TOREX

Torex...Powerfully Small!

Load Switch with Ideal Diode function
Product Overview

XC8110/XC8111 (0.5A / 1A)
XC8114 (3A)
XC8112/XC8113 (2ch x 0.5A / 2ch x 1A)

July 2024

TOREX Semiconductor

Rev. 0.4

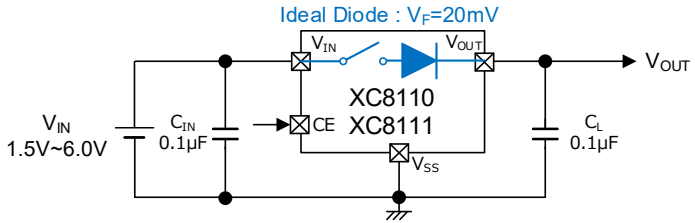
Ideal Diode Function / No Input Current under Reverse bias / Small Solution / IEC 62368-1 Certified

Features

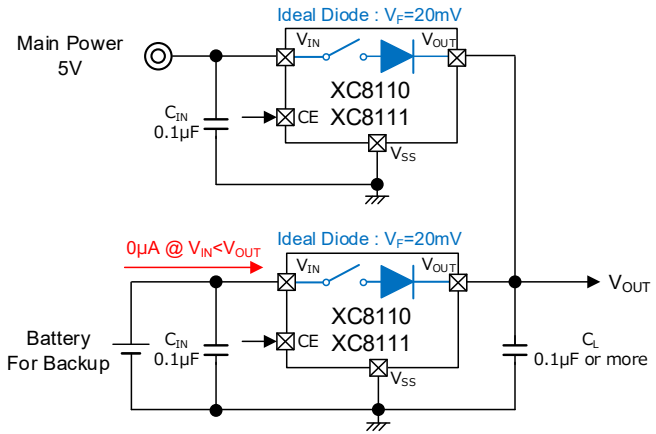
Input Voltage	: 1.5V ~ 6.0V
Output Current	: XC8110 / 500mA (V_{IN} > 1.7V) XC8111 / 1A (V_{IN} >2.0V)
Stand-by Current	: 0.65µA
Supply Current	: 3.6µA (at Forward bias) 0.0µA (at Reverse bias)
Reverse Bias Current	: 0.8µA
Forward Voltage	: 20mV
Current Limit	: XC8110 / 850mA XC8111 / 1700mA
Short Current	: 50mA
Function	: Ideal diode function
Protection	: Inrush Current Protection Current limit Thermal Shutdown
Standard	: IEC 62368-1:2023 Certified
Packages	: WLP-4-02, SOT-25, USP-6B06
Operating Ambient Temp.	: -40℃ ~ 105℃

Typical Application Circuit

Diode / substitute for load switch

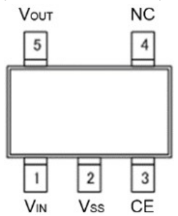


OR circuit: backup circuit, etc.

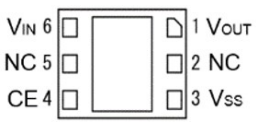


Packages

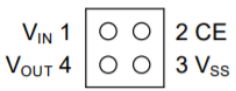
SOT-25 (2.8x2.9x1.3mm)

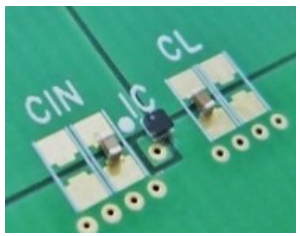


USP-6B06 (1.5x1.8x0.33mm)



WLP-4-02 (0.82x0.82x0.5mm)





Ideal Diode Function / No Input Current under Reverse bias / High current support / IEC 62368-1 Certified

Features

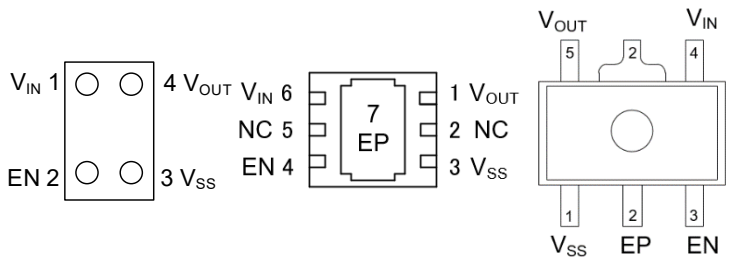
Input Voltage	: 1.5V ~ 6.0V
Output Current	: 3A (V_{IN} > 2.6V)
Stand-by Current	: 0.65μA
Supply Current	: 3.6μA (at Forward bias) 0.0μA (at Reverse bias)
Reverse Bias Current	: 0.8μA
Forward Voltage	: 20mV
Current Limit	: 4500mA
Short Current	: 60mA
Function	: Ideal diode function
Protection	: Inrush Current Protection Current limit Thermal Shutdown
Standard	: IEC 62368-1:2023 Certified
Packages	: WLP-4-04, DFN2018-6G, SOT-89-5
Operating Ambient Temp.	: -40 ~ 105℃

Packages

WLP-4-04 (0.82x1.48x0.495mm)

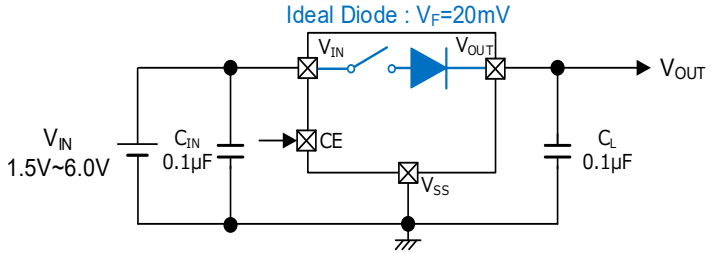
DFN2018-6G (1.8x2.0x0.6mm)

SOT-89-5 (4.5x4.6x1.6mm)

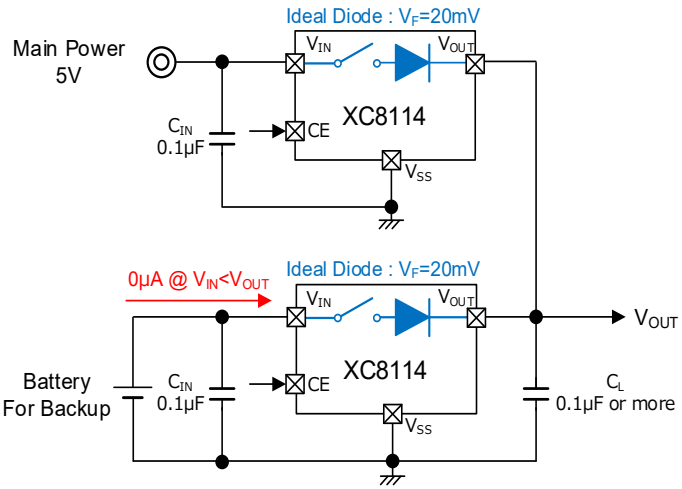


Typical Application Circuit

Diode / substitute for load switch



OR circuit: backup circuit, etc.



Ideal Diode x 2ch / Vout OR Connection, Parallel connection Supports high current and low Ron

UNDER DEVELOPMENT

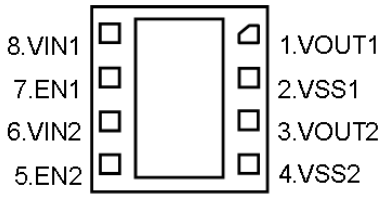
Features

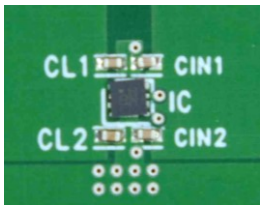
Input Voltage	: 1.5V ~ 6.0V (Absolute Max.:6.6V)
Output Current	: XC8112 : 2ch x 500mA (V_{IN}> 1.7V)
	XC8113 : 2ch x 1000mA (V_{IN}> 2.0V)
Stand-by Current	: 0.65μA/ch
Supply Current	: 3.6μA/ch (at Forward bias)
	0.0μA (at Reverse bias)
Reverse Bias Current	: 0.8μA/ch
Forward Voltage	: 20mV
Current Limit	: 2ch x 850mA (XC8112)
	2ch x 1700mA (XC8113)
Short Current	: 50mA
Function	: Ideal diode function
Protection	: Inrush Current Protection
	Current limit
	Thermal Shutdown
Standard	: IEC 62368-1:2023 Certified
Package	: USP-8B06
Operating Ambient Temp.	: -40℃ ~ 105℃

Packages

USP-8B06

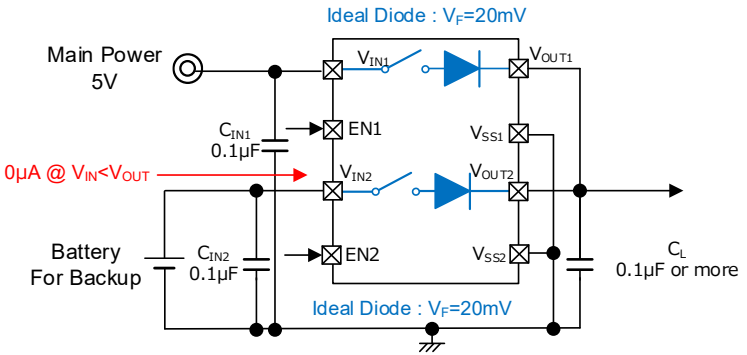
(2.0x2.0x0.33mm)



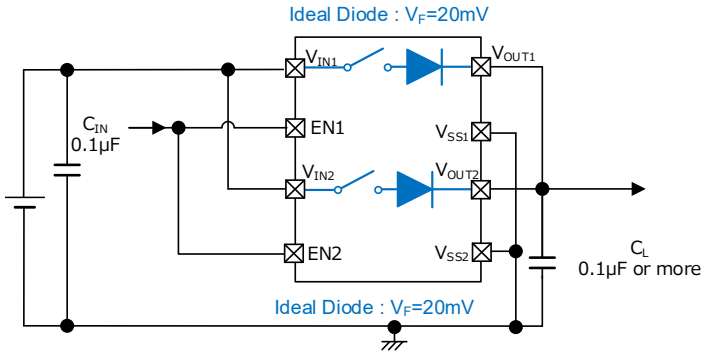


Typical Application Circuit

●OR Circuit：Backup circuit etc(XC8112/XC8113)



●Parallel connection(XC8112/XC8113)



List of Load Switch ICs with Ideal Diode Function

				UNDER DEVELOPMENT	UNDER DEVELOPMENT
	XC8110	XC8111	XC8114	XC8112	XC8113
V_{IN}	1.5V ~ 6.0V				
I_{OUT}	500mA	1000mA	3000mA	2ch x 500mA	2ch x 1000mA
Iq	Forward bias : 3.6µA Reverse bias : 0.0µA			Forward bias : 3.6µA/ch Reverse bias : 0.0µA/ch	
Function	Ideal Diode function EN function				
Protection Function	Inrush Protection Current Limit (Fold-Back+Drop) Thermal Shutdown				
Package	WLP-4-02 (0.82x0.82x0.5mm) USP-6B06 (1.5x1.8x0.33mm) SOT-25 (2.8x2.9x1.3mm)		WLP-4-01 (0.82x1.48x0.495mm) DFN2018-6G (1.8x2.0x0.6mm) SOT-89-5 (4.5x4.6x1.6mm)	USP-8B06 (2.0x2.0x0.33mm)	
Standard	IEC 62368-1:2023				
Feature	Small Space		high current	2ch product Small Space	

What is the ideal diode function?

Ideal Diode function

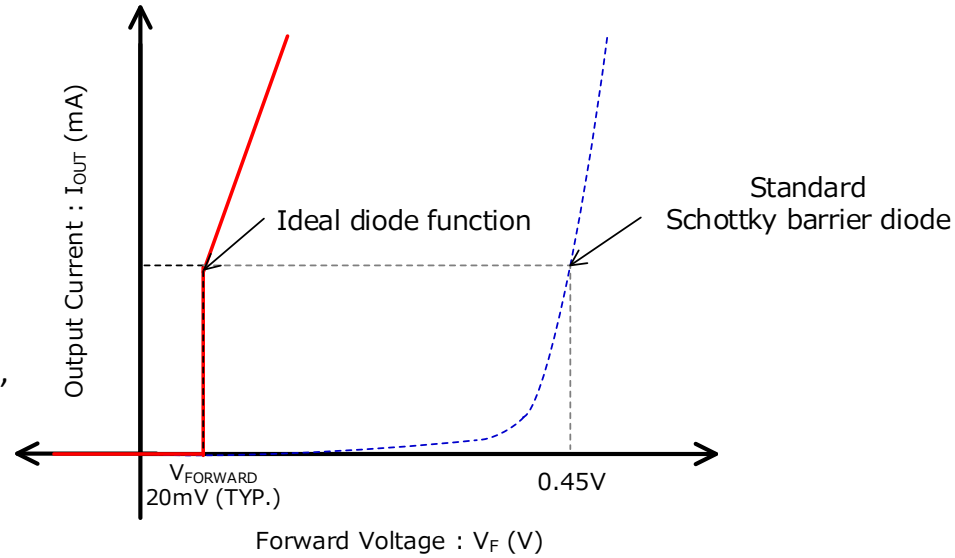
VF and leakage current are much smaller than SBD.

- VF of SBD is around 0.3~0.4V. When an SBD is inserted in series with a battery, the battery life is shortened due to VF losses. With ideal diodes, VF losses can be reduced and battery life can be prolonged.
- Good to avoid heat issue as well.

Lower leakage current from V_{OUT} to V_{IN}

- SBDs have a leakage current of several µA to several hundred µA, which have a negative impact on battery life.
  Whereas the ideal diode have almost no leakage current.

IV curve of Ideal diode



Reverse current function

✓ **True Reverse Current Prevention: XC8110/XC8111, XC8112/XC8113, XC8114**

Normally V_{OUT} is maintained at "V_{IN}-20mV". If V_{OUT} becomes higher than this, the reverse current prevention is activated.
This function provides complete reverse current prevention like a diode.

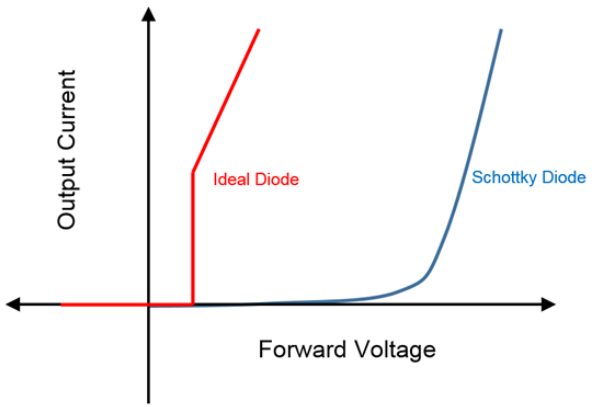
✓ **Reverse current prevention: usual load SWs**

This function prevents reverse current when the voltage on the input side becomes lower, but since reverse current is prevented after it has flowed, complete reverse current prevention is not possible.
* When CE = "L", reverse current prevention is possible without reverse current flow.

XC8110/XC8111, XC8112/XC8113, XC8114 : Protection functions

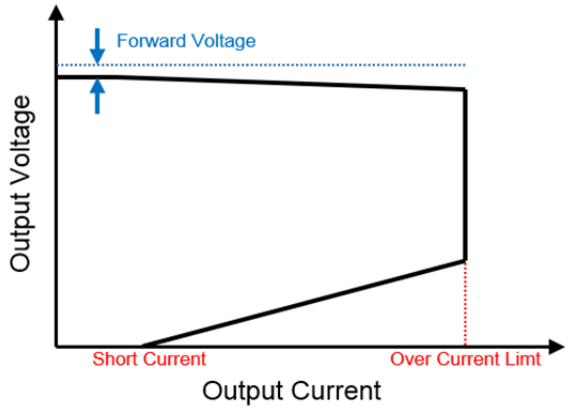
- Equipped with protective functions which are not found in diodes.

IV Characteristic



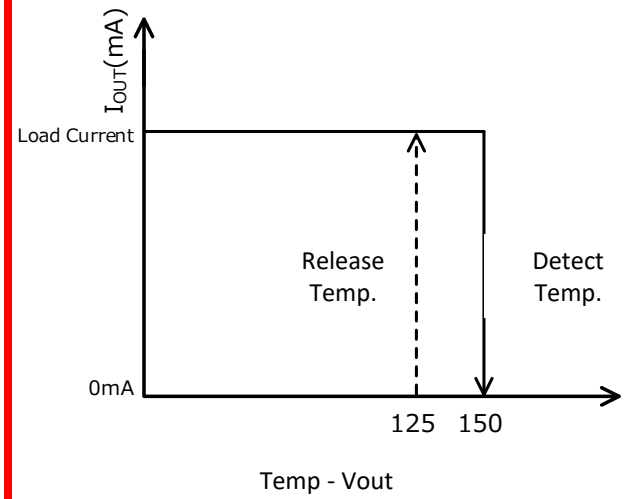
1/20 Almost no VF Compared to SBD

Current Limit



Current limit with foldback
⇒ Pseudo Fuse that can be used repeatedly

Thermal Protection



Thermal shutdown (Automatic recovery)

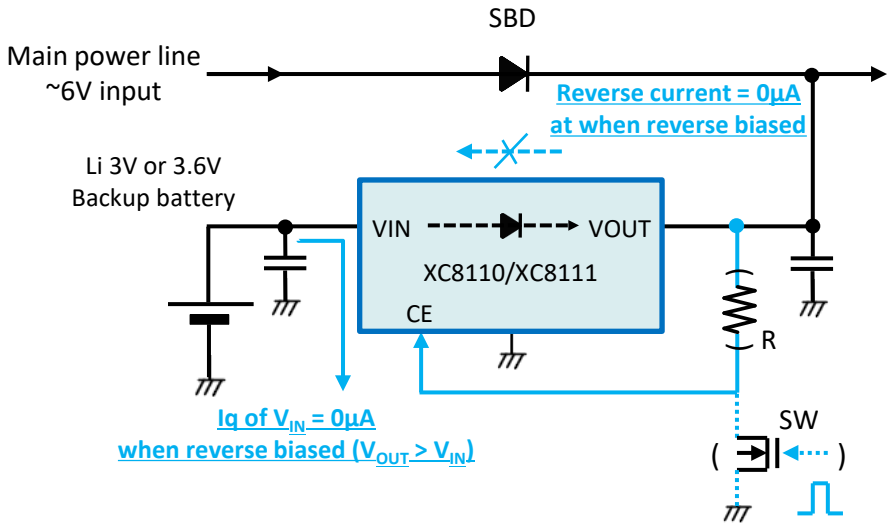
- Equipped with protection functions such as current limit function. Significantly improved safety.

IEC 62368-1:2023 certified, enabling simplification of stand-alone failure testing of the post-stage components.

Application circuit 1

OR Connection / Backup circuit

- There is no voltage drop such as VF of SBD.
- Iq of V_{IN} is 0.0µA when reverse biased, so suitable for a backup circuit.
- Easy automatic switching of power supply path without control



Additional shutdown function for shipping.

Basic use as ideal diode.
It is ideal for OR connection applications as it is equipped with true reverse current prevention.

A shutdown function at the time of shipment can also be installed by making the CE connection point on the output side.

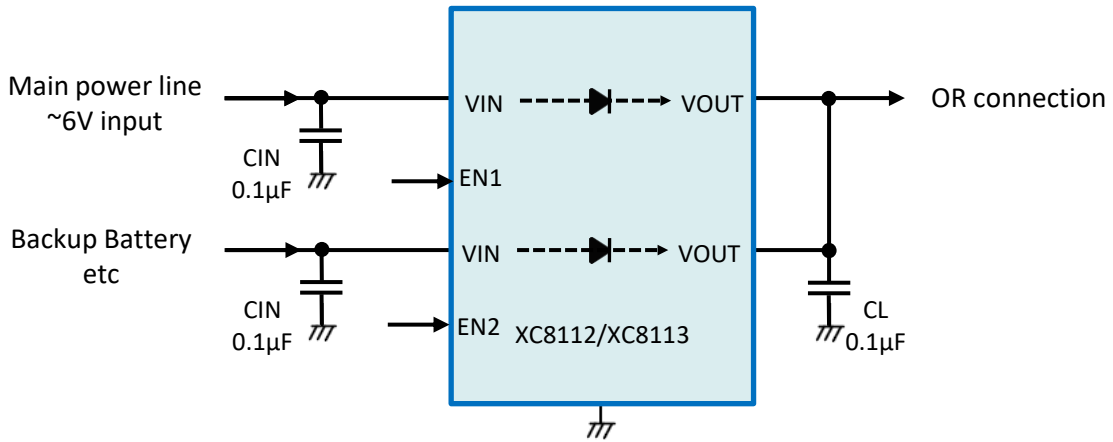
Condition	CE	Usual case	IV_{IN} (Iq)	IV_{OUT}	ICE
Forward bias	"H"	Forward bias as a diode	3.6µA	0µA	0.48µA
Reverse bias		Reverse bias as a diode	0µA	0.8µA	
Forward bias	"L"	SW off as Load SW, Ship mode	0.65µA	0µA	0µA
Reverse bias		SW off as Load SW with Reverse bias	0µA	0.8µA	

Application circuit 2

Backup circuit (OR connection) / Reverse current protection when batteries are in parallel

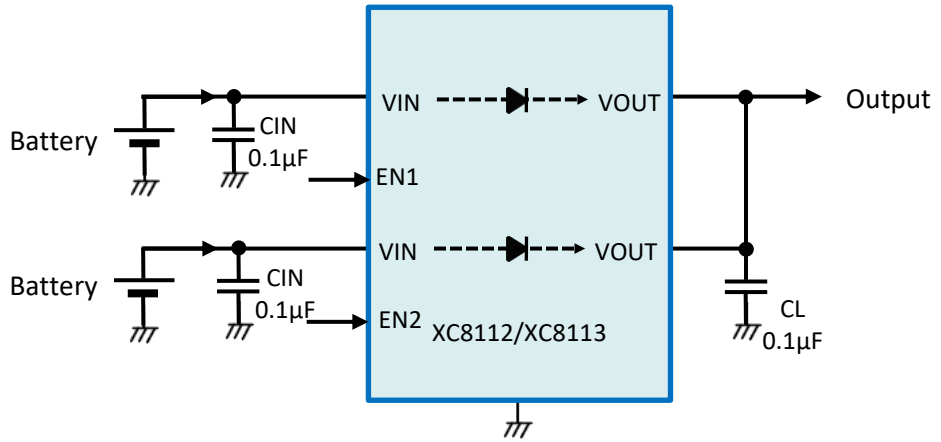
Backup circuit

For switching power to a back-up power supply in the event of loss of main line power.



Prevention of backflow when batteries are paralleled

When new and old batteries are used in parallel,
For applications where backflow from one battery to the other is prevented.



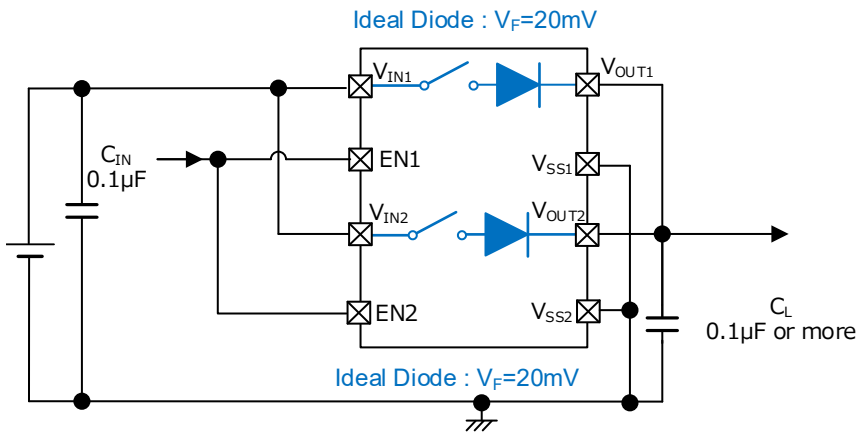
Application circuit 3

Parallel connection for high current / low Ron

XC8110 ~ XC8114 can be connected in parallel.

By connecting the 3A product XC8114 in parallel, it can be used for output currents of 3A or more.
When connected in parallel, the Ron is ½.

By increasing the number of ICs, more than two in parallel can be supported.



XC8113 Parallel Connection