# MIC94052/94053

## 84mΩ P-Channel MOSFET in SC-70-6

## 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

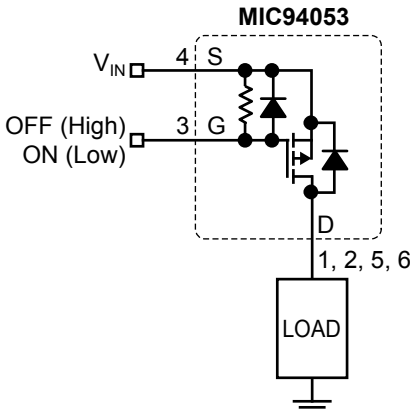
- Load switch in portable applications:
  - Cellular phones
  - PDAs
  - MP3 players
  - Notebook PCs
  - Barcode scanners

## Ordering Information

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

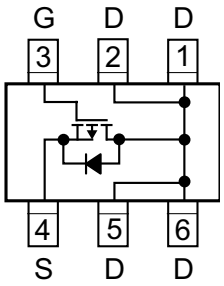
* Under bar symbol may not be to scale.

## Typical Application

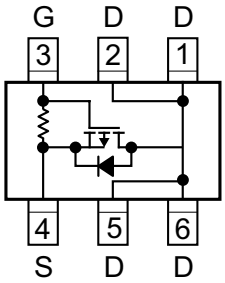



**Load Switch Application**

## Pin Configuration

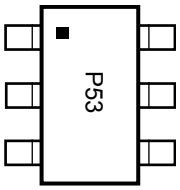



**MIC94052**
**SC-70-6 (C6)**

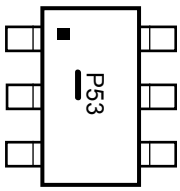



**MIC94053**
**SC-70-6 (C6)**

**SN - Pb**




**Pb -Free**




**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 (ID) **Note 3**
$T_A$ = 25°C ..... ±2A
$T_A$ = 85°C ..... ±1.4A
Pulsed Drain Current ($I_{DP}$) **Note 3** ..... ±6A
Continous Diode Current ($I_S$) **Note 7** ..... –50mA
Power Dissipation **Note 3**
SC-70-6 lead ($T_A$ = 85°C) ..... 270mW
Ambient Storage Temperature ($T_S$) ..... –55°C to +150°C
ESD Rating **Note 4**

## 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 **Note 3**
$\theta_{JA}$ SC-70-6 lead ..... 240°C/W

## Electrical Characteristics

$T_A$ = 25°C, unless otherwise specified. **Bold** values indicate –40°C≤$T_J$≤+150°C.

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

**Note 1.** $T_A$ = 25°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 = 300µs, duty cycle = 2%.

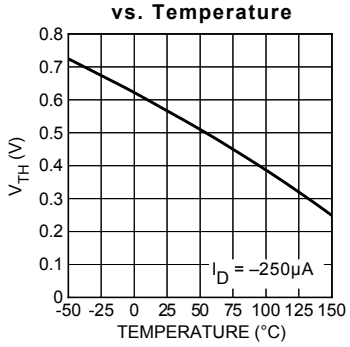
**Note 6.** Guaranteed by design.

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

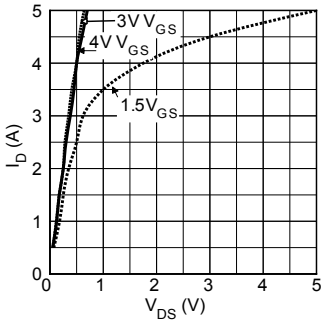
**Note 8.** Ensure that all drain pins are connected together to optimize $R_{DS(ON)}$ perfomance.

## Typical Characteristics

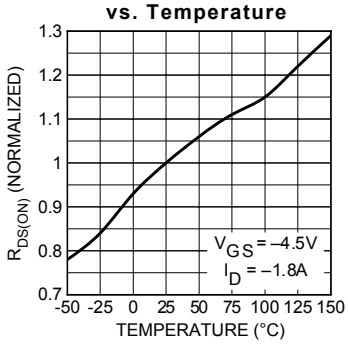
**$V_{TH}$ Variance vs. Temperature**



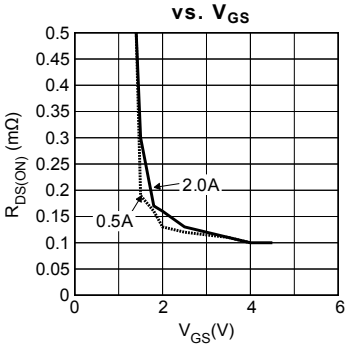

**$V_{DS}$ vs. $I_D$**



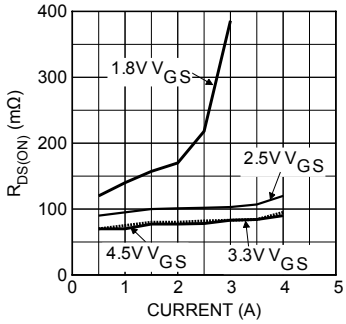

**$R_{DS(ON)}$ Variance vs. Temperature**



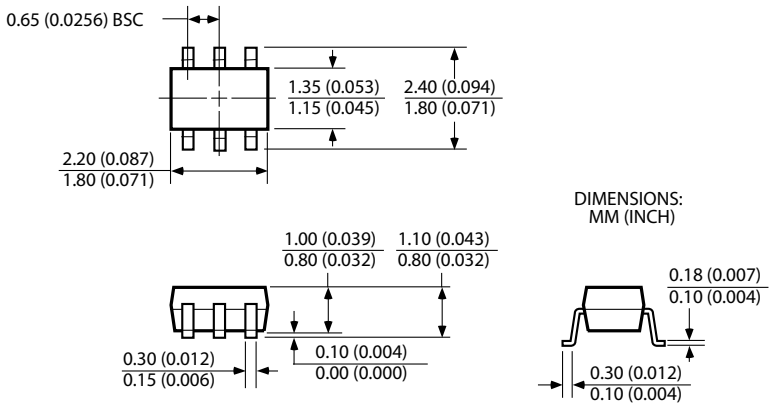

**On-Resistance vs. $V_{GS}$**




**On-Resistance vs. $I_D$**



## Package Information




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

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