ABSTRACT

The user guide provides instructions on the correct connection and operation of the test board. The guide explains the function and location of each test point on the board, which are intended for voltage measurement, waveform analysis, and signal verification. The test board supports the full input voltage range and full output current of the following products.

- MYMGK1R820FRSR
- MYMGK1R820ERSR
- MYMGK1R820FRSR-H
- MYMGK1R820ERSR-H
- MYMGK1R820GRSR-H

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Description

The Evaluation Module (EVM) is a hardware platform designed for customers to evaluate the performance of the non-isolated DC-DC converters, MYMGK1R820FRSR, MYMGK1R820ERSR, MYMGK1R820FRSR-H, MYMGK1R820ERSR-H and MYMGK1R820GRSR-H

The board is equipped with appropriate parts such as input and output capacitors to cover the specification of the product.

Monitoring test points are provided to allow accurate measurement of input/output voltages and currents, as well as enable control and power-good signals. Note that power dissipation and efficiency can be calculated from these measurements.

MYMGK1R820FRSR and MYMGK1R820FRSR-H modules operate with an input voltage range of 4.5 V to 8 V. MYMGK1R820ERSR and MYMGK1R820ERSR-H modules support an input voltage range of 8 V to 15 V, while MYMGK1R820GRSR-H module supports 4.5 V to 15 V. All modules deliver a maximum output current of 20 A. Based on a fixed-frequency synchronous buck converter topology, these high-efficiency PoL (Point-of-Load) modules feature an adjustable output voltage range of 0.7 V to 1.8 V. Additional functions include On/Off control, Power Good signal output, undervoltage lockout (UVLO), output short-circuit protection, and overcurrent protection.

Detailed application information for the products can be found in the datasheet.

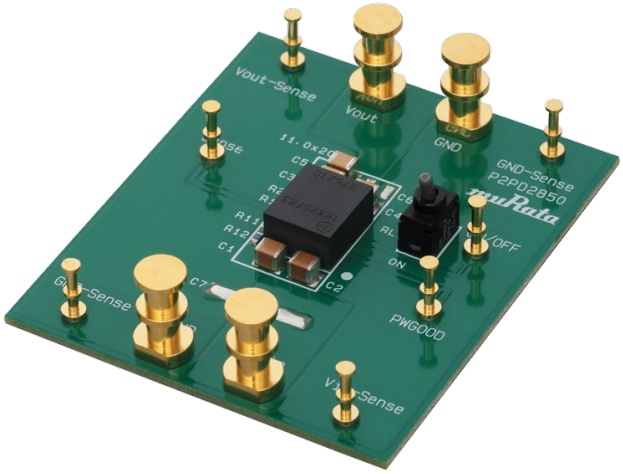


Figure 1. Evaluation Board

Performance Summary

Table 1. Performance Summary

PARAMETER	SYMBOL	CONDITIONS		MIN	TYP	MAX	UNITS
INPUT SUPPLY							
Input Voltage Range	V_{IN}	MYMGK1R820FRSR, MYMGK1R820FRSR-H		4.5	-	8	V
		MYMGK1R820ERSR, MYMGK1R820ERSR-H		8	-	15	V
		MYMGK1R820GRSR-H		4.5	-	15	V
ON/OFF pin Low Voltage	$V_{TH\ ENL}$			-0.3	-	0.6	V
ON/OFF pin High Voltage	$V_{TH\ ENH}$	7.8V ≤ VIN		1.8	-	6.3	V
		VIN < 7.8V				V_{IN}-1.5	
					OPEN		
OUTPUT							
Output Voltage	V_{OUT}				1.0		V
Adjustable Output Voltage Range				0.7	-	1.8	V
Output Current	I_{OUT}			0	-	20	A
Efficiency	EFF	V_{IN} = 5.0V, V_{OUT} = 1.8V, I_{OUT} = 20A	MYMGK1R820FRSR, MYMGK1R820FRSR-H	-	89.2	-	%
		V_{IN} = 5.0V, V_{OUT} = 1.0V, I_{OUT} = 20A		-	84.1	-	%
		V_{IN} = 12V, V_{OUT} = 1.8V, I_{OUT} = 20A	MYMGK1R820ERSR, MYMGK1R820ERSR-H MYMGK1R820GRSR-H	-	87.8	-	%
		V_{IN} = 12V, V_{OUT} = 1.0V, I_{OUT} = 20A		-	81.5	-	%
Short Circuit Protection	SCP	When output is shorted to GND, the DC-DC converter shall be operated in a hiccup mode. After the short circuit event has cleared, the output is automatically brought back into normal operation.		-	30	-	A

Quick Start Guide

Figure 2. highlights the user interface items associated with the EVM.
The VIN power terminals are used for connection to the host input supply and the VOUT power terminals are used for connection to the load. Sense(+/-) test points for both VIN and VOUT, located near the power terminals are intended to be used as voltage monitoring points where voltmeters can be connected to measure VIN and VOUT. **Do not connect these "Sense" monitoring test points as the input supply or output load connection points.**

Evaluation Overview

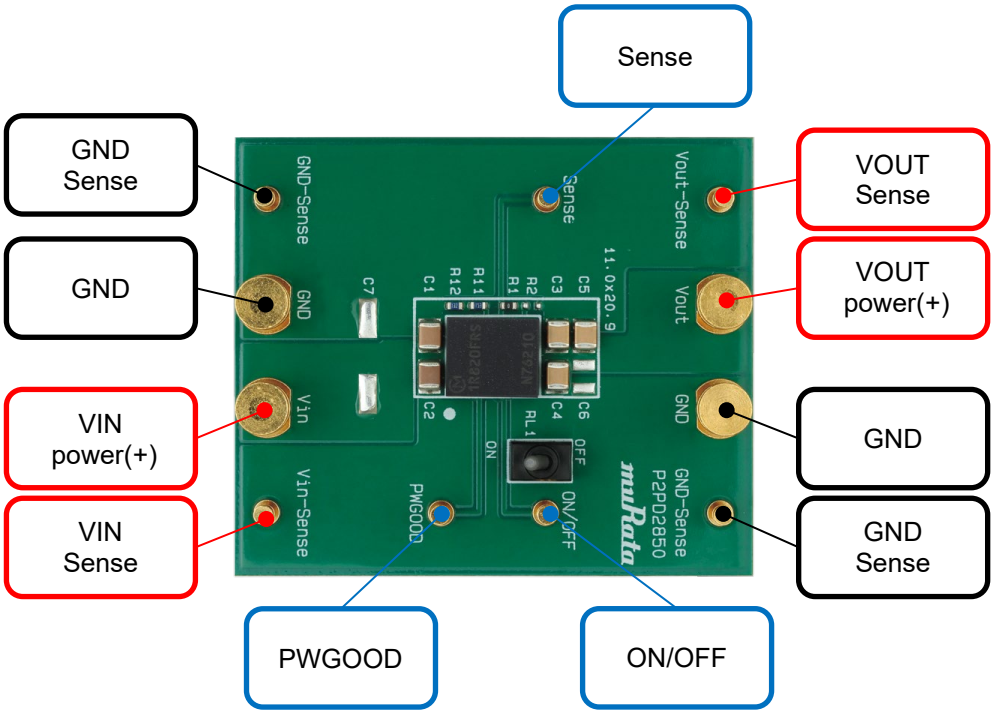


Figure 2. Evaluation Board Top View

Terminal Functions

Table 2. Terminal Functions

FUNCTION/TERMINAL	DESCRIPTION
VIN	Power input pin
VIN Sense	Sensing pin of VIN for measuring voltage
GND	Ground pin
GND Sense	Sensing pin of ground for measuring voltage
ON/OFF	ON/OFF pin. If this is high level or OPEN, the module operates. (This pin is internally pulled up.)
Sense	Output voltage sensing pin. (It is not a problem to leave this pin open, because it is connected to VOUT internally with 10ohm resistor) "
PWGOOD	Power good output pin. The output of PWGOOD is an open-drain signal.

Power Input and Output Descriptions

The VIN power terminals are used to connect to the input supply, and the VOUT power terminals are used to connect to the load.

Caution: Do not use these sense(+) and sense(-) terminals as the input supply or output load connection points. The PCB traces connecting to these sense terminals are not designed to support high currents. High currents may cause damage to the PCB traces.

Test Point Descriptions

The sense(+) and sense(-) test points for both VIN and VOUT, located near the power terminal are intended to be used as voltage monitoring points where voltmeters can be connected to measure VIN and VOUT.

EVM Connection

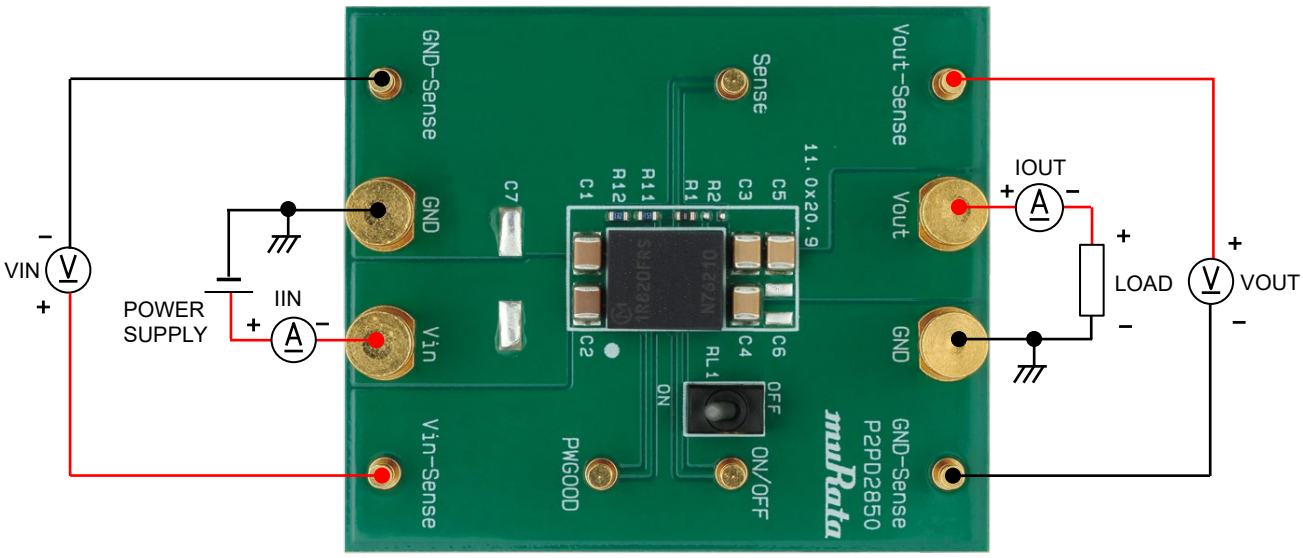


Figure 3. EVM Connection

Start-Up Procedure

1. Connect the power supply for input to VIN power(+) and GND.
   Set the input voltage to 5V or 12V and power supply current limit to at least 9A.

2. Connect one electronic load with more than 20A capacity between VOUT power(+) and GND.

3. PWGOOD pin is an open-drain output of a MOSFET and is already pulled up to the internal 5V regulator with a 100kohm resistor. When using PWGOOD function, make sure to follow the instructions in the datasheet.

4. Turn the power supply for input. It doesn't matter whether the load is on or off.
   The product can also be started using the ON/OFF switch.

5. Measure the output voltages. VOUT should be 1.0V with initial setting.

Output Voltage Adjustment

The output voltage can be adjusted within a specified range by connecting an external TRIM resistor (R_{TRIM} is R11 and R21) between the TRIM pin and GND pin. The R_{TRIM} resistor must be a 1/10W precision metal film type, ±0.5% accuracy (or better) with low temperature coefficient, ±100 ppm/ degC or better. Mount the resistor close to the converter with very short leads or use a surface mount trim resistor.

*Determine the R_{TRIM} value using following formula.

MYMGK1R820FRSR / MYMGK1R820FRSR-H

R_{TRIM} [kohm] = 10 x A / (V_{OUT} - A)

A = 0.617 + 0.01 x (V_{OUT} – 0.6)

MYMGK1R820ERSR / MYMGK1R820ERSR-H

R_{TRIM} [kohm] = 10 x A / (V_{OUT} - A)

A = 0.612 + 0.01 x (V_{OUT} – 0.6)

MYMGK1R820GRSR-H

R_{TRIM} [kohm] = 10 x A / (V_{OUT} - A)

A = 0.613 + 0.01 x (V_{OUT} – 0.6)

Table 3. R_{TRIM} Calculation Example

OUTPUT VOLTAGE [V]	ESTIMATED RTRIM [kohm]		
	MYMGK1R820FRSR MYMGK1R820FRSR-H	MYMGK1R820ERSR MYMGK1R820ERSR-H	MYMGK1R820GRSR-H
0.7	75;0.36	65+2.4	68+3.3
1.0	16+0.39	16	16+0.1
1.2	10+0.75	10+0.62	10+0.68
1.5	6.8+0.33	6.8+0.24	6.8+0.27
1.8	5.1+0.27	5.1+0.2	5.1+0.22

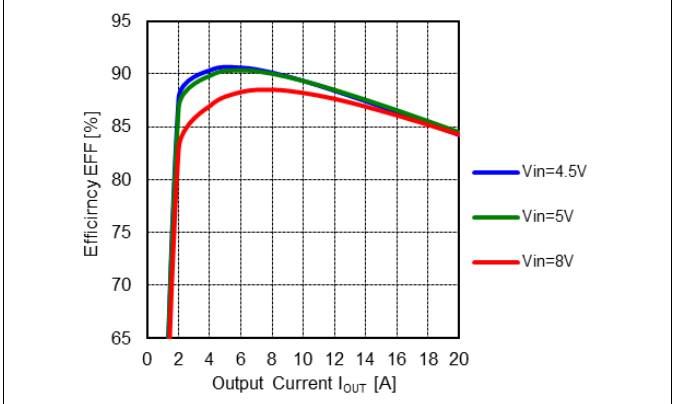
CAUTION

Do not exceed the specified limits of the output voltage or the converter's maximum power rating when applying these resistors.

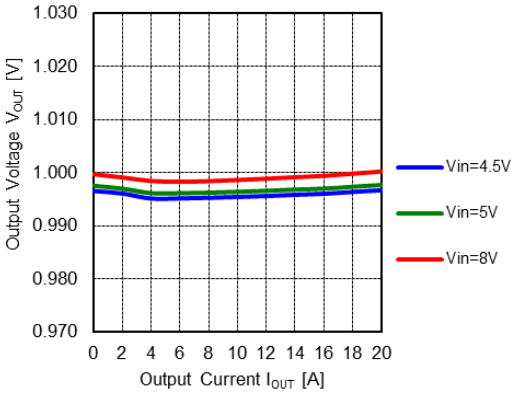
Performance Data

The following data demonstrates the performance of MYMGK1R820FRSR-EVM, MYMGK1R820FRSR-H-EVM, MYMGK1R820ERSR-EVM, MYMGK1R820ERSR-H-EVM and MYMGK1R820GRSR-H-EVM.
The test results represent the typical performance of the evaluation board, measured at T_A = 25degC with no airflow unless otherwise noted.

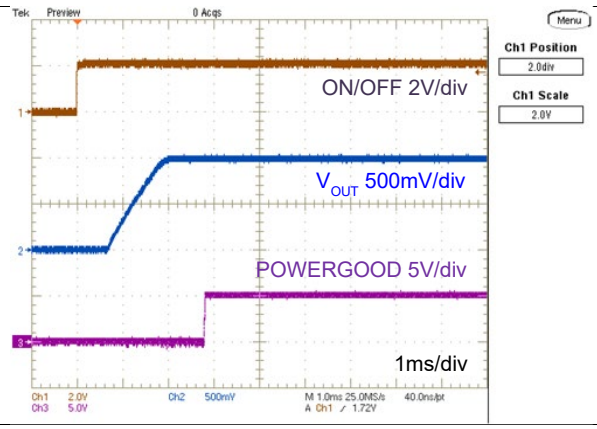
MYMGK1R820FRSR-EVM / MYMGK1R820FRSR-H-EVM (V_{OUT} = 1.0V, Ta = 25degC)



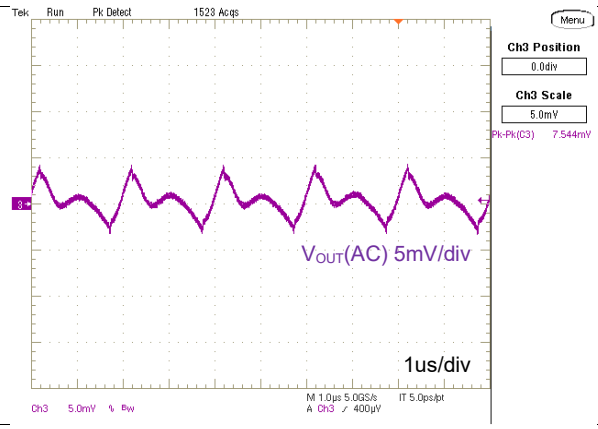
Efficiency



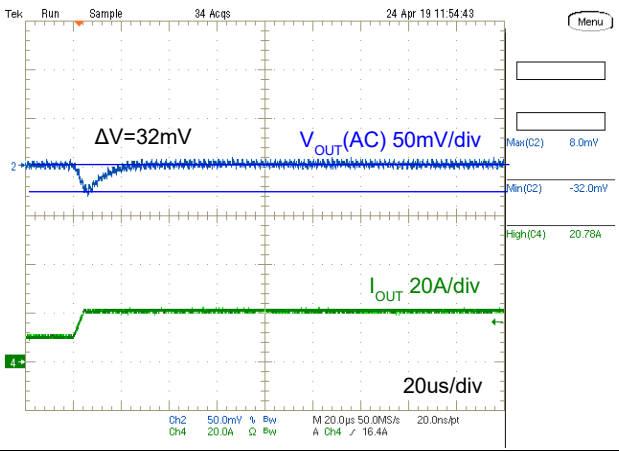
Load Regulation



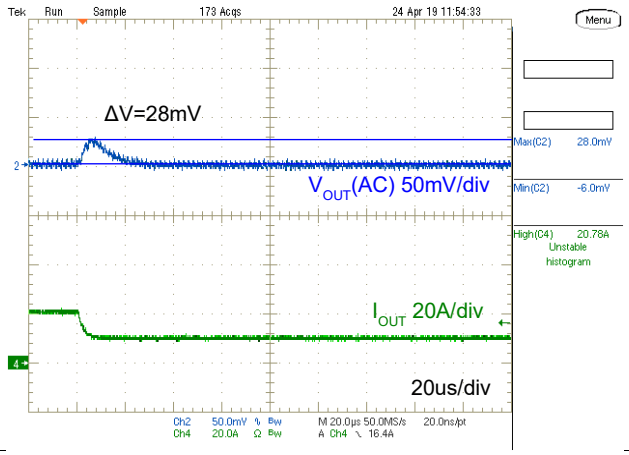
V_{OUT} Start-up
(V_{IN} = 5V, I_{OUT} = 20A)



Output Ripple and Noise
(V_{IN} = 5V, I_{OUT} = 20A, C_{OUT} = 660uF, ScopeBW = 20MHz)

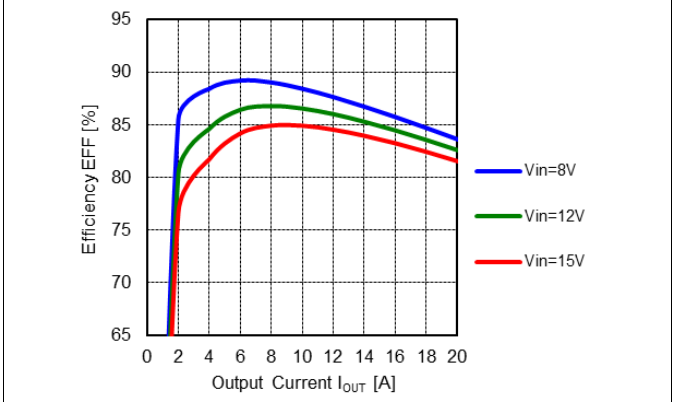


Load Transient Response
(V_{IN} = 5V, C_{OUT} = 660uF, I_{OUT} = 10 to 20A, 1.0A/us)

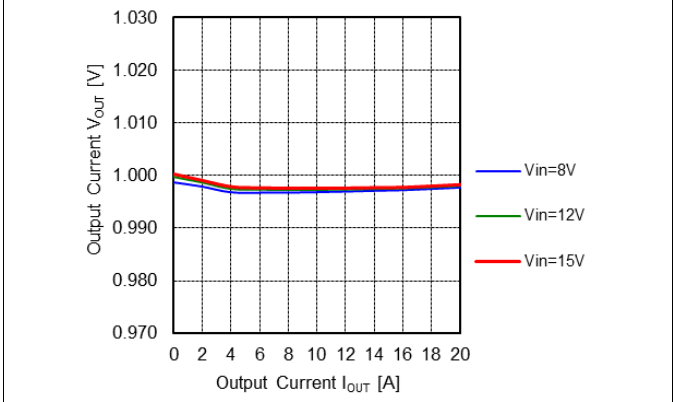


Load Transient Response
(V_{IN} = 5V, C_{OUT} = 660uF, I_{OUT} = 20 to 10A, 1.0A/us)

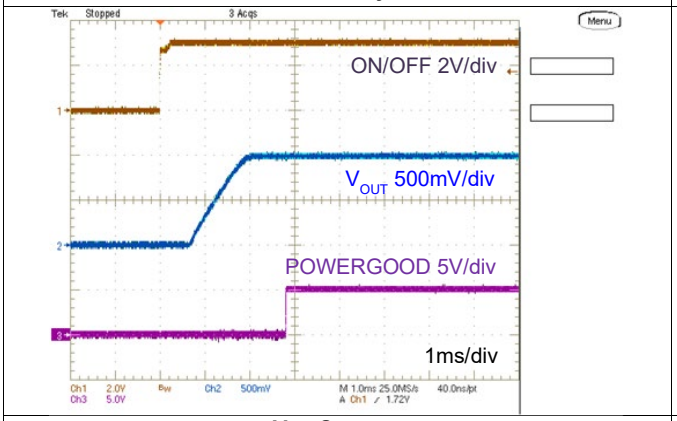
MYMGK1R820ERSR-EVM / MYMGK1R820ERSR-H-EVM (V_{OUT} = 1.0V, Ta = 25degC)



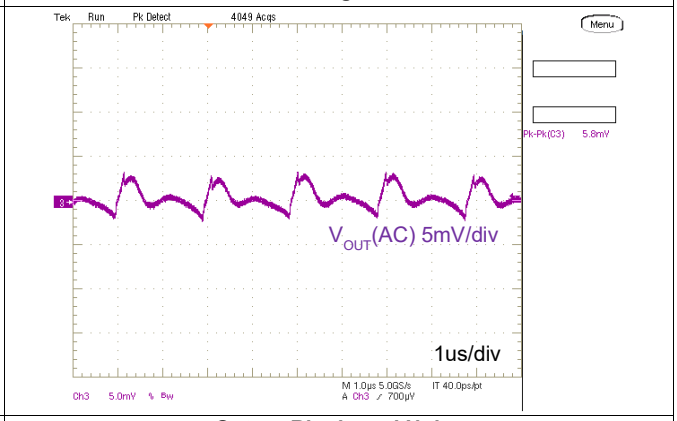
Efficiency



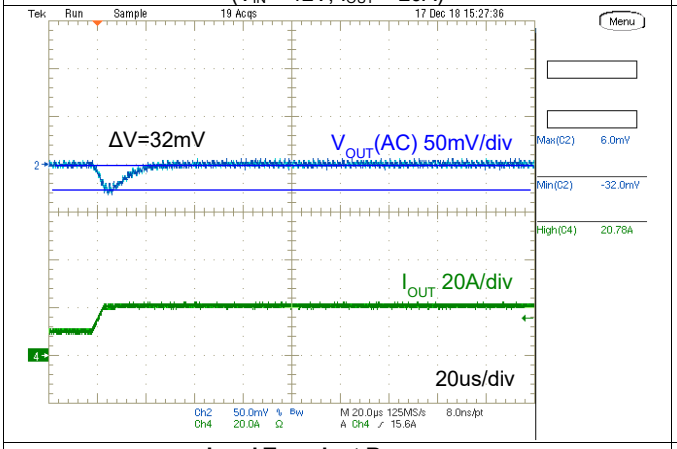
Load Regulation



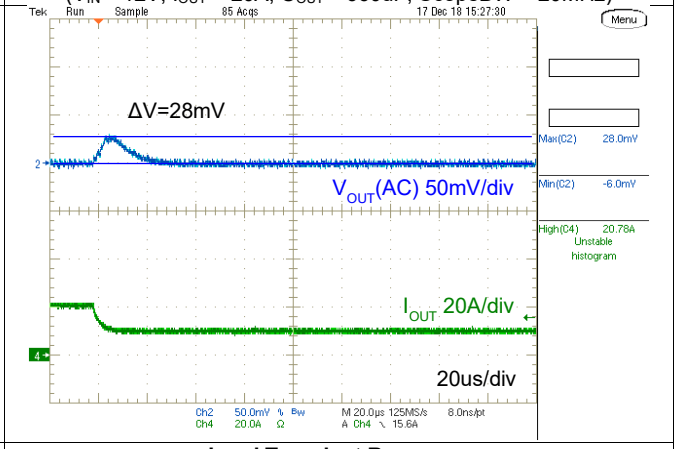
V_{OUT} Start-up
(V_{IN} = 12V, I_{OUT} = 20A)



Output Ripple and Noise
(V_{IN} = 12V, I_{OUT} = 20A, C_{OUT} = 660uF, ScopeBW = 20MHz)

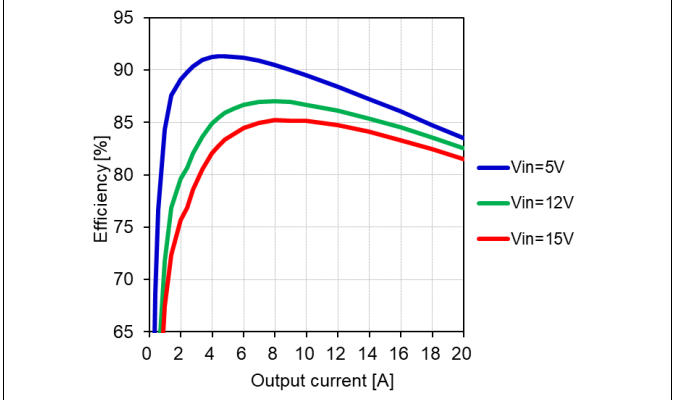


Load Transient Response
(V_{IN} = 12V, C_{OUT} = 660uF, I_{OUT} = 10 to 20A, 1.0A/us)

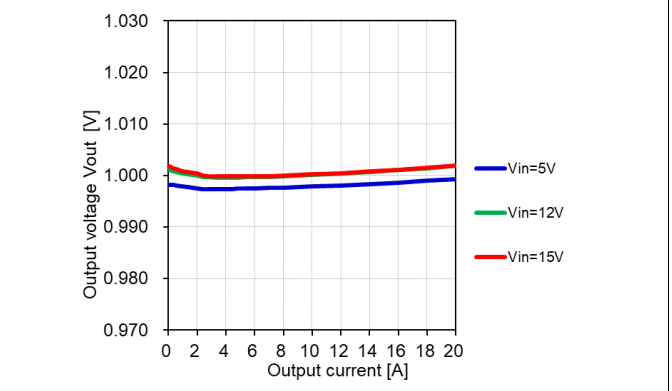


Load Transient Response
(V_{IN} = 12V, C_{OUT} = 660uF, I_{OUT} = 20 to 10A, 1.0A/us)

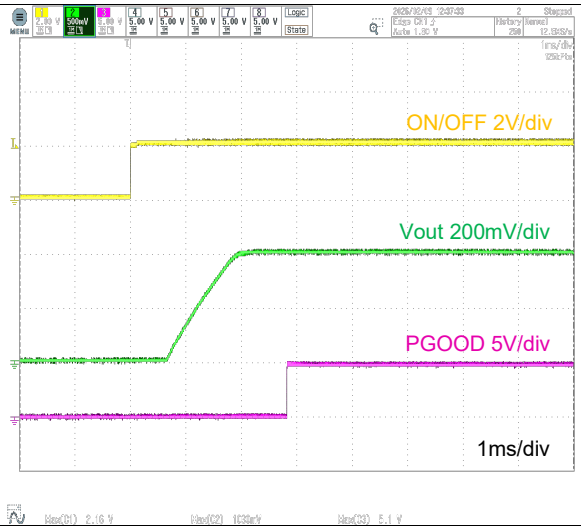
MYMGK1R820GRSR-H-EVM (V_{OUT} = 1.0V, Ta = 25degC)



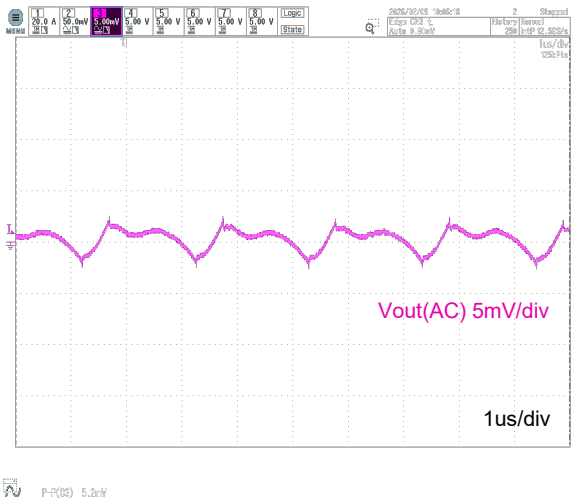
Efficiency



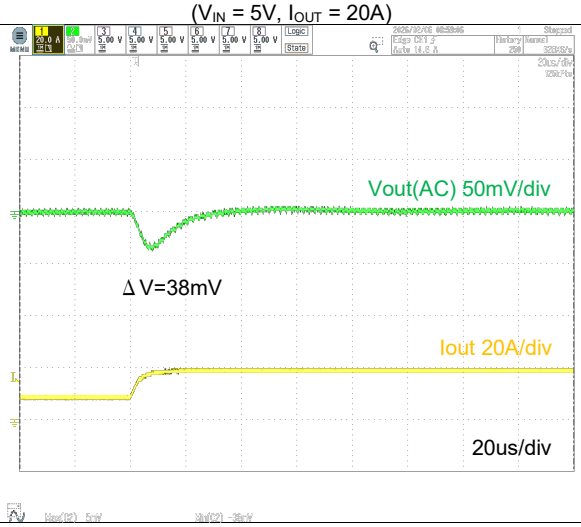
Load Regulation



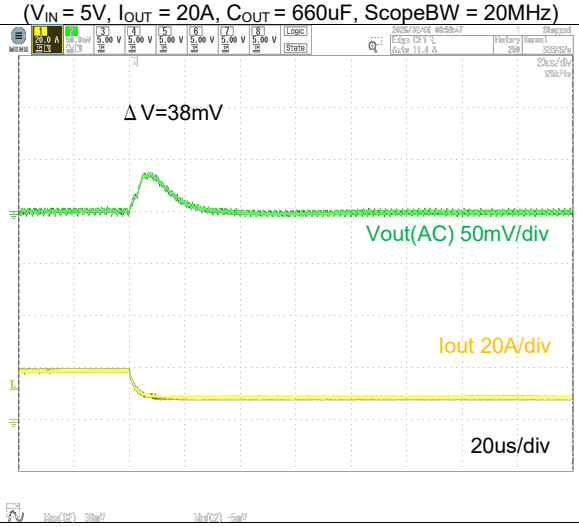
V_{OUT} Start-up
(V_{IN} = 5V, I_{OUT} = 20A)



Output Ripple and Noise
(V_{IN} = 5V, I_{OUT} = 20A, C_{OUT} = 660uF, ScopeBW = 20MHz)

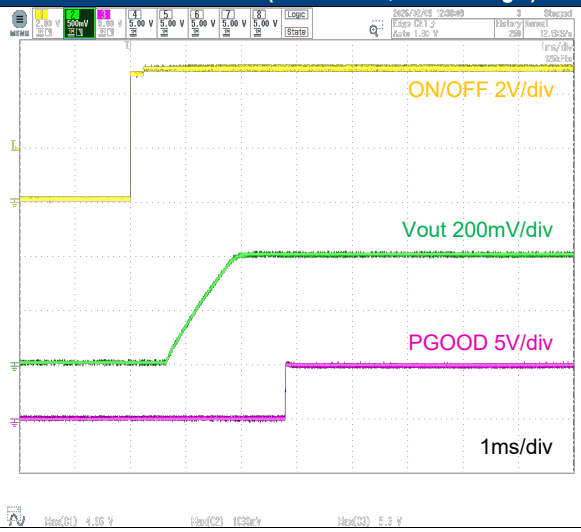


Load Transient Response
(V_{IN} = 5V, C_{OUT} = 660uF, I_{OUT} = 10 to 20A, 1.0A/us)

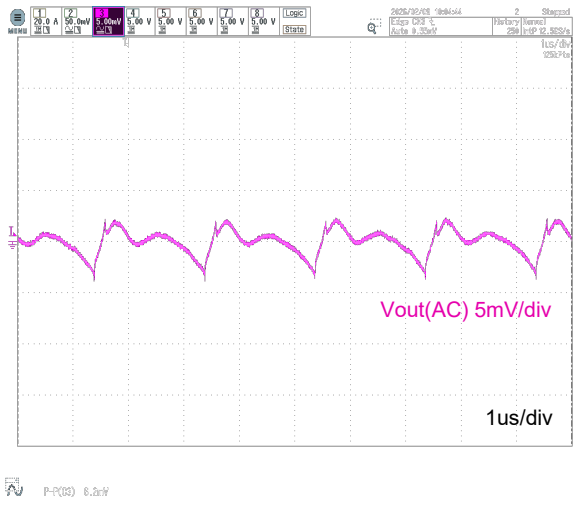


Load Transient Response
(V_{IN} = 5V, C_{OUT} = 660uF, I_{OUT} = 20 to 10A, 1.0A/us)

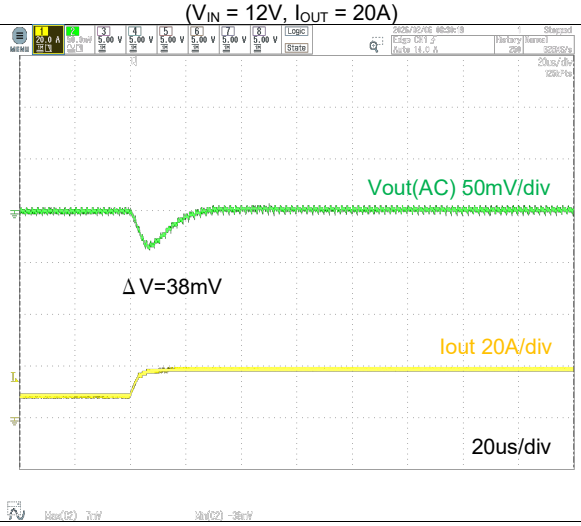
MYMGK1R820GRSR-H-EVM (V_{OUT} = 1.0V, Ta = 25degC)



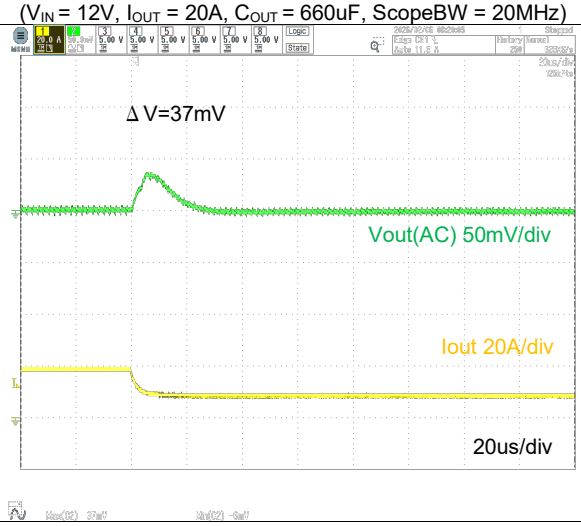
V_{OUT} Start-up
(V_{IN} = 12V, I_{OUT} = 20A)



Output Ripple and Noise
(V_{IN} = 12V, I_{OUT} = 20A, C_{OUT} = 660uF, ScopeBW = 20MHz)



Load Transient Response
(V_{IN} = 12V, C_{OUT} = 660uF, I_{OUT} = 10 to 20A, 1.0A/us)



Load Transient Response
(V_{IN} = 12V, C_{OUT} = 660uF, I_{OUT} = 20 to 10A, 1.0A/us)

EVM Bill of Materials (BOM)

Table 4. EVM Bill of Materials (4.5V ≤ VIN ≤ 5.5V)

REFERENCE	QTY	VALUE	DESCRIPTION	PART NUMBER	MANUFACTURER
MonoBK	1		Power Module	MYMGK1R820 FRSR or MYMGK1R820 FRSR-H or MYMGK1R820 GRSR-H	Murata
C1, C2	2	47uF	Input Capacitor Ceramic capacitor, 47uF, 10V, ±10%, X7R	GRM32ER71A 476KE15	Murata
C3, C4, C5	3	220uF	Output Capacitor Ceramic capacitor, 220uF, 4V, ±20%, X6S	GRM32EC80G 227ME05	Murata
R11	1	16kohm	Chip resistor, 1/10W, ±0.5% The value is determined by the target output voltage.	RK73G1JTTD 1602D	KOA
R12	1	390ohm	Chip resistor, 1/10W, ±0.5% The value is determined by the target output voltage.	RK73G1JTTD 3900D	KOA
RL1	1		Switch	2UD1-T1-A1-M2-R-E	marutsu
C6, C7, C11, C12, C13, C14, C15, C16, C23, C24, C25, C26, C31, C32, C36, C37, R2			OPEN		

Table 5. EVM Bill of Materials (5.5V ≤ VIN ≤ 15.0V)

REFERENCE	QTY	VALUE	DESCRIPTION	PART NUMBER	MANUFACTURER
MonoBK	1		Power Module	MYMGK1R820 ERSR or MYMGK1R820 ERSR-H or MYMGK1R820 GRSR-H	Murata
C1, C2	2	22uF	Input Capacitor Ceramic capacitor, 22uF, 25V, ±10%, X7R	GRM32ER71E 226KE15	Murata
C3, C4, C5	3	220uF	Output Capacitor Ceramic capacitor, 220uF, 4V, ±20%, X6S	GRM32EC80G 227ME05	Murata
R11	1	16kohm	Chip resistor, 1/10W, ±0.5% The value is determined by the target output voltage.	RK73G1JTTD 1602D	KOA
R12	1	0ohm	Chip resistor, 1/10W, ±0.5% The value is determined by the target output voltage.	RK73Z1JTTD	KOA
RL1	1		Switch	2UD1-T1-A1-M2-R-E	marutsu
C6, C7, C11, C12, C13, C14, C15, C16, C23, C24, C25, C26, C31, C32, C36, C37, R2			OPEN		

EVM Schematic

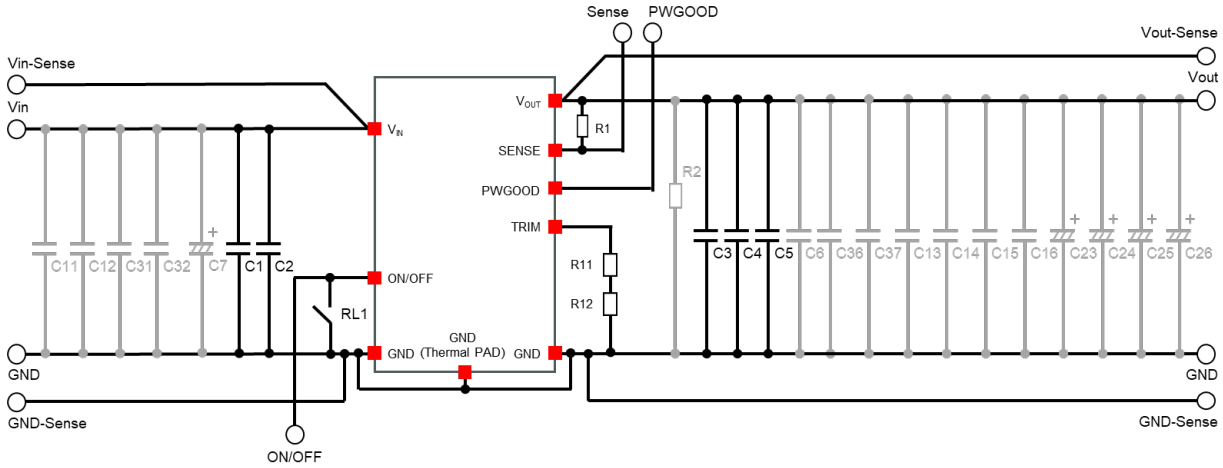
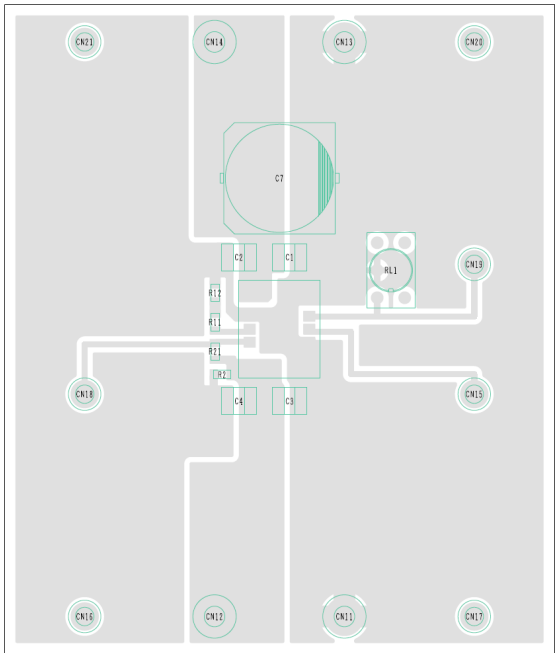
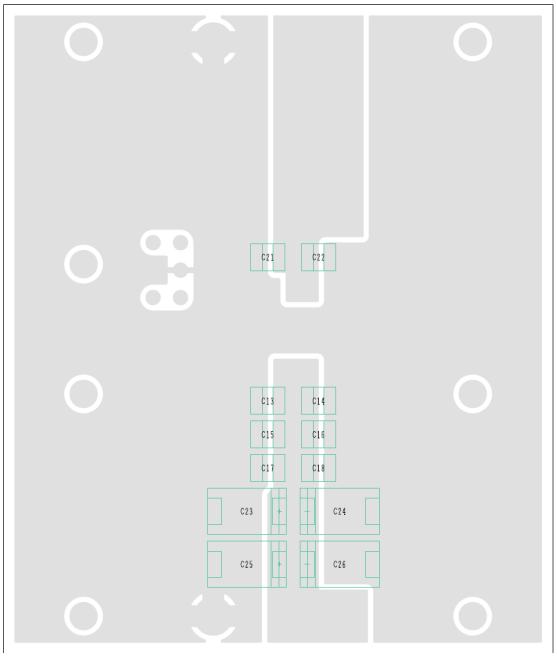


Figure 4. EVM Schematic

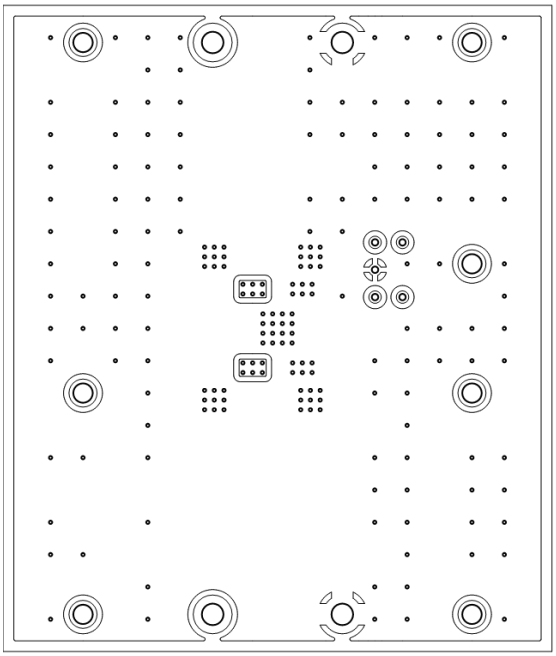
EVM PCB Layout



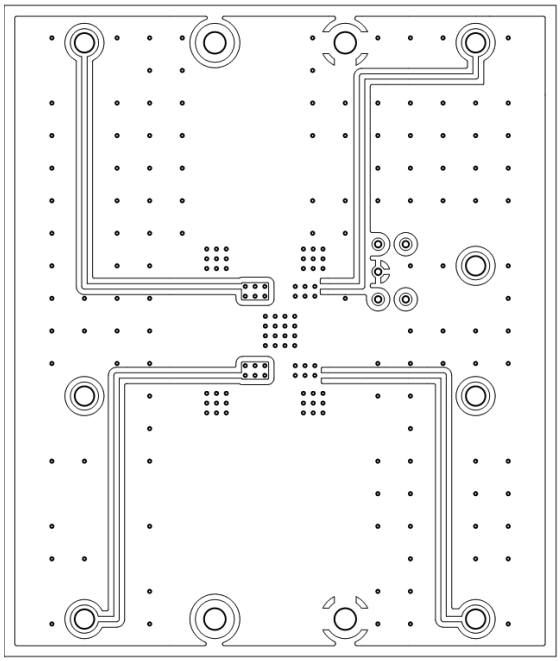
Layer1 (Top View)



Layer4 (Bottom view)

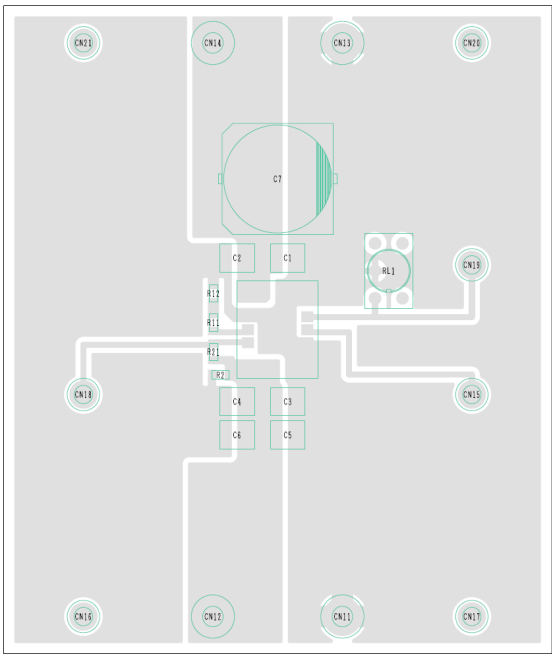


Layer2 (Top View)

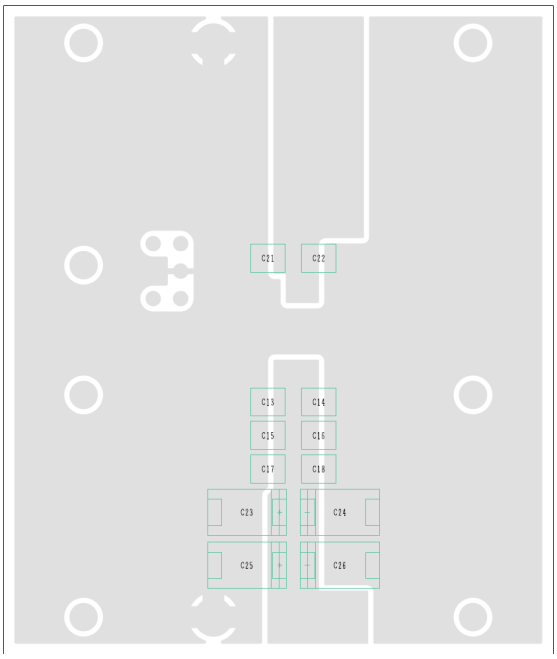


Layer3 (Top view)

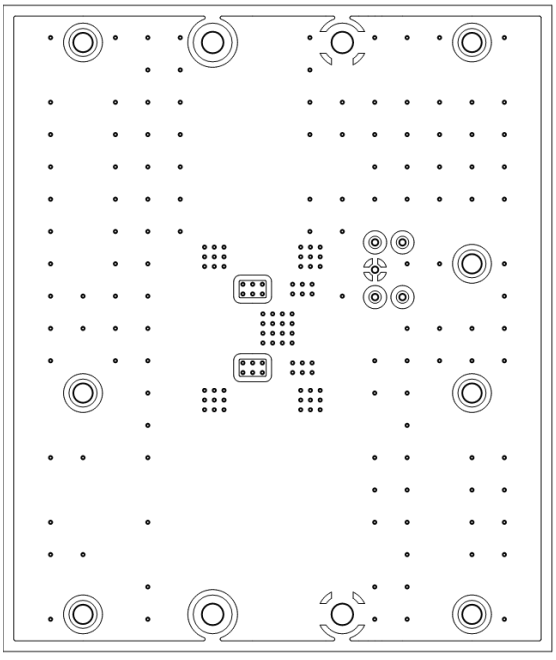
Figure 5. Evaluation Board Layout (V_{OUT} < 3V)



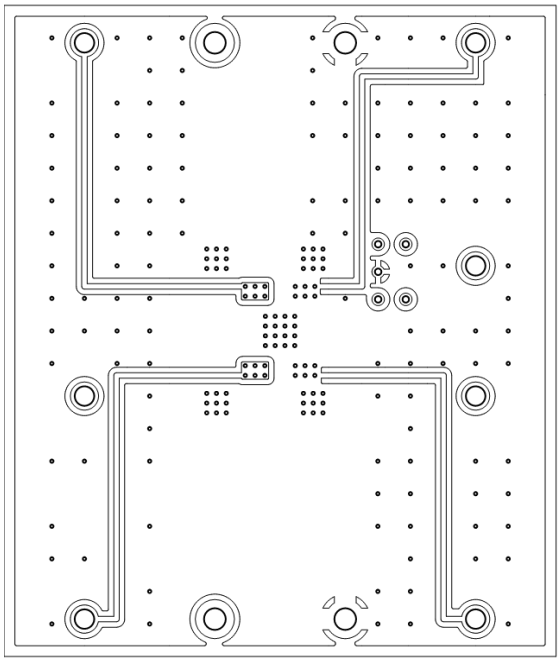
Layer1 (Top View)



Layer4 (Bottom view)



Layer2 (Top View)



Layer3 (Top view)

Figure 6. Evaluation Board Layout (3V ≤ V_{OUT})

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⚠ CAUTION

1. EVMs are not finished products. Murata delivers EVM for use in a research and development evaluation purpose only.
2. Please make sure that your product has been evaluated and confirmed to your specifications when our product is used in your product.
3. All the items and parameters in this approval sheet for product specification are based on the premise that our product is used for the purpose, under the condition and in the environment agreed upon between you and us. You are requested not to use our product in a manner deviating from such agreement.
4. If you have any concerns about materials other than those listed in the RoHS directive, please contact us.
5. Be sure to provide an appropriate fail-safe functionality in your product to prevent secondary damage that could be caused by the abnormal function or failure of our product.
6. Do not allow our product to be exposed to excess moisture under any circumstances.

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https://www.murata.com/contactform?Product=Power%20Device

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