



## 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

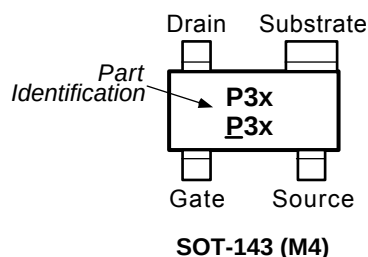
## Applications

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

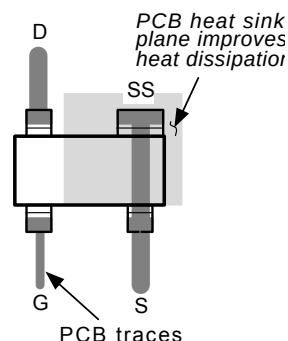
## Ordering Information

| 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



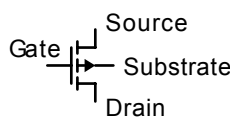
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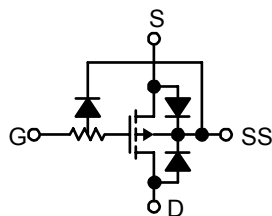
M9999-071106

## Schematic Symbol

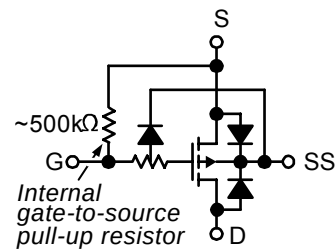


**Schematic Symbol**

## 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.

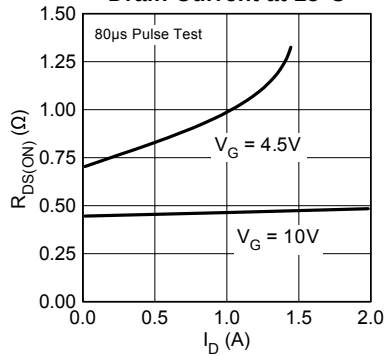
| Symbol       | Parameter                       | Condition (Note 1)                                                                          | Min  | Typ                  | Max  | Units                            |
|--------------|---------------------------------|---------------------------------------------------------------------------------------------|------|----------------------|------|----------------------------------|
| $V_{BDSS}$   | 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    | $V_{GS} = 10V, I_D = 100mA$<br>$V_{GS} = 4.5V, I_D = 100mA$<br>$V_{GS} = 2.7V, I_D = 100mA$ |      | 0.45<br>0.75<br>1.20 | 1.00 | $\Omega$<br>$\Omega$<br>$\Omega$ |
| $g_{FS}$     | Forward Transconductance        | $V_{DS} = 10V, I_D = 200mA$ , <b>Note 5</b>                                                 |      | 480                  |      | mS                               |

Notes:

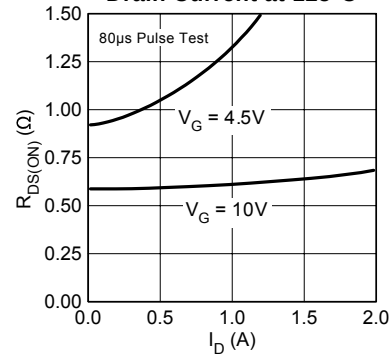
1.  $T_A = 25^\circ\text{C}$  unless noted. Substrate connected to source for all conditions.
2. ESD gate protection diode conducts during positive gate-to-source voltage excursions.
3. MIC94030 only.
4. MIC94031 only.
5. Pulse Test: Pulse Width  $\leq 80\mu\text{sec}$ , Duty Cycle  $\leq 0.5\%$ .

## Typical Characteristics

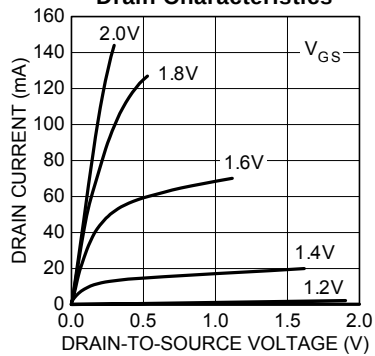
On Resistance vs.  
Drain Current at 25°C



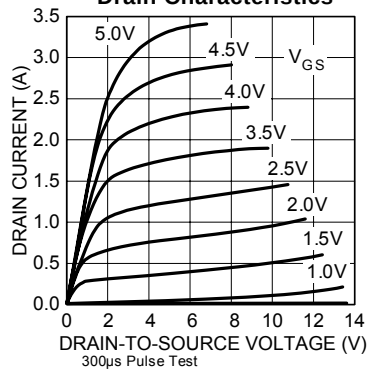
On Resistance vs.  
Drain Current at 125°C



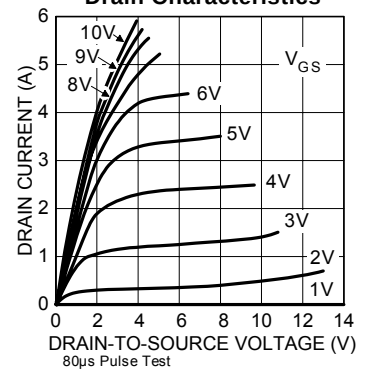
Drain Characteristics



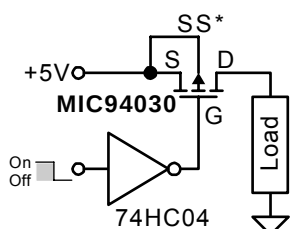
Drain Characteristics



Drain Characteristics

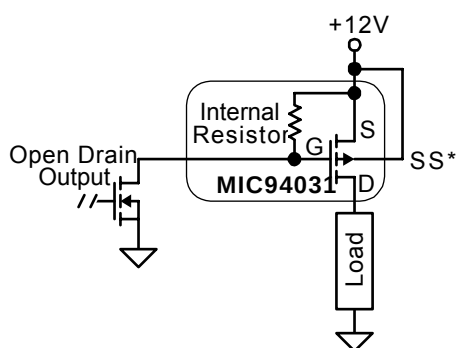


## Typical Applications



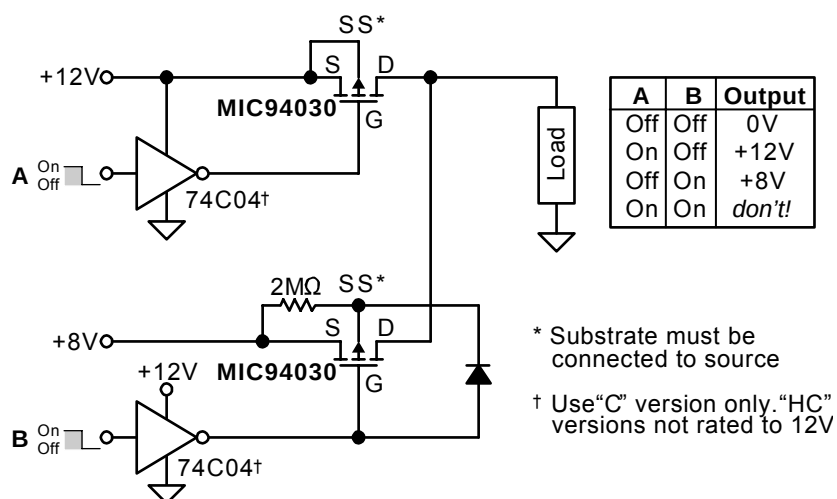
\* Substrate must be connected to source

Figure 1. Power Switch Application



\* Substrate must be connected to source

Figure 2. Power Control Application

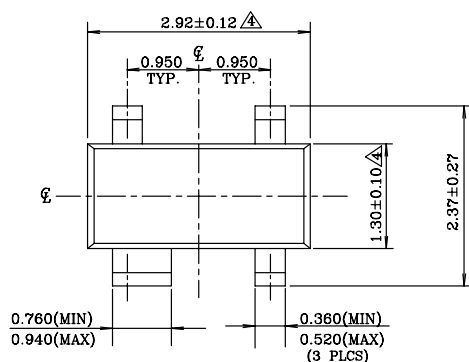


\* Substrate must be connected to source

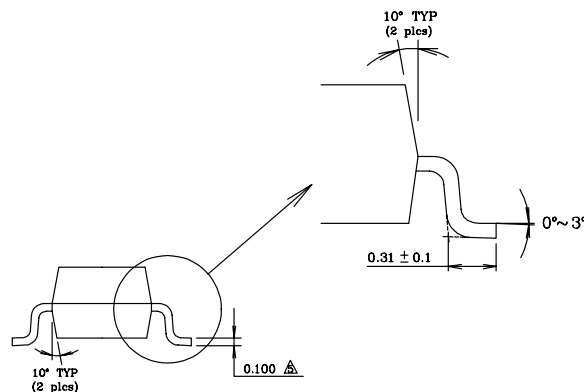
† Use "C" version only. "HC" versions not rated to 12V

Figure 3. Analog Switch Application

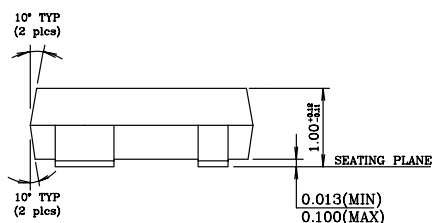
## Package Information



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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