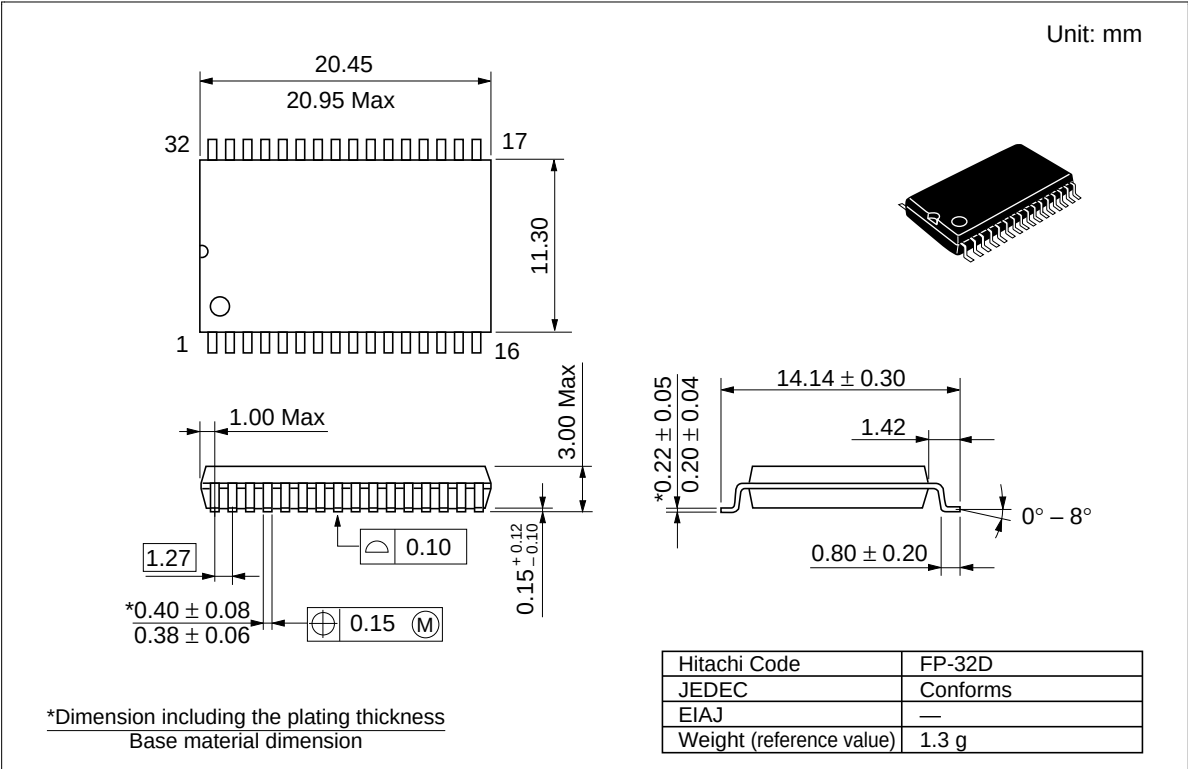
Unit: mm



Hitachi Code	DP-32
JEDEC	—
EIAJ	Conforms
Weight (reference value)	5.1 g

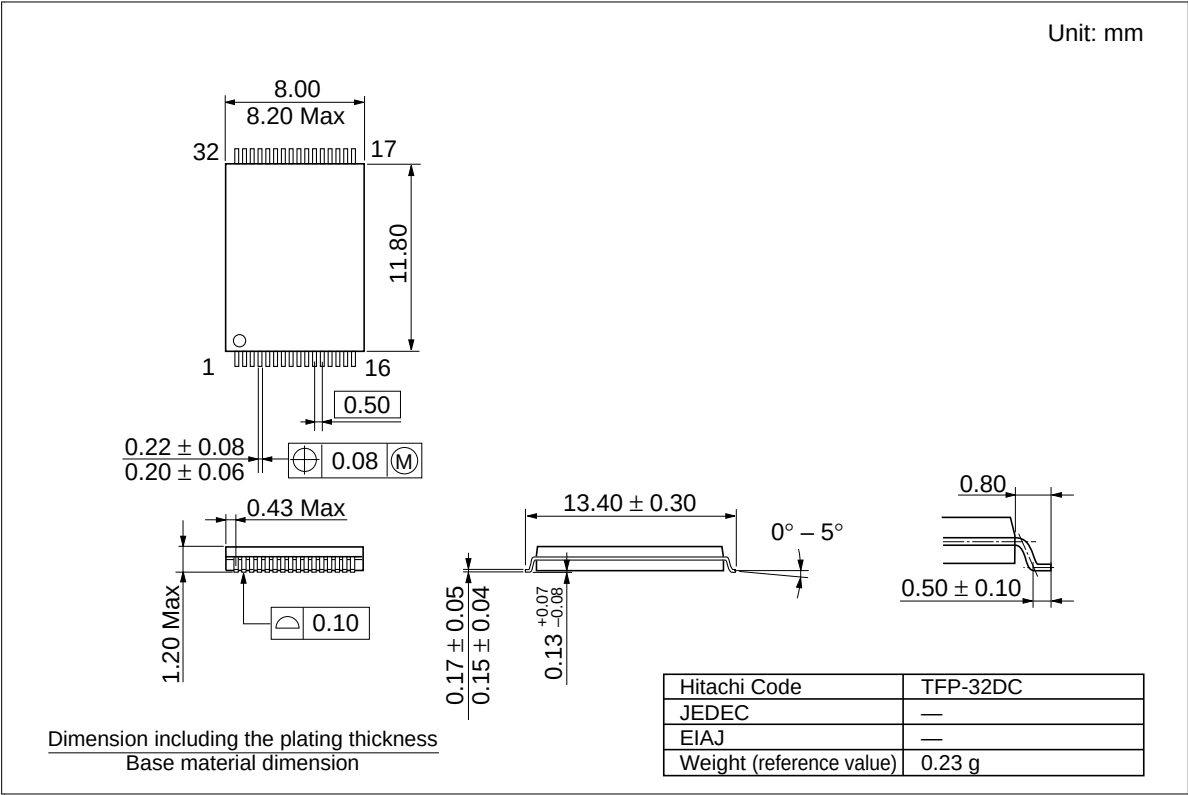
HM628128D Series

HM628128DLFP Series (FP-32D)



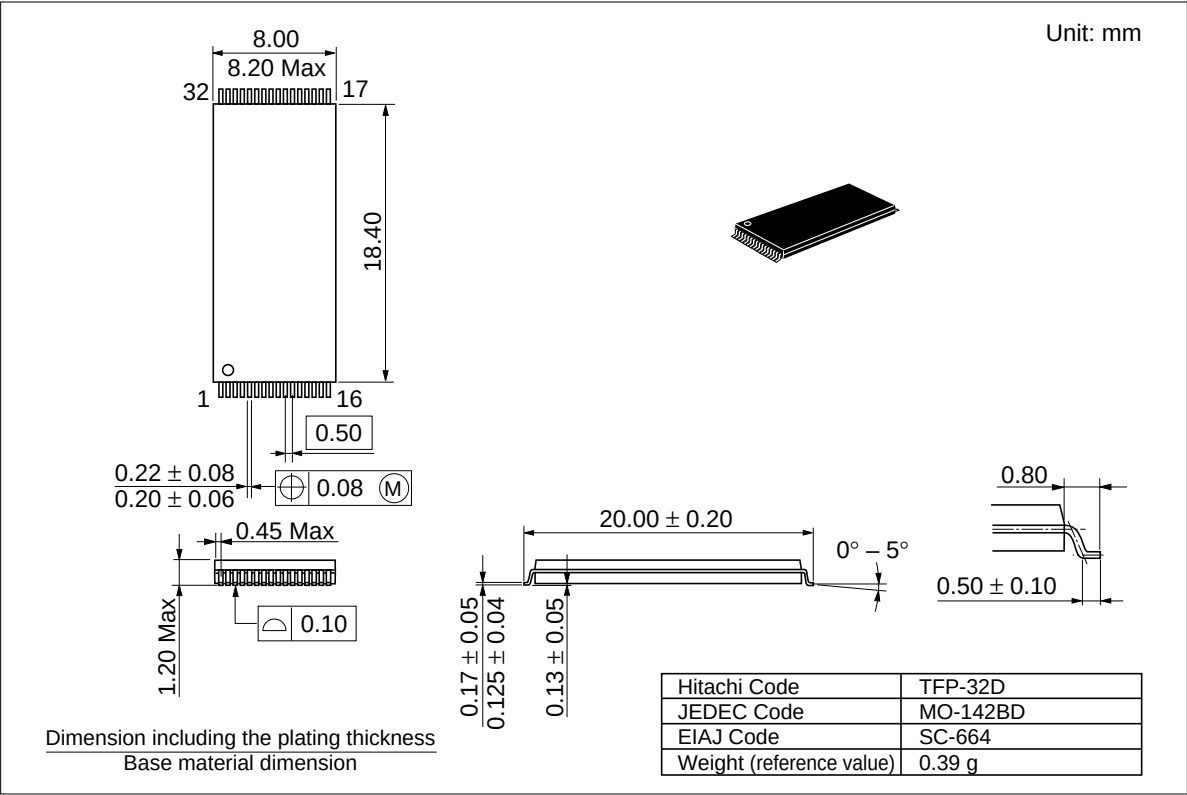
HM628128D Series

HM628128DLTS Series (TFP-32DC)



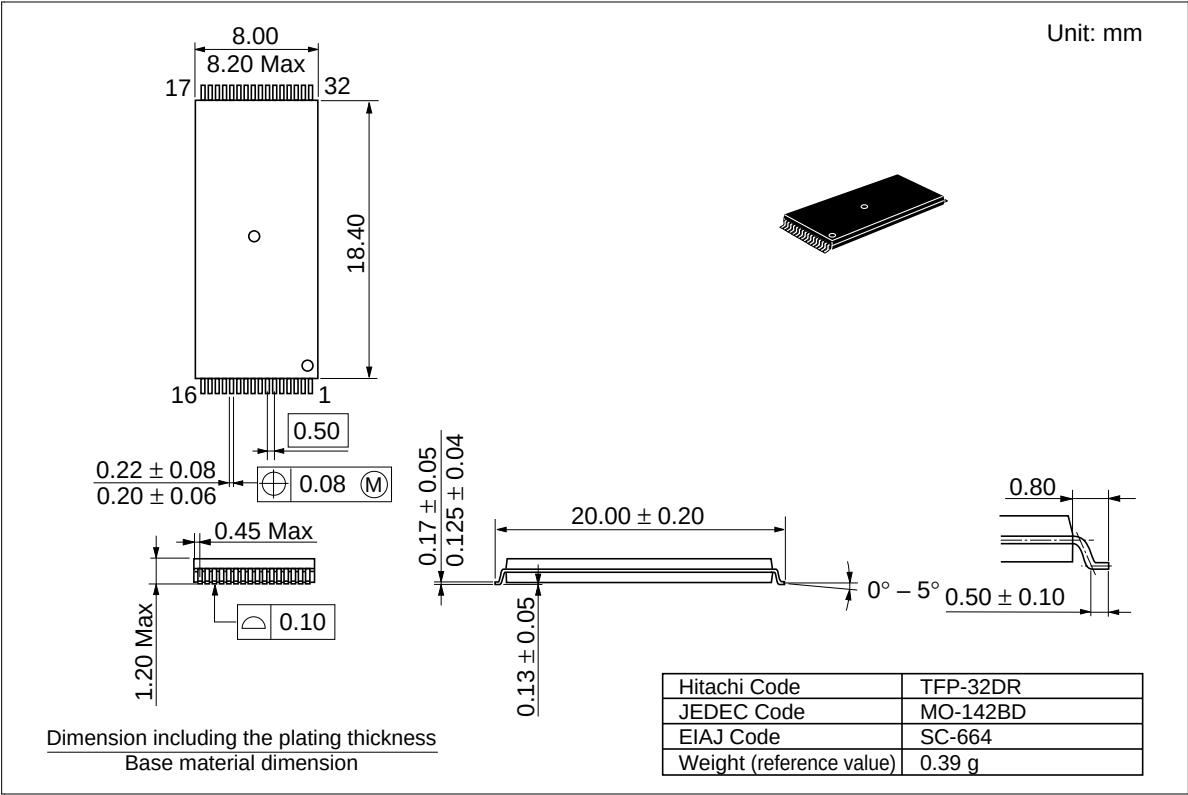
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HM628128DLT Series (TFP-32D)



HM628128D Series

HM628128DLR Series (TFP-32DR)



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HM628128D Series

Revision Record

Rev.	Date	Contents of Modification	Drawn by	Approved by
0.0	Jan. 20, 1999	Initial issue		
