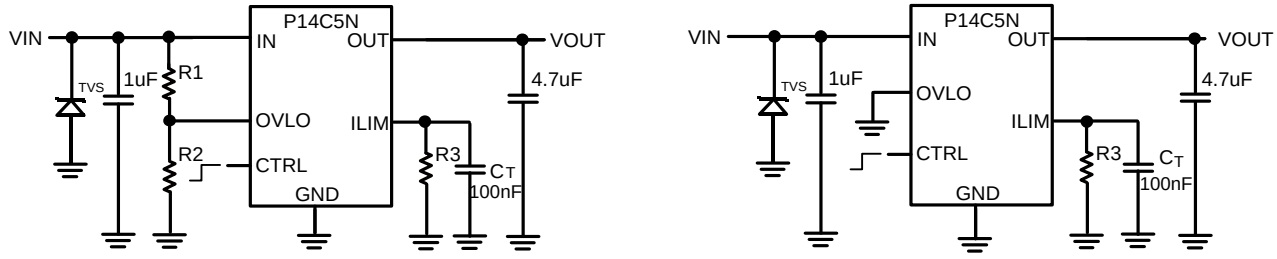
Description

The P14C5N is an Over-Voltage-Protection (OVP) load switch with adjustable OVLO threshold voltage. The device will switch off internal MOSFET to disconnect IN to OUT to protect load when any of input voltage over the threshold.

When the OVLO input set below the external OVLO select voltage, the P14C5N automatically chooses the internal fixed OVLO threshold voltage. The over voltage protection threshold voltage can be adjusted with external resistor divider and the OVLO threshold voltage range is 4.5V~16V. The Over temperature protection (OTP) function monitors chip temperature to protect the device. The OCP function turns off OUTPUT if the load current is over the threshold and recovers either by re-applying input power, or by disabling and re-enabling the device with the CTRL pin.

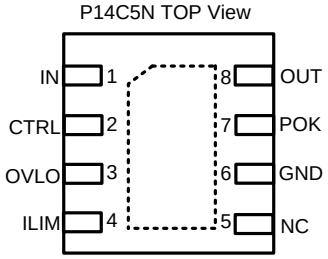
The P14C5N is available in DFN2x2-8L. Standard products are Pb-free and Halogen-free.

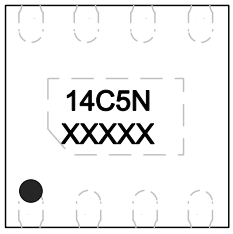


OVP w/i External OVLO Threshold

OVP w/i Internal OVLO Threshold

Figure 1. Typical Application





14C5N: P14C5N

XXXXX: Production Tracing Code

Figure 2. Pin order (Top view) and Marking (Top view)

Feature

- Maximum input voltage : 30V
- Switch ON resistance : 55mΩ Typ.
- Ultra fast OVP response time: 50ns Typ.
- Programmed over-current protection
- Adjustable OVLO threshold voltage**:** 4.5V-16V,±3%
- Fixed internal OVLO threshold voltage: 6.8V, ±3%
- OCP setting range: 300mA-3.0A, ±150mA
- Over temperature protection

Application

- Mobile Handsets and Tablets
- Portable Media Players
- Peripherals

Pin Definitions

Pin No.	Symbol	Descriptions
1	IN	Switch Input and Device Power Supply.
2	CTRL	OUTPUT power path is enabled when CTRL is logic low or floating;
3	OVLO	External OVLO adjustment. Connect a resistor-divider to set different OVLO threshold, V_{OVLO}=1.2x(1+R1/R2) as shown typical application diagram. Connect OVLO to GND when using the internal fixed threshold voltage. R2=120kohm is recommended.
4	ILIM	Current limit adjustment. Connect a resistor to GND to set over current threshold. I_{Lim} = 5.6÷R3 (current in A, resistance in kΩ). For example, I_{Lim} = 2.07A if R3 = 2.7kΩ. Short ILIM to GND will **disable** current limitation. An optional capacitor to GND for OCP response time setting.
5	NC	No connect.
6	GND	Ground.
7	POK	Regulated output whenever VBUS is present. The recommended load current is less than 1mA.
8	OUT	Switch Output to Load.

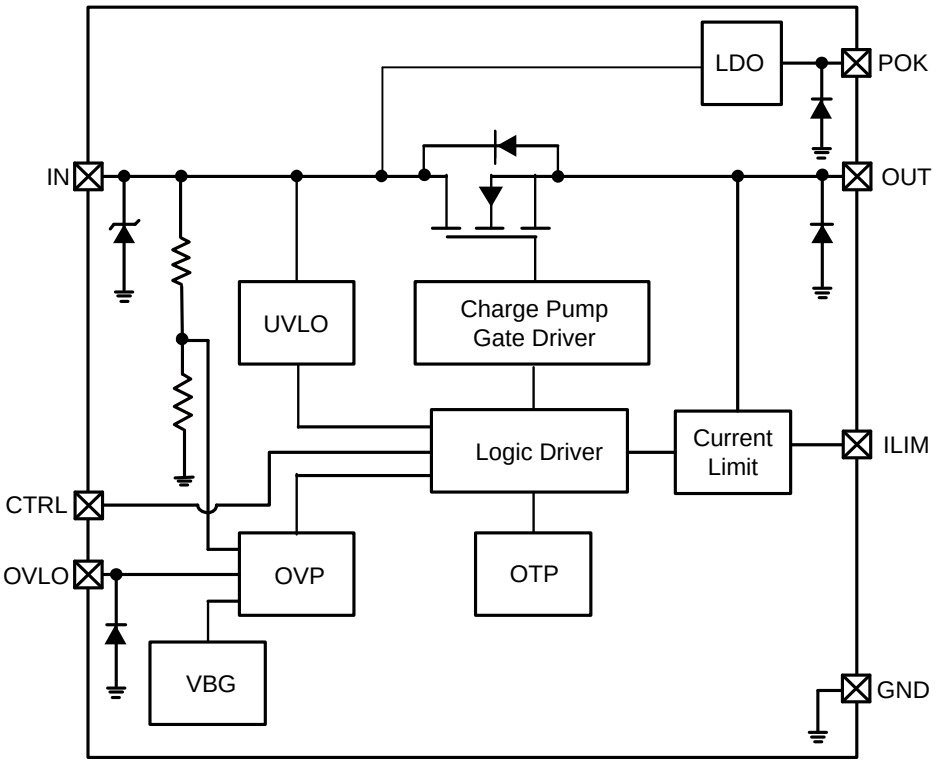


Figure 3. IC Block Diagram

Absolute maximum rating

Parameter(Note1)	Symbol	Value	Units
Input voltage (IN pin)	V_{IN}	-0.3 ~ 30	V
Output voltage (OUT pin)	V_{OUT}	-0.3 ~ 20	V
Input voltage (CTRL, OVLO pin)	V_{CTRL}, V_{OVLO}	-0.3 ~ 6.0	V
Junction temperature	T_J	150	℃
Lead temperature(10s)	T_L	260	℃
Storage temperature	Tstg	-55~150	℃

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

Recommended Operating Conditions

Parameter	Symbol	Value	Units
Input voltage	V_{IN}	3.5~30	V
MAX Continuous Output current	I_{OUT}	3	A
Ambient operating temperature	Topr	-40~85	℃

Electrical Characteristics

（T_A=25℃，V_{IN}=5V，C_{IN}=1uF，C_{OUT}=4.7uF，unless otherwise specified.）

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input voltage range	V_{IN}		3.5		30	V
Quiescent current	I_Q	NO Load, CTRL=GND, OVLO=GND V_{IN}=5V		145	250	uA
Over voltage quiescent current	I_{Q_OVP}	NO Load, CTRL=GND, OVLO=GND V_{IN}=30V		200	300	uA
Disable OVP quiescent current	I_{Q_DIS}	NO Load, CTRL=5V, OVLO=GND V_{IN}=5V		58	108	uA
ON resistance	R_{ON}	V_{IN}=5V, I_{OUT}=1A		55	70	mΩ
OVP response time	t_{OVP}	V_{IN} rising, C_{IN}=C_L=0pF (Note2)		50		ns
OVP set threshold voltage	V_{OVLO_TH}		1.135	1.2	1.265	V
Adjust OVP voltage range	VOVP_EXTSEL	VIN rising	4.5		16	V
	VOVP_INTSEL		6.596	6.8	7.004	V
External OVLO select voltage	VOVLO_EXTSEL		0.6			V
Internal OVLO select voltage	VOVLO_INTSEL				0.15	V
CTRL high threshold voltage	V_{CTRL_H}	VCTRL Rising	0.6			
CTRL low threshold voltage	V_{CTRL_L}	VCTRL Falling			0.25	
UVLO threshold voltage	VUVLO	VIN rising		2.34		V
UVLO hysteresis voltage	VUVLO_HYS	VIN falling		25		mV
POK output voltage	V_{POK}	V_{IN}=5V, I_{POK}=0mA		3.8	4.0	V
		V_{IN}=5V, I_{POK}=1mA		3.6	3.9	V
		V_{IN}=30V, I_{POK}=0mA		5.6	6.0	V
		V_{IN}=30V, I_{POK}=1mA		5.4	6.0	V
OCP setting range	IOCP_RANG		0.30		3.0	A
OCP current accuracy	Δ I_{OCP}		-150		+150	mA
Power on delay time	t_{ON_DELAY}	VIN=0V to 5V		18	25	ms
OCP detect delay time at start-up	t_{SDD}	VIN=0V to 5V		18	25	ms
OCP response time	t_{OCP}	C_T not connect		1	5	us
Turn On Time	t_{ON}	VOUT=VIN*10% to VOUT=VIN*90%		200	400	us
Output discharge resistance	RDCHG	VIN=5V	300	400	500	Ω
OTP threshold temperature	TOTP	VIN=5V		155		℃
OTP hysteresis temperature	THYS	VIN=5V		20		℃

Note 2: Guaranteed by design

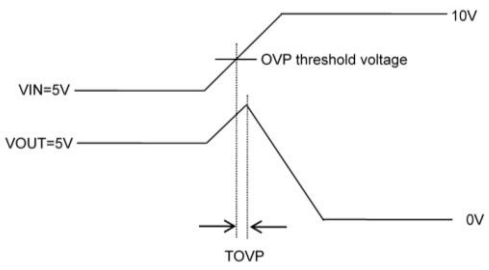


Figure 4. OVP response time test

Function Descriptions

1. OCP Response Time Setting

The OCP response time can be set by connect a capacitor from ILIM pin to ground. Besides the value of capacitor, the response time also depend on the load current step. Some measurement value are list as below for general design reference. The OCP response time is 1us(TYP), when C_T is not connect.

Ilimit(mA)	C_T(nF)	Iload step(mA)	OCP response time, tocp_res(us)
510	47	0-600	727
510	47	0-800	424
510	47	0-1000	324
510	47	200-600	807
510	47	200-800	384
510	47	300-600	653
510	47	300-800	284
990	47	0-1100	367
990	47	0-1200	264
990	47	0-1500	112
990	47	500-1200	283
990	47	500-1500	167
990	47	600-1200	252
990	47	600-1500	137
990	68	0-1100	633
990	68	0-1200	503
990	68	0-1500	350
990	68	500-1200	433
990	68	500-1500	244
990	68	600-1200	374
990	68	600-1500	203
990	100	0-1100	1047
990	100	0-1200	827
990	100	0-1500	547
990	100	500-1200	668
990	100	500-1500	387
990	100	600-1200	587
990	100	600-1500	327

2. Over Current Protection (OCP) at Start-up

After VIN power on, the IC then waits for duration t_{ON_DELAY} for the input voltage to stabilize. If, after t_{ON_DELAY}, the input voltage are safe, the OUTPUT is turned on. At this time, If the load current exceed the I_{OCP} threshold, the device will continuously detect the current for a blanking duration of t_{SDD}. If the load current returns to less than I_{OCP} before t_{SDD} times out, the device continues to operate. However, if the over current situation persists for t_{SDD}, the device will cut off the output voltage. The OUTPUT is turned on either by re-applying input power, or by disabling and re-enabling the device with the CTRL pin.

3. Over Current Protection (OCP) after Start-up

If the load current rises to the OCP threshold after start-up, the device will cut off the output voltage immediately (response in 1us), see figure 10. The OUTPUT is turned on either by re-applying input power, or by disabling and re-enabling the device with the CTRL pin. The OCP threshold is calculated by the equation:

$$I_{Lim} = 5.6 \div R3 \text{ (current in A, resistance in k}\Omega\text{)}$$

For example, $I_{Lim} = 2.07A$ if $R3 = 2.7k\Omega$.
Note: It takes 18ms after OUTPUT on for OCP begins to detect. See figure 9.

4. Over-voltage Lockout (OVLO)

When VIN exceeds 6.8V (or the set value by external resistors), the over-voltage lockout (OVLO) circuit turns off the protected power switch.
The OVP threshold is calculated by the equation: $V_{OVLO}=1.2x(1+R1/R2)$. R2=120kohm is recommended.

5. Under-voltage Lockout (UVLO)

The under-voltage lockout (UVLO) circuit disables the power switch until the input voltage reaches the UVLO turn on threshold. Built-in hysteresis prevents unwanted on and off cycling because of input voltage droop during turn on.

Typical Operating Performance

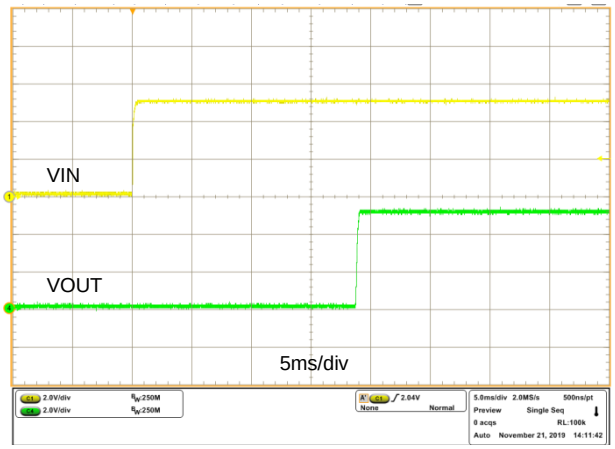


Figure 5. Input Power on Response

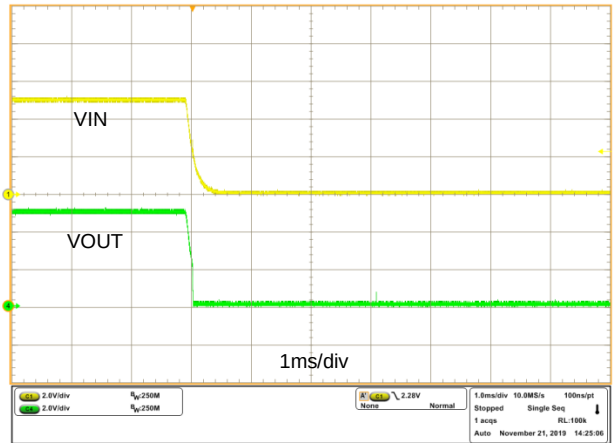


Figure 6. Input Power off Response

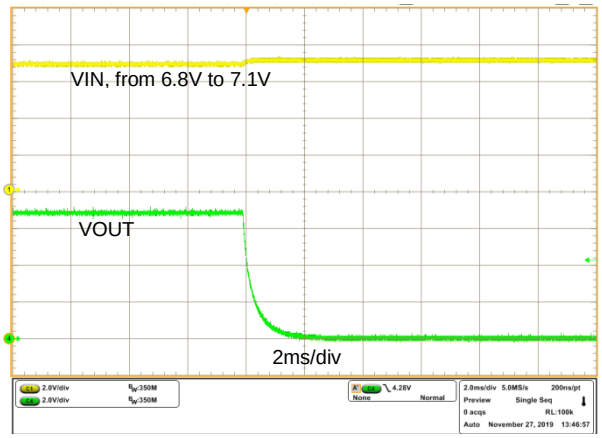


Figure 7. OVP Response

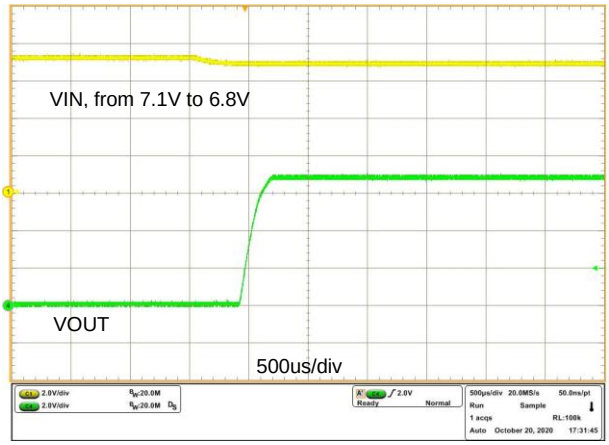


Figure 8. OVP Recovery Response

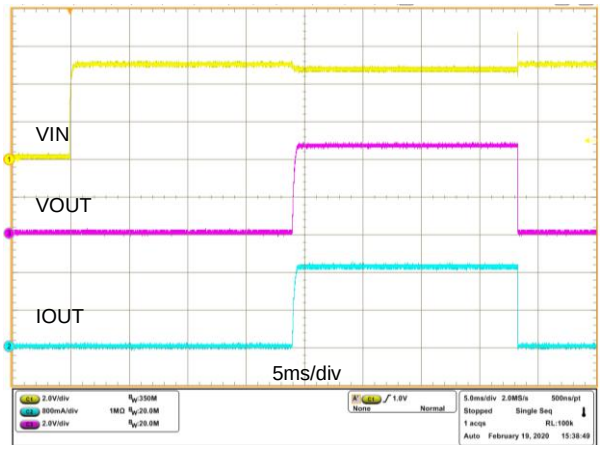


Figure 9. OCP Response at Start-up
(Rload=3Ω,Rlim=5.6kΩ)

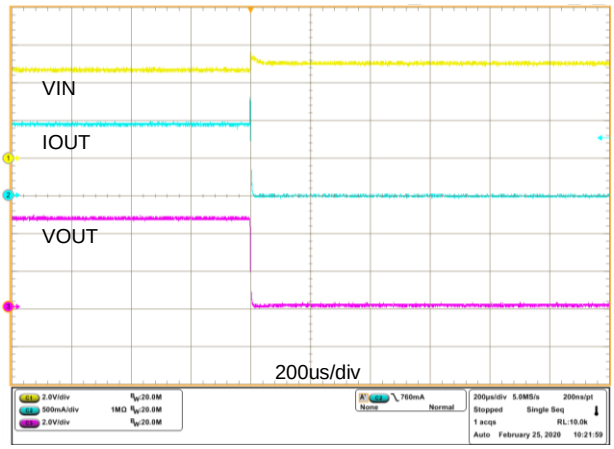


Figure 10. OCP Response after Start-up
(Rload=5Ω to 3.5Ω,Rlim=5.6kΩ)

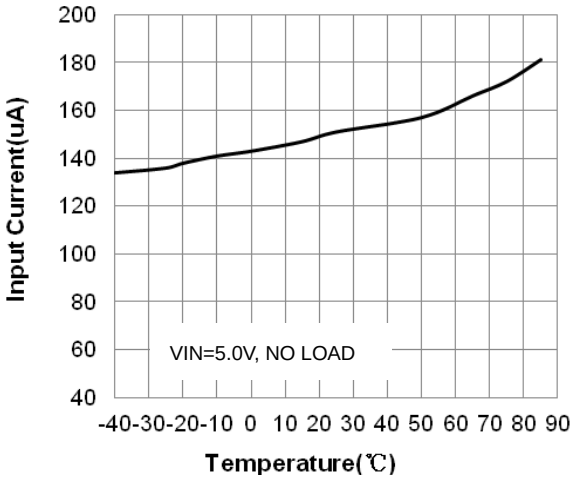


Figure 11. Input current vs. Temperature

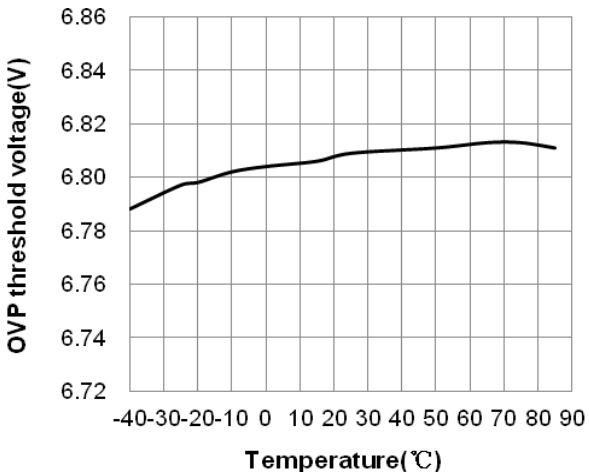
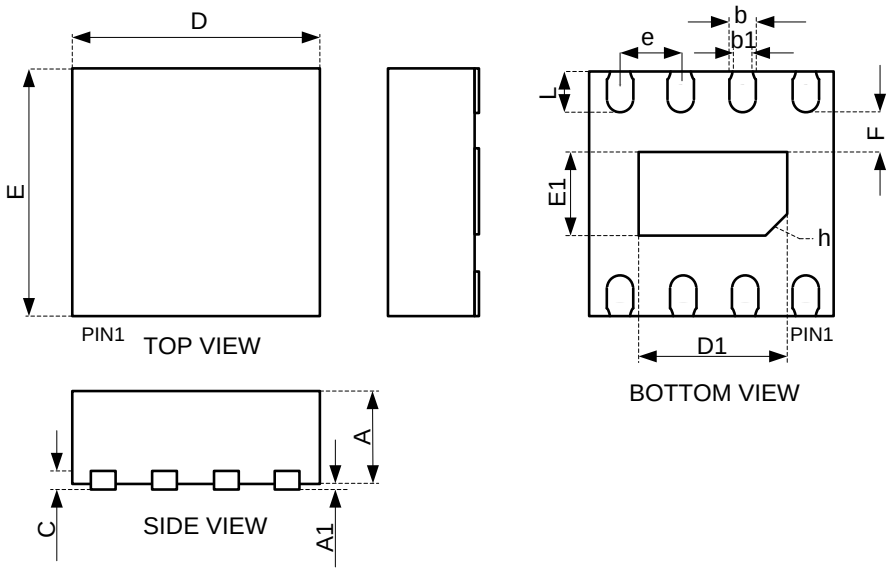


Figure 12. OVP threshold voltage vs. Temperature

Product dimension (DFN2X2-8L)



Dim	Millimeters		
	MIN	Typ.	MAX
A	0.70	0.75	0.80
A1	0.000	0.020	0.050
b	0.200	0.250	0.300
b1	0.18REF		
C	0.180	0.200	0.220
D	1.900	2.000	2.100
E	1.900	2.000	2.100
D1	1.100	1.200	1.300
E1	0.600	0.700	0.800
e	0.475	0.500	0.525
L	0.300	0.350	0.400
F	0.280	0.300	0.320
h	0.230	0.280	0.330

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