Product Change Notification / SYST-02WMWU601

Date:

03-May-2023

Product Category:

Memory

PCN Type:

Document Change

Notification Subject:

Data Sheet - 93AA56A/B/C, 93LC56A/B/C, 93C56A/B/C - 2-Kbit Microwire Compatible Serial EEPROM Data Sheet

Affected CPNs:

SYST-02WMWU601_Affected_CPN_05032023.pdf
SYST-02WMWU601_Affected_CPN_05032023.csv

Notification Text:

SYST-02WMWU601

Microchip has released a new Datasheet for the 93AA56A/B/C, 93LC56A/B/C, 93C56A/B/C - 2-Kbit Microwire Compatible Serial EEPROM Data Sheet of devices. If you are using one of these devices please read the document located at 93AA56A/B/C, 93LC56A/B/C, 93C56A/B/C - 2-Kbit Microwire Compatible Serial EEPROM Data Sheet.

Notification Status: Final

Description of Change:
Corrected “1st Line Marking Codes” table.

Impacts to Data Sheet: See above details.

Reason for Change: To improve Productivity.

Change Implementation Status: Complete

Date Document Changes Effective: 03 May 2023

NOTE: Please be advised that this is a change to the document only the product has not been changed.

Markings to Distinguish Revised from Unrevised Devices: N/A

Attachments:

93AA56A/B/C, 93LC56A/B/C, 93C56A/B/C - 2-Kbit Microwire Compatible Serial EEPROM Data Sheet

Please contact your local Microchip sales office with questions or concerns regarding this notification.

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Affected Catalog Part Numbers (CPN)

93LC56B/SNRVA
93LC56BX/SNRVA
93LC56B/STRVA
93LC56B-I/SNRVA
93LC56BX-I/SNRVA
93LC56B-I/SNVAO
93LC56B-I/STRVA
93LC56BXT/SNRVA
93LC56BT/STRVA
93LC56BT-I/SNRVA
93LC56BXT-I/SNRVA
93LC56BT-I/SNV26
93LC56BT-I/SNVAO
93LC56BT-I/STRVA
93LC56A/SNRVA
93LC56AX/SNRVA
93LC56A/STRVA
93LC56A-I/SNRVA
93LC56AX-I/SNRVA
93LC56A-I/STRVA
93LC56AT/SNRVA
93LC56AXT/SNRVA
93LC56AT/STRVA
93LC56AT-I/SNRVA
93LC56AXT-I/SNRVA
93LC56AT-I/SNV01
93LC56AT-I/SNGVAO
93LC56AT-I/SNVAO
93LC56AT-I/STRVA
93LC56BT-I/SNC22VAO
93LC56A/SN
93LC56B/SN
93LC56BX/SN
93LC56A/P
93LC56B/P
93LC56A/ST
93LC56B/ST
93LC56C-E/MS
93LC56A-E/MS
93LC56B-E/MS
93LC56C-E/SN
93LC56CX-E/SN
93LC56A-E/SN
93LC56AX-E/SN
93LC56B-E/SN
93LC56BX-E/SN

93LC56C-E/P
93LC56A-E/P
93LC56B-E/P
93LC56C-E/ST
93LC56A-E/ST
93LC56B-E/ST
93LC56C-I/MS
93AA56C-I/MS
93LC56A-I/MS
93AA56A-I/MS
93LC56B-I/MS
93AA56B-I/MS
93LC56C-I/SN
93LC56CX-I/SN
93AA56C-I/SN
93AA56CX-I/SN
93LC56A-I/SN
93LC56AX-I/SN
93AA56A-I/SN
93AA56AX-I/SN
93LC56B-I/SN
93LC56BX-I/SN
93AA56B-I/SN
93AA56BX-I/SN
93LC56B-I/SN15KVAO
93LC56C-I/P
93AA56C-I/P
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93AA56A-I/P
93LC56B-I/P
93AA56B-I/P
93LC56C-I/ST
93AA56C-I/ST
93LC56A-I/ST
93AA56A-I/ST
93LC56B-I/ST
93AA56B-I/ST
93LC56AT/SN
93LC56BT/SN
93LC56BXT/SN
93LC56BT/ST
93LC56CT-I/MNY
93AA56CT-I/MNY
93LC56AT-I/MNY
93AA56AT-I/MNY
93LC56BT-I/MNY
93AA56BT-I/MNY
93LC56CT-I/MS
93AA56CT-I/MS

93LC56AT-I/MS
93AA56AT-I/MS
93LC56BT-I/MS
93AA56BT-I/MS
93LC56CT-I/MC
93AA56CT-I/MC
93LC56AT-I/MC
93AA56AT-I/MC
93LC56BT-I/MC
93AA56BT-I/MC
93LC56CT-I/MC15KVAO
93LC56CT-I/SN
93LC56CXT-I/SN
93AA56CT-I/SN
93AA56CXT-I/SN
93LC56AT-I/SN
93LC56AXT-I/SN
93AA56AT-I/SN
93AA56AXT-I/SN
93LC56BT-I/SN
93LC56BXT-I/SN
93AA56BT-I/SN
93AA56BXT-I/SN
93LC56BT-I/SN15KV03
93LC56AT-I/SN15KV06
93LC56CT-I/SN15KVAO
93LC56AT-I/SNG15KVAO
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93LC56CT-I/ST
93AA56CT-I/ST
93LC56AT-I/ST
93AA56AT-I/ST
93LC56BT-I/ST
93AA56BT-I/ST
93LC56AT-I/OT
93AA56AT-I/OT
93LC56BT-I/OT
93AA56BT-I/OT
93LC56CT-E/MNY
93LC56AT-E/MNY
93LC56BT-E/MNY
93LC56CT-E/MS
93LC56AT-E/MS
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93LC56BT-E/SN15KV08
93LC56CT-E/SN15KV10
93LC56CT-E/SN15KVAO
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93LC56BT-E/ST
93LC56BT-E/ST15KV09
93LC56BT-E/ST15KV12
93LC56AT-E/OT
93LC56BT-E/OT
93LC56BT-E/OTV07
93C56C-E/MS
93C56A-E/MS
93C56B-E/MS
93C56C-E/SN
93C56A-E/SN
93C56B-E/SN
93C56C-E/P
93C56A-E/P
93C56B-E/P
93C56C-E/ST
93C56A-E/ST
93C56B-E/ST
93C56C-I/MS
93C56A-I/MS
93C56B-I/MS
93C56C-I/SN
93C56A-I/SN
93C56B-I/SN
93C56C-I/P
93C56A-I/P
93C56B-I/P
93C56C-I/ST
93C56A-I/ST
93C56B-I/ST
93C56CT-I/MNY
93C56AT-I/MNY
93C56BT-I/MNY
93C56CT-I/MS
93C56AT-I/MS
93C56BT-I/MS
93C56CT-I/MC
93C56AT-I/MC

93C56BT-I/MC
93C56CT-I/SN
93C56AT-I/SN
93C56BT-I/SN
93C56CT-I/ST
93C56AT-I/ST
93C56BT-I/ST
93C56AT-I/OT
93C56BT-I/OT
93C56CT-E/MNY
93C56AT-E/MNY
93C56BT-E/MNY
93C56CT-E/MS
93C56AT-E/MS
93C56BT-E/MS
93C56CT-E/SN
93C56AT-E/SN
93C56BT-E/SN
93C56AT-E/SNG15KVAO
93C56CT-E/ST
93C56AT-E/ST
93C56BT-E/ST
93C56AT-E/OT
93C56BT-E/OT

93AA56A/B/C, 93LC56A/B/C, 93C56A/B/C

2-Kbit Microwire Compatible Serial EEPROM

Device Selection Table

Part Number	Vcc Range	ORG Pin	Word Size	Temperature Ranges	Packages
93AA56A	1.8V-5.5V	No	8-bit	I	MC, MS, P, SN, OT, MN, ST
93AA56B	1.8V-5-5V	No	16-bit	I	MC, MS, P, SN, OT, MN, ST
93LC56A	2.5V-5.5V	No	8-bit	I, E	MC, MS, P, SN, OT, MN, ST
93LC56B	2.5V-5.5V	No	16-bit	I, E	MC, MS, P, SN, OT, MN, ST
93C56A	4.5V-5.5V	No	8-bit	I, E	MC, MS, P, SN, OT, MN, ST
93C56B	4.5V-5.5V	No	16-bit	I, E	MC, MS, P, SN, OT, MN, ST
93AA56C	1.8V-5.5V	Yes	8-bit or 16-bit	I	MC, MS, P, SN, MN, ST
93LC56C	2.5V-5.5V	Yes	8-bit or 16-bit	I, E	MC, MS, P, SN, MN, ST
93C56C	4.5V-5.5V	Yes	8-bit or 16-bit	I, E	MC, MS, P, SN, MN, ST

Features

- Low-Power CMOS Technology
- ORG Pin to Select Word Size for ‘56C’ Version
- 256 x 8-bit Organization ‘A’ Version (no ORG)
- 128 x 16-bit Organization ‘B’ Version (no ORG)
- Self-Timed Erase/Write Cycles (including Auto-Erase)
- Automatic Erase All (ERAL) before Write All (WRAL)
- Power-On/Off Data Protection Circuitry
- Industry Standard Three-Wire Serial I/O
- Device Status Signal (Ready/$\overline{\text{Busy}}$)
- Sequential Read Function
- High Reliability:
  - Endurance: 1,000,000 erase/write cycles
  - Data retention: > 200 years
  - ESD protection: > 4000V
- RoHS Compliant:
- Automotive AEC-Q100 Qualified
- Temperature Ranges Supported:
  - Industrial (I) -40°C to +85°C
  - Extended (E) -40°C to +125°C

Packages

- 8-Lead DFN, 8-Lead MSOP, 8-Lead PDIP, 8-Lead SOIC, 6-Lead SOT-23, 8-Lead TDFN and 8-Lead TSSOP

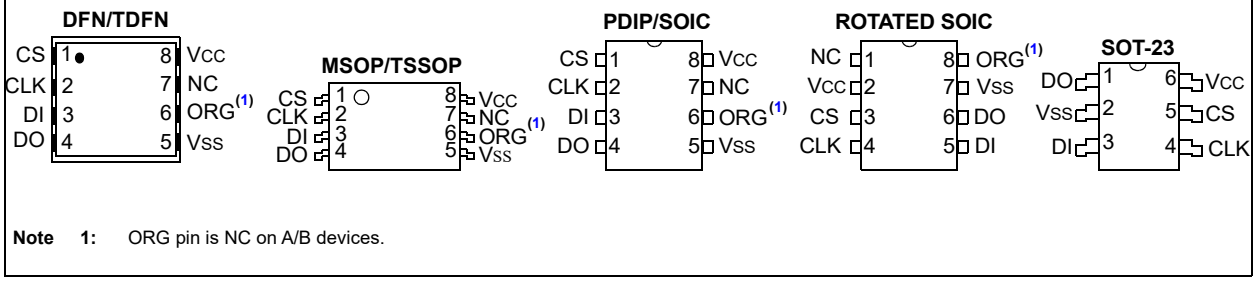
Pin Function Table

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. 93XX56A/B/C devices are 2-Kbit low-voltage serial Electrically Erasable PROMs (EEPROM). Word-selectable devices such as the 93AA56C, 93LC56C or 93C56C are dependent upon external logic levels driving the ORG pin to set word size. For dedicated 8-bit communication, the 93XX56A devices are available, while the 93XX56B devices provide dedicated 16-bit communication. Advanced CMOS technology makes these devices ideal for low-power, nonvolatile memory applications.

Package Types (not to scale)



Note 1: ORG pin is NC on A/B devices.

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings(†)

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** **Extended (E): TA = -40°C to +125°C, VCC = +2.5V to +5.5V**				
Param. No.	**Symbol**	**Parameter**	**Minimum**	**Typical**	**Maximum**	**Units**	**Conditions**
D1	VIH1	High-level Input Voltage	2.0	—	VCC +1	V	VCC ≥ 2.7V
	VIH2		0.7 VCC	—	VCC +1	V	VCC < 2.7V
D2	VIL1	Low-level Input Voltage	-0.3	—	0.8	V	VCC ≥ 2.7V
	VIL2		-0.3	—	0.2 VCC	V	VCC < 2.7V
D3	Vol1	Low-level Output Voltage	—	—	0.4	V	IOL = 2.1 mA, VCC = 4.5V
	Vol2		—	—	0.2	V	IOL = 100 µA, VCC = 2.5V
D4	VOH1	High-level Output Voltage	2.4	—	—	V	IOH = -400 µA, VCC = 4.5V
	VOH2		VCC - 0.2	—	—	V	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 (**Note 1**) TA = +25°C, FCLK = 1 MHz
D8	ICC write	Write Current	—	—	2	mA	FCLK = 3 MHz, Vcc = 5.5V FCLK = 2 MHz, Vcc = 2.5V
			—	500	—	µA	
D9	ICC read	Read Current	—	—	1	mA	FCLK = 3 MHz, VCC = 5.5V
			—	—	500	µA	FCLK = 2 MHz, VCC = 3.0V
			—	100	—	µA	FCLK = 2 MHz, VCC = 2.5V
D10	ICCS	Standby Current	—	—	1	µA	I–Temp. CLK = CS = 0V ORG = DI = VSS or VCC (**Note 2** and **Note 3**)
			—	—	5	µA	E–Temp. CLK = CS = 0V ORG = DI = VSS or VCC (**Note 2** and **Note 3**)

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

2: ORG pin not available on ‘A’ or ‘B’ versions.

3: Ready/$\overline{\text{Busy}}$ status must be cleared from DO; see **Section 3.4 “Data Out (DO)”**.

TABLE 1-1: DC CHARACTERISTICS (CONTINUED)

All parameters apply over the specified ranges unless otherwise noted.			Industrial (I): T_A = -40°C to +85°C, V_{CC} = +1.8V to +5.5V Extended (E): T_A = -40°C to +125°C, V_{CC} = +2.5V to +5.5V				
Param. No.	**Symbol**	**Parameter**	**Minimum**	**Typical**	**Maximum**	**Units**	**Conditions**
D11	V_{POR}	V_{CC} Voltage Detect	—	1.5	—	V	93AA56A/B/C,93LC56A/B/C (**Note 1**)
			—	3.8	—	V	93C56A/B/C (**Note 1**)

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

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

3: Ready/$\overline{\text{Busy}}$ status must be cleared from DO; see **Section 3.4 "Data Out (DO)"**.

TABLE 1-2: AC CHARACTERISTICS

All parameters apply over the specified ranges unless otherwise noted.			Industrial (I): T_A = -40°C to +85°C, V_{CC} = +1.8V to +5.5V Extended (E): T_A = -40°C to +125°C, V_{CC} = +2.5V to +5.5V			
Param. No.	**Symbol**	**Parameter**	**Minimum**	**Maximum**	**Units**	**Conditions**
A1	F_{CLK}	Clock Frequency	—	3	MHz	4.5V ≤ V_{CC} < 5.5V, 93XX56C only
			—	2	MHz	2.5V ≤ V_{CC} < 5.5V
			—	1	MHz	1.8V ≤ V_{CC} < 2.5V
A2	T_{CKH}	Clock High Time	200	—	ns	4.5V ≤ V_{CC} < 5.5V, 93XX56C only
			250	—	ns	2.5V ≤ V_{CC} < 5.5V
			450	—	ns	1.8V ≤ V_{CC} < 2.5V
A3	T_{CKL}	Clock Low Time	100	—	ns	4.5V ≤ V_{CC} < 5.5V, 93XX56C only
			200	—	ns	2.5V ≤ V_{CC} < 5.5V
			450	—	ns	1.8V ≤ V_{CC} < 2.5V
A4	T_{CSS}	Chip Select Setup Time	50	—	ns	4.5V ≤ V_{CC} < 5.5V
			100	—	ns	2.5V ≤ V_{CC} < 4.5V
			250	—	ns	1.8V ≤ V_{CC} < 2.5V
A5	T_{CSH}	Chip Select Hold Time	0	—	ns	1.8V ≤ V_{CC} < 5.5V
A6	T_{CSL}	Chip Select Low Time	250	—	ns	1.8V ≤ V_{CC} < 5.5V
A7	T_{DIS}	Data Input Setup Time	50	—	ns	4.5V ≤ V_{CC} < 5.5V, 93XX56C only
			100	—	ns	2.5V ≤ V_{CC} < 5.5V
			250	—	ns	1.8V ≤ V_{CC} < 2.5V
A8	T_{DIH}	Data Input Hold Time	50	—	ns	4.5V ≤ V_{CC} < 5.5V, 93XX56C only
			100	—	ns	2.5V ≤ V_{CC} < 5.5V
			250	—	ns	1.8V ≤ V_{CC} < 2.5V
A9	T_{PD}	Data Output Delay Time	—	200	ns	4.5V ≤ V_{CC} < 5.5V, CL = 100 pF
			—	250	ns	2.5V ≤ V_{CC} < 4.5V, CL = 100 pF
			—	400	ns	1.8V ≤ V_{CC} < 2.5V, CL = 100 pF
A10	T_{CZ}	Data Output Disable Time	—	100	ns	4.5V ≤ V_{CC} < 5.5V, (**Note 1**)
			—	200	ns	1.8V ≤ V_{CC} < 4.5V, (**Note 1**)
A11	T_{SV}	Status Valid Time	—	200	ns	4.5V ≤ V_{CC} < 5.5V, CL = 100 pF
			—	300	ns	2.5V ≤ V_{CC} < 4.5V, CL = 100 pF
			—	500	ns	1.8V ≤ V_{CC} < 2.5V, CL = 100 pF

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

2: This parameter is not tested but ensured by characterization.

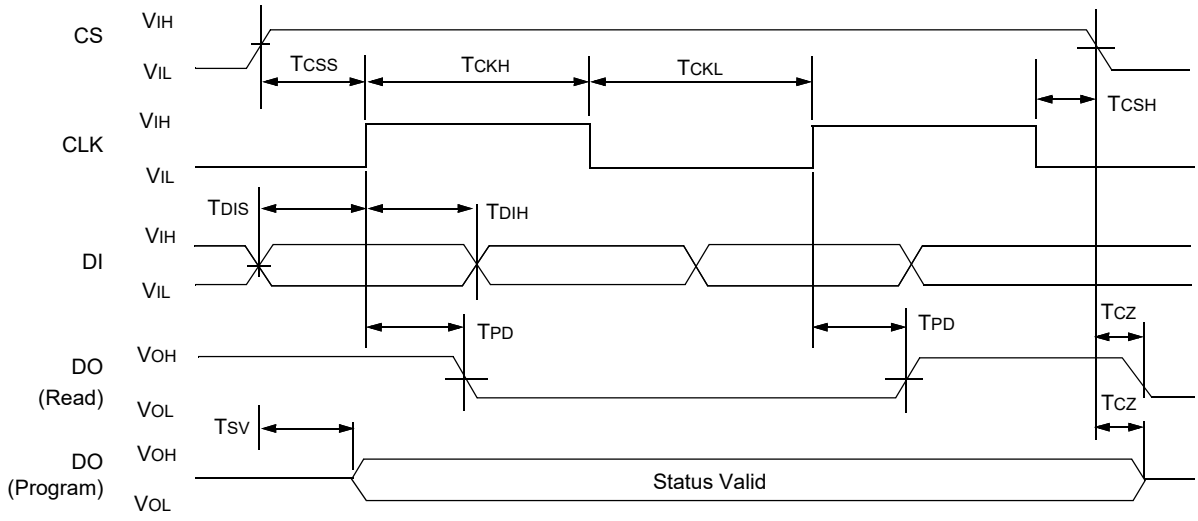
TABLE 1-2: AC CHARACTERISTICS (CONTINUED)

All parameters apply over the specified ranges unless otherwise noted.			Industrial (I): TA = -40°C to +85°C, VCC = +1.8V TO +5.5V Extended (E): TA = -40°C to +125°C, VCC = +2.5V TO +5.5V			
Param. No.	**Symbol**	**Parameter**	**Minimum**	**Maximum**	**Units**	**Conditions**
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 parameter is not tested but ensured by characterization.

FIGURE 1-1: SYNCHRONOUS DATA TIMING



Note 1: TSV is relative to CS.

TABLE 1-3: INSTRUCTION SET FOR X16 ORGANIZATION (93XX56B OR 93XX56C WITH ORG=1)

Instruction	SB	Opcode	Address								Data In	Data Out	Req. CLK Cycles
ERASE	1	11	X	A6	A5	A4	A3	A2	A1	A0	—	(RDY/$\overline{BSY}$)	11
ERAL	1	00	1	0	X	X	X	X	X	X	—	(RDY/$\overline{BSY}$)	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	X	A6	A5	A4	A3	A2	A1	A0	—	D15-D0	27
WRITE	1	01	X	A6	A5	A4	A3	A2	A1	A0	D15-D0	(RDY/$\overline{BSY}$)	27
WRAL	1	00	0	1	X	X	X	X	X	X	D15-D0	(RDY/$\overline{BSY}$)	27

TABLE 1-4: INSTRUCTION SET FOR X8 ORGANIZATION (93XX56A OR 93XX56C WITH ORG =0)

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

2.0 FUNCTIONAL DESCRIPTION

When the ORG pin (93XX56C) 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. To limit this current, a resistor should be connected between DI and DO.

2.3 Data Protection

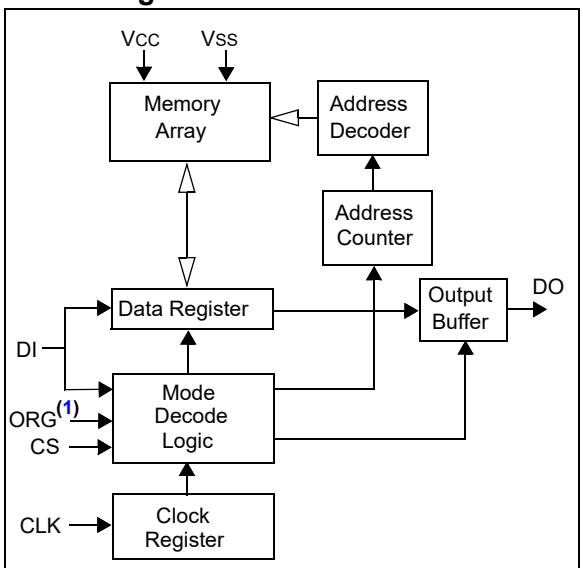
All modes of operation are inhibited when VCC is below a typical voltage of 1.5V for ‘93AA’ and ‘93LC’ devices or 3.8V for ‘93C’ devices.

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 and an external 10 kΩ pull-down protection resistor should be added to the CS pin.

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



Note 1: ORG input is not available on A/B devices.

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 (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:	After the Erase cycle is complete, 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

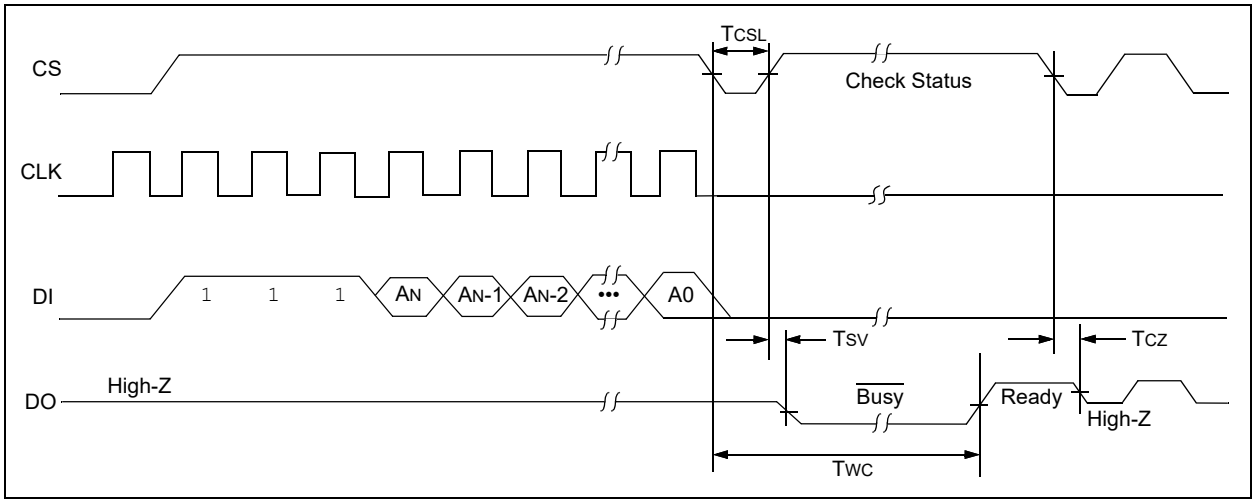
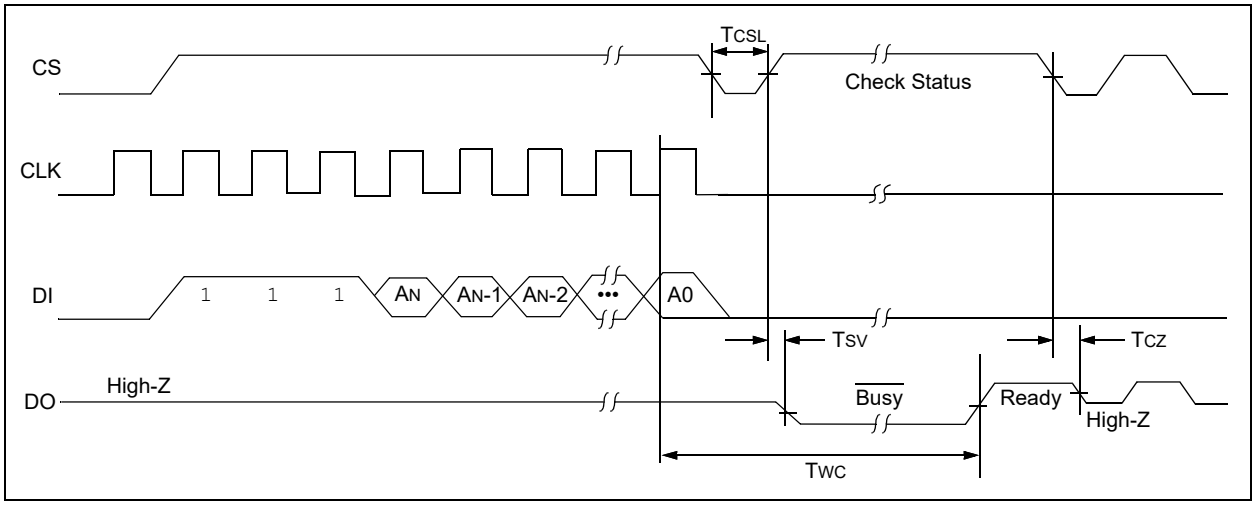


FIGURE 2-2: ERASE TIMING FOR 93C DEVICES



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

Note:	After the ERAL command is complete, issuing a Start bit and then taking CS low will clear the Ready/$\overline{\text{Busy}}$ status from DO.

V_{CC} must be ≥4.5V for proper operation of ERAL.

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

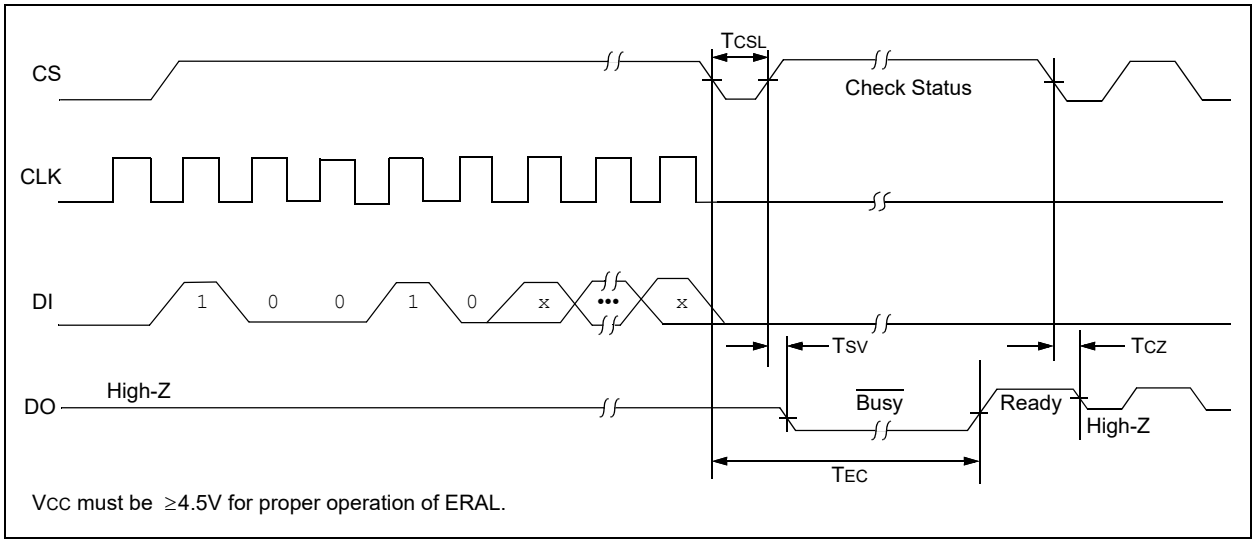
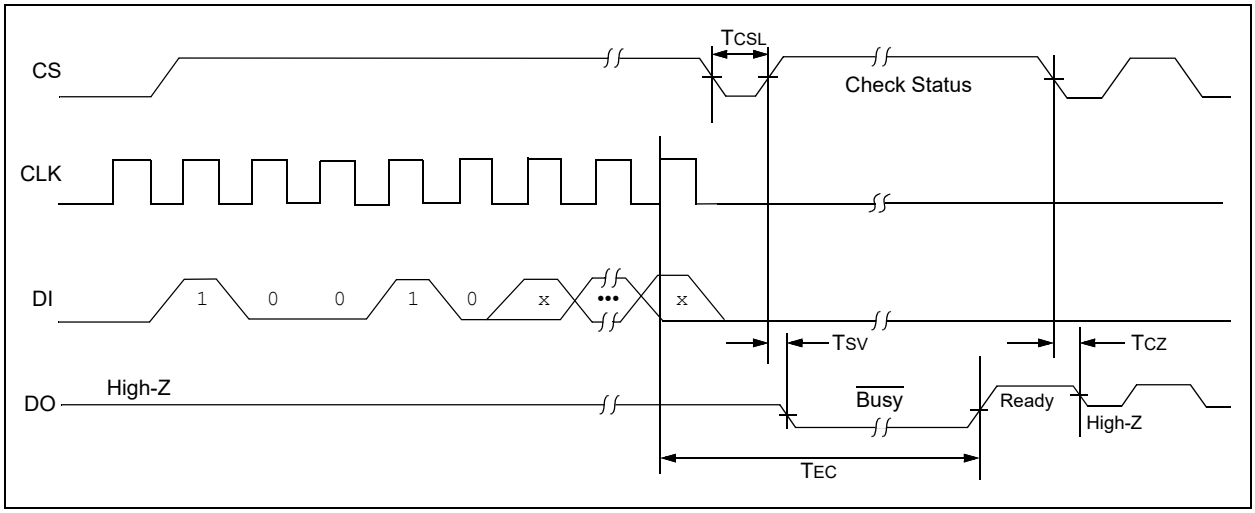


FIGURE 2-4: ERAL TIMING FOR 93C DEVICES



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

The 93XX56A/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

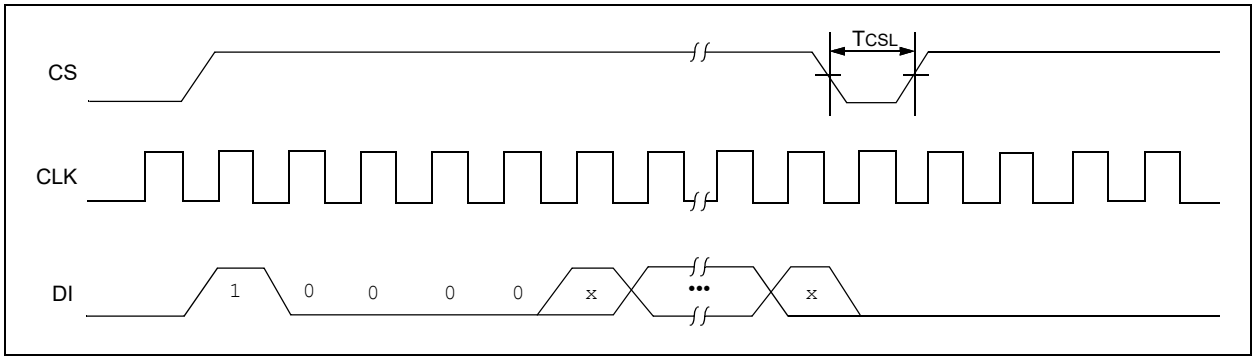
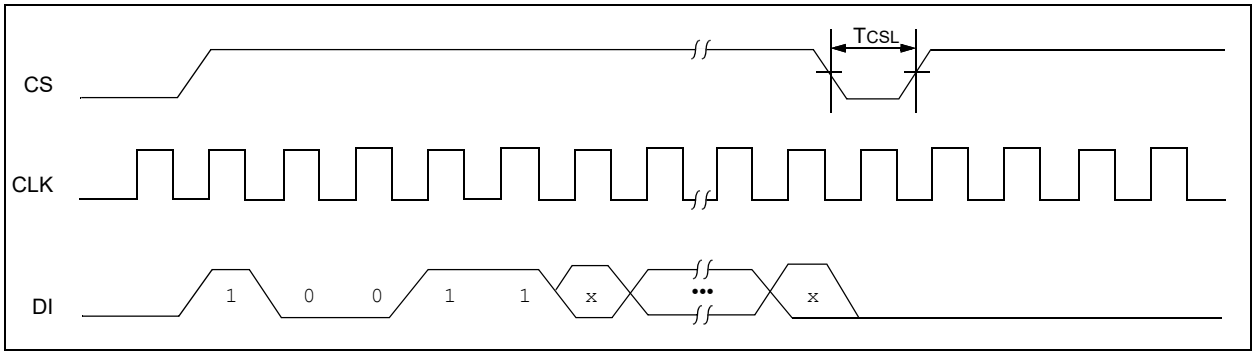


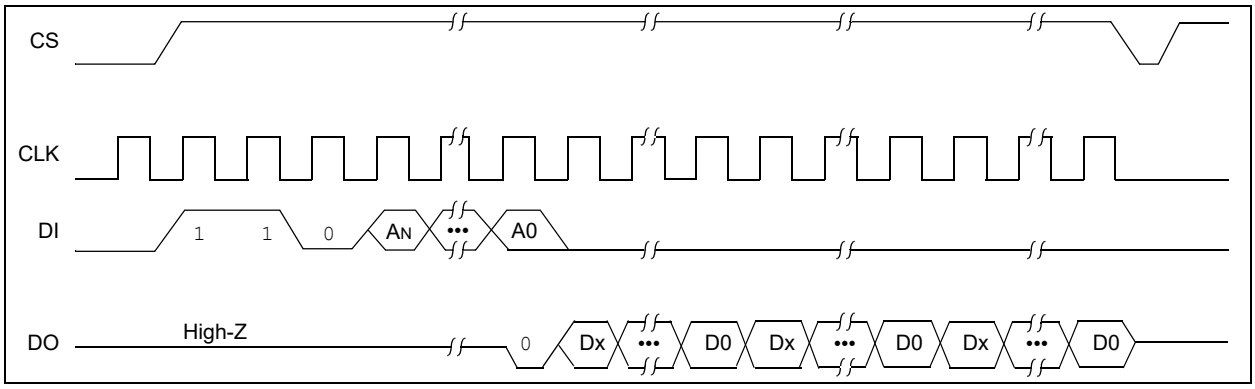
FIGURE 2-6: EWEN TIMING



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



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 93AA56A/B/C and 93LC56A/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 93C56A/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_{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:	After the Write cycle is complete, 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

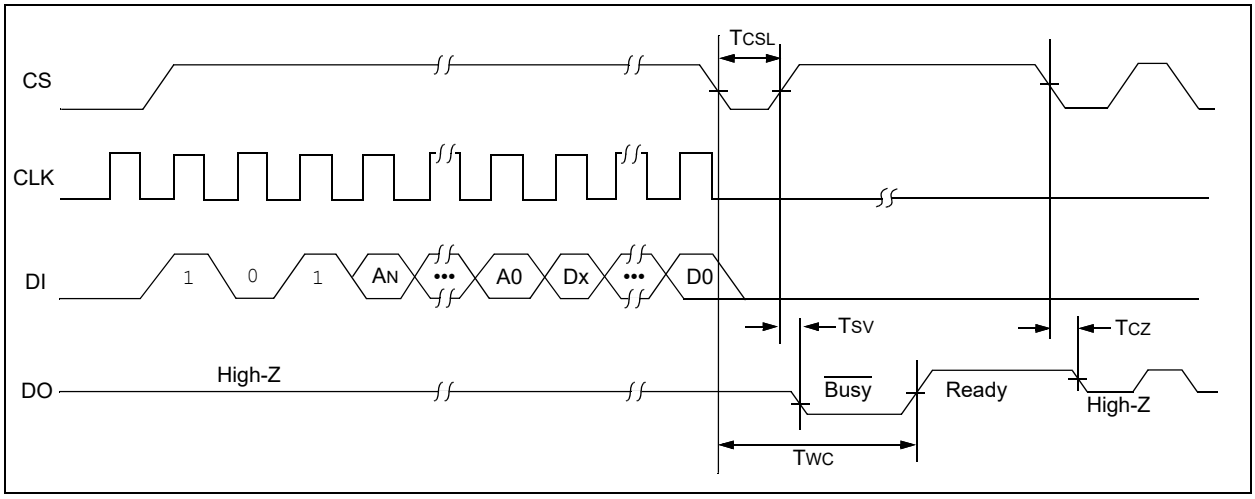
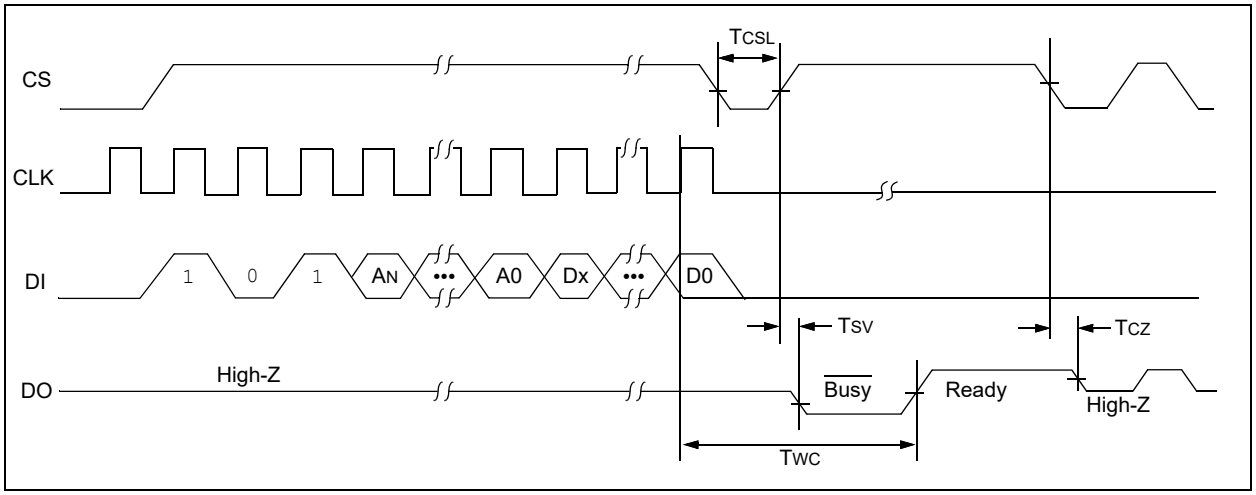


FIGURE 2-9: WRITE TIMING FOR 93C DEVICES



2.9 Write All (WRAL)

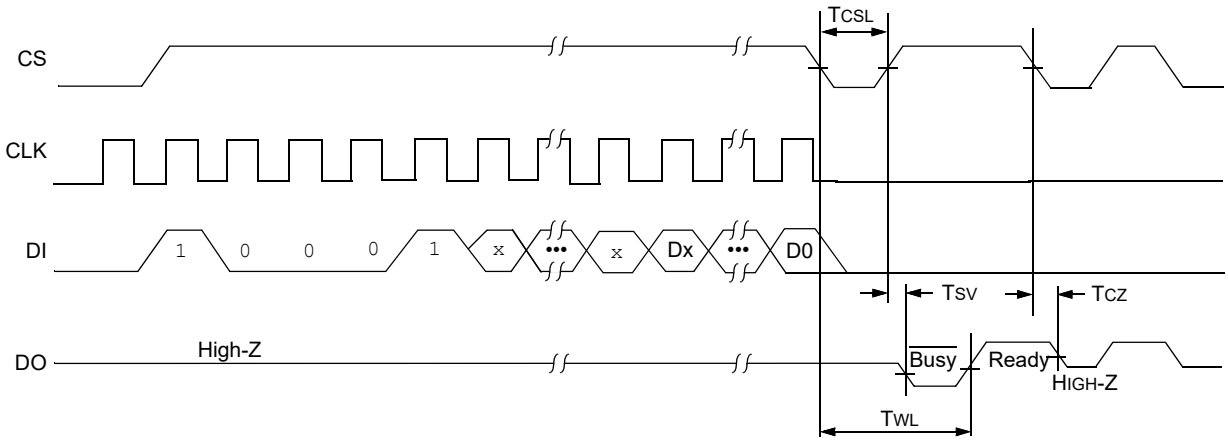
The Write All (WRAL) instruction will write the entire memory array with the data specified in the command. For 93AA56A/B/C and 93LC56A/B/C devices, after the last data bit is clocked into DI, the falling edge of CS initiates the self-timed auto-erase and programming cycle. For 93C56A/B/C devices, the 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/$\overline{\text{Busy}}$ status of the device if CS is brought high after a minimum of 250 ns low (T_{CSL}).

Note:	After the Write All cycle is complete, issuing a Start bit and then taking CS low will clear the Ready/$\overline{\text{Busy}}$ status from DO.

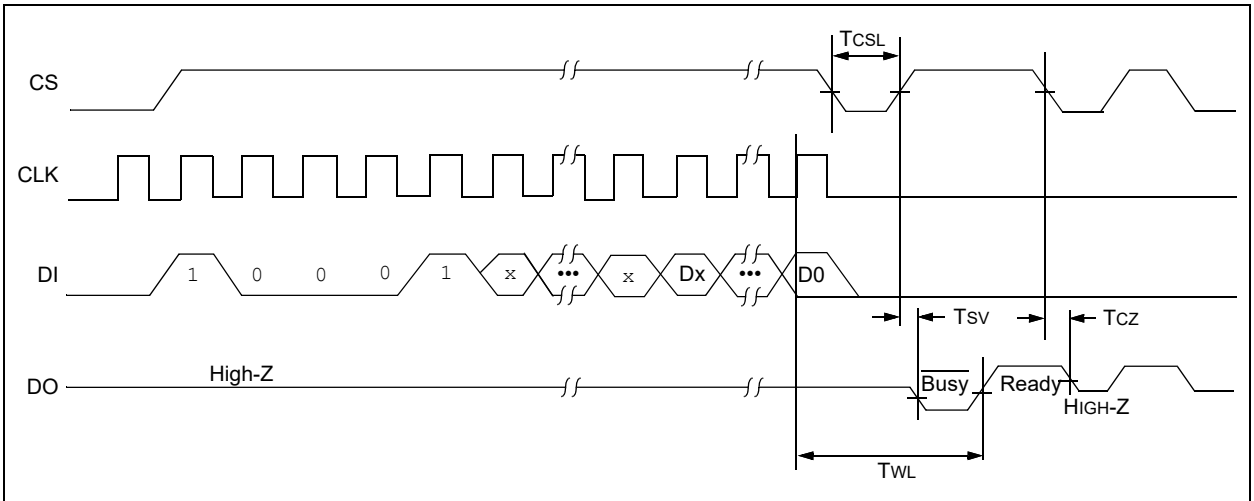
V_{CC} must be ≥4.5V for proper operation of WRAL.

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



Note 1: V_{CC} must be ≥4.5V for proper operation of WRAL.

FIGURE 2-11: WRAL TIMING FOR 93C DEVICES



3.0 PIN DESCRIPTIONS

TABLE 3-1: PIN DESCRIPTIONS

Name	DFN(1)	MSOP	PDIP	SOIC	Rotated SOIC	SOT-23	TDFN(1)	TSSOP	Function
CS	1	1	1	1	3	5	1	1	Chip Select
CLK	2	2	2	2	4	4	2	2	Serial Clock
DI	3	3	3	3	5	3	3	3	Data In
DO	4	4	4	4	6	1	4	4	Data Out
VSS	5	5	5	5	7	2	5	5	Ground
ORG/NC	6	6	6	6	8	—	6	6	Organization/93XX56C No Internal Connection/93XX56A/B
NC	7	7	7	7	1	—	7	7	No Internal Connection
VCC	8	8	8	8	2	6	8	8	Power Supply

Note 1: The exposed pad on the DFN/TDFN packages may be connected to VSS or left floating.

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 that 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 host 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 host 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/$\overline{\text{Busy}}$ 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 (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:	After a programming cycle is complete, 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.

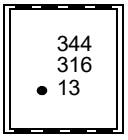
93XX56A devices are always (x8) organization and 93XX56B devices are always (x16) organization.

4.0 PACKAGING INFORMATION

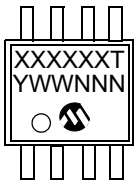
4.1 Package Marking Information

8-Lead 2x3 DFN

Example

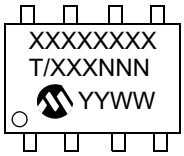


8-Lead MSOP (150 mil)

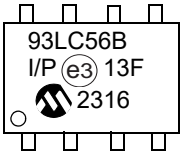


Example

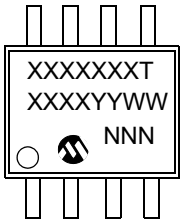
8-Lead PDIP



Example

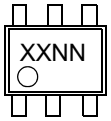


8-Lead SOIC

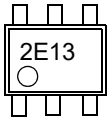


Example

6-Lead SOT-23

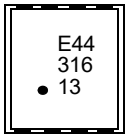


Example



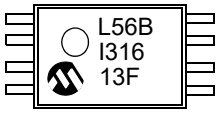
8-Lead 2x3 TDFN

Example



8-Lead TSSOP

Example



Part Number	1st Line Marking Codes									
	TSSOP	MSOP	SOIC	Rotated SOIC	SOT-23		DFN		TDFN	
					I Temp.	E Temp.	I Temp.	E Temp.	I Temp.	E Temp.
93AA56A	A56A	3A56AT	93AA56AT	93A56AXT	2BNN	—	331	—	E31	—
93AA56B	A56B	3A56BT	93AA56BT	93A56BXT	2LNN	—	341	—	E41	—
93AA56C	A56C	3A56CT	93AA56CT	93A56CXT	—	—	351	—	E51	—
93LC56A	L56A	3L56AT	93LC56AT	93L56AXT	2ENN	2FNN	334	—	E34	E35
93LC56B	L56B	3L56BT	93LC56BT	93L56BXT	2PNN	2RNN	344	—	E44	E45
93LC56C	L56C	3L56CT	93LC56CT	93L56CXT	—	—	354	355	E54	E55
93C56A	C56A	3C56AT	93C56AT	—	2HNN	2JNN	337	—	E37	E38
93C56B	C56B	3C56BT	93C56BT	—	2TNN	2UNN	347	—	E47	E48
93C56C	C56C	3C56CT	93C56CT	—	—	—	357	—	E57	E58

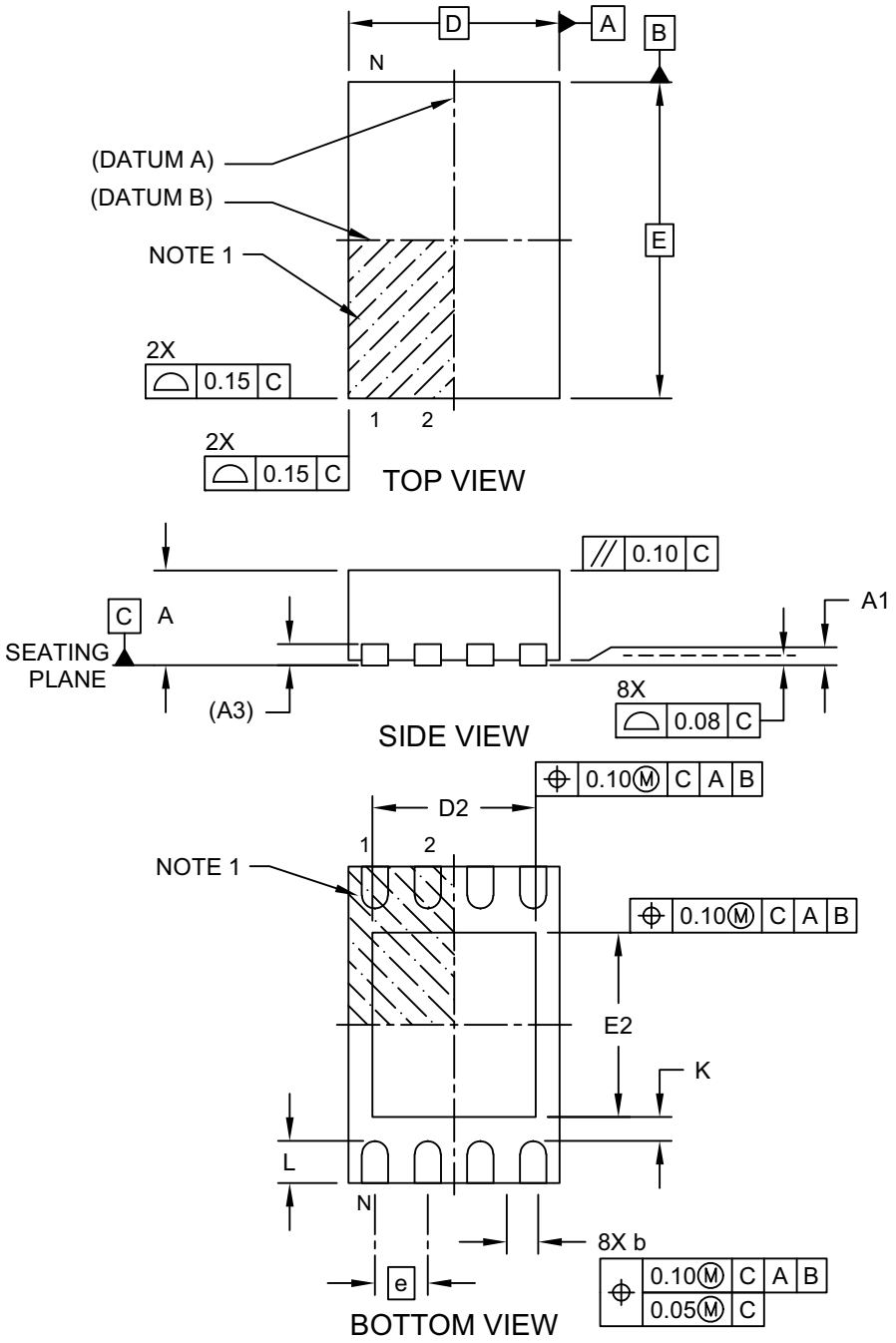
Legend:	XX...X	Part number or part number code
	T	Temperature (I, E)
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week ‘01’)
	NNN	Alphanumeric traceability code (2 characters for small packages)
	(e3)	RoHS Compliant JEDEC® designator for Matte Tin (Sn)

Note: For very small packages with no room for the RoHS Compliant 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.

8-Lead Plastic Dual Flat, No Lead Package (MC) - 2x3x1 mm Body [DFN]

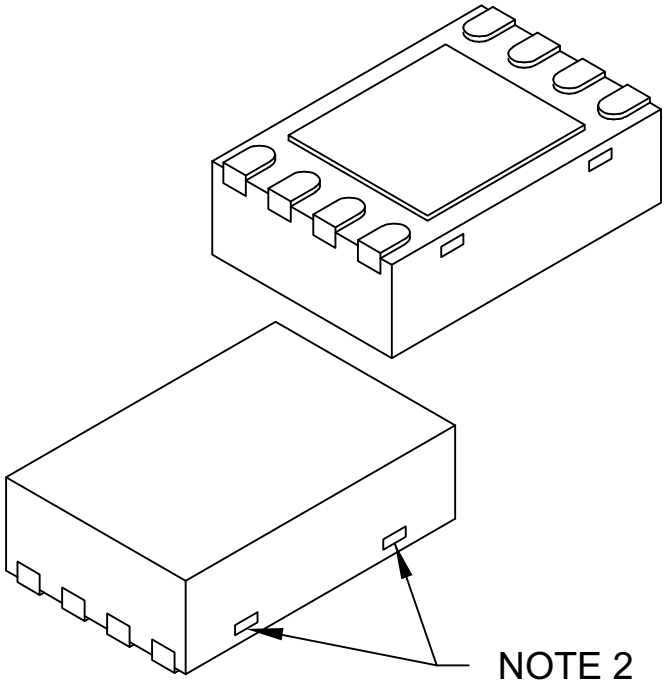
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Microchip Technology Drawing C04-123 Rev E Sheet 1 of 2

8-Lead Plastic Dual Flat, No Lead Package (MC) - 2x3x1 mm Body [DFN]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N		8	
Pitch	e		0.50 BSC	
Overall Height	A	0.80	0.90	1.00
Standoff	A1	0.00	0.02	0.05
Terminal Thickness	A3		0.20 REF	
Overall Length	D		2.00 BSC	
Exposed Pad Length	D2	1.30	-	1.55
Overall Width	E		3.00 BSC	
Exposed Pad Width	E2	1.50	-	1.75
Terminal Width	b	0.20	0.25	0.30
Terminal Length	L	0.30	0.40	0.50
Terminal-to-Exposed-Pad	K	0.20	-	-

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Package may have one or more exposed tie bars at ends.
3. Package is saw singulated
4. Dimensioning and tolerancing per ASME Y14.5M

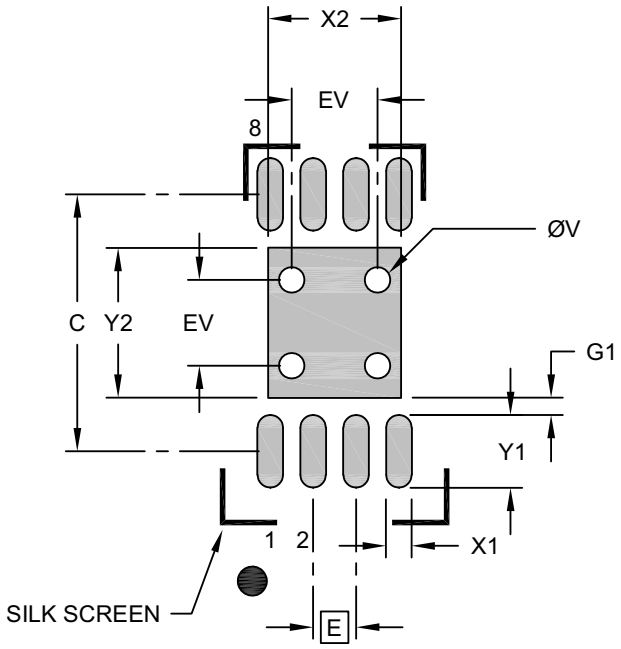
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

   REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-123 Rev E Sheet 2 of 2

8-Lead Plastic Dual Flat, No Lead Package (MC) - 2x3x1 mm Body [DFN]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	0.50 BSC		
Optional Center Pad Width	X2			1.55
Optional Center Pad Length	Y2			1.75
Contact Pad Spacing	C		3.00	
Contact Pad Width (X8)	X1			0.30
Contact Pad Length (X8)	Y1			0.85
Contact Pad to Center Pad (X8)	G1	0.20		
Thermal Via Diameter	V		0.30	
Thermal Via Pitch	EV		1.00	

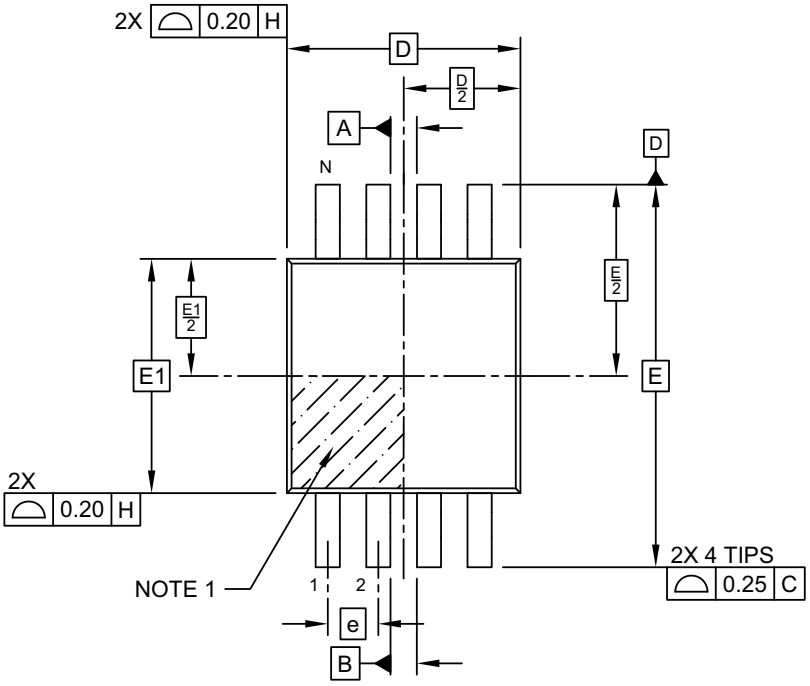
Notes:

1. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
2. For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

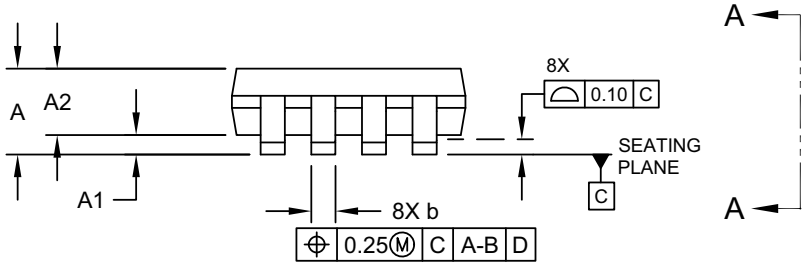
Microchip Technology Drawing C04-2123 Rev E

8-Lead Plastic Micro Small Outline Package (MS) - 3x3 mm Body [MSOP]

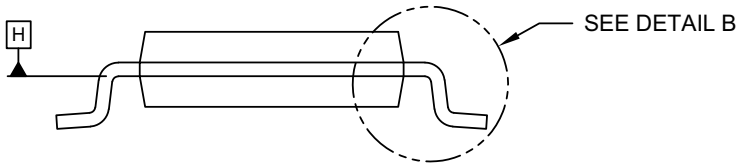
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



TOP VIEW



SIDE VIEW

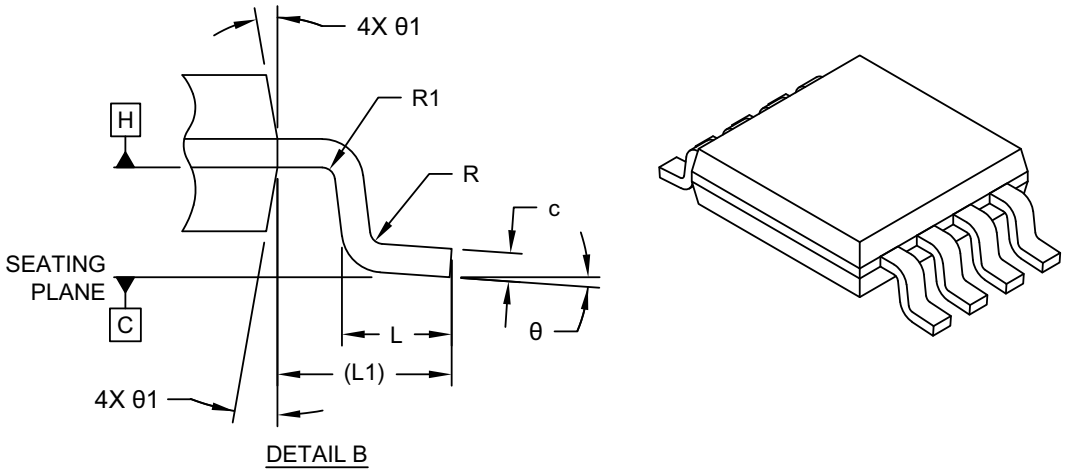


VIEW A–A

Microchip Technology Drawing C04-111-MS Rev F Sheet 1 of 2

8-Lead Plastic Micro Small Outline Package (MS) - 3x3 mm Body [MSOP]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N		8	
Pitch	e		0.65 BSC	
Overall Height	A	–	–	1.10
Standoff	A1	0.00	–	0.15
Molded Package Thickness	A2	0.75	0.85	0.95
Overall Length	D		3.00 BSC	
Overall Width	E		4.90 BSC	
Molded Package Width	E1		3.00 BSC	
Terminal Width	b	0.22	–	0.40
Terminal Thickness	c	0.08	–	0.23
Terminal Length	L	0.40	0.60	0.80
Footprint	L1		0.95 REF	
Lead Bend Radius	R	0.07	–	–
Lead Bend Radius	R1	0.07	–	–
Foot Angle	θ	0°	–	8°
Mold Draft Angle	θ1	5°	–	15°

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
3. Dimensioning and tolerancing per ASME Y14.5M

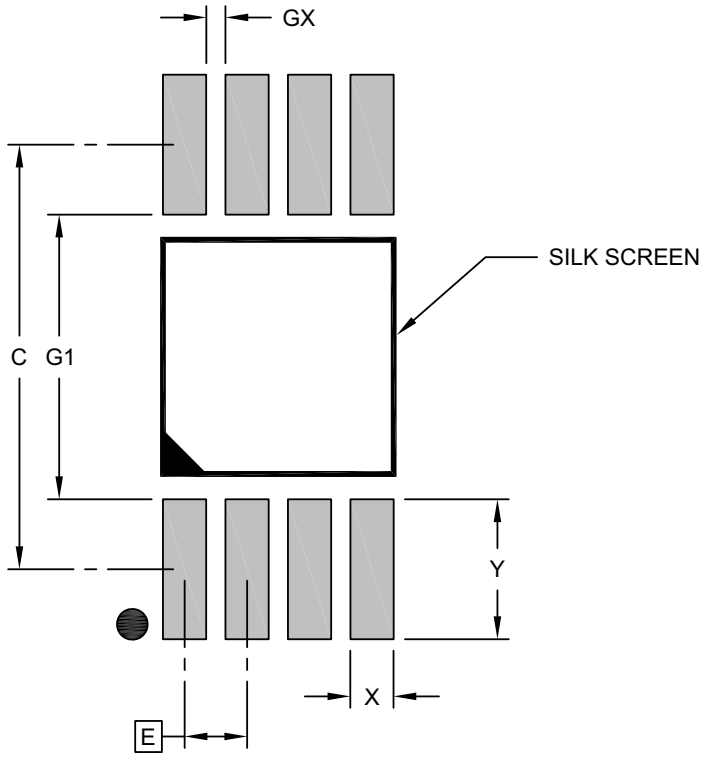
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

   REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-111-MS Rev F Sheet 2 of 2

8-Lead Plastic Micro Small Outline Package (MS) - 3x3 mm Body [MSOP]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	0.65 BSC		
Contact Pad Spacing	C		4.40	
Contact Pad Width (X8)	X			0.45
Contact Pad Length (X8)	Y			1.45
Contact Pad to Contact Pad (X4)	G1	2.95		
Contact Pad to Contact Pad (X6)	GX	0.20		

Notes:

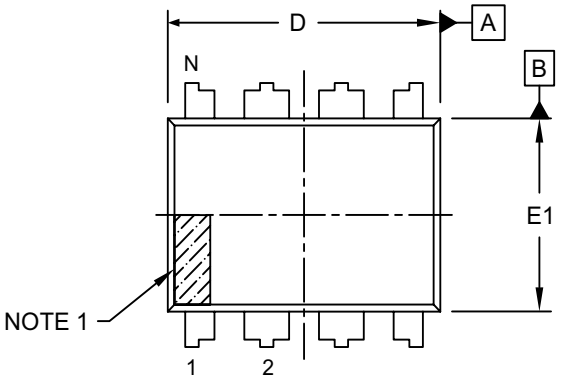
1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

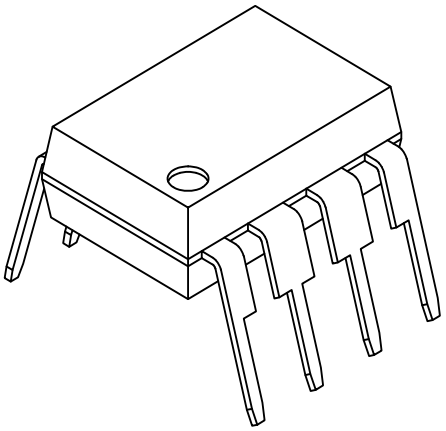
Microchip Technology Drawing C04-2111-MS Rev F

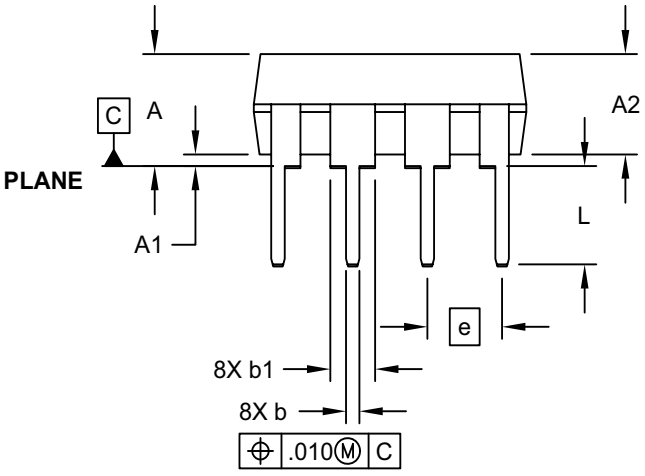
8-Lead Plastic Dual In-Line (P) - 300 mil Body [PDIP]

Note:	For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging

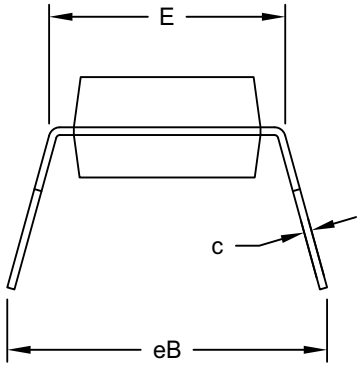


TOP VIEW





SIDE VIEW

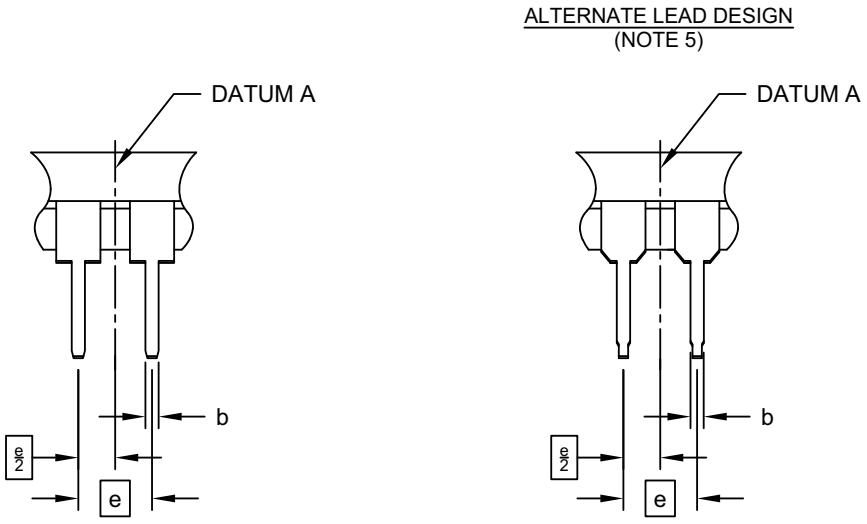


END VIEW

Microchip Technology Drawing No. C04-018-P Rev F Sheet 1 of 2

8-Lead Plastic Dual In-Line (P) - 300 mil Body [PDIP]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		INCHES		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		.100 BSC	
Top to Seating Plane	A	-	-	.210
Molded Package Thickness	A2	.115	.130	.195
Base to Seating Plane	A1	.015	-	-
Shoulder to Shoulder Width	E	.290	.310	.325
Molded Package Width	E1	.240	.250	.280
Overall Length	D	.348	.365	.400
Tip to Seating Plane	L	.115	.130	.150
Lead Thickness	c	.008	.010	.015
Upper Lead Width	b1	.040	.060	.070
Lower Lead Width	b	.014	.018	.022
Overall Row Spacing §	eB	-	-	.430

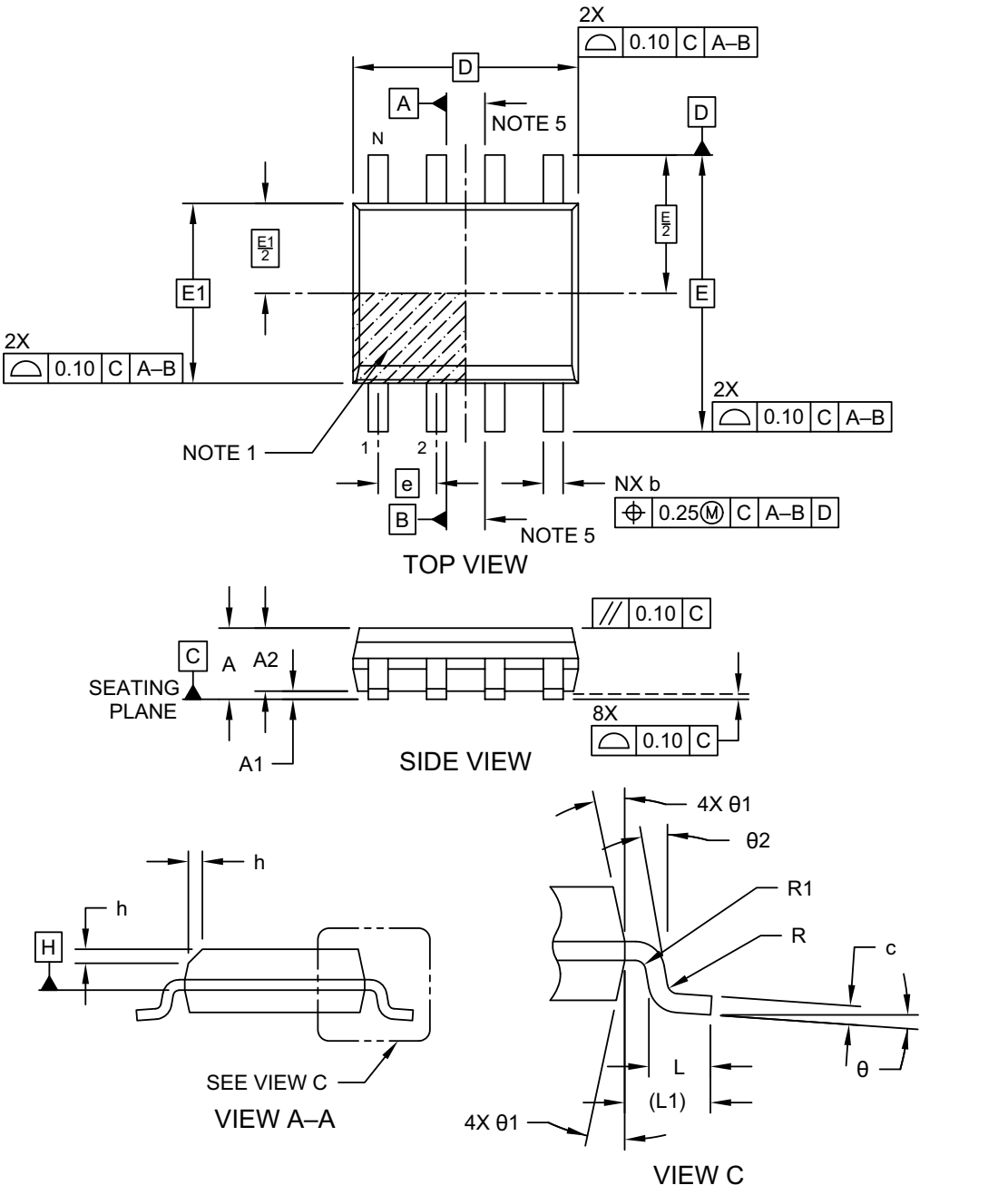
Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. § Significant Characteristic
3. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" per side.
4. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
5. Lead design above seating plane may vary, based on assembly vendor.

Microchip Technology Drawing No. C04-018-P Rev F Sheet 2 of 2

8-Lead Plastic Small Outline (SN) - Narrow, 3.90 mm (.150 In.) Body [SOIC]

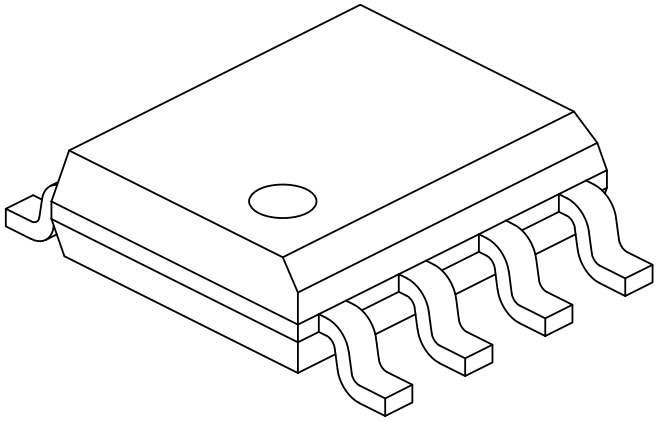
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Microchip Technology Drawing No. C04-057-SN Rev K Sheet 1 of 2

8-Lead Plastic Small Outline (SN) - Narrow, 3.90 mm (.150 In.) Body [SOIC]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		1.27 BSC	
Overall Height	A	–	–	1.75
Molded Package Thickness	A2	1.25	–	-
Standoff §	A1	0.10	–	0.25
Overall Width	E		6.00 BSC	
Molded Package Width	E1		3.90 BSC	
Overall Length	D		4.90 BSC	
Chamfer (Optional)	h	0.25	–	0.50
Foot Length	L	0.40	–	1.27
Footprint	L1		1.04 REF	
Lead Thickness	c	0.17	–	0.25
Lead Width	b	0.31	–	0.51
Lead Bend Radius	R	0.07	–	–
Lead Bend Radius	R1	0.07	–	–
Foot Angle	θ	0°	–	8°
Mold Draft Angle	θ1	5°	–	15°
Lead Angle	θ2	0°	–	–

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. § Significant Characteristic
3. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
4. Dimensioning and tolerancing per ASME Y14.5M

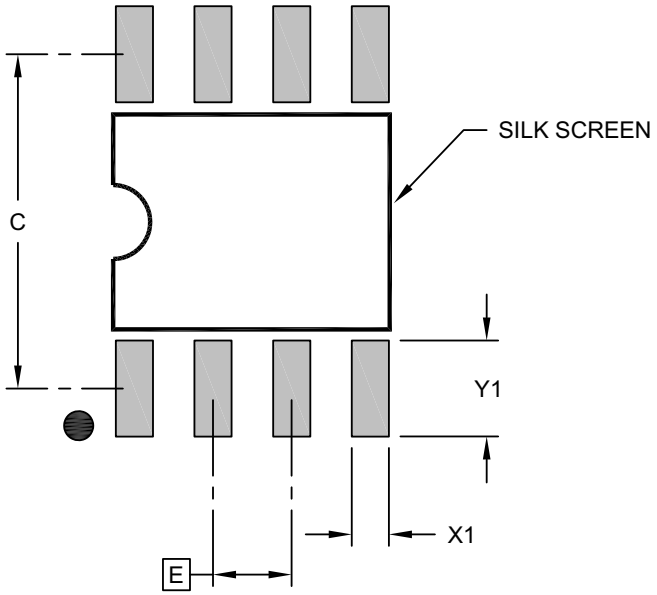
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

   REF: Reference Dimension, usually without tolerance, for information purposes only.
5. Datums A & B to be determined at Datum H.

Microchip Technology Drawing No. C04-057-SN Rev K Sheet 2 of 2

8-Lead Plastic Small Outline (SN) - Narrow, 3.90 mm (.150 In.) Body [SOIC]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E		1.27 BSC	
Contact Pad Spacing	C		5.40	
Contact Pad Width (X8)	X1			0.60
Contact Pad Length (X8)	Y1			1.55

Notes:

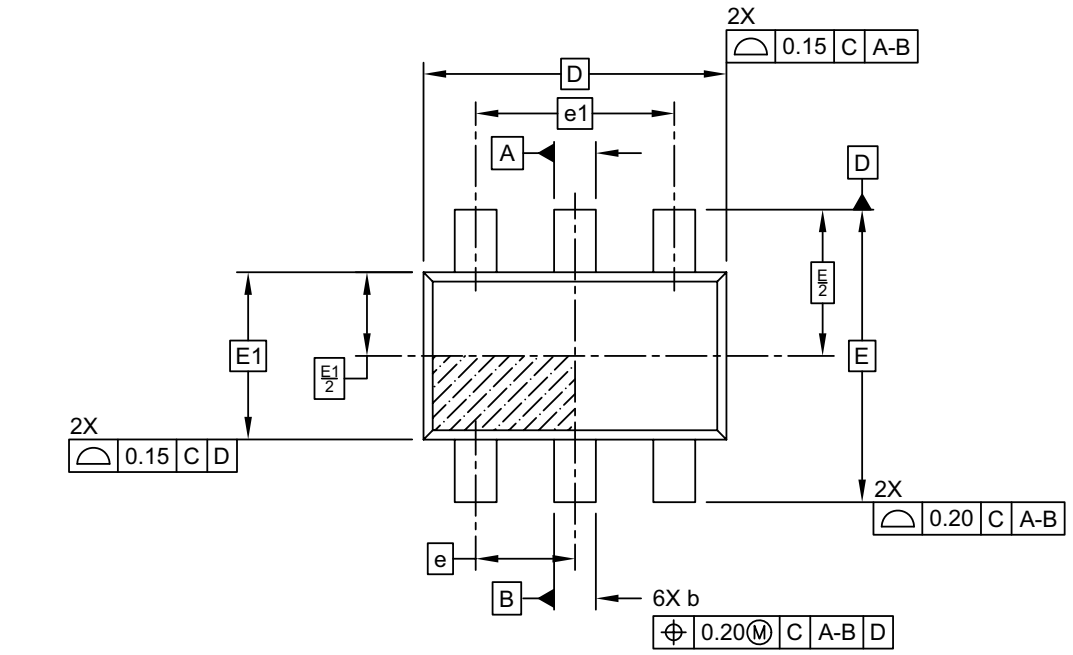
1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

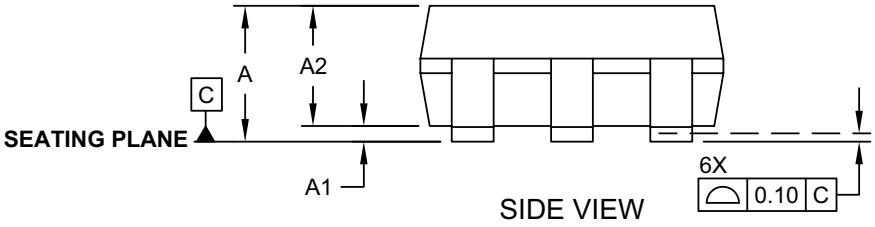
Microchip Technology Drawing C04-2057-SN Rev K

6-Lead Plastic Small Outline Transistor (OT, OTY) [SOT-23]

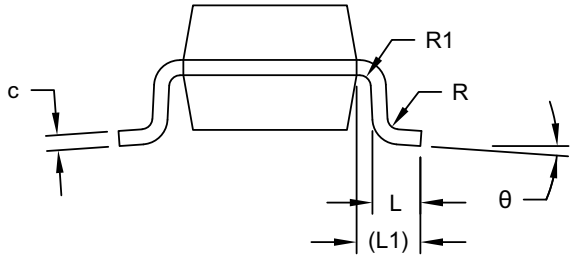
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



TOP VIEW



SIDE VIEW

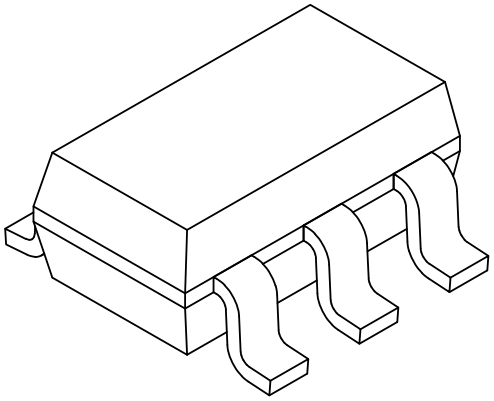


END VIEW

Microchip Technology Drawing C04-028-OT Rev E Sheet 1 of 2

6-Lead Plastic Small Outline Transistor (OT, OTY) [SOT-23]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Leads	N		6	
Pitch	e		0.95 BSC	
Outside lead pitch	e1		1.90 BSC	
Overall Height	A	0.90	-	1.45
Molded Package Thickness	A2	0.89	1.15	1.30
Standoff	A1	0.00	-	0.15
Overall Width	E		2.80 BSC	
Molded Package Width	E1		1.60 BSC	
Overall Length	D		2.90 BSC	
Foot Length	L	0.30	0.45	0.60
Footprint	L1		0.60 REF	
Foot Angle	θ	0°	-	10°
Lead Thickness	c	0.08	-	0.26
Lead Width	b	0.20	-	0.51

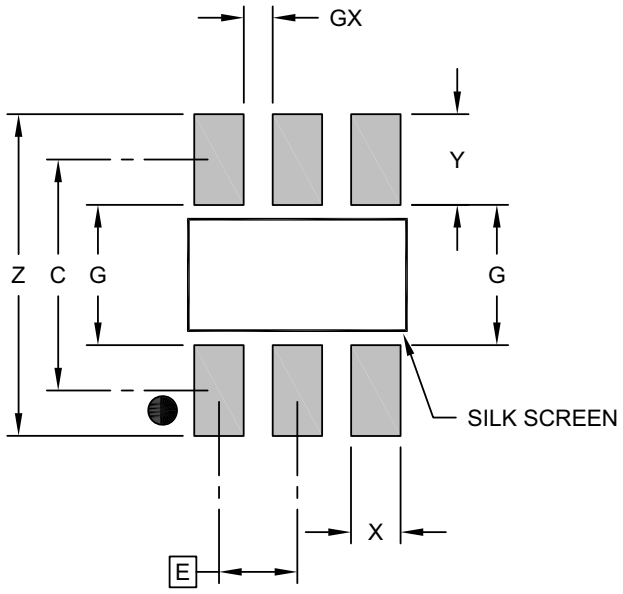
Notes:

1. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.25mm per side.
2. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
   REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-028-OT Rev E Sheet 2 of 2

6-Lead Plastic Small Outline Transistor (OT, OTY) [SOT-23]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E		0.95 BSC	
Contact Pad Spacing	C		2.80	
Contact Pad Width (X3)	X			0.60
Contact Pad Length (X3)	Y			1.10
Distance Between Pads	G	1.70		
Distance Between Pads	GX	0.35		
Overall Width	Z			3.90

Notes:

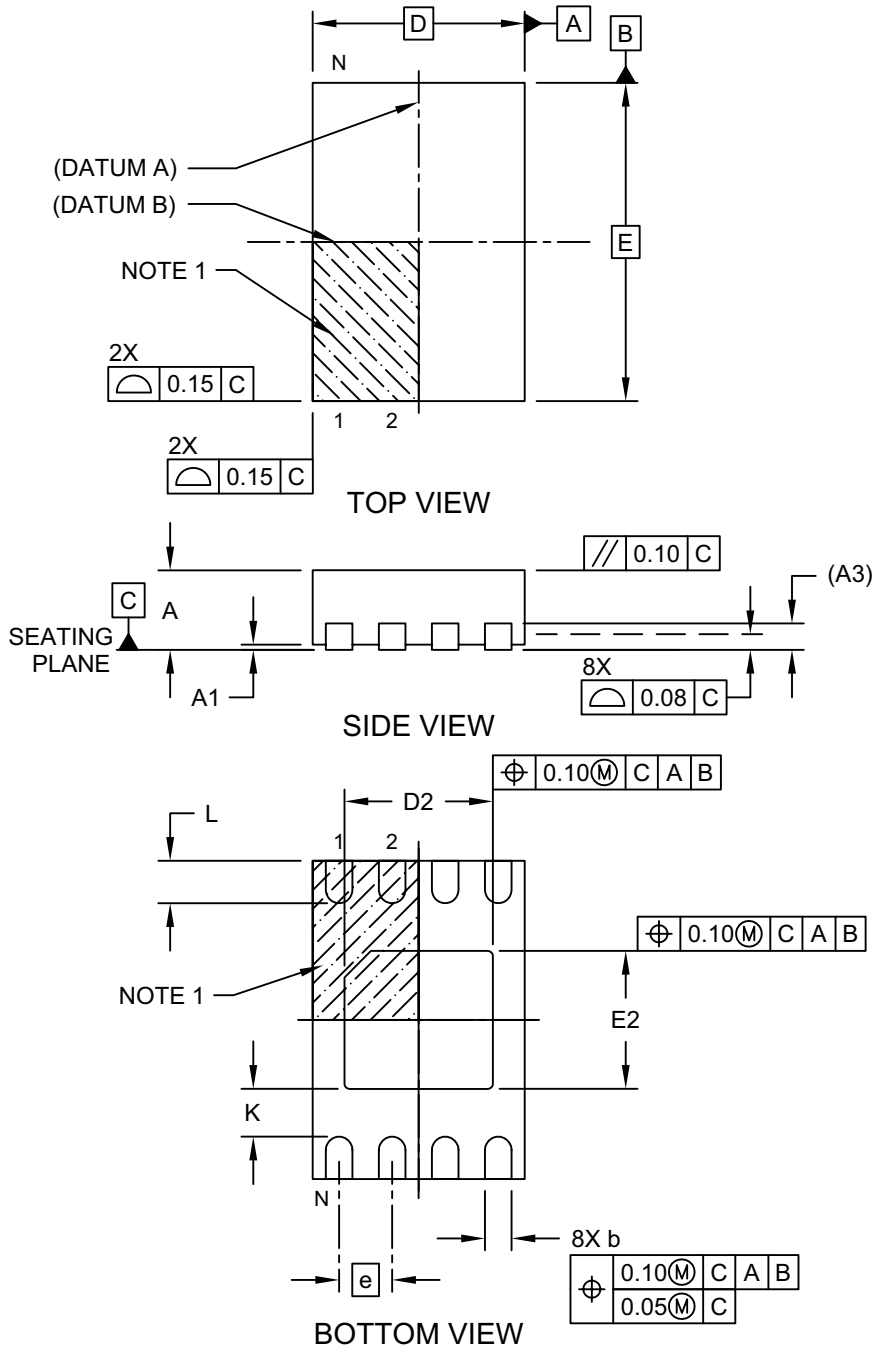
1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-2028-OT Rev E

8-Lead Plastic Dual Flat, No Lead Package (MN) – 2x3x0.8 mm Body [TDFN]
With 1.4x1.3 mm Exposed Pad (JEDEC Package type WDFN)

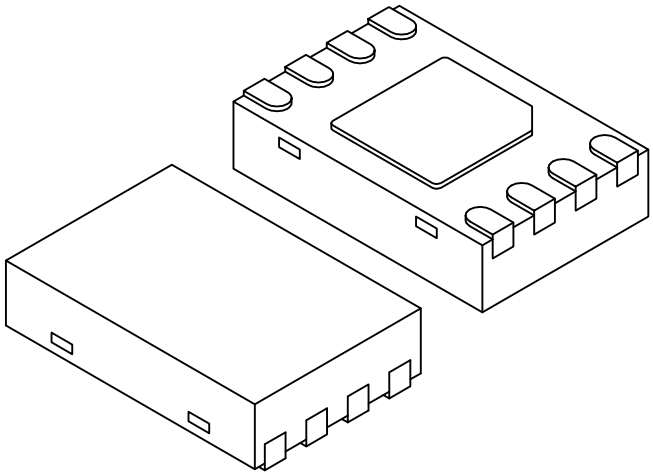
Note:	For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Microchip Technology Drawing No. C04-129-MN Rev E Sheet 1 of 2

8-Lead Plastic Dual Flat, No Lead Package (MN) – 2x3x0.8 mm Body [TDFN] With 1.4x1.3 mm Exposed Pad (JEDEC Package type WDFN)

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		0.50 BSC	
Overall Height	A	0.70	0.75	0.80
Standoff	A1	0.00	0.02	0.05
Contact Thickness	A3		0.20 REF	
Overall Length	D		2.00 BSC	
Overall Width	E		3.00 BSC	
Exposed Pad Length	D2	1.35	1.40	1.45
Exposed Pad Width	E2	1.25	1.30	1.35
Contact Width	b	0.20	0.25	0.30
Contact Length	L	0.25	0.30	0.45
Contact-to-Exposed Pad	K	0.20	-	-

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Package may have one or more exposed tie bars at ends.
3. Package is saw singulated
4. Dimensioning and tolerancing per ASME Y14.5M

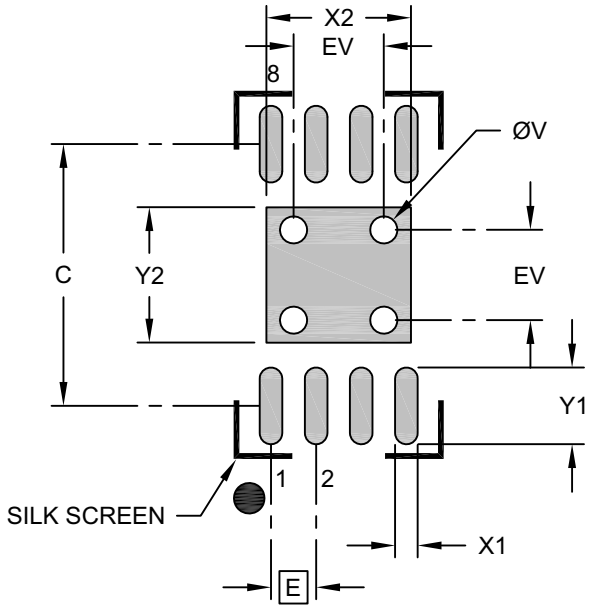
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing No. C04-129-MN Rev E Sheet 2 of 2

8-Lead Plastic Dual Flat, No Lead Package (MN) – 2x3x0.8 mm Body [TDFN] With 1.4x1.3 mm Exposed Pad (JEDEC Package type WDFN)

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E		0.50 BSC	
Optional Center Pad Width	X2			1.60
Optional Center Pad Length	Y2			1.50
Contact Pad Spacing	C		2.90	
Contact Pad Width (X8)	X1			0.25
Contact Pad Length (X8)	Y1			0.85
Thermal Via Diameter	V		0.30	
Thermal Via Pitch	EV		1.00	

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

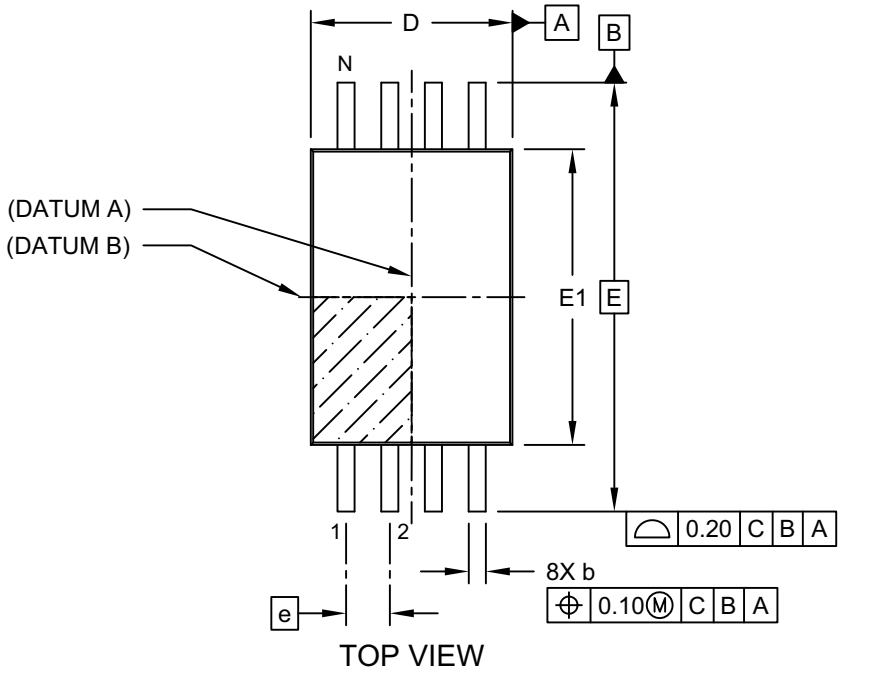
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

2. For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

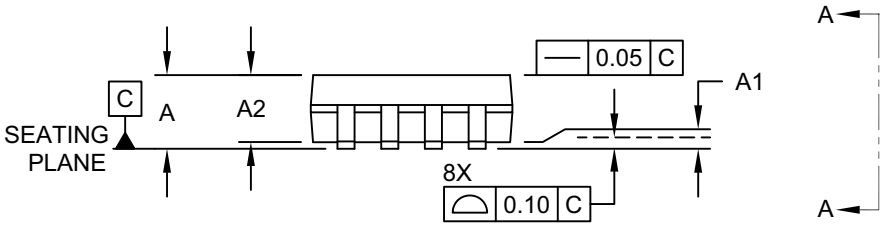
Microchip Technology Drawing No. C04-129-MN Rev. B

8-Lead Plastic Thin Shrink Small Outline (ST) - 4.4 mm Body [TSSOP]

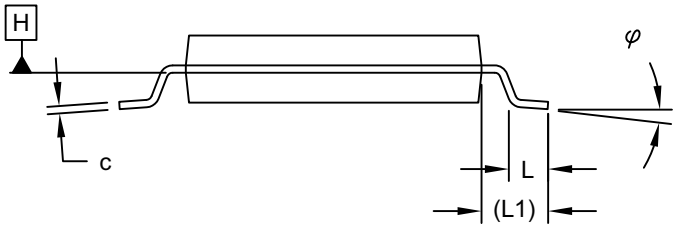
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



TOP VIEW



SIDE VIEW

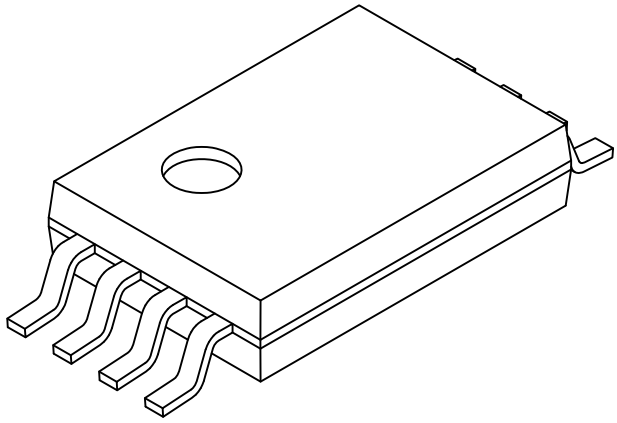


VIEW A-A

Microchip Technology Drawing C04-086 Rev C Sheet 1 of 2

8-Lead Plastic Thin Shrink Small Outline (ST) - 4.4 mm Body [TSSOP]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		0.65 BSC	
Overall Height	A	-	-	1.20
Molded Package Thickness	A2	0.80	1.00	1.05
Standoff	A1	0.05	-	-
Overall Width	E		6.40 BSC	
Molded Package Width	E1	4.30	4.40	4.50
Overall Length	D	2.90	3.00	3.10
Foot Length	L	0.45	0.60	0.75
Footprint	L1		1.00 REF	
Lead Thickness	c	0.09	-	0.25
Foot Angle	φ	0°	4°	8°
Lead Width	b	0.19	-	0.30

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.20mm per side.
3. Dimensioning and tolerancing per ASME Y14.5M

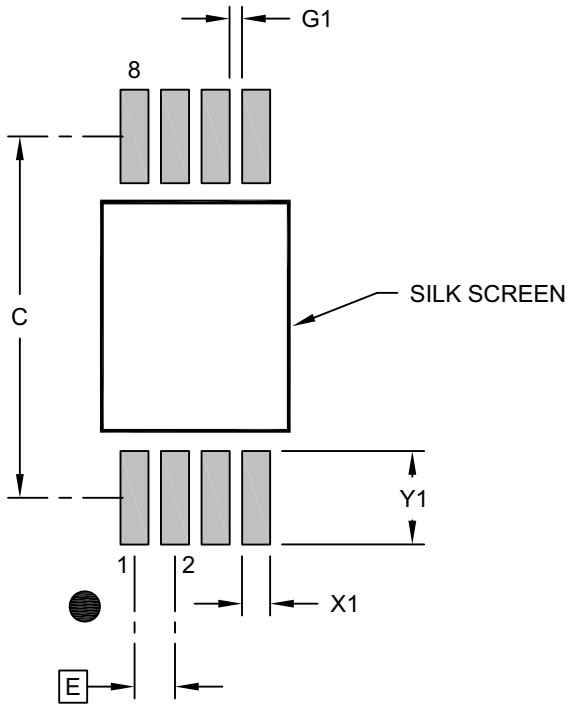
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

   REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-086 Rev C Sheet 2 of 2

8-Lead Plastic Thin Shrink Small Outline (ST) - 4.4 mm Body [TSSOP]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E		0.65 BSC	
Contact Pad Spacing	C		5.80	
Contact Pad Width (X8)	X1			0.45
Contact Pad Length (X8)	Y1			1.50
Contact Pad to Center Pad (X6)	G1	0.20		

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
2. For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

Microchip Technology Drawing C04-2086 Rev B

APPENDIX A: REVISION HISTORY

Revision J (05/2023)

Corrected "1st Line Marking Codes" table.

Revision H (06/2022)

Added Automotive Product ID; Changed Automotive (E) to Extended (E); Updated "master" terminology with "host"; Updated DFN, MSOP, PDIP, SOIC, SOT-23, TDFN and TSSOP package drawings.

Revision G (12/2011)

Added TDFN package.

Revision F (05/2008)

Revised Figures 2-1 through 2-4 and Figures 2-8 through 2-11; Revised Package Marking Information; Replaced Package Drawings; Revised Product ID section.

Revision E (03/2007)

Replaced Package Drawings; Revised Product ID System (SOIC-SN package).

Revision D (11/2006)

Updated Package Drawings and Product ID System

Revision C (04/2005)

Added DFN package.

Revision B (12/2003)

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

Revision A (05/2003)

Initial Release.

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- **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

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- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

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 website at: http://microchip.com/support

PRODUCT IDENTIFICATION SYSTEM (NON-AUTOMOTIVE)

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

PART NO.	X	X[1]	-X	/XX
Device	Pinout	Tape and Reel	Temperature Range	Package

Device:	93AA56A = 2-Kbit 1.8V Microwire Serial EEPROM 93AA56B = 2-Kbit 1.8V Microwire Serial EEPROM 93AA56C = 2-Kbit 1.8V Microwire Serial EEPROM w/ORG 93LC56A = 2-Kbit 2.5V Microwire Serial EEPROM 93LC56B = 2-Kbit 2.5V Microwire Serial EEPROM 93LC56C = 2-Kbit 2.5V Microwire Serial EEPROM w/ORG 93C56A = 2-Kbit 5.0V Microwire Serial EEPROM 93C56B = 2-Kbit 5.0V Microwire Serial EEPROM 93C56C = 2-Kbit 5.0V Microwire Serial EEPROM w/ORG	
Pinout:	Blank = Standard pinout X = Rotated pinout	
Tape and Reel[1]:	Blank = Standard packaging T = Tape and Reel[1]	
Temperature Range:	I = -40°C to +85°C (Industrial) E = -40°C to +125°C (Extended)	
Package:	MC = Plastic Dual Flat, No lead - 2x3x0.9 mm Body, 8-lead (DFN) MS = Plastic Micro Small Outline - 8-lead (MSOP) P = Plastic Dual In-Line – 300 mil Body, 8-lead (PDIP) SN = Plastic Small Outline - Narrow, 3.90 mm, 8-lead (SOIC) OT = Plastic Small Outline Transistor - 6-lead (SOT-23) (Tape and Reel only) MNY[2] = Plastic Dual Flat, No Lead - 2x3x0.8 mm Body, 8-lead (TDFN) (Tape and Reel only) ST = Plastic Thin Shrink Small Outline - 4.4 mm, 8-lead (TSSOP)	

Examples:

a) 93AA56C-I/P: 2-Kbit, 256x8 or 128x16, 1.8V Serial EEPROM, Industrial Temperature, PDIP package

b) 93AA56B-I/MS: 2-Kbit, 128x16, 1.8V Serial EEPROM, Industrial Temperature, MSOP package

c) 93AA56AT-I/OT: 2-Kbit, 256x8, 1.8V Serial EEPROM, Industrial Temperature, Tape and Reel, SOT-23 package

d) 93AA56CT-I/SN: 2-Kbit, 256x8 or 128x16, 1.8V Serial EEPROM, Industrial Temperature, Tape and Reel, SOIC package

a) 93LC56A-I/MS: 2-Kbit, 256x8, 2.5V Serial EEPROM, Industrial Temperatrue, MSOP package

b) 93LC56BT-I/OT: 2-Kbit, 128x16, 2.5V Serial EEPROM, Industrial Temperature, Tape and Reel, SOT-23 Package

c) 93LC56B-I/ST: 2-Kbit, 128x16, 2.5V Serial EEPROM, Industrial Temperature, TSSOP package

d) 93LC56CT-E/MNY: 2-Kbit, 256x8 or 128x16, 2.5V Serial EEPROM, Extended Temperature, Tape and Reel, TDFN package

a) 93C56B-I/MS: 2-Kbit, 128x16, 5.0V Serial EEPROM, Industrial Temperature, MSOP package

b) 93C56C-E/SN: 2-Kbit, 256x8 or 128x16, 5.0V Serial EEPROM, Extended Temperature, SOIC package

c) 93C56AT-I/OT: 2-Kbit, 256x8, 5.0V Serial EEPROM, Industrial Temperature, Tape and Reel, SOT-23 Package

d) 93C56BX-I/SN: 2-Kbit, 128x16, 5.0V Serial EEPROM, Industrial Temperature, X-rotated, SOIC package

Note 1: Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option.

2: “Y” indicates a Nickel Palladium Gold (NiPdAu) finish.

PRODUCT IDENTIFICATION SYSTEM (AUTOMOTIVE)

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

PART NO.	X	X[1]	-X	/XX	XXX[2, 3]
Device	Pinout	Tape and Reel	Temperature Range	Package	Variant

Device:	93AA56A = 2-Kbit 1.8V Microwire Serial EEPROM 93AA56B = 2-Kbit 1.8V Microwire Serial EEPROM 93AA56C = 2-Kbit 1.8V Microwire Serial EEPROM w/ORG 93LC56A = 2-Kbit 2.5V Microwire Serial EEPROM 93LC56B = 2-Kbit 2.5V Microwire Serial EEPROM 93LC56C = 2-Kbit 2.5V Microwire Serial EEPROM w/ORG 93C56A = 2-Kbit 5.0V Microwire Serial EEPROM 93C56B = 2-Kbit 5.0V Microwire Serial EEPROM 93C56C = 2-Kbit 5.0V Microwire Serial EEPROM w/ORG		
Pinout:	Blank	=	Standard pinout
Tape and Reel[1]:	Blank T	= =	Standard packaging Tape and Reel [1]
Temperature Range:	I E	= =	-40°C to +85°C (AEC-Q100 Grade 3) -40°C to +125°C (AEC-Q100 Grade 1)
Package:	MS SN OT ST	= = = =	Plastic Micro Small Outline - 8-lead (MSOP) Plastic Small Outline - Narrow, 3.90 mm, 8-lead (SOIC) Plastic Small Outline Transistor - 6-lead (SOT-23) (Tape and Reel only) Plastic Thin Shrink Small Outline - 4.4 mm, 8-lead (TSSOP)
Variant[2, 3]:	15KVAO = Standard Automotive, 15K Process 15KVXX = Customer-Specific Automotive, 15K Process		

Examples:

a) 93LC56B-I/SN15KVAO: 2-Kbit, 128x16, 2.5V Serial EEPROM, Automotive Grade 3, SOIC package

b) 93LC56CT-I/SN15KVAO: 2-Kbit, 256x8 or 128x16, 2.5V Serial EEPROM, Automotive Grade 3, Tape and Reel, SOIC package

c) 93LC56AT-I/SN15KVAO: 2-Kbit, 256x8, 2.5V Serial EEPROM, Automotive Grade 3, Tape and Reel, SOIC package

d) 93LC56BT-I/SN15KVAO: 2-Kbit, 128x16, 2.5V Serial EEPROM, Automotive Grade 3, Tape and Reel, SOIC package

e) 93LC56CT-E/SN15KVAO: 2-Kbit, 256x8 or 128x16, 2.5V Serial EEPROM, Automotive Grade 1, Tape and Reel, SOIC package

a) 93C56AT-E/SN15KVAO: 2-Kbit, 256x8, 5.0V Serial EEPROM, Automotive Grade 1, Tape and Reel, SOIC package

Note 1: Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option.

2: The VAO/VXX automotive variants have been designed, manufactured, tested and qualified in accordance with AEC-Q100 requirements for automotive applications.

3: For customers requesting a PPAP, a customer- specific part number will be generated and provided. A PPAP is not provided for VAO part numbers.

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