Texas Instruments

UCC25661 High Voltage Sensing Evaluation

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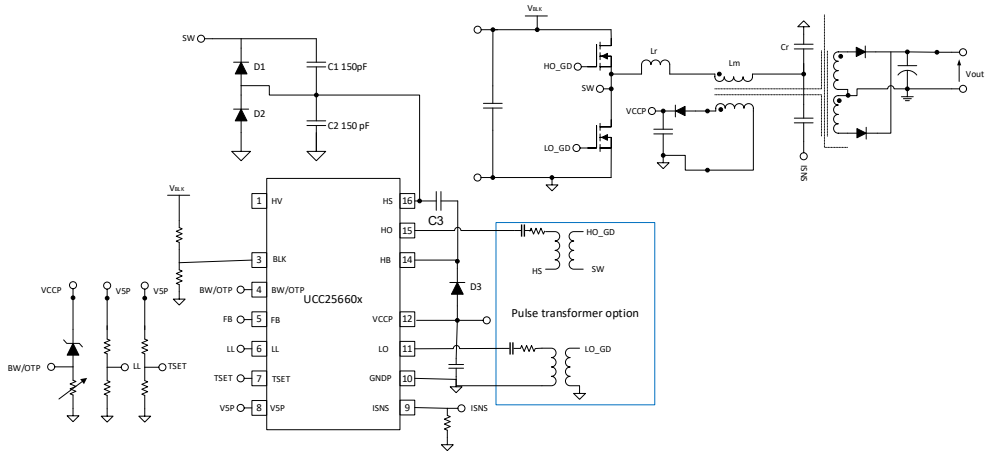
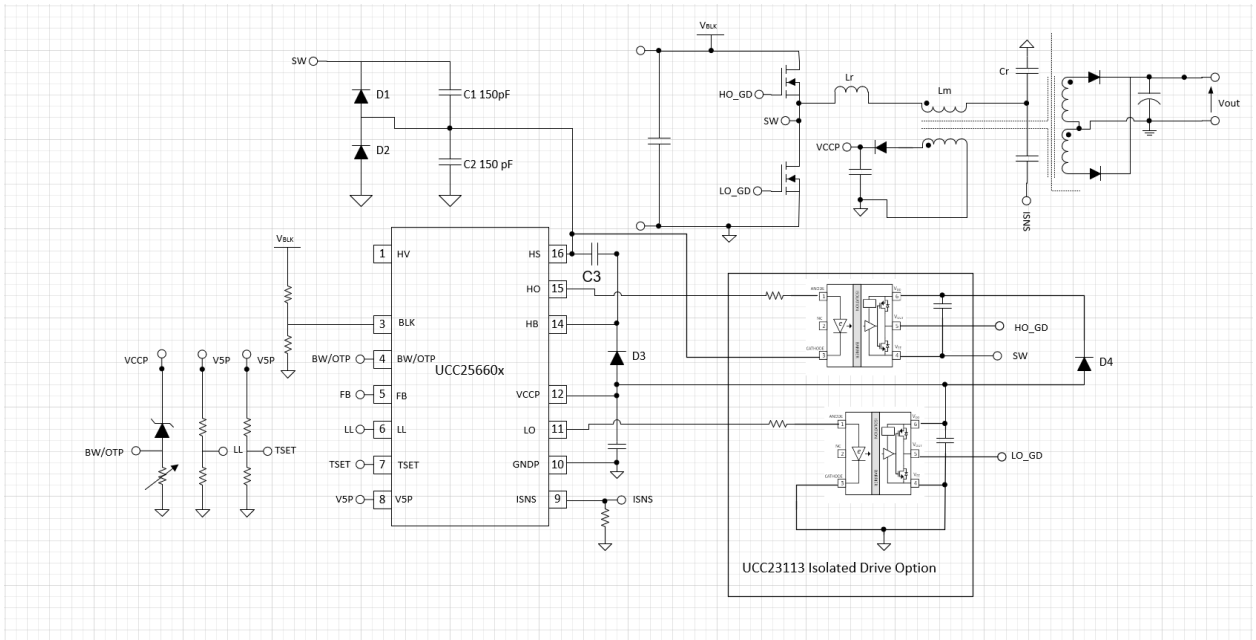
6/21/24

Purpose:

1. Propose and evaluate a circuit for HS voltage sensing with greater switch node greater than a 700 V input for the UCC25661x products.
    a. The maximum HS pin rating is 700 V.

Proposed Circuits:





UCC25660x maximum ratings.

>HV = HS

6 Specifications

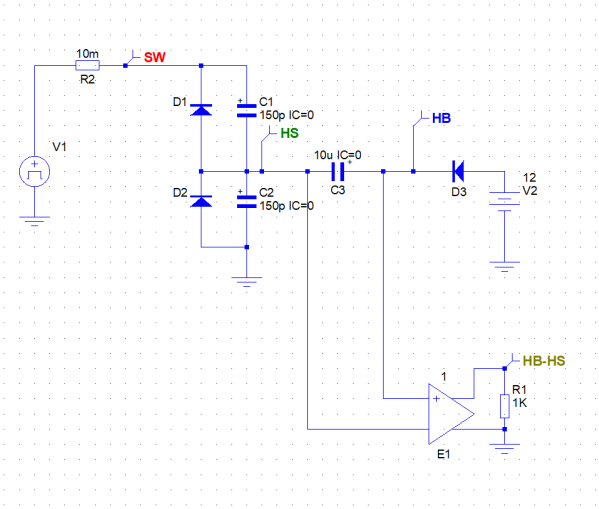
6.1 Absolute Maximum Ratings

Over operating free-air temperature range (unless otherwise noted), all voltages are with respect to GND, currents are positive into and negative out of the specified terminal.(1)

		MIN	MAX	UNIT
Input voltage	HV, HB	-0.3	700	V
	ISNS	-6.5	6.5	V
	BLK, LL, TSET	-0.55	5.5	V
	HB - HS	-0.3	25	V
	VCCP	-0.55	30	V
	OVP/OTP	-0.55	5.5	V
5V	DC	-0.55	5.5	V
HO output voltage	DC	HS – 0.3	HB + 0.3	V
	Transient, less than 100 ns	HS – 2	HB + 0.3	
LO output voltage	DC	-0.3	VCCP+ 0.3	V
	Transient, less than 100 ns	-2	VCCP + 0.3	
Floating ground slew rate	dV_{HS}/dt	-200	200	V/ns
HO, LO pulsed current	I_{OUT_PULSED}	-0.6	1.2	A
Junction temperature range	T_J	-40	150	°C
Storage temperature range, T_{stg}	T_{stg}	-65	150	
Lead temperature	Soldering, 10 second		300	
	Reflow		260	

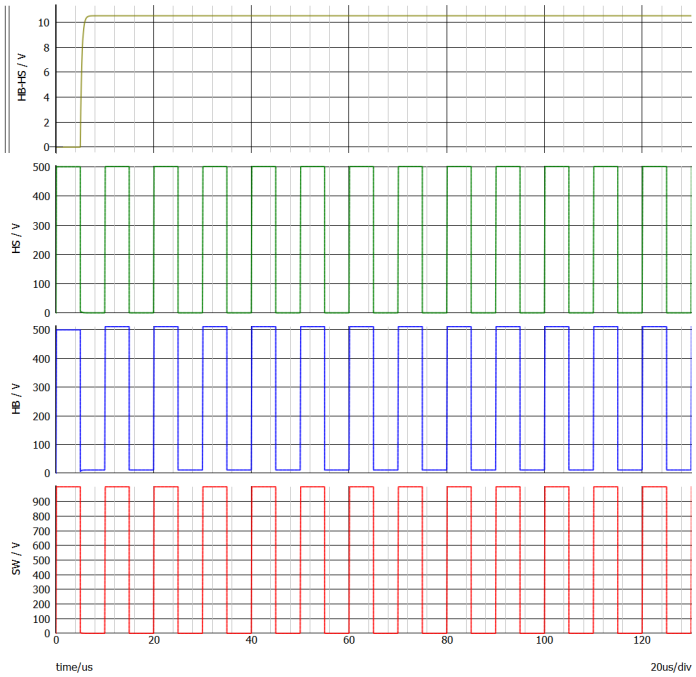
Built HS sensing circuit and C3 capacitor charging scheme in Simplis:

1. V1 was a 1000 V square, 100 kHz, 50 Duty cycle and was used to simulate the switch node.



Simulated HS sensing circuit and C3 capacitor charging scheme in Simplis:

1. V1 is a 1000 V, 100 kHz square wave to simulate the switch node.
2. From the simulation
    - C3 charged up to 11.4V this bias voltage for the HB pin, (HB-HS).
    - The HS switch node was a 500 V square wave as expected.
        - This was caused by attenuating the switch node with capacitor voltage divider formed by C1 and C2.



Summary:

1. Potential circuit will attenuate the SW voltage by 50% and charge the HB Capacitor.
2. In a 1000 V application the HS pin would see 500 V peak.
    a. This is less than the 600 V maximum
    b. HB would see 600 V + (VCCP- VD3)
3. The HB capacitor will charge up to (VCCP- VD3).
4. The simulation showed the circuit behaves as predicted.