



# MX23L1610

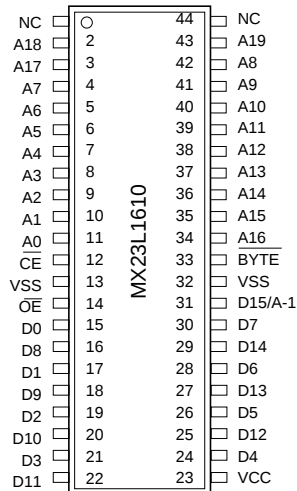
## 3.3 Volt 16-Mbit (2M x 8 / 1M x 16) Mask ROM

### FEATURES

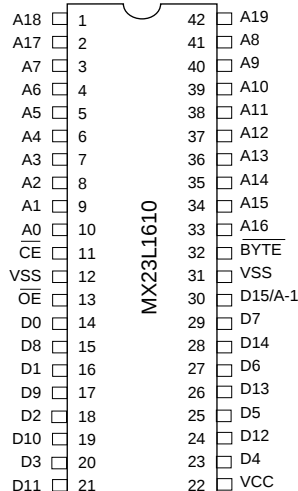
- Bit organization
  - 2M x 8 (byte mode)
  - 1M x 16 (word mode)
- Fast access time
  - 70ns (max.)@3.3V±10%
- Current
  - Operating:25mA
  - Standby:15uA
- Supply voltage
  - 3.0V ~ 3.6V
- Package
  - 44 pin SOP (500mil)
  - 42 pin DIP (600mil)
  - 48 pin TSOP (12mm x 20mm)
  - 44 pin TSOP (Type II)

### PIN CONFIGURATION

#### 44 SOP/44 TSOP



#### 42 PDIP



### ORDER INFORMATION

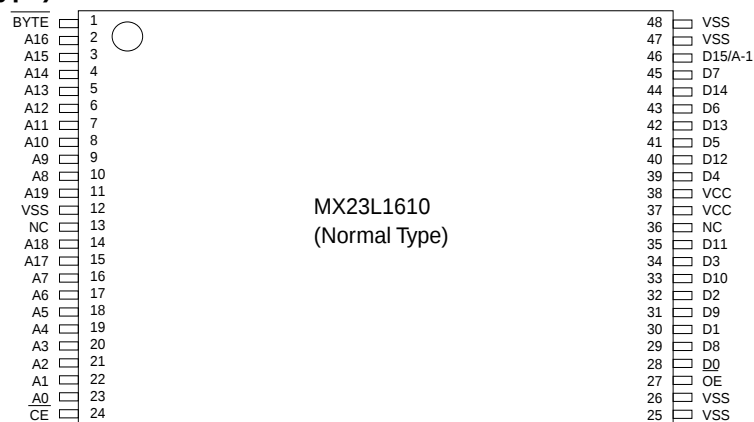
| Part No.        | Access | Package                       |
|-----------------|--------|-------------------------------|
| MX23L1610MC-70  | 70ns   | 44 pin SOP                    |
| MX23L1610MC-90  | 90ns   | 44 pin SOP                    |
| MX23L1610MC-10  | 100ns  | 44 pin SOP                    |
| MX23L1610MC-12  | 120ns  | 44 pin SOP                    |
| MX23L1610MC-15  | 150ns  | 44 pin SOP                    |
| MX23L1610PC-10  | 100ns  | 42 pin PDIP                   |
| MX23L1610PC-12  | 120ns  | 42 pin PDIP                   |
| MX23L1610PC-15  | 150ns  | 42 pin PDIP                   |
| MX23L1610TC-70  | 70ns   | 48 pin TSOP                   |
| MX23L1610TC-90  | 90ns   | 48 pin TSOP                   |
| MX23L1610TC-10  | 100ns  | 48 pin TSOP                   |
| MX23L1610TC-12  | 120ns  | 48 pin TSOP                   |
| MX23L1610TC-15  | 150ns  | 48 pin TSOP                   |
| MX23L1610RC-10  | 100ns  | 48 pin TSOP<br>(Reverse type) |
| MX23L1610RC-90  | 90ns   | 48 pin TSOP<br>(Reverse type) |
| MX23L1610RC-12  | 120ns  | 48 pin TSOP<br>(Reverse type) |
| MX23L1610RC-15  | 150ns  | 48 pin TSOP<br>(Reverse type) |
| MX23L1610TI-12* | 120ns  | 48 pin TSOP                   |
| MX23L1610YC-10  | 100ns  | 44 pin TSOP                   |
| MX23L1610YC-12  | 120ns  | 44 pin TSOP                   |
| MX23L1610YC-15  | 150ns  | 44 pin TSOP                   |

\*Note:Temperature: -40~85°C

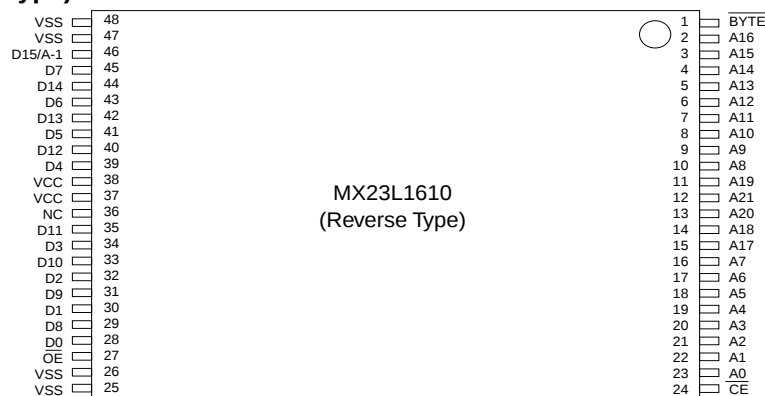
### PIN DESCRIPTION

| Symbol          | Pin Function                                |
|-----------------|---------------------------------------------|
| A0~A19          | Address Inputs                              |
| D0~D14          | Data Outputs                                |
| D15/A-1         | D15 (Word Mode)/ LSB Address<br>(Byte Mode) |
| $\overline{CE}$ | Chip Enable Input                           |
| $\overline{OE}$ | Output Enable Input                         |
| Byte            | Word/ Byte Mode Selection                   |
| VCC             | Power Supply Pin                            |
| VSS             | Ground Pin                                  |
| NC              | No Connection                               |

## 48 TSOP (Normal Type)



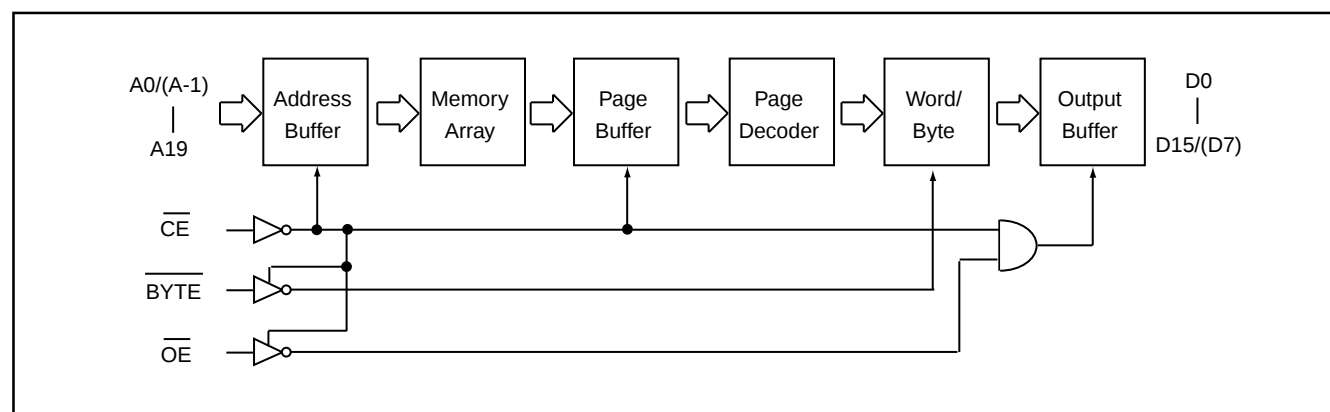
## 48 TSOP (Reverse Type)



## MODE SELECTION

| CE | OE | Byte | D15/A-1 | D0~D7  | D8~D15 | Mode | Power    |
|----|----|------|---------|--------|--------|------|----------|
| H  | X  | X    | X       | High Z | High Z | -    | Stand-by |
| L  | H  | X    | X       | High Z | High Z | -    | Active   |
| L  | L  | H    | Output  | D0~D7  | D8~D15 | Word | Active   |
| L  | L  | L    | Input   | D0~D7  | High Z | Byte | Active   |

## BLOCK DIAGRAM



**ABSOLUTE MAXIMUM RATINGS**

| Item                               | Symbol | Ratings        |
|------------------------------------|--------|----------------|
| Voltage on any Pin Relative to VSS | VIN    | -0.3V to 4.3V  |
| Ambient Operating Temperature      | Topr   | 0°C to 70°C    |
| Storage Temperature                | Tstg   | -65°C to 125°C |

Note: Minimum DC voltage on input or I/O pins is -0.5V. During voltage transitions, inputs may undershoot VSS to -1.3V for periods of up to 20ns. Maximum DC voltage on input or I/O pins is VCC+0.5V. During voltage transitions, input may overshoot VCC to VCC+2.0V for periods of up to 20ns.

**DC CHARACTERISTICS** (Ta = 0°C ~ 70°C, VCC = 3.0V~3.6V)

| Item                   | Symbol | MIN.  | MAX.      | Conditions                                                                                     |
|------------------------|--------|-------|-----------|------------------------------------------------------------------------------------------------|
| Output High Voltage    | VOH    | 2.4V  | -         | IOH = -400uA                                                                                   |
| Output Low Voltage     | VOL    | -     | 0.4V      | IOL = 1.6mA                                                                                    |
| Input High Voltage     | VIH    | 2.2V  | VCC+0.3V* | MAX. number: VCC+0.3V is under normal operation mode, and VCC+0.7V is under non-operating mode |
| Input Low Voltage      | VIL    | -0.3V | 0.2 x VCC |                                                                                                |
| Input Leakage Current  | ILI    | -     | 5uA       | 0V, VCC                                                                                        |
| Output Leakage Current | ILO    | -     | 5uA       | 0V, VCC                                                                                        |
| Operating Current      | ICC1   | -     | 25mA      | tRC = 120ns, all output open                                                                   |
| Standby Current (TTL)  | ISTB1  | -     | 0.5mA     | CE = VIH                                                                                       |
| Standby Current (cmos) | ISTB2  | -     | 15uA      | CE > VCC-0.2V                                                                                  |
| Input Capacitance      | CIN    | -     | 10pF      | Ta = 25°C, f = 1MHZ                                                                            |
| Output Capacitance     | COUT   | -     | 10pF      | Ta = 25°C, f = 1MHZ                                                                            |

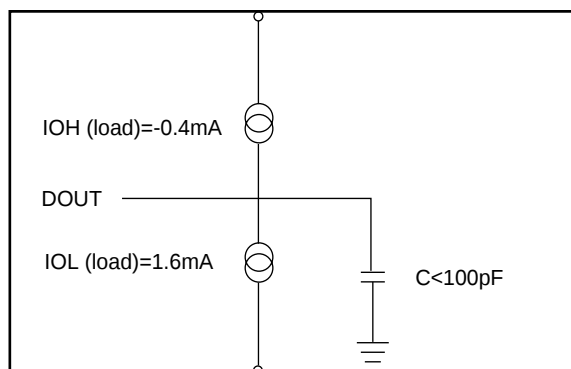
**AC CHARACTERISTICS** (Ta = 0°C ~ 70°C, VCC = 3.0V~3.6V)

| Item                      | Symbol | 23L1610-70 |      | 23L1610-90 |      | 23L1610-10 |       | 23L1610-12 |       | 23L1610-15 |       |
|---------------------------|--------|------------|------|------------|------|------------|-------|------------|-------|------------|-------|
|                           |        | MIN.       | MAX. | MIN.       | MAX. | MIN.       | MAX.  | MIN.       | MAX.  | MIN.       | MAX.  |
| Read Cycle Time           | tRC    | 70ns       | -    | 90ns       | -    | 100ns      | -     | 120ns      | -     | 150ns      | -     |
| Address Access Time       | tAA    | -          | 70ns | -          | 90ns | -          | 100ns | -          | 120ns | -          | 150ns |
| Chip Enable Access Time   | tACE   | -          | 70ns | -          | 90ns | -          | 100ns | -          | 120ns | -          | 150ns |
| Output Enable Time        | tOE    | -          | 35ns | -          | 45ns | -          | 50ns  | -          | 60ns  | -          | 70ns  |
| Output Hold After Address | tOH    | 0ns        | -    | 0ns        | -    | 0ns        | -     | 0ns        | -     | 0ns        | -     |
| Output High Z Delay       | tHZ    | -          | 20ns | -          | 20ns | -          | 20ns  | -          | 20ns  | -          | 20ns  |

Note: Output high-impedance delay (tHZ) is measured from OE or CE going high, and this parameter guaranteed by design over the full voltage and temperature operating range - not tested.

## AC Test Conditions

|                           |            |
|---------------------------|------------|
| Input Pulse Levels        | 0.4V~ 2.4V |
| Input Rise and Fall Times | 10ns       |
| Input Timing Level        | 1.4V       |
| Output Timing Level       | 1.4V       |
| Output Load               | See Figure |



Note:

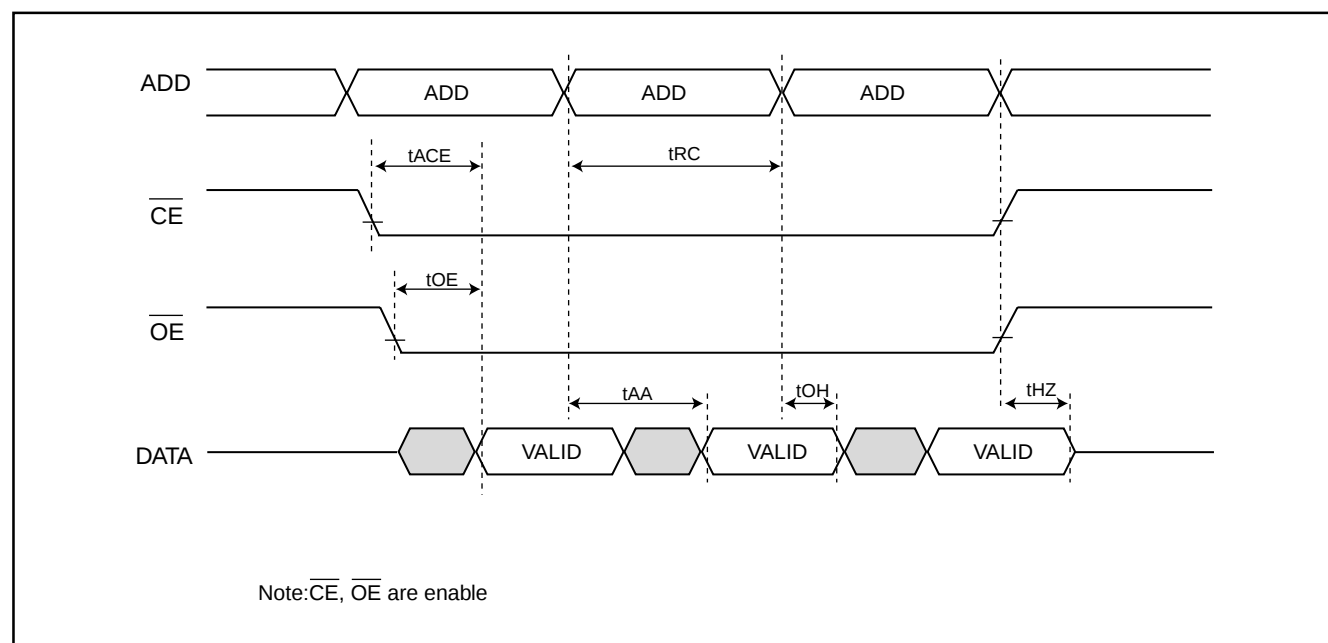
No output loading is present in tester load board.

Active loading is used and under software programming control.

Output loading capacitance includes load board's and all stray capacitance.

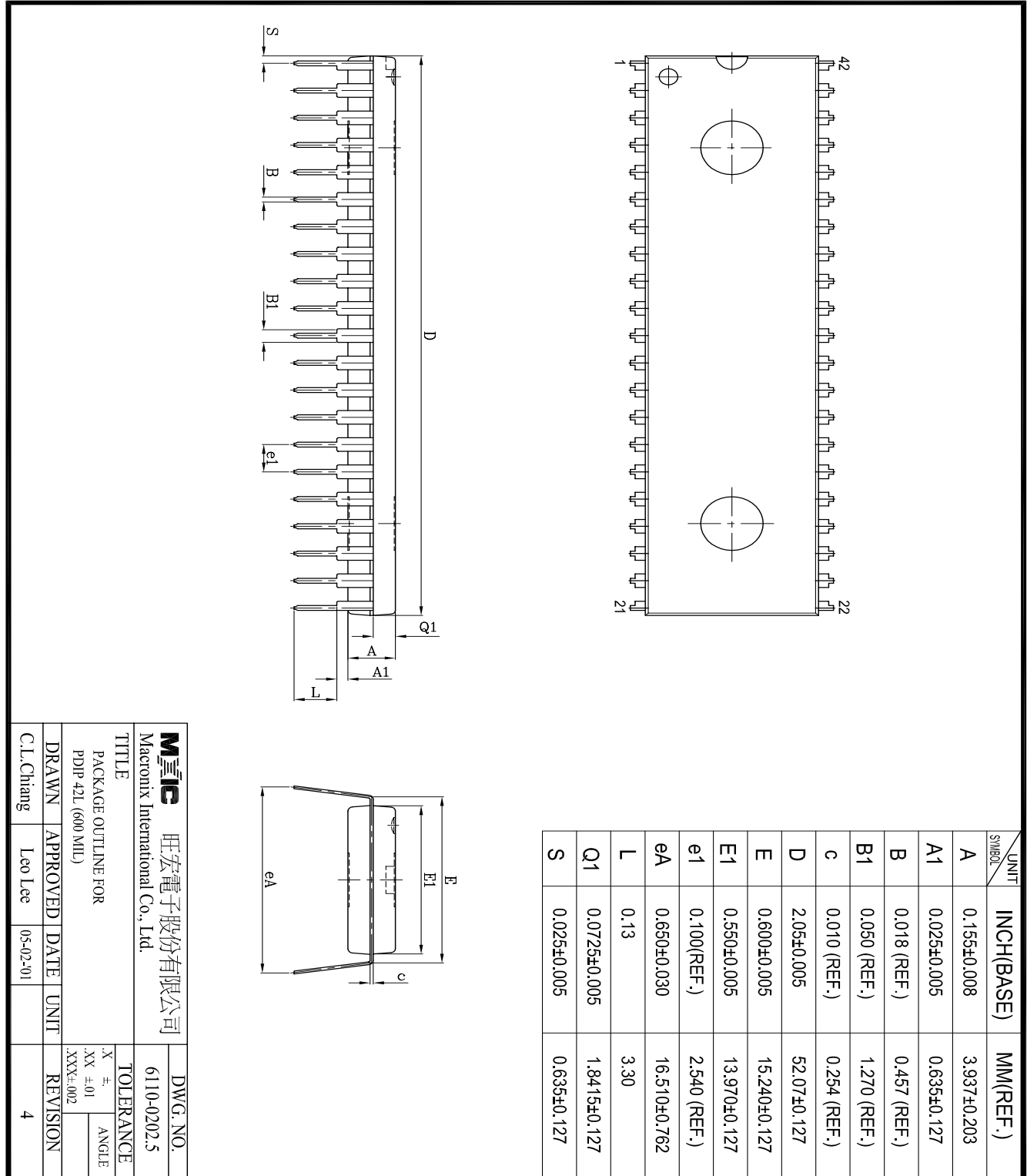
## TIMING DIAGRAM

### RANDOM READ

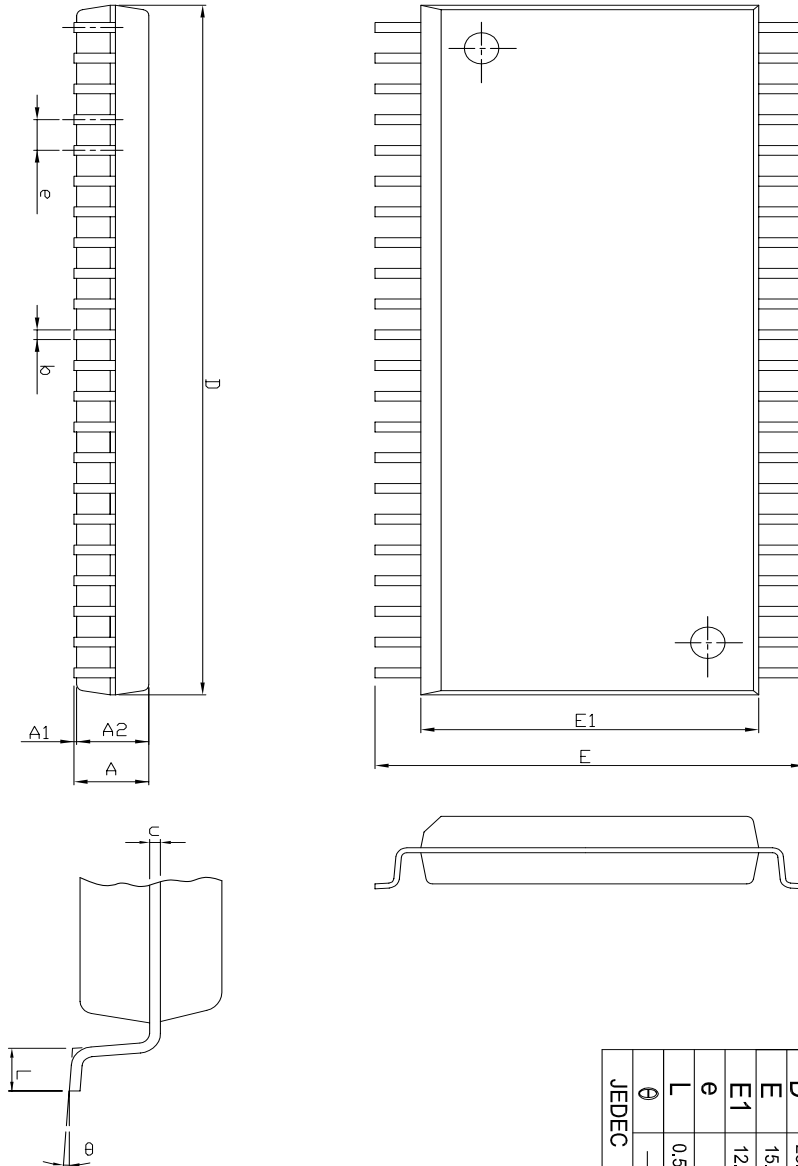


## PACKAGE INFORMATION

### 42-PIN PLASTIC DIP(600 mil)



## 44-PIN PLASTIC SOP

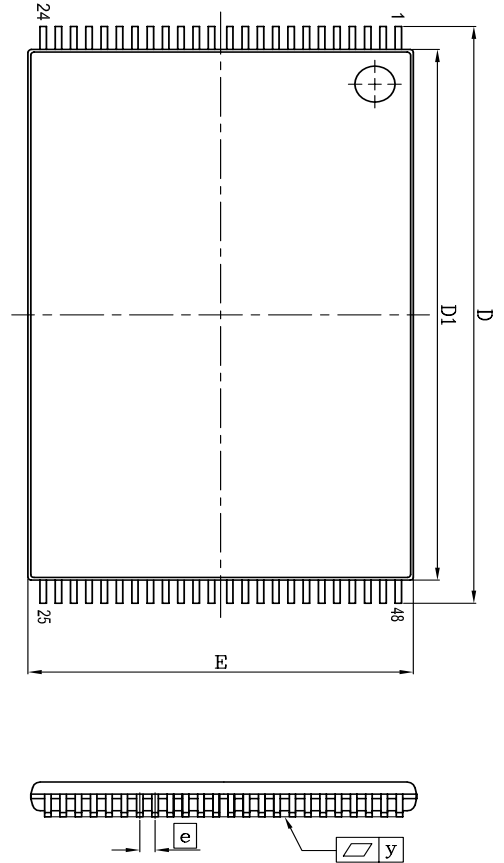


| Symbol | Dimension in mm (Base) |       |       | Dimension in inch (Ref.) |       |       |
|--------|------------------------|-------|-------|--------------------------|-------|-------|
|        | Min                    | Nom   | Max   | Min                      | Nom   | Max   |
| A      | —                      | —     | 3.00  | —                        | —     | 0.118 |
| A1     | 0.10                   | —     | —     | 0.004                    | —     | —     |
| A2     | 2.57                   | 2.69  | 2.82  | 0.101                    | 0.106 | 0.111 |
| b      | 0.41 REF               |       |       | 0.016 REF                |       |       |
| C      | 0.20 REF               |       |       | 0.008 REF                |       |       |
| D      | 28.37                  | 28.50 | 28.63 | 1.117                    | 1.122 | 1.127 |
| E      | 15.77                  | 16.03 | 16.28 | 0.621                    | 0.631 | 0.641 |
| E1     | 12.47                  | 12.60 | 12.73 | 0.491                    | 0.496 | 0.501 |
| e      | 1.27 REF               |       |       | 0.050 REF                |       |       |
| L      | 0.58                   | 0.79  | 0.99  | 0.023                    | 0.031 | 0.039 |
| θ      | —                      | 5°    | —     | —                        | 5°    | —     |

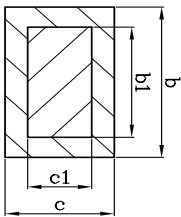
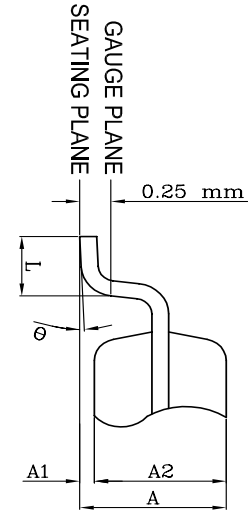
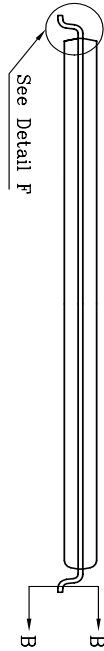
JEDEC

|                                                            |  |  |  |              |  |
|------------------------------------------------------------|--|--|--|--------------|--|
| <b>Mxic</b> 旺宏電子股份有限公司<br>Macronix International Co., Ltd. |  |  |  | DWG. NO.     |  |
| TITLE                                                      |  |  |  | 6110-0207    |  |
| PACKAGE OUTLINE FOR                                        |  |  |  | TOLERANCE    |  |
| SOP 44L (500 MIL)                                          |  |  |  | .X ±.01      |  |
| DRAWN                                                      |  |  |  | .XXX±.002    |  |
| APPROVED                                                   |  |  |  | REVISION     |  |
| DATE                                                       |  |  |  | 2            |  |
| UNIT                                                       |  |  |  | 2            |  |
| C.L.Chang                                                  |  |  |  | Dennis Chang |  |
| 05-03-01                                                   |  |  |  | INCH         |  |

## 48-PIN PLASTIC TSOP



| Symbol | Dimension in inch (Ref.) |       |       | Dimension in mm (Base) |       |       |
|--------|--------------------------|-------|-------|------------------------|-------|-------|
|        | Min                      | Nom   | Max   | Min                    | Nom   | Max   |
| A      | —                        | —     | 0.047 | —                      | —     | 1.20  |
| A1     | 0.002                    | —     | 0.006 | 0.05                   | —     | 0.15  |
| A2     | 0.037                    | 0.039 | 0.041 | 0.95                   | 1.00  | 1.05  |
| b      | 0.007                    | 0.009 | 0.011 | 0.17                   | 0.22  | 0.27  |
| b1     | 0.007                    | 0.008 | 0.009 | 0.17                   | 0.20  | 0.23  |
| c      | 0.004                    | —     | 0.008 | 0.10                   | —     | 0.21  |
| c1     | 0.004                    | —     | 0.006 | 0.10                   | —     | 0.16  |
| D      | 0.779                    | 0.787 | 0.795 | 19.80                  | 20.00 | 20.20 |
| D1     | 0.720                    | 0.724 | 0.728 | 18.30                  | 18.40 | 18.50 |
| E      | 0.465                    | 0.472 | 0.480 | 11.80                  | 12.00 | 12.20 |
| e      | 0.020BSC                 |       |       | 0.50BSC                |       |       |
| L      | 0.016                    | 0.020 | 0.024 | 0.40                   | 0.50  | 0.60  |
| y      | —                        | —     | 0.003 | —                      | —     | 0.076 |
| θ      | 0°                       | 5°    | 8°    | 0°                     | 5°    | 8°    |

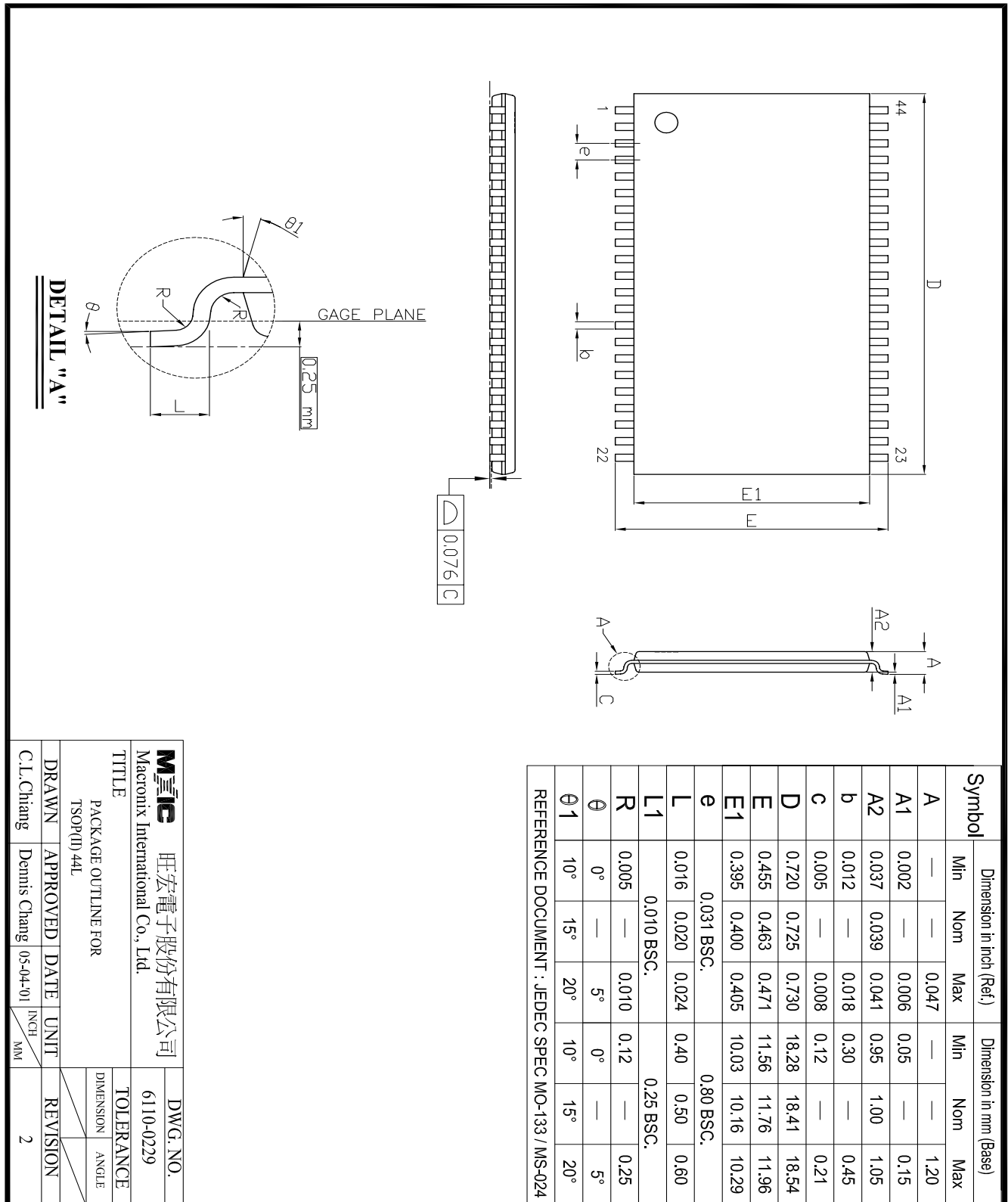


**DETAIL F**

**SECTION B-B**

|                                                                   |          |          |      |                                              |  |
|-------------------------------------------------------------------|----------|----------|------|----------------------------------------------|--|
| <b>Mxic</b> 旺宏電子股份有限公司<br>Macronix International Co., Ltd.        |          |          |      | DWG. NO.<br>6110-0214                        |  |
| TITLE<br>PACKAGE OUTLINE FOR<br>TSOP(0) 48L (12X20MM) NORMAL FORM |          |          |      | TOLERANCE<br>.X ±.<br>.XX ±.01<br>.XXX ±.002 |  |
| DRAWN                                                             | APPROVED | DATE     | UNIT | REVISION                                     |  |
| C.L.Chiang                                                        | Leo Lee  | 05-04-00 |      | 4                                            |  |

## 44-PIN TSOP (Type II)



**REVISION HISTORY**

| <b>REVISION</b> | <b>DESCRIPTION</b>                                                                                                                                                                                                                                                                                                                                                                                  | <b>PAGE</b>  | <b>DATE</b> |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------|
| 1.9             | 1. Package Type:Add 42-PDIP package type.<br>2. DC Characteristics:The input low voltage VIL Max. value is changed as 0.2xVCC instead of 0.8V.<br>3. AC Characteristics:The output high Z delay is changed as 20ns instead of 70ns.<br>4. Add 105ns speed grade.<br>5. Add 100ns speed grade @3.3V±5%<br>6. AC Test Conditions:The output timing level is changed as 1.4V instead of 0.8V and 2.0V. |              | JUN/11/1998 |
| 2.0             | AC CHARACTERISTICS tOH 10ns-->0ns                                                                                                                                                                                                                                                                                                                                                                   | P4           | FEB/01/1999 |
| 2.1             | Typing error correction                                                                                                                                                                                                                                                                                                                                                                             | P1           | JAN/18/2000 |
| 2.2             | 1.Added 44-pin TSOP (Type II) Package<br>2.Modify Package Information                                                                                                                                                                                                                                                                                                                               | P1,8<br>P5~7 | JUL/18/2001 |
| 2.3             | 1.Add 90ns speed grade<br>2.Delete 105ns speed grade                                                                                                                                                                                                                                                                                                                                                | P1,3<br>P1,3 | JUL/31/2001 |
| 2.4             | 1.Added 70ns speed grade                                                                                                                                                                                                                                                                                                                                                                            | P1,3         | AUG/14/2001 |
| 2.5             | Change VOH(MIN.):2.3V-->2.4V; VIH(MIN.):2.1V-->2.2V                                                                                                                                                                                                                                                                                                                                                 | P3           | AUG/15/2001 |



**MX23L1610**

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