

DESCRIPTION

The EVQ1530 evaluation board is designed to demonstrate the capabilities of MPS' MPQ1530 triple output step-up converter which is capable of powering a TFT panel from a regulated 3.3V or 5V.

The MPQ1530 includes a 1.4MHz fixed-frequency step-up converter and a positive and negative linear regulator. The linear regulators are powered from a charge-pump driven by the step-up converter switch node (SW).

A single on/off control enables all 3 outputs. The outputs are internally sequenced at power on and power off for ease of use. An internal soft-start prevents overloading the input source at startup. Cycle-by-cycle over current protection limits component overstress.

ELECTRICAL SPECIFICATIONS

Parameter	Symbol	Value	Units
Input Voltage	V_{IN}	2.7 – 5.5	V
Output Voltage 1	V_{MAIN}	+13	V
Output Current 1	I_{MAIN}	350	mA
Output Voltage 2	V_{GH}	+27	V
Output Current 2	I_{GH}	20	mA
Output Voltage 3	V_{GL}	–8.5	V
Output Current 3	I_{GL}	20	mA

FEATURES

- 2.7 to 5.5V Operating Input Range
- 2.8A Switch Current Limit
- 3 Outputs In Single Package
 - Step-Up Converter up to 22V
 - Positive 20mA Linear Regulator
 - Negative 20mA Linear Regulator
- 250mΩ Internal Power MOSFET Switch
- Up to 95% Efficiency
- 1μA Shutdown Mode
- Fixed 1.4MHz Frequency
- Positive Regulator up to 38V
- Negative Regulator down to –20V
- Internal Power-On Sequencing
- Adjustable Soft-Start/Fault Timer
- Thermal Shutdown
- Cycle-by-Cycle Over Current Protection
- Under Voltage Lockout
- Ready Flag

APPLICATIONS

- TFT LCD Displays
- Portable DVD Players
- Tablet PCs
- Car Navigation Displays

All MPS parts are lead-free and adhere to the RoHS directive. For MPS green status, please visit MPS website under Products, Quality Assurance page.

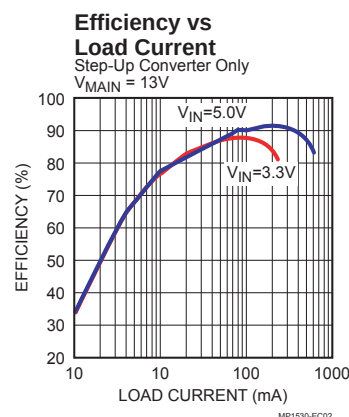
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EVQ1530 EVALUATION BOARD

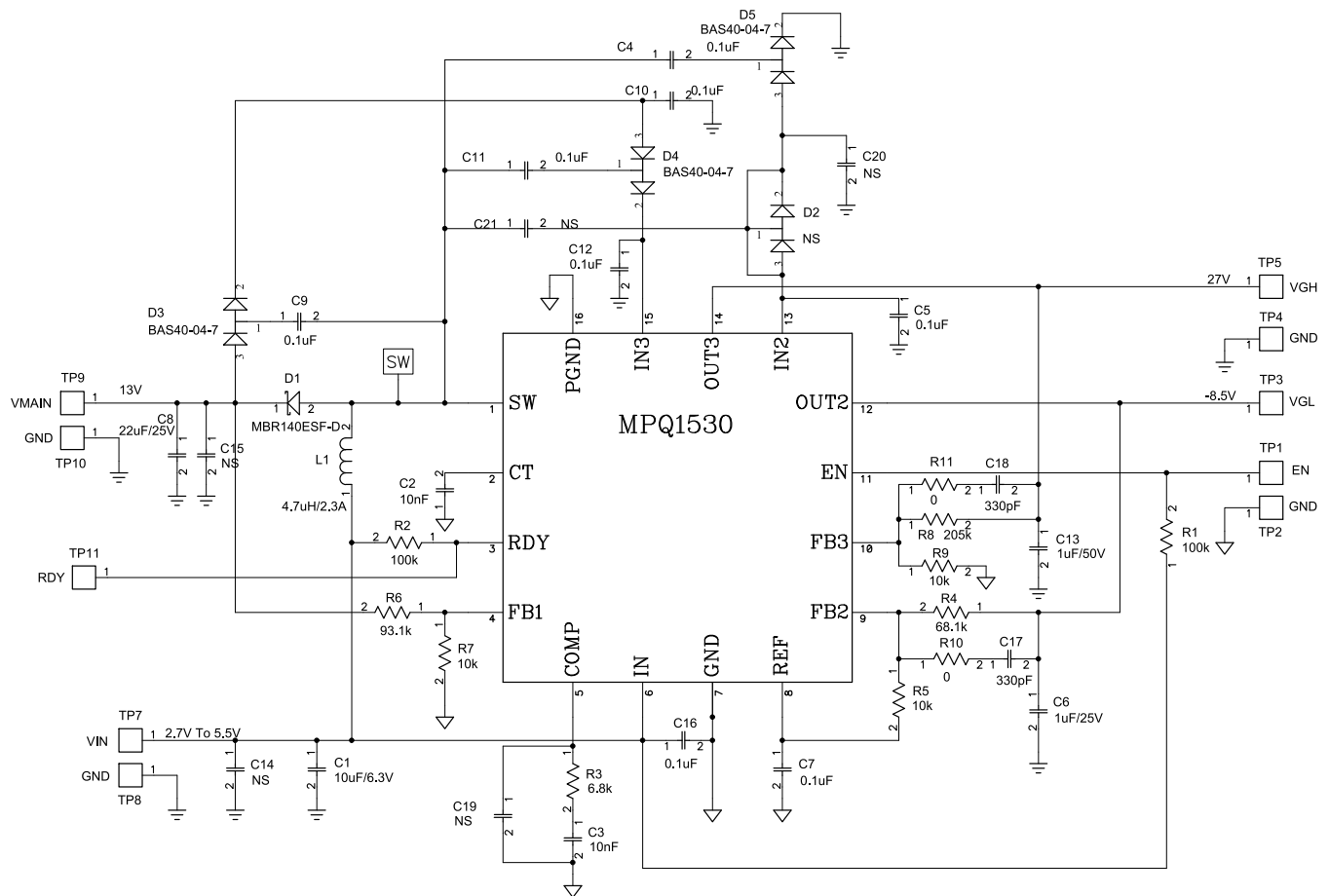


Dimensions (2.4"X x 2.2"Y x 0.5"Z)

Board Number	MPS IC Number
EVQ1530	MPQ1530



EVALUATION BOARD SCHEMATIC



EVQ1530 BILL OF MATERIALS

Qty	Ref	Value	Description	Package	Manufacturer P/N	Distributor P/N
1	C1	10μF	Ceramic Capacitor, 6.3V, X5R	1210	Panasonic: ECJ-4YB1A106K	Digikey: PCC2170CT-ND
2	C2, C3	10nF	Ceramic Capacitor, 50V, X7R	0805	Panasonic: ECJ-2VB1H103K	Digikey: PCC103BNCT-ND
8	C4, C5, C7, C9, C10, C11, C12, C16	0.1μF	Ceramic Capacitor, 50V, X7R	0805	Panasonic: ECJ-2YB1H104K	Digikey: PCC1840CT-ND
1	C6	1μF	Ceramic Capacitor, 25V, X7R	1206	Panasonic: ECJ-3YB1E105K	Digikey: PCC1893CT-ND
1	C8	10μF	Ceramic Capacitor, 25V, X5R	1210	Panasonic: ECJ-4YB1E106M	Digikey: PCC2243CT-ND
1	C13	1μF	Ceramic Capacitor, 50V, X7R	1210	TDK: C3225X7R1H105K	Digikey: 445-1430-1-ND

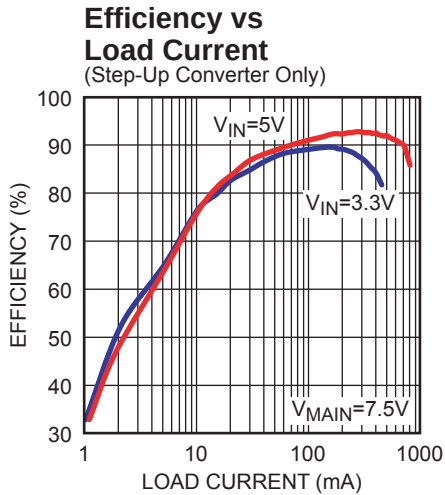
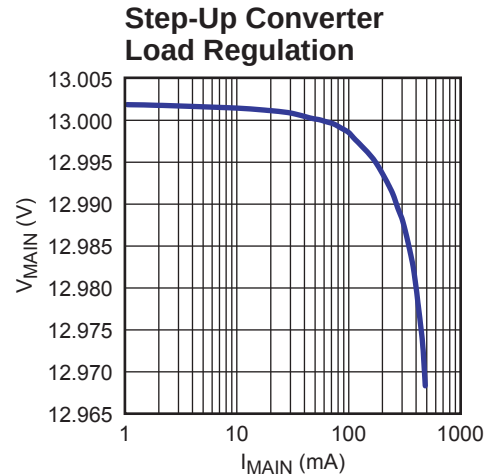
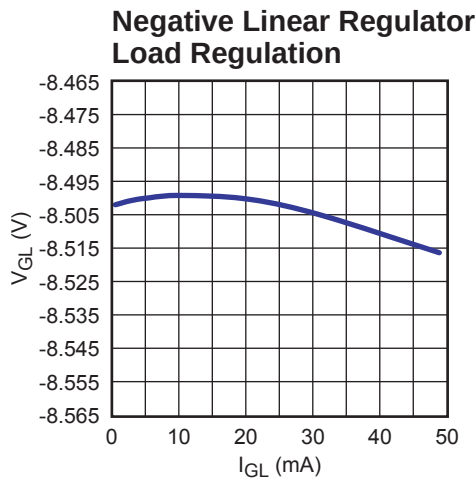
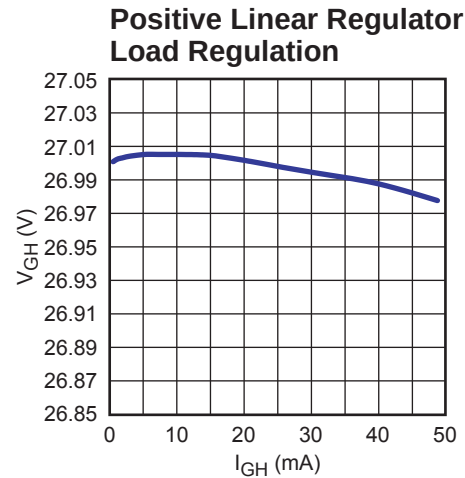
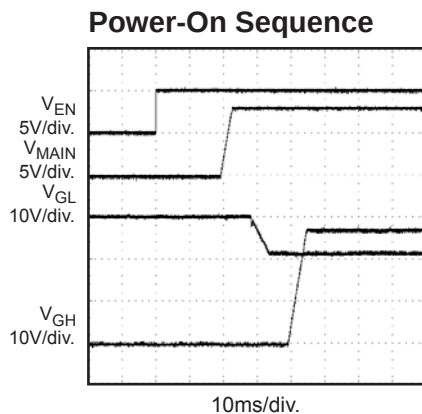
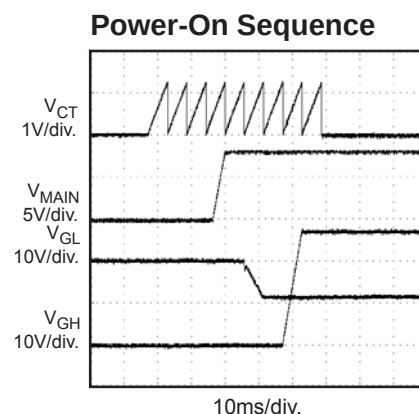
EVQ1530 BILL OF MATERIALS *(continued)*

Qty	Ref	Value	Description	Package	Manufacturer P/N	Distributor P/N
5	C14, C15, C19, C20, C21	NS	Not Stuffed			
2	C17, C18	330pF	Ceramic Capacitor, 50V, NPO	0805	Panasonic: ECJ-2VC1H331J	Digikey: PCC471CGCT-ND
1	D1		Schottky Diode, 40V, 1A	SOD- 123FL	Diodes Inc: MBR140SF	Digikey: MBR140SFT3G-ND
1	D2	NS	Not Stuffed			
3	D3, D4, D5		Schottky Diodes, Dual, 40V, 200mA	SOT23	Diodes Inc: BAS40-04-7	Digikey: BAS40-04DICT-ND
1	L1	4.7μH	2.26A, SMD, Unshielded		Toko: 817FY-4R7M=P3	
2	R1, R2	100kΩ	Resistor, 5%	0805	Panasonic: ERJ-6GEYJ104V	Digikey: P100KACT-ND
1	R3	6.8kΩ	Resistor, 5%	0805	Panasonic: ERJ-6GEYJ682V	Digikey: P6.8KACT-ND
1	R4	68.1kΩ	Resistor, 1%	0805	Panasonic: ERJ-6ENF6812V	Digikey: P68.1KCCT-ND
3	R5, R7, R9	10kΩ	Resistor, 5%	0805	Panasonic: ERJ-6GEYJ103V	Digikey: P10KACT-ND
1	R6	93.1kΩ	Resistor, 1%	0805	Panasonic: ERJ-6ENF9312V	Digikey: P93.1KCCT-ND
1	R8	205kΩ	Resistor, 1%	0805	Panasonic: ERJ-6ENF2053V	Digikey: P205KCCT-ND
2	R10, R11	0Ω	Resistor, 5%	0805	Panasonic: ERJ-6GEY0R00V	Digikey: P0.0ACT-ND
1	U1		MPQ1530	QFN16	MPS: MPQ1530DQ	

EVB TEST RESULTS

Performance waveforms are tested on the evaluation board.

$V_{IN} = 5V$, $V_{MAIN} = 13V$, $I_{MAIN} = 200mA$, $V_{GL} = -8.5V$, $I_{GL} = 10mA$, $V_{GH} = 27V$, $I_{GH} = 10mA$, $T_A = +25^\circ C$, unless otherwise noted.

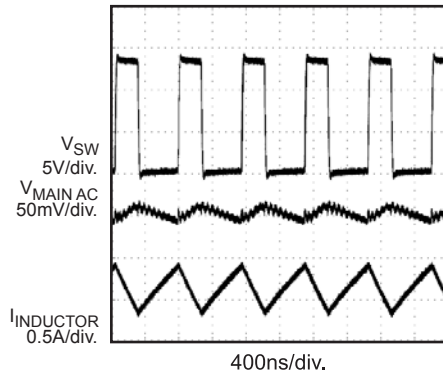


EVB TEST RESULTS *(continued)*

Performance waveforms are tested on the evaluation board.

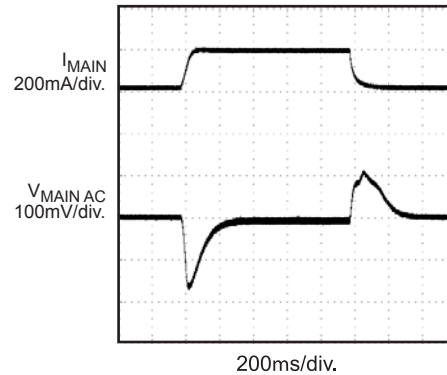
$V_{IN} = 5V$, $V_{MAIN} = 13V$, $I_{MAIN} = 200mA$, $V_{GL} = -8.5V$, $I_{GL} = 10mA$, $V_{GH} = 27V$, $I_{GH} = 10mA$, $T_A = +25^{\circ}C$, unless otherwise noted.

Normal Operation



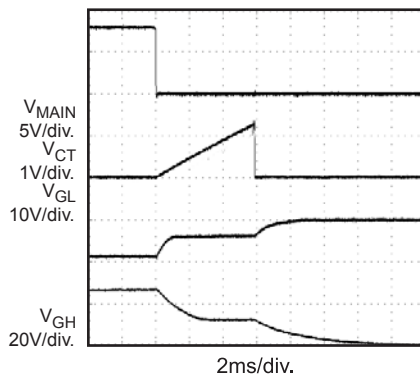
Load Transient on V_{MAIN}

$I_{MAIN} = 20mA - 200mA$ Step

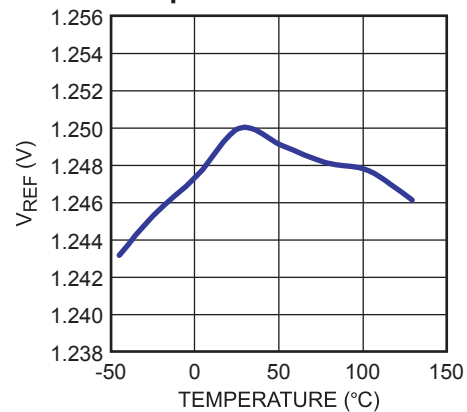


Fault Timer

V_{MAIN} Shorted to V_{IN}

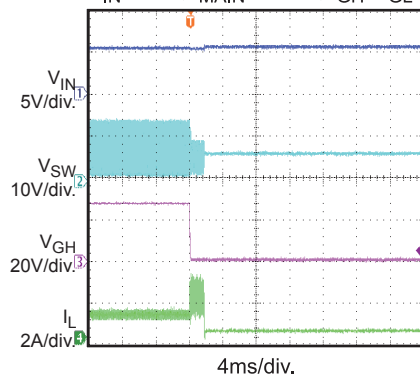


Reference Voltage vs Temperature

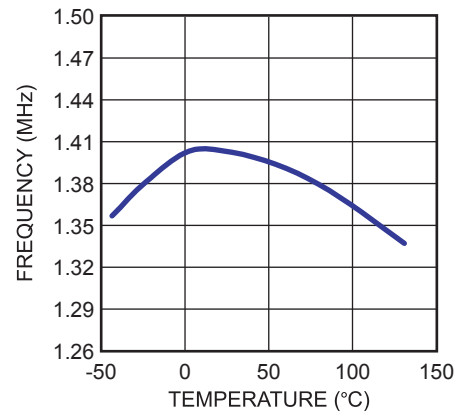


Short Protection for Main Output

$V_{IN} = 5.5V$, $I_{MAIN} = 0.35A$, $I_{GH} = I_{GL} = 20mA$



Oscillator Frequency vs Temperature



PRINTED CIRCUIT BOARD LAYOUT

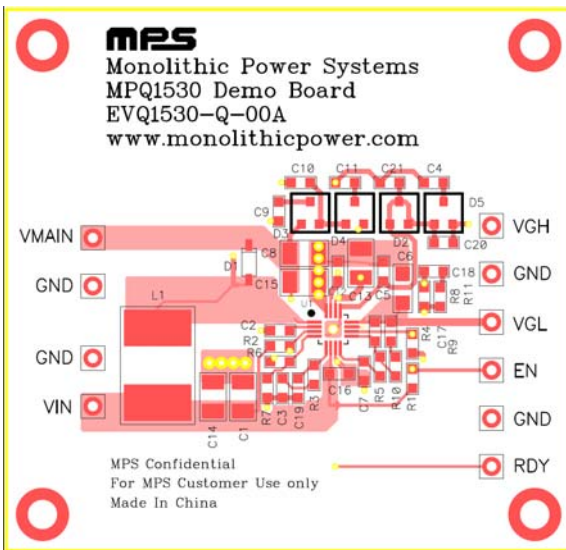


Figure 1—Top Layer & Top Silk Layer

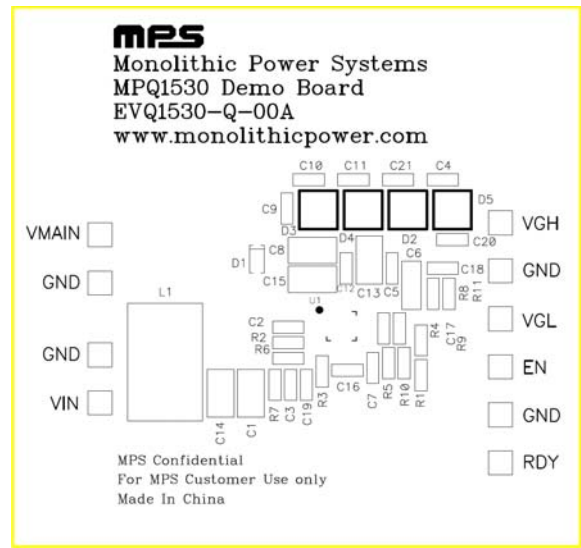


Figure 2—Top Silk Layer

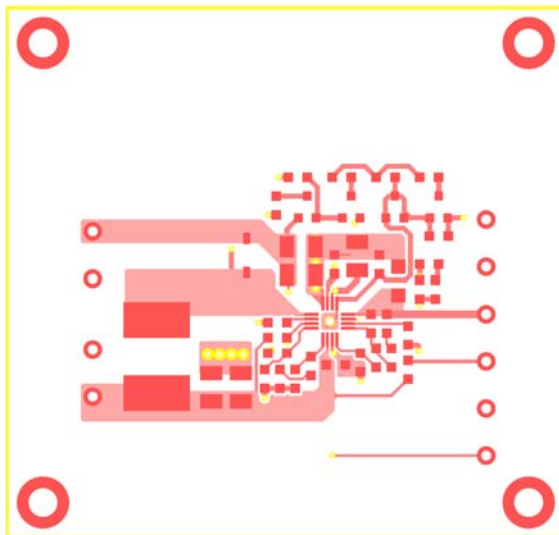


Figure 3—Top Layer

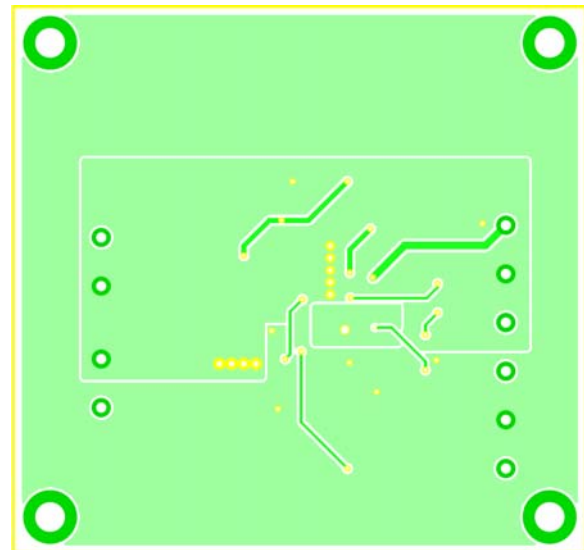


Figure 4—Bottom Layer

QUICK START GUIDE

The three output voltages of this board are set to +13V, +27V, and –8.5V. The board layout accommodates most commonly used inductors and output capacitors.

1. Attach the positive end of loads to the VMAIN, VGH and GND (for the negative output) pins, respectively. Attach negative ends of the loads to GND and VGL (for the negative output) pins.
2. Attach an input voltage $2.7V \leq V_{IN} \leq 5.5V$ and input ground to the VIN and GND pins, respectively.
3. The demo board starts up automatically once V_{IN} is applied due to the pull-up resistor R1. To disable the MPQ1530 connect the EN pin to ground.
4. During startup $\overline{RDY}$ will be left HIGH. Once the turn-on sequence is complete, this pin will be pulled LOW if all regulators exceed 80% of their specified voltages. After all regulators are turned-on, a fault in any regulator will cause $\overline{RDY}$ to go HIGH after approximately 15 μ s. If the fault persists for more than approximately 6ms (for $C_T=10nF$), the entire chip will shut down.
5. To adjust the output voltages:

Use a 10k Ω to 50k Ω for the low-side resistor of each voltage divider (i.e. R7, R9 and R5).

$$V_{FB1} = V_{FB3} = V_{REF} = 1.25V.$$

For the step-up converter, determine the high-side resistor R6 using the equation:

$$R6 = \frac{V_{MAIN} - V_{FB1}}{\left(\frac{V_{FB1}}{R7}\right)}$$

Where V_{MAIN} is the output voltage of the step-up converter.

For the positive charge-pump, determine the high-side resistor R8 by the equation:

$$R8 = \frac{V_{GH} - V_{FB3}}{\left(\frac{V_{FB3}}{R9}\right)}$$

Where V_{GH} is the output voltage of the positive linear regulator. Determine the number of positive charge pump stages (N_{POS}) by:

$$N_{POS} = \frac{V_{GH} + V_{DROPOUT} - V_{MAIN}}{V_{MAIN} - 2V_D}$$

Use $V_{DROPOUT} = 1V$ and $V_D = 0.4V$ for Schottky diodes.

For the negative charge-pump, determine the high-side resistor R4 by the equation:

$$R4 = \frac{-V_{GL}}{\left(\frac{V_{REF}}{R5}\right)}$$

Where V_{GL} is the output voltage of the negative linear regulator. Determine the number of negative charge pump stages (N_{NEG}) by:

$$N_{NEG} = \frac{-V_{GL} + V_{DROPOUT}}{V_{MAIN} - 2V_D}$$

6. Use $V_{DROPOUT} = 0.3V$ and $V_D = 0.4V$ for Schottky diodes.

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