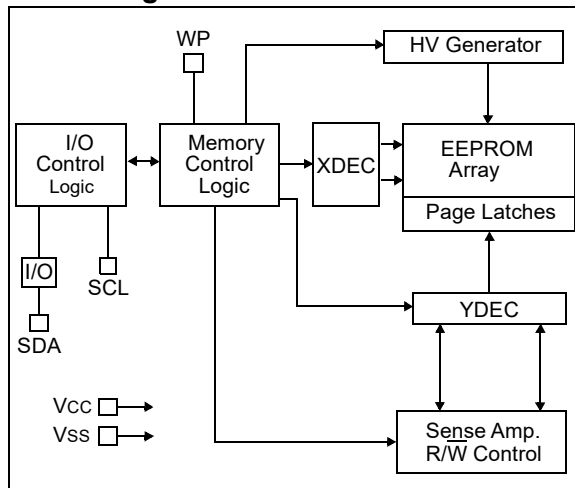


Block Diagram



24AA08/24LC08B/24FC08

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings (†)

V _{CC}	6.5V
All inputs and outputs w.r.t. V _{SS}	-0.3V to V _{CC} +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

DC CHARACTERISTICS			Industrial (I): TA = -40°C to +85°C, V _{CC} = +1.7V to +5.5V Extended (E): TA = -40°C to +125°C, V _{CC} = +2.5V to +5.5V (24LC08B) Extended (E): TA = -40°C to +125°C, V _{CC} = +1.7V to +5.5V (24FC08)				
Param. No.	Symbol	Characteristic	Min.	Typical	Max.	Units	Conditions
D1	V _{IH}	High-Level Input Voltage	0.7 V _{CC}	—	—	V	
D2	V _{IL}	Low-Level Input Voltage	—	—	0.3 V _{CC}	V	
D3	V _{HYS}	Hysteresis of Schmitt Trigger Inputs (SDA, SCL pins)	0.05 V _{CC}	—	—	V	Note
D4	V _{OL}	Low-Level Output Voltage	—	—	0.40	V	I _{OL} = 3.0 mA, V _{CC} = 2.5V
D5	I _{LI}	Input Leakage Current	—	—	±1	µA	V _{IN} = V _{SS} or V _{CC}
D6	I _{LO}	Output Leakage Current	—	—	±1	µA	V _{OUT} = V _{SS} or V _{CC}
D7	C _{IN} , C _{OUT}	Pin Capacitance (all inputs/outputs)	—	—	10	pF	V _{CC} = 5.0V (Note) TA = 25°C, F _{CLK} = 1 MHz
D8	I _{CCWRITE}	Operating Current	—	—	3	mA	V _{CC} = 5.5V, SCL = 400 kHz
D9	I _{CCREAD}		—	—	1	mA	V _{CC} = 5.5V, SCL = 400 kHz
D10	I _{CCS}	Standby Current	—	—	1	µA	SDA = SCL = V _{CC} WP = V _{SS} , I-Temp.
			—	—	3	µA	SDA = SCL = V _{CC} WP = V _{SS} , E-Temp. (24FC08)
			—	—	5	µA	SDA = SCL = V _{CC} WP = V _{SS} , E-Temp. (24LC08B)

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

24AA08/24LC08B/24FC08

TABLE 1-1 AC CHARACTERISTICS

AC CHARACTERISTICS			Industrial (I): TA = -40°C to +85°C, VCC = +1.7V to +5.5V Extended (E): TA = -40°C to +125°C, VCC = +2.5V to +5.5V (24LC08B) Extended (E): TA = -40°C to +125°C, VCC = +1.7V to +5.5V (24FC08)			
Param. No.	Symbol	Characteristic	Min.	Max.	Units	Conditions
1	FCLK	Clock Frequency	—	400	kHz	2.5V ≤ VCC ≤ 5.5V
			—	100	kHz	1.7V ≤ VCC < 2.5V (24AA08)
			—	1000	kHz	1.7V ≤ VCC ≤ 5.5V (24FC08)
2	THIGH	Clock High Time	600	—	ns	2.5V ≤ VCC ≤ 5.5V
			4000	—	ns	1.7V ≤ VCC < 2.5V (24AA08)
			260	—	ns	1.7V ≤ VCC ≤ 5.5V (24FC08)
3	TLOW	Clock Low Time	1300	—	ns	2.5V ≤ VCC ≤ 5.5V
			4700	—	ns	1.7V ≤ VCC < 2.5V (24AA08)
			500	—	ns	1.7V ≤ VCC ≤ 5.5V (24FC08)
4	TR	SDA and SCL Rise Time	—	300	ns	2.5V ≤ VCC ≤ 5.5V (Note 1)
			—	1000	ns	1.7V ≤ VCC < 2.5V (24AA08) (Note 1)
			—	1000	ns	1.7V ≤ VCC ≤ 5.5V (24FC08) (Note 1)
5	TF	SDA and SCL Fall Time	—	300	ns	Note 1
6	THD:STA	Start Condition Hold Time	600	—	ns	2.5V ≤ VCC ≤ 5.5V
			4000	—	ns	1.7V ≤ VCC < 2.5V (24AA08)
			250	—	ns	1.7V ≤ VCC ≤ 5.5V (24FC08)
7	TSU:STA	Start Condition Setup Time	600	—	ns	2.5V ≤ VCC ≤ 5.5V
			4700	—	ns	1.7V ≤ VCC < 2.5V (24AA08)
			250	—	ns	1.7V ≤ VCC ≤ 5.5V (24FC08)
8	THD:DAT	Data Input Hold Time	0	—	ns	Note 2
9	TSU:DAT	Data Input Setup Time	100	—	ns	2.5V ≤ VCC ≤ 5.5V
			250	—	ns	1.7V ≤ VCC < 2.5V (24AA08)
			50	—	ns	1.7V ≤ VCC ≤ 5.5V (24FC08)
10	TSU:STO	Stop Condition Setup Time	600	—	ns	2.5V ≤ VCC ≤ 5.5V
			4000	—	ns	1.7V ≤ VCC < 2.5V (24AA08)
			250	—	ns	1.7V ≤ VCC ≤ 5.5V (24FC08)
11	TSU:WP	WP Setup Time	600	—	ns	1.7V ≤ VCC ≤ 5.5V (24FC08)
12	THD:WP	WP Hold Time	600	—	ns	1.7V ≤ VCC ≤ 5.5V (24FC08)
13	TAA	Output Valid from Clock	—	900	ns	2.5V ≤ VCC ≤ 5.5V (Note 2)
			—	3500	ns	1.7V ≤ VCC < 2.5V (24AA08) (Note 2)
			—	450	ns	1.7V ≤ VCC ≤ 5.5V (24FC08) (Note 2)
14	TBUF	Bus Free Time: The time the bus must be free before a new transmission can start	1300	—	ns	2.5V ≤ VCC ≤ 5.5V
			4700	—	ns	1.7V ≤ VCC < 2.5V (24AA08)
			500	—	ns	1.7V ≤ VCC ≤ 5.5V (24FC08)

Note 1: Characterized but not 100% tested.

2: As a transmitter, the device must provide an internal minimum delay time to bridge the undefined region (minimum 300 ns) of the falling edge of SCL to avoid unintended generation of Start or Stop conditions.

3: CB = total capacitance of one bus line in pF.

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

24AA08/24LC08B/24FC08

TABLE 1-1 AC CHARACTERISTICS (CONTINUED)

AC CHARACTERISTICS (Continued)			Industrial (I): TA = -40°C to +85°C, VCC = +1.7V to +5.5V Extended (E): TA = -40°C to +125°C, VCC = +2.5V to +5.5V (24LC08B) Extended (E): TA = -40°C to +125°C, VCC = +1.7V to +5.5V (24FC08)			
Param. No.	Symbol	Characteristic	Min.	Max.	Units	Conditions
15	TOF	Output Fall Time from VIH Minimum to VIL Maximum	—	250	ns	2.5V ≤ VCC ≤ 5.5V (Notes 1, 3 and 4)
			—	250	ns	1.7V ≤ VCC < 2.5V (24AA08) (Notes 1, 3 and 4)
16	TSP	Input Filter Spike Suppression (SDA and SCL pins)	—	50	ns	Note 1
			—	100	ns	1.7V ≤ VCC ≤ 5.5V (24FC08) (Note 1)
17	TWC	Write Cycle Time (byte or page)	—	5	ms	
18		Endurance	1,000,000	—	cycles	25°C, 5.5V, Page Mode (Note 4)

Note 1: Characterized but not 100% tested.

2: As a transmitter, the device must provide an internal minimum delay time to bridge the undefined region (minimum 300 ns) of the falling edge of SCL to avoid unintended generation of Start or Stop conditions.

3: CB = total capacitance of one bus line in pF.

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

FIGURE 1-1: BUS TIMING DATA

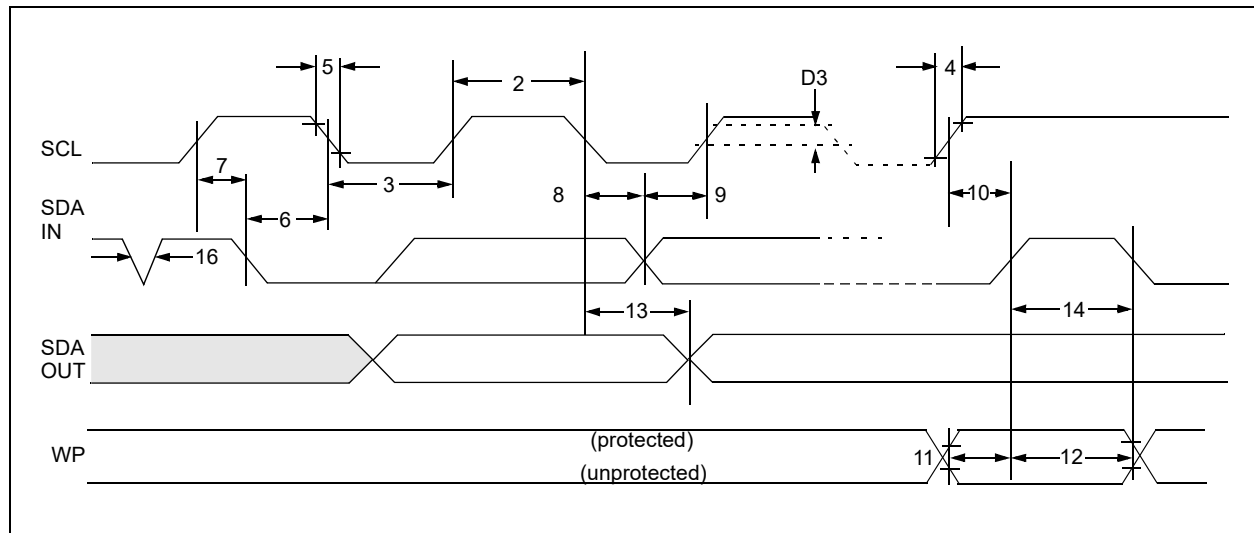
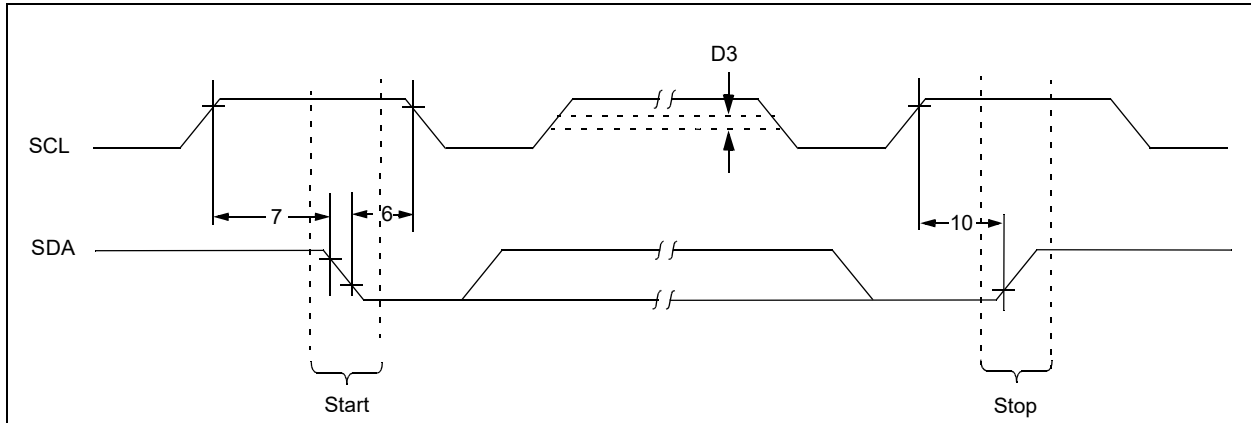


FIGURE 1-2: BUS TIMING START/STOP



2.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in [Table 2-1](#).

TABLE 2-1: PIN FUNCTION TABLE

Name	DFN ⁽¹⁾	MSOP	PDIP	SOIC	TDFN ⁽¹⁾	TSSOP	UDFN ⁽¹⁾	SOT-23	CSP	Description
A0	1	1	1	1	1	1	1	—	—	Not Connected
A1	2	2	2	2	2	2	2	—	—	Not Connected
A2	3	3	3	3	3	3	3	—	—	Not Connected
Vss	4	4	4	4	4	4	4	2	2	Ground
SDA	5	5	5	5	5	5	5	3	4	Serial Address/Data I/O
SCL	6	6	6	6	6	6	6	1	3	Serial Clock
WP	7	7	7	7	7	7	7	5	—	Write-Protect Input
Vcc	8	8	8	8	8	8	8	4	1	Power Supply

Note 1: The exposed pad on the DFN/TDFN/UDFN package can be connected to Vss or left floating.

2.1 A0, A1, A2

The A0, A1 and A2 pins are not used by the 24XX08. They may be left floating or tied to either Vss or Vcc.

2.2 Serial Address/Data Input/Output (SDA)

The SDA input is a bidirectional pin used to transfer addresses and data into and out of the device. Since it is an open-drain terminal, the SDA bus requires a pull-up resistor to Vcc (typical 10 k Ω for 100 kHz, 2 k Ω for 400 kHz and 1 MHz).

For normal data transfer, SDA is allowed to change only during SCL low. Changes during SCL high are reserved for indicating Start and Stop conditions.

2.3 Serial Clock (SCL)

The SCL input is used to synchronize the data transfer to and from the device.

2.4 Write-Protect (WP)

This pin must be connected to either Vss or Vcc.

If tied to Vss, normal memory operation is enabled (read/write the entire memory 000-3FF).

If tied to Vcc, write operations are inhibited. The entire memory will be write-protected. Read operations are not affected.

The Chip Scale package does not support the write-protect feature.

3.0 FUNCTIONAL DESCRIPTION

The 24XX08 supports a bidirectional, two-wire bus and data transmission protocol. A device that sends data onto the bus is defined as transmitter, while defining a device receiving data as a receiver. The bus has to be controlled by a host device which generates the Serial Clock (SCL), controls the bus access and generates the Start and Stop conditions, while the 24XX08 works as client. Both host and client can operate as transmitter or receiver, but the host device determines which mode is activated.

4.0 BUS CHARACTERISTICS

The following **bus protocol** has been defined:

- Data transfer may be initiated only when the bus is not busy.
- During data transfer, the data line must remain stable whenever the clock line is high. Changes in the data line while the clock line is high will be interpreted as a Start or Stop condition.

Accordingly, the following bus conditions have been defined (Figure 4-1).

4.1 Bus Not Busy (A)

Both data and clock lines remain high.

4.2 Start Data Transfer (B)

A high-to-low transition of the SDA line while the clock (SCL) is high determines a Start condition. All commands must be preceded by a Start condition.

4.3 Stop Data Transfer (C)

A low-to-high transition of the SDA line while the clock (SCL) is high determines a Stop condition. All operations must be ended with a Stop condition.

4.4 Data Valid (D)

The state of the data line represents valid data when, after a Start condition, the data line is stable for the duration of the high period of the clock signal.

The data on the line must be changed during the low period of the clock signal. There is one clock pulse per bit of data.

Each data transfer is initiated with a Start condition and terminated with a Stop condition. The number of data bytes transferred between the Start and Stop conditions is determined by the host device and is, theoretically, unlimited (although only the last sixteen will be stored when doing a write operation). When an overwrite does occur, it will replace data based on the first-in first-out (FIFO) principle.

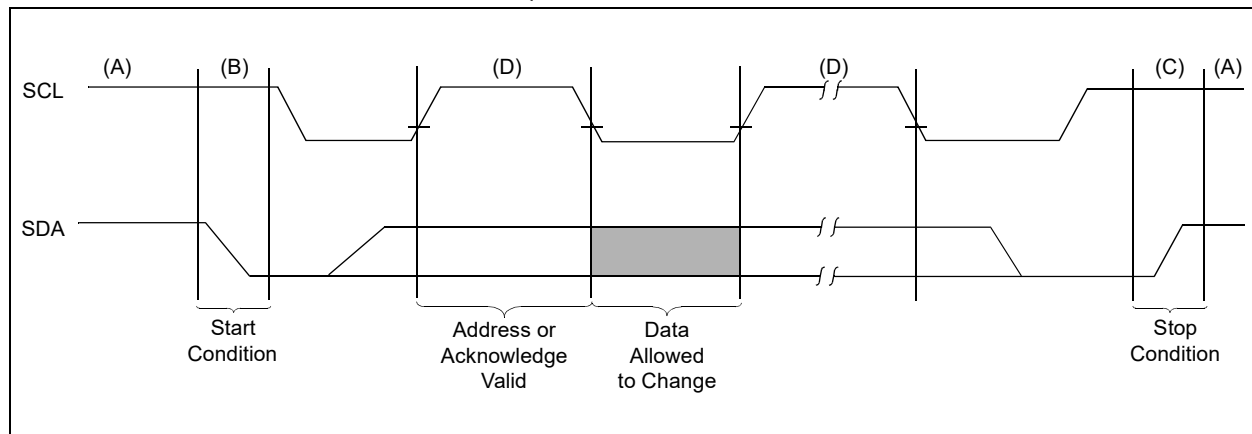
4.5 Acknowledge

Each receiving device, when addressed, is obliged to generate an Acknowledge after the reception of each byte. The host device must generate an extra clock pulse which is associated with this Acknowledge bit.

Note: The 24XX08 does not generate any Acknowledge bits if an internal programming cycle is in progress.

The device that acknowledges has to pull down the SDA line during the Acknowledge clock pulse in such a way that the SDA line is stable-low during the high period of the Acknowledge-related clock pulse. Moreover, setup and hold times must be taken into account. During reads, a host must signal an end of data to the client by not generating an Acknowledge bit on the last byte that has been clocked out of the client. In this case, the client (24XX08) will leave the data line high to enable the host to generate the Stop condition.

FIGURE 4-1: DATA TRANSFER SEQUENCE ON THE SERIAL BUS



5.0 DEVICE ADDRESSING

A control byte is the first byte received following the Start condition from the host device. The control byte consists of a four-bit control code. For the 24XX08, this is set as '1010' binary for read and write operations. The next bit of the control byte is a "don't care" for the 24XX08. The last two bits, B1 and B0, are used by the host device to select which of the four 256-word blocks of memory are to be accessed. These bits, in effect, are the Most Significant bits of the word address. The combination of the 4-bit control code and the next three bits are called the client address.

The last bit of the control byte is the Read/Write ($\overline{R/W}$) bit and it defines the operation to be performed. When set to '1', a read operation is selected. When set to '0', a write operation is selected. Following the Start condition, the 24XX08 monitors the SDA bus, checking the device type identifier being transmitted. Upon receiving a valid client address and the $\overline{R/W}$ bit, the client device outputs an Acknowledge signal on the SDA line. Depending on the state of the $\overline{R/W}$ bit, the 24XX08 will select a read or write operation.

The next byte received defines the address of the first data byte within the selected block (Figure 5-2). The word address byte uses all eight bits.

Operation	Control Code	Block Select	$\overline{R/W}$
Read	1010	Block Address	1
Write	1010	Block Address	0

FIGURE 5-1: CONTROL BYTE ALLOCATION

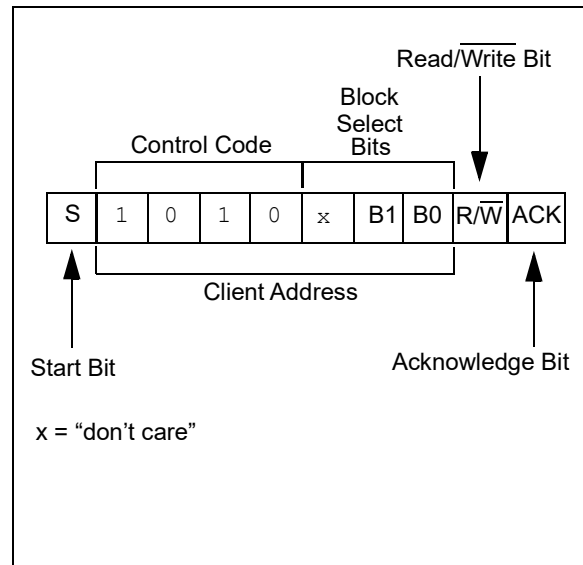
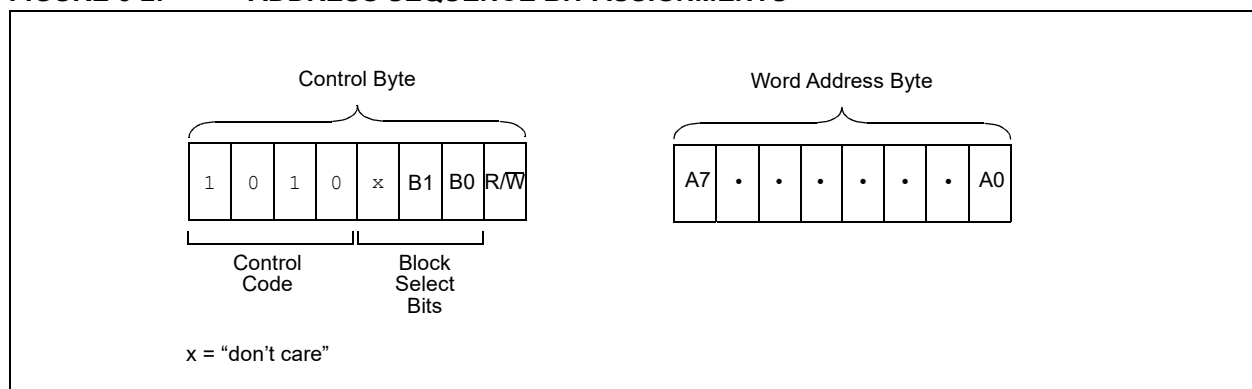


FIGURE 5-2: ADDRESS SEQUENCE BIT ASSIGNMENTS



6.0 WRITE OPERATION

6.1 Byte Write

Following the Start condition from the host, the device code (4 bits), the block address (1 bit is a “don't care”, plus B1 and B0 bits) and the R/W bit, which is a logic-low, is placed onto the bus by the host transmitter. This indicates to the addressed client receiver that a byte with a word address will follow after it has generated an Acknowledge bit during the ninth clock cycle. Therefore, the next byte transmitted by the host is the word address and will be written into the Address Pointer of the 24XX08. After receiving another Acknowledge signal from the 24XX08, the host device will transmit the data word to be written into the addressed memory location. The 24XX08 acknowledges again and the host generates a Stop condition. This initiates the internal write cycle, and, during this time, the 24XX08 will not generate Acknowledge signals (Figure 6-1).

6.2 Page Write

The write control byte, word address and first data byte are transmitted to the 24XX08 in the same way as in a byte write. However, instead of generating a Stop condition, the host transmits up to 16 data bytes to the 24XX08, which are temporarily stored in the on-chip page buffer and will be written into the memory once the host has transmitted a Stop condition. Upon receipt of each word, the four lower-order Address Pointer bits, which form the byte counter, are internally incremented by one. The higher-order four bits of the word address and bits B1 and B0 remain constant. If the host should transmit more than 16 words prior to generating the Stop condition, the Address Pointer will roll over and the previously received data will be overwritten. As with the byte write operation, once the Stop condition is received, an internal write cycle will begin (Figure 6-2).

Note: Page write operations are limited to writing bytes within a single physical page **regardless** of the number of bytes actually being written. Physical page boundaries start at addresses that are integer multiples of the page buffer size (or ‘page size’) and end at addresses that are integer multiples of page size – 1. If a page write command attempts to write across a physical page boundary, the result is that the data wraps around to the beginning of the current page (overwriting data previously stored there), instead of being written to the next page, as might be expected. It is therefore necessary for the application software to prevent page write operations that would attempt to cross a page boundary.

6.3 Write Protection

The WP pin allows the user to write-protect the entire array (000-3FF) when the pin is tied to VCC. If tied to VSS, the write protection is disabled. The Chip Scale package does not support the write-protect feature.

FIGURE 6-1: BYTE WRITE

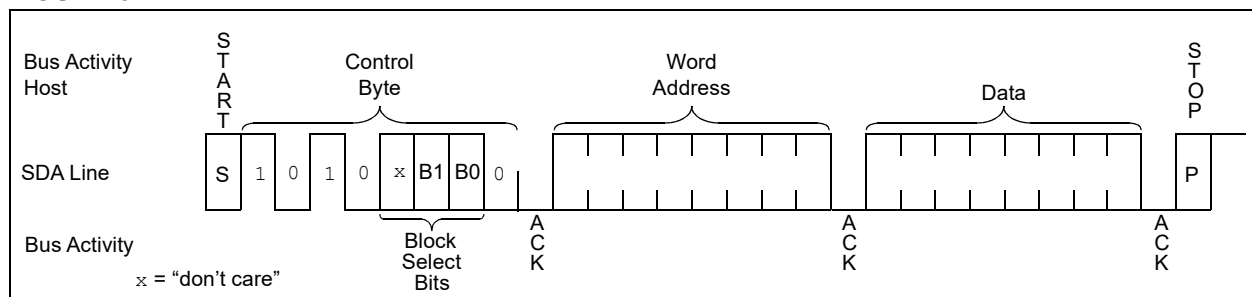
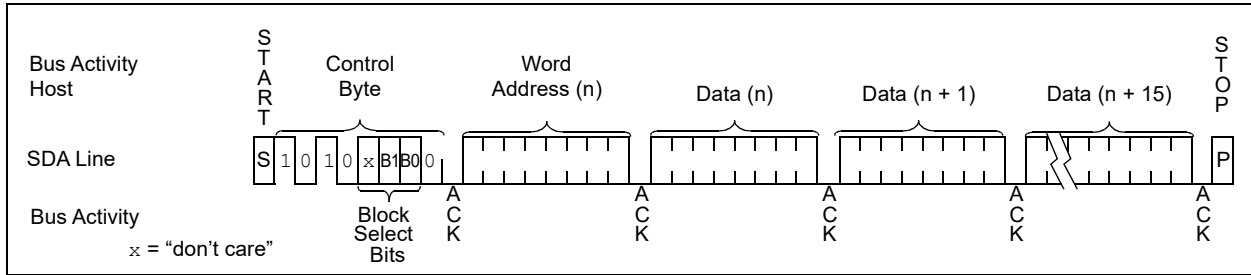


FIGURE 6-2: PAGE WRITE



7.0 ACKNOWLEDGE POLLING

Since the device will not acknowledge during a write cycle, this can be used to determine when the cycle is complete (this feature can be used to maximize bus throughput). Once the Stop condition for a write command has been issued from the host, the device initiates the internally-timed write cycle. ACK polling can then be initiated immediately. This involves the host sending a Start condition followed by the control byte for a write command ($R/\overline{W} = 0$). If the device is still busy with the write cycle, no ACK will be returned. If the cycle is complete, the device will return the ACK and the host can then proceed with the next read or write operation. See [Figure 7-1](#) for a flow diagram of this operation.

FIGURE 7-1: ACKNOWLEDGE POLLING FLOW

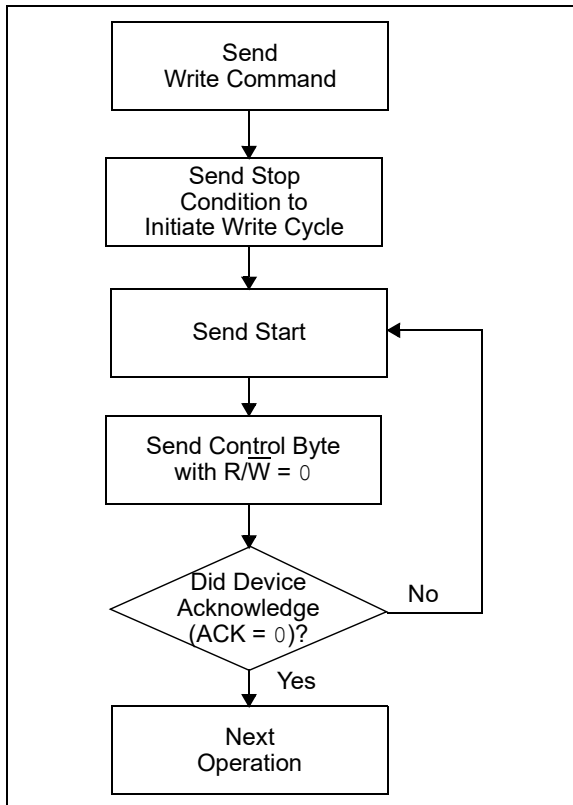


FIGURE 8-2: RANDOM READ

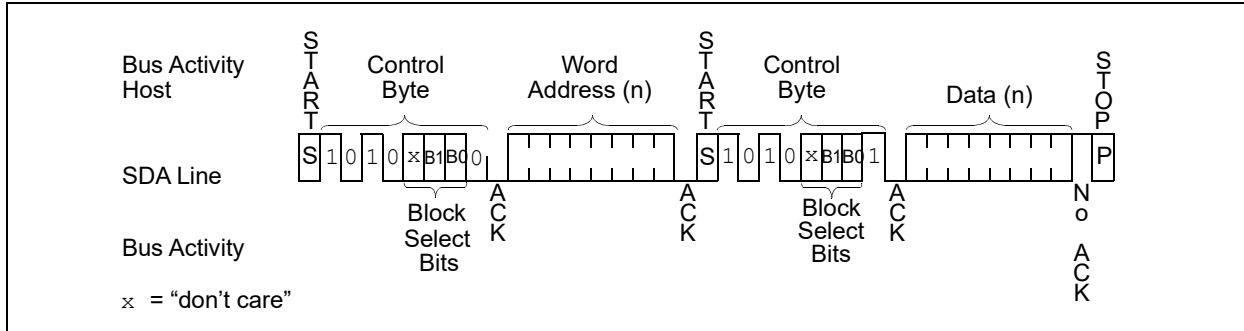
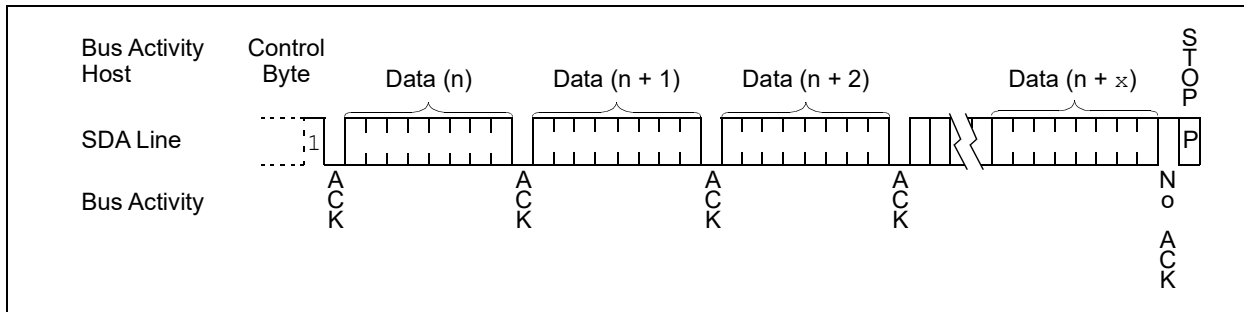


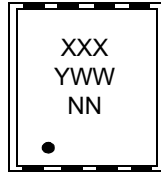
FIGURE 8-3: SEQUENTIAL READ



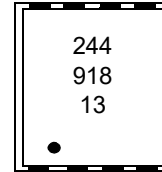
9.0 PACKAGING INFORMATION

9.1 Package Marking Information*

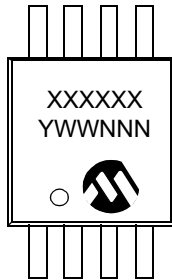
8-Lead 2x3 DFN



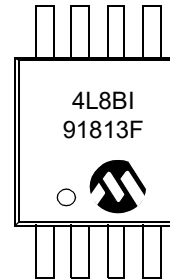
Example



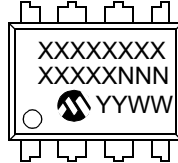
8-Lead MSOP



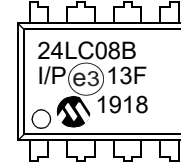
Example



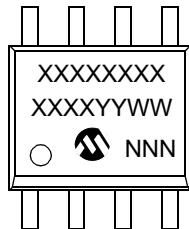
8-Lead PDIP (300 mil)



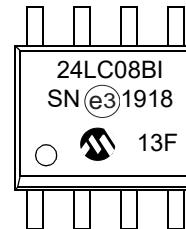
Example



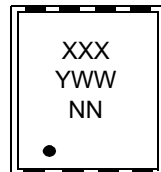
8-Lead SOIC (3.90 mm)



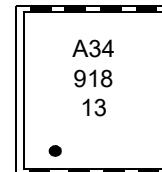
Example



8-Lead 2x3 TDFN

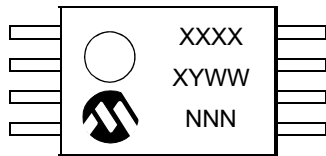


Example

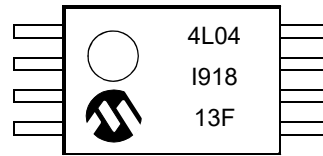


24AA08/24LC08B/24FC08

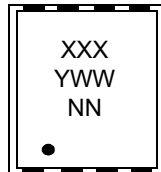
8-Lead TSSOP



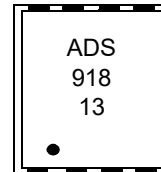
Example



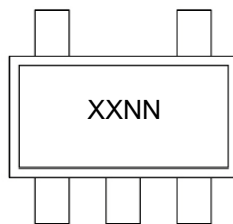
8-Lead 2x3 UDFN



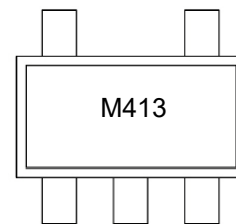
Example



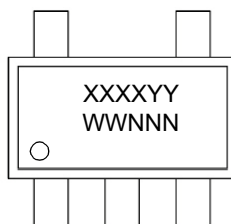
5-Lead SOT-23 (1-Line Marking)



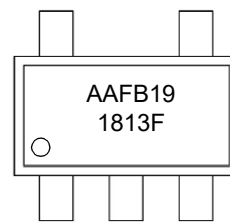
Example



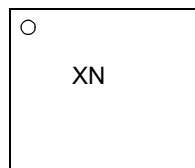
5-Lead SOT-23 (2-Line Marking)



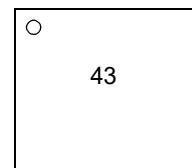
Example



4-Ball CSP



Example



24AA08/24LC08B/24FC08

Part Number	1st Line Marking Codes										
	DFN		MSOP	SOIC	TDFN		TSSOP	UDFN	SOT-23		CSP
	I-Temp.	E-Temp.			I-Temp.	E-Temp.			I-Temp.	E-Temp.	
24AA08	241	—	4A08T ⁽¹⁾	24AA08T ⁽¹⁾	A41	—	4A08	—	B4NN ^(2,3)	—	4N
24LC08B	244	245	4L8BT ⁽¹⁾	24LC08BT ⁽¹⁾	A44	A45	4L08	—	M4NN ^(2,3)	N4NN ^(2,3)	—
24FC08	—	—	24FC08	24FC08	—	—	AADY	ADS	AAFBYY ⁽⁴⁾	AAFBYY ⁽⁴⁾	—

Note 1: T = Temperature grade (I, E)

2: NN = Alphanumeric traceability code

3: These parts use the 1-line SOT-23 marking format

4: These parts use the 2-line SOT-23 marking format

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)
Ⓔ3 JEDEC® designator for Matte Tin (Sn)

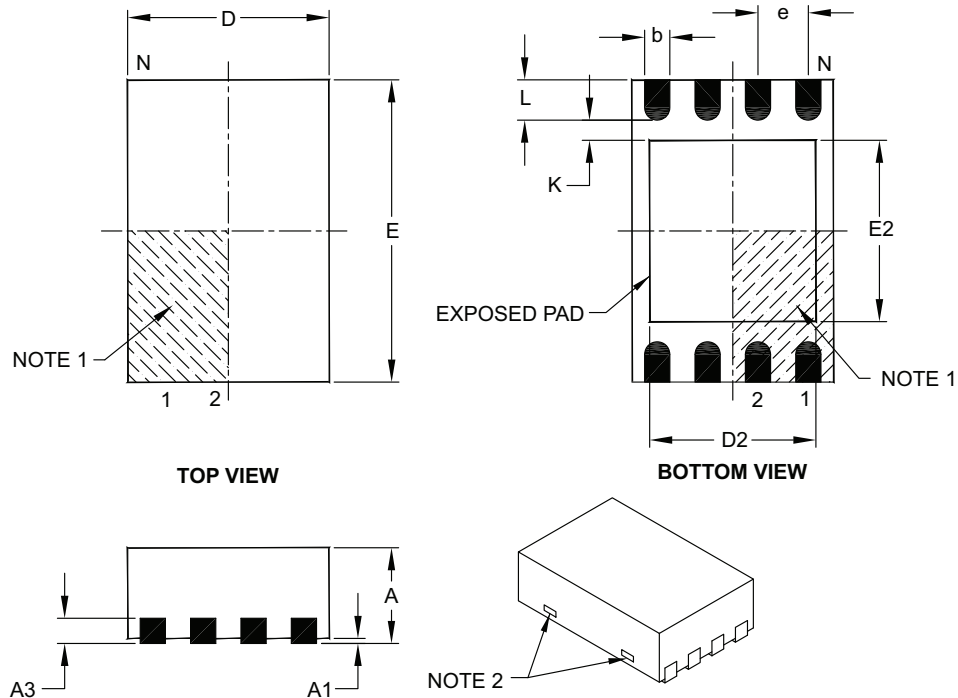
* Standard OTP marking consists of Microchip part number, year code, week code, and traceability code.

Note: For very small packages with no room for the JEDEC® designator Ⓔ3, 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) – 2x3x0.9 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 Pins	N		8		
Pitch	e		0.50 BSC		
Overall Height	A		0.80	0.90	1.00
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		1.30	–	1.55
Exposed Pad Width	E2		1.50	–	1.75
Contact Width	b		0.20	0.25	0.30
Contact Length	L		0.30	0.40	0.50
Contact-to-Exposed Pad	K		0.20	–	–

Notes:

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

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

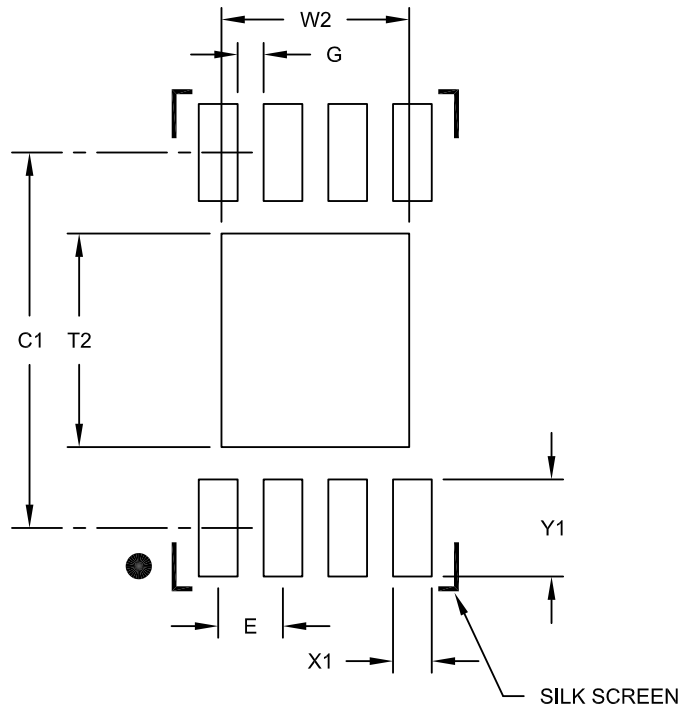
REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-123C

24AA08/24LC08B/24FC08

8-Lead Plastic Dual Flat, No Lead Package (MC) - 2x3x0.9mm 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	W2			1.45
Optional Center Pad Length	T2			1.75
Contact Pad Spacing	C1		2.90	
Contact Pad Width (X8)	X1			0.30
Contact Pad Length (X8)	Y1			0.75
Distance Between Pads	G	0.20		

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

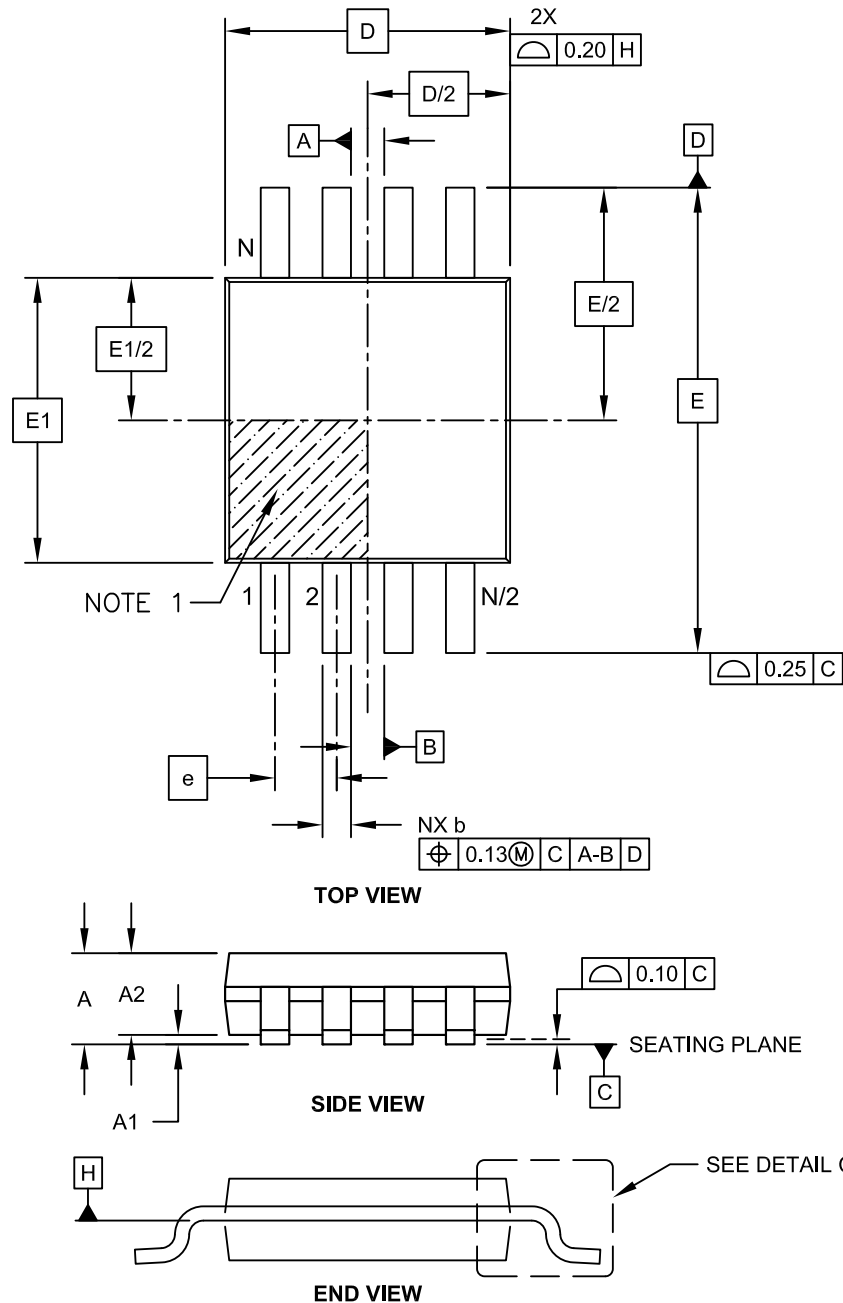
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-2123B

24AA08/24LC08B/24FC08

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

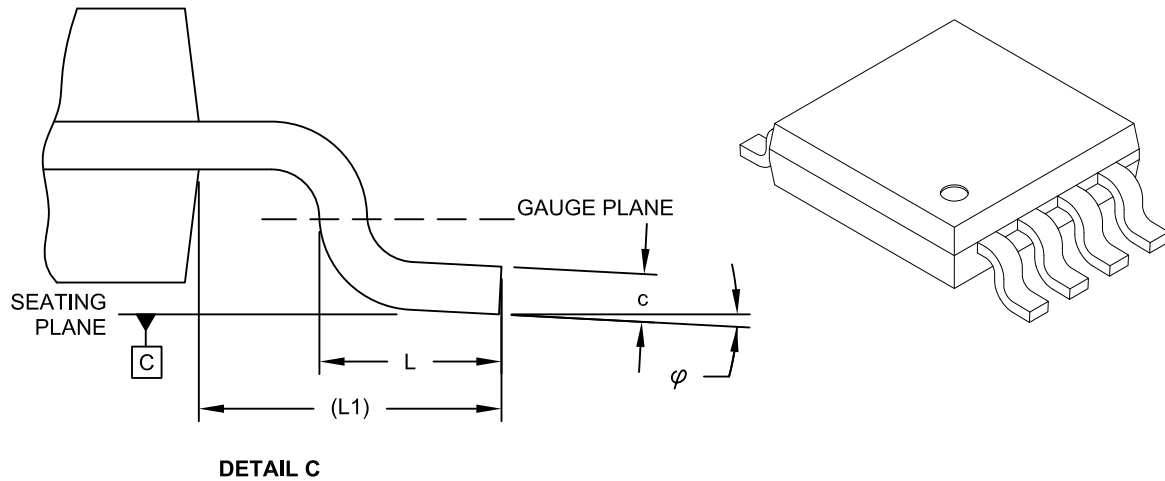
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing C04-111C Sheet 1 of 2

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

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



Dimension Limits	Units	MILLIMETERS		
		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e	0.65 BSC		
Overall Height	A	-	-	1.10
Molded Package Thickness	A2	0.75	0.85	0.95
Standoff	A1	0.00	-	0.15
Overall Width	E	4.90 BSC		
Molded Package Width	E1	3.00 BSC		
Overall Length	D	3.00 BSC		
Foot Length	L	0.40	0.60	0.80
Footprint	L1	0.95 REF		
Foot Angle	φ	0°	-	8°
Lead Thickness	c	0.08	-	0.23
Lead Width	b	0.22	-	0.40

Notes:

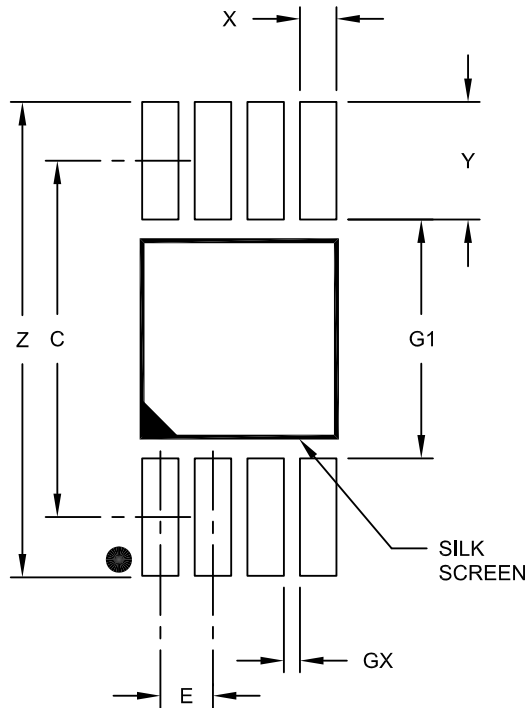
- Pin 1 visual index feature may vary, but must be located within the hatched area.
- Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
- Dimensioning and tolerancing per ASME Y14.5M.
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-111C Sheet 2 of 2

24AA08/24LC08B/24FC08

8-Lead Plastic Micro Small Outline Package (MS) [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	
Overall Width	Z			5.85
Contact Pad Width (X8)	X1			0.45
Contact Pad Length (X8)	Y1			1.45
Distance Between Pads	G1	2.95		
Distance Between Pads	GX	0.20		

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

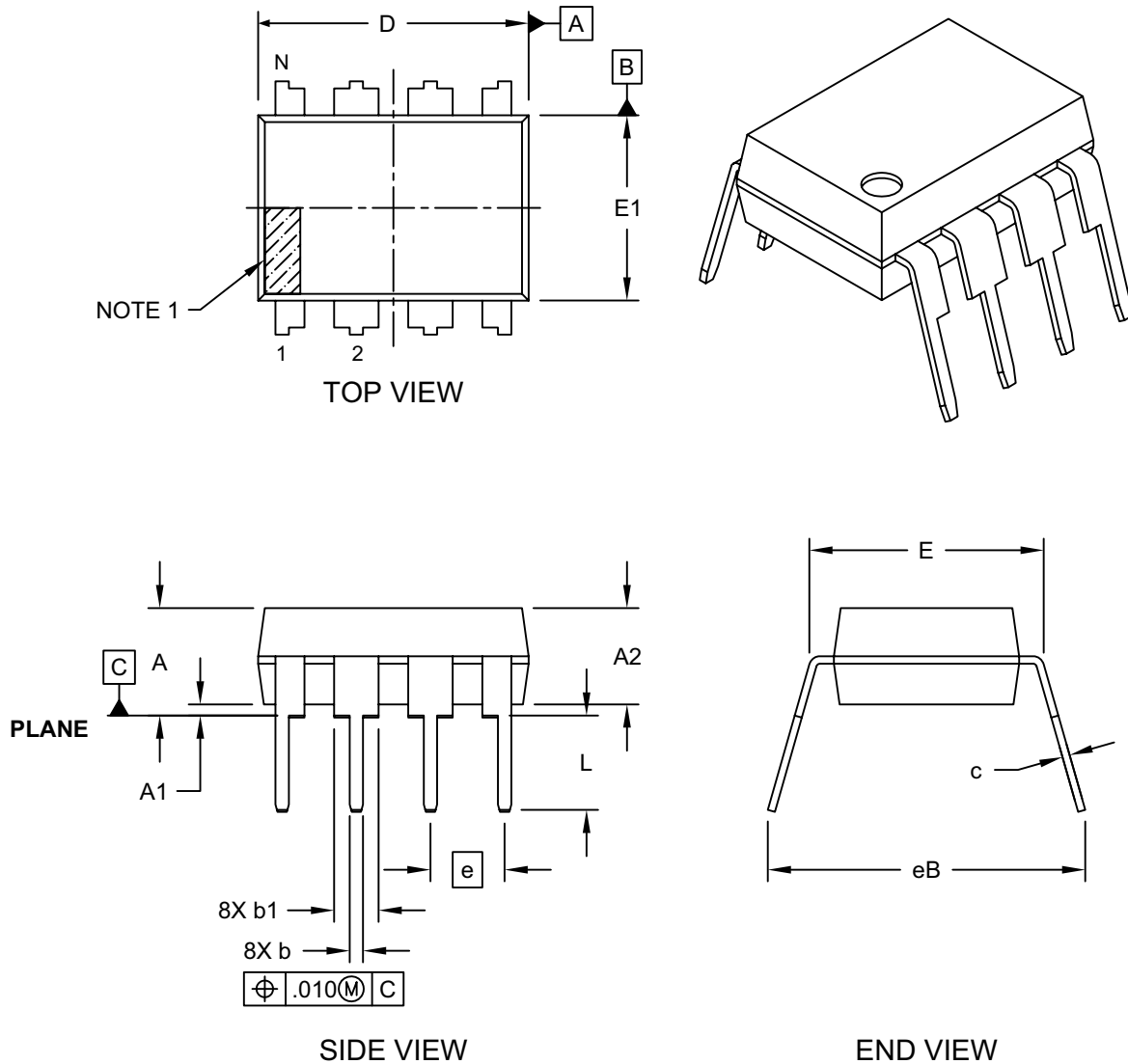
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-2111A

24AA08/24LC08B/24FC08

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>

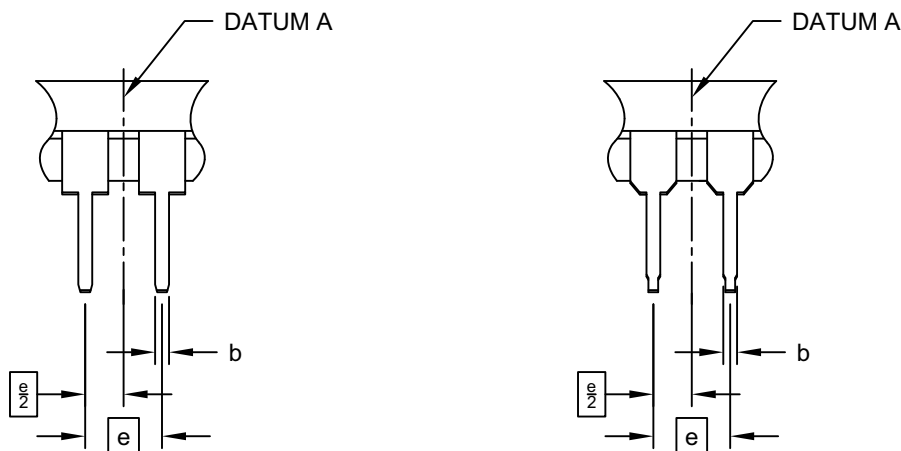


Microchip Technology Drawing No. C04-018-P Rev E Sheet 1 of 2

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>

ALTERNATE LEAD DESIGN (NOTE 5)



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:

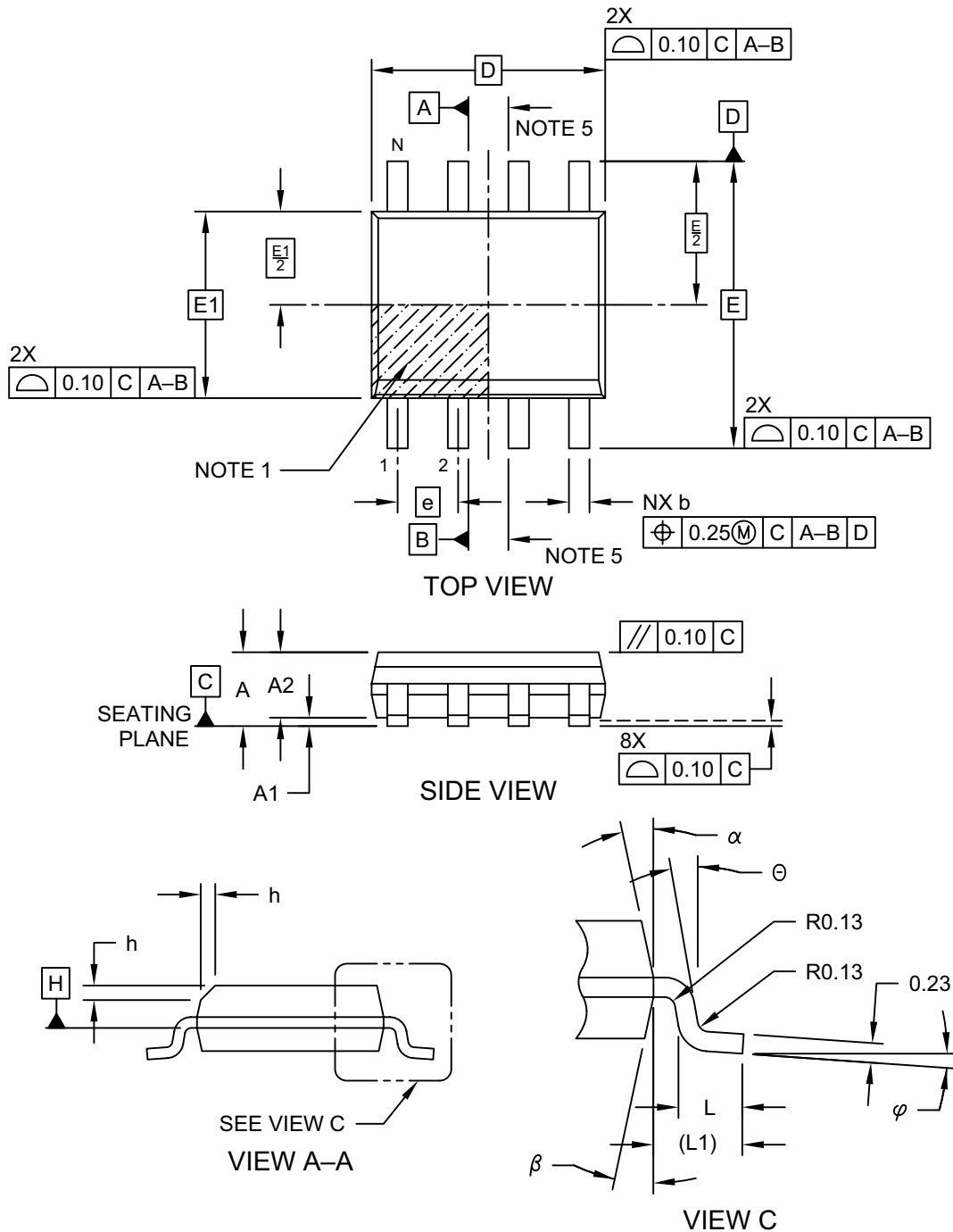
- Pin 1 visual index feature may vary, but must be located within the hatched area.
- § Significant Characteristic
- Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" per side.
- Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension.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

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

24AA08/24LC08B/24FC08

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

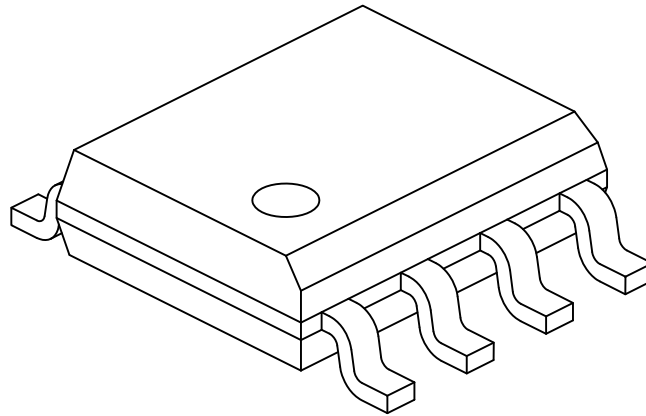
Note: For the most current package drawings, please see the Microchip Packaging Specification located at <http://www.microchip.com/packaging>



Microchip Technology Drawing No. C04-057-SN Rev F 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>



Dimension Limits	Units	MILLIMETERS		
		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		
Foot Angle	φ	0°	-	8°
Lead Thickness	c	0.17	-	0.25
Lead Width	b	0.31	-	0.51
Mold Draft Angle Top	α	5°	-	15°
Mold Draft Angle Bottom	β	5°	-	15°

Notes:

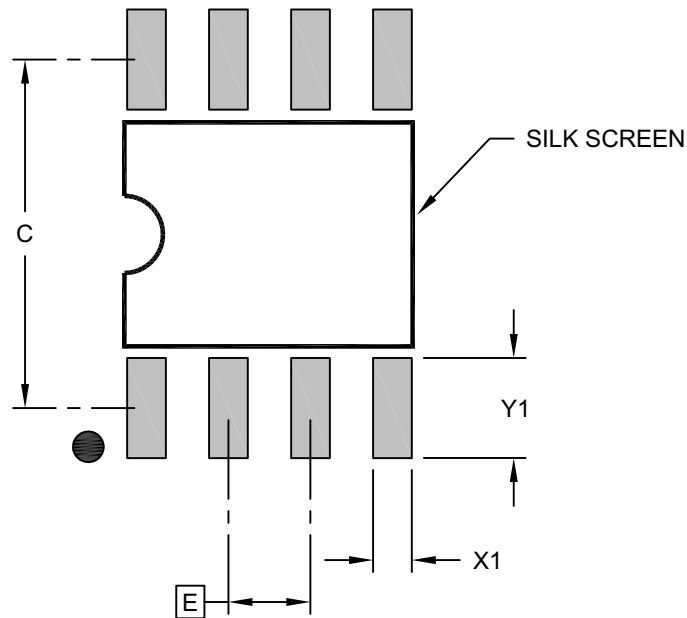
- Pin 1 visual index feature may vary, but must be located within the hatched area.
- § Significant Characteristic
- Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
- Dimensioning and tolerancing per ASME Y14.5M
 - BSC: Basic Dimension. Theoretically exact value shown without tolerances.
 - REF: Reference Dimension, usually without tolerance, for information purposes only.
- Datums A & B to be determined at Datum H.

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

24AA08/24LC08B/24FC08

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

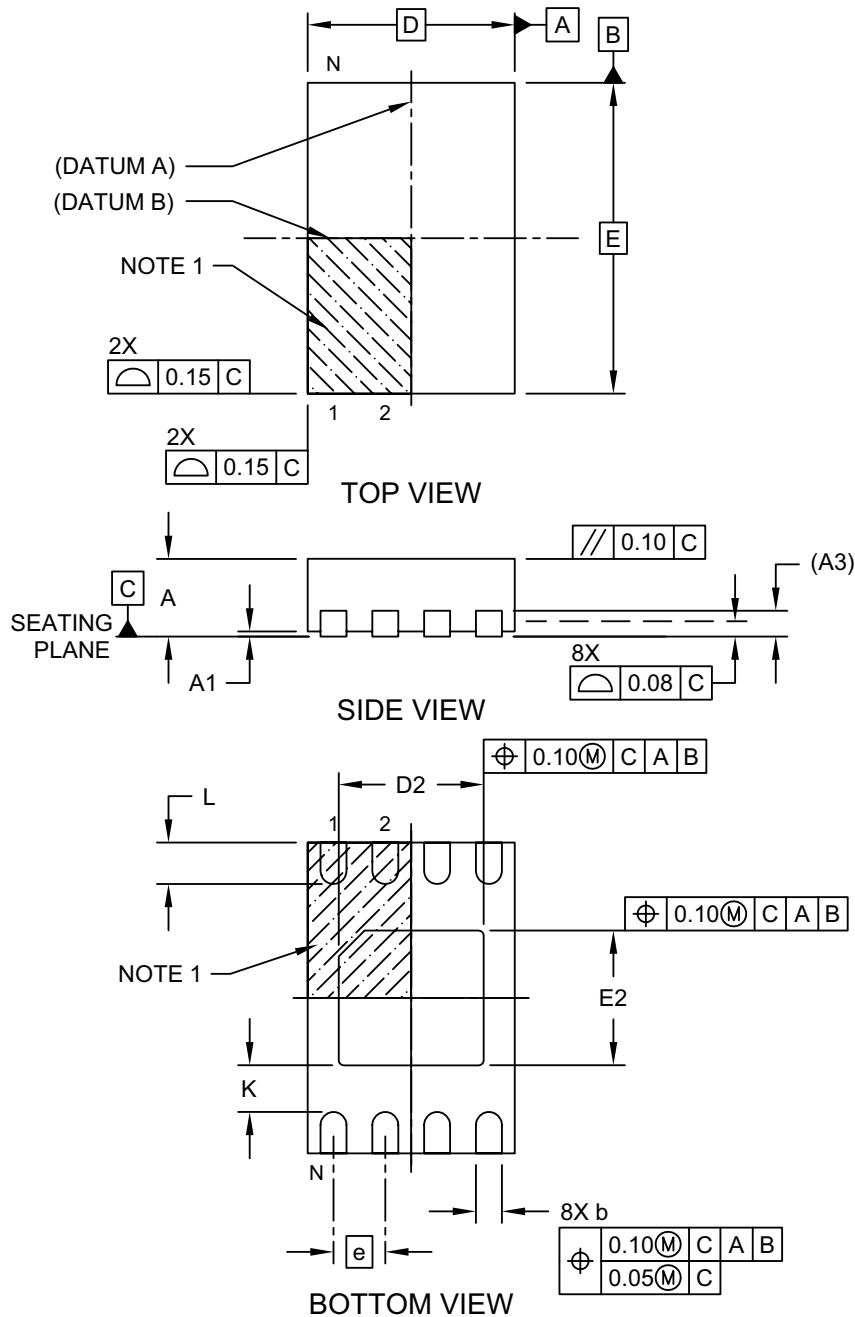
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-2057-SN Rev F

24AA08/24LC08B/24FC08

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>

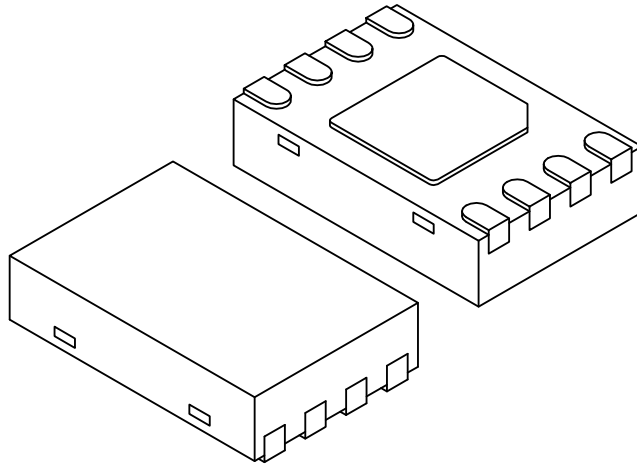


Microchip Technology Drawing No. C04-129-MN Rev E Sheet 1 of 2

24AA08/24LC08B/24FC08

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

Diagram illustrating the top view of a mechanical part with feature control frames and datum labels.

Feature Control Frames:

- Feature A: $\text{0.10} \text{ (M) } \text{C B A}$
- Feature B: 0.20 C B A

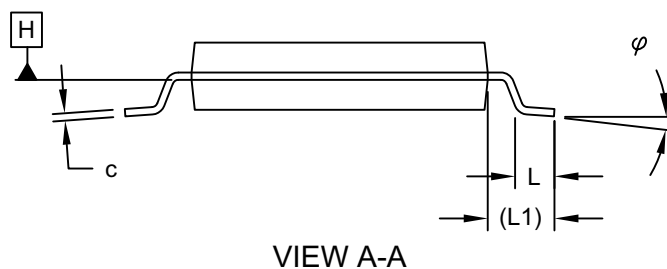
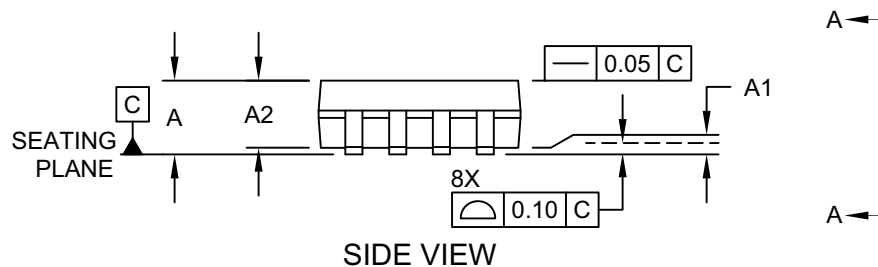
Datum Labels:

- (DATUM A) points to the centerline of the part.
- (DATUM B) points to the right edge of the part.

Dimensions and Tolerances:

- Dimension D: Overall width of the part.
- Dimension E1: Distance from the centerline to the right edge.
- Dimension E: Total distance from the centerline to the right edge of the feature control frame.
- Dimension e: Distance from the centerline to the left edge of the feature control frame.
- Dimension 8X b: Distance from the centerline to the right edge of the feature control frame.
- Feature A: $\text{0.10} \text{ (M) } \text{C B A}$
- Feature B: 0.20 C B A

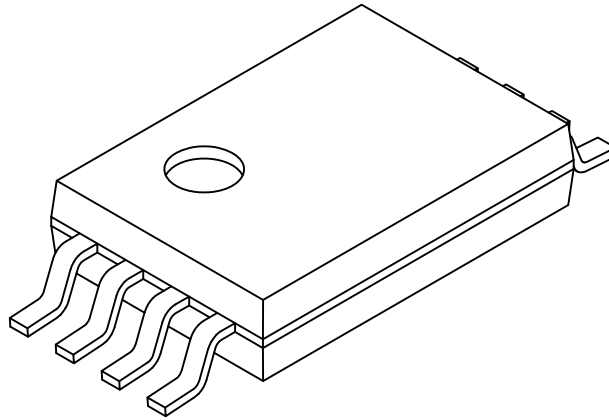
TOP VIEW

Downloaded from [Arrow.com](https://arrow.com).

24AA08/24LC08B/24FC08

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.

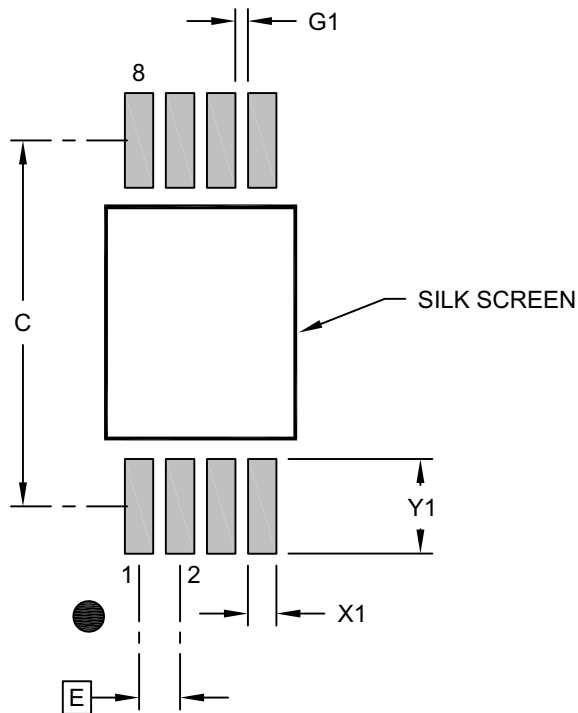
REF: Reference Dimension, usually without tolerance, for information purposes only.

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

24AA08/24LC08B/24FC08

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:

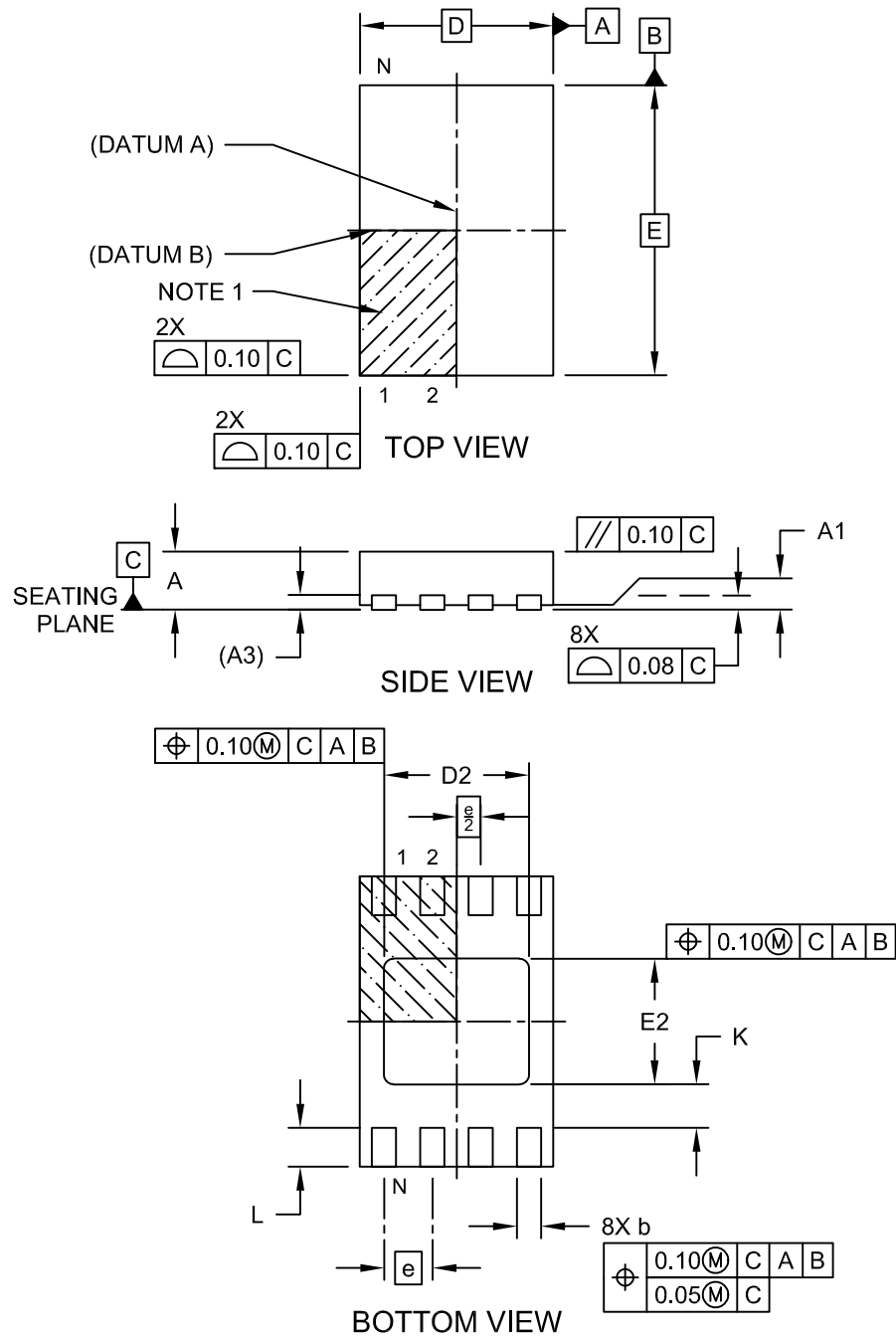
- Dimensioning and tolerancing per ASME Y14.5M
BSC: Basic Dimension. Theoretically exact value shown without tolerances.
- For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

Microchip Technology Drawing C04-2086 Rev B

24AA08/24LC08B/24FC08

8-Lead Ultra Thin Plastic Dual Flat, No Lead Package (Q4B) - 2x3 mm Body [UDFN] Atmel Legacy Global Package Code YNZ

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

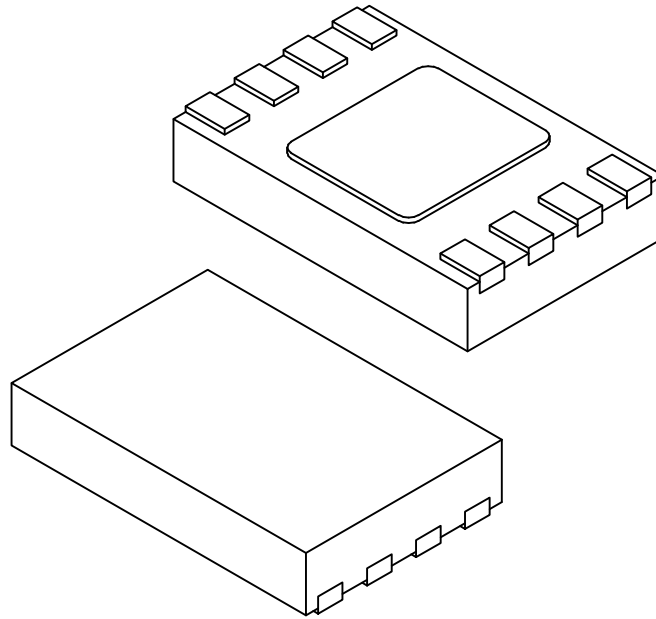


Microchip Technology Drawing C04-21355-Q4B Rev C Sheet 1 of 2

24AA08/24LC08B/24FC08

8-Lead Ultra Thin Plastic Dual Flat, No Lead Package (Q4B) - 2x3 mm Body [UDFN] Atmel Legacy Global Package Code YNZ

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	0.50	0.55	0.60
Standoff	A1	0.00	0.02	0.05
Terminal Thickness	A3	0.152 REF		
Overall Length	D	2.00 BSC		
Exposed Pad Length	D2	1.40	1.50	1.60
Overall Width	E	3.00 BSC		
Exposed Pad Width	E2	1.20	1.30	1.40
Terminal Width	b	0.18	0.25	0.30
Terminal Length	L	0.25	0.35	0.45
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 is saw singulated
3. Dimensioning and tolerancing per ASME Y14.5M

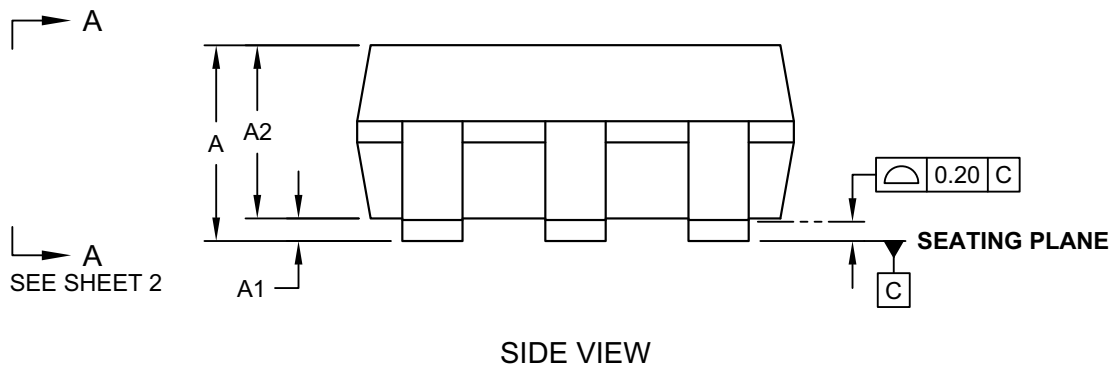
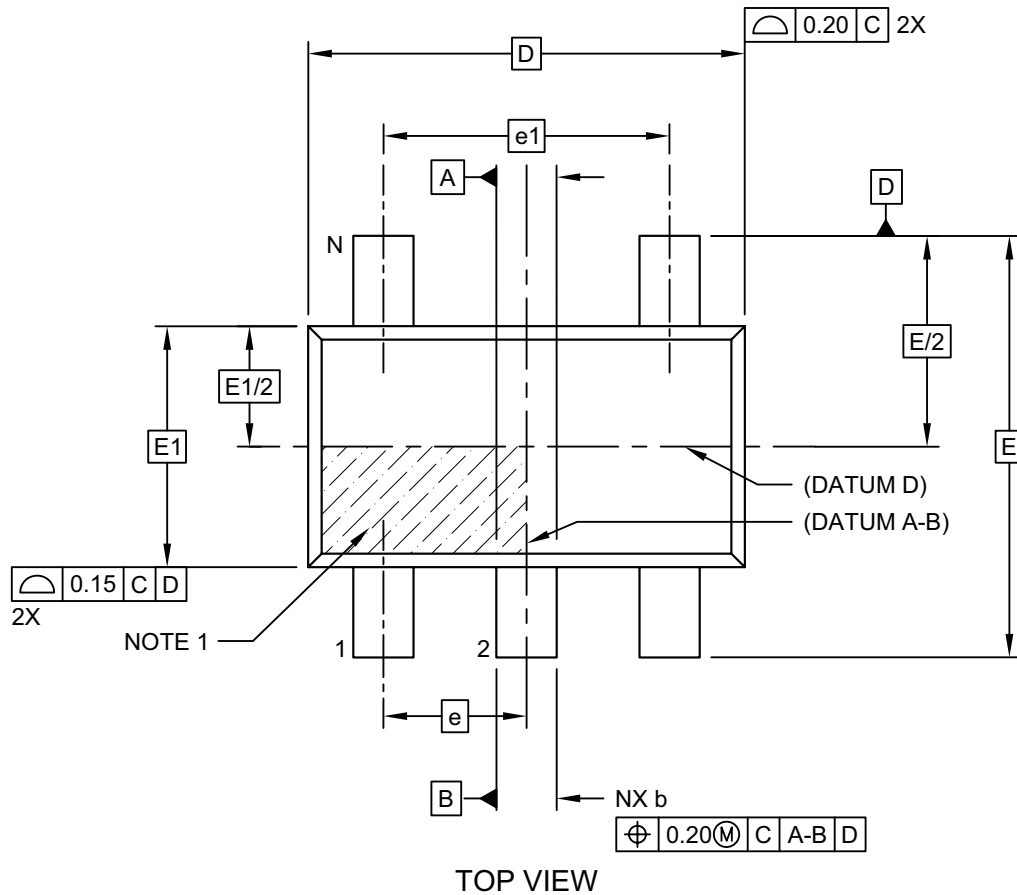
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

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

Microchip Technology Drawing C04-21355-Q4B Rev C Sheet 2 of 2

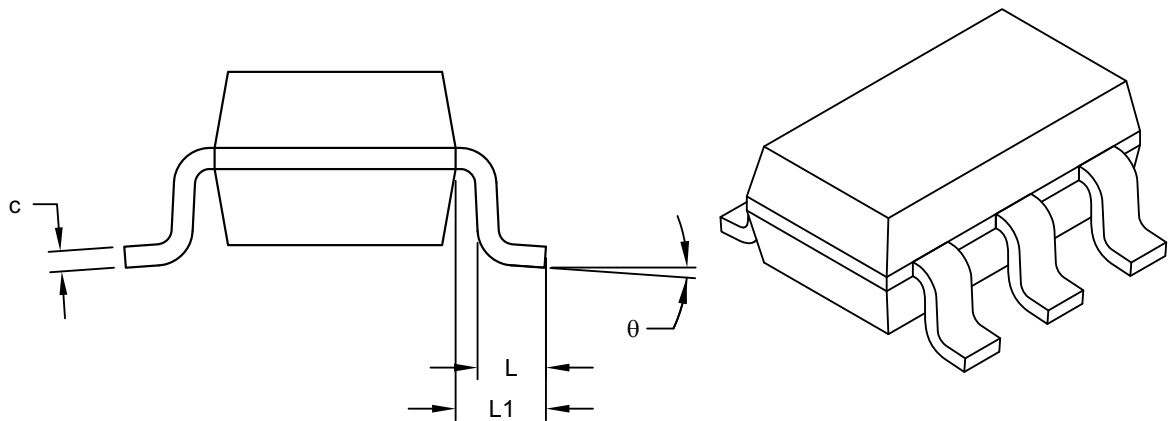
5-Lead Plastic Small Outline Transistor (OT) [SOT23]

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



5-Lead Plastic Small Outline Transistor (OT) [SOT23]

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



VIEW A-A
SHEET 1

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N	5		
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	-	1.30
Standoff	A1	-	-	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	-	0.60
Footprint	L1	0.60 REF		
Foot Angle	φ	0°	-	10°
Lead Thickness	c	0.08	-	0.26
Lead Width	b	0.20	-	0.51

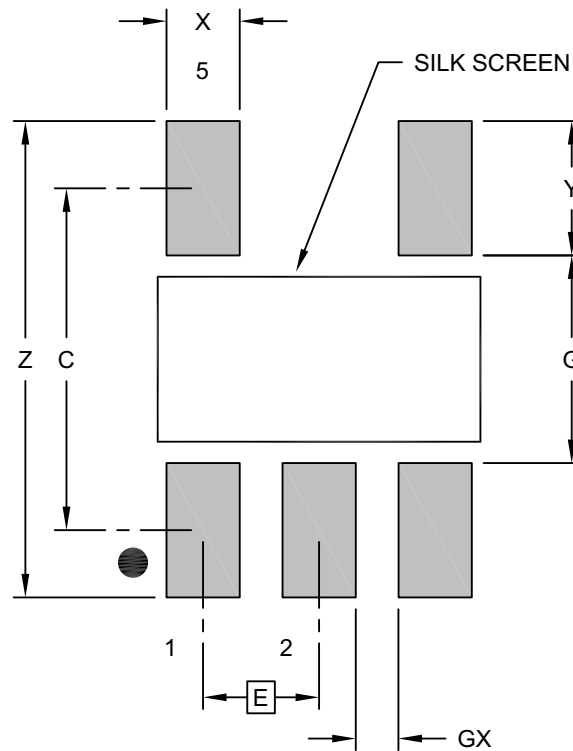
Notes:

- Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.25mm per side.
- 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 C04-091-OT Rev F Sheet 2 of 2

5-Lead Plastic Small Outline Transistor (OT) [SOT23]

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 (X5)	X			0.60
Contact Pad Length (X5)	Y			1.10
Distance Between Pads	G	1.70		
Distance Between Pads	GX	0.35		
Overall Width	Z			3.90

Notes:

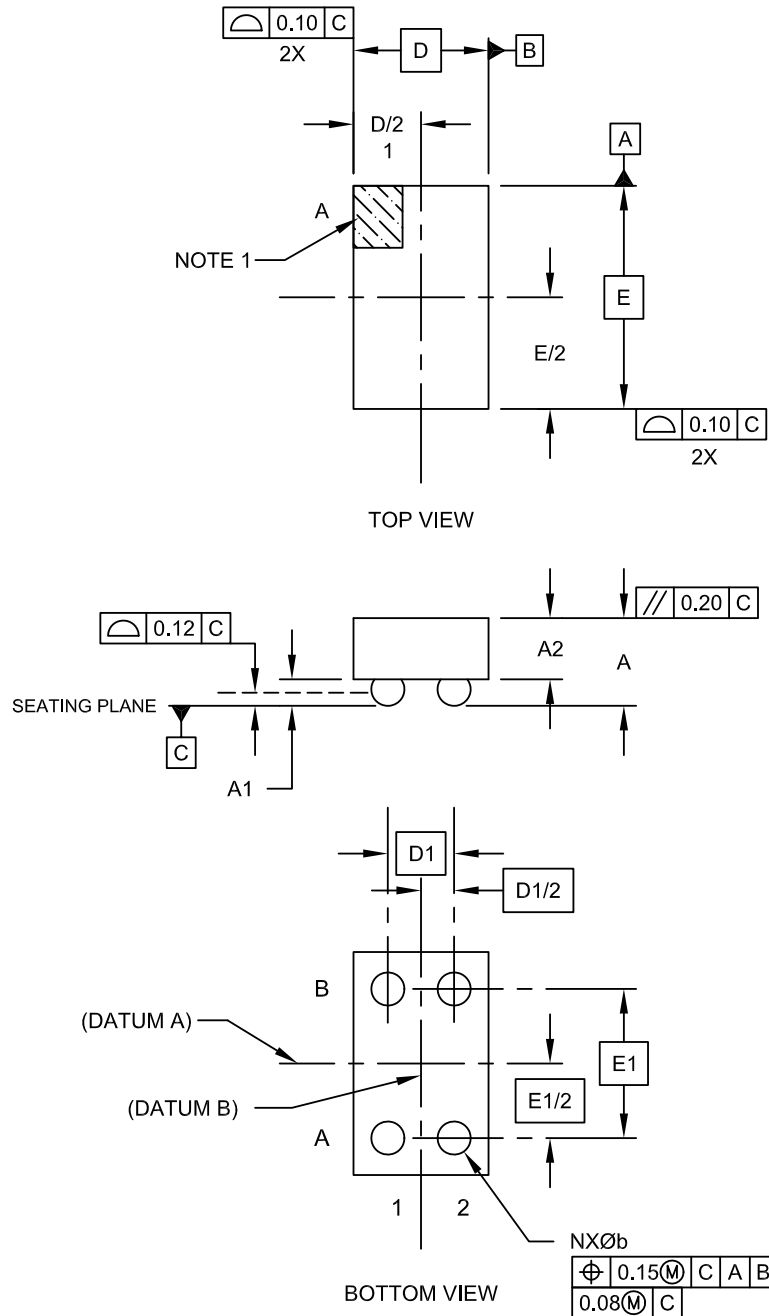
1. Dimensioning and tolerancing per ASME Y14.5M

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

Microchip Technology Drawing No. C04-2091-OT Rev F

4-Lead Chip Scale Package (CS) - [CSP]

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

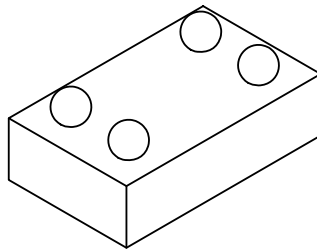


Microchip Technology Drawing C04-6008A Sheet 1 of 2

24AA08/24LC08B/24FC08

4-Lead Chip Scale Package (CS) - [CSP]

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 Contacts	N		4	
Adjacent Column X-Pitch	D1	0.400 BSC		
Adjacent Row Y-Pitch	E1	0.900 BSC		
Overall Height	A	0.47	0.51	0.55
Die Height	A2	0.33	0.35	0.37
Bump Height	A1	0.14	0.16	0.18
Overall Width	D	NOTE 4		
Overall Length	E	NOTE 4		
Ball Diameter	b	0.18	0.20	0.22

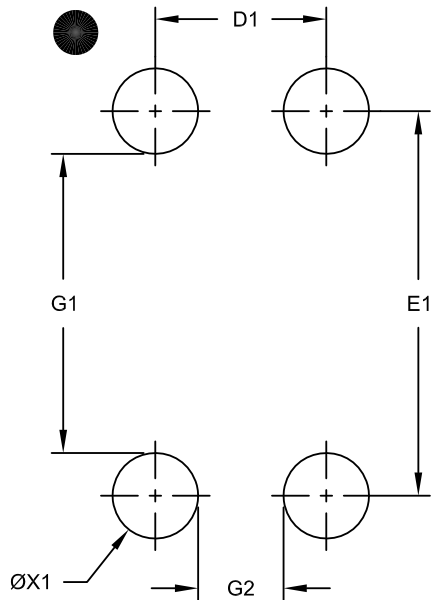
Notes:

1. Orientation reference feature may vary, but must be located within the hatched area.
2. Package is saw singulated.
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.
4. Package size varies with specific devices. Please see the specific Product Data Sheet.

Microchip Technology Drawing C04-6008A Sheet 2 of 2

4-Lead Chip Scale Package (CS) - [CSP]

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
Number of Contacts	N	4		
Contact Pad Spacing	D1		0.40	
Contact Pad Spacing	E1		0.90	
Contact Pad Diameter (X4)	ØX1		0.20	
Distance Between Pads	G1		0.70	
Distance Between Pads	G2		0.20	

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

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

Microchip Technology Drawing No. C04-8008A

APPENDIX A: REVISION HISTORY

Revision M (03/2021)

Replaced terminology “Master” and “Slave” with “Host” and “Client” respectively. Changed “MUY” with “Q4B” part number for UDFN package. Updated TSSOP and UDFN package drawings. Added Automotive Product Identification System.

Revision L (12/2019)

Added the 24FC08 device; Updated Package Drawings; Updated formatting throughout for clarification.

Revision K (03/2012)

Added Chip Scale package; Revised Table 1-1, Table 2-1; Product Identification System.

Revision J (02/2009)

Moved Pin Descriptions to Section 2.0, renumbered remaining sections. Added Figure 5-2.

Revision H (03/2008)

Added TDFN package.

Revision G (02/2007)

Replaced Package Drawings.

Revision F (02/2007)

Updated Device Selection Table; Features section; Changed 1.8V to 1.7V throughout document; Revised Electrical Characteristics Ambient Temperature; Replaced Package Drawings; Revised Product ID System.

Revision E (09/2005)

Revised Figure 3-1: Control Byte Allocation; Figure 4-1 Byte Write; Figure 4-2 Page Write; Section 6.0 Write Protection; Figure 7-1 Current Address Read; Figure 7-2 Random Read; Figure 7-3 Sequential Read; 8.3 Write-Protect (000-3FF).

Revision D (02/2005)

Added DFN package.

Revision C (12/2003)

Corrections to Section 1.0, Electrical Characteristics. Section 9.1, 24LC08B standard marking code.

THE MICROCHIP WEBSITE

Microchip provides online support via our website at www.microchip.com. This website is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the website 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 website at www.microchip.com. Under "Support", 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

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 (INDUSTRIAL)

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

<u>PART NO.</u>	<u>IXI</u> ⁽¹⁾	<u>-X</u>	<u>/XX</u>
Device	Tape and Reel Option	Temperature Range	Package
Device: 24AA08: = 1.7V, 8-Kbit I ² C Serial EEPROM 24LC08B: = 2.5V, 8-Kbit I ² C Serial EEPROM 24FC08: = 1.7V, High Speed, 8-Kbit I ² C Serial EEPROM			
Tape and Reel Option: Blank = Standard packaging (tube or tray) 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 Package – 2x3x0.9 mm Body, 8-lead (DFN) MS = Plastic Micro Small Outline Package, 8-lead (MSOP) P = Plastic Dual In-Line – 300 mil Body, 8-lead (PDIP) SN = Plastic Small Outline - Narrow, 3.90 mm Body, 8-lead (SOIC) OT = Plastic Small Outline Transistor, 5-lead (SOT-23) (Tape and Reel only) MNY = Plastic Dual Flat, No Lead Package - 2x3x0.8 mm Body, 8-lead (TDFN) ST = Plastic Thin Shrink Small Outline – 4.4 mm, 8-lead (TSSOP) Q4B = Plastic Dual Flat, No Lead Package - 2x3x0.6 mm Body, 8-lead (UDFN) CS16K ⁽²⁾ = Chip Scale, 4-lead (CSP)			
Examples: a) 24AA08-I/P: Industrial Temperature, 1.7V, PDIP package. b) 24AA08-I/SN: Industrial Temperature, 1.7V, SOIC package. c) 24AA08T-I/OT: Tape and Reel, Industrial Temperature, 1.7V, SOT-23 package. d) 24AA08T-I/CS16K: Tape and Reel, Industrial Temperature, 1.7V, Chip Scale package. e) 24LC08B-I/P: Industrial Temperature, 2.5V, PDIP package. f) 24LC08B-E/SN: Extended Temperature, 2.5V, SOIC package. g) 24LC08BT-I/OT: Tape and Reel, Industrial Temperature, 2.5V, SOT-23 package. h) 24AA08T-I/MNY: Tape and Reel, Industrial Temperature, 1.7V, TDFN package. i) 24FC08-I/SN: Industrial Temperature, 1.7V, SOIC package. j) 24FC08-E/ST: Extended Temperature, 1.7V, TSSOP package. k) 24FC08T-I/Q4B: Tape and Reel, Industrial Temperature, 1.7V, UDFN 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: 16K indicates 160K technology.			

PRODUCT IDENTIFICATION SYSTEM (AUTOMOTIVE)

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

<u>PART NO.</u>	<u>IXI</u> ⁽¹⁾	<u>X</u>	<u>XX</u>	<u>XXX</u> ^(2,3)	
Device	Tape and Reel Option	Temperature Range	Package	Variant	
Device: 24AA08: = 1.7V, 8Kbit I ² C Serial EEPROM 24LC08B: = 2.5V, 8Kbit I ² C Serial EEPROM					
Tape and Reel Option: Blank = Standard packaging (tube or tray) T = Tape and Reel ⁽¹⁾					
Temperature Range: I = -40°C to +85°C AEC-Q100 Grade 3 E = -40°C to +125°C AEC-Q100 Grade 1					
Package: OT = Plastic Small Outline Transistor, 5-Lead (SOT-23) (Tape and Reel Only) SN = Plastic Small Outline – Narrow, 3.90 mm Body, 8-Lead (SOIC) MS = Plastic Micro Small Outline Package, 8-Lead (MSOP)					
Variant^(2,3): 15KVAO =Standard Automotive, 15K Process ⁽⁴⁾ 15KVXX =Customer-Specific Automotive, 15K Process ⁽⁴⁾ 16KVAO =Standard Automotive, 16K Process 16KVXX =Customer-Specific Automotive, 16K Process					
					Examples: a) 24LC08BT-I/MS16KVAO: Tape and Reel, Automotive Grade 3, 2.5V, MSOP Package. b) 24LC08B-E/SN16KVAO: Automotive Grade 1, 2.5V, SOIC Package. c) 24LC08BT-E/OT16KVAO: Tape and Reel, Automotive Grade 1, 2.5V, SOT-23 Package. d) 24LC08BT-E/SN16KVAO: Tape and Reel, Automotive Grade 1, 2.5V 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. 4: Not recommended for new designs.

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

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods being used in attempts to breach the code protection features of the Microchip devices. We believe that these methods require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Attempts to breach these code protection features, most likely, cannot be accomplished without violating Microchip's intellectual property rights.
- Microchip is willing to work with any customer who is concerned about the integrity of its code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is "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 is provided for the sole purpose of designing with and using Microchip products. Information 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.

THIS INFORMATION IS PROVIDED BY MICROCHIP "AS IS". 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 ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE OR WARRANTIES RELATED TO ITS CONDITION, QUALITY, OR PERFORMANCE.

IN NO EVENT WILL MICROCHIP BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL OR CONSEQUENTIAL LOSS, DAMAGE, COST OR EXPENSE OF ANY KIND WHATSOEVER RELATED TO THE INFORMATION OR ITS USE, HOWEVER CAUSED, EVEN IF MICROCHIP HAS BEEN ADVISED OF THE POSSIBILITY OR THE DAMAGES ARE FORESEEABLE. TO THE FULLEST EXTENT ALLOWED BY LAW, MICROCHIP'S TOTAL LIABILITY ON ALL CLAIMS IN ANY WAY RELATED TO THE INFORMATION OR ITS USE WILL NOT EXCEED THE AMOUNT OF FEES, IF ANY, THAT YOU HAVE PAID DIRECTLY TO MICROCHIP FOR THE INFORMATION. Use of Microchip devices in life support and/or safety applications is entirely at the buyer's risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Trademarks

The Microchip name and logo, the Microchip logo, Adaptec, AnyRate, AVR, AVR logo, AVR Freaks, BesTime, BitCloud, chipKIT, chipKIT logo, CryptoMemory, CryptoRF, dsPIC, FlashFlex, flexPWR, HELDO, IGLOO, JukeBlox, KeeLoq, Kleer, LANCheck, LinkMD, maXStylus, maXTouch, MediaLB, megaAVR, Microsemi, Microsemi logo, MOST, MOST logo, MPLAB, OptoLyzer, PackTime, PIC, picoPower, PICSTART, PIC32 logo, PolarFire, Prochip Designer, QTouch, SAM-BA, SenGenuity, SpyNIC, SST, SST Logo, SuperFlash, Symmetricom, SyncServer, Tachyon, TimeSource, tinyAVR, UNI/O, Vectron, and XMEGA are registered trademarks of Microchip Technology Incorporated in the U.S.A. and other countries.

AgileSwitch, APT, ClockWorks, The Embedded Control Solutions Company, EtherSynch, FlashTec, Hyper Speed Control, HyperLight Load, IntelliMOS, Libero, motorBench, mTouch, Powermite 3, Precision Edge, ProASIC, ProASIC Plus, ProASIC Plus logo, Quiet-Wire, SmartFusion, SyncWorld, Temux, TimeCesium, TimeHub, TimePictra, TimeProvider, WinPath, and ZL are registered trademarks of Microchip Technology Incorporated in the U.S.A.

Adjacent Key Suppression, AKS, Analog-for-the-Digital Age, Any Capacitor, AnyIn, AnyOut, Augmented Switching, BlueSky, BodyCom, CodeGuard, CryptoAuthentication, CryptoAutomotive, CryptoCompanion, CryptoController, dsPICDEM, dsPICDEM.net, Dynamic Average Matching, DAM, ECAN, Espresso T1S, EtherGREEN, IdealBridge, In-Circuit Serial Programming, ICSP, INICnet, Intelligent Paralleling, Inter-Chip Connectivity, JitterBlocker, maxCrypto, maxView, memBrain, Mindi, MiWi, MPASM, MPF, MPLAB Certified logo, MPLIB, MPLINK, MultiTRAK, NetDetach, Omniscient Code Generation, PICDEM, PICDEM.net, PICkit, PICtail, PowerSmart, PureSilicon, QMatrix, REAL ICE, Ripple Blocker, RTAX, RTG4, SAM-ICE, Serial Quad I/O, simpleMAP, SimpliPHY, SmartBuffer, SMART-I.S., storClad, SQI, SuperSwitcher, SuperSwitcher II, Switchtec, SynchroPHY, Total Endurance, TSHARC, USBCheck, VariSense, VectorBlox, VeriPHY, ViewSpan, WiperLock, XpressConnect, and ZENA 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.

The Adaptec logo, Frequency on Demand, Silicon Storage Technology, and Symmcom are registered trademarks of Microchip Technology Inc. in other countries.

GestIC is a registered trademark of Microchip Technology Germany II GmbH & Co. KG, a subsidiary of Microchip Technology Inc., in other countries.

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

© 2002-2021, Microchip Technology Incorporated, All Rights Reserved.

ISBN: 978-1-5224-7683-2

For information regarding Microchip's Quality Management Systems, please visit www.microchip.com/quality.

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://www.microchip.com/support>
Web Address:
www.microchip.com

Atlanta
Duluth, GA
Tel: 678-957-9614
Fax: 678-957-1455

Austin, TX
Tel: 512-257-3370

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
Novi, MI
Tel: 248-848-4000

Houston, TX
Tel: 281-894-5983

Indianapolis
Noblesville, IN
Tel: 317-773-8323
Fax: 317-773-5453
Tel: 317-536-2380

Los Angeles
Mission Viejo, CA
Tel: 949-462-9523
Fax: 949-462-9608
Tel: 951-273-7800

Raleigh, NC
Tel: 919-844-7510

New York, NY
Tel: 631-435-6000

San Jose, CA
Tel: 408-735-9110
Tel: 408-436-4270

Canada - Toronto
Tel: 905-695-1980
Fax: 905-695-2078

ASIA/PACIFIC

Australia - Sydney
Tel: 61-2-9868-6733

China - Beijing
Tel: 86-10-8569-7000

China - Chengdu
Tel: 86-28-8665-5511

China - Chongqing
Tel: 86-23-8980-9588

China - Dongguan
Tel: 86-769-8702-9880

China - Guangzhou
Tel: 86-20-8755-8029

China - Hangzhou
Tel: 86-571-8792-8115

China - Hong Kong SAR
Tel: 852-2943-5100

China - Nanjing
Tel: 86-25-8473-2460

China - Qingdao
Tel: 86-532-8502-7355

China - Shanghai
Tel: 86-21-3326-8000

China - Shenyang
Tel: 86-24-2334-2829

China - Shenzhen
Tel: 86-755-8864-2200

China - Suzhou
Tel: 86-186-6233-1526

China - Wuhan
Tel: 86-27-5980-5300

China - Xian
Tel: 86-29-8833-7252

China - Xiamen
Tel: 86-592-2388138

China - Zhuhai
Tel: 86-756-3210040

ASIA/PACIFIC

India - Bangalore
Tel: 91-80-3090-4444

India - New Delhi
Tel: 91-11-4160-8631

India - Pune
Tel: 91-20-4121-0141

Japan - Osaka
Tel: 81-6-6152-7160

Japan - Tokyo
Tel: 81-3-6880-3770

Korea - Daegu
Tel: 82-53-744-4301

Korea - Seoul
Tel: 82-2-554-7200

Malaysia - Kuala Lumpur
Tel: 60-3-7651-7906

Malaysia - Penang
Tel: 60-4-227-8870

Philippines - Manila
Tel: 63-2-634-9065

Singapore
Tel: 65-6334-8870

Taiwan - Hsin Chu
Tel: 886-3-577-8366

Taiwan - Kaohsiung
Tel: 886-7-213-7830

Taiwan - Taipei
Tel: 886-2-2508-8600

Thailand - Bangkok
Tel: 66-2-694-1351

Vietnam - Ho Chi Minh
Tel: 84-28-5448-2100

EUROPE

Austria - Wels
Tel: 43-7242-2244-39
Fax: 43-7242-2244-393

Denmark - Copenhagen
Tel: 45-4485-5910
Fax: 45-4485-2829

Finland - Espoo
Tel: 358-9-4520-820

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

Germany - Garching
Tel: 49-8931-9700

Germany - Haan
Tel: 49-2129-3766400

Germany - Heilbronn
Tel: 49-7131-72400

Germany - Karlsruhe
Tel: 49-721-625370

Germany - Munich
Tel: 49-89-627-144-0
Fax: 49-89-627-144-44

Germany - Rosenheim
Tel: 49-8031-354-560

Israel - Ra'anana
Tel: 972-9-744-7705

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

Italy - Padova
Tel: 39-049-7625286

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

Norway - Trondheim
Tel: 47-7288-4388

Poland - Warsaw
Tel: 48-22-3325737

Romania - Bucharest
Tel: 40-21-407-87-50

Spain - Madrid
Tel: 34-91-708-08-90
Fax: 34-91-708-08-91

Sweden - Gothenberg
Tel: 46-31-704-60-40

Sweden - Stockholm
Tel: 46-8-5090-4654

UK - Wokingham
Tel: 44-118-921-5800
Fax: 44-118-921-5820