

High-Current Over-voltage Protector with Adjustable OVLO

General Description

ET9523CL can disconnect the systems from its output pin(OUT) in case wrong input operating conditions are detected. The system is positive over-voltage protected up to 28V. The internal over-voltage thresholds(OVLO) is 6.8V, and external OVLO setting also available. ET9523CL has internal thermal shutdown Protection and Input Voltage detection.

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

Features

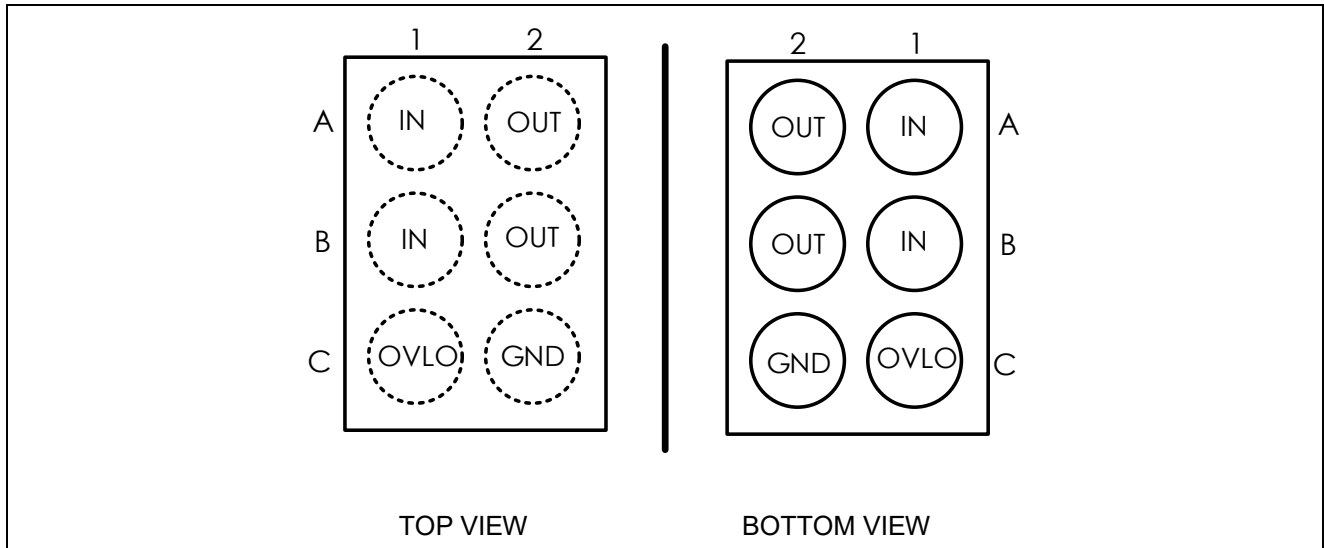
- 4A Continuous Current Capability
- Typical R_{ON} : 29m Ω N-Channel MOSFET
- V_{IN} Operating Range: 2.5V to 28V
- Internal Over-voltage Lockout : 6.8V
- Over-voltage Protection Response Time: 50ns(TYP)
- Startup Debounce Time: 15ms(TYP).
- Internal Thermal-Shutdown Protection
- ESD Protected: Human Body Model (JESD22-A114) All pins ± 2 KV Pass
- WLCSP6 Package (ball pitch=0.4mm)

Application

- 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

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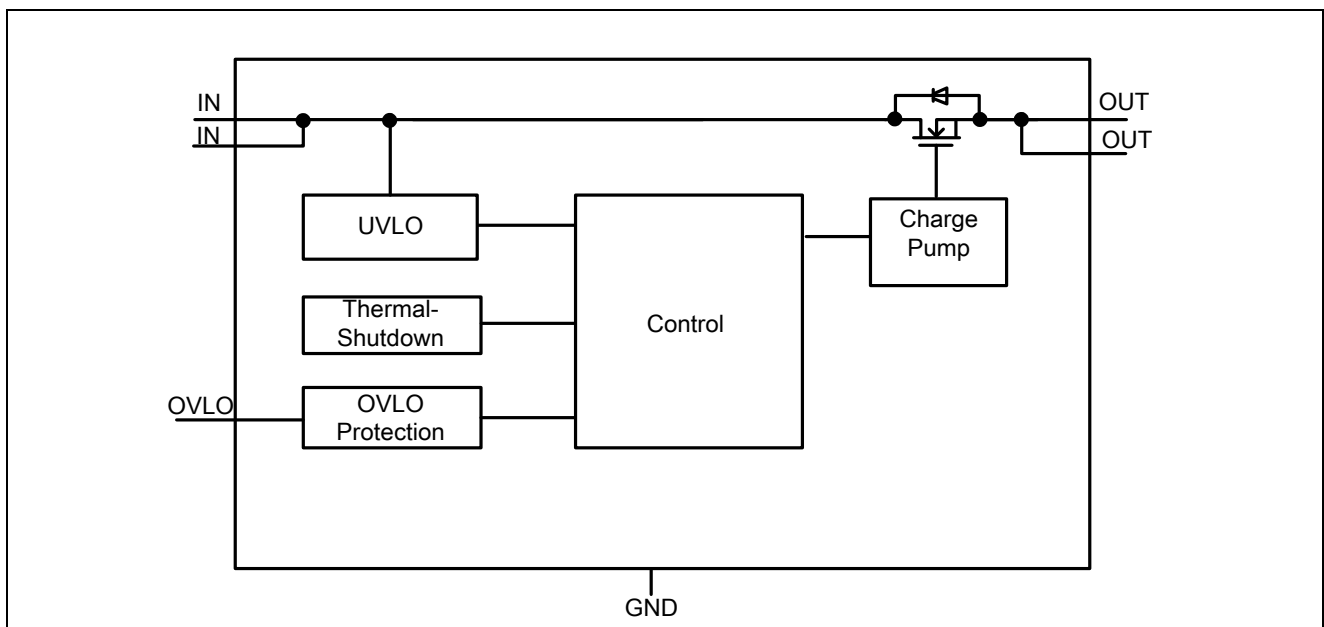
Pin Configuration



Pin Function

Pin No.	Name	Description
A1、B1	IN	Voltage Input. Connect IN pins together for proper operation.
A2、B2	OUT	Output Voltage. Output of internal switch. Connect OUT pins together for proper operation.
C1	OVLO	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.
C2	GND	Ground. Connect GND pins together for proper operation.

Block Diagram



Functional Description

The OVP switch with over-voltage protection feature a low 29mΩ (TYP.) on-resistance(R_{ON}) internal FET and protect low-voltage systems against voltage faults up to 28V_{DC}. If the input voltage(V_{IN}) exceeds 6.8V, the internal FET is quickly turned off to prevent damage to the protected downstream components.

OVLO Setting

When input (OVLO) is set lower than 0.2V. The over-voltage protection threshold is 6.8V.

The over-voltage protection threshold can also be adjusted by external resistors when input (OVLO) is set higher than 0.3V.

$$V_{IN_OVLO} = V_{OVLO_TH} \times (1 + R1/R2)$$

Note : $V_{OVLO_TH} = 1.2V$ (TYP.)

The internal FET turns off when the junction temperature exceeds +150°C (TYP.). The device exits thermal shutdown after the junction temperature cools by 20°C (TYP.).

Input Capacitor

To limit the voltage drop on the input supply caused by transient inrush current when the switch turns on into a discharged load capacitor or short-circuit, a capacitor 1μF or larger must be placed between the IN and GND pins.

Output Capacitor

A 1μF or larger capacitor should be placed between the OUT and GND pins.

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Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameters		Min	Max	Unit
V _{IN}	IN to GND		-0.3	36	V
V _{OUT}	OUT to GND		-0.3	28	V
V _{OVLO}	OVLO to GND		-0.3	7	V
I _{SW1}	Maximum Continuous Current of switch IN-OUT			4	A
I _{SW2}	Maximum Peak Current of switch IN-OUT(10ms)			6	A
P _D	Power Dissipation at T _A = +70°C			1000	mW
T _{STG}	Storage Junction Temperature		-65	+150	°C
T _A	Operating Temperature Range		-40	+85	°C
T _L	Soldering Temperature (reflow).			+260	°C
T _{JMAX}	Max Junction Temperature			+150	°C
ESD	IEC 61000-4-2 System Level ESD	Air Discharge	15.0		KV
		Contact Discharge	8.0		
	Human Body Model, ANSI/ESDA/JEDEC JS-001-2012	All Pins	>2.0		
	Charged Device Model, JESD22-C101	All Pins	>1.5		

Thermal Resistance

Package	PCB Version	θ _{JA}	Unit
CSP6(1.23mm×0.83mm)	ETPB4076	85	°C/W

Notes:

1. The maximum allowable Power Dissipation is recording to maximum allowable Junction Temperature.

$$P_{D(MAX)} @ T_A = (T_{J(MAX)} - T_A) / \theta_{JA}.$$

2. Measured on ETPB4076, 2-layer PCB, 1oz Cu, 60mm×42mm;

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Electrical Characteristics

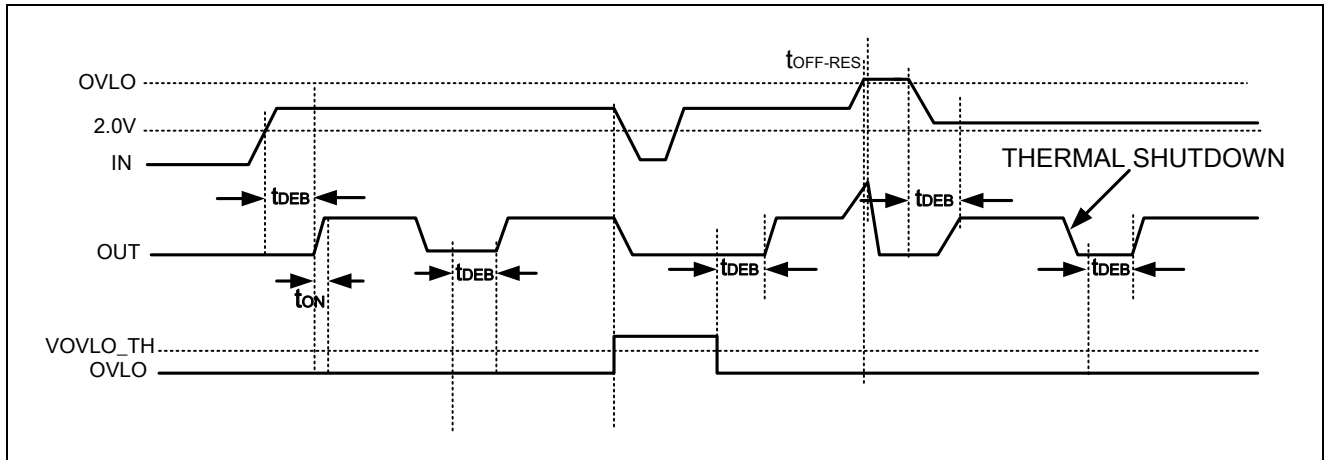
Unless otherwise noted, typical values are at $V_{IN}=5V$ and $T_A=25^{\circ}C$.

Symbol	Parameters	Conditions	Min	Typ	Max	Unit
Basic Operation						
V_{IN}	Input Voltage		2.5		28	V
I_{IN}	V_{IN} Quiescent Current	$V_{IN}=5V$, OUT floating	60	90	150	μA
R_{ON}	On-Resistance of Switch IN-OUT	$V_{IN}=5V$, $I_{OUT}=1A$	20	35	48	m Ω
V_{OVLO}	Over-voltage Protect of V_{IN}	V_{IN} rise up	6.6	6.8	7.0	V
V_{OVLO_HYS}	Over-voltage Protect Hysteresis of V_{IN}		0.1	0.25	0.35	V
V_{OVLO_RG}	Adjustable OVLO Threshold Range		4		24	V
V_{OVLO_TH}	OVLO Set Threshold		1.17	1.2	1.23	V
V_{OVLO_SEL}	External OVLO Select Threshold		0.2		0.3	V
V_{UVLO}	Under Voltage Lockout Threshold	V_{IN} Rising	1.7	2.0	2.5	V
		V_{IN} Falling	1.5	1.8	2.3	V
I_{OVLO}	OVLO Input Leakage Current	$V_{OVLO}=V_{OVLO_TH}$	-100		100	nA
V_{UVLO_R}	Under Voltage Lockout Threshold	V_{IN} Rising		2.0		
$T_{SD}^{(1)}$	Thermal Shutdown			150		$^{\circ}C$
$T_{SD_HYS}^{(1)}$	Thermal-shutdown Hysteresis			20		$^{\circ}C$
Dynamic Characteristics: see figure						
t_{DEB}	Debounce Time	Time from $V_{UVLO_R}<V_{IN}<V_{OVLO}$ to $V_{OUT}=10\%$ of V_{IN}		15	30	ms
t_{ON}	Switch Turn-On Time	$R_L=100\Omega$, $C_L=22\mu F$, V_{OUT} from $0.1\times V_{IN}$ to $0.9\times V_{IN}$		2	8	ms
$t_{OFF_RES}^{(1)}$	Switch Turn-off Response Time	$V_{IN} > V_{OVLO}$ to V_{OUT} stop rising		50	100	ns

Note1: Guaranteed by characterization and design.

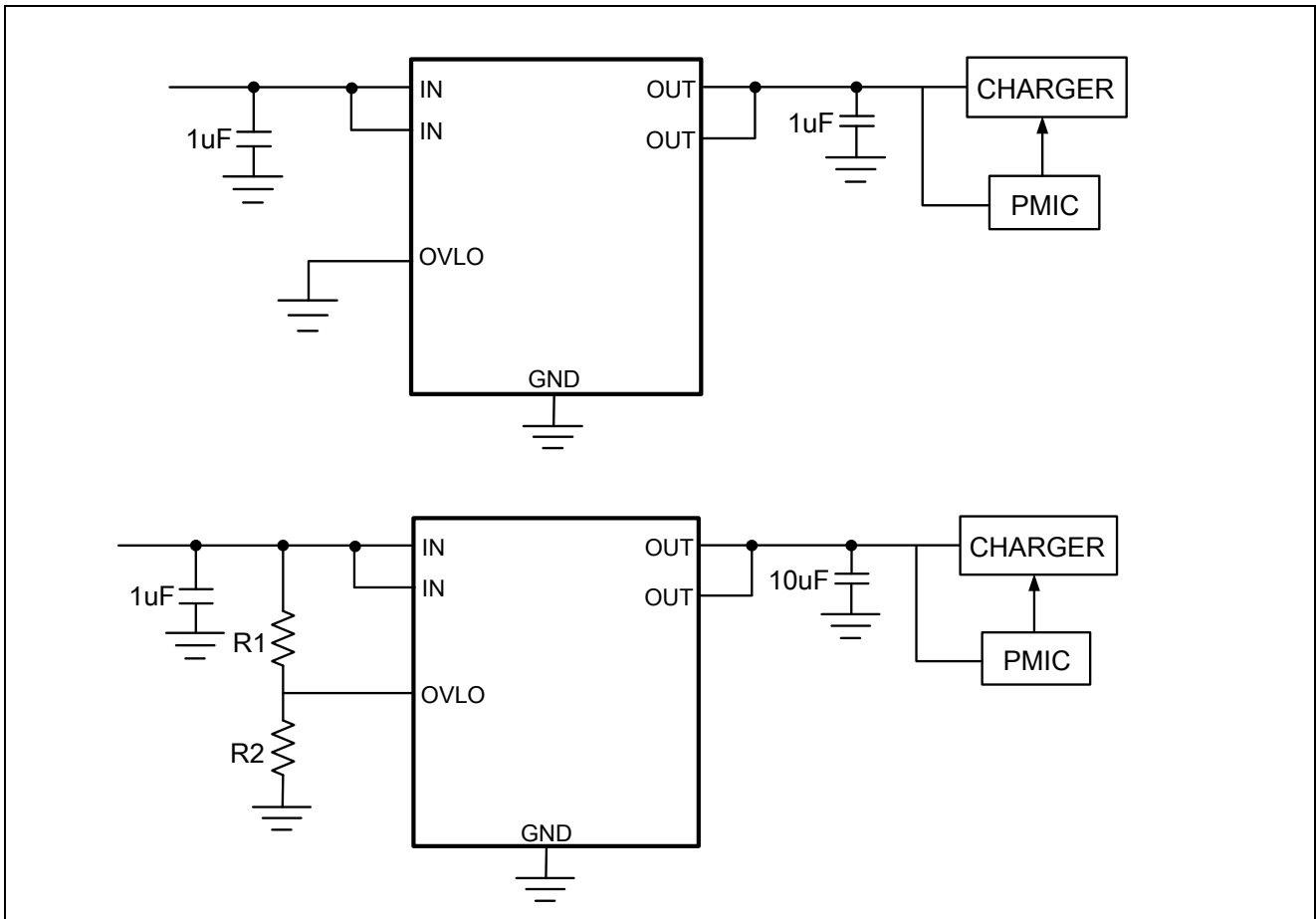
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Timing Waveform



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Application Circuits

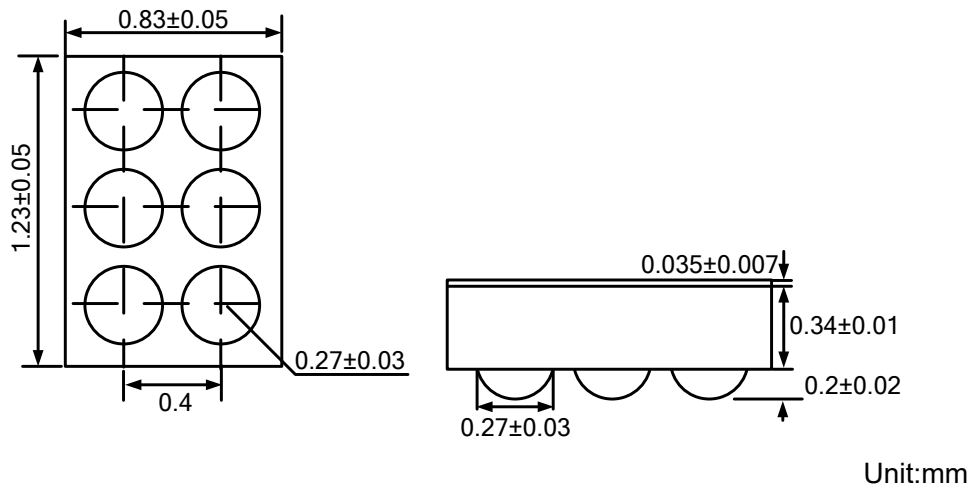


Notes*:

- This electric circuit only supplies for reference.
- R1 and R2 are only required for adjustable OVLO; otherwise connect OVLO to GND.
- Recommend $30K \leq R2 \leq 51K$

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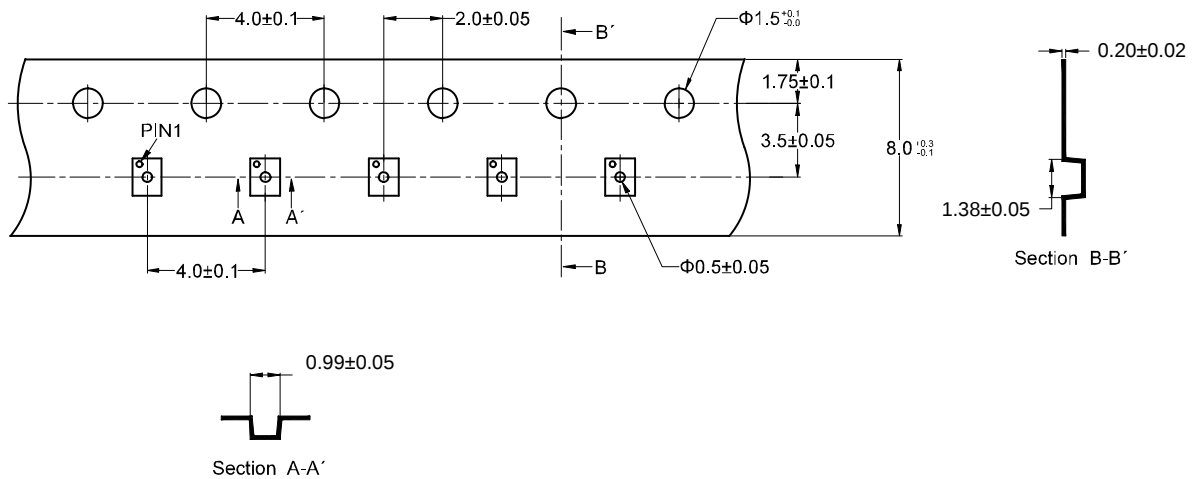
Package Dimension



Marking

ET9523CL	Part No.
XXXXX	Tracking No.

Tape Information



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Revision History and Checking Table

Version	Date	Revision Item	Modifier	Function & Spec Checking	Package & Tape Checking
1.0	2017-10-18	Preliminary Version	Wum	Wum	Zhuji
1.1	2020-03-13	Add marking	Wum	Wum	Liuji
1.2	2020-09-04	Add tape information	Wum	Wum	Liuji
1.3	2021-4-2	Update EC table	Wum	Wum	Liuji
1.4	2023-1-31	Update Typeset	Shibo	Wum	Liuji
1.5	2025-09-05	Update VIN AMR& θ_{JA}	Wuhs	Wum	Liuji