



The Infinite Bandwidth Company™

## MIC94050/94051

### 4-Terminal TinyFET™ P-Channel MOSFET

Final

## 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  $0.125\Omega$  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

- $0.125\Omega$  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

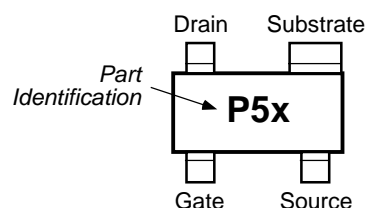
- Distributed power management
- PCMCIA card power management
- USB ports
- Battery-powered computers, peripherals
- Handheld bar-code scanners
- Portable communications equipment
- Reverse blocking battery management

## Ordering Information

Part Number	Temperature Range*	Package
MIC94050BM4	-40°C to +150°C	SOT-143
MIC94051BM4	-40°C to +150°C	SOT-143

\* Operating Junction Temperature

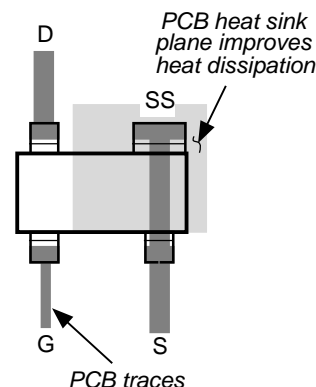
## Pin Configuration



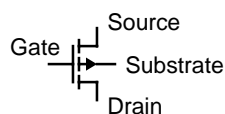
SOT-143 Package (M4)

Part Number	Identification
MIC94050BM4	P50
MIC94051BM4	P51

## Typical PCB Layout

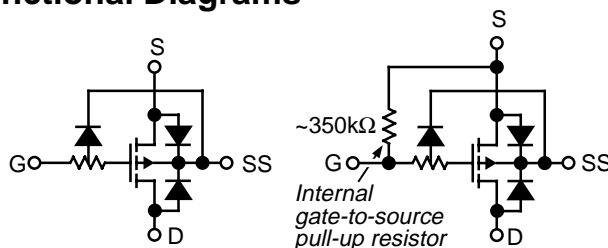


## Schematic Symbol



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 .....  $-40^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$   
 Storage Temperature .....  $-55^{\circ}\text{C}$  to  $+150^{\circ}\text{C}$   
 ESD Rating, **Note 2**

**Operating Ratings**

Thermal Resistance  
    $\theta_{JA}$  .....  $220^{\circ}\text{C/W}$   
    $\theta_{JC}$  .....  $130^{\circ}\text{C/W}$

**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	$\text{k}\Omega$
$C_{ISS}$	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	0.280	$\Omega$
$g_{FS}$	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.

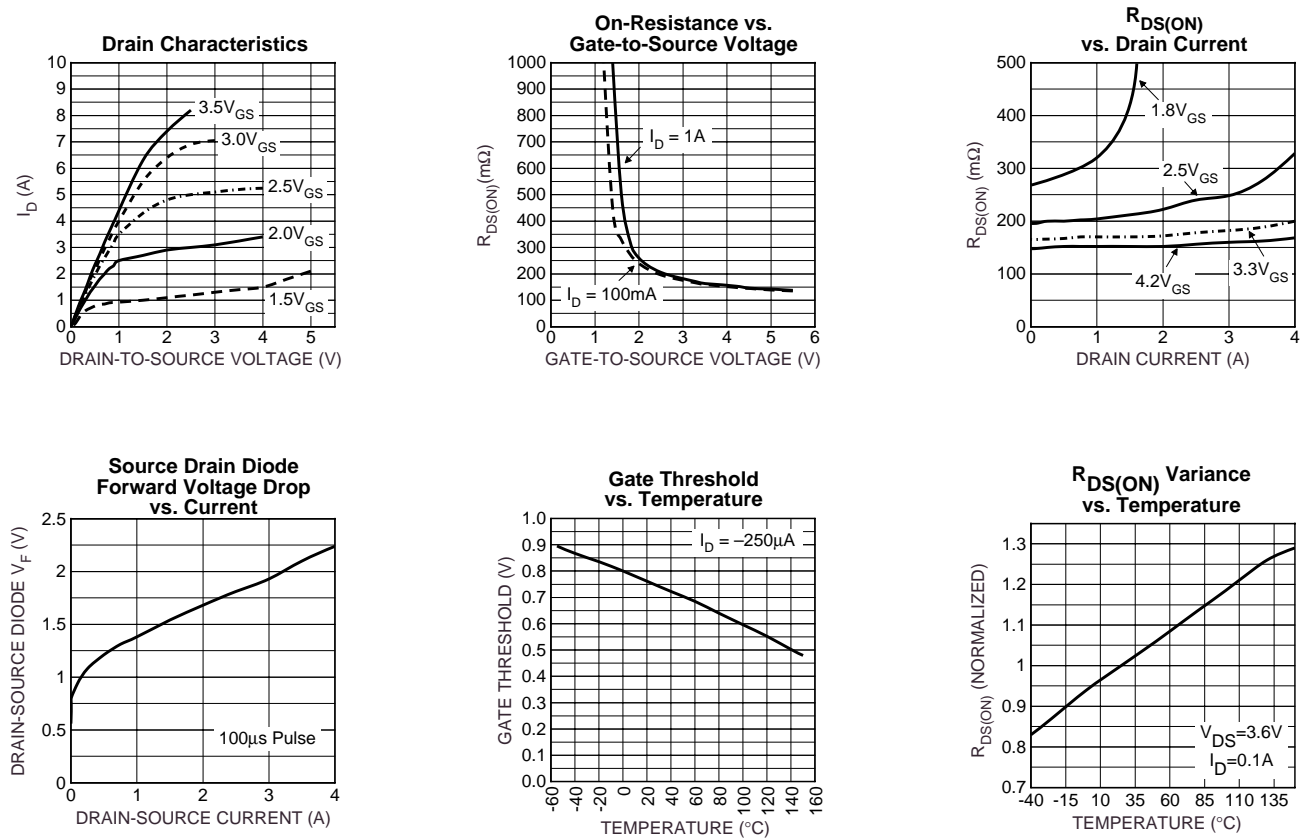
**Note 2.** ESD gate protection diode conducts during positive gate-to-source voltage excursions. IC devices are inherently ESD sensitive. Handling precautions required

**Note 3.** MIC94050 only.

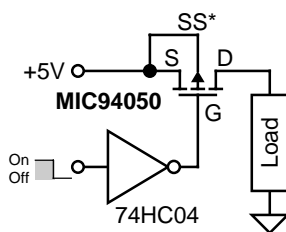
**Note 4.** MIC94051 only.

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

Typical Characteristics

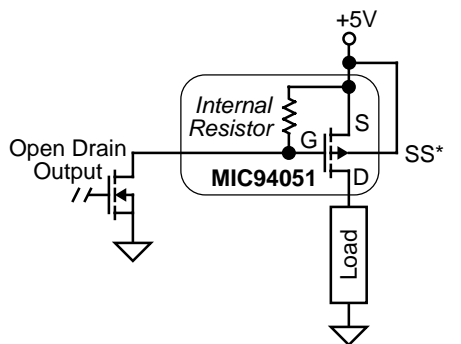


## Typical Applications



\* Substrate must be connected to source

Figure 1. Load Switch Application



\* Substrate must be connected to source

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

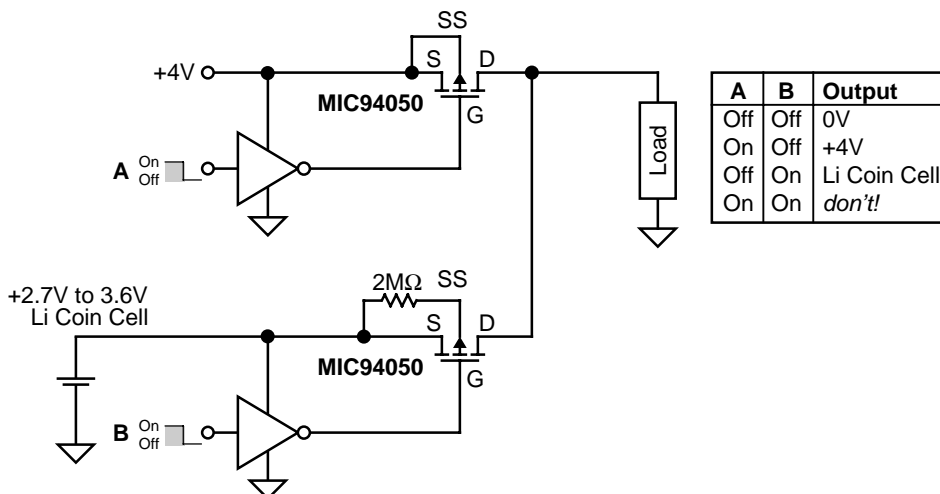
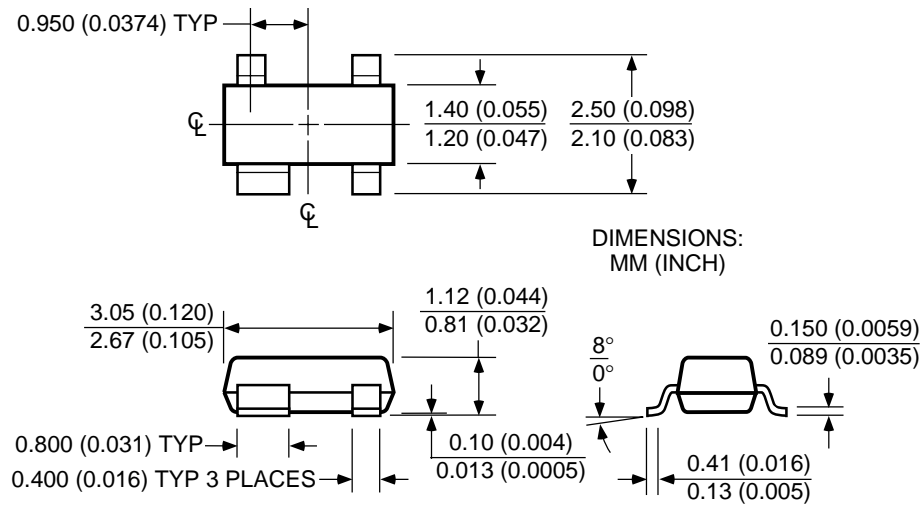


Figure 3. Reverse-Blocking Battery Back-Up Application

## Package Information



**SOT-143 (M4)**

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