CW3301

Ultra-Small, Slew-Rate-Controlled Load Switch

Features

- 1.1V to 5.5V Input Voltage Operating Range
- Maximum Continuous Current (I_{MAX}): 2A
- Typical Ron:
  - 30mΩ at V_{IN}=5.5V
  - 39mΩ at V_{IN}=3.3V
  - 62mΩ at V_{IN}=1.8V
  - 130mΩ at V_{IN}=1.1V
- Slew Rate Control:
  - t_R=115μs, Typ.
- Ultra-low Power Consumption:
  - On State I_Q: 5nA Typ. at V_{IN}=1.8V
  - Off State I_{SD}: 12nA Typ. at V_{IN}=1.8V
- Quick Output Discharge (QOD) Supported
- Internal ON Pull-down Resistor
- Lead-free WLCSP-4 package

Applications

- Wearables
- Smartphone
- IoT Devices
- Low-Power Handheld Devices

General Description

The CW3301 is an ultra-small and ultra-efficiency, 2A rated load switch with integrated slew rate control. The best in class efficiency makes it an ideal choice for use in wearables, IoT and mobile devices.

The CW3301 input voltage range operates from 1.1V to 5.5V to provide power-disconnect capability for post-regulated power rails. The integrated slew rate control can enhance system reliability by mitigating bus voltage swings during switching events and specifically limits inrush current during turn-on to minimize voltage drop.

The CW3301 features an ultra-efficient technology to low the quiescent current (I_Q) and shutdown current (I_{SD}), which helps to reduce system leakage current and increase battery lifetime.

The CW3301 is controlled by a logic input (ON pin) compatible with standard CMOS GPIO circuitry.

The IC is available in a tiny lead-free 0.4mm pitch, 0.76mm x 0.76mm, 4-ball WLCSP package.

Application Diagram

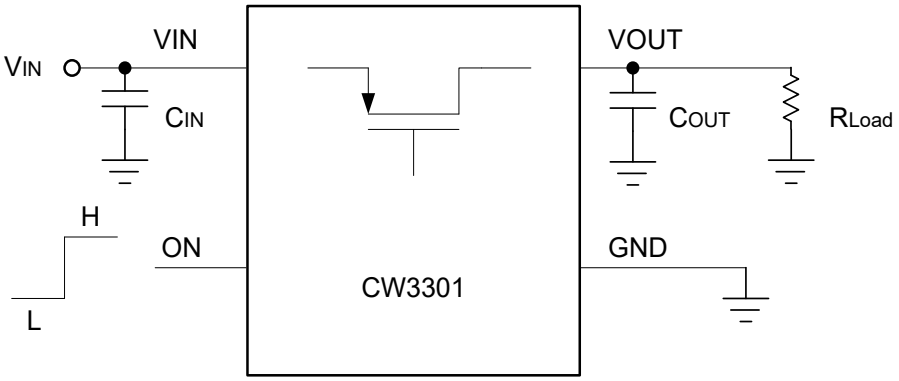


Figure 1. Typical Application

Ordering Information

Part Number	Temperature Range	ON Pin Activity	Output Discharge	Package and Pin	Top Mark**	Shipping
CW3301AAAC	-40°C to 85°C	Active High	78Ω	WLCSP-4	A1X XXX	Tape&Reel 3000
CW3301AABC	-40°C to 85°C	Active High	NA	WLCSP-4	B1X XXX	Tape&Reel 3000
CW3301AACC*	-40°C to 85°C	Active Low	78Ω	WLCSP-4	C1X XXX	Tape&Reel 3000
CW3301AADC*	-40°C to 85°C	Active Low	NA	WLCSP-4	D1X XXX	Tape&Reel 3000

Notes: * stands for future products and supply on request.

**XXXX stands for the manufacture information. Contact manufacturer for details.

Pin Configuration

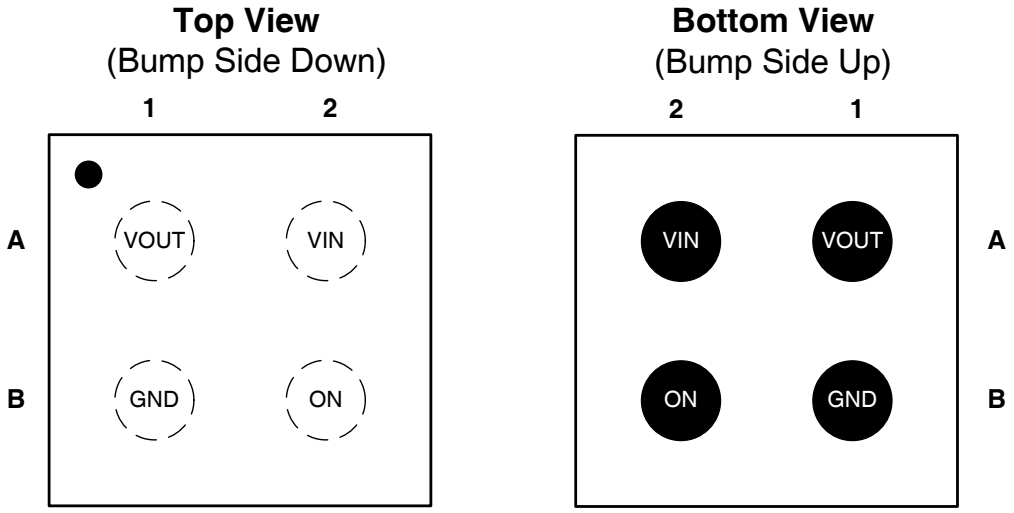


Figure 2. Pin Configuration

Pin Descriptions

#	PIN NAME	PIN TYPE	PIN DESCRIPTION
A1	VOUT	Power	Switch Output
A2	VIN	Power	Switch Input. Supply Voltage for IC
B1	GND	GND	Ground
B2	ON	I/O	Enable to Control the Switch

Absolute Maximum Ratings (1)

		MIN	MAX	UNIT
Input Voltage	V_{IN}, V_{OUT}, V_{ON} to GND	-0.3	6	V
Output Current	Maximum Continuous Switch Current		2	A
Output Current	Maximum Peak Switch Current at Ambient Temperature		2.3	A
Power Dissipation	Power Dissipation at T_A=25°C		1	W
Junction Temperature	T_J	-40	150	°C
Storage Temperature	T_{STG}	-65	150	°C
ESD	All Pins. HBM model.	±4000		V
	All Pins. CDM model.	±1000		V
Moisture Sensitivity Level	MSL	Level 1		

Note:

(1) Stresses beyond "Absolute Maximum Ratings" condition may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other 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.

Recommended DC Operating Conditions

		MIN	MAX	UNIT
Input Voltage	V_{IN}	-0.3	5.5	V
Ambient Temperature	T_A	-40	85	°C

Electrical Characteristics

V_{IN}=3.3V, T_A=+25°C, unless otherwise noted.

Parameter	Symbol	Test Condition	MIN	TYP	MAX	UNIT
Basic Operation						
Supply Voltage	V_{IN}		1.1		5.5	V
OFF Supply Current	$I_{Q(OFF)}$	V_{ON}=GND, V_{OUT}=Open, V_{IN}=5.5V		214		nA
		V_{ON}=GND, V_{OUT}=Open, V_{IN}=3.3V		16		nA
		V_{ON}=GND, V_{OUT}=Open, V_{IN}=1.8V		12		nA
		V_{ON}=GND, V_{OUT}=Open, V_{IN}=1.1V		11		nA
Shutdown Current	I_{SD}	V_{ON}=GND, V_{OUT}=GND, V_{IN}=5.5V		210		nA
		V_{ON}=GND, V_{OUT}=GND, V_{IN}=3.3V		16		nA
		V_{ON}=GND, V_{OUT}=GND, V_{IN}=1.8V		12		nA
		V_{ON}=GND, V_{OUT}=GND, V_{IN}=1.1V		11		nA
Quiescent Current	I_Q	I_{OUT}=0mA, V_{ON}= V_{IN}, V_{IN}=5.5V		8		nA
		I_{OUT}=0mA, V_{ON}= V_{IN}, V_{IN}=3.3V		6		nA
		I_{OUT}=0mA, V_{ON}= V_{IN}, V_{IN}=1.8V		5		nA
		I_{OUT}=0mA, V_{ON}= V_{IN}, V_{IN}=1.1V		4		nA
ON Resistance	R_{on}	V_{IN}=5.5V, I_{OUT}=200mA, T_A=25°C		30		mΩ
		V_{IN}=3.3V, I_{OUT}=200mA, T_A=25°C		39		mΩ
		V_{IN}=1.8V, I_{OUT}=200mA, T_A=25°C		63		mΩ
		V_{IN}=1.1V, I_{OUT}=200mA, T_A=25°C		138		mΩ
Output Discharge Resistance	R_{PD}	V_{IN}=3.3V, V_{ON}=GND, I_{OUT}=20mA, T_A=25°C, CW3301AAAC		78		Ω
ON Pull Down Resistance	R_{ON_PD}	V_{IN}=1.1V to 5.5V		10		MΩ
ON Input Leakage	I_{ON}	V_{ON}=V_{IN} or GND			1	μA
Input High Threshold Level	V_H		1.1			V
Input Low Threshold Level	V_L				0.4	V
Dynamic Operation						
Turn-On Delay	t_{dON}	V_{IN}=3.3 V, R_{LOAD}=10Ω, C_{OUT}=0.1μF, T_A=25°C		60		μs
Turn-On Time	t_{ON}	V_{IN}=3.3 V, R_{LOAD}=10Ω, C_{OUT}=0.1μF, T_A=25°C		175		μs
V_{OUT} Rise Time	t_R	V_{IN}=3.3 V, R_{LOAD}=10Ω, C_{OUT}=0.1μF, T_A=25°C		115		μs
Turn-Off Delay	t_{dOFF}	V_{IN}=3.3 V, R_{LOAD}=10Ω, C_{OUT}=0.1μF, T_A=25°C		3.6		μs
Turn-Off Time	t_{OFF}	V_{IN}=3.3 V, R_{LOAD}=10Ω, C_{OUT}=0.1μF, T_A=25°C		6		μs
V_{OUT} Fall Time	t_F	V_{IN}=3.3 V, R_{LOAD}=10Ω, C_{OUT}=0.1μF, T_A=25°C		2.4		μs
Turn-Off Delay	t_{dOFF}	V_{IN}=3.3 V, R_{LOAD}=500Ω, C_{OUT}=0.1μF, T_A=25°C		4.5		μs
Turn-Off Time	t_{OFF}	V_{IN}=3.3 V, R_{LOAD}=500Ω, C_{OUT}=0.1μF, T_A=25°C		20.5		μs
V_{OUT} Fall Time	t_F	V_{IN}=3.3 V, R_{LOAD}=500Ω, C_{OUT}=0.1μF, T_A=25°C		16		μs

Timing Diagram

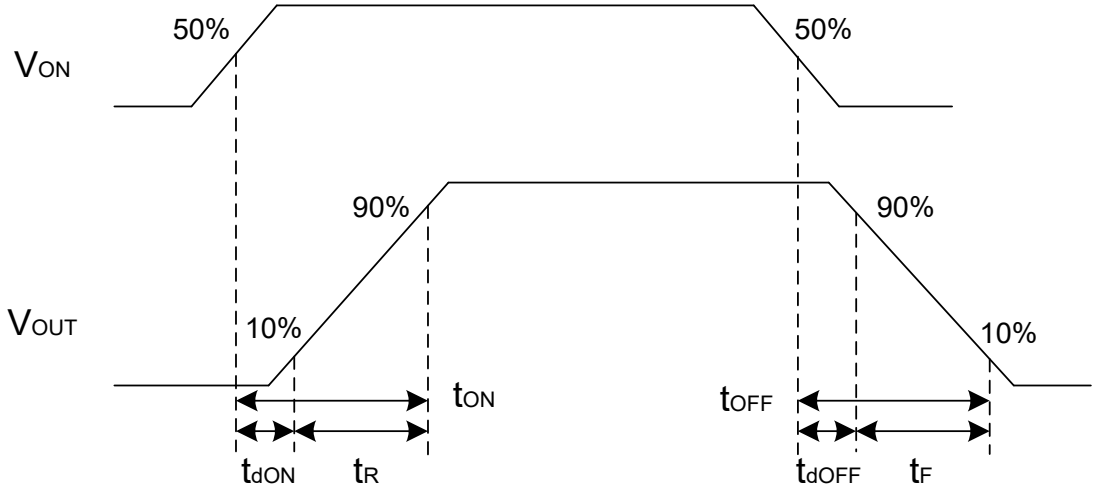
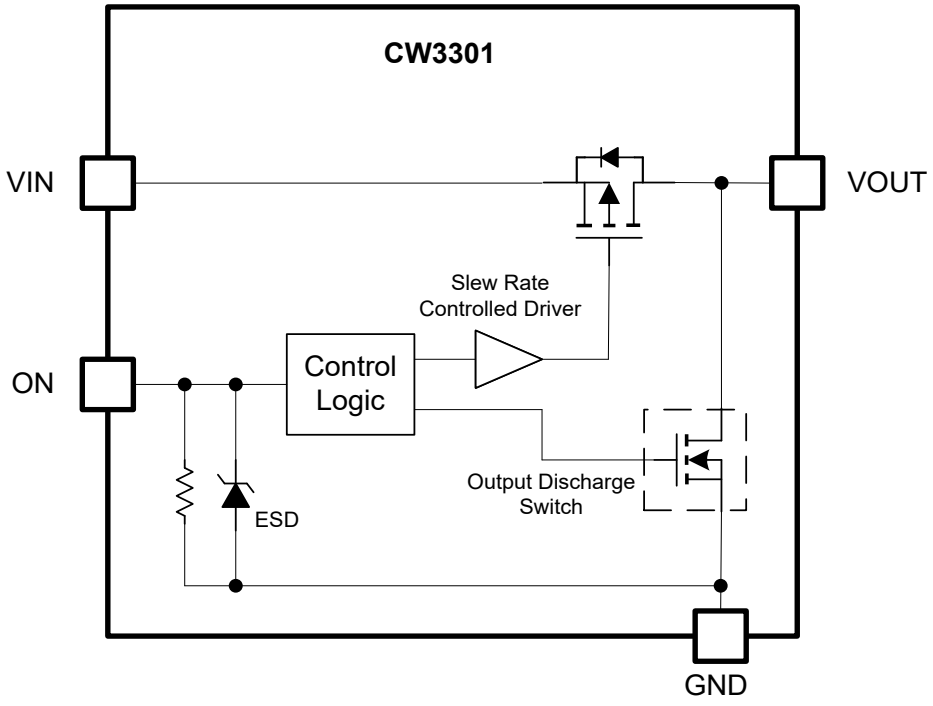


Figure 3. Timing Diagram

Functional Block Diagram



Note: Output discharge is optional.

Figure 4. Functional Block Diagram

Typical Characteristics

V_{IN}=3.3V, T_A=+25°C, unless otherwise noted.

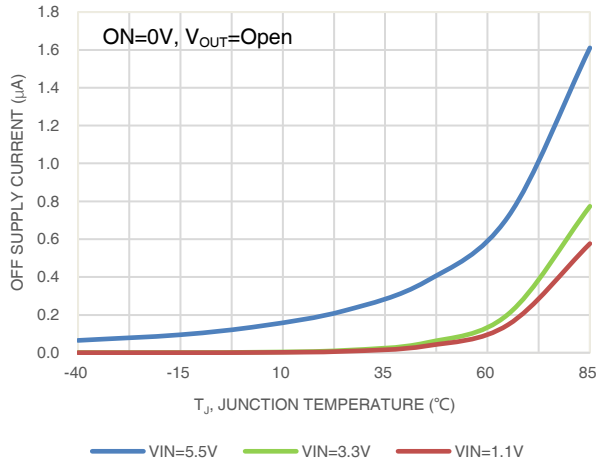


Figure 5. Off Current vs. Temperature

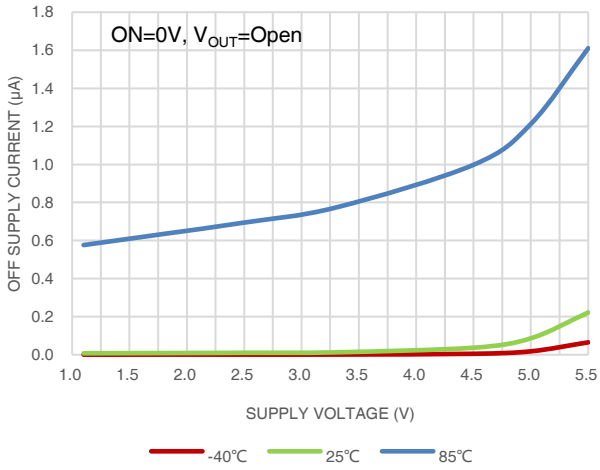


Figure 6. Off Current vs. Supply Voltage

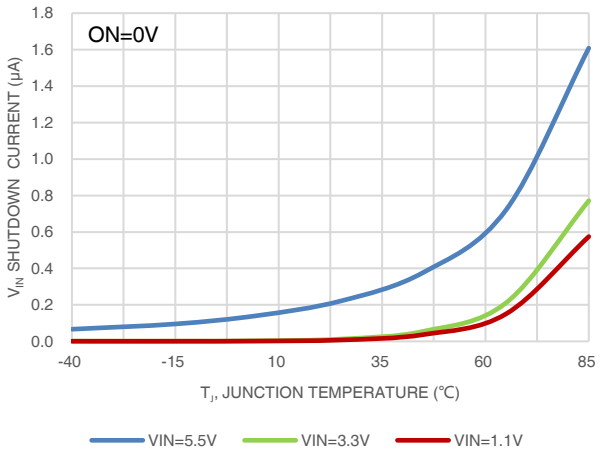


Figure 7. Shutdown Current vs. Temperature

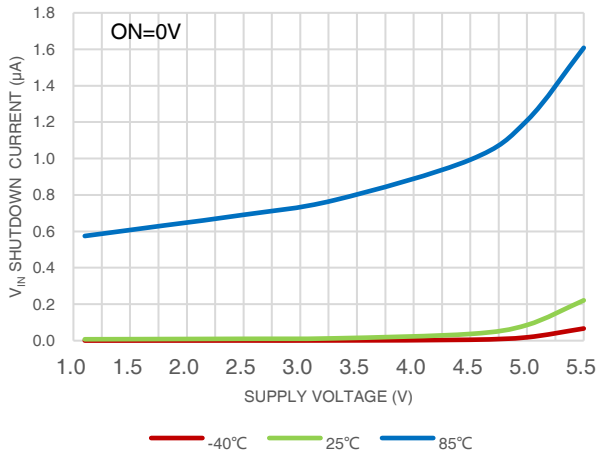


Figure 8. Shutdown Current vs. Supply Voltage

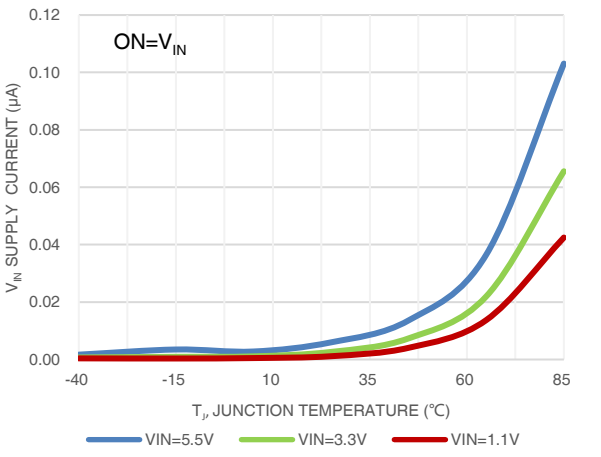


Figure 9. Quiescent Current vs. Temperature

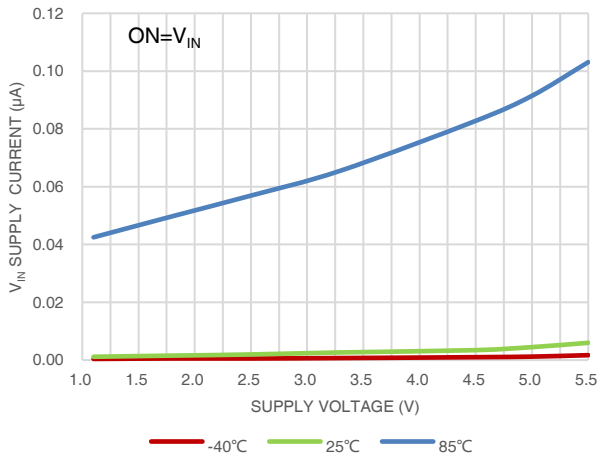


Figure 10. Quiescent Current vs. Supply Voltage

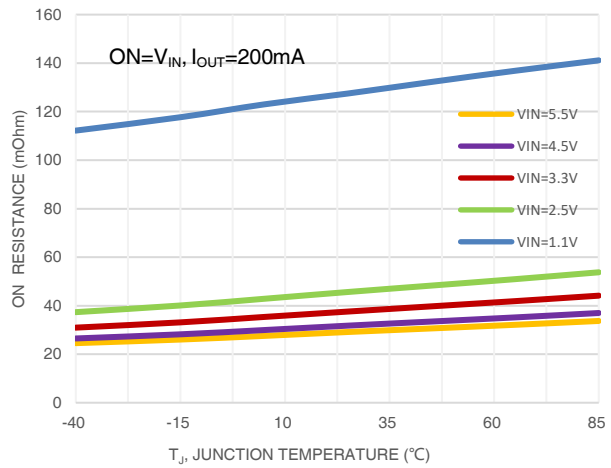


Figure 11. R_{ON} Resistance vs. Temperature

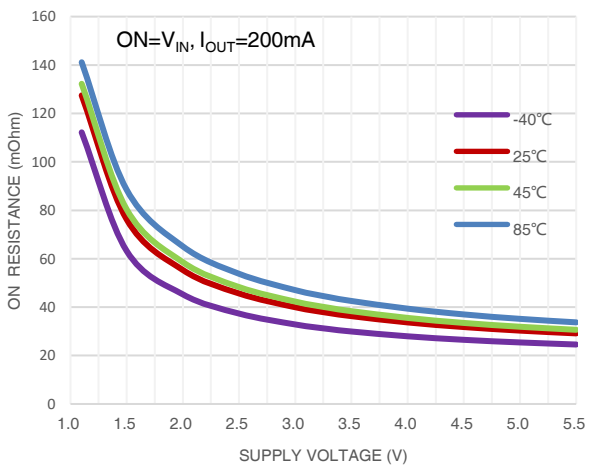


Figure 12. R_{on} Resistance vs. Supply Voltage

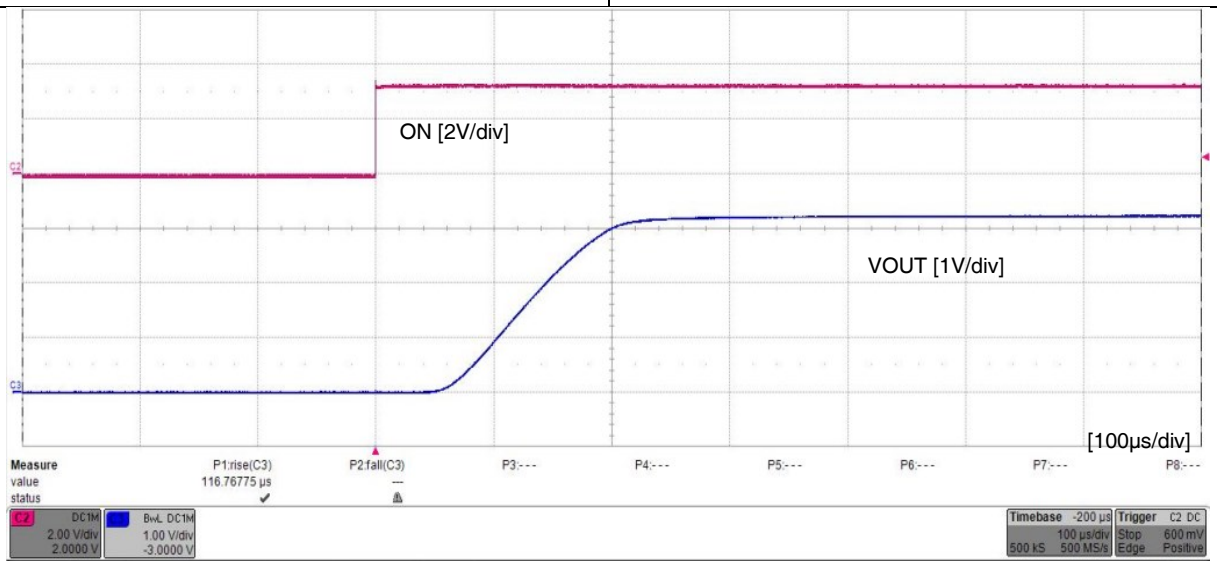


Figure 13. Turn ON Response(V_{IN}=3.3V, C_{IN}=1μF, C_{OUT}=0.1μF, R_{LOAD}=10ohm)

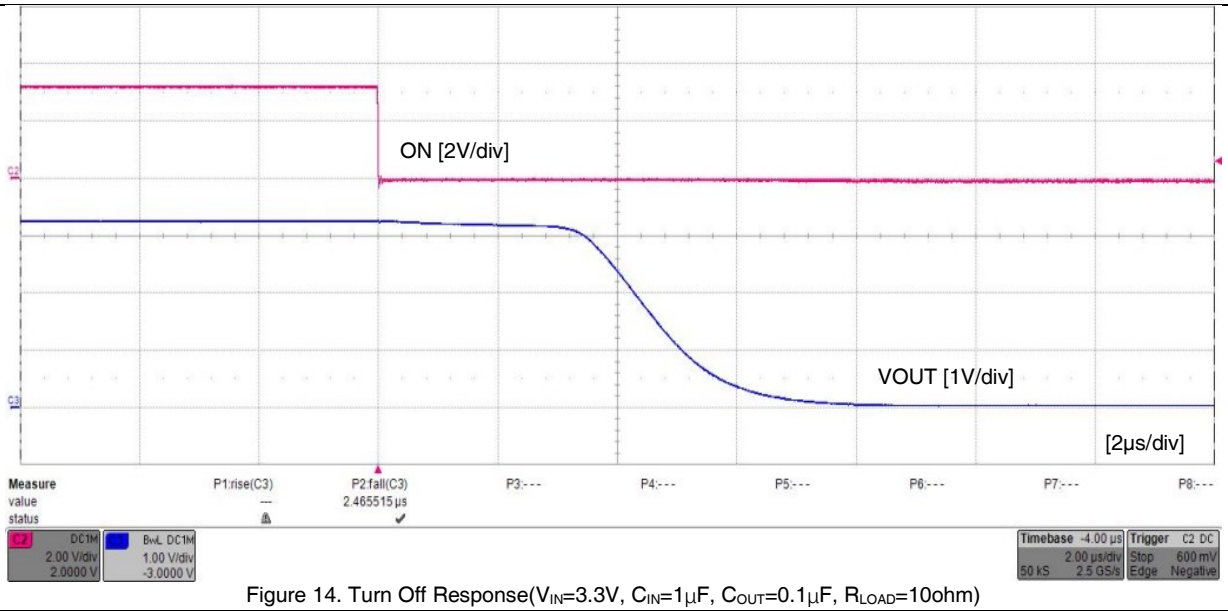


Figure 14. Turn Off Response(V_{IN}=3.3V, C_{IN}=1μF, C_{OUT}=0.1μF, R_{LOAD}=10ohm)

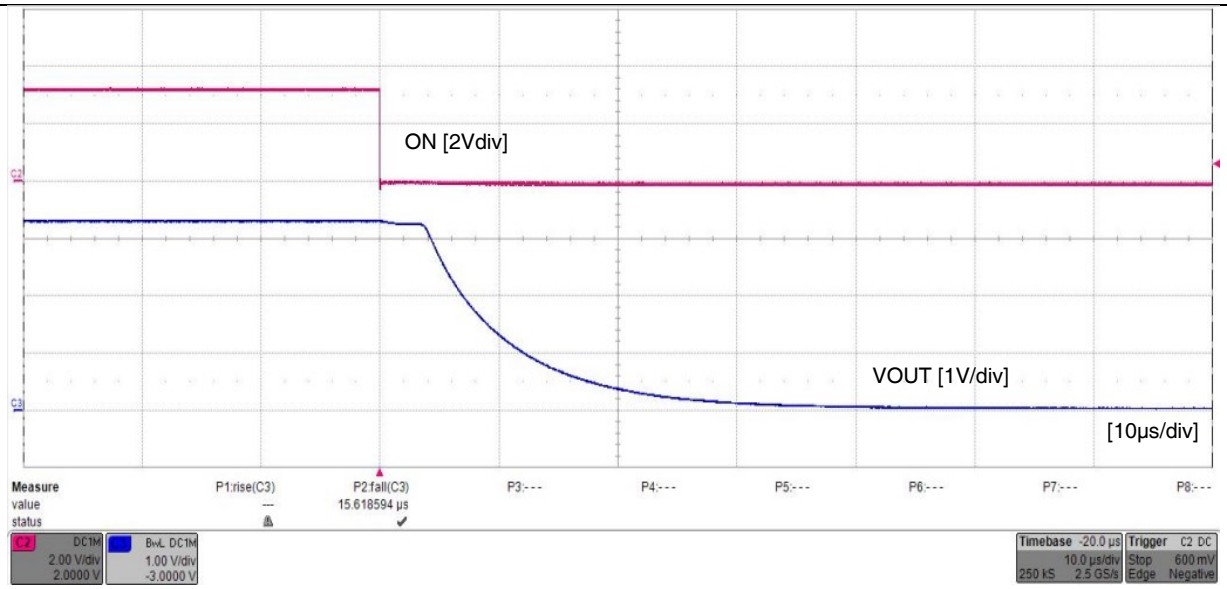


Figure 15. Turn Off Response(V_{IN}=3.3V, C_{IN}=1μF, C_{OUT}=0.1μF, R_{LOAD}=500ohm)

Operation and Application Description

The CW3301 is an ultra-small P-channel load switch with integrated slew rate control. It is capable of operating over a wide input range from 1.1V to 5.5V with very low on-resistance to reduce conduction loss. In the off state, the device consumes very low leakage current to avoid unwanted standby current and save limited input power.

Quick Output Discharge (QOD)

The CW3301 serial has the optional on-chip load resistor on the VOUT pin for quick output discharge when the switch is turned off. See Ordering Information Section.

ON pin

The CW3301 can be activated by ON pin high level. Note that the ON pin has an internal pull-down resistor to help pull the switch to a known “off state” when no ON signal is applied from an external controller.

Input Capacitor

A 1μF ceramic capacitor, C_{IN} is recommended to be placed close to the VIN pin to reduce the voltage drop on the input power rail caused by transient inrush current when the switch turns on into a discharged load capacitor. A higher input capacitor value can be used to further reduce the input voltage drop in higher-current application.

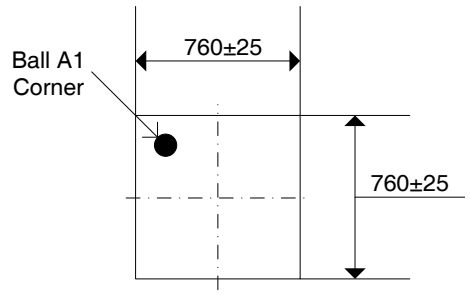
Output Capacitor

A 0.1μF ceramic capacitor, C_{OUT}, is recommended to mitigate voltage undershoot on the output pin when the switch is turned off. Undershoot can be caused by parasitic inductance from board traces or intentional load inductances. C_{IN} greater than C_{OUT} is highly recommended. C_{OUT} greater than C_{IN} can cause VOUT to exceed VIN when the system supply is removed. This could result in current flow through the body diode from VOUT to VIN.

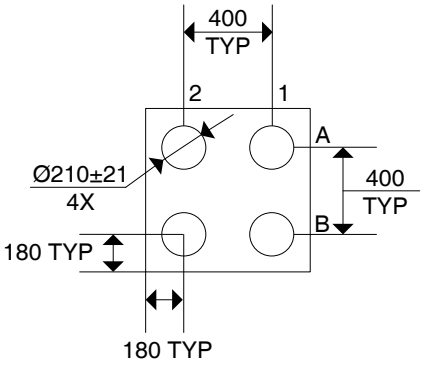
Layout Guide

For best performance, traces should be as short as possible. To be most effective, the C_{IN} and C_{OUT} capacitors should be placed close to the device to minimize the effect of parasitic trace inductance on normal and short-circuit operation. Using wide traces or large copper planes for all pins (VIN, VOUT, ON and GND) minimizes the parasitic electrical effects and the case-ambient thermal impedance. However, the VOUT pin should not connect directly to the battery source due to the discharge mechanism of the load switch.

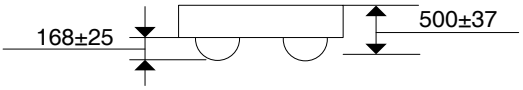
Package Information



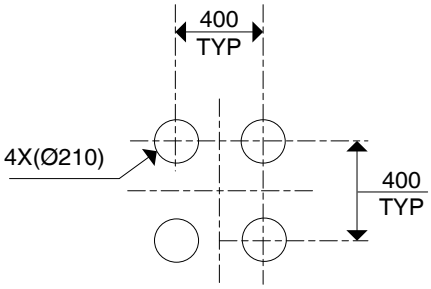
TOP VIEW



BOTTOM VIEW



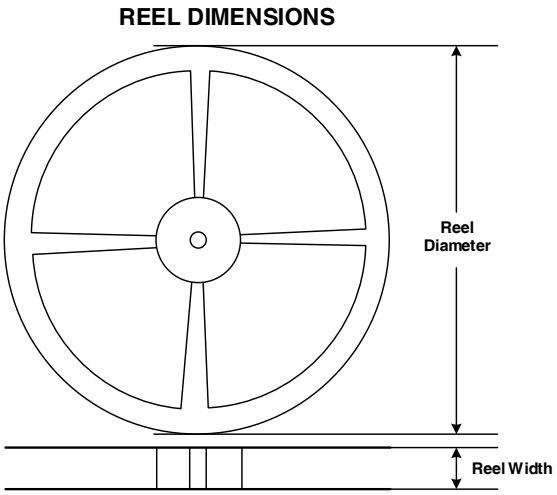
SIDE VIEW

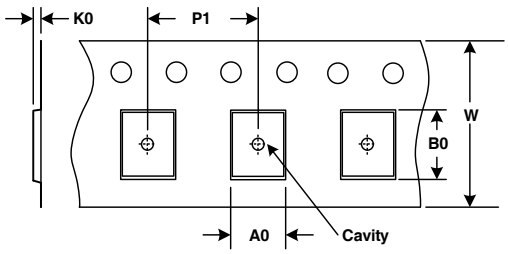


Land Pattern
Example

Note:
1)All Dimensions Are In Micrometers(Unit: μm).
2)Drawing Is Not To Scale.
3)This Drawing Is Subject To Change Without Notice.

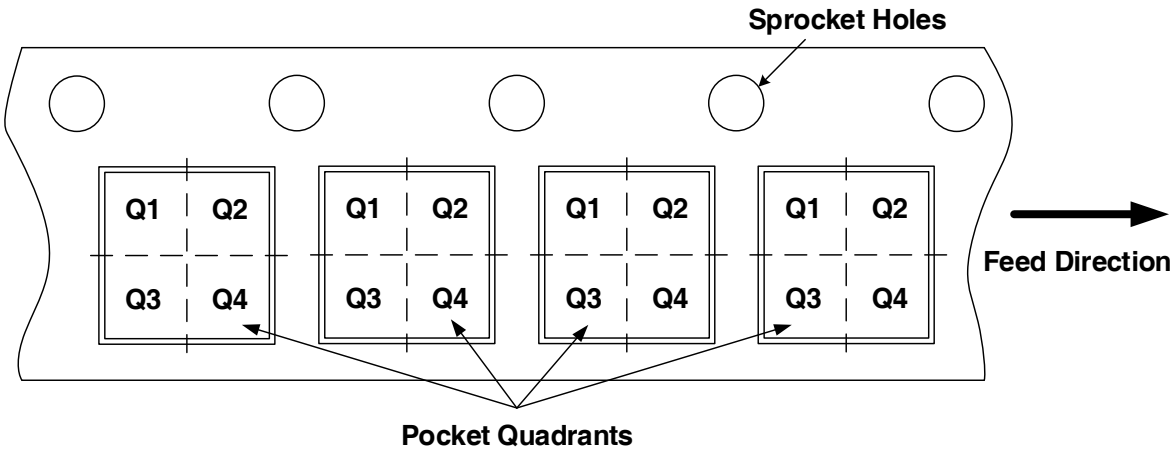
Tape and Reel Information





A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



Device	Package Type	Reel Diameter (mm)	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin 1 Quadrant
CW3301AAAC	WLCSP-4	180	9	0.85	0.85	0.59	4	8	Q1
CW3301AABC	WLCSP-4	180	9	0.85	0.85	0.59	4	8	Q1

Note：All dimensions are nominal.

Revision History

Release No.	Date	Revision Description
1.0	2021-09-22	Initial Release

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