

### General Description

The MIC94052/94053 are low on-resistance, 84mΩ(max) P-channel MOSFETs. They are housed in a *Teeny*™ SC-70-6 package.

Designed for high-side switch applications where space is critical, the MIC94052/3 exhibit a typical on-resistance of 70mΩ at 4.5V gate-to-source voltage. The devices operate down to 1.8V gate-to-source voltage. Their operating voltage range makes the MIC94052/3 ideal for Li Ion applications as well as other sub-5V load switch applications.

The MIC94053 is an option that includes an internal gate pull-up resistor. The pull-up resistor ensures that the P-channel MOSFET is OFF until actively pulled down. Integrating the pull-up resistor saves valuable board space and reduces component placement cost.

The MIC94052/3 have a junction temperature range of -40°C to +150°C.

### Features

- 1.8V to 5.5V input voltage range
- Low on-resistance P-channel MOSFET:  
70mΩ at  $V_{GS} = 4.5V$  (typ)  
2A continuous current
- $V_{GS}$  pull-up resistor (MIC94053)
- *Teeny*™ SC-70-6 package
- -40°C to +150°C junction temperature range

### Applications

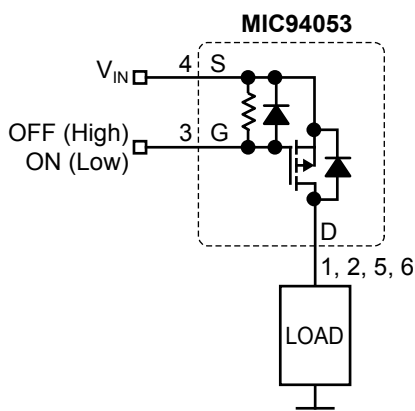
- Load switch in portable applications:  
Cellular phones  
PDAs  
MP3 players  
Notebook PCs  
Barcode scanners

### Ordering Information

| Part Number |         |             |             | Gate-Source Pull Up | Junction Temp Range | Package |
|-------------|---------|-------------|-------------|---------------------|---------------------|---------|
| Standard    | Marking | Pb-Free     | Marking*    |                     |                     |         |
| MIC94052BC6 | P52     | MIC94052YC6 | <u>P</u> 52 | NO                  | -40°C to +150°C     | SC-70-6 |
| MIC94053BC6 | P53     | MIC94053YC6 | <u>P</u> 53 | YES                 | -40°C to +150°C     | SC-70-6 |

\* Under bar symbol may not be to scale.

### Typical Application



Load Switch Application

Pin Configuration



Package Marking - Top View

Pin Description

| Pin Number | Pin Name | Pin Function                                                                                   |
|------------|----------|------------------------------------------------------------------------------------------------|
| 1, 2, 5, 6 | D        | Drain. Ensure that all drain pins are connected together to optimize $R_{DS(ON)}$ performance. |
| 3          | G        | Gate                                                                                           |
| 4          | S        | Source                                                                                         |

**Absolute Maximum Ratings (Note 1)**

|                                                  |                   |
|--------------------------------------------------|-------------------|
| Drain-Source Voltage ( $V_{DS}$ )                | –6V               |
| Gate-Source Voltage ( $V_{GS}$ )                 | –6V               |
| Continuous Drain Current ( $I_D$ ) <b>Note 3</b> |                   |
| $T_A = 25^\circ\text{C}$                         | $\pm 2\text{A}$   |
| $T_A = 85^\circ\text{C}$                         | $\pm 1.4\text{A}$ |
| Pulsed Drain Current ( $I_{DP}$ ) <b>Note 3</b>  | $\pm 6\text{A}$   |
| Continuous Diode Current ( $I_S$ ) <b>Note 7</b> | –50mA             |
| Power Dissipation <b>Note 3</b>                  |                   |
| SC-70-6 lead ( $T_A = 85^\circ\text{C}$ )        | 270mW             |
| Ambient Storage Temperature ( $T_S$ )            | –55°C to +150°C   |
| ESD Rating <b>Note 4</b>                         |                   |

**Operating Ratings (Note 2)**

|                                         |                 |
|-----------------------------------------|-----------------|
| Input Voltage Range                     | 1.8V to 5.5V    |
| Junction Temperature Range ( $T_J$ )    | –40°C to +150°C |
| Package Thermal Impedance <b>Note 3</b> |                 |
| $\theta_{JA}$ SC-70-6 lead              | 240°C/W         |

**Electrical Characteristics**

$T_A = 25^\circ\text{C}$ , unless otherwise specified. **Bold** values indicate  $-40^\circ\text{C} \leq T_J \leq +150^\circ\text{C}$ .

| Symbol                 | Parameter                                   | Condition                                                                                                                                                                                                            | Min  | Typ                   | Max                     | Units                                                |
|------------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|-----------------------|-------------------------|------------------------------------------------------|
| <b>Static</b>          |                                             |                                                                                                                                                                                                                      |      |                       |                         |                                                      |
| $V_{GS(th)}$           | Gate Threshold Voltage                      | $V_{DS} = V_{GS}$ , $I_D = -250\mu\text{A}$                                                                                                                                                                          | –0.5 |                       | –1.2                    | V                                                    |
| $I_{GSS}$              | Gate Body Leakage<br>(MIC94052 only)        | $V_{DS} = 0\text{V}$ , $V_{GS} = -5.5\text{V}$                                                                                                                                                                       |      |                       | 100                     | nA                                                   |
| $R_{GS}$               | Gate-Source Resistance<br>(MIC94053 only)   | $V_{DS} = 0\text{V}$ , $V_{GS} = -5.5\text{V}$                                                                                                                                                                       | 250  | 400                   | 550                     | k $\Omega$                                           |
| $I_{DSS}$              | Zero Gate Voltage Drain<br>Current          | $V_{DS} = -5.5\text{V}$ , $V_{GS} = 0\text{V}$<br>$T_J = +85^\circ\text{C}$                                                                                                                                          |      |                       | –1<br><b>–5</b>         | $\mu\text{A}$<br>$\mu\text{A}$                       |
| $R_{DS(ON)}$           | Drain-Source On-Resistance<br><b>Note 8</b> | $V_{GS} = -4.5\text{V}$ , $I_{DS} = -100\text{mA}$<br>$V_{GS} = -3.6\text{V}$ , $I_{DS} = -100\text{mA}$<br>$V_{GS} = -2.5\text{V}$ , $I_{DS} = -100\text{mA}$<br>$V_{GS} = -1.8\text{V}$ , $I_{DS} = -100\text{mA}$ |      | 70<br>76<br>92<br>125 | 84<br>110<br>130<br>180 | m $\Omega$<br>m $\Omega$<br>m $\Omega$<br>m $\Omega$ |
| <b>Dynamic, Note 6</b> |                                             |                                                                                                                                                                                                                      |      |                       |                         |                                                      |
| $t_{d(on)}$            | Turn-On Delay Time                          | $V_{DD} = -5\text{V}$ , $I_D = -0.5\text{A}$ , $V_{GS} = -4.5\text{V}$ ,<br>$R_{GEN} = 50\Omega$                                                                                                                     |      | 15                    |                         | ns                                                   |
| $t_r$                  | Turn-On Rise Time                           | $V_{DD} = -5\text{V}$ , $I_D = -0.5\text{A}$ , $V_{GS} = -4.5\text{V}$ ,<br>$R_{GEN} = 50\Omega$                                                                                                                     |      | 15                    |                         | ns                                                   |
| $t_{d(off)}$           | Turn-Off Delay Time                         | $V_{DD} = -5\text{V}$ , $I_D = -0.5\text{A}$ , $V_{GS} = -4.5\text{V}$ ,<br>$R_{GEN} = 50\Omega$                                                                                                                     |      | 60                    |                         | ns                                                   |
| $t_f$                  | Turn-Off Fall Time                          | $V_{DD} = -5\text{V}$ , $I_D = -0.5\text{A}$ , $V_{GS} = -4.5\text{V}$ ,<br>$R_{GEN} = 50\Omega$                                                                                                                     |      | 20                    |                         | ns                                                   |

**Note 1.**  $T_A = 25^\circ\text{C}$  unless otherwise noted. Absolute maximum ratings indicate limits beyond which damage to the component may occur. Electrical specifications do not apply when operating the device outside of its operating ratings.

**Note 2.** This device is not guaranteed to operate beyond its specified operating rating.

**Note 3.** Mounted on 1 square-inch pad of 2 oz. copper.

**Note 4.** IC devices are inherently ESD sensitive. Handling precautions required.

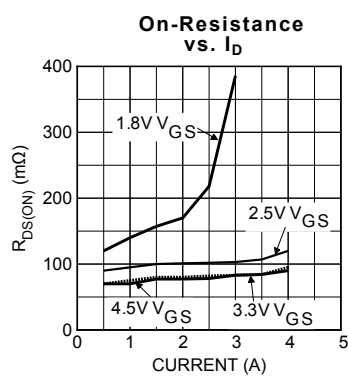
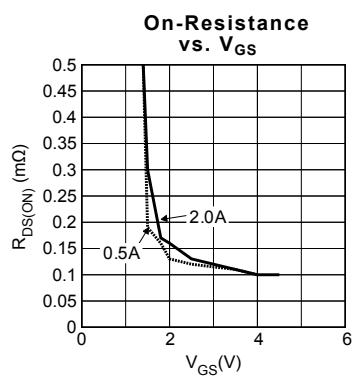
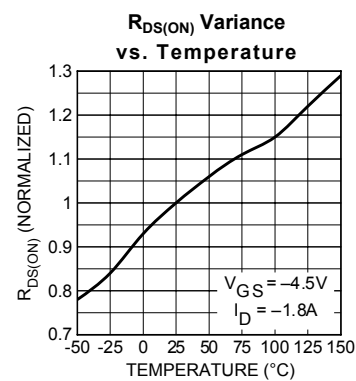
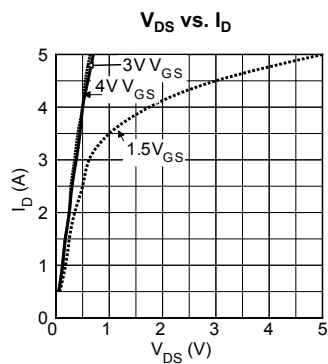
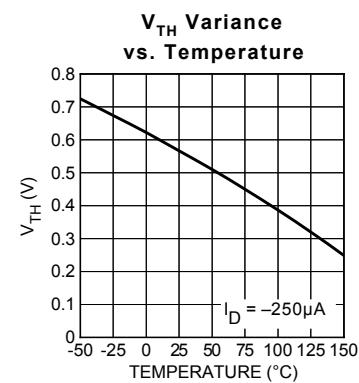
**Note 5.** Pulse test; pulse width = 300 $\mu\text{s}$ , duty cycle = 2%.

**Note 6.** Guaranteed by design.

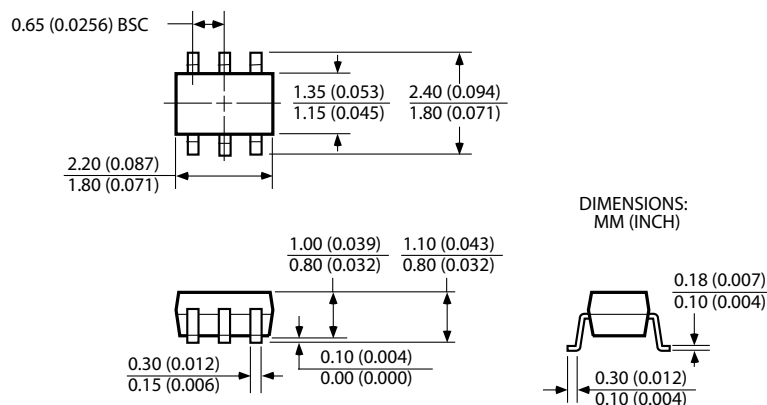
**Note 7.** Body diode current conduction is not recommended.

**Note 8.** Ensure that all drain pins are connected together to optimize  $R_{DS(ON)}$  performance.

## Typical Characteristics



## Package Information



**SC-70-6 Pin (C6)**

**MICREL INC. 2180 FORTUNE DRIVE SAN JOSE, CA 95131 USA**  
 TEL + 1 (408) 944-0800 FAX + 1 (408) 474-1000 WEB <http://www.micrel.com>

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#### Как с нами связаться

**Телефон:** 8 (812) 309 58 32 (многоканальный)

**Факс:** 8 (812) 320-02-42

**Электронная почта:** [org@eplast1.ru](mailto:org@eplast1.ru)

**Адрес:** 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.