



## BiCMOS LOW-POWER CURRENT-MODE PWM CONTROLLER

### FEATURES

- Enhanced Replacement for UC3842A Family With Pin-to-Pin Compatibility
- 1-MHz Operation
- 50- $\mu$ A Standby Current, 100- $\mu$ A Maximum
- Low Operating Current of 2.3 mA at 52 kHz
- Fast 35-ns Cycle-by-Cycle Overcurrent Limiting
- $\pm 1$ -A Peak Output Current
- Rail-to-Rail Output Swings with 25-ns Rise and 20-ns Fall Times
- $\pm 1\%$  Initial Trimmed 2.5-V Error Amplifier Reference
- Trimmed Oscillator Discharge Current
- New Under Voltage Lockout Versions
- MSOP-8 Package Minimizes Board Space

### APPLICATIONS

- Switch-Mode Power Supplies
- dc-to-dc Converters
- Board Mount Power Modules

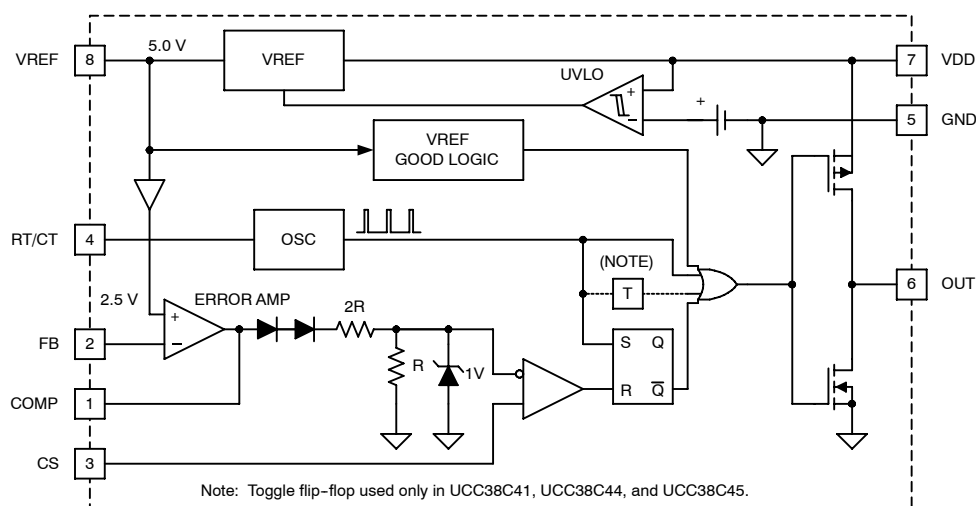
### DESCRIPTION

UCC38C4x family is a high-performance current-mode PWM controller. It is an enhanced BiCMOS version with pin-for-pin compatibility to the industry standard UC384xA family and UC384x family of PWM controllers. In addition, lower startup voltage versions of 7 V are offered as UCC38C40 and UCC38C41.

Providing necessary features to control fixed frequency, peak current-mode power supplies, this family offers the following performance advantages. The device offers high-frequency operation up to 1 MHz with low start-up and operating currents, thus minimizing start-up loss and low operating power consumption for improved efficiency. The device also features a very fast current-sense-to-output delay time of 35 ns and a  $\pm 1$  A peak output current capability with improved rise and fall times for driving large external MOSFETs directly.

The UCC38C4x family is offered in 8-pin packages, MSOP (DGK), SOIC (D) and PDIP (P).

### FUNCTIONAL BLOCK DIAGRAM



UDG-99139



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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

# UCC28C40, UCC28C41, UCC28C42, UCC28C43, UCC28C44, UCC28C45 UCC38C40, UCC38C41, UCC38C42, UCC38C43, UCC38C44, UCC38C45

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## recommended operating conditions

|                                                    | MIN | MAX | UNIT |
|----------------------------------------------------|-----|-----|------|
| Input voltage, $V_{DD}$                            |     | 18  | V    |
| Output voltage range, $V_{OUT}$                    |     | 18  | V    |
| Average output current, $I_{OUT}^{\dagger}$        |     | 200 | mA   |
| Reference output current, $I_{OUT(ref)}^{\dagger}$ |     | -20 | mA   |
| Operating junction temperature, $T_J^{\dagger}$    | -40 | 105 | °C   |

<sup>†</sup> It is not recommended that the device operate under conditions beyond those specified in this table for extended periods of time.

## absolute maximum ratings over operating free-air temperature (unless otherwise noted)<sup>‡§</sup>

|                                                                   |                  |
|-------------------------------------------------------------------|------------------|
| Supply voltage ( $V_{DD}$ )                                       | 20 V             |
| (MAX ICC)                                                         | 30 mA            |
| Output current, $I_{OUT}$ peak                                    | ±1 A             |
| Output energy, capacitive load                                    | 5 µJ             |
| Voltage rating (COMP, CS, FB)                                     | -0.3 V to 6.3 V  |
| (OUT)                                                             | -0.3 V to 20 V   |
| (RT/CT)                                                           | -0.3 V to 6.3 V  |
| (VREF)                                                            | 7 V              |
| Error amplifier output sink current                               | 10 mA            |
| Total Power Dissipation at $T_A = 25^{\circ}\text{C}$ : D package | 50 °C/W          |
| DGK package                                                       | 120 °C/W         |
| P package                                                         | 65 °C/W          |
| Operating junction temperature range, $T_J$                       | -55 °C to 150 °C |
| Storage temperature range $T_{stg}$                               | -65 °C to 150 °C |
| Lead Temperature (Soldering, 10 seconds)                          | 300 °C           |

<sup>‡</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

<sup>§</sup> All voltages are with respect to ground. Currents are positive into and negative out of the specified terminals. Consult the Packaging Section of the Databook for thermal limitations and considerations of the package.

## AVAILABLE OPTIONS

| $T_A = T_J$      | MAXIMUM DUTY CYCLE | UVLO ON/OFF  | SOIC-8 SMALL OUTLINE (D) <sup>†</sup> | PDIP-8 PLASTIC DIP (P) | MSOP-8 SMALL OUTLINE (DGK) <sup>†</sup> |
|------------------|--------------------|--------------|---------------------------------------|------------------------|-----------------------------------------|
| -40 °C to 105 °C | 100%               | 14.5V / 9.0V | UCC28C42D                             | UCC28C42P              | UCC28C42DGK                             |
|                  |                    | 8.4V / 7.6V  | UCC28C43D                             | UCC28C43P              | UCC28C43DGK                             |
|                  |                    | 7.0V / 6.6V  | UCC28C40D                             | UCC28C40P              | UCC28C40DGK                             |
|                  | 50%                | 14.5V / 9.0V | UCC28C44D                             | UCC28C44P              | UCC28C44DGK                             |
|                  |                    | 8.4V / 7.6V  | UCC28C45D                             | UCC28C45P              | UCC28C45DGK                             |
|                  |                    | 7.0V / 6.6V  | UCC28C41D                             | UCC28C41P              | UCC28C41DGK                             |
| 0 °C to 70 °C    | 100%               | 14.5V / 9.0V | UCC38C42D                             | UCC38C42P              | UCC38C42DGK                             |
|                  |                    | 8.4V / 7.6V  | UCC38C43D                             | UCC38C43P              | UCC38C43DGK                             |
|                  |                    | 7.0V / 6.6V  | UCC38C40D                             | UCC38C40P              | UCC38C40DGK                             |
|                  | 50%                | 14.5V / 9.0V | UCC38C44D                             | UCC38C44P              | UCC38C44DGK                             |
|                  |                    | 8.4V / 7.6V  | UCC38C45D                             | UCC38C45P              | UCC38C45DGK                             |
|                  |                    | 7.0V / 6.6V  | UCC38C41D                             | UCC38C41P              | UCC38C41DGK                             |

<sup>†</sup> D (SOIC-8) and DGK (MSOP-8) packages are available taped and reeled. Add R suffix to device type (e.g. UCC28C42DR) to order quantities of 2500 devices per reel. Tube quantities are 75 for D packages (SOIC-8) and 80 for DGK package (MSOP-8), and 50 for P package (PDIP-8).

# UCC28C40, UCC28C41, UCC28C42, UCC28C43, UCC28C44, UCC28C45 UCC38C40, UCC38C41, UCC38C42, UCC38C43, UCC38C44, UCC38C45

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**electrical characteristics  $V_{DD} = 15\text{ V}$  (See Note 1),  $R_T = 10\text{ k}\Omega$ ,  $C_T = 3.3\text{ nF}$ ,  $C_{VDD} = 0.1\mu\text{F}$  and no load on the outputs,  $T_A = -40^\circ\text{C}$  to  $105^\circ\text{C}$  for the UCC28C4x and  $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$  for the UCC38C4x,  $T_A = T_J$  (unless otherwise noted)**

| PARAMETER                                | TEST CONDITIONS                                              | MIN   | TYP   | MAX   | UNITS                |
|------------------------------------------|--------------------------------------------------------------|-------|-------|-------|----------------------|
| <b>Reference Section</b>                 |                                                              |       |       |       |                      |
| Output voltage, initial accuracy         | $T_A = 25^\circ\text{C}$ $I_{OUT} = 1\text{ mA}$             | 4.9   | 5.0   | 5.1   | V                    |
| Line regulation                          | $V_{DD} = 12\text{ V}$ to $18\text{ V}$                      |       | 0.2   | 20    | mV                   |
| Load regulation                          | 1 mA to 20 mA                                                |       | 3     | 25    | mV                   |
| Temperature stability                    | See Note 2                                                   |       | 0.2   | 0.4   | mV/ $^\circ\text{C}$ |
| Total output variation                   | See Note 2                                                   | 4.82  |       | 5.18  | V                    |
| Output noise voltage                     | 10 Hz to 10 kHz, $T_A = 25^\circ\text{C}$ ,      See Note 2  |       | 50    |       | $\mu\text{V}$        |
| Long term stability                      | 1000 hours, $T_A = 125^\circ\text{C}$ ,      See Note 2      |       | 5     | 25    | mV                   |
| Output short circuit                     |                                                              | -30   | -45   | -55   | mA                   |
| <b>Oscillator Section</b>                |                                                              |       |       |       |                      |
| Initial accuracy                         | $T_A = 25^\circ\text{C}$ ,      See Note 3                   | 50.5  | 53    | 55    | kHz                  |
| Voltage stability                        | $V_{DD} = 12\text{ V}$ to $18\text{ V}$                      |       | 0.2%  | 1.0%  |                      |
| Temperature stability                    | $T_{MIN}$ to $T_{MAX}$ ,      See Note 2                     |       | 1%    | 2.5%  |                      |
| Amplitude                                | RT/CT Pin peak-to-peak                                       |       | 1.9   |       | V                    |
| Discharge current                        | $T_A = 25^\circ\text{C}$ ,      RT/CT = 2 V,      See Note 4 | 7.7   | 8.4   | 9.0   | mA                   |
|                                          | RT/CT = 2 V,      See Note 4                                 | 7.2   | 8.4   | 9.5   | mA                   |
| <b>Error Amplifier Section</b>           |                                                              |       |       |       |                      |
| Feedback input voltage, initial accuracy | $V_{COMP} = 2.5\text{ V}$ , $T_A = 25^\circ\text{C}$         | 2.475 | 2.500 | 2.525 | V                    |
| Feedback input voltage, total variation  | $V_{COMP} = 2.5\text{ V}$ ,                                  | 2.45  | 2.50  | 2.55  | V                    |
| Input bias current                       | $V_{FB} = 5.0\text{ V}$                                      |       | -0.1  | -2.0  | $\mu\text{A}$        |
| Open-loop voltage gain ( $A_{VOL}$ )     | $V_{OUT} = 2\text{ V}$ to $4\text{ V}$                       | 65    | 90    |       | dB                   |
| Unity gain bandwidth                     | See Note 2                                                   | 1.0   | 1.5   |       | MHz                  |
| Power supply rejection ratio (PSRR)      | $V_{DD} = 12\text{ V}$ to $18\text{ V}$                      | 60    |       |       | dB                   |
| Output sink current                      | $V_{FB} = 2.7\text{ V}$ , $V_{COMP} = 1.1\text{ V}$          | 2     | 14    |       | mA                   |
| Output source current                    | $V_{FB} = 2.3\text{ V}$ , $V_{COMP} = 5\text{ V}$            | -0.5  | -1.0  |       | mA                   |
| High-level output voltage (VOH)          | $V_{FB} = 2.7\text{ V}$ , $R_{LOAD} = 15\text{ k}$ to GND    | 5     | 6.8   |       | V                    |
| Low-level output voltage (VOL)           | $V_{FB} = 2.7\text{ V}$ , $R_{LOAD} = 15\text{ k}$ to VREF   |       | 0.1   | 1.1   | V                    |
| <b>Current Sense Section</b>             |                                                              |       |       |       |                      |
| Gain                                     | See Note 5, 6                                                | 2.85  | 3.00  | 3.15  | V/V                  |
| Maximum input signal                     | $V_{FB} < 2.4\text{ V}$                                      | 0.9   | 1.0   | 1.1   | V                    |
| Power supply rejection ratio (PSRR)      | $V_{DD} = 12\text{ V}$ to $18\text{ V}$ , See Note 2, 5      |       | 70    |       | dB                   |
| Input bias current                       |                                                              |       | -0.1  | -2.0  | $\mu\text{A}$        |
| CS to output delay                       |                                                              |       | 35    | 70    | ns                   |
| COMP to CS offset                        | $V_{CS} = 0\text{ V}$                                        |       | 1.15  |       | V                    |

NOTE: 1. Adjust  $V_{DD}$  above the start threshold before setting at 15 V.

NOTE: 2. Ensured by design. Not production tested.

NOTE: 3. Output frequencies of the UCC38C41, UCC38C44 and the UCC38C45 are half the oscillator frequency.

NOTE: 4. Oscillator discharge current is measured with  $R_T = 10\text{ k}\Omega$  to  $V_{REF}$ .

NOTE: 5. Parameter measured at trip point of latch with  $V_{FB} = 0\text{ V}$ .

NOTE: 6. Gain is defined as  $ACS = \frac{\Delta V_{COM}}{\Delta V_{CS}}$ ,  $0\text{ V} \leq V_{CS} \leq 900\text{ mV}$

# UCC28C40, UCC28C41, UCC28C42, UCC28C43, UCC28C44, UCC28C45 UCC38C40, UCC38C41, UCC38C42, UCC38C43, UCC38C44, UCC38C45

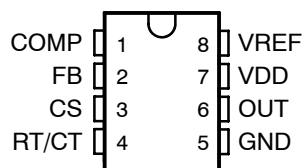
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electrical characteristics  $V_{DD} = 15\text{ V}$  (See Note 1),  $R_T = 10\text{ k}\Omega$ ,  $C_T = 3.3\text{ nF}$ ,  $C_{VDD} = 0.1\text{ }\mu\text{F}$  and no load on the outputs,  $T_A = -40^\circ\text{C}$  to  $105^\circ\text{C}$  for the UCC28C4x and  $T_A = 0^\circ\text{C}$  to  $70^\circ\text{C}$  for the UCC38C4x,  $T_A = T_J$  (unless otherwise noted)

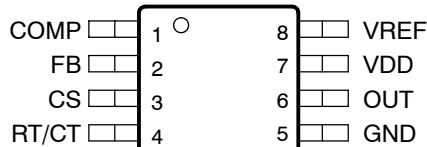
| PARAMETER                                            | TEST CONDITIONS                                                 | MIN  | TYP  | MAX  | UNITS |
|------------------------------------------------------|-----------------------------------------------------------------|------|------|------|-------|
| Output Section                                       |                                                                 |      |      |      |       |
| V <sub>OUT</sub> low (R <sub>DS(on)</sub> pull-down) | I <sub>SINK</sub> = 200 mA                                      |      | 5.5  | 15   | Ω     |
| V <sub>OUT</sub> high (R <sub>DS(on)</sub> pull-up)  | I <sub>SOURCE</sub> = 200 mA                                    |      | 10   | 25   |       |
| Rise t <sub>lme</sub>                                | T <sub>A</sub> = 25°C, C <sub>LOAD</sub> = 1 nF                 |      | 25   | 50   | ns    |
| Fall time                                            | T <sub>A</sub> = 25°C, C <sub>LOAD</sub> = 1 nF                 |      | 20   | 40   |       |
| Undervoltage Lockout Section                         |                                                                 |      |      |      |       |
| Start threshold                                      | UCC38C42, UCC38C44                                              | 13.5 | 14.5 | 15.5 | V     |
|                                                      | UCC38C43, UCC38C45                                              | 7.8  | 8.4  | 9.0  |       |
|                                                      | UCC38C40, UCC38C41                                              | 6.5  | 7.0  | 7.5  |       |
| Minimum operating voltage                            | UCC38C42, UCC38C44                                              | 8    | 9    | 10   |       |
|                                                      | UCC38C43, UCC38C45                                              | 7.0  | 7.6  | 8.2  |       |
|                                                      | UCC38C40, UCC38C41                                              | 6.1  | 6.6  | 7.1  |       |
| PWM Section                                          |                                                                 |      |      |      |       |
| Maximum duty cycle                                   | UCC38C42, UCC38C43, UCC38C40, V <sub>FB</sub> < 2.4 V           | 94%  | 96%  |      |       |
|                                                      | UCC38C44, UCC38C45, UCC38C41, V <sub>FB</sub> < 2.4 V           | 47%  | 48%  |      |       |
| Minimum duty cycle                                   | V <sub>FB</sub> > 2.6 V                                         |      |      | 0%   |       |
| Current Supply Section                               |                                                                 |      |      |      |       |
| Start-up current (I <sub>START-UP</sub> )            | V <sub>DD</sub> = Undervoltage lockout start threshold (–0.5 V) |      | 50   | 100  | μA    |
| Operating supply current (I <sub>DD</sub> )          | V <sub>FB</sub> = V <sub>CS</sub> = 0 V                         |      | 2.3  | 3.0  | mA    |

NOTE 1: Adjust  $V_{DD}$  above the start threshold before setting at 15 V.

PDIP (P) or SOIC (D) PACKAGE  
(TOP VIEW)



MSOP (DGK) PACKAGE  
(TOP VIEW)



## pin assignments

**COMP:** This pin provides the output of the error amplifier for compensation. In addition, the COMP pin is frequently used as a control port by utilizing a secondary-side error amplifier to send an error signal across the secondary-primary isolation boundary through an opto-isolator.

**CS:** The current sense pin is the non-inverting input to the PWM comparator. This is compared to a signal proportional to the error amplifier output voltage. A voltage ramp can be applied to this pin to run the device with a voltage mode control configuration.

**FB:** This pin is the inverting input to the error amplifier. The non-inverting input to the error amplifier is internally trimmed to 2.5 V  $\pm$ 1%.

**GND:** Ground return pin for the output driver stage and the logic level controller section.

**OUT:** The output of the on-chip drive stage. OUT is intended to directly drive a MOSFET. The OUT pin in the UCC38C40, UCC38C42 and UCC38C43 is the same frequency as the oscillator, and can operate near 100% duty cycle. In the UCC38C41, UCC38C44 and the UCC38C45, the frequency of OUT is one-half that of the oscillator due to an internal T flipflop. This limits the maximum duty cycle to < 50%.

**RT/CT:** Timing resistor and timing capacitor. The timing capacitor should be connected to the device ground using minimal trace length.

**VDD:** Power supply pin for the device. This pin should be bypassed with a 0.1- $\mu$ F capacitor with minimal trace lengths. Additional capacitance may be needed to provide hold up power to the device during startup.

**VREF:** 5-V reference. For stability, the reference should be bypassed with a 0.1- $\mu$ F capacitor to ground using the minimal trace length possible.

## **APPLICATION INFORMATION**

This device is a pin-for-pin replacement of the bipolar UC3842 family of controllers, the industry standard PWM controller for single-ended converters. Familiarity with this controller family is assumed.

The UCC28C4x/UCC38C4x series is an enhanced replacement with pin-to-pin compatibility to the bipolar UC284x/UC384x and UC284xA/UC384xA families. The new series offers improved performance when compared to older bipolar devices and other competitive BiCMOS devices with similar functionality. Note that these improvements discussed below generally consist of tighter specification limits that are a subset of the older product ratings, maintaining drop-in capability. In new designs these improvements can be utilized to reduce the component count or enhance circuit performance when compared to the previously available devices.

### **advantages**

This device increases the total circuit efficiency whether operating off-line or in dc input circuits. In off-line applications the low start-up current of this device reduces steady state power dissipation in the startup resistor, and the low operating current maximizes efficiency while running. The low running current also provides an efficiency boost in battery operated supplies.

#### **low voltage operation**

Two members of the UCC38C4x family are intended for applications that require a lower start-up voltage than the original family members. The UCC38C40 and UCC38C41 have a turn-on voltage of 7.0 V typical and exhibit hysteresis of 0.4 V for a turn-off voltage of 6.6 V. This reduced start-up voltage enables use in systems with lower voltages, such as 12-V battery systems which are nearly discharged.

#### **high speed operation**

The BiCMOS design allows operation at high frequencies that were not feasible in the predecessor bipolar devices. First, the output stage has been redesigned to drive the external power switch in approximately half the time of the earlier devices. Second, the internal oscillator is more robust with less variation as frequency increases. In addition, the current sense to output delay has been reduced by a factor of three, to 45ns typical. These features combine to provide a device capable of reliable high frequency operation.

The UCC38C4x family oscillator is true to the curves of the original bipolar devices at lower frequencies yet extends the frequency programmability range to at least 1MHz. This allows the device to offer pin to pin capability where required yet capable of extending the operational range to the higher frequencies typical of latest applications. When the original UC3842 was released in 1984 most switching supplies operated between 20kHz and 100kHz. Today, the UCC38C4x can be used in designs cover a span roughly ten times higher than those numbers.

#### **start/run current improvements**

The start-up current is only 60  $\mu$ A typical, a significant reduction from the bipolar device's ratings of 300 $\mu$ A (UC384xA). For operation over the temperature range of -40 to 85°C the UCC28C4x devices offer a maximum startup current of 100  $\mu$ A, an improvement over competitive BiCMOS devices. This allows the power supply designer to further optimize the selection of the startup resistor value to provide a more efficient design. In applications where low component cost overrides maximum efficiency the low run current of 2.3 mA, typical, may allow the control device to run directly through the single resistor to (+) rail, rather than needing a bootstrap winding on the power transformer, along with a rectifier. The start/run resistor for this case must also pass enough current to allow driving the primary switching MOSFET, which may be a few milliamps in small devices.

## APPLICATION INFORMATION

### ± 1% initial reference voltage

The BiCMOS internal reference of 2.5 V has an enhanced design and utilizes production trim to allow initial accuracy of  $\pm 1\%$  at room temperature and  $\pm 2\%$  over the full temperature range. This can be used to eliminate an external reference in applications that do not require the extreme accuracy afforded by the additional device. This is very useful for nonisolated dc-to-dc applications where the control device is referenced to the same common as the output. It is also applicable in offline designs that regulate on the primary side of the isolation boundary by looking at a primary bias winding, or perhaps from a winding on the output inductor of a buck-derived circuit.

### reduced discharge current variation

The original UC3842 oscillator did not have trimmed discharged current, and the parameter was not specified on the datasheet. Since many customers attempted to use the discharge current to set a crude deadtime limit the UC3842A family was released with a trimmed discharge current specified at 25°C. The UCC28C4x/UCC38C4x series now offers even tighter control of this parameter, with approximately  $\pm 3\%$  accuracy at 25°C, and less than 10% variation over temperature using the UCC28C4x devices. This level of accuracy can enable a meaningful limit to be programmed, a feature not currently seen in competitive BiCMOS devices. The improved oscillator and reference also contribute to decreased variation in the peak to peak variation in the oscillator waveform, which is often used as the basis for slope compensation for the complete power system.

### soft-start

The following diagram provides a typical soft-start circuit for use with the UCC38C42. The values of R and C should be selected to bring the COMP pin up at a controlled rate, limiting the peak current supplied by the power stage. After the soft-start interval is complete the capacitor continues to charge to  $V_{REF}$ , effectively removing the PNP transistor from circuit considerations.

The optional diode in parallel with the resistor forces a soft-start each time the PWM goes through UVLO and the reference ( $V_{REF}$ ) goes low. Without the diode, the capacitor otherwise remains charged during a brief loss of supply or brown-out, and no soft-start is enabled upon reapplication of  $V_{IN}$ .

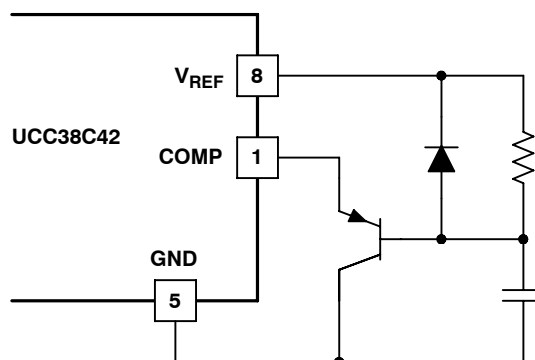


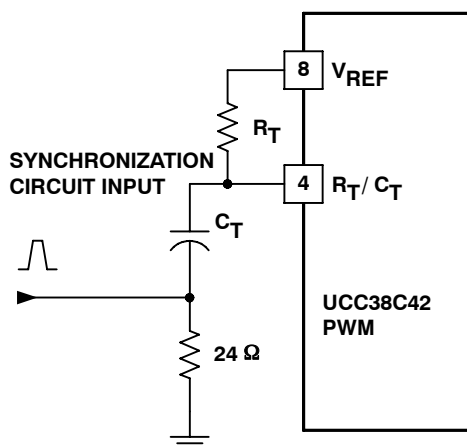
Figure 1

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## APPLICATION INFORMATION

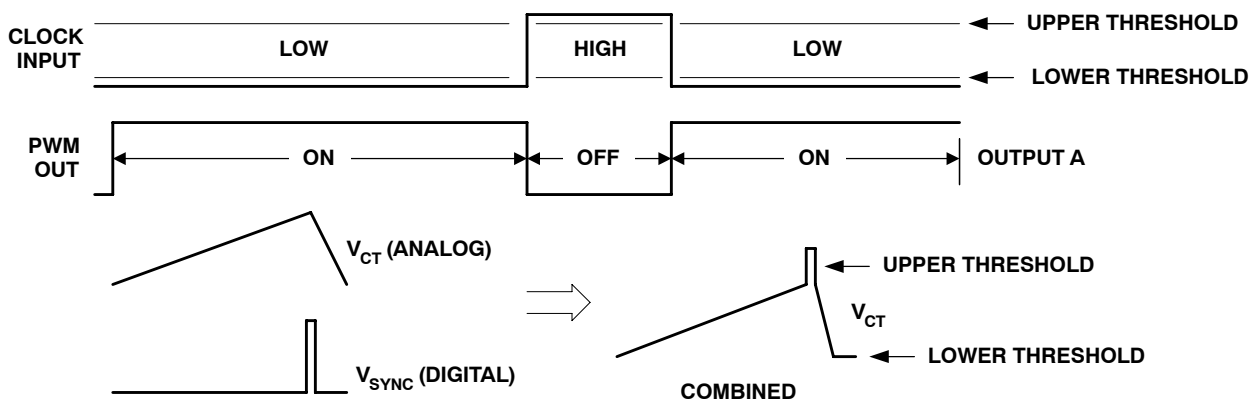
### oscillator synchronization

The UCC38C4x oscillator has the same synchronization characteristics as the original bipolar devices. Thus, the information in the Application Note U-100A, *UC3842/3/4/5 Provides Low-Cost Current-Mode Control*, (TI Literature No. SLUA143) still applies. The application note describes how a small resistor from the timing capacitor-to-ground can offer an insertion point for synchronization to an external clock, (see Figures 2 and 3). Figure 2 shows how the UCC38C42 can be synchronized to an external clock source. This allows precise control of frequency and dead time with a digital pulse train.



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**Figure 2. Oscillator Synchronization Circuit**

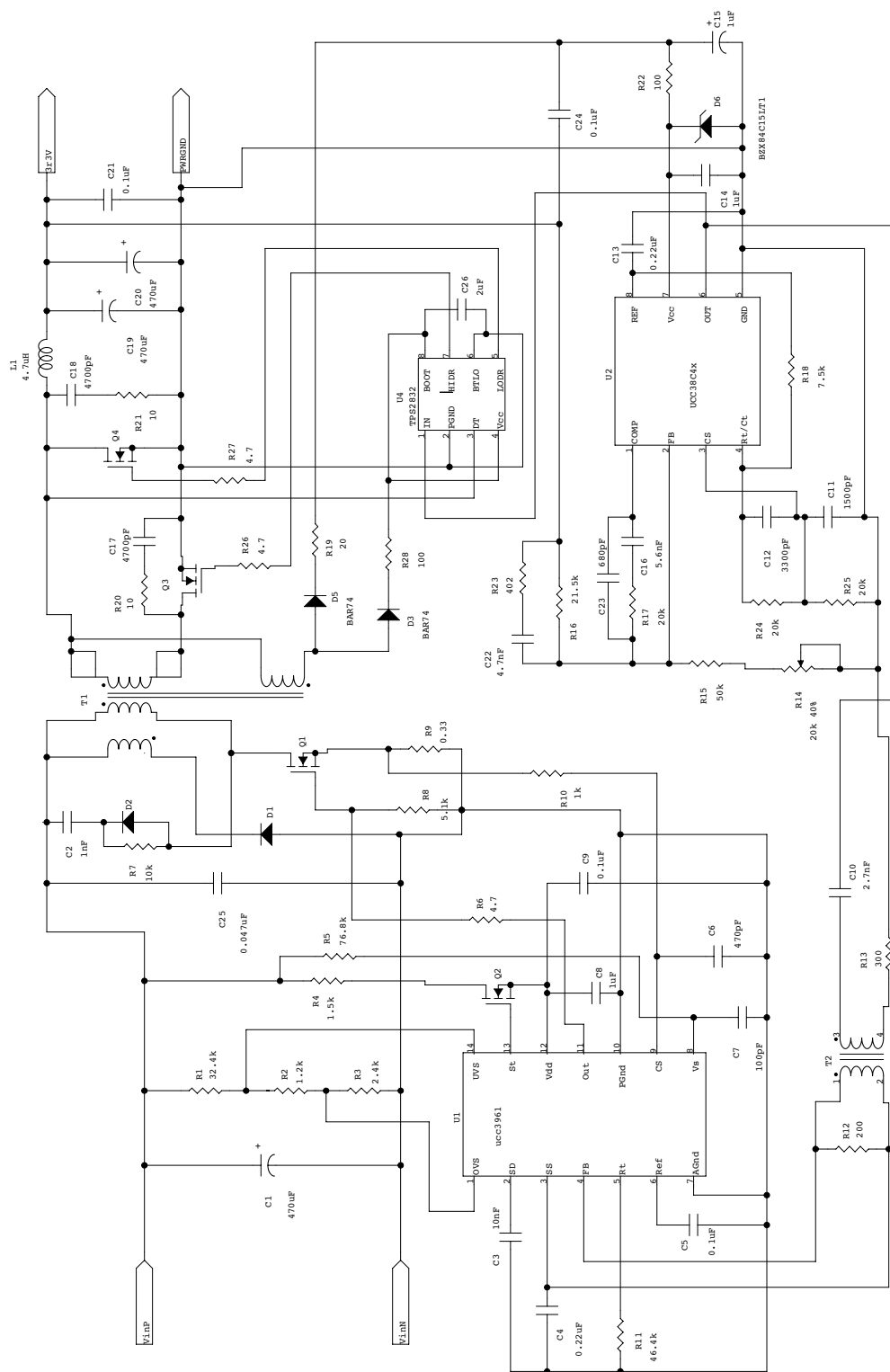


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**Figure 3. Synchronization to an External Clock**

## 9

## APPLICATION INFORMATION



**Figure 5. Forward Converter with Synchronous Rectification Using the UCC38C42 as the Secondary-Side Controller**

## TYPICAL CHARACTERISTICS

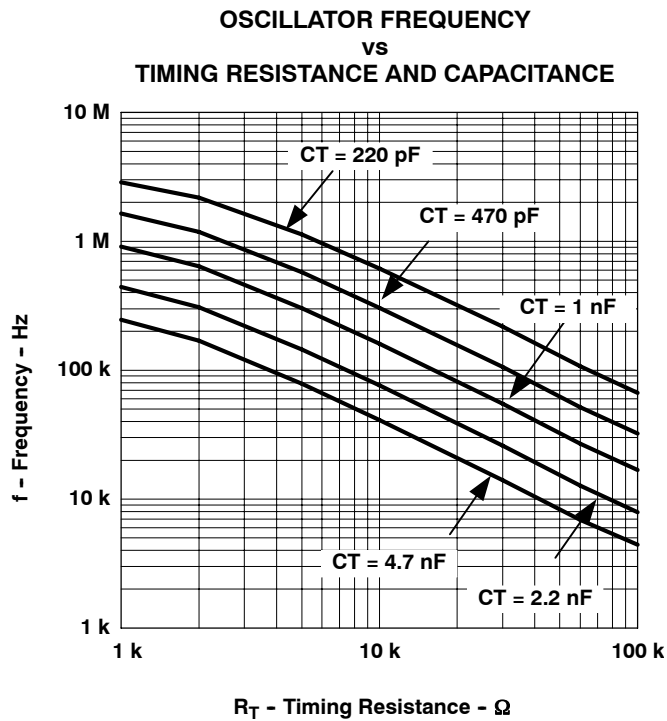


Figure 6

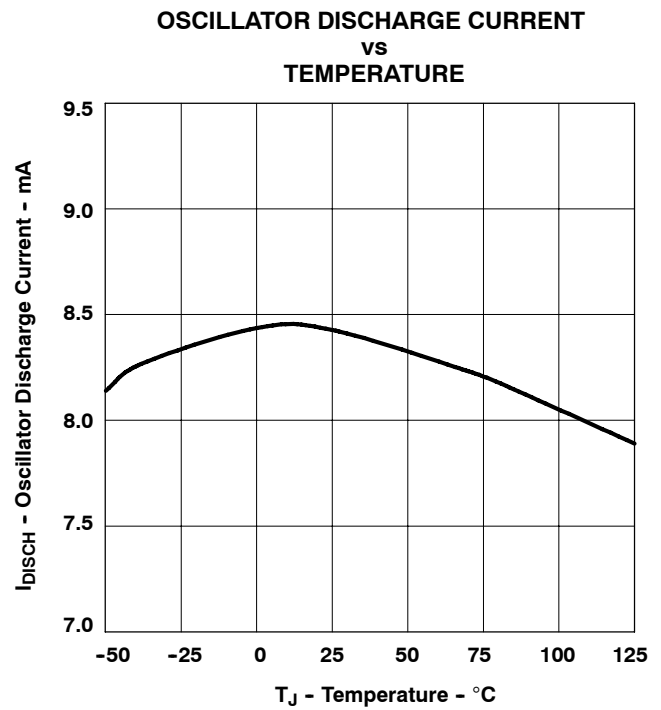


Figure 7

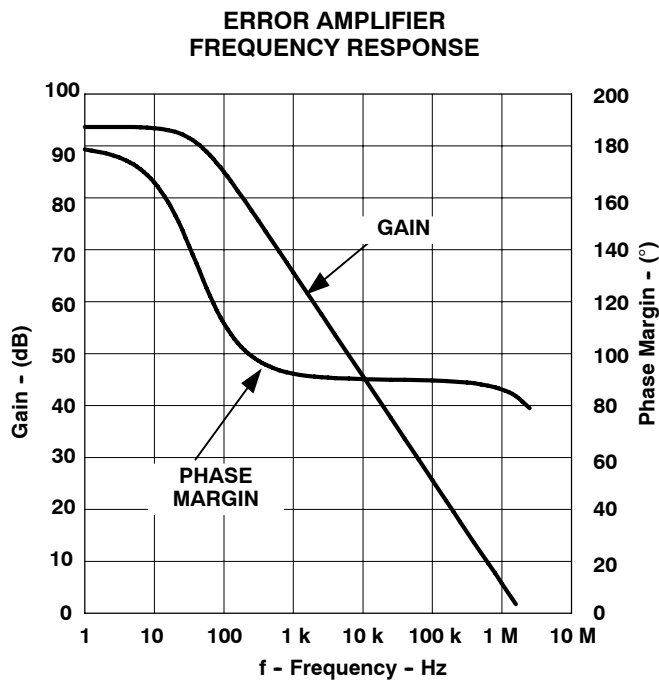


Figure 8

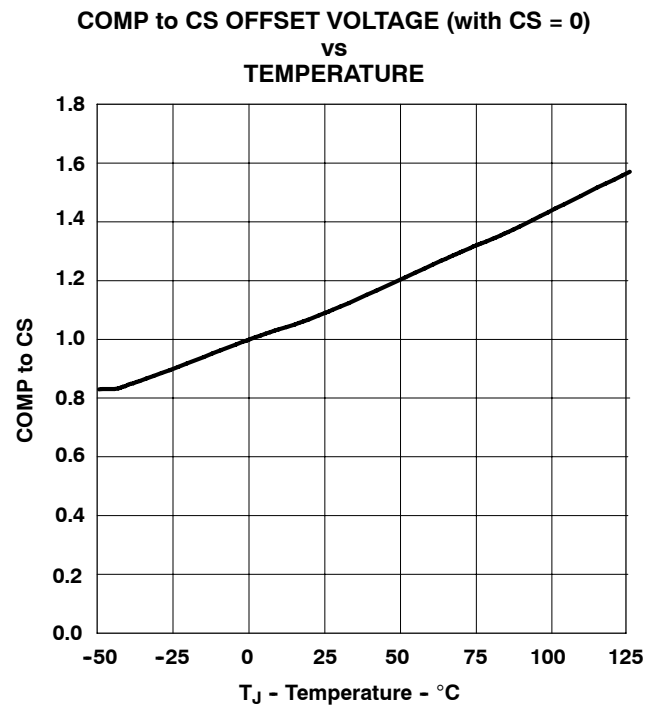


Figure 9

## TYPICAL CHARACTERISTICS

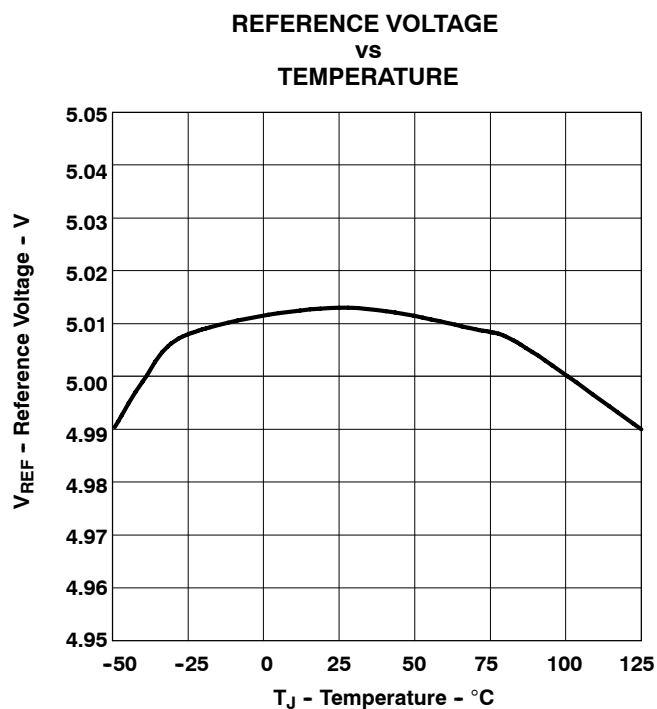


Figure 10

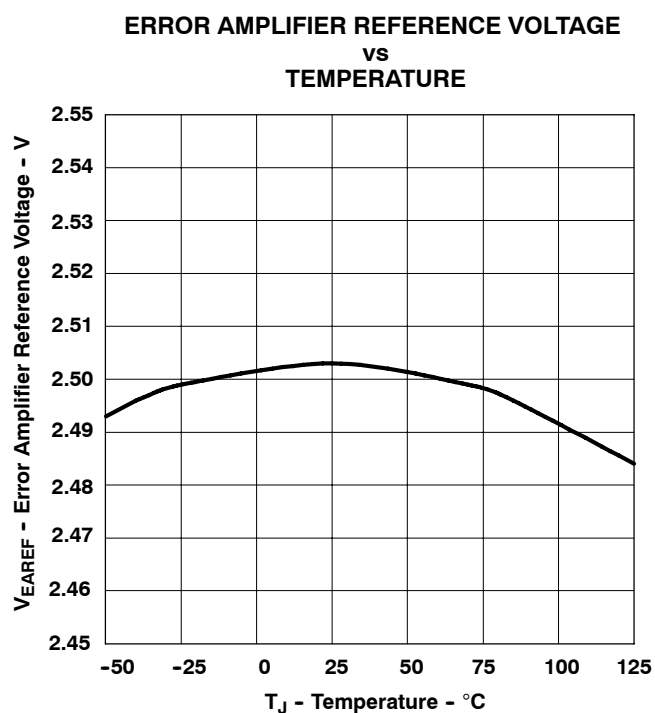


Figure 11

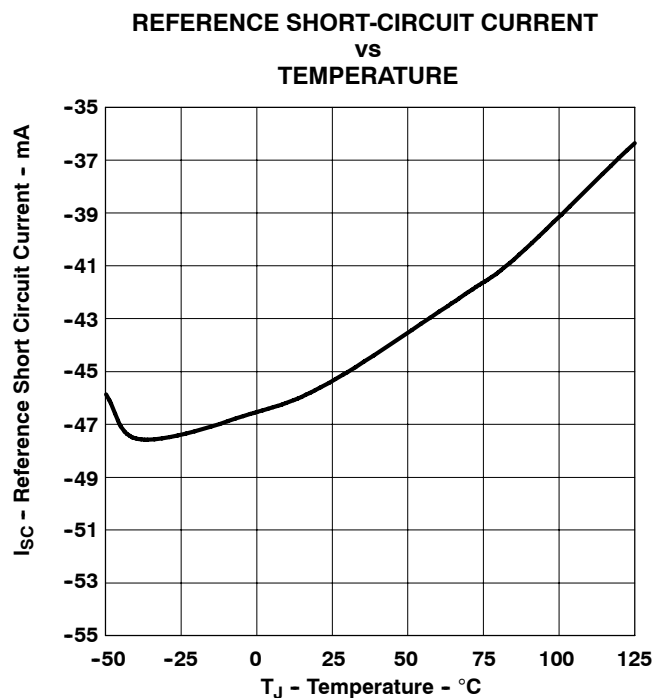


Figure 12

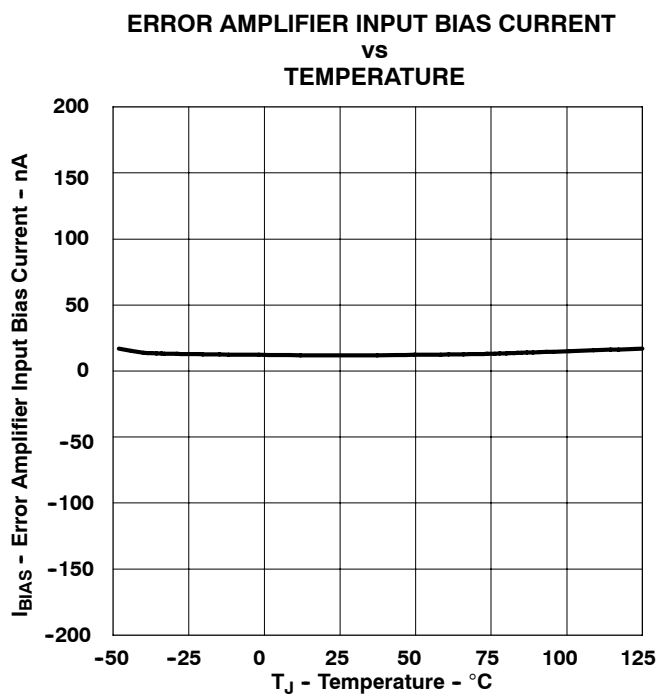


Figure 13

## TYPICAL CHARACTERISTICS

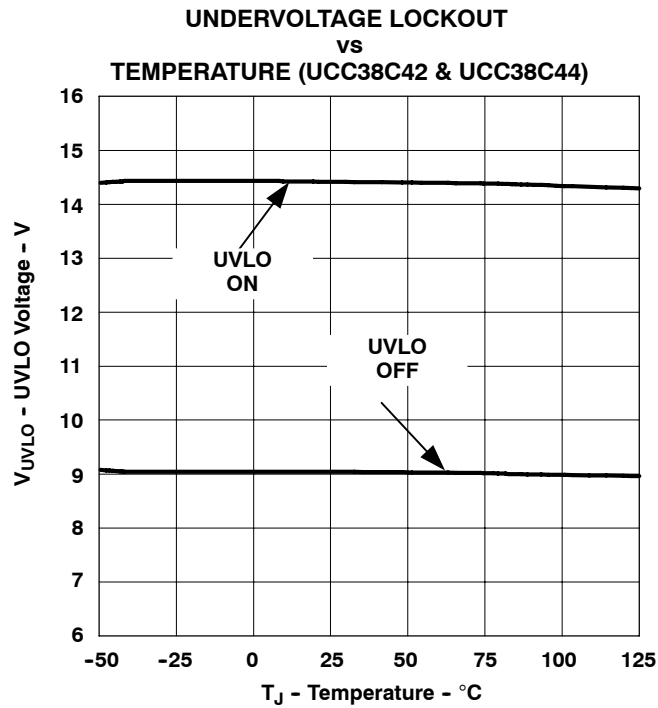


Figure 14

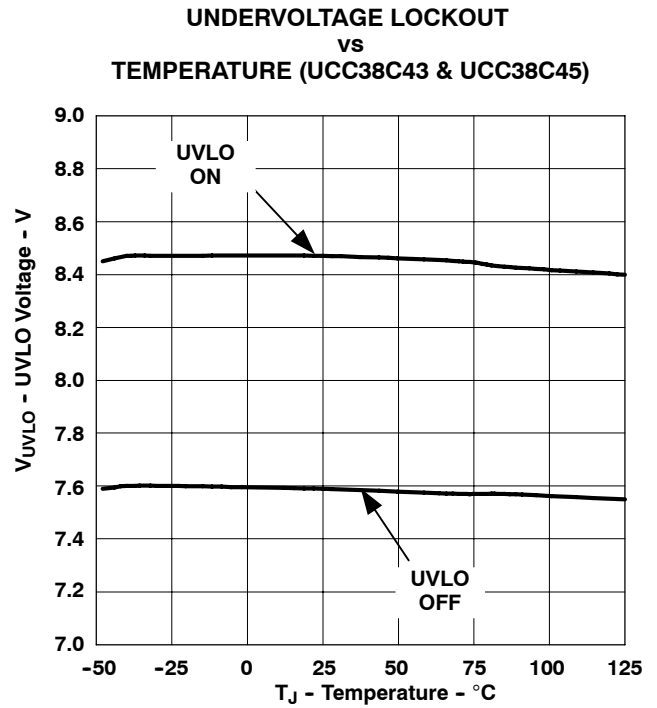


Figure 15

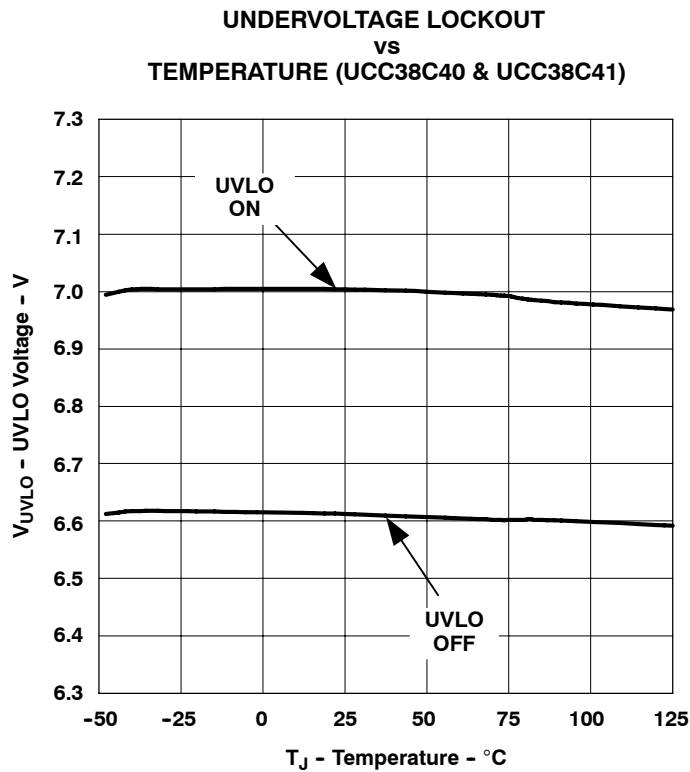


Figure 16

## TYPICAL CHARACTERISTICS

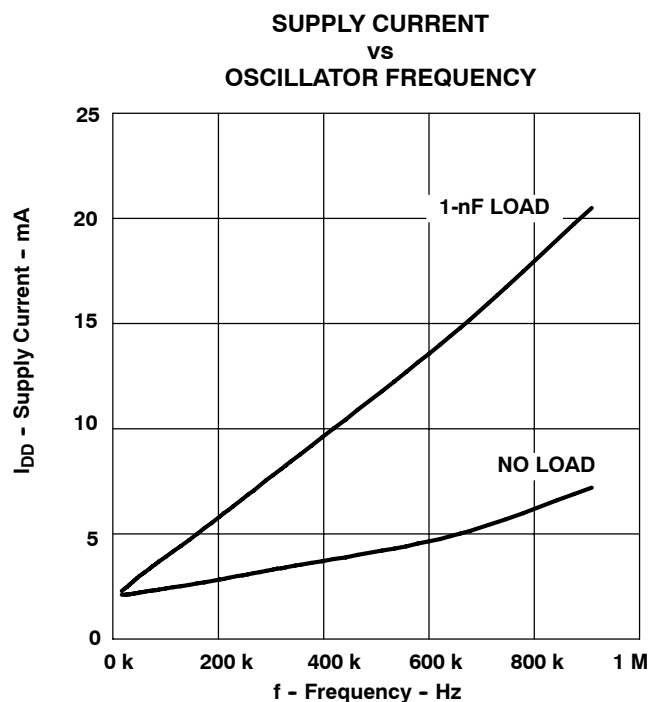


Figure 17

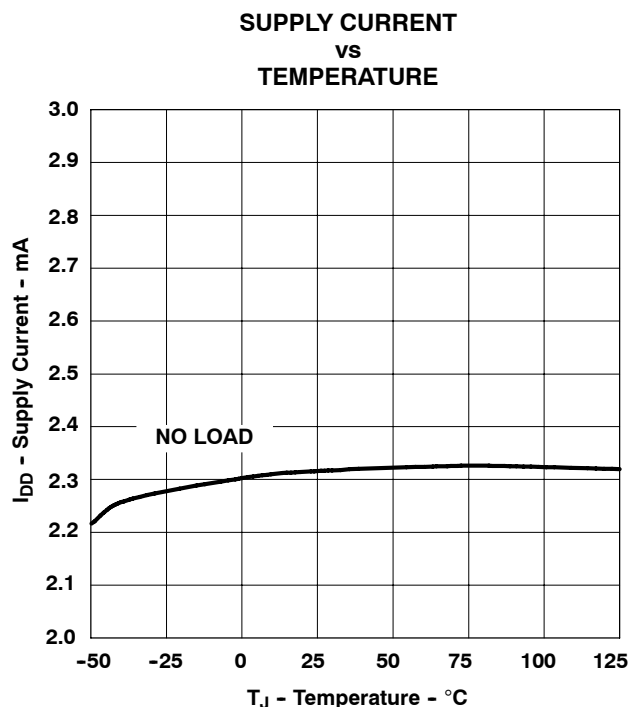


Figure 18

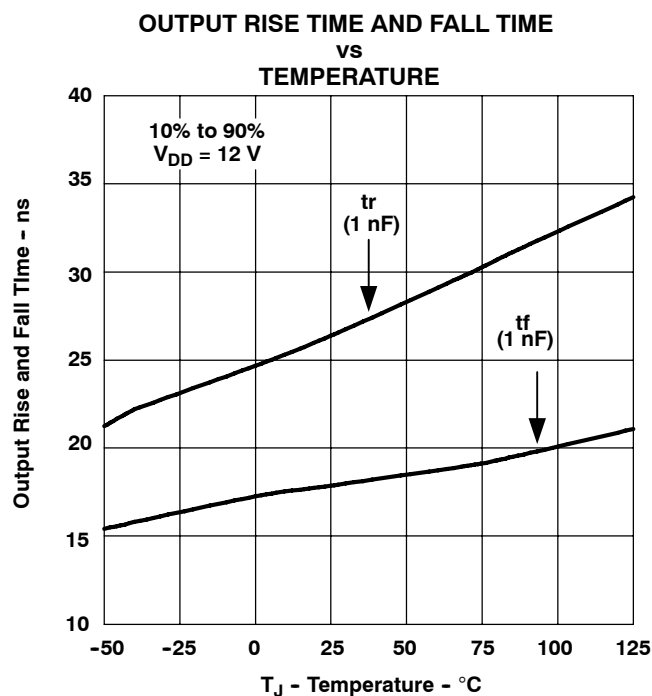


Figure 19

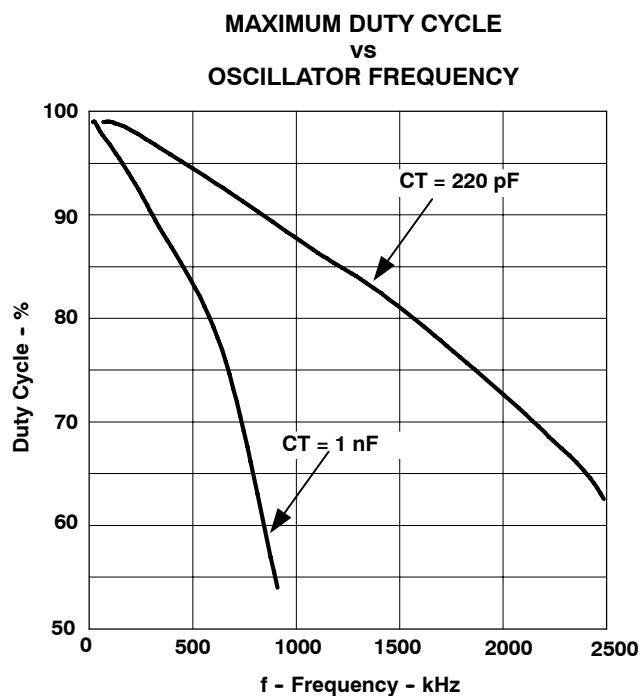


Figure 20

## TYPICAL CHARACTERISTICS

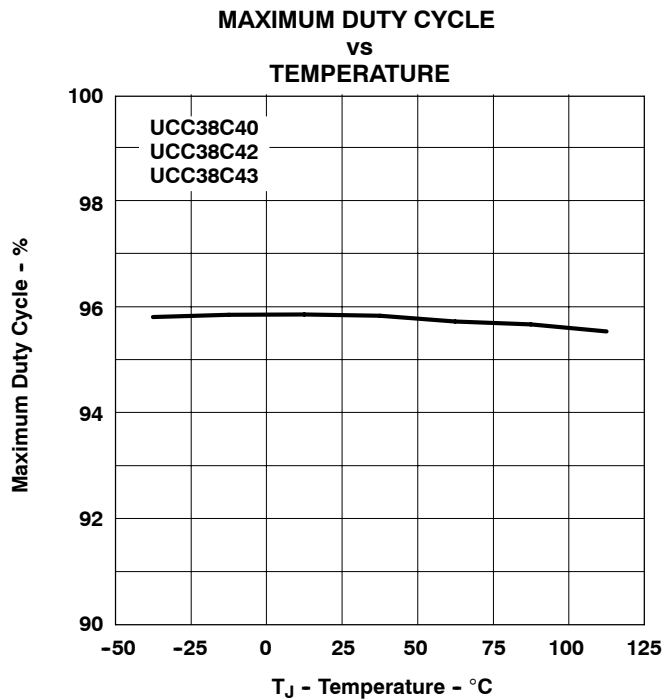


Figure 21

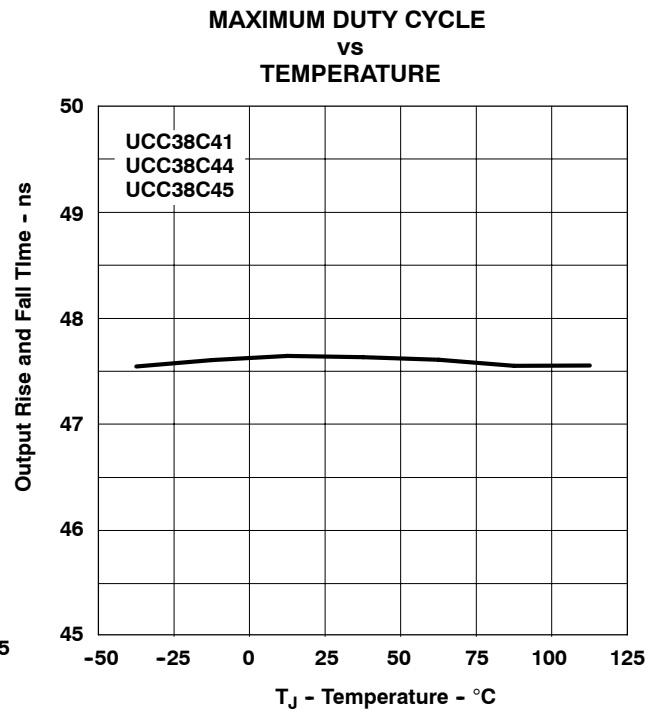


Figure 22

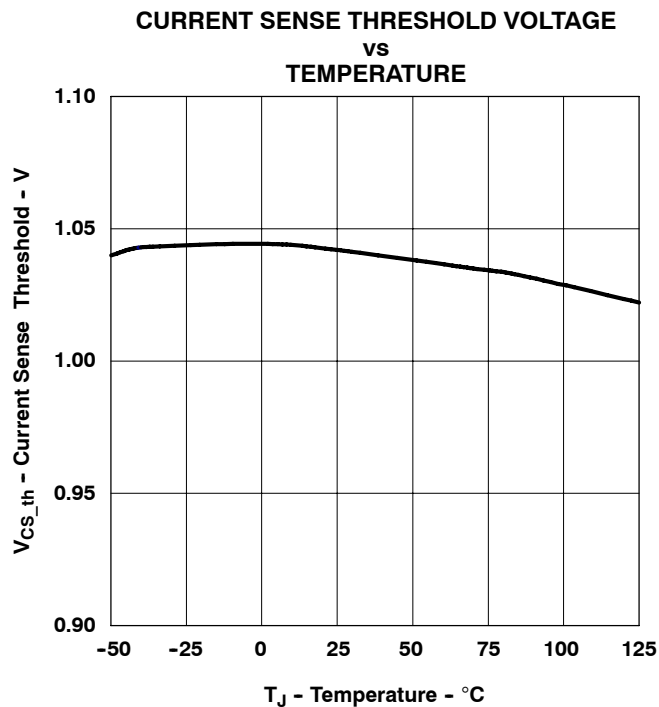


Figure 23

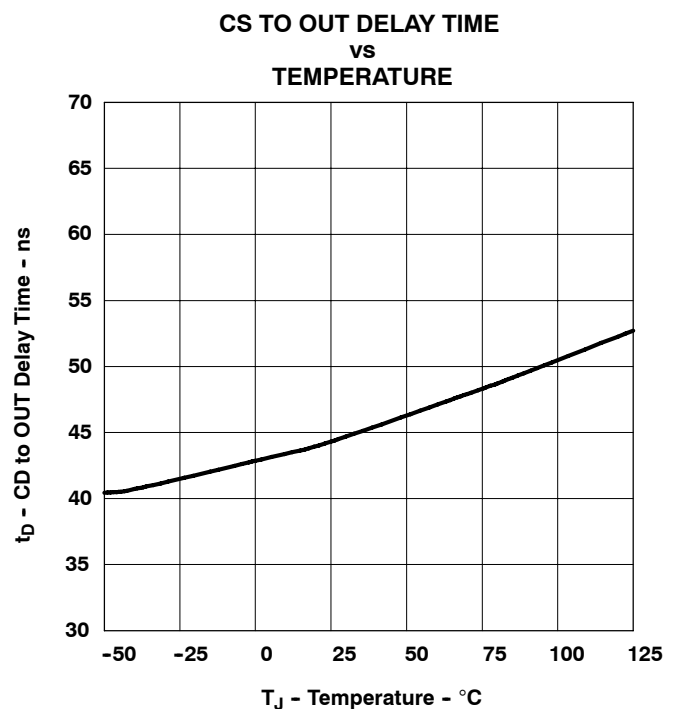


Figure 24

## **Revision History**

Revision SLUS458D to SLUS458E, 10/2010

- 1) Updated Operating Junction Temperature in the Recommended Operating Conditions Table, from -55 to 150 to -40 to 105.
- 2) Updated Available Options Table heading from  $T_A$  to  $T_A = T_J$ .

**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup>    | Lead/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|----------------------------|----------------------|------------------------------|-----------------------------|
| UCC28C40D        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C40DG4      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C40DGK      | ACTIVE                | VSSOP        | DGK             | 8    | 80          | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C40DGKG4    | ACTIVE                | VSSOP        | DGK             | 8    | 80          | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C40DGKR     | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C40DGKRG4   | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C40DR       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C40DRG4     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C40P        | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC28C40PG4      | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC28C41D        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C41DG4      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C41DGK      | ACTIVE                | VSSOP        | DGK             | 8    | 100         | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C41DGKG4    | ACTIVE                | VSSOP        | DGK             | 8    | 100         | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C41DGKR     | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C41DGKRG4   | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C41DR       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup>    | Lead/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|----------------------------|----------------------|------------------------------|-----------------------------|
| UCC28C41DRG4     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C42D        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C42DG4      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C42DGK      | ACTIVE                | VSSOP        | DGK             | 8    | 100         | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C42DGKG4    | ACTIVE                | VSSOP        | DGK             | 8    | 100         | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C42DGKR     | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C42DGKRG4   | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C42DR       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C42DRG4     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C42P        | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC28C42PG4      | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC28C43D        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C43DG4      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C43DGK      | ACTIVE                | VSSOP        | DGK             | 8    | 80          | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C43DGKG4    | ACTIVE                | VSSOP        | DGK             | 8    | 80          | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C43DGKR     | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C43DGKRG4   | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C43DR       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup>    | Lead/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|----------------------------|----------------------|------------------------------|-----------------------------|
| UCC28C43DRG4     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C43P        | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC28C43PG4      | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC28C44D        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C44DG4      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C44DGK      | ACTIVE                | VSSOP        | DGK             | 8    | 80          | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C44DGKG4    | ACTIVE                | VSSOP        | DGK             | 8    | 80          | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C44DGKR     | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C44DGKRG4   | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C44DR       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C44DRG4     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C44P        | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC28C44PG4      | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC28C45D        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C45DG4      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C45DGK      | ACTIVE                | VSSOP        | DGK             | 8    | 100         | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C45DGKG4    | ACTIVE                | VSSOP        | DGK             | 8    | 100         | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC28C45DGKR     | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup>    | Lead/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|----------------------------|----------------------|------------------------------|-----------------------------|
| UCC28C45DGKRG4   | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC28C45DR       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C45DRG4     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC28C45P        | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC28C45PG4      | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC38C40D        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C40DG4      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C40DGK      | ACTIVE                | VSSOP        | DGK             | 8    | 80          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC38C40DGKG4    | ACTIVE                | VSSOP        | DGK             | 8    | 80          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC38C40DGKR     | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC38C40DGKRG4   | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC38C40DR       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C40DRG4     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C40P        | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC38C40PG4      | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC38C41D        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C41DG4      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C41DGK      | ACTIVE                | VSSOP        | DGK             | 8    | 100         | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup>    | Lead/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|----------------------------|----------------------|------------------------------|-----------------------------|
| UCC38C41DGKG4    | ACTIVE                | VSSOP        | DGK             | 8    | 100         | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC38C41DR       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C41DRG4     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C41P        | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC38C41PG4      | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC38C42D        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C42DG4      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C42DGK      | ACTIVE                | VSSOP        | DGK             | 8    | 100         | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC38C42DGKG4    | ACTIVE                | VSSOP        | DGK             | 8    | 100         | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC38C42DGKR     | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC38C42DGKRG4   | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC38C42DR       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C42DRG4     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C42P        | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC38C42PG4      | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC38C43D        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C43DG4      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C43DGK      | ACTIVE                | VSSOP        | DGK             | 8    | 80          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup>    | Lead/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|----------------------------|----------------------|------------------------------|-----------------------------|
| UCC38C43DGKG4    | ACTIVE                | VSSOP        | DGK             | 8    | 80          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC38C43DGKR     | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC38C43DGKRG4   | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC38C43DR       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C43DRG4     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C43P        | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC38C43PG4      | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC38C44D        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C44DG4      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C44DGK      | ACTIVE                | VSSOP        | DGK             | 8    | 80          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC38C44DGKG4    | ACTIVE                | VSSOP        | DGK             | 8    | 80          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC38C44DGKR     | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC38C44DGKRG4   | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-2-260C-1 YEAR          |                             |
| UCC38C44DR       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C44DRG4     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C44P        | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC38C44PG4      | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC38C45D        | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/<br>Ball Finish | MSL Peak Temp <sup>(3)</sup> | Samples<br>(Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|----------------------|------------------------------|-----------------------------|
| UCC38C45DG4      | ACTIVE                | SOIC         | D               | 8    | 75          | Green (RoHS & no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C45DGK      | ACTIVE                | VSSOP        | DGK             | 8    | 80          | Green (RoHS & no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC38C45DGKG4    | ACTIVE                | VSSOP        | DGK             | 8    | 80          | Green (RoHS & no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC38C45DGKR     | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC38C45DGKRG4   | ACTIVE                | VSSOP        | DGK             | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAUAG          | Level-2-260C-1 YEAR          |                             |
| UCC38C45DR       | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C45DRG4     | ACTIVE                | SOIC         | D               | 8    | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU            | Level-1-260C-UNLIM           |                             |
| UCC38C45P        | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |
| UCC38C45PG4      | ACTIVE                | PDIP         | P               | 8    | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU            | N / A for Pkg Type           |                             |

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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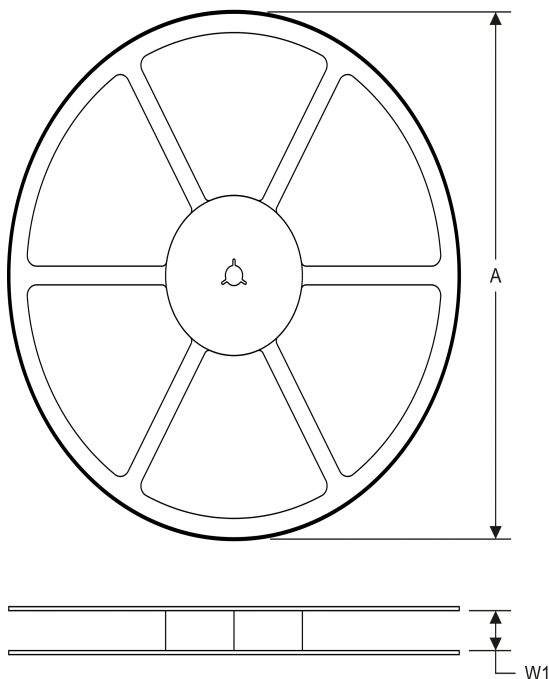
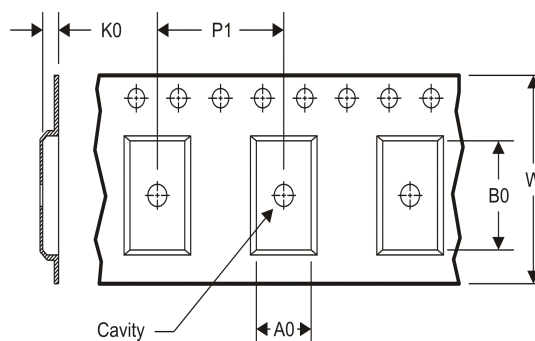
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**OTHER QUALIFIED VERSIONS OF UCC28C41, UCC28C43, UCC28C45 :**

- Automotive: [UCC28C41-Q1](#)
- Enhanced Product: [UCC28C43-EP](#), [UCC28C45-EP](#)

**NOTE: Qualified Version Definitions:**

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects
- Enhanced Product - Supports Defense, Aerospace and Medical Applications

**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


|    |                                                           |
|----|-----------------------------------------------------------|
| A0 | Dimension designed to accommodate the component width     |
| B0 | Dimension designed to accommodate the component length    |
| K0 | Dimension designed to accommodate the component thickness |
| W  | Overall width of the carrier tape                         |
| P1 | Pitch between successive cavity centers                   |

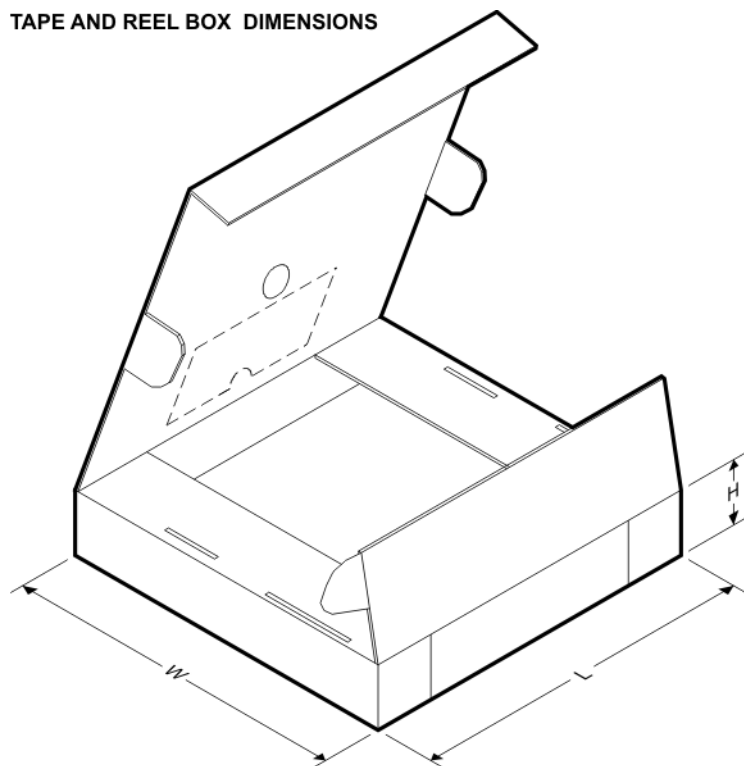
**TAPE AND REEL INFORMATION**

\*All dimensions are nominal

| Device       | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| UCC28C40DGKR | VSSOP        | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |
| UCC28C40DR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| UCC28C41DGKR | VSSOP        | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |
| UCC28C41DR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| UCC28C42DGKR | VSSOP        | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |
| UCC28C42DR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| UCC28C43DGKR | VSSOP        | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |
| UCC28C43DR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| UCC28C44DGKR | VSSOP        | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |
| UCC28C44DR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| UCC28C45DGKR | VSSOP        | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |
| UCC28C45DR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| UCC38C40DGKR | VSSOP        | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |
| UCC38C40DR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| UCC38C41DR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| UCC38C42DGKR | VSSOP        | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |
| UCC38C42DR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| UCC38C43DGKR | VSSOP        | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |

| Device       | Package Type | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| UCC38C43DR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| UCC38C44DGKR | VSSOP        | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |
| UCC38C44DR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |
| UCC38C45DGKR | VSSOP        | DGK             | 8    | 2500 | 330.0              | 12.4               | 5.3     | 3.4     | 1.4     | 8.0     | 12.0   | Q1            |
| UCC38C45DR   | SOIC         | D               | 8    | 2500 | 330.0              | 12.4               | 6.4     | 5.2     | 2.1     | 8.0     | 12.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device       | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| UCC28C40DGKR | VSSOP        | DGK             | 8    | 2500 | 366.0       | 364.0      | 50.0        |
| UCC28C40DR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| UCC28C41DGKR | VSSOP        | DGK             | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| UCC28C41DR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| UCC28C42DGKR | VSSOP        | DGK             | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| UCC28C42DR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| UCC28C43DGKR | VSSOP        | DGK             | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| UCC28C43DR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| UCC28C44DGKR | VSSOP        | DGK             | 8    | 2500 | 366.0       | 364.0      | 50.0        |
| UCC28C44DR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| UCC28C45DGKR | VSSOP        | DGK             | 8    | 2500 | 366.0       | 364.0      | 50.0        |
| UCC28C45DR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |

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| Device       | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| UCC38C40DGKR | VSSOP        | DGK             | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| UCC38C40DR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| UCC38C41DR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| UCC38C42DGKR | VSSOP        | DGK             | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| UCC38C42DR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| UCC38C43DGKR | VSSOP        | DGK             | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| UCC38C43DR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| UCC38C44DGKR | VSSOP        | DGK             | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| UCC38C44DR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |
| UCC38C45DGKR | VSSOP        | DGK             | 8    | 2500 | 367.0       | 367.0      | 35.0        |
| UCC38C45DR   | SOIC         | D               | 8    | 2500 | 340.5       | 338.1      | 20.6        |

P (R-PDIP-T8)

PLASTIC DUAL-IN-LINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MS-001 variation BA.

DGK (S-PDSO-G8)

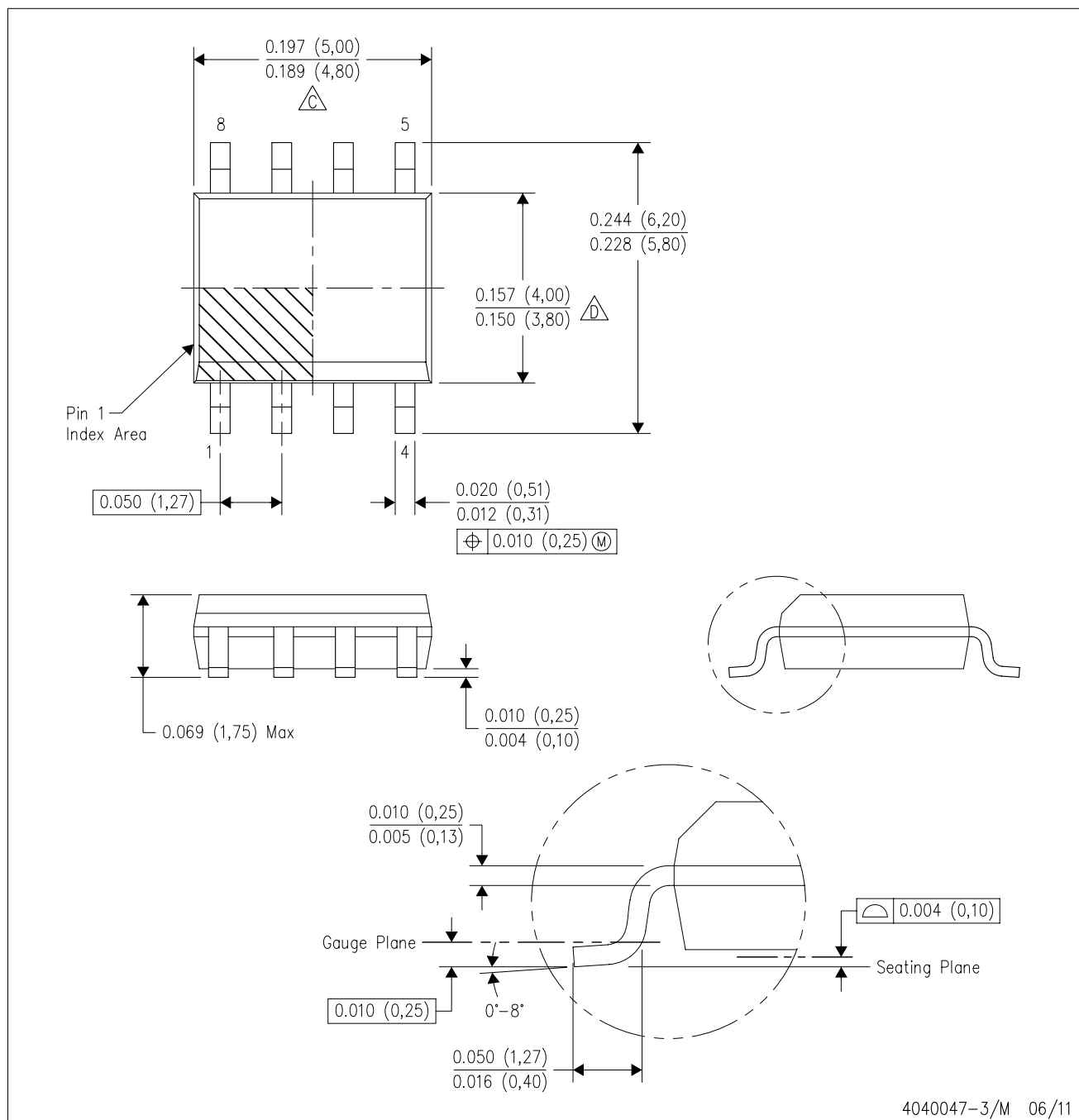
PLASTIC SMALL-OUTLINE PACKAGE



4073329/E 05/06

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - $\triangle C$  Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.
  - $\triangle D$  Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.
  - E. Reference JEDEC MS-012 variation AA.

D (R-PDSO-G8)

PLASTIC SMALL OUTLINE



- NOTES:
- All linear dimensions are in millimeters.
  - This drawing is subject to change without notice.
  - Publication IPC-7351 is recommended for alternate designs.
  - Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525 for other stencil recommendations.
  - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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| DLP® Products          | <a href="http://www.dlp.com">www.dlp.com</a>                                         |
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| RFID                   | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>                                 |
| OMAP Mobile Processors | <a href="http://www.ti.com/omap">www.ti.com/omap</a>                                 |
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### Applications

|                               |                                                                                          |
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| Computers and Peripherals     | <a href="http://www.ti.com/computers">www.ti.com/computers</a>                           |
| Consumer Electronics          | <a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a>                   |
| Energy and Lighting           | <a href="http://www.ti.com/energy">www.ti.com/energy</a>                                 |
| Industrial                    | <a href="http://www.ti.com/industrial">www.ti.com/industrial</a>                         |
| Medical                       | <a href="http://www.ti.com/medical">www.ti.com/medical</a>                               |
| Security                      | <a href="http://www.ti.com/security">www.ti.com/security</a>                             |
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