

# GM76C28A

2,048 WORDS × 8 BIT  
CMOS STATIC RAM

## Description

The GM76C28A is 2,048 words × 8 bits asynchronous, static random access memory on a monolithic CMOS chip. Its very low standby power requirement makes it ideal for applications requiring non-volatile storage with back-up batteries. The asynchronous and static nature of the memory requires no external clock or refreshing circuit. Both the input and output ports are TTL compatible and the 3-state output allows easy expansion of memory capacity.

## Features

- Access time: 100/120ns
- Low Power Consumption  
Standby: 1μA  
Operation: 25/30mA
- Complete static operation
- Single power supply: 5V ± 10%
- TTL compatible inputs and outputs
- 3-state output with Wired-OR capability
- Non-volatile storage with back-up batteries
- Standard 24 DIP, 24 SOP and 24 S-DIP

## Pin Description

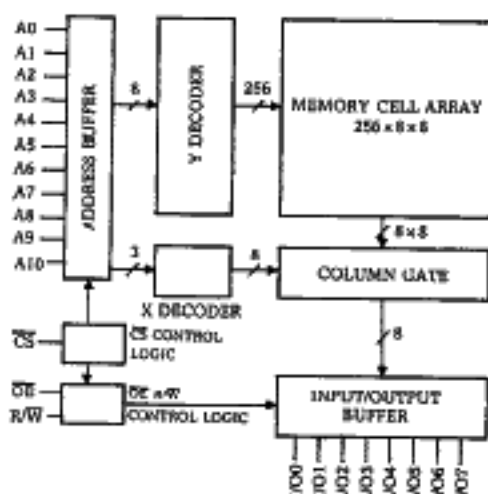
Pin	Function
A0 – A10	Address Inputs
R/W	Read/Write
OE	Output Enable
CS	Chip Select
I/O0 – 7	Data Input/Output
Vcc	Power Supply (+5V)
Vss	Ground

## Pin Configuration



(Top View)

## Block Diagram



## Absolute Maximum Ratings\*

Symbol	Parameter	Rating	Unit
T <sub>A</sub>	Ambient Temperature under Bias	0~70	°C
T <sub>STG</sub>	Storage Temperature	-65~150	°C
V <sub>IN</sub> /V <sub>OUT</sub>	Voltage on any Pin Relative to V <sub>SS</sub>	-0.5~7.0	V
P <sub>D</sub>	Power Dissipation	1.0	W

\*Note: Operation at or above "Absolute Maximum Ratings" can adversely affect device reliability.

Recommended Operating Conditions (T<sub>A</sub>=0 ~ 70°C)

Symbol	Parameter	Min	Typ	Max	Unit
V <sub>CC</sub>	Supply Voltage	4.5	5.0	5.5	V
V <sub>IH</sub>	Input High Voltage	2.2	—	6.0	V
V <sub>IL</sub>	Input Low Voltage	-0.5	—	0.8	V

\*All voltages are referenced to V<sub>SS</sub> pin = 0V.

## Truth Table

CS	OE	R/W	A0 to A10	DATA I/O	MODE	I <sub>CC</sub>
H	X	X	X	Hi-Z	Unselected	I <sub>CCS1</sub> , I <sub>CCS2</sub>
L	L	H	Stable	Output Data	Read	I <sub>CC</sub>
L	H	L	Stable	Input Data	Write	I <sub>CC</sub>
L	L	L	Stable	Input Data	Write	I <sub>CC</sub>

Note: X means "H", "L" or "Hi-Z"

## Electrical Characteristics

DC Electrical Characteristics (V<sub>CC</sub>=5V ± 10%, V<sub>SS</sub>=0V, T<sub>A</sub>=0~70°C)

Symbol	Parameter	Conditions	GM76C28A-10			GM76C28A-12			Unit
			Min	Typ*	Max	Min	Typ*	Max	
V <sub>OL</sub>	Low Level Output Voltage	I <sub>OL</sub> = 4.0mA			0.4			0.4	V
V <sub>OH</sub>	High Level Output Voltage	I <sub>OH</sub> = -1.0mA	2.4			2.4			V
I <sub>CC1</sub>	Operating Supply Current	CS = V <sub>IL</sub> , I <sub>I/O</sub> = 0mA		30	60		25	50	mA
I <sub>CC2</sub>		V <sub>IH</sub> = 3.5V, V <sub>IL</sub> = 0.5V, I <sub>I/O</sub> = 0mA		16			16		mA
I <sub>CC</sub>	Average Operating Current	Min cycle, duty = 100%, I <sub>I/O</sub> = 0mA		30	60		25	50	mA
I <sub>CCS1</sub>	Standby Supply Current	CS = V <sub>IH</sub>		1.5	3.0		1.5	3.0	mA
I <sub>CCS2</sub>		CS = V <sub>CC</sub> - 0.2V		1	50		1	50	μA
I <sub>IL1</sub>	Input Leakage Current	V <sub>CC</sub> = 5.5V, V <sub>I</sub> = 0 to V <sub>CC</sub>	-1		1	-1		1	μA
I <sub>OL1</sub>	Output Leakage Current	CS = V <sub>IH</sub> , or OE = V <sub>IH</sub> , V <sub>I/O</sub> = 0 to V <sub>CC</sub>	-1		1	-1		1	μA

\*Typical values are for reference with V<sub>CC</sub> = 5V and T<sub>A</sub> = 25°C assumed.

**AC Electrical Characteristics:**

**Read Cycle** ( $V_{CC}=5V \pm 10\%$ ,  $T_A=0 \sim 70^\circ C$ )

Symbol	Parameter	Conditions	GM76C28A-10		GM76C28A-12		Unit
			Min	Max	Min	Max	
t <sub>RC</sub>	Read Cycle Time	*1	100		120		ns
t <sub>AA</sub>	Address Access Time			100		120	ns
t <sub>ACS</sub>	$\overline{CS}$ Access Time			100		120	ns
t <sub>CLZ</sub>	$\overline{CS}$ Output Setup Time	*2	10		10		ns
t <sub>OE</sub>	$\overline{OE}$ Access Time	*1		55		60	ns
t <sub>OLZ</sub>	$\overline{OE}$ Output Setup Time	*2	5		10		ns
t <sub>CHZ</sub>	$\overline{CS}$ Output Floating		0	40	0	40	ns
t <sub>OHZ</sub>	$\overline{OE}$ Output Floating		0	40	0	40	ns
t <sub>OH</sub>	Output Hold Time	*1	10		10		ns

**Write Cycle:** ( $V_{CC}=5V \pm 10\%$ ,  $T_A=0 \sim 70^\circ C$ )

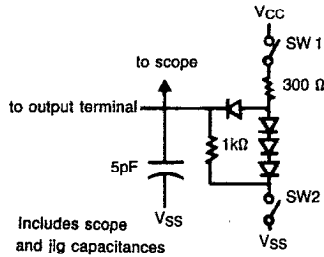
Symbol	Parameter	Conditions	GM76C28A-10		GM76C28A-12		Unit
			Min	Max	Min	Max	
t <sub>WC</sub>	Write Cycle Time	1	100	—	120	—	ns
t <sub>CW</sub>	Chip Select Time ( $\overline{CS}$ )		80	—	85	—	ns
t <sub>AW</sub>	Address Enable Time		80	—	85	—	ns
t <sub>AS</sub>	Address Setup Time		0	—	0	—	ns
t <sub>WP</sub>	Write Pulse Width		65	—	70	—	ns
t <sub>OHZ</sub>	$\overline{OE}$ Output Floating	*2	0	40	0	40	ns
t <sub>WHZ</sub>	R/W Output Floating	*3	0	45	0	50	ns
t <sub>DW</sub>	Input Data Setup Time	*1	45	—	50	—	ns
t <sub>WR</sub>	Address Hold Time		0	—	0	—	ns
t <sub>DH</sub>	Input Data Hold Time		0	—	0	—	ns
t <sub>OW</sub>	R/W Output Setup Time	*3	5	—	10	—	ns

**\*1 Test conditions.**

1. Input pulse level: 0.8V to 2.2V
2.  $t_r = t_f = 10\text{ns}$
3. Input/output timing reference level: 1.5V
4. Output load: 1 TTL +  $C_L = 100\text{pF}$

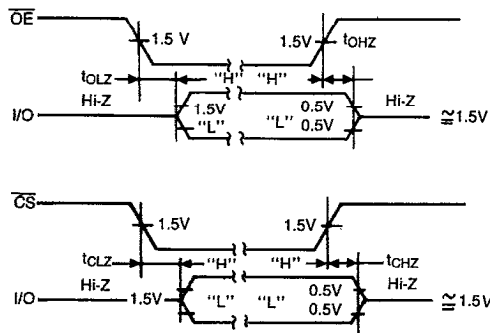
**\*2 Test conditions.**

1. Input pulse level: 0.8V to 2.2V
2.  $t_r = t_f = 10\text{ns}$
3. Test circuit



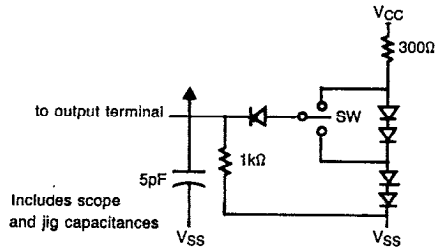
- Both SW1 and SW2 are closed when measuring  $t_{CHZ}$  or  $t_{OHZ}$ .
- SW1 is open and SW2 is closed when measuring Hi-Z-high of  $t_{CLZ}$  or  $t_{OLZ}$
- SW1 is closed and SW2 is open when measuring Hi-Z-low  $t_{CLZ}$  or  $t_{OLZ}$

**Output turn-on turn-off time**



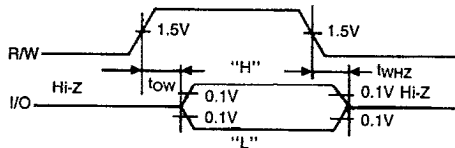
**\*3 Test conditions.**

1. Input pulse level: 0.8V to 2.2V
2.  $t_r = t_f = 10\text{ns}$
3. Test circuit

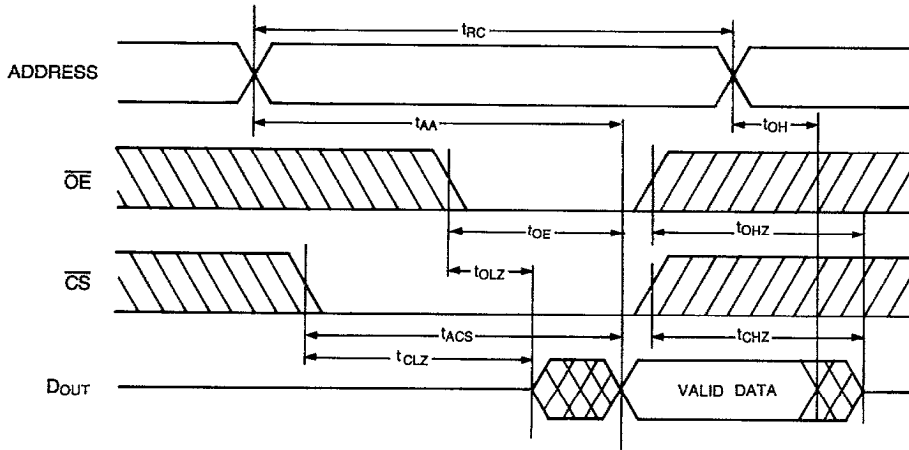


- SW is set to the  $V_{CC}$  side when measuring Hi-Z-high and high-Hi-Z of  $t_{OW}$  or  $t_{WHZ}$
- SW is set to the  $V_{SS}$  side when measuring Hi-Z-low and low-Hi-Z of  $t_{OW}$  or  $t_{WHZ}$

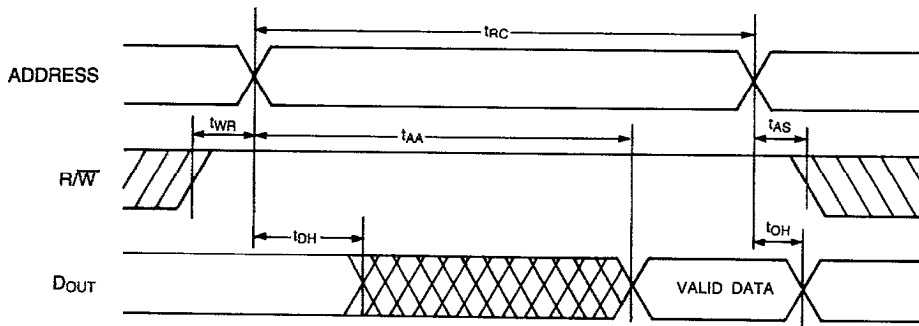
**Output turn-on turn-off time**



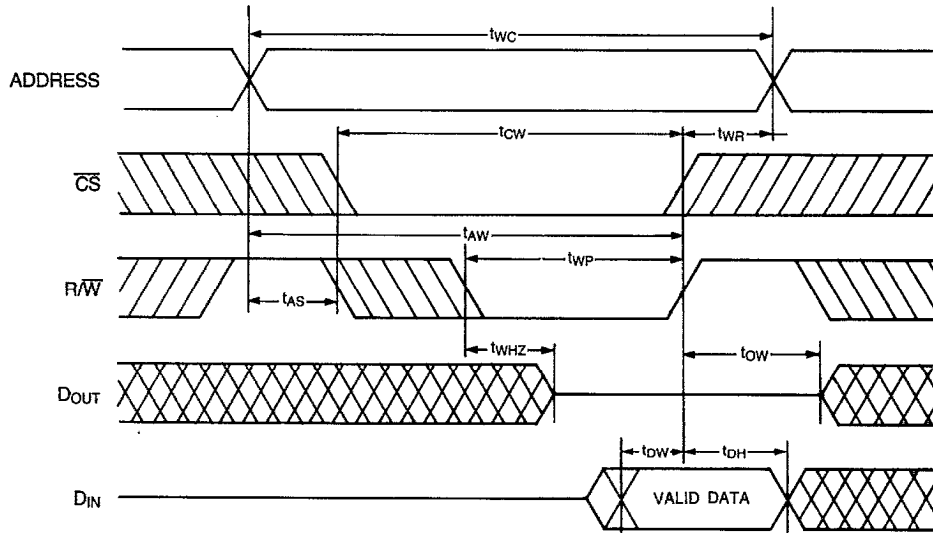
READ CYCLE 1 ( $\overline{OE}$ ,  $\overline{CS}$  CONTROL,  $R/\overline{W}$  = HIGH)



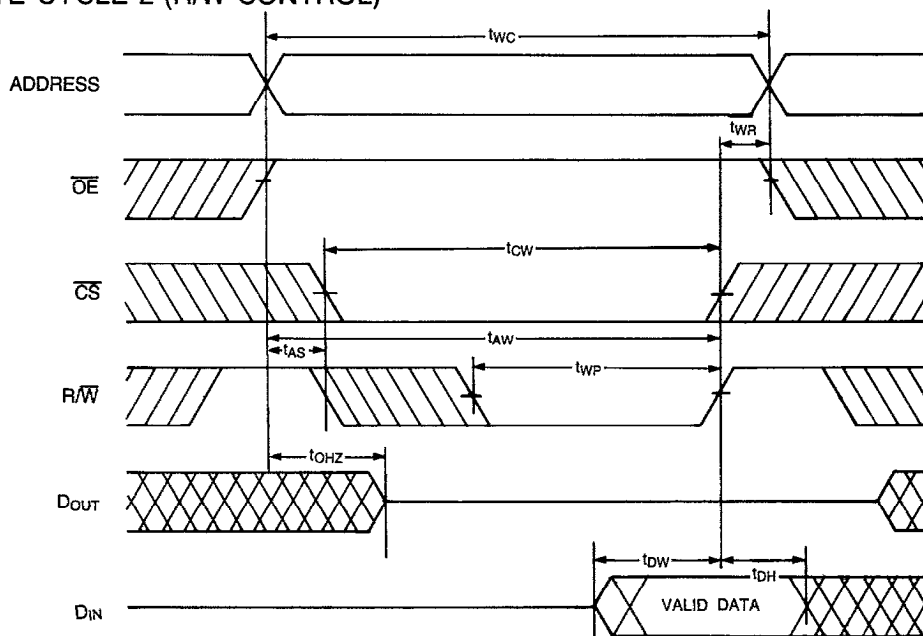
READ CYCLE 2 ( $R/\overline{W}$  CONTROL,  $\overline{OE}$  = LOW,  $\overline{CS}$  = LOW)



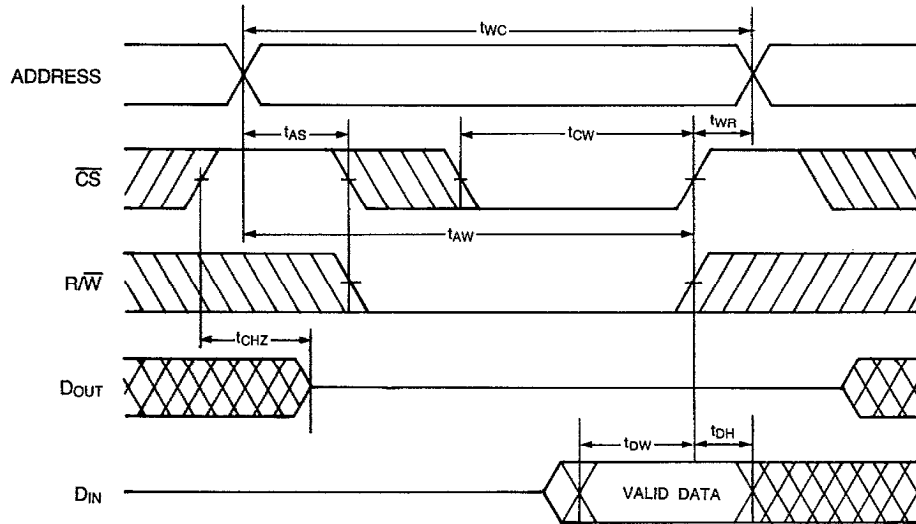
WRITE CYCLE 1 ( $R/\bar{W}$  CONTROL,  $\bar{OE} = \text{LOW}$ )



WRITE CYCLE 2 ( $R/\bar{W}$  CONTROL)



WRITE CYCLE 3 ( $\overline{CS}$  CONTROL,  $\overline{OE} = \text{LOW}$ )



Capacitance ( $f = 1\text{MHz}$ ,  $T_A = 25^\circ\text{C}$ )

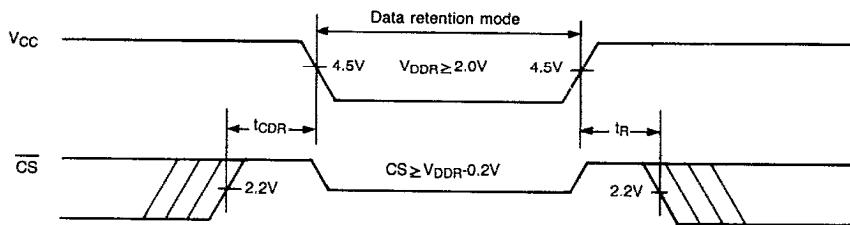
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$C_I$	Input Capacitance	$V_I = 0\text{V}$		4	6	pF
$C_{I/O}$	I/O Capacitance	$V_{I/O} = 0\text{V}$		6	8	pF

Data Retention Characteristics ( $T_A = 0 \sim 70^\circ\text{C}$ )

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{CCR}$	Data Retention Supply Voltage	$\overline{CS} \geq V_{CCR} - 0.2\text{V}$	2.0	—	5.5	V
$I_{CCR}$	Data Retention Current	$V_{CC} = 3.0\text{V}$ , $\overline{CS} \geq 2.8\text{V}$	—	—	25	$\mu\text{A}$
$t_{CDR}$	Chip Select Data Hold Time	Refer to the figure below	0	—	—	ns
$t_R$	Operation Recovery Time		$t_{RC}^*$	—	—	ns

\* $t_{RC}$ : read cycle time

**Data retention timing**



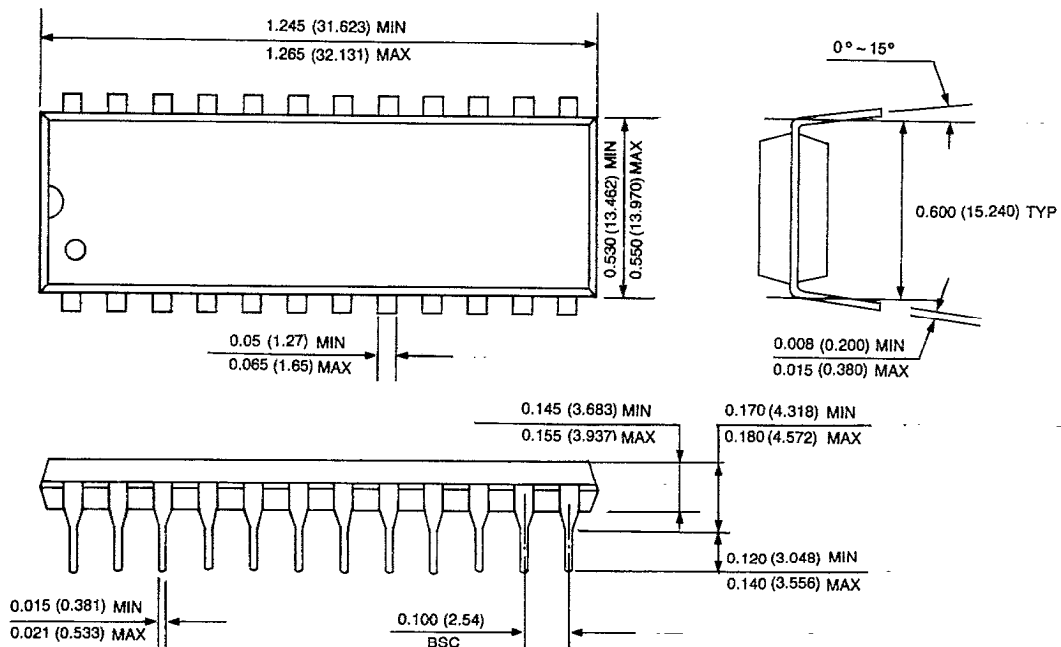
**Note:** When retaining data in standby mode, supply voltage can be lowered within a certain range. Read or write cycle cannot be performed while the supply voltage is low.



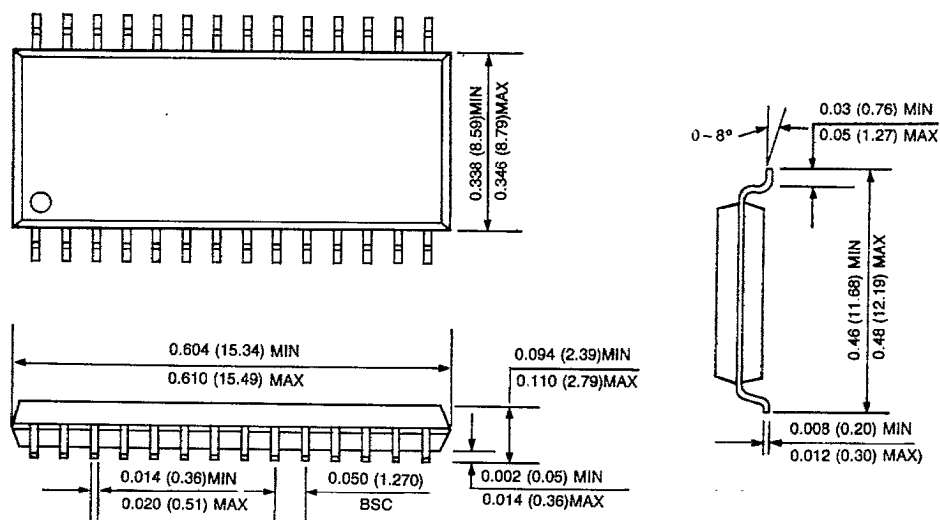
Package Dimensions

Unit: inches (mm)

24 DIP

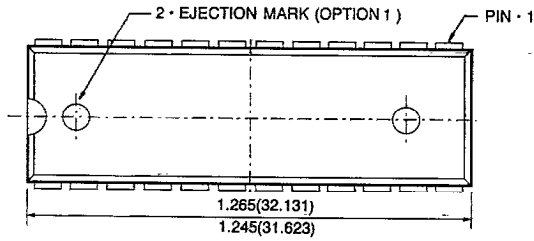


24 SOP

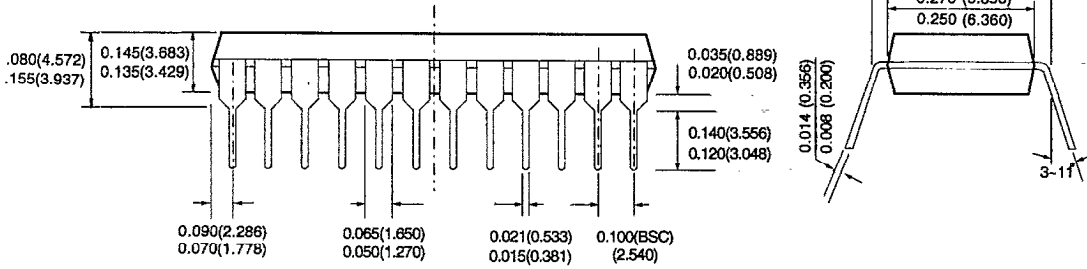


24 SKINNY

UNIT: INCH (mm) MAX  
MIN



- NOTE
1. LEAD FRAME, COPPER TTT
  2. LEAD FINISH, SOLDER PLATED OR SOLDER COATED.
  3. BACK EJECTOR PIN MARKED "KOREA"
  4. BOTH PACKAGE LENGTH AND WIDTH DO NOT INCLUDE FLASH.
  5. CONTROLLING DIMENSION; INCHES (mm)



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