# MIC2940A/41A

## 1.25A Low Dropout Voltage Regulator

### Features

- High Output Voltage Accuracy
- Guaranteed 1.25A Output
- Low Quiescent Current
- Low Dropout Voltage
- Extremely Tight Load and Line Regulation
- Very Low Temperature Coefficient
- Current and Thermal Limiting
- Input Can Withstand –20V Reverse Battery and +60V Positive Transients
- Logic-Controlled Electronic Shutdown
- Output Programmable from 1.24V to 26V (MIC2941A)
- Available in TO-220, TO-263, TO-220-5, and TO-263-5 Packages

### Applications

- Battery-Powered Equipment
- Cellular Telephones
- Laptop, Notebook, and Palmtop Computers
- PCMCIA $V_{CC}$ and $V_{PP}$ Regulation/Switching
- Barcode Scanners
- Automotive Electronics
- SMPS Post-Regulator/DC-to-DC Modules
- Voltage Reference
- High Efficiency Linear Power Supplies

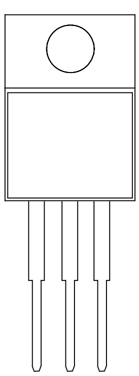
### General Description

The MIC2940A and MIC2941A are “bulletproof” efficient voltage regulators with very low dropout voltage (typically 40 mV at light loads and 350 mV at 1A), and low quiescent current (240 µA typical). The quiescent current of the MIC2940A increases only slightly in dropout, thus prolonging battery life. Key MIC2940A features include protection against reversed battery, fold-back current-limiting, and automotive “load dump” protection (60V positive transient).

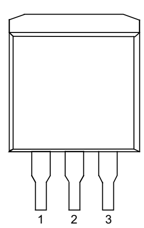
The MIC2940A is available in both fixed voltage (3.3V, 5V, and 12V) and adjustable voltage configurations. The MIC2940A-xx devices are three pin, fixed-voltage regulators. A logic-compatible shutdown input is provided on the adjustable MIC2941A, which enables the regulator to be switched on and off.

### Package Types

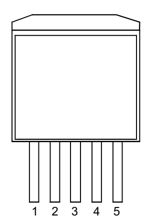
**MIC2940A-x.xWT**
TO-220-3 (T)
(Top View)



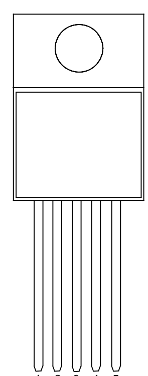

**MIC2940A-x.xWU**
TO-263-3 (U)
(Top View)




**MIC2941AWU**
TO-263-5 (U)
(Top View)

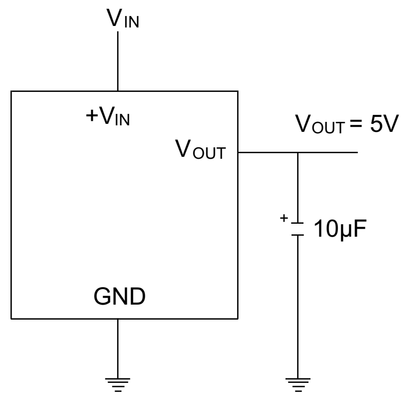



**MIC2941AWT**
TO-220-5 (T)
(Top View)

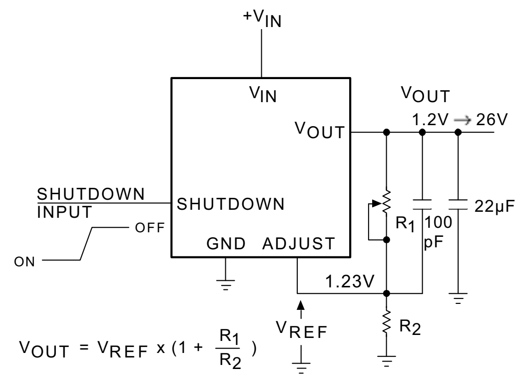


## Typical Application Circuits

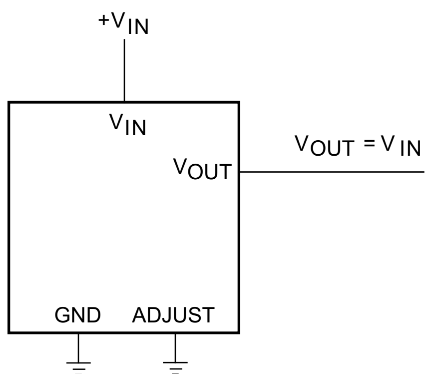
**MIC2940A-5.0 FIXED +5V REGULATOR**




**MIC2941A ADJUSTABLE REGULATOR**

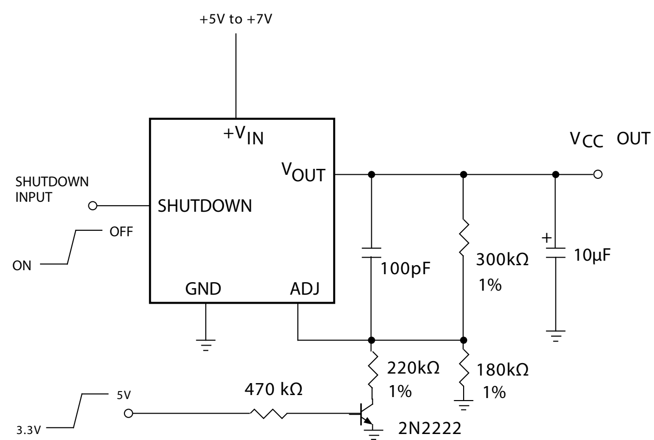



**MIC2941A WIDE INPUT VOLTAGE RANGE CURRENT-LIMIT**



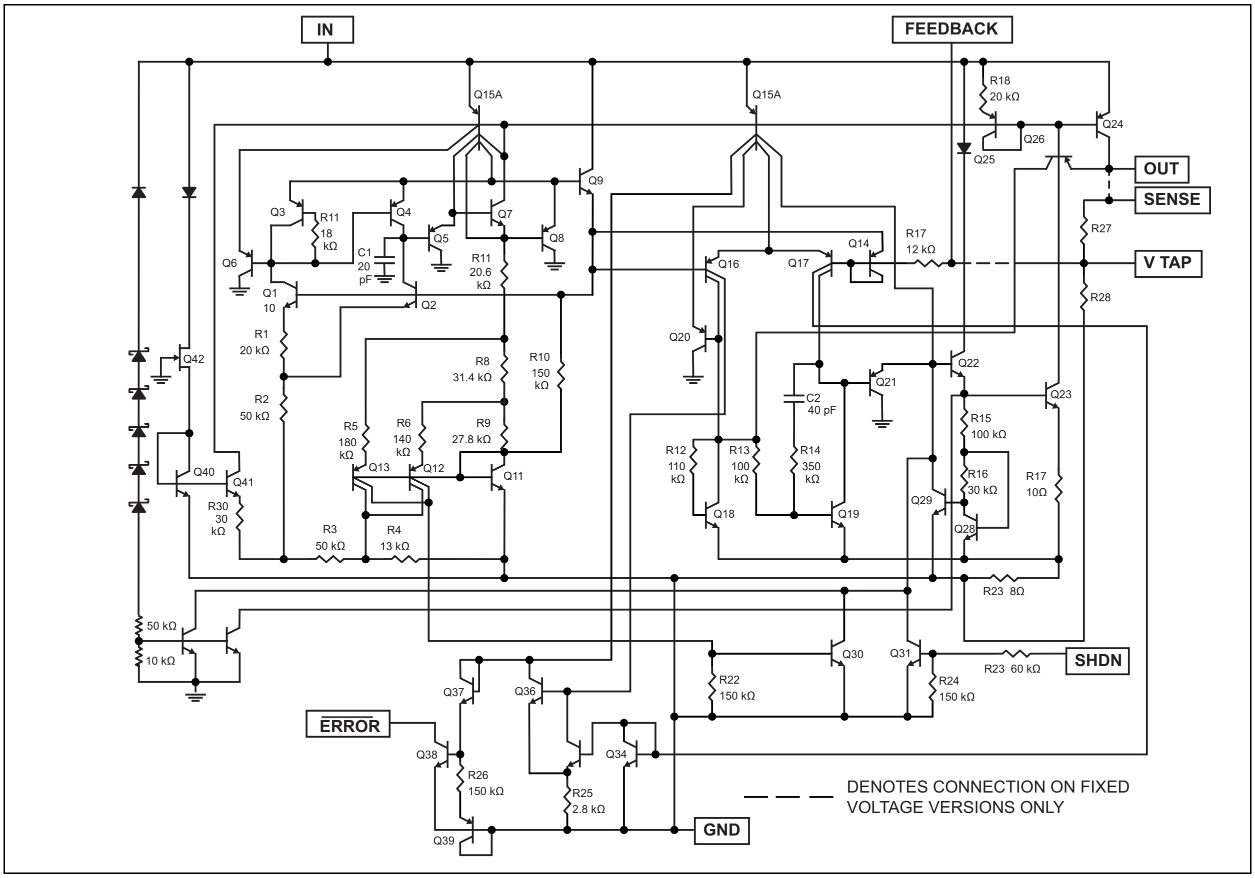

MINIMUM INPUT-OUTPUT VOLTAGE RANGES FROM 40MV TO 400MV, DEPENDING ON LOAD CURRENT

**MIC2941A 5V OR 3.3V SELECTABLE REGULATOR WITH SHUTDOWN**




Adjust Pin Low = Enable Output. Q1 ON = 3.3V, Q1 OFF = 5.0V.

## Functional Block Diagram



## 1.0 ELECTRICAL CHARACTERISTICS

### Absolute Maximum Ratings †

Power Dissipation ($P_D$) .......... Internally Limited, Note 1
Input Supply Voltage .......... –20V to +60V
Adjust Input Voltage (Note 2, Note 3) .......... –1.5V to +26V
Shutdown Input Voltage .......... –0.3V to +30V
Error Comparator Output Voltage .......... –0.3V to +30V

### Operating Ratings ‡

Input Supply Voltage (Note 4) .......... +2V to +26V

† **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.

‡ **Notice:** The device is not guaranteed to function outside its operating ratings.

**Note 1:** The maximum allowable power dissipation of any $T_A$ (ambient temperature) is $P_{D(max)} = (T_{J(max)} – T_A)/\theta_{JA}$. Exceeding the maximum allowable power dissipation will result in excessive die temperature, and the regulator will go into thermal shutdown.

**2:** Circuit of MIC2941A Adjustable Regulator in the Typical Application Circuits section (upper right) with R1 ≥ 150 kΩ. $V_{SHUTDOWN}$ ≥ 2V and $V_{IN}$ ≤ 26V, $V_{OUT}$ = 0.

**3:** When used in dual supply systems where the regulator load is returned to a negative supply, the output voltage must be diode clamped to ground.

**4:** Across the full operating temperature, the minimum input voltage range for full output current is 4.3V to 26V. Output will remain in regulation at lower output voltages and low current loads down to an input of 2V at 25°C.

**TABLE 1-1: ELECTRICAL CHARACTERISTICS**

**Electrical Characteristics:** Limits in standard typeface are for $T_J$ = +25°C and limits in **boldface** apply over the full operating temperature range. Unless otherwise specified, $V_{IN} = V_{OUT}$ + 1V, $I_L$ = 1000 mA, $C_L$ = 10 µF. The MIC2941A is programmed to output 5V and has $V_{SHUTDOWN}$ 0.6V.

| Parameter | Symbol | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| Output Voltage Accuracy | $V_O$ | –1 | — | 1 | % | — |
| | | –2 | — | 2 | | — |
| | | –2.5 | — | 2.5 | | 5mA ≤ $I_L$ ≤ 1A |
| Output Voltage Temperature Coefficient | $\Delta V_O/\Delta T$ | — | 20 | 100 | ppm/°C | Note 1 |
| Line Regulation | $\Delta V_O/V_O$ | — | 0.06 | 0.50 | % | $I_O$ = 10 mA, ($V_{OUT}$ + 1V) ≤ $V_{IN}$ ≤ 26V |
| Load Regulation | | — | 0.04 | 0.16 | | $I_L$ = 5 mA to 1.25A |
| | | — | — | 0.20 | | $I_L$ = 5 mA to 1A, Note 2 |
| Dropout Voltage, Note 3 | $V_{IN} – V_O$ | — | 60 | 150 | mV | $I_L$ = 5 mA |
| | | — | — | **180** | | |
| | | — | 200 | 250 | | $I_L$ = 250 mA |
| | | — | — | **320** | | |
| | | — | 350 | 450 | | $I_L$ = 1000 mA |
| | | — | — | **600** | | |
| | | — | 400 | 600 | | $I_L$ = 1250 mA |

**TABLE 1-1: ELECTRICAL CHARACTERISTICS (CONTINUED)**

**Electrical Characteristics:** Limits in standard typeface are for $T_J$ = +25°C and limits in **boldface** apply over the full operating temperature range. Unless otherwise specified, $V_{IN}$ = $V_{OUT}$ + 1V, $I_L$ = 1000 mA, $C_L$ = 10 µF. The MIC2941A is programmed to output 5V and has $V_{SHUTDOWN}$ 0.6V.

| Parameter | Symbol | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| Ground Pin Current, Note 4 | $I_{GND}$ | — | 240 | 500 | µA | $I_L$ = 5 mA |
| | | — | 3 | 4.5 | mA | $I_L$ = 250 mA |
| | | — | — | **6** | | |
| | | — | 22 | 35 | | $I_L$ = 1000 mA |
| | | — | — | **45** | | |
| | | — | 35 | 70 | | $I_L$ = 1250 mA |
| Ground Pin Current at Dropout, Note 4 | $I_{GNDDO}$ | — | 330 | 600 | µA | $V_{IN}$ = 0.5V less than designed $V_{OUT}$ ($V_{OUT}$ 3.3), $I_L$ = 5 mA |
| Current-Limit | $I_{LIMIT}$ | — | 1.6 | 3.5 | A | $V_{OUT}$ = 0V, Note 5 |
| Thermal Regulation | $\Delta V_O/\Delta P_D$ | — | 0.05 | 0.2 | %/W | Note 6 |
| Output Noise Voltage (10 Hz to 100 kHz) $I_L$ = 100 mA | $e_n$ | — | 400 | — | $\mu V_{RMS}$ | $C_L$ = 10 µF |
| | | — | 260 | — | | $C_L$ = 33 µF |
| **Electrical Characteristics for MIC2941A Only** | | | | | | |
| Reference Voltage | $V_{REF}$ | 1.223 | 1.235 | 1.247 | V | Note 7 |
| | | 1.210 | — | 1.260 | | |
| | | 1.204 | — | 1.266 | | |
| Adjust Pin Bias Current | $I_{BIAS}$ | — | 20 | 40 | nA | — |
| | | — | — | **60** | | |
| Reference Voltage Temperature Coefficient | $\Delta V_{REF}/\Delta T$ | — | 20 | — | ppm/°C | — |
| Adjust Pin Bias Current Temperature Coefficient | $\Delta I_{BIAS}/\Delta T$ | — | 0.1 | — | nA/°C | — |

**TABLE 1-1: ELECTRICAL CHARACTERISTICS (CONTINUED)**

**Electrical Characteristics:** Limits in standard typeface are for $T_J$ = +25°C and limits in **boldface** apply over the full operating temperature range. Unless otherwise specified, $V_{IN} = V_{OUT}$ + 1V, $I_L$ = 1000 mA, $C_L$ = 10 µF. The MIC2941A is programmed to output 5V and has $V_{SHUTDOWN}$ 0.6V.

| Parameter | Symbol | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| **Shutdown Input** | | | | | | |
| Input Logic Voltage | $V_{IL}$ | — | 1.3 | **0.7** | V | Low (ON) |
| | $V_{IH}$ | **2.0** | — | — | | High (OFF) |
| Shutdown Pin Input Current | $I_{SHDN}$ | — | 30 | 50 | µA | $V_{SHUTDOWN}$ = 2.4V |
| | | — | — | **100** | | |
| | | — | 450 | 600 | | $V_{SHUTDOWN}$ = 26V |
| | | — | — | **750** | | |
| Regulator Output Current in Shutdown | $I_{OUT(SHDN)}$ | — | 3 | 30 | µA | Note 8 |
| | | — | — | **60** | | |

**Note 1:** Output voltage temperature coefficient is defined as the worst case voltage change divided by the total temperature range.

**2:** Regulation is measured at constant junction temperature using low duty cycle pulse testing. Changes in output voltage due to heating effects are covered by the thermal regulation specification.

**3:** Dropout voltage is defined as the input to output differential at which the output voltage drops 100 mV below its nominal value measured at 1V differential. At low values of programmed output voltage, the minimum input supply voltage of 4.3V over temperature must be taken into account.

**4:** Ground pin current is the regulator quiescent current. The total current drawn from the source is the sum of the load current plus the ground pin current.

**5:** The MIC2940A features fold-back current limiting. The short-circuit ($V_{OUT}$ = 0V) current-limit is less than the maximum current with normal output voltage.

**6:** Thermal regulation is defined as the change in output voltage at a time (T) after a change in power dissipation is applied, excluding load or line regulation effects. Specifications are for a 200 mA load pulse at $V_{IN}$ = 20V (a 4W pulse) for T = 10 ms.

**7:** $V_{REF} \le V_{OUT} \le (V_{IN} – 1\text{ V})$, 4.3V ≤ $V_{IN}$ 26V, 5 mA < $I_L$ ≤ 1.25A, $T_J \le T_{J(MAX)}$.

**8:** When used in dual supply systems where the regulator load is returned to a negative supply, the output voltage must be diode clamped to ground.

## TEMPERATURE SPECIFICATIONS (Note 1)

| Parameters | Sym. | Min. | Typ. | Max. | Units | Conditions |
|---|---|---|---|---|---|---|
| **Temperature Ranges** | | | | | | |
| Storage Temperature Range | $T_S$ | –65 | — | +150 | °C | — |
| Junction Operating Temperature Range | $T_J$ | –40 | — | +125 | °C | — |
| Lead Temperature | — | — | — | +260 | °C | Soldering, 5s |
| **Package Thermal Resistances** | | | | | | |
| Thermal Resistance TO-220 | $\theta_{JC}$ | — | 2 | — | °C/W | — |
| Thermal Resistance TO-263 | $\theta_{JC}$ | — | 2 | — | °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.

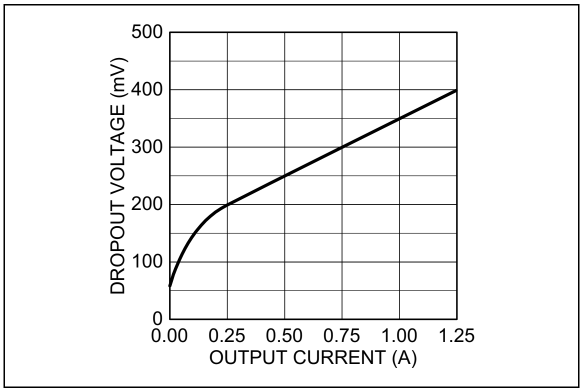



***FIGURE 2-1:*** *Dropout Voltage vs. Output Current.*

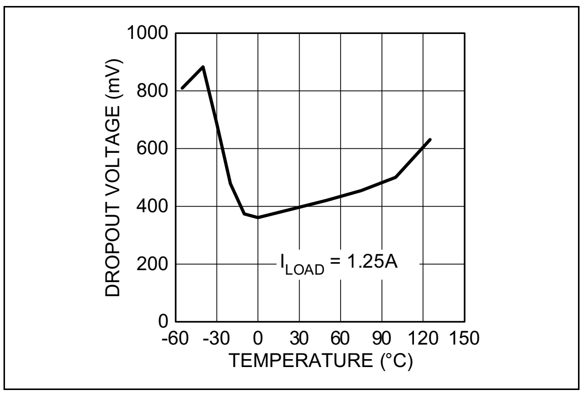



***FIGURE 2-2:*** *Dropout Voltage vs. Temperature.*

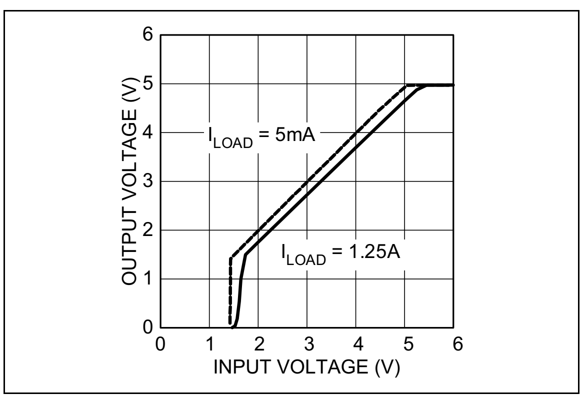



***FIGURE 2-3:*** *Dropout Characteristics.*

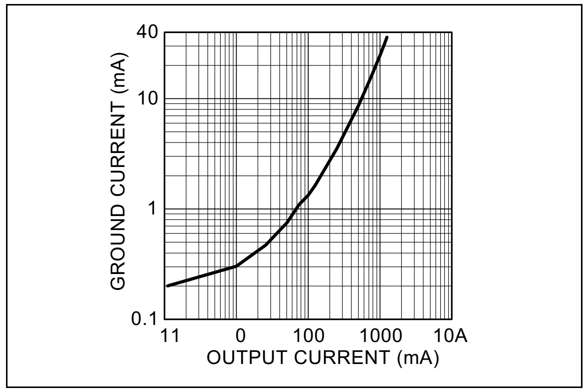



***FIGURE 2-4:*** *Ground Current vs. Output Current.*

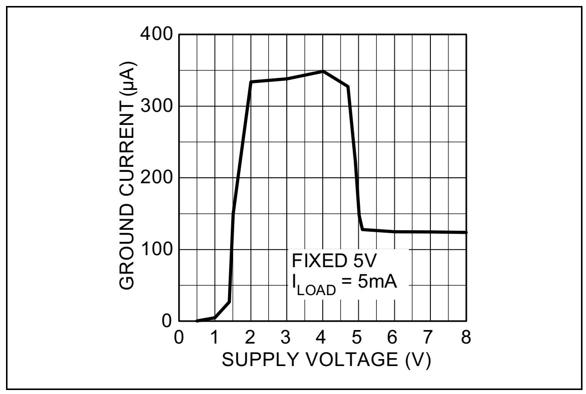



***FIGURE 2-5:*** *Ground Current vs. Supply Voltage.*

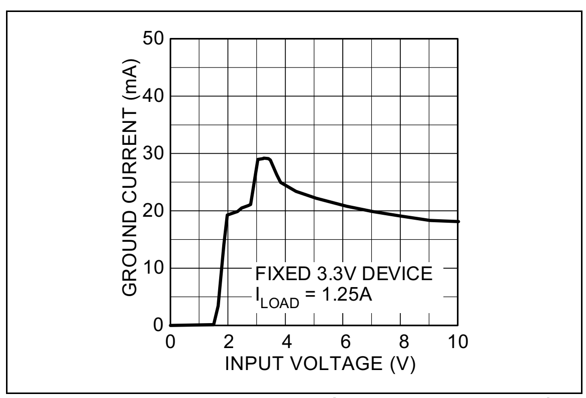



***FIGURE 2-6:*** *Ground Current vs. Supply Voltage.*

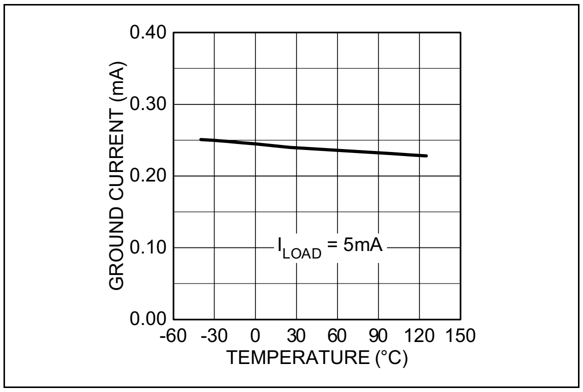



***FIGURE 2-7:*** *Ground Current vs. Temperature.*

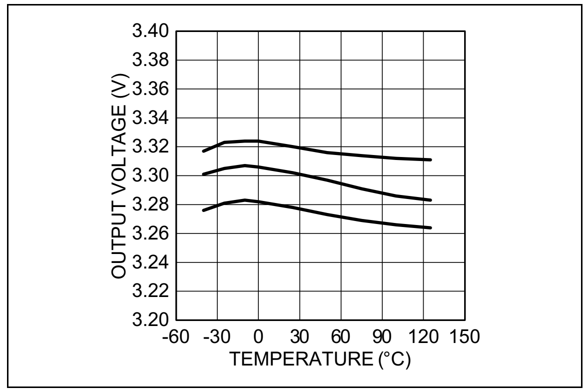



***FIGURE 2-10:*** *Fixed 3.3V Output Voltage vs. Temperature.*

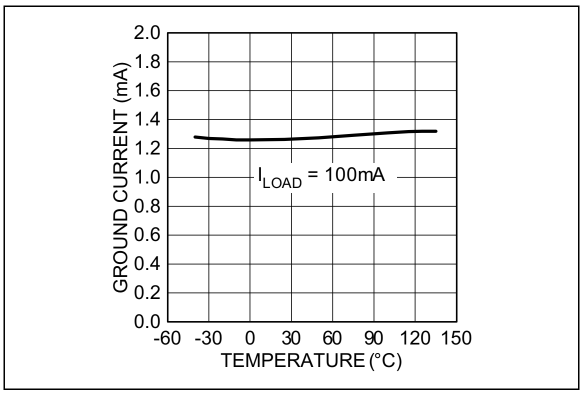



***FIGURE 2-8:*** *Ground Current vs. Temperature.*

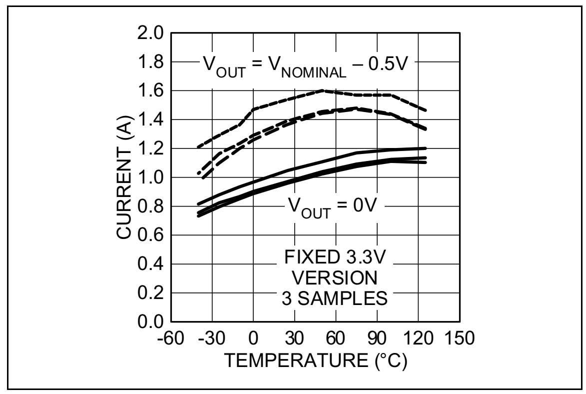



***FIGURE 2-11:*** *Short-Circuit and Maximum Current vs. Temperature.*

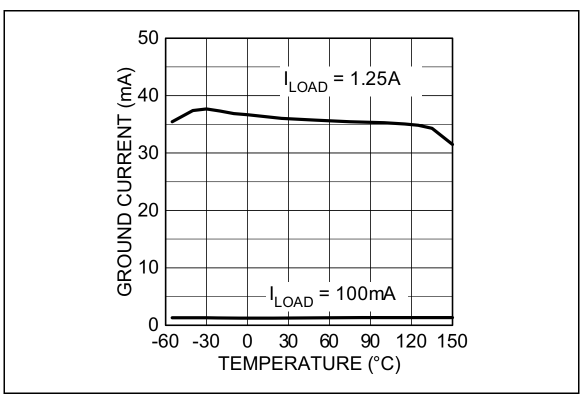



***FIGURE 2-9:*** *Ground Current vs. Temperature.*

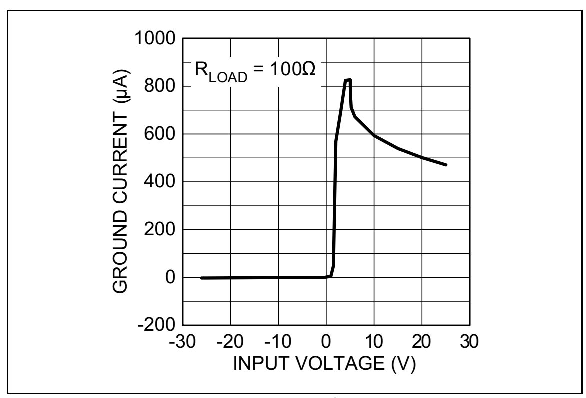



***FIGURE 2-12:*** *Ground Current vs. Input Voltage.*

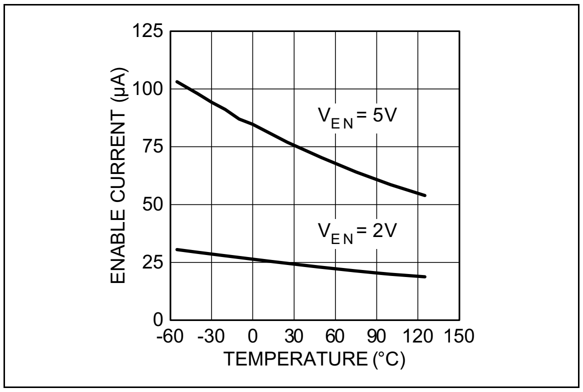



**FIGURE 2-13:** *MIC2941A Shutdown Current vs. Temperature.*

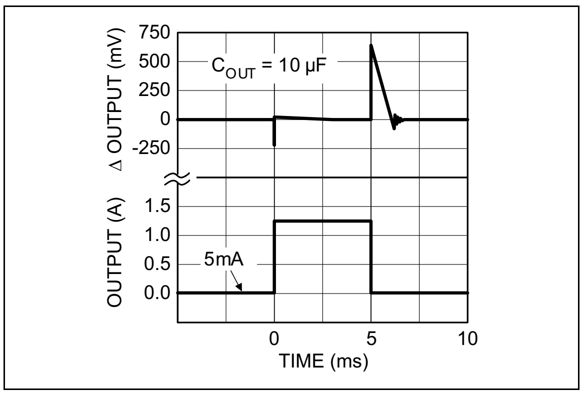



**FIGURE 2-14:** *Load Transient.*

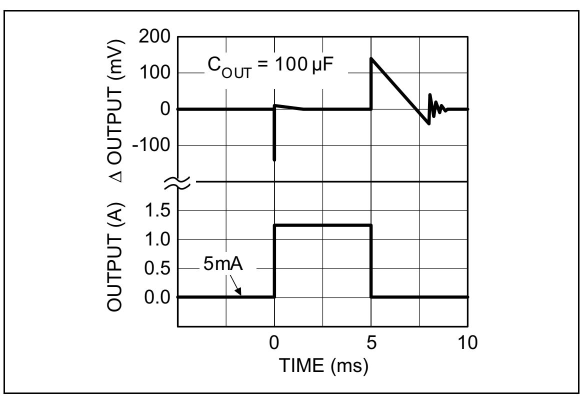



**FIGURE 2-15:** *Load Transient.*

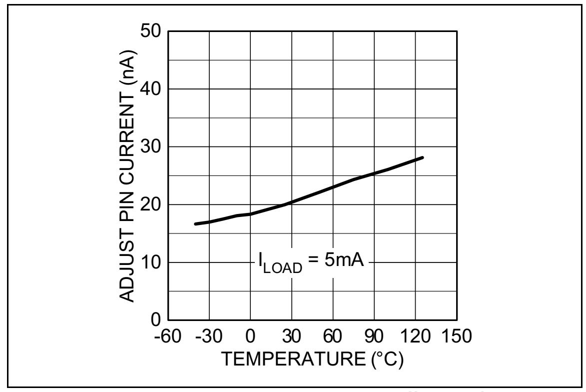



**FIGURE 2-16:** *MIC2941A Adjust Pin Current vs. Temperature.*

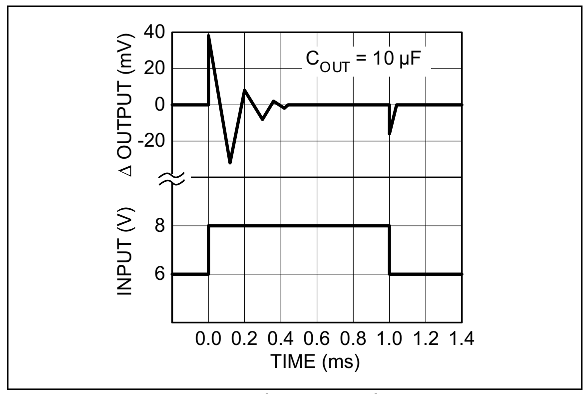



**FIGURE 2-17:** *Line Transient.*

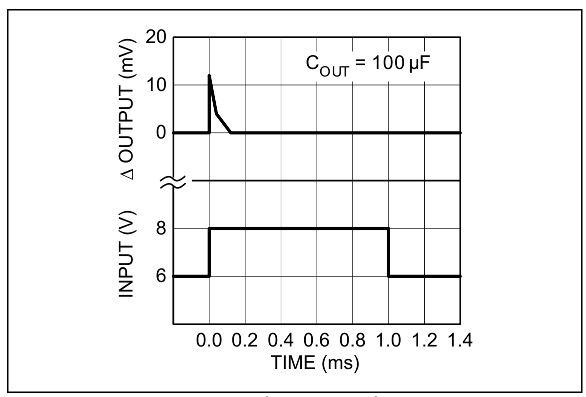



**FIGURE 2-18:** *Line Transient.*

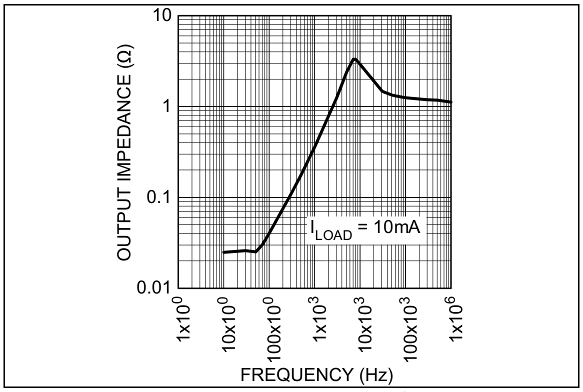



***FIGURE 2-19:*** *Output Impedance vs. Frequency.*

## 3.0 PIN DESCRIPTIONS

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

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

| MIC2940A Pin Number | MIC2941A Pin Number | Pin Name | Description |
|---|---|---|---|
| 1 | 4 | Input | Unregulated input supply. |
| 2 | 3 | Ground | Ground. |
| 3 | 5 | Output | Regulated output voltage. |
| — | 1 | Adjust | Adjust (input): Connect to an external resistor voltage divider to set the output voltage. |
| — | 2 | Shutdown | Shutdown/Enable (input): Logic level low = Enable. Logic level high = Shutdown. |

# 4.0 APPLICATION INFORMATION

## 4.1 External Capacitors

A 10 µF (or greater) capacitor is required between the MIC2940A output and ground to prevent oscillations due to instability. Most types of tantalum or aluminum electrolytics will be adequate; film types will work, but are costly and therefore not recommended. Many aluminum electrolytics have electrolytes that freeze at about –30°C, so solid tantalums are recommended for operation below –25°C. The important parameters of the capacitor are an effective series resistance of about 5Ω or less and a resonant frequency above 500 kHz. The value of this capacitor may be increased without limit.

At lower values of output current, less output capacitance is required for output stability. The capacitor can be reduced to 3.3 µF for current below 100 mA or 2.2 µF for currents below 10 mA. Adjusting the MIC2941A to voltages below 5V runs the error amplifier at lower gains so that more output capacitance is needed. For the worst-case situation of a 1.25A load at 1.23V output (Output shorted to Adjust) a 22 µF (or greater) capacitor should be used.

The MIC2940A will remain stable and in regulation with load currents ranging from 5 mA on up to the full 1.25A rating. The external resistors of the MIC2941A version may be scaled to draw this minimum load current.

A 0.22 µF capacitor should be placed from the MIC2940A input to ground if there is more than 10 inches of wire between the input and the AC filter capacitor or if a battery is used as the input.

## 4.2 Programming the Output Voltage (MIC2941A)

The MIC2941A may be programmed for any output voltage between its 1.235V reference and its 26V maximum rating. An external pair of resistors is required, as shown in the MIC2941A Adjustable Regulator Typical Application Circuit.

**EQUATION 4-1:**

$$V_{OUT} = V_{REF} \times \left(1 + \frac{R1}{R2}\right) - |I_{FB}| \times R1$$

Where:

$V_{REF}$ = The nominal 1.235V reference voltage.

$I_{FB}$ = The adjust pin bias current (nom. 20 nA).

The minimum recommended load current of 1 µA forces an upper limit of 1.2 MΩ on the value of R2, if the regulator must work with no load (a condition often found in CMOS in standby), $I_{FB}$ will produce a –2% typical error in $V_{OUT}$ which may be eliminated at room temperature by trimming R1. For better accuracy, choosing R2 = 100 kΩ reduces this error to 0.17% while increasing the resistor program current to 12 µA. Because the MIC2941A typically draws 100 µA at no load with SHUTDOWN open-circuited, this is a negligible addition.

## 4.3 Reducing Output Noise

In reference applications, it may be advantageous to reduce the AC noise present at the output. One method is to reduce the regulator bandwidth by increasing the size of the output capacitor. This is relatively inefficient, as increasing the capacitor from 1 µF to 220 µF only decreases the noise from 430 µV to 160 $\mu V_{RMS}$ for a 100 kHz bandwidth at 5V output. Noise can be reduced by a factor of four with the MIC2941A by adding a bypass capacitor across R1.

**EQUATION 4-2:**

$$C_{BYPASS} = \frac{1}{2\pi \times R1 \times 200Hz}$$

Pick a bypass capacitor of about 0.01 µF. When doing this, the output capacitor must be increased to 22 µF to maintain stability. These changes reduce the output noise from 430 µV to 100 $\mu V_{RMS}$ for a 100 kHz bandwidth at 5V output. With the bypass capacitor added, noise no longer scales with output voltage so that improvements are more dramatic at higher output voltages.

## 4.4 Automotive Applications

The MIC2940A is ideally suited for automotive applications for a variety of reasons. It will operate over a wide range of input voltages with very low dropout voltages (40 mV at light loads), and very low quiescent currents (240 µA typical). These features are necessary for use in battery powered systems, such as automobiles. It is a “bulletproof” device with the ability to survive both reverse battery (negative transients up to 20V below ground), and load dump (positive transients up to 60V) conditions. A wide operating temperature range with low temperature coefficients is yet another reason to use these versatile regulators in automotive designs.

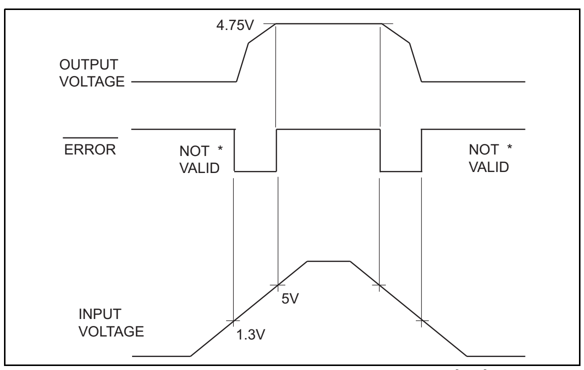
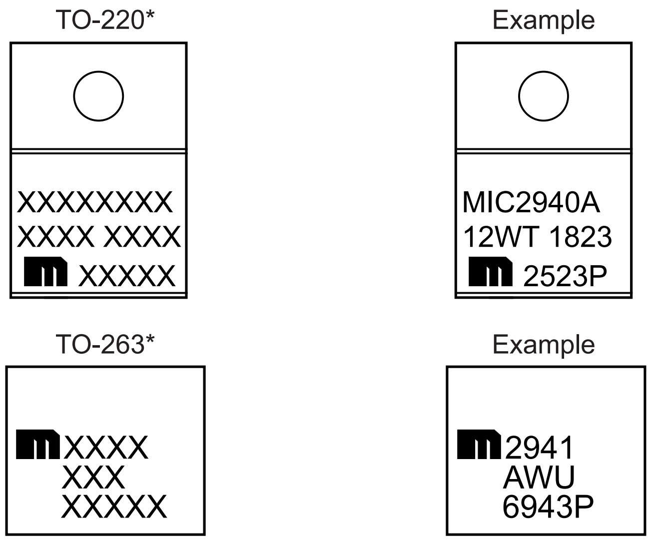



*FIGURE 4-1: ERROR Output Timing.*

# 5.0 PACKAGING INFORMATION

## 5.1 Package Marking Information




**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 |
| (e3) | Pb-free JEDEC® designator for Matte Tin (Sn) |
| * | This package is Pb-free. The Pb-free JEDEC designator ((e3)) 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.

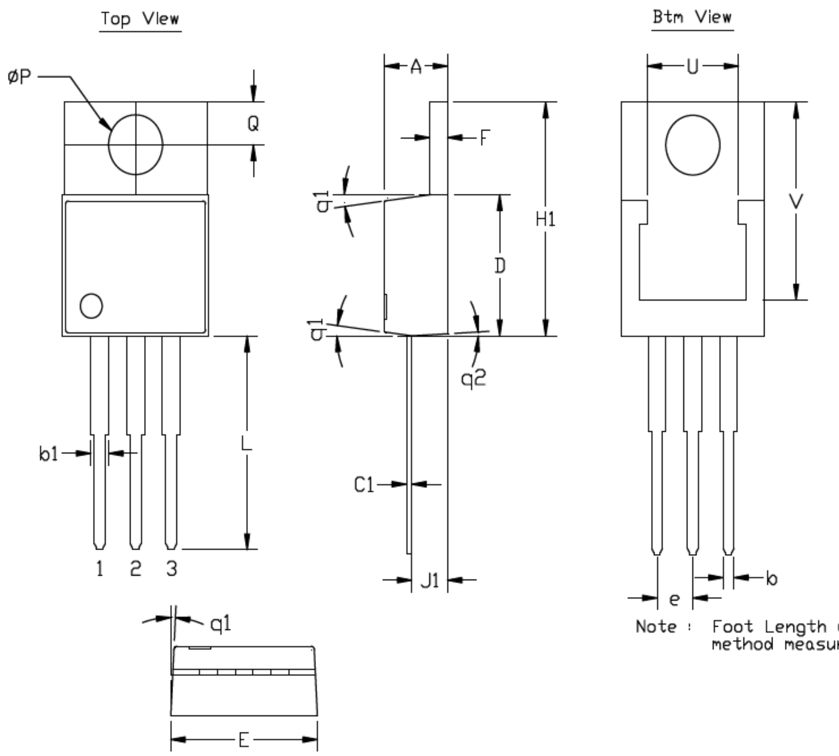
Underbar (_) and/or Overbar (‾) symbol may not be to scale.

### 3-Lead TO-220 Package Outline and Recommended Land Pattern

**TITLE**

3 LEAD TO220 PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

| | | | |
|---|---|---|---|
| **DRAWING #** | TO220-3LD-PL-1 | **UNIT** | INCH |
| **Lead Frame** | Copper Alloy | **Lead Finish** | Matte Tin |



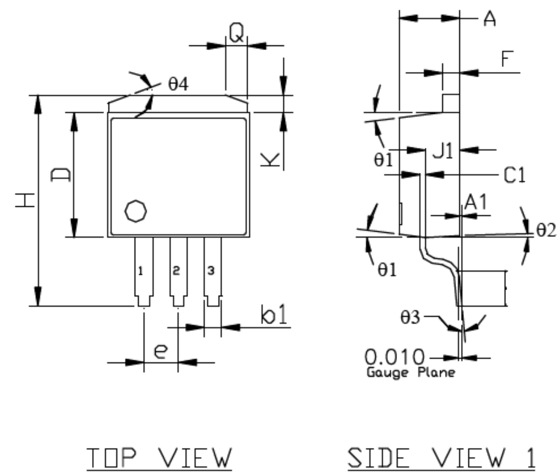

| POS | INCH MIN | INCH MAX |
|---|---|---|
| A | 0.160 | 0.190 |
| b | 0.025 | 0.040 |
| b1 | 0.045 | 0.060 |
| C1 | 0.012 | 0.022 |
| D | 0.348 | 0.360 |
| E | 0.385 | 0.420 |
| e | 0.090 | 0.110 |
| F | 0.045 | 0.055 |
| H1 | 0.541 | 0.619 |
| J1 | 0.080 | 0.120 |
| øP | 0.146 | 0.156 |
| Q | 0.103 | 0.113 |
| L | 0.500 | 0.580 |
| q1 | 3° | 10° |
| q2 | 1° | 7° |
| U | 0.256 Ref. | |
| V | 0.486 Ref. | |

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

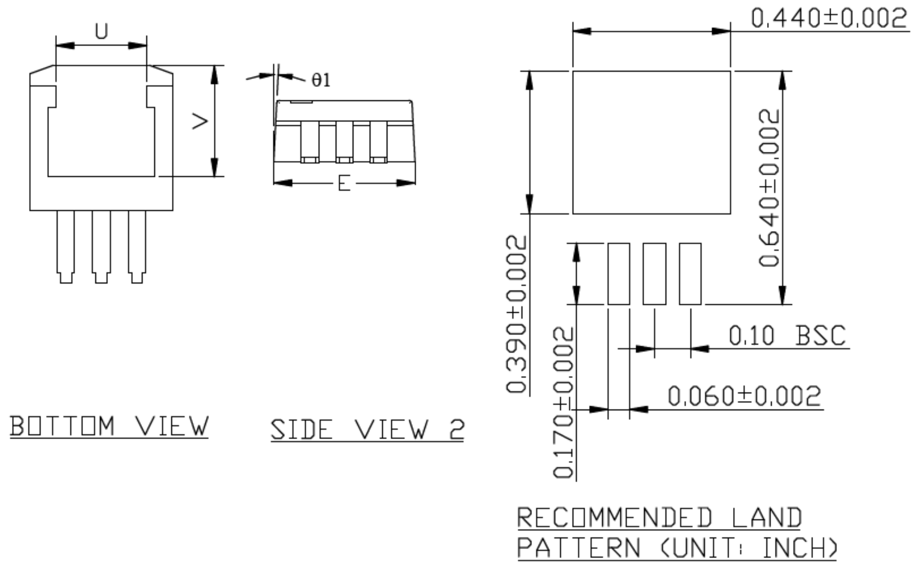
## 3-Lead TO-263 Package Outline and Recommended Land Pattern

**TITLE**
3 LEAD TO263 PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

| DRAWING # | TO263-3LD-PL-1 | UNIT | INCH/MM |
|---|---|---|---|




| | INCH | | MM | |
|---|---|---|---|---|
| POS | MIN | MAX | MIN | MAX |
| A | 0.170 | 0.181 | 4.318 | 4.597 |
| A1 | 0.000 | 0.012 | 0.000 | 0.305 |
| b1 | 0.047 | 0.053 | 1.194 | 1.346 |
| C1 | 0.012 | 0.023 | 0.305 | 0.584 |
| D | 0.330 | 0.361 | 8.382 | 9.169 |
| E | 0.396 | 0.420 | 10.058 | 10.668 |
| e | 0.095 | 0.105 | 2.413 | 2.667 |
| F | 0.045 | 0.055 | 1.143 | 1.397 |
| H | 0.575 | 0.625 | 14.605 | 15.875 |
| J1 | 0.080 | 0.120 | 2.032 | 3.048 |
| L1 | 0.090 | 0.110 | 2.286 | 2.794 |
| K | 0.045 | 0.066 | 1.143 | 1.676 |
| θ1 | 3° | 10° | 3° | 10° |
| θ2 | 1° | 7° | 1° | 7° |
| θ3 | 0° | 8° | 0° | 8° |
| θ4 | 18° | 22° | 18° | 22° |
| Q | 0.055 | 0.075 | 1.397 | 1.905 |
| U | 0.256 Ref. | | 6.502 Ref. | |
| V | 0.303 Ref. | | 7.696 Ref. | |



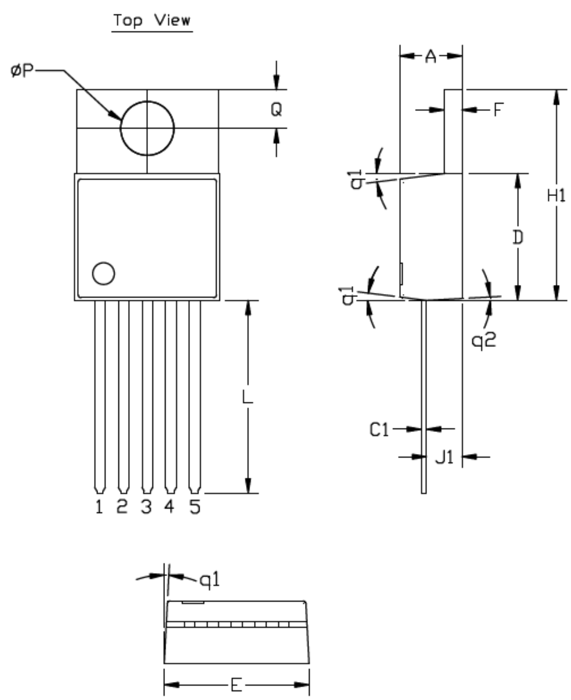

NOTES:
FOOT LENGTH USE GUAGE PLANE METHOD MEASUREMENT 0.010″

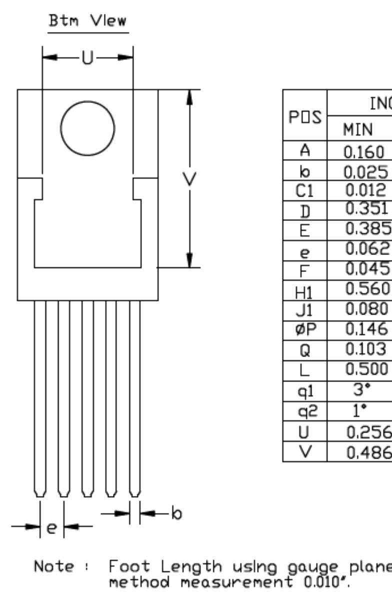
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging.

## 5-Lead TO-220 Package Outline and Recommended Land Pattern

**TITLE**
5 LEAD TO220 PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

| | | | |
|---|---|---|---|
| **DRAWING #** | TO220-5LD-PL-1 | **UNIT** | INCH |
| **Lead Frame** | Copper Alloy | **Lead Finish** | Matte Tin |




| POS | INCH | |
|---|---|---|
| | MIN | MAX |
| A | 0.160 | 0.190 |
| b | 0.025 | 0.040 |
| C1 | 0.012 | 0.022 |
| D | 0.351 | 0.361 |
| E | 0.385 | 0.420 |
| e | 0.062 | 0.072 |
| F | 0.045 | 0.055 |
| H1 | 0.560 | 0.619 |
| J1 | 0.080 | 0.120 |
| øP | 0.146 | 0.156 |
| Q | 0.103 | 0.113 |
| L | 0.500 | 0.580 |
| q1 | 3° | 10° |
| q2 | 1° | 7° |
| U | 0.256 Ref. | |
| V | 0.486 Ref. | |

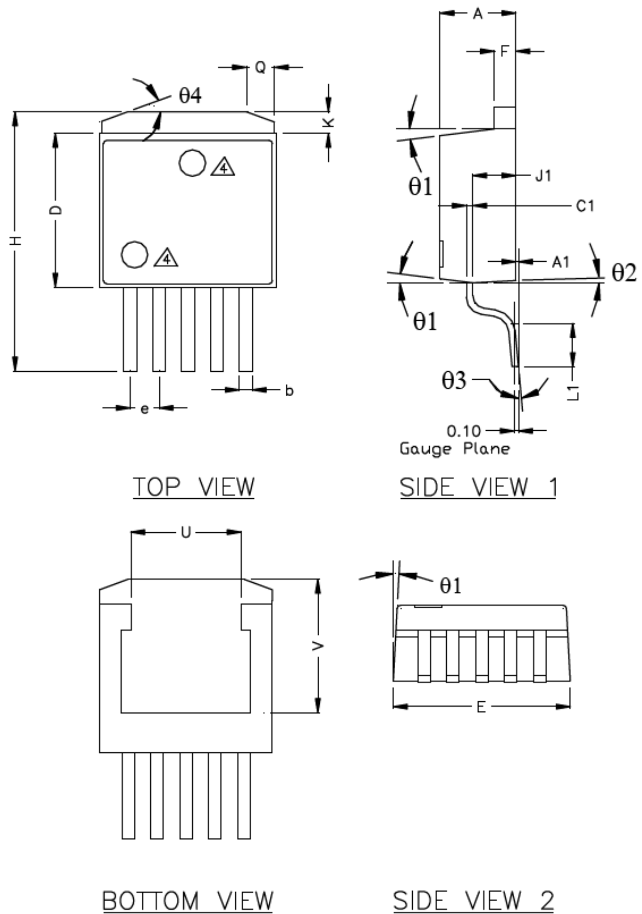
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging.

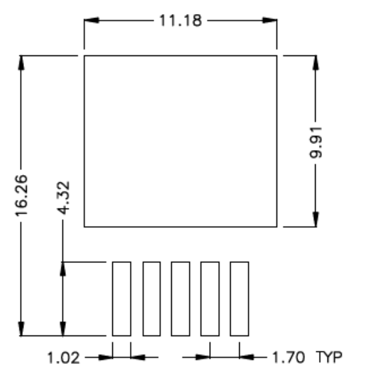
## 5-Lead TO-263 Package Outline and Recommended Land Pattern

**TITLE**
5 LEAD T0263 PACKAGE OUTLINE & RECOMMENDED LAND PATTERN

| **DRAWING #** | T0263-5LD-PL-1 | **UNIT** | INCH/MM |
|---|---|---|---|




| POS | INCH | | MM | |
|---|---|---|---|---|
| | MIN | MAX | MIN | MAX |
| A | 0.170 | 0.181 | 4.318 | 4.597 |
| A1 | 0.000 | 0.012 | 0.000 | 0.305 |
| b | 0.026 | 0.036 | 0.660 | 0.914 |
| C1 | 0.012 | 0.023 | 0.305 | 0.584 |
| D | 0.330 | 0.361 | 8.392 | 9.169 |
| E | 0.396 | 0.420 | 10.058 | 10.668 |
| e | 0.062 | 0.072 | 1.575 | 1.829 |
| F | 0.045 | 0.055 | 1.143 | 1.397 |
| H | 0.575 | 0.625 | 14.605 | 15.875 |
| J1 | 0.080 | 0.120 | 2.032 | 3.048 |
| K | 0.045 | 0.066 | 1.143 | 1.676 |
| L1 | 0.090 | 0.110 | 2.286 | 2.794 |
| θ1 | 3° | 10° | 3° | 10° |
| θ2 | 1° | 7° | 1° | 7° |
| θ3 | 0° | 8° | 0° | 8° |
| θ4 | 18° | 22° | 18° | 22° |
| Q | 0.055 | 0.075 | 1.397 | 1.905 |
| U | 0.256 Ref. | | 6.502 Ref. | |
| V | 0.305 Ref. | | 7.747 Ref. | |




RECOMMENDED LAND PATTERN
(UNIT : mm)

NOTE:
1. PACKAGE OUTLINE EXCLUSIVE OF MOLD FLASH & METAL BURR.
2. PACKAGE OUTLINE INCLUSIVE OF PLATING THICKNESS.
3. FOOT LENGTH USING GAUGE PLANE METHOD MEASUREMENT 0.010"
4. PACKAGE TOP MARK MAY BE IN TOP CENTER OR LOWER LEFT CORNER
5. ALL DIMENSIONS ARE IN INCHES/MILLIMETERS.

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 (April 2018)

- Converted Micrel document MIC2940A/41A to Microchip data sheet DS20006000A.
- Minor text changes throughout.
- Corrected bold values in Table 1-1.

**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 | X | X | -XX |
|---|---|---|---|---|
| Part No. | Output Voltage | Junction Temp. Range | Package | Media Type |

| | |
|---|---|
| **Device:** | MIC2940A: 1.25A Low Dropout Voltage Regulator, Fixed Output Voltage<br>MIC2941A: 1.25A Low Dropout Voltage Regulator, Adjustable Output Voltage + Shutdown |
| **Output Voltage:** | 3.3 = 3.3V (MIC2940A only)<br>5.0 = 5.0V (MIC2940A only)<br>12 = 12V (MIC2940A only)<br><blank>= Adjustable (MIC2941A only) |
| **Junction Temperature Range:** | W = –40°C to +125°C, RoHS-Compliant* |
| **Package:** | T = 3-Lead TO-220 (MIC2940A)<br>5-Lead TO-220 (MIC2941A)<br>U = 3-Lead TO-263 (MIC2940A)<br>5-Lead TO-263 (MIC2941A) |
| **Media Type:** | <blank>= 50/Tube<br>TR = 750/Reel (TO-263 Package only) |

* RoHS-compliant with "high-melting solder" exemption.

**Examples:**

a) MIC2940A-3.3WT: MIC2940A, 3.3V Output Voltage, –40°C to +125°C Temperature Range, 3-Lead TO-220, 50/Tube

b) MIC2940A-3.3WU-TR: MIC2940A, 3.3V Output Voltage, –40°C to +125°C Temperature Range, 3-Lead TO-263, 750/Reel

c) MIC2940A-5.0WU: MIC2940A, 5.0V Output Voltage, –40°C to +125°C Temperature Range, 3-Lead TO-263, 50/Tube

d) MIC2940A-12WT: MIC2940A, 12V Output Voltage, –40°C to +125°C Temperature Range, 3-Lead TO-220, 50/Tube

e) MIC2940A-12WU-TR: MIC2940A, 12V Output Voltage, –40°C to +125°C Temperature Range, 3-Lead TO-263, 750/Reel

f) MIC2941AWT: MIC2941A, Adjustable Output Voltage, –40°C to +125°C Temperature Range, 3-Lead TO-220, 50/Tube

g) MIC2941AWU: MIC2941A, Adjustable Output Voltage, –40°C to +125°C Temperature Range, 5-Lead TO-263, 50/Tube

h) MIC2941AWU-TR: MIC2941A, Adjustable Output Voltage, –40°C to +125°C Temperature Range, 5-Lead TO-263, 750/Reel

**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 specification contained in their particular Microchip Data Sheet.
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- Microchip is willing to work with the customer who is concerned about the integrity of their code.
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