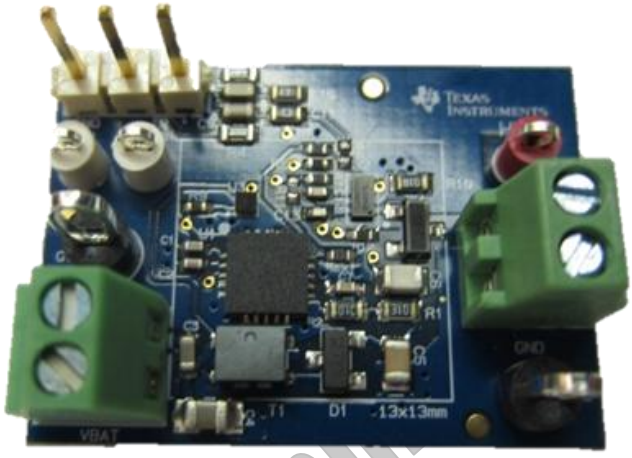
DRV2700EVM-HV User's Guide

Brian Burk *Haptic Products*

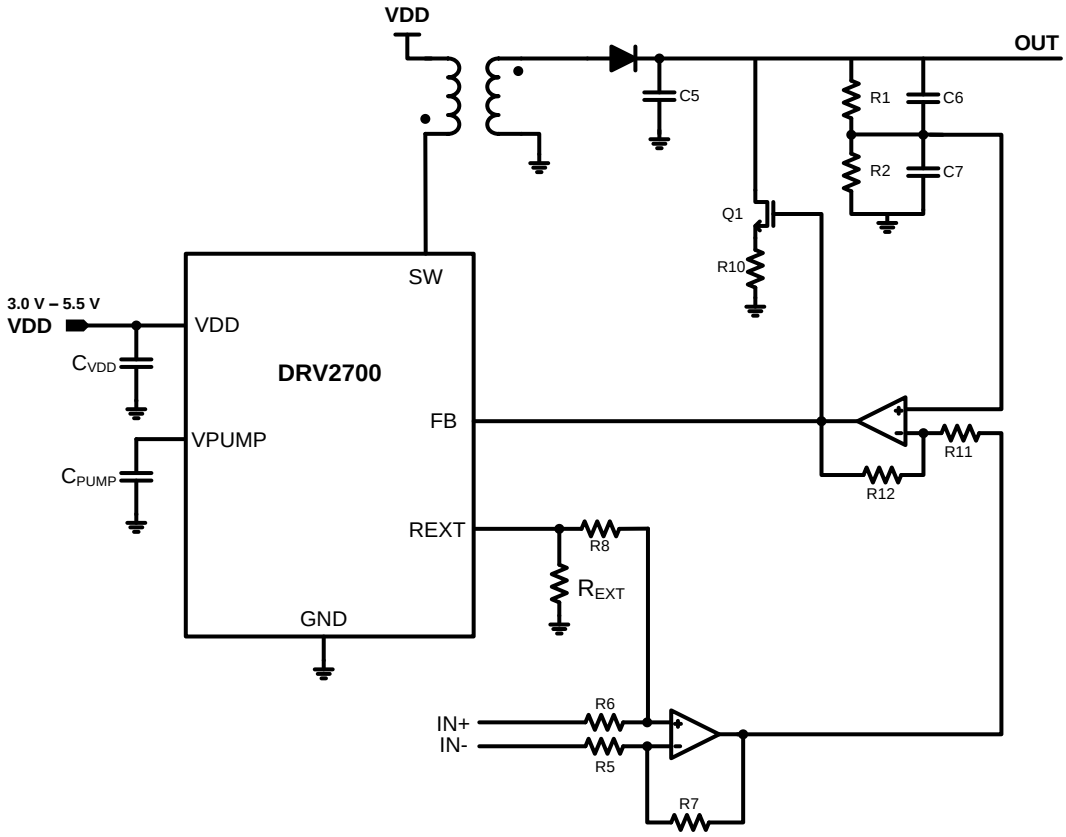
The DRV2700EVM-HV is a single-ended high-voltage Piezo driver reference design that can drive loads up to 500Vp. This document provides general background information on the circuit and the design instructions.



Contents

1 Introduction

The DRV2700EVM-HV is a single-ended high-voltage Piezo driver application circuit that uses the DRV2700 integrated driver.



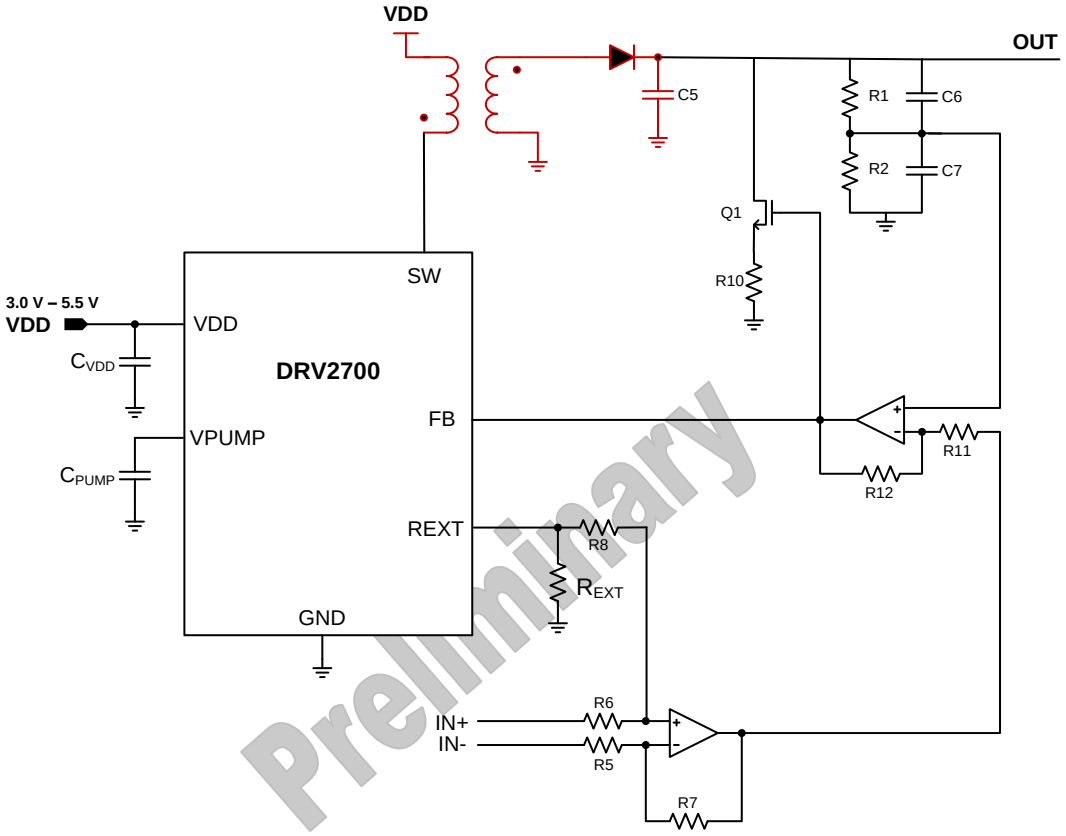
DRV2700 Application Diagram

The circuit is comprised of three main components:

- **Flyback Converter** – the DRV2700 internal flyback controller and integrated FET with gate drive create a high voltage rail using a 1:10 transformer, enabling up to 500Vp
- **Feedback Network** – sets the output voltage based on an integrated 1.32V reference.
- **Input Network** – two operational amplifiers and FET (Q1) modulate the input signal onto the feedback network. This allows the DRV2700 to produce a sine wave or other dynamic output waveform using an efficient Class-H style architecture.

2 Flyback Converter

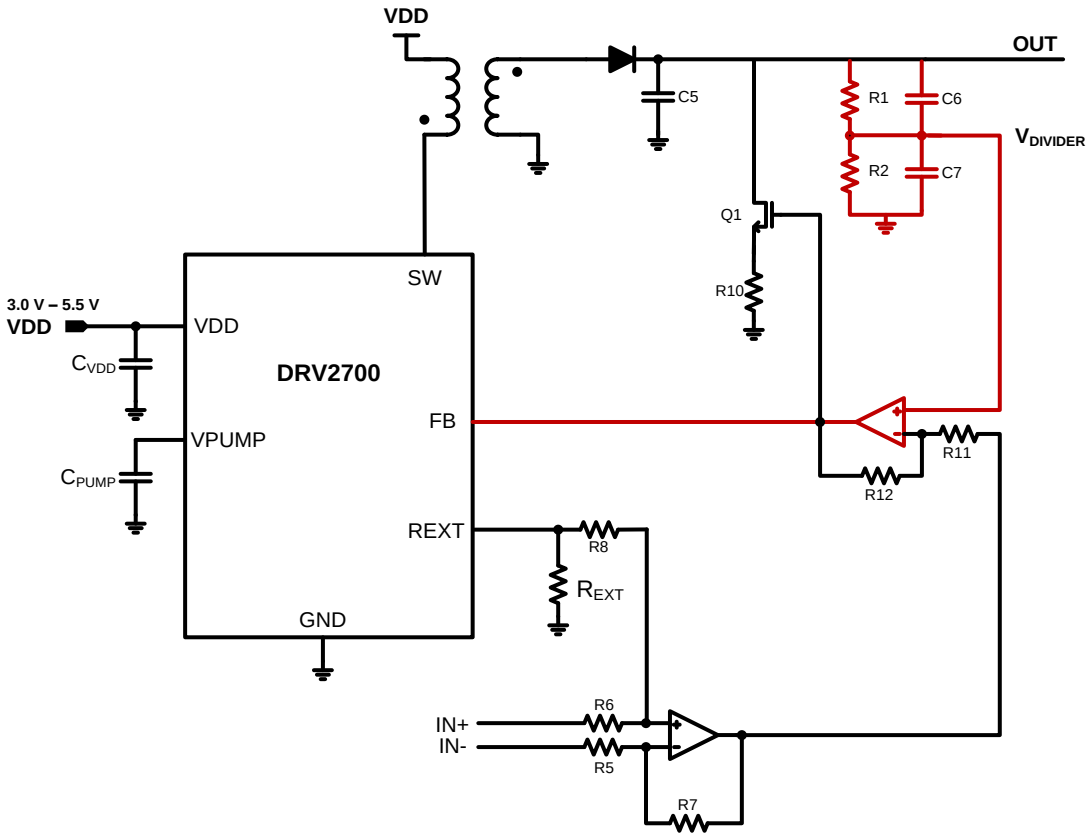
The flyback converter (highlighted in red) is a high-voltage DC-DC converter controller that uses a 1:10 transformer to create up to 500Vp. It consists of the transformer, diode, capacitor (C5), and the integrated high-voltage FET.



The voltage on the primary side of the transformer (SW) can reach up to 105V. The transformer turns ration is used to multiply the primary side voltage up to 500V. The 500V limit is a restriction of the specific TDK transformer, which has a standoff voltage of 500V.

3 Setting the Output Voltage

The feedback network ensures the output voltage is the correct amplitude. By using the DRV2700 flyback controller, the output voltage can be monitored and adjusted dynamically.



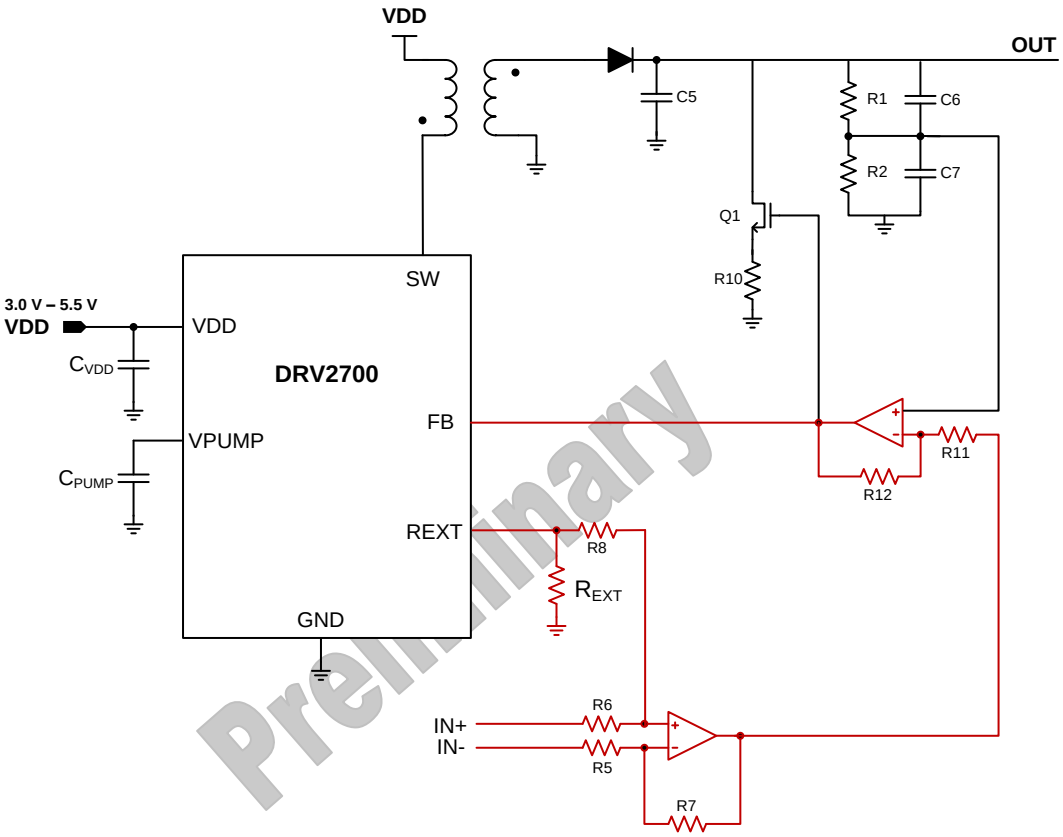
Use R1 and R2 to set the midpoint ($V_{OUT\text{-}MAX}$ / 2) or DC offset of the output waveform. The equation below can be used to calculate the output voltage.

$$V_{OUT} = V_{divider}\left(1 + \frac{R_1}{R_2}\right)$$

where $V_{divider} = V_{FB} = 1.32V$. $V_{divider}$ is the voltage created by the resistor divider using resistors R1 and R2.

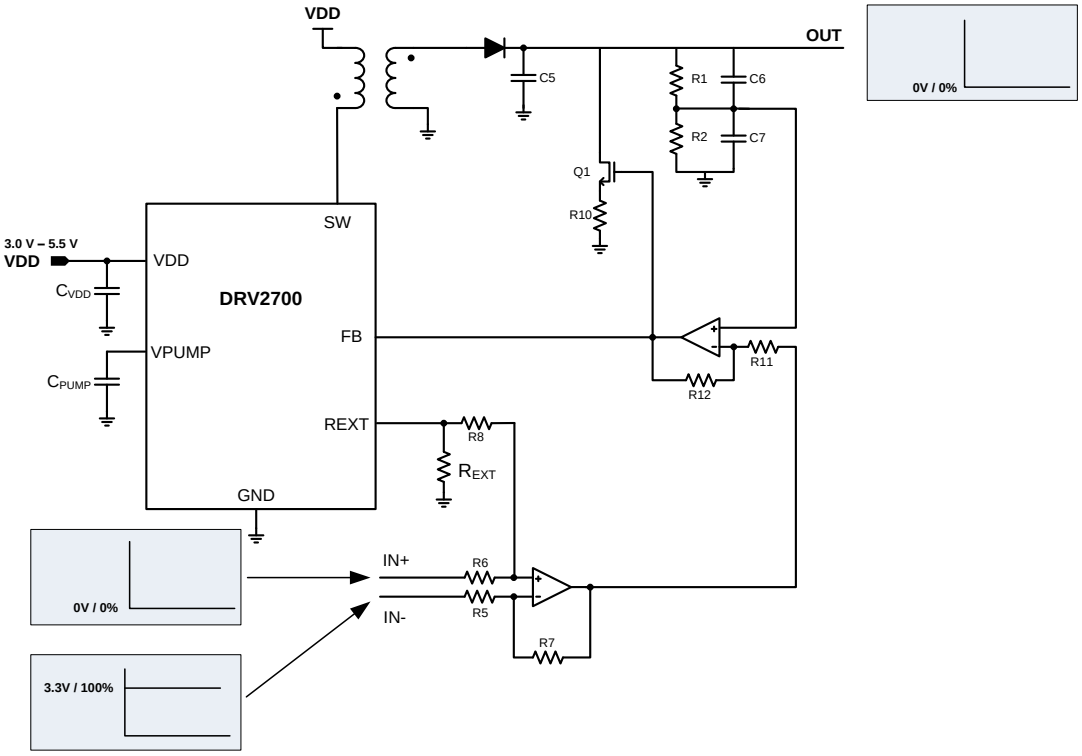
4 Input Network

The input network consists of two operational amplifiers that control the FET Q1 and modulate the input voltage around the reference feedback voltage (FB). The reference voltage on the feedback node is 1.32V.

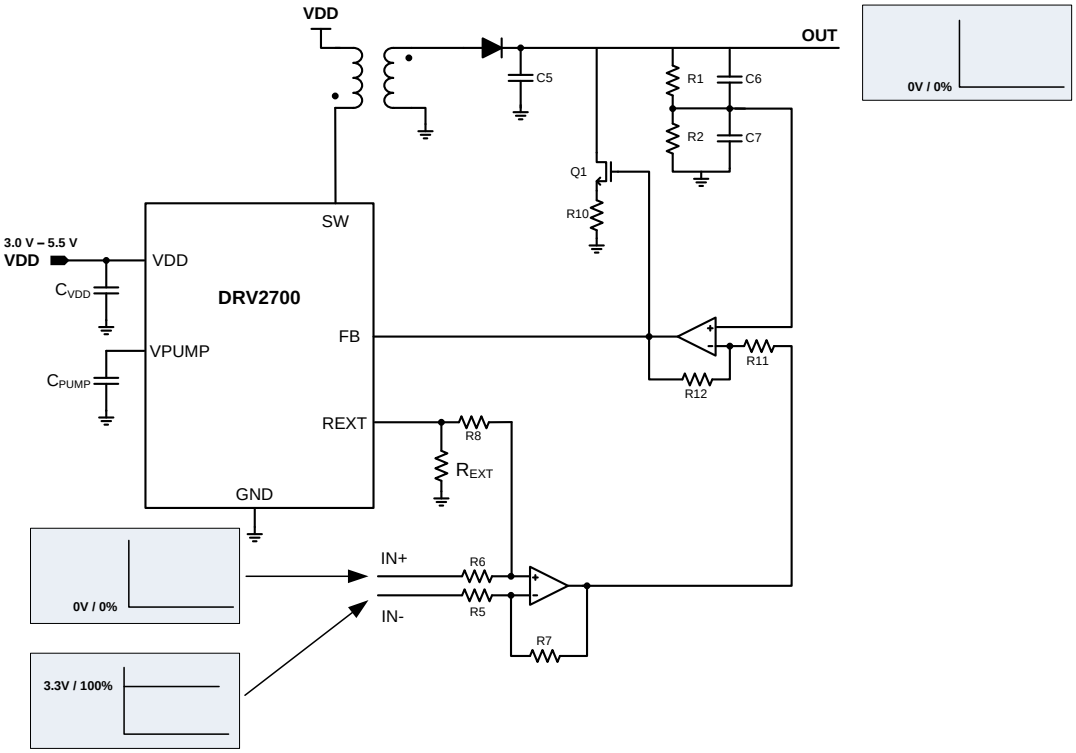


The input common mode on IN+ / IN- is 1.32V supplied by the 1.32V reference voltage from REXT.

4.1 100% Output Example

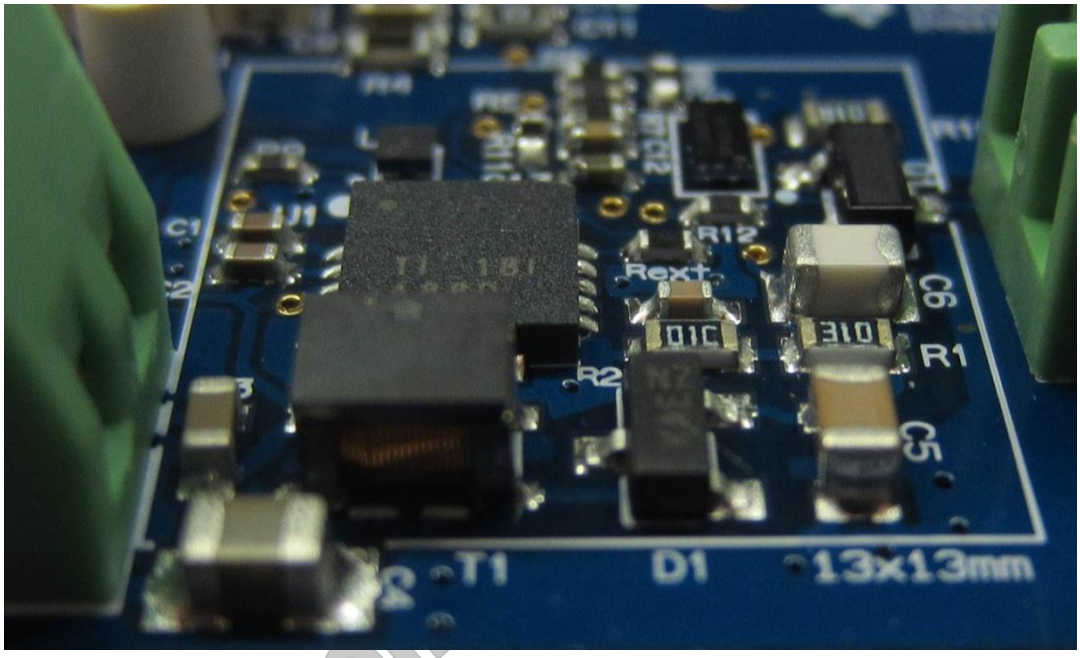


4.2 0% Output Example

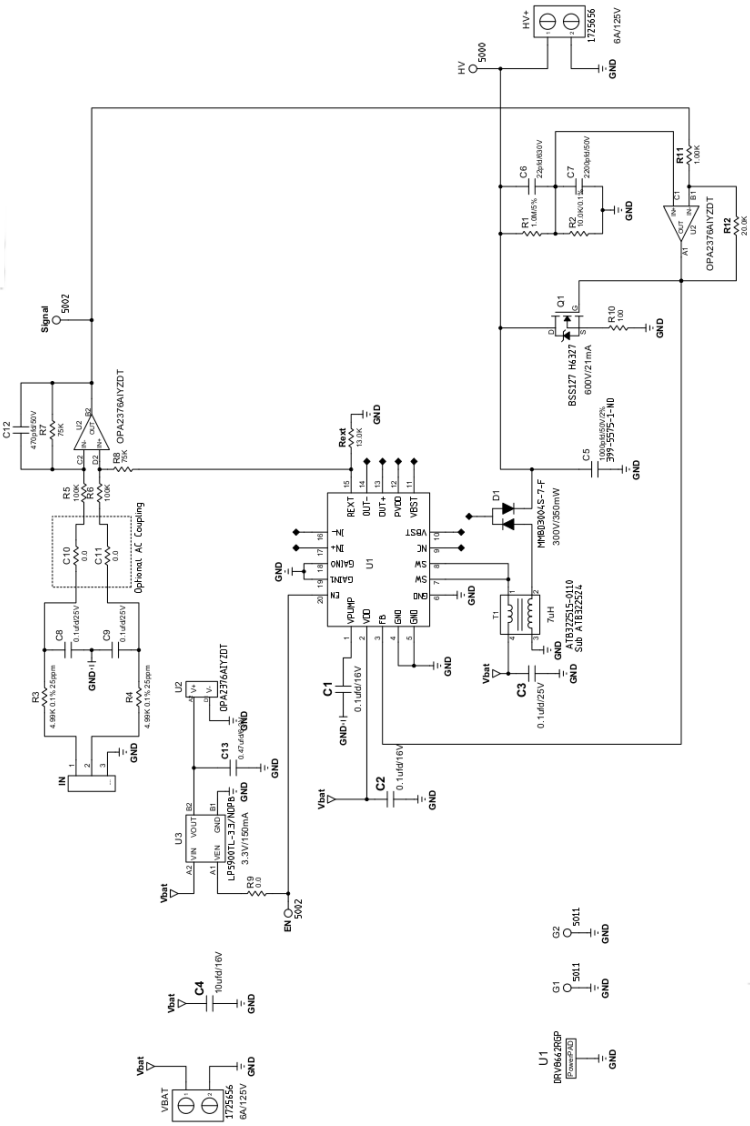


5 Solution Size

The solution solutions size for the DRV2700EVM-HV-500V is approximately 13mm x 13mm . The board is shown below.

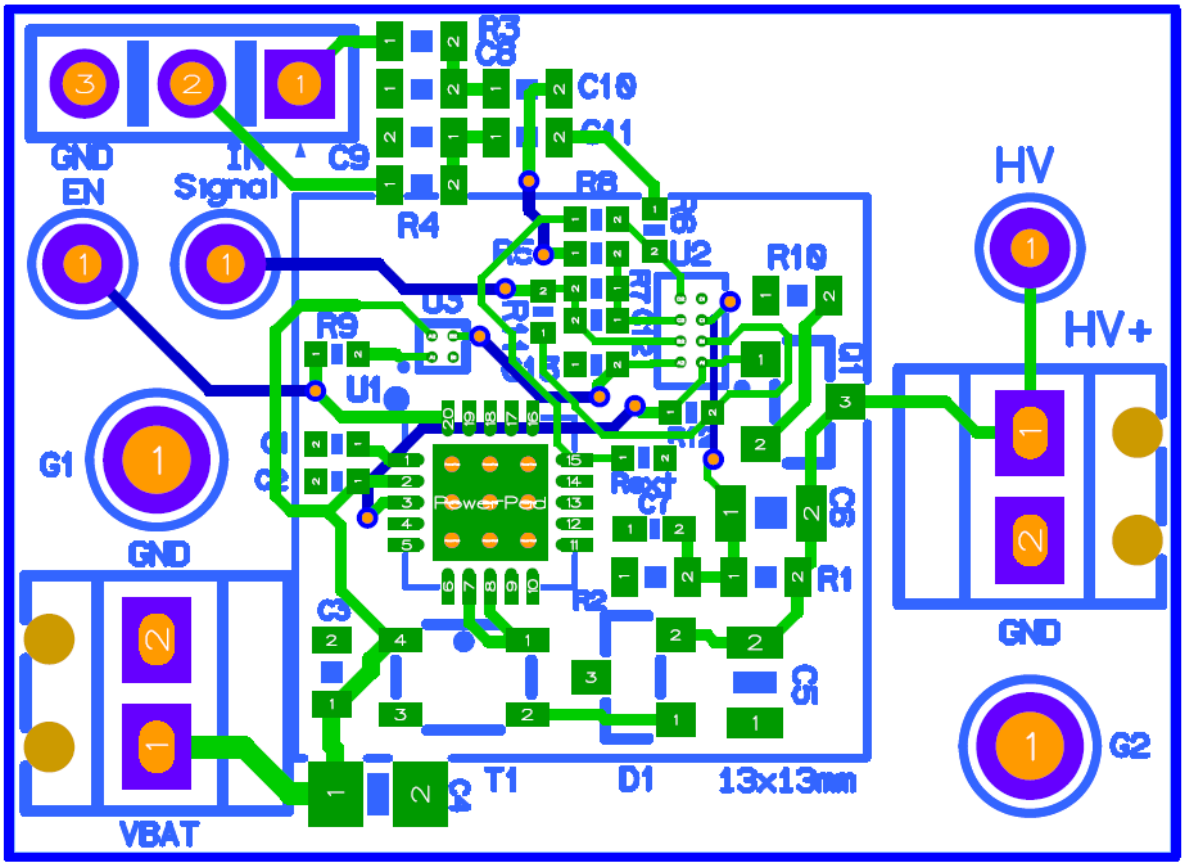


6 Schematic



7 Layout

The image below shows the traces from all layers of the DRV2700EVM-HV.



8 BOM

QTY	VALUE	DESIGNATORS	PKG/ CASE	T.COEFF/ PWR	TOL	VOLT RATED	MANUFACTURER	MNFR. PART #
2	0.1µF	C1, C2	0402	X7R	10	16V	TDK Corporation	C1005X7R1C104K
1	0.47µF	C13	0402	X5R	10	10V	Murata Electronics North America	GRM155R61A474KE15D
1	4700pF	C7	0402	X7R	10	50V	TDK Corporation	C1005X7R1H472K
1	470pF	C12	0402	X7R	10	50V	Murata Electronics North America	GRM155R71H471KA01D
3	0.1µF	C3, C8, C9	0603	X7R	10	50V	Murata Electronics North America	GRM188R71H104KA93D
1	1000pF	C5	0805	X7R	10	630V	Kemet	C0805C102KBRACTU
1	10µF	C4	0805	X5R	10	16V	Taiyo Yuden	EMK212BJ106KG-T
1	22pF	C6	0805	X7R	10	630V	Kemet	C0805C220KBRACTU
1	0.0 (Zero Ohm)	R9	0402	1/10W	5		Panasonic - ECG	ERJ-2GE0R00X
1	1.00K	R11	0402	1/16W	1		Vishay/Dale	CRCW04021K00FKED
2	100K	R5, R6	0402	1/16W	1		Yageo America	RC0402FR-07100KL
1	20.0K	R12	0402	1/16W	1		Panasonic - ECG	ERJ-2RKF2002X
1	20.0K	Rext	0402	1/16W	1		Panasonic - ECG	ERJ-2RKF2002X
2	75K	R7, R8	0402	1/10W	1		Panasonic - ECG	ERJ-2RKF7502X
2	0.0 (Zero Ohm)	C10, C11	0603	1/10W	5		Panasonic - ECG	ERJ-3GEY0R00V
1	10.0K	R2	0603	1/10W	1		Yageo America	RC0603FR-0710KL
1	100	R10	0603	±100ppm/°C	1	1/10W	Panasonic - ECG	ERJ-3EKF1000V
1	2.00M	R1	0603	1/10W	1		Stackpole	RMCF 1/16 2M 1% R
2	4.99K	R3,R4	0603	1/10W	0.1	150V	Susumu Co Ltd	RG1608P-4991-B-T5
1	MMBD3004S-7-F	D1	SOT-23-3	350mW		300V	Diodes Inc	MMBD3004S-7-F

1	MOSFET N-Channel	Q1	SOT-23-3	21mA		600V	Infineon Technologies	BSS127 H6327
1	DRV8662RGP	U1	20-QFN				Texas Instruments	DRV8662RGP
1	LP5900TL-3.3/NOPB	U3	4-WFBGA			3.3V	National Semiconductor	LP5900TL-3.3/NOPB
1	OPA2376AIYZDT	U2	8-DSBGA				Texas Instruments	OPA2376AIYZDT
1	Test Loop - Red	HV	0.040				Keystone Electronic	5000
2	Test Loop - White	EN, Signal	0.040				Keystone Electronics	5002
2	Test Loop - Black	G1, G2	0.063 - Long Loop				Keystone Electronics	5011
1	7µH	T1	3.20mm x 2.50mm				TDK Corporation	ATB322515-0110
1	1 X 3	IN	0.1"	High Temp			Samtec	HTSW-150-07-G-S
2	2 Pin Female R/A with alignment pin	HV+, VBAT	2.54mm 20-26 AWG	6A		125V	Phoenix Contact	1725656