



---

# Three-wire Serial EEPROM

---

BM93C56

---

Bestow Mascot

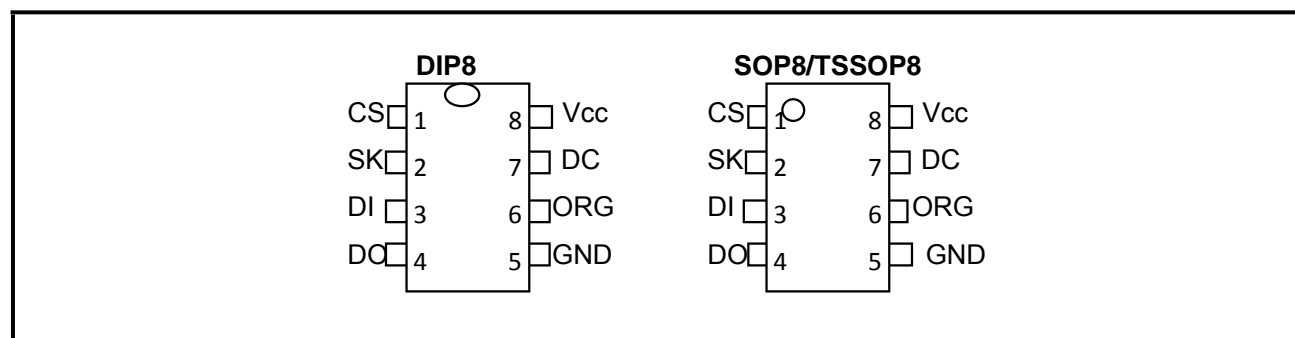
---

**GENERAL DESCRIPTION**

The BM93C56 provides 2048 bits of serial electrically erasable programmable read only memory (EEPROM) organized as 64 words of 16 bits each, when the ORG pin is connected to VCC and 256 words of 8 bits each when it is tied to ground. The BM93C56 is available in space-saving 8-lead DIP/SOP/TSSOP packages. The BM93C56 is enabled through the Chip Select pin (CS), and accessed via a 3-wire serial interface consisting of Data Input (DI), Data Output (DO), and Shift Clock (SK) signals. Upon receiving a Read instruction at DI, the address is decoded and the data is clocked out serially on the data output pin DO. The WRITE cycle is completely self-timed and no separate erase cycle is required before write. The Write cycle is only enabled when it is in the Erase/Write Enable state. When CS is brought "high" following the initiation of a write cycle, the DO pin outputs the Ready/Busy status.

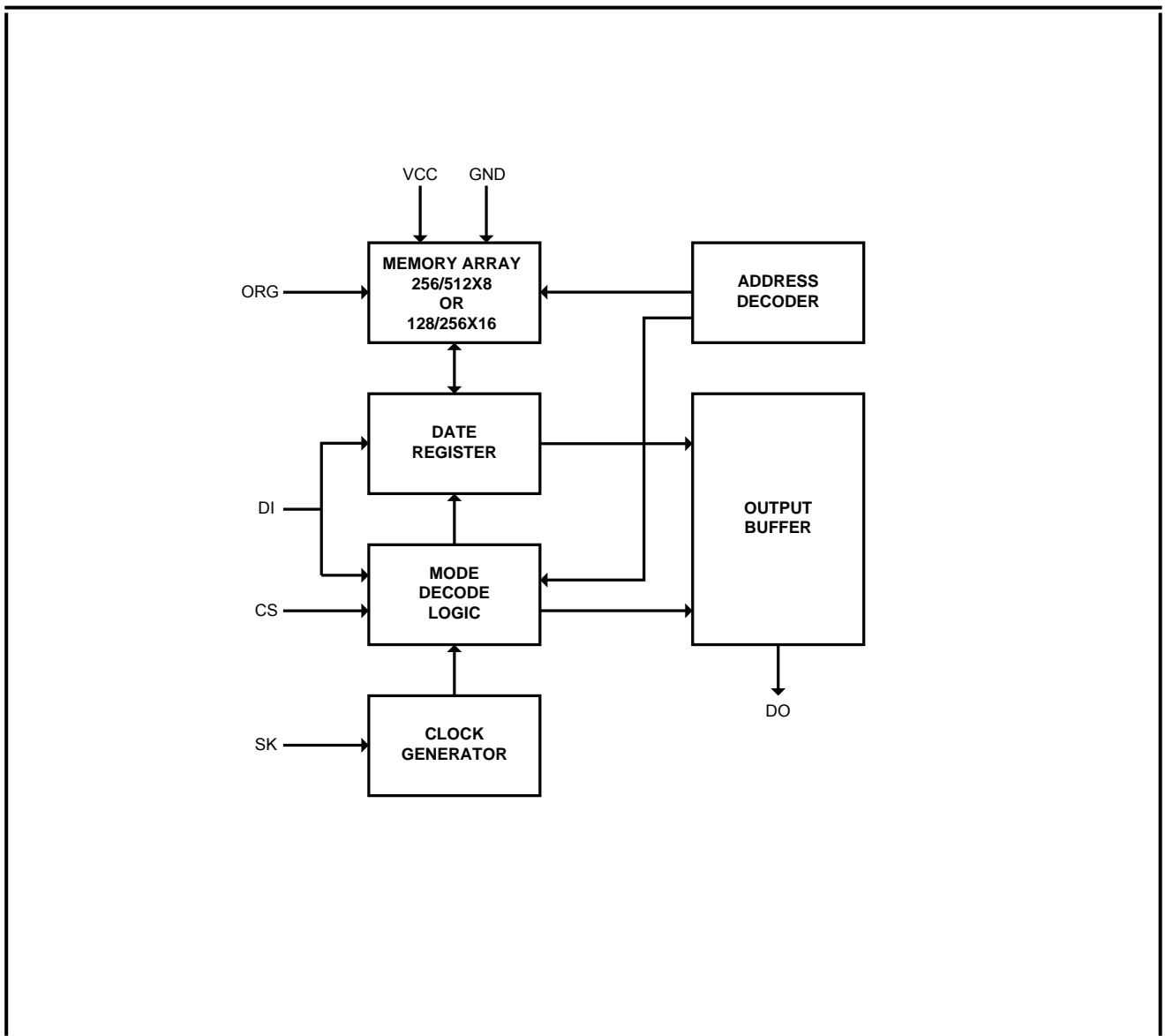
**FEATURES**

- Low-voltage Operation  
-1.7 ( $V_{CC}=1.7V$  to 5.5V)
- Three-wire Serial Interface
- Sequential Read Operation
- 2 MHz Clock Rate (5V) Compatibility
- Self-timed Write Cycle (5 ms max)
- High-reliability  
-Endurance: 1 Million Write Cycles  
-Data Retention: 100 Years
- 8-lead DIP/SOP/TSSOP Packages

**PIN CONFIGURATION**

Pin Name	Functions
CS	Chip Select
SK	Serial Data Clock
DI	Serial Data Input
DO	Serial Data Output
GND	Ground
V <sub>CC</sub>	Power Supply
ORG	Internal Organization
DC	Don't Connect

## BLOCK DIAGRAM



Notes: When the ORG pin is connected to VCC, the "×16" organization is selected. When it is connected to ground, the "×8" organization is selected. If the ORG pin is left unconnected and the application does not load the input beyond the capability of the internal 1 Meg ohm pullup, then the "×16" organization is selected.

## FUNCTIONAL DESCRIPTION

The BM93C56 is accessed via a simple and versatile three-wire serial communication interface. Device operation is controlled by seven instructions issued by the host processor. A valid instruction starts with a rising edge of CS and consists of a start bit (logic“1”) followed by the appropriate op code and the desired memory address location.

**Table 2:** Instruction Set for the BM93C56

Instruction	SB	OP Code	Address		Data		Comments
			×8	×16	×8	×16	
READ	1	10	A8-A0	A7- A0			Reads data stored in memory, at specified address
EWEN	1	00	11XXXXXXXX	11XXXXXXXX			Write enable must precede all programming modes
ERASE	1	11	A8 - A0	A7- A0			Erase memory location An- A0
WRITE	1	01	A8 - A0	A7- A0	D7-D0	D15-D0	Writes memory location An- A0
ERAL	1	00	10XXXXXXXX	10XXXXXXXX			Erases all memory locations. Valid only at V <sub>CC</sub> =4.5V to 5.5V
WRAL	1	00	01XXXXXXXX	01XXXXXXXX	D7-D0	D15-D0	Writes all memory locations. Valid only at V <sub>CC</sub> =4.5V to 5.5V
EWDS	1	00	00XXXXXXXX	00XXXXXXXX			Disables all programming instructions

Notes: The X's in the address field represent don't care values and must be clocked

**READ (READ):** The Read (READ) instruction contains the address code for the memory location to be read. After the instruction and address are decoded, data from the selected memory location is available at the serial output pin DO. Output data changes are synchronized with the rising edges of serial clock SK. It should be noted that a dummy bit (logic “0”) precedes the 8- or 16-bit data output string. The BM93C56 supports sequential read operations. The device will automatically increment the internal address pointer and clock out the next memory location as long as Chip Select(CS) is held high. In this case, the dummy bit (logic “0”) will not be clocked out between memory locations, thus allowing for a continuous stream of data to be read.

**ERASE/WRITE (EWEN):** To assure data integrity, the part automatically goes into the Erase/Write Disable (EWDS) state when power is first applied. An Erase/Write Enable (EWEN) instruction must be executed first before any programming instructions can be carried out. Please note that once in the EWEN state, programming remains enabled until a EWDS instruction is executed or VCC power is removed from the part.

**ERASE (ERASE):** The Erase (ERASE) instruction programs all bits in the specified memory location to the logical “1” state. The self-timed erase cycle starts once the ERASE instruction and address are decoded. The DO pin outputs the Ready/Busy status of the part if CS is brought high after being kept low for a minimum of 250 ns (TCS). A logic “1” at pin DO indicates that the selected memory location has

been erased, and the part is ready for another instruction.

**WRITE (WRITE):** The Write (WRITE) instruction contains the 8 or 16 bits of data to be written into the specified memory location. The self-timed programming cycle, tWP, starts after the last bit of data is received at serial data input pin DI. The DO pin outputs the Ready/Busy status of the part if CS is brought high after being kept low for a minimum of 250 ns (TCS). A logic “0” at DO indicates that programming is still in progress. A logic “1” indicates that the memory location at the specified address has been written with the data pattern contained in the instruction and the part is ready for further instructions. A Ready/Busy status cannot be obtained if the CS is brought high after the end of the self-timed programming cycle, TWP.

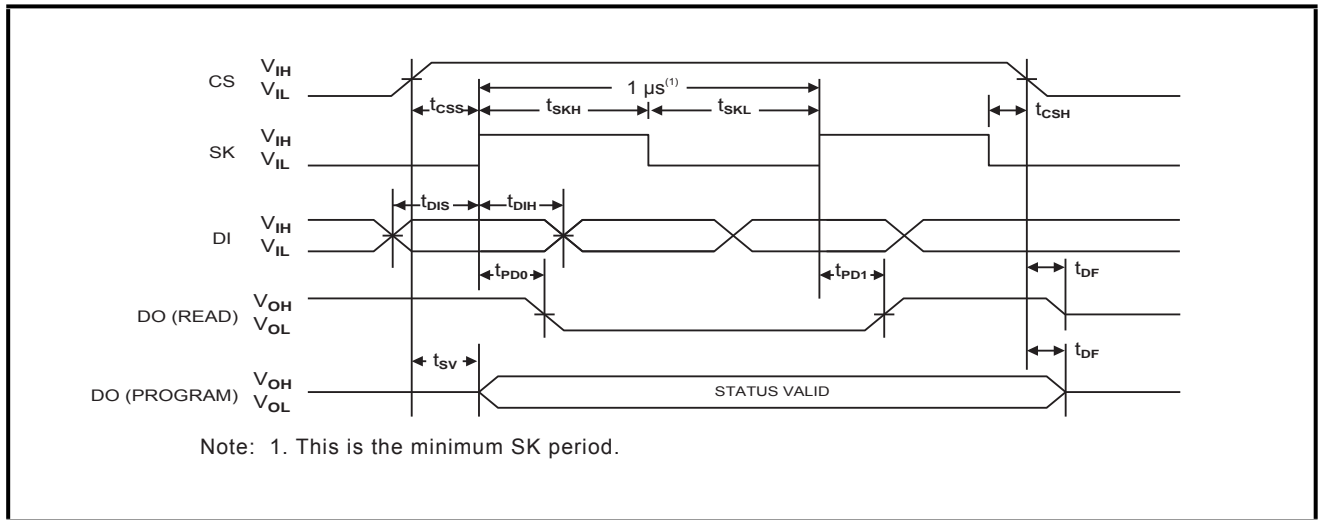
**ERASE ALL (ERAL):** The Erase All (ERAL) instruction programs every bit in the memory array to the logic “1” state and is primarily used for testing purposes. The DO pin outputs the Ready/Busy status of the part if CS is brought high after being kept low for a minimum of 250 ns (TCS). The ERAL instruction is valid only at  $VCC = 5.0V \pm 10\%$ .

**WRITE ALL (WRAL):** The Write All (WRAL) instruction programs all memory locations with the data patterns specified in the instruction. The DO pin outputs the Ready/Busy status of the part if CS is brought high after being kept low for a minimum of 250 ns (TCS). The WRAL instruction is valid only at  $VCC = 5.0V \pm 10\%$ .

**ERASE/WRITE DISABLE (EWDS):** To protect against accidental data disturb, the Erase/Write Disable (EWDS) instruction disables all programming modes and should be executed after all programming operations. The operation of the Read instruction is independent of both the EWEN and EWDS instructions and can be executed at any time.

**TIMING DIAGRAMS:**

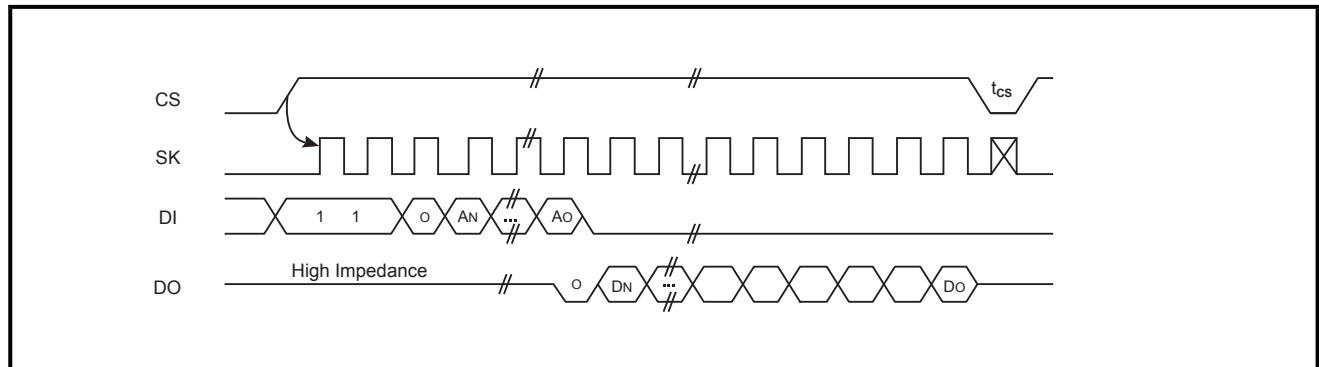
**Figure 1.** Synchronous Data Timing



**Table 3:** Organization Key for Timing Diagram

I/O	BM93C56 (2K)	
	X8	X16
AN	A8(1)	A7(2)
DN	D7	D15

**Figure 2.** READ Timing



**Figure 3.** EWEN Timing

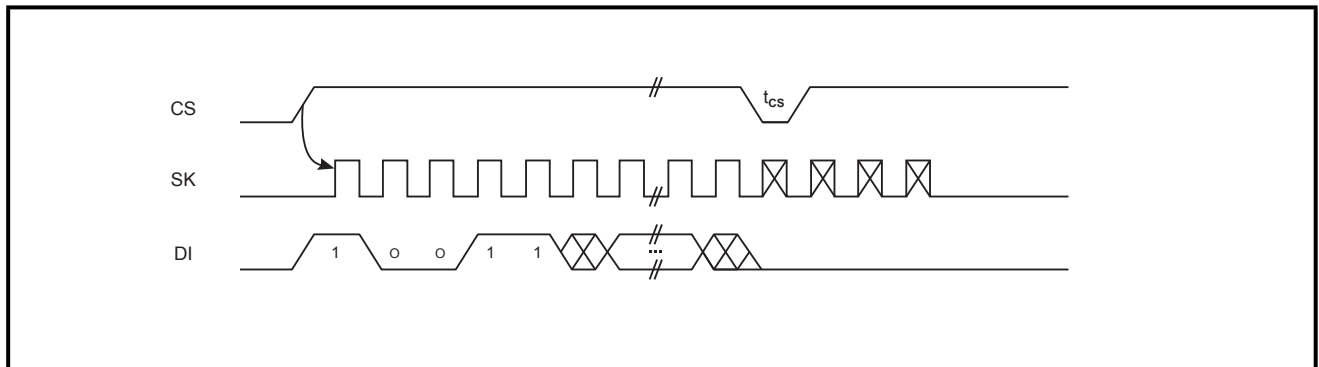


Figure 4. EWDS Timing

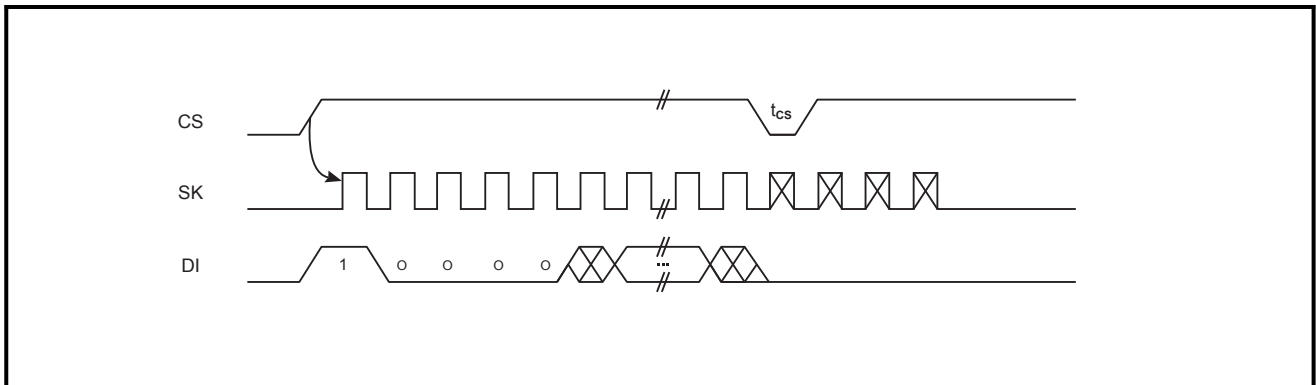


Figure 5. WRITE Timing

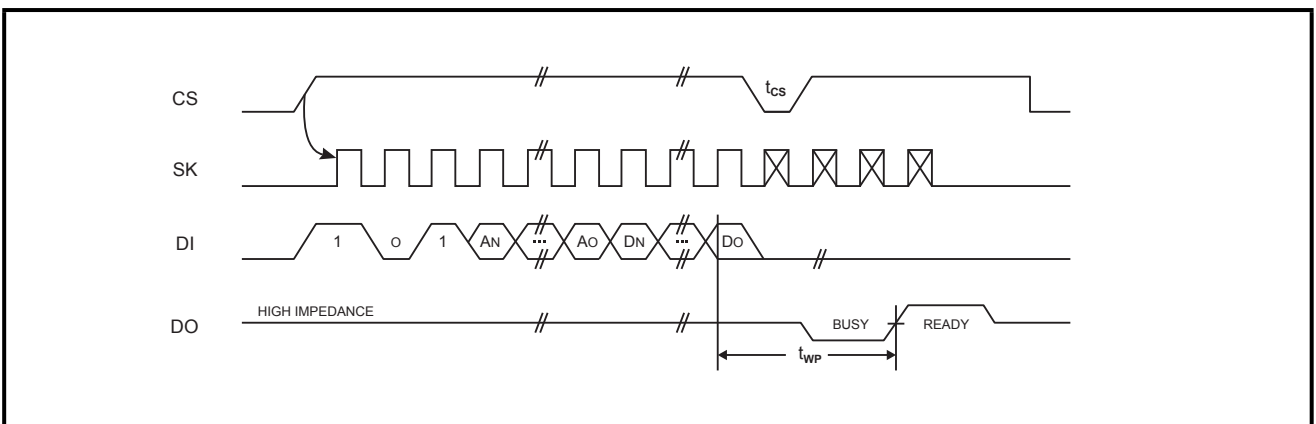


Figure 6. WRAL Timing

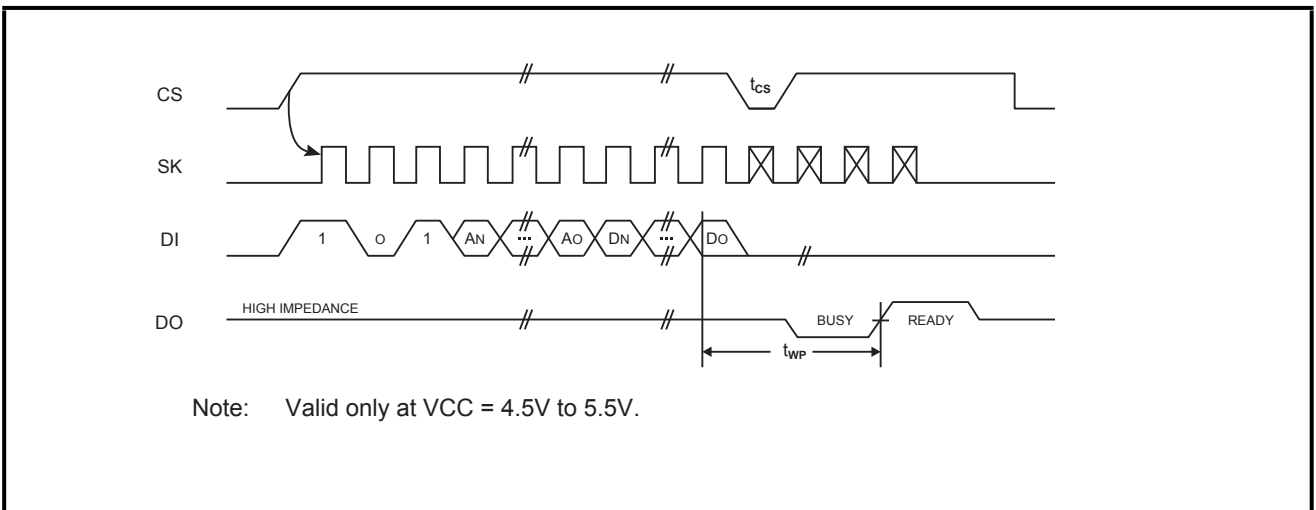


Figure 7. ERASE Timing

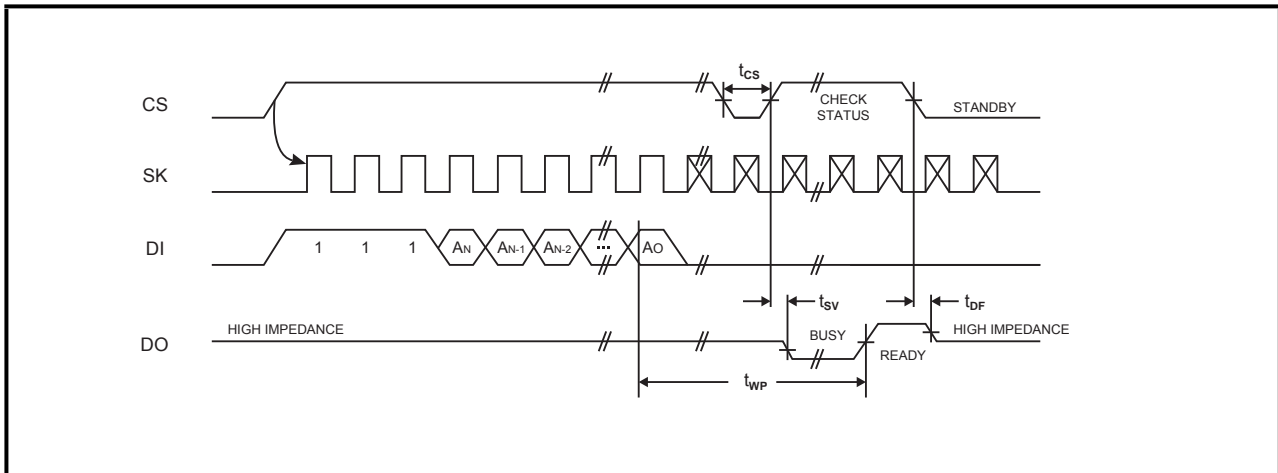
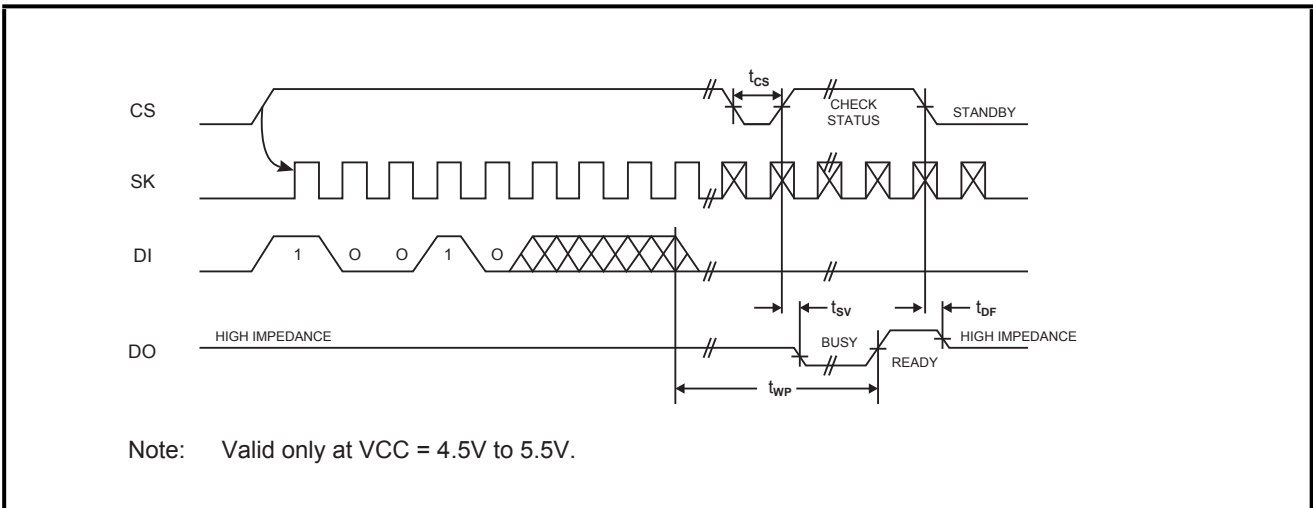


Figure 8. ERAL Timing



**ELECTRICAL CHARACTERISTICS:**

**Absolute Maximum Stress Ratings**

- DC Supply Voltage..... -0.3V to +6.5V
- Input/ Output Voltage....GND-0.3V to V<sub>CC</sub>+0.3V
- Operating Ambient Temperature...-40°C to +85°C
- Storage Temperature..... -65°C to +150°C

**Comments**

Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to this device. These are stress ratings only. Functional operation of this device at these or any other conditions above those indicated in the operational sections of this specification is not implied or intended. Exposure to the absolute maximum rating conditions for extended periods may affect device reliability.



**DC ELECTRICAL CHARACTERISTICS:**

Applicable over recommended operating range from:  $T_A = -40$  to  $+85^\circ\text{C}$ ,  $V_{CC} = +1.7\text{V}$  to  $+5.5\text{V}$  (unless otherwise noted)

Symbol	Parameter	Test Condition		Min.	Typ.	Max.	Units
$V_{CC1}$	Supply Voltage	-		1.7	-	5.5	V
$V_{CC2}$	Supply Voltage	-		2.7	-	5.5	V
$V_{CC3}$	Supply Voltage	-		4.5	-	5.5	V
$I_{CC}$	Supply Current	$V_{CC}=5.0\text{V}$	Read @ 1.0MHz	-	0.5	2.0	mA
			Write @ 1.0MHz	-	2	3.0	mA
$I_{SB1}$	Standby Current	$V_{CC}=1.7\text{V}$	CS = 0V	-	-	1.0	$\mu\text{A}$
$I_{SB2}$	Standby Current	$V_{CC}=2.7\text{V}$	CS = 0V	-	-	1.0	$\mu\text{A}$
$I_{SB3}$	Standby Current	$V_{CC}=5.0\text{V}$	CS = 0V	-	-	1.0	$\mu\text{A}$
$I_{IL(1)}$	Input Leakage	$V_{in} = 0\text{V to } V_{CC}$		-	0.1	1.0	$\mu\text{A}$
$I_{IL(2)}$	Input Leakage	$V_{in} = 0\text{V to } V_{CC}$		-	2.0	3.0	$\mu\text{A}$
$I_{OL}$	Output Leakage	$V_{in} = 0\text{V to } V_{CC}$		-	0.1	1.0	$\mu\text{A}$
$V_{IL(3)}$	Input Low Voltage	$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$		-0.3	-	0.8	V
$V_{IH(3)}$	Input High Voltage			2.0	-	$V_{CC}+0.3$	
$V_{IL2(3)}$	Input Low Voltage	$1.8\text{V} \leq V_{CC} \leq 2.7\text{V}$		-0.5	-	$V_{CC} \times 0.3$	V
$V_{IH2(3)}$	Input High Voltage			$V_{CC} \times 0.7$	-	$V_{CC}+0.3$	
$V_{IL3(3)}$	Input Low Voltage	$V_{CC}=1.7\text{V}$		-0.5	-	$V_{CC} \times 0.2$	V
$V_{IH3(3)}$	Input High Voltage			$V_{CC} \times 0.7$	-	$V_{CC}+0.3$	
$V_{OL1}$	Output Low Voltage	$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$	$I_{OL}=2.1\text{mA}$	-	-	0.4	V
$V_{OH1}$	Output High Voltage		$I_{OH}=-0.4\text{mA}$	2.4	-	-	V
$V_{OL2}$	Output Low Voltage	$1.7\text{V} \leq V_{CC} \leq 2.7\text{V}$	$I_{OL}=0.15\text{mA}$	-	-	0.2	V
$V_{OH2}$	Output High Voltage		$I_{OH}=-100\mu\text{A}$	$V_{CC}-0.2$	-	-	V

Note:1.DI, CS, SK input pin

2.ORG input pin

3. $V_{IL}$  min and  $V_{IH}$  max are reference only and are not tested

**PIN CAPACITANCE:**

Applicable over recommended operating range from  $T_A = 25^\circ\text{C}$ ,  $f=1.0\text{MHz}$ ,  $V_{CC}=+1.7\text{V}$  (unless otherwise noted)

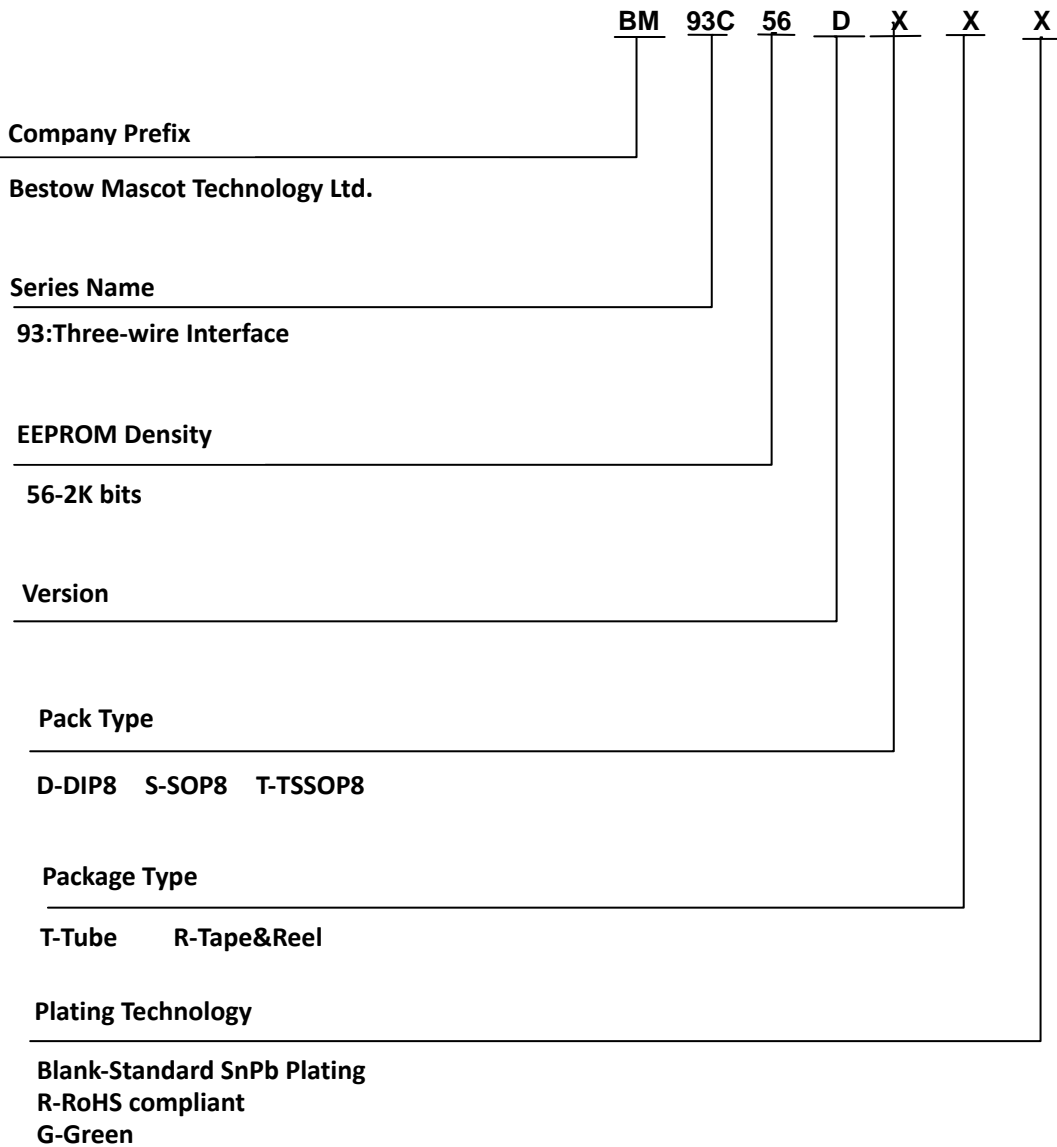
Symbol	Test Conditions	Max.	Unit	Conditions
COUT	Output Capacitance (DO)	5	pF	$V_{OUT}=0\text{V}$
CIN	Input Capacitance (CS, SK, DI, ORG)	5	pF	$V_{IN}=0\text{V}$

**AC CHARACTERISTIC:**Applicable over recommended operating range from  $T_A = -40$  to  $+85^\circ\text{C}$ ,  $V_{CC} = +1.7\text{V}$  to  $+5.5\text{V}$  $C_L = 1$  TTL Gate and 100 pF (unless otherwise noted)

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Units	
$f_{SK}$	SK Clock Frequency	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$	0	-	2	MHz	
		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$	0		1		
		$1.7\text{V} \leq V_{CC} \leq 5.5\text{V}$	0		0.25		
$t_{SKH}$	SK High Time	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$	250	-	-	ns	
		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$	250				
		$1.7\text{V} \leq V_{CC} \leq 5.5\text{V}$	1000				
$t_{SKL}$	SK Low Time	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$	250	-	-	ns	
		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$	250				
		$1.7\text{V} \leq V_{CC} \leq 5.5\text{V}$	1000				
$t_{CS}$	Minimun CS Low Time	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$	250	-	-	ns	
		$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$	250				
		$1.7\text{V} \leq V_{CC} \leq 5.5\text{V}$	1000				
$t_{CSS}$	CS Setup Time	Relative to SK	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$	50	-	-	ns
			$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$	50			
			$1.7\text{V} \leq V_{CC} \leq 5.5\text{V}$	200			
$t_{DIS}$	DI Setup Time	Relative to SK	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$	100	-	-	ns
			$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$	100			
			$1.7\text{V} \leq V_{CC} \leq 5.5\text{V}$	400			
$t_{CSH}$	CS Hold Time	Relative to SK	-	0	-	-	ns
$t_{DIH}$	DI Hold Time	Relative to SK	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$	100	-	-	ns
			$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$	100			
			$1.7\text{V} \leq V_{CC} \leq 5.5\text{V}$	400			
$t_{PD1}$	Output Delay to "1"	AC Test	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$	-	-	250	ns
			$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$			250	
			$1.7\text{V} \leq V_{CC} \leq 5.5\text{V}$			1000	
$t_{PD0}$	Output Delay to "0"	AC Test	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$	-	-	250	ns
			$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$			250	
			$1.7\text{V} \leq V_{CC} \leq 5.5\text{V}$			1000	
$t_{SV}$	CS to Status Valid	AC Test	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$	-	-	250	ns
			$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$			250	
			$1.7\text{V} \leq V_{CC} \leq 5.5\text{V}$			1000	
$t_{DF}$	CS to DO in High Impedance	AC Test	$4.5\text{V} \leq V_{CC} \leq 5.5\text{V}$	-	-	100	ns
			$2.7\text{V} \leq V_{CC} \leq 5.5\text{V}$			100	
			$1.7\text{V} \leq V_{CC} \leq 5.5\text{V}$			400	
$t_{WP}$	Write Cycle Time	-	-	-	1.5	5	ms
Endurance	5.0V, 25 °C	-	-	1M	-	-	Write Cycle

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

**ORDERING INFORMATION**



Model	DIP8	SOP8	TSSOP8
BM93C56	√	√	√

√ : Mass-produced

\* : Design in

-: Be customized

**ORDERING INFORMATION**

<b>Package</b>	<b>Temperature Range</b>	<b>Vcc</b>	<b>HSF</b>	<b>Packaging</b>	<b>Order code</b>
DIP8	-40°C-85°C	1.7V-5.5V	RoHS	Tube	BM93C56D-D-T-R
SOP8	-40°C-85°C	1.7V-5.5V	RoHS	Tube	BM93C56D-S-T-R
				Tape and Reel	BM93C56D-S-R-R
			Green	Tube	BM93C56D-S-T-G
				Tape and Reel	BM93C56D-S-R-G
TSSOP8	-40°C-85°C	1.7V-5.5V	RoHS	Tube	BM93C56D-T-T-R
				Tape and Reel	BM93C56D-T-R-R
			Green	Tube	BM93C56D-T-T-G
				Tape and Reel	BM93C56D-T-R-G

**TAPE and REEL INFORMATION**

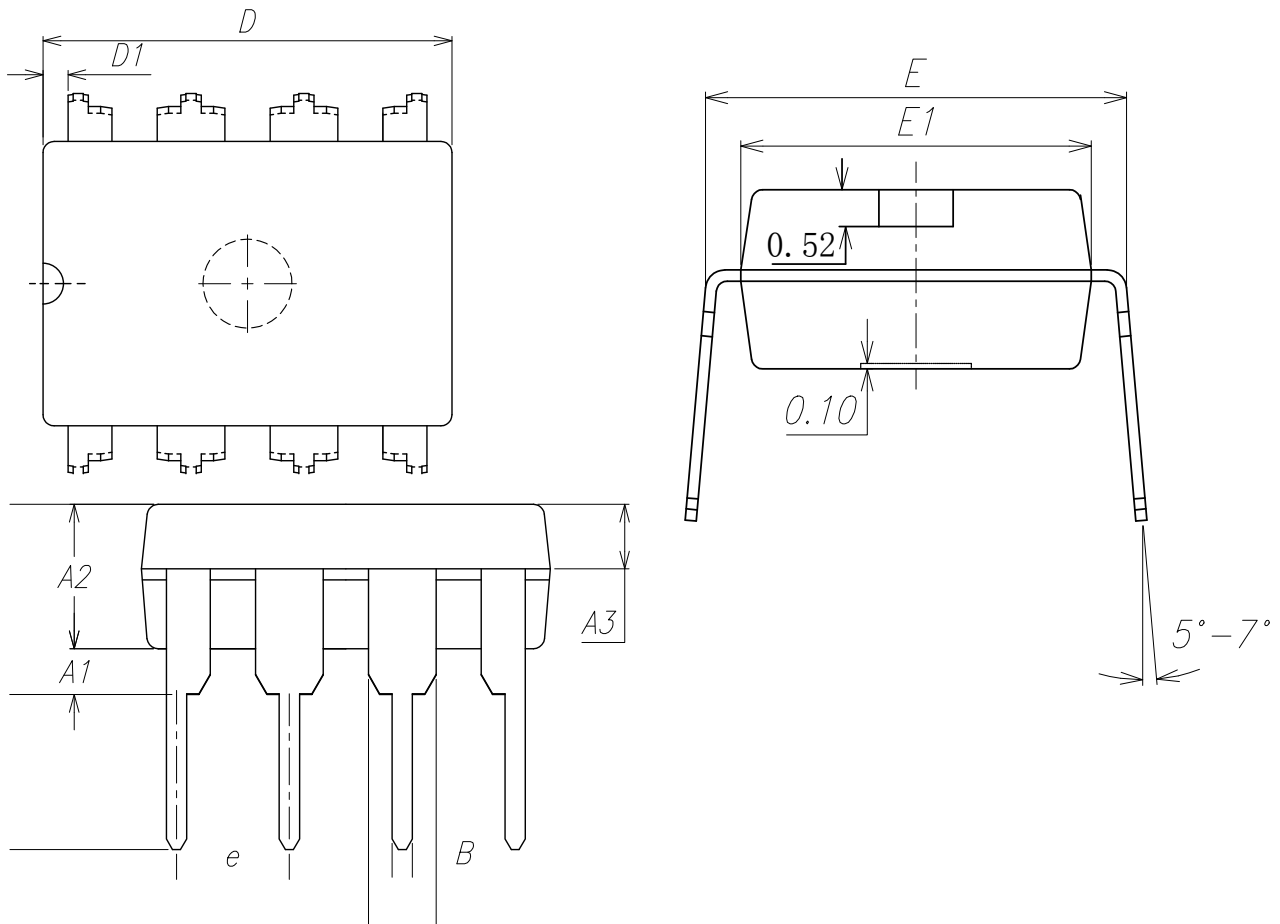
Container	Tube
Quantity	2000pcs
Direction of feed	Direction of products is fixed in a container tube

\*Order quantity needs to be multiple of the minimum quantity.

Tape	Embossed carrier tape
Quantity	2500pcs
Direction of feed	E2 ( The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand )

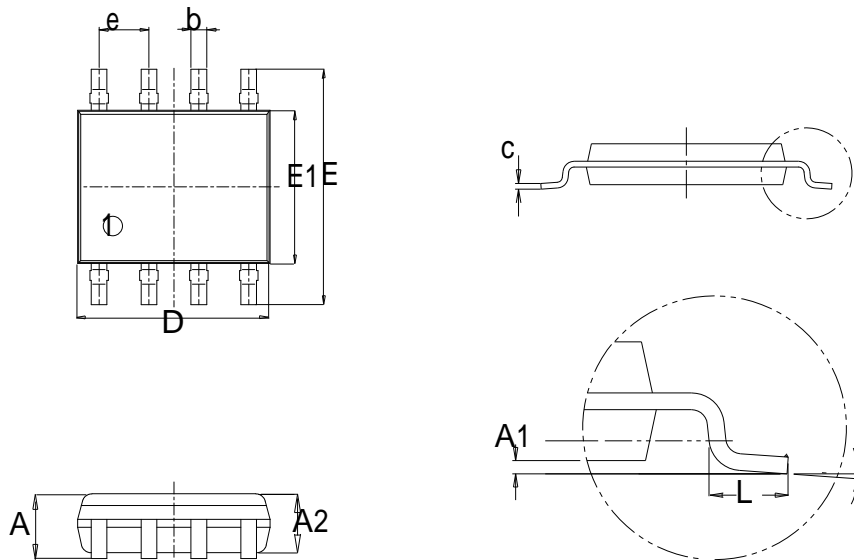
\*Order quantity needs to be multiple of the minimum quantity.

**DIP PACKAGE OUTLINE DIMENSIONS**



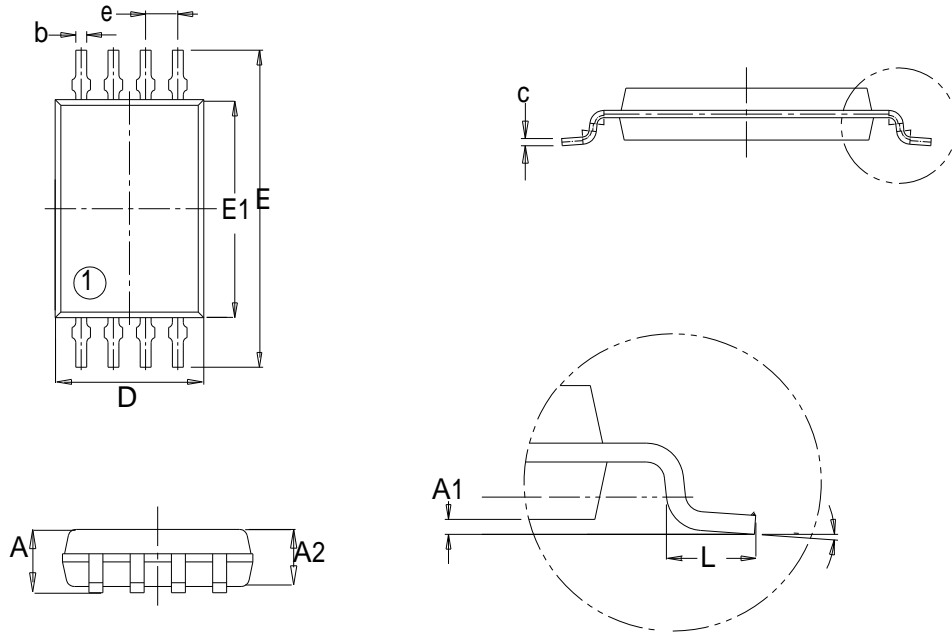
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	3.60	4.00	0.142	0.157
A1	0.51	-	0.020	-
A2	3.10	3.50	0.122	0.138
A3	1.50	1.70	0.059	0.067
B	0.44	0.53	0.017	0.021
B1	1.52	1.57	0.060	0.062
D	9.20	9.25	0.362	0.364
D1	0.561	0.611	0.022	0.024
E	7.63	7.68	0.300	0.302
E1	6.35	6.40	0.250	0.252
e	2.54BSC		0.100 BSC	
L	3.49	3.81	0.138	0.150

SOP8 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	1.350	1.650	0.053	0.065
A1	0.100	0.250	0.004	0.010
A2	1.450	1.525	0.057	0.060
b	0.375	0.425	0.015	0.017
c	0.245 (BSC)		0.010 (BSC)	
D	4.875	4.925	0.192	0.194
E	5.900	6.100	0.232	0.240
E1	3.825	3.925	0.151	0.155
e	1.245	1.295	0.049	0.051
L	0.615	0.765	0.024	0.030
$\alpha$	0°	5°	0°	5°

TSSOP8 PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.850	1.100	0.033	0.043
A1	0.070	0.130	0.003	0.005
A2	0.850	0.900	0.033	0.035
b	0.195	0.245	0.008	0.010
c	0.127 (BSC)		0.005 (BSC)	
D	2.910	3.030	0.115	0.119
E	6.230	6.480	0.245	0.255
E1	4.370	4.430	0.172	0.174
e	0.625	0.675	0.025	0.027
L	0.562	0.638	0.022	0.025
H	0.350 (BSC)		0.014 (BSC)	
α	1°	7°	1°	7°



**NOTICE****●General Precaution**

- 1) Before you use our Products, you are requested to carefully read this document and fully understand its contents. BM shall not be in any way responsible or liable for failure, malfunction or accident arising from the use of any BM's Products against warning, caution or note contained in this document.
- 2) All information contained in this document is current as of the issuing date and subject to change without any prior notice. Before purchasing or using BM's Products, please confirm the latest information with a BM sales representative.

**●Precaution on using BM Products**

- 1) Our Products are designed and manufactured for application in ordinary electronic equipments (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment, transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the BM sales representative in advance. Unless otherwise agreed in writing by BM in advance, BM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any BM's Products for Specific Applications.
- 2) BM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
  - [a] Installation of protection circuits or other protective devices to improve system safety
  - [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure
- 3) Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, BM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any BM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
  - [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
  - [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
  - [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases,

including Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>

[d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves

[e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items

[f] Sealing or coating our Products with resin or other coating materials

[g] Use of our Products without cleaning residue of flux (even if you use no-clean type fluxes, cleaning residue of flux is recommended); or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering

[h] Use of the Products in places subject to dew condensation

4) The Products are not subject to radiation-proof design.

5) Please verify and confirm characteristics of the final or mounted products in using the Products.

6) In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse) is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7) De-rate Power Dissipation (Pd) depending on Ambient temperature (Ta). When used in sealed area, confirm the actual ambient temperature.

8) Confirm that operation temperature is within the specified range described in the product specification.

9) BM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

### ●Precaution for Mounting / Circuit board design

1) When a highly active halogen us (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2) In principle, the reflow soldering method must be used; if flow soldering method is preferred, please consult with the BM representative in advance. For details, please refer to BM Mounting specification

### ●Precautions Regarding Application Examples and External Circuits

1) If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2) You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. BM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

**●Precaution for Electrostatic**

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of lonizer, friction prevention and temperature / humidity control).

**●Precaution for Storage / Transportation**

1) Product performance and soldered connections may deteriorate if the Products are stored in the places where:

- [a] the Products are exposed to sea winds or corrosive gases, including Cl<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, and NO<sub>2</sub>
- [b] the temperature or humidity exceeds those recommended by BM
- [c] the Products are exposed to direct sunshine or condensation
- [d] the Products are exposed to high Electrostatic

2) Even under BM recommended storage condition, solder ability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solder ability before using Products of which storage time is exceeding the recommended storage time period.

3) Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4) Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

**●Precaution for Product Label**

QR code printed on BM Products label is for BM's internal use only.

**●Precaution for Disposition**

When disposing Products please dispose them properly using an authorized industry waste company.

**●Precaution for Foreign Exchange and Foreign Trade act**

Since our Products might fall under controlled goods prescribed by the applicable foreign exchange and foreign trade act, please consult with BM representative in case of export.

**●Precaution Regarding Intellectual Property Rights**

1) All information and data including but not limited to application example contained in this document is for reference only. BM does not warrant that foregoing information or data will not infringe any intellectual property rights or any other rights of any third party regarding such information or data. BM shall not be in any way responsible or liable for infringement of any intellectual property rights or other damages

arising from use of such information or data.

2) No license, expressly or implied, is granted hereby under any intellectual property rights or other rights of BM or any third parties with respect to the information contained in this document.

**●Other Precaution**

1) The information contained in this document is provided on an “as is” basis and BM does not warrant that all information contained in this document is accurate and/or error-free. BM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties resulting from inaccuracy or errors of or concerning such information.

2) This document may not be reprinted or reproduced, in whole or in part, without prior written consent of BM.

3) The Products may not be disassembled, converted, modified, reproduced or otherwise changed without prior written consent of BM.

4) In no event shall you use in any way whatsoever the Products and the related technical information contained in the Products or this document for any military purposes, including but not limited to, the development of mass-destruction weapons.

5) The proper names of companies or products described in this document are trademarks or registered trademarks of BM, its affiliated companies or third parties.

**Revision History**

<b>version</b>	<b>Publication date</b>	<b>pages</b>	<b>Revise Description</b>
1.0	Oct.2012	19	Initial Document Release
2.0	May.2014	21	Package Type Update
2.1	Jul.2016	21	Correct some description error