IL2931 SERIES
LOW DROPOUT VOLTAGE REGULATORS

The LM2931 series consists of positive fixed and adjustable output voltage regulators that are specifically designed to maintain proper regulation with an extremely low input-to-output voltage differential. These devices are capable of supplying output currents in excess of 100 mA and feature a low bias current of 0.4 mA at 10 mA output.

Designed primarily to survive in the harsh automotive environment, these devices will protect all external load circuitry from battery jump starts, and excessive line transients during load dump. This series also includes internal current limiting, thermal shutdown, and additionally, is able to withstand temporary power-up with mirror-image insertion.

Due to the low dropout voltage and bias current specifications, the LM2931 series is ideally suited for battery powered industrial and consumer equipment where an extension of useful battery life is desirable. The 'C' suffix adjustable output regulators feature an output inhibit pin which is extremely useful in microprocessor-based systems.

- Input-to-Output Voltage Differential of Less Then 0.6 V at 100mA
- Output Current in Excess of 100 mA
- Low Bias Current
- 60 V Load Dump Protection
- -50 V Reverse Transient Protection
- Internal Current Limiting with Thermal Shutdown
- Temporary Mirror-Image Protection
- Ideally Suited for Battery Powered Equipment

Ordering Information

<table>
<thead>
<tr>
<th>Device</th>
<th>Output Voltage</th>
<th>Tolerance</th>
<th>Package Case Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Il2931-5</td>
<td>5.0 V</td>
<td>+5%</td>
<td>TO-226AA/TO92, TO-220AB</td>
</tr>
<tr>
<td>Il2931-9</td>
<td>9.0 V</td>
<td>+5%</td>
<td>TO-226AA/TO92, TO-220AB</td>
</tr>
</tbody>
</table>

Maximum Ratings

<table>
<thead>
<tr>
<th>Rating</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Voltage Continuous</td>
<td>Vin</td>
<td>40</td>
<td>Vdc</td>
</tr>
<tr>
<td>Transient Input Voltage (r ≤ 100 ms)</td>
<td>Vin(r)</td>
<td>60</td>
<td>Vpk</td>
</tr>
<tr>
<td>Transient Reverse Polarity Input Voltage 1.0% Duty Cycle, r ≤ 100 ms</td>
<td>-Vin(r)</td>
<td>-50</td>
<td>Vpk</td>
</tr>
<tr>
<td>Power Dissipation Case TO-220AA (TO-92)</td>
<td>PD</td>
<td>Internally Limited</td>
<td>Watts</td>
</tr>
<tr>
<td>TA = +25 °C</td>
<td></td>
<td>178</td>
<td>°C/W</td>
</tr>
<tr>
<td>Thermal Resistance Junction to Ambient</td>
<td>RθJA</td>
<td>83</td>
<td>°C/W</td>
</tr>
<tr>
<td>Thermal Resistance Junction to Case</td>
<td>RθJC</td>
<td></td>
<td>°C/W</td>
</tr>
<tr>
<td>Power Dissipation Case TO-220AB</td>
<td>PD</td>
<td>Internally Limited</td>
<td>Watts</td>
</tr>
<tr>
<td>TA = +25 °C</td>
<td></td>
<td>65</td>
<td>°C/W</td>
</tr>
<tr>
<td>Thermal Resistance Junction to Ambient</td>
<td>RθJC</td>
<td>5.0</td>
<td>°C/W</td>
</tr>
<tr>
<td>Thermal Resistance Junction to Case</td>
<td>RθJC</td>
<td></td>
<td>°C/W</td>
</tr>
<tr>
<td>Tested Operating Junction Temperature Range</td>
<td>TJ</td>
<td>-40 to +125</td>
<td>°C</td>
</tr>
<tr>
<td>Storage Temperature Range</td>
<td>Tstg</td>
<td>-65 to +150</td>
<td>°C</td>
</tr>
</tbody>
</table>
IL2931 SERIES

**IL2931-5**

**Electrical characteristics**

(Vin = 14V, Io = 10mA, Co = 100 μF, Co(ESR) = 0.3 Ω, TJ = +25 °C Note 1, unless otherwise noted)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fixed Output</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Voltage</td>
<td>VO</td>
<td>4.75</td>
<td>5.0</td>
<td>5.25</td>
<td>Vcd</td>
</tr>
<tr>
<td>Vin = 14 V, Io = 10 mA, TJ = 25 °C</td>
<td></td>
<td>4.5</td>
<td>-</td>
<td>5.5</td>
<td></td>
</tr>
<tr>
<td>Vin = 6.0 to 26 V, Io ≤ 100mA, Tj = -40 to 125°C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line Regulation</td>
<td>Reglin</td>
<td>-</td>
<td>2.0</td>
<td>10</td>
<td>mV</td>
</tr>
<tr>
<td>Vin = 9.0 V to 16 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vin = 6.0 V to 26 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load Regulation (Io = 5.0 mA to 100 mA)</td>
<td>Regload</td>
<td>-</td>
<td>14</td>
<td>50</td>
<td>mV</td>
</tr>
<tr>
<td>Output Impedance</td>
<td>Zo</td>
<td>-</td>
<td>200</td>
<td>-</td>
<td>mΩ</td>
</tr>
<tr>
<td>Io = 10 mA, ΔIo = 1.0 mA, f = 100 Hz to 10 kHz</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bias Current</td>
<td>IB</td>
<td>-</td>
<td>5.8</td>
<td>30</td>
<td>mA</td>
</tr>
<tr>
<td>Vin = 14 V, Io = 100 mA, TJ = 25 °C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vin = 6.0 V to 26 V, Io = 10 mA, Tj = -40 to +125 °C</td>
<td></td>
<td>-</td>
<td>0.4</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Output Noise Voltage (f = 10 Hz to 100 Hz)</td>
<td>Vn</td>
<td>-</td>
<td>700</td>
<td>-</td>
<td>μVrms</td>
</tr>
<tr>
<td>Long-Term Stability</td>
<td>S</td>
<td>-</td>
<td>20</td>
<td>-</td>
<td>mV/kHz</td>
</tr>
<tr>
<td>Ripple Rejection (f = 120 Hz)</td>
<td>RR</td>
<td>60</td>
<td>90</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Dropout Voltage</td>
<td>Vm-Vn</td>
<td>-</td>
<td>0.015</td>
<td>0.2</td>
<td>V</td>
</tr>
<tr>
<td>Io=10A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Io=100A</td>
<td></td>
<td></td>
<td>0.06</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>Over-Voltage Shutdown Threshold</td>
<td>Vth(ov)</td>
<td>26</td>
<td>29.5</td>
<td>40</td>
<td>V</td>
</tr>
<tr>
<td>Vin = -15 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Voltage with Reverse Polarity Input</td>
<td>Vn</td>
<td>-</td>
<td>0.3</td>
<td>0</td>
<td>V</td>
</tr>
<tr>
<td>(Vin = -15 V)</td>
<td></td>
<td></td>
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<td></td>
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</tr>
</tbody>
</table>

**IL2931-9**

**Electrical characteristics**

(Vin = 16V, Io = 10 mA)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Unit</th>
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<tbody>
<tr>
<td><strong>Fixed Output</strong></td>
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<td></td>
</tr>
<tr>
<td>Output Voltage</td>
<td>VO</td>
<td>8.55</td>
<td>9.0</td>
<td>9.45</td>
<td>Vcd</td>
</tr>
<tr>
<td>Vin = 16 V, Io = 10 mA, TJ = 25 °C</td>
<td></td>
<td>8.1</td>
<td>-</td>
<td>9.9</td>
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</tr>
<tr>
<td>Vin = 10 to 26 V, Io ≤ 100mA, Tj = -40 to +125°C</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Line Regulation</td>
<td>Reglin</td>
<td>-</td>
<td>4.0</td>
<td>20</td>
<td>mV</td>
</tr>
<tr>
<td>Vin = 9.0 V to 16 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vin = 6.0 V to 26 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load Regulation (Io = 5.0 mA to 100 mA)</td>
<td>Regload</td>
<td>-</td>
<td>30</td>
<td>100</td>
<td>mV</td>
</tr>
<tr>
<td>Output Impedance</td>
<td>Zo</td>
<td>-</td>
<td>200</td>
<td>-</td>
<td>mΩ</td>
</tr>
<tr>
<td>Io = 10 mA, ΔIo = 1.0 mA, f = 100 Hz to 10 kHz</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bias Current</td>
<td>IB</td>
<td>-</td>
<td>5.8</td>
<td>30</td>
<td>mA</td>
</tr>
<tr>
<td>Vin = 14 V, Io = 100 mA, TJ = 25 °C</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Vin = 6.0 V to 26 V, Io = 10 mA, Tj = -40 to +125 °C</td>
<td></td>
<td>-</td>
<td>0.4</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Output Noise Voltage (f = 10 Hz to 100 Hz)</td>
<td>Vn</td>
<td>-</td>
<td>700</td>
<td>-</td>
<td>μVrms</td>
</tr>
<tr>
<td>Long-Term Stability</td>
<td>S</td>
<td>-</td>
<td>20</td>
<td>-</td>
<td>mV/kHz</td>
</tr>
<tr>
<td>Ripple Rejection (f = 120 Hz)</td>
<td>RR</td>
<td>60</td>
<td>90</td>
<td>-</td>
<td>dB</td>
</tr>
<tr>
<td>Dropout Voltage</td>
<td>Vm-Vn</td>
<td>-</td>
<td>0.015</td>
<td>0.2</td>
<td>V</td>
</tr>
<tr>
<td>Io=10A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Io=100A</td>
<td></td>
<td></td>
<td>0.06</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>Over-Voltage Shutdown Threshold</td>
<td>Vth(ov)</td>
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<td>40</td>
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</tr>
<tr>
<td>Vin = -15 V</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output Voltage with Reverse Polarity Input</td>
<td>Vn</td>
<td>-</td>
<td>0.3</td>
<td>0</td>
<td>V</td>
</tr>
<tr>
<td>(Vin = -15 V)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
1. Low duty cycle pulse techniques are used during test to maintain junction temperature as close to ambient as possible.