



11AA010/11LC010
 11AA020/11LC020
 11AA040/11LC040

11AA080/11LC080
 11AA160/11LC160

1K-16K UNI/O[®] Serial EEPROM Family Data Sheet

Features:

- Single I/O, UNI/O[®] Serial Interface Bus
- Low-Power CMOS Technology
 - 1 mA active current, typical
 - 1 μ A standby current (max.) (I-temp)
- 128 x 8 through 2,048 x 8 Bit Organizations
- Schmitt Trigger Inputs for Noise Suppression
- Output Slope Control to Eliminate Ground Bounce
- 100 kbps Max. Bit Rate – Equivalent to 100 kHz Clock Frequency
- Self-Timed Write Cycle (including Auto-Erase)
- Page-Write Buffer for up to 16 Bytes
- STATUS Register for Added Control:
 - Write enable latch bit
 - Write-In-Progress bit
- Block Write Protection
 - Protect none, 1/4, 1/2 or all of array
- Built-in Write Protection
 - Power-on/off data protection circuitry
 - Write enable latch
- High Reliability
 - Endurance: 1,000,000 erase/write cycles
 - Data retention: > 200 years
 - ESD protection: > 4,000V
- 3-lead SOT-23 Package
- 8-lead PDIP, SOIC, MSOP, TDFN Packages
- Pb-Free and RoHS Compliant
- Available Temperature Ranges:
 - Industrial (I): -40°C to +85°C
 - Automotive (E): -40°C to +125°C

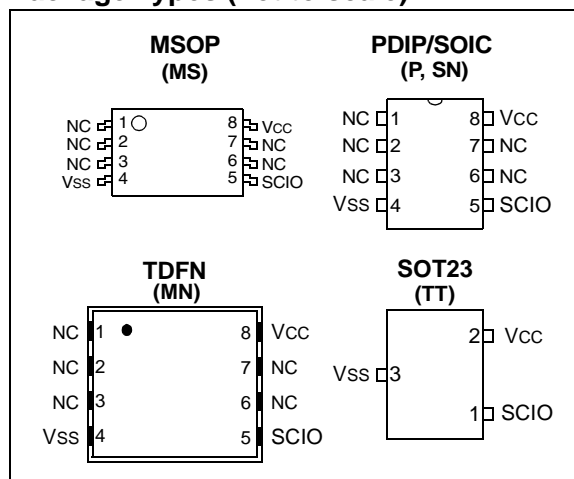
Description:

The Microchip Technology Inc. 11AAXXX/11LCXXX (11XX*) devices are a family of 1 Kbit through 16 Kbit Serial Electrically Erasable PROMs. The devices are organized in blocks of x8-bit memory and support the patented** single I/O UNI/O[®] serial bus. By using Manchester encoding techniques, the clock and data are combined into a single, serial bit stream (SCIO), where the clock signal is extracted by the receiver to correctly decode the timing and value of each bit.

Low-voltage design permits operation down to 1.8V (for 11AAXXX devices), with standby and active currents of only 1 μ A and 1 mA, respectively.

The 11XX family is available in standard packages including 8-lead PDIP and SOIC, and advanced packaging including 3-lead SOT-23, 8-lead TDFN, and 8-lead MSOP.

Package Types (not to scale)



Pin Function Table

| Name | Function |
|------|---------------------------------|
| SCIO | Serial Clock, Data Input/Output |
| Vss | Ground |
| Vcc | Supply Voltage |

* 11XX is used in this document as a generic part number for the 11 series devices.

** Microchip's UNI/O[®] Bus products are covered by the following patent issued in the U.S.A.: 7,376,020.

11AAXX/11LCXX

DEVICE SELECTION TABLE

| Part Number | Density (bits) | Organization | Vcc Range | Page Size (Bytes) | Temp. Ranges | Packages |
|-------------|----------------|--------------|-----------|-------------------|--------------|-------------------|
| 11LC010 | 1K | 128 x 8 | 2.5-5.5V | 16 | I,E | P, SN, MS, MN, TT |
| 11AA010 | 1K | 128 x 8 | 1.8-5.5V | 16 | I | P, SN, MS, MN, TT |
| 11LC020 | 2K | 256 x 8 | 2.5-5.5V | 16 | I,E | P, SN, MS, MN, TT |
| 11AA020 | 2K | 256 x 8 | 1.8-5.5V | 16 | I | P, SN, MS, MN, TT |
| 11LC040 | 4K | 512 x 8 | 2.5-5.5V | 16 | I,E | P, SN, MS, MN, TT |
| 11AA040 | 4K | 512 x 8 | 1.8-5.5V | 16 | I | P, SN, MS, MN, TT |
| 11LC080 | 8K | 1,024 x 8 | 2.5-5.5V | 16 | I,E | P, SN, MS, MN, TT |
| 11AA080 | 8K | 1,024 x 8 | 1.8-5.5V | 16 | I | P, SN, MS, MN, TT |
| 11LC160 | 16K | 2,048 x 8 | 2.5-5.5V | 16 | I,E | P, SN, MS, MN, TT |
| 11AA160 | 16K | 2,048 x 8 | 1.8-5.5V | 16 | I | P, SN, MS, MN, TT |

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings (†)

| | |
|-------------------------------------|--------------------------------|
| V _{CC} | 6.5V |
| SCIO w.r.t. V _{SS} | -0.6V to V _{CC} +1.0V |
| Storage temperature | -65°C to 150°C |
| Ambient temperature under bias..... | -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 an extended period of time may affect device reliability.

TABLE 1-1: DC CHARACTERISTICS

| DC CHARACTERISTICS | | | Electrical Characteristics: | | | |
|--------------------|-----------------------|---|--------------------------------|---------------------|----------------------------------|---|
| | | | Industrial (I): | | Automotive (E): | |
| Param. No. | Sym. | Characteristic | Min. | Max. | Units | Test Conditions |
| | | | V _{CC} = 2.5V to 5.5V | | T _A = -40°C to +85°C | |
| | | | V _{CC} = 1.8V to 2.5V | | T _A = -20°C to +85°C | |
| | | | V _{CC} = 2.5V to 5.5V | | T _A = -40°C to +125°C | |
| D1 | V _{IH} | High-level input voltage | 0.7*V _{CC} | V _{CC} +1 | V | |
| D2 | V _{IL} | Low-level input voltage | -0.3 | 0.3*V _{CC} | V | V _{CC} ≥ 2.5V |
| | | | -0.3 | 0.2*V _{CC} | V | V _{CC} < 2.5V |
| D3 | V _{HYS} | Hysteresis of Schmitt Trigger inputs (SCIO) | 0.05*V _{CC} | — | V | V _{CC} ≥ 2.5V (Note 1) |
| D4 | V _{OH} | High-level output voltage | V _{CC} -0.5 | — | V | I _{OH} = -300 μA, V _{CC} = 5.5V |
| | | | V _{CC} -0.5 | — | V | I _{OH} = -200 μA, V _{CC} = 2.5V |
| D5 | V _{OL} | Low-level output voltage | — | 0.4 | V | I _{OL} = 300 μA, V _{CC} = 5.5V |
| | | | — | 0.4 | V | I _{OL} = 200 μA, V _{CC} = 2.5V |
| D6 | I _O | Output current limit (Note 2) | — | ±4 | mA | V _{CC} = 5.5V (Note 1) |
| | | | — | ±3 | mA | V _{CC} = 2.5V (Note 1) |
| D7 | I _{LI} | Input leakage current (SCIO) | — | ±1 | μA | V _{IN} = V _{SS} or V _{CC} |
| D8 | C _{INT} | Internal Capacitance (all inputs and outputs) | — | 7 | pF | T _A = 25°C, F _{CLK} = 1 MHz, V _{CC} = 5.0V (Note 1) |
| D9 | I _{CC} Read | Read Operating Current | — | 3 | mA | V _{CC} =5.5V; F _{BUS} =100 kHz, C _B =100 pF |
| | | | — | 1 | mA | V _{CC} =2.5V; F _{BUS} =100 kHz, C _B =100 pF |
| D10 | I _{CC} Write | Write Operating Current | — | 5 | mA | V _{CC} = 5.5V |
| | | | — | 3 | mA | V _{CC} = 2.5V |
| D11 | I _{CCS} | Standby Current | — | 5 | μA | V _{CC} = 5.5V T _A = 125°C |
| | | | — | 1 | μA | V _{CC} = 5.5V T _A = 85°C |
| D12 | I _{CCI} | Idle Mode Current | — | 50 | μA | V _{CC} = 5.5V |

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

2: The SCIO output driver impedance will vary to ensure I_O is not exceeded.

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TABLE 1-2: AC CHARACTERISTICS

| AC CHARACTERISTICS | | | Electrical Characteristics: | | | |
|--------------------|--------|---|-----------------------------|---------|--------------------|--|
| | | | Industrial (I): | | VCC = 2.5V to 5.5V | TA = -40°C to +85°C |
| | | | | | VCC = 1.8V to 2.5V | TA = -20°C to +85°C |
| | | | Automotive (E): | | VCC = 2.5V to 5.5V | TA = -40°C to +125°C |
| Param. No. | Sym. | Characteristic | Min. | Max. | Units | Test Conditions |
| 1 | FBUS | Serial bus frequency | 10 | 100 | kHz | — |
| 2 | TE | Bit period | 10 | 100 | μs | — |
| 3 | TIJIT | Input edge jitter tolerance | — | ±0.08 | UI | (Note 3) |
| 4 | FDRIFT | Serial bus frequency drift rate tolerance | — | ±0.75 | % per byte | — |
| 5 | FDEV | Serial bus frequency drift limit | — | ±5 | % per command | — |
| 6 | TOJIT | Output edge jitter | — | ±0.25 | UI | (Note 3) |
| 7 | TR | SCIO input rise time (Note 1) | — | 100 | ns | — |
| 8 | TF | SCIO input fall time (Note 1) | — | 100 | ns | — |
| 9 | TSTBY | Standby pulse time | 600 | — | μs | — |
| 10 | TSS | Start header setup time | 10 | — | μs | — |
| 11 | THDR | Start header low pulse time | 5 | — | μs | — |
| 12 | TSP | Input filter spike suppression (SCIO) | — | 50 | ns | (Note 1) |
| 13 | TWC | Write cycle time (byte or page) | — | 5 10 | ms ms | Write, WRSR commands ERAL, SETAL commands |
| 14 | — | Endurance (per page) | 1M | — | cycles | 25°C, VCC = 5.5V (Note 2) |

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

Note 2: This parameter is not tested but ensured by characterization. For endurance estimates in a specific application, please consult the Total Endurance™ Model which can be obtained on Microchip's web site:

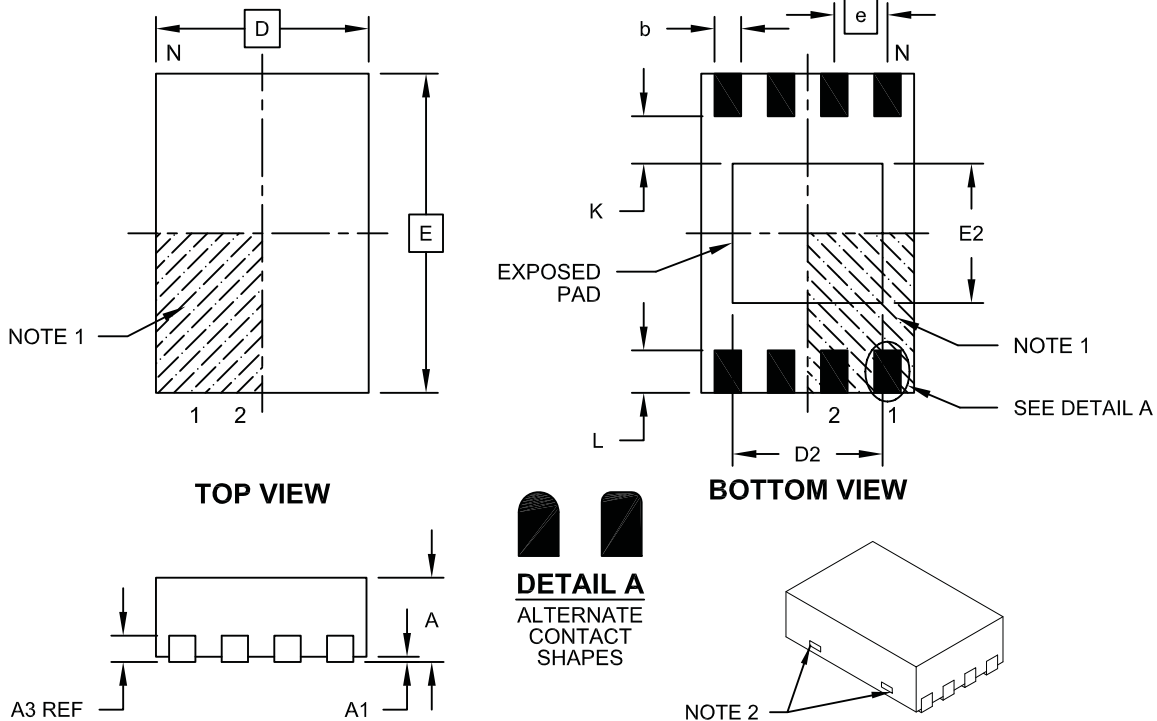
Note 3: A Unit Interval (UI) is equal to 1-bit period (TE) at the current bus frequency.

TABLE 1-3: AC TEST CONDITIONS

| AC Waveform: | |
|------------------------------------|---------|
| VLO = 0.2V | |
| VHI = VCC - 0.2V | |
| CL = 100 pF | |
| Timing Measurement Reference Level | |
| Input | 0.5 VCC |
| Output | 0.5 VCC |

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8-Lead Plastic Dual Flat, No Lead Package (MN) – 2x3x0.75 mm Body [TDFN]



| Dimension | Units | MILLIMETERS | | |
|------------------------|-------|-------------|------|------|
| | | 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 | 1.20 | - | 1.60 |
| Exposed Pad Width | E2 | 1.20 | - | 1.60 |
| 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:

- 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 No. C04-129B

PRODUCT IDENTIFICATION SYSTEM

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

| <u>PART NO.</u> | X | — | X | /XXX |
|---|-------------|---|-------------------|---|
| Device | Tape & Reel | | Temperature Range | Package |
| <p>Device:</p> <p>11AA010 = 1 Kbit, 1.8V UNI/O Serial EEPROM 11LC010 = 1 Kbit, 2.5V UNI/O Serial EEPROM 11AA020 = 2 Kbit, 1.8V UNI/O Serial EEPROM 11LC020 = 2 Kbit, 2.5V UNI/O Serial EEPROM 11AA040 = 4 Kbit, 1.8V UNI/O Serial EEPROM 11LC040 = 4 Kbit, 2.5V UNI/O Serial EEPROM 11AA080 = 8 Kbit, 1.8V UNI/O Serial EEPROM 11LC080 = 8 Kbit, 2.5V UNI/O Serial EEPROM 11AA160 = 16 Kbit, 1.8V UNI/O Serial EEPROM 11LC160 = 16 Kbit, 2.5V UNI/O Serial EEPROM</p> | | | | |
| <p>Tape & Reel:</p> <p>T = Tape and Reel Blank = Tube</p> | | | | |
| <p>Temperature Range:</p> <p>I = -40°C to +85°C (Industrial) E = -40°C to +125°C (Extended)</p> | | | | |
| <p>Package:</p> <p>P = 8-lead Plastic DIP (300 mil body) SN = 8-lead Plastic SOIC (3.90 mm body) MS = 8-lead Plastic Micro Small Outline (MSOP) MNY⁽¹⁾ = 8-lead 2x3 mm TDFN TT = 3-lead SOT 23 (Tape and Reel only)</p> | | | | |
| <p>Note 1: "Y" indicates a Nickel Palladium Gold (NiPdAu) finish.</p> | | | | |
| | | | | <p>Examples:</p> <p>a) 11AA010-I/P = 1 Kbit, 1.8V Serial EEPROM, Industrial temp., PDIP package b) 11LC160T-E/TT = 16 Kbit, 2.5V Serial EEPROM, Extended temp., Tape & Reel, SOT-23 package c) 11AA080-I/MS = 8 Kbit, 1.8V Serial EEPROM, Industrial temp., MSOP package d) 11LC020T-I/SN = 2 Kbit, 2.5V Serial EEPROM, Industrial temp., Tape & Reel, SOIC package e) 11AA040T-I/MNY = 4 Kbit, 1.8V Serial EEPROM, Industrial temp., Tape and Reel, 2x3 mm TDFN package, Nickel Palladium Gold finish</p> |