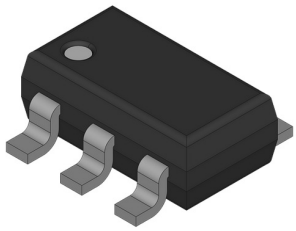
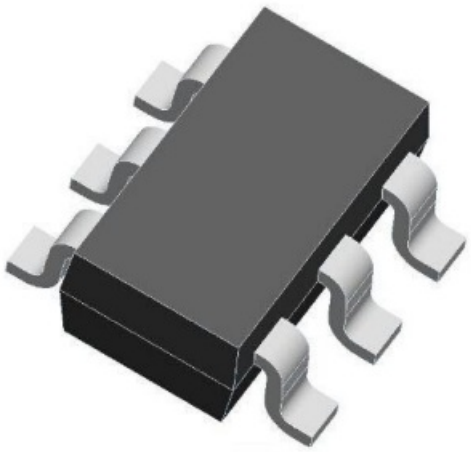


OMNI-VISION WS4667E Ultra-low Ron Load Switch User Manual

WS4667E
4.5A, 22mΩ, Ultra-low Ron Load Switch
with Quick Output Discharge

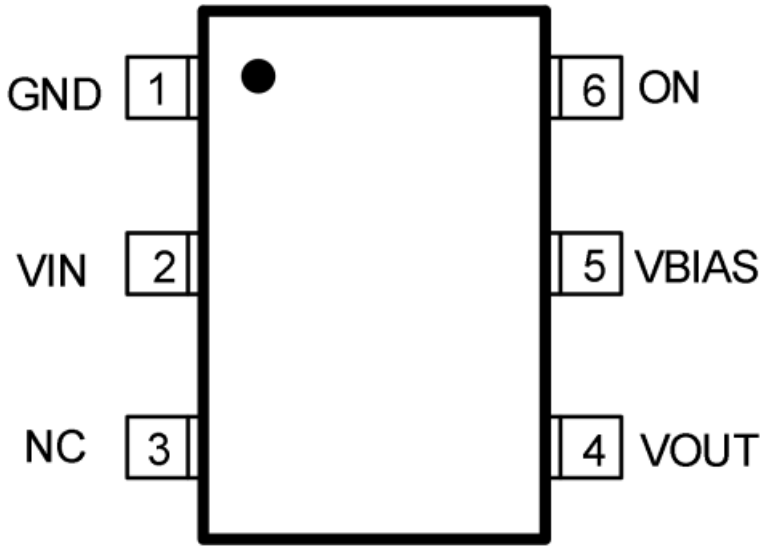
Descriptions
The WS4667E is a small, ultra-low Ron, single channel load switch with a controlled turn-on. The device contains an N-channel MOSFET that can operate over an input voltage range of 0.8V to 3.5V and supports a maximum continuous current of 4.5A.

http://www.ovt.com



SOT23-6L

This device is suitable for driving processor power rails with very strict voltage dropout tolerances. Quick rise time of the device allows for power rails to come up quickly when the device is enabled, thereby reducing response time for power distribution. The ON terminal can be directly connected with the low-voltage control signals generated by microcontrollers or low-voltage discrete logic circuits.

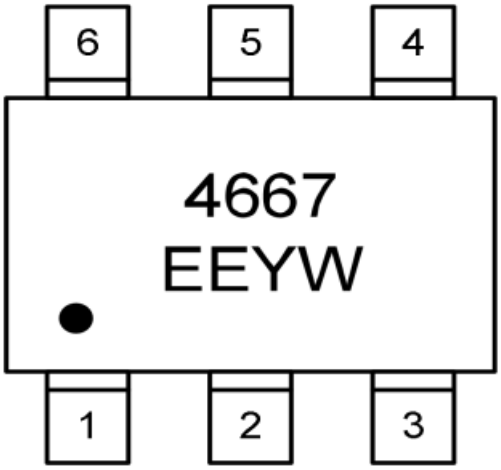


Pin configuration (Top view)
The WS4667E is available in the SOT23-6L package. The standard product is Pb-free and Halogen-free.

Contents

Features

- Input Voltage Range: 0.8V to 3.5V
- Ultra-Low On Resistance (RON) RON = 22mΩ at VBIAS = 5V
- 4.5 A Maximum Continuous Switch Current
- Low Control Input Threshold Enables Use of 1.2V, 1.8V, 2.5V and 3.3V Logic
- Quick Output Discharge (QOD)
- SOT23-6L Package
- ESD Performance Tested per JESD 22 2kV HBM and 1kV CDM



SOT23-6L

For detailed order information, please see page 2.

Applications

- Ultrabook™
- Notebooks/Netbooks
- Tablet PC
- Consumer Electronics
- Set-top Boxes/Residential Gateways
- Telecom Systems

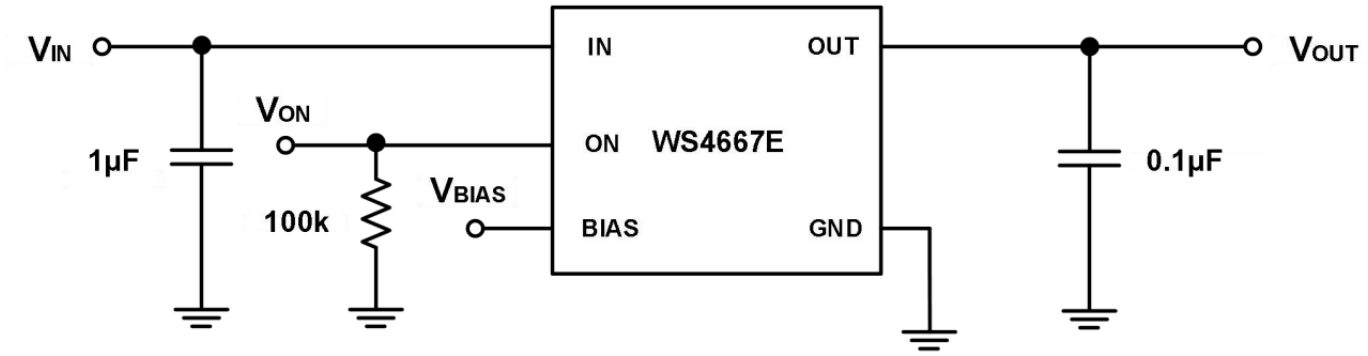
Order Information

Ordering No.	Continuous Current	Rise Time	Enable	Output Discharge Resistor	Package	Operating Temperature	Marking	Shipping
WS4667EAA-6/TR	4.5A	3.4us	Active High	Yes	SOT23-6L	-40-85°C	4667 EEYW	3000/Reel& Tape

Marking Information

4667 = Device code
EE = Special code
Y = Year code
W = Week code
Marking

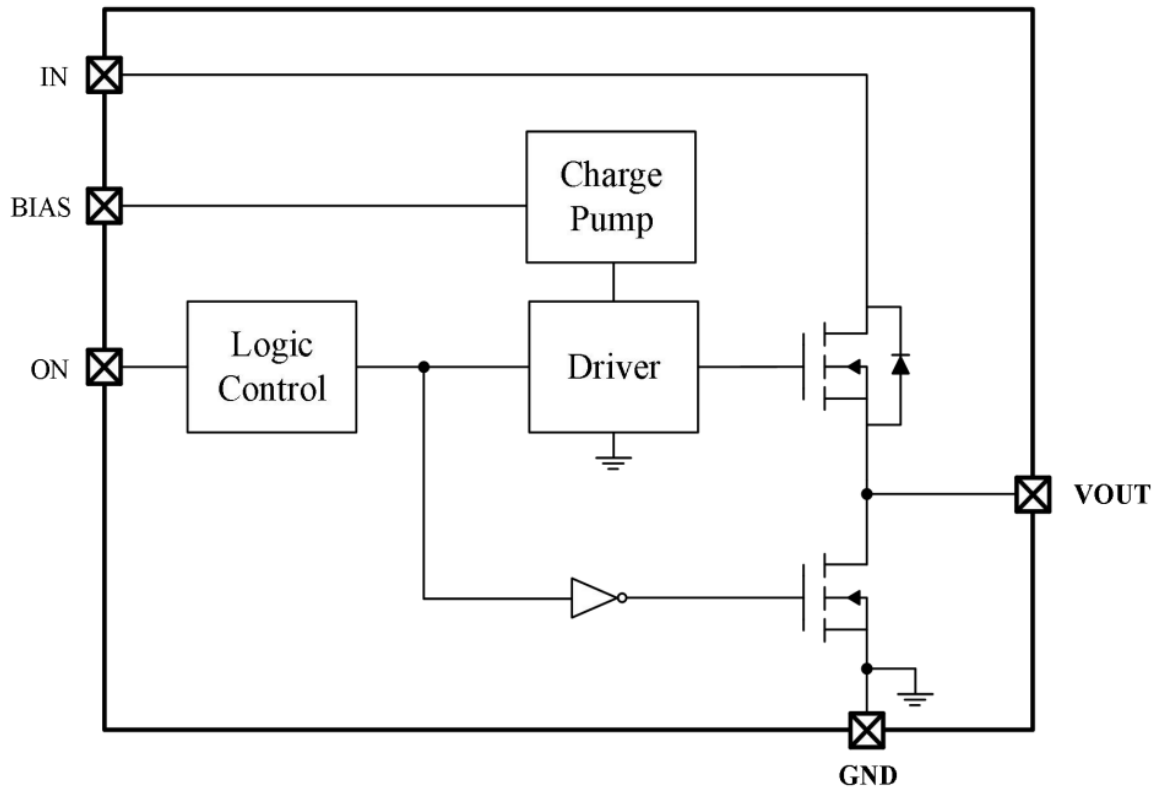
Typical Application



Pin Description

Pin Number	Symbol	I/O	Description
1	GND	—	Ground.
2	VIN	I	Switch input. Place ceramic bypass capacitor(s) between this terminal and GND.
3	NC	—	Not connected.
4	VOUT	0	Switch output. Place ceramic bypass capacitor(s) between this termi nal and GND.
5	VBIAS	—	Bias voltage. Power supply to the device.
6	ON	I	Active high switch control input. Do not leave floating.

Block Diagram



Absolute Maximum Ratings

Symbol	Parameter		Value	Unit
VIN	Input voltage range		-0.3~5.5	V
VouT	Output voltage range		-0.3~5.5	V
VBIAS	Bias voltage range		-0.3~5.5	V
VON	Input voltage range		-0.3~5.5	V
ImAx	Maximum continuous switch current		5.	A
T jmAx	Maximum junction temperature		150	°C
TSTG	Storage temperature range		-60~150	°C
TLEAD	Maximum lead temperature (10-s soldering time)		260	°C
ESD	Electrostatic discharge protection	Human-Body Model (HBM)	±2000	V
		Charged-Device Model (CDM)	±1000	

Thermal Information

Thermal Resistance	WS4667E SOT23-6L	Unit
Thermal Resistance, RθJA Junction-to-Ambient Without Copper Pour	198	°C/W
Thermal Resistance, RθJA Junction-to-Ambient With Copper Pour*	133	°C/W

*: Surface mounted on FR-4 Board using 2 oz, 1 square inch Cu area, PCB board size 1.5*1.5 square inches.

Recommended Operating Conditions

Symbol	**Parameter**	**Value**	**Unit**
VIN	Input voltage range	0.8 VBIAS–2	V
VBIAS	Bias voltage range	3 5.5	V
VON	ON voltage range	0 5.5	V
VOUT	Output voltage range	0 VIN	V
TJ	Junction temperature range	-40 125	°C
TA	Ambient temperature range	0 85	°C
CIN	Input capacitor	1	μF
CL	Output capacitor	0.1	μF

Electrical Characteristics

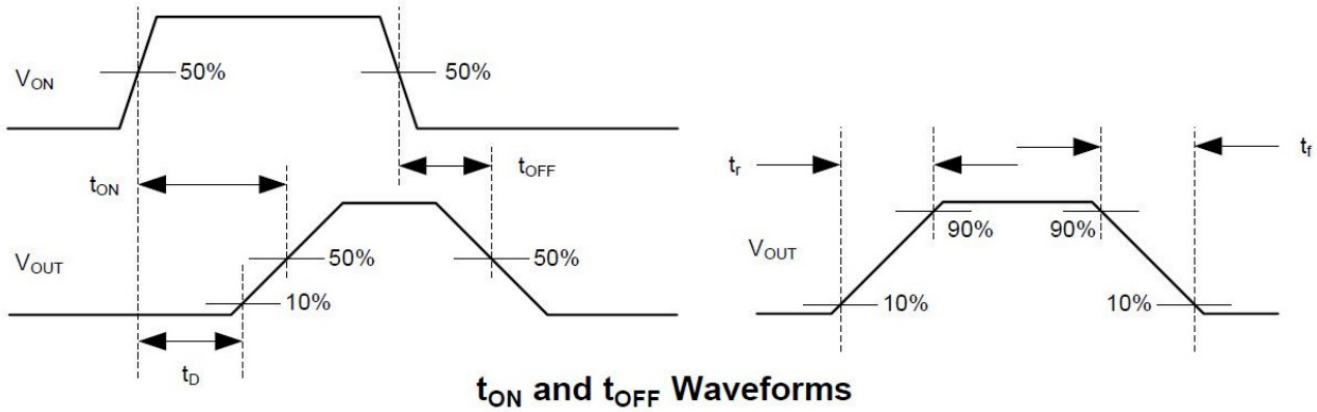
VBIAS=5.0V, Cin=1uF, TA=25°C, unless otherwise noted.

Parameter	Symbol	Test Conditions		Min	Typ	Max	Unit
VBIAS Quiescent Current	10.VBIAS	IOUT =0mA, VIN = 3.OV			20	40	pA
VBIAS Shutdown Current	ISD.VBIAS	VON = OV , VOUT = OV			0.1	1	pA
VIN Shutdown Current	ISD.VIN	VON = OV , VOUT = OV	VIN = 3.OV		0.001	0.3	pA
			VIN = 2.5V		0.001	0.3	
			VIN = 2.0V		0.001	0.3	
			VIN = 1.05V		0.001	0.3	
			VIN = 0.8V		0.001	0.3	
ON Pin Input Leakage Current	ION	VON = 5.5V			0.1	1	pA
ON Logic High Input Voltage	VON.H	VBIAS = 3.OV to 5.5V		1.			V
ON Logic Low Input Voltage	VON.L	VBIAS = 3.OV to 5.5V				0.4	V
ON-state Resistance	RoN	IouT = -1.0A	VIN = 3.OV		22	40	ma
			VIN = 2.5V		22	40	
			VIN = 2.0V		22	40	
			VIN = 1.05V		22	40	
			VIN = 0.8V		22	40	
Output Pull-down Resistance	Rao	VIN = VOUT=5.0V, VON = OV			260		Ω

Electrical Characteristics (Continued)
VBIAS=3.0V, Cin=1uF, TA=25°C, unless otherwise noted.

Parameter	**Symbol**	**Test Conditions**		**Min**	**Typ**	**Max**	**Unit**
VBIAS Quiescent Current	lo.vms	louT =0mA,VIN = 1.0V			12	25	μA
VBIAS Shutdown Current	ISD.VBIAS	VON = OV , VOUT = OV			0.1	1	μA
VIN Shutdown Current	Iso.viN	VON = OV , VOUT = OV	VIN = 1.05V		0.001	0.3	μA
			VIN = 0.8V		0.001	0.3	
ON Pin Input Leakage Current	ION	VON = 5.5V			0.1	1	μA
ON Logic High Input Voltage	VON.H	VIN = 0.8V to 1.0V		1.			V
ON Logic Low Input Voltage	VON.L	VIN = 0.8V to 1.0V				0.4	V
ON-state resistance	RON	IOUT = -1.0A	MN = 1.0V		22	40	mΩ
			VIN = 0.8V		22	40	
Output pull-down resistance	RPD	VIN = VOUT=1.0V, VON = OV			260		Ω

Switching Characteristics Measurement Information

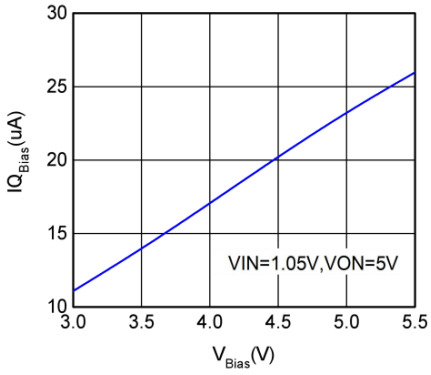


t_{ON} and t_{OFF} Waveforms

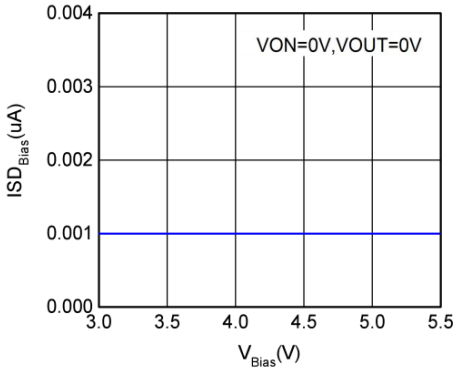
Switching Characteristics

Parameter	Test Conditions	Min Typ Max	Unit
VIN = 2.5V, VON = VBIAS = 5V, TA = 25 °C (unless otherwise noted)			
tON Turn-on time	RL= 10Ω, CL= 0.1uF	4.1	µs
toFF Turn-off time		1.2	
tR VOUT rise time		3.4	
tF VOUT fall time		2	
to ON delay time		3.1	
VIN = 1.05V, VON = VBIAS = 5V, TA = 25 °C (unless otherwise noted)			
toN Turn-on time	RL= 10Ω, CL= 0.1uF	4	µs
toFF Turn-off time		1.3	
tR VOUT rise time		1.5	
tF Vou-r fall time		1.8	
to ON delay time		3.4	
VIN = 1.05V, VON = 5V, VBIAS = 3.3V, TA = 25 °C (unless otherwise noted)			
tON Turn-on time	RL= 10Ω, CL.= 0.1uF	7	µs
toFF Turn-off time		2	
tR VOUT rise time		5	
tF Vou-r fall time		2	
to ON delay time		5.5	

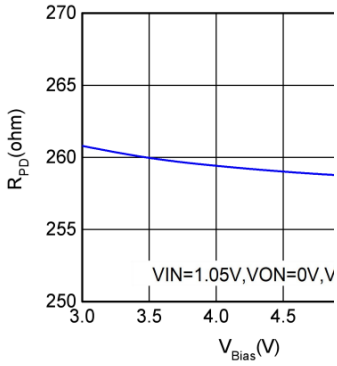
Typical Characteristics



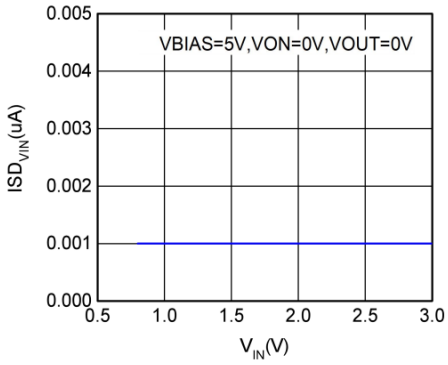
$I_{Q,BIAS}$ vs. V_{BIAS}



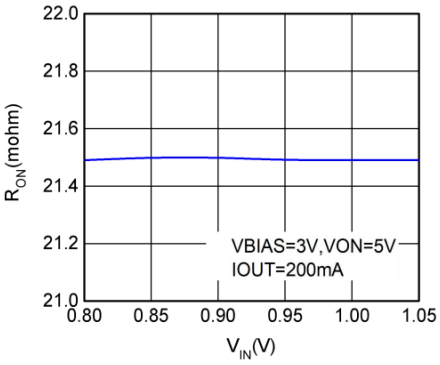
$I_{SD,BIAS}$ vs. V_{BIAS}



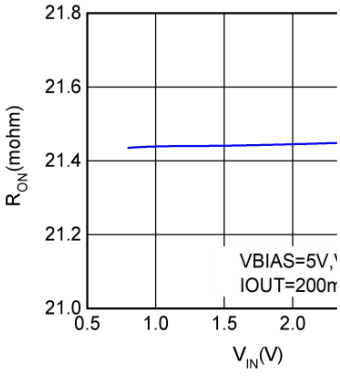
R_{PD} vs. V_{BIAS}



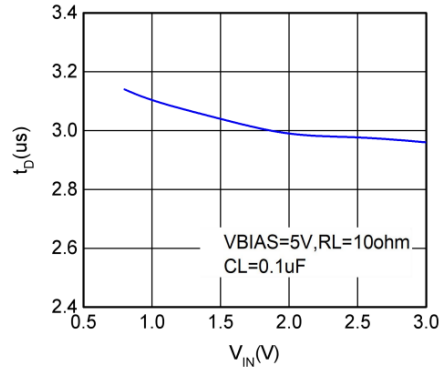
$I_{SD,VIN}$ vs. V_{IN}



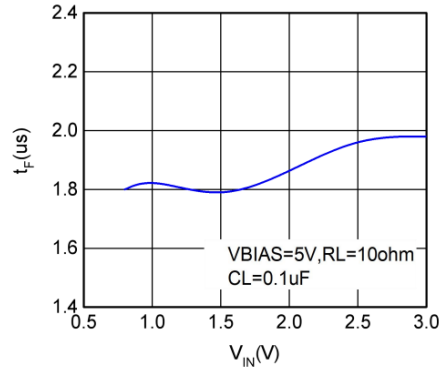
R_{ON} VS. V_{IN}



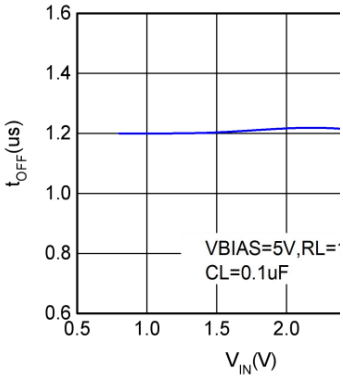
R_{ON} vs. V_{IN}



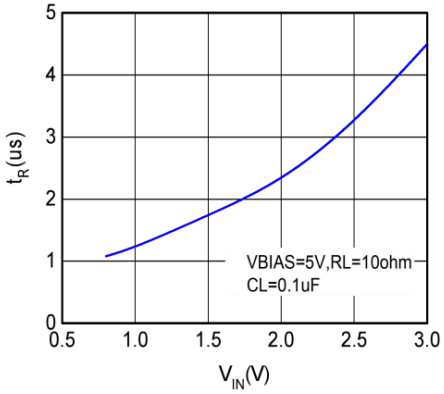
t_D vs. V_{IN}



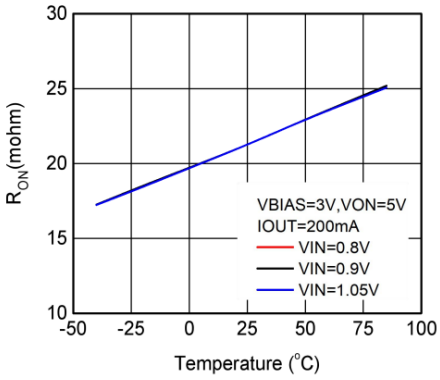
t_F vs. V_{IN}



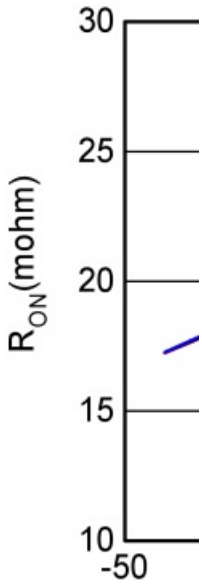
t_{OFF} vs. V_{IN}



t_R vs. V_{IN}



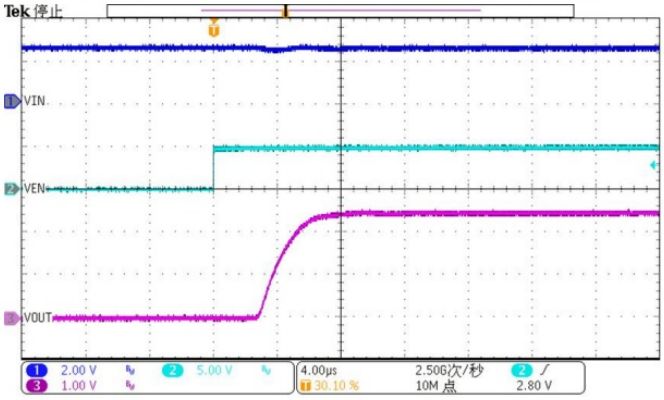
R_{ON} vs. Temperature



Working Waveforms

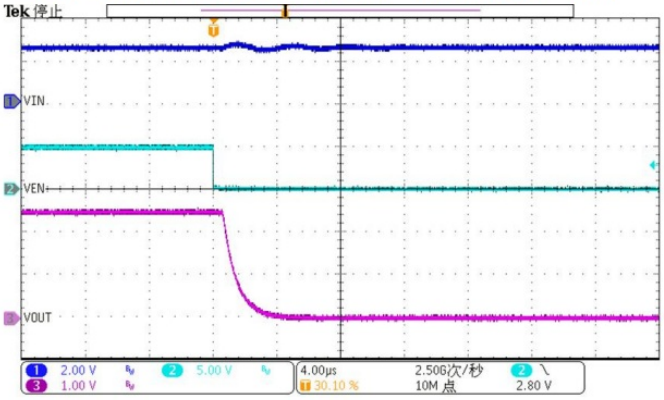
Start up by EN

V_{BIAS}=5V,V_{IN}=2.5V,C_{IN}=1uF,C_{OUT}=0.1uF,R_{LOAD}=10Ω



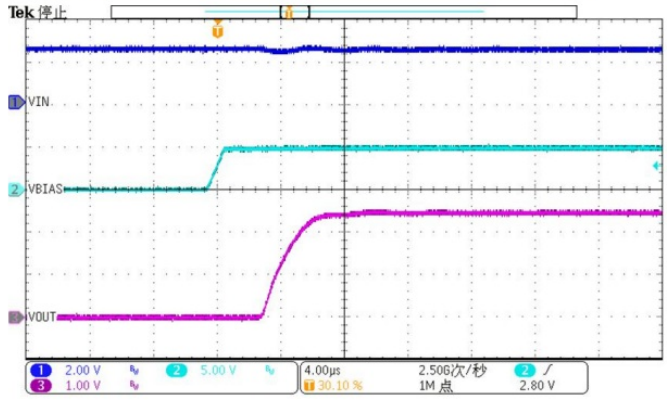
Shutdown by EN

V_{BIAS}=5V,V_{IN}=2.5V,C_{IN}=1uF,C_{OUT}=0.1uF,R_{LOAD}=10Ω



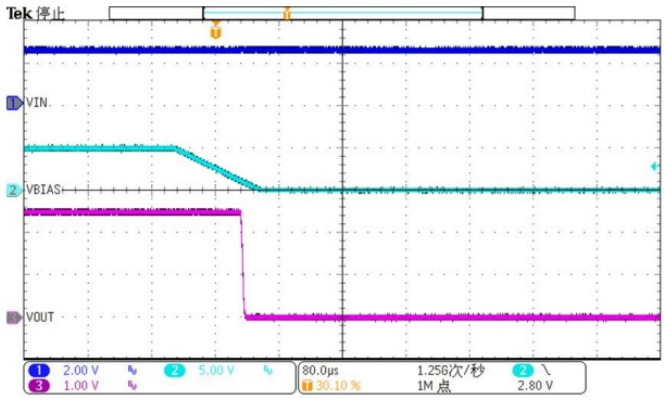
Start up by V_{BIAS}

V_{BIAS}=5V,V_{IN}=2.5V,C_{IN}=1uF,C_{OUT}=0.1uF,R_{LOAD}=10Ω



Shutdown by V_{BIAS}

V_{BIAS}=5V,V_{IN}=2.5V,C_{IN}=1uF,C_{OUT}=0.1uF,R_{LOAD}=10Ω



Detailed Description

Overview

The WS4667E device is a 3.5V, 4.5A load switch in a DFN3x2-8L package. To reduce voltage drop for low voltage and high current rails, the device implements an ultra-low resistance N-channel MOSFET. The device has a controlled, fixed slew rate for applications that require a specific rise-time. During the shutdown, the device has very low leakage currents, thereby reducing unnecessary leakages for downstream modules during standby. The integrated control logic, driver, and output discharge FET eliminate the need for ny external components, which reduces solution size and bill of materials (BOM) count.

ON and OFF Control

The ON pin controls the state of the load switch. ON is active high and has a 1.2 V ON pin enable threshold, making it capable of interfacing with low-voltage signals. The ON pin is compatible with standard GPIO logic thresholds. It can be used with any microcontroller with 1.2 V or higher GPIO voltage. This pin cannot be left floating and must be driven either high or low for proper functionality.

Input Capacitor (CIN) (Optional)

To limit the voltage drop on the input supply caused by transient inrush currents when the switch turns on into a discharged load capacitor or short-circuit, a capacitor needs to be placed between VIN and GND. A 1µF ceramic capacitor, CIN, placed close to the pins, is usually sufficient. Higher values of CIN can be used to further reduce the voltage drop in high-current applications. When switching heavy loads, it is recommended to have an input capacitor about 10 times higher than the output capacitor (CL) to avoid excessive voltage drop.

Output Capacitor (CL) (Optional)

Because of the integrated body diode in the NMOS switch, a CIN greater than CL is highly recommended. A CL

greater than CIN 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. A CIN to CL ratio of 10 to 1 is recommended for minimizing VIN dip caused by inrush currents during startup; however, a 10 to 1 ratio for capacitance is not required for the proper functionality of the device. A ratio smaller than 10 to 1 (such as 1) could cause slightly more VIN dip upon turn-on because of inrush currents.

Quick-Output Discharge

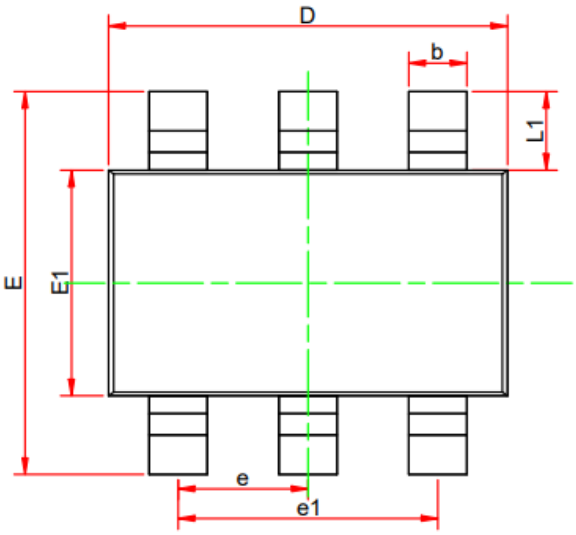
When the switch is disabled an internal discharge resistance is connected between VOUT and GND to remove the remaining charge from the output. This resistance has a typical value of 260 Ω and prevents the output from floating while the switch is disabled. For best results, it is recommended that the device gets disabled before VBIAS falls below the minimum recommended voltage.

Layout guide

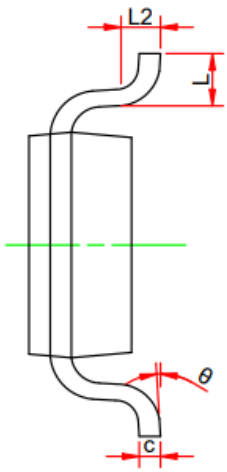
For best performance, all traces should be as short as possible. To be most effective, the input and output capacitors should be placed close to the device to minimize the effect that parasitic trace inductance may have on normal and short-circuit operation. Using wide traces for VIN, VOUT, GND helps minimize parasitic electrical effects along with minimizing the case-to-ambient thermal impedance.

PACKAGE OUTLINE DIMENSIONS

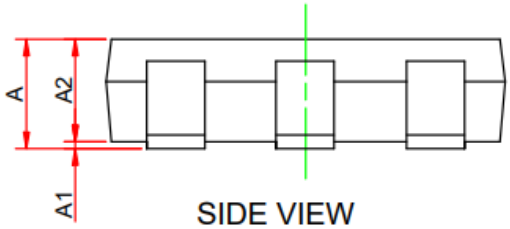
SOT-23-6L



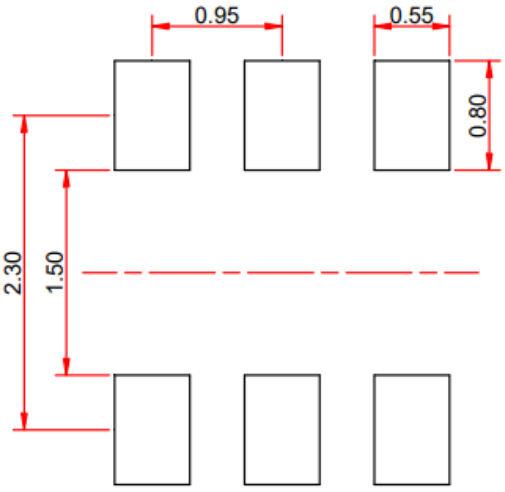
TOP VIEW



SIDE VIEW



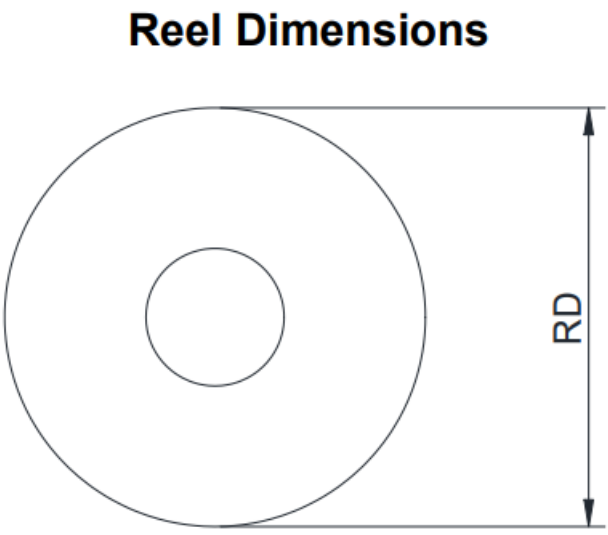
SIDE VIEW



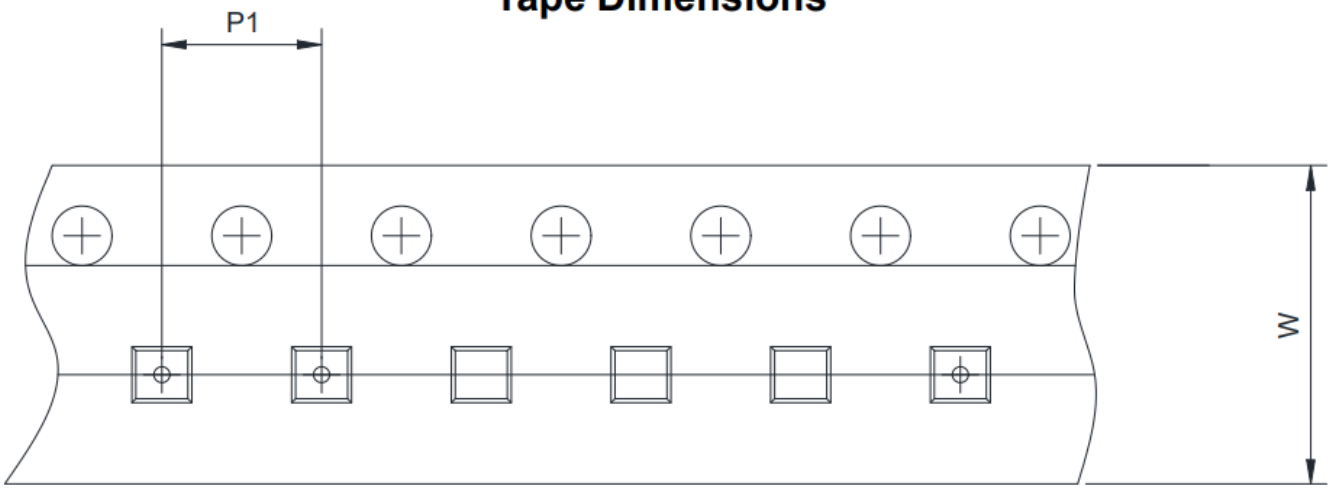
RECOMMENDED LAND PATTERN(unit:mm)

Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A	1.05	–	1.25
Al	0	–	0.15
A2	1.00	1.10	1.20
b	0.30	0.40	0.50
c	0.10	–	0.21
D	2.72	2.92	3.12
E	2.60	2.80	3.00
El	1.40	1.60	1.80
e	0.95BSC		
el	1.80	1.90	2.00
L	0.30	–	0.60
Ll	0.59Ref		
L2	0.25Ref		
0	0	–	8

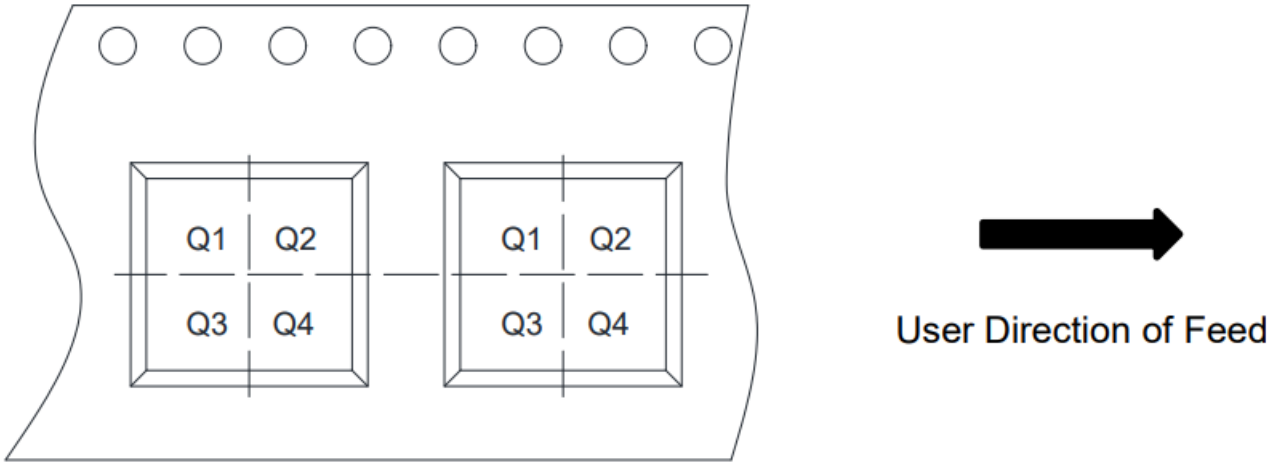
TAPE AND REEL INFORMATION



Tape Dimensions



Quadrant Assignments For PIN1 Orientation In Tape



RD	Reel Dimension	☑ 7inch ☐ 13inch
W	Overall width of the carrier tape	☑ 8mm ☐ 12mm ☐ 16mm
P1	Pitch between successive cavity centers	☐ 2mm ☑ 4mm ☐ 8mm
Pin1	Pin1 Quadrant	☐ Q1 ☐ Q2 ☑ Q3 ☐ Q4

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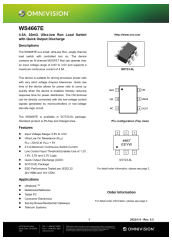
Documents / Resources

	OMNI-VISION WS4667E Ultra-low Ron Load Switch [pdf] User Manual WS4667E Ultra-low Ron Load Switch, Ultra-low Ron Load Switch, Ron Load Switch, Load Switch, SOT23-6L