# MIC38C42/43/44/45

## BiCMOS Current-Mode PWM Controllers

### Features

- Fast 40 ns Output Rise and 30 ns Output Fall Times
- –40°C to +85°C Ambient Temperature Range Meets UC284x Specifications
- High-Performance, Low-Power BiCMOS Process
- Ultra-Low Start-Up Current (50 µA Typical)
- Low Quiescent Operating Current (4 mA Typical)
- CMOS Outputs with Rail-to-Rail Swing
- Up to 500 kHz Current-Mode Operation
- Trimmed 5V Bandgap Reference
- Pin-for-Pin Compatible with UC3842/3843/3844/3845(A)
- Trimmed Oscillator Discharge Current
- UVLO with Hysteresis
- Low Cross-Conduction Currents

### Applications

- Current-Mode, Offline, Switched-Mode Power Supplies
- Current-Mode, DC-to-DC Converters
- Step-Down Buck Regulators
- Step-Up Boost Regulators
- Flyback, Isolated Regulators
- Forward Converters
- Synchronous FET Converters

### General Description

The MIC38C4x are fixed-frequency, high performance, current-mode PWM controllers. Microchip's BiCMOS devices are pin compatible with 384x bipolar devices, but feature several improvements.

Undervoltage lockout circuitry allows the '42 and '44 versions to start up at 14.5V and operate down to 9V, and the '43 and '45 versions start at 8.4V with operation down to 7.6V. All versions operate up to 20V.

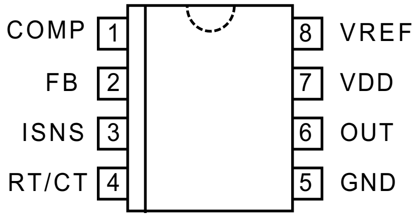
When compared to bipolar 384x devices operating from a 15V supply, start-up current has been reduced to 50 µA typical and operating current has been reduced to 4.0 mA typical. Decreased output rise and fall times drive larger MOSFETs, and rail-to-rail output capability increases efficiency, especially at lower supply voltages. The MIC38C4x also features a trimmed oscillator discharge current and bandgap reference.

The MIC38C4x denotes 8-pin plastic DIP, SOIC, and MSOP packages. MIC38C4x-1 denotes 14-pin plastic DIP and SOIC packages. 8-pin devices feature small size, while 14-pin devices separate the analog and power connections for improved performance and power dissipation.

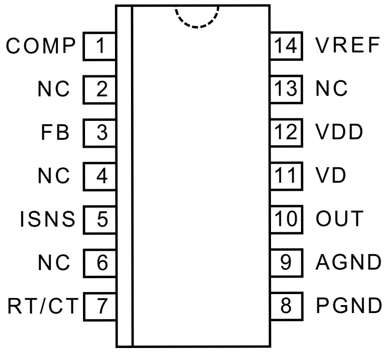
For fast rise and fall times and higher output drive, refer to the MIC38HC4x.

### Package Types

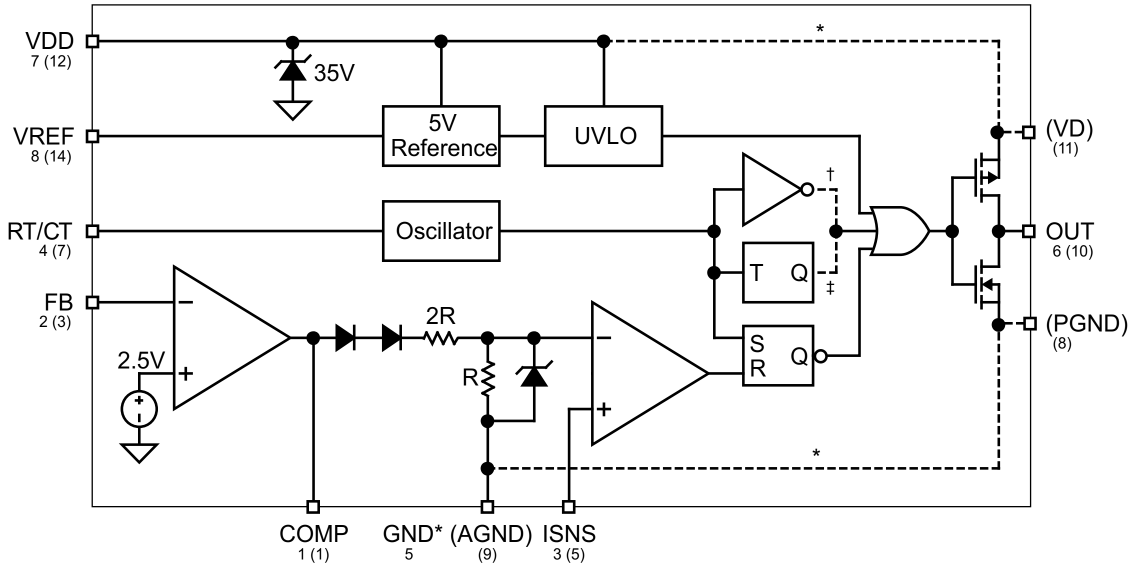
**MIC38C42/43/44/45**
8-Lead SOIC (M)
8-Lead MSOP (MM)
8-Lead DIP (N)



**MIC38C42-1/43-1/44-1/45-1**
14-Lead SOIC (M)
14-Lead DIP (N)



## Functional Block Diagram



( ) pins are on MIC38C4x-1 (14-lead) versions only
* MIC38C4x, (8-lead) versions only
† MIC38C42, MIC38C43 (96% max. duty cycle) versions only
‡ MIC38C44, MIC38C45 (50% max. duty cycle) versions only

## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings †

| | |
|---|---|
| Zener Current ($I_Z$ at VDD Pin) | 30 mA |
| Operation at ≥ 18V may require special precautions. See Note 1. | |
| Supply Voltage ($V_{DD}$, Note 1) | +20V |
| Switch Supply Voltage ($V_D$) | +20V |
| Current Sense Voltage ($V_{ISNS}$) | –0.3V to +5.5V |
| Feedback Voltage ($V_{FB}$) | –0.3V to +5.5V |
| Output Current ($I_{OUT}$) | 0.5A |

**† 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 sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability.

**Note 1:** On the 8-pin version, 20V is the maximum input on Pin 7 because this is also the supply pin for the output stage. On the 14-pin version, 40V is the maximum for Pin 12 and 20V is the maximum for Pin 11.

## ELECTRICAL CHARACTERISTICS

**Electrical Characteristics:** $V_{DD}$ = 15V, Adjust $V_{DD}$ above the start threshold before setting at 15V; $R_T$ = 11.0 kΩ; $C_T$ = 3.3 nF; –40°C ≤ $T_A$ ≤ +85°C; unless noted. Note 1

| Parameter | Symbol | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| **Reference** | | | | | | |
| Output Voltage | $V_{REF}$ | 4.90 | 5.00 | 5.10 | V | $T_A$ = +25°C, $I_{VREF}$ = 1 mA |
| Line Regulation | $\Delta V_{REF(LINE)}$ | — | 2 | 20 | mV | 12V ≤ $V_{DD}$ ≤ 18V, $I_{VREF}$ = 5 µA, Note 6 |
| Load Regulation | $\Delta V_{REF(LOAD)}$ | — | 1 | 25 | mV | 1 mA ≤ $I_{VREF}$ ≤ 20 mA |
| Temperature Stability | $TC_{VREF}$ | — | 0.2 | — | mV/°C | Note 2 |
| Total Output Variation | $\Delta V_{REF(TOT)}$ | 4.82 | — | 5.18 | V | Line, Load, Temperature, Note 2 |
| Output Noise Voltage | $V_{NOISE}$ | — | 50 | — | µV | 10 Hz ≤ f ≤ 10 kHz, $T_A$ = +25°C, Note 2 |
| Long-Term Stability | $\Delta V_{REF(LT)}$ | — | 5 | 25 | mV | $T_A$ = +125°C, 1000 hours, Note 2 |
| Output Short-Circuit | $I_{VREF(SC)}$ | –30 | –80 | –180 | mA | — |
| **Oscillator** | | | | | | |
| Initial Accuracy | $\Delta f_{OSC(INIT)}$ | 49 | 52 | 55 | kHz | $T_A$ = +25°C, Note 3 |
| Voltage Stability | $\Delta f_{OSC(VS)}$ | — | 0.2 | 1.0 | % | 12V ≤ $V_{DD}$ ≤ 18V, Note 6 |
| Temperature Stability | $TC_{FOSC}$ | — | 0.04 | — | %/°C | $T_{MIN}$ ≤ $T_A$ ≤ $T_{MAX}$, Note 2 |
| Clock Ramp Reset Current | $I_{DISCHG}$ | 6.0 | 8.4 | 9.0 | mA | $T_A$ = +25°C, $V_{RT/CT}$ = 2V |
| | | 6.0 | 8.4 | 9.5 | mA | $T_A$ = $T_{MIN}$ to $T_{MAX}$ |
| Amplitude | $V_{AMP}$ | — | 1.9 | — | $V_{PP}$ | $V_{RT/CT}$ peak-to-peak |
| **Error Amp** | | | | | | |
| Input Voltage | $V_{IN(EA)}$ | 2.42 | 2.50 | 2.58 | V | $V_{COMP}$ = 2.5V |
| Input Bias Current | $I_{BIAS(EA)}$ | — | –0.1 | –2 | µA | $V_{FB}$ = 5.0V |
| Open Loop Voltage Gain | $A_{VOL}$ | 65 | 90 | — | dB | 2V ≤ $V_{COMP}$ ≤ 4V |
| Unity Gain Bandwidth | GBW | 0.7 | 1.0 | — | MHz | Note 2 |
| Power Supply Rejection Ratio | $PSRR_{EA}$ | 60 | — | — | dB | 12V ≤ $V_{DD}$ ≤ 18V |
| Output Sink Current | $I_{COMP(SINK)}$ | 2 | 14 | — | mA | $V_{FB}$ = 2.7V, $V_{COMP}$ = 1.1V |
| Output Source Current | $I_{COMP(SRC)}$ | –0.5 | –1 | — | mA | $V_{FB}$ = 2.3V, $V_{COMP}$ = 5V |
| COMP High Voltage | $V_{COMP\_H}$ | 5 | 6.8 | — | V | $V_{FB}$ = 2.3V, $R_{LOAD}$ = 15 kΩ to ground |
| COMP Low Voltage | $V_{COMP\_L}$ | — | 0.1 | 1.1 | V | $V_{FB}$ = 2.7V, $R_{LOAD}$ = 15 kΩ to $V_{REF}$ |
| **Current Sense** | | | | | | |
| Divider Gain Input-to-Output | $A_{DIV}$ | 2.85 | 3.0 | 3.15 | V/V | Note 4, Note 5 |
| Maximum Threshold | $V_{TH(MAX)}$ | 0.9 | 1 | 1.1 | V | $V_{COMP}$ = 5V, Note 4 |
| Power Supply Rejection Ratio | $PSRR_{CS}$ | — | 70 | — | dB | 12V ≤ $V_{DD}$ ≤ 18V, Note 4 |
| Input Bias Current | $I_{BIAS(CS)}$ | — | –0.1 | –2 | µA | — |
| Delay to Output | $t_D$ | — | 120 | 250 | ns | — |
| **Output** | | | | | | |
| $R_{DS(ON)}$ Pull High | $R_{DSON\_H}$ | — | 20 | — | Ω | $I_{SOURCE}$ = 200 mA |
| $R_{DS(ON)}$ Pull Low | $R_{DSON\_L}$ | — | 11 | — | Ω | $I_{SINK}$ = 200 mA |
| Rise Time | $t_R$ | — | 40 | 80 | ns | $T_A$ = +25°C, $C_{LOAD}$ = 1 nF |
| Fall Time | $t_F$ | — | 30 | 60 | ns | $T_A$ = +25°C, $C_{LOAD}$ = 1 nF |

## ELECTRICAL CHARACTERISTICS (CONTINUED)

**Electrical Characteristics:** $V_{DD}$ = 15V, Adjust $V_{DD}$ above the start threshold before setting at 15V; $R_T$ = 11.0 kΩ; $C_T$ = 3.3 nF; –40°C ≤ $T_A$ ≤ +85°C; unless noted. Note 1

| Parameter | Symbol | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| **Undervoltage Lockout** | | | | | | |
| Start Threshold | $V_{TH(ST)}$ | 13.5 | 14.5 | 15.5 | V | MIC38C42/4 |
| | | 7.8 | 8.4 | 9.0 | V | MIC38C43/5 |
| Minimum Operating Voltage | $V_{DD(MIN)}$ | 8 | 9 | 10 | V | MIC38C42/4 |
| | | 7.0 | 7.6 | 8.2 | V | MIC38C43/5 |
| **Pulse Width Modulator** | | | | | | |
| Maximum Duty Cycle | $D_{MAX}$ | 94 | 96 | — | % | MIC38C42/3 |
| | | 46 | 50 | — | % | MIC38C44/5 |
| Minimum Duty Cycle | $D_{MIN}$ | — | — | 0 | % | — |
| **Total Standby Current** | | | | | | |
| Start-Up Current | $I_{DD(START)}$ | — | 50 | 200 | µA | $V_{DD}$ = 13V for MIC38C42/44 |
| | | | | | | $V_{DD}$ = 7.5V for MIC38C43/45 |
| Operating Supply Current | $I_{DD(Q)}$ | — | 4.0 | 6.0 | mA | $V_{FB}$ = $V_{ISNS}$ = 0V |
| Zener Voltage at VDD Pin | $V_Z$ | 30 | 37 | — | V | $I_{DD}$ = 25 mA, Note 6 |

**Note 1:** Specification for packaged product only.

**2:** These parameters, although guaranteed, are not 100% tested in production.

**3:** Output frequency equals oscillator frequency for the MIC38C42 and MIC38C43. Output frequency for the MIC38C44 and MIC38C45 equals one-half the oscillator frequency.

**4:** Parameter measured at trip point of latch with $V_{FB}$ = 0V.

**5:** Gain defined as Equation 1-1; 0V ≤ $V_{TH(ISNS)}$ ≤ 0.8V.

**6:** On the 8-pin version, 20V is the maximum input on Pin 7 because this is also the supply pin for the output stage. On the 14-pin version, 40V is the maximum for Pin 12 and 20V is the maximum for Pin 11.

### EQUATION 1-1:

$$A_{DIV} = \frac{\Delta V_{COMP}}{\Delta V_{TH(ISNS)}}$$

## TEMPERATURE SPECIFICATIONS (Note 1)

| Parameters | Sym. | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| **Temperature Ranges** | | | | | | |
| Storage Temperature Range | $T_S$ | –65 | — | +150 | °C | — |
| Operating Ambient Temperature Range | $T_A$ | –40 | — | +85 | °C | — |
| Operating Junction Temperature Range | $T_J$ | –40 | — | +125 | °C | — |
| Maximum Junction Temperature | $T_{J(MAX)}$ | — | — | +150 | °C | — |
| **Package Thermal Resistance** | | | | | | |
| Thermal Resistance 8-Ld Plastic DIP | $\theta_{JA}$ | — | 125 | — | °C/W | — |
| Thermal Resistance 8-Ld MSOP | $\theta_{JA}$ | — | 250 | — | °C/W | — |
| Thermal Resistance 8-Ld SOIC | $\theta_{JA}$ | — | 170 | — | °C/W | — |
| Thermal Resistance 14-Ld Plastic DIP | $\theta_{JA}$ | — | 90 | — | °C/W | — |
| Thermal Resistance 14-Ld SOIC | $\theta_{JA}$ | — | 145 | — | °C/W | — |

**Note 1:** The maximum allowable power dissipation is a function of ambient temperature, the maximum allowable junction temperature and the thermal resistance from junction to air (i.e., $T_A$, $T_J$, $\theta_{JA}$). Exceeding the maximum allowable power dissipation will cause the device operating junction temperature to exceed the maximum +125°C rating. Sustained junction temperatures above +125°C can impact the device reliability.

## 2.0 TYPICAL PERFORMANCE CURVES

**Note:** The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

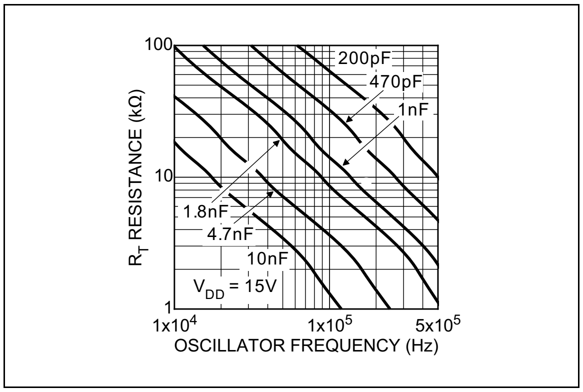


***FIGURE 2-1:*** *Oscillator Frequency Configuration.*

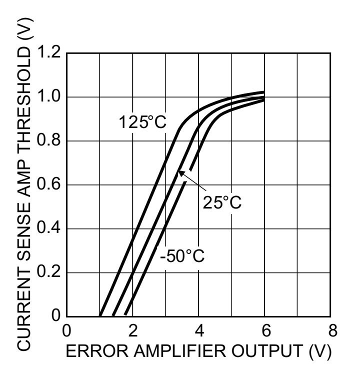


***FIGURE 2-4:*** *Current Sense Amplifier Threshold vs. Error Amplifier Output.*

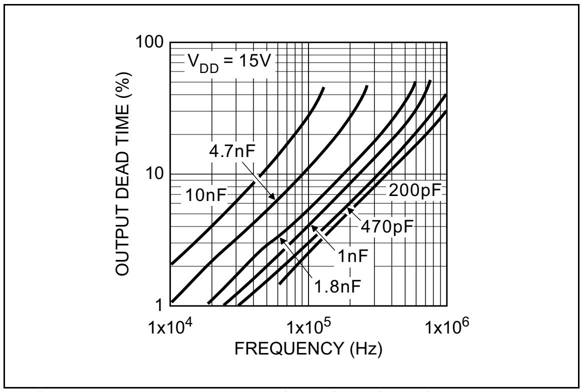


***FIGURE 2-2:*** *MIC38C42/43 Output Dead Time vs. Oscillator Frequency.*

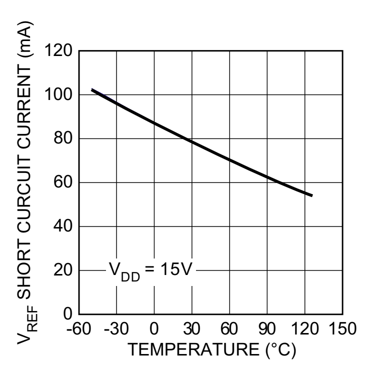


***FIGURE 2-5:*** *Short-Circuit Reference Current vs. Temperature.*

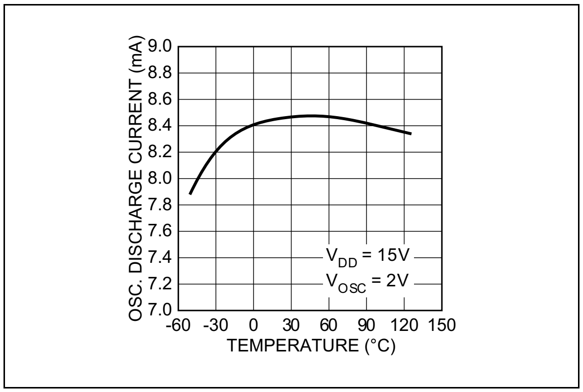


***FIGURE 2-3:*** *Oscillator Discharge Current vs. Temperature.*

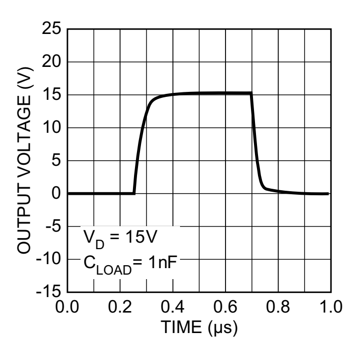


***FIGURE 2-6:*** *MIC38C4x Output Waveform.*

## 3.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in Table 3-1.

**TABLE 3-1: PIN FUNCTION TABLE**

| Pin Number 8-Pin DIP, SOIC, MSOP | Pin Number 14-Pin DIP and SOIC | Pin Name | Description |
|---|---|---|---|
| 1 | 1 | COMP | Compensation: Connect external compensation network to modify the error amplifier output. |
| — | 2 | NC | Not internally connected. |
| 2 | 3 | FB | Feedback (Input): Error amplifier input. Feedback is 2.5V at desired output voltage. |
| — | 4 | NC | Not internally connected. |
| 3 | 5 | ISNS | Current Sense (Input): Current sense comparator input. Connect to current sensing resistor or current transformer. |
| — | 6 | NC | Not internally connected. |
| 4 | 7 | RT/CT | Timing Resistor/Timing Capacitor: Connect external RC network to select switching frequency. |
| 5 | — | GND | Ground: Combined analog and power ground. |
| — | 8 | PGND | Power Ground: N-channel driver transistor ground. |
| — | 9 | AGND | Analog Ground: Controller circuitry ground. |
| 6 | 10 | OUT | Gate Driver Output: Totem-pole output. |
| — | 11 | VD | Power Supply (Input): P-channel driver transistor supply input. Return to power ground (PGND). |
| 7 | 12 | VDD | Analog Supply (Input): Controller circuitry supply input. Return to analog ground (AGND). |
| — | 13 | NC | Not internally connected. |
| 8 | 14 | VREF | 5V Reference (Output): Connect external RC network. |

# 4.0 FUNCTIONAL DESCRIPTION

Familiarity with 384x converter designs is assumed.

## 4.1 MIC38C4x Advantages

### 4.1.1 START-UP CURRENT

Start-up current has been reduced to an ultra-low 50 µA (typical) permitting higher-resistance, lower-wattage, start-up resistors (powers controller during power supply start-up). The reduced resistor wattage reduces cost and printed circuit space.

### 4.1.2 OPERATING CURRENT

Quiescent operating current has been reduced to 4 mA compared to 11 mA for a typical bipolar controller. The controller runs cooler and the $V_{DD}$ hold-up capacitance required during start-up may be reduced.

### 4.1.3 OUTPUT DRIVER

Complementary internal P-channel and N-channel MOSFETs produce rail-to-rail output voltages for better performance driving external power MOSFETs. The driver transistor's low on resistance and high peak current capability can drive gate capacitances of greater than 1000 pF. The value of output capacitance which can be driven is determined only by the rise/fall time requirements. Within the restrictions of output capacity and controller power dissipation, maximum switching frequency can approach 500 kHz.

## 4.2 Design Precautions

When operating near 20V, circuit transients can easily exceed the 20V absolute maximum rating, permanently damaging the controller's CMOS construction. To reduce transients, connect a 0.1 µF low-ESR capacitor to next to the controller's supply $V_{DD}$ (or $V_D$ for '-1' versions) and ground connections. Film type capacitors, such as Wima MKS2, are recommended.

When designing high-frequency converters, avoid capacitive and inductive coupling of the switching waveform into high impedance circuitry such as the error amplifier, oscillator, and current sense amplifier. Avoid long printed-circuit traces and component leads. Locate oscillator and compensation circuitry near the IC. Use high frequency decoupling capacitors on $V_{REF}$, and if necessary, on $V_{DD}$. Return high di/dt currents directly to their source and use large area ground planes.

## 4.3 Buck Converter

Refer to Figure 4-1. When at least 26V is applied to the input, C5 is charged through R2 until the voltage $V_{DD}$ is greater than 14.5V (the undervoltage lockout value of the MIC38C42). Output switching begins when Q1 is turned on by the gate drive transformer T1, charging the output filter capacitor C3 through L1. D5 supplies a regulated +12V to $V_{DD}$ once the circuit is running.

Current sense transformer CT1 provides current feedback to ISNS for current-mode operation and cycle-by-cycle current limiting. This is more efficient than a high-power sense resistor and provides the required ground-referenced level shift.

When Q1 turns off, current flow continues from ground through D1 and L1 until Q1 is turned on again.

The 100V Schottky diode D1 reduces the forward voltage drop in the main current path, resulting in higher efficiency than could be accomplished using an ultra-fast-recovery diode. R1 and C2 suppress parasitic oscillations from D1.

Using a high-value inductance for L1 and a low-ESR capacitor for C3 permits small capacitance with minimum output ripple. This inductance value also improves circuit efficiency by reducing the flux swing in L1.

Magnetic components are carefully chosen for minimal loss at 500 kHz. CT1 and T1 are wound on Magnetics, Inc. P-type material toroids. L1 is wound on a Siemens N49 EFD core.

**TABLE 4-1: MAGNETIC COMPONENTS**

| Symbol | Custom Coils (Note 1) | ETS (Note 2) |
|---|---|---|
| CT1 | 4923 | ETS 92420 |
| T1 | 4924 | ETS 92419 |
| L1 | 4925 | ETS 92421 |

**Note 1:** Custom Coils, Alcester, SD. Tel: (605) 934-2460.

**2:** Energy Transformation Systems, Inc. Tel: (510) 656-2012.

**TABLE 4-2: COMPONENT TEST RESULTS**

| Test | Conditions | Results |
|---|---|---|
| Line Regulation | $V_{IN}$ = 26V to 80V, $V_{OUT}$ = 12V, $I_O$ = 2A | 0.5% |
| Load Regulation | $V_{IN}$ = 48V, $V_{OUT}$ = 12V, $I_O$ = 0.2A to 2A | 0.6% |
| Efficiency | $V_{IN}$ = 48V, $V_{OUT}$ = 12V, $I_O$ = 2A | 90% |
| Output Ripple | $V_{IN}$ = 48V, $V_{OUT}$ = 12V, $I_O$ = 2A (20 MHz BW) | 100 mV |

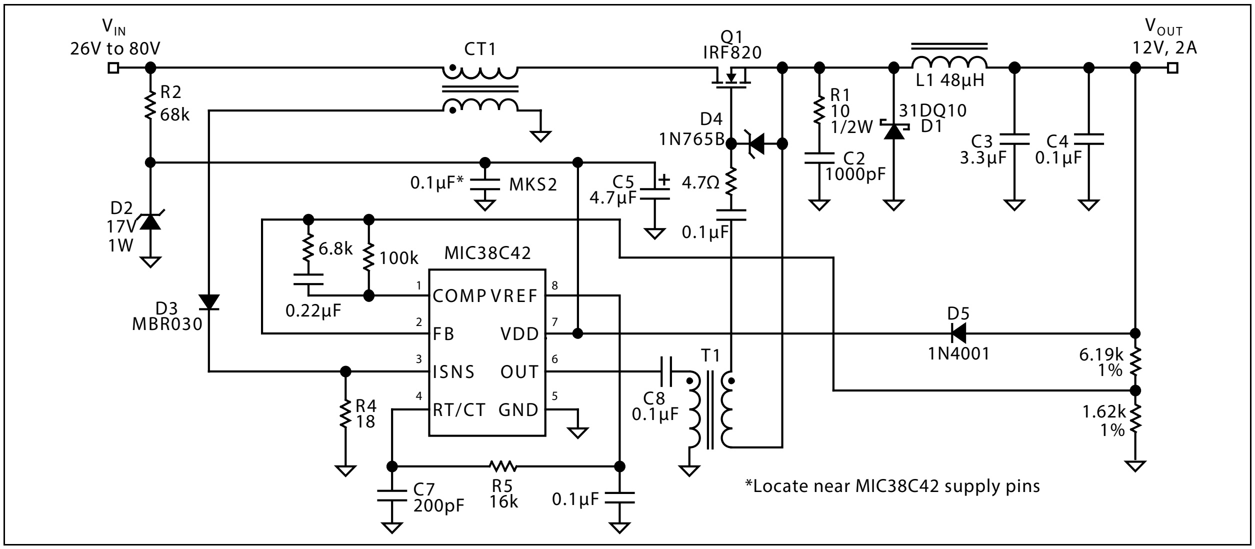


**FIGURE 4-1:** *500 kHz, 25W, Buck Converter.*

## 4.4 Synchronous Buck Converter

Refer to Figure 4-2. This MIC38C43 synchronous buck converter uses an MIC5022 half-bridge driver to alternately drive the PWM switch MOSFET (driven by GATEH, or high-side output) and a MOSFET which functions as a synchronous rectifier (driven by the GATEL, or low-side output).

The low-side MOSFET turns on when the high-side MOSFET is off, allowing current to return from ground. Current flows through the low-side MOSFET in the source to drain direction.

The on-state voltage drop of the low-side MOSFET is lower than the forward voltage drop of an equivalent Schottky rectifier. This lower voltage drop results in higher efficiency.

A sense resistor (5 mΩ) is connected to the driver's high-side current sense inputs to provide overcurrent protection. Refer to the MIC5020, MIC5021, and MIC5022 data sheets for more information.

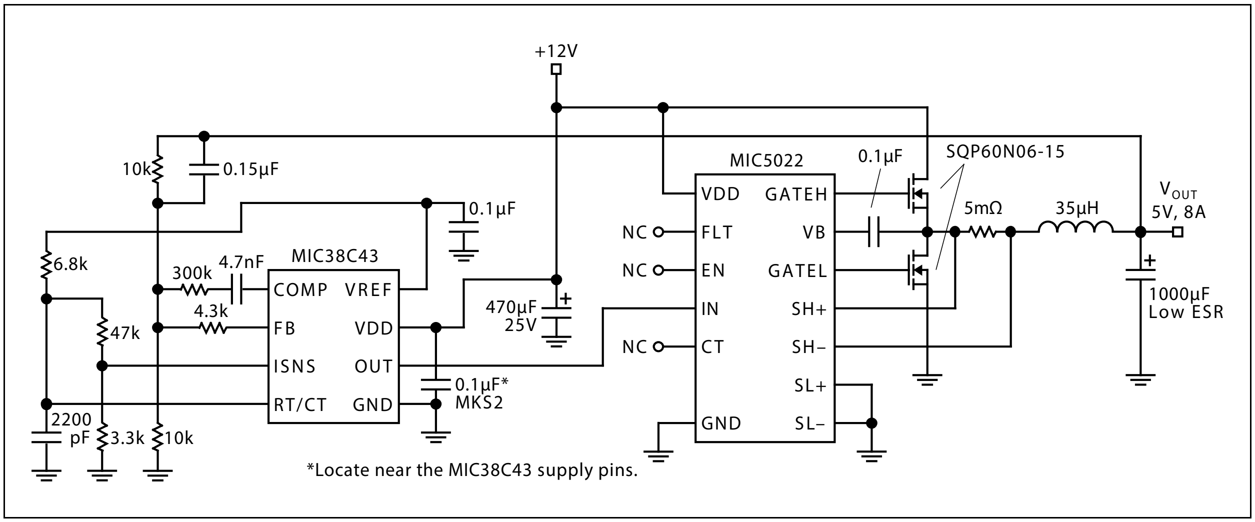
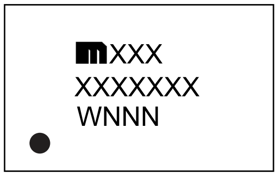


**FIGURE 4-2:** *100 kHz Synchronous Buck Converter.*

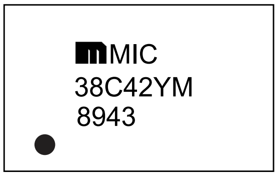
## 5.0 PACKAGING INFORMATION

### 5.1 Package Marking Information

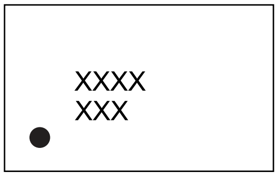
8-Lead SOIC*



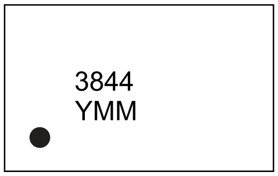
Example



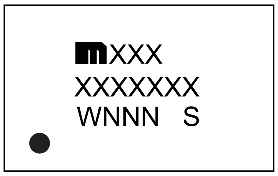
8-Lead MSOP*



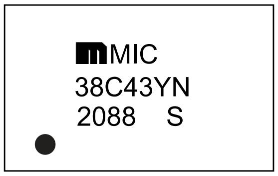
Example



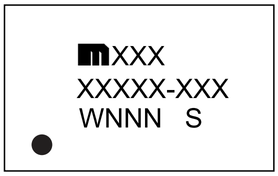
8-Lead DIP*



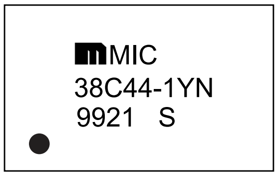
Example



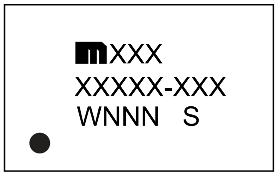
14-Lead DIP*



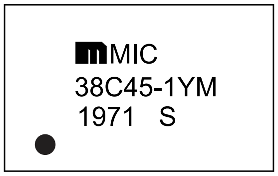
Example



14-Lead SOIC*



Example



| | | |
|---|---|---|
| **Legend:** | XX...X | Product code or customer-specific information |
| | 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 |
| | ⓔ3 | Pb-free JEDEC® designator for Matte Tin (Sn) |
| | * | This package is Pb-free. The Pb-free JEDEC designator (ⓔ3) can be found on the outer packaging for this package. |
| | ●, ▲, ▼ | Pin one index is identified by a dot, delta up, or delta down (triangle mark). |

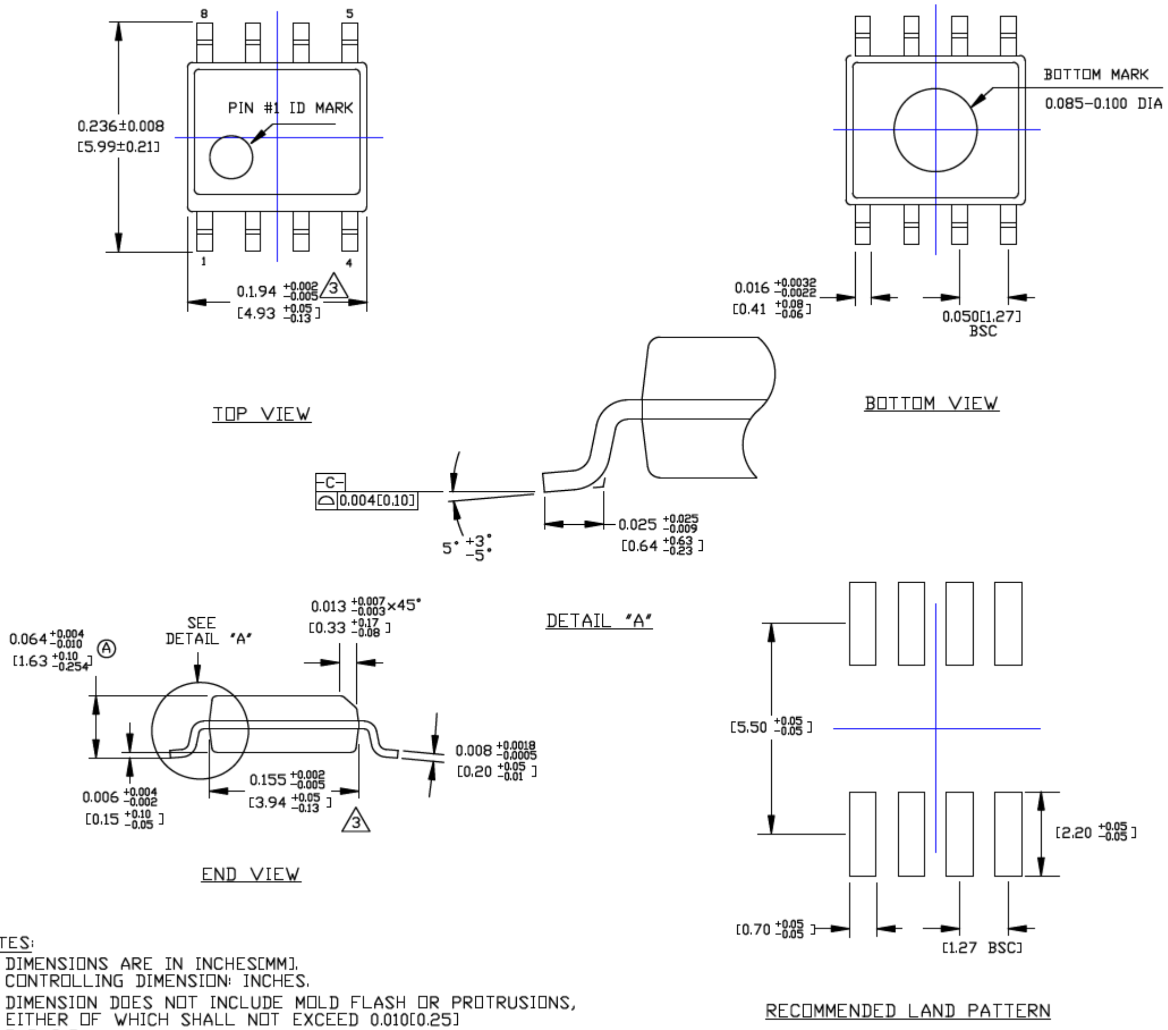
**Note**: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information. Package may or may not include the corporate logo.

Underbar (_) and/or Overbar (‾) symbol may not be to scale.

## 8-Lead SOIC Package Outline and Recommended Land Pattern

**TITLE**
8 LEAD SOICN PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

| | | | |
|---|---|---|---|
| **DRAWING #** | SOICN-8LD-PL-1 | **UNIT** | INCH [MM] |



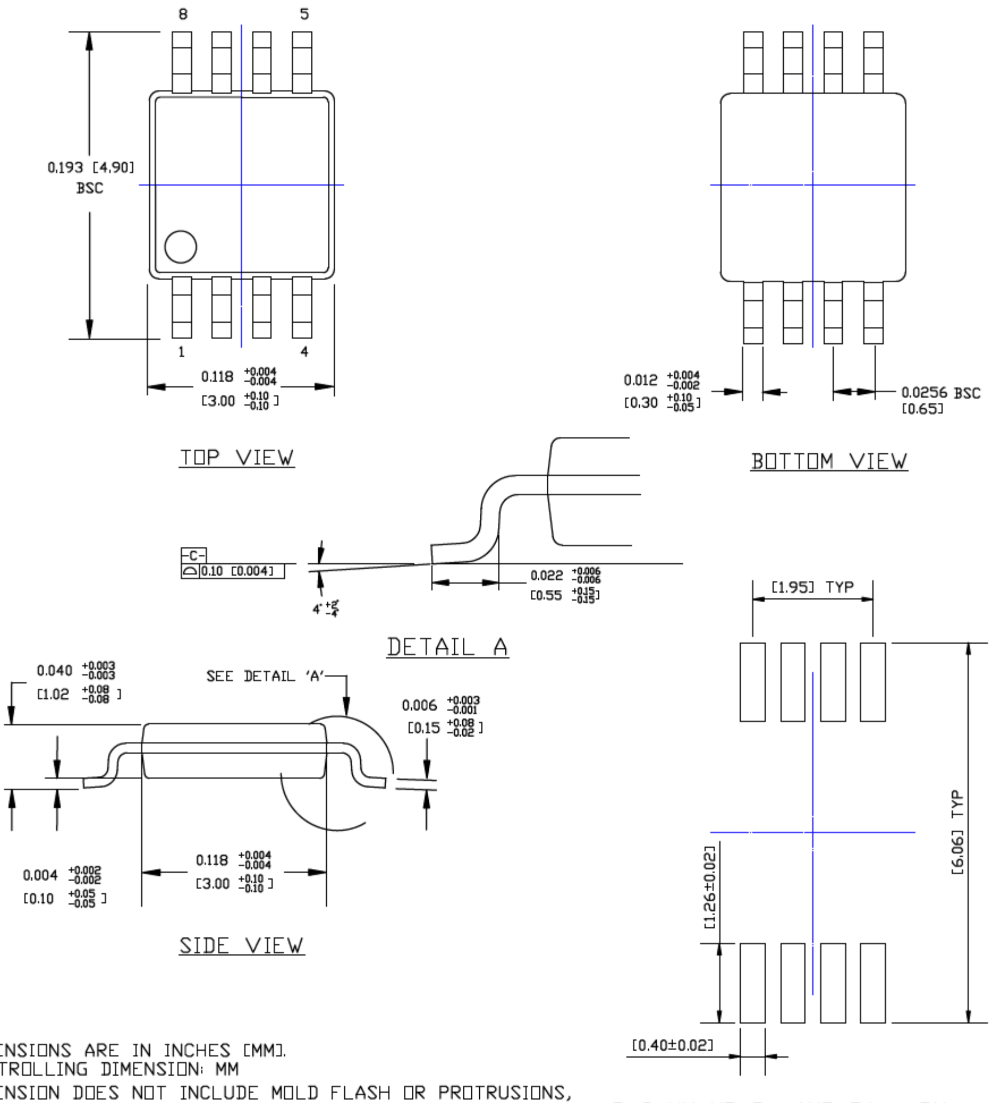
NOTES:
1. DIMENSIONS ARE IN INCHES[MM].
2. CONTROLLING DIMENSION: INCHES.
3. DIMENSION DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS, EITHER OF WHICH SHALL NOT EXCEED 0.010[0.25] PER SIDE.

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

## 8-Lead MSOP Package Outline and Recommended Land Pattern

**TITLE**
8 LEAD MSOP PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

| | | | |
|---|---|---|---|
| **DRAWING #** | MSOP-8LD-PL-1 | **UNIT** | INCH [MM] |



NOTES:
1. DIMENSIONS ARE IN INCHES [MM].
2. CONTROLLING DIMENSION: MM
3. DIMENSION DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS, EITHER OF WHICH SHALL NOT EXCEED 0.008 [0.20] PER SIDE.

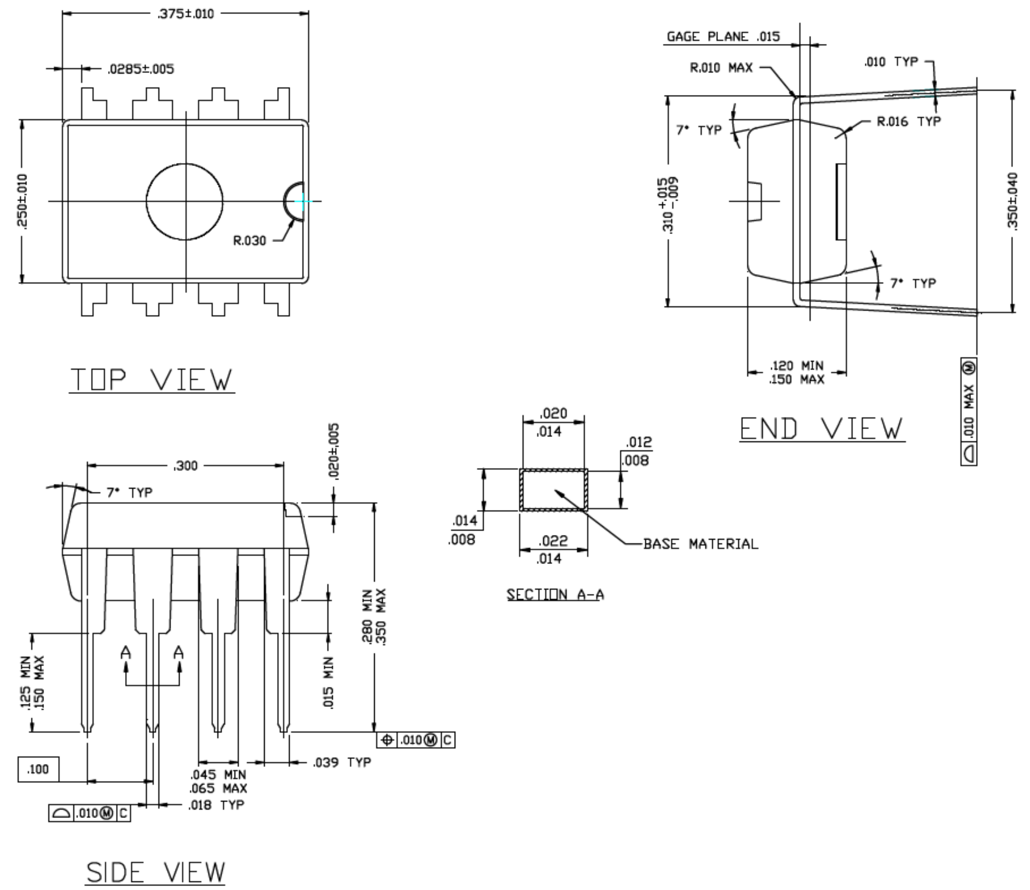
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging.

## 8-Lead DIP Package Outline and Recommended Land Pattern

**TITLE**

8 LEAD PDIP PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

| | | | |
|---|---|---|---|
| **DRAWING #** | PDIP-8LD-PL-1 | **UNIT** | INCH |
| **Lead Frame** | Copper | **Lead Finish** | Matte Tin |



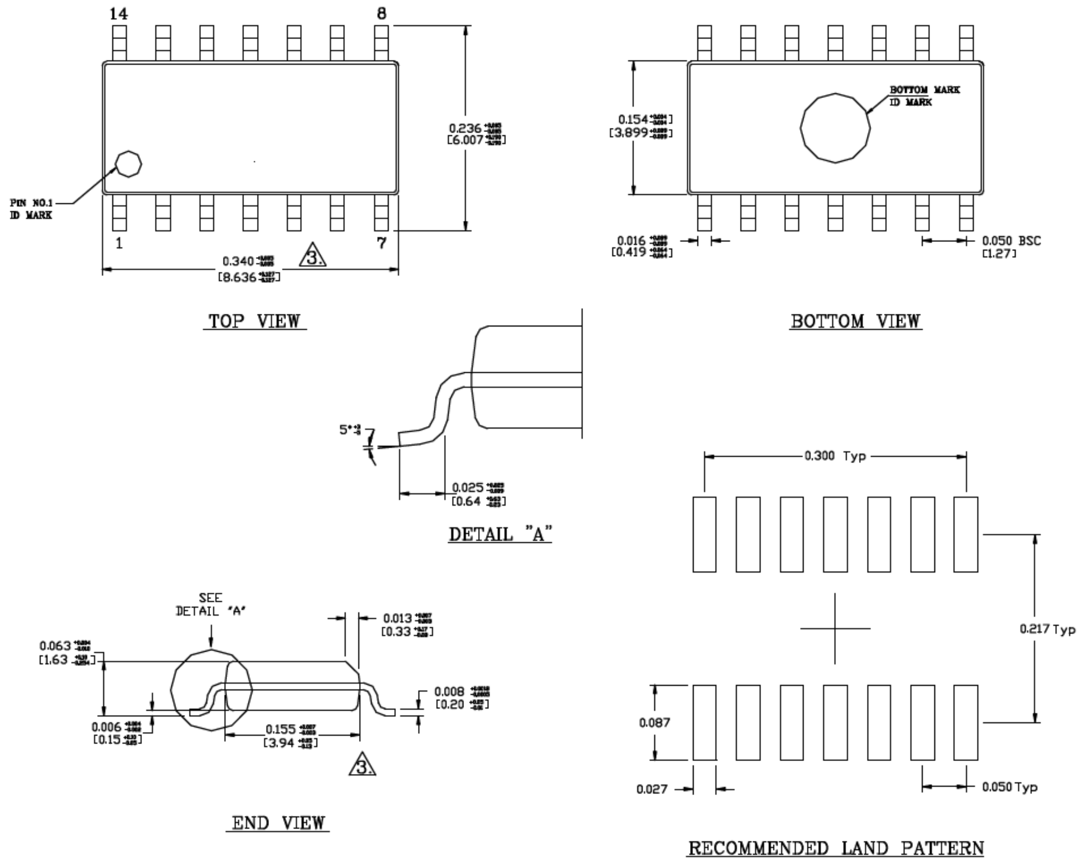
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging.

## 14-Lead SOIC Package Outline and Recommended Land Pattern

**TITLE**

14 LEAD SOICN PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

| | | | |
|---|---|---|---|
| **DRAWING #** | SOICN-14LD-PL-1 | **UNIT** | INCH [MM] |
| **Lead Frame** | Copper | **Lead Finish** | Matte Tin |



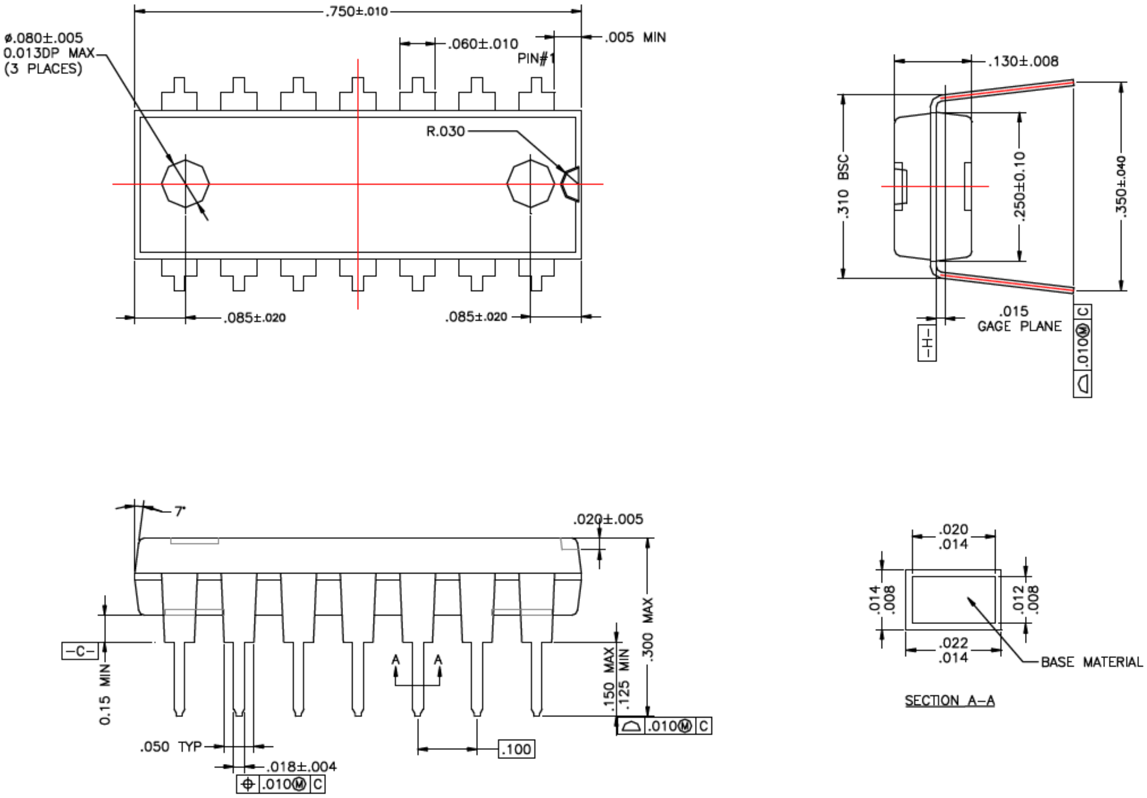
NOTES:
1. DIMENSIONS ARE IN INCHES [MILLIMETER].
2. CONTTROLLING DIMENSION: INCHES.
3. DIMENSION DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS, EITHER OF WHICH SHALL NOT EXCEED 0.010 [0.25] PER SIDE.

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

## 14-Lead DIP Package Outline and Recommended Land Pattern

**TITLE**
14 LEAD PDIP PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

| | | | |
|---|---|---|---|
| **DRAWING #** | PDIP-14LD-PL-1 | **UNIT** | INCH |
| **LEAD FRAME** | Copper | **LEAD FINISH** | Matte Tin |



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

## APPENDIX A: REVISION HISTORY

### Revision A (October 2020)

- Converted Micrel document MIC38C42/43/44/45 to Microchip data sheet DS20006436A.
- Minor text changes throughout.

**NOTES:**

# PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, contact your local Microchip representative or sales office.

| Device | [-X] | X | XX | [-XX] |
|---|---|---|---|---|
| Part No. | Product Feature | Temp. Range | Package | Media Type |

| | | |
|---|---|---|
| **Device:** | MIC38C4x: | BiCMOS Current-Mode PWM Controller (See Selection Guide Below for Part-Specific Detail) |
| | MIC38C42: | 96% Max. Duty Cycle, UVLO Threshold Startup 14.5V, Min. Operating 9V |
| | MIC38C43: | 96% Max. Duty Cycle, UVLO Threshold Startup 8.4V, Min. Operating 7.6V |
| | MIC38C44: | 50% Max. Duty Cycle, UVLO Threshold Startup 14.5V, Min. Operating 9V |
| | MIC38C45: | 50% Max. Duty Cycle, UVLO Threshold Startup 8.4V, Min. Operating 7.6V |

**Product Feature:**
<blank> = 8-Lead
1 = 14-Lead

**Junction Temperature Range:**
Y = –40°C to +125°C, RoHS-Compliant

**Package:**
M = SOIC Package
MM = MSOP Package
N = DIP Package

**Media Type:**
TR = 2,500/Reel
<blank>= 95/Tube for 8-Lead M Package
<blank>= 100/Tube for MM Package
<blank>= 50/Tube for 8-Lead N Package
<blank>= 25/Tube for 14-Lead N Package
<blank>= 54/Tube for 14-Lead M Package

## Selection Guide

| Duty Cycle | UVLO Thresholds | |
|---|---|---|
| — | Start-Up 8.4V<br>Min. Operating 7.6V | Start-Up 14.5V<br>Min. Operating 9V |
| 0% to 96% | MIC38C43 | MIC38C42 |
| 0% to 50% | MIC38C45 | MIC38C44 |

**Examples:**

| | |
|---|---|
| a) MIC38C42: | BiCMOS Current-Mode PWM Controller, 96% Max. Duty Cycle, UVLO Threshold Startup 14.5V, Min. Operating 9V, –40°C to +125°C Junction Temperature Range |
| MIC38C42YM: | 8-Lead SOIC, 95/Tube |
| MIC38C42-1YM | 14-Lead SOIC, 54/Tube |
| MIC38C42YM-TR: | 8-Lead SOIC, 2,500/Reel |
| MIC38C42-1YM-TR | 14-Lead SOIC, 2,500/Reel |
| MIC38C42YMM: | 8-Lead MSOP, 100/Tube |
| MIC38C42YMM-TR: | 8-Lead MSOP, 2,500/Reel |
| MIC38C42-1YN | 14-Lead DIP, 25/Tube |
| MIC38C42YN | 8-Lead DIP, 50/Tube |
| b) MIC38C43: | BiCMOS Current-Mode PWM Controller, 96% Max. Duty Cycle, UVLO Threshold Startup 8.4V, Min. Operating 7.6V, –40°C to +125°C Junction Temperature Range |
| MIC38C43YM: | 8-Lead SOIC, 95/Tube |
| MIC38C43-1YM | 14-Lead SOIC, 54/Tube |
| MIC38C43YM-TR: | 8-Lead SOIC, 2,500/Reel |
| MIC38C43-1YM-TR | 14-Lead SOIC, 2,500/Reel |
| MIC38C43YMM: | 8-Lead MSOP, 100/Tube |
| MIC38C43YMM-TR: | 8-Lead MSOP, 2,500/Reel |
| MIC38C43-1YN | 14-Lead DIP, 25/Tube |
| MIC38C43YN | 8-Lead DIP, 50/Tube |
| c) MIC38C44: | BiCMOS Current-Mode PWM Controller, 50% Max. Duty Cycle, UVLO Threshold Startup 14.5V, Min. Operating 9V, –40°C to +125°C Junction Temperature Range |
| MIC38C44YM: | 8-Lead SOIC, 95/Tube |
| MIC38C44-1YM | 14-Lead SOIC, 54/Tube |
| MIC38C44YM-TR: | 8-Lead SOIC, 2,500/Reel |
| MIC38C44-1YM-TR | 14-Lead SOIC, 2,500/Reel |
| MIC38C44YMM: | 8-Lead MSOP, 100/Tube |
| MIC38C44YMM-TR: | 8-Lead MSOP, 2,500/Reel |
| MIC38C44-1YN | 14-Lead DIP, 25/Tube |
| MIC38C44YN | 8-Lead DIP, 50/Tube |
| d) MIC38C45: | BiCMOS Current-Mode PWM Controller, 50% Max. Duty Cycle, UVLO Threshold Startup 8.4V, Min. Operating 7.6V, –40°C to +125°C Junction Temperature Range |
| MIC38C45YM: | 8-Lead SOIC, 95/Tube |
| MIC38C45-1YM | 14-Lead SOIC, 54/Tube |
| MIC38C45YM-TR: | 8-Lead SOIC, 2,500/Reel |
| MIC38C45-1YM-TR | 14-Lead SOIC, 2,500/Reel |
| MIC38C45YMM: | 8-Lead MSOP, 100/Tube |
| MIC38C45YMM-TR: | 8-Lead MSOP, 2,500/Reel |
| MIC38C45-1YN | 14-Lead DIP, 25/Tube |
| MIC38C45YN | 8-Lead DIP, 50/Tube |

**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.

**NOTES:**

**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.
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- Microchip is willing to work with any customer who is concerned about the integrity of its code.
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