



The Infinite Bandwidth Company™

## MIC94052/94053

84mΩ P-Channel MOSFET in SC-70-6

Final

### 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

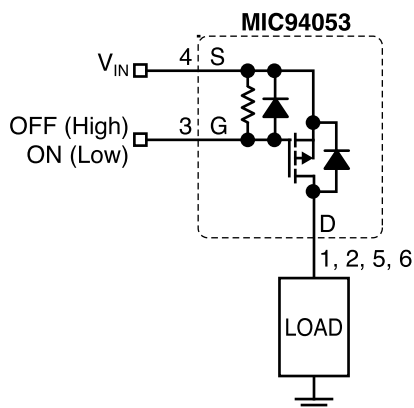
- Load switch in portable applications:
  - Cellular phones
  - PDA's
  - MP3 players
  - Notebook PCs
  - Barcode scanners

### Ordering Information

Part Number	Gate-Source Pull Up	Marking	Junction Temp. Range	Package
MIC94052BC6	NO	P52	-40°C to +150°C	SC-70-6
MIC94053BC6	YES	P53	-40°C to +150°C	SC-70-6

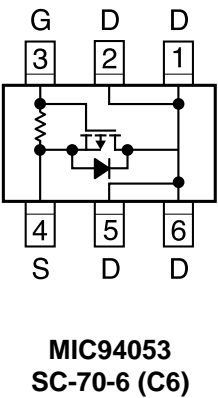
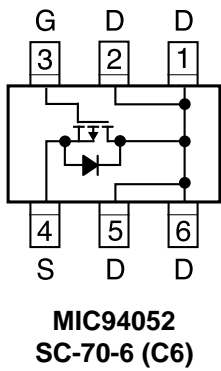
Other voltages available. Contact Micrel for details.

### Typical Application



Load Switch Application

Pin Configuration



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 (MIC94052 only)	$V_{DS} = 0\text{V}$ , $V_{GS} = -5.5\text{V}$			100	nA
$R_{GS}$	Gate-Source Resistance (MIC94053 only)	$V_{DS} = 0\text{V}$ , $V_{GS} = -5.5\text{V}$	250	400	550	k $\Omega$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -5.5\text{V}$ , $V_{GS} = 0\text{V}$ $T_J = +85^\circ\text{C}$			–1 <b>–5</b>	$\mu\text{A}$ $\mu\text{A}$
$R_{DS(ON)}$	Drain-Source On-Resistance <b>Note 8</b>	$V_{GS} = -4.5\text{V}$ , $I_{DS} = -100\text{mA}$ $V_{GS} = -3.6\text{V}$ , $I_{DS} = -100\text{mA}$ $V_{GS} = -2.5\text{V}$ , $I_{DS} = -100\text{mA}$ $V_{GS} = -1.8\text{V}$ , $I_{DS} = -100\text{mA}$		70 76 92 125	84 110 130 180	m $\Omega$ m $\Omega$ m $\Omega$ m $\Omega$

**Dynamic, Note 6**

$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -5\text{V}$ , $I_D = -0.5\text{A}$ , $V_{GS} = -4.5\text{V}$ , $R_{GEN} = 50\Omega$		15		ns
$t_r$	Turn-On Rise Time	$V_{DD} = -5\text{V}$ , $I_D = -0.5\text{A}$ , $V_{GS} = -4.5\text{V}$ , $R_{GEN} = 50\Omega$		15		ns
$t_{d(off)}$	Turn-Off Delay Time	$V_{DD} = -5\text{V}$ , $I_D = -0.5\text{A}$ , $V_{GS} = -4.5\text{V}$ , $R_{GEN} = 50\Omega$		60		ns
$t_f$	Turn-Off Fall Time	$V_{DD} = -5\text{V}$ , $I_D = -0.5\text{A}$ , $V_{GS} = -4.5\text{V}$ , $R_{GEN} = 50\Omega$		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.

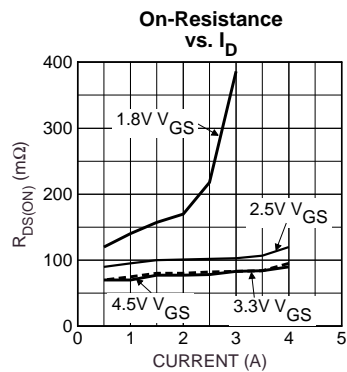
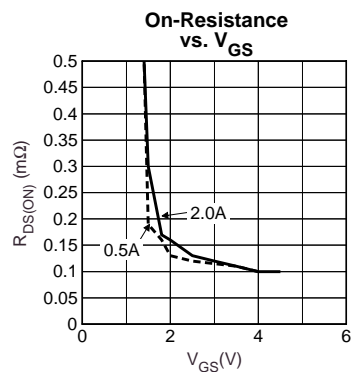
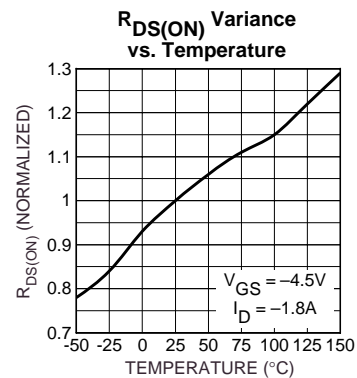
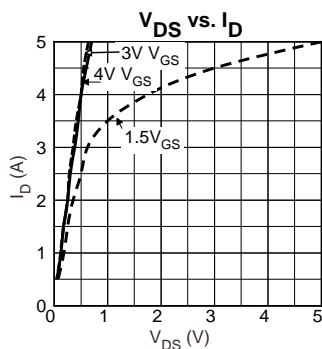
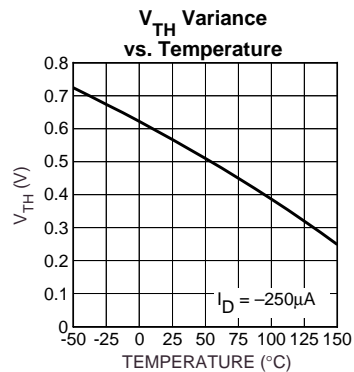
**Note 5.** Pulse test; pulse width = 300 $\mu\text{s}$ , duty cycle = 2%.

**Note 6.** Guaranteed by design.

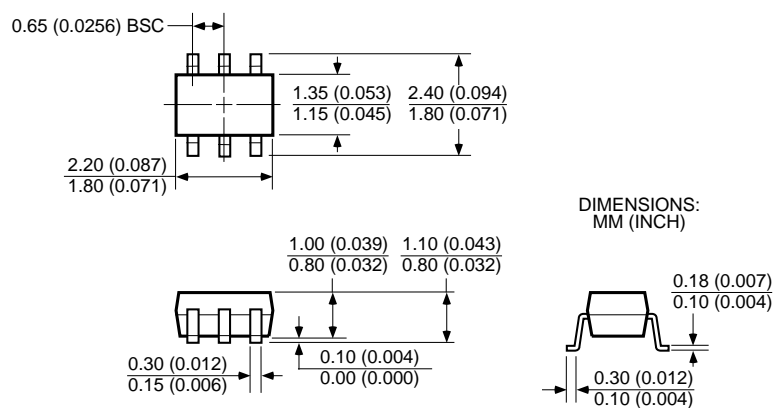
**Note 7.** Body diode current conduction is not recommended.

**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)**

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