Standard Interface Guide
Technology ideal for all applications

ti.com/interface

2014
Standard Interface Overview

Why RS Serial Communication?
RS-232/422/485 are standards for serial communication transmission of data. These interface standards were once used in personal computers in order to communicate with peripherals such as printers, displays and other external systems. Although USB has displaced the RS standard in personal computers, it remains present within systems such as networking equipment, industrial machines and scientific instruments. Unlike USB, RS-232/422/485 is not limited to cable lengths of 5 meters or less, thus favoring applications that require longer distances; i.e. across a room, from one system to another. Furthermore; the RS standard does not require complex software support since it does not incorporate a protocol for transfer and does not require an external device for decoding data. Within industrial applications such as PLCs, servo drivers or other automation systems, RS-232 is used for direct programming. Serial ports are also commonly used to communicate to headless systems such as servers or other networking systems like routers, where no monitor or keyboard is installed and during boot when no network connection is possible and condition monitoring is needed. Here are some of the key benefits from these standards:

- **RS-232**: Single ended and can drive high voltage devices
- **RS-422**: Differential operation and up to 1000m of cable length
- **RS-485**: Similar to RS-422 but allows an increased number of drivers and receivers (up to 32)

Why Peripheral Drivers?
Low voltage logic systems, microcontrollers and FPGAs are often tasked with controlling or driving high voltage or high current systems. A common solution to driving these high voltage systems is the use of discrete MOSFETs; however when the system requires a large number of peripherals, an integrated solution is a great space and cost saving alternative. TI has a broad portfolio of peripheral drivers covering applications with a large number of peripherals to very high voltages and currents.
RS232 Interfaces
3V to 5.5V Supply, with ESD Protection, and automatic power down

TI's RS-232 devices are commonly used in computer serial ports for battery powered systems, laptops, industrial automation, and home automation. These devices generate their own higher voltage to drive the RS-232 and operate with a 3V to 5.5V supply. TI's RS-232 devices also offer ESD protection up to 15kV, data transfer rates of up to 1,000kbit/s, and a power down state to reduce the supply current.

<table>
<thead>
<tr>
<th>Device</th>
<th>Data Rate (kbps)</th>
<th># of TX</th>
<th># of RX</th>
<th>Supply Voltage(s) (V)</th>
<th>ESD (kV)</th>
<th>IEC 61000-4-2 Support</th>
<th>Icc (max) (mA)</th>
<th>Powerdown Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td>MC1489/A</td>
<td>&gt;1,000</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>—</td>
<td>—</td>
<td>26</td>
<td>—</td>
</tr>
<tr>
<td>SN75x189/A</td>
<td>&gt;1,000</td>
<td>0</td>
<td>4</td>
<td>5</td>
<td>—</td>
<td>—</td>
<td>26</td>
<td>—</td>
</tr>
<tr>
<td>SN65C3221E</td>
<td>1,000</td>
<td>1</td>
<td>1</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>1</td>
<td>Auto-Powerdown</td>
</tr>
<tr>
<td>SN751701</td>
<td>300</td>
<td>1</td>
<td>1</td>
<td>±12.0</td>
<td>—</td>
<td>—</td>
<td>14</td>
<td>—</td>
</tr>
<tr>
<td>SN75C3221E</td>
<td>1,000</td>
<td>1</td>
<td>1</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>1</td>
<td>Auto-Powerdown</td>
</tr>
<tr>
<td>MAX/TRS3221</td>
<td>250</td>
<td>1</td>
<td>1</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>—</td>
<td>1</td>
<td>Auto-Powerdown</td>
</tr>
<tr>
<td>MAX/TRS3221E</td>
<td>250</td>
<td>1</td>
<td>1</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>1</td>
<td>Auto-Powerdown</td>
</tr>
<tr>
<td>MAX/TRS3227E</td>
<td>1,000</td>
<td>1</td>
<td>1</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>2</td>
<td>Auto-Powerdown+</td>
</tr>
<tr>
<td>TRSF3221E</td>
<td>1,000</td>
<td>1</td>
<td>1</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>1</td>
<td>Auto-Powerdown</td>
</tr>
<tr>
<td>UA9636A</td>
<td>7+</td>
<td>2</td>
<td>0</td>
<td>±12.0</td>
<td>—</td>
<td>—</td>
<td>±18</td>
<td>—</td>
</tr>
<tr>
<td>SN65C322x2E</td>
<td>1,000</td>
<td>2</td>
<td>2</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>1</td>
<td>Auto-Powerdown</td>
</tr>
<tr>
<td>SN75C32xxE</td>
<td>1,000</td>
<td>2</td>
<td>2</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>SNx5C322xE</td>
<td>100</td>
<td>2</td>
<td>2</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>1</td>
<td>Auto-Powerdown</td>
</tr>
<tr>
<td>MAX/TRS202</td>
<td>120</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>±15</td>
<td>—</td>
<td>15</td>
<td>—</td>
</tr>
<tr>
<td>MAX/TRS232/E</td>
<td>250</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>±15</td>
<td>Yes</td>
<td>10</td>
<td>—</td>
</tr>
<tr>
<td>MAX/TRS322xE</td>
<td>500</td>
<td>2</td>
<td>2</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>1</td>
<td>Auto-Powerdown</td>
</tr>
<tr>
<td>MAX/TRS3232E</td>
<td>250</td>
<td>2</td>
<td>2</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>MAX/TRS3318/E</td>
<td>460</td>
<td>2</td>
<td>2</td>
<td>2.25 to 3.0</td>
<td>±15</td>
<td>Yes</td>
<td>2</td>
<td>Auto-Powerdown+</td>
</tr>
<tr>
<td>TRS202E</td>
<td>120</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>±15</td>
<td>Yes</td>
<td>15</td>
<td>—</td>
</tr>
<tr>
<td>TRSF32xxE</td>
<td>1,000</td>
<td>2</td>
<td>2</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>MAX/TRS3386E</td>
<td>250</td>
<td>3</td>
<td>2</td>
<td>3.3 or 5.0 and 1.8</td>
<td>±15</td>
<td>Yes</td>
<td>1</td>
<td>Powerdown</td>
</tr>
<tr>
<td>TL145406</td>
<td>120</td>
<td>3</td>
<td>3</td>
<td>±9.0 and 5.0</td>
<td>±2</td>
<td>—</td>
<td>±25</td>
<td>—</td>
</tr>
<tr>
<td>SN75185</td>
<td>120</td>
<td>3</td>
<td>5</td>
<td>±9.0 and 5.0</td>
<td>±10</td>
<td>—</td>
<td>30</td>
<td>—</td>
</tr>
<tr>
<td>SN75C185</td>
<td>120</td>
<td>3</td>
<td>5</td>
<td>±12.0 and 5.0</td>
<td>±2</td>
<td>—</td>
<td>0</td>
<td>—</td>
</tr>
<tr>
<td>SN75LV4737A</td>
<td>128</td>
<td>3</td>
<td>5</td>
<td>3.3 or 5.0</td>
<td>±4</td>
<td>—</td>
<td>21</td>
<td>—</td>
</tr>
<tr>
<td>MAX/TRS3243</td>
<td>250</td>
<td>3</td>
<td>5</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>—</td>
<td>1</td>
<td>Auto-Powerdown</td>
</tr>
<tr>
<td>MAX/TRS3243E</td>
<td>500</td>
<td>3</td>
<td>5</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>1</td>
<td>Auto-Powerdown</td>
</tr>
<tr>
<td>TRS3253E</td>
<td>1,000</td>
<td>3</td>
<td>5</td>
<td>3.3 or 5.0 and 1.8</td>
<td>±15</td>
<td>—</td>
<td>1</td>
<td>Auto-Powerdown+</td>
</tr>
<tr>
<td>TRSF3243</td>
<td>1,000</td>
<td>3</td>
<td>5</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>—</td>
<td>1</td>
<td>Auto-Powerdown</td>
</tr>
<tr>
<td>LT1030</td>
<td>120</td>
<td>4</td>
<td>0</td>
<td>±15.0</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>—</td>
</tr>
<tr>
<td>MAX/TRS208</td>
<td>120</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>±15</td>
<td>—</td>
<td>20</td>
<td>—</td>
</tr>
<tr>
<td>MAX/TRS211/3</td>
<td>120</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>±15</td>
<td>—</td>
<td>20</td>
<td>—</td>
</tr>
<tr>
<td>GD753323</td>
<td>120</td>
<td>5</td>
<td>3</td>
<td>±9.0 and 5.0</td>
<td>—</td>
<td>—</td>
<td>±32</td>
<td>—</td>
</tr>
<tr>
<td>SN65C3238E</td>
<td>1,000</td>
<td>5</td>
<td>3</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>2</td>
<td>Auto-Powerdown+</td>
</tr>
<tr>
<td>SN75C3238E</td>
<td>1,000</td>
<td>5</td>
<td>3</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>2</td>
<td>Auto-Powerdown+</td>
</tr>
<tr>
<td>MAX/TRS3237E</td>
<td>1,000</td>
<td>5</td>
<td>3</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>2</td>
<td>—</td>
</tr>
<tr>
<td>MAX/TRS3238</td>
<td>250</td>
<td>5</td>
<td>3</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>—</td>
<td>2</td>
<td>Auto-Powerdown</td>
</tr>
<tr>
<td>MAX/TRS3238E</td>
<td>400</td>
<td>5</td>
<td>3</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>2</td>
<td>Auto-Powerdown</td>
</tr>
<tr>
<td>TRSF3238E</td>
<td>1,000</td>
<td>5</td>
<td>3</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>Yes</td>
<td>2</td>
<td>Auto-Powerdown+</td>
</tr>
<tr>
<td>TRSF3243</td>
<td>250</td>
<td>6</td>
<td>10</td>
<td>3.3 or 5.0</td>
<td>±15</td>
<td>—</td>
<td>2</td>
<td>Auto-Powerdown</td>
</tr>
</tbody>
</table>
RS-422/RS-485 Interfaces

Low supply voltage, with three state driver and receiver output

Texas Instruments is the world leader in RS-422/RS-485, with a selection of transceivers for any application. TI provides industry-standard RS-422/RS-485 solutions for industrial automation, motion control, e-meters, security electronics, building automation and hundreds of other applications where robust communication with high noise-immunity is needed over long cable lengths. TI offers single channels or multiple channels, half- or full-duplex, 3.3V-supply or 5V-supply, with a variety of features including high voltage standoff, failsafe receivers, and integrated isolation. Evaluation kits, simulation models, and application notes make it easy to design with RS-422/RS-485 from Texas Instruments.

### RS-422

<table>
<thead>
<tr>
<th>Part Number</th>
<th># of TX/RX</th>
<th>Supply Voltage(s) (V)</th>
<th>Sampling Rate (Mbps)</th>
<th>ESD (kV)</th>
<th>Icc (max) (mA)</th>
<th>Footprint</th>
<th>RS422</th>
<th>RS423</th>
</tr>
</thead>
<tbody>
<tr>
<td>UA9637A</td>
<td>0 TX/2 RX</td>
<td>5</td>
<td>10</td>
<td>2</td>
<td>50</td>
<td>uA9637</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>AM26C32/LS32A/LS33A</td>
<td>0 TX/4 RX</td>
<td>5</td>
<td>10</td>
<td>2</td>
<td>70</td>
<td>AM26LS32</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>AM26LV32/E</td>
<td>0 TX/4 RX</td>
<td>3</td>
<td>32</td>
<td>15</td>
<td>17</td>
<td>AM26LS32</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>SN75176A/6B/8B</td>
<td>1 TX/1 RX</td>
<td>5</td>
<td>10</td>
<td>2</td>
<td>50</td>
<td>SN75176</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>SN75179B</td>
<td>1 TX/1 RX</td>
<td>5</td>
<td>10</td>
<td>2</td>
<td>70</td>
<td>SN75179</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>SN75ALS180/181</td>
<td>1 TX/1 RX</td>
<td>5</td>
<td>25</td>
<td>2</td>
<td>30</td>
<td>SN75ALS180</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>AM26LS31/C31</td>
<td>4 TX/0 RX</td>
<td>5</td>
<td>15</td>
<td>2</td>
<td>65</td>
<td>uA9638</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>AM26LV31/E</td>
<td>4 TX/0 RX</td>
<td>3</td>
<td>32</td>
<td>15</td>
<td>0</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>MC3487</td>
<td>4 TX/0 RX</td>
<td>5</td>
<td>10</td>
<td>2</td>
<td>85</td>
<td>MC3487</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>SN75ALS174/A</td>
<td>4 TX/0 RX</td>
<td>5</td>
<td>20</td>
<td>2</td>
<td>55</td>
<td>MC3487</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

### RS-485

<table>
<thead>
<tr>
<th>Device Name</th>
<th># of TX/RX</th>
<th>Supply Voltage(s) (V)</th>
<th>Sampling Rate (Mbps)</th>
<th>Duplex</th>
<th>ESD (kV)</th>
<th>Icc (mA)</th>
<th>Fail Safe</th>
<th>Footprint</th>
</tr>
</thead>
<tbody>
<tr>
<td>SN75157</td>
<td>0 TX/2 RX</td>
<td>5</td>
<td>4</td>
<td>Simplex</td>
<td>2</td>
<td>50</td>
<td>None</td>
<td>SN75157</td>
</tr>
<tr>
<td>SN75173/ALS173</td>
<td>0 TX/4 RX</td>
<td>5</td>
<td>10</td>
<td>Simplex</td>
<td>2</td>
<td>70</td>
<td>Open</td>
<td>AM26LS32</td>
</tr>
<tr>
<td>SN65175</td>
<td>0 TX/4 RX</td>
<td>5</td>
<td>10</td>
<td>Simplex</td>
<td>2</td>
<td>70</td>
<td>None</td>
<td>MC3486</td>
</tr>
<tr>
<td>SN75175/ALS175</td>
<td>0 TX/4 RX</td>
<td>5</td>
<td>10</td>
<td>Half</td>
<td>2</td>
<td>70</td>
<td>None</td>
<td>MC3486</td>
</tr>
<tr>
<td>SN65HVD3080E/83E/86E</td>
<td>1 TX/1 RX</td>
<td>5</td>
<td>20</td>
<td>Full</td>
<td>16</td>
<td>0</td>
<td>Short,Open,Idle</td>
<td>LBC180</td>
</tr>
<tr>
<td>SN65176B</td>
<td>1 TX/1 RX</td>
<td>5</td>
<td>10</td>
<td>Half</td>
<td>2</td>
<td>70</td>
<td>None</td>
<td>SN75176</td>
</tr>
<tr>
<td>SN65ALS176</td>
<td>1 TX/1 RX</td>
<td>5</td>
<td>35</td>
<td>Half</td>
<td>2</td>
<td>30</td>
<td>Open</td>
<td>SN75176</td>
</tr>
<tr>
<td>SN65HVD3082E/5E/8E</td>
<td>1 TX/1 RX</td>
<td>5</td>
<td>20</td>
<td>Half</td>
<td>15</td>
<td>0</td>
<td>Short,Open,Idle</td>
<td>SN75176</td>
</tr>
<tr>
<td>SN65HVD485E</td>
<td>1 TX/1 RX</td>
<td>5</td>
<td>10</td>
<td>Half</td>
<td>15</td>
<td>2</td>
<td>Open</td>
<td>SN75176</td>
</tr>
<tr>
<td>SN75176A</td>
<td>1 TX/1 RX</td>
<td>5</td>
<td>10</td>
<td>Half</td>
<td>2</td>
<td>50</td>
<td>None</td>
<td>SN75176</td>
</tr>
<tr>
<td>SN7517xB</td>
<td>1 TX/1 RX</td>
<td>5</td>
<td>10</td>
<td>Half</td>
<td>2</td>
<td>70</td>
<td>None</td>
<td>SN75176</td>
</tr>
<tr>
<td>SN75ALS176/A/B</td>
<td>1 TX/1 RX</td>
<td>5</td>
<td>35</td>
<td>Half</td>
<td>2</td>
<td>30</td>
<td>Open</td>
<td>SN75176</td>
</tr>
<tr>
<td>TL3695</td>
<td>1 TX/1 RX</td>
<td>5</td>
<td>10</td>
<td>Half</td>
<td>2</td>
<td>50</td>
<td>Open</td>
<td>SN75176</td>
</tr>
<tr>
<td>SN75179B</td>
<td>1 TX/1 RX</td>
<td>5</td>
<td>10</td>
<td>Full</td>
<td>2</td>
<td>70</td>
<td>None</td>
<td>SN75179</td>
</tr>
<tr>
<td>SNx5ALS180</td>
<td>1 TX/1 RX</td>
<td>5</td>
<td>25</td>
<td>Full</td>
<td>2</td>
<td>30</td>
<td>Open</td>
<td>SN75ALS180</td>
</tr>
<tr>
<td>SN751177/ALS1177</td>
<td>2 TX/2 RX</td>
<td>5</td>
<td>10</td>
<td>Full</td>
<td>2</td>
<td>110</td>
<td>None</td>
<td>MC34050</td>
</tr>
<tr>
<td>SN65C1168</td>
<td>2 TX/2 RX</td>
<td>5</td>
<td>10</td>
<td>Full</td>
<td>2</td>
<td>9</td>
<td>Open</td>
<td>MC34051</td>
</tr>
<tr>
<td>SN751178/ALS1178</td>
<td>2 TX/2 RX</td>
<td>5</td>
<td>10</td>
<td>Full</td>
<td>2</td>
<td>110</td>
<td>Open</td>
<td>MC34051</td>
</tr>
<tr>
<td>SN75ALS170/A</td>
<td>3 TX/3 RX</td>
<td>5</td>
<td>20</td>
<td>Half</td>
<td>2</td>
<td>90</td>
<td>Open</td>
<td>SN75ALS170</td>
</tr>
</tbody>
</table>
Peripheral Drivers

Dual Very-High Speed, High-Current, Open-Collector, Quadruple Half-H Peripheral Drivers

TI’s peripheral drivers are the perfect choice for relay drivers, power supplies, motor control, incandescent lamps, and driving MOSFET gates. These devices use logic gates and output transistors to switch large currents at high voltages. With support for up to 2A of current output per channel, and up to 50V, these devices are useful for driving low and high voltage peripherals within refrigerators, washing machines, HVAC, motor control, and power delivery for telecom infrastructure.

Over Current Protected Relay Driver

<table>
<thead>
<tr>
<th>Device</th>
<th>Peak Output Current (mA)</th>
<th>Output Voltage (max) (V)</th>
<th>Delay Time (typ) (ns)</th>
<th>Input Compatibility</th>
<th>Drives per Package</th>
<th>GATE</th>
<th>Quad Half-H</th>
<th>Output Clamp Diodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>DS3680</td>
<td>100</td>
<td>60</td>
<td>1,000</td>
<td>CMOS, TTL</td>
<td>4</td>
<td>BUFFER</td>
<td>—</td>
<td>Yes</td>
</tr>
<tr>
<td>ULN2003LV</td>
<td>140</td>
<td>8</td>
<td>80</td>
<td>CMOS</td>
<td>7</td>
<td>INVERT</td>
<td>—</td>
<td>Yes</td>
</tr>
<tr>
<td>ULN2003V12</td>
<td>140</td>
<td>16</td>
<td>80</td>
<td>CMOS</td>
<td>7</td>
<td>INVERT</td>
<td>—</td>
<td>Yes</td>
</tr>
<tr>
<td>TPL9201/2</td>
<td>150</td>
<td>17</td>
<td>10,80</td>
<td>CMOS</td>
<td>8</td>
<td>INVERT</td>
<td>—</td>
<td>Yes</td>
</tr>
<tr>
<td>SN75372</td>
<td>500</td>
<td>24</td>
<td>20</td>
<td>TTL</td>
<td>2</td>
<td>NAND</td>
<td>—</td>
<td>Yes</td>
</tr>
<tr>
<td>SN75374</td>
<td>500</td>
<td>24</td>
<td>20</td>
<td>TTL</td>
<td>4</td>
<td>NAND</td>
<td>—</td>
<td>Yes</td>
</tr>
<tr>
<td>SN7545x/B</td>
<td>500</td>
<td>30</td>
<td>27</td>
<td>TTL</td>
<td>2</td>
<td>AND, NAND, OR, NOR</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>SN75462/3</td>
<td>500</td>
<td>35</td>
<td>45</td>
<td>TTL</td>
<td>2</td>
<td>NAND, OR</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>SN75468/9</td>
<td>500</td>
<td>100</td>
<td>250</td>
<td>CMOS, TTL</td>
<td>7</td>
<td>INVERT</td>
<td>—</td>
<td>Yes</td>
</tr>
<tr>
<td>SN75471/2</td>
<td>500</td>
<td>70</td>
<td>45</td>
<td>TTL</td>
<td>2</td>
<td>AND, NAND</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>SN75477/8</td>
<td>500</td>
<td>100</td>
<td>200</td>
<td>CMOS, TTL</td>
<td>2</td>
<td>NAND, OR</td>
<td>—</td>
<td>Yes</td>
</tr>
<tr>
<td>ULN2002A</td>
<td>500</td>
<td>50</td>
<td>250</td>
<td>CMOS</td>
<td>7</td>
<td>INVERT</td>
<td>—</td>
<td>Yes</td>
</tr>
<tr>
<td>ULN2003A/B</td>
<td>500</td>
<td>50</td>
<td>250</td>
<td>CMOS, TTL</td>
<td>7</td>
<td>INVERT</td>
<td>—</td>
<td>Yes</td>
</tr>
<tr>
<td>ULN2004A</td>
<td>500</td>
<td>50</td>
<td>250</td>
<td>CMOS</td>
<td>7</td>
<td>INVERT</td>
<td>—</td>
<td>Yes</td>
</tr>
<tr>
<td>ULN2803A</td>
<td>500</td>
<td>50</td>
<td>130</td>
<td>CMOS, TTL</td>
<td>8</td>
<td>INVERT</td>
<td>—</td>
<td>Yes</td>
</tr>
<tr>
<td>TPL7407L</td>
<td>600</td>
<td>40</td>
<td>250</td>
<td>CMOS, TTL</td>
<td>7</td>
<td>INVERT</td>
<td>—</td>
<td>Yes</td>
</tr>
<tr>
<td>SN75437A</td>
<td>750</td>
<td>70</td>
<td>1,950</td>
<td>CMOS, TTL</td>
<td>4</td>
<td>INVERT</td>
<td>—</td>
<td>Yes</td>
</tr>
<tr>
<td>L293/D</td>
<td>2,000</td>
<td>36</td>
<td>800</td>
<td>TTL</td>
<td>4</td>
<td>BUFFER</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SN754410</td>
<td>2,000</td>
<td>36</td>
<td>800</td>
<td>CMOS, TTL</td>
<td>4</td>
<td>BUFFER</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Product and Packaging Quick Select Tool

TI has developed the industry’s largest selection of low-power and wide functionality interface parts with features designed to satisfy an extensive range of applications. Use the below tool to help make the selection process easier.

### Interface Quick Select

- **RS-232**
  - MAX/TRS323 2E
    - RX/TX = 2/2
  - MAX/TRS3243
    - RX/TX = 3/5
  - MAX/TRS3238
    - RX/TX = 5/3
  - MAX/TRS208
    - RX/TX = 4/4

- **RS-422**
  - AM26LS31/C31
    - RX/TX = 4/0
  - AM26C32/LS32A/LS33A
    - RX/TX = 4/0
  - SN75C1168
    - RX/TX = 2/2
  - UA9637A
    - RX/TX = 0/2

- **Peripheral Drivers**
  - SN75176A/6B/8B
    - RX/TX = 1/1
  - SN75ALS180/181
    - RX/TX = 1/1
  - SN75175/ALS175
    - RX/TX = 0/4
  - SN75117/ALS1177
    - RX/TX = 2/2
  - ULN200 3A/B
    - 500 mA/ch, 7ch
  - TPL7407L
    - 600 mA/ch, 7ch
  - ULN280 3A
    - 500 mA/ch, 8ch
  - L293/D
    - 200 mA/ch, 4ch

### Small Packaging

<table>
<thead>
<tr>
<th>Pin Count</th>
<th>Package Type</th>
<th>TI Package Designator</th>
<th>Body Length (mm)</th>
<th>Body Width (mm)</th>
<th>Lead Width (mm)</th>
<th>Pitch Nom</th>
<th>Lead Foot (mm)</th>
<th>Pkg Width (mm)</th>
<th>Height (max) (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>SOIC</td>
<td>D</td>
<td>4.8-5</td>
<td>3.81-4</td>
<td>0.35-0.51</td>
<td>1</td>
<td>0.4-1.12</td>
<td>5.8-6.2</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>SOIC</td>
<td>D</td>
<td>8.55-8.75</td>
<td>3.81-4</td>
<td>0.35-0.51</td>
<td>1</td>
<td>0.4-1.12</td>
<td>5.8-6.2</td>
<td>2</td>
</tr>
<tr>
<td>16</td>
<td>SOIC</td>
<td>D</td>
<td>9.8-10</td>
<td>3.81-4</td>
<td>0.35-0.51</td>
<td>1</td>
<td>0.4-1.12</td>
<td>5.8-6.2</td>
<td>2</td>
</tr>
<tr>
<td>14</td>
<td>SSOP</td>
<td>DB</td>
<td>5.9-6.5</td>
<td>5-5.6</td>
<td>0.22-0.38</td>
<td>0</td>
<td>0.55-0.95</td>
<td>7.4-8.2</td>
<td>2</td>
</tr>
<tr>
<td>16</td>
<td>SSOP</td>
<td>DB</td>
<td>5.9-6.5</td>
<td>5-5.6</td>
<td>0.22-0.38</td>
<td>0</td>
<td>0.55-0.95</td>
<td>7.4-8.2</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>MSOP</td>
<td>DGK</td>
<td>2.9-3.1</td>
<td>2.9-3.1</td>
<td>0.25-0.38</td>
<td>0</td>
<td>0.4-0.7</td>
<td>4.75-5.05</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>SOIC</td>
<td>DWR</td>
<td>11.35-11.75</td>
<td>7.4-7.6</td>
<td>0.31-0.51</td>
<td>1</td>
<td>0.4-1.27</td>
<td>9.97-10.63</td>
<td>3</td>
</tr>
<tr>
<td>14</td>
<td>PDIP</td>
<td>N</td>
<td>18.92-19.69</td>
<td>6.1-6.6</td>
<td>0.76-1.14</td>
<td>3</td>
<td>N/A</td>
<td>6.1-6.6</td>
<td>5</td>
</tr>
<tr>
<td>16</td>
<td>PDIP</td>
<td>N</td>
<td>18.92-19.69</td>
<td>6.1-6.6</td>
<td>0.76-1.14</td>
<td>3</td>
<td>N/A</td>
<td>6.1-6.6</td>
<td>5</td>
</tr>
<tr>
<td>20</td>
<td>PDIP</td>
<td>N</td>
<td>23.88-26.92</td>
<td>6.1-6.6</td>
<td>0.76-1.14</td>
<td>3</td>
<td>N/A</td>
<td>6.1-6.6</td>
<td>5</td>
</tr>
<tr>
<td>14</td>
<td>TSSOP</td>
<td>PW</td>
<td>4.9-5.1</td>
<td>4.3-4.5</td>
<td>0.19-0.3</td>
<td>0</td>
<td>0.5-0.75</td>
<td>6.2-6.6</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>TSSOP</td>
<td>PW</td>
<td>4.9-5.1</td>
<td>4.3-4.5</td>
<td>0.19-0.3</td>
<td>0</td>
<td>0.5-0.75</td>
<td>6.2-6.6</td>
<td>1</td>
</tr>
<tr>
<td>20</td>
<td>TSSOP</td>
<td>PW</td>
<td>6.4-6.6</td>
<td>4.3-4.5</td>
<td>0.19-0.3</td>
<td>0</td>
<td>0.5-0.75</td>
<td>6.2-6.6</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>X2QFN</td>
<td>RUG</td>
<td>1.45-1.55</td>
<td>1.45-1.55</td>
<td>0.2-0.3</td>
<td>0</td>
<td>0.3-0.4</td>
<td>1.45-1.55</td>
<td>0</td>
</tr>
</tbody>
</table>
## 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.

<table>
<thead>
<tr>
<th>Products</th>
<th>Applications</th>
<th>URLs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio</td>
<td>Automotive and Transportation</td>
<td><a href="http://www.ti.com/automotive">www.ti.com/automotive</a></td>
</tr>
<tr>
<td>Amplifiers</td>
<td>Communications and Telecom</td>
<td><a href="http://www.ti.com/communications">www.ti.com/communications</a></td>
</tr>
<tr>
<td>Data Converters</td>
<td>Computers and Peripherals</td>
<td><a href="http://www.ti.com/computers">www.ti.com/computers</a></td>
</tr>
<tr>
<td>DLP® Products</td>
<td>Consumer Electronics</td>
<td><a href="http://www.ti.com/consumer-apps">www.ti.com/consumer-apps</a></td>
</tr>
<tr>
<td>DSP</td>
<td>Energy and Lighting</td>
<td><a href="http://www.ti.com/energy">www.ti.com/energy</a></td>
</tr>
<tr>
<td>Clocks and Timers</td>
<td>Industrial</td>
<td><a href="http://www.ti.com/industrial">www.ti.com/industrial</a></td>
</tr>
<tr>
<td>Interface</td>
<td>Medical</td>
<td><a href="http://www.ti.com/medical">www.ti.com/medical</a></td>
</tr>
<tr>
<td>Logic</td>
<td>Security</td>
<td><a href="http://www.ti.com/security">www.ti.com/security</a></td>
</tr>
<tr>
<td>Power Mgmt</td>
<td>Space, Avionics and Defense</td>
<td><a href="http://www.ti.com/space-avionics-defense">www.ti.com/space-avionics-defense</a></td>
</tr>
<tr>
<td>Microcontrollers</td>
<td>Video and Imaging</td>
<td><a href="http://www.ti.com/video">www.ti.com/video</a></td>
</tr>
<tr>
<td>RFID</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OMAP Applications Processors</td>
<td>TI E2E Community</td>
<td>e2e.ti.com</td>
</tr>
<tr>
<td>Wireless Connectivity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2015, Texas Instruments Incorporated