



MIC94050/94051

4-Terminal SymFET™ P-Channel MOSFET



General Description

The MIC94050 and MIC94051 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 MIC94050/1 exhibits an on-resistance of typically 0.125Ω at 4.5V gate-to-source voltage. The MIC94050/1 also operates with only 1.8V gate-to-source voltage.

The MIC94050 is the basic 4-lead P-channel MOSFET. The MIC94051 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 θ_{JA} (improved heat dissipation) and makes reverse-blocking switch applications practical.

The small size, low threshold, and low $R_{DS(on)}$ make the MIC94050/1 the ideal choice for PCMCIA, USB, back-up battery-power, and distributed power management applications.

Features

- 0.125Ω typical on-resistance at 4.5V gate-to-source voltage
- Operates with 1.8V gate-to-source voltage
- Separate substrate connection allows reverse-blocking

Applications

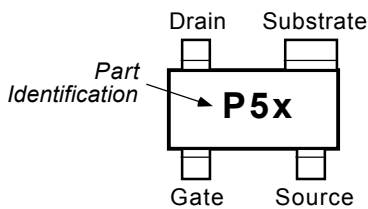
- Distributed power management
- PCMCIA card power management
- USB ports
- Battery-powered computers, peripherals
- Handheld bar-code scanners
- Portable communications equipment
- Reverse blocking battery management

Ordering Information

| Part Number | Temp. Range* | Package | Pb-FREE |
|-------------|-----------------|---------|---------|
| MIC94050BM4 | -40°C to +150°C | SOT-143 | NO |
| MIC94051BM4 | -40°C to +150°C | SOT-143 | NO |
| MIC94050YM4 | -40°C to +150°C | SOT-143 | YES |
| MIC94051YM4 | -40° to +150°C | SOT-143 | YES |

* Operating Junction Temperature

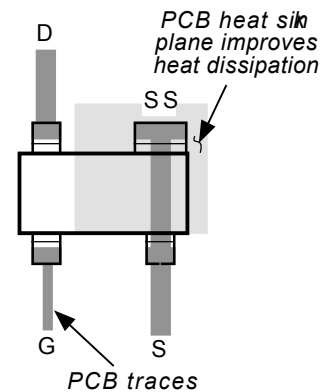
Pin Configuration



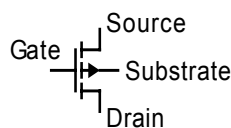
| Part Number | Identification |
|-------------|----------------|
| MIC94050BM4 | P50 |
| MIC94051BM4 | P51 |
| MIC94050YM4 | P50 |
| MIC94051YM4 | P51 |

SOT-143 Package (M4)

Typical PCB Layout

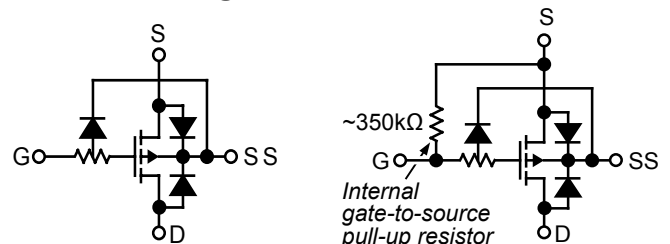


Schematic Symbol



Schematic Symbol

Functional Diagrams



MIC94050

MIC94051

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Absolute Maximum Ratings

| | |
|--|-----------------|
| Drain-to-Source Voltage | -6V |
| Gate-to-Source Voltage | -6V |
| Continuous Drain Current | |
| $T_A = 25^\circ\text{C}$ ($V_{GS} = 4.5\text{V}$) | 1.8A |
| $T_A = 100^\circ\text{C}$ ($V_{GS} = 4.5\text{V}$) | 1.2A |
| Total Power Dissipation | |
| $T_A = 25^\circ\text{C}$ | 568mW |
| $T_A = 100^\circ\text{C}$ | 227mW |
| Operating Junction Temperature | -40°C to +150°C |
| Storage Temperature | -55°C to +150°C |
| ESD Rating, Note 2 | |

Operating Ratings

| | |
|---------------------|---------|
| Thermal Resistance | |
| θ_{JA} | 220°C/W |
| θ_{JC} | 130°C/W |

Electrical Characteristics (Note 1)

| Symbol | Parameter | Condition (Note 1) | Min | Typ | Max | Units |
|--------------|---------------------------------|---|-----|-------|-------|---------------|
| V_{GS} | Gate Threshold Voltage | $V_{DS} = V_{GS}$, $I_D = -250\mu\text{A}$ | 0.5 | | 1.2 | V |
| I_{GSS} | Gate-Body Leakage | $V_{DS} = 0\text{V}$, $V_{GS} = -4.5\text{V}$, Note 2, Note 3 | | | 1 | μA |
| R_{GS} | Gate-Source Resistance | $V_{DS} = 0\text{V}$, $V_{GS} = -4.5\text{V}$, Note 2, Note 4 | 200 | 350 | 500 | k Ω |
| C_{ISS} | Input Capacitance | $V_{GS} = 0\text{V}$, $V_{DS} = -5.5\text{V}$ | | 600 | | pF |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = -5.5\text{V}$, $V_{GS} = 0\text{V}$ | | | 1 | μA |
| | | $V_{DS} = -5.5\text{V}$, $V_{GS} = 0\text{V}$, $T_J = 85^\circ\text{C}$ | | | 5 | μA |
| $R_{DS(ON)}$ | Drain-Source On-Resistance | $V_{GS} = -4.5\text{V}$, $I_D = -100\text{mA}$ | | 0.125 | 0.160 | Ω |
| | | $V_{GS} = -3.6\text{V}$, $I_D = -100\text{mA}$ | | 0.135 | 0.180 | Ω |
| | | $V_{GS} = -2.5\text{V}$, $I_D = -100\text{mA}$ | | 0.165 | 0.200 | Ω |
| | | $V_{GS} = -1.8\text{V}$, $I_D = -100\text{mA}$ | | 0.225 | 0.320 | Ω |
| g_{FS} | Forward Transconductance | $V_{DS} = -5.5\text{V}$, $I_D = -200\text{mA}$, Note 5 | | 3 | | S |

Note 1. $T_A = 25^\circ\text{C}$ unless noted. Substrate connected to source for all conditions.

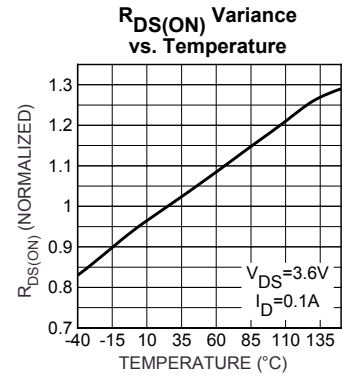
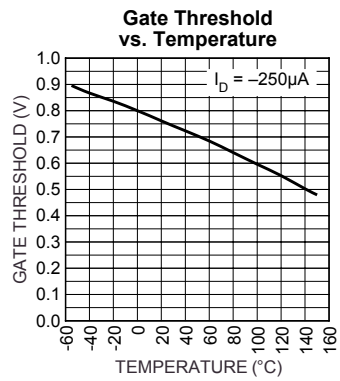
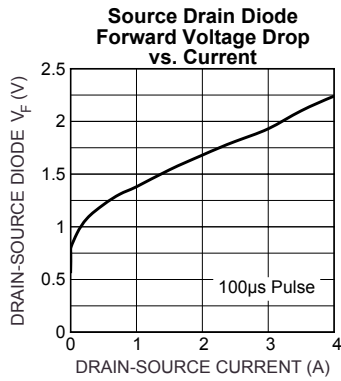
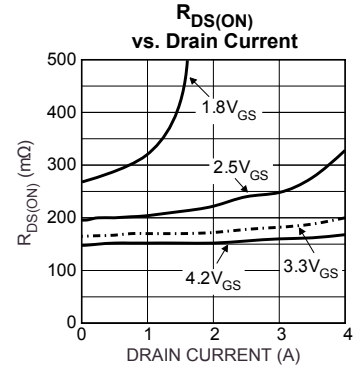
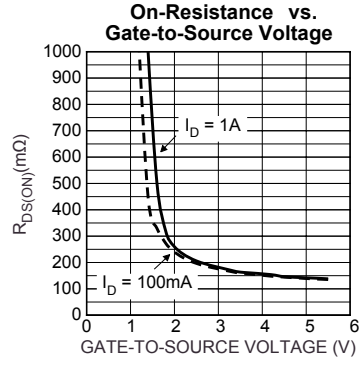
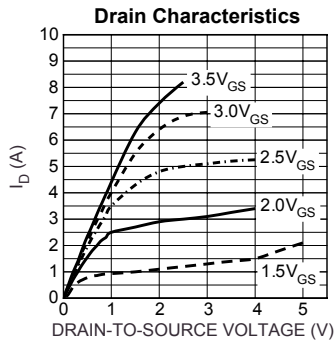
Note 2. ESD gate precautions required

Note 3. MIC94050 only.

Note 4. MIC94051 only.

Note 5. Pulse Test: Pulse Width $\leq 80\mu\text{s}$, Duty Cycle $\leq 0.5\%$.

Typical Characteristics



Typical Applications

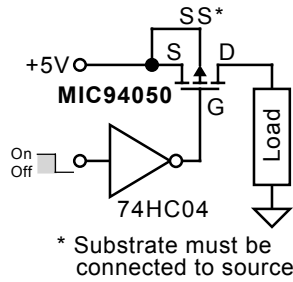


Figure 1. Load Switch Application

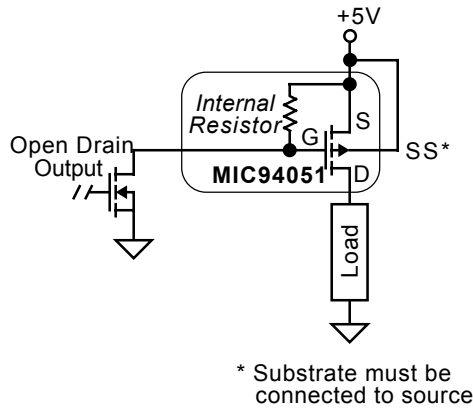


Figure 2. Load Switch Application (with internal gate-source pull-up)

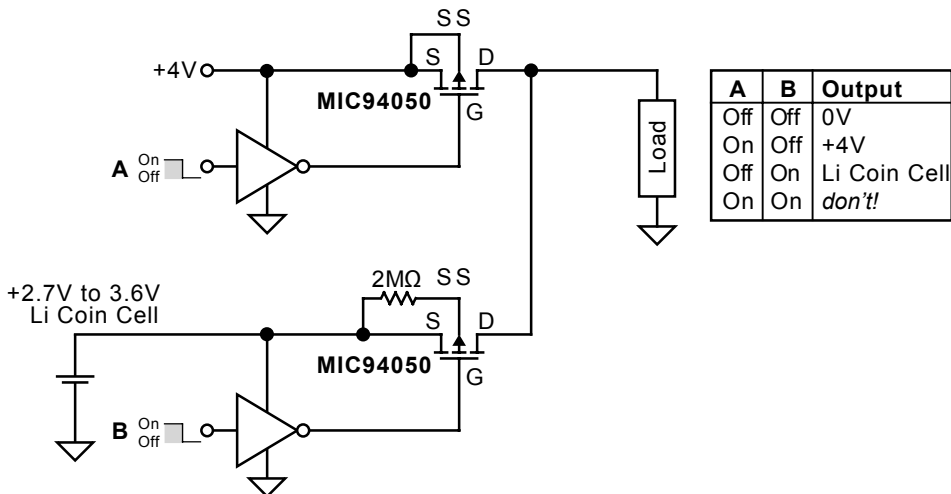
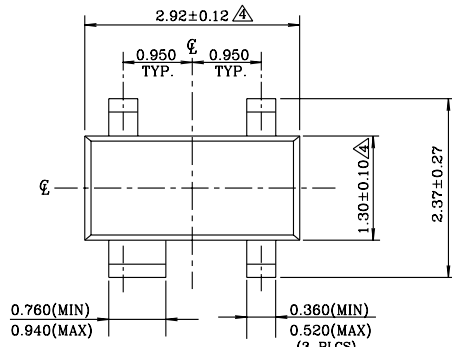
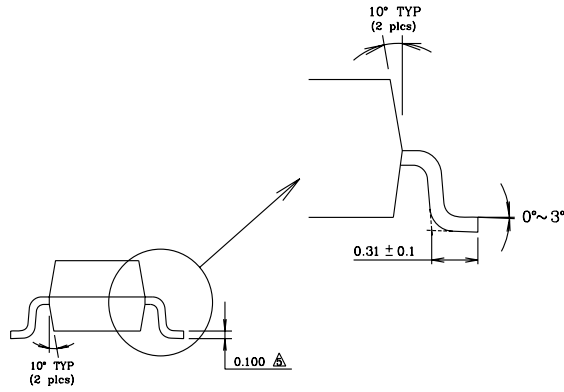


Figure 3. Reverse-Blocking Battery Back-Up Application

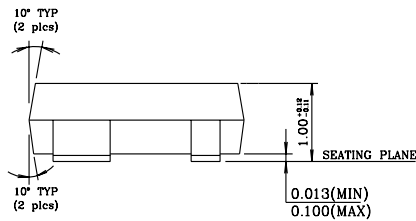
Package Information



TOP VIEW



END VIEW



SIDE VIEW

NOTE:

1. Dimensions and tolerances are as per ANSI Y14.5M, 1982.
 2. Package surface to be mirror finish.
 3. Die is facing up for mold & trim/form.
- △ Dimension are exclusive of mold flash and gate burr.
 △ Dimension are exclusive of solder plating.

SOT-143 (M4)

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