8M/16M-bit Serial Flash Memories with 2-pin NXS Interface

Features

- **Tailored for Portable and Mobile Media-Storage**
  - Ideal for portable/mobile applications that transfer and store data, audio (voice), or images
  - Removable Serial Flash Module package option
- ***NexFLASH*™ Non-Volatile Memory Technology**
  - Patented Single-Transistor EEPROM Cell
  - High-density, cost-effective, low-voltage/power
  - 10K/100K endurance, 10 years data retention
- **Flash Memory for Battery-Operation**
  - Single 5V or 3V supply for read, erase/write
  - Icc 15mA active with 1µA standby power
  - 5 mS erase/write times for efficient battery use
- **8/16-megabits of *NexFLASH* Serial Memory**
  - 2,048/4,096 sectors of 536 bytes each
  - Simple commands: reset, read, write, ready/busy
  - No pre-erase required, auto-erases before write
- **Two-pin *NXS* Serial Interface**
  - Saves µC-pins, simplifies PCB layout, low switching noise compared to parallel Flash
  - Supports clock operation as fast as 16MHz
  - Multi-device cascading, up to 16 devices
- **Development Tools and Accessories**
  - SFK-NXS Serial Flash Development Kit

General Description

The *NexFLASH*™ IS26F080A/26F160 Serial Flash Memory is tailored for portable/mobile media-storage applications that transfer and store data, audio and images (see fig. 1). Manufactured using ISSI's patented single transistor EE-NOR memory cell, the IS26F080A/26F160 provides a high-density, low-voltage, low-power, and cost effective solution for battery-operated non-volatile data storage requirements. The IS26F080A/26F160 can operate with a single 5V or 3V supply for read, write and erase. Power- consumption is very low due to µA stand-by current and fast erase/write performance (as fast as 5mS per sector) that minimizes power-on time, resulting in a highly efficient energy-per-transfer ratio. The IS26F080A /26F160 offers 8/16-megabits (8,781,824 / 17,563,648 bits) of flash memory organized as 2,048/4,096 sectors of 536 bytes each. Each sector is individually addressable through basic commands or control functions such as reset, read, erase/write, and ready/busy. The *NXS (NexFlash Serial)* two-wire serial interface is ideal for use with microcontrollers since it only requires two pins. This leaves pins normally used for parallel Flash free for other uses. The NXS interface supports clock rates as fast as 16MHz and allows for multi-device cascading of up to 16 devices. It also simplifies PC-board layout and generates less transient noise than parallel devices. Development is supported with the SFK-NXS Serial Flash Development Kit.

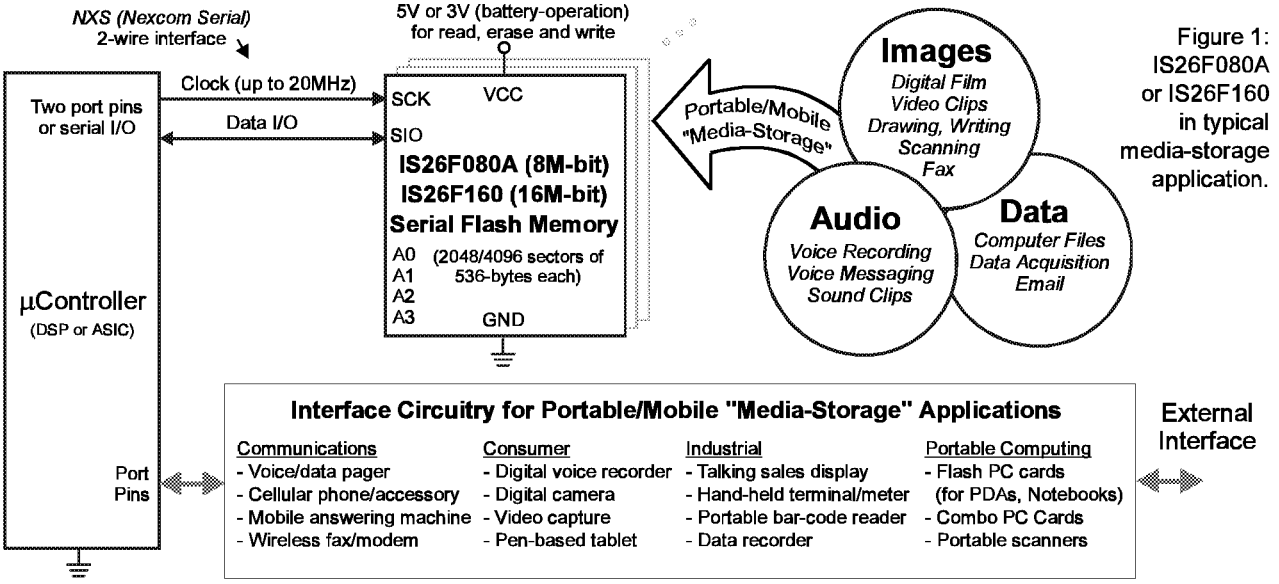
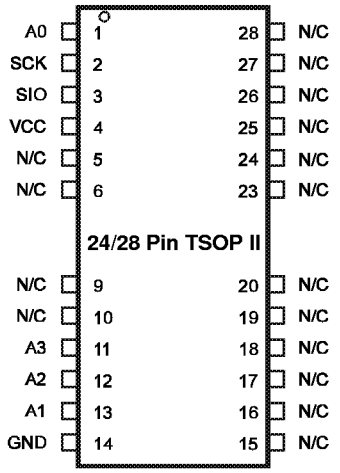


Figure 1: IS26F080A or IS26F160 in typical media-storage application.



Pin Name	Function
A0, A1, A2, A3	Device Address
SCK	Serial Clock
SIO	Serial Data I/O
VCC	Power Supply
GND	Ground
N/C	No Connect

Figure 2. IS26F080A/26F160 Pin Names and Diagram

Package and Pin Descriptions

Package Types

The IS26F080A/26F160 is available in a 24/28 pin TSOP II package (see fig. 2) or a removable Serial Flash Module (see Serial Flash Module data sheet for further information). Detailed package diagrams are provided at the end of this specification (see figures 12 and 13)

Power Supply Pins (Vcc and Gnd)

The 26F080A/26F160 supports single power supply read, erase, and write operations available in 5V and 3V Vcc versions. Active power requirements are as low as 15mA for 3V versions with standby current in the 1µA range.

NXS Serial Interface Pins (SCK and SIO)

The two-wire NXS (NexFlash Serial) interface includes a clock input pin (SCK) and a single bi-directional I/O pin for data (SIO). All data to or from the SIO pin is clocked relative to the rising edge of SCK. The two-wire NXS serial interface makes the 26F080A/26F160 an ideal solution for removable non-volatile storage. A simple edge connector or cable/connector with four contacts (SCK, SIO, Vcc, and Gnd) can support communications with space efficiency and reliability. The NXS interface can operate at clock rates up to 16MHz.

Device Address Pins (A0,A1,A2,A3)

There is no active chip-select on the 26F080A/26F160. Instead, four static device address pins (A0, A1, A2 and A3) are provided for decoding from 1 to 16 possible devices (see fig. 3). This allows a memory addressable range from 8/16-megabits or 1MB/2MB (1 device) to 128/256-megabits or 16MB/32MB (16 devices) on the same two-wire NXS interface. The static address pins (A0-A3) must be tied high or low to match the device address field (DA3-DA0) in the sector read and erase/write instruction sequences.

No Connect Pins (N/C)

The 26F080A/26F160 uses only a few signal pins. As a result the TSOP package has numerous no-connects (N/C) that have no electrical contact to the die.

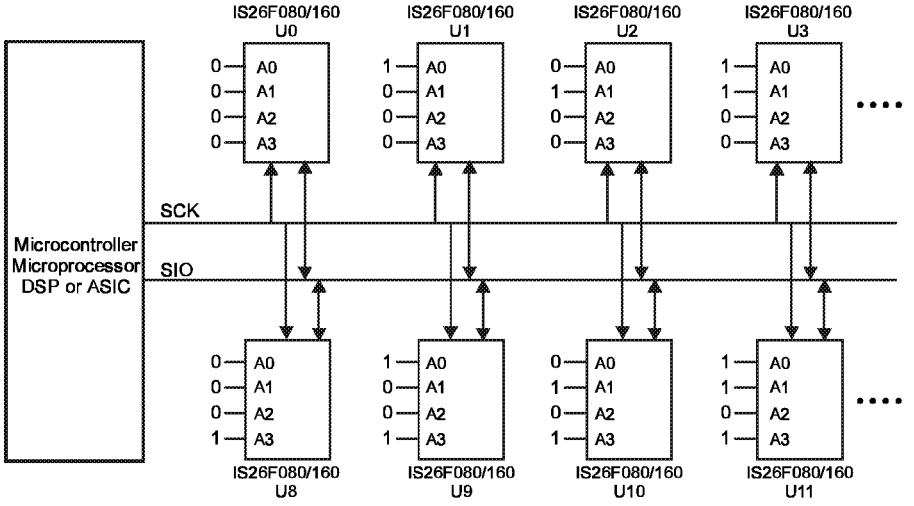


Figure 3: The IS26F080A/26F160 used in a multi-device configuration with up to 16-devices on the 2-wire NXS

Functional Overview

The *NexFLASH* IS26F080A/26F160 Serial Memory provides up to 8/16-megabits (17,563,648 bits) of non-volatile memory organized as 4,096 small sectors of 536 bytes (4,288 bits) each. (see fig. 4) Each sector is individually addressable using basic instruction sequences and control functions communicated through the devices 2-wire NXS interface.

Read and Erase/Write Instruction Sequences

The 26F080A/26F160 has two basic instruction sequences: read and erase/write. Unlike some other Flash technologies, the erase and write operations of the 26F080A/26F160 are performed together in single quick operation (as fast as 5mS per sector). Thus, pre-erase of the memory is not necessary.

Both read and erase/write instructions are made up of a series of serial bit fields that include command, sector address, device address, and sector data. The Read instruction sequence also allows the device to be polled for Ready/Busy status.

The instruction sequence format, flow charts, clocking diagrams for read and erase/write operations are shown in figures 6 and 7, figures 8 and 9, and figure 10 and 11, respectively. All data within an instruction sequence is clocked on the rising edge. All instruction sequence fields are ordered by most significant bit (MSB) first.

Reset and Idle

Upon power-up, and between read and erase/write instruction sequences, the device's internal control logic will be reset. This is accomplished by asserting the SCK pin low (to VIL) for greater than tRESET (~5µs to 10µs depending on the voltage version being used). Once reset, the device enters µA standby operation and will not wake-up until the next rising edge of SCK. After an initial rising SCK occurs the device becomes ready for a new instruction sequence. Full active power consumption starts after the correct device address is decoded during a read or write instruction sequence. To idle an instruction sequence between clocks, SCK must be kept high (at VIH) for as long as needed. Note that power will be in the active state when SCK is held high.

Device Initialization

After power-up it is recommended that the device information sector be read to electronically identify the device. The device information format contains a device ID that identifies the manufacturer, part number (memory size), and operating range. It also contains a list of any restricted sectors (see Sector Tag/Sync bytes). For further description of the 26F080A/26F160 device information format, see the 26Fxxx Series Application Note AN-1A from ISSI.

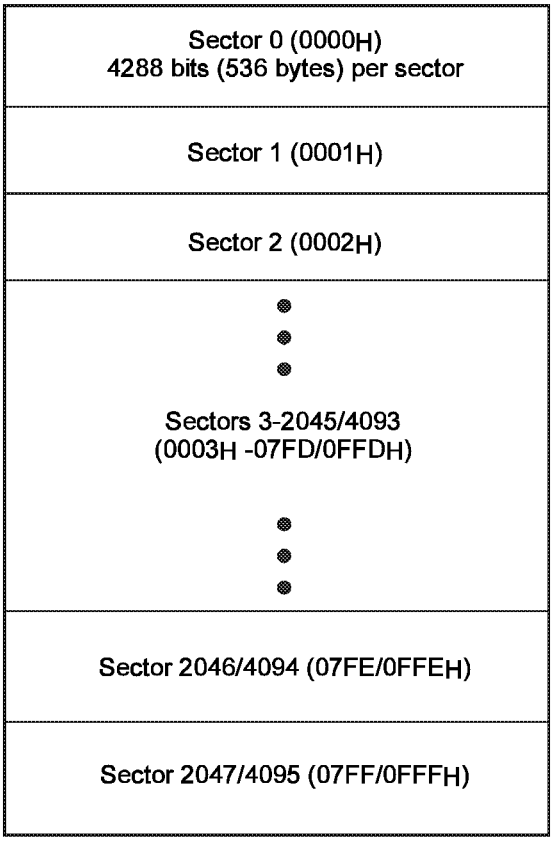


Figure 4. *NexFLASH* IS26F080A/26F160 array

As shown in figures 5 and 6, the address for the device information sector is 5FFFH for 26F080A and 2FFFH for the 26F160. The device information sector is a "read-only" sector. This assures that all device specific information, such as the restricted sector list, is maintained and never written over inadvertently.

For compatibility with applications that used the original 26F080 which does not have a separate device information sector, a copy of the device information sector is also provided in the last two sectors of the 26F080A/26F160 (0FFFH and 0FFEH.)

Ready/Busy Status

After a Erase/Write instruction sequence has been executed, the device will become Busy while it erases and writes the addressed sector's memory. This period of time will not exceed Twp (~ 5 or 30 milliseconds based on the specified power supply operating voltage). During this time the device can be tested for a Ready/Busy condition via a 16-bit status value obtained

in the Read instruction sequence. The Busy status condition (6666H) indicates that the device has not yet completed its write operation and will not accept read or write instructions. The Ready status condition (9999H) indicates that the device is available for further read or write operations. Note that a delay time of Trp (~30µs to 100µs depending on the voltage version being used) is required after the first low to high clock transition of the Ready/Busy status read.

Sector Tag/Sync Bytes

The first byte of each sector is pre-programmed during manufacturing with a Tag/Sync value of "C9H". Although the first byte of each sector can be changed, it is recommended that Tag/Sync value be maintained and incorporated as part of the application's sector formatting.

The Tag/Sync values serve two purposes. First, they provide a sync-detect that can help verify if the instruction sequence was clocked into the device properly. Secondly, they serve as a tag to identify a fully functional (valid) sector. This is especially important if "restricted sector" devices are used.

Restricted sector devices provide a more cost effective alternative to 26F080A/26F160 devices with 100% valid sectors. Restricted sector devices have a limited number of sectors (64 max. for the 26F080A/26F160) that do not meet manufacturing programming criteria over the specified operating range. When such a sector is detected, the first byte is tagged with a pattern other than "C9H". In addition to individual sector tagging, all restricted sectors for a given device are listed in the "device information format" (see Device Initialization).

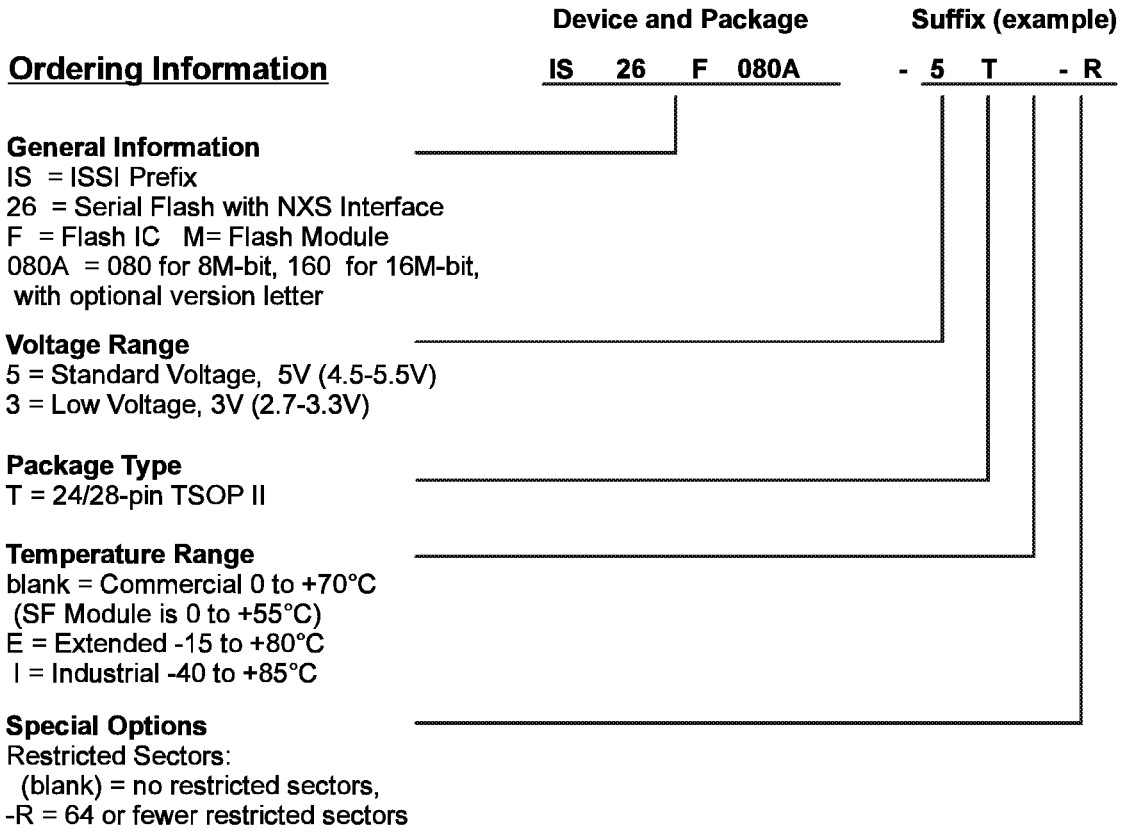


Figure: 5. IS26F080A/26F160 Ordering Information

(Not all possible device number combinations are available, contact ISSI for specific availability)

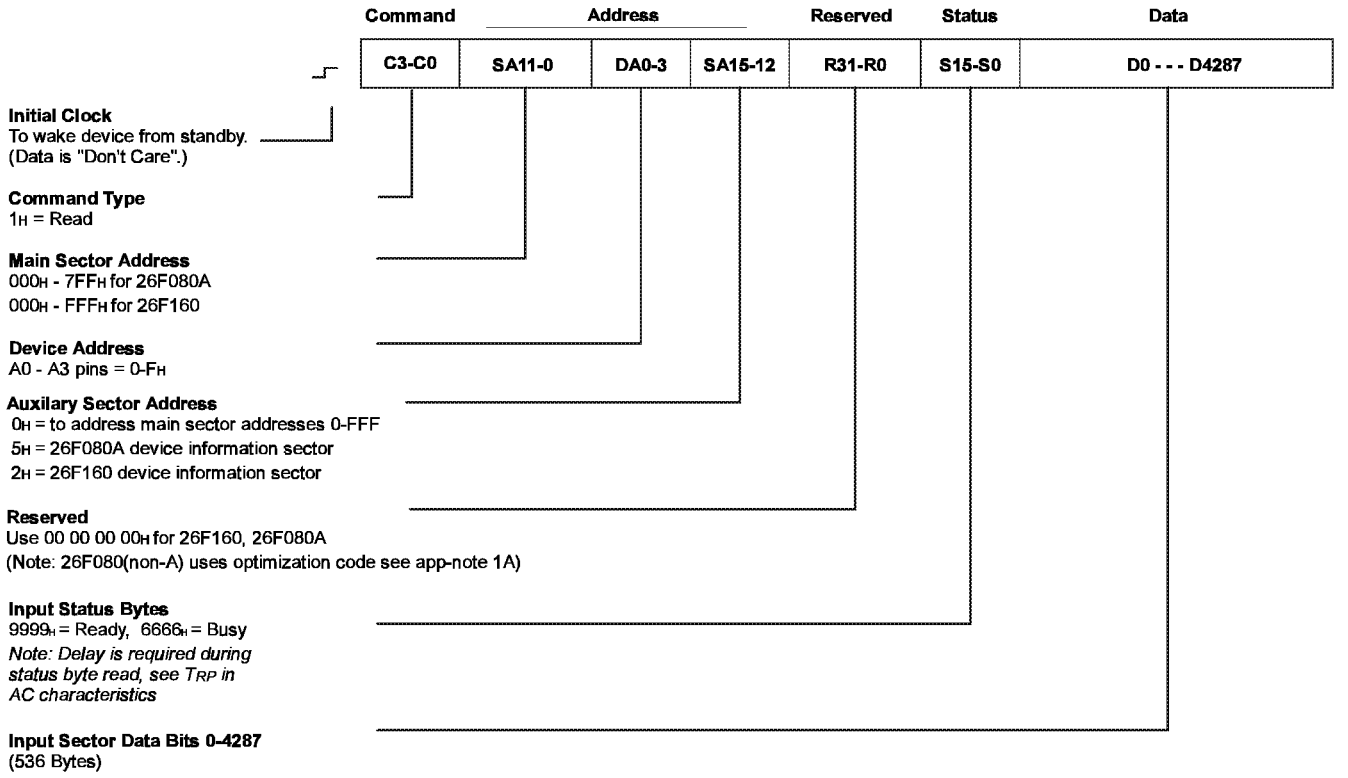


Figure 6. Sector Read Instruction - Sequence and Bit Format

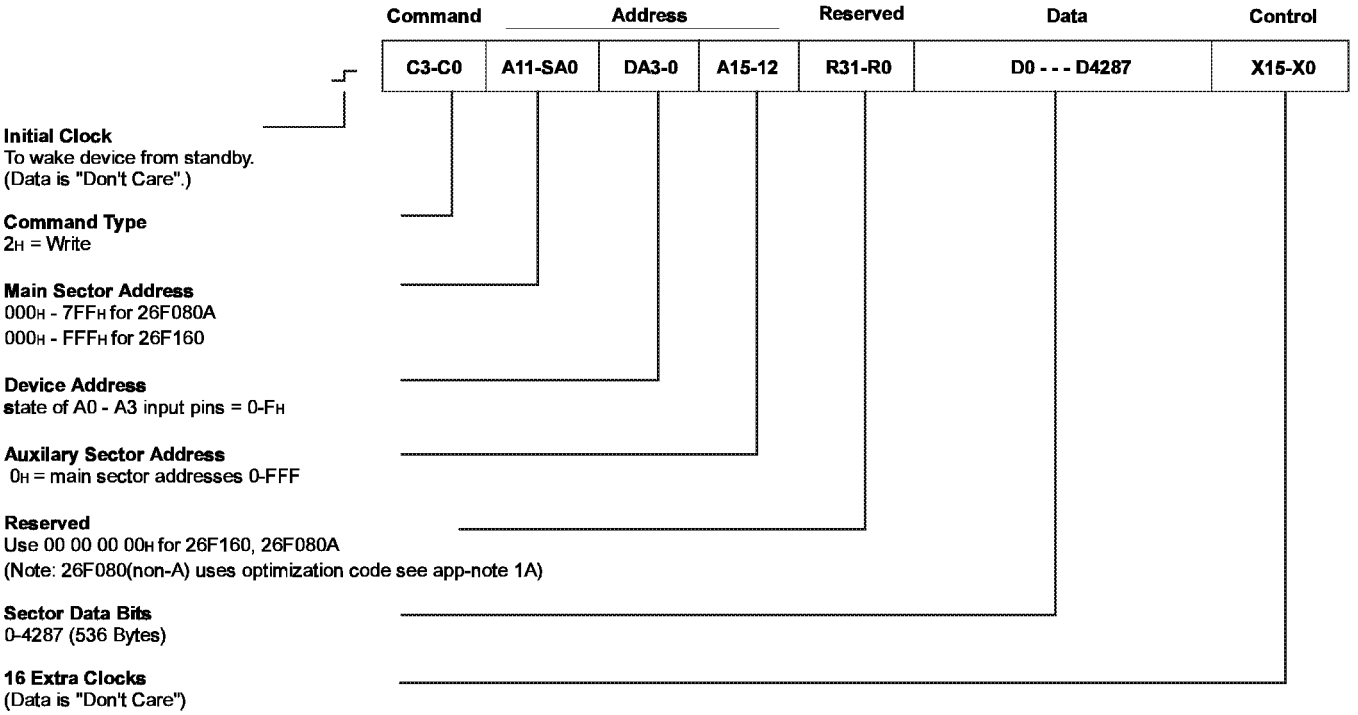


Figure 7. Sector Erase / Write Instruction - Sequence and Bit Format

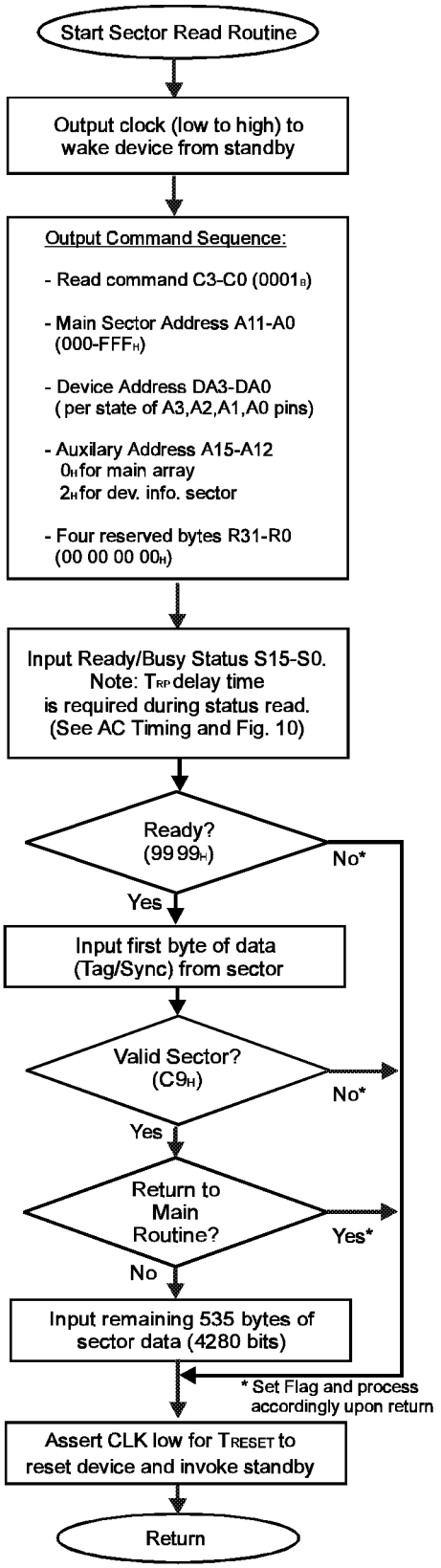


Figure 8. Sector Read Operation Flow Chart

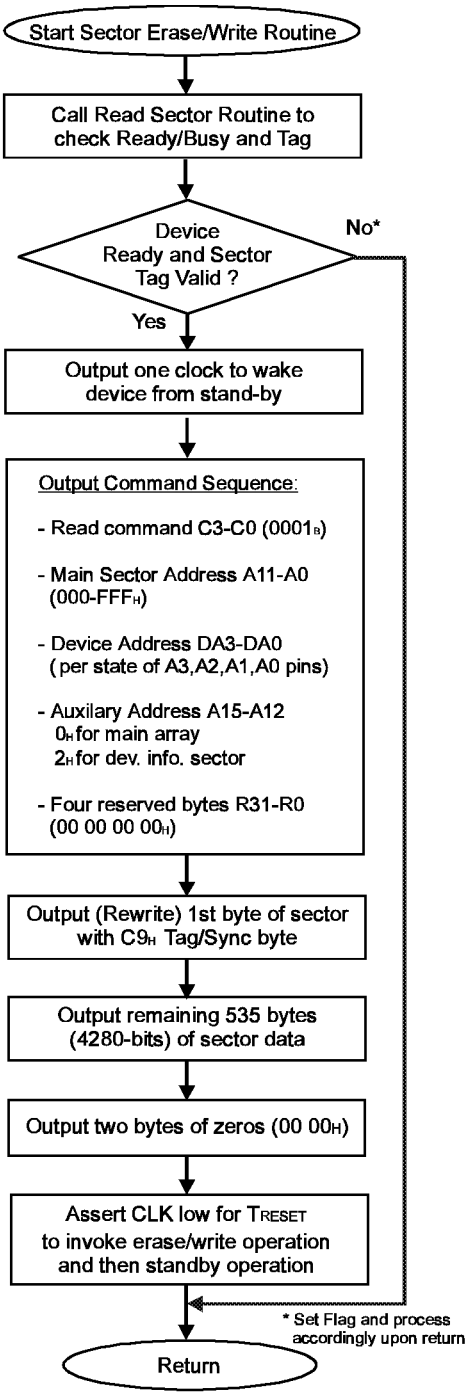


Figure 9. Sector Erase / Write Operation Flow Chart

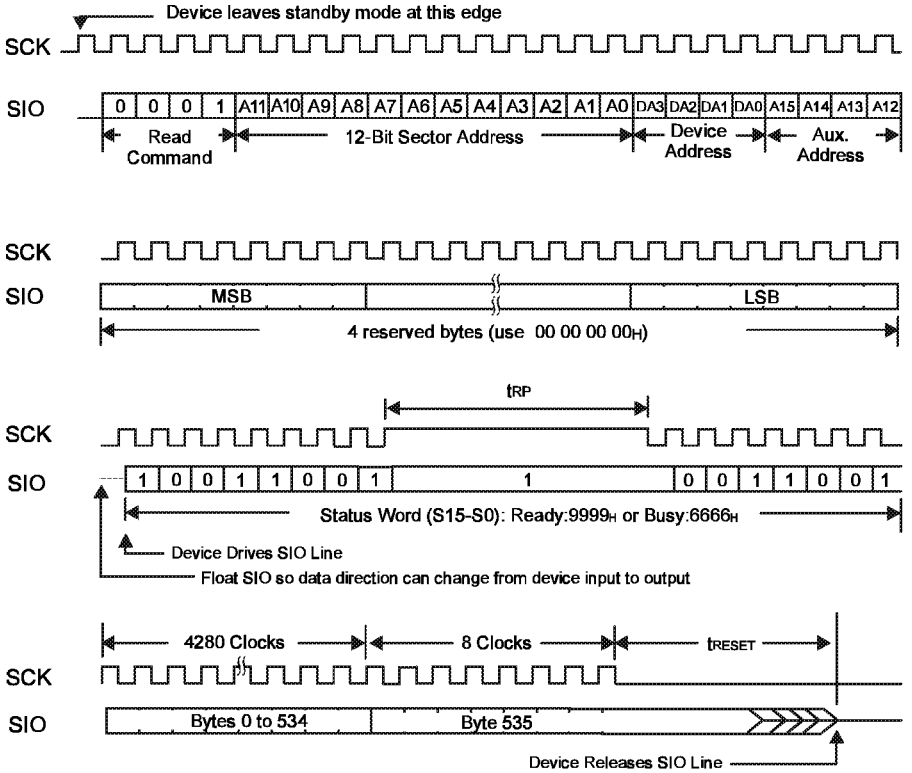


Figure 10. Read Instruction Sequence Clocking

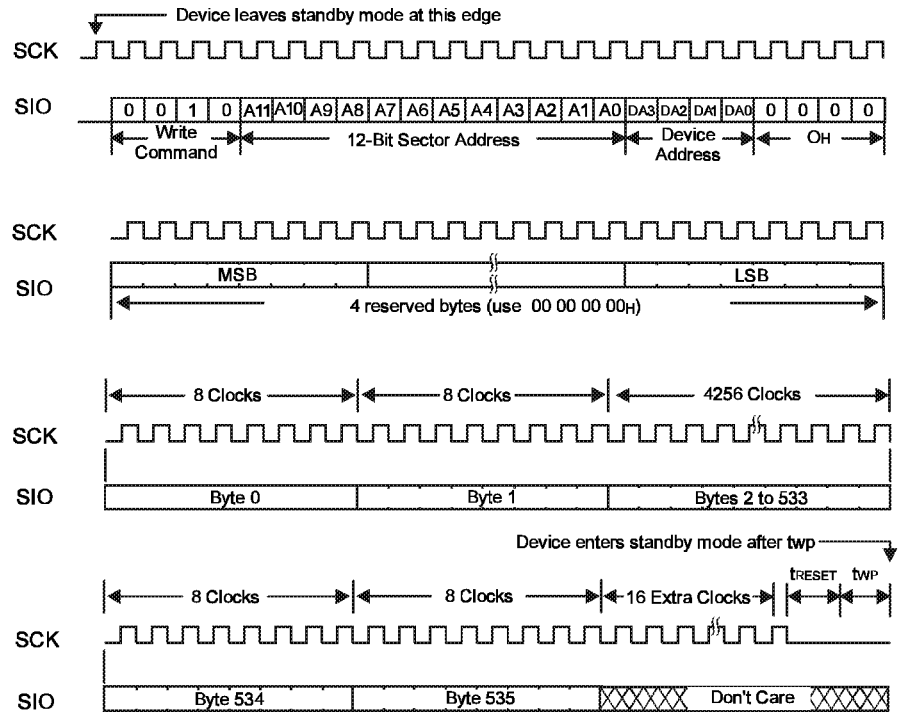


Figure 11. Erase / Write Instruction Sequence Clocking

Absolute Maximum Ratings

SYMBOL	PARAMETER	CONDITIONS	Range	UNIT
V_{CC}	Supply Voltage		0 - 7.0	V
V_I, V_O	Voltage Applied to Any Pin	Relative to Ground	-0.5 to V_{CC} + 0.6	V
T_{ST}	Storage Temperature		-65 to +150	°C
T_{LT}	Lead Temperature	Soldering 10 seconds	+300	°C

WARNING: This device has been designed and tested for the specified operation ranges. Proper operation outside of these levels is not guaranteed. Exposure beyond absolute maximum ratings (listed above) may cause permanent damage.

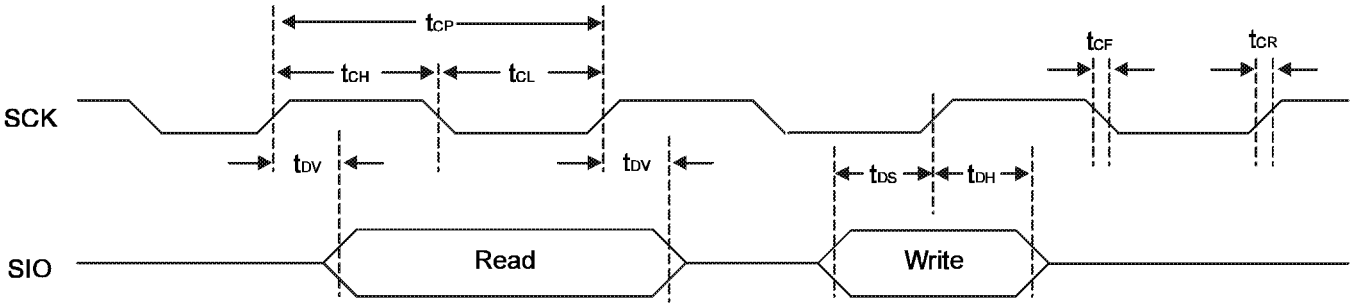
Operating Ranges *(preliminary)*

SYMBOL	PARAMETER	CONDITIONS	MIN	MAX	UNIT
V_{CC}	Supply Voltage	Standard Voltage 5.0V	4.5	5.5	V
		Low Voltage 3.0V (*1)	2.7	3.3	
TA	Ambient Temperature, operating	Commercial	0	+70	°C
		Extended	-15	+80	
		Industrial	-40	+85	

DC Electrical Characteristics *(preliminary)*

SYMBOL	PARAMETER	CONDITIONS		MIN	MAX	UNIT
V_{IL}	Input Low Voltage			-0.4	V_{CC} x 0.2	V
V_{IH}	Input High Voltage			V_{CC} x 0.6	V_{CC} +0.5	V
V_{OL}	Output Low Voltage	I_{OL} = 2mA V_{CC} = 4.5V			0.45	V
V_{OH}	Output High Voltage	I_{OH} = -400µA V_{CC} = 4.5V		2.4		V
V_{OLC}	Output Low Voltage CMOS [2]	V_{CC} = Min, I_{OL} = 10µA			0.15	V
V_{OHC}	Output High Voltage CMOS [2]	V_{CC} = Min, I_{OH} = -10µA		V_{CC} -0.3		V
I_{IL}	Input Leakage	0 < V_{IN} < V_{CC}			±10	µA
I_{OL}	I/O Leakage	0 < V_{IN} < V_{CC}			±10	µA
I_{CC} (active)	Active Power Supply Current [5]	f_{CLOCK} ≤ 8MHz (1/ t_{CP})	V_{CC} = 4.5 to 5.5V		30 (20 typ.)	mA
			V_{CC} = 2.7 to 3.3V		20 (15 typ.)	
I_{CC} (standby)	Standby Power Supply Current	SIO = 0V or Vcc, SCK = 0V			10 (<1 typ.)	µA
C_{IN}	Input Capacitance [2]	TA = 25°C, Vcc= 5V or 3V freq =1MHz			10	pF
C_{OUT}	Output Capacitance [2]				10	pF

Clock and Data Timing



AC Electrical Characteristics *(preliminary)*

SYMBOL	DESCRIPTION		5V-16MHz		3V- 8MHz		UNIT
			MIN	MAX	MIN	MAX	
t_{CP}	SCK period		62		125		ns
t_{CL}, t_{CH}	SCK high or low time		26		57		ns
t_{CR}	SCK rise time [3]			7		10	ns
t_{CF}	SCK fall time [3]			7		10	ns
t_{DS}	SIO set up time to SCK rising edge		40		100		ns
t_{DH}	SIO hold time from SCK rising edge		0		0		ns
t_{DV}	SIO valid after rising edge of SCK [4]	Vcc = 5V		60		70	ns
		3V				115	ns
t_{RESET}	SCK Low Duration for Valid Reset or Standby	Vcc = 5V	1.5	5	1.5	5	µs
		3V			3	10	
t_{RP}	Read Pre-Data Delay (see fig. 9)	Vcc = 5V	30		30		µs
		3V			100		
t_{WP}	Erase/Write Program Time (see fig. 10 and note 6)	Vcc = 5V		5		5	ms
		3V				30	

Notes:

1. Contact ISSI for availability of 5V 16MHz and 3V 8MHz (2.7-3.3V) devices.

2. Tested on a sample basis or specified via design or characterization data.

3. Test points are 10% and 90% points for Trise/fall times. All others timings are measured at 50% point.

4. With 50pf (8MHz) or 30pf (16/16MHz) load SIO to GND.

5. The device leaves "standby" power consumption after the clock transitions from low to high. Full "active" power consumption starts after the correct device address has been decoded during a sector read or write sequence.

6. The IS26F080A/0160 is designed for erase/write endurance of 10K cycles. Endurace in the range of 100K cyles can be obtained using ECC software methods like those provided in the SFK Serial Flash Development Kit.

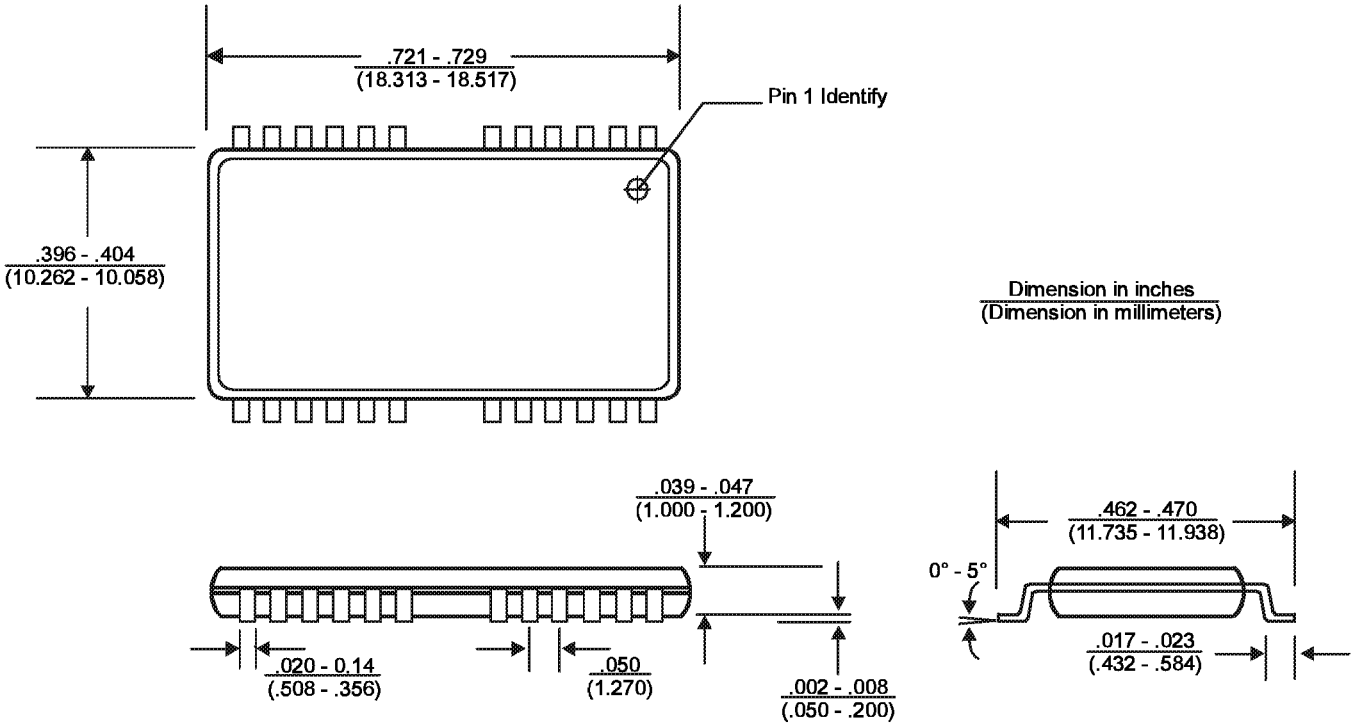


Figure 12. IS26F080A/26F160 24/28 TSOP II Package Dimensions

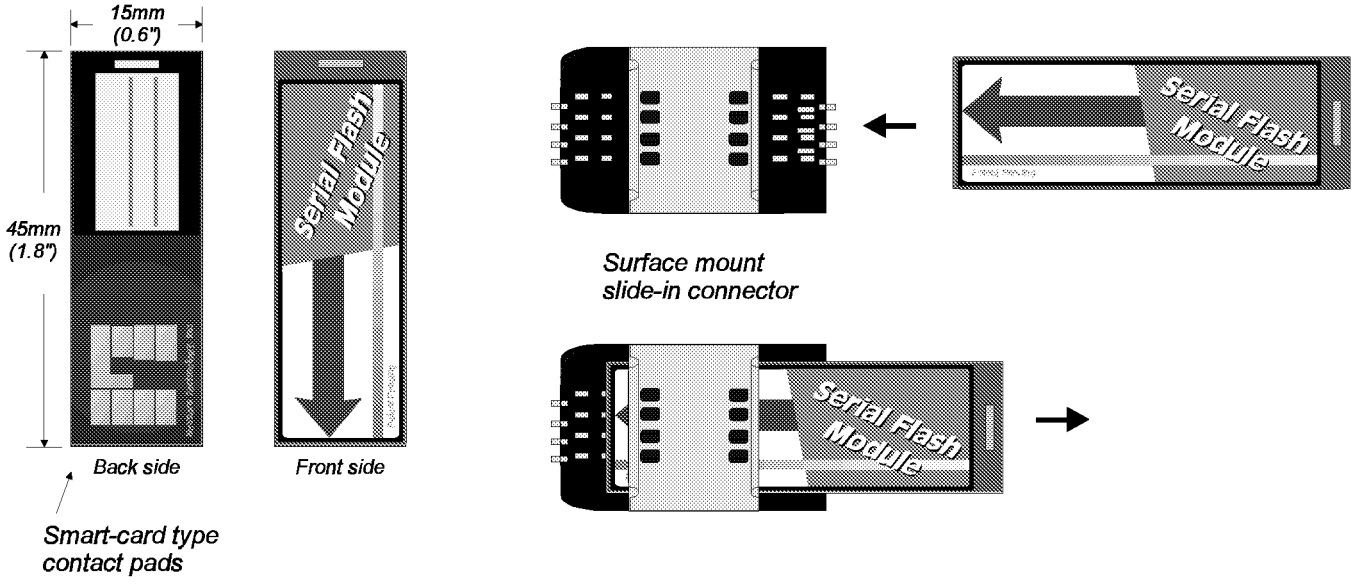


Figure 13. The IS26F080A/26F160 is available in a removable Serial Flash Module package (IS26M080/26M160). Serial Flash Modules offer a cost effective removable flash storage solution for applications limited in space, pins, and power. See the Serial Flash Module data sheet for further information.

Preliminary Designation:

The "Preliminary" designation on an ISSI data sheet indicates that the product is not fully characterized. The specifications are subject to change and are not guaranteed. ISSI or an authorized sales representative should be consulted for current information before using this product.

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(b) the user assumes all such risks; and

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Integrated Silicon Solution, Inc. (ISSI)

2231 Lawson Lane, Santa Clara, CA 95054-3311

Phone: 1-800 379-4774, Fax: (408) 588-0806

www.issiusa.com