

# High Current FET Driver

## FEATURES

- Totem Pole Output with 6A Source/Sink Drive
- 3ns Delay
- 20ns Rise and Fall Time into 2.2nF
- 8ns Rise and Fall Time into 30nF
- 4.7V to 18V Operation
- Inverting and Non-Inverting Outputs
- Under-Voltage Lockout with Hysteresis
- Thermal Shutdown Protection
- MINIDIP and Power Packages

## DESCRIPTION

The UC1710 family of FET drivers is made with a high-speed Schottky process to interface between low-level control functions and very high-power switching devices-particularly power MOSFET's. These devices accept low-current digital inputs to activate a high-current, totem pole output which can source or sink a minimum of 6A.

Supply voltages for both  $V_{IN}$  and  $V_C$  can independently range from 4.7V to 18V. These devices also feature under-voltage lockout with hysteresis.

The UC1710 is packaged in an 8-pin hermetically sealed dual in-line package for  $-55^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$  operation. The UC2710 and UC3710 are specified for a temperature range of  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  and  $0^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$  respectively and are available in either an 8-pin plastic dual in-line or a 5-pin, TO-220 package. Surface mount devices are also available.

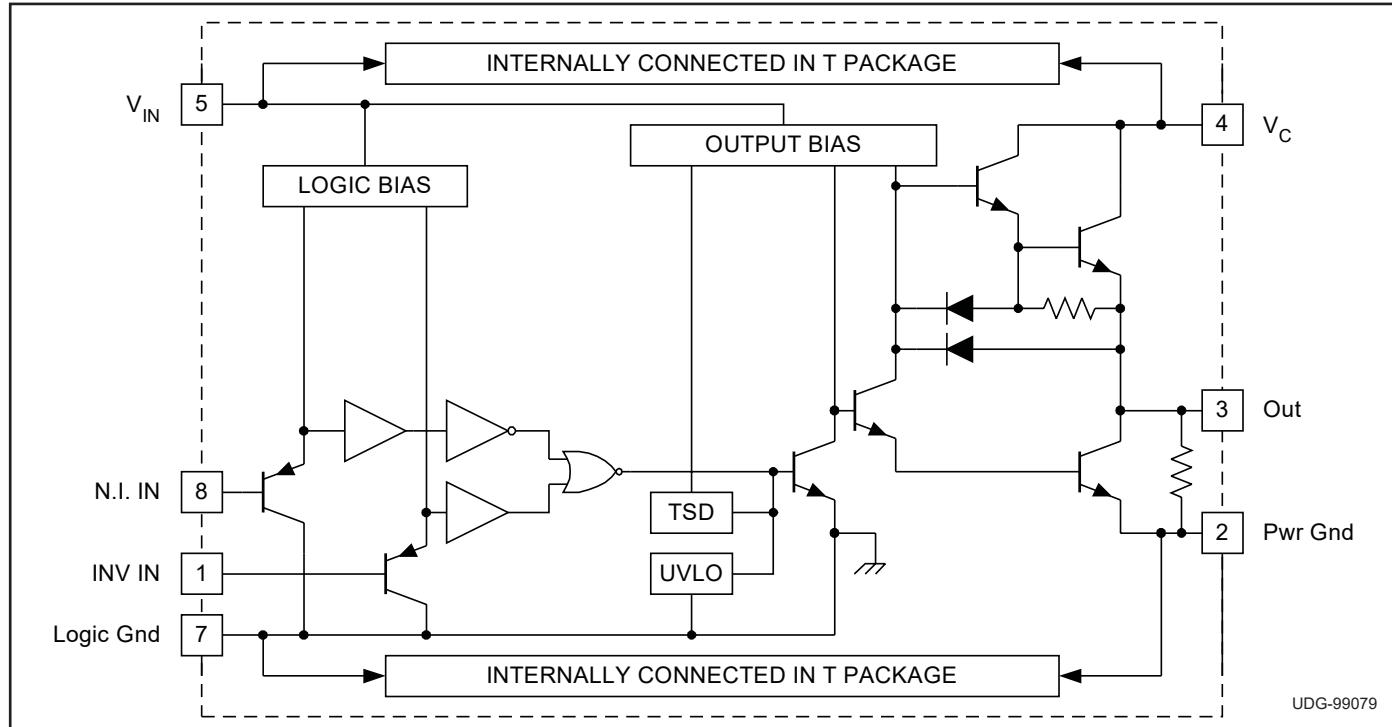
## TRUTH TABLE

| INV | N.I. | Out | OUT= $\overline{\text{INV}}$ and N.I. |
|-----|------|-----|---------------------------------------|
| H   | H    | L   | OUT= INV and N.I.                     |
| L   | H    | H   | OUT= INV or N.I.                      |
| H   | L    | L   |                                       |
| L   | L    | L   |                                       |

## ORDERING INFORMATION

|          | TEMPERATURE RANGE                               | PACKAGE          |
|----------|---|------------------|
| UC1710J  | $-55^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ | 8 pin CDIP       |
| UC2710DW | $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$  | Not Available    |
| UC2710J  |   | Not Available    |
| UC2710N  |   | 8 pin PDIP       |
| UC2710T  |   | 5 pin TO220      |
| UC3710DW | $0^{\circ}\text{C}$ to $+70^{\circ}\text{C}$    | 16 pin SOIC-wide |
| UC3710N  |   | 8 pin PDIP       |
| UC3710T  |   | 5 pin TO220      |

## BLOCK DIAGRAM



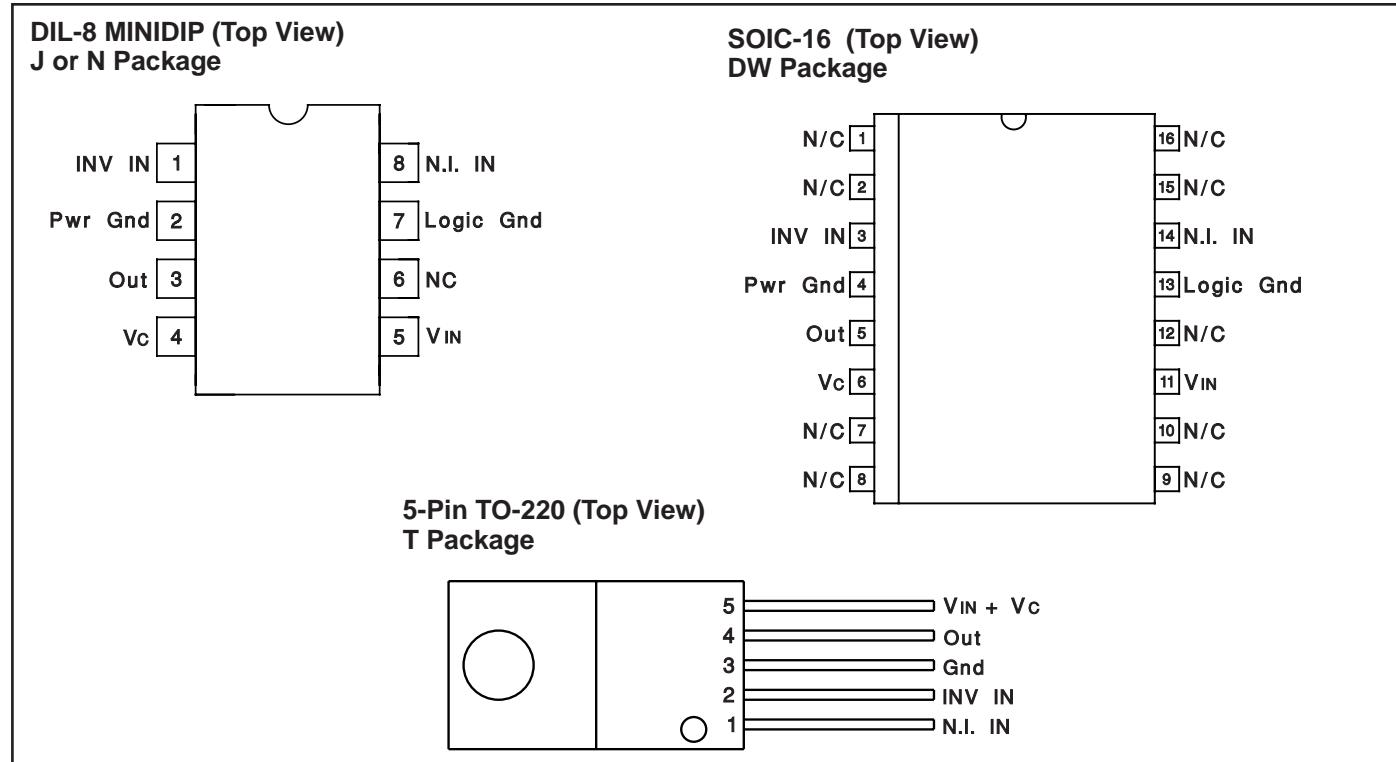
## ABSOLUTE MAXIMUM RATINGS

|  | N-Package                                   | J-Package                                   | T-Package                                   |
|--|---|---|---|
| Supply Voltage, $V_{IN}$                             | 20V   | 20V   | 20V   |
| Collector Supply Voltage, $V_C$                      | 20V   | 20V   | 20V   |
| Operating Voltage                                    | 18V   | 18V   | 18V   |
| Output Current (Source or Sink)                      |   |   |   |
| Steady-State   | $\pm 500\text{mA}$                          | $\pm 500\text{mA}$                          | $\pm 1\text{A}$                             |
| Digital Inputs                                       | $-0.3\text{V} - V_{IN}$                     | $-0.3\text{V} - V_{IN}$                     | $-0.3\text{V} - V_{IN}$                     |
| Power Dissipation at $T_A=25^\circ\text{C}$          | 1W  | 1W  | 3W  |
| Power Dissipation at $T$ (Case) = $25^\circ\text{C}$ | 2W  | 2W  | 25W   |
| Operating Junction Temperature                       | $-55^\circ\text{C}$ to $+150^\circ\text{C}$ | $-55^\circ\text{C}$ to $+150^\circ\text{C}$ | $-55^\circ\text{C}$ to $+150^\circ\text{C}$ |
| Storage Temperature                                  | $-65^\circ\text{C}$ to $+150^\circ\text{C}$ | $-65^\circ\text{C}$ to $+150^\circ\text{C}$ | $-65^\circ\text{C}$ to $+150^\circ\text{C}$ |
| Lead Temperature (Soldering, 10 seconds)             | 300°C                                       | 300°C                                       | 300°C                                       |

Note 1: All currents are positive into, negative out of the specified terminal.

Note 2: Consult Unitrode Integrated Circuits databook for information regarding thermal specifications and limitations of packages.

## CONNECTION DIAGRAMS



**ELECTRICAL CHARACTERISTICS:** Unless otherwise stated, these specifications apply for  $V_{IN} = V_C = 15\text{V}$ , No load,  $T_A = T_J$ .

| PARAMETERS              | TEST CONDITIONS  | MIN | TYP | MAX | UNITS |
|-------------------------|--|-----|-----|-----|-------|
| $V_{IN}$ Supply Current | $V_{IN} = 18\text{V}$ , $V_C = 18\text{V}$ , Output Low  |     | 26  | 35  | mA    |
|                         | $V_{IN} = 18\text{V}$ , $V_C = 18\text{V}$ , Output High |     | 21  | 30  | mA    |
| $V_C$ Supply Current    | $V_{IN} = 18\text{V}$ , $V_C = 18\text{V}$ , Output Low  |     | 1.5 | 5.0 | mA    |
|                         | $V_{IN} = 18\text{V}$ , $V_C = 18\text{V}$ , Output High |     | 5.0 | 8   | mA    |
| UVLO Threshold          | $V_{IN}$ High to Low                                     | 3.8 | 4.1 | 4.4 | V     |
|                         | $V_{IN}$ Low to High                                     | 4.1 | 4.4 | 4.8 | V     |

**ELECTRICAL CHARACTERISTICS:** Unless otherwise stated, these specifications apply for  $V_{IN} = V_C = 15V$ , No load,  $T_A = T_J$ .

| PARAMETERS                    | TEST CONDITIONS      | MIN | TYP  | MAX | UNITS |
|-------------------------------|----------------------|-----|------|-----|-------|
| UVLO Threshold Hysteresis     |                      | 0.1 | 0.3  | 0.5 | V     |
| Digital Input Low Level       |                      |     |      | 0.8 | V     |
| Digital Input High Level      |                      | 2.0 |      |     | V     |
| Digital Input Current         | Digital Input = 0.0V | -70 | -4.0 |     | µA    |
| Output High Sat., $V_C - V_O$ | $I_O = -100mA$       |     | 1.35 | 2.2 | V     |
|                               | $I_O = -6A$          |     | 3.2  | 4.5 | V     |
| Output Low Sat., $V_O$        | $I_O = 100mA$        |     | 0.25 | 0.6 | V     |
|                               | $I_O = 6A$           |     | 3.4  | 4.5 | V     |
| Thermal Shutdown              |                      |     | 165  |     | °C    |

**From Inv., Input to Output (Note 3, 4):**

|                 |            |  |    |     |    |
|-----------------|------------|--|----|-----|----|
| Rise Time Delay | CL = 0     |  | 35 | 70  | ns |
|                 | CL = 2.2nF |  | 35 | 70  | ns |
|                 | CL = 30nF  |  | 35 | 70  | ns |
| 10% to 90% Rise | CL = 0     |  | 20 | 40  | ns |
|                 | CL = 2.2nF |  | 25 | 40  | ns |
|                 | CL = 30nF  |  | 85 | 150 | ns |
| Fall Time Delay | CL = 0     |  | 35 | 70  | ns |
|                 | CL = 2.2nF |  | 35 | 70  | ns |
|                 | CL = 30nF  |  | 35 | 80  | ns |
| 90% to 10% Fall | CL = 0     |  | 15 | 40  | ns |
|                 | CL = 2.2nF |  | 20 | 40  | ns |
|                 | CL = 30nF  |  | 85 | 150 | ns |

**From N.I. Input to Output (Note 3,4):**

|   |                                     |  |    |     |    |
|---|-------------------------------------|--|----|-----|----|
| Rise Time Delay   | CL = 0                              |  | 35 | 70  | ns |
|   | CL = 2.2nF                          |  | 35 | 70  | ns |
|   | CL = 30nF                           |  | 35 | 70  | ns |
| 10% to 90% Rise   | CL = 0                              |  | 20 | 40  | ns |
|   | CL = 2.2nF                          |  | 25 | 40  | ns |
|   | CL = 30nF                           |  | 85 | 150 | ns |
| Fall Time Delay   | CL = 0                              |  | 35 | 70  | ns |
|   | CL = 2.2nF                          |  | 35 | 70  | ns |
|   | CL = 30nF                           |  | 35 | 80  | ns |
| 90% to 10% Fall   | CL = 0                              |  | 15 | 40  | ns |
|   | CL = 2.2nF                          |  | 20 | 50  | ns |
|   | CL = 30nF                           |  | 85 | 150 | ns |
| Total Supply Current at 200kHz Input<br>Switching Frequency | $T_A = 25^{\circ}C$ (Note 5) CL = 0 |  | 30 | 40  | mA |

Note: 3. Delay measured from 50% input change to 10% output change.

Note: 4. Those parameters with  $CL = 30nF$  are not tested in production.

Note: 5. Inv. Input pulsed at 50% duty cycle with N.I. Input = 3V. or N.I. Input pulsed at 50% duty cycle with Inv. Input = 0V.

**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2)         | Lead/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples   |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|---|
| 5962-0152001QPA  | ACTIVE        | CDIP         | JG              | 8    | 1           | TBD                     | A42                     | N / A for Pkg Type   | -55 to 125   | 0152001QPA<br>UC1710    | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |
| 5962-0152001VPA  | ACTIVE        | CDIP         | JG              | 8    | 1           | TBD                     | A42                     | N / A for Pkg Type   | -55 to 125   | 0152001VPA<br>UC1710    | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |
| UC1710J          | ACTIVE        | CDIP         | JG              | 8    | 1           | TBD                     | A42                     | N / A for Pkg Type   | -55 to 125   | UC1710J                 | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |
| UC1710J883B      | ACTIVE        | CDIP         | JG              | 8    | 1           | TBD                     | A42                     | N / A for Pkg Type   | -55 to 125   | 0152001QPA<br>UC1710    | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |
| UC2710N          | ACTIVE        | PDIP         | P               | 8    | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU               | N / A for Pkg Type   | -40 to 85    | UC2710N                 | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |
| UC2710NG4        | ACTIVE        | PDIP         | P               | 8    | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU               | N / A for Pkg Type   | -40 to 85    | UC2710N                 | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |
| UC2710T          | ACTIVE        | TO-220       | KC              | 5    | 50          | Green (RoHS & no Sb/Br) | CU SN                   | N / A for Pkg Type   | -40 to 85    | UC2710T                 | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |
| UC2710TG3        | ACTIVE        | TO-220       | KC              | 5    | 50          | Green (RoHS & no Sb/Br) | CU SN                   | N / A for Pkg Type   | -40 to 85    | UC2710T                 | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |
| UC3710DW         | ACTIVE        | SOIC         | DW              | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | 0 to 70      | UC3710DW                | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |
| UC3710DWG4       | ACTIVE        | SOIC         | DW              | 16   | 40          | Green (RoHS & no Sb/Br) | CU NIPDAU               | Level-2-260C-1 YEAR  | 0 to 70      | UC3710DW                | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |
| UC3710N          | ACTIVE        | PDIP         | P               | 8    | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU   Call TI     | N / A for Pkg Type   | 0 to 70      | UC3710N                 | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |
| UC3710NG4        | ACTIVE        | PDIP         | P               | 8    | 50          | Green (RoHS & no Sb/Br) | Call TI                 | N / A for Pkg Type   | 0 to 70      | UC3710N                 | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |
| UC3710T          | ACTIVE        | TO-220       | KC              | 5    | 50          | Green (RoHS & no Sb/Br) | CU SN                   | N / A for Pkg Type   | 0 to 70      | UC3710T                 | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |
| UC3710TG3        | ACTIVE        | TO-220       | KC              | 5    | 50          | Green (RoHS & no Sb/Br) | CU SN                   | N / A for Pkg Type   | 0 to 70      | UC3710T                 | <span style="background-color: red; color: white; padding: 2px;">Samples</span> |

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

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

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**OTHER QUALIFIED VERSIONS OF UC1710, UC1710-SP, UC3710 :**

- Catalog: [UC3710](#), [UC1710](#)
- Military: [UC1710](#)
- Space: [UC1710-SP](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications



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## PACKAGE OPTION ADDENDUM

8-Apr-2018

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- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

**PACKAGING INFORMATION**

| Orderable part number | Status<br>(1) | Material type<br>(2) | Package   Pins  | Package qty   Carrier | RoHS<br>(3) | Lead finish/<br>Ball material<br>(4) | MSL rating/<br>Peak reflow<br>(5) | Op temp (°C) | Part marking<br>(6)  |
|-----------------------|---------------|----------------------|-----------------|-----------------------|-------------|--------------------------------------|-----------------------------------|--------------|----------------------|
| 5962-0152001QPA       | Active        | Production           | CDIP (JG)   8   | 50   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 0152001QPA<br>UC1710 |
| 5962-0152001VPA       | Active        | Production           | CDIP (JG)   8   | 50   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 0152001VPA<br>UC1710 |
| 5962-0152001VPA.A     | Active        | Production           | CDIP (JG)   8   | 50   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 0152001VPA<br>UC1710 |
| UC1710J               | Active        | Production           | CDIP (JG)   8   | 50   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | UC1710J              |
| UC1710J.A             | Active        | Production           | CDIP (JG)   8   | 50   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | UC1710J              |
| UC1710J883B           | Active        | Production           | CDIP (JG)   8   | 50   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 0152001QPA<br>UC1710 |
| UC1710J883B.A         | Active        | Production           | CDIP (JG)   8   | 50   TUBE             | No          | SNPB                                 | N/A for Pkg Type                  | -55 to 125   | 0152001QPA<br>UC1710 |
| UC2710N               | Active        | Production           | PDIP (P)   8    | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -40 to 85    | UC2710N              |
| UC2710N.A             | Active        | Production           | PDIP (P)   8    | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | -40 to 85    | UC2710N              |
| UC3710DW              | Active        | Production           | SOIC (DW)   16  | 40   TUBE             | Yes         | NIPDAU                               | Level-2-260C-1 YEAR               | 0 to 70      | UC3710DW             |
| UC3710DW.A            | Active        | Production           | SOIC (DW)   16  | 40   TUBE             | Yes         | NIPDAU                               | Level-2-260C-1 YEAR               | 0 to 70      | UC3710DW             |
| UC3710DWG4            | Active        | Production           | SOIC (DW)   16  | 40   TUBE             | Yes         | NIPDAU                               | Level-2-260C-1 YEAR               | 0 to 70      | UC3710DW             |
| UC3710N               | Active        | Production           | PDIP (P)   8    | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | UC3710N              |
| UC3710N.A             | Active        | Production           | PDIP (P)   8    | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | UC3710N              |
| UC3710NG4             | Active        | Production           | PDIP (P)   8    | 50   TUBE             | Yes         | NIPDAU                               | N/A for Pkg Type                  | 0 to 70      | UC3710N              |
| UC3710T               | Active        | Production           | TO-220 (KC)   5 | 50   TUBE             | Yes         | SN                                   | N/A for Pkg Type                  | 0 to 70      | UC3710T              |
| UC3710T.A             | Active        | Production           | TO-220 (KC)   5 | 50   TUBE             | Yes         | SN                                   | N/A for Pkg Type                  | 0 to 70      | UC3710T              |
| UC3710TG3             | Active        | Production           | TO-220 (KC)   5 | 50   TUBE             | Yes         | SN                                   | N/A for Pkg Type                  | 0 to 70      | UC3710T              |

<sup>(1)</sup> **Status:** For more details on status, see our [product life cycle](#).

<sup>(2)</sup> **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

<sup>(3)</sup> **RoHS values:** Yes, No, RoHS Exempt. See the [TI RoHS Statement](#) for additional information and value definition.

<sup>(4)</sup> **Lead finish/Ball material:** Parts 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.

<sup>(5)</sup> **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

<sup>(6)</sup> **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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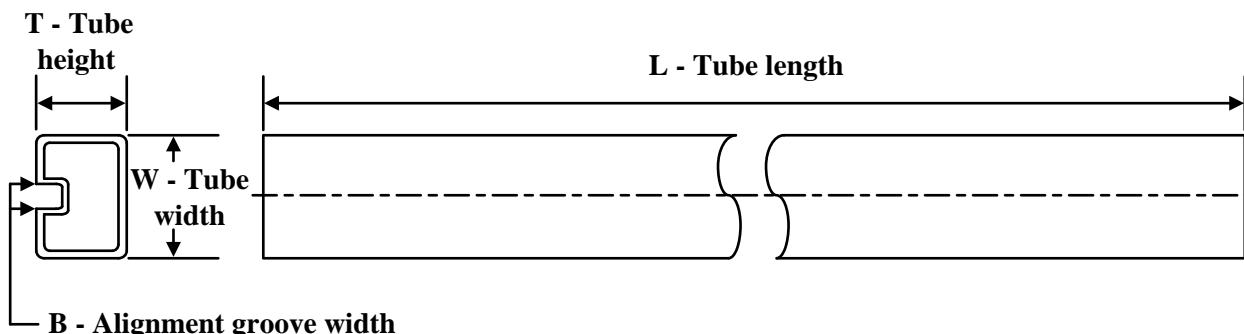
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**TUBE**


\*All dimensions are nominal

| Device     | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| UC2710N    | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| UC2710N.A  | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| UC3710DW   | DW           | SOIC         | 16   | 40  | 507    | 12.83  | 5080   | 6.6    |
| UC3710DW.A | DW           | SOIC         | 16   | 40  | 507    | 12.83  | 5080   | 6.6    |
| UC3710DWG4 | DW           | SOIC         | 16   | 40  | 507    | 12.83  | 5080   | 6.6    |
| UC3710N    | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| UC3710N.A  | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| UC3710NG4  | P            | PDIP         | 8    | 50  | 506    | 13.97  | 11230  | 4.32   |
| UC3710T    | KC           | TO-220       | 5    | 50  | 546    | 31     | 11930  | 3.17   |
| UC3710T.A  | KC           | TO-220       | 5    | 50  | 546    | 31     | 11930  | 3.17   |
| UC3710TG3  | KC           | TO-220       | 5    | 50  | 546    | 31     | 11930  | 3.17   |

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