



# 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  $\theta_{JA}$  (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

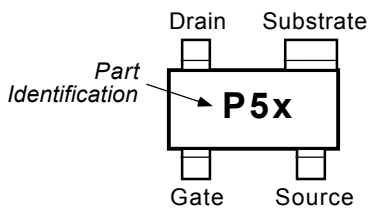
- Distributed power management
- PCMCIA card power management
- USB ports
- Battery-powered computers, peripherals
- Handheld bar-code scanners
- Portable communications equipment
- Reverse blocking battery management

### 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°C to +150°C	SOT-143	YES

\* Operating Junction Temperature

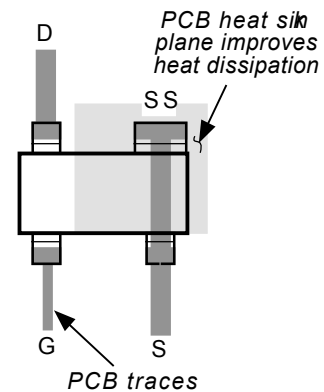
### Pin Configuration



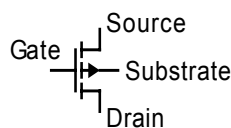
Part Number	Identification
MIC94050BM4	P50
MIC94051BM4	P51
MIC94050YM4	P50
MIC94051YM4	P51

SOT-143 Package (M4)

### Typical PCB Layout

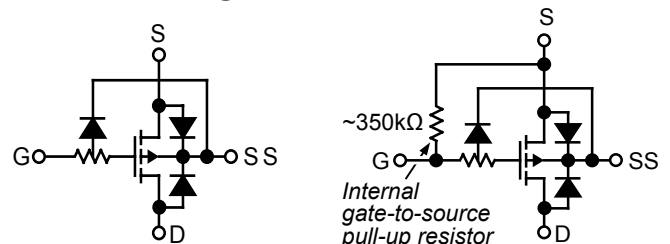


### Schematic Symbol



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, <b>Note 2</b>	

**Operating Ratings**

Thermal Resistance	
$\theta_{JA}$ .....	220°C/W
$\theta_{JC}$ .....	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	$V_{DS} = 0\text{V}$ , $V_{GS} = -4.5\text{V}$ , <b>Note 2, Note 3</b>			1	$\mu\text{A}$
$R_{GS}$	Gate-Source Resistance	$V_{DS} = 0\text{V}$ , $V_{GS} = -4.5\text{V}$ , <b>Note 2, Note 4</b>	200	350	500	k $\Omega$
$C_{ISS}$	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	$\mu\text{A}$
		$V_{DS} = -5.5\text{V}$ , $V_{GS} = 0\text{V}$ , $T_J = 85^\circ\text{C}$			5	$\mu\text{A}$
$R_{DS(ON)}$	Drain-Source On-Resistance	$V_{GS} = -4.5\text{V}$ , $I_D = -100\text{mA}$		0.125	0.160	$\Omega$
		$V_{GS} = -3.6\text{V}$ , $I_D = -100\text{mA}$		0.135	0.180	$\Omega$
		$V_{GS} = -2.5\text{V}$ , $I_D = -100\text{mA}$		0.165	0.200	$\Omega$
		$V_{GS} = -1.8\text{V}$ , $I_D = -100\text{mA}$		0.225	0.320	$\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = -5.5\text{V}$ , $I_D = -200\text{mA}$ , <b>Note 5</b>		3		S

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

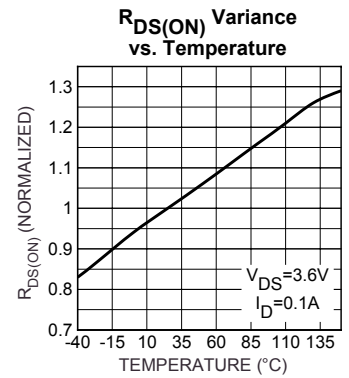
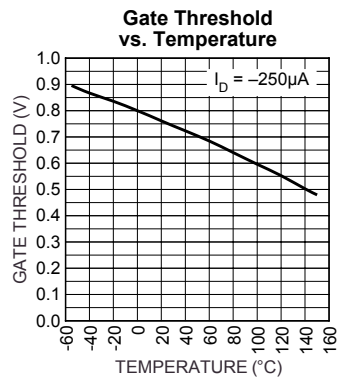
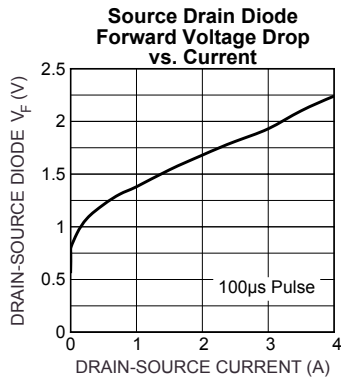
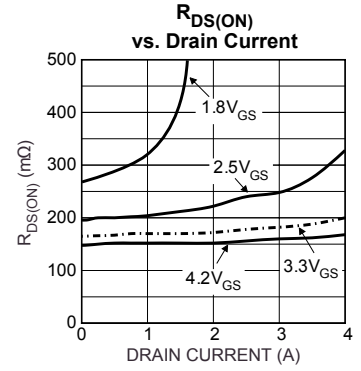
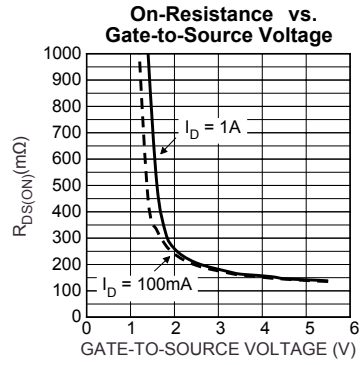
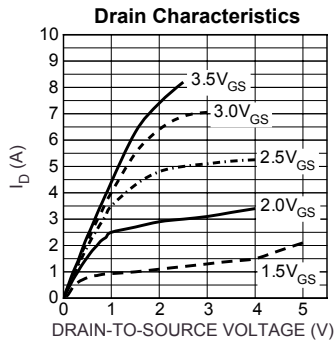
**Note 2.** ESD gate  $\square$  precautions required

**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

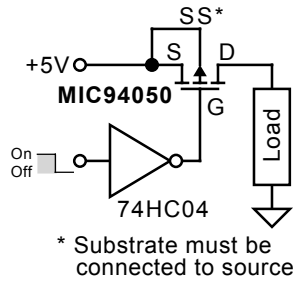


Figure 1. Load Switch Application

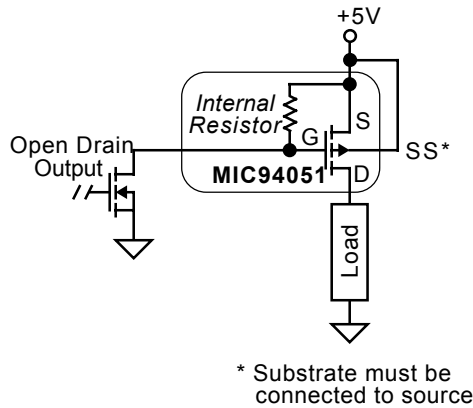


Figure 2. Load Switch Application (with internal gate-source pull-up)

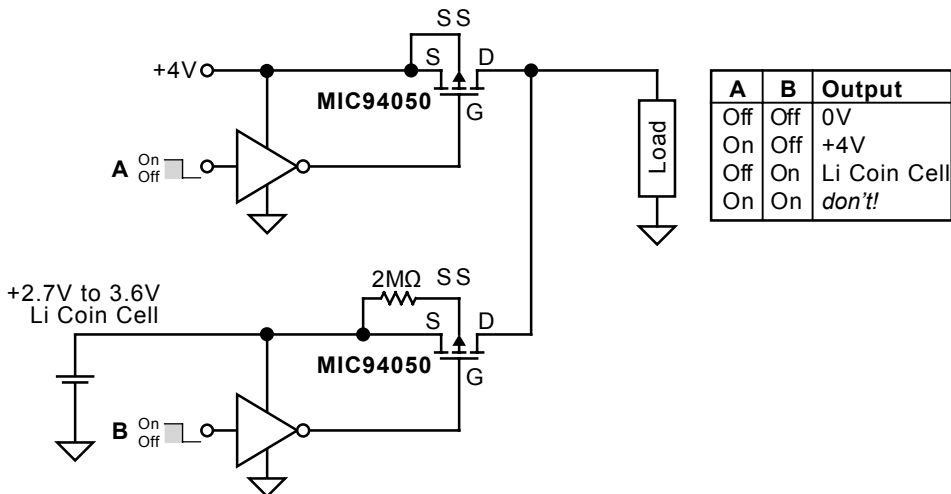
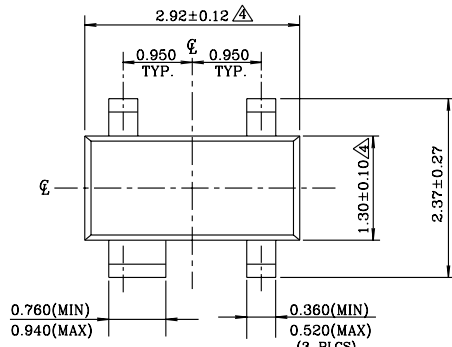
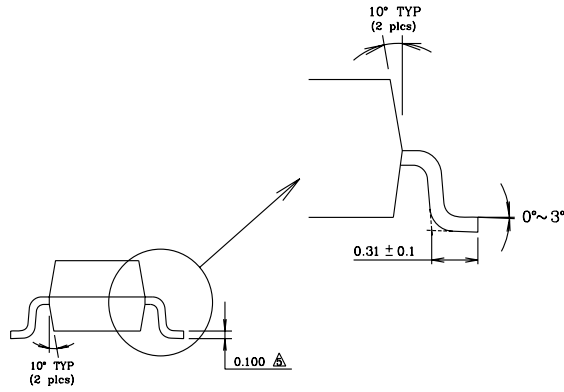


Figure 3. Reverse-Blocking Battery Back-Up Application

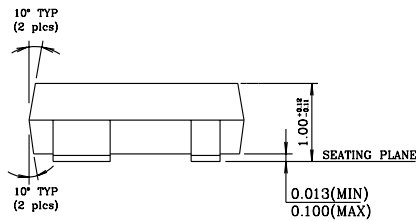
Package Information



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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