

# DS14C237 Single Supply TIA/EIA-232 5 x 3 Driver/Receiver

## General Description

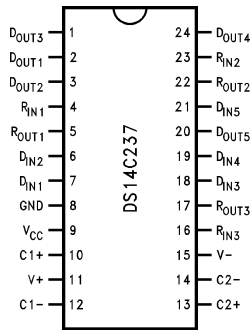
The DS14C237 is a five driver, three receiver device which conforms to the TIA/EIA-232-E standard and CCITT V.28 recommendations. This device eliminates  $\pm 12V$  supplies by employing an internal DC-DC converter to generate the necessary output levels from a single +5V supply. Driver slew rate control and receiver noise filtering have also been internalized to eliminate the need for external slew rate control and noise filtering capacitors.

One device is capable of implementing a complete nine pin interface. The combination of its extended operating temperature range and low power requirement makes this device an ideal choice for a wide variety of commercial, industrial, and battery powered applications.

## Features

- Conforms to TIA/EIA-232-E and CCITT V.28
- Internal DC-DC converter
- Operates with single +5V supply
- Low power requirement— $I_{CC}$  10 mA max
- Internal driver slew rate control
- Receiver Noise Filtering
- Operates above 120 kbits/sec
- Direct replacement for MAX237
- Industrial temperature range option-DS14C237T ( $-40^{\circ}C$  to  $+85^{\circ}C$ )

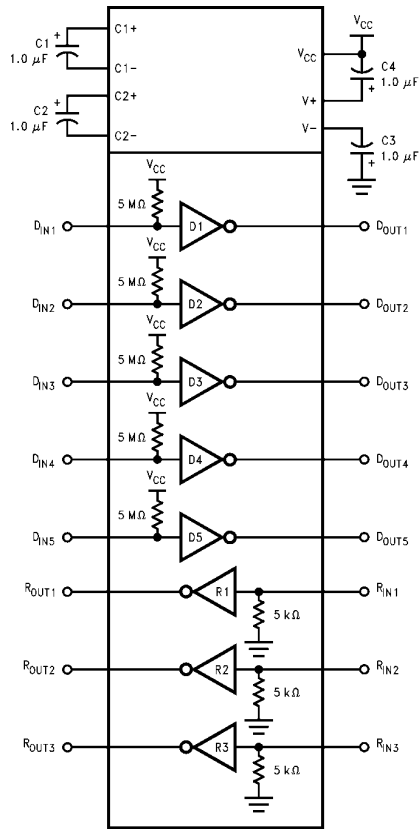
## Connection Diagram



TL/F/11284-1

**Order Number**  
DS14C237N, DS14C237WM,  
DS14C237TN or DS14C237TWM  
See NS Package Number M24B or NA24G

## Functional Diagram



TL/F/11284-2

DS14C237 Single Supply TIA/EIA-232 5 x 3 Driver/Receiver

## Absolute Maximum Ratings (Note 1)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

|  |                                  |
|--|----------------------------------|
| Supply Voltage ( $V_{CC}$ )                        | -0.3V to +6V                     |
| $V^+$ Pin  | $(V_{CC} - 0.3V)$ to +15V        |
| $V^-$ Pin  | +0.3V to -15V                    |
| Driver Input Voltage                               | -0.3V to $(V_{CC} + 0.3V)$       |
| Driver Output Voltage                              | $(V^+ + 0.3V)$ to $(V^- - 0.3V)$ |
| Receiver Input Voltage                             | $\pm 30V$                        |
| Receiver Output Voltage                            | -0.3V to $(V_{CC} + 0.3V)$       |
| Junction Temperature                               | +150°C                           |
| Maximum Package Power Dissipation @ +25°C (Note 6) |                                  |
| N Package  | 2400 mW                          |
| WM Package   | 1400 mW                          |

|   |                 |
|---|-----------------|
| Storage Temperature Range                 | -65°C to +150°C |
| Lead Temperature (Soldering, 4 sec.)      | +260°C          |
| Short Circuit Duration ( $D_{OUT}$ )      | continuous      |
| ESD Rating (HBM, 1.5 k $\Omega$ , 100 pF) | $\geq 2.0$ kV   |

## Recommended Operating Conditions

|  | Min | Max | Units |
|--|-----|-----|-------|
| Supply Voltage, $V_{CC}$                 | 4.5 | 5.5 | V     |
| Operating Free Air Temperature ( $T_A$ ) |     |     |       |
| DS14C237                                 | 0   | +70 | °C    |
| DS14C237T                                | -40 | +85 | °C    |

## Electrical Characteristics

Over recommended operating conditions, unless otherwise specified (Note 2)

| Symbol                          | Parameter                         | Conditions  | Min  | Typ  | Max      | Units         |
|---------------------------------|-----------------------------------|---|------|------|----------|---------------|
| <b>DEVICE CHARACTERISTICS</b>   |                                   |   |      |      |          |               |
| $V^+$                           | Positive Power Supply             | $R_L = 3\text{ k}\Omega$ , $C_1 - C_4 = 1.0\ \mu\text{F}$ , $D_{IN} = 0.8V$ |      | 9.0  |          | V             |
| $V^-$                           | Negative Power Supply             | $R_L = 3\text{ k}\Omega$ , $C_1 - C_4 = 1.0\ \mu\text{F}$ , $D_{IN} = 2.0V$ |      | -8.5 |          | V             |
| $I_{CC}$                        | Supply Current ( $V_{CC}$ )       | No Load   |      | 6.5  | 10       | mA            |
| <b>DRIVER CHARACTERISTICS</b>   |                                   |   |      |      |          |               |
| $V_{IH}$                        | High Level Input Voltage          |   | 2.0  |      | $V_{CC}$ | V             |
| $V_{IL}$                        | Low Level Input Voltage           |   | GND  |      | 0.8      | V             |
| $I_{IH}$                        | High Level Input Current          | $V_{IN} \geq 2.0V$  | -10  |      | 10       | $\mu\text{A}$ |
| $I_{IL}$                        | Low Level Input Current           | $V_{IN} \leq 0.8V$  | -10  |      | 10       | $\mu\text{A}$ |
| $V_{OH}$                        | High Level Output Voltage         | $R_L = 3\text{ k}\Omega$  | 5.0  | 7.4  |          | V             |
| $V_{OL}$                        | Low Level Output Voltage          |   |      | -6.3 | -5.0     | V             |
| $I_{OS}^+$                      | Output High Short Circuit Current | $V_O = 0V$ , $V_{IN} = 0.8V$  | -30  | -15  | -5.0     | mA            |
| $I_{OS}^-$                      | Output Low Short Circuit Current  | $V_O = 0V$ , $V_{IN} = 2.0V$  | 5.0  | 12   | 30       | mA            |
| $R_O$                           | Output Resistance                 | $-2V \leq V_O \leq +2V$ ,<br>$V_{CC} = \text{GND} = 0V$                     | 300  |      |          | $\Omega$      |
| <b>RECEIVER CHARACTERISTICS</b> |                                   |   |      |      |          |               |
| $V_{TH}$                        | Input High Threshold Voltage      |   |      | 1.9  | 2.4      | V             |
| $V_{TL}$                        | Input Low Threshold Voltage       |   | 0.8  | 1.5  |          | V             |
| $V_{HY}$                        | Hysteresis                        |   | 0.2  | 0.4  | 1.0      | V             |
| $R_{IN}$                        | Input Resistance                  |   | 3.0  | 4.5  | 7.0      | k $\Omega$    |
| $I_{IN}$                        | Input Current                     | $V_{IN} = +15V$   | 2.14 | 3.8  | 5.0      | mA            |
|                                 |                                   | $V_{IN} = +3V$  | 0.43 | 0.6  | 1.0      | mA            |
|                                 |                                   | $V_{IN} = -3V$  | -1.0 | -0.6 | -0.43    | mA            |
|                                 |                                   | $V_{IN} = -15V$   | -5.0 | -3.8 | -2.14    | mA            |
| $V_{OH}$                        | High Level Output Voltage         | $V_{IN} = -3V$ , $I_O = -3.2\text{ mA}$                                     | 3.5  | 4.5  |          | V             |
|                                 |                                   | $V_{IN} = -3V$ , $I_O = -20\ \mu\text{A}$                                   | 4.0  | 4.9  |          | V             |
| $V_{OL}$                        | Low Level Output Voltage          | $V_{IN} = +3V$ , $I_O = +3.2\text{ mA}$                                     |      | 0.25 | 0.4      | V             |

## Switching Characteristics

Over recommended operating conditions, unless otherwise specified (Note 4)

| Symbol                          | Parameter                     | Conditions  | Min | Typ | Max | Units                  |
|---------------------------------|-------------------------------|---|-----|-----|-----|------------------------|
| <b>DRIVER CHARACTERISTICS</b>   |                               |   |     |     |     |                        |
| $t_{PLH}$                       | Propagation Delay LOW to HIGH | $R_L = 3\text{ k}\Omega$<br>$C_L = 50\text{ pF}$<br><i>Figures 1 and 2</i>                    |     | 0.7 | 4.0 | $\mu\text{s}$          |
| $t_{PHL}$                       | Propagation Delay HIGH to LOW |   |     | 0.6 | 4.0 | $\mu\text{s}$          |
| $t_{sk}$                        | Skew $ t_{PLH} - t_{PHL} $    |   |     | 0.1 | 1.0 | $\mu\text{s}$          |
| SR1                             | Output Slew Rate              | $R_L = 3\text{ k}\Omega$ to $7\text{ k}\Omega$ , $C_L = 50\text{ pF}$                         | 4.0 | 15  | 30  | $\text{V}/\mu\text{s}$ |
| SR2                             | Output Slew Rate              | $R_L = 3\text{ k}\Omega$ , $C_L = 2500\text{ pF}$   | 3.0 | 5.0 |     | $\text{V}/\mu\text{s}$ |
| <b>RECEIVER CHARACTERISTICS</b> |                               |   |     |     |     |                        |
| $t_{PLH}$                       | Propagation Delay LOW to HIGH | Input Pulse Width $> 10\text{ }\mu\text{s}$<br>$C_L = 50\text{ pF}$<br><i>Figures 3 and 4</i> |     | 2.0 | 6.5 | $\mu\text{s}$          |
| $t_{PHL}$                       | Propagation Delay HIGH to LOW |   |     | 2.8 | 6.5 | $\mu\text{s}$          |
| $t_{sk}$                        | Skew $ t_{PLH} - t_{PHL} $    |   |     | 0.8 | 2.0 | $\mu\text{s}$          |
| $t_{nw}$                        | Noise Pulse Width Rejected    |   |     | 2.5 | 1.0 | $\mu\text{s}$          |

**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The tables of "Electrical Characteristics" specify conditions for device operation.

**Note 2:** Current into device pins is defined as positive. Current out of device pins is defined as negative. All voltages are referenced to ground unless otherwise specified.

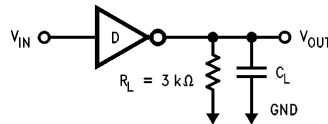
**Note 3:**  $I_{OS}^+$  and  $I_{OS}^-$  values are for one output at a time. If more than one output is shorted simultaneously, the device power dissipation may be exceeded.

**Note 4:** Receiver AC input waveform for test purposes:  $t_r = t_f = 200\text{ ns}$ ,  $V_{IH} = 3\text{V}$ ,  $V_{IL} = -3\text{V}$ ,  $f = 64\text{ kHz}$  (128 kbits/sec). Drive AC Input Waveform for test purposes:  $t_r = t_f \leq 10\text{ ns}$ ,  $V_{IH} = 3\text{V}$ ,  $V_{IL} = 0\text{V}$ ,  $f = 64\text{ kHz}$  (128 kbits/sec).

**Note 5:** All typicals are given for  $V_{CC} = 5.0\text{V}$  and  $T_A = +25^\circ\text{C}$ .

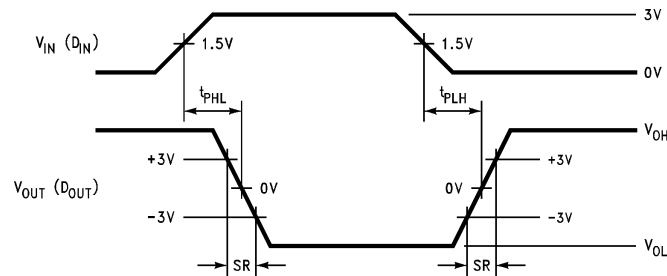
**Note 6:** Ratings apply to ambient temperature at  $+25^\circ\text{C}$ . Above this temperature derate: N package  $20\text{ mW}/^\circ\text{C}$  and WM package  $13.5\text{ mW}/^\circ\text{C}$ .

## Parameter Measurement Information



TL/F/11284-4

FIGURE 1. Driver Load Circuit



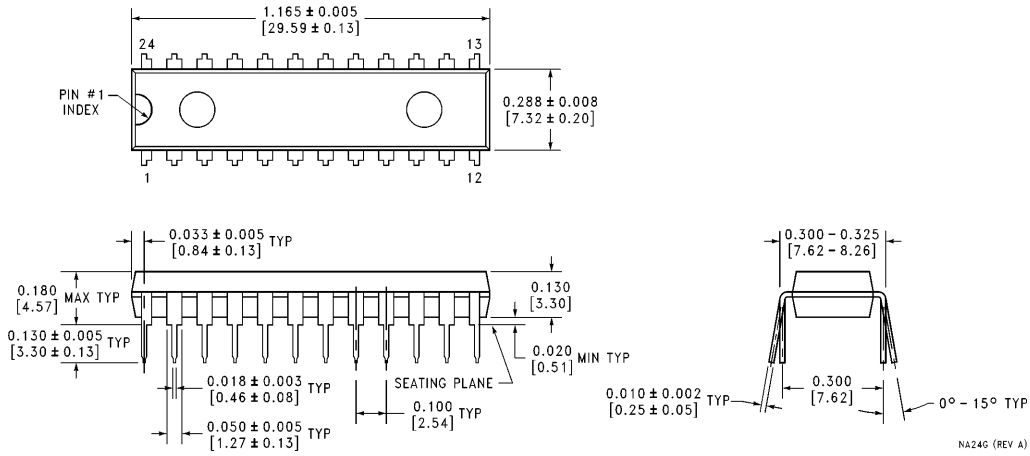
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FIGURE 2. Driver Switching Waveform





**Physical Dimensions** inches (millimeters) (Continued)



**Order Number DS14C237N or DS14C237TN  
NS Package Number NA24G**

NA24G (REV A)

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