1. General Description

WP3883CL can disconnect the systems from its output pin (OUT) in case wrong input operating conditions are detected.

The system is positive overvoltage protected up to 28V. The internal overvoltage threshold (OVLO) is fixed, and external OVLO setting also available. WP3883CL has internal thermal shutdown Protection and Input Voltage detection.

The device is packaged in advanced full-Green compliant Wafer Level Chip Scale Packaging (WLCSP6).

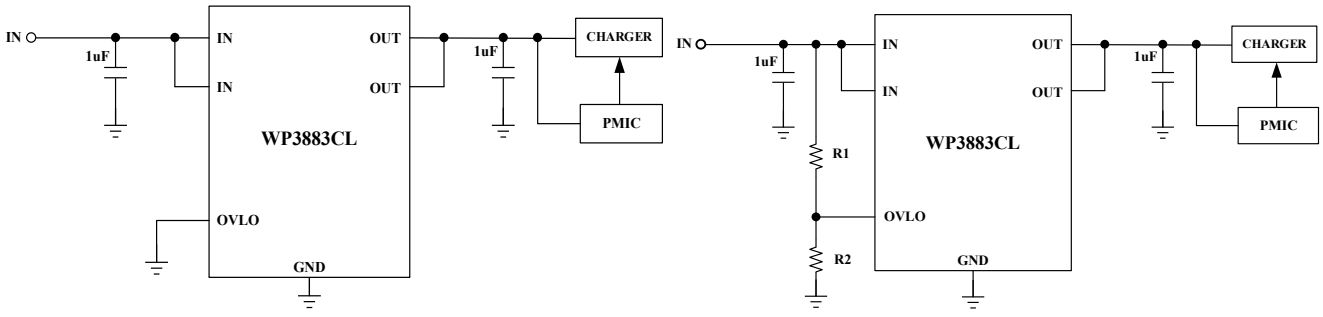
2. Features

- 4A Continuous Current Capability
- $R_{DS(ON)}$: 29mΩ (Typ.) N-Channel MOSFET
- VIN Operating Range: 2.5V to 28V
- Overvoltage Lockout: OVLO=6.8V(Typ.)
- Overvoltage-Protection Response Time: 50ns (Typ.)
- OVLO Threshold Range: +4V to +20V
- Startup Debounce Time: 15ms (Typ.)
- Internal Thermal-Shutdown Protection
- ESD Protected Human Body Model: JESD22-A114 (All pins) ±2KV
- WLCSP6 Package （ball pitch=0.4mm）
- AEC-Q100 qualified for automotive applications: Ambient temperature grade 1: - 40℃ to 125℃

3. Applications

- Smart Phones
- Smartphones, Tablet PC
- HDD, Storage and Solid State Memory Devices
- Portable Media Devices, Laptop & MID
- SLR Digital Cameras
- GPS and Navigation Equipment
- Industrial Handheld and Enterprise Equipment

4. Typical Application

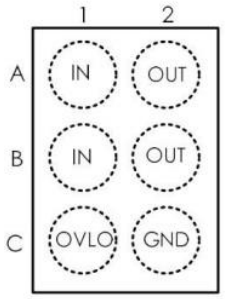


Note1: $V_{IN_OVLO}=\frac{R_1+R_2}{R_2}V_{OVLO_TH}$

Note2: Recommend 30 kΩ ≤ R_2 ≤ 51 kΩ

5. Pin Configuration

(TOP VIEW)



WLCSP6

6. Pin Description

PIN NUMBER	PIN NAME	I/O	PIN FUNCTIONS
A2, B2	OUT	O	Output Voltage. Output of internal switch. Connect OUT pins together for proper operation.
C2	GND		Ground. Connect GND pins together for proper operation.
A1, B1,	IN	I	Voltage Input. Connect IN pins together for proper operation.
C1	OVLO	I	External OVLO Adjustment. Connect OVLO to GND when using the internal threshold. Connect a resistor-divider to OVLO to set a different OVLO threshold; this external resistor-divider is completely independent of the internal threshold.

7. Absolute Maximum Ratings [3]

Over operating free-air temperature range (unless otherwise noted)

SYMBOL	PARAMETER		RATING	UNIT
V_{IN}	Input Voltage Range [4]		-0.3 to 36	V
V_{OUT}	Output Voltage Range [4]		-0.3 to 28	V
V_{OVLO}	OVLO Voltage Range [4]		-0.3 to 7	V
I_{OUT}	Maximum Continuous Current IN to OUT		4	A
I_{PEAK}	Maximum Peak Current IN to OUT		6	A
P_D	Power Dissipation @T_A = 70℃		1000	mW
$R_{\theta JA}$	Junction-to-ambient Thermal Resistance		93	℃/W
$R_{\theta JB}$	Junction-to-board Thermal Resistance		58	
$R_{\theta JC(TOP)}$	Junction-to-case (Top) Thermal Resistance		6	
$R_{\theta JC(BOT)}$	Junction-to-case (Bottom) Thermal Resistance		12	
$T_{J(MAX)}$	Maximum Junction Temperature		150	℃
T_{STG}	Lead Temperature Range		260	℃
T_{SDR}	Storage Temperature Range		-65 ~ 150	℃
V_{ESD}	ESD Susceptibility	HBM	±2000	V

Note3: Stresses beyond those listed under Absolute Maximum Ratings may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under Recommended Operating Conditions. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Note4: Tested in 1ms width pulse voltage.

8. Recommended Operating Conditions

SYMBOL	PARAMETER	MIN	MAX	UNIT
V_{IN}	Operating Supply voltage	2.5	28	V
T_A	Operating Ambient Temperature	-40	125	℃

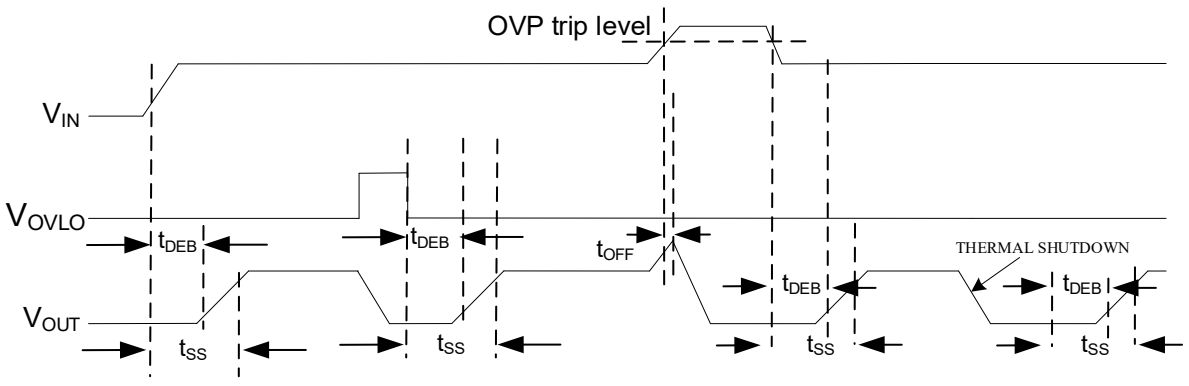
9. Electrical Characteristics

(T_A=25℃, V_{IN}=5V, C_{IN}= C_{OUT}=1μF, unless otherwise noted)

SYMBOL	PARAMETER	TEST CONDITIONS	MIN	TYP.	MAX	UNIT
V_{IN}	Input Voltage		2.5		28	V
I_{IN}	VIN Quiescent Current	V_{IN}=5V, OUT Floating		90		uA
R_{ON}	On-Resistance of switch IN-OUT	V_{IN}=5V, I_{OUT}=1A		29	45	mΩ
V_{OVLO}	Overvoltage Protect of V_{IN}	V_{IN} Rise up	6.6	6.8	7.0	V
	Overvoltage Protect hysteresis of V_{IN}			0.2		V
	Adjustable OVLO Threshold Range	V_{IN} =2.5V to V_{IN_OVLO}	4		20	V
V_{OVLO_TH}	OVLO Set Threshold	V_{IN} =2.5V to V_{IN_OVLO}	1.18	1.2	1.22	V
V_{OVLO_SELECT}	External OVLO Select Threshold		0.2		0.3	V
V_{UVLO_R}	Under Voltage Lockout Threshold	V_{IN} Rising		2.0		V
T_{SD}	Thermal Shutdown	V_{IN} = 5V		155		℃
ΔT_{SD}	Thermal-shutdown Hysteresis	V_{IN} = 5V		20		℃
t_{DEB}	Debounce Time	From V_{IN}>V_{UVLO} to 10% V_{OUT}		15		ms
t_{ON}	Switch turn-on time	R_L=100Ω，C_L=22μF，V_{OUT} from 10%V_{IN} to 90%V_{IN}		2		ms
t_{OFF_RES}[5]	Switch turn-off time	V_{IN}>V_{OVLO} to V_{OUT} stop rising		50		ns

Note5: Guaranteed by design.

10. Timing Diagram



11. Typical Performance Characteristics

(V_{IN} = 5V, C_{IN}=1μF, C_{OUT}=1μF, T_A=25℃, unless otherwise noted)

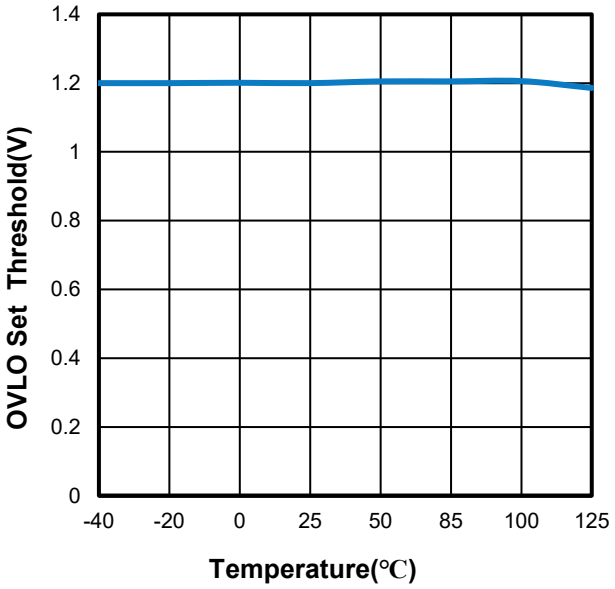


Figure 1. OVLO Set Threshold vs. Ambient Temperature

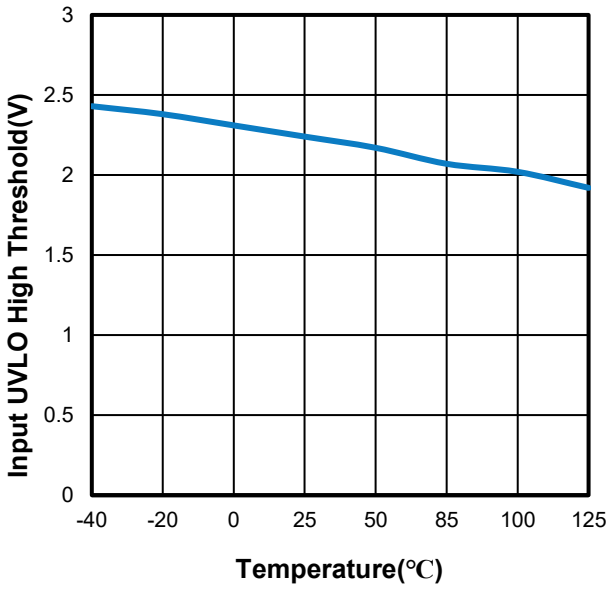


Figure 2. Input UVLO High Threshold vs. Ambient Temperature

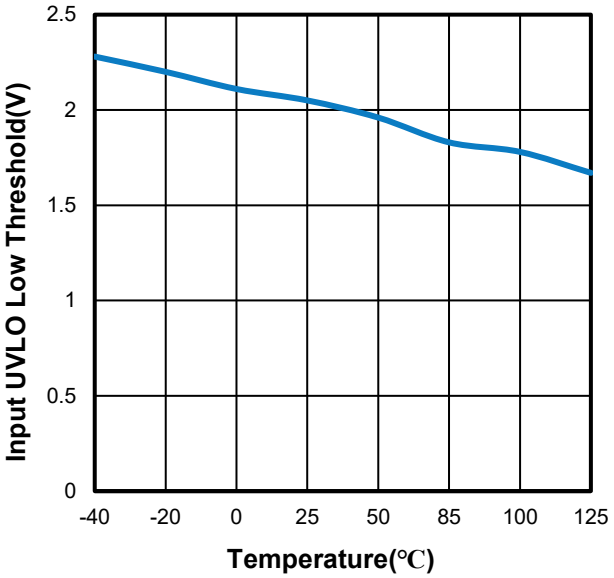


Figure 3. Input UVLO High Threshold vs. Ambient Temperature

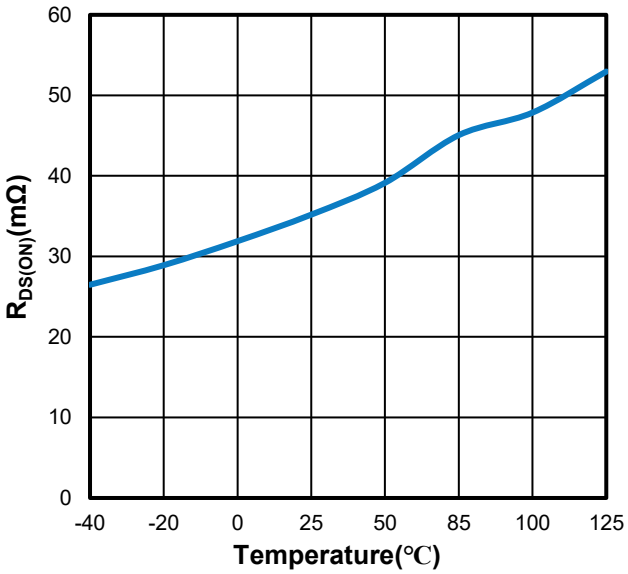


Figure 4. $R_{DS(ON)}$ vs. Free-Air Temperature

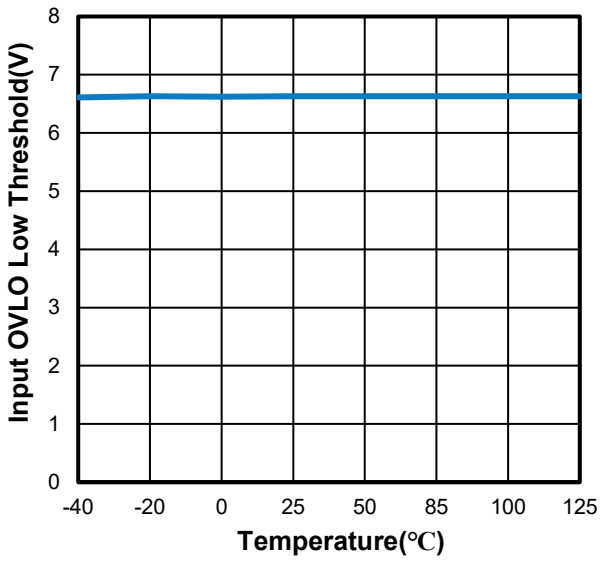


Figure 5. Input OVLO Low Threshold vs. Ambient Temperature

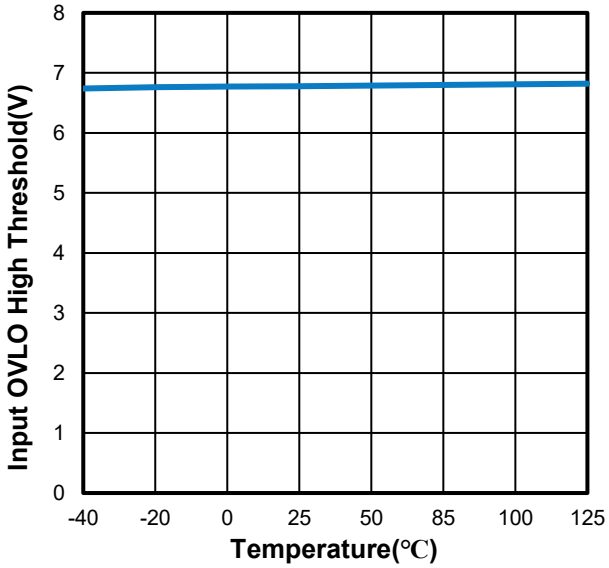


Figure 6. Input OVLO High Threshold vs. Ambient Temperature

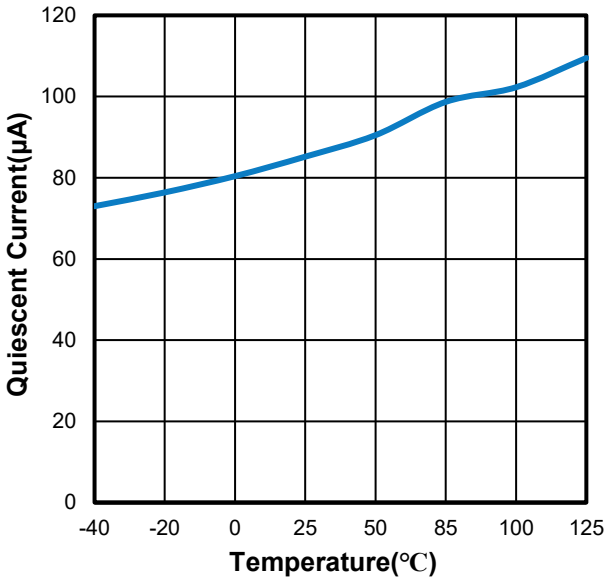


Figure 7. Quiescent Current vs. Ambient Temperature

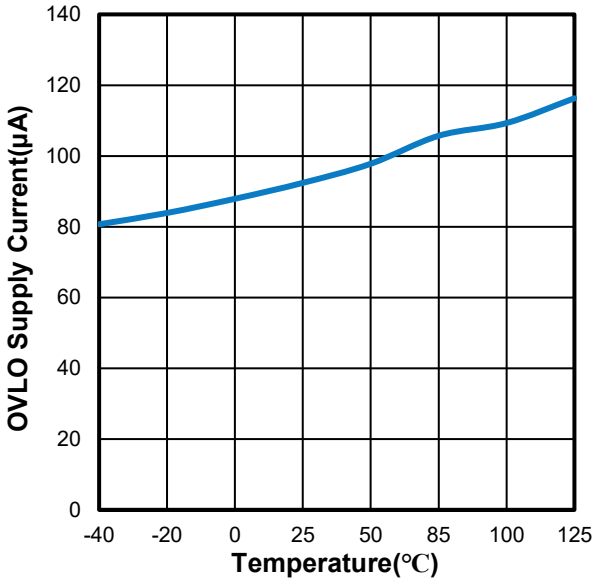


Figure 8. OVLO Supply Current vs. Ambient Temperature

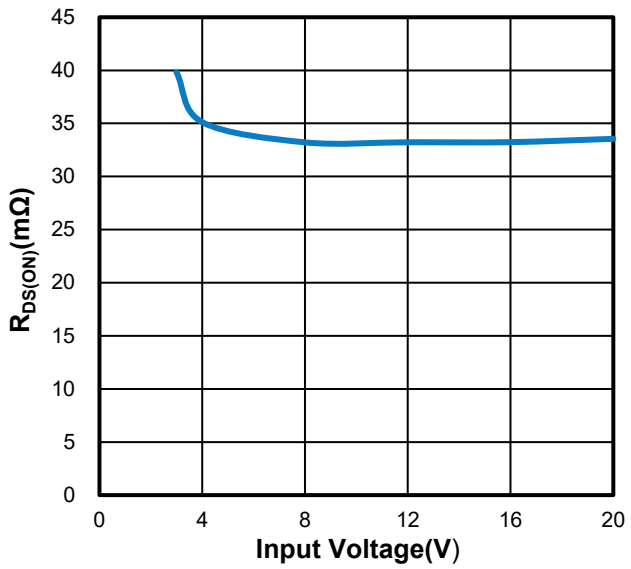


Figure 10. $R_{DS(ON)}$ vs. Input Voltage (I_{OUT} = 1A)

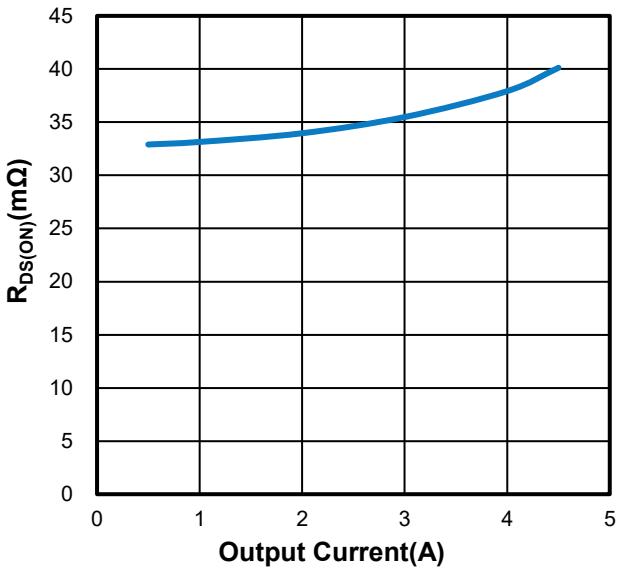


Figure 11. $R_{DS(ON)}$ vs. Output Current

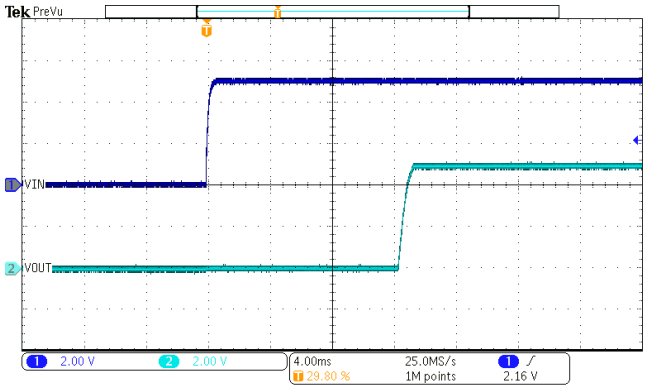


Figure 12. t_{DEB} & t_{ON}

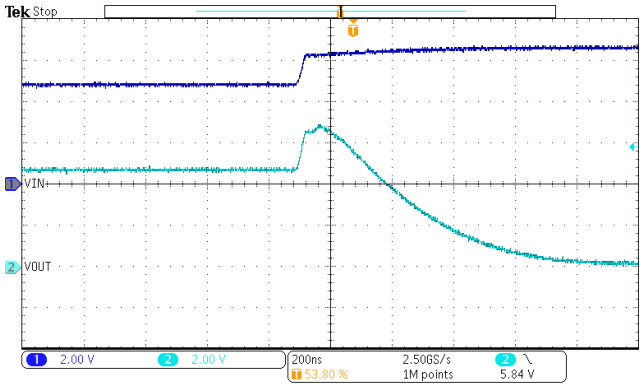


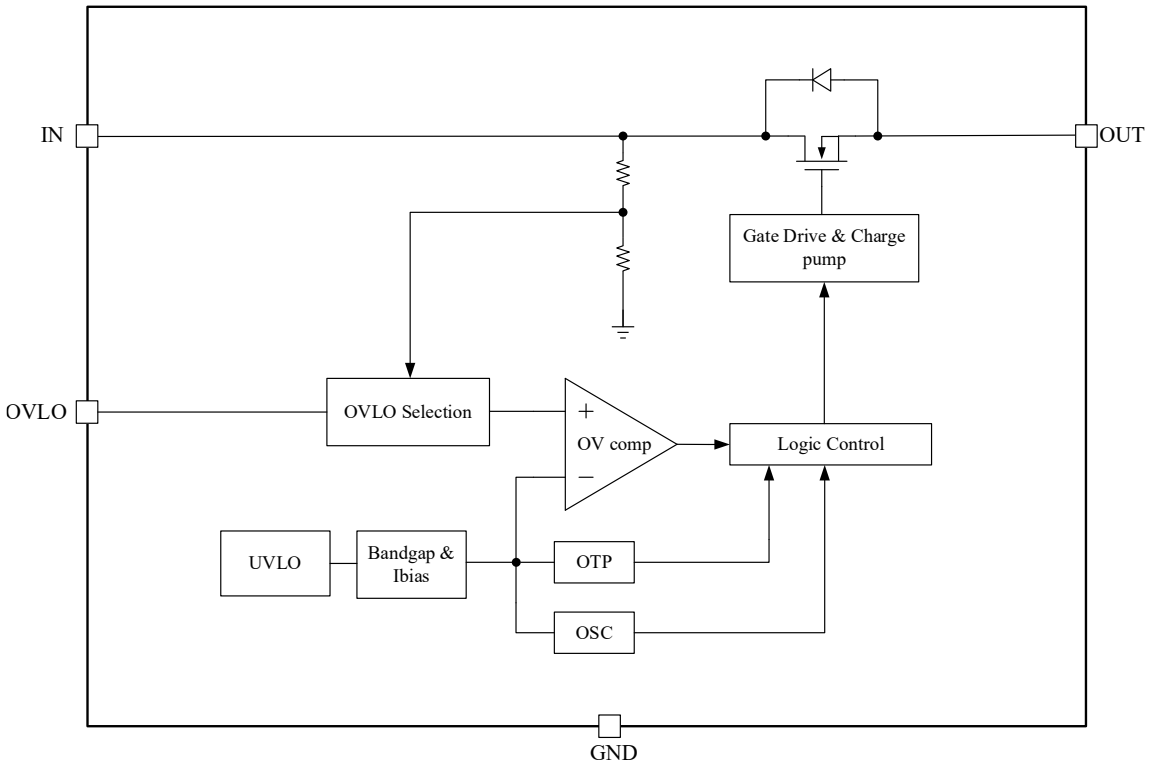
Figure 13. t_{OFF_RES}

12. Function Description

12.1 Overview

If the WP3883CL is enabled and the input voltage is between UVLO and OVP threshold, the internal charge pump begins to work after debounce time, the gate of the nFET switch will be slowly charged high till the switch is fully on. If the input voltage exceeds the OVP trip level, the switch will be turned off in about 50ns. If input voltage falls below UVLO threshold, or over-temperature happens, the switch will also be turned off.

12.2 Block Diagram



12.3 Feature Description

12.3.1 Over-Voltage Protection

If the input voltage exceeds the OVP rising trip level, the switch will be turned off in about 50ns. The switch will remain off until VIN falls below the OVP falling trip level.

12.3.2 OVP Threshold Adjustment

If V_{OVLO}=GND, the OVP threshold is default OVP threshold. If OVLO pin is not grounded, the OVP threshold can be adjusted by external resistor divider connecting to OVLO pin as shown in the typical application circuit, between IN and GND.

The OVP threshold can be adjusted as following:

$$V_{IN_OVLO}=\frac{R_1+R_2}{R_2}V_{OVLO_TH}$$

The OVP threshold adjustment range is from 4V to 20V. OVLO pin must not be floated.

12.3.3 Over Temperature Protection (OTP)

The WP3883CL monitors its own internal temperature to prevent thermal failures. The chip turns off the MOSFET when the internal temperature reaches 155℃. The IC will resume after the internal temperature is cooled down 20℃.

12.3.4 USB On-The-Go (OTG) Operation

If V_{IN} = 0V and OUT is supplied by OTG voltage, the body diode of the load switch conducts current from OUT to IN and the voltage drop from OUT to IN is approximately 0.7V. When $V_{IN} > V_{IN_UVLO}$, internal charge pump begins to open the load switch after debounce time (about 15ms). After switch is fully on, current is supplied through switch channel and the voltage drop from OUT to IN is minimum.

13. Application and Implementation

13.1 Application Information

13.1.1 Input Capacitor

To limit the voltage drop on the input supply caused by transient in-rush currents when the switch turns on into a discharged load capacitor or a short-circuit, a capacitor needs to be placed between VIN and GND. A 1μf ceramic capacitor, C_{IN}, placed close to the pins is usually sufficient. Higher values of CIN can be used to further reduce the voltage drop.

13.1.2 Output Capacitor

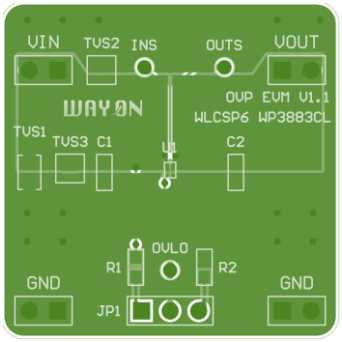
A 1μF capacitor, C_{OUT}, should be placed between V_{OUT} and GND. This capacitor will prevent parasitic board inductances from forcing V_{OUT} below GND when the switch turns off.

14. Layout

To make fully use of the performance of WP3883CL, the guidelines below should be followed.

1. All the peripherals should be placed as close to the device as possible. Place the input capacitor C_{IN} on the top layer (same layer as the WP3883CL) and close to IN pin, and place the output capacitor C_{OUT} on the top layer (same layer as the WP3883CL) and close to OUT pin.
2. If external TVS is used, IN pin routing passes through the external TVS firstly, and then connect WP3883CL.
3. If R_1 and R_2 are used, route OVLO line on PCB as short as possible to reduce parasitic capacitance.

14.1 Layout Example



15. Evaluation Modules

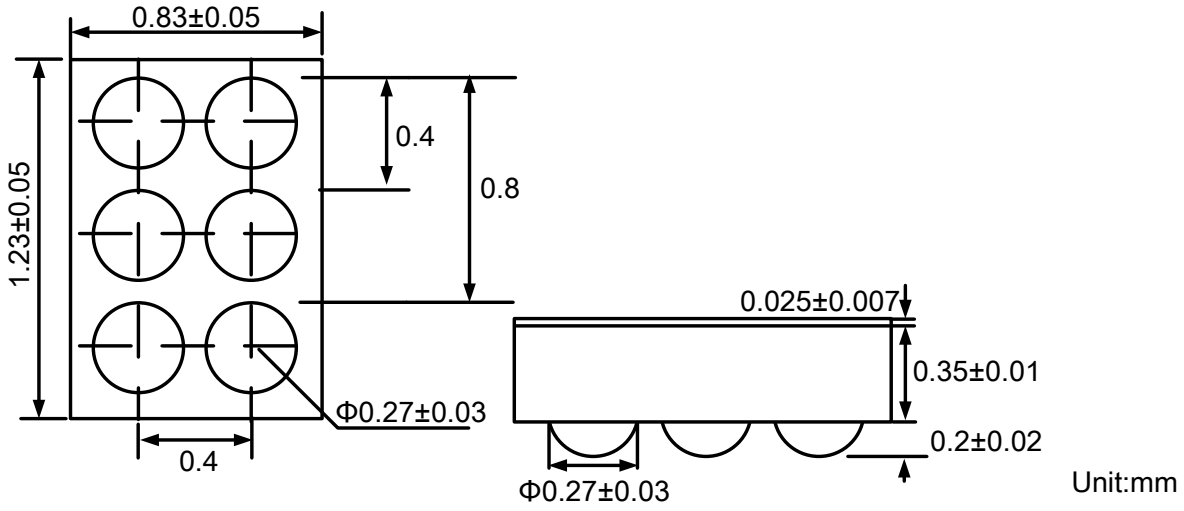
Evaluation Modules (EVMs) are available to help evaluate initial circuit performance. We have evaluation modules for different packages, and you can contact us at the end to get the evaluation module or schematic.

The module names are listed in the following table below.

NAME	PACKAGE	EVALUATION MODULE
WP3883CL	WLCSP6	OVP EVM V1.1 WLCSP6 WP3883CL

16. Package Information

WLCSP6



17. Ordering Information

PART NUMBER	PACKAGE	PACKING QUANTITY	MARKING*
WP3883CL	WLCSP6	3k/Reel	WP3883CL XXXXX

* XXXXX is variable.

Contact Information

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Tel: 86-21-50310888 Fax: 86-21-50757680 Email: market@way-on.com
WAYON website: http://www.way-on.com
For additional information, please contact your local Sales Representative.
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Specifications are subject to change without notice.
The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time.
Users should verify actual device performance in their specific applications.

Product Specification Statement

- The product specification aims to provide users with a reference regarding various product parameters, performance, and usage. It presents certain aspects of the product's performance in graphical form and is intended solely for users to select product and make product comparisons, enabling users to better understand and evaluate the characteristics and advantages of the product. It does not constitute any commitment, warranty, or guarantee.
- The product parameters described in the product specification are numerical values, characteristics, and functions obtained through actual testing or theoretical calculations of the product in an independent or ideal state. Due to the complexity of product applications and variations in test conditions and equipment, there may be slight fluctuations in parameter test values. WAYON shall not guarantee that the actual performance of the product when installed in the customer's system or equipment will be entirely consistent with the product specification, especially concerning dynamic parameters. It is recommended that users consult with professionals for product selection and system design. Users should also thoroughly validate and assess whether the actual parameters and performance when installed in their respective systems or equipment meet their requirements or expectations. Additionally, users should exercise caution in verifying product compatibility issues, and WAYON assumes no responsibility for the application of the product.
- WAYON strives to provide accurate and up-to-date information to the best of our ability. However, due to technical, human, or other reasons, WAYON cannot guarantee that the information provided in the product specification is entirely accurate and error-free. WAYON shall not be held responsible for any losses or damages resulting from the use or reliance on any information in these product specifications. WAYON reserves the right to revise or update the product specification and the products at any time without prior notice, and the user's continued use of the product specification is considered an acceptance of these revisions and updates. Prior to purchasing and using the product, users should verify the above information with WAYON to ensure that the product specification is the most current, effective, and complete. If users are particularly concerned about product parameters, please consult WAYON in detail or request relevant product test reports. Any data not explicitly mentioned in the product specification shall be subject to separate agreement.
- Users are advised to pay attention to the parameter limit values specified in the product specification and maintain a certain margin in design or application to ensure that the product does not exceed the parameter limit values defined in the product specification. This precaution should be taken to avoid exceeding one or more of the limit values, which may result in permanent irreversible damage to the product, ultimately affecting the quality and reliability of the system or equipment.
- The design of the product is intended to meet civilian needs and is not guaranteed for use in harsh environments or precision equipment. It is not recommended for use in systems or equipment such as medical devices, aircraft, nuclear power, and similar systems, where failures in these systems or equipment could reasonably be expected to result in personal injury. WAYON shall assume no responsibility for any consequences resulting from such usage.
- Users should also comply with relevant laws, regulations, policies, and standards when using the product specification. Users are responsible for the risks and liabilities arising from the use of the product specification and must ensure that it is not used for illegal purposes. Additionally, users should respect the intellectual property rights related to the product specification and refrain from infringing upon any third-party legal rights. WAYON shall assume no responsibility for any disputes or controversies arising from the above-mentioned issues in any form.