EV0055 (MP1530)

Triple Output Step-Up Plus Charge Pump for TFT Bias

EVALUATION BOARD

DESCRIPTION

The EV0055 evaluation board is designed to demonstrate the capabilities of MPS' MP1530 triple output step-up converter which is capable of powering a TFT panel from a regulated 3.3V or 5V.

The MP1530 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

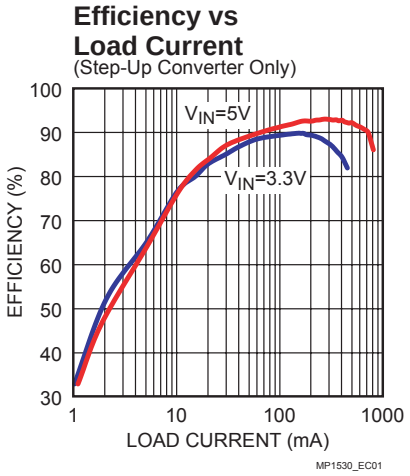
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EV0055 EVALUATION BOARD



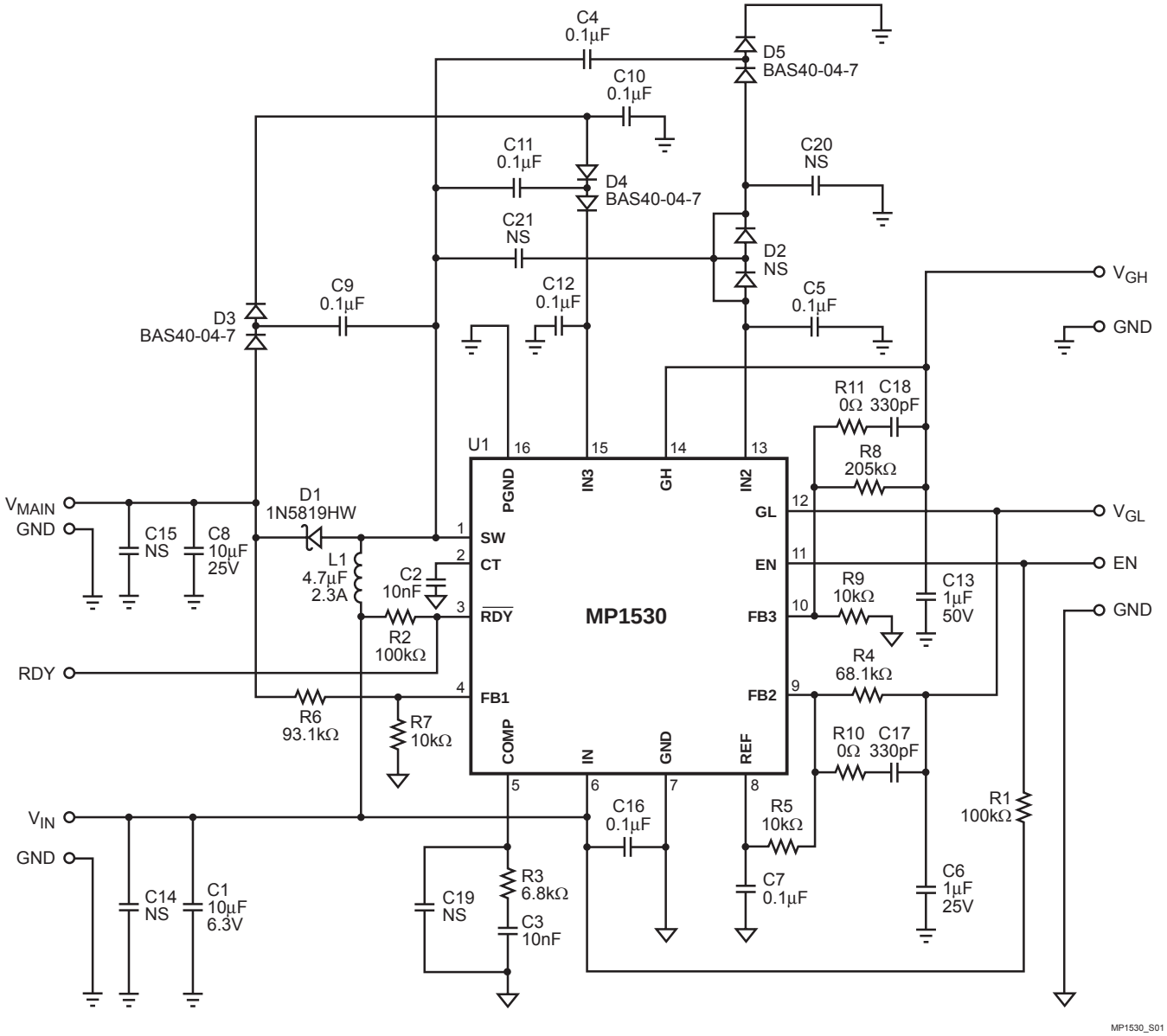
Dimensions (2.4"X x 2.3"Y x 0.4"Z)

Board Number	MPS IC Number
EV0055	MP1530DQ



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EVALUATION BOARD SCHEMATIC



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EV0055 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
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-123	Diodes Inc: 1N5819HW-7	Digikey: 1N5819HWDICT-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		MP1530	QFN16 (3x3)	MPS: MP1530DQ	

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PRINTED CIRCUIT BOARD LAYOUT

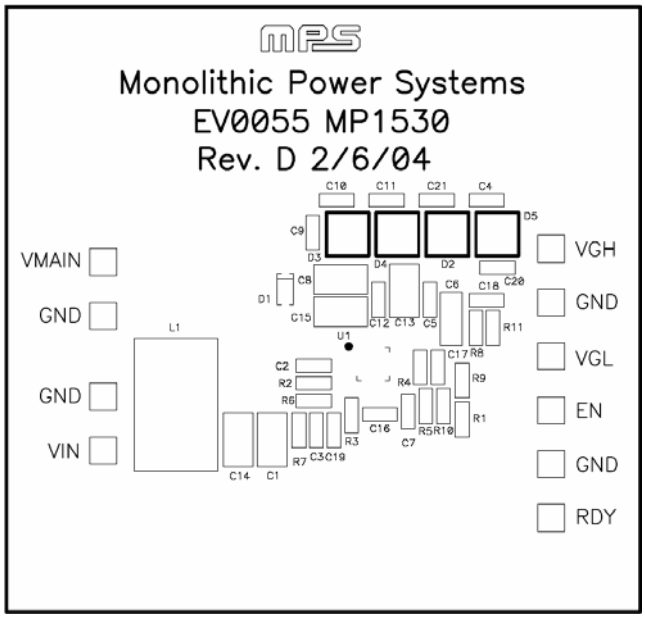


Figure 1—Top Silk Layer

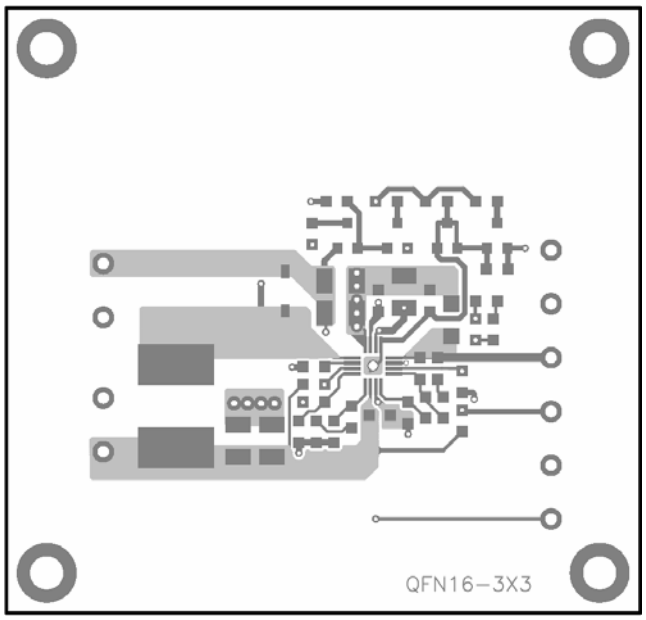


Figure 2—Top Layer

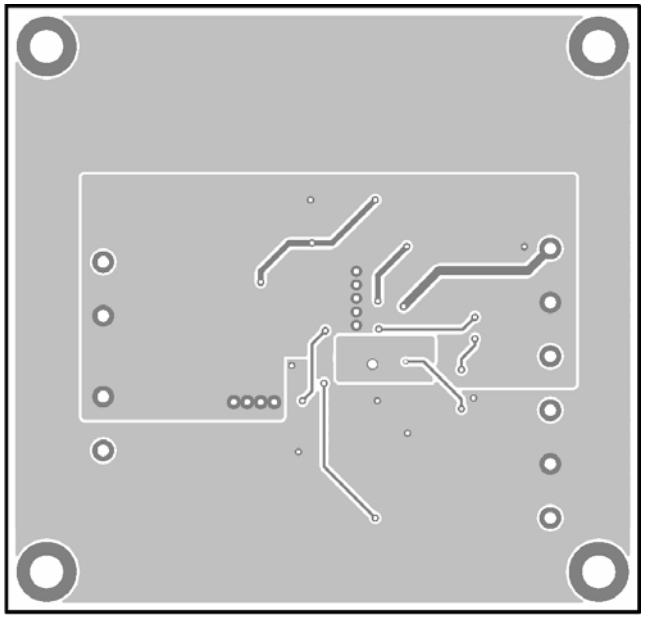


Figure 3—Bottom Layer

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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 ≤ V_{IN} ≤ 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 MP1530 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 15μs. If the fault persists for more than approximately 6ms (for CT=10nF), the entire chip will shut down.
5. To adjust the output voltages:

   Use a 10kΩ to 50kΩ 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:

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

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

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