



## MIC94030/94031

### TinyFET® P-Channel MOSFET

## 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  $0.75\Omega$  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  $\theta_{JA}$  (improved heat dissipation) and makes analog switch applications practical.

The small size, low threshold, and low  $R_{DS(on)}$  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
- $0.75\Omega$  typical on-resistance
  - at 4.5V gate-to-source voltage
- $0.45\Omega$  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

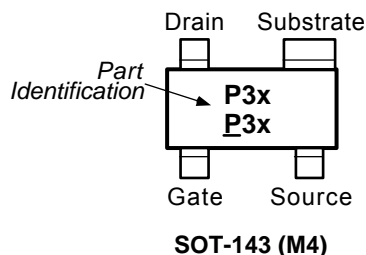
## Applications

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

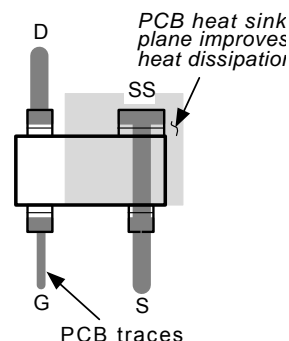
## Ordering Information

Part Number				Junction Temp. Range	Package
Standard	Marking	Pb-Free	Marking		
MIC94030BM4	P30	MIC94030YM4	<u>P</u> 30	-55° to +150°C	SOT-143
MIC94031BM4	P31	MIC94031YM4	<u>P</u> 31	-55° to +150°C	SOT-143

## Pin Configuration



## Typical PCB Layout



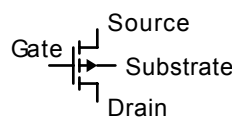
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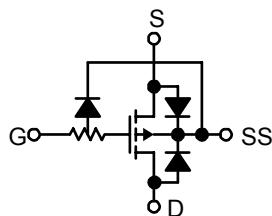
M9999-071106

## Schematic Symbol

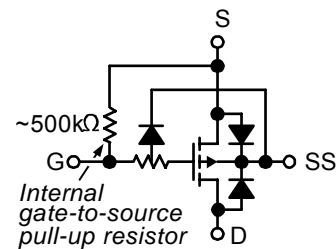


**Schematic Symbol**

## Functional Diagrams



**MIC94030**



**MIC94031**

## Absolute Maximum Ratings<sup>(1)</sup>

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

$T_A = 25^\circ\text{C}$ .....1A

$T_A = 100^\circ\text{C}$ .....0.5A

Operating Junction Temperature ..... $-55^\circ\text{C}$  to  $+150^\circ\text{C}$

Storage Temperature ..... $-55^\circ\text{C}$  to  $+150^\circ\text{C}$

Total Power Dissipation

$T_A = 25^\circ\text{C}$ .....568mW

$T_A = 100^\circ\text{C}$ .....227mW

Thermal Resistance

$\theta_{JA}$ ..... $220^\circ\text{C/W}$

$\theta_{JC}$ ..... $130^\circ\text{C/W}$

Lead Temperature

1/16" from case, 10s..... $+300^\circ\text{C}$

## Electrical Characteristics

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

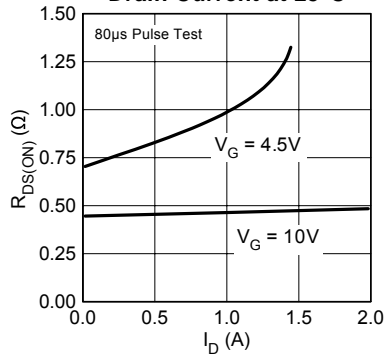
Symbol	Parameter	Condition (Note 1)	Min	Typ	Max	Units
$V_{BDSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V$ , $I_D = 250\mu A$	13.5			V
$V_{GS}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 250\mu A$	0.6	1.0	1.4	V
$I_{GSS}$	Gate-Body Leakage	$V_{DS} = 0V$ , $V_{GS} = 12V$ , <b>Note 2, Note 3</b>			1	$\mu A$
$R_{GS}$	Gate-Source Resistor	$V_{DS} = 0V$ , $V_{GS} = 12V$ , <b>Note 2, Note 4</b>	500	750	1000	k $\Omega$
$C_{ISS}$	Input Capacitance	$V_{GS} = 0V$ , $V_{DS} = 12V$		100		pF
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = 12V$ , $V_{GS} = 0V$			25	$\mu A$
		$V_{DS} = 12V$ , $V_{GS} = 0V$ , $T_J = 125^\circ\text{C}$		0.010	250	$\mu A$
$I_{D(ON)}$	On-State Drain Current	$V_{DS} = 10V$ , $V_{GS} = 10V$ , <b>Note 5</b>		6.3		A
$R_{DS(ON)}$	Drain-Source On-State Resist	$V_{GS} = 10V$ , $I_D = 100mA$ $V_{GS} = 4.5V$ , $I_D = 100mA$ $V_{GS} = 2.7V$ , $I_D = 100mA$		0.45 0.75 1.20	1.00	$\Omega$ $\Omega$ $\Omega$
$g_{FS}$	Forward Transconductance	$V_{DS} = 10V$ , $I_D = 200mA$ , <b>Note 5</b>		480		mS

Notes:

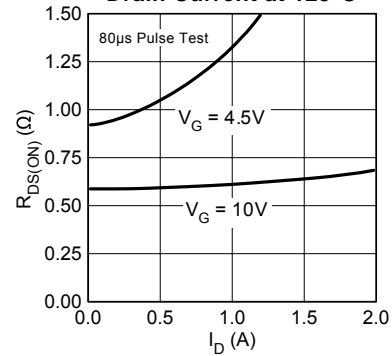
1.  $T_A = 25^\circ\text{C}$  unless noted. Substrate connected to source for all conditions.
2. ESD gate protection diode conducts during positive gate-to-source voltage excursions.
3. MIC94030 only.
4. MIC94031 only.
5. Pulse Test: Pulse Width  $\leq 80\mu\text{sec}$ , Duty Cycle  $\leq 0.5\%$ .

## Typical Characteristics

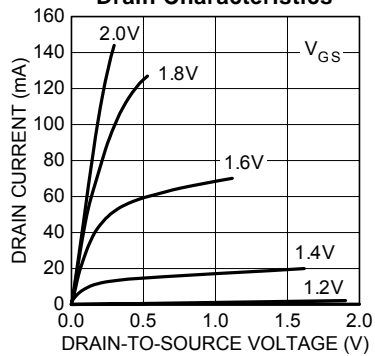
On Resistance vs.  
Drain Current at 25°C



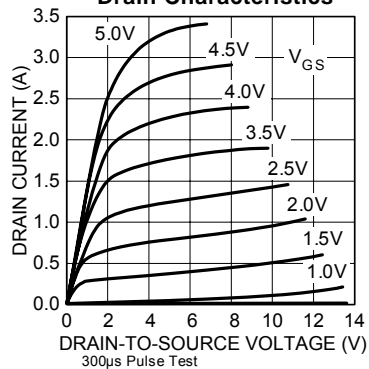
On Resistance vs.  
Drain Current at 125°C



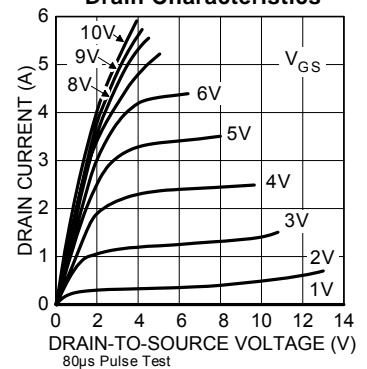
Drain Characteristics



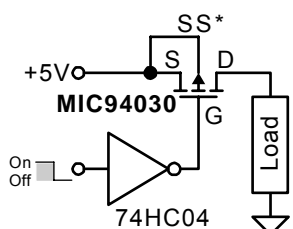
Drain Characteristics



Drain Characteristics

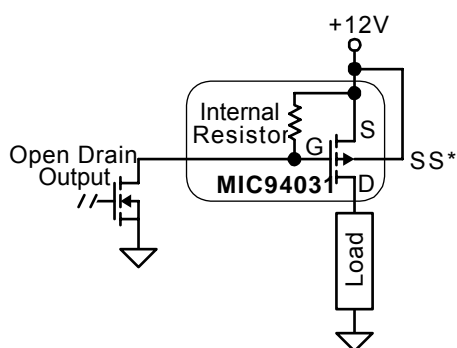


## Typical Applications



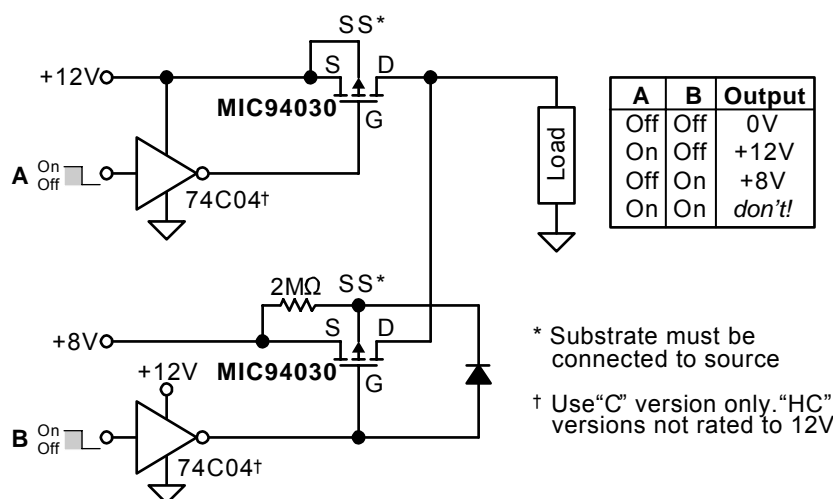
\* Substrate must be connected to source

Figure 1. Power Switch Application



\* Substrate must be connected to source

Figure 2. Power Control Application

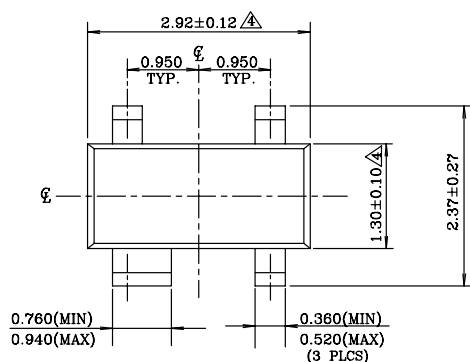


\* Substrate must be connected to source

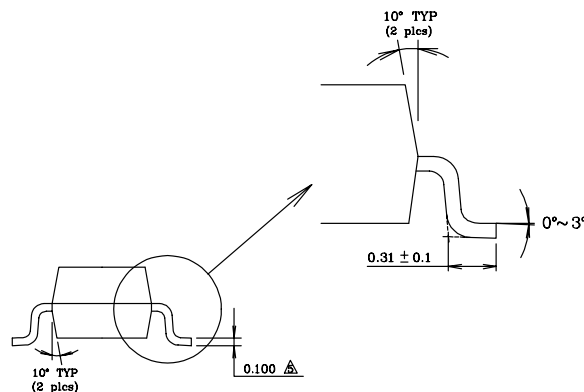
† Use "C" version only. "HC" versions not rated to 12V

Figure 3. Analog Switch Application

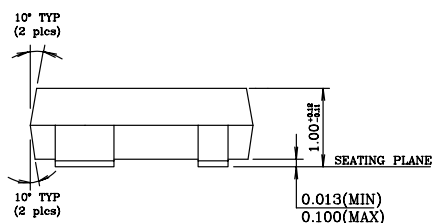
## Package Information



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.
- △4 Dimension are exclusive of mold flash and gate burr.
- △5 Dimension are exclusive of solder plating.

### SOT-143 (M4)

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