

Application Note

AP22913 Application Information and Demo Board User Guide

Description

The AP22913 slew rate controlled load switch is a single P-channel MOSFET power switch designed for high-side load-switching applications. The MOSFET has a typical $R_{DS(ON)}$ of $54m\Omega$ at 5V(X1-WLB0909-4), allowing increased load current handling capacity with a low forward voltage drop. The turn-on slew rate of the device is controlled internally. V_{IN} and V_{OUT} are isolated during OFF state with TRCB (True Reverse Current Blocking) feature.

The AP22913 load switch is designed to operate from 1.4V to 5.5V, making it ideal for 1.8V, 2.5V, 3.3V, and 5V systems. The typical quiescent supply current is only $1\mu A$.

The AP22913 is available in the wafer level chip scale 4-pin, X1-WLB0909-4 0.5mm pitch package.

Applications

- Mobile Device and Smart Phones
- Portable Media Devices
- Wearable Devices
- Advanced Notebook, UMPC and MID
- Portable Medical Devices
- GPS and Navigation Equipment

Features

- Wide Input Voltage Range: 1.4V to 5.5V
- Low On-Resistance(X1-WLB0909-4):
 - $92m\Omega$ Typical @1.5V
 - $76m\Omega$ Typical @1.8V
 - $56m\Omega$ Typical @3.3V
 - $54m\Omega$ Typical @5.0V
- High DC Current Capability up to 2A
- Truly Reverse Current Block (TRCB)
- Discharging Resistor on V_{OUT} When Disabled
- Ultra Low Quiescent Current $1\mu A$
- Active-high Control Pin
 - Minimum 1.1V V_{IH} of ON
- ESD Protection:
 - Human Body Model: 2kV
 - Charged Device Model: 1kV
- Totally Lead-Free & Fully RoHS compliant (Notes 1 & 2)
- Halogen and Antimony Free. "Green" Device (Note 3)

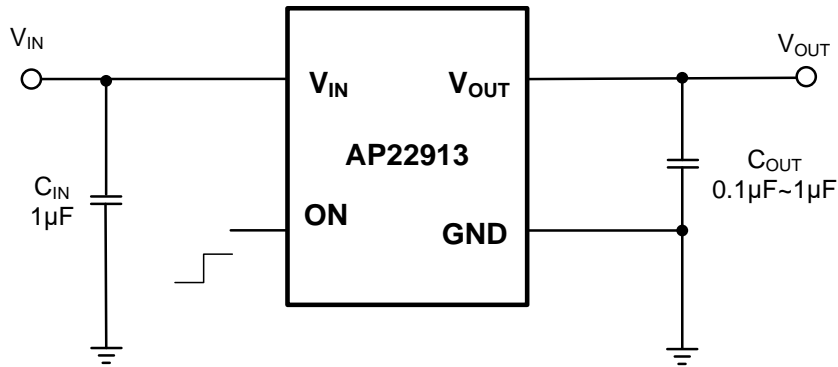
Notes:

1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

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Typical Applications Circuit



Absolute Maximum Ratings

Symbol	Parameter	Ratings		Unit
ESD HBM	Human Body Model ESD Protection	6		kV
ESD CDM	Charged Device Model ESD Protection	2		kV
V_{IN}	Input Voltage	-0.3 to 6		V
V_{OUT}	Output Voltage	-0.3 to 6		V
V_{ON}	ON Voltage	-0.3 to 6		V
I_{LOAD}	Maximum Continuous Load Current	2		A
I_{LOAD}	Maximum Pulse Load Current, Pulse <300μs, 2% Duty Cycle	2.5		A
T_J	Maximum Junction Temperature	+125		°C
T_{ST}	Storage Temperature Range	-65 to +150		°C
P_D	Power Dissipation	WLB0909-4	735	mW
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 4)	WLB0909-4	136	°C/W
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Note 5)	WLB0909-4	31	°C/W

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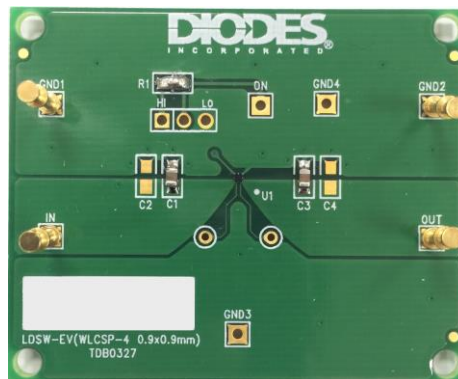
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Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit	
V_{IN}	Input Voltage	1.4	5.5	V	
V_{ON}	ON Voltage Range	0	5.5	V	
V_{OUT}	Output Voltage	1.4	5.5	V	
I_{OUT}	Output Current	0	2.0	A	
V_{IH}	ON High-Level Input Voltage	1.1	5.5	V	
V_{IL}	ON Low-Level Input Voltage	$V_{IN} = 3.6V \text{ to } 5.5V$	0	0.6	V
		$V_{IN} = 1.4V \text{ to } 3.6V$	0	0.4	V
T_A	Operating Ambient Temperature	-40	+85	°C	

Evaluation Board

Top View



Dimensions: 53.34mm(L) x 43.82 mm(w)

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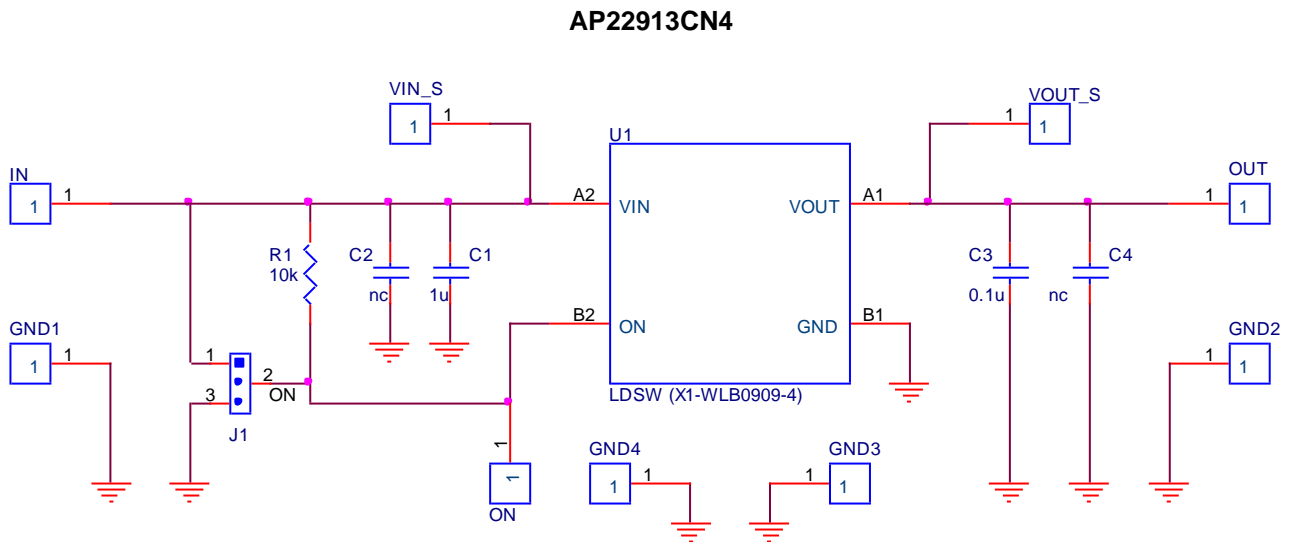
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Quick Start Guide

AP22913 is a single p-channel MOSFET load switch. It has an input voltage range between 1.4V to 5.5V and is capable of handling up to 2A continuous current. The board demonstrates the AP22913's current handling capacity with its controlled turn on, low $R_{DS(on)}$ and very low quiescent current specification. All inputs and output are brought out to test points for control and monitoring. All passive components are included on the EVM for device operation.

1. Connect a power supply between IN and GND terminals.
2. Connect the positive connection to the IN and the negative connection to the GND.
3. Connect an adjustable current or resistive load to OUT and GND terminals.
4. Connect the positive connection of the load to the OUT and the negative connection to the GND.
5. IN via reserved resistor R1 connect to ON terminal or installed shorting jumper on J1 in either the Hi or Lo positions. The default is shorted directly between IN and ON terminals.
6. Turn on the power supply.
7. Increase the load current of OUT and observe that the load current stop increasing after reaching limit level.

Evaluation Board Schematic

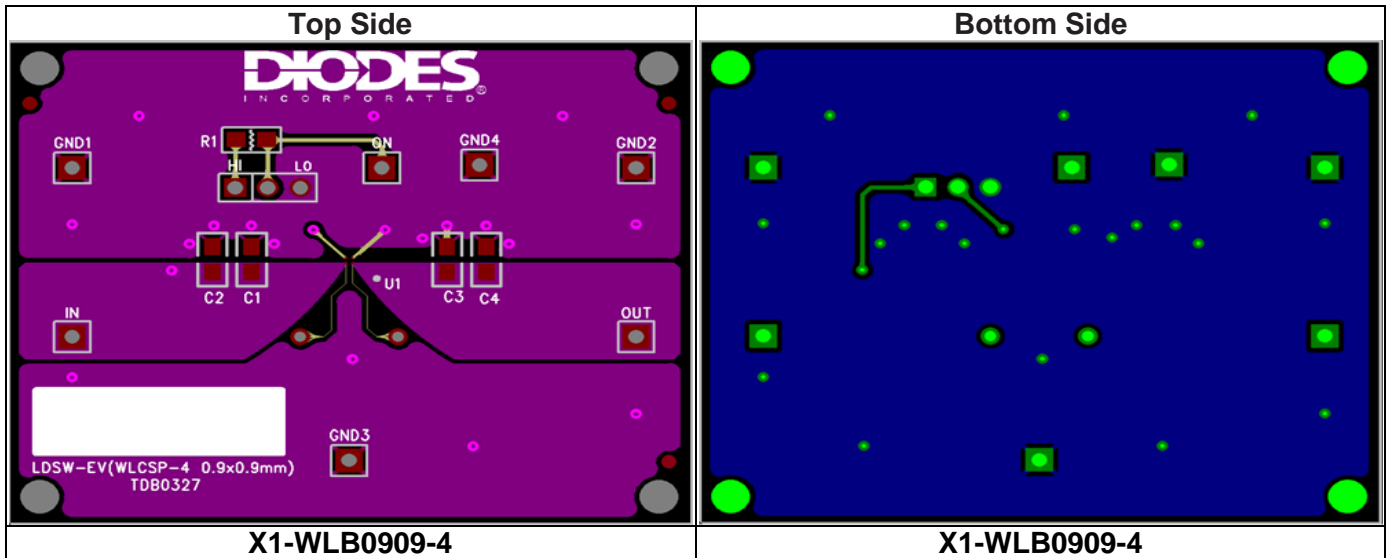


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PCB Layout



Bill of Materials

Component Location	Q'ty	Value	Specification	Vendor	Part No.	Size
U1	1	AP22913	2A single channel load switch	Diodes	AP22913CCN4-7	WLCSP-4
C1	1	1 μ F	X7R 10% 25V Cap MLCC	Taiyo Yuden	TMK212B7105KG	0805
C3	1	0.1 μ F	X7R 10% 50V Cap MLCC	Taiyo Yuden	UMK212B7104KG	0805
C2,C4	2	-	NC	-	-	-
R1	1	10k Ω	0603 \pm 1% 1/10W Resistor	Yageo	RC0603FR-0710KL	0603
PCB	1		AP22913 EV Board	Diodes Inc.	TDB0327	-

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Vendors of peripheral components

Suggested Capacitors :

Vendor	Application	Value	Capacitance	Type	Series
Taiyo Yuden	Cin Cout	1 μ F	25V/X7R, 10%	SMD	TMK212B7105KG
				SMD	TMK107B7105KA
	Cout	0.1 μ F	25V/X7R, 20%	SMD	TWK107B7104MV
				SMD	UMK212B7104KG
Murata	Cin Cout	1 μ F	25V/X7R, 10%	SMD	GRM21BR71E105KA99
				SMD	GRM188R71E104KA01
	Cout	0.1 μ F	25V/X7R, 10%	SMD	GRM21BR71E104KA01

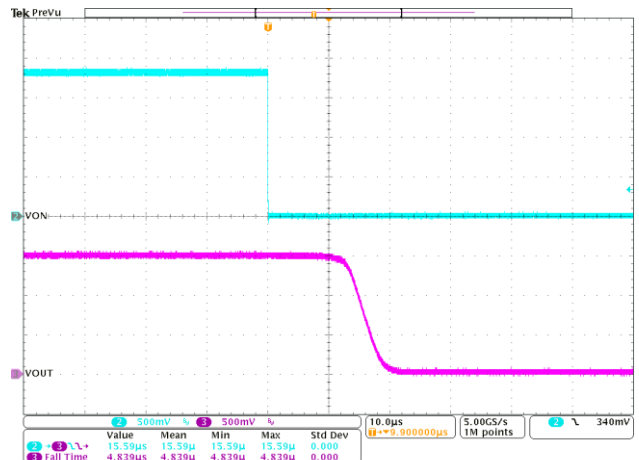
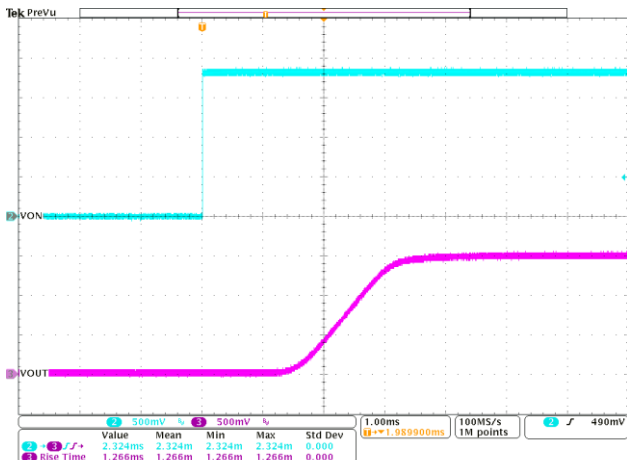
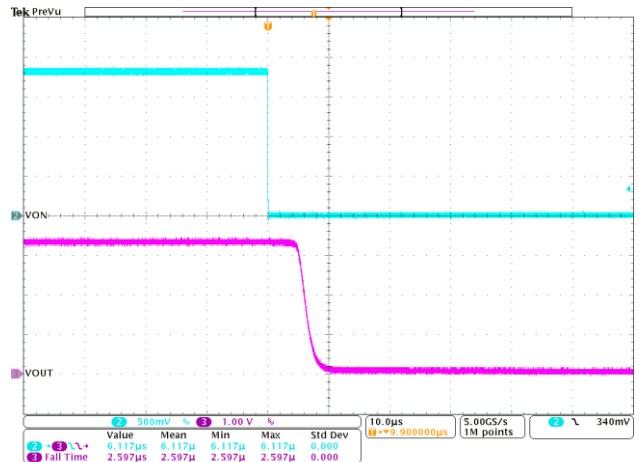
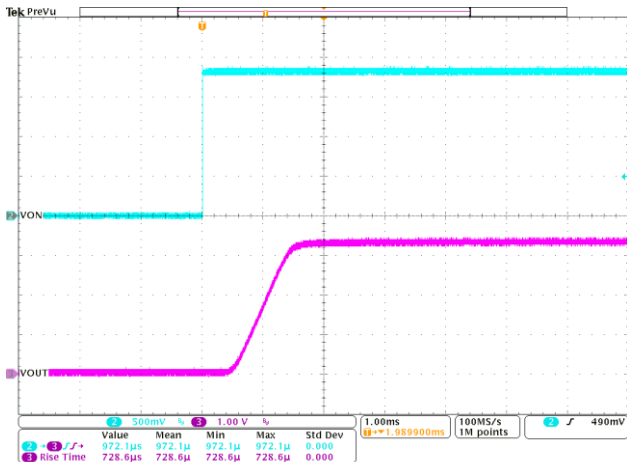
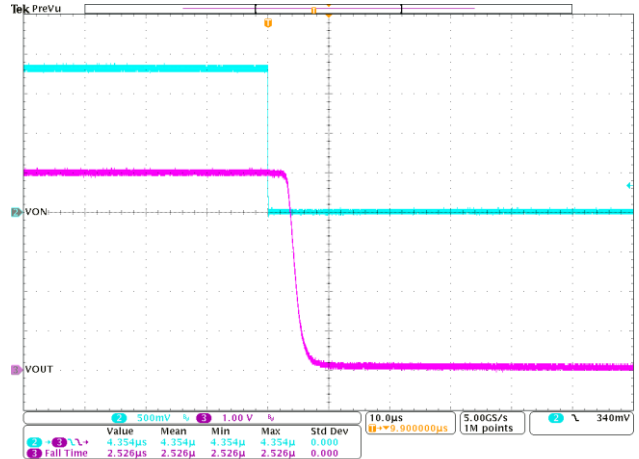
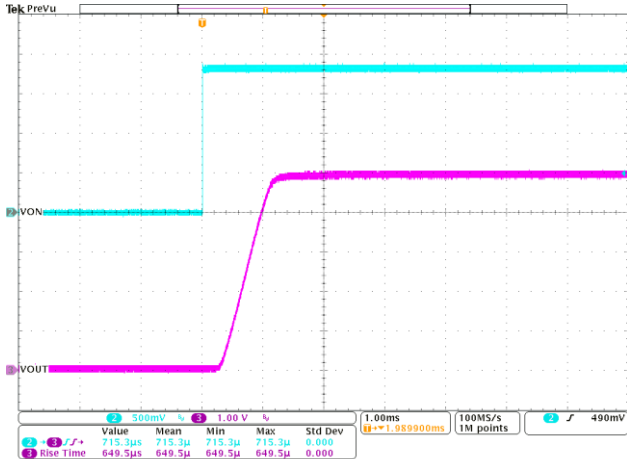
Suggested Resistor :

Vendor	Type	Series
Yageo	SMD	RC0603FR

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VOUT Turn On/Off Response Example (CH1: V_{ON}, CH2: V_{OUT})



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