



# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

## 1K Microwire<sup>®</sup>-Compatible Serial EEPROM

### Device Selection Table

Part Number	Vcc Range	ORG Pin	Word Size	Temp Ranges	Packages
93AA46A	1.8-5.5	No	8-bit	I	P, SN, ST, MS, OT
93AA46B	1.8-5.5	No	16-bit	I	P, SN, ST, MS, OT
93LC46A	2.5-5.5	No	8-bit	I, E	P, SN, ST, MS, OT
93LC46B	2.5-5.5	No	16-bit	I, E	P, SN, ST, MS, OT
93C46A	4.5-5.5	No	8-bit	I, E	P, SN, ST, MS, OT
93C46B	4.5-5.5	No	16-bit	I, E	P, SN, ST, MS, OT
93AA46C	1.8-5.5	Yes	8 or 16-bit	I	P, SN, ST, MS
93LC46C	2.5-5.5	Yes	8 or 16-bit	I, E	P, SN, ST, MS
93C46C	4.5-5.5	Yes	8 or 16-bit	I, E	P, SN, ST, MS

### Features

- Low power CMOS technology
- ORG pin to select word size for '46C version
- 128 x 8-bit organization 'A' ver. devices (no ORG)
- 64 x 16-bit organization 'B' ver. devices (no ORG)
- Self-timed ERASE/WRITE cycles (including auto-erase)
- Automatic ERAL before WRAL
- Power on/off data protection circuitry
- Industry standard 3-wire serial I/O
- Device status signal (READY/BUSY)
- Sequential READ function
- 1,000,000 E/W cycles
- Data retention > 200 years
- Temperature ranges supported
  - Industrial (I) -40°C to +85°C
  - Automotive (E) -40°C to +125°C

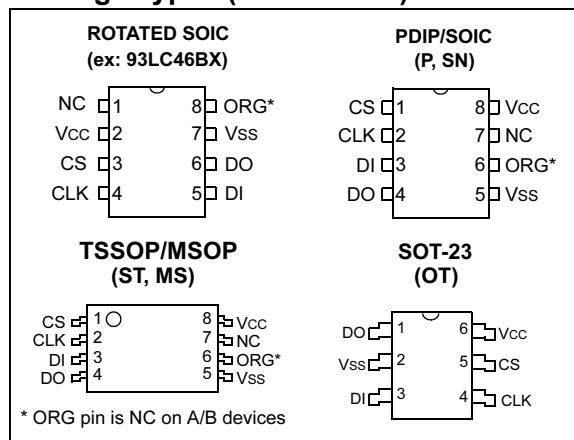
### Pin Function Table

Name	Function
CS	Chip Select
CLK	Serial Data Clock
DI	Serial Data Input
DO	Serial Data Output
Vss	Ground
NC	No internal connection
ORG	Memory Configuration
Vcc	Power Supply

### Description

The Microchip Technology Inc. 93XX46A/B/C devices are 1K bit low voltage serial Electrically Erasable PROMs (EEPROM). Word-selectable devices such as the 93AA46C, 93LC46C or 93C46C are dependent upon external logic levels driving the ORG pin to set word size. For dedicated 8-bit communication, the 93AA46A, 93LC46A or 93C46A devices are available, while the 93AA46B, 93LC46B and 93C46B devices provide dedicated 16-bit communication. Advanced CMOS technology makes these devices ideal for low power, non-volatile memory applications. The entire 93XX Series is available in standard packages including 8-lead PDIP and SOIC, and advanced packaging including 8-lead MSOP, 6-lead SOT-23, and 8-lead TSSOP. Pb-free (Pure Matte Sn) finish is also available.

### Package Types (not to scale)



Microwire is a registered trademark of National Semiconductor.

# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings†

V <sub>CC</sub> .....	7.0V
All inputs and outputs w.r.t. V <sub>SS</sub> .....	-0.6V to V <sub>CC</sub> +1.0V
Storage temperature .....	-65°C to +150°C
Ambient temperature with power applied.....	-40°C to +125°C
ESD protection on all pins .....	≥ 4 kV

† **NOTICE:** Stresses above those listed under “Maximum ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

### DC CHARACTERISTICS

All parameters apply over the specified ranges unless otherwise noted.			V <sub>CC</sub> = range by device (see Table on Page 1) Industrial (I): T <sub>AMB</sub> = -40°C to +85°C Automotive (E): T <sub>AMB</sub> = -40°C to +125°C				
Param. No.	Symbol	Parameter	Min	Typ	Max	Units	Conditions
D1	V <sub>IH1</sub>	High level input voltage	2.0	—	V <sub>CC</sub> +1	V	V <sub>CC</sub> ≥ 2.7V
	V <sub>IH2</sub>		0.7 V <sub>CC</sub>	—	V <sub>CC</sub> +1	V	V <sub>CC</sub> < 2.7V
D2	V <sub>IL1</sub>	Low level input voltage	-0.3	—	0.8	V	V <sub>CC</sub> ≥ 2.7V
	V <sub>IL2</sub>		-0.3	—	0.2 V <sub>CC</sub>	V	V <sub>CC</sub> < 2.7V
D3	V <sub>OL1</sub>	Low level output voltage	—	—	0.4	V	I <sub>OL</sub> = 2.1 mA, V <sub>CC</sub> = 4.5V
	V <sub>OL2</sub>		—	—	0.2	V	I <sub>OL</sub> = 100 μA, V <sub>CC</sub> = 2.5V
D4	V <sub>OH1</sub>	High level output voltage	2.4	—	—	V	I <sub>OH</sub> = -400 μA, V <sub>CC</sub> = 4.5V
	V <sub>OH2</sub>		V <sub>CC</sub> - 0.2	—	—	V	I <sub>OH</sub> = -100 μA, V <sub>CC</sub> = 2.5V
D5	I <sub>LI</sub>	Input leakage current	—	—	±10	μA	V <sub>IN</sub> = V <sub>SS</sub> to V <sub>CC</sub>
D6	I <sub>LO</sub>	Output leakage current	—	—	±10	μA	V <sub>OUT</sub> = V <sub>SS</sub> to V <sub>CC</sub>
D7	C <sub>IN</sub> , C <sub>OUT</sub>	Pin capacitance (all inputs/outputs)	—	—	7	pF	V <sub>IN</sub> /V <sub>OUT</sub> = 0V ( <b>Note 1</b> ) T <sub>AMB</sub> = 25°C, F <sub>CLK</sub> = 1 MHz
D8	I <sub>CC</sub> write	Write current	—	—	2	mA	F <sub>CLK</sub> = 3 MHz, V <sub>CC</sub> = 5.5V
			—	500	—	μA	F <sub>CLK</sub> = 2 MHz, V <sub>CC</sub> = 2.5V
D9	I <sub>CC</sub> read	Read current	—	—	1	mA	F <sub>CLK</sub> = 3 MHz, V <sub>CC</sub> = 5.5V
			—	—	500	μA	F <sub>CLK</sub> = 2 MHz, V <sub>CC</sub> = 3.0V
			—	100	—	μA	F <sub>CLK</sub> = 2 MHz, V <sub>CC</sub> = 2.5V
D10	I <sub>CCS</sub>	Standby current	—	—	1	μA	I-Temp
			—	—	5	μA	E-Temp CLK = CS = 0V ORG = DI = V <sub>SS</sub> or V <sub>CC</sub> ( <b>Note 2</b> ) ( <b>NOTE 3</b> )
D11	V <sub>POR</sub>	V <sub>CC</sub> voltage detect 93AA46A/B/C, 93LC46A/B/C 93C46A/B/C	—	1.5V	—	V	<b>(Note 1)</b>
			—	3.8V	—	V	

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

**2:** ORG pin not available on 'A' or 'B' versions.

**3:** READY/BUSY status must be cleared from DO, see Section 3.4.

# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

## AC CHARACTERISTICS

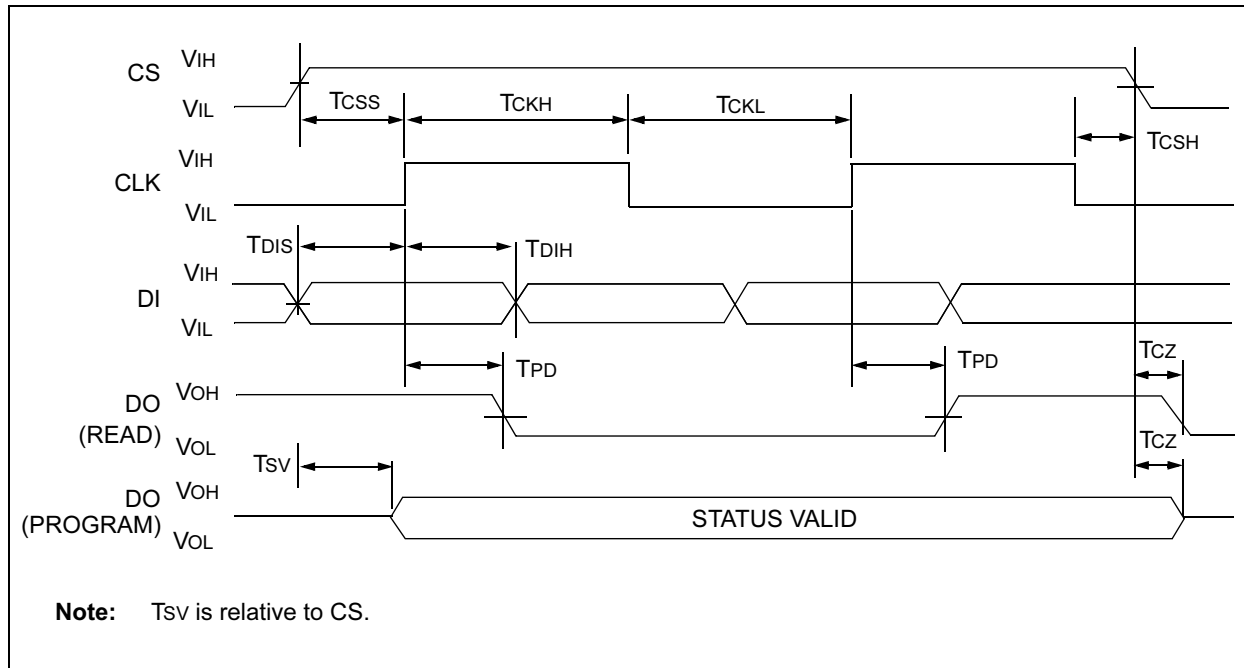
All parameters apply over the specified ranges unless otherwise noted.			VCC = range by device (see Table on Page 1) Industrial (I): TAMB = -40°C to +85°C Automotive (E): TAMB = -40°C to +125°C			
Param. No.	Symbol	Parameter	Min	Max	Units	Conditions
A1	FCLK	Clock frequency	—	3 2 1	MHz MHz MHz	4.5V ≤ VCC < 5.5V, 93XX46C only 2.5V ≤ VCC < 5.5V 1.8V ≤ VCC < 2.5V
A2	TCKH	Clock high time	200 250 450	—	ns ns ns	4.5V ≤ VCC < 5.5V, 93XX46C only 2.5V ≤ VCC < 5.5V 1.8V ≤ VCC < 2.5V
A3	TCKL	Clock low time	100 200 450	—	ns ns ns	4.5V ≤ VCC < 5.5V, 93XX46C only 2.5V ≤ VCC < 5.5V 1.8V ≤ VCC < 2.5V
A4	Tcss	Chip select setup time	50 100 250	—	ns ns ns	4.5V ≤ VCC < 5.5V 2.5V ≤ VCC < 4.5V 1.8V ≤ VCC < 2.5V
A5	Tcsh	Chip select hold time	0	—	ns	1.8V ≤ VCC < 5.5V
A6	TCSL	Chip select low time	250	—	ns	1.8V ≤ VCC < 5.5V
A7	TDis	Data input setup time	50 100 250	—	ns	4.5V ≤ VCC < 5.5V, 93XX46C only 2.5V ≤ VCC < 5.5V 1.8V ≤ VCC < 2.5V
A8	TDIH	Data input hold time	50 100 250	—	ns	4.5V ≤ VCC < 5.5V, 93XX46C only 2.5V ≤ VCC < 5.5V 1.8V ≤ VCC < 2.5V
A9	TPD	Data output delay time	— — —	200 250 400	ns	4.5V ≤ VCC < 5.5V, CL = 100 pF 2.5V ≤ VCC < 4.5V, CL = 100 pF 1.8V ≤ VCC < 2.5V, CL = 100 pF
A10	TcZ	Data output disable time	— —	100 200	ns	4.5V ≤ VCC < 5.5V, <b>(Note 1)</b> 1.8V ≤ VCC < 4.5V, <b>(Note 1)</b>
A11	Tsv	Status valid time	—	200 300 500	ns	4.5V ≤ VCC < 5.5V, CL = 100 pF 2.5V ≤ VCC < 4.5V, CL = 100 pF 1.8V ≤ VCC < 2.5V, CL = 100 pF
A12	TWC	Program cycle time	—	6	ms	ERASE/WRITE mode (AA and LC versions)
A13	TWC		—	2	ms	ERASE/WRITE mode (93C versions)
A14	TEC		—	6	ms	ERAL mode, 4.5V ≤ VCC ≤ 5.5V
A15	TWL		—	15	ms	WRAL mode, 4.5V ≤ VCC ≤ 5.5V
A16	—		Endurance	1M	—	cycles

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

**2:** This application is not tested but ensured by characterization. For endurance estimates in a specific application, please consult the Total Endurance Model which may be obtained on [www.microchip.com](http://www.microchip.com).

# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

**FIGURE 1-1: SYNCHRONOUS DATA TIMING**



**TABLE 1-1: INSTRUCTION SET FOR X 16 ORGANIZATION (93XX46B OR 93XX46C WITH ORG = 1)**

Instruction	SB	Opcode	Address	Data In	Data Out	Req. CLK Cycles
ERASE	1	11	A5 A4 A3 A2 A1 A0	—	(RDY/ $\overline{\text{BSY}}$ )	9
ERAL	1	00	1 0 X X X X	—	(RDY/ $\overline{\text{BSY}}$ )	9
EWDS	1	00	0 0 X X X X	—	HIGH-Z	9
EWEN	1	00	1 1 X X X X	—	HIGH-Z	9
READ	1	10	A5 A4 A3 A2 A1 A0	—	D15 - D0	25
WRITE	1	01	A5 A4 A3 A2 A1 A0	D15 - D0	(RDY/ $\overline{\text{BSY}}$ )	25
WRAL	1	00	0 1 X X X X	D15 - D0	(RDY/ $\overline{\text{BSY}}$ )	25

**TABLE 1-2: INSTRUCTION SET FOR X 8 ORGANIZATION (93XX46A OR 93XX46C WITH ORG = 0)**

Instruction	SB	Opcode	Address	Data In	Data Out	Req. CLK Cycles
ERASE	1	11	A6 A5 A4 A3 A2 A1 A0	—	(RDY/ $\overline{\text{BSY}}$ )	10
ERAL	1	00	1 0 X X X X X	—	(RDY/ $\overline{\text{BSY}}$ )	10
EWDS	1	00	0 0 X X X X X	—	HIGH-Z	10
EWEN	1	00	1 1 X X X X X	—	HIGH-Z	10
READ	1	10	A6 A5 A4 A3 A2 A1 A0	—	D7 - D0	18
WRITE	1	01	A6 A5 A4 A3 A2 A1 A0	D7 - D0	(RDY/ $\overline{\text{BSY}}$ )	18
WRAL	1	00	0 1 X X X X X	D7 - D0	(RDY/ $\overline{\text{BSY}}$ )	18

# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

## 2.0 FUNCTIONAL DESCRIPTION

When the **ORG\*** pin is connected to **VCC**, the (x16) organization is selected. When it is connected to ground, the (x8) organization is selected. Instructions, addresses and write data are clocked into the **DI** pin on the rising edge of the clock (**CLK**). The **DO** pin is normally held in a HIGH-Z state except when reading data from the device, or when checking the **READY/BUSY** status during a programming operation. The **READY/BUSY** status can be verified during an Erase/Write operation by polling the **DO** pin; **DO** low indicates that programming is still in progress, while **DO** high indicates the device is ready. **DO** will enter the HIGH-Z state on the falling edge of **CS**.

### 2.1 START Condition

The **START** bit is detected by the device if **CS** and **DI** are both HIGH with respect to the positive edge of **CLK** for the first time.

Before a **START** condition is detected, **CS**, **CLK**, and **DI** may change in any combination (except to that of a **START** condition), without resulting in any device operation (**READ**, **WRITE**, **ERASE**, **EWEN**, **EWDS**, **ERAL**, or **WRAL**). As soon as **CS** is HIGH, the device is no longer in Standby mode.

An instruction following a **START** condition will only be executed if the required opcode, address and data bits for any particular instruction are clocked in.

### 2.2 Data In/Data Out (DI/DO)

It is possible to connect the Data In and Data Out pins together. However, with this configuration it is possible for a "bus conflict" to occur during the "dummy zero" that precedes the **READ** operation, if **A0** is a logic HIGH level. Under such a condition the voltage level seen at Data Out is undefined and will depend upon the relative impedances of Data Out and the signal source driving **A0**. The higher the current sourcing capability of **A0**, the higher the voltage at the Data Out pin. In order to limit this current, a resistor should be connected between **DI** and **DO**.

## 2.3 Data Protection

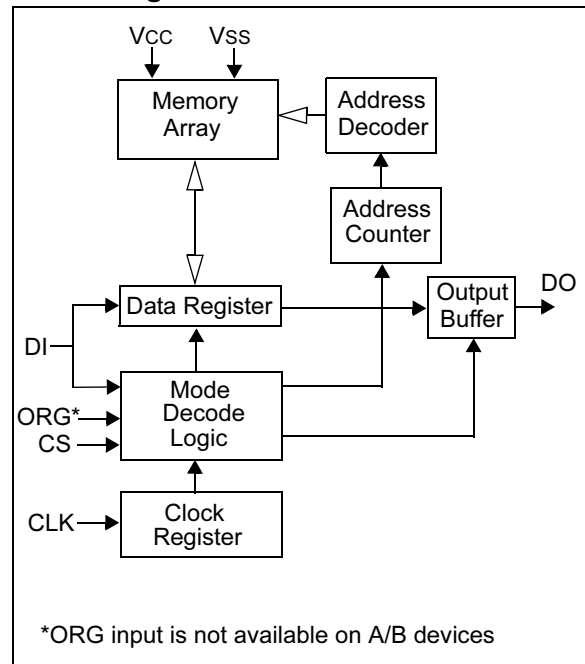
All modes of operation are inhibited when **VCC** is below a typical voltage of 1.5V for '93AA' and '93LC' devices or 3.8V for '93C' devices.

The **EWEN** and **EWDS** commands give additional protection against accidentally programming during normal operation.

**Note:** For added protection, an **EWDS** command should be performed after every write operation.

After power-up, the device is automatically in the **EWDS** mode. Therefore, an **EWEN** instruction must be performed before the initial **ERASE** or **WRITE** instruction can be executed.

### Block Diagram



# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

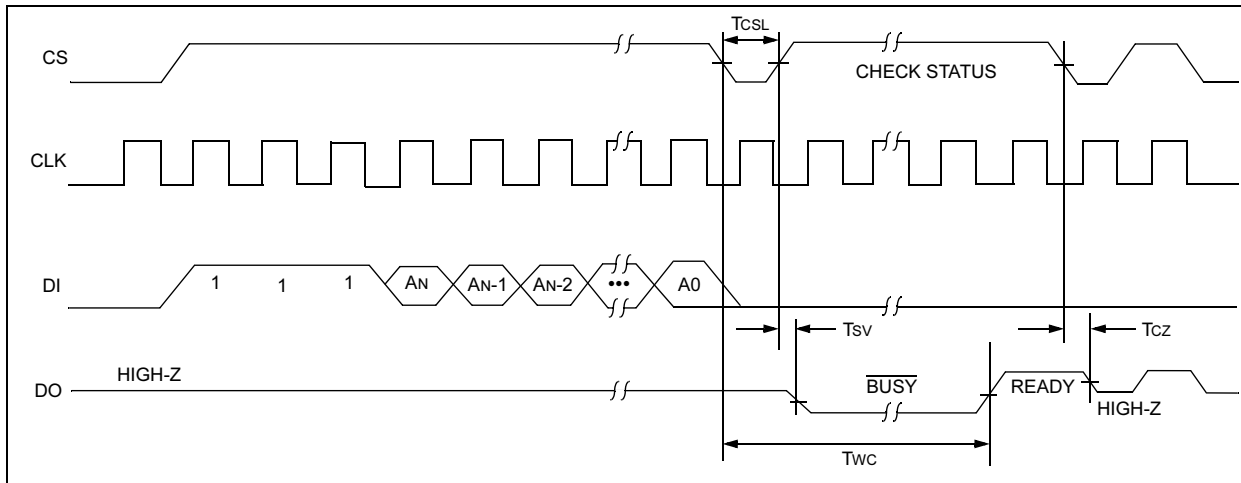
## 2.4 ERASE

The ERASE instruction forces all data bits of the specified address to the logical "1" state. CS is brought low following the loading of the last address bit. This falling edge of the CS pin initiates the self-timed programming cycle, except on '93C' devices where the rising edge of CLK before the last address bit initiates the write cycle.

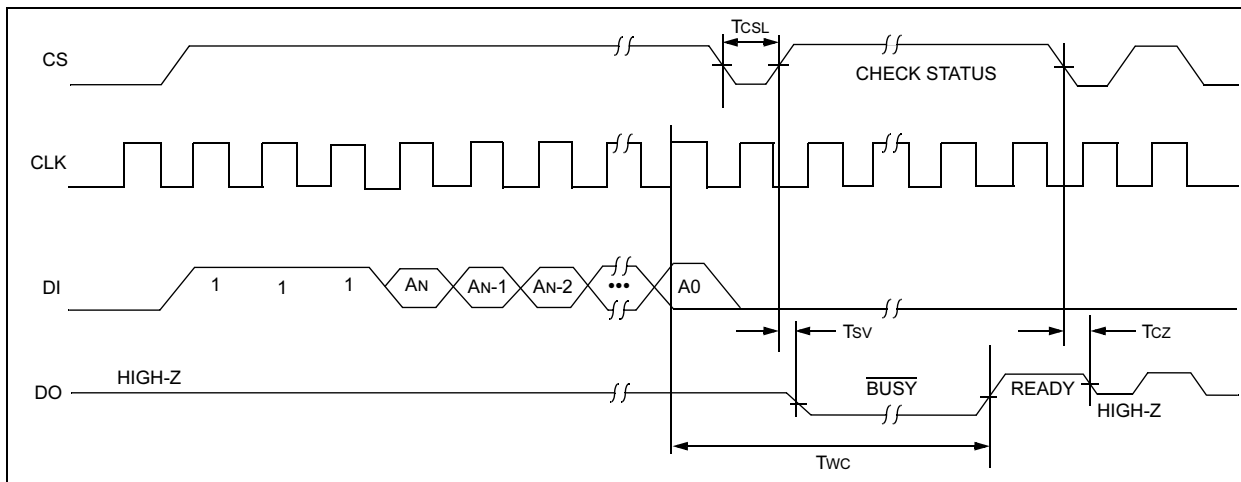
The DO pin indicates the READY/ $\overline{\text{BUSY}}$  status of the device if CS is brought high after a minimum of 250 ns low ( $T_{\text{CSL}}$ ). DO at logical "0" indicates that programming is still in progress. DO at logical "1" indicates that the register at the specified address has been erased and the device is ready for another instruction.

**Note:** Issuing a START bit and then taking CS low will clear the READY/ $\overline{\text{BUSY}}$  status from DO.

**FIGURE 2-1: ERASE TIMING FOR 93AA AND 93LC DEVICES**



**FIGURE 2-2: ERASE TIMING FOR 93C DEVICES**



# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

## 2.5 ERASE ALL (ERAL)

The Erase All (ERAL) instruction will erase the entire memory array to the logical "1" state. The ERAL cycle is identical to the ERASE cycle, except for the different opcode. The ERAL cycle is completely self-timed and commences at the falling edge of the CS, except on '93C' devices where the rising edge of CLK before the last data bit initiates the write cycle. Clocking of the CLK pin is not necessary after the device has entered the ERAL cycle.

The DO pin indicates the  $\overline{\text{READY}}/\overline{\text{BUSY}}$  status of the device, if CS is brought high after a minimum of 250 ns low ( $T_{\text{CSL}}$ ).

**Note:** Issuing a START bit and then taking CS low will clear the  $\overline{\text{READY}}/\overline{\text{BUSY}}$  status from DO.

VCC must be  $\geq 4.5\text{V}$  for proper operation of ERAL.

FIGURE 2-3: ERAL TIMING FOR 93AA AND 93LC DEVICES

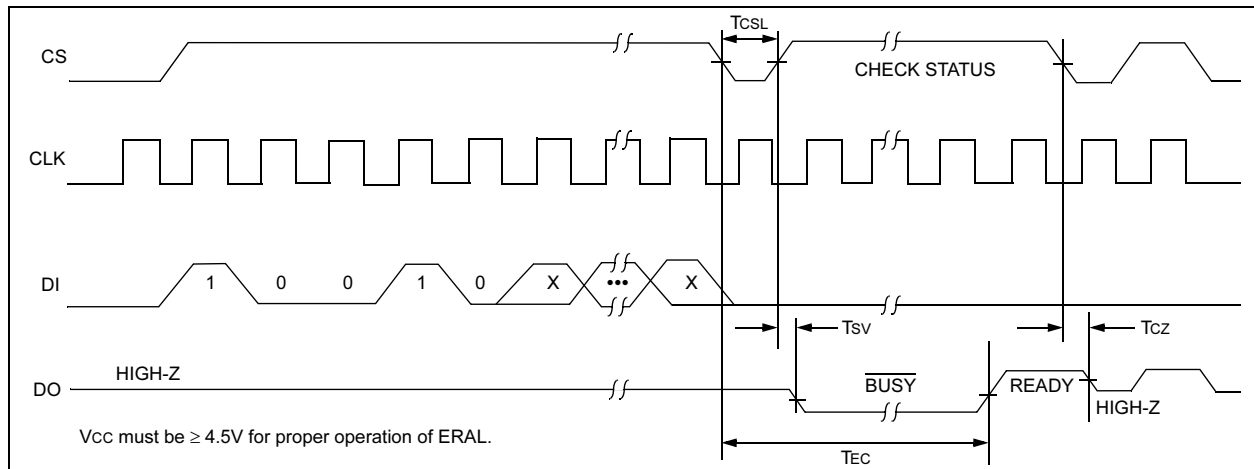
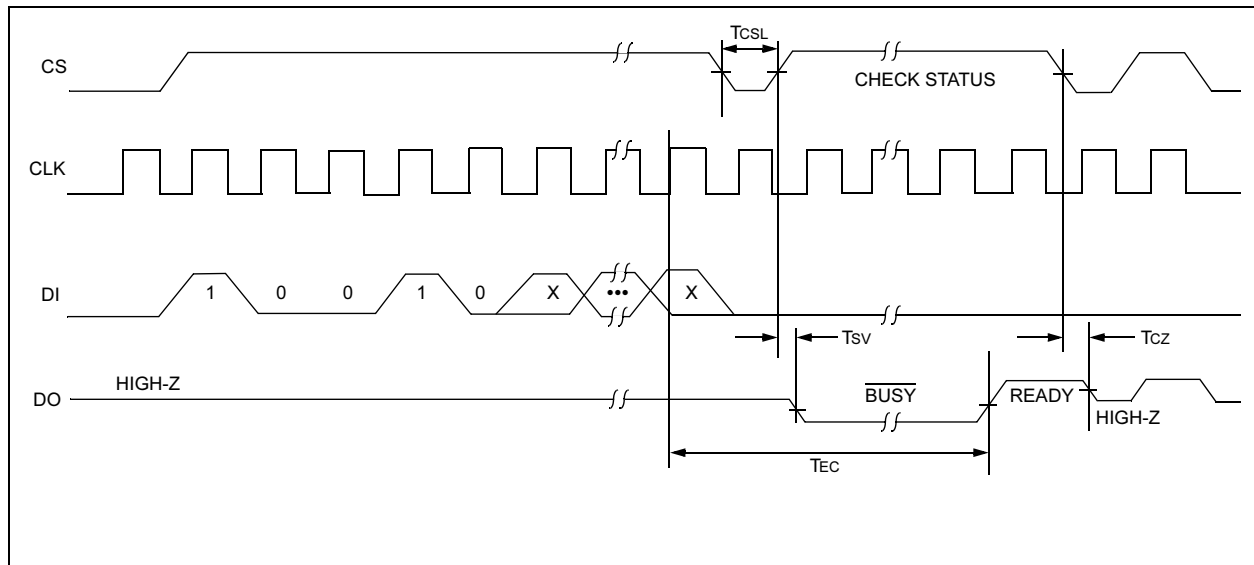


FIGURE 2-4: ERAL TIMING FOR 93C DEVICES



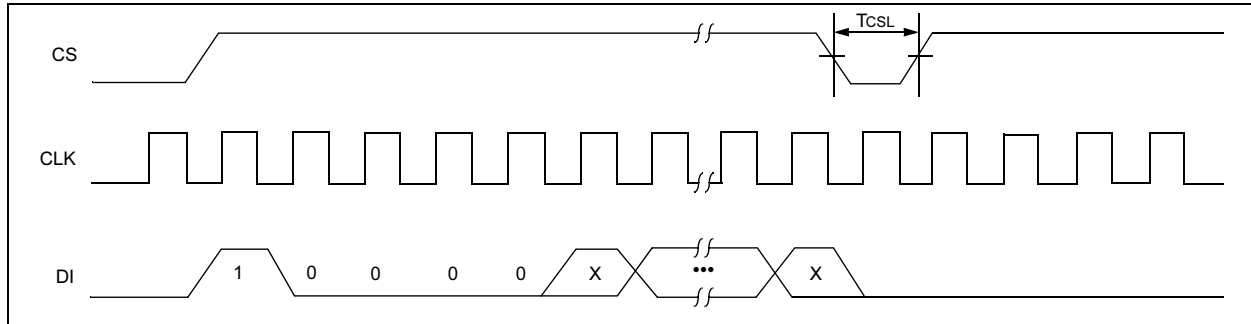
# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

## 2.6 ERASE/WRITE DISABLE And ENABLE (EWDS/EWEN)

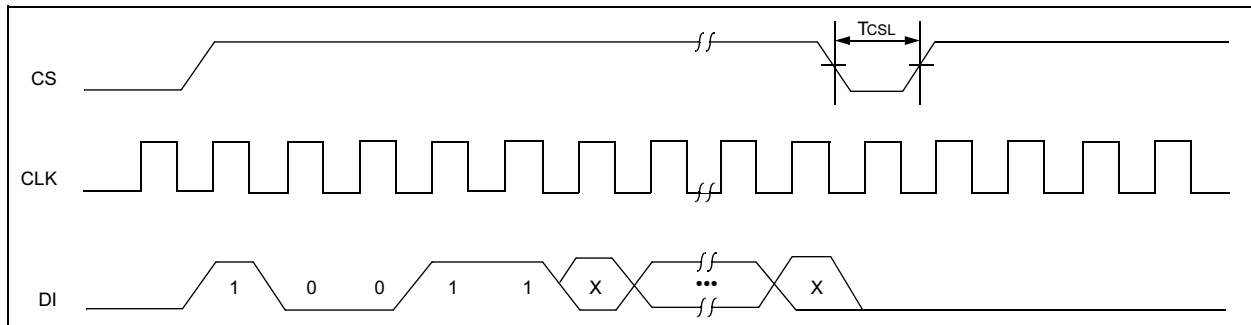
The 93XX46A/B/C powers up in the ERASE/WRITE Disable (EWDS) state. All Programming modes must be preceded by an ERASE/WRITE Enable (EWEN) instruction. Once the EWEN instruction is executed, programming remains enabled until an EWDS instruction is executed or Vcc is removed from the device. To protect

against accidental data disturbance, the EWDS instruction can be used to disable all ERASE/WRITE functions and should follow all programming operations. Execution of a READ instruction is independent of both the EWEN and EWDS instructions.

**FIGURE 2-5: EWDS TIMING**



**FIGURE 2-6: EWEN TIMING**

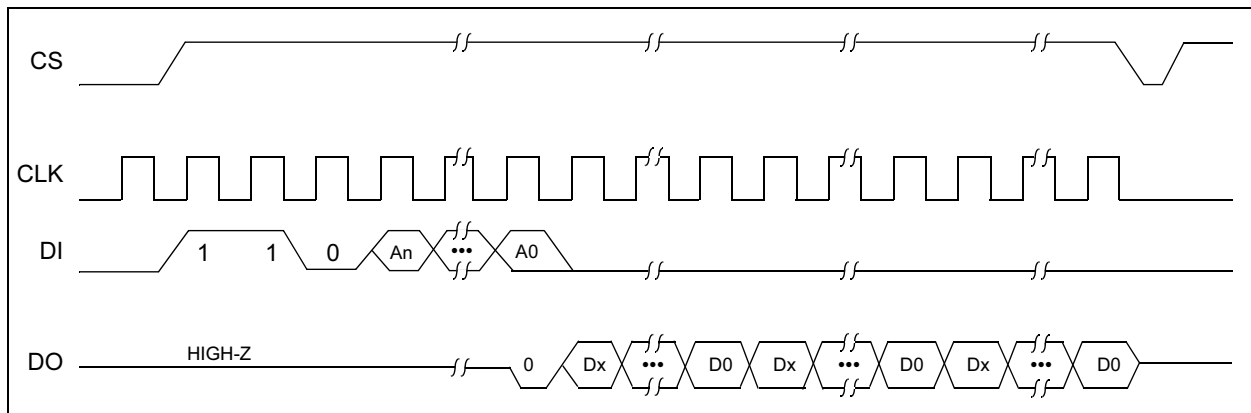


## 2.7 READ

The READ instruction outputs the serial data of the addressed memory location on the DO pin. A dummy zero bit precedes the 8-bit (If ORG pin is low or A-Version devices) or 16-bit (If ORG pin is high or B-version devices) output string. The output data bits will toggle on

the rising edge of the CLK and are stable after the specified time delay (TPD). Sequential read is possible when CS is held high. The memory data will automatically cycle to the next register and output sequentially.

**FIGURE 2-7: READ TIMING**





# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

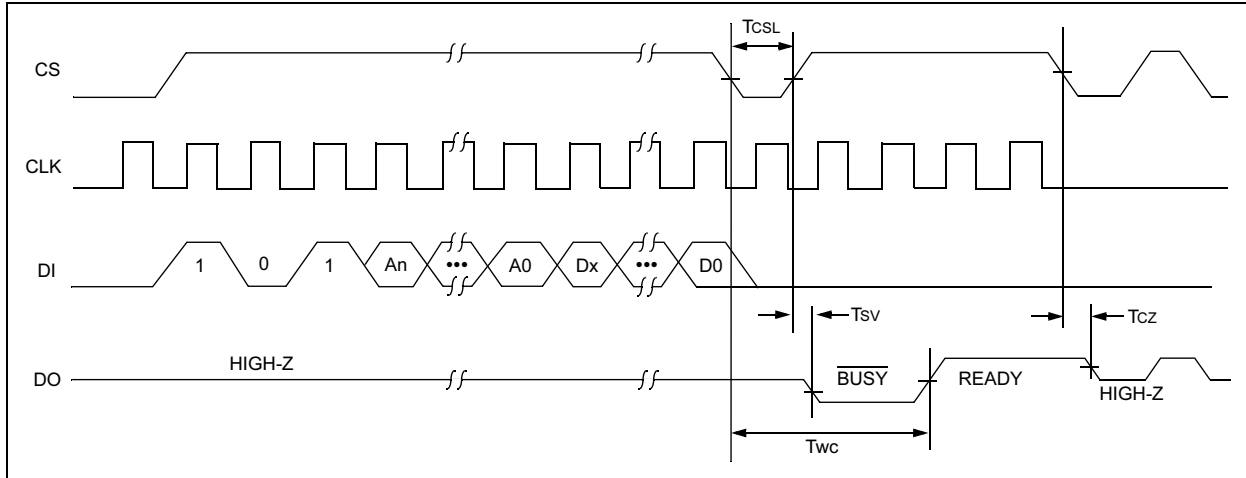
## 2.8 WRITE

The WRITE instruction is followed by 8 bits (If ORG is low or A-version devices) or 16 bits (If ORG pin is high or B-version devices) of data which are written into the specified address. For 93AA46A/B/C and 93LC46A/B/C devices, after the last data bit is clocked into DI, the falling edge of CS initiates the self-timed auto-erase and programming cycle. For 93C46A/B/C devices, the self-timed auto-erase and programming cycle is initiated by the rising edge of CLK on the last data bit.

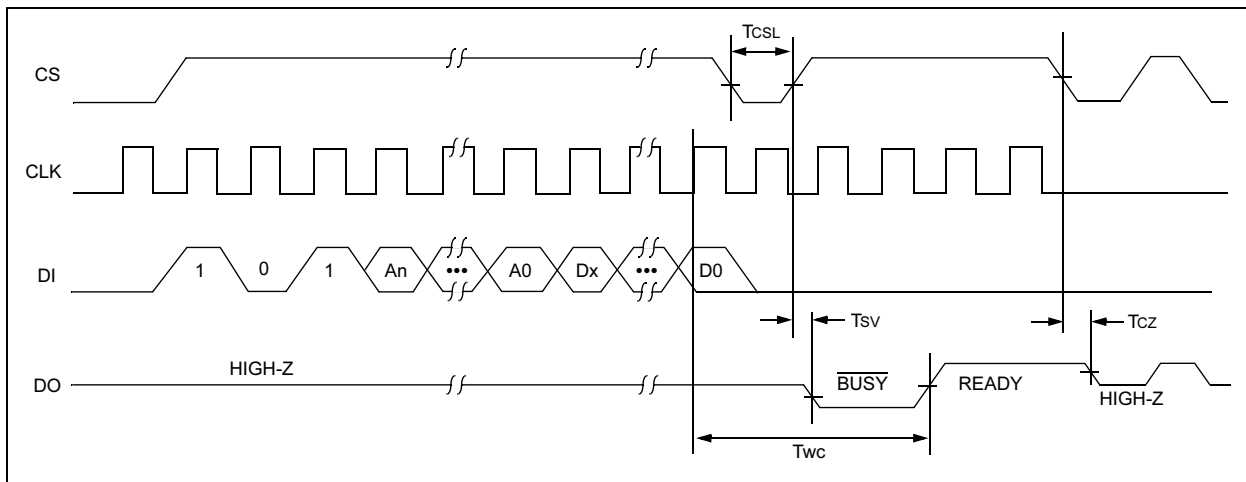
The DO pin indicates the READY/ $\overline{\text{BUSY}}$  status of the device, if CS is brought high after a minimum of 250 ns low ( $T_{\text{CSL}}$ ). DO at logical "0" indicates that programming is still in progress. DO at logical "1" indicates that the register at the specified address has been written with the data specified and the device is ready for another instruction.

**Note:** Issuing a START bit and then taking CS low will clear the READY/ $\overline{\text{BUSY}}$  status from DO.

**FIGURE 2-8: WRITE TIMING FOR 93AA AND 93LC DEVICES**



**FIGURE 2-9: WRITE TIMING FOR 93C DEVICES**



# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

## 2.9 WRITE ALL (WRAL)

The Write All (WRAL) instruction will write the entire memory array with the data specified in the command. For 93AA46A/B/C and 93LC46A/B/C devices, after the last data bit is clocked into DI, the falling edge of CS initiates the self-timed auto-erase and programming cycle. For 93C46A/B/C devices, the self-timed auto-erase and programming cycle is initiated by the rising edge of CLK on the last data bit. Clocking of the CLK pin is not necessary after the device has entered the WRAL cycle. The WRAL command does include an

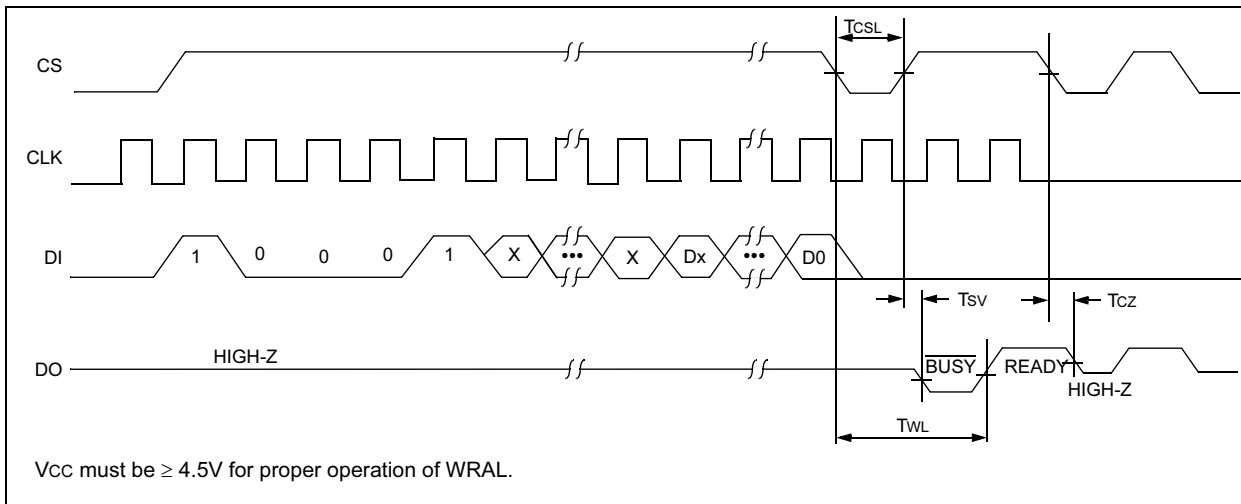
automatic ERAL cycle for the device. Therefore, the WRAL instruction does not require an ERAL instruction but the chip must be in the EWEN status.

The DO pin indicates the READY/BUSY status of the device if CS is brought high after a minimum of 250 ns low ( $T_{CSL}$ ).

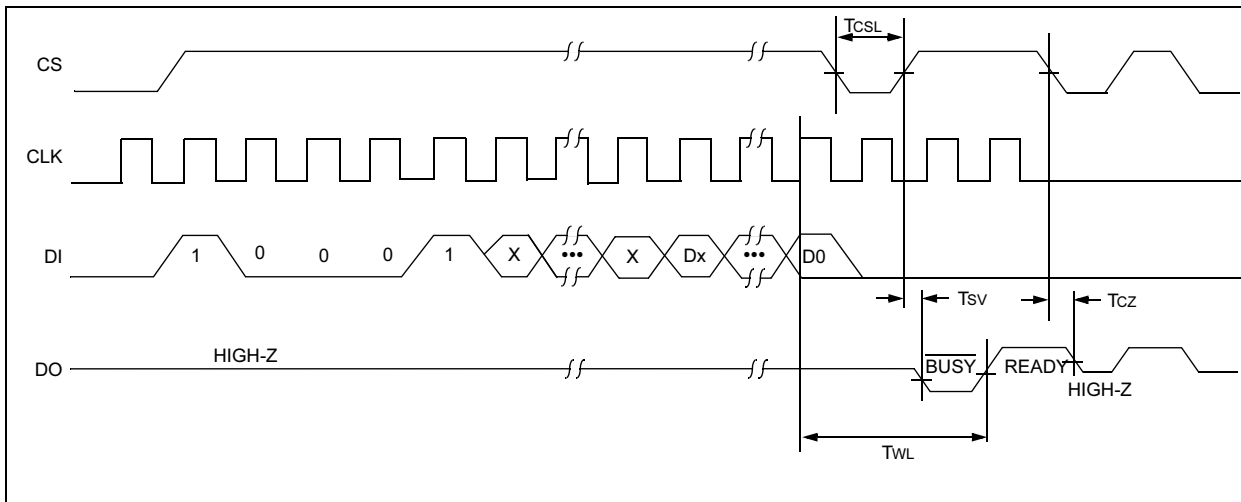
**Note:** Issuing a START bit and then taking CS low will clear the READY/BUSY status from DO.

$V_{CC}$  must be  $\geq 4.5V$  for proper operation of WRAL.

**FIGURE 2-10: WRAL TIMING FOR 93AA AND 93LC DEVICES**



**FIGURE 2-11: WRAL TIMING FOR 93C DEVICES**



# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

## 3.0 PIN DESCRIPTIONS

TABLE 3-1: PIN DESCRIPTIONS

Name	SOIC/PDIP/ MSOP/ TSSOP	SOT-23	Rotated SOIC	Function
CS	1	5	3	Chip Select
CLK	2	4	4	Serial Clock
DI	3	3	5	Data In
DO	4	1	6	Data Out
Vss	5	2	7	Ground
ORG/NC	6	N/A	8	Organization / 93XX46C No internal connection / 93XX46A/B
NC	7	N/A	1	No Internal Connection
Vcc	8	6	2	Power Supply

### 3.1 Chip Select (CS)

A high level selects the device; a low level deselects the device and forces it into Standby mode. However, a programming cycle which is already in progress will be completed, regardless of the Chip Select (CS) input signal. If CS is brought low during a program cycle, the device will go into Standby mode as soon as the programming cycle is completed.

CS must be low for 250 ns minimum (T<sub>CSL</sub>) between consecutive instructions. If CS is low, the internal control logic is held in a RESET status.

### 3.2 Serial Clock (CLK)

The Serial Clock is used to synchronize the communication between a master device and the 93XX series device. Opcodes, address and data bits are clocked in on the positive edge of CLK. Data bits are also clocked out on the positive edge of CLK.

CLK can be stopped anywhere in the transmission sequence (at high or low level) and can be continued anytime with respect to clock high time (T<sub>CKH</sub>) and clock low time (T<sub>CKL</sub>). This gives the controlling master freedom in preparing opcode, address and data.

CLK is a "Don't Care" if CS is low (device deselected). If CS is high, but the START condition has not been detected (DI = 0), any number of clock cycles can be received by the device without changing its status (i.e., waiting for a START condition).

CLK cycles are not required during the self-timed WRITE (i.e., auto ERASE/WRITE) cycle.

After detection of a START condition the specified number of clock cycles (respectively low to high transitions of CLK) must be provided. These clock cycles are required to clock in all required opcode, address and data bits before an instruction is executed. CLK and DI then become don't care inputs waiting for a new START condition to be detected.

### 3.3 Data In (DI)

Data In (DI) is used to clock in a START bit, opcode, address and data synchronously with the CLK input.

### 3.4 Data Out (DO)

Data Out (DO) is used in the READ mode to output data synchronously with the CLK input (T<sub>PD</sub> after the positive edge of CLK).

This pin also provides READY/ $\overline{\text{BUSY}}$  status information during ERASE and WRITE cycles. READY/ $\overline{\text{BUSY}}$  status information is available on the DO pin if CS is brought high after being low for minimum chip select low time (T<sub>CSL</sub>) and an ERASE or WRITE operation has been initiated.

The status signal is not available on DO, if CS is held low during the entire ERASE or WRITE cycle. In this case, DO is in the HIGH-Z mode. If status is checked after the ERASE/WRITE cycle, the data line will be high to indicate the device is ready.

**Note:** Issuing a START bit and then taking CS low will clear the READY/ $\overline{\text{BUSY}}$  status from DO.

### 3.5 Organization (ORG)

When the ORG pin is connected to Vcc or Logic HI, the (x16) memory organization is selected. When the ORG pin is tied to Vss or Logic LO, the (x8) memory organization is selected. For proper operation, ORG must be tied to a valid logic level.

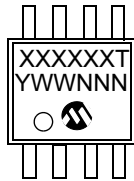
93XX46A devices are always x8 organization and 93XX46B devices are always x16 organization.

# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

## 4.0 PACKAGING INFORMATION

### 4.1 Package Marking Information

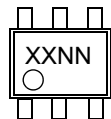
8-Lead MSOP (150 mil)



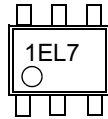
Example:



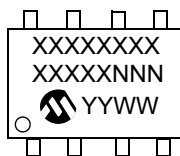
6-Lead SOT-23



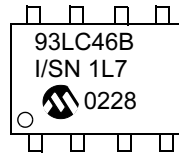
Example:



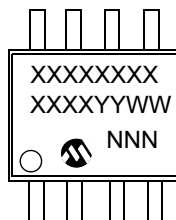
8-Lead PDIP



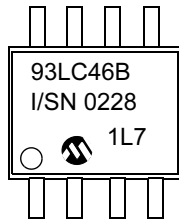
Example:



8-Lead SOIC



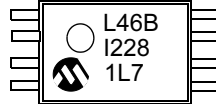
Example:



8-Lead TSSOP



Example:



MSOP 1st Line Marking Codes		
Device	std mark	Pb-free mark
93AA46A	3A46AT	GA46AT
93AA46B	3A46BT	GA46BT
93AA46C	3A46CT	GA46CT
93LC46A	3L46AT	GL46AT
93LC46B	3L46BT	GL46BT
93LC46C	3L46CT	GL46CT
93C46A	3C46AT	GC46AT
93C46B	3C46BT	GC46BT
93C46C	3C46CT	GC46CT

T = blank for commercial, "I" for Industrial, "E" for Extended.

SOT23 Marking Codes		
Device	I-temp	E-temp
93AA46A	1BNN	–
93AA46B	1LNN	–
93LC46A	1ENN	1FNN
93LC46B	1PNN	1RNN
93C46A	1HNN	1JNN
93C46B	1TNN	1UNN

Pb-free topside mark is same; Pb-free noted only on carton label.

TSSOP 1st Line Marking Codes		
Device	std mark	Pb-free mark
93AA46A	A46A	GAAA
93AA46B	A46B	GAAB
93AA46C	A46C	GAAC
93LC46A	L46A	GLAA
93LC46B	L46B	GLAB
93LC46C	L46C	GLAC
93C46A	C46A	GCAA
93C46B	C46B	GCAB
93C46C	C46C	GCAC

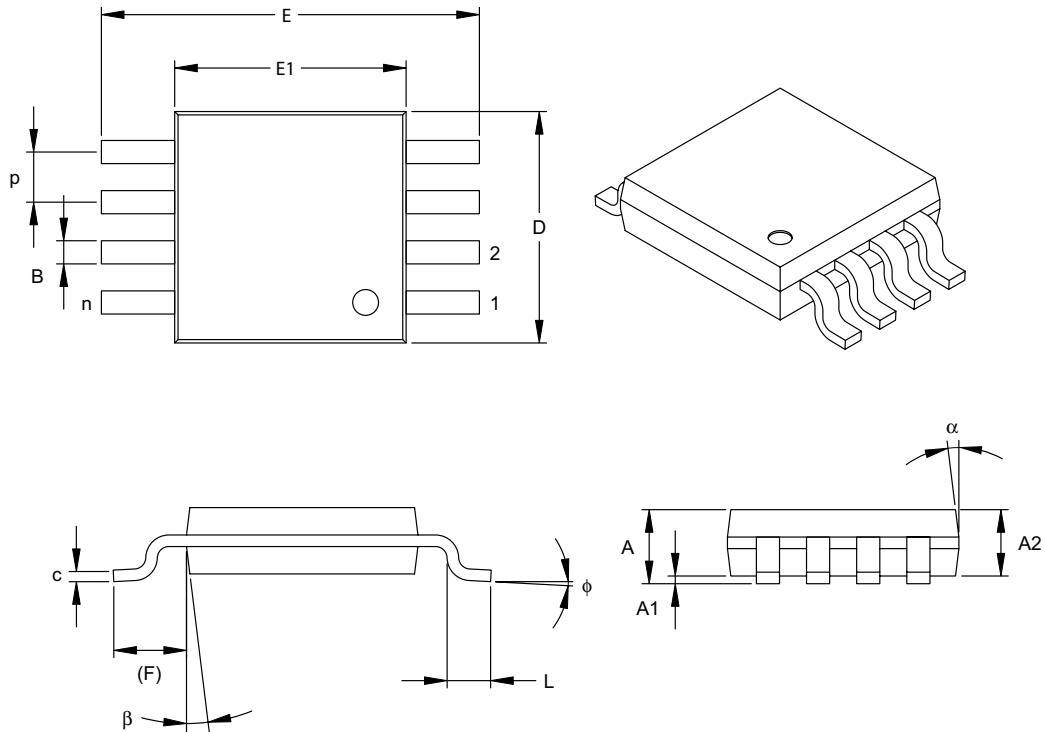
Temperature grade is marked on line 2.

Legend:	
XX...X	Part number
T	Temperature
Blank	Commercial
I	Industrial
E	Extended
YY	Year code (last 2 digits of calendar year) except TSSOP and MSOP which use only the last 1 digit
WW	Week code (week of January 1 is week '01')
NNN	Alphanumeric traceability code

**Note:** Custom marking available.

# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

## 8-Lead Plastic Micro Small Outline Package (MS) (MSOP)



Dimension Limits	Units	INCHES			MILLIMETERS*		
		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n	8			8		
Pitch	P	.026 BSC			0.65 BSC		
Overall Height	A	-	-	.043	-	-	1.10
Molded Package Thickness	A2	.030	.033	.037	0.75	0.85	0.95
Standoff	A1	.000	-	.006	0.00	-	0.15
Overall Width	E	.193 TYP.			4.90 BSC		
Molded Package Width	E1	.118 BSC			3.00 BSC		
Overall Length	D	.118 BSC			3.00 BSC		
Foot Length	L	.016	.024	.031	0.40	0.60	0.80
Footprint (Reference)	F	.037 REF			0.95 REF		
Foot Angle	φ	0°	-	8°	0°	-	8°
Lead Thickness	c	.003	.006	.009	0.08	-	0.23
Lead Width	B	.009	.012	.016	0.22	-	0.40
Mold Draft Angle Top	α	5°	-	15°	5°	-	15°
Mold Draft Angle Bottom	β	5°	-	15°	5°	-	15°

\*Controlling Parameter

Notes:

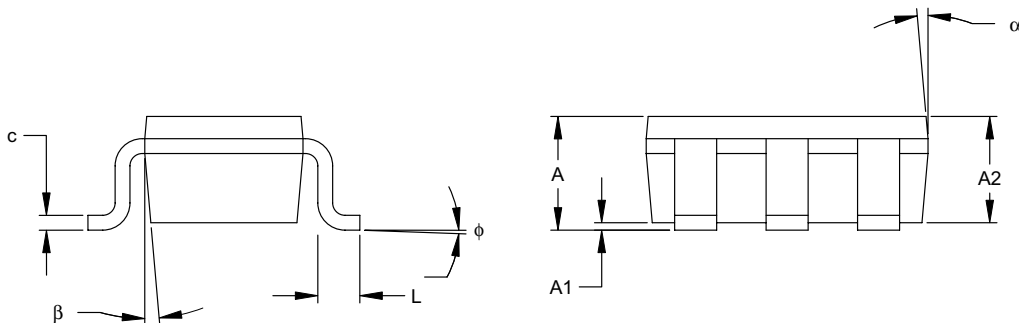
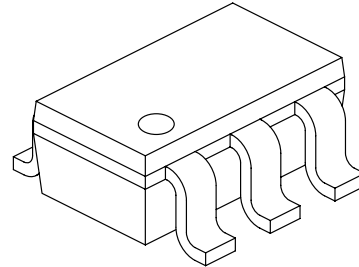
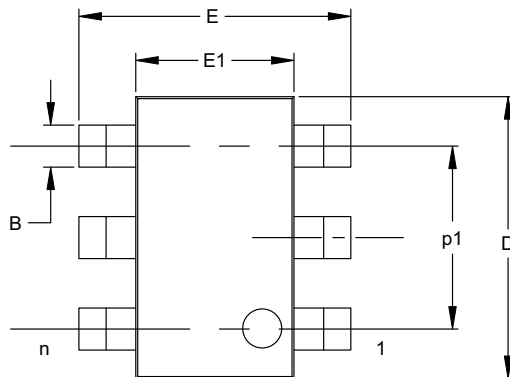
Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.

JEDEC Equivalent: MO-187

Drawing No. C04-111

# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

## 6-Lead Plastic Small Outline Transistor (CH) (SOT23)



Dimension Limits	Units	INCHES*			MILLIMETERS		
		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		6			6	
Pitch	p		.038			0.95	
Outside lead pitch (basic)	p1		.075			1.90	
Overall Height	A	.035	.046	.057	0.90	1.18	1.45
Molded Package Thickness	A2	.035	.043	.051	0.90	1.10	1.30
Standoff	A1	.000	.003	.006	0.00	0.08	0.15
Overall Width	E	.102	.110	.118	2.60	2.80	3.00
Molded Package Width	E1	.059	.064	.069	1.50	1.63	1.75
Overall Length	D	.110	.116	.122	2.80	2.95	3.10
Foot Length	L	.014	.018	.022	0.35	0.45	0.55
Foot Angle	$\phi$	0	5	10	0	5	10
Lead Thickness	c	.004	.006	.008	0.09	0.15	0.20
Lead Width	B	.014	.017	.020	0.35	0.43	0.50
Mold Draft Angle Top	$\alpha$	0	5	10	0	5	10
Mold Draft Angle Bottom	$\beta$	0	5	10	0	5	10

\*Controlling Parameter

Notes:

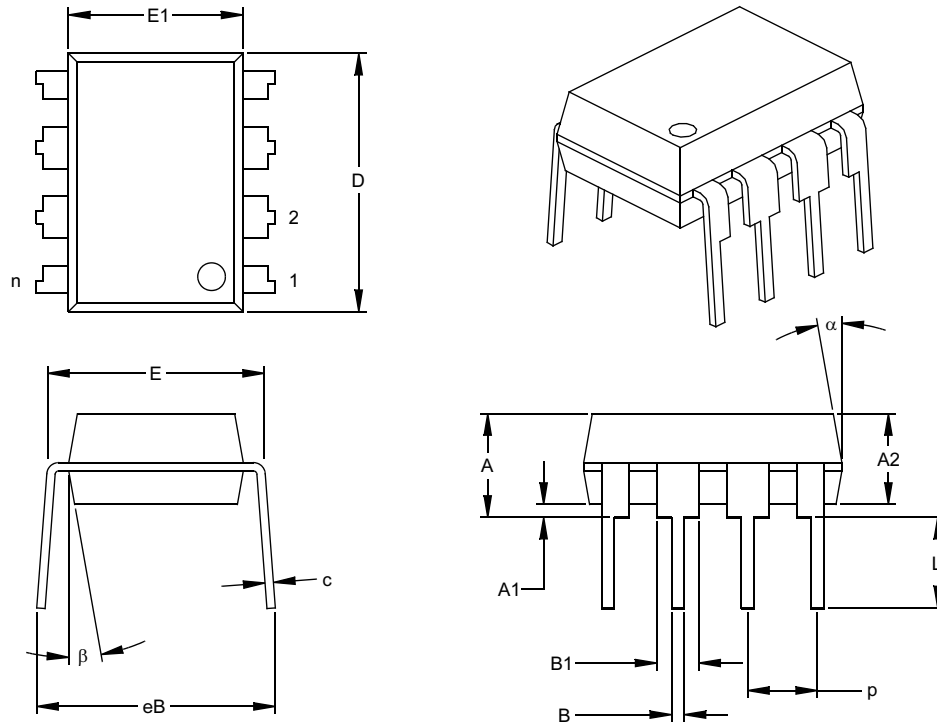
Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .005" (0.127mm) per side.

JEITA (formerly EIAJ) equivalent: SC-74A

Drawing No. C04-120

# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

## 8-Lead Plastic Dual In-line (P) – 300 mil (PDIP)



Dimension Limits	Units	INCHES*			MILLIMETERS		
		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		8			8	
Pitch	p		.100			2.54	
Top to Seating Plane	A	.140	.155	.170	3.56	3.94	4.32
Molded Package Thickness	A2	.115	.130	.145	2.92	3.30	3.68
Base to Seating Plane	A1	.015			0.38		
Shoulder to Shoulder Width	E	.300	.313	.325	7.62	7.94	8.26
Molded Package Width	E1	.240	.250	.260	6.10	6.35	6.60
Overall Length	D	.360	.373	.385	9.14	9.46	9.78
Tip to Seating Plane	L	.125	.130	.135	3.18	3.30	3.43
Lead Thickness	c	.008	.012	.015	0.20	0.29	0.38
Upper Lead Width	B1	.045	.058	.070	1.14	1.46	1.78
Lower Lead Width	B	.014	.018	.022	0.36	0.46	0.56
Overall Row Spacing	§ eB	.310	.370	.430	7.87	9.40	10.92
Mold Draft Angle Top	α	5	10	15	5	10	15
Mold Draft Angle Bottom	β	5	10	15	5	10	15

\* Controlling Parameter

§ Significant Characteristic

**Notes:**

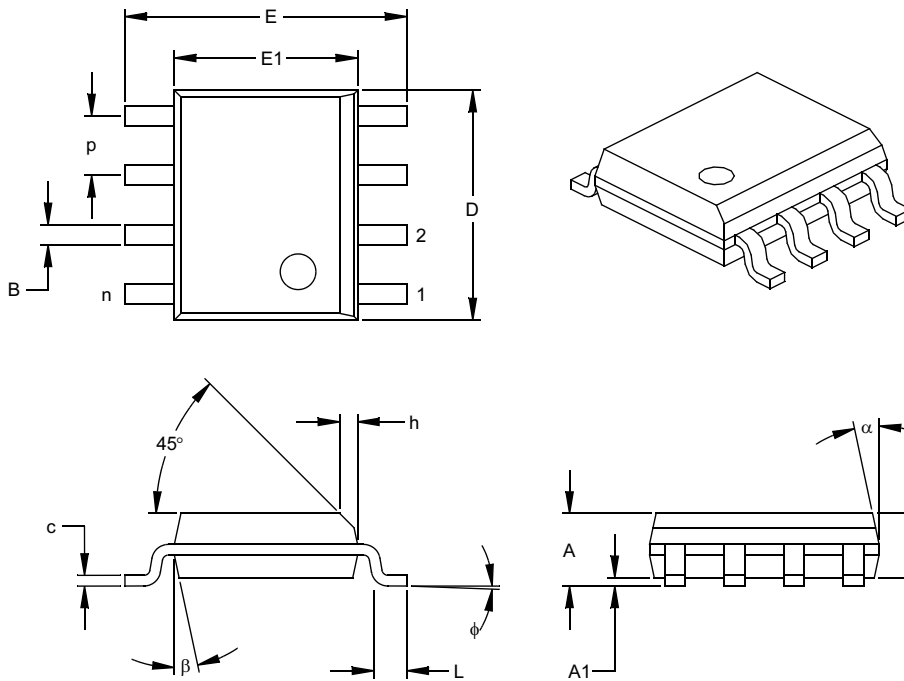
Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.

JEDEC Equivalent: MS-001

Drawing No. C04-018

# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

8-Lead Plastic Small Outline (SN) – Narrow, 150 mil (SOIC)



Dimension Limits	Units	INCHES*			MILLIMETERS		
		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		8			8	
Pitch	p		.050			1.27	
Overall Height	A	.053	.061	.069	1.35	1.55	1.75
Molded Package Thickness	A2	.052	.056	.061	1.32	1.42	1.55
Standoff §	A1	.004	.007	.010	0.10	0.18	0.25
Overall Width	E	.228	.237	.244	5.79	6.02	6.20
Molded Package Width	E1	.146	.154	.157	3.71	3.91	3.99
Overall Length	D	.189	.193	.197	4.80	4.90	5.00
Chamfer Distance	h	.010	.015	.020	0.25	0.38	0.51
Foot Length	L	.019	.025	.030	0.48	0.62	0.76
Foot Angle	φ	0	4	8	0	4	8
Lead Thickness	c	.008	.009	.010	0.20	0.23	0.25
Lead Width	B	.013	.017	.020	0.33	0.42	0.51
Mold Draft Angle Top	α	0	12	15	0	12	15
Mold Draft Angle Bottom	β	0	12	15	0	12	15

\* Controlling Parameter

§ Significant Characteristic

Notes:

Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.

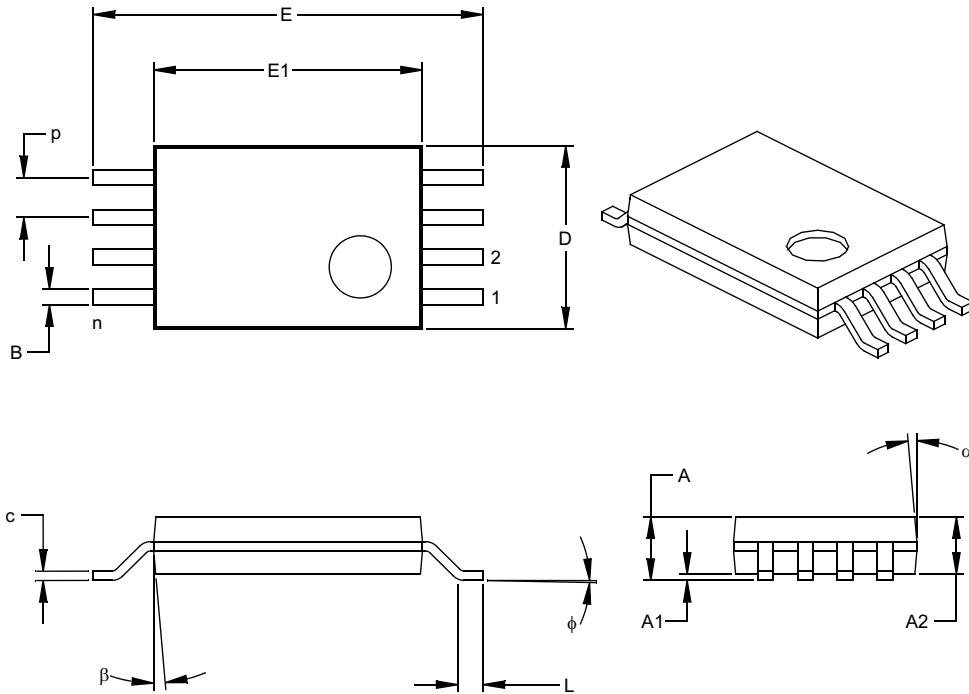
JEDEC Equivalent: MS-012

Drawing No. C04-057



# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

## 8-Lead Plastic Thin Shrink Small Outline (ST) – 4.4 mm (TSSOP)



Units		INCHES			MILLIMETERS*		
Dimension	Limits	MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		8			8	
Pitch	p		.026			0.65	
Overall Height	A			.043			1.10
Molded Package Thickness	A2	.033	.035	.037	0.85	0.90	0.95
Standoff §	A1	.002	.004	.006	0.05	0.10	0.15
Overall Width	E	.246	.251	.256	6.25	6.38	6.50
Molded Package Width	E1	.169	.173	.177	4.30	4.40	4.50
Molded Package Length	D	.114	.118	.122	2.90	3.00	3.10
Foot Length	L	.020	.024	.028	0.50	0.60	0.70
Foot Angle	φ	0	4	8	0	4	8
Lead Thickness	c	.004	.006	.008	0.09	0.15	0.20
Lead Width	B	.007	.010	.012	0.19	0.25	0.30
Mold Draft Angle Top	α	0	5	10	0	5	10
Mold Draft Angle Bottom	β	0	5	10	0	5	10

\* Controlling Parameter

§ Significant Characteristic

### Notes:

Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .005" (0.127mm) per side.

JEDEC Equivalent: MO-153

Drawing No. C04-086

# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

---

NOTES:

## ON-LINE SUPPORT

Microchip provides on-line support on the Microchip World Wide Web site.

The web site is used by Microchip as a means to make files and information easily available to customers. To view the site, the user must have access to the Internet and a web browser, such as Netscape® or Microsoft® Internet Explorer. Files are also available for FTP download from our FTP site.

## Connecting to the Microchip Internet Web Site

The Microchip web site is available at the following URL:

**[www.microchip.com](http://www.microchip.com)**

The file transfer site is available by using an FTP service to connect to:

**<ftp://ftp.microchip.com>**

The web site and file transfer site provide a variety of services. Users may download files for the latest Development Tools, Data Sheets, Application Notes, User's Guides, Articles and Sample Programs. A variety of Microchip specific business information is also available, including listings of Microchip sales offices, distributors and factory representatives. Other data available for consideration is:

- Latest Microchip Press Releases
- Technical Support Section with Frequently Asked Questions
- Design Tips
- Device Errata
- Job Postings
- Microchip Consultant Program Member Listing
- Links to other useful web sites related to Microchip Products
- Conferences for products, Development Systems, technical information and more
- Listing of seminars and events

## SYSTEMS INFORMATION AND UPGRADE HOT LINE

The Systems Information and Upgrade Line provides system users a listing of the latest versions of all of Microchip's development systems software products. Plus, this line provides information on how customers can receive the most current upgrade kits. The Hot Line Numbers are:

1-800-755-2345 for U.S. and most of Canada, and

1-480-792-7302 for the rest of the world.

042003

# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

---

---

## READER RESPONSE

It is our intention to provide you with the best documentation possible to ensure successful use of your Microchip product. If you wish to provide your comments on organization, clarity, subject matter, and ways in which our documentation can better serve you, please FAX your comments to the Technical Publications Manager at (480) 792-4150.

Please list the following information, and use this outline to provide us with your comments about this document.

To: Technical Publications Manager  
RE: Reader Response  
Total Pages Sent \_\_\_\_\_

From: Name \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_  
City / State / ZIP / Country \_\_\_\_\_  
Telephone: (\_\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_ FAX: (\_\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_

Application (optional):

Would you like a reply? \_\_\_Y \_\_\_N

Device: 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C Literature Number: DS21749C

Questions:

1. What are the best features of this document?

---

---

2. How does this document meet your hardware and software development needs?

---

---

3. Do you find the organization of this document easy to follow? If not, why?

---

---

4. What additions to the document do you think would enhance the structure and subject?

---

---

5. What deletions from the document could be made without affecting the overall usefulness?

---

---

6. Is there any incorrect or misleading information (what and where)?

---

---

7. How would you improve this document?

---

---

# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

## PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

<u>PART NO.</u>	<u>X</u>	<u>X</u>	<u>X</u>	<u>/XX</u>	<u>X</u>
Device	Pinout	Tape & Reel	Temperature Range	Package	Lead Finish
Device					
93AA46A:			1K 1.8V	Microwire	Serial EEPROM
93AA46B:			1K 1.8V	Microwire	Serial EEPROM
93AA46C:			1K 1.8V	Microwire	Serial EEPROM w/ORG
93LC46A:			1K 2.5V	Microwire	Serial EEPROM
93LC46B:			1K 2.5V	Microwire	Serial EEPROM
93LC46C:			1K 2.5V	Microwire	Serial EEPROM w/ORG
93C46A:			1K 5.0V	Microwire	Serial EEPROM
93C46B:			1K 5.0V	Microwire	Serial EEPROM
93C46C:			1K 5.0V	Microwire	Serial EEPROM w/ORG
Pinout:	Blank =		Standard pinout		
	X =		Rotated pinout		
Tape & Reel:	Blank =		Standard packaging		
	T =		Tape & Reel		
Temperature Range	I =		-40°C to +85°C		
	E =		-40°C to +125°C		
Package	MS =		Plastic MSOP (Micro Small outline, 8-lead)		
	OT =		SOT-23, 6-lead (Tape & Reel only)		
	P =		Plastic DIP (300 mil body), 8-lead		
	SN =		Plastic SOIC (150 mil body), 8-lead		
	ST =		TSSOP, 8-lead		
Lead Finish:	Blank =		Standard 63% / 37% SnPb		
	G =		Pure Matte Sn		

**Examples:**

a) 93AA46C-I/MS: 1K, 128x8 or 64x16 Serial EEPROM, MSOP package, 1.8V

b) 93AA46B-I/MS: 1K, 64x16 Serial EEPROM, MSOP package, 1.8V

c) 93AA46AT-I/OT: 1K, 128x8 Serial EEPROM, SOT-23 package, tape and reel, 1.8V

d) 93AA46CT-I/MS: 1K, 128x8 or 16x16 Serial EEPROM, MSOP package, tape and reel, 1.8V

a) 93LC46A-I/MS: 1K, 128x8 Serial EEPROM, MSOP package, 2.5V

b) 93LC46BT-I/OT: 1K, 64x16 Serial EEPROM, SOT-23 package, tape and reel, 2.5V

c) 93LC46B-I/MS: 1K, 64x16 Serial EEPROM, MSOP package, 2.5V

d) 93LC46BXT-I/SNG: 1K, 64x16 Serial EEPROM, SOIC package, rotated pinout, Industrial temperature, Pb-free finish, 2.5V

a) 93C46B-I/MS: 1K, 64x16 Serial EEPROM, MSOP package, 5.0V

b) 93C46C-I/MS: 1K, 128x8 or 16x16 Serial EEPROM, MSOP package, 5.0V

c) 93C46AT-I/OT: 1K, 128x8 Serial EEPROM, SOT-23 package, tape and reel, 5.0V

## Sales and Support

### Data Sheets

Products supported by a preliminary Data Sheet may have an errata sheet describing minor operational differences and recommended workarounds. To determine if an errata sheet exists for a particular device, please contact one of the following:

1. Your local Microchip sales office
2. The Microchip Corporate Literature Center U.S. FAX: (480) 792-7277
3. The Microchip Worldwide Site ([www.microchip.com](http://www.microchip.com))

Please specify which device, revision of silicon and Data Sheet (include Literature #) you are using.

### New Customer Notification System

Register on our web site ([www.microchip.com/cn](http://www.microchip.com/cn)) to receive the most current information on our products.

# 93AA46A/B/C, 93LC46A/B/C, 93C46A/B/C

---

NOTES:

---

**Note the following details of the code protection feature on Microchip devices:**

- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

Code protection is constantly evolving. We at Microchip are committed to continuously improving the code protection features of our products. Attempts to break microchip's code protection feature may be a violation of the Digital Millennium Copyright Act. If such acts allow unauthorized access to your software or other copyrighted work, you may have a right to sue for relief under that Act.

---

Information contained in this publication regarding device applications and the like is intended through suggestion only and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. No representation or warranty is given and no liability is assumed by Microchip Technology Incorporated with respect to the accuracy or use of such information, or infringement of patents or other intellectual property rights arising from such use or otherwise. Use of Microchip's products as critical components in life support systems is not authorized except with express written approval by Microchip. No licenses are conveyed, implicitly or otherwise, under any intellectual property rights.

**Trademarks**

The Microchip name and logo, the Microchip logo, KEELOQ, MPLAB, PIC, PICmicro, PICSTART, PRO MATE and PowerSmart are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.


FilterLab, microID, MXDEV, MXLAB, PICMASTER, SEEVAL and The Embedded Control Solutions Company are registered trademarks of Microchip Technology Incorporated in the U.S.A.

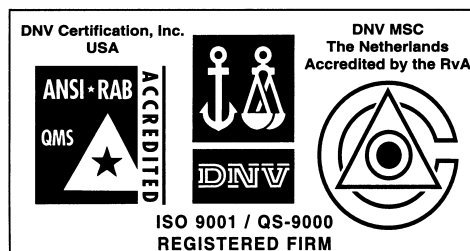
Accuron, Application Maestro, dsPIC, dsPICDEM, dsPICDEM.net, ECONOMONITOR, FanSense, FlexROM, fuzzyLAB, In-Circuit Serial Programming, ICSP, ICEPIC, microPort, Migratable Memory, MPASM, MPLIB, MPLINK, MPSIM, PICC, PICkit, PICDEM, PICDEM.net, PowerCal, PowerInfo, PowerMate, PowerTool, rLAB, rPIC, Select Mode, SmartSensor, SmartShunt, SmartTel and Total Endurance are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

Serialized Quick Turn Programming (SQTP) is a service mark of Microchip Technology Incorporated in the U.S.A.

All other trademarks mentioned herein are property of their respective companies.

© 2003, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.

 Printed on recycled paper.



*Microchip received QS-9000 quality system certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona in July 1999 and Mountain View, California in March 2002. The Company's quality system processes and procedures are QS-9000 compliant for its PICmicro® 8-bit MCUs, KEELOQ® code hopping devices, Serial EEPROMs, microperipherals, non-volatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001 certified.*



# MICROCHIP

## WORLDWIDE SALES AND SERVICE

### AMERICAS

#### Corporate Office

2355 West Chandler Blvd.  
Chandler, AZ 85224-6199  
Tel: 480-792-7200 Fax: 480-792-7277  
Technical Support: 480-792-7627  
Web Address: <http://www.microchip.com>

#### Atlanta

3780 Mansell Road, Suite 130  
Alpharetta, GA 30022  
Tel: 770-640-0034 Fax: 770-640-0307

#### Boston

2 Lan Drive, Suite 120  
Westford, MA 01886  
Tel: 978-692-3848 Fax: 978-692-3821

#### Chicago

333 Pierce Road, Suite 180  
Itasca, IL 60143  
Tel: 630-285-0071 Fax: 630-285-0075

#### Dallas

4570 Westgrove Drive, Suite 160  
Addison, TX 75001  
Tel: 972-818-7423 Fax: 972-818-2924

#### Detroit

Tri-Atria Office Building  
32255 Northwestern Highway, Suite 190  
Farmington Hills, MI 48334  
Tel: 248-538-2250 Fax: 248-538-2260

#### Kokomo

2767 S. Albright Road  
Kokomo, Indiana 46902  
Tel: 765-864-8360 Fax: 765-864-8387

#### Los Angeles

18201 Von Karman, Suite 1090  
Irvine, CA 92612  
Tel: 949-263-1888 Fax: 949-263-1338

#### Phoenix

2355 West Chandler Blvd.  
Chandler, AZ 85224-6199  
Tel: 480-792-7966 Fax: 480-792-4338

#### San Jose

Microchip Technology Inc.  
2107 North First Street, Suite 590  
San Jose, CA 95131  
Tel: 408-436-7950 Fax: 408-436-7955

#### Toronto

6285 Northam Drive, Suite 108  
Mississauga, Ontario L4V 1X5, Canada  
Tel: 905-673-0699 Fax: 905-673-6509

### ASIA/PACIFIC

#### Australia

Microchip Technology Australia Pty Ltd  
Marketing Support Division  
Suite 22, 41 Rawson Street  
Epping 2121, NSW  
Australia  
Tel: 61-2-9868-6733 Fax: 61-2-9868-6755

#### China - Beijing

Microchip Technology Consulting (Shanghai)  
Co., Ltd., Beijing Liaison Office  
Unit 915  
Bei Hai Wan Tai Bldg.  
No. 6 Chaoyangmen Beidajie  
Beijing, 100027, No. China  
Tel: 86-10-85282100 Fax: 86-10-85282104

#### China - Chengdu

Microchip Technology Consulting (Shanghai)  
Co., Ltd., Chengdu Liaison Office  
Rm. 2401-2402, 24th Floor,  
Ming Xing Financial Tower  
No. 88 TIDU Street  
Chengdu 610016, China  
Tel: 86-28-86766200 Fax: 86-28-86766599

#### China - Fuzhou

Microchip Technology Consulting (Shanghai)  
Co., Ltd., Fuzhou Liaison Office  
Unit 28F, World Trade Plaza  
No. 71 Wusi Road  
Fuzhou 350001, China  
Tel: 86-591-7503506 Fax: 86-591-7503521

#### China - Hong Kong SAR

Microchip Technology Hongkong Ltd.  
Unit 901-6, Tower 2, Metroplaza  
223 Hing Fong Road  
Kwai Fong, N.T., Hong Kong  
Tel: 852-2401-1200 Fax: 852-2401-3431

#### China - Shanghai

Microchip Technology Consulting (Shanghai)  
Co., Ltd.  
Room 701, Bldg. B  
Far East International Plaza  
No. 317 Xian Xia Road  
Shanghai, 200051  
Tel: 86-21-6275-5700 Fax: 86-21-6275-5060

#### China - Shenzhen

Microchip Technology Consulting (Shanghai)  
Co., Ltd., Shenzhen Liaison Office  
Rm. 1812, 18/F, Building A, United Plaza  
No. 5022 Binhe Road, Futian District  
Shenzhen 518033, China  
Tel: 86-755-82901380 Fax: 86-755-82966626

#### China - Qingdao

Rm. B505A, Fullhope Plaza,  
No. 12 Hong Kong Central Rd.  
Qingdao 266071, China  
Tel: 86-532-5027355 Fax: 86-532-5027205

#### India

Microchip Technology Inc.  
India Liaison Office  
Marketing Support Division  
Divyasree Chambers  
1 Floor, Wing A (A3/A4)  
No. 11, O'Shaughnessy Road  
Bangalore, 560 025, India  
Tel: 91-80-2290061 Fax: 91-80-2290062

### Japan

Microchip Technology Japan K.K.  
Benex S-1 6F  
3-18-20, Shinyokohama  
Kohoku-Ku, Yokohama-shi  
Kanagawa, 222-0033, Japan  
Tel: 81-45-471-6166 Fax: 81-45-471-6122

### Korea

Microchip Technology Korea  
168-1, Youngbo Bldg. 3 Floor  
Samsung-Dong, Kangnam-Ku  
Seoul, Korea 135-882  
Tel: 82-2-554-7200 Fax: 82-2-558-5934

### Singapore

Microchip Technology Singapore Pte Ltd.  
200 Middle Road  
#07-02 Prime Centre  
Singapore, 188980  
Tel: 65-6334-8870 Fax: 65-6334-8850

### Taiwan

Microchip Technology (Barbados) Inc.,  
Taiwan Branch  
11F-3, No. 207  
Tung Hua North Road  
Taipei, 105, Taiwan  
Tel: 886-2-2717-7175 Fax: 886-2-2545-0139

### EUROPE

#### Austria

Microchip Technology Austria GmbH  
Durisolstrasse 2  
A-4600 Wels  
Austria  
Tel: 43-7242-2244-399  
Fax: 43-7242-2244-393

#### Denmark

Microchip Technology Nordic ApS  
Regus Business Centre  
Lautrup høj 1-3  
Ballerup DK-2750 Denmark  
Tel: 45 4420 9895 Fax: 45 4420 9910

#### France

Microchip Technology SARL  
Parc d'Activite du Moulin de Massy  
43 Rue du Saule Trapu  
Batiment A - 1er Etage  
91300 Massy, France  
Tel: 33-1-69-53-63-20 Fax: 33-1-69-30-90-79

#### Germany

Microchip Technology GmbH  
Steinheilstrasse 10  
D-85737 Ismaning, Germany  
Tel: 49-89-627-144-0  
Fax: 49-89-627-144-44

#### Italy

Microchip Technology SRL  
Via Quasimodo, 12  
20025 Legnano (MI)  
Milan, Italy  
Tel: 39-0331-742611 Fax: 39-0331-466781

#### United Kingdom

Microchip Ltd.  
505 Eskdale Road  
Winnersh Triangle  
Wokingham  
Berkshire, England RG41 5TU  
Tel: 44 118 921 5869 Fax: 44-118 921-5820

03/25/03