



MIC58P42

8-Bit Serial-Input Protected Latched Driver

General Description

The MIC58P42 serial-input latched driver is a high-voltage (80V), high-current (500mA) integrated circuit comprised of eight CMOS data latches, a bipolar Darlington transistor driver for each latch, and CMOS control circuitry for the common STROBE, CLOCK, SERIAL DATA INPUT, and OUTPUT ENABLE functions. Similar to the MIC5842, additional protection circuitry supplied on this device includes thermal shutdown, under voltage lockout (UVLO), and overcurrent shutdown.

The bipolar/CMOS combination provides an extremely low-power latch with maximum interface flexibility. The MIC58P42 has open-collector outputs capable of sinking 500 mA and integral diodes for inductive load transient suppression with a minimum output breakdown voltage rating of 80V (50V sustaining). The drivers can be operated with a split supply, where the negative supply is down to -20V and may be paralleled for higher load current capability.

With a 5V logic supply, the MIC58P42 will typically operate at better than 5MHz. With a 12V logic supply, significantly higher speeds are obtained. The CMOS inputs are compatible with standard CMOS, PMOS, and NMOS circuits. TTL circuits may require pull-up resistors. By using the serial data output, drivers may be cascaded for interface applications requiring additional drive lines.

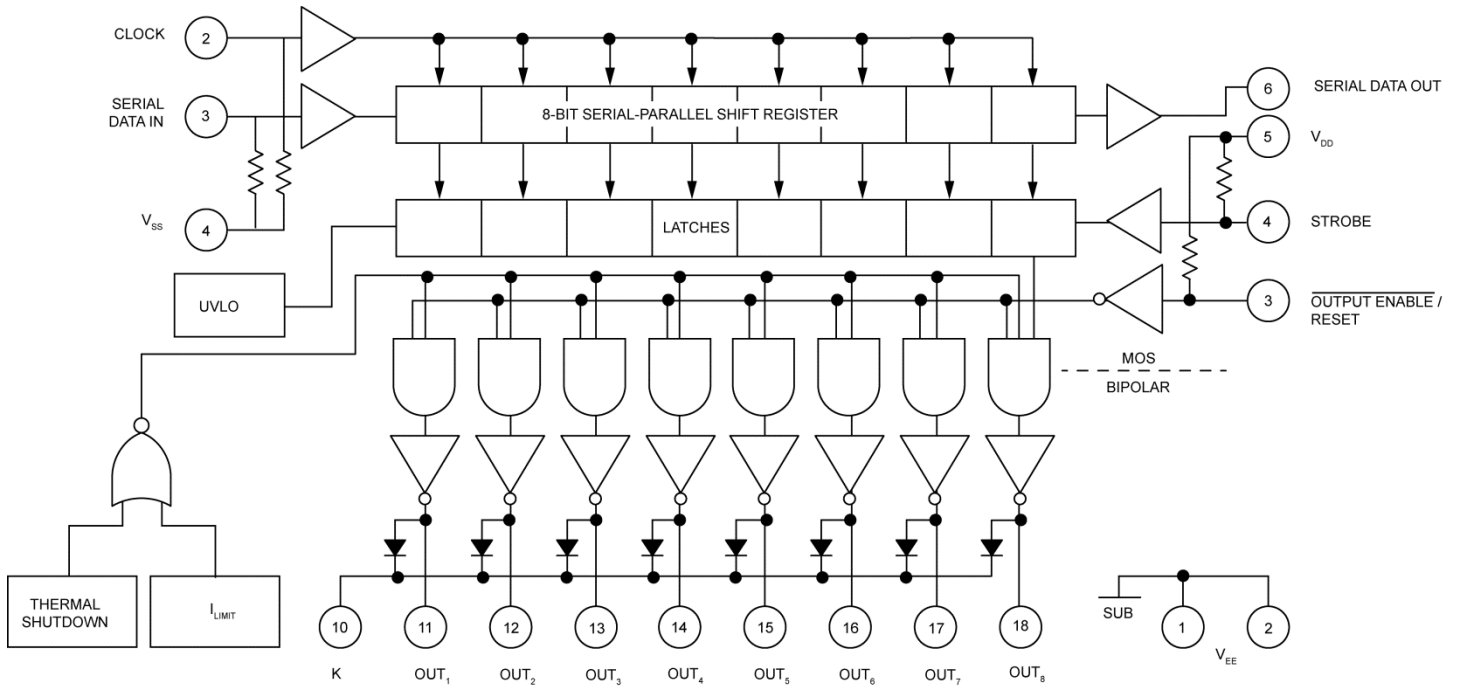
Each of these eight outputs has an independent over current shutdown of 500 mA. Upon over-current detection, the affected channel will turn OFF until VDD is cycled or the ENABLE/RESET pin is pulsed high. Current pulses less than 2 μ s will not activate current shutdown. Temperatures above 165°C will shut down the device. The UVLO circuit prevents operation at low VDD; hysteresis of 0.5V is provided. See the MIC59P60 for a similar device that additionally provides an error flag output.

Datasheets and support documentation are available on Micrel's web site at: www.micrel.com.

Features

- 3.3 MHz Minimum Data-Input Rate
- CMOS, PMOS, NMOS, and TTL Compatible
- Internal Pull-Up/Pull-Down Resistors
- Low Power CMOS Logic and Latches
- High Voltage (80V) Current-Sink Outputs
- Output Transient-Protection Diodes
- Single or Split Supply Operation
- Thermal Shutdown
- Under-Voltage Lockout
- Per-Output Over-Current Shutdown (500mA typical)

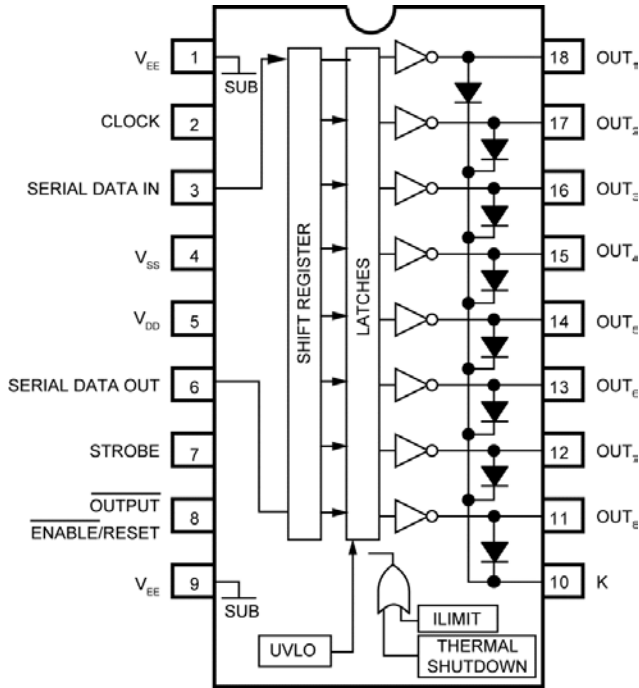
Functional Diagram



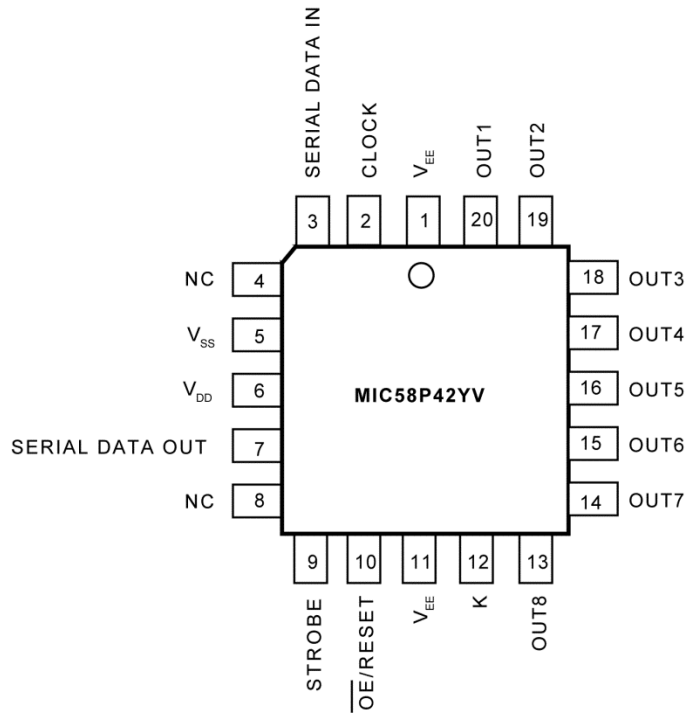
Ordering Information

| Part Number | Junction Temperature Range | Package | Pb-Free |
|-------------|----------------------------|--------------------|---------|
| MIC58P42YN | -40°C to +85°C | 18-Pin Plastic DIP | √ |
| MIC58P42YV | -40°C to +85°C | 20-Pin PLCC | √ |
| MIC58P42YWM | -40°C to +85°C | 18-Pin Wide SOIC | √ |

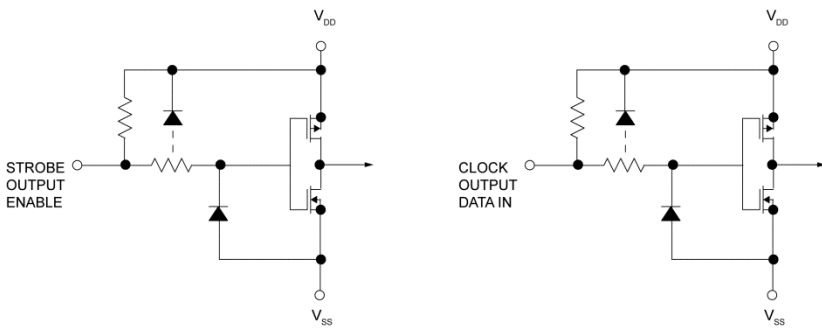
Pin Configuration



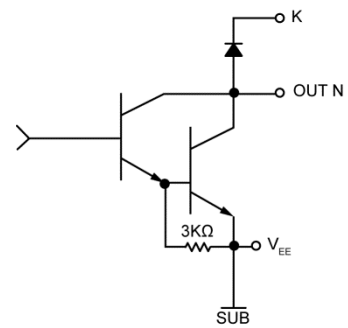
18-pin DIP (N) and 18-pin Wide SOIC (WM)
(Top View)



20-pin PLCC (V)
(Top View)



Typical Input Circuits



Typical Output Driver

Pin Description

| Pin Number DIP & SOIC | Pin Number PLCC | Pin Name | Pin Function |
|--------------------------|--------------------|--|---|
| 1, 9 | 1, 11 | V_{EE} | Substrate. Most Negative voltage in the system connects here. |
| 2 | 2 | CLOCK | Serial Data Clock. A CLEAR input must also be clocked into the latches. |
| 3 | 3 | SERIAL DATA IN | Serial Data Input pin. |
| 4 | 5 | V_{SS} | Logic reference (Ground) pin. |
| 5 | 6 | V_{DD} | Logic Positive Supply voltage. |
| 6 | 7 | SERIAL DATA OUT | Serial Data Output pin. (Flow-through). |
| 7 | 9 | STROBE | Output Strobe pin. Loads output latches when high. Strobe is needed to clear latch. |
| 8 | 10 | $\overline{\text{OUTPUT}}ENABLE/RESET$ | When Low, Outputs are active. When High, device is reset from a fault condition. |
| 10 | 12 | K | Transient suppression diode's cathode common pin. |
| 11 – 18 | 13 – 20 | OUT_N | Open Collector outputs 8 through 1. |

Absolute Maximum Ratings⁽¹⁾

| | |
|---|--------------------------|
| Output Voltage | +80V |
| Output Voltage, $V_{CE(SUS)}$ ⁽³⁾ | +50V |
| Logic Supply Voltage Range (V_{DD}) | 4.5V to 15V |
| V_{DD} with reference to V_{EE} | 25V |
| Emitter Supply Voltage (Substrate) (V_{EE}) | -20V |
| Input Voltage Range (V_{IN}) | -0.3V to $V_{DD} + 0.3V$ |
| Operating Temperature Range (T_A) | -65°C to +125°C |
| Storage Temperature Range (T_S) | -60°C to +150°C |
| ESD Rating ⁽⁴⁾ | ESD Sensitive |

Operating Ratings⁽²⁾

| | |
|---|----------------|
| Package Power Dissipation, P_D | |
| MIC58P42YN | 1.82W |
| Derate above $T_A = +25^\circ C$ | 18mW/°C |
| MIC58P42YV | 1.4W |
| Derate above $T_A = +25^\circ C$ | 14mW/°C |
| MIC58P42YWM | 1.2W |
| Derate above $T_A = +25^\circ C$ | 12mW/°C |
| Operating Temperature Range (T_A) | -40°C to +85°C |

Electrical Characteristics⁽⁵⁾

$T_A = 25^\circ C$, $V_{DD} = 5V$; $V_{SS} = V_{EE} = 0V$, unless otherwise noted.

| Symbol | Parameter | Condition | Min. | Typ. | Max. | Units |
|----------------|--|--|------|--------------------|------|------------|
| I_{CEX} | Output Leakage Current | $V_{OUT} = 80V$ | | | 50 | μA |
| | | $V_{OUT} = 80V, T_A = +70^\circ C$ | | | 100 | |
| $V_{CE(SAT)}$ | Collector-Emitter Saturation Voltage | $I_{OUT} = 100mA$ | | 0.9 | 1.1 | V |
| | | $I_{OUT} = 200mA$ | | 1.1 | 1.3 | |
| | | $I_{OUT} = 350mA$ | | 1.3 | 1.6 | |
| $V_{CE(SUS)}$ | Collector-Emitter Sustaining Voltage | $I_{OUT} = 350mA, L = 2mH$ | 50 | | | V |
| $V_{IN(0)}$ | Input Voltage (Low) | | | | 1.0 | V |
| $V_{IN(1)}$ | Input Voltage (High) | $V_{DD} = 12V$ $V_{DD} = 10V$ $V_{DD} = 5.0V$, Note 6 | | 10.5 8.5 3.5 | | |
| R_{IN} | Input Resistance | $V_{DD} = 12V$ | 50 | 200 | | k Ω |
| | | $V_{DD} = 10V$ | 50 | 300 | | |
| | | $V_{DD} = 5.0V$ | 50 | 600 | | |
| $I_{DD(ON)}$ | Supply Current | All Drivers ON, $V_{DD} = 12V$ | | 6.4 | 10.0 | mA |
| | | All Drivers ON, $V_{DD} = 10V$ | | 6.0 | 9.0 | |
| | | All Drivers ON, $V_{DD} = 5.0V$ | | 4.6 | 7.5 | |
| $I_{DD(1 ON)}$ | | One Driver ON, All others OFF, $V_{DD} = 12V$ | | 3.1 | 4.5 | |
| | One Driver ON, All others OFF, $V_{DD} = 10V$ | | 2.9 | 4.5 | | |
| | One Driver ON, All others OFF, $V_{DD} = 5.0V$ | | 2.3 | 3.6 | | |
| $I_{DD(OFF)}$ | | All Drivers OFF, $V_{DD} = 12V$ | | 2.6 | 4.2 | |
| | | All Drivers OFF, $V_{DD} = 10V$ | | 2.4 | 3.6 | |
| | | All Drivers OFF, $V_{DD} = 5.0V$ | | 1.9 | 3.0 | |

Notes:

- Exceeding the absolute maximum ratings may damage the device.
- The device is not guaranteed to function outside its operating ratings.
- For inductive load applications.
- Devices are ESD sensitive. Handling precautions are recommended. Human body model, 1.5k Ω in series with 100pF.
- Specification for packaged product only.
- Operation of these devices with standard TTL or DTL may require the use of appropriate pull-up resistors to insure a minimum logic "1".

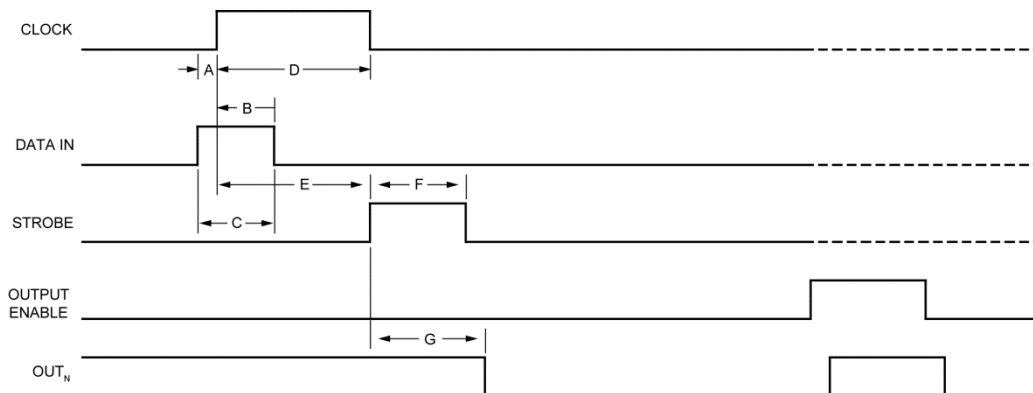
Electrical Characteristics (Continued)

| Symbol | Parameter | Condition | Min. | Typ. | Max. | Units |
|--------------|-----------------------------------|---------------|------|------|------|-------------|
| I_R | Clamp Diode Leakage Current | $V_R = 80V$ | | | 50 | μA |
| V_F | Clamp Diode Forward Voltage | $I_F = 350mA$ | | 1.7 | 2.0 | V |
| I_{LIM} | Output Current Shutdown Threshold | | | 500 | | mA |
| V_{SU} | Start Up Voltage | Note 7 | 3.5 | 4.0 | 4.5 | V |
| $V_{DD MIN}$ | Minimum Supply (V_{DD}) | | 3.0 | 3.5 | 4.0 | V |
| | Thermal Shutdown | | | 165 | | $^{\circ}C$ |
| | Thermal Shutdown Hysteresis | | | 10 | | $^{\circ}C$ |

Note:

7. Undervoltage Lockout is guaranteed to release device at no more than 4.5V, and disable the device at no less than 3.0V.

Timing Diagram



Timing Conditions

(T_A = +25°C, Logic Levels are V_{DD} and V_{SS}), V_{DD} = 5V

| | |
|--|-------|
| A. Typical Data Active Time Before Clock Pulse (Data Set-Up Time)..... | 75ns |
| B. Minimum Data Active Time After Clock Pulse (Data Hold Time). | 75ns |
| C. Minimum Data Pulse Width | 150ns |
| D. Minimum Clock Pulse Width | 150ns |
| E. Minimum Time Between Clock Activation and Strobe..... | 300ns |
| F. Minimum Strobe Pulse Width | 100ns |
| G. Typical Time Between Strobe Activation and Output Transition | 500ns |

SERIAL DATA present at the input is transferred to the shift register on the logic “0” to logic “1” transition of the CLOCK input pulse. On succeeding CLOCK pulses, the registers shift data information towards the SERIAL DATA OUTPUT. The SERIAL DATA must appear at the input prior to the rising edge of the CLOCK input waveform.

Information present at any register is transferred to its respective latch when the STROBE is high (serial-to-parallel conversion). The latches will continue to accept new data as long as the STROBE is held high. Applications where the latches are bypassed (STROBE tied high) will require that the ENABLE input be high to prevent invalid output states.

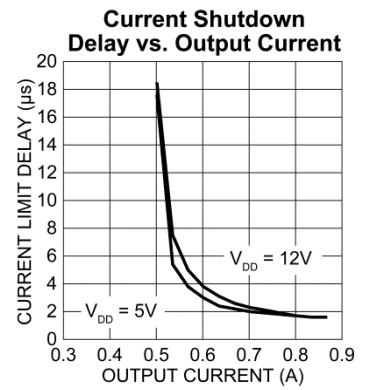
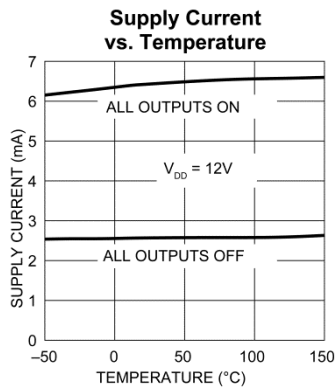
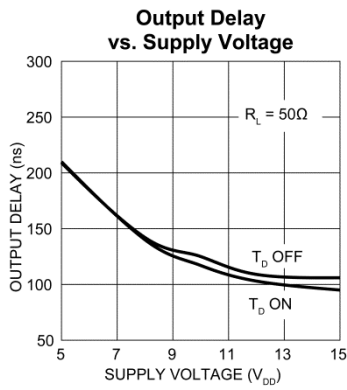
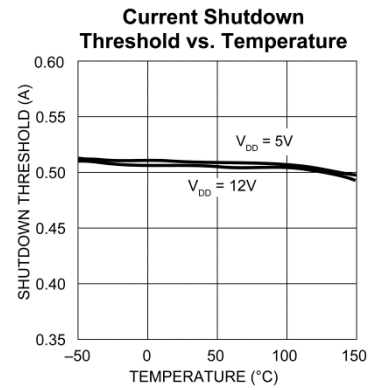
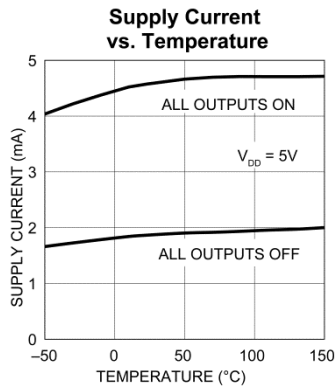
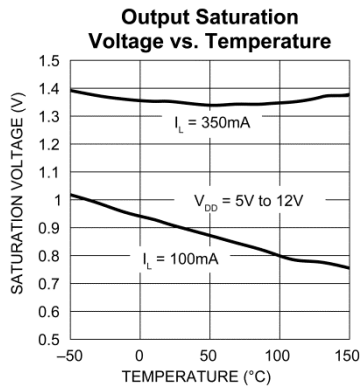
When the ENABLE input is high, all of the output buffers are disabled (OFF) without affecting information stored in the latches or shift register. With the ENABLE input low, the outputs are controlled by the state of the latches. A positive OUTPUT ENABLE/ RESET pulse resets the output after a current shutdown fault. Thermal limit faults are not latched and require no reset pulse.

MIC58P42 Truth Table

| Serial Data Input | Clock Input | Shift Register Contents | Serial Data Output | Strobe Input | Latch Contents | Output Enable | Output Contents |
|-------------------|-------------|---|--------------------|--------------|---|---------------|---|
| | | I ₁ I ₂ I ₃ I ₈ | | | I ₁ I ₂ I ₃ I ₈ | | I ₁ I ₂ I ₃ I ₈ |
| H | ┌ | H R ₁ R ₂ R ₇ | R ₇ | | | | |
| L | ┐ | L R ₁ R ₂ R ₇ | R ₇ | | | | |
| X | └ | R ₁ R ₂ R ₃ R ₈ | R ₈ | | | | |
| | ┌ | O O O O | L | | | | |
| | | X X X X | X | L | R ₁ R ₂ R ₃ R ₈ | | |
| | | P ₁ P ₂ P ₃ P ₈ | P ₈ | H | P ₁ P ₂ P ₃ P ₈ | L | P ₁ P ₂ P ₃ P ₈ |
| | | | | | X X X X | H | H H H H |

L = Low Level Logic
 H = High Level Logic
 X = Irrelevant
 P = Present State
 R = Previous State
 O = Output OFF

Typical Characteristics



Maximum Allowable Duty Cycle, Plastic DIP

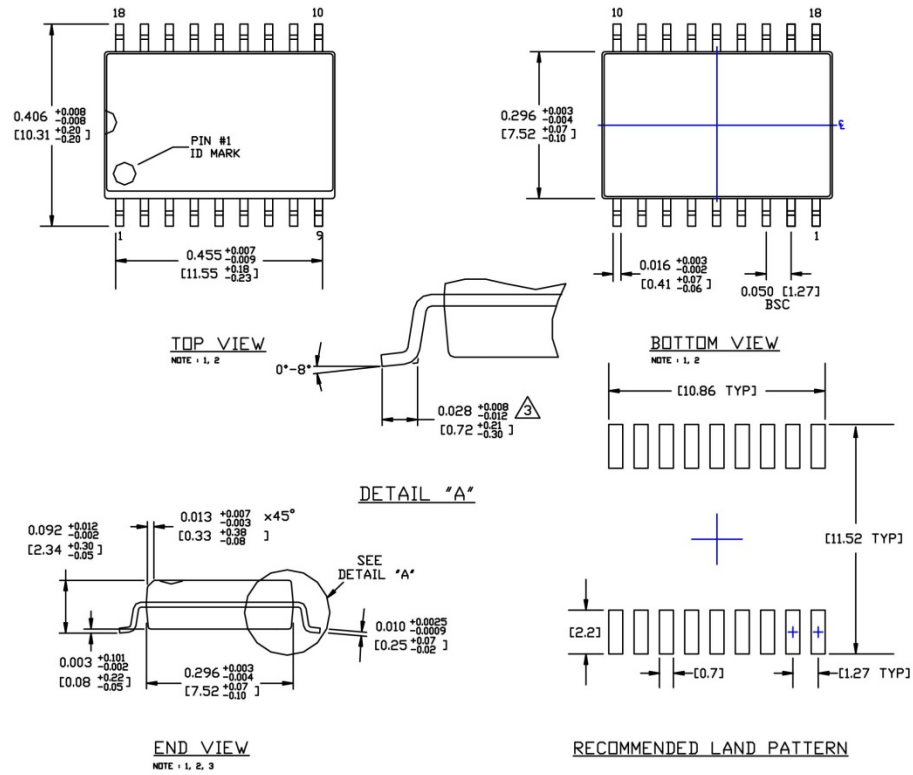
$V_{DD} = 5.0V$

| Number of Outputs ON ($I_{OUT} = 200mA$ $V_{DD} = 5.0V$) | Max. Allowable Duty Cycle at Ambient Temperatures | | | | |
|--|---|------|------|------|------|
| | 25°C | 40°C | 50°C | 60°C | 70°C |
| 8 | 85% | 72% | 64% | 55% | 46% |
| 7 | 97% | 82% | 73% | 63% | 53% |
| 6 | 100% | 96% | 85% | 73% | 62% |
| 5 | 100% | 100% | 100% | 88% | 75% |
| 4 | 100% | 100% | 100% | 100% | 93% |
| 3 | 100% | 100% | 100% | 100% | 100% |
| 2 | 100% | 100% | 100% | 100% | 100% |
| 1 | 100% | 100% | 100% | 100% | 100% |

$V_{DD} = 12V$

| Number of Outputs ON ($I_{OUT} = 200mA$ $V_{DD} = 12V$) | Max. Allowable Duty Cycle at Ambient Temperatures | | | | |
|---|---|------|------|------|------|
| | 25°C | 40°C | 50°C | 60°C | 70°C |
| 8 | 80% | 68% | 60% | 52% | 44% |
| 7 | 91% | 77% | 68% | 59% | 50% |
| 6 | 100% | 90% | 79% | 69% | 58% |
| 5 | 100% | 100% | 95% | 82% | 69% |
| 4 | 100% | 100% | 100% | 100% | 86% |
| 3 | 100% | 100% | 100% | 100% | 100% |
| 2 | 100% | 100% | 100% | 100% | 100% |
| 1 | 100% | 100% | 100% | 100% | 100% |

Package Information and Recommended Landing Pattern⁽⁸⁾



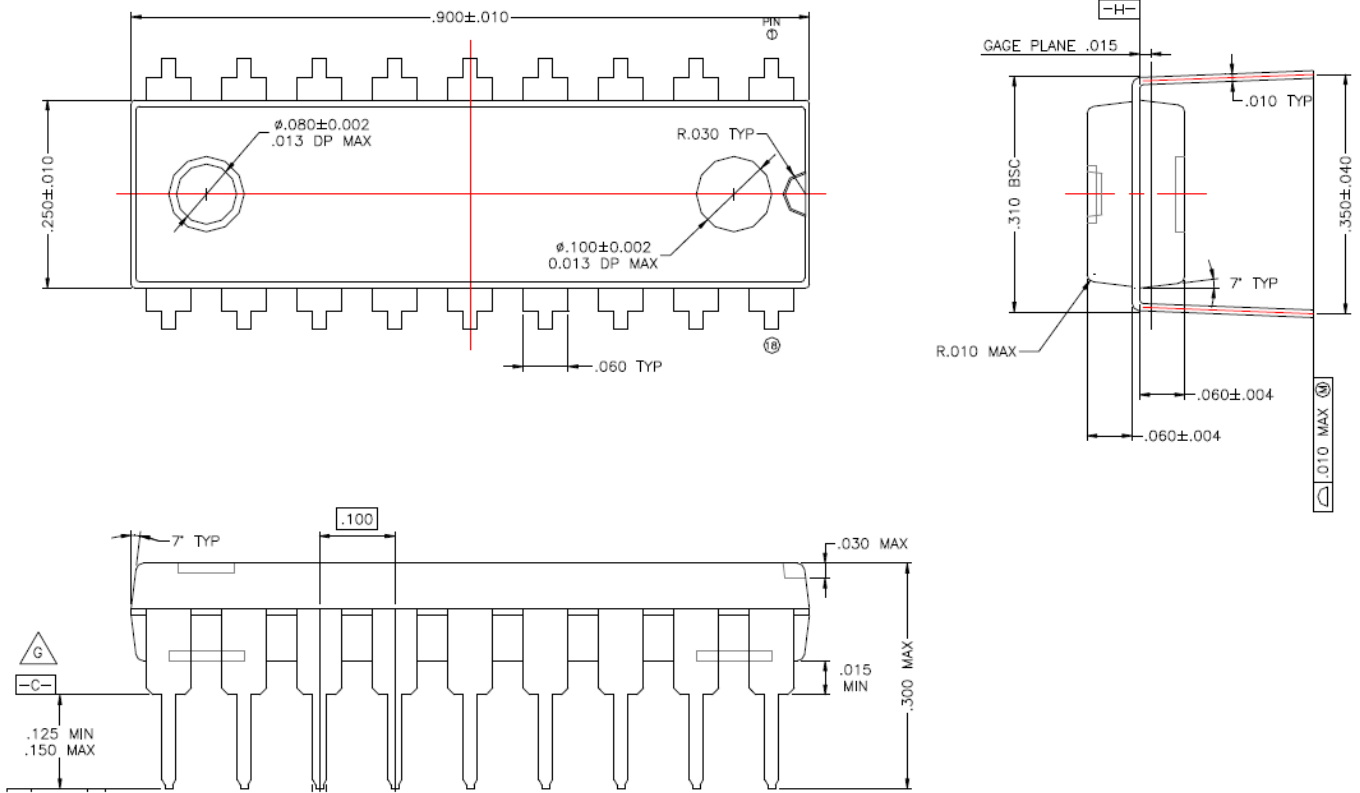
- NOTES:**
1. DIMENSIONS ARE IN INCHES[MM].
 2. CONTROLLING DIMENSION: INCHES.
 3. DIMENSION DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS, EITHER OF WHICH SHALL NOT EXCEED 0.006[0.15] PER SIDE.

18-Pin Wide SOIC (WM)

Note:

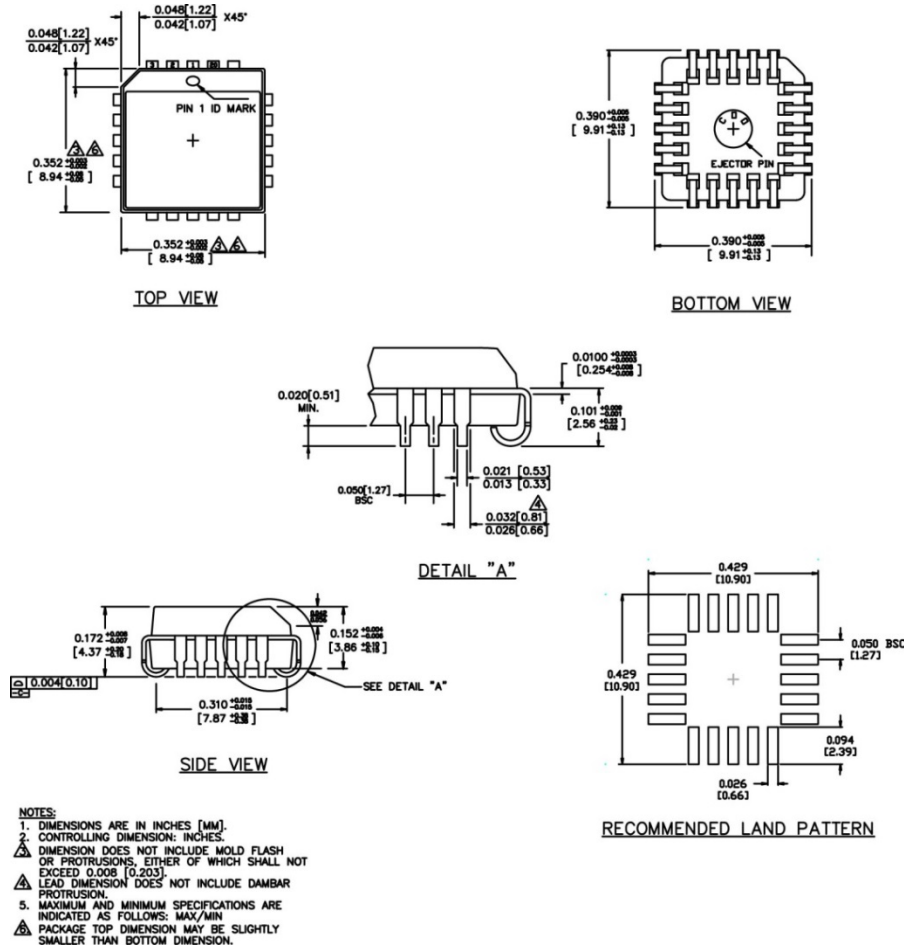
8. Package information is correct as of the publication date. For updates and most current information, go to www.micrel.com.

Package Information and Recommended Landing Pattern⁽⁸⁾ Continued



18-Pin DIP (N)

Package Information and Recommended Landing Pattern⁽⁸⁾ Continued



20-Pin PLCC (V)

MICREL, INC. 2180 FORTUNE DRIVE SAN JOSE, CA 95131 USA
 TEL +1 (408) 944-0800 FAX +1 (408) 474-1000 WEB <http://www.micrel.com>

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