General Description

The MIC94030 and MIC94031 are 4-terminal silicon gate P-channel MOSFETs that provide low on-resistance in a very small package.

Designed for high-side switch applications where space is critical, the MIC94030/1 exhibits an on-resistance of typically 0.75 Ω at 4.5V gate-to-source voltage. The MIC94030/1 also operates with only 2.7V gate-to-source voltage.

The MIC94030 is the basic 4-lead P-channel MOSFET. The MIC94031 is a variation that includes an internal gate pull-up resistor that can reduce the system parts count in many applications.

The 4-terminal SOT-143 package permits a substrate connection separate from the source connection. This 4-terminal configuration improves the θJA (improved heat dissipation) and makes analog switch applications practical.

The small size, low threshold, and low RDS(on) make the MIC94030/1 the ideal choice for PCMCIA card sleep mode or distributed power management applications.

Features

- 13.5V minimum drain-to-source breakdown
- 0.75 Ω typical on-resistance
  - at 4.5V gate-to-source voltage
- 0.45 Ω typical on-resistance
  - at 10V gate-to-source voltage
- Operates with 2.7V gate-to-source voltage
- Separate substrate connection for added control
- Industry’s smallest surface mount package

Applications

- Distributed power management
- PCMCIA card power management
- Battery-powered computers, peripherals
- Hand-held bar-code scanners
- Portable communications equipment

Ordering Information

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Standard</th>
<th>Marking</th>
<th>Pb-Free</th>
<th>Marking</th>
<th>Junction Temp. Range</th>
<th>Package</th>
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<tbody>
<tr>
<td>MIC94030BM4</td>
<td>P30</td>
<td>MIC94030YM4</td>
<td>P30</td>
<td>−55° to +150°C</td>
<td>SOT-143</td>
<td></td>
</tr>
<tr>
<td>MIC94031BM4</td>
<td>P31</td>
<td>MIC94031YM4</td>
<td>P31</td>
<td>−55° to +150°C</td>
<td>SOT-143</td>
<td></td>
</tr>
</tbody>
</table>

Pin Configuration

![Pin Configuration Diagram](image)

Typical PCB Layout

![Typical PCB Layout Diagram](image)

TinyFET is a registered trademark of Micrel, Inc.
Schematic Symbol

Functional Diagrams

Schematic Symbol

MIC94030

MIC94031

Internal gate-to-source pull-up resistor

~500kΩ
### Absolute Maximum Ratings\(^{(1)}\)

*Voltage and current values are negative. Signs not shown for clarity.*

- **Drain-to-Source Voltage (pulse)**: 16V
- **Gate-to-Source Voltage (pulse)**: 16V
- **Continuous Drain Current**
  - TA = 25°C: 1A
  - TA = 100°C: 0.5A
- **Operating Junction Temperature**: –55°C to +150°C
- **Storage Temperature**: –55°C to +150°C

**Total Power Dissipation**
- TA = 25°C: 568mW
- TA = 100°C: 227mW

**Thermal Resistance**
- θJA: 220°C/W
- θJC: 130°C/W

**Lead Temperature**
- 1/16” from case, 10s: +300°C

### Electrical Characteristics

*Voltage and current values are negative. Signs not shown for clarity.*

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Condition (Note 1)</th>
<th>Min</th>
<th>Typ</th>
<th>Max</th>
<th>Units</th>
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</thead>
<tbody>
<tr>
<td>V(_{BDSS})</td>
<td>Drain-Source Breakdown Voltage</td>
<td>V(_{GS}) = 0V, (I_D) = 250µA</td>
<td>13.5</td>
<td></td>
<td></td>
<td>V</td>
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<tr>
<td>V(_{GS})</td>
<td>Gate Threshold Voltage</td>
<td>V(<em>{DS}) = V(</em>{GS}), (I_D) = 250µA</td>
<td>0.6</td>
<td>1.0</td>
<td>1.4</td>
<td>V</td>
</tr>
<tr>
<td>(I_{GSS})</td>
<td>Gate-Body Leakage</td>
<td>V(<em>{DS}) = 0V, V(</em>{GS}) = 12V, \Note 2, Note 3</td>
<td>1</td>
<td></td>
<td></td>
<td>µA</td>
</tr>
<tr>
<td>R(_{GS})</td>
<td>Gate-Source Resistor</td>
<td>V(<em>{DS}) = 0V, V(</em>{GS}) = 12V, \Note 2, Note 4</td>
<td>500</td>
<td>750</td>
<td>1000</td>
<td>kΩ</td>
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<tr>
<td>C(_{ISS})</td>
<td>Input Capacitance</td>
<td>V(<em>{GS}) = 0V, V(</em>{DS}) = 12V</td>
<td>100</td>
<td></td>
<td></td>
<td>pF</td>
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<tr>
<td>(I_{DSS})</td>
<td>Zero Gate Voltage Drain Current</td>
<td>V(<em>{DS}) = 12V, V(</em>{GS}) = 0V</td>
<td>25</td>
<td></td>
<td></td>
<td>µA</td>
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<tr>
<td>(I_{D(ON)})</td>
<td>On-State Drain Current</td>
<td>V(<em>{DS}) = 10V, V(</em>{GS}) = 10V, \Note 5</td>
<td>6.3</td>
<td></td>
<td></td>
<td>A</td>
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<tr>
<td>R(_{DS(ON)})</td>
<td>Drain-Source On-State Resist</td>
<td>V(_{GS}) = 10V, (I_D) = 100mA</td>
<td>0.45</td>
<td>0.75</td>
<td>1.00</td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V(_{GS}) = 4.5V, (I_D) = 100mA</td>
<td></td>
<td></td>
<td></td>
<td>Ω</td>
</tr>
<tr>
<td></td>
<td></td>
<td>V(_{GS}) = 2.7V, (I_D) = 100mA</td>
<td></td>
<td></td>
<td></td>
<td>Ω</td>
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<tr>
<td>(g_{FS})</td>
<td>Forward Transconductance</td>
<td>V(_{DS}) = 10V, (I_D) = 200mA, \Note 5</td>
<td>480</td>
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<td></td>
<td>mS</td>
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</tbody>
</table>

**Notes:**
1. \(T_A\) = 25°C unless noted. Substrate connected to source for all conditions.
2. ESD gate protection diode conducts during positive gate-to-source voltage excursions.
3. MIC94030 only.
4. MIC94031 only.
5. Pulse Test: Pulse Width ≤ 80µsec, Duty Cycle ≤ 0.5%.
Typical Characteristics

On Resistance vs. Drain Current at 25°C

On Resistance vs. Drain Current at 125°C

Drain Characteristics

Drain Characteristics

Drain Characteristics
Typical Applications

Figure 1. Power Switch Application

Figure 2. Power Control Application

Figure 3. Analog Switch Application