



DUAL 4-A PEAK HIGH SPEED LOW-SIDE POWER MOSFET DRIVERS

FEATURES

- Industry-Standard Pin-Out
- High Current Drive Capability of ± 4 A at the Miller Plateau Region
- Efficient Constant Current Sourcing Even at Low Supply Voltages
- TTL/CMOS Compatible Inputs Independent of Supply Voltage
- 20-ns Typical Rise and 15-ns Typical Fall Times with 1.8-nF Load
- Typical Propagation Delay Times of 25 ns with Input Falling and 35 ns with Input Rising
- 4.5-V to 15-V Supply Voltage
- Supply Current of 0.3 mA
- Dual Outputs Can Be Paralleled for Higher Drive Current
- Available in Thermally Enhanced MSOP PowerPAD™ Package with 4.7°C/W θ_{jc}
- Rated From -40°C to 125°C
- TrueDrive Output Architecture Using Bipolar and CMOS Transistors in Parallel

APPLICATIONS

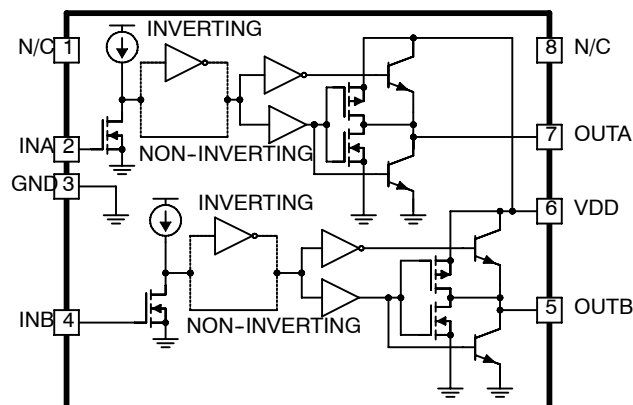
- Switch Mode Power Supplies
- DC/DC Converters
- Motor Controllers
- Line Drivers
- Class D Switching Amplifiers

DESCRIPTION

The UCC37323/4/5 family of high-speed dual MOSFET drivers can deliver large peak currents into capacitive loads. Three standard logic options are offered – dual-inverting, dual-noninverting and one-inverting and one-noninverting driver. The thermally enhanced 8-pin PowerPAD™ MSOP package (DGN) drastically lowers the thermal resistance to improve long-term reliability. It is also offered in the standard SOIC-8 (D) or PDIP-8 (P) packages.

Using a design that inherently minimizes shoot-through current, these drivers deliver 4-A of current where it is needed most at the Miller plateau region during the MOSFET switching transition. A unique BiPolar and MOSFET hybrid output stage in parallel also allows efficient current sourcing and sinking at low supply voltages.

BLOCK DIAGRAM



UDG-01063



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet. PowerPAD™ is a trademark of Texas Instruments Incorporated.

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.

UCC27323, UCC27324, UCC27325 UCC37323, UCC37324, UCC37325

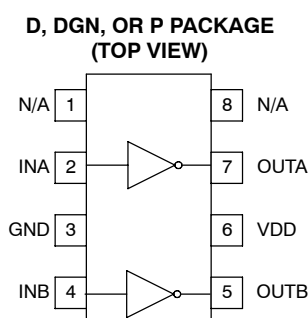
SLUS492G - JUNE 2001 - REVISED MARCH 2010

ORDERING INFORMATION

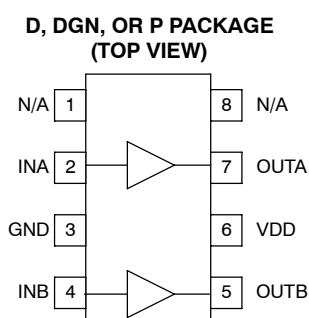
| OUTPUT CONFIGURATION | TEMPERATURE RANGE $T_A = T_J$ | PACKAGED DEVICES | | |
|------------------------------------|----------------------------------|------------------|------------------------|------------|
| | | SOIC-8 (D) | MSOP-8 PowerPAD (DGN)‡ | PDIP-8 (P) |
| Dual inverting | -40°C to +125°C | UCC27323D | UCC27323DGN | UCC27323P |
| | 0°C to +70°C | UCC37323D | UCC37323DGN | UCC37323P |
| Dual nonInverting | -40°C to +125°C | UCC27324D | UCC27324DGN | UCC27324P |
| | 0°C to +70°C | UCC37324D | UCC37324DGN | UCC37324P |
| One inverting, one noninverting | -40°C to +125°C | UCC27325D | UCC27325DGN | UCC27325P |
| | 0°C to +70°C | UCC37325D | UCC37325DGN | UCC37325P |

† D (SOIC-8) and DGN (PowerPAD-MSOP) packages are available taped and reeled. Add R suffix to device type (e.g. UCC27323DR, UCC27324DGNR) to order quantities of 2,500 devices per reel for D or 1,000 devices per reel for DGN package.

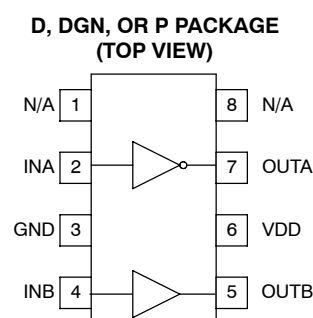
‡ The PowerPAD™ is not directly connected to any leads of the package. However, it is electrically and thermally connected to the substrate which is the ground of the device.



(DUAL INVERTING)



(DUAL NONINVERTING)



(ONE INVERTING,
ONE NONINVERTING)

power dissipation rating table

| PACKAGE | SUFFIX | θ_{jc} (°C/W) | θ_{ja} (°C/W) | Power Rating (mW) $T_A = 70^\circ\text{C}$ See Note 1 | Derating Factor Above 70°C (mW/°C) See Note 1 |
|-------------------------------|--------|----------------------|----------------------|--|---|
| SOIC-8 | D | 42 | 84 – 160‡ | 344–655 See Note 2 | 6.25 – 11.9 See Note 2 |
| PDIP-8 | P | 49 | 110 | 500 | 9 |
| MSOP PowerPAD-8 See Note 3 | DGN | 4.7 | 50 – 59‡ | 1370 | 17.1 |

- Notes: 1. 125°C operating junction temperature is used for power rating calculations
 2. The range of values indicates the effect of pc-board. These values are intended to give the system designer an indication of the best and worst case conditions. In general, the system designer should attempt to use larger traces on the pc-board where possible in order to spread the heat away from the device more effectively. For information on the PowerPAD™ package, refer to Technical Brief, *PowerPad Thermally Enhanced Package*, Texas Instruments Literature No. SLMA002 and Application Brief, *PowerPad Made Easy*, Texas Instruments Literature No. SLMA004.
 3. The PowerPAD™ is not directly connected to any leads of the package. However, it is electrically and thermally connected to the substrate which is the ground of the device.

Table 1. Input/Output Table

| INPUTS (VIN_L, VIN_H) | | UCC37323 | | UCC37324 | | UCC37325 | |
|-----------------------|-----|----------|------|----------|------|----------|------|
| INA | INB | OUTA | OUTB | OUTA | OUTB | OUTA | OUTB |
| L | L | H | H | L | L | H | L |
| L | H | H | L | L | H | H | H |
| H | L | L | H | H | L | L | L |
| H | H | L | L | H | H | L | H |

absolute maximum ratings over operating free-air temperature (unless otherwise noted)^{†‡}

| | |
|---|--|
| Supply voltage, V_{DD} | -0.3 V to 16 V |
| Analog input voltage (INA, INB) | -0.3 V to $V_{DD} + 0.3$ V, not to exceed 16 V |
| Output voltage, (OUTA, OUTB) | 16 V |
| Output body diode DC current, (OUTA, OUTB) | 0.2 A |
| Output current (OUTA, OUTB) DC, I_{OUT_DC} | 0.2 A |
| Pulsed, ($\bar{0}.5 \mu\text{s}$), I_{OUT_PULSED} | 4.5 A |
| Power dissipation at $T_A = 25^\circ\text{C}$ (DGN package) | 2.12 W |
| (D package) | 1.14 W |
| (P package) | 780 mW |
| Junction operating temperature, T_J | -55°C to 150°C |
| Storage temperature, T_{stg} | -65°C to 150°C |
| Lead temperature (soldering, 10 sec.), | 300°C |

[†] 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.

[‡] All voltages are with respect to GND. Currents are positive into, negative out of the specified terminal.

electrical characteristics, $V_{DD} = 4.5$ V to 15 V, $T_A = T_J$, (unless otherwise noted)

input (INA, INB)

| PARAMETER | TEST CONDITION | MIN | TYP | MAX | UNITS |
|---------------------------------------|---------------------------------------|-----|-----|-----|---------------|
| V_{IN_H} , logic 1 input threshold | | 2 | | | V |
| V_{IN_L} , logic 0 input threshold | | | | 1 | V |
| Input current | $0 \text{ V} \leq V_{IN} \leq V_{DD}$ | -10 | 0 | 10 | μA |

output (OUTA, OUTB)

| PARAMETER | TEST CONDITION | MIN | TYP | MAX | UNITS |
|--------------------------------------|---|-----|-----|-----|----------|
| Output current | $V_{DD} = 14$ V, See Note 1 | | 4 | | A |
| V_{OH} , high-level output voltage | $V_{OH} = V_{DD} - V_{OUT}$, $I_{OUT} = -10$ mA | | 300 | 450 | mV |
| V_{OL} , low-level output level | $I_{OUT} = 10$ mA | | 22 | 45 | mV |
| Output resistance high | $T_A = 25^\circ\text{C}$, $I_{OUT} = -10$ mA, $V_{DD} = 14$ V, See Note 2 | 25 | 30 | 35 | Ω |
| | $T_A = \text{full range}$, $I_{OUT} = -10$ mA, $V_{DD} = 14$ V, See Note 2 | 18 | | 42 | Ω |
| Output resistance low | $T_A = 25^\circ\text{C}$, $I_{OUT} = 10$ mA, $V_{DD} = 14$ V, See Note 2 | 1.9 | 2.2 | 2.5 | Ω |
| | $T_A = \text{full range}$, $I_{OUT} = 10$ mA, $V_{DD} = 14$ V, See Note 2 | 1.2 | | 4.0 | Ω |
| Latch-up protection | | 500 | | | mA |

NOTES: 1 The pullup / pulldown circuits of the driver are bipolar and MOSFET transistors in parallel. The pulsed output current rating is the combined current from the bipolar and MOSFET transistors.
 2 The pullup / pulldown circuits of the driver are bipolar and MOSFET transistors in parallel. The output resistance is the $R_{DS(ON)}$ of the MOSFET transistor when the voltage on the driver output is less than the saturation voltage of the bipolar transistor.

UCC27323, UCC27324, UCC27325 UCC37323, UCC37324, UCC37325

SLUS492G - JUNE 2001 - REVISED MARCH 2010

electrical characteristics, $V_{DD} = 4.5\text{ V to }15\text{ V}$, $T_A = -40^\circ\text{C to }125^\circ\text{C}$ for the UCC2732x, $T_A = 0^\circ\text{C to }70^\circ\text{C}$ for the UCC3732x, $T_A = T_J$, (unless otherwise noted)

switching time

| PARAMETER | TEST CONDITION | MIN | TYP | MAX | UNITS |
|--|---|-----|-----|-----|-------|
| t_R , rise time (OUTA, OUTB) | $C_{LOAD} = 1.8\text{ nF}$, See Figure 1 | | 20 | 40 | ns |
| t_F , fall time (OUTA, OUTB) | $C_{LOAD} = 1.8\text{ nF}$, See Figure 1 | | 15 | 40 | ns |
| t_{D1} , delay, IN rising (IN to OUT) | $C_{LOAD} = 1.8\text{ nF}$, See Figure 1 | | 25 | 40 | ns |
| t_{D2} , delay, IN falling (IN to OUT) | $C_{LOAD} = 1.8\text{ nF}$, See Figure 1 | | 35 | 50 | ns |

overall

| PARAMETER | TEST CONDITION | MIN | TYP | MAX | UNITS | |
|-------------------------------------|----------------|------------------------|-----|-----|-------|---------------|
| I_{DD} , static operating current | UCCx7323 | INA = 0 V, INB = 0 V | | 300 | 450 | μA |
| | | INA = 0 V, INB = HIGH | | 300 | 450 | |
| | | INA = HIGH, INB = 0 V | | 300 | 450 | |
| | | INA = HIGH, INB = HIGH | | 300 | 450 | |
| | UCCx7324 | INA = 0 V, INB = 0 V | | 2 | 50 | |
| | | INA = 0 V, INB = HIGH | | 300 | 450 | |
| | | INA = HIGH, INB = 0 V | | 300 | 450 | |
| | | INA = HIGH, INB = HIGH | | 600 | 750 | |
| | UCCx7325 | INA = 0 V, INB = 0 V | | 150 | 300 | |
| | | INA = 0 V, INB = HIGH | | 450 | 600 | |
| | | INA = HIGH, INB = 0 V | | 150 | 300 | |
| | | INA = HIGH, INB = HIGH | | 450 | 600 | |

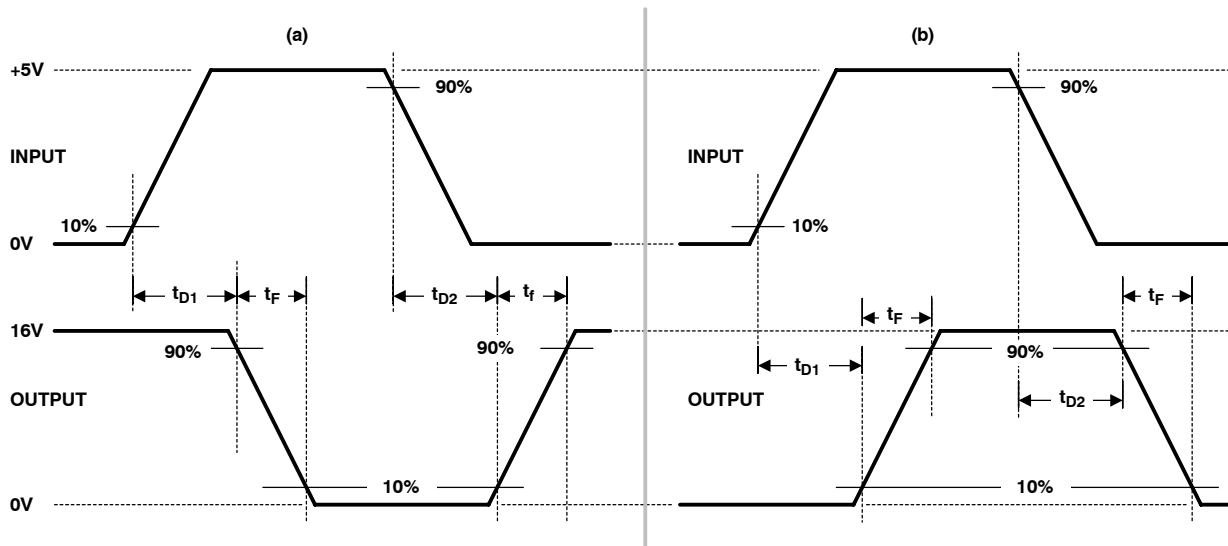


Figure 1. Switching Waveforms for (a) Inverting Driver and (b) Noninverting Driver

Terminal Functions

| TERMINAL | | | FUNCTION |
|----------|------|-----|---|
| NO. | NAME | I/O | |
| 1 | N/C | - | No connection. Should be grounded. |
| 2 | INA | I | Input A. Input signal of the A driver which has logic compatible threshold and hysteresis. If not used, this input should be tied to either VDD or GND. It should not be left floating. |
| 3 | GND | - | Common ground. This ground should be connected very closely to the source of the power MOSFET which the driver is driving. |
| 4 | INB | I | Input B. Input signal of the A driver which has logic compatible threshold and hysteresis. If not used, this input should be tied to either VDD or GND. It should not be left floating. |
| 5 | OUTB | O | Driver output B. The output stage is capable of providing 4-A drive current to the gate of a power MOSFET. |
| 6 | VDD | I | Supply. Supply voltage and the power input connection for this device. |
| 7 | OUTA | O | Driver output A. The output stage is capable of providing 4-A drive current to the gate of a power MOSFET. |
| 8 | N/C | - | No Connection. Should be grounded. |

APPLICATION INFORMATION

general information

High frequency power supplies often require high-speed, high-current drivers such as the UCC37323/4/5 family. A leading application is the need to provide a high power buffer stage between the PWM output of the control IC and the gates of the primary power MOSFET or IGBT switching devices. In other cases, the driver IC is utilized to drive the power device gates through a drive transformer. Synchronous rectification supplies also have the need to simultaneously drive multiple devices which can present an extremely large load to the control circuitry.

Driver ICs are utilized when it is not feasible to have the primary PWM regulator IC directly drive the switching devices for one or more reasons. The PWM IC may not have the brute drive capability required for the intended switching MOSFET, limiting the switching performance in the application. In other cases there may be a desire to minimize the effect of high frequency switching noise by placing the high current driver physically close to the load. Also, newer ICs that target the highest operating frequencies may not incorporate onboard gate drivers at all. Their PWM outputs are only intended to drive the high impedance input to a driver such as the UCC37323/4/5. Finally, the control IC may be under thermal stress due to power dissipation, and an external driver can help by moving the heat from the controller to an external package.

APPLICATION INFORMATION

input stage

The input thresholds have a 3.3-V logic sensitivity over the full range of V_{DD} voltage; yet it is equally compatible with 0 V to V_{DD} signals.

The inputs of UCC37323/4/5 family of drivers are designed to withstand 500-mA reverse current without either damage to the IC for logic upset. The input stage of each driver should be driven by a signal with a short rise or fall time. This condition is satisfied in typical power supply applications, where the input signals are provided by a PWM controller or logic gates with fast transition times (<200 ns). The input stages to the drivers function as a digital gate, and they are not intended for applications where a slow changing input voltage is used to generate a switching output when the logic threshold of the input section is reached. While this may not be harmful to the driver, the output of the driver may switch repeatedly at a high frequency.

Users should not attempt to shape the input signals to the driver in an attempt to slow down (or delay) the signal at the output. If limiting the rise or fall times to the power device is desired, limit the rise or fall times to the power device, then an external resistance can be added between the output of the driver and the load device, which is generally a power MOSFET gate. The external resistor may also help remove power dissipation from the IC package, as discussed in the section on Thermal Considerations.

output stage

Inverting outputs of the UCC37323 and OUTA of the UCC37325 are intended to drive external P-channel MOSFETs. Noninverting outputs of the UCC37324 and OUTB of the UCC37325 are intended to drive external N-channel MOSFETs.

Each output stage is capable of supplying ± 4 -A peak current pulses and swings to both V_{DD} and GND. The pullup/pulldown circuits of the driver are constructed of bipolar and MOSFET transistors in parallel. The peak output current rating is the combined current from the bipolar and MOSFET transistors. The output resistance is the $R_{DS(on)}$ of the MOSFET transistor when the voltage on the driver output is less than the saturation voltage of the bipolar transistor. Each output stage also provides a very low impedance to overshoot and undershoot due to the body diode of the internal MOSFET. This means that in many cases, external-schottky-clamp diodes are not required.

The UCC37323 family delivers 4-A of gate drive where it is most needed during the MOSFET switching transition – at the Miller plateau region – providing improved efficiency gains. A unique BiPolar and MOSFET hybrid output stage in parallel also allows efficient current sourcing at low supply voltages.

APPLICATION INFORMATION

source/sink capabilities during Miller plateau

Large power MOSFETs present a large load to the control circuitry. Proper drive is required for efficient, reliable operation. The UCC37323/4/5 drivers have been optimized to provide maximum drive to a power MOSFET during the Miller plateau region of the switching transition. This interval occurs while the drain voltage is swinging between the voltage levels dictated by the power topology, requiring the charging/discharging of the drain-gate capacitance with current supplied or removed by the driver IC. [1]

Two circuits are used to test the current capabilities of the UCC37323 driver. In each case external circuitry is added to clamp the output near 5 V while the IC is sinking or sourcing current. An input pulse of 250 ns is applied at a frequency of 1 kHz in the proper polarity for the respective test. In each test there is a transient period where the current peaked up and then settled down to a steady-state value. The noted current measurements are made at a time of 200 ns after the input pulse is applied, after the initial transient.

The first circuit in Figure 2 is used to verify the current sink capability when the output of the driver is clamped around 5 V, a typical value of gate-source voltage during the Miller plateau region. The UCC37323 is found to sink 4.5 A at $V_{DD} = 15$ V and 4.28 A at $V_{DD} = 12$ V.

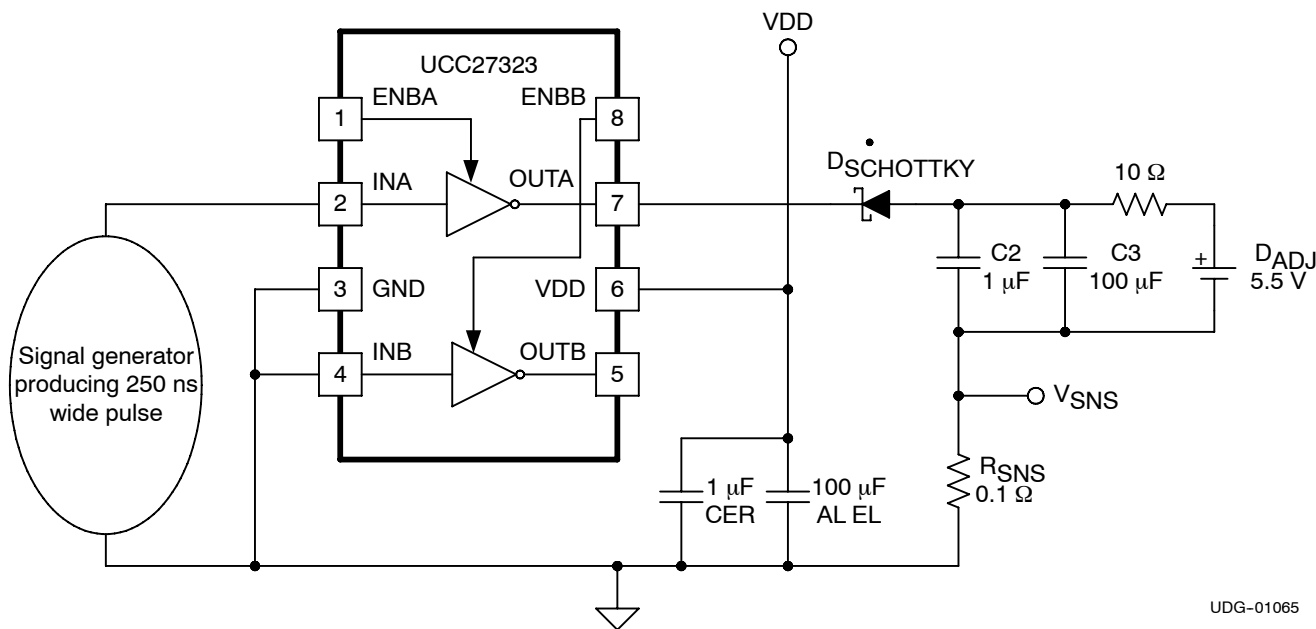
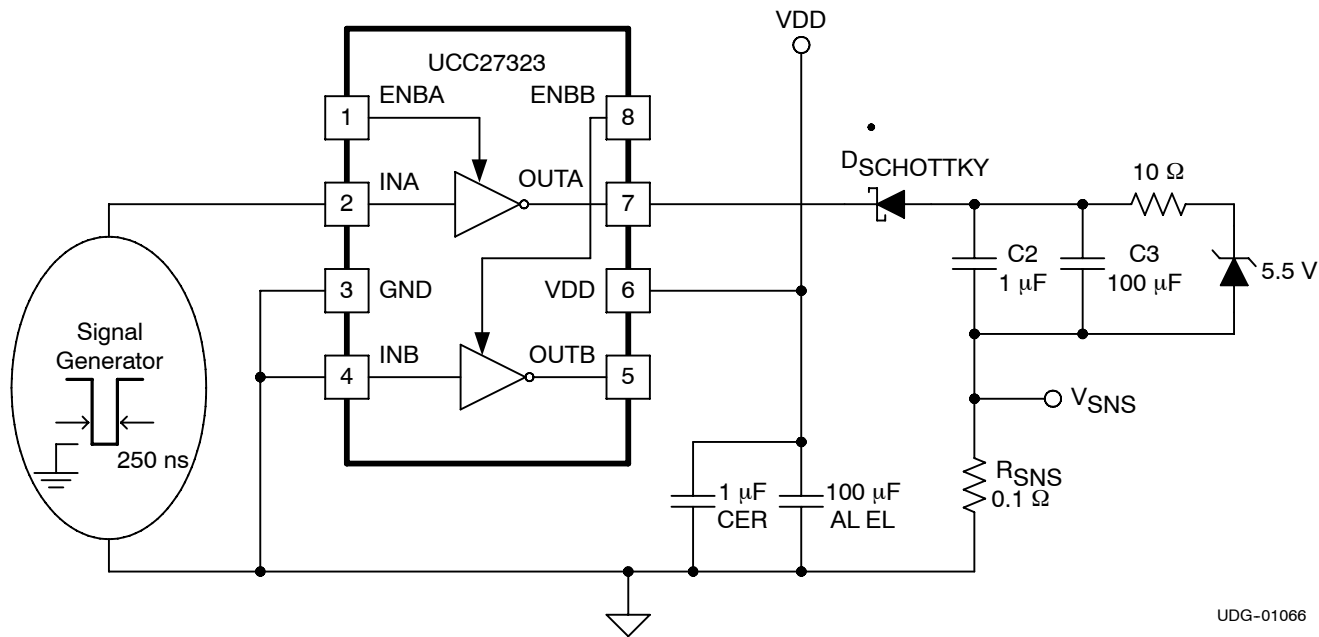


Figure 2.

UDG-01065

APPLICATION INFORMATION

The circuit shown in Figure 3 is used to test the current source capability with the output clamped to around 5 V with a string of Zener diodes. The UCC37323 is found to source 4.8 A at $V_{DD} = 15\text{ V}$ and 3.7 A at $V_{DD} = 12\text{ V}$.



UDG-01066

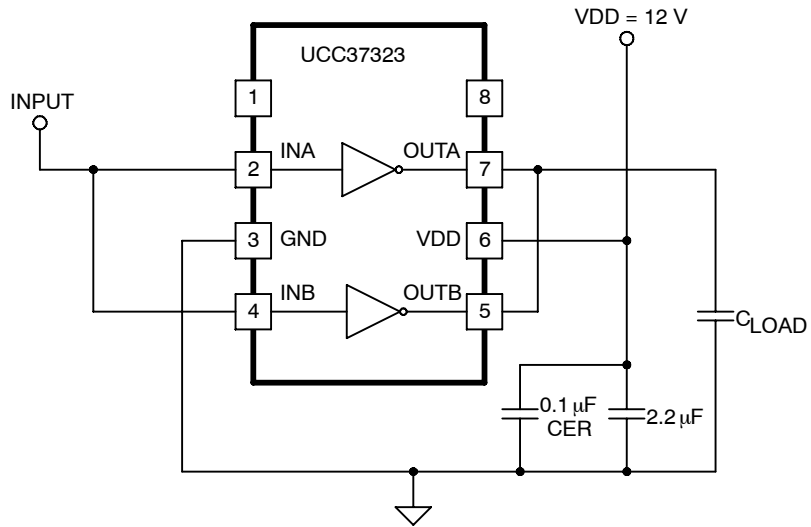
Figure 3.

It should be noted that the current sink capability is slightly stronger than the current source capability at lower V_{DD} . This is due to the differences in the structure of the bipolar-MOSFET power output section, where the current source is a P-channel MOSFET and the current sink has an N-channel MOSFET.

In a large majority of applications it is advantageous that the turn-off capability of a driver is stronger than the turn-on capability. This helps to ensure that the MOSFET is held OFF during common power supply transients which may turn the device back ON.

parallel outputs

The A and B drivers may be combined into a single driver by connecting the INA/INB inputs together and the OUTA/OUTB outputs together. Then, a single signal can control the paralleled combination as shown in Figure 4.



UDG-01067

Figure 4.

APPLICATION INFORMATION

operational waveforms and circuit layout

Figure 5 shows the circuit performance achievable with a single driver (1/2 of the 8-pin IC) driving a 10-nF load. The input pulsewidth (not shown) is set to 300 ns to show both transitions in the output waveform. Note the linear rise and fall edges of the switching waveforms. This is due to the constant output current characteristic of the driver as opposed to the resistive output impedance of traditional MOSFET-based gate drivers.

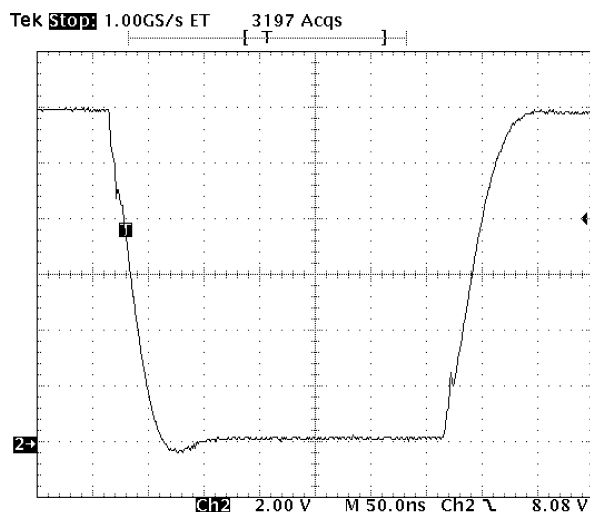


Figure 5.

In a power driver operating at high frequency, it is a significant challenge to get clean waveforms without much overshoot/undershoot and ringing. The low output impedance of these drivers produces waveforms with high di/dt. This tends to induce ringing in the parasitic inductances. Utmost care must be used in the circuit layout. It is advantageous to connect the driver IC as close as possible to the leads. The driver IC layout has ground on the opposite side of the output, so the ground should be connected to the bypass capacitors and the load with copper trace as wide as possible. These connections should also be made with a small enclosed loop area to minimize the inductance.

VDD

Although quiescent VDD current is very low, total supply current will be higher, depending on OUTA and OUTB current and the programmed oscillator frequency. Total VDD current is the sum of quiescent VDD current and the average OUT current. Knowing the operating frequency and the MOSFET gate charge (Qg), average OUT current can be calculated from:

$$I_{OUT} = Q_g \times f, \text{ where } f \text{ is frequency}$$

For the best high-speed circuit performance, two V_{DD} bypass capacitors are recommended to prevent noise problems. The use of surface mount components is highly recommended. A 0.1-μF ceramic capacitor should be located closest to the VDD to ground connection. In addition, a larger capacitor (such as 1-μF) with relatively low ESR should be connected in parallel, to help deliver the high current peaks to the load. The parallel combination of capacitors should present a low impedance characteristic for the expected current levels in the driver application.

APPLICATION INFORMATION

drive current and power requirements

The UCC37323/4/5 family of drivers are capable of delivering 4-A of current to a MOSFET gate for a period of several hundred nanoseconds. High peak current is required to turn the device ON quickly. Then, to turn the device OFF, the driver is required to sink a similar amount of current to ground. This repeats at the operating frequency of the power device. A MOSFET is used in this discussion because it is the most common type of switching device used in high frequency power conversion equipment.

References 1 and 2 discuss the current required to drive a power MOSFET and other capacitive-input switching devices. Reference 2 includes information on the previous generation of bipolar IC gate drivers.

When a driver IC is tested with a discrete, capacitive load it is a fairly simple matter to calculate the power that is required from the bias supply. The energy that must be transferred from the bias supply to charge the capacitor is given by:

$$E = \frac{1}{2} CV^2, \text{ where } C \text{ is the load capacitor and } V \text{ is the bias voltage feeding the driver.}$$

There is an equal amount of energy transferred to ground when the capacitor is discharged. This leads to a power loss given by the following:

$$P = 2 \times \frac{1}{2} CV^2 f, \text{ where } f \text{ is the switching frequency.}$$

This power is dissipated in the resistive elements of the circuit. Thus, with no external resistor between the driver and gate, this power is dissipated inside the driver. Half of the total power is dissipated when the capacitor is charged, and the other half is dissipated when the capacitor is discharged. An actual example using the conditions of the previous gate drive waveform should help clarify this.

With $V_{DD} = 12 \text{ V}$, $C_{LOAD} = 10 \text{ nF}$, and $f = 300 \text{ kHz}$, the power loss can be calculated as:

$$P = 10 \text{ nF} \times (12)^2 \times (300 \text{ kHz}) = 0.432 \text{ W}$$

With a 12-V supply, this would equate to a current of:

$$I = \frac{P}{V} = \frac{0.432 \text{ W}}{12 \text{ V}} = 0.036 \text{ A}$$

The actual current measured from the supply was 0.037 A, and is very close to the predicted value. But, the I_{DD} current that is due to the IC internal consumption should be considered. With no load the IC current draw is 0.0027 A. Under this condition the output rise and fall times are faster than with a load. This could lead to an almost insignificant, yet measurable current due to cross-conduction in the output stages of the driver. However, these small current differences are buried in the high frequency switching spikes, and are beyond the measurement capabilities of a basic lab setup. The measured current with 10-nF load is reasonably close to that expected.

APPLICATION INFORMATION

The switching load presented by a power MOSFET can be converted to an equivalent capacitance by examining the gate charge required to switch the device. This gate charge includes the effects of the input capacitance plus the added charge needed to swing the drain of the device between the ON and OFF states. Most manufacturers provide specifications that provide the typical and maximum gate charge, in nC, to switch the device under specified conditions. Using the gate charge Q_g , one can determine the power that must be dissipated when charging a capacitor. This is done by using the equivalence $Q_g = C_{eff}V$ to provide the following equation for power:

$$P = C \times V^2 \times f = Q_g \times f$$

This equation allows a power designer to calculate the bias power required to drive a specific MOSFET gate at a specific bias voltage.

THERMAL INFORMATION

The useful range of a driver is greatly affected by the drive power requirements of the load and the thermal characteristics of the IC package. In order for a power driver to be useful over a particular temperature range the package must allow for the efficient removal of the heat produced while keeping the junction temperature within rated limits. The UCC37323/4/5 family of drivers is available in three different packages to cover a range of application requirements.

As shown in the power dissipation rating table, the SOIC-8 (D) and PDIP-8 (P) packages each have a power rating of around 0.5 W with $T_A = 70^\circ\text{C}$. This limit is imposed in conjunction with the power derating factor also given in the table. Note that the power dissipation in our earlier example is 0.432 W with a 10-nF load, 12 VDD, switched at 300 kHz. Thus, only one load of this size could be driven using the D or P package, even if the two onboard drivers are paralleled. The difficulties with heat removal limit the drive available in the older packages.

The MSOP PowerPAD-8 (DGN) package significantly relieves this concern by offering an effective means of removing the heat from the semiconductor junction. As illustrated in Reference 3, the PowerPAD packages offer a leadframe die pad that is exposed at the base of the package. This pad is soldered to the copper on the PC board directly underneath the IC package, reducing the θ_{jc} down to 4.7°C/W . Data is presented in Reference 3 to show that the power dissipation can be quadrupled in the PowerPAD configuration when compared to the standard packages. The PC board must be designed with thermal lands and thermal vias to complete the heat removal subsystem, as summarized in Reference 4. This allows a significant improvement in heatsinking over that available in the D or P packages, and is shown to more than double the power capability of the D and P packages.

NOTE:

The PowerPAD™ is not directly connected to any leads of the package. However, it is electrically and thermally connected to the substrate which is the ground of the device.

references

1. Power Supply Seminar SEM-1400 Topic 2: *Design And Application Guide For High Speed MOSFET Gate Drive Circuits*, by Laszlo Balogh, Texas Instruments Literature No. SLUP133.
2. Application Note, *Practical Considerations in High Performance MOSFET, IGBT and MCT Gate Drive Circuits*, by Bill Andreyca, Texas Instruments Literature No. SLUA105
3. Technical Brief, *PowerPad Thermally Enhanced Package*, Texas Instruments Literature No. SLMA002
4. Application Brief, *PowerPAD Made Easy*, Texas Instruments Literature No. SLMA004

PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/ Ball Finish | MSL Peak Temp ⁽³⁾ | Samples (Requires Login) |
|------------------|-----------------------|-------------------|-----------------|------|-------------|-------------------------|----------------------|------------------------------|--------------------------------------|
| UCC27323D | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC27323DG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC27323DGN | ACTIVE | MSOP- PowerPAD | DGN | 8 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC27323DGNG4 | ACTIVE | MSOP- PowerPAD | DGN | 8 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC27323DGNR | ACTIVE | MSOP- PowerPAD | DGN | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC27323DGNRG4 | ACTIVE | MSOP- PowerPAD | DGN | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC27323DR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC27323DRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC27323P | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | Request Free Samples |
| UCC27323PE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | Request Free Samples |
| UCC27324D | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC27324DG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC27324DGN | ACTIVE | MSOP- PowerPAD | DGN | 8 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC27324DGNG4 | ACTIVE | MSOP- PowerPAD | DGN | 8 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC27324DGNR | ACTIVE | MSOP- PowerPAD | DGN | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC27324DGNRG4 | ACTIVE | MSOP- PowerPAD | DGN | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC27324DR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC27324DRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |



www.ti.com

PACKAGE OPTION ADDENDUM

30-Sep-2010

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/ Ball Finish | MSL Peak Temp ⁽³⁾ | Samples (Requires Login) |
|------------------|-----------------------|---------------|-----------------|------|-------------|-------------------------|-------------------|------------------------------|--------------------------------------|
| UCC27324P | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | Request Free Samples |
| UCC27324PE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | Request Free Samples |
| UCC27325D | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC27325DG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC27325DGN | ACTIVE | MSOP-PowerPAD | DGN | 8 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC27325DGNG4 | ACTIVE | MSOP-PowerPAD | DGN | 8 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC27325DGNR | ACTIVE | MSOP-PowerPAD | DGN | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC27325DGNRG4 | ACTIVE | MSOP-PowerPAD | DGN | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC27325DR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC27325DRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC27325P | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | Request Free Samples |
| UCC27325PE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | Request Free Samples |
| UCC37323D | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC37323DG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC37323DGN | ACTIVE | MSOP-PowerPAD | DGN | 8 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC37323DGNG4 | ACTIVE | MSOP-PowerPAD | DGN | 8 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC37323DGNR | ACTIVE | MSOP-PowerPAD | DGN | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC37323DGNRG4 | ACTIVE | MSOP-PowerPAD | DGN | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC37323DR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |



www.ti.com

PACKAGE OPTION ADDENDUM

30-Sep-2010

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/ Ball Finish | MSL Peak Temp ⁽³⁾ | Samples (Requires Login) |
|------------------|-----------------------|---------------|-----------------|------|-------------|-------------------------|----------------------|------------------------------|--------------------------------------|
| UCC37323DRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC37323P | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | Request Free Samples |
| UCC37323PE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | Request Free Samples |
| UCC37324D | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC37324DG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC37324DGN | ACTIVE | MSOP-PowerPAD | DGN | 8 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC37324DGNG4 | ACTIVE | MSOP-PowerPAD | DGN | 8 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC37324DGNR | ACTIVE | MSOP-PowerPAD | DGN | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC37324DGNRG4 | ACTIVE | MSOP-PowerPAD | DGN | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC37324DR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC37324DRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC37324P | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | Request Free Samples |
| UCC37324PE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | Request Free Samples |
| UCC37325D | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC37325DG4 | ACTIVE | SOIC | D | 8 | 75 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC37325DGN | ACTIVE | MSOP-PowerPAD | DGN | 8 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC37325DGNG4 | ACTIVE | MSOP-PowerPAD | DGN | 8 | 80 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Request Free Samples |
| UCC37325DGNR | ACTIVE | MSOP-PowerPAD | DGN | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC37325DGNRG4 | ACTIVE | MSOP-PowerPAD | DGN | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |



www.ti.com

PACKAGE OPTION ADDENDUM

30-Sep-2010

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/ Ball Finish | MSL Peak Temp ⁽³⁾ | Samples (Requires Login) |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|-------------------|------------------------------|--------------------------------------|
| UCC37325DR | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC37325DRG4 | ACTIVE | SOIC | D | 8 | 2500 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | Purchase Samples |
| UCC37325P | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | Request Free Samples |
| UCC37325PE4 | ACTIVE | PDIP | P | 8 | 50 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type | Request Free Samples |

⁽¹⁾ 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.

⁽²⁾ 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)

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

Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

OTHER QUALIFIED VERSIONS OF UCC27324 :

- Automotive: [UCC27324-Q1](#)



www.ti.com

PACKAGE OPTION ADDENDUM

30-Sep-2010

NOTE: Qualified Version Definitions:

- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

TAPE AND REEL INFORMATION



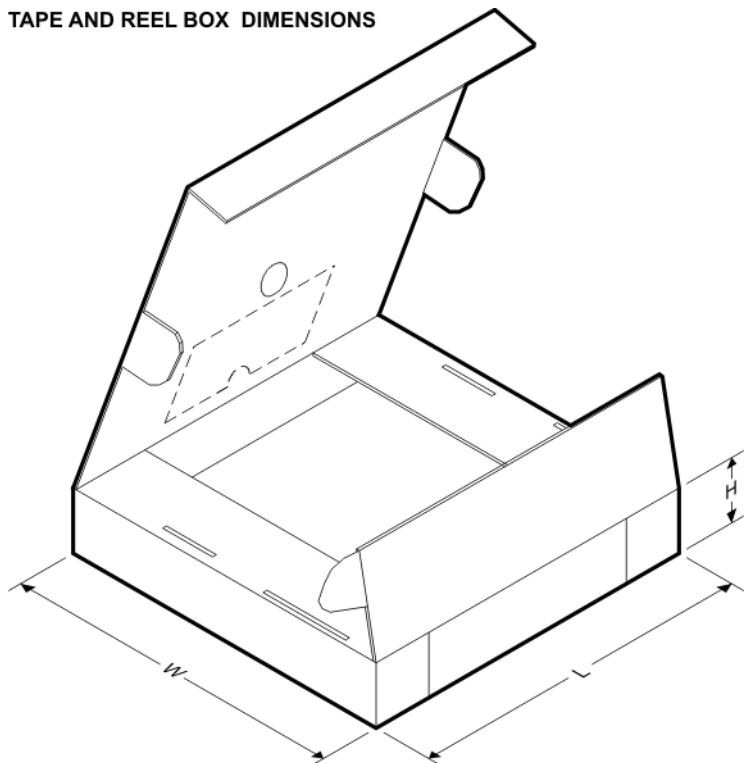
QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*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 |
|--------------|----------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| UCC27323DGNR | MSOP-Power PAD | DGN | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| UCC27323DR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| UCC27324DGNR | MSOP-Power PAD | DGN | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| UCC27324DR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| UCC27325DGNR | MSOP-Power PAD | DGN | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| UCC27325DR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| UCC37323DGNR | MSOP-Power PAD | DGN | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| UCC37323DR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| UCC37324DGNR | MSOP-Power PAD | DGN | 8 | 2500 | 330.0 | 12.4 | 5.3 | 3.4 | 1.4 | 8.0 | 12.0 | Q1 |
| UCC37324DR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |
| UCC37325DGNR | MSOP- | DGN | 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 |
|------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| | Power PAD | | | | | | | | | | | |
| UCC37325DR | SOIC | D | 8 | 2500 | 330.0 | 12.4 | 6.4 | 5.2 | 2.1 | 8.0 | 12.0 | Q1 |

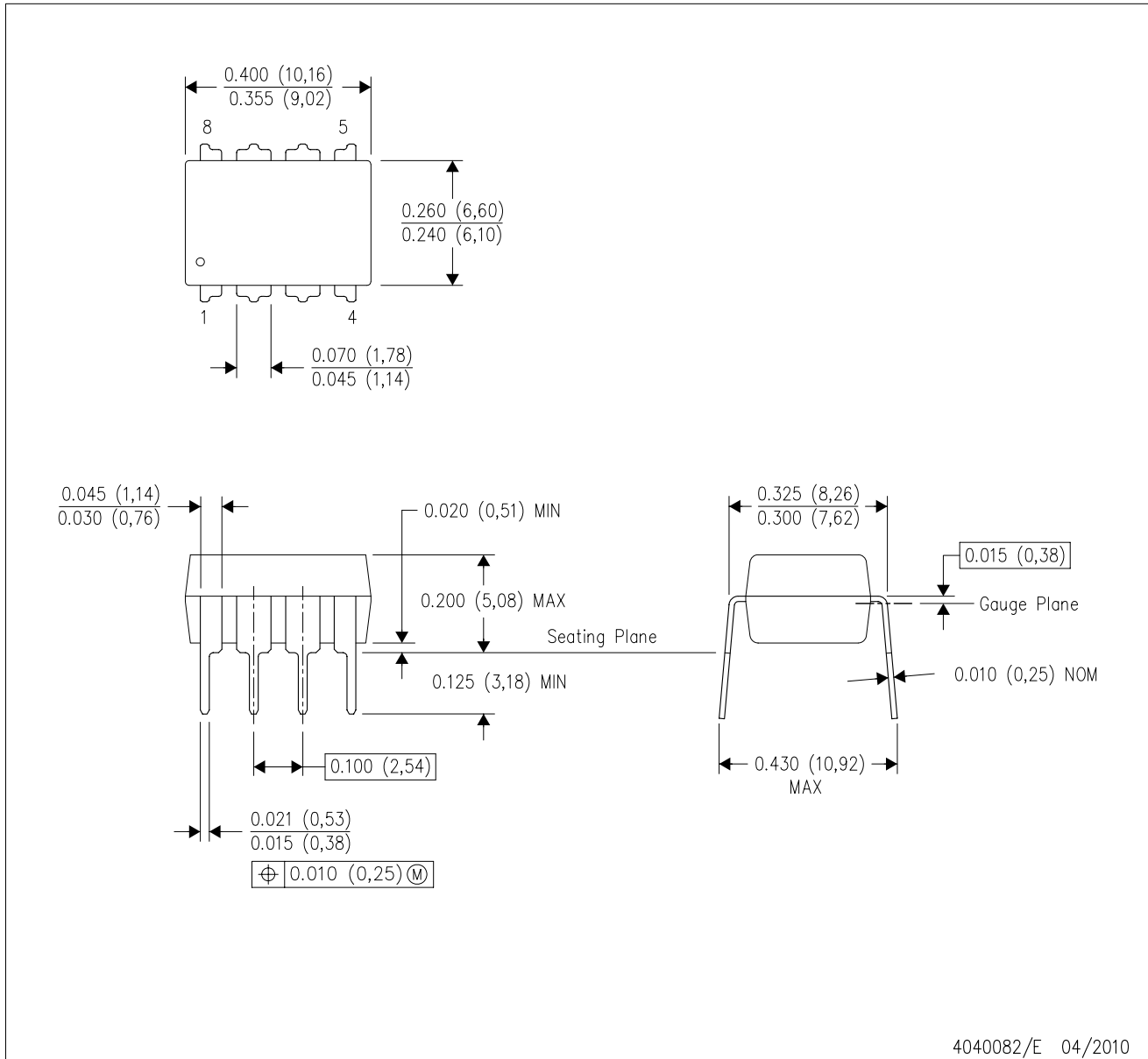
TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|--------------|---------------|-----------------|------|------|-------------|------------|-------------|
| UCC27323DGNR | MSOP-PowerPAD | DGN | 8 | 2500 | 346.0 | 346.0 | 29.0 |
| UCC27323DR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| UCC27324DGNR | MSOP-PowerPAD | DGN | 8 | 2500 | 346.0 | 346.0 | 29.0 |
| UCC27324DR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| UCC27325DGNR | MSOP-PowerPAD | DGN | 8 | 2500 | 346.0 | 346.0 | 29.0 |
| UCC27325DR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| UCC37323DGNR | MSOP-PowerPAD | DGN | 8 | 2500 | 346.0 | 346.0 | 29.0 |
| UCC37323DR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| UCC37324DGNR | MSOP-PowerPAD | DGN | 8 | 2500 | 346.0 | 346.0 | 29.0 |
| UCC37324DR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |
| UCC37325DGNR | MSOP-PowerPAD | DGN | 8 | 2500 | 346.0 | 346.0 | 29.0 |
| UCC37325DR | SOIC | D | 8 | 2500 | 340.5 | 338.1 | 20.6 |

P (R-PDIP-T8)

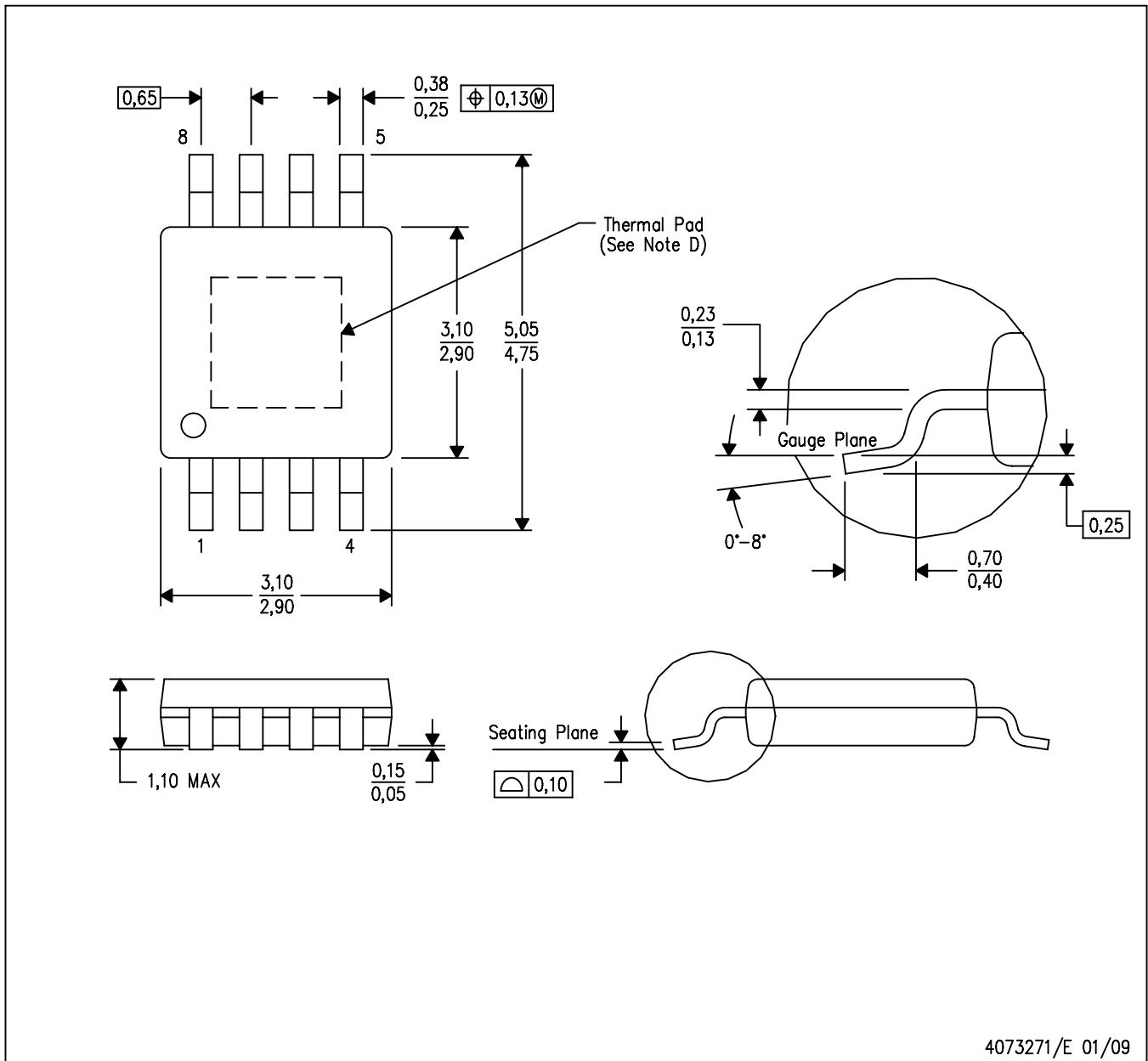
PLASTIC DUAL-IN-LINE PACKAGE



- 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.

DGN (S-PDSO-G8)

PowerPAD™ PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Body dimensions do not include mold flash or protrusion.
 - This package is designed to be soldered to a thermal pad on the board. Refer to Technical Brief, PowerPAD Thermally Enhanced Package, Texas Instruments Literature No. SLMA002 for information regarding recommended board layout. This document is available at www.ti.com <<http://www.ti.com>>.
 - Falls within JEDEC MO-187 variation AA-T

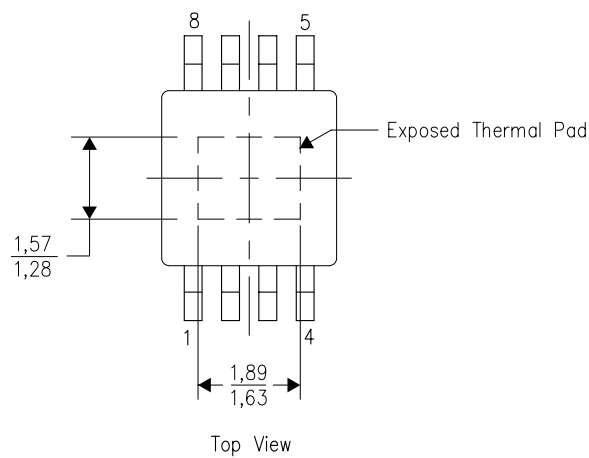
PowerPAD is a trademark of Texas Instruments.

THERMAL INFORMATION

This PowerPAD™ package incorporates an exposed thermal pad that is designed to be attached to a printed circuit board (PCB). The thermal pad must be soldered directly to the PCB. After soldering, the PCB can be used as a heatsink. In addition, through the use of thermal vias, the thermal pad can be attached directly to the appropriate copper plane shown in the electrical schematic for the device, or alternatively, can be attached to a special heatsink structure designed into the PCB. This design optimizes the heat transfer from the integrated circuit (IC).

For additional information on the PowerPAD package and how to take advantage of its heat dissipating abilities, refer to Technical Brief, PowerPAD Thermally Enhanced Package, Texas Instruments Literature No. SLMA002 and Application Brief, PowerPAD Made Easy, Texas Instruments Literature No. SLMA004. Both documents are available at www.ti.com.

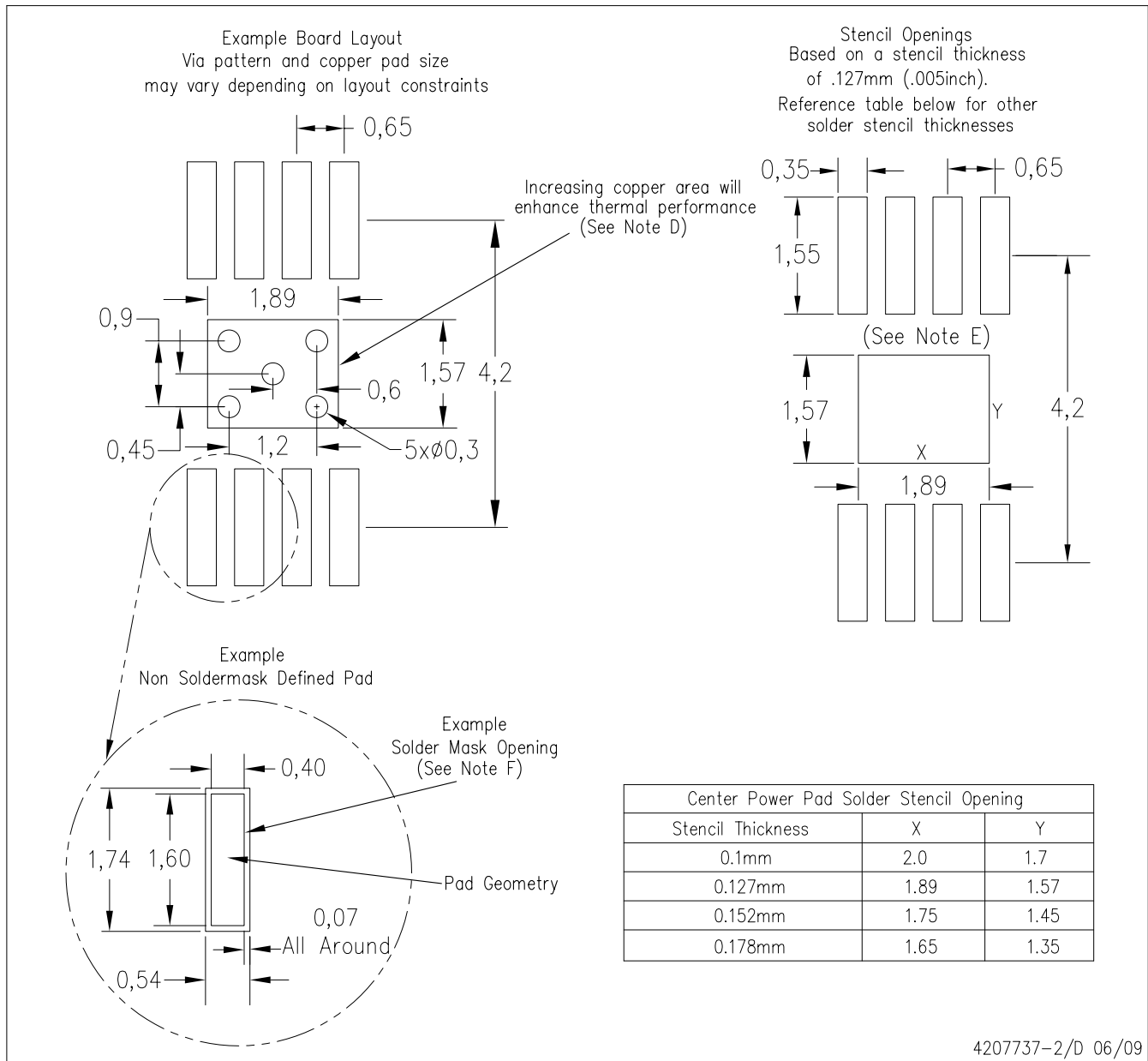
The exposed thermal pad dimensions for this package are shown in the following illustration.



NOTE: All linear dimensions are in millimeters

Exposed Thermal Pad Dimensions

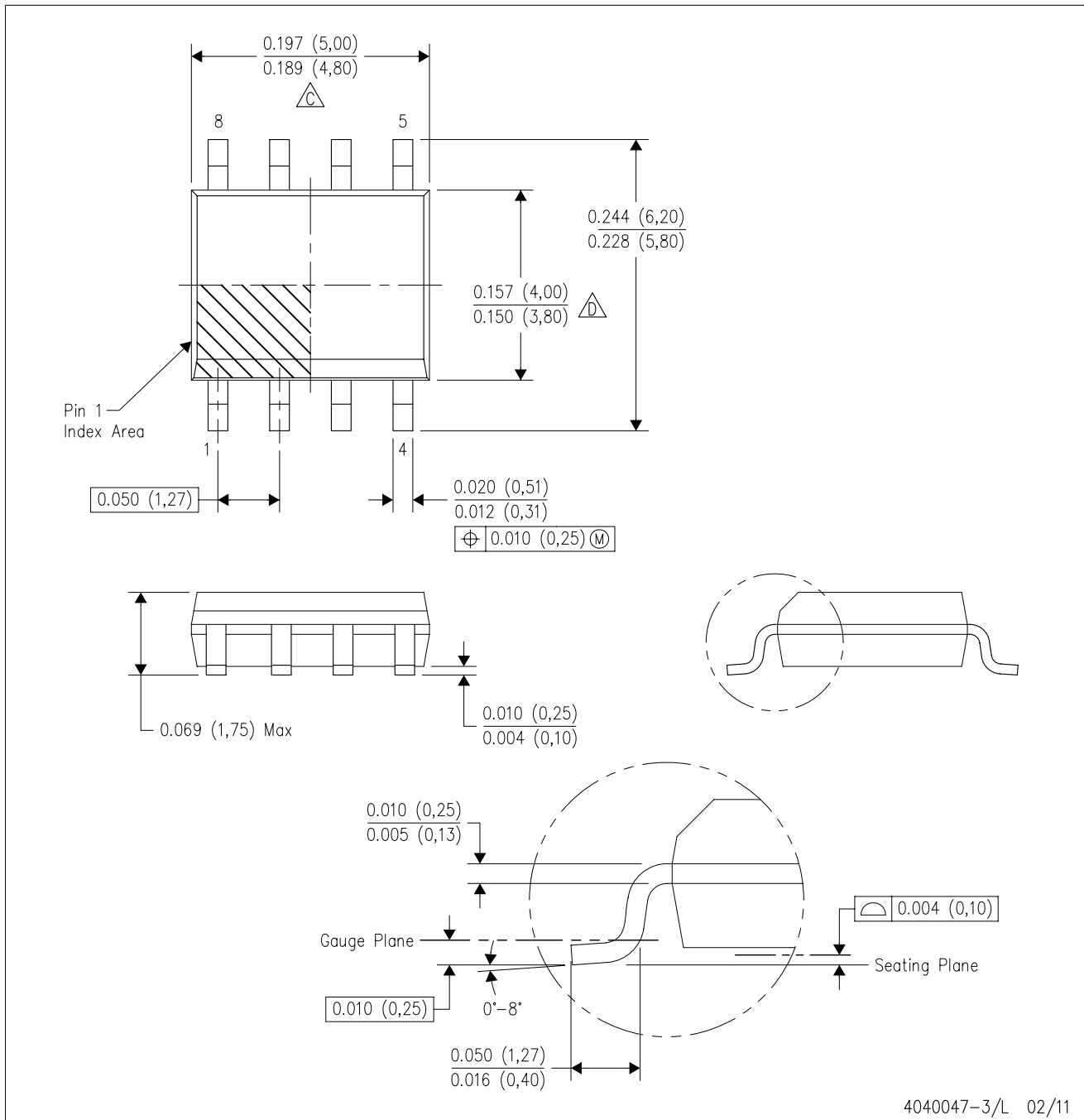
DGN (R-PDS0-G8) PowerPAD™





- NOTES:
- All linear dimensions are in millimeters.
 - This drawing is subject to change without notice.
 - Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
 - This package is designed to be soldered to a thermal pad on the board. Refer to Technical Brief, PowerPad Thermally Enhanced Package, Texas Instruments Literature No. SLMA002, SLMA004, and also the Product Data Sheets for specific thermal information, via requirements, and recommended board layout. These documents are available at www.ti.com <<http://www.ti.com>>. 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. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.
 - Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

D (R-PDSO-G8)

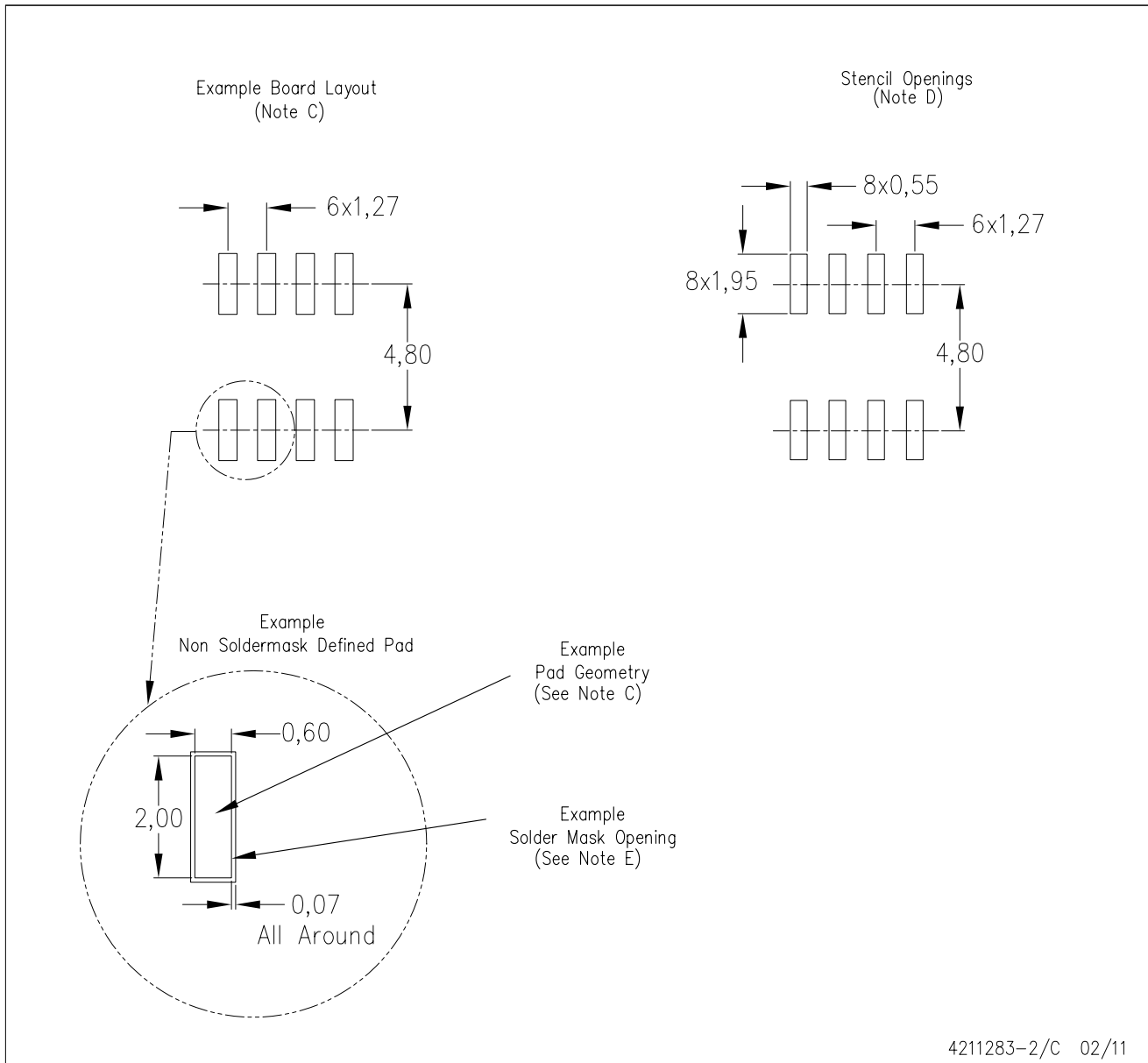
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 -  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.
 -  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.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products

| | |
|-----------------------------|--|
| Audio | www.ti.com/audio |
| Amplifiers | amplifier.ti.com |
| Data Converters | dataconverter.ti.com |
| DLP® Products | www.dlp.com |
| DSP | dsp.ti.com |
| Clocks and Timers | www.ti.com/clocks |
| Interface | interface.ti.com |
| Logic | logic.ti.com |
| Power Mgmt | power.ti.com |
| Microcontrollers | microcontroller.ti.com |
| RFID | www.ti-rfid.com |
| RF/IF and ZigBee® Solutions | www.ti.com/lprf |

Applications

| | |
|-------------------------------|--|
| Communications and Telecom | www.ti.com/communications |
| Computers and Peripherals | www.ti.com/computers |
| Consumer Electronics | www.ti.com/consumer-apps |
| Energy and Lighting | www.ti.com/energy |
| Industrial | www.ti.com/industrial |
| Medical | www.ti.com/medical |
| Security | www.ti.com/security |
| Space, Avionics and Defense | www.ti.com/space-avionics-defense |
| Transportation and Automotive | www.ti.com/automotive |
| Video and Imaging | www.ti.com/video |
| Wireless | www.ti.com/wireless-apps |

TI E2E Community Home Page

e2e.ti.com

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2011, Texas Instruments Incorporated