

- 1.5 Amp Source/Sink Drive
- Pin Compatible with 0026 Products
- 40 ns Rise and Fall into 1000pF
- Low Quiescent Current
- 5 V to 40 V Operation
- Thermal Protection

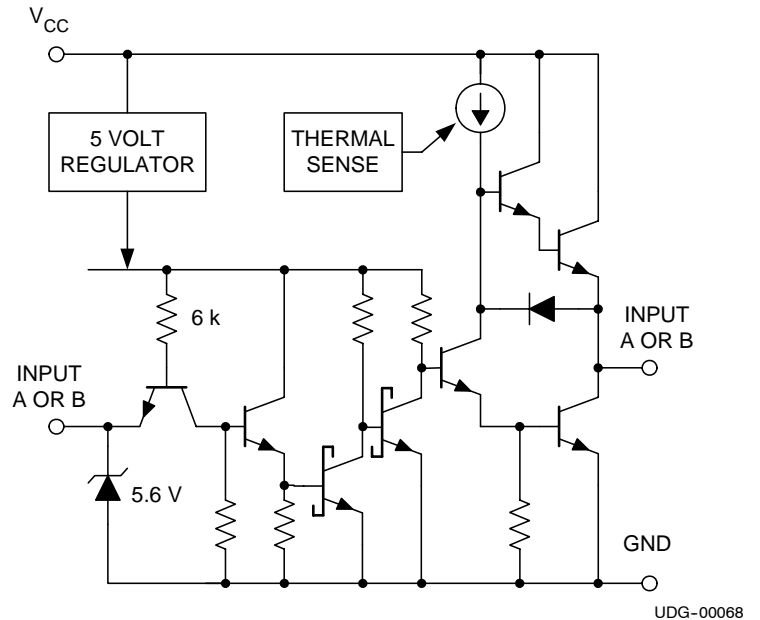
**description**

The UC3709 family of power drivers is an effective low-cost solution to the problem of providing fast turn-on and off for the capacitive gates of power MOSFETs. Made with a high-speed Schottky process, these devices will provide up to 1.5 A of either source or sink current from a totem-pole output stage configured for minimal cross-conduction current spike.

The UC3709 is pin compatible with the MMH0026 or DS0026, and while the delay times are longer, the supply current is much less than these older devices.

With inverting logic, these units feature complete TTL compatibility at the inputs with an output stage that can swing over 30 V. This design also includes thermal shutdown protection.

**simplified schematic (only one driver shown)**



**absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†‡</sup>**

| Parameter                                      | DW PACKAGE | J PACKAGE  | L PACKAGE  | N PACKAGE  | UNIT             |
|--|------------|------------|------------|------------|------------------|
| Supply Voltage, $V_{CC}$                       | 40         | 40         | 40         | 40         | V                |
| Output Current (Source or Sink)                |            |            |            |            |                  |
| ..... Steady-State                             | ±500       | ±500       | ±500       | ±500       | mA               |
| ..... Peak Transient                           | ±1.5       | ±1.0       | ±1.0       | ±1.5       | A                |
| ..... Capacitive Discharge Energy              | 20         | 15         | 15         | 20         | mJ               |
| Digital Inputs <sup>‡</sup>                    | 5.5        | 5.5        | 5.5        | 5.5        | V                |
| Power Dissipation at $T_A = 25^\circ\text{C}$  | 1          | 1          | 1          | 1          | W                |
| Power Dissipation at $T_C = 25^\circ\text{C}$  | 3          | 2          | 2          | 3          | W                |
| Operating Junction Temperature Range ( $T_J$ ) | -55 to 125 | -55 to 125 | -55 to 125 | -55 to 125 | $^\circ\text{C}$ |
| Storage Temperature Range                      | -65 to 150 | -65 to 150 | -65 to 150 | -65 to 150 | $^\circ\text{C}$ |
| Lead Temperature (Soldering, 10 Seconds)       | 300        | 300        | 300        | 300        | $^\circ\text{C}$ |

<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 currents are positive into and negative out of the specified terminals. Digital drive can exceed 5.5V if input is limited to 10mA. Consult the Packaging Section of the Databook for thermal limitations and considerations of the package.



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.

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.

# UC1709, UC2709, UC3709 DUAL HIGH-SPEED FET DRIVER

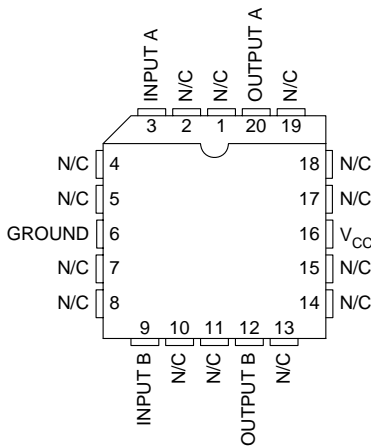
SLUS196C - NOVEMBER 1996 - REVISED FEBRUARY 2008

**THERMAL RESISTANCE TABLE**

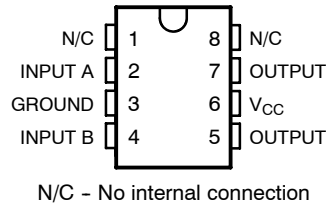
| PACKAGE      | $\theta_{jc} (^{\circ}\text{C}/\text{W})$ | $\theta_{ja} (^{\circ}\text{C}/\text{W})$ |
|--------------|---|---|
| SOIC-16 (DW) | 20 <sup>(1)</sup>                         | 35 to 58 <sup>(3)</sup>                   |
| DIL-16 (J)   | 28 <sup>(2)</sup>                         | 125 to 160                                |
| LCC-16 (L)   | 20 <sup>(2)</sup>                         | 70 to 80                                  |
| DIL-16 (N)   | 45  | 90 <sup>(3)</sup>                         |

- NOTES: (1) Specified thermal resistance is  $\theta_{jl}$  (junction to lead) where noted.  
 (2)  $\theta_{jc}$  data values stated were derived from MIL-STD-1835B. MIL-STD-1835B states, "The baseline values shown are worst case (mean +2s) for a 60x60 mil microcircuit device silicon die and applicable for devices with die sizes up to 14400 square mils. For device die sizes greater than 14400 square mils use the following values; dual-in-line, 11 $^{\circ}\text{C}/\text{W}$ ; flat pack, .10 $^{\circ}\text{C}/\text{W}$ ; pin grid array, 10 $^{\circ}\text{C}/\text{W}$ ".  
 (3) Specified  $\theta_{ja}$  (junction to ambient) is for devices mounted to 5-inch<sup>2</sup> FR4 PC board with one ounce copper where noted. When resistance range is given, lower values are for 5 inch<sup>2</sup> aluminum PC board. Test PWB was 0.062 inch thick and typically used 0.635-mm trace widths for power packages and 1.3-mm trace widths for non-power packages with a 100-mil x 100-mil probe land area at the end of each trace.

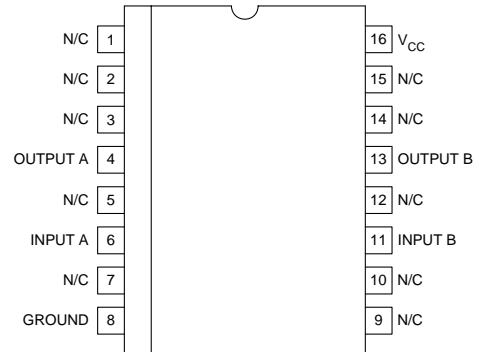
**LCC-20 (TOP VIEW)  
L PACKAGES**



**8 PIN DIL N OR J PACKAGE  
(TOP VIEW)**



**SOIC-16 (TOP VIEW)  
DW PACKAGE**



# UC1709, UC2709, UC3709 DUAL HIGH-SPEED FET DRIVER

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**electrical characteristics over recommended operating free-air temperature range,  $T_A = 55^\circ\text{C}$  to  $125^\circ\text{C}$  for the UC1709,  $-40^\circ\text{C}$  to  $85^\circ\text{C}$  for the UC2709, and  $0^\circ\text{C}$  to  $70^\circ\text{C}$  for the UC3709;  $V_{CC} = 20\text{ V}$ ,  $T_A = T_J$ .**

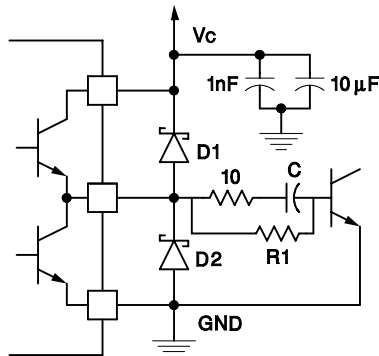
| PARAMETER                           | TEST CONDITIONS        | MIN | TYP  | MAX  | UNIT |
|-------------------------------------|------------------------|-----|------|------|------|
| Supply current                      | Both outputs low       |     | 10   | 12   | mA   |
|                                     | Both outputs high      |     | 7    | 10   | mA   |
| Logic 0 input voltage               |                        |     |      | 0.8  | V    |
| Logic 1 input voltage               |                        | 2.2 |      |      | V    |
| Input current                       | $V_I = 0$              |     | -0.6 | -1.0 | mA   |
| Input leakage                       | $V_I = 5\text{ V}$     |     | 0.05 | 0.1  | mA   |
| Output high saturation $V_{CC}-V_O$ | $I_O = -50\text{ mA}$  |     | 1.5  | 2.0  | V    |
|                                     | $I_O = -500\text{ mA}$ |     | 2.0  | 2.5  | V    |
| Output low saturation $V_O$         | $I_O = 50\text{ mA}$   |     | 0.1  | 0.4  | V    |
|                                     | $I_O = 500\text{ mA}$  |     | 2.0  | 2.5  | V    |
| Thermal shutdown                    |                        |     | 155  |      | mA   |

**typical switching characteristics,  $V_{CC} = 20\text{ V}$ ,  $T_A = 25^\circ\text{C}$ , delays measured to 10% output change**

| PARAMETER                                   | TEST CONDITIONS | OUTPUT $C_L =$ |        | UNITS |
|---|-----------------|----------------|--------|-------|
|   |                 | 0 nF           | 2.2 nF |       |
| Rise time delay                             |                 | 80             | 80     | ns    |
| 10% to 90% rise                             |                 | 20             | 40     | ns    |
| Fall time delay                             |                 | 60             | 80     | ns    |
| 10% to 90% fall                             |                 | 20             | 40     | ns    |
| VCC cross-conduction current spike duration | Output rise     | 25             |        | ns    |
|   | Output fall     | 0              |        | ns    |

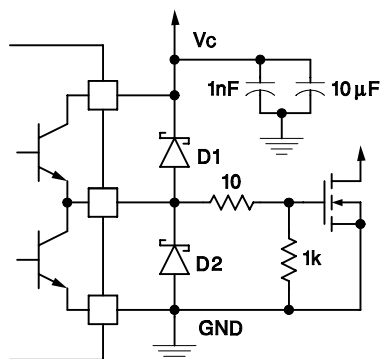
NOTE: Refer to UC1705 specifications for further information.

**APPLICATION INFORMATION**



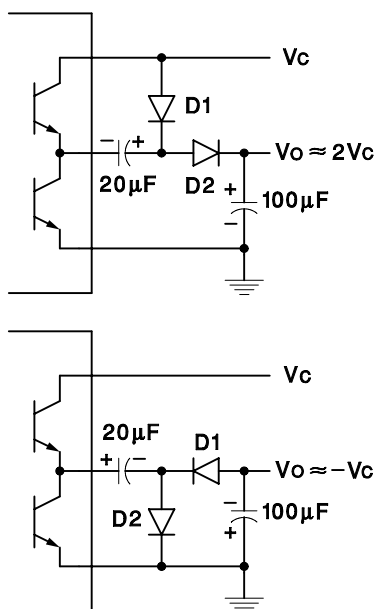
D1, D2: UC3611 Schottky Diodes

**Figure 1. Power bipolar drive circuit.**

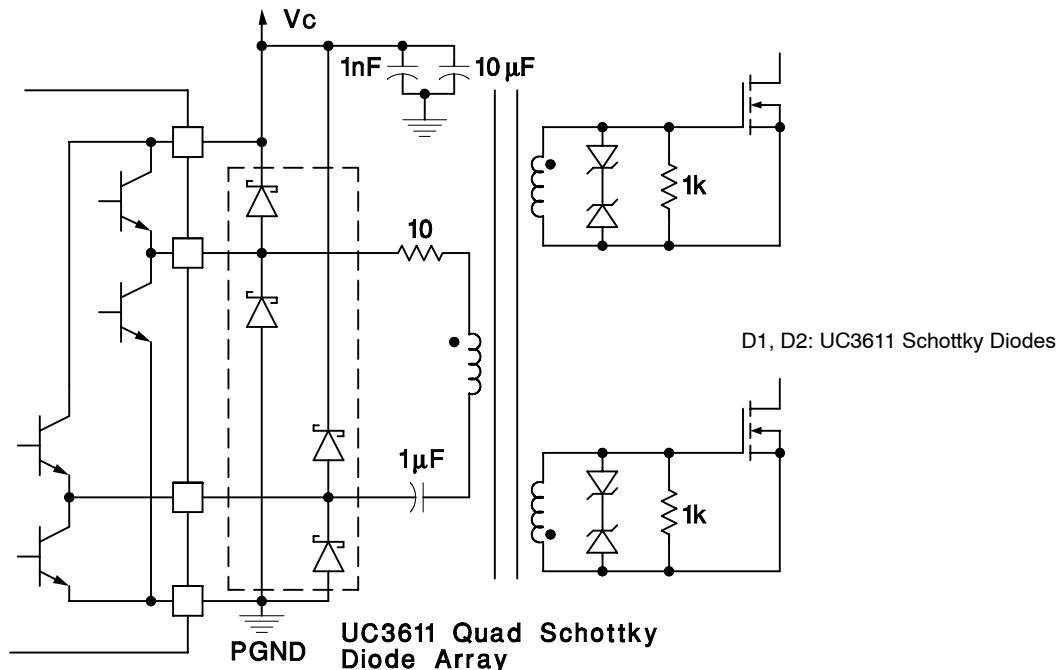


D1, D2: UC3611 Schottky Diodes

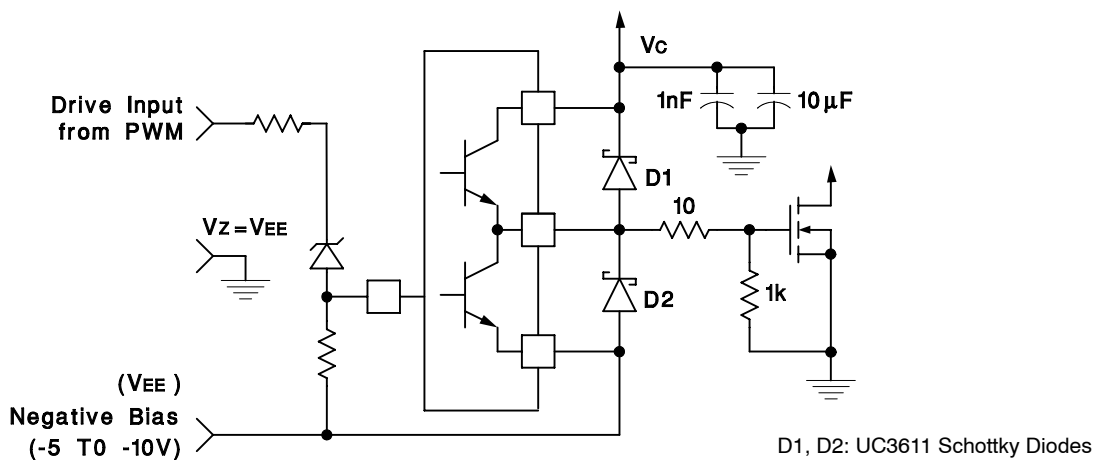
**Figure 2. Power MOSFET drive circuit.**



**Figure 3. Charge pump circuits.**



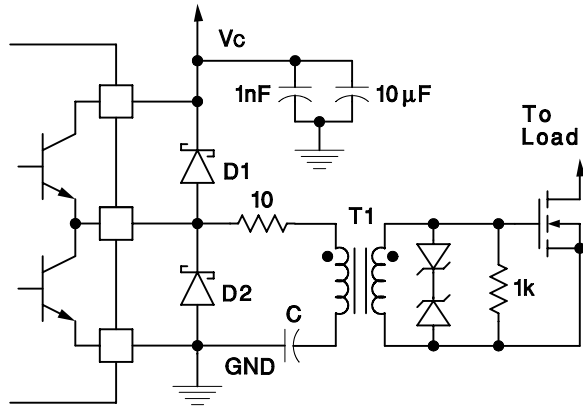
**Figure 4. Transformer coupled push-pull MOSFET drive circuit.**



**Figure 5. Power MOSFET drive circuit using negative bias voltage and level shifting to ground referenced PWM**

# UC1709, UC2709, UC3709 DUAL HIGH-SPEED FET DRIVER

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D1, D2: UC3611 Schottky Diodes

Figure 6. Transformer coupled MOSFET drive circuit.

**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2)  | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|------------------|---------------|--------------|-----------------|------|-------------|------------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| 5962-0151201VPA  | ACTIVE        | CDIP         | JG              | 8    | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | 0151201VPA<br>UC1709    | <a href="#">Samples</a> |
| UC1709J          | ACTIVE        | CDIP         | JG              | 8    | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | UC1709J                 | <a href="#">Samples</a> |
| UC1709J883B      | ACTIVE        | CDIP         | JG              | 8    | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | UC1709J/<br>883B        | <a href="#">Samples</a> |
| UC1709L          | ACTIVE        | LCCC         | FK              | 20   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | UC1709L                 | <a href="#">Samples</a> |
| UC1709L883B      | ACTIVE        | LCCC         | FK              | 20   | 1           | Non-RoHS & Green | SNPB                                 | N / A for Pkg Type   | -55 to 125   | UC1709L/<br>883B        | <a href="#">Samples</a> |
| UC2709DW         | ACTIVE        | SOIC         | DW              | 16   | 40          | RoHS & Green     | NIPDAU                               | Level-2-260C-1 YEAR  | -40 to 85    | UC2709DW                | <a href="#">Samples</a> |
| UC2709N          | ACTIVE        | PDIP         | P               | 8    | 50          | RoHS & Green     | NIPDAU                               | N / A for Pkg Type   | -40 to 85    | UC2709N                 | <a href="#">Samples</a> |
| UC3709DW         | ACTIVE        | SOIC         | DW              | 16   | 40          | RoHS & Green     | NIPDAU                               | Level-2-260C-1 YEAR  | 0 to 70      | UC3709DW                | <a href="#">Samples</a> |
| UC3709N          | ACTIVE        | PDIP         | P               | 8    | 50          | RoHS & Green     | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | UC3709N                 | <a href="#">Samples</a> |
| UC3709NG4        | ACTIVE        | PDIP         | P               | 8    | 50          | RoHS & Green     | NIPDAU                               | N / A for Pkg Type   | 0 to 70      | UC3709N                 | <a href="#">Samples</a> |

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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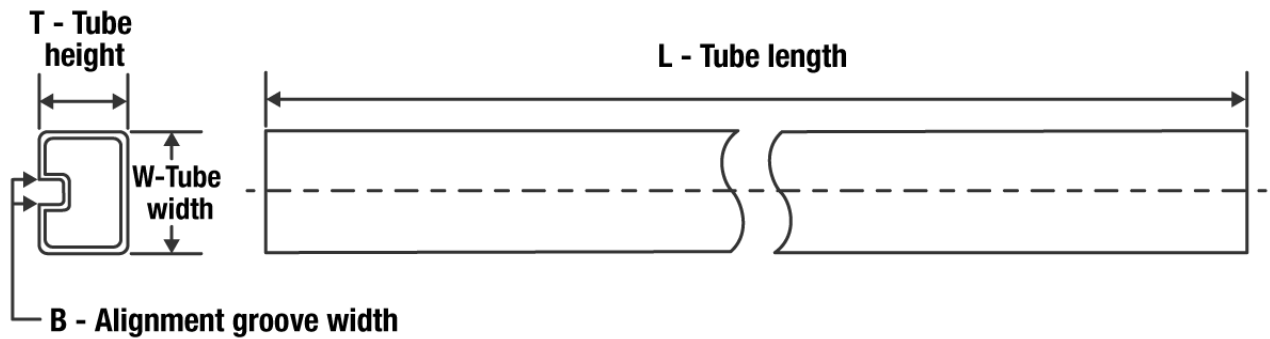
**OTHER QUALIFIED VERSIONS OF UC1709, UC1709-SP, UC3709 :**

- Catalog : [UC3709](#), [UC1709](#)
- Military : [UC1709](#)
- Space : [UC1709-SP](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application



**TUBE**


\*All dimensions are nominal

| Device      | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| UC1709L     | FK           | LCCC         | 20   | 1   | 506.98 | 12.06  | 2030   | NA     |
| UC1709L883B | FK           | LCCC         | 20   | 1   | 506.98 | 12.06  | 2030   | NA     |
| UC2709DW    | DW           | SOIC         | 16   | 40  | 507    | 12.83  | 5080   | 6.6    |
| UC2709N     | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| UC3709DW    | DW           | SOIC         | 16   | 40  | 507    | 12.83  | 5080   | 6.6    |
| UC3709N     | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| UC3709NG4   | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



| NO. OF TERMINALS ** | A                |                  | B                |                  |
|---------------------|------------------|------------------|------------------|------------------|
|                     | MIN              | MAX              | MIN              | MAX              |
| 20                  | 0.342<br>(8,69)  | 0.358<br>(9,09)  | 0.307<br>(7,80)  | 0.358<br>(9,09)  |
| 28                  | 0.442<br>(11,23) | 0.458<br>(11,63) | 0.406<br>(10,31) | 0.458<br>(11,63) |
| 44                  | 0.640<br>(16,26) | 0.660<br>(16,76) | 0.495<br>(12,58) | 0.560<br>(14,22) |
| 52                  | 0.740<br>(18,78) | 0.761<br>(19,32) | 0.495<br>(12,58) | 0.560<br>(14,22) |
| 68                  | 0.938<br>(23,83) | 0.962<br>(24,43) | 0.850<br>(21,6)  | 0.858<br>(21,8)  |
| 84                  | 1.141<br>(28,99) | 1.165<br>(29,59) | 1.047<br>(26,6)  | 1.063<br>(27,0)  |



4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - Falls within JEDEC MS-004

## GENERIC PACKAGE VIEW

**DW 16**

**SOIC - 2.65 mm max height**

7.5 x 10.3, 1.27 mm pitch

SMALL OUTLINE INTEGRATED CIRCUIT

This image is a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.



4224780/A



DW0016A

# PACKAGE OUTLINE

SOIC - 2.65 mm max height

SOIC



4220721/A 07/2016

NOTES:

1. All linear dimensions are in millimeters. Dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm, per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm, per side.
5. Reference JEDEC registration MS-013.

# EXAMPLE BOARD LAYOUT

DW0016A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:7X



SOLDER MASK DETAILS

4220721/A 07/2016

NOTES: (continued)

6. Publication IPC-7351 may have alternate designs.

7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DW0016A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:7X

4220721/A 07/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

JG (R-GDIP-T8)

CERAMIC DUAL-IN-LINE



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. This package can be hermetically sealed with a ceramic lid using glass frit.  
 D. Index point is provided on cap for terminal identification.  
 E. Falls within MIL STD 1835 GDIP1-T8

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.



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