



**THE DATASHEET OF  
MAX14680EWC+T**



# MAX14634/MAX14680

## Ultra-Low On-Resistance and Compact Bidirectional Battery Switches

### General Description

The MAX14634/MAX14680 bidirectional battery switches feature reverse blocking capability to isolate the battery from the system. These internal switches feature ultra-low  $7\text{m}\Omega$  (typ) on-resistance and operate from a +2.3V to +5.5V input voltage range, making these devices ideal battery-disconnect switches for high-capacity battery applications. The slew-rate controlled switches are also ideal for a large load capacitor as well as high-current load switching applications.

The devices are available in an ultra-small 12-bump (1.3mm x 1.7mm, 0.4mm pitch) WLP package. The tiny, low-profile package is suitable for space-limited portable device applications. The devices operate over the  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  extended temperature range.

### Applications

Tablet PC Battery Switches  
 Smartphone Battery Switches  
 Battery Isolators

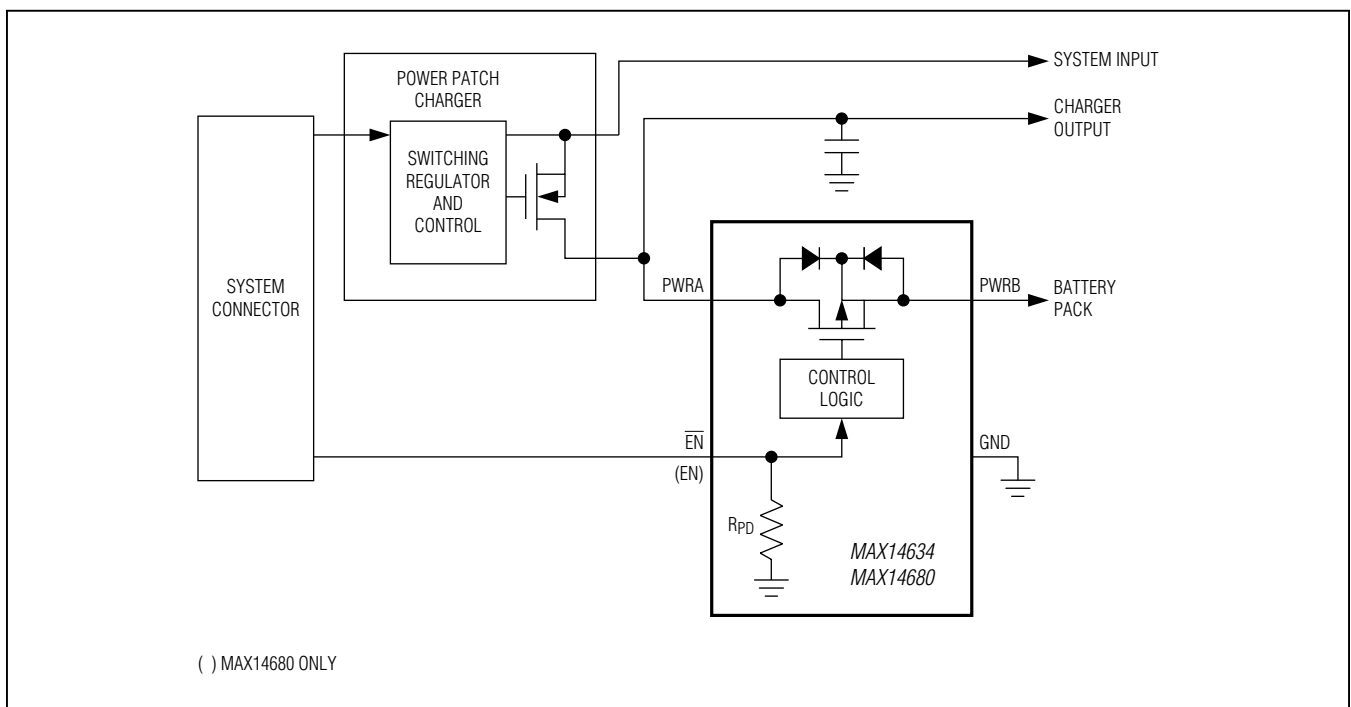
### Benefits and Features

- ◆ **Provide Efficient System Battery Switch**
  - ◇ **Integrated FET for Bidirectional Blocking**
  - ◇ **Ultra-Low  $7\text{m}\Omega$  (typ)  $R_{\text{ON}}$**
  - ◇ **Wide +2.3V to +5.5V Input Voltage Range**
  - ◇ **Low Quiescent Current**
- ◆ **Save Space**
  - ◇ **Integrated Pulldown and Logic Buffer Circuits**
  - ◇ **12-Bump, 1.3mm x 1.7mm, 0.4mm Pitch WLP Package**

*Ordering Information appears at end of data sheet.*

*For related parts and recommended products to use with this part, refer to [www.maximintegrated.com/MAX14634.related](http://www.maximintegrated.com/MAX14634.related).*

### Typical Operating Circuit



# MAX14634/MAX14680

## Ultra-Low On-Resistance and Compact Bidirectional Battery Switches

### ABSOLUTE MAXIMUM RATINGS

(All voltages referenced to GND.)

PWRA, PWRB,  $\overline{EN}$ , EN ..... -0.3V to +6V  
 Current into PWRA, PWRB .....  $\pm 7A$   
 Continuous Power Dissipation ( $T_A = +70^\circ C$ )  
 WLP (derate 13.7mW/ $^\circ C$  above +70 $^\circ C$ )..... 1096mW

Operating Temperature Range ..... -40 $^\circ C$  to +85 $^\circ C$   
 Maximum Junction Temperature..... +150 $^\circ C$   
 Storage Temperature Range..... -65 $^\circ C$  to +150 $^\circ C$   
 Soldering Temperature (reflow) ..... +260 $^\circ C$

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

### PACKAGE THERMAL CHARACTERISTICS (Note 1)

WLP

Junction-to-Ambient Thermal Resistance ( $\theta_{JA}$ ) ..... 73 $^\circ C/W$

**Note 1:** Package thermal resistances were obtained using the method described in JEDEC specification JESD51-7, using a four-layer board. For detailed information on package thermal considerations, refer to [www.maximintegrated.com/thermal-tutorial](http://www.maximintegrated.com/thermal-tutorial).

### ELECTRICAL CHARACTERISTICS

( $V_{PWRA}$ ,  $V_{PWRB} = 2.3V$  to 5.5V;  $T_A = -40^\circ C$  to +85 $^\circ C$ , unless otherwise noted. Typical values are at  $V_{PWRA}$ ,  $V_{PWRB} = 4.2V$ ;  $C_{PWRA}$ ,  $C_{PWRB} = 0.1\mu F$ ;  $T_A = +25^\circ C$ .) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
<b>SUPPLY OPERATION</b>						
Operating Voltage	$V_{PWRA}$ $V_{PWRB}$		2.3		5.5	V
Quiescent Current	$I_{PWRA}$ $I_{PWRB}$	$V_{\overline{EN}} = 0.4V$ ( $V_{EN} = 1.6V$ ), no load			1	$\mu A$
Transient Supply Current		$\overline{EN}$ (EN) from high to low or low to high		30		$\mu A$
Shutdown Current	$I_{SHDN}$	$V_{\overline{EN}} = 5.5V$ ( $V_{EN} = 0V$ ), ( $V_{PWRA} = 5.5V$ , $V_{PWRB} = open$ ) or ( $V_{PWRB} = 5.5V$ , $V_{PWRA} = open$ )			1	$\mu A$
<b>INTERNAL FET</b>						
On-Resistance Between PWRA and PWRB	$R_{ON}$	$T_A = +25^\circ C$ , $I_{LOAD} = 100mA$	$V_{PWRA}$ , $V_{PWRB} = 2.3V$	8	13	m $\Omega$
			$V_{PWRA}$ , $V_{PWRB} = 3.3V$	7	10	
<b>ENABLE INPUT (Note 3)</b>						
Enable Input Logic-High Voltage	$V_{IH}$		1.6			V
Enable Input Logic-Low Voltage	$V_{IL}$				0.4	V
Enable Internal Pulldown Resistor	RPD			500	700	k $\Omega$
<b>DYNAMIC</b>						
Turn-On Time	$t_{ON}$	Time from $\overline{EN}$ high-to-low (EN low-to-high) signal to $V_{PWRB/A} = 90\%$ of $V_{PWRA/B}$		3		ms
Turn-Off Time	$t_{OFF}$	Time from $\overline{EN}$ low-to-high (EN high-to-low) signal to $V_{PWRB/A} = 10\%$ of $V_{PWRA/B}$ , $R_{LOAD} = 100\Omega$		3		ms

**Note 2:** All devices are 100% production tested at  $T_A = +25^\circ C$ . Specifications over the operating temperature range are guaranteed by design.

**Note 3:**  $\overline{EN}$  for MAX14634, EN for MAX14680.

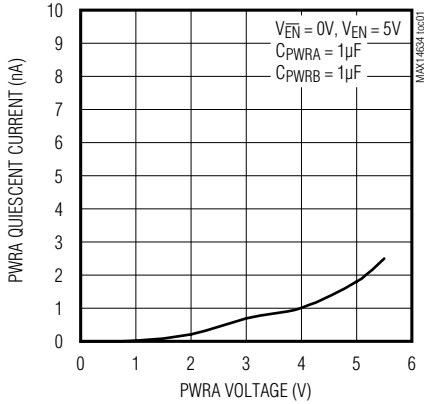
# MAX14634/MAX14680

## Ultra-Low On-Resistance and Compact Bidirectional Battery Switches

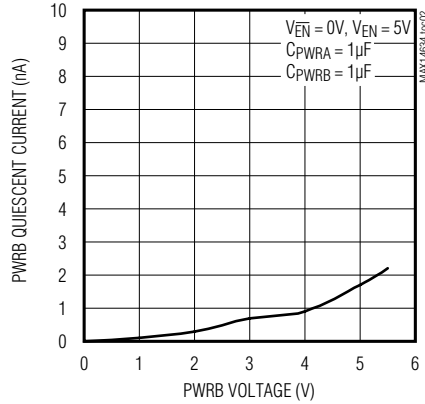
### Typical Operating Characteristics

( $T_A = +25^\circ\text{C}$ , unless otherwise noted.)

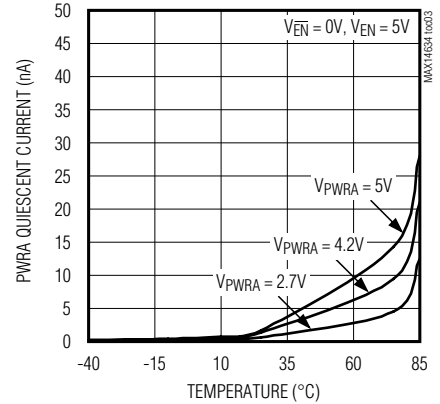
**PWRA QUIESCENT SUPPLY CURRENT vs. SUPPLY VOLTAGE**



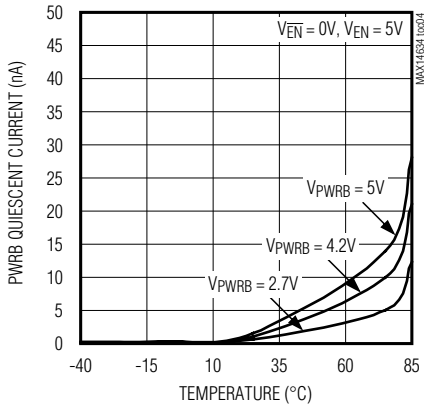
**PWRB QUIESCENT SUPPLY CURRENT vs. SUPPLY VOLTAGE**



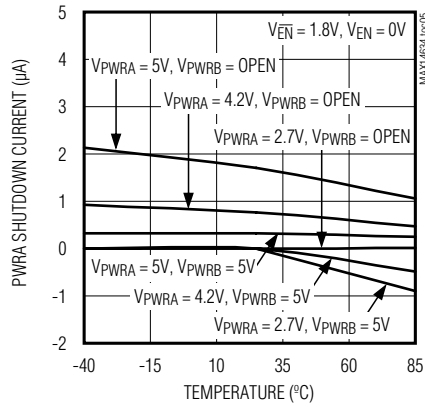
**PWRA QUIESCENT SUPPLY CURRENT vs. TEMPERATURE**



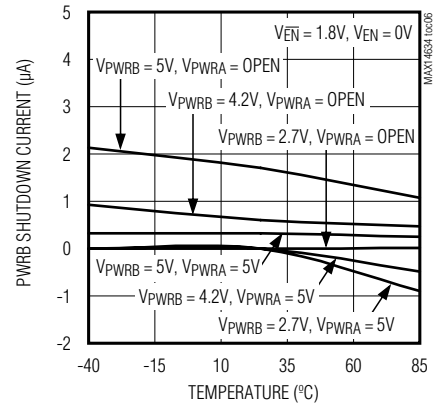
**PWRB QUIESCENT SUPPLY CURRENT vs. TEMPERATURE**



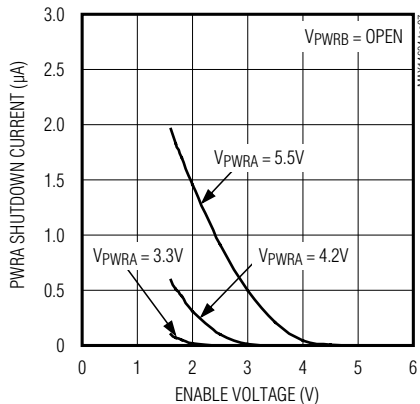
**PWRA SHUTDOWN SUPPLY CURRENT vs. TEMPERATURE**



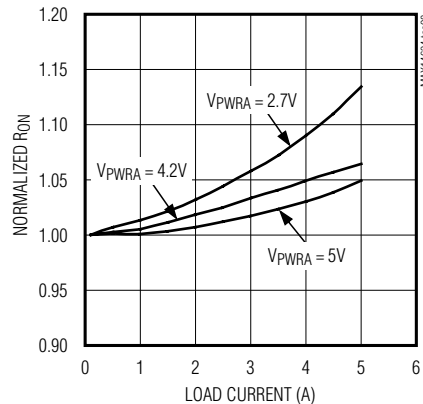
**PWRB SHUTDOWN SUPPLY CURRENT vs. TEMPERATURE**



**PWRA SHUTDOWN CURRENT vs. EN VOLTAGE**



**NORMALIZED ON-RESISTANCE vs. LOAD CURRENT**

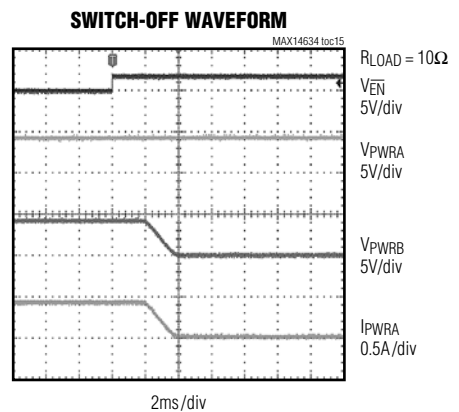
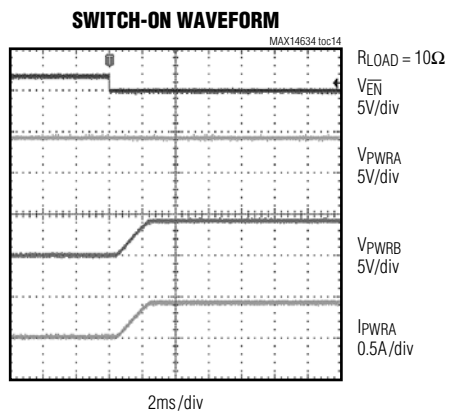
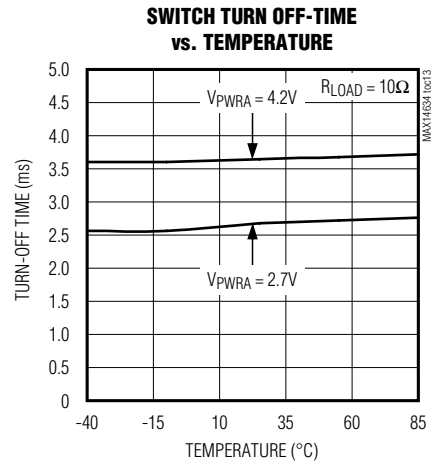
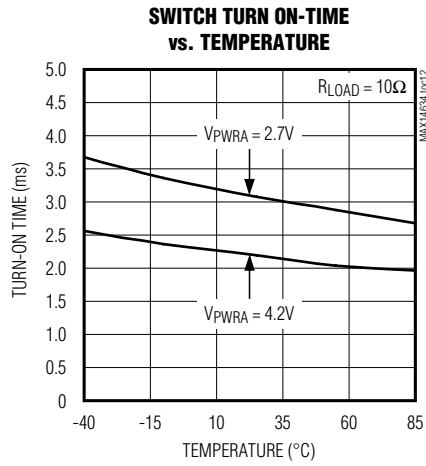
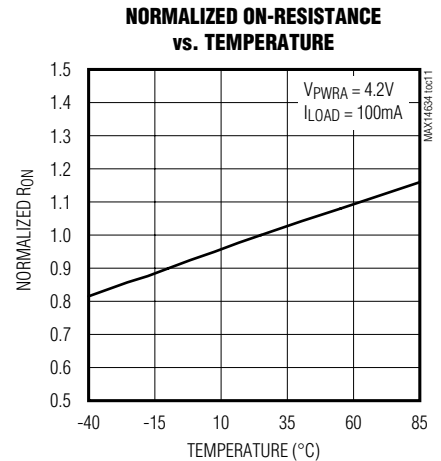
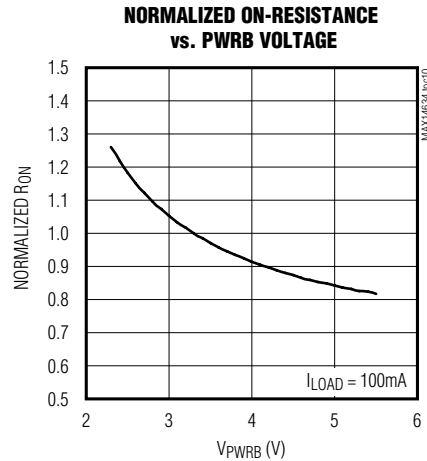
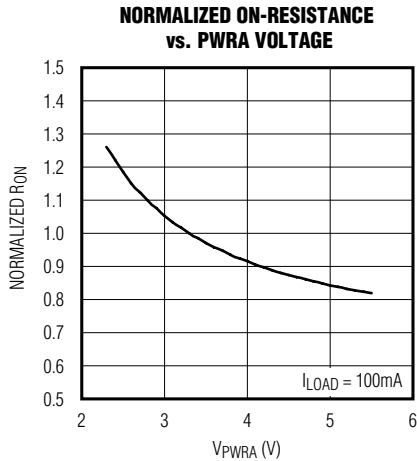


# MAX14634/MAX14680

## Ultra-Low On-Resistance and Compact Bidirectional Battery Switches

### Typical Operating Characteristics (continued)

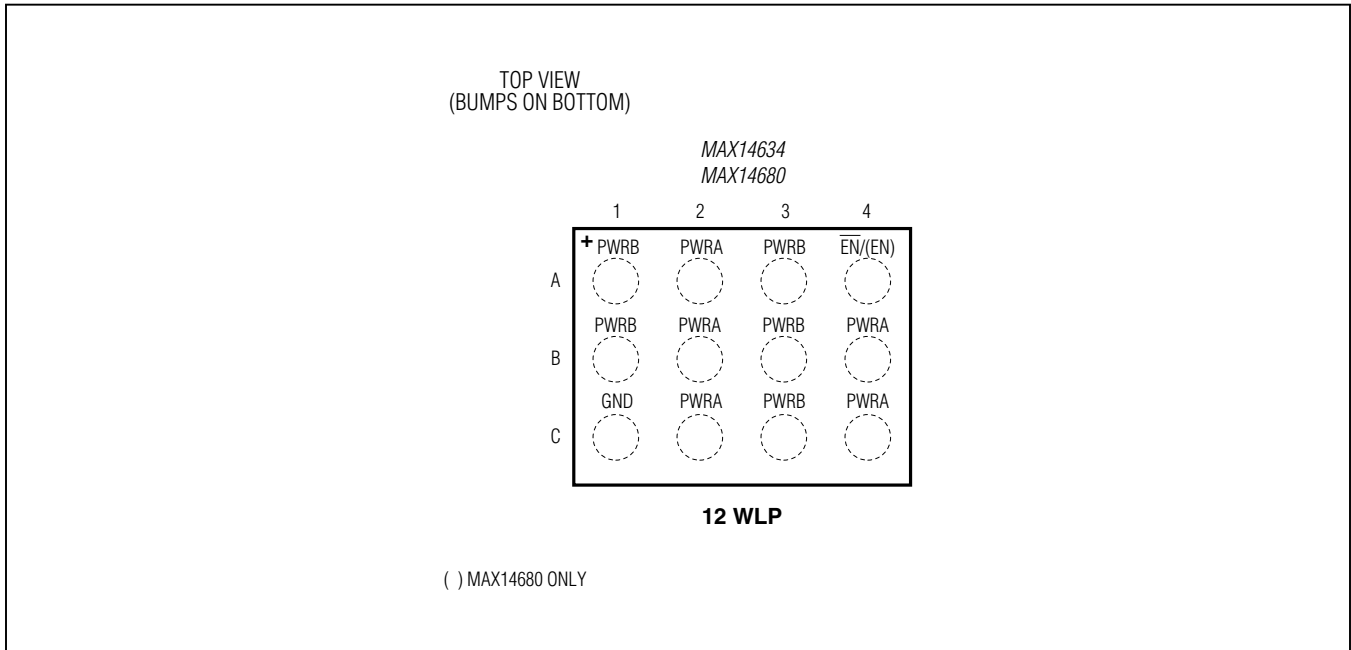
( $T_A = +25^\circ\text{C}$ , unless otherwise noted.)



# MAX14634/MAX14680

## Ultra-Low On-Resistance and Compact Bidirectional Battery Switches

### Bump Configuration



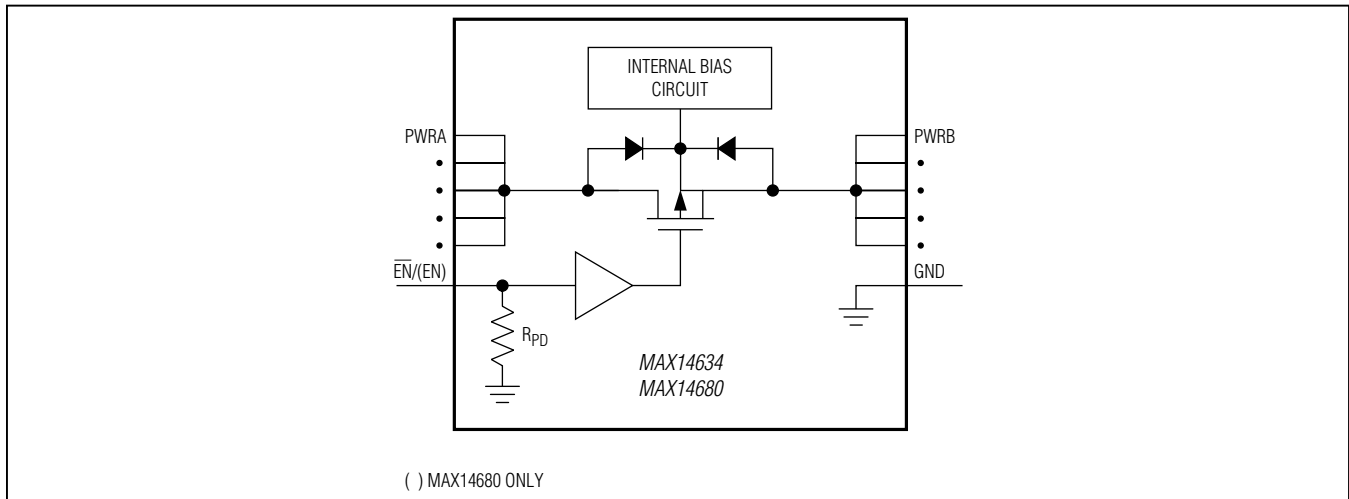
### Bump Description

MAX14634	MAX14680	NAME	FUNCTION
A1, A3, B1, B3, C3	A1, A3, B1, B3, C3	PWRB	Power I/O
A2, B2, B4, C2, C4	A2, B2, B4, C2, C4	PWRA	Power I/O
A4	—	$\overline{\text{EN}}$	Active-Low Enable Input. Drive $\overline{\text{EN}}$ low to turn on the switch.
—	A4	EN	Active-High Enable Input. Drive EN high to turn on the switch.
C1	C1	GND	Ground

# MAX14634/MAX14680

## Ultra-Low On-Resistance and Compact Bidirectional Battery Switches

### Functional Diagram



### Detailed Description

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#### Reverse-Current Blocking

The bidirectional FET switch prevents current flowing from either power input to the other when the switch is disabled.

#### $\overline{\text{EN}}/\text{EN}$ Input

The MAX14634's switch position is controlled by an  $\overline{\text{EN}}$  active-low logic input. The switch is on when  $\overline{\text{EN}}$  is logic-low and off when  $\overline{\text{EN}}$  is logic-high.  $\overline{\text{EN}}$  is internally pulled down to ground by  $R_{\text{PD}}$ .

The MAX14680's switch position is controlled by an EN active-high logic input. The switch is on when EN is logic-high and off when EN is logic-low. EN is internally pulled down to ground by  $R_{\text{PD}}$ .

### Ordering Information

PART	TEMP RANGE	TOP MARK	PIN-PACKAGE
MAX14634EWC+T	$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	ACO	12 WLP
MAX14680EWC+T	$-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$	ACV	12 WLP

+ Denotes a lead(Pb)-free/RoHS-compliant package.  
T = Tape and reel

### Chip Information

PROCESS: BiCMOS

### Package Information

For the latest package outline information and land patterns (footprints), go to [www.maximintegrated.com/packages](http://www.maximintegrated.com/packages). Note that a "+", "#", or "-" in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

PACKAGE TYPE	PACKAGE CODE	OUTLINE NO.	LAND PATTERN NO.
12 WLP	W121F1+1	<a href="#">21-0542</a>	Refer to <a href="#">Application Note 1891</a>

# MAX14634/MAX14680

## Ultra-Low On-Resistance and Compact Bidirectional Battery Switches

### Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	5/12	Initial release	—
1	1/13	Updated <i>Absolute Maximum Ratings</i> section	2
2	4/13	Added MAX14680 active-high part information to data sheet	1, 2, 3, 5, 6



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