

# Octal Line Driver

## FEATURES

- Eight Single Ended Line Drivers in One Package
- Meets EIA Standards EIA232E/V.28, EIA423A and CCITT V.10/X.26
- Single External Resistor Controls Slew Rate
- Wide Supply Voltage Range
- Tri-State Outputs
- Output Short-Circuit Protection

## DESCRIPTION

The UC5170C is a single-ended octal line driver designed to meet both standard modem control applications (EIA232E/V.28), and long line drive applications (EIA423A/V.10/X.26). The slew rate for all eight drivers is controlled by a single external resistor. The slew rate and output levels in Low Mode are independent of the power variations.

Mode selection is easily accomplished by taking the select pins (Ms+ and Ms-) to ground for low output mode (EIA232E/V.28 and EIA423A/V.10) or to their respective supplies for high mode (EIA232E/V.28). High mode should only be used to drive adapters that take power from the control lines, or applications using high threshold receivers.

## ABSOLUTE MAXIMUM RATINGS (Note 1)

V+ (Pin 20) ..... 15V  
 V- (Pin 11) ..... -15V  
 PLCC Power Dissipation, T<sub>A</sub> = 25°C (Note 2) ..... 1000 mW  
 DIP Power Dissipation, T<sub>A</sub> = 25°C (Note 2) ..... 1250 mW  
 Input Voltage ..... -1.5V to +7V  
 Output Voltage ..... -12V to +12V  
 Slew Rate Resistor ..... 2k to 10kΩ  
 Storage Temperature ..... -65°C to +150°C

Note 1: All voltages are with respect to ground, pin 18.

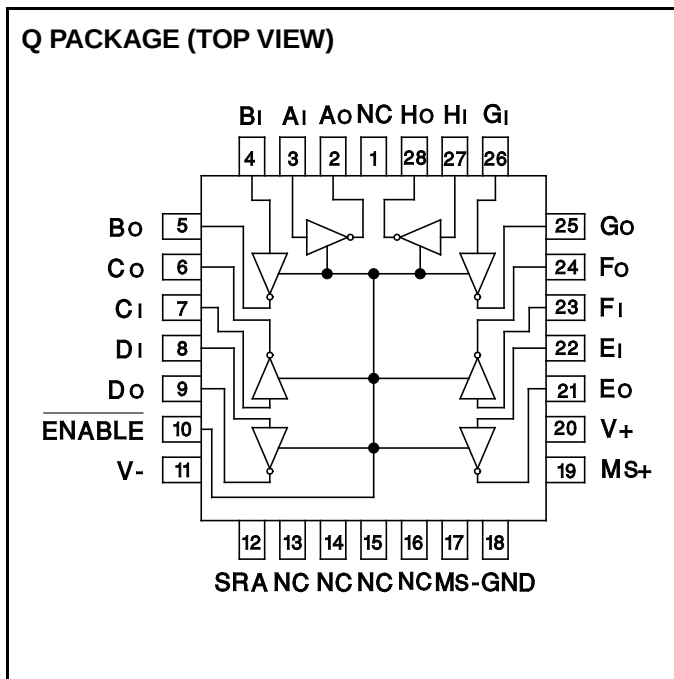
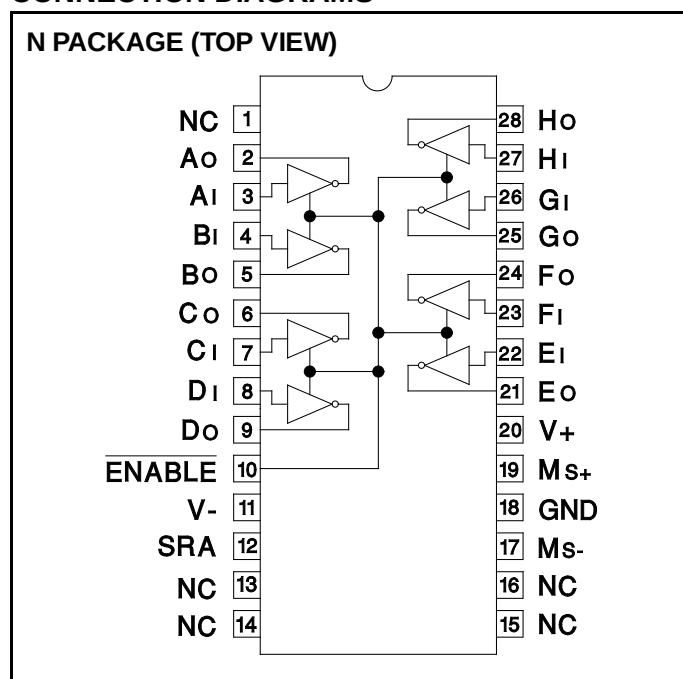
Note 2: Consult Packaging Section of Databook for thermal limitations and considerations of packages.

## FUNCTIONAL TABLE

| INPUTS                 |      | OUTPUTS                 |                 |
|------------------------|------|-------------------------|-----------------|
| $\overline{\text{EN}}$ | DATA | HIGH                    | LOW             |
|                        |      | EIA-232E <sup>(2)</sup> | EIA423A+EIA232E |
| 0                      | 0    | (V+)-3V                 | 5V to 6V        |
| 0                      | 1    | (V-)-3V                 | -5V to -6V      |
| 1                      | X    | High Z                  | High Z          |

Note 2: Minimum output swings.

## CONNECTION DIAGRAMS



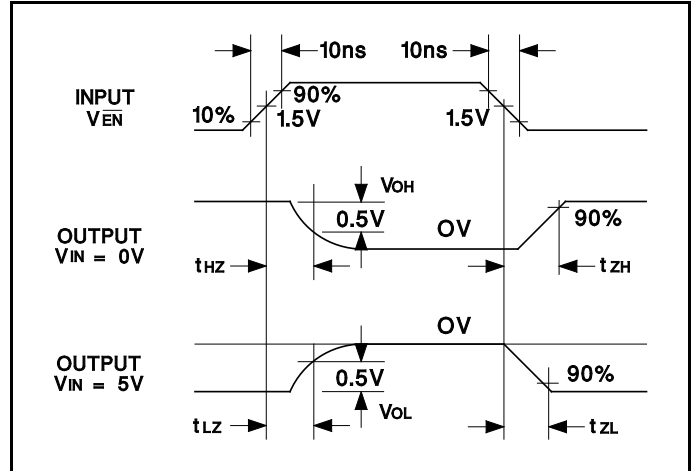
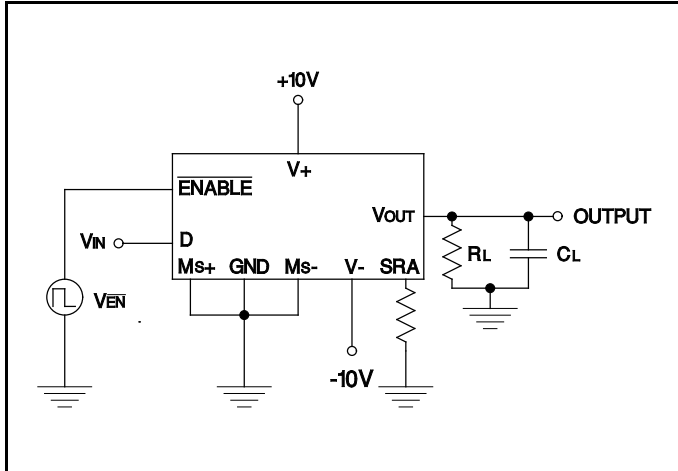
**DC ELECTRICAL CHARACTERISTICS:** Unless otherwise stated these specifications hold for  $|V_+| = |V_-| = 10V$ ,  
 $0 < T_A < +70^\circ C$ ,  $M_{S+} = M_{S-} = 0V$ ,  $R_{SRA} = +10k$ ,  $T_A = T_J$ .

| PARAMETERS                                                           | SYMBOL           | TEST CONDITIONS                                                              | MIN  | TYP  | MAX  | UNITS |
|----------------------------------------------------------------------|------------------|------------------------------------------------------------------------------|------|------|------|-------|
| <b>POWER SUPPLY REQUIREMENTS</b>                                     |                  |                                                                              |      |      |      |       |
| V+ Range                                                             |                  |                                                                              | 9    |      | 15   | V     |
| V- Range                                                             |                  |                                                                              | -9   |      | -15  | V     |
| V+ Supply Current                                                    | I+               | $R_L = \text{Infinite}$ $\overline{E_n} = 0V$                                |      | 25   | 42   | mA    |
| V- Supply Current                                                    | I-               | $R_L = \text{Infinite}$ $\overline{E_n} = 0V$                                |      | -23  | -42  | mA    |
| <b>INPUTS</b>                                                        |                  |                                                                              |      |      |      |       |
| High Level Input Voltage                                             | V <sub>IH</sub>  |                                                                              | 2.0  |      |      | V     |
| Low Level Input Voltage                                              | V <sub>IL</sub>  |                                                                              |      |      | 0.8  | V     |
| Input Clamp Voltage                                                  | V <sub>IK</sub>  | I <sub>I</sub> = -15 mA                                                      |      | -1.1 | -1.8 | V     |
| High Level Input Current                                             | I <sub>IH</sub>  | V <sub>IH</sub> = 2.4V                                                       |      | 0.25 | 40   | μA    |
| Low Level Input Current                                              | I <sub>IL</sub>  | V <sub>IL</sub> = 0.4V                                                       | -200 | -8.0 |      | μA    |
| <b>OUTPUTS</b>                                                       |                  |                                                                              |      |      |      |       |
| High Level (Low Mode) Output Voltage<br>(EIA423A/V.10, EIA232E/V.28) | V <sub>OH</sub>  | V <sub>IN</sub> = 0.8V $R_L = \text{Inf.}$                                   | 5.0  | 5.3  | 6.0  | V     |
|                                                                      |                  | $\overline{E_n} = 0.8V$ $R_L = 3k$                                           | 5.0  | 5.3  | 6.0  | V     |
|                                                                      |                  | $R_L = 450$                                                                  | 4.5  | 5.2  | 6.0  | V     |
| Low Level (Low Mode) Output Voltage<br>(EIA423A/V.10, EIA232E/V.28)  | V <sub>OL</sub>  | V <sub>IN</sub> = 2.0V $R_L = \text{Inf.}$                                   | -5.0 | -5.3 | -6.0 | V     |
|                                                                      |                  | $\overline{E_n} = 0.8V$ $R_L = 3k$                                           | -5.0 | -5.3 | -6.0 | V     |
|                                                                      |                  | $R_L = 450$                                                                  | -4.5 | -5.2 | -6.0 | V     |
| Output Balance (EIA423A/V.10)                                        | V <sub>BAL</sub> | $R_L = 450$ $V_{OH} - V_{OL} = V_{BAL}$                                      |      | 0.2  | 0.4  | V     |
| High Level (High Mode) Output Voltage<br>(EIA232E/V.28)              | V <sub>OH</sub>  | V <sub>IN</sub> = 0.8V $R_L = \text{Inf.}$ , $M_{S+} = V_+$ , $M_{S-} = V_-$ | 7.0  | 7.6  | 10   | V     |
|                                                                      |                  | $\overline{E_n} = 0.8V$ $R_L = 3k$ , $M_{S+} = V_+$ , $M_{S-} = V_-$         | 7.0  | 7.6  | 10   | V     |
| Low Level (High Mode) Output Voltage<br>(EIA232E, V.28)              | V <sub>OL</sub>  | V <sub>IN</sub> = 2.0V $R_L = \text{Inf.}$ , $M_{S+} = V_+$ , $M_{S-} = V_-$ | -7.0 | -7.7 | -10  | V     |
|                                                                      |                  | $\overline{E_n} = 0.8V$ $R_L = 3k$ , $M_{S+} = V_+$ , $M_{S-} = V_-$         | -7.0 | -7.7 | -10  | V     |
| Off-State Output Current                                             | I <sub>oz</sub>  | $\overline{E_n} = 2.0V$ , $V_o = \pm 6V$ , $V_+ = 15V$ , $V_- = -15V$        | -100 |      | 100  | μA    |
| Short-Circuit Current                                                | I <sub>os</sub>  | V <sub>IN</sub> = 0V, $\overline{E_n} = 0V$                                  | -25  | -50  |      | mA    |
|                                                                      |                  | V <sub>IN</sub> = 5V, $\overline{E_n} = 0V$                                  | 25   | 40   |      | mA    |

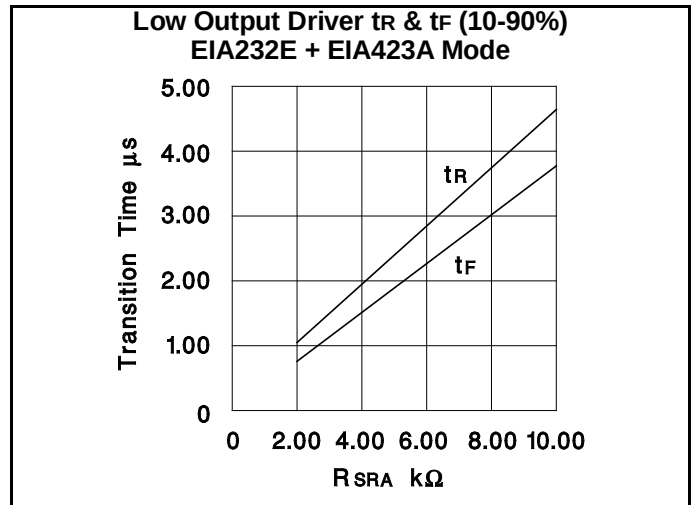
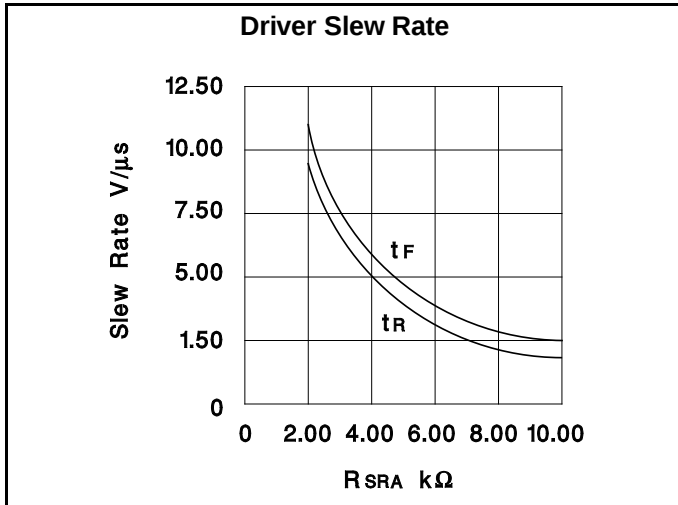
**AC ELECTRICAL CHARACTERISTICS:** at  $|V_+| = |V_-| = 10V$ ,  $0 < T_A < +70^\circ C$ ,  $M_{S+} = M_{S-} = 0V$ ,  $T_A = T_J$ .

| PARAMETERS                              | SYMBOL          | TEST CONDITIONS            | MIN  | TYP | MAX  | UNITS |
|-----------------------------------------|-----------------|----------------------------|------|-----|------|-------|
| Output Slew Rate                        | t <sub>R</sub>  | $R_{SRA} = 2k$             | 6.65 | 9.5 | 12.3 | V/μs  |
|                                         | t <sub>F</sub>  | $R_L = 450$ , $C_L = 50pF$ | 6.65 | 10  | 12.3 | V/μs  |
| Output Slew Rate                        | t <sub>R</sub>  | $R_{SRA} = 10k$            | 1.33 | 1.9 | 2.45 | V/μs  |
|                                         | t <sub>F</sub>  | $R_L = 450$ , $C_L = 50pF$ | 1.33 | 2.2 | 2.45 | V/μs  |
| Propagation Output to<br>High Impedance | t <sub>HZ</sub> | $R_{SRA} = 10k$            |      | 0.3 | 1.0  | μs    |
|                                         | t <sub>LZ</sub> | $R_L = 450$ , $C_L = 50pF$ |      | 0.5 | 2.0  | μs    |
| Propagation High Impedance to<br>Output | t <sub>ZH</sub> | $R_{SRA} = 10k$            |      | 6.0 | 17   | μs    |
|                                         | t <sub>ZL</sub> | $R_L = 450$ , $C_L = 50pF$ |      | 7.0 | 17   | μs    |

## AC PARAMETER TEST CIRCUIT AND WAVEFORMS



## AC CHARACTERISTICS



## APPLICATION INFORMATION

### Slew Rate Programming

Slew rate for the UC5170C is set up by a single external resistor connected between the SRA pin and ground. Slew rate adjustments can be approximated by using the following formula:

$$V/\mu s = \frac{20}{R_{SRA}} (R_{SRA} \text{ in } k\Omega)$$

The slew rate resistor can vary between 2k and 10k which allows slew rates between 10 to 2.2V/μs, respectively. The relationship between slew rate and RSRA is shown in the typical characteristics.

Waveshaping of the output lets the user control the level of interference (near-end crosstalk) that may be coupled to adjacent circuits in an interconnection. The recommended output characteristics for cable length and data rates can be found in EIA standard EIA423A +V.10. Approximations of these standards are given by the following equations:

Max. Data Rate = 300/t (For data rates 1k to 100k bit/s)

Max. Cable Length (feet) = 100 x t (Max. length 4000 feet)

where t is the transition time from 10% to 90% of the output swing in microseconds. For data rates below 1k bit/s t may be up to 300 microseconds.

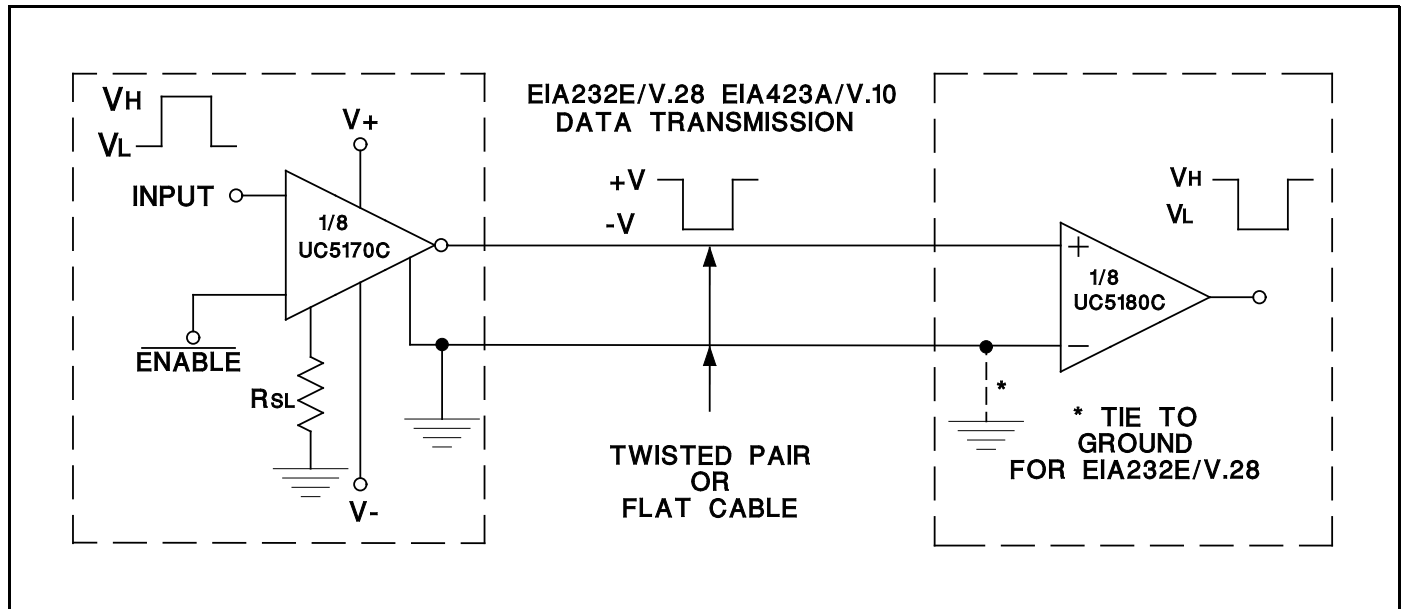
### Output Voltage Programming

The UC5170C has two programmable output modes, either a low voltage mode which meets EIA423A, EIA232E/V.28/V.10 specifications, or the high output mode which meets the EIA232E, V.28 specifications.

The high output mode provides greater output swings, minimum of 3V below and supply rails for driving higher, attenuated lines. This mode is selected by connecting the mode select pins to their respected supplies, Ms+ to V+ and Ms- to V-.

The low output mode provides a controlled output swing and is accomplished by connecting both mode select pins to ground.

## APPLICATIONS



## SPECIFIC LAYOUT NOTES

The UC5170C layout must have bulk bypassing close to the device. Peak slew current is greater than 500mA when all eight drivers slew at once in the same direction. Some applications mount the UC5170C on a bulkhead or isolated plane for RFI/FCC/VDE reasons. If bulk bypassing is not used, the -10V supply may go above -8.5 volts, causing the slew rate control circuit to become unstable.

The UC5170C can have output oscillation at 100kHz if the +10V supply is applied before the -10V supply. This has been a problem in some terminal designs where the +10V was developed from the flyback, which can result in a 500ms difference in the application of the supplies at power up.

## GENERAL LAYOUT NOTES

The drivers and receivers should be mounted close to the system common ground point, with the ground reference tied to the common point to reduce RFI/EMI.

Filter connectors or transzorb should be used to reduce the RFI/EMI, protecting the system from static (ESD), and electrical overstress (EOS). A filter connector or capacitor will reduce the ESD pulse by 90% typically. A cable dragged across a carpet and connected to a system can easily be charged to over 25,00 volts. This is a metal to metal contact when the cable is connected to the system (no resistance), currents exceed 80 amps with less than a nanosecond rise time. A transzorb provides two functions, the device capacitance inherently acts as a filter capacitor, and the device clamps the ESD and EOS pulses which would pass through the capacitor and destroy the devices. The recommended transzorb for the UC5170C is P6KEIOCA.

\*Transzorb is a trademark of General Semiconductor Industries.

## PACKAGING INFORMATION

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2)            | Lead/Ball Finish | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples |
|------------------|---------------|--------------|--------------------|------|----------------|----------------------------|------------------|----------------------|--------------|-------------------------|---------|
| UC5170CJ         | OBSOLETE      | CDIP         | J                  | 28   |                | TBD                        | Call TI          | Call TI              |              |                         |         |
| UC5170CN         | OBSOLETE      |              | UTR                |      |                | TBD                        | Call TI          | Call TI              |              |                         |         |
| UC5170CQ         | LIFEBUY       | PLCC         | FN                 | 28   | 37             | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-3-260C-168 HR  |              | UC5170CQ                |         |
| UC5170CQTR       | OBSOLETE      | PLCC         | FN                 | 28   |                | TBD                        | Call TI          | Call TI              |              | UC5170CQ                |         |

(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.

(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.

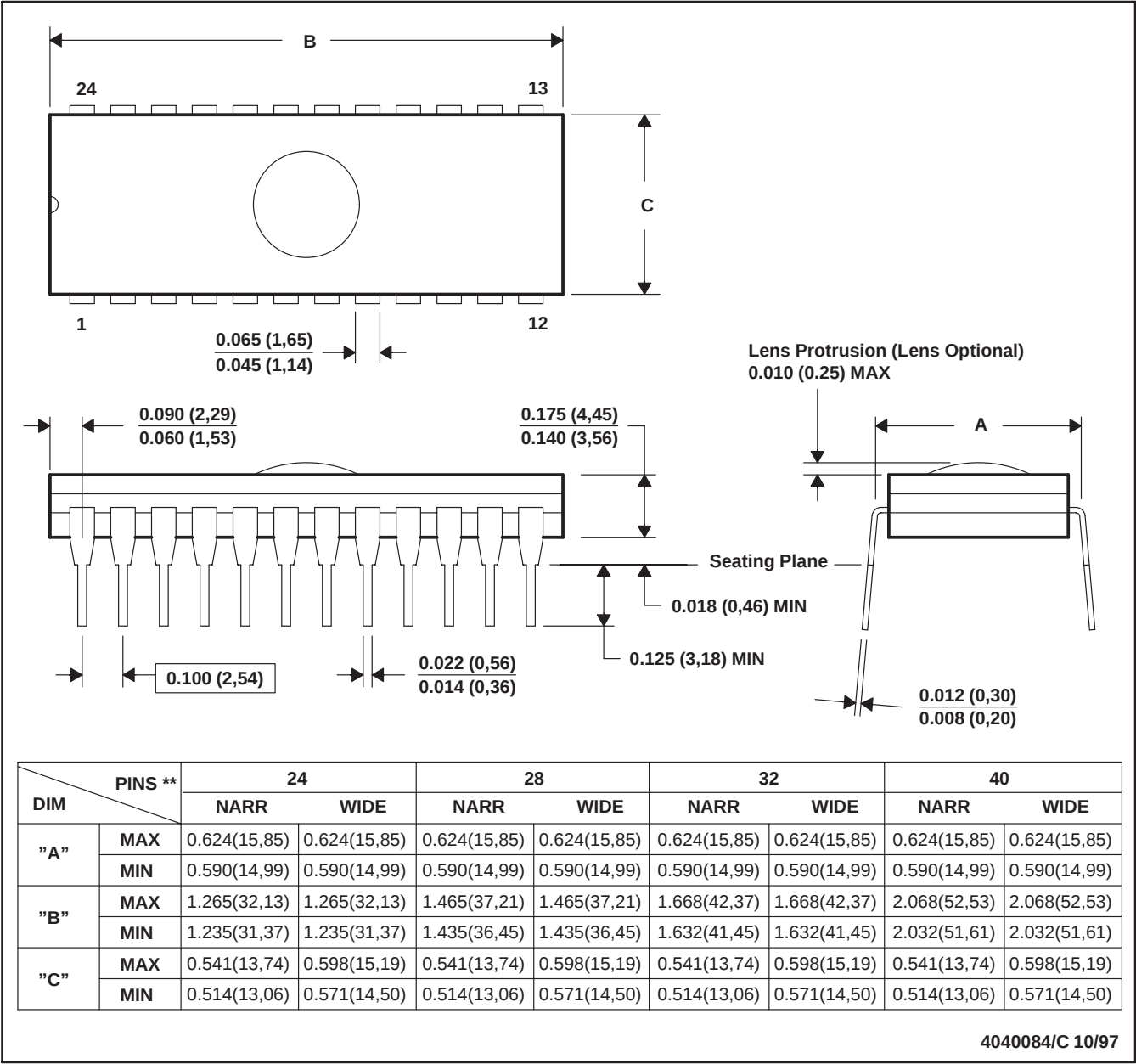
**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. 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.



J (R-GDIP-T\*\*)
24 PINS SHOWN

CERAMIC DUAL-IN-LINE PACKAGE

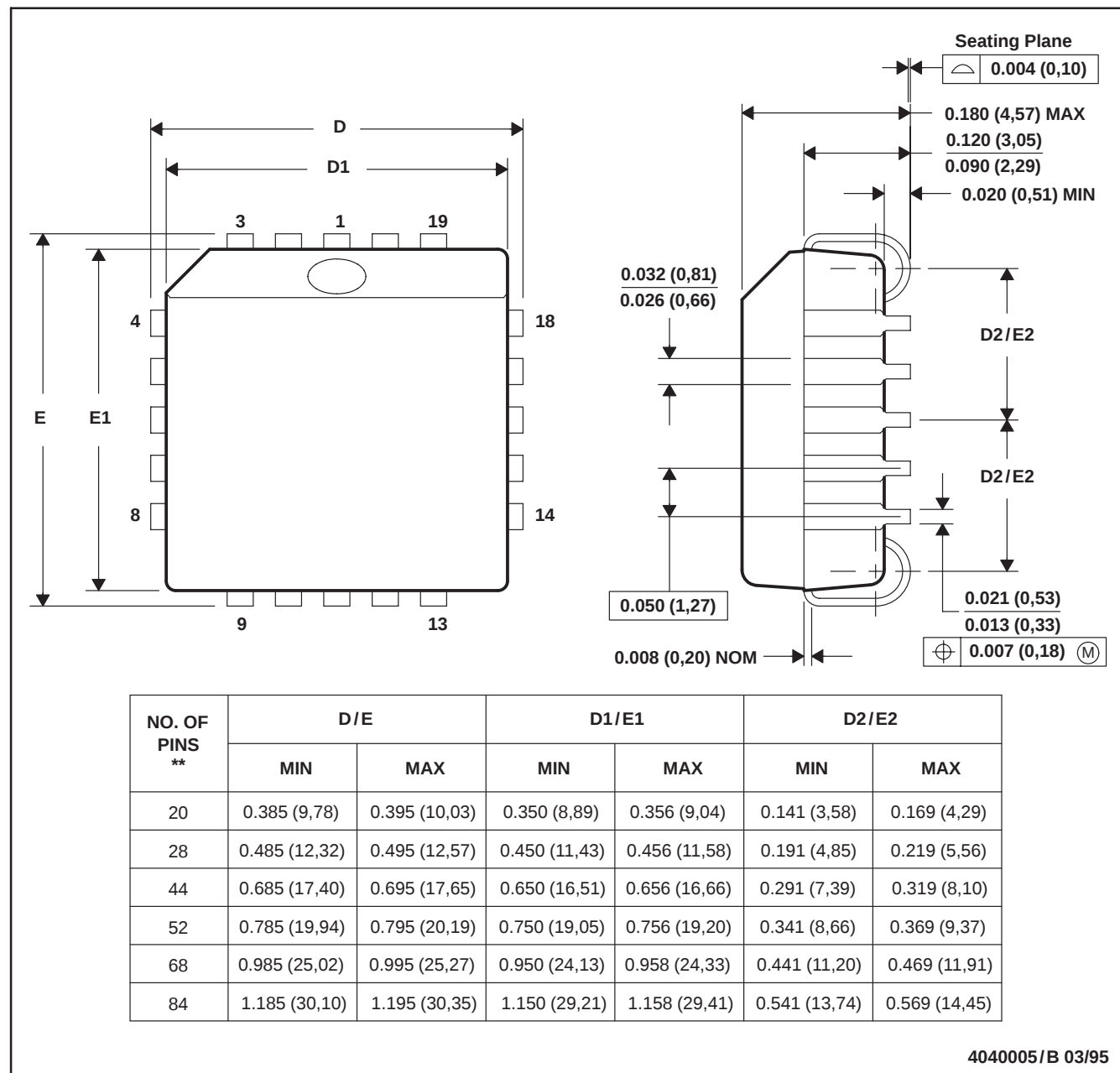


- NOTES: A. All linear dimensions are in inches (millimeters).  
B. This drawing is subject to change without notice.  
C. Window (lens) added to this group of packages (24-, 28-, 32-, 40-pin).  
D. This package can be hermetically sealed with a ceramic lid using glass frit.  
E. Index point is provided on cap for terminal identification.

## FN (S-PQCC-J\*\*)

## PLASTIC J-LEADED CHIP CARRIER

20 PIN SHOWN



- NOTES: A. All linear dimensions are in inches (millimeters).  
 B. This drawing is subject to change without notice.  
 C. Falls within JEDEC MS-018

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, enhancements, improvements and other changes to its semiconductor products and services per JESD46, latest issue, and to discontinue any product or service per JESD48, latest issue. Buyers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All semiconductor products (also referred to herein as "components") are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

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

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

TI does not warrant or represent that any license, either express or implied, is granted under any patent right, copyright, mask work right, or other intellectual property right relating to any combination, machine, or process in which TI components or services are used. Information published by TI regarding third-party products or services does not constitute a license 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 significant portions 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. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

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

Buyer acknowledges and agrees that it is solely responsible for compliance with all legal, regulatory and safety-related requirements concerning its products, and any use of TI components in its applications, notwithstanding any applications-related information or support that may be provided by TI. Buyer represents and agrees that it has all the necessary expertise to create and implement safeguards which anticipate dangerous consequences of failures, monitor failures and their consequences, lessen the likelihood of failures that might cause harm and take appropriate remedial actions. Buyer will fully indemnify TI and its representatives against any damages arising out of the use of any TI components in safety-critical applications.

In some cases, TI components may be promoted specifically to facilitate safety-related applications. With such components, TI's goal is to help enable customers to design and create their own end-product solutions that meet applicable functional safety standards and requirements. Nonetheless, such components are subject to these terms.

No TI components are authorized for use in FDA Class III (or similar life-critical medical equipment) unless authorized officers of the parties have executed a special agreement specifically governing such use.

Only those TI components which TI has specifically designated as military grade or "enhanced plastic" are designed and intended for use in military/aerospace applications or environments. Buyer acknowledges and agrees that any military or aerospace use of TI components which have **not** been so designated is solely at the Buyer's risk, and that Buyer is solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI has specifically designated certain components as meeting ISO/TS16949 requirements, mainly for automotive use. In any case of use of non-designated products, TI will not be responsible for any failure to meet ISO/TS16949.

### Products

|                              |                                                                                      |
|------------------------------|--------------------------------------------------------------------------------------|
| Audio                        | <a href="http://www.ti.com/audio">www.ti.com/audio</a>                               |
| Amplifiers                   | <a href="http://amplifier.ti.com">amplifier.ti.com</a>                               |
| Data Converters              | <a href="http://dataconverter.ti.com">dataconverter.ti.com</a>                       |
| DLP® Products                | <a href="http://www.dlp.com">www.dlp.com</a>                                         |
| DSP                          | <a href="http://dsp.ti.com">dsp.ti.com</a>                                           |
| Clocks and Timers            | <a href="http://www.ti.com/clocks">www.ti.com/clocks</a>                             |
| Interface                    | <a href="http://interface.ti.com">interface.ti.com</a>                               |
| Logic                        | <a href="http://logic.ti.com">logic.ti.com</a>                                       |
| Power Mgmt                   | <a href="http://power.ti.com">power.ti.com</a>                                       |
| Microcontrollers             | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a>                   |
| RFID                         | <a href="http://www.ti-rfid.com">www.ti-rfid.com</a>                                 |
| OMAP Applications Processors | <a href="http://www.ti.com/omap">www.ti.com/omap</a>                                 |
| Wireless Connectivity        | <a href="http://www.ti.com/wirelessconnectivity">www.ti.com/wirelessconnectivity</a> |

### Applications

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

### TI E2E Community

[e2e.ti.com](http://e2e.ti.com)