



# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

## 4K Microwire Compatible Serial EEPROM

### Device Selection Table

Part Number	Vcc Range	ORG Pin	Word Size	Temp Ranges	Packages
93AA66A	1.8-5.5	No	8-bit	I	P, SN, ST, MS, OT, MC
93AA66B	1.8-5.5	No	16-bit	I	P, SN, ST, MS, OT, MC
93LC66A	2.5-5.5	No	8-bit	I, E	P, SN, ST, MS, OT, MC
93LC66B	2.5-5.5	No	16-bit	I, E	P, SN, ST, MS, OT, MC
93C66A	4.5-5.5	No	8-bit	I, E	P, SN, ST, MS, OT, MC
93C66B	4.5-5.5	No	16-bit	I, E	P, SN, ST, MS, OT, MC
93AA66C	1.8-5.5	Yes	8 or 16-bit	I	P, SN, ST, MS, MC
93LC66C	2.5-5.5	Yes	8 or 16-bit	I, E	P, SN, ST, MS, MC
93C66C	4.5-5.5	Yes	8 or 16-bit	I, E	P, SN, ST, MS, MC

### Features:

- Low-power CMOS technology
- ORG pin to select word size for '66C' version
- 512 x 8-bit organization 'A' ver. devices (no ORG)
- 256 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

### Description:

The Microchip Technology Inc. 93XX66A/B/C devices are 4K bit low-voltage serial Electrically Erasable PROMs (EEPROM). Word-selectable devices such as the 93AA66C, 93LC66C or 93C66C are dependent upon external logic levels driving the ORG pin to set word size. For dedicated 8-bit communication, the 93XX66A devices are available, while the 93XX66B devices provide dedicated 16-bit communication. Advanced CMOS technology makes these devices ideal for low-power, nonvolatile 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, 8-lead 2x3 DFN and 8-lead TSSOP. Pb-free (Pure Matte Sn) finish is available.

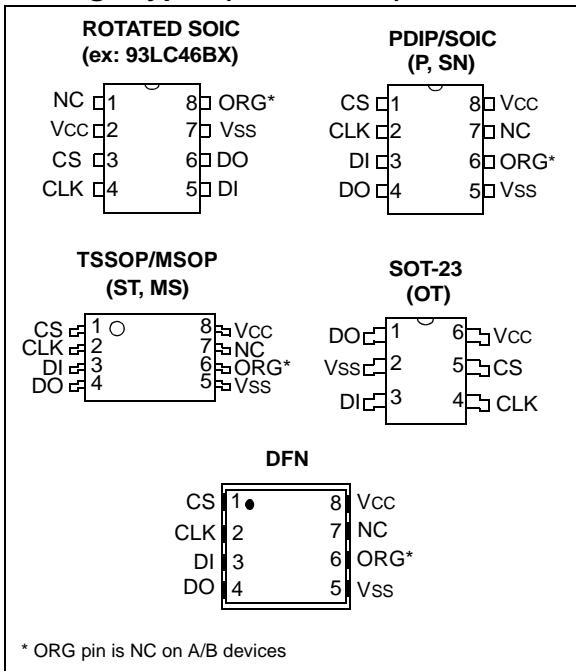
### Pin Function Table

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

# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

---

## Package Types (not to scale)



\* ORG pin is NC on A/B devices

# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings<sup>(†)</sup>

VCC.....	7.0V
All inputs and outputs w.r.t. Vss .....	-0.6V to Vcc +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 "Absolute 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.

TABLE 1-1: DC CHARACTERISTICS

All parameters apply over the specified ranges unless otherwise noted.			Industrial (I): TA = -40°C to +85°C, VCC = +1.8V to +5.5V Automotive (E): TA = -40°C to +125°C, VCC = +2.5V to +5.5V				
Param. No.	Symbol	Parameter	Min	Typ	Max	Units	Conditions
D1	VIH1 VIH2	High-level input voltage	2.0 0.7 VCC	— —	VCC +1 VCC +1	V	VCC ≥ 2.7V VCC < 2.7V
D2	VIL1 VIL2	Low-level input voltage	-0.3 -0.3	— —	0.8 0.2 VCC	V	VCC ≥ 2.7V VCC < 2.7V
D3	VOL1 VOL2	Low-level output voltage	— —	— —	0.4 0.2	V	IOL = 2.1 mA, VCC = 4.5V IOL = 100 µA, VCC = 2.5V
D4	VOH1 VOH2	High-level output voltage	2.4 VCC - 0.2	— —	— —	V	IOH = -400 µA, VCC = 4.5V IOH = -100 µA, VCC = 2.5V
D5	ILI	Input leakage current	—	—	±1	µA	VIN = Vss or VCC
D6	ILO	Output leakage current	—	—	±1	µA	VOUT = Vss or VCC
D7	CIN, COUT	Pin capacitance (all inputs/outputs)	—	—	7	pF	VIN/VOUT = 0V ( <b>Note 1</b> ) TA = 25°C, FCLK = 1 MHz
D8	Icc write	Write current	— —	— 500	2 —	mA µA	FCLK = 3 MHz, VCC = 5.5V FCLK = 2 MHz, VCC = 2.5V
D9	Icc read	Read current	— — —	— 500 100	1 500 —	mA µA µA	FCLK = 3 MHz, VCC = 5.5V FCLK = 2 MHz, VCC = 3.0V FCLK = 2 MHz, VCC = 2.5V
D10	Iccs	Standby current	— —	— —	1 5	µA µA	I – Temp E – Temp CLK = CS = 0V ORG = DI = Vss or VCC ( <b>Note 2</b> ) ( <b>Note 3</b> )
D11	VPOR	VCC voltage detect 93AA66A/B/C, 93LC66A/B/C 93C66A/B/C	— —	1.5V 3.8V	— —	V V	( <b>Note 1</b> )

**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 "Data Out (DO)"**.

# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

TABLE 1-2: AC CHARACTERISTICS

All parameters apply over the specified ranges unless otherwise noted.			Industrial (I): TA = -40°C to +85°C, VCC = +1.8V to +5.5V Automotive (E): TA = -40°C to +125°C, VCC = +2.5V to +5.5V			
Param. No.	Symbol	Parameter	Min	Max	Units	Conditions
A1	FCLK	Clock frequency	—	3 2 1	MHz	4.5V ≤ VCC < 5.5V, 93XX66C 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, 93XX66C 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, 93XX66C 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 ns ns	4.5V ≤ VCC < 5.5V, 93XX66C only 2.5V ≤ VCC < 5.5V 1.8V ≤ VCC < 2.5V
A8	TDIH	Data input hold time	50 100 250	—	ns ns ns	4.5V ≤ VCC < 5.5V, 93XX66C only 2.5V ≤ VCC < 5.5V 1.8V ≤ VCC < 2.5V
A9	TPD	Data output delay time	—	200 250 400	ns ns 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 ns	4.5V ≤ VCC < 5.5V, (Note 1) 1.8V ≤ VCC < 4.5V, (Note 1)
A11	Tsv	Status valid time	—	200 300 500	ns ns 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	25°C, VCC = 5.0V, (Note 2)

**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 from Microchip's web site at [www.microchip.com](http://www.microchip.com).

# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

FIGURE 1-1: SYNCHRONOUS DATA TIMING

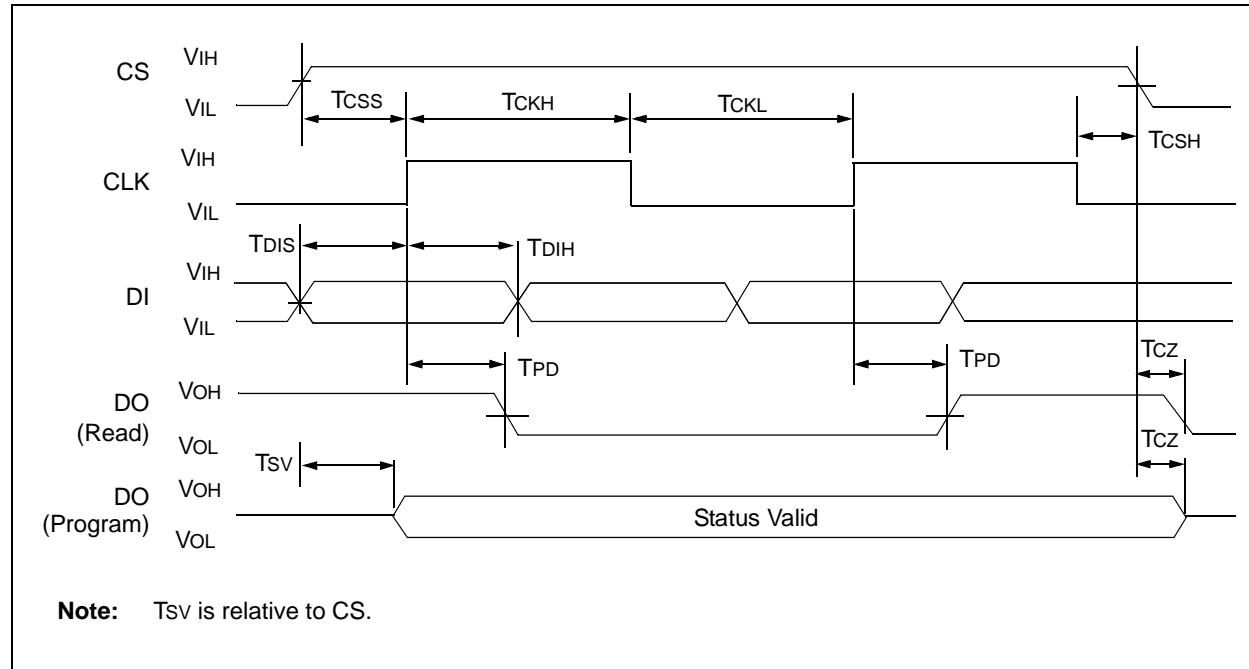


TABLE 1-3: INSTRUCTION SET FOR X 16 ORGANIZATION (93XX66B OR 93XX66C WITH ORG = 1)

Instruction	SB	Opcode	Address	Data In	Data Out	Req. CLK Cycles
ERASE	1	11	A7 A6 A5 A4 A3 A2 A1 A0	—	(RDY/BSY)	11
ERAL	1	00	1 0 X X X X X X	—	(RDY/BSY)	11
EWDS	1	00	0 0 X X X X X X	—	High-Z	11
EWEN	1	00	1 1 X X X X X X	—	High-Z	11
READ	1	10	A7 A6 A5 A4 A3 A2 A1 A0	—	D15 – D0	27
WRITE	1	01	A7 A6 A5 A4 A3 A2 A1 A0	D15 – D0	(RDY/BSY)	27
WRAL	1	00	0 1 X X X X X X	D15 – D0	(RDY/BSY)	27

TABLE 1-4: INSTRUCTION SET FOR X 8 ORGANIZATION (93XX66A OR 93XX66C WITH ORG = 0)

Instruction	SB	Opcode	Address	Data In	Data Out	Req. CLK Cycles
ERASE	1	11	A8 A7 A6 A5 A4 A3 A2 A1 A0	—	(RDY/BSY)	12
ERAL	1	00	1 0 X X X X X X	—	(RDY/BSY)	12
EWDS	1	00	0 0 X X X X X X	—	High-Z	12
EWEN	1	00	1 1 X X X X X X	—	High-Z	12
READ	1	10	A8 A7 A6 A5 A4 A3 A2 A1 A0	—	D7 – D0	20
WRITE	1	01	A8 A7 A6 A5 A4 A3 A2 A1 A0	D7 – D0	(RDY/BSY)	20
WRAL	1	00	0 1 X X X X X X	D7 – D0	(RDY/BSY)	20

# 93AA66A/B/C, 93LC66A/B/C, 93C66A/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.

**Note:** When preparing to transmit an instruction, either the CLK or DI signal levels must be at a logic low as CS is toggled active high.

## 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

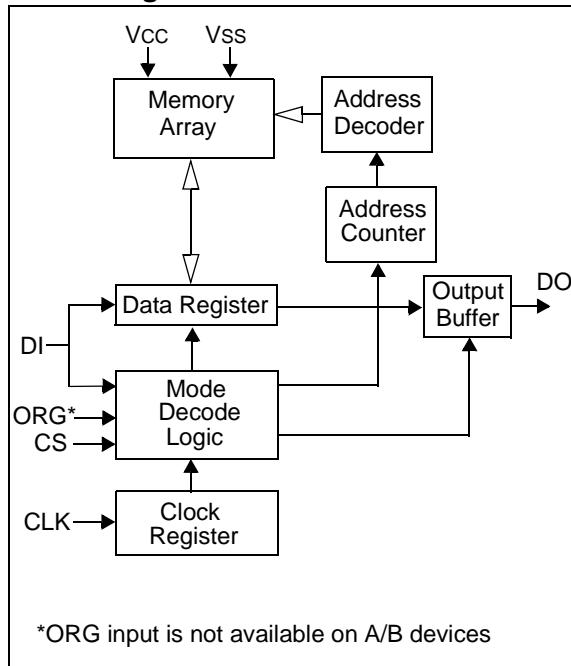
All modes of operation are inhibited when Vcc is below a typical voltage of 1.5V for '93AA' and '93LC' devices or 3.8V for '93C' devices.

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



# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

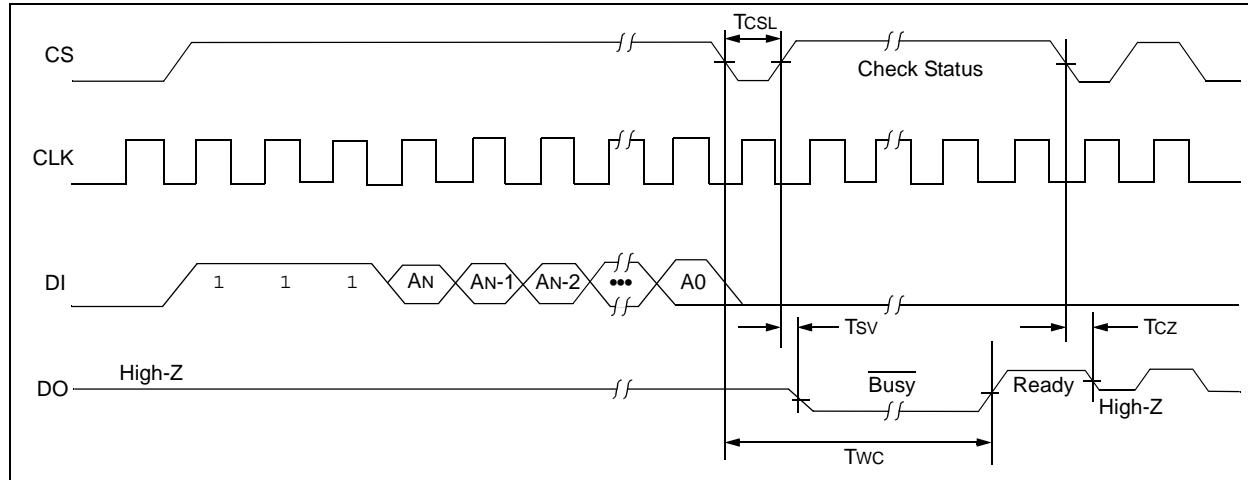
## 2.4 Erase

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.

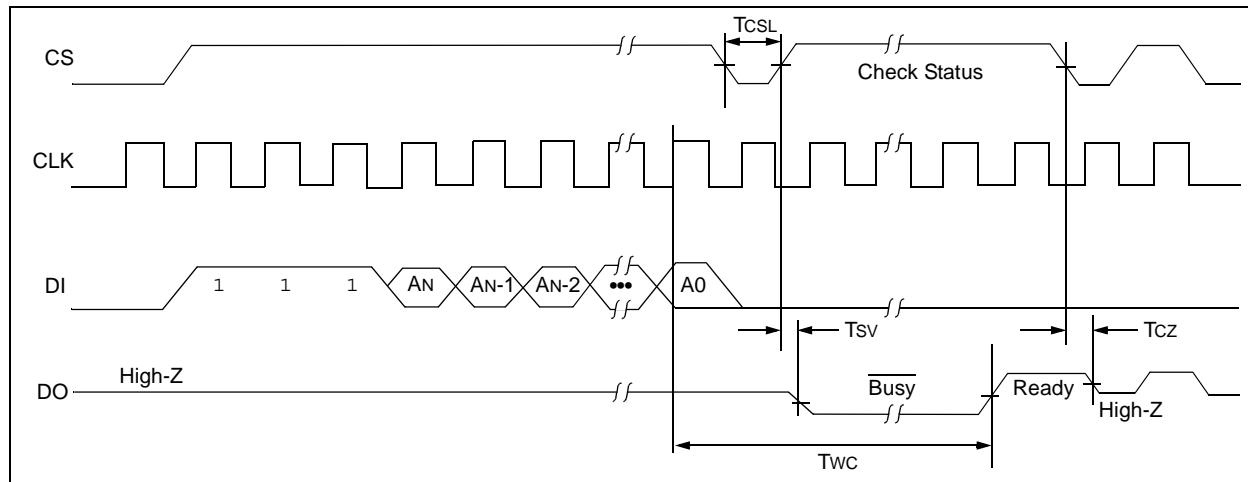
The DO pin indicates the Ready/Busy status of the device if CS is brought high after a minimum of 250 ns low (TCSL). DO at logical '0' indicates that programming is still in progress. DO at logical '1' indicates that the register at the specified address has been erased and the device is ready for another instruction.

**Note:** Issuing a Start bit and then taking CS low will clear the Ready/Busy status from DO.

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



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



# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

## 2.5 Erase All (ERAL)

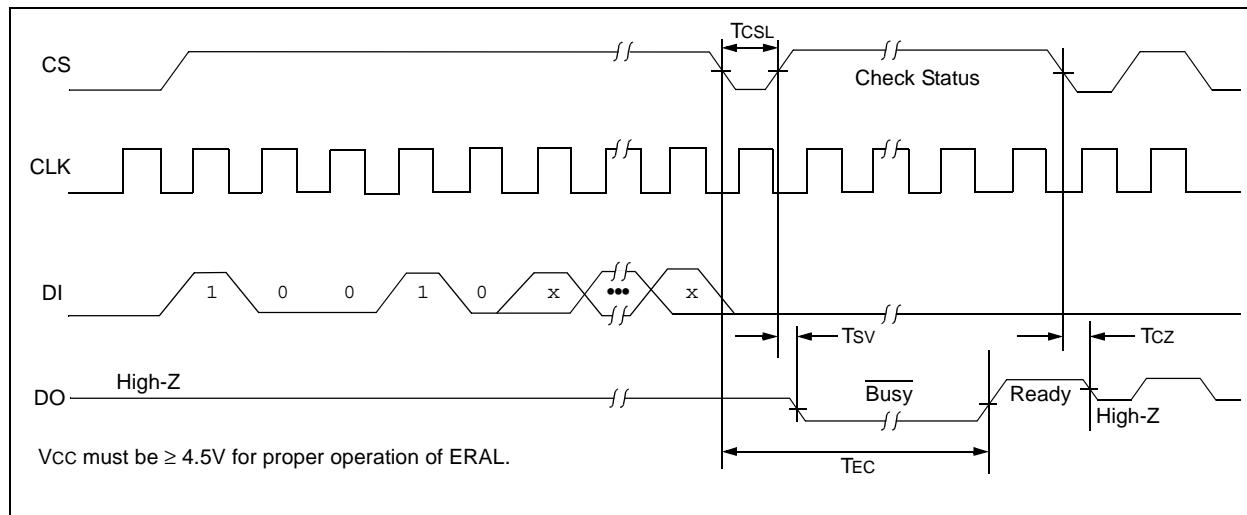
The Erase All (ERAL) instruction will erase the entire memory array to the logical '1' state. The ERAL cycle is identical to the erase cycle, except for the different opcode. The ERAL cycle is completely self-timed and commences at the falling edge of the CS, except on '93C' devices where the rising 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 Ready/Busy status of the device, if CS is brought high after a minimum of 250 ns low (TCSL).

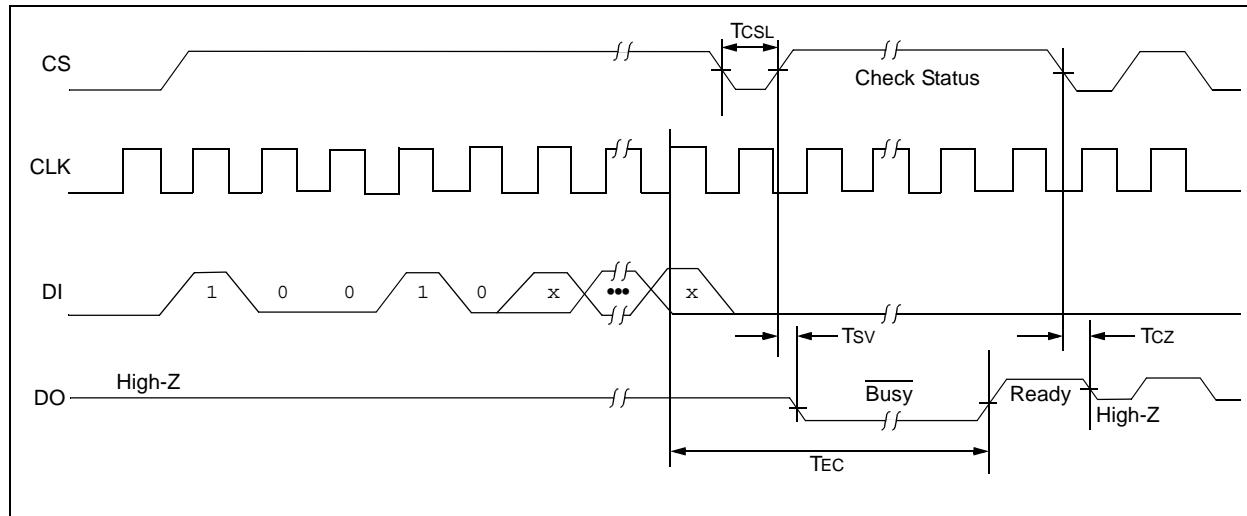
**Note:** Issuing a Start bit and then taking CS low will clear the Ready/Busy status from DO.

Vcc must be  $\geq 4.5V$  for proper operation of ERAL.

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



**FIGURE 2-4: ERAL TIMING FOR 93C DEVICES**



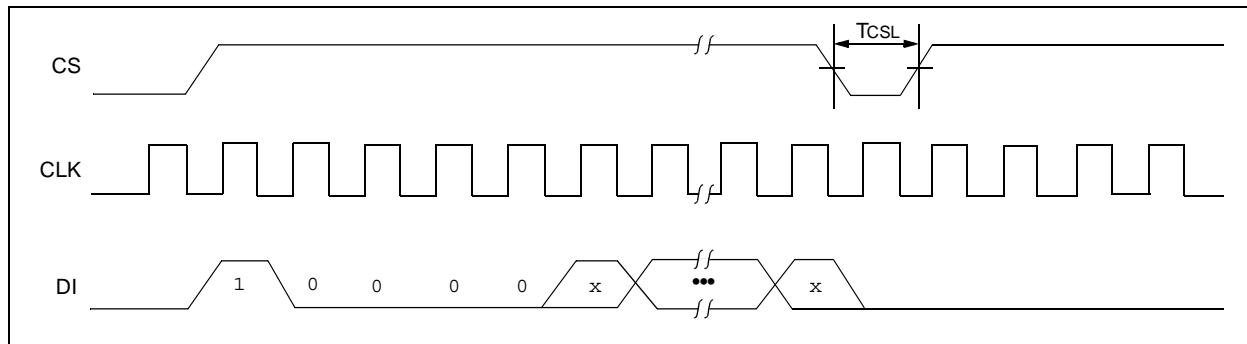
# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

## 2.6 Erase/Write Disable and Enable(EWDS/EWEN)

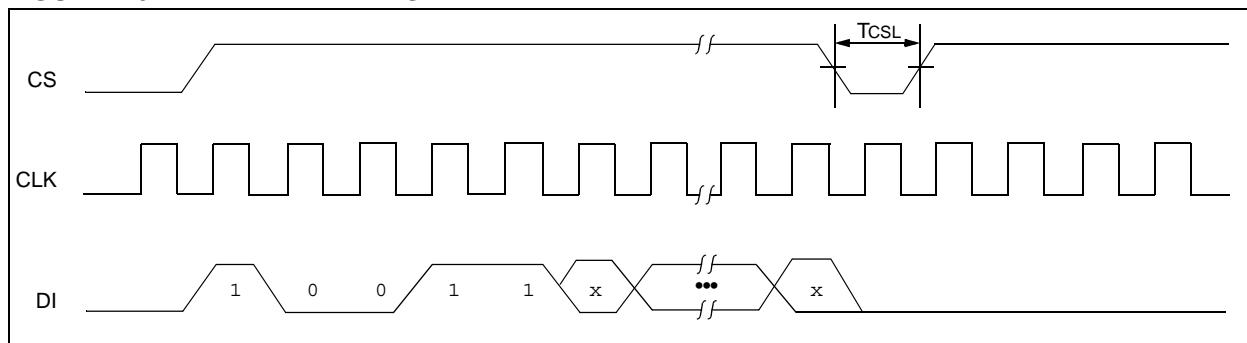
The 93XX66A/B/C powers up in the Erase/Write Disable (EWDS) state. All Programming modes must be preceded by an Erase/Write Enable (EWEN) instruction. Once the EWEN instruction is executed, programming remains enabled until an EWDS instruction is executed or Vcc is removed from the device.

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**

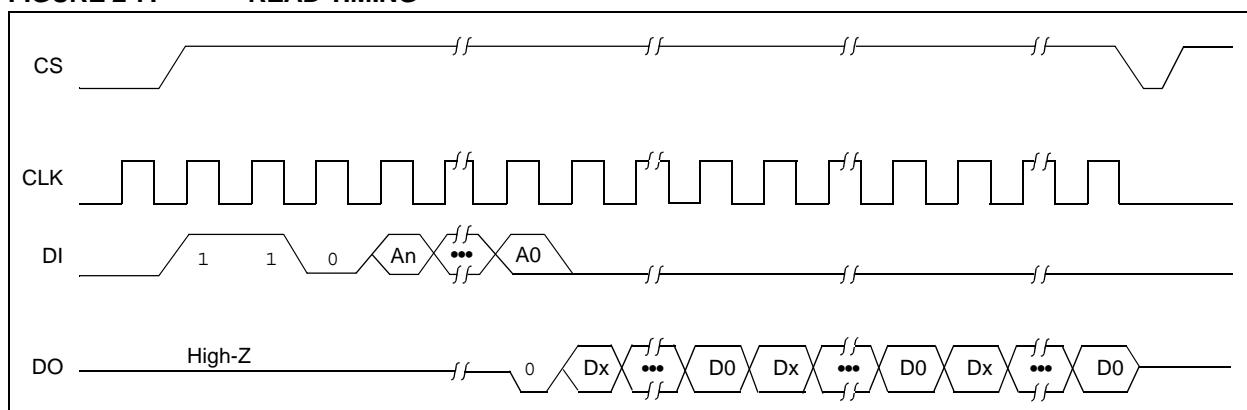


## 2.7 Read

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**



# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

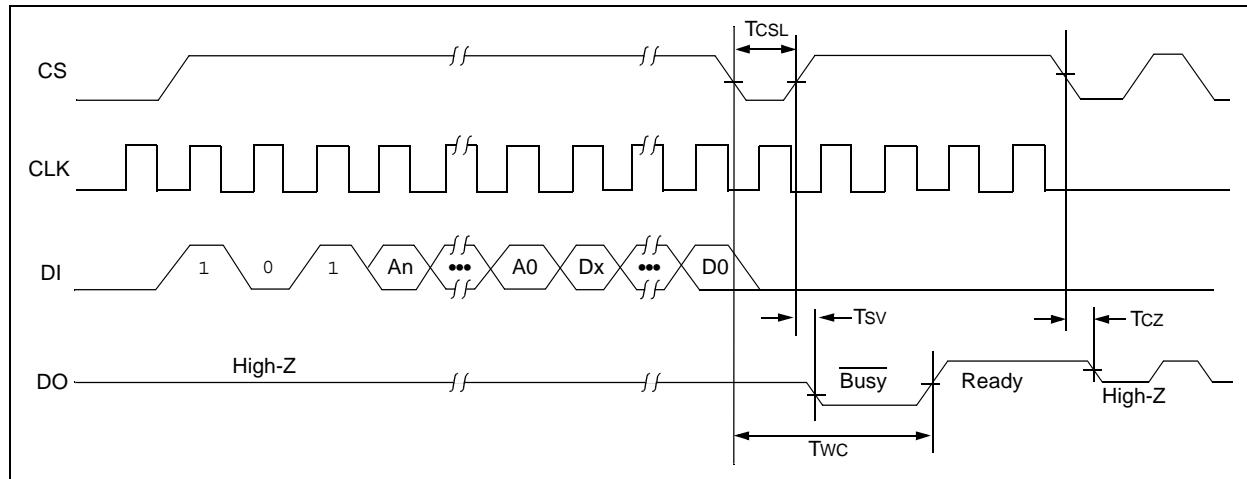
## 2.8 Write

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 93AA66A/B/C and 93LC66A/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 93C66A/B/C devices, the self-timed auto-erase and programming cycle is initiated by the rising edge of CLK on the last data bit.

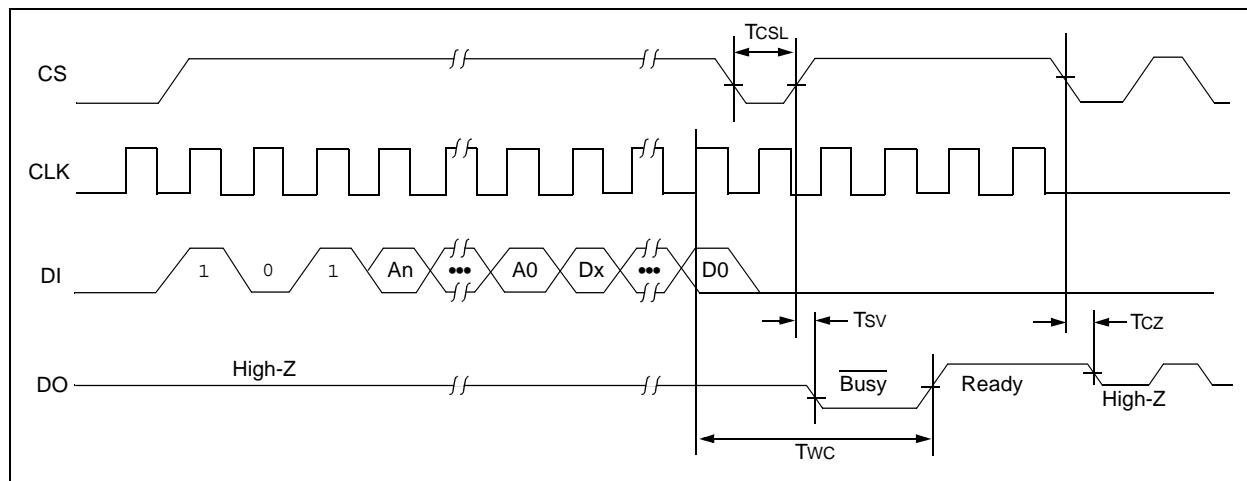
The DO pin indicates the Ready/Busy status of the device, if CS is brought high after a minimum of 250 ns low (T<sub>CSL</sub>). DO at logical '0' indicates that programming is still in progress. DO at logical '1' indicates that the register at the specified address has been written with the data specified and the device is ready for another instruction.

**Note:** Issuing a Start bit and then taking CS low will clear the Ready/Busy status from DO.

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



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



# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

## 2.9 Write All (WRAL)

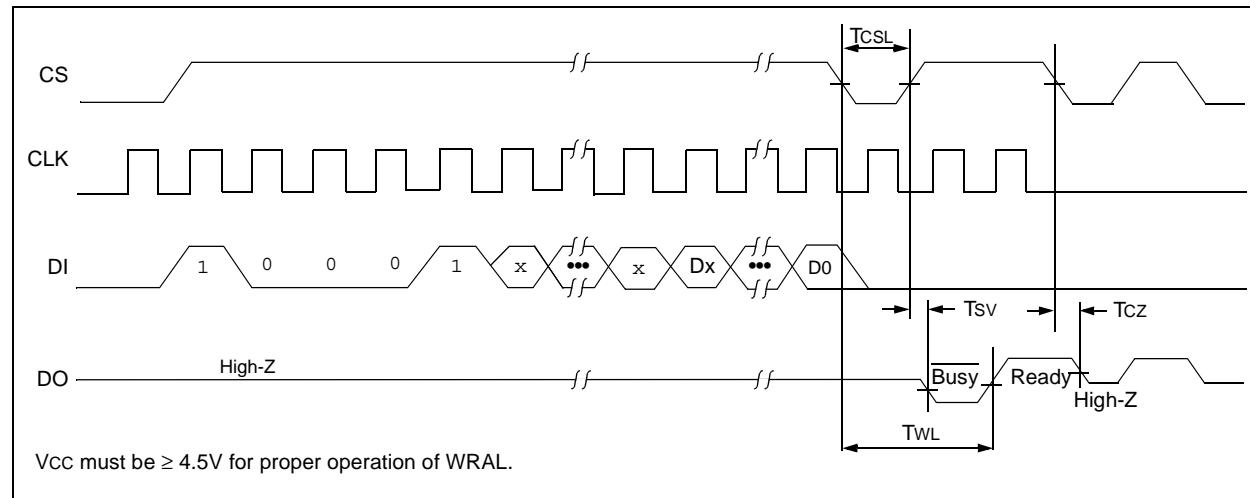
The Write All (WRAL) instruction will write the entire memory array with the data specified in the command. For 93AA66A/B/C and 93LC66A/B/C devices, after the last data bit is clocked into DI, the falling edge of CS initiates the self-timed auto-erase and programming cycle. For 93C66A/B/C devices, the 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 (TCSL).

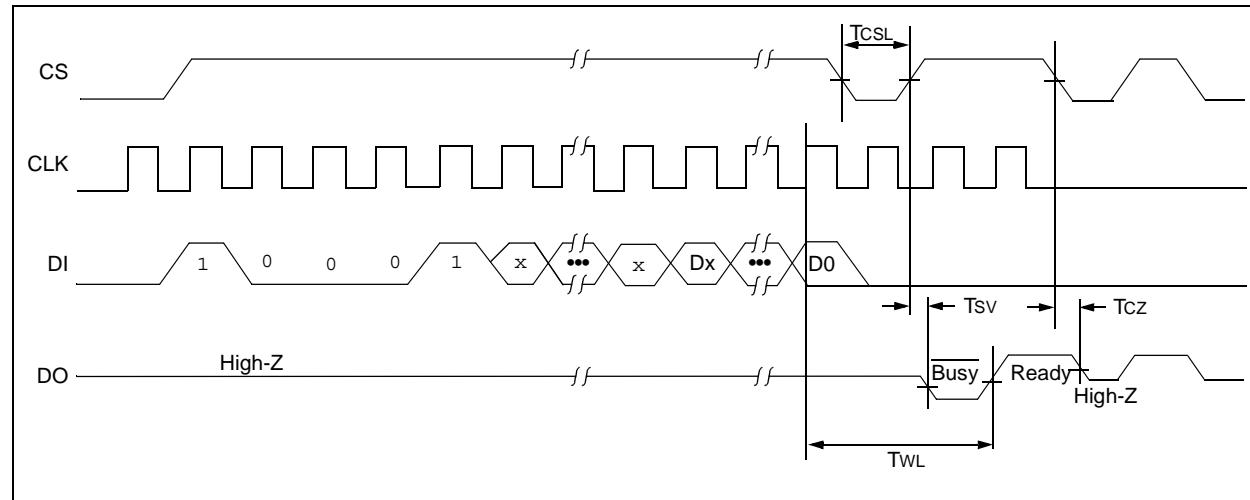
**Note:** Issuing a Start bit and then taking CS low will clear the Ready/Busy status from DO.

V<sub>CC</sub> 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**



# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

---

## 3.0 PIN DESCRIPTIONS

TABLE 3-1: PIN DESCRIPTIONS

Name	SOIC/PDIP/ MSOP/TSSOP/ DFN	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 / 93XX66C No Internal Connection / 93XX66A/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 (TCSL) 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 (TCKH) and Clock Low Time (TCKL). 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 (TPD after the positive edge of CLK).

This pin also provides Ready/Busy status information during erase and write cycles. Ready/Busy status information is available on the DO pin if CS is brought high after being low for minimum Chip Select Low Time (TCSL) 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/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.

93XX66A devices are always x8 organization and 93XX66B devices are always x16 organization.

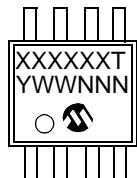
# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

---

## 4.0 PACKAGING INFORMATION

### 4.1 Package Marking Information

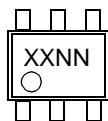
8-Lead MSOP (150 mil)



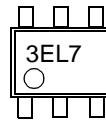
Example:



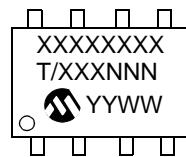
6-Lead SOT-23



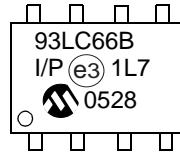
Example:



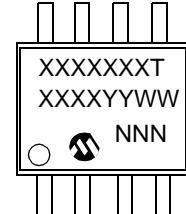
8-Lead PDIP



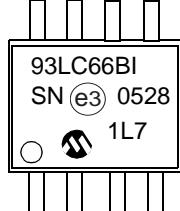
Example:



8-Lead SOIC



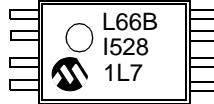
Example:



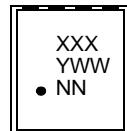
8-Lead TSSOP



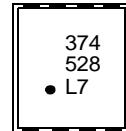
Example:



8-Lead 2x3 DFN



Example:



# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

---

---

Part Number	1st Line Marking Codes					
	TSSOP	MSOP	SOT-23		DFN	
			I Temp.	E Temp.	I Temp.	E Temp.
93AA66A	A66A	3A66AT	3BNN	—	361	—
93AA66B	A66B	3A66BT	3LNN	—	371	—
93AA66C	A66C	3A66CT	—	—	381	—
93LC66A	L66A	3L66AT	3ENN	3FNN	364	365
93LC66B	L66B	3L66BT	3PNN	3RNN	374	375
93LC66C	L66C	3L66CT	—	—	384	385
93C66A	C66A	3C66AT	3HNN	3JNN	367	368
93C66B	C66B	3C66BT	3TNN	3UNN	377	378
93C66C	C66C	3C66CT	—	—	387	388

**Note:** T = Temperature grade (I, E)

NN = Alphanumeric traceability code

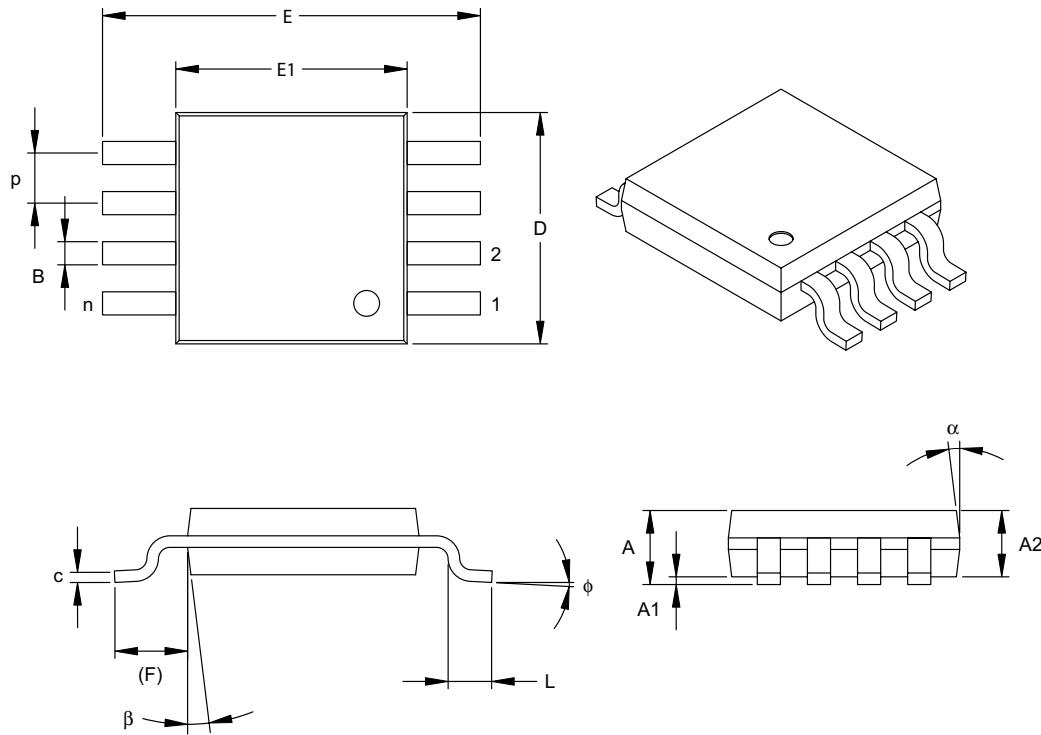
<b>Legend:</b>	XX...X	Part number or part number code
	T	Temperature (I, E)
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code (2 characters for small packages)
	(e3)	Pb-free JEDEC designator for Matte Tin (Sn)

**Note:** For very small packages with no room for the Pb-free JEDEC designator (e3), the marking will only appear on the outer carton or reel label.

**Note:** In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information.

# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

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



Units		INCHES			MILLIMETERS*		
Dimension Limits		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:

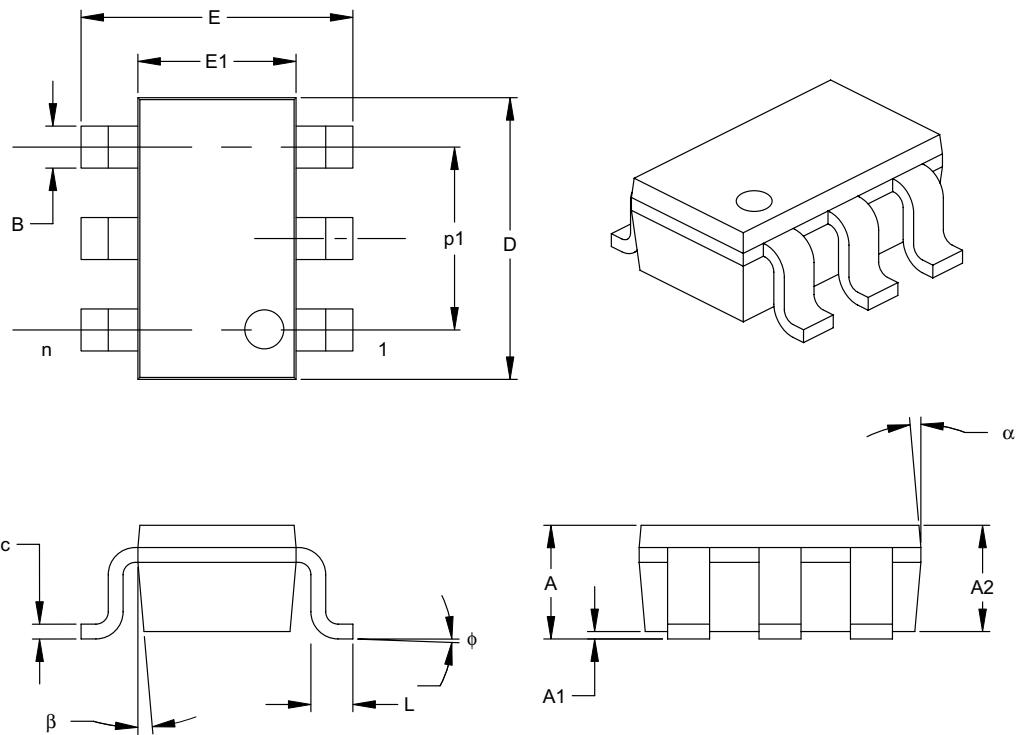
Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.

JEDEC Equivalent: MO-187

Drawing No. C04-111

# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

## 6-Lead Plastic Small Outline Transistor (OT) (SOT-23)



Units		INCHES*			MILLIMETERS		
Dimension Limits		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:

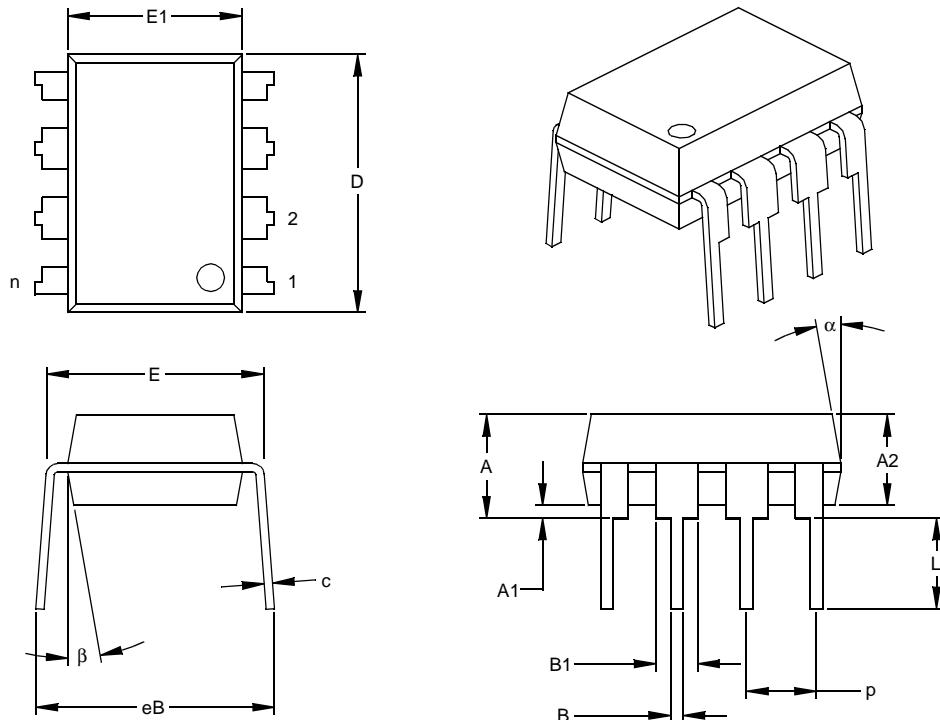
Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .005" (0.127mm) per side.

JEITA (formerly EIAJ) equivalent: SC-74A

Drawing No. C04-120

# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

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



Dimension	Limits	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:

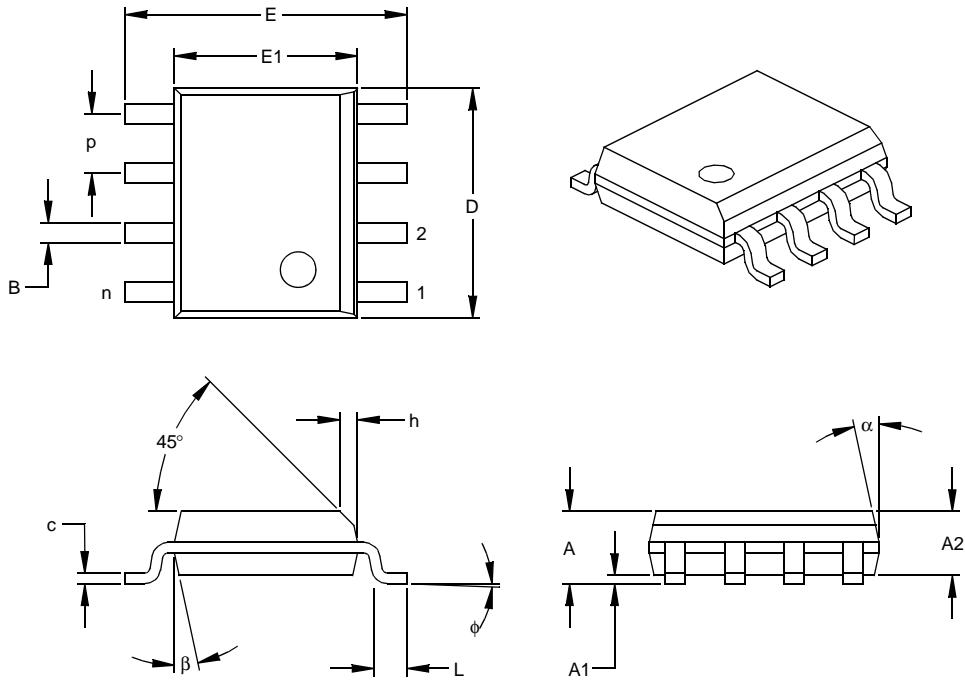
Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.

JEDEC Equivalent: MS-001

Drawing No. C04-018

# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

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



Dimension	Limits	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 $\frac{S}{2}$	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	$\phi$	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	$\alpha$	0	12	15	0	12	15
Mold Draft Angle Bottom	$\beta$	0	12	15	0	12	15

\* Controlling Parameter

$\frac{S}{2}$  Significant Characteristic

### Notes:

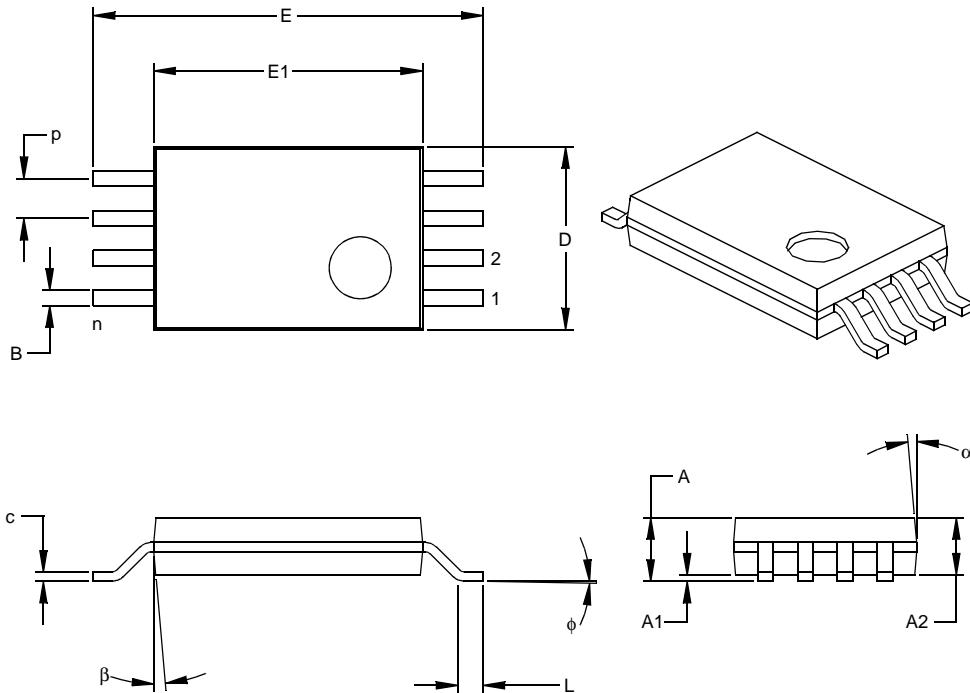
Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.

JEDEC Equivalent: MS-012

Drawing No. C04-057

# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

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



Dimension Limits		INCHES			MILLIMETERS*		
		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:

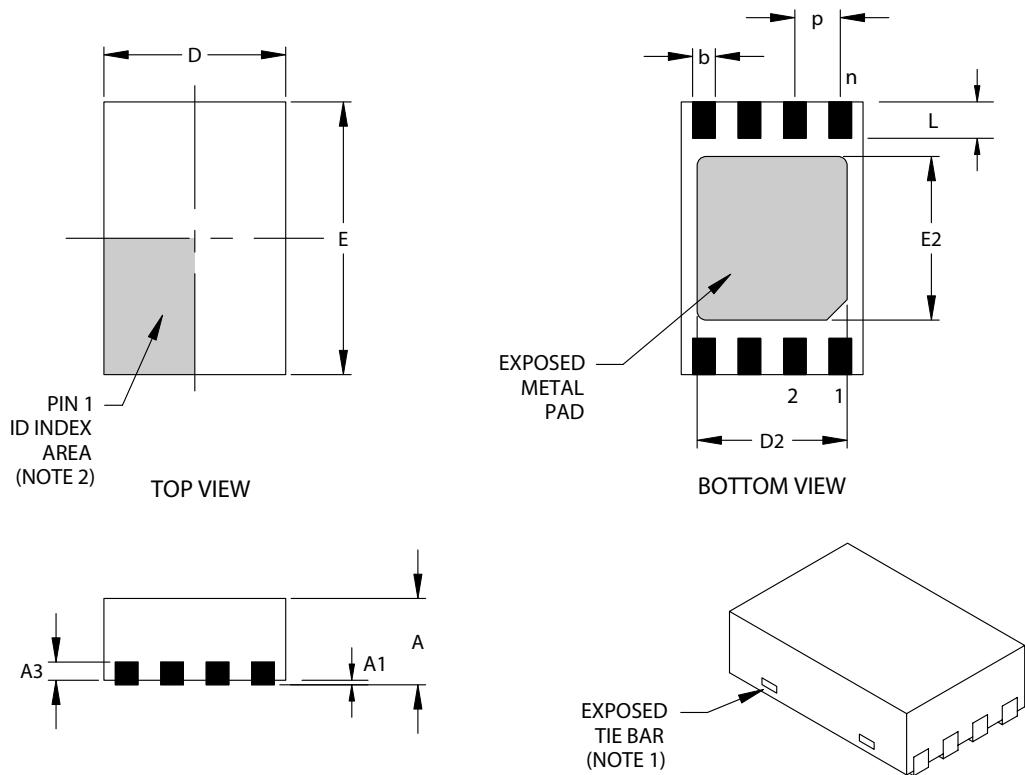
Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .005" (0.127mm) per side.

JEDEC Equivalent: MO-153

Drawing No. C04-086

# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

## 8-Lead Plastic Dual Flat No Lead Package (MC) 2x3x0.9 mm Body (DFN) – Saw Singulated



Dimension Limits		INCHES			MILLIMETERS*		
		MIN	NOM	MAX	MIN	NOM	MAX
Number of Pins	n		8			8	
Pitch	p		.020 BSC			0.50 BSC	
Overall Height	A	.031	.035	.039	0.80	0.90	1.00
Standoff	A1	.000	.001	.002	0.00	0.02	0.05
Contact Thickness	A3	.008 REF.			0.20 REF.		
Overall Length	D	.079 BSC			2.00 BSC		
Exposed Pad Length (Note 3)	D2	.055	--	.064	1.39	--	1.62
Overall Width	E	.118 BSC			3.00 BSC		
Exposed Pad Width (Note 3)	E2	.047	--	.071	1.20	--	1.80
Contact Width	b	.008	.010	.012	0.20	0.25	0.30
Contact Length	L	.012	.016	.020	0.30	0.40	0.50

\*Controlling Parameter

Notes:

1. Package may have one or more exposed tie bars at ends.
2. Pin 1 visual index feature may vary, but must be located within the hatched area.
3. Exposed pad dimensions vary with paddle size.
4. JEDEC equivalent: MO-229

# **93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C**

---

## **APPENDIX A: REVISION HISTORY**

### **Revision B**

Corrections to Section 1.0, Electrical Characteristics.  
Section 4.1, 6-Lead SOT-23 package to OT.

### **Revision C**

Added DFN package.

# **93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C**

---

---

**NOTES:**



# 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C

---

## THE MICROCHIP WEB SITE

Microchip provides online support via our WWW site at [www.microchip.com](http://www.microchip.com). This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQ), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

## CUSTOMER CHANGE NOTIFICATION SERVICE

Microchip's customer notification service helps keep customers current on Microchip products. Subscribers will receive e-mail notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, access the Microchip web site at [www.microchip.com](http://www.microchip.com), click on Customer Change Notification and follow the registration instructions.

## CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support
- Development Systems Information Line

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

**Technical support is available through the web site at: <http://support.microchip.com>**

In addition, there is a Development Systems Information Line which lists the latest versions of Microchip's development systems software products. This line also provides information on how customers can receive currently available upgrade kits.

**The Development Systems Information Line numbers are:**

1-800-755-2345 – United States and most of Canada

1-480-792-7302 – Other International Locations

# **93AA66A/B/C, 93LC66A/B/C, 93C66A/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 Total Pages Sent

## RE: Reader Response

From: Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City / State / ZIP / Country \_\_\_\_\_

Telephone: (\_\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_ FAX: (\_\_\_\_\_) \_\_\_\_\_ - \_\_\_\_\_

ation (optional):

### Application (optional):

Would you like a reply?        Y        N

Device: 93AA66A/B/C, 93LC66A/B/C, 93C66A/B/C Literature Number: DS21795C

## 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?

---

Digitized by srujanika@gmail.com

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

---

Page 10 of 10

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

---

Digitized by srujanika@gmail.com

7. How would you improve this document?

---

Page 10 of 10

# 93AA66A/B/C, 93LC66A/B/C, 93C66A/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.

PART NO.	X	X	X	XX	X
Device	Pinout	Tape & Reel	Temperature Range	Package	Lead Finish
<b>Device:</b> 93AA66A: 4K 1.8V Microwire Serial EEPROM 93AA66B: 4K 1.8V Microwire Serial EEPROM 93AA66C: 4K 1.8V Microwire Serial EEPROM w/ORG  93LC66A: 4K 2.5V Microwire Serial EEPROM 93LC66B: 4K 2.5V Microwire Serial EEPROM 93LC66C: 4K 2.5V Microwire Serial EEPROM w/ORG  93C66A: 4K 5.0V Microwire Serial EEPROM 93C66B: 4K 5.0V Microwire Serial EEPROM 93C66C: 4K 5.0V Microwire Serial EEPROM w/ORG					
<b>Pinout:</b>	Blank	=	Standard pinout		
	X	=	Rotated pinout		
<b>Tape &amp; Reel:</b>	Blank	=	Standard packaging		
	T	=	Tape & Reel		
<b>Temperature Range:</b>	I	=	-40°C to +85°C		
	E	=	-40°C to +125°C		
<b>Package:</b>	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		
	MC	=	2x3 DFN, 8-lead		
<b>Lead Finish:</b>	Blank	=	Pb-free – Matte Tin (see Note 1)		
	G	=	Pb-free – Matte Tin only		

### Examples:

- a) 93AA66C-I/MS: 4K, 512x8 or 256x16 Serial EEPROM, MSOP package, 1.8V
- b) 93AA66B-I/MS: 4K, 256x16 Serial EEPROM, MSOP package, 1.8V
- c) 93AA66AT-I/OT: 4K, 512x8 Serial EEPROM, SOT-23 package, tape and reel, 1.8V
- d) 93AA66CT-I/MS: 4K, 512x8 or 256x16 Serial EEPROM, MSOP package, tape and reel, 1.8V
  
- a) 93LC66A-I/MS: 4K, 512x8 Serial EEPROM, MSOP package, 2.5V
- b) 93LC66BT-I/OT: 4K, 256x16 Serial EEPROM, SOT-23 package, tape and reel, 2.5V
- c) 93LC66B-I/MS: 4K, 256x16 Serial EEPROM, MSOP package, 2.5V
  
- a) 93C66B-I/MS: 4K, 256x16 Serial EEPROM, MSOP package, 5.0V
- b) 93C66C-I/MS: 4K, 512x8 or 256x16 Serial EEPROM, MSOP package, 5.0V
- c) 93C66AT-I/OT: 4K, 512x8 Serial EEPROM, SOT-23 package, tape and reel, 5.0V

**Note 1:** Most products manufactured after January 2005 will have a Matte Tin (Pb-free) finish. Most products manufactured before January 2005 will have a finish of approximately 63% Sn and 37% Pb (Sn/Pb).

Please visit [www.microchip.com](http://www.microchip.com) for the latest information on Pb-free conversion, including conversion date codes.

## 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.

# **93AA66A/B/C, 93LC66A/B/C, 93C66A/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 provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. **MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION, INCLUDING BUT NOT LIMITED TO ITS CONDITION, QUALITY, PERFORMANCE, MERCHANTABILITY OR FITNESS FOR PURPOSE.** Microchip disclaims all liability arising from this information and its use. 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 Microchip intellectual property rights.

#### Trademarks

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

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

Analog-for-the-Digital Age, Application Maestro, dsPICDEM, dsPICDEM.net, dsPICworks, ECAN, ECONOMONITOR, FanSense, FlexROM, fuzzyLAB, In-Circuit Serial Programming, ICSP, ICEPIC, MPASM, MPLIB, MPLINK, MPSIM, PICkit, PICDEM, PICDEM.net, PICLAB, PICtail, PowerCal, PowerInfo, PowerMate, PowerTool, rfLAB, rfPICDEM, Select Mode, Smart Serial, SmartTel, Total Endurance and WiperLock are trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

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.

© 2005, Microchip Technology Incorporated, Printed in the U.S.A., All Rights Reserved.



Printed on recycled paper.

---

**QUALITY MANAGEMENT SYSTEM  
CERTIFIED BY DNV  
=ISO/TS 16949:2002=**

*Microchip received ISO/TS-16949:2002 quality system certification for its worldwide headquarters, design and wafer fabrication facilities in Chandler and Tempe, Arizona and Mountain View, California in October 2003. The Company's quality system processes and procedures are for its PICmicro® 8-bit MCUs, KEELOQ® code hopping devices, Serial EEPROMS, microperipherals, nonvolatile memory and analog products. In addition, Microchip's quality system for the design and manufacture of development systems is ISO 9001:2000 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:  
<http://support.microchip.com>  
Web Address:  
[www.microchip.com](http://www.microchip.com)

**Atlanta**

Alpharetta, GA  
Tel: 770-640-0034  
Fax: 770-640-0307

**Boston**

Westborough, MA  
Tel: 774-760-0087  
Fax: 774-760-0088

**Chicago**

Itasca, IL  
Tel: 630-285-0071  
Fax: 630-285-0075

**Dallas**

Addison, TX  
Tel: 972-818-7423  
Fax: 972-818-2924

**Detroit**

Farmington Hills, MI  
Tel: 248-538-2250  
Fax: 248-538-2260

**Kokomo**

Kokomo, IN  
Tel: 765-864-8360  
Fax: 765-864-8387

**Los Angeles**

Mission Viejo, CA  
Tel: 949-462-9523  
Fax: 949-462-9608

**San Jose**

Mountain View, CA  
Tel: 650-215-1444  
Fax: 650-961-0286

**Toronto**

Mississauga, Ontario,  
Canada  
Tel: 905-673-0699  
Fax: 905-673-6509

### ASIA/PACIFIC

**Australia - Sydney**  
Tel: 61-2-9868-6733  
Fax: 61-2-9868-6755

**China - Beijing**  
Tel: 86-10-8528-2100  
Fax: 86-10-8528-2104

**China - Chengdu**  
Tel: 86-28-8676-6200  
Fax: 86-28-8676-6599

**China - Fuzhou**  
Tel: 86-591-8750-3506  
Fax: 86-591-8750-3521

**China - Hong Kong SAR**  
Tel: 852-2401-1200  
Fax: 852-2401-3431

**China - Shanghai**  
Tel: 86-21-5407-5533  
Fax: 86-21-5407-5066

**China - Shenyang**  
Tel: 86-24-2334-2829  
Fax: 86-24-2334-2393

**China - Shenzhen**  
Tel: 86-755-8203-2660  
Fax: 86-755-8203-1760

**China - Shunde**  
Tel: 86-757-2839-5507  
Fax: 86-757-2839-5571

**China - Qingdao**  
Tel: 86-532-502-7355  
Fax: 86-532-502-7205

### ASIA/PACIFIC

**India - Bangalore**  
Tel: 91-80-2229-0061  
Fax: 91-80-2229-0062

**India - New Delhi**  
Tel: 91-11-5160-8631  
Fax: 91-11-5160-8632

**Japan - Kanagawa**  
Tel: 81-45-471- 6166  
Fax: 81-45-471-6122

**Korea - Seoul**  
Tel: 82-2-554-7200  
Fax: 82-2-558-5932 or  
82-2-558-5934

**Singapore**  
Tel: 65-6334-8870  
Fax: 65-6334-8850

**Taiwan - Kaohsiung**  
Tel: 886-7-536-4818  
Fax: 886-7-536-4803

**Taiwan - Taipei**  
Tel: 886-2-2500-6610  
Fax: 886-2-2508-0102

**Taiwan - Hsinchu**  
Tel: 886-3-572-9526  
Fax: 886-3-572-6459

### EUROPE

**Austria - Weis**  
Tel: 43-7242-2244-399  
Fax: 43-7242-2244-393

**Denmark - Ballerup**  
Tel: 45-4450-2828  
Fax: 45-4485-2829

**France - Massy**  
Tel: 33-1-69-53-63-20  
Fax: 33-1-69-30-90-79

**Germany - Ismaning**  
Tel: 49-89-627-144-0  
Fax: 49-89-627-144-44

**Italy - Milan**  
Tel: 39-0331-742611  
Fax: 39-0331-466781

**Netherlands - Drunen**  
Tel: 31-416-690399  
Fax: 31-416-690340

**England - Berkshire**  
Tel: 44-118-921-5869  
Fax: 44-118-921-5820