LM5156EVM-BST User's Guide

The LM5156EVM-BST evaluation module showcases the features and performance of the LM5156 device, wide input voltage, non-synchronous boost controller. The standard configuration is designed to provide a regulate output of 12 V at 36 W from a minimum input of 4 V, switching at a frequency of 440 kHz, withstanding voltage transients from 3 V to 42 V. The module is designed for ease of configuration, enabling a user to evaluate different applications on the same module. Functionality includes dual random spread spectrum (DRSS), external clock synchronization, programmable slope compensation, adjustable soft-start, programmable cycle-by-cycle current limit, and output over voltage protection.

Contents

List of Figures

Copyright © 2020, Texas Instruments Incorporated

List of Tables

Trademarks

All trademarks are the property of their respective owners.

Copyright © 2020, Texas Instruments Incorporated

1 Features and Electrical Performance

The LM5156EVM-BST supports the following features and performance capabilities:

- Tightly regulated output voltage of 12 V with 1% accurate reference voltage
- High conversion efficiency of > 95% at full load.
- Constant cycle-by-cycle peak inductor current limit over input voltage range
- User adjustable soft-start time using C_{SS}
- Output over-voltage protection
- Multiple BIAS pin and VCC pin connections to test multiple configurations
  - BIAS connect to VCC
  - BIAS supplied with external power supply
  - VCC supplied by external power supply
  - BIAS supplied by output voltage
- Power good (PGOOD) indicator with selectable pull-up source
- 440kHz Switching frequency
- External clock synchronization
- Programable slope compensation

1.1 Electrical Parameters

Table 1. Electrical Performance Standard Configuration

Parameter	Test Conditions	MIN	TYP	MAX	UNIT
INPUT CHARACTERISTICS					
Input voltage Range V_{IN}	Static, full load operation	4	9	12	V
	Transient: (50% load)	3			
Input voltage turn on $V_{IN(ON)}$	Initial turn-on		5		V
Input voltage turn off $V_{IN(OFF)}$	Adjusted by the UVLO/SYNC resistors		2.5		V
OUTPUT CHARACTERISTICS					
Output Voltage V_{OUT}			12		V
Maximum Output Current I_{OUT}			3		A
Output Over-voltage V_{OUT_OV}			13.22		V
SYSTEM CHARACTERISTICS					
Switching frequency			440		kHz
External Clock Synchronization		375		505	kHz
Full load efficiency	V_{IN} = 4 V, I_{OUT} = 3 A		95.6		%
Junction Temperature, T_J		-40		150	C

Copyright © 2020, Texas Instruments Incorporated

1.2 Configuration Points

Table 2 indicates the available test points and configuration jumpers. These points offer flexibility in configuring the evaluation module and include but are not limited to;

- BIAS pin to be connected to:
  - External supply (VAUX)
  - Input voltage (VIN)
  - Regulated output voltage (VOUT)
  - VCC pin
- PGOOD pin to be supplied by either VCC or VAUX
- External clock synchronization
- Shut-down signal by pulling the UVLO pin low.

Table 2. Jumper Description

Jumper	Pin	Description
TP1	VIN	Positive input voltage sense connection
TP2	SW	Probe point for the switch node of the LM5156 boost circuit
TP3	VOUT	Positive output voltage sense connection
TP4	VIN-	Negative input voltage sense connection
TP5	GND	Negative output voltage sense connection
TP6	VCCext	Supply VCC from and external supply. Note VCCext must be less than the voltage on the BIAS pin.
TP7	VAUX	Supply the BIAS pin from and external supply. R12 also connect to this rail
TP8	VOUT+	Loop response positive injection point
TP9	VOUT-	Loop response negative injection point
TP10	SYNC	Input for external clock synchronization
TP11	SD	High signal pulls UVLO pin to ground entering shutdown mode
J6	Pin 1 to pin 2	Connect VOUT to the BIAS pin of the LM5156 through D3
	Pin 2 to pin 3	Directly connect VOUT to BIAS pin of the LM5156
J7	Pin 1 to pin 2	Connect VIN to the BIAS pin of the LM5156 through D4
	Pin 2 to pin 3	Directly connect VIN to BIAS pin of the LM5156
J8	Pin 1 to pin 2	Directly Connect VCC to the BIAS pin
J9	Pin 1 to pin 2	Directly connect VAUX to the BIAS pin
J10	Pin 1 to Pin 2	Disable spread spectrum
	Pin 2 to Pin 3	Enable spread spectrum
J11	VCC (Pin 1)	Monitor the VCC pin
	BIAS-IC (Pin 2)	Monitor the BIAS pin
	PGOOD (Pin 3)	Monitor the PGOOD pin
	COMP (Pin 4)	Monitor the COMP pin
	SS (Pin 5)	Monitor the SS pin
	UVLO (Pin 6)	Monitor the UVLO pin
	AGND (Pin 7)	Connection to AGND plan

Copyright © 2020, Texas Instruments Incorporated

2 Application Schematic

The LM5156EVM-BST is capable of multiple configurations. Figure 1 shows the standard configuration of the LM5156EVM-BST for which the parameters in Table 1 are valid. Section 4.2 describes the correct jumper settings and measurement locations recreate the data presented in Section 5.

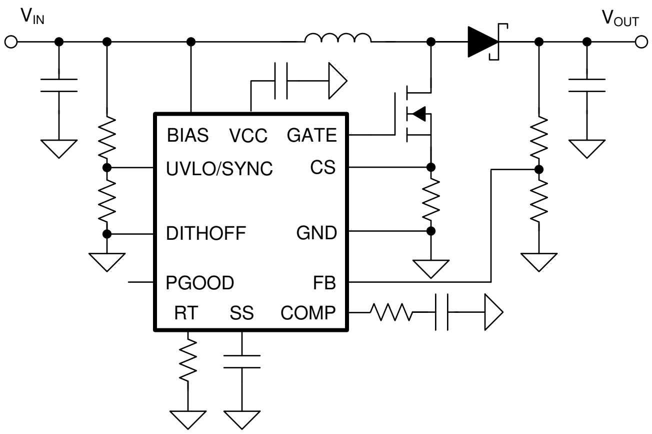

Figure 1. Application Circuit

3 EVM Photo

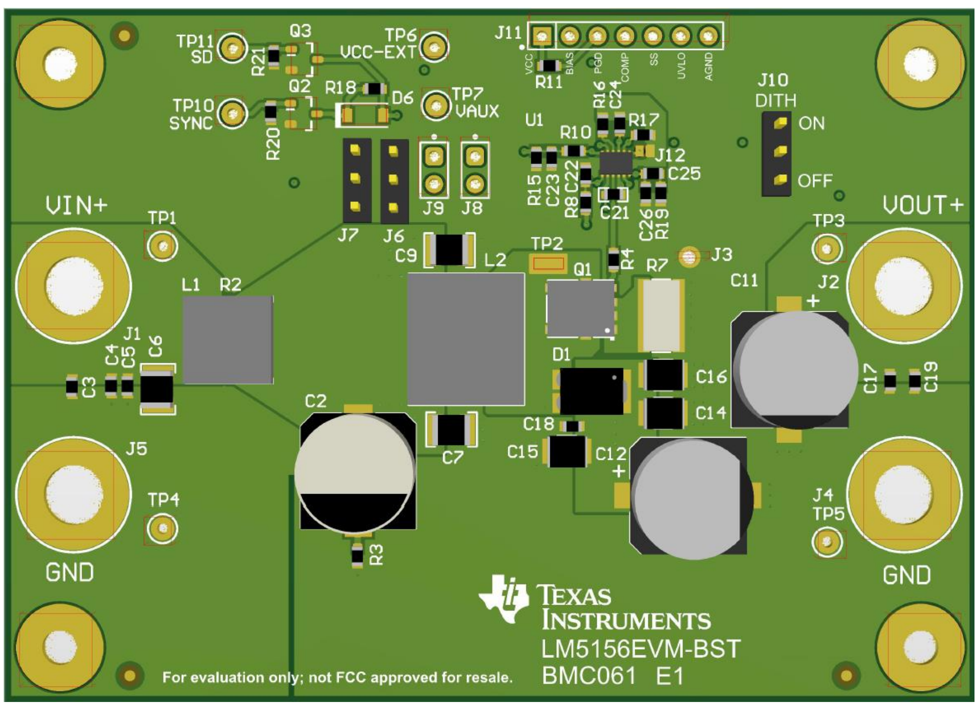

Figure 2. EVM Photo

Copyright © 2020, Texas Instruments Incorporated

4 Test Setup and Procedure

4.1 Test Setup

Figure 3 shows the correct jumper positions to configure the evaluation module for the typical application, as shown in Figure 1. The correct equipment connections and measurement points are shown in Table 3

Table 3. Standard Configuration Jumper Connections

Jumper	Position
J6	Jumper from pin 2 to pin 3

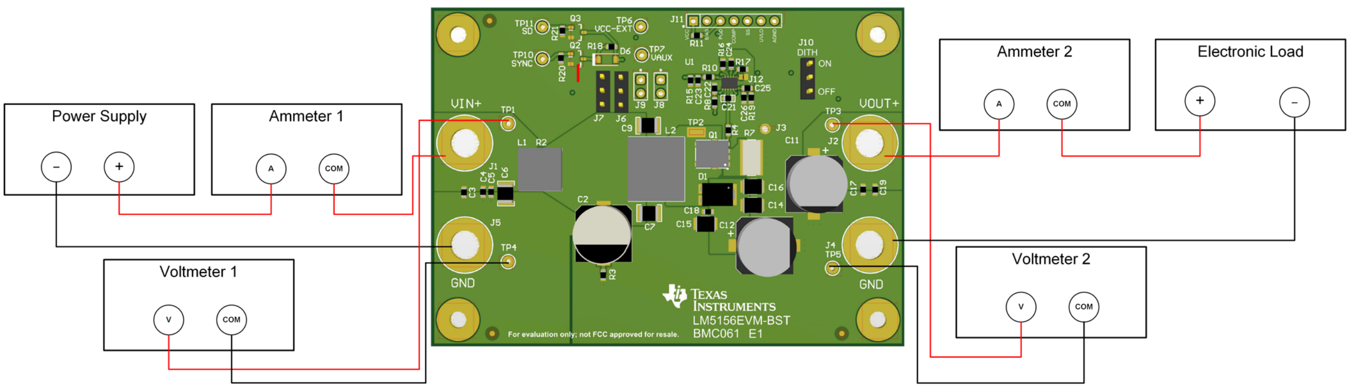

Figure 3. Test Setup

4.2 Test Equipment

Power Supply: The input voltage source (VIN) should be a variable supply capable of 0V to 20V and source at least 15A.

Multi-meters:

- Voltmeter 1: Input voltage, connect from VIN to VIN-
- Voltmeter 2: Output voltage, connect from VOUT to GND
- Ammeter 1: Input current, must be able to handle 15A. Shunt resistor can be used as needed.
- Ammeter 2: Output current, must be able to handle 3A. Shunt resistor can be used as needed.

Electronic Load: The load should be constant resistance (CR) or constant current (CC) capable. It should safely handle 3A at 12V.

Oscilloscope: 20-MHz bandwidth and AC coupling. Measure the output voltage ripple directly across an output capacitor with a short ground lead. It is not recommended to use a long-leaded ground connection due to the possibility of noise being coupled into the signal. To measure other waveforms, adjust the oscilloscope as needed.

5 Test Results

Figure 4 through Figure 19 present the typical performance of the LM5156EVM-BST according to the BOM and the configuration described in Section 4. Based on measurement techniques and environmental variables measurements might differ slightly than the data presented.

Copyright © 2020, Texas Instruments Incorporated

5.1 Efficiency Curves

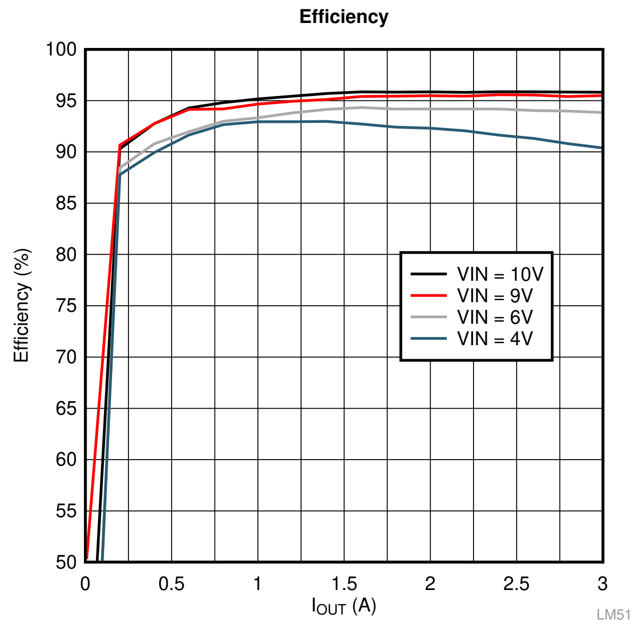

Figure 4. Efficiency vs Load

5.2 Load Regulation Curves

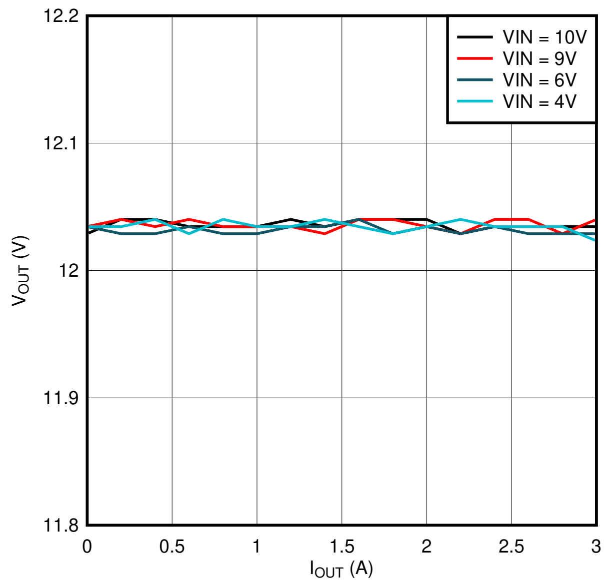

Figure 5. Load Regulation

Copyright © 2020, Texas Instruments Incorporated

5.3 Thermal Performance

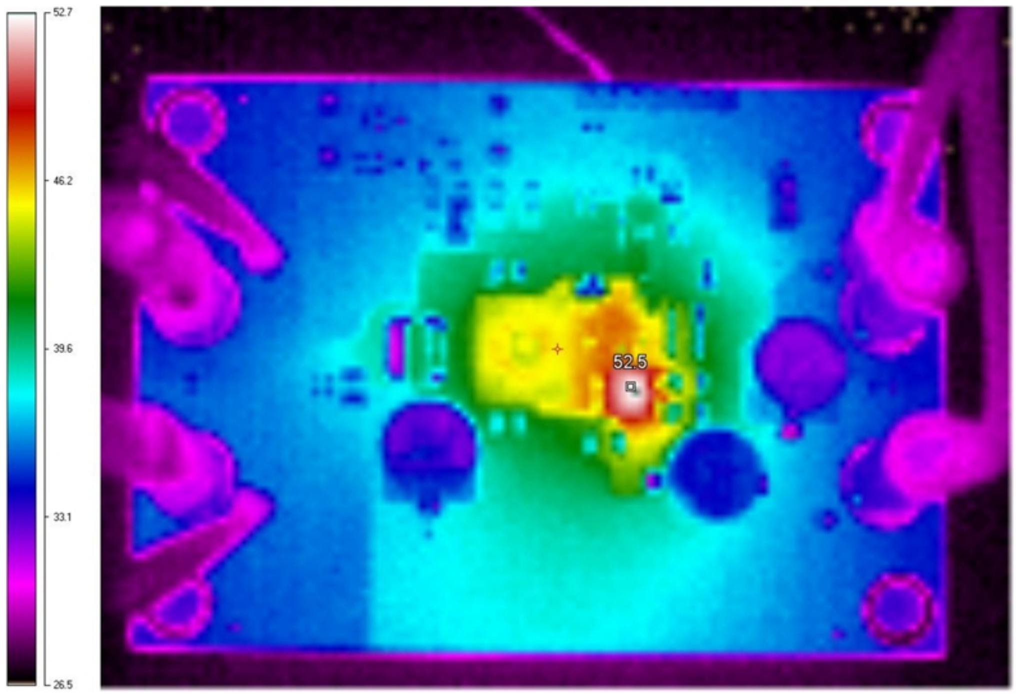

Figure 6. Thermal Image V_{IN} = 4 V I_{OUT} = 3 A, No forced air cooling

Copyright © 2020, Texas Instruments Incorporated

5.4 Steady State Waveforms

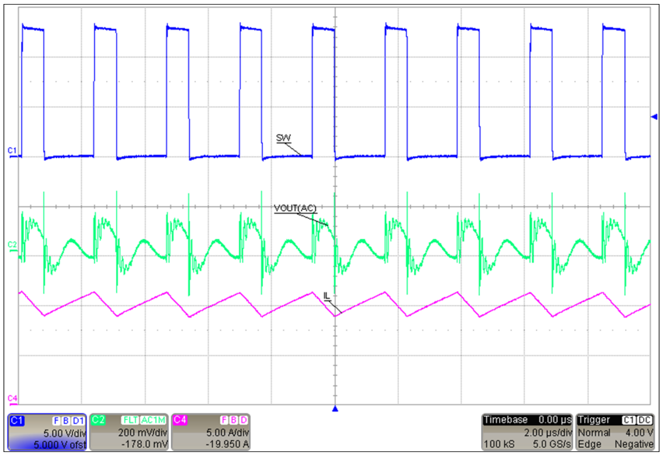

Figure 7. Steady State, V_{IN} = 4 V, I_{OUT} = 3 A

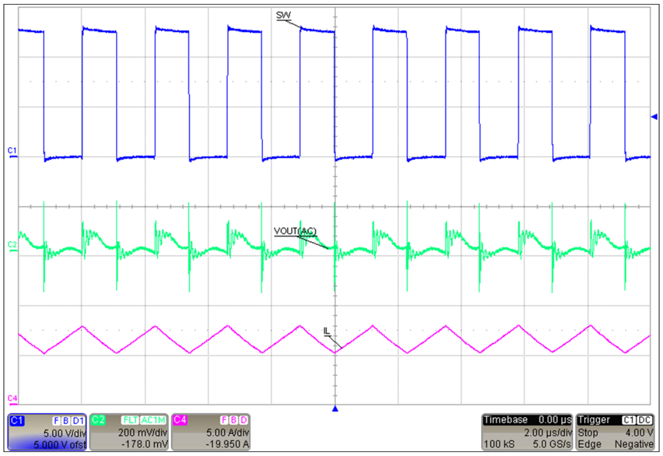

Figure 8. Steady State, V_{IN} = 6 V, I_{OUT} = 3 A

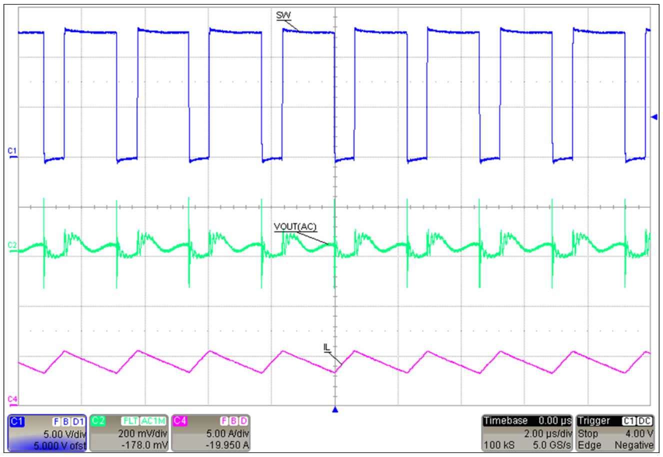

Figure 9. Steady State, V_{IN} = 9 V, I_{OUT} = 3 A

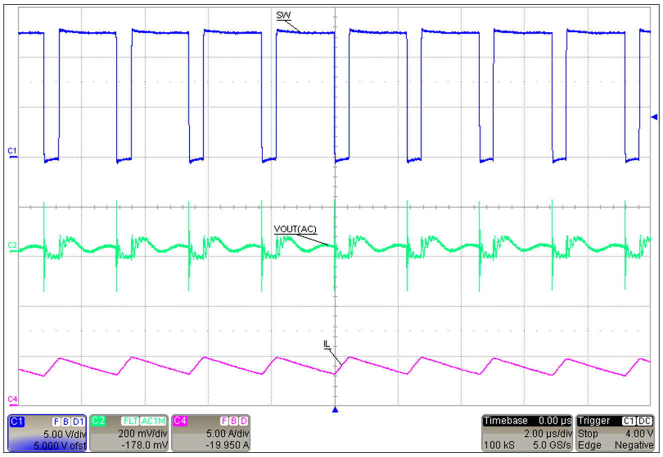

Figure 10. Steady State, V_{IN} = 10 V, I_{OUT} = 3 A

Copyright © 2020, Texas Instruments Incorporated

5.5 Start-Up Waveforms

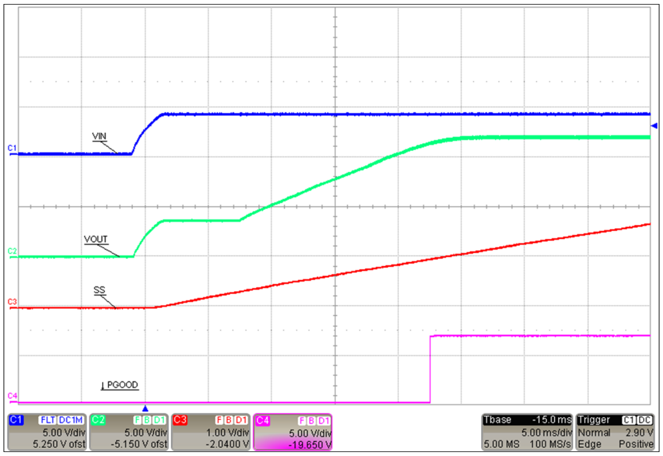

Figure 11. Start-Up, V_{IN} = 4V, I_{OUT} = 3 A

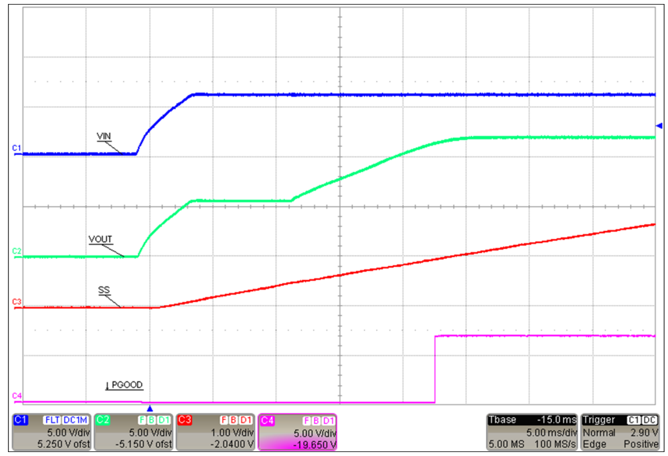

Figure 12. Start-Up, V_{IN} = 6V, I_{OUT} = 3 A

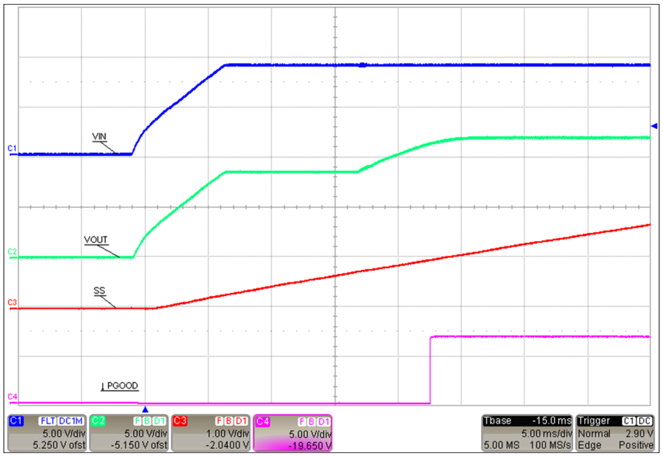

Figure 13. Start-Up, V_{IN} = 9 V, I_{OUT} = 3 A

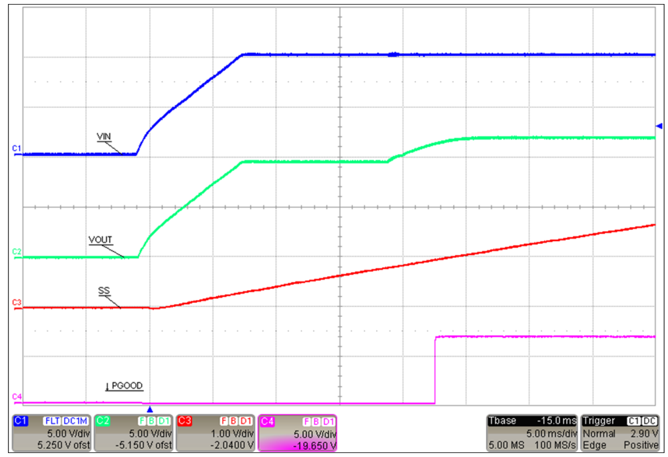

Figure 14. Start-Up, V_{IN} = 10 V, I_{OUT} = 3 A

Copyright © 2020, Texas Instruments Incorporated

5.6 Load Transient Waveforms

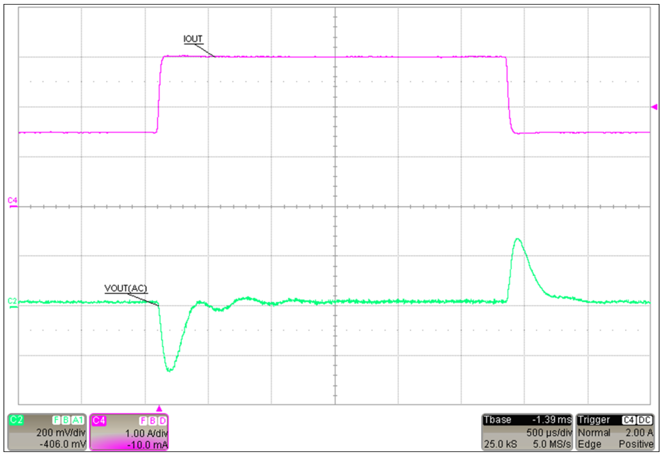

Figure 15. Load Transient, V_{IN} = 4 V, I_{OUT} = 1.5 A to 3 A

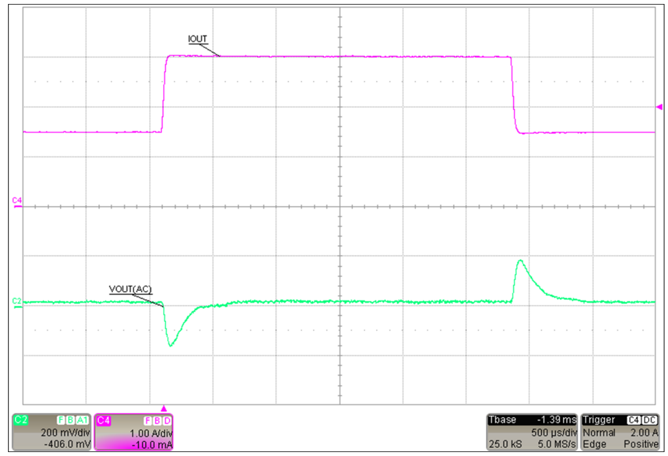

Figure 16. Load Transient, V_{IN} = 6 V, I_{OUT} = 1.5 A to 3 A

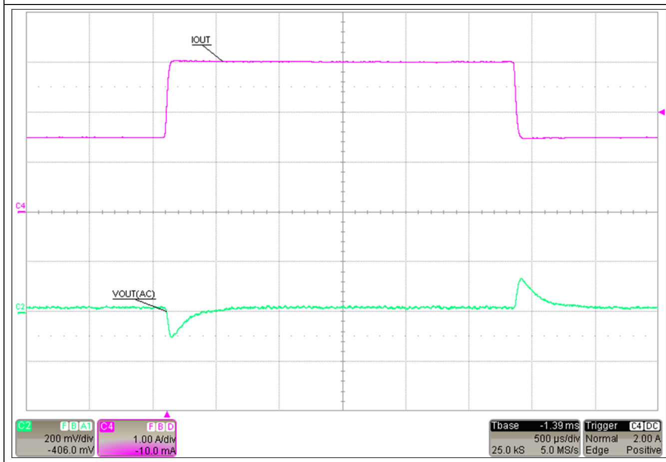

Figure 17. Load Transient, V_{IN} = 9 V, I_{OUT} = 1.5 A to 3 A

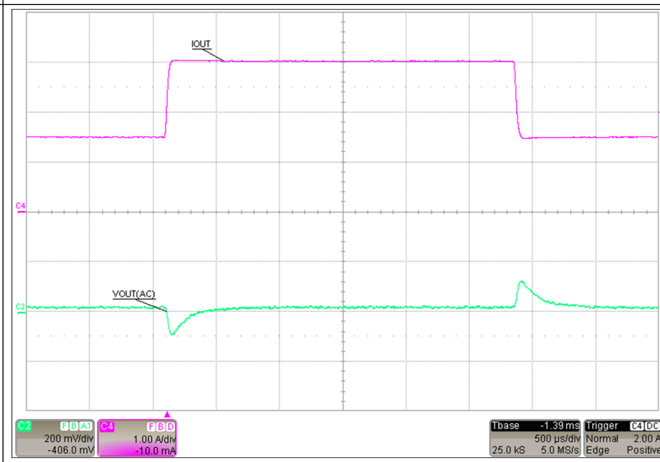

Figure 18. Load Transient, V_{IN} = 10 V, I_{OUT} = 1.5 A to 3 A

5.7 AC Loop Response Curves

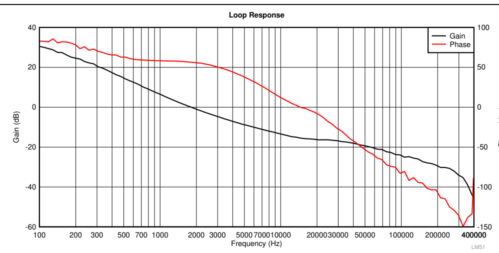

Figure 19. Control Loop Response, V_{IN} = 4 V, I_{OUT} = 3 A

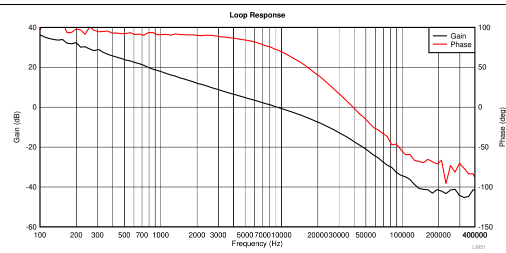

Figure 20. Control Loop Response, V_{IN} = 9 V, I_{OUT} = 3 A

Copyright © 2020, Texas Instruments Incorporated

6 Design Files

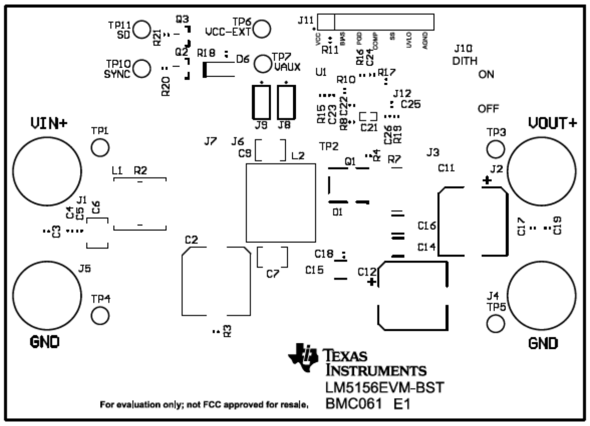

Figure 21. Top Silkscreen

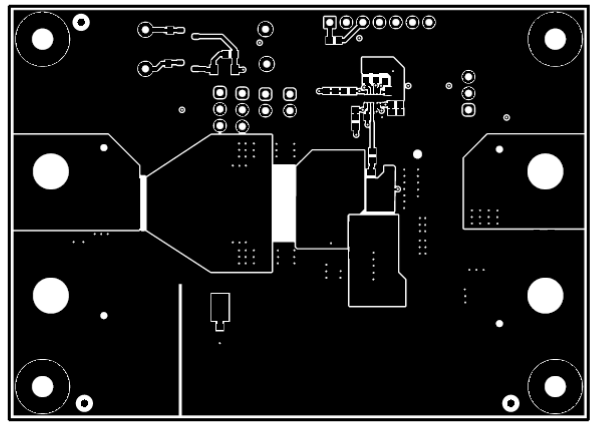

Figure 22. Top Layer

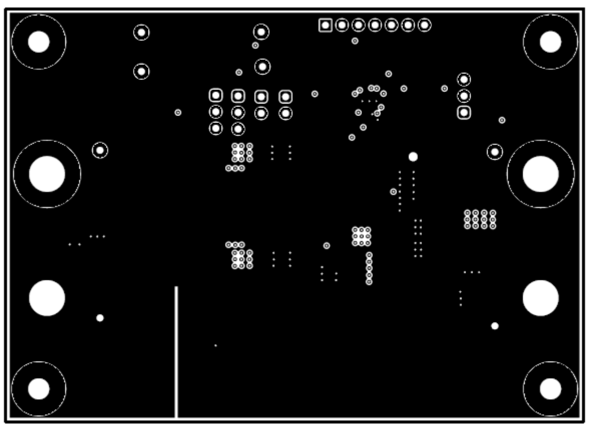

Figure 23. Signal Layer 1

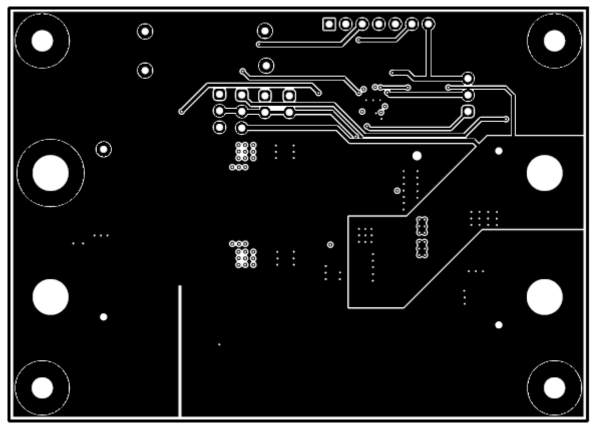

Figure 24. Signal Layer 2

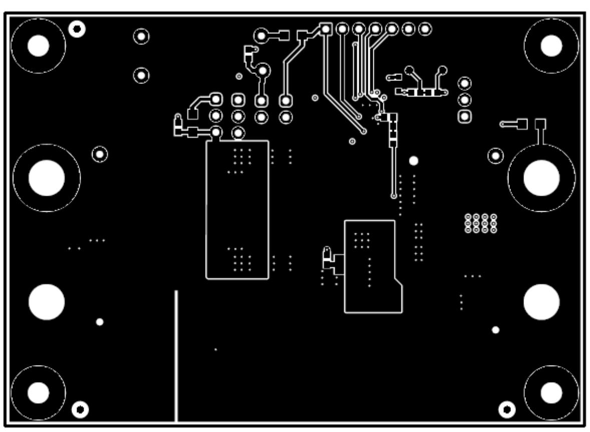

Figure 25. Bottom Layer

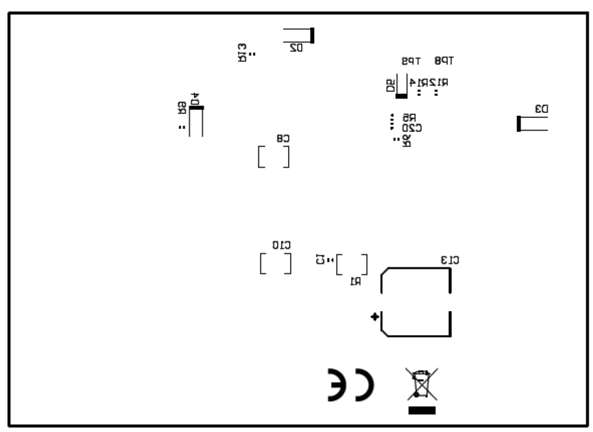

Figure 26. Bottom Silkscreen

Copyright © 2020, Texas Instruments Incorporated

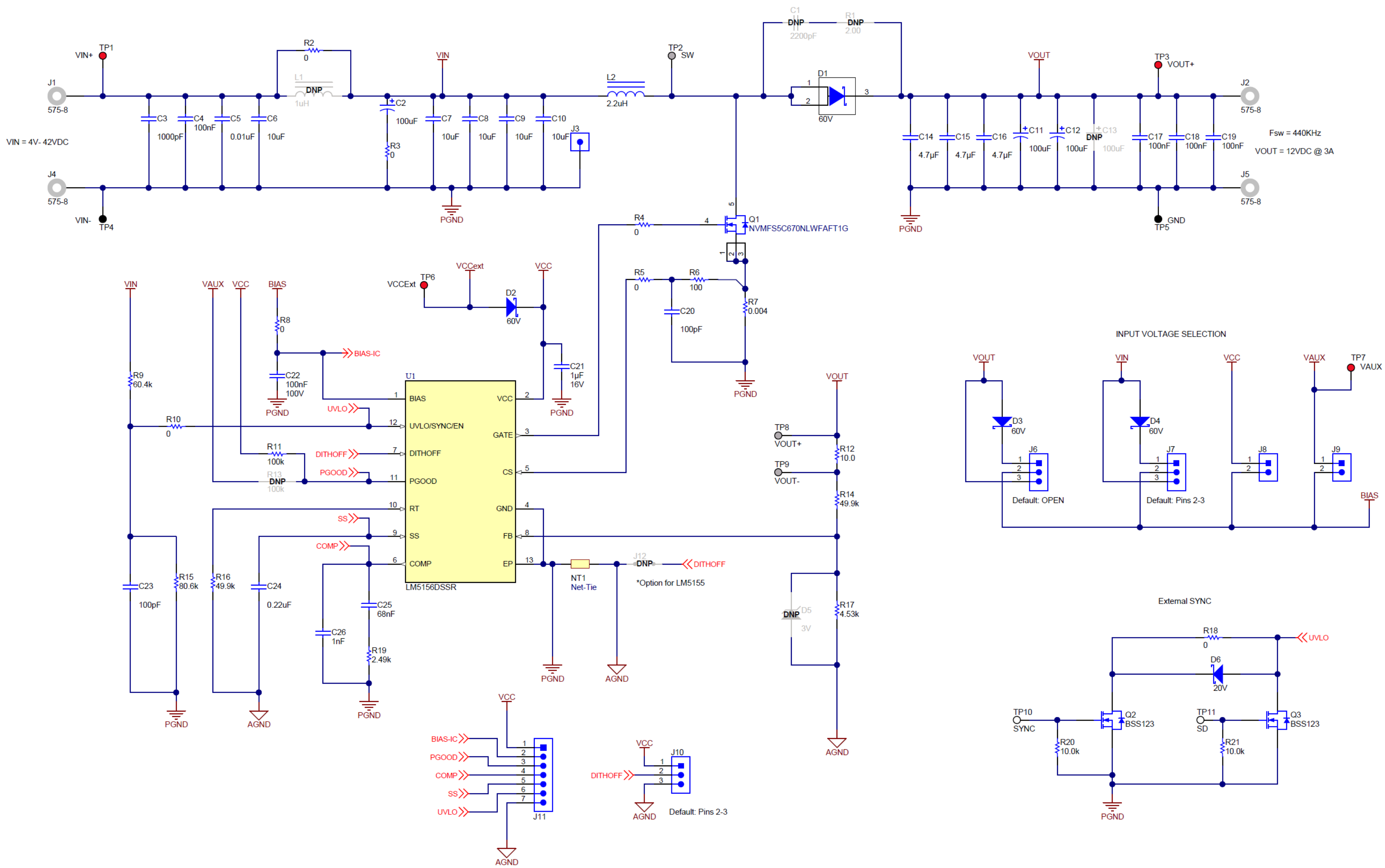

Figure 27. LM5156EVM-BST Schematic

Copyright © 2020, Texas Instruments Incorporated

Table 4. LM5156EVM-BST Bill of Materials

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		BMC061	Any
C2	1	100uF	CAP, Polymer Hybrid, 100 uF, 50 V, +/- 20%, 28 ohm, 10x10 SMD	10x10	EEHZC1H101P	Panasonic
C3	1	1000pF	CAP, CERM, 1000 pF, 50 V, +/- 10%, X7R, 0603	0603	C0603X102K5RACTU	Kemet
C4, C17, C18, C19	4	0.1uF	CAP, CERM, 0.1 µF, 50 V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	C0603C104K5RACAUTO	Kemet
C5	1	0.01uF	CAP, CERM, 0.01 uF, 50 V, +/- 10%, X7R, 0603	0603	CL10B103KB8NNC	Samsung Electro-Mechanics
C6, C7, C8, C9, C10	5	10uF	CAP, CERM, 10 uF, 50 V, +/- 10%, X7R, 1210	1210	GRM32ER71H106KA12L	MuRata
C11, C12	2	100uF	CAP, Aluminum Polymer, 100 uF, 50 V, +/- 20%, 0.025 ohm, AEC-Q200 Grade 2, D10xL10mm SMD	D10xL10mm	HHXB500ARA101MJA0G	Chemi-Con
C14, C15, C16	3	4.7uF	CAP, CERM, 4.7 µF, 50 V,+/- 10%, X7R, AEC-Q200 Grade 1, 1210	1210	C1210C475K5RACAUTO	Kemet
C20, C23	2	100pF	CAP, CERM, 100 pF, 50 V,+/- 1%, C0G/NP0, 0603	0603	C0603C101F5GACTU	Kemet
C21	1	1uF	CAP, CERM, 1 µF, 16 V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E1X7R1C105K080AC	TDK
C22	1	0.1uF	CAP, CERM, 0.1 uF, 100 V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	GCJ188R72A104KA01D	MuRata
C24	1	0.22uF	CAP, CERM, 0.22 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E3X7R1H224K080AB	TDK
C25	1	0.068uF	CAP, CERM, 0.068 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E2X7R1H683K080AA	TDK
C26	1	1000pF	CAP, CERM, 1000 pF, 50 V, +/- 5%, X7R, AEC-Q200 Grade 1, 0603	0603	C0603C102J5RACAUTO	Kemet
D1	1	60V	Diode, Schottky, 60 V, 10 A, AEC-Q101, CFP15	CFP15	PMEG060V100EPDZ	Nexperia
D2, D3, D4	3	60V	Diode, Schottky, 60 V, 1 A, SOD-123F	SOD-123F	PMEG6010CEH,115	Nexperia
D6	1	20V	Diode, Schottky, 20 V, 0.35 A, SOD-123	SOD-123	SD103CW-13-F	Diodes Inc.
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone
J1, J2, J4, J5	4		Standard Banana Jack, Uninsulated, 8.9mm	Keystone575-8	575-8	Keystone
J3	1		TEST POINT SLOTTED .118", TH	Test point, TH Slot Test point	1040	Keystone
J6, J7, J10	3		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec
J8, J9	2		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec
J11	1		Header, 100mil, 7x1, Gold, TH	7x1 Header	TSW-107-07-G-S	Samtec
L2	1	2.2uH	Inductor, Shielded, Composite, 2.2 uH, 20 A, 0.0045 ohm, AEC-Q200 Grade 1, SMD	Inductor, 10x6x11.3mm	XAL1060-222MEB	Coilcraft
Q1	1	60V	MOSFET, N-CH, 60 V, 17 A, AEC-Q101, SO-8FL	SO-8FL	NVMFS5C670NLWFAFT1G	ON Semiconductor
Q2, Q3	2	100V	MOSFET, N-CH, 100 V, 0.17 A, SOT-23	SOT-23	BSS123	Fairchild Semiconductor
R6	1	100	RES, 100, 1%, 0.1 W, 0603	0603	RC0603FR-07100RL	Yageo
R7	1	0.004	RES, 0.004, 1%, 3 W, 2512 WIDE	2512 WIDE	KRL6432E-M-R004-F-T1	Susumu Co Ltd

Copyright © 2020, Texas Instruments Incorporated

Table 4. LM5156EVM-BST Bill of Materials (continued)

R9	1	60.4k	RES, 60.4 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060360K4FKEA	Vishay-Dale
R11	1	100k	RES, 100 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603100KFKEA	Vishay-Dale
R12	1	10.0	RES, 10.0, 1%, 0.1 W, 0603	0603	RC0603FR-0710RL	Yageo
R14, R16	2	49.9k	RES, 49.9 k, 1%, 0.1 W, 0603	0603	RC0603FR-0749K9L	Yageo
R15	1	80.6k	RES, 80.6 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060380K6FKEA	Vishay-Dale
R17	1	4.53k	RES, 4.53 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06034K53FKEA	Vishay-Dale
R19	1	2.49k	RES, 2.49 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06032K49FKEA	Vishay-Dale
R20, R21	2	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060310K0FKEA	Vishay-Dale
SH-J1, SH-J2	2		Single Operation 2.54mm Pitch Open Top Jumper Socket	Single Operation 2.54mm Pitch Open Top Jumper Socket	M7582-05	Harwin
TP1, TP3, TP6, TP7	4		Test Point, Miniature, Red, TH	Red Miniature Testpoint	5000	Keystone
TP4, TP5	2		Test Point, Miniature, Black, TH	Black Miniature Testpoint	5001	Keystone
TP10, TP11	2		Test Point, Miniature, White, TH	White Miniature Testpoint	5002	Keystone
U1	1		2.2-MHz Wide VIN 65-V Non-synchronous Boost/SEPIC/Flyback Controller with Dual Random Spread Spectrum, DSS0012B (WSON-12)	DSS0012B	LM5156DSSR	Texas Instruments

Table 5. LM5156EVM-BST Alternate Bill of Materials, f_{SW} = 2.2 MHz

Designator	Qty	Value	Description	Package Reference	Part Number	Manufacturer
!PCB1	1		Printed Circuit Board		BMC061	Any
C2	1	100uF	CAP, Polymer Hybrid, 100 uF, 50 V, +/- 20%, 28 ohm, 10x10 SMD	10x10	EEHZC1H101P	Panasonic
C3	1	1000pF	CAP, CERM, 1000 pF, 50 V, +/- 10%, X7R, 0603	0603	C0603X102K5RACTU	Kemet
C4, C17, C18, C19	4	0.1uF	CAP, CERM, 0.1 µF, 50 V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	C0603C104K5RACAUTO	Kemet
C5	1	0.01uF	CAP, CERM, 0.01 uF, 50 V, +/- 10%, X7R, 0603	0603	CL10B103KB8NCNC	Samsung Electro-Mechanics
C6, C7, C8, C9, C10	5	10uF	CAP, CERM, 10 uF, 50 V, +/- 10%, X7R, 1210	1210	GRM32ER71H106KA12L	MuRata
C11	1	100uF	CAP, Aluminum Polymer, 100 uF, 50 V, +/- 20%, 0.025 ohm, AEC-Q200 Grade 2, D10xL10mm SMD	D10xL10mm	HHXB500ARA101MJA0G	Chemi-Con
C14, C15, C16	3	4.7uF	CAP, CERM, 4.7 µF, 50 V,+/- 10%, X7R, AEC-Q200 Grade 1, 1210	1210	C1210C475K5RACAUTO	Kemet
C20, C23	2	100pF	CAP, CERM, 100 pF, 50 V,+/- 1%, C0G/NP0, 0603	0603	C0603C101F5GACTU	Kemet
C21	1	1uF	CAP, CERM, 1 µF, 16 V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E1X7R1C105K080AC	TDK

Copyright © 2020, Texas Instruments Incorporated

Table 5. LM5156EVM-BST Alternate Bill of Materials, f_{SW} = 2.2 MHz (continued)

C22	1	0.1uF	CAP, CERM, 0.1 uF, 100 V,+/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	GCJ188R72A104KA01D	MuRata
C24	1	0.22uF	CAP, CERM, 0.22 uF, 50 V, +/- 10%, X7R, AEC-Q200 Grade 1, 0603	0603	CGA3E3X7R1H224K080AB	TDK
C25	1	6800pF	CAP, CERM, 6800 pF, 25 V, +/- 10%, X7R, 0603	0603	GRM188R71E682KA01D	MuRata
C26	1	1000pF	CAP, CERM, 1000 pF, 50 V, +/- 5%, X7R, AEC-Q200 Grade 1, 0603	0603	C0603C102J5RACAUTO	Kemet
D1	1	60V	Diode, Schottky, 60 V, 10 A, AEC-Q101, CFP15	CFP15	PMEG060V100EPDZ	Nexperia
D2, D3, D4	3	60V	Diode, Schottky, 60 V, 1 A, SOD-123F	SOD-123F	PMEG6010CEH,115	Nexperia
D6	1	20V	Diode, Schottky, 20 V, 0.35 A, SOD-123	SOD-123	SD103CW-13-F	Diodes Inc.
H1, H2, H3, H4	4		Machine Screw, Round, #4-40 x 1/4, Nylon, Philips panhead	Screw	NY PMS 440 0025 PH	B&F Fastener Supply
H5, H6, H7, H8	4		Standoff, Hex, 0.5"L #4-40 Nylon	Standoff	1902C	Keystone
J1, J2, J4, J5	4		Standard Banana Jack, Uninsulated, 8.9mm	Keystone575-8	575-8	Keystone
J3	1		TEST POINT SLOTTED .118", TH	Test point, TH Slot Test point	1040	Keystone
J6, J7, J10	3		Header, 100mil, 3x1, Gold, TH	3x1 Header	TSW-103-07-G-S	Samtec
J8, J9	2		Header, 100mil, 2x1, Gold, TH	2x1 Header	TSW-102-07-G-S	Samtec
J11	1		Header, 100mil, 7x1, Gold, TH	7x1 Header	TSW-107-07-G-S	Samtec
L2	1	680nH	Inductor, Shielded, 680 nH, 8.2A, 0.009 Ohm, AEC-Q200 Grade 1, SMD	Inductor, 4.1x41.1x2.1mm	744383560068	Wurth
Q1	1	60V	MOSFET, N-CH, 60 V, 17 A, AEC-Q101, SO-8FL	SO-8FL	NVMFS5C670NLWFAFT1G	ON Semiconductor
Q2, Q3	2	100V	MOSFET, N-CH, 100 V, 0.17 A, SOT-23	SOT-23	BSS123	Fairchild Semiconductor
R6	1	100	RES, 100, 1%, 0.1 W, 0603	0603	RC0603FR-07100RL	Yageo
R7	1	0.004	RES, 0.004, 1%, 3 W, 2512 WIDE	2512 WIDE	KRL6432E-M-R004-F-T1	Susumu Co Ltd
R9	1	243k	RES, 243 k, 1%, 0.1 W, 0603	0603	RC0603FR-07243KL	Yageo
R11	1	100k	RES, 100 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW0603100KFKEA	Vishay-Dale
R12	1	10.0	RES, 10.0, 1%, 0.1 W, 0603	0603	RC0603FR-0710RL	Yageo
R14	1	105k	RES, 105 k, 1%, 0.1 W, 0603	0603	RC0603FR-07105KL	Yageo
R16	1	9.09k	RES, 9.09 k, 1%, 0.1 W, 0603	0603	RC0603FR-079K09L	Yageo
R15	1	80.6k	RES, 80.6 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060380K6FKEA	Vishay-Dale
R17	1	4.53k	RES, 4.53 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW06034K53FKEA	Vishay-Dale
R19	1	15k	RES, 15 k, 5%, 0.1 W, 0603	0603	RC0603JR-0715KL	Yageo
R20, R21	2	10.0k	RES, 10.0 k, 1%, 0.1 W, AEC-Q200 Grade 0, 0603	0603	CRCW060310K0FKEA	Vishay-Dale

Copyright © 2020, Texas Instruments Incorporated

Table 5. LM5156EVM-BST Alternate Bill of Materials, f_{SW} = 2.2 MHz (continued)

SH-J1, SH-J2	2		Single Operation 2.54mm Pitch Open Top Jumper Socket	Single Operation 2.54mm Pitch Open Top Jumper Socket	M7582-05	Harwin
TP1, TP3, TP6, TP7	4		Test Point, Miniature, Red, TH	Red Miniature Testpoint	5000	Keystone
TP4, TP5	2		Test Point, Miniature, Black, TH	Black Miniature Testpoint	5001	Keystone
TP10, TP11	2		Test Point, Miniature, White, TH	White Miniature Testpoint	5002	Keystone
U1	1		2.2-MHz Wide VIN 65-V Non-synchronous Boost/SEPIC/Flyback Controller with Dual Random Spread Spectrum, DSS0012B (WSON-12)	DSS0012B	LM5156DSSR	Texas Instruments

Copyright © 2020, Texas Instruments Incorporated

Revision History

NOTE: Page numbers for previous revisions may differ from page numbers in the current version.

Changes from Original (February 2020) to A Revision	Page
• Added *LM5156EVM-BST Alternate Bill of Materials, f_{sw} = 2.2 MHz* table	15

Copyright © 2020, Texas Instruments Incorporated

IMPORTANT NOTICE AND DISCLAIMER

TI PROVIDES TECHNICAL AND RELIABILITY DATA (INCLUDING DATA SHEETS), DESIGN RESOURCES (INCLUDING REFERENCE DESIGNS), APPLICATION OR OTHER DESIGN ADVICE, WEB TOOLS, SAFETY INFORMATION, AND OTHER RESOURCES "AS IS" AND WITH ALL FAULTS, AND DISCLAIMS ALL WARRANTIES, EXPRESS AND IMPLIED, INCLUDING WITHOUT LIMITATION ANY IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS.

These resources are intended for skilled developers designing with TI products. You are solely responsible for (1) selecting the appropriate TI products for your application, (2) designing, validating and testing your application, and (3) ensuring your application meets applicable standards, and any other safety, security, regulatory or other requirements.

These resources are subject to change without notice. TI grants you permission to use these resources only for development of an application that uses the TI products described in the resource. Other reproduction and display of these resources is prohibited. No license is granted to any other TI intellectual property right or to any third party intellectual property right. TI disclaims responsibility for, and you will fully indemnify TI and its representatives against, any claims, damages, costs, losses, and liabilities arising out of your use of these resources.

TI's products are provided subject to TI's Terms of Sale or other applicable terms available either on ti.com or provided in conjunction with such TI products. TI's provision of these resources does not expand or otherwise alter TI's applicable warranties or warranty disclaimers for TI products.

TI objects to and rejects any additional or different terms you may have proposed.

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265
Copyright © 2022, Texas Instruments Incorporated