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S6SBP501A00VA1001, S6SBP502A00VA1001

## Automotive PMIC Evaluation Kit Operation Guide

Doc. No. 002-08766 Rev. \*E

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# Preface



This manual explains how to use the evaluation board. Be sure to read this manual before using the product. For this product, consult Cypress sales representatives or support representatives.

## **Handling and use**

Handling and use of this product and notes regarding its safe use are described in the manual.

Follow the instructions in the manual to use this product.

## **Notice on this document**

All information included in this document is current as of the date it is issued. Such information is subject to change without any prior notice.


Confirm the latest relevant information with Cypress sales representatives.

# Cautions




## Caution of the products described in this document

The following precautions apply to the product described in this manual.

 <b>WARNING</b>	Indicates a potentially hazardous situation which could result in death or serious injury and/or a fault in the user's system if the product is not used correctly.
--	---

<b>Electric shock, Damage</b>	Before performing any operation described in this manual, turn OFF all power supplies to the system. Performing such an operation with the power on may cause an electric shock or device fault.
<b>Electric shock, Damage</b>	Once the product has been turned ON, do not touch any metal part of it. Doing so may cause an electric shock or device fault.

 <b>CAUTION</b>	Indicates the presence of a hazard that may cause a minor or moderate injury, damages to this product or devices connected to it, or may cause to lose software resources and other properties such as data, if the device is not used appropriately.
--	---

<b>Cuts, Damage</b>	Before moving the product, be sure to turn off all the power supplies and unplug the cables. Watch your step when carrying the product. Do not use the product in an unstable location such as a place exposed to strong vibration or a sloping surface. Doing so may cause the product to fall, resulting in an injury or fault.
<b>Cuts</b>	The product contains sharp edges that are left unavoidably exposed, such as jumper plugs. Handle the product with due care not to get injured with such pointed parts.
<b>Damage</b>	Do not place anything on the product or expose the product to physical shocks. Do not carry the product after the power has been turned on. Doing so may cause a malfunction due to overloading or shock.
<b>Damage</b>	Since the product contains many electronic components, keep it away from direct sunlight, high temperature, and high humidity to prevent condensation. Do not use or store the product where it is exposed to much dust or a strong magnetic or electric field for an extended period of time. Inappropriate operating or storage environments may cause a fault.
<b>Damage</b>	Use the product within the ranges given in the specifications. Operation over the specified ranges may cause a fault.
<b>Damage</b>	To prevent electrostatic breakdown, do not let your finger or other object come into contact with the metal parts of any of the connectors. Before handling the product, touch a metal object (such as a door knob) to discharge any static electricity from your body.

<b>Damage</b>	When turning the power on or off, follow the relevant procedure as described in this document. Before turning the power on, in particular, be sure to finish making all the required connections. Furthermore, be sure to configure and use the product by following the instructions given in this document. Using the product incorrectly or inappropriately may cause a fault.
<b>Damage</b>	Always turn the power off before connecting or disconnecting any cables from the product. When unplugging a cable, unplug the cable by holding the connector part without pulling on the cable itself. Pulling the cable itself or bending it may expose or disconnect the cable core, resulting in a fault.
<b>Damage</b>	Because the product has no casing, it is recommended that it be stored in the original packaging. Transporting the product may cause a damage or fault. Therefore, keep the packaging materials and use them when re-shipping the product.

# Contents



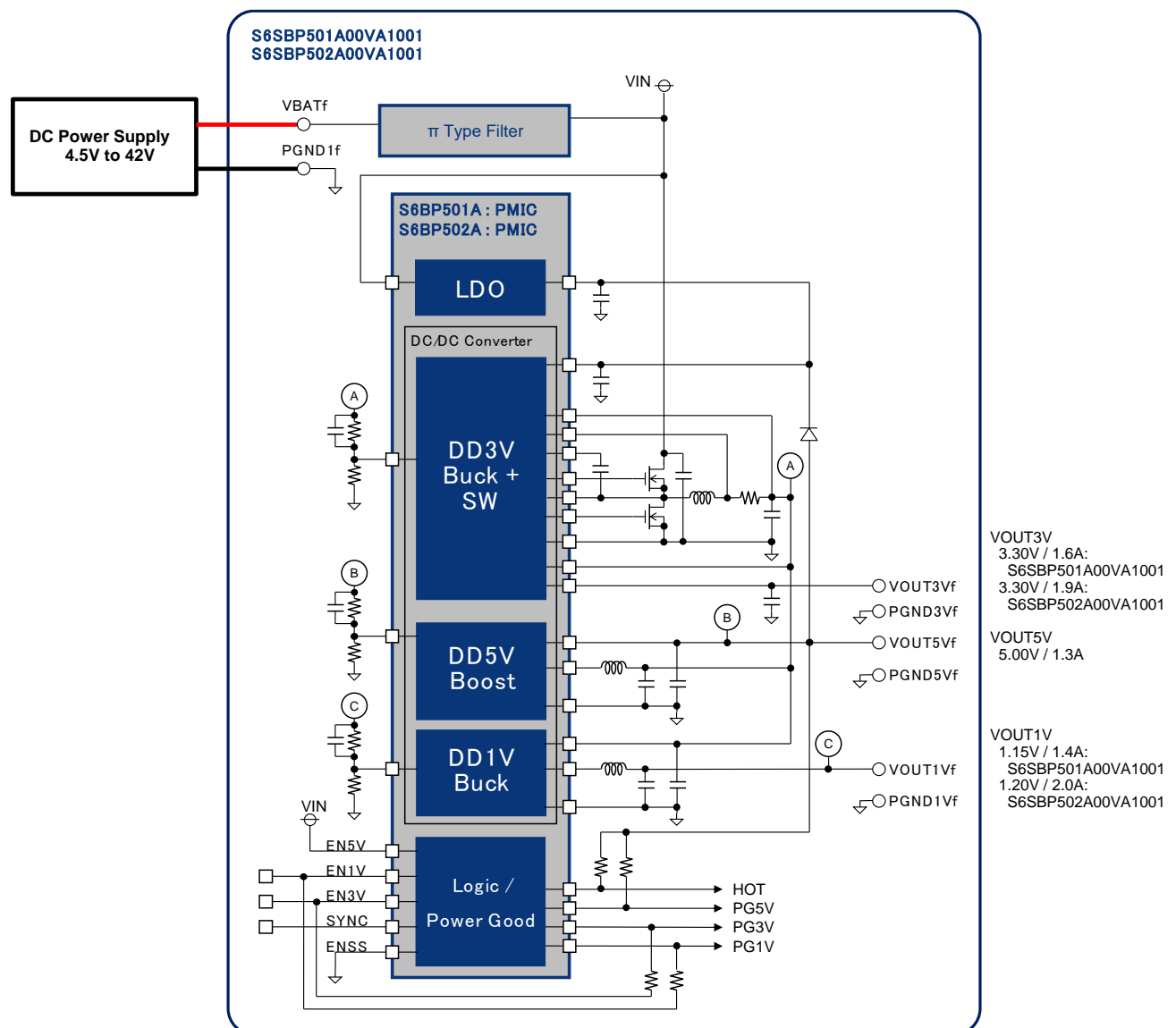
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# 1. Description



S6SBP501A00VA1001 and S6SBP502A00VA1001 are evaluation kits for the power block of an automotive instrument cluster. These boards implement the Cypress power management IC S6BP501A and S6BP502A, respectively.

Figure 1-1. Evaluation Board Block Diagram



## 2. Evaluation Board Specification



Table 2-1. Evaluation Board Specification

Item		Symbol	Min.	Typ.	Max.	Unit
Input Voltage		VIN	4.5	12	42	V
S6SBP501A00VA1001	Output Voltage	VOUT3V	-	3.30	-	V
		VOUT5V	-	5.00	-	V
		VOUT1V	-	1.15	-	V
	Output Current	IOUT3	-	-	1.6	A
		IOUT5	-	-	1.3	A
		IOUT1	-	-	1.4	A
S6SBP502A00VA1001	Output Voltage	VOUT3V	-	3.30	-	V
		VOUT5V	-	5.00	-	V
		VOUT1V	-	1.20	-	V
	Output Current	IOUT3	-	-	1.9	A
		IOUT5	-	-	1.3	A
		IOUT1	-	-	2.0	A

# 3. Pin Descriptions

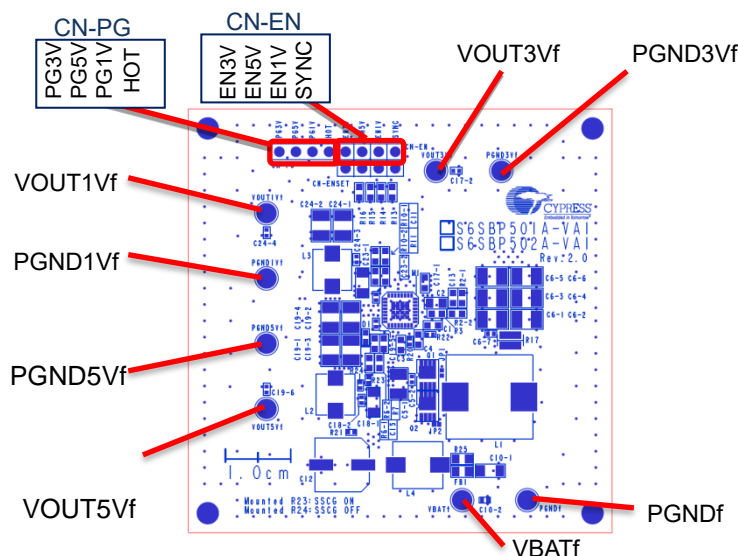


## 3.1 Input/Output Pin and Pin Socket Descriptions

Table 3-1. Input/Output Pin Descriptions

Connector Symbol		I/O	Function Description
VBATf		I	DC power supply terminal
VOUT3Vf		O	DD3V via load switch output terminal
VOUT5Vf		O	DD5V DC/DC convertor output terminal
VOUT1Vf		O	DD1V DC/DC convertor output terminal
PGNDf, PGND3Vf, PGND5Vf, PGND1Vf		-	Ground terminal
CN-EN	EN3V	I	VOUT3V: Load switch of DD3V enable terminal
	EN5V	I	VOUT5V: DD3V and DD5V enable terminal
	EN1V	I	VOUT1V: DD1V enable terminal
	SYNC	I	Mode setting or external clock input terminal. See the S6BP501A, S6BP502A datasheet.
CN-PG	PG3V	O	VOUT3V power good terminal
	PG5V	O	VOUT5V power good terminal
	PG1V	O	VOUT1V power good terminal
	HOT	O	Thermal warning output terminal

Figure 3-1. Pin Layout



## 3.2 Jumper and Pin Socket Descriptions

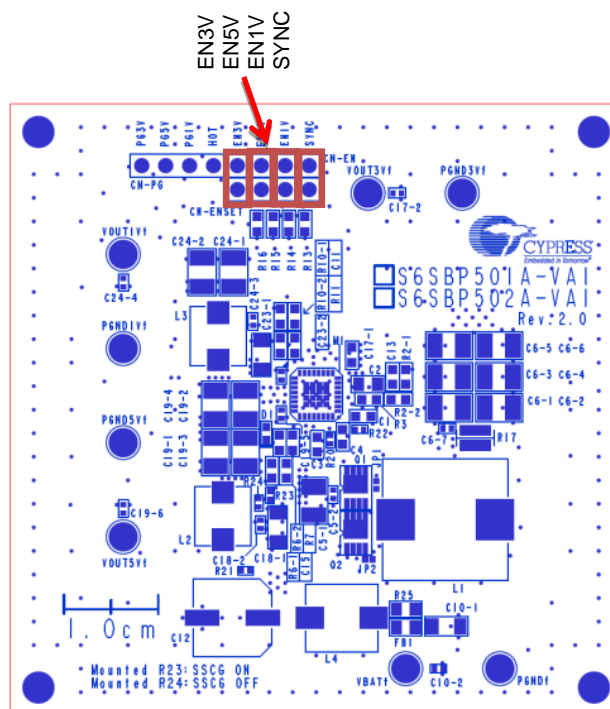
Table 3-2. Jumper Descriptions

Jumper	Description	Initial Setting
R23	Shorted VB or GND to ENSS. R23 Short: Shorted between VB and ENSS. SSCG function is ON.	Not mounted
R24	R24 Short: Shorted between GND and ENSS. SSCG function is OFF. R23 and R24 must not be shorted simultaneously.	Short

Table 3-3. Pin Socket Descriptions

Pin Socket	Function Description	Initial Setting
EN3V	Shorted between EN3V and VB	Inserted
EN5V	Shorted between EN5V and VIN through R21	Inserted
EN1V	Shorted between EN1V and VB	Inserted
SYNC	Shorted between SYNC and VB.	Not inserted

Figure 3-2. Pin Socket Layout



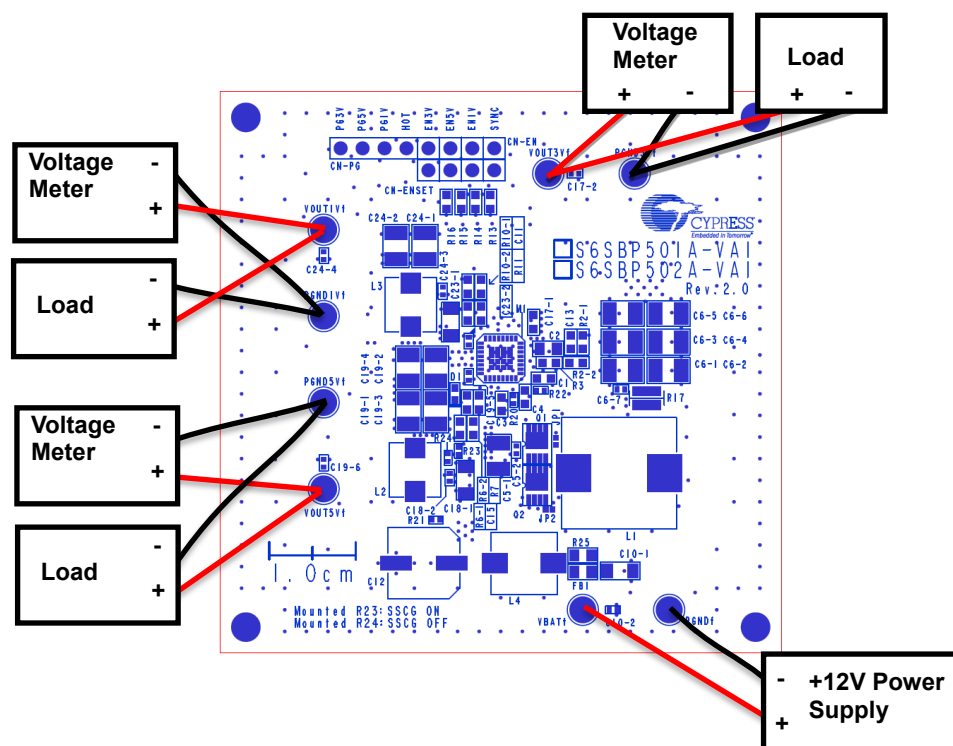
## 4. Setup



### 4.1 Connecting

Connect the board to the power supply, load equipment, and voltage meter as shown in Figure 4-1.

Figure 4-1. Connecting the Board and Equipment



### 4.2 Verification

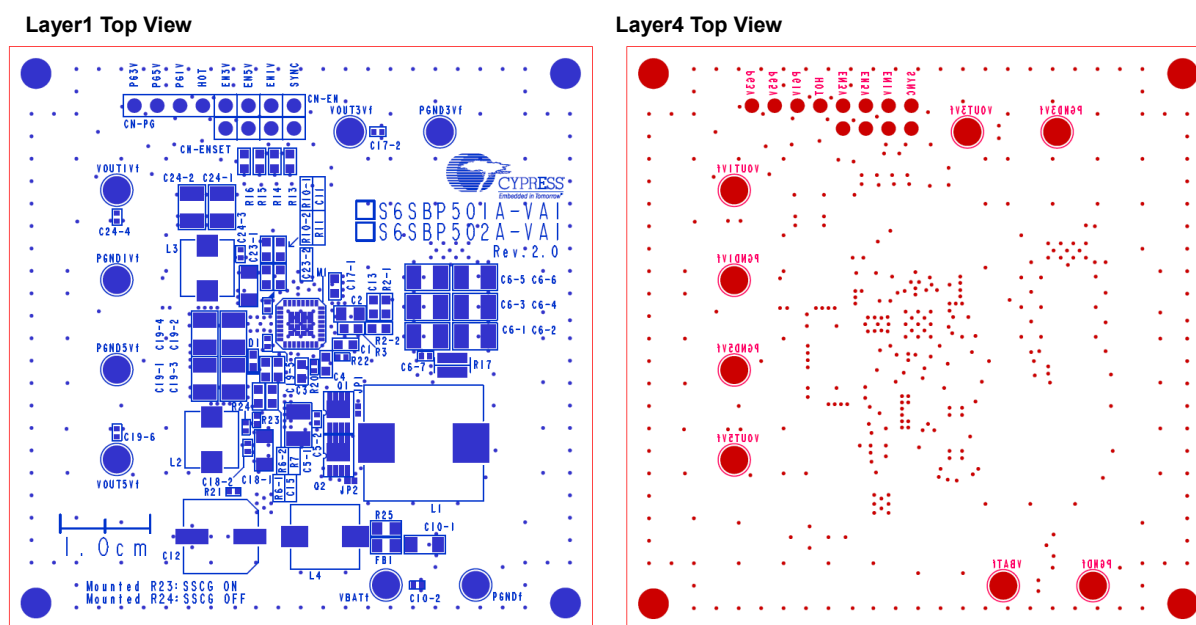
1. Insert pin sockets of EN1V, EN3V, and EN5V.
2. Turn ON the +12 V power supply. VOUT1Vf, VOUT3Vf, and VOUT5Vf will start output.
3. Check that each output voltage is the same as the 'Output Voltage' listed in Table 2-1.

# 5. Layout



## 5.1 Component Layout

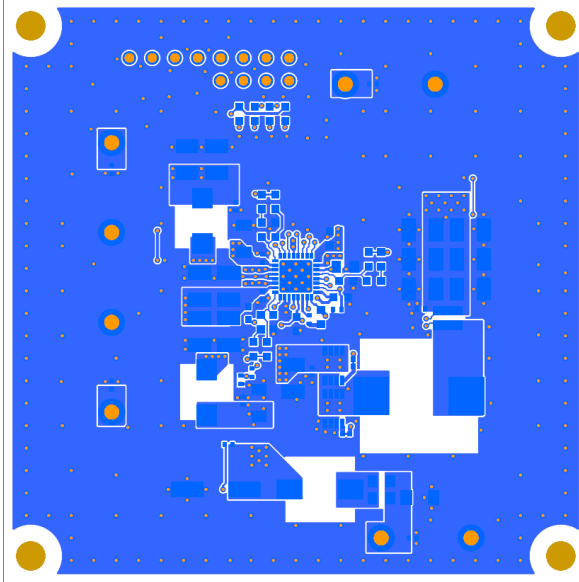
Figure 5-1. Evaluation Board Component Layout



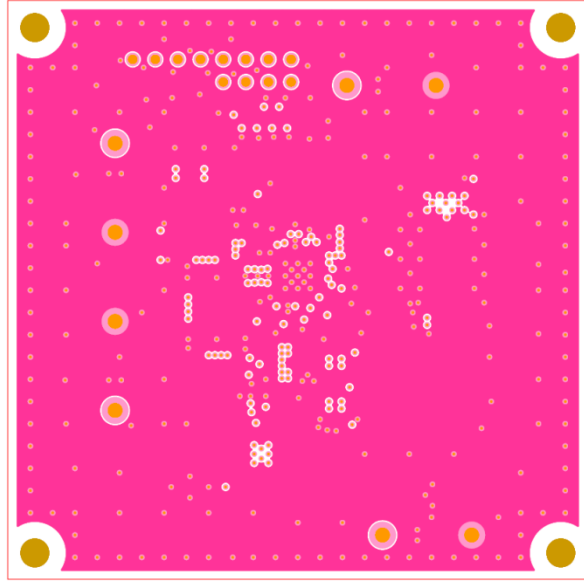
## 5.2 Wiring Layout

Figure 5-2. Evaluation Board Wiring Layout

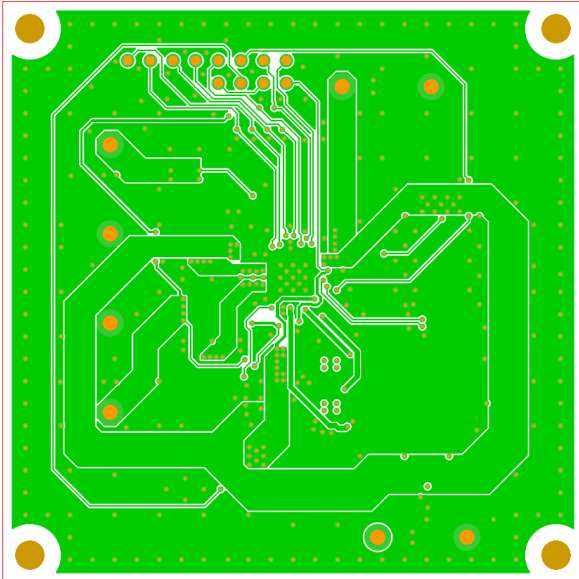
layer 1 Top View



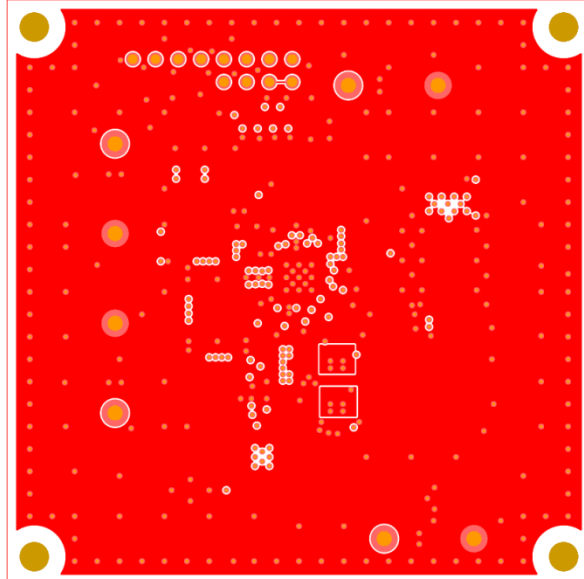
layer 2 Top View



layer 3 Top View



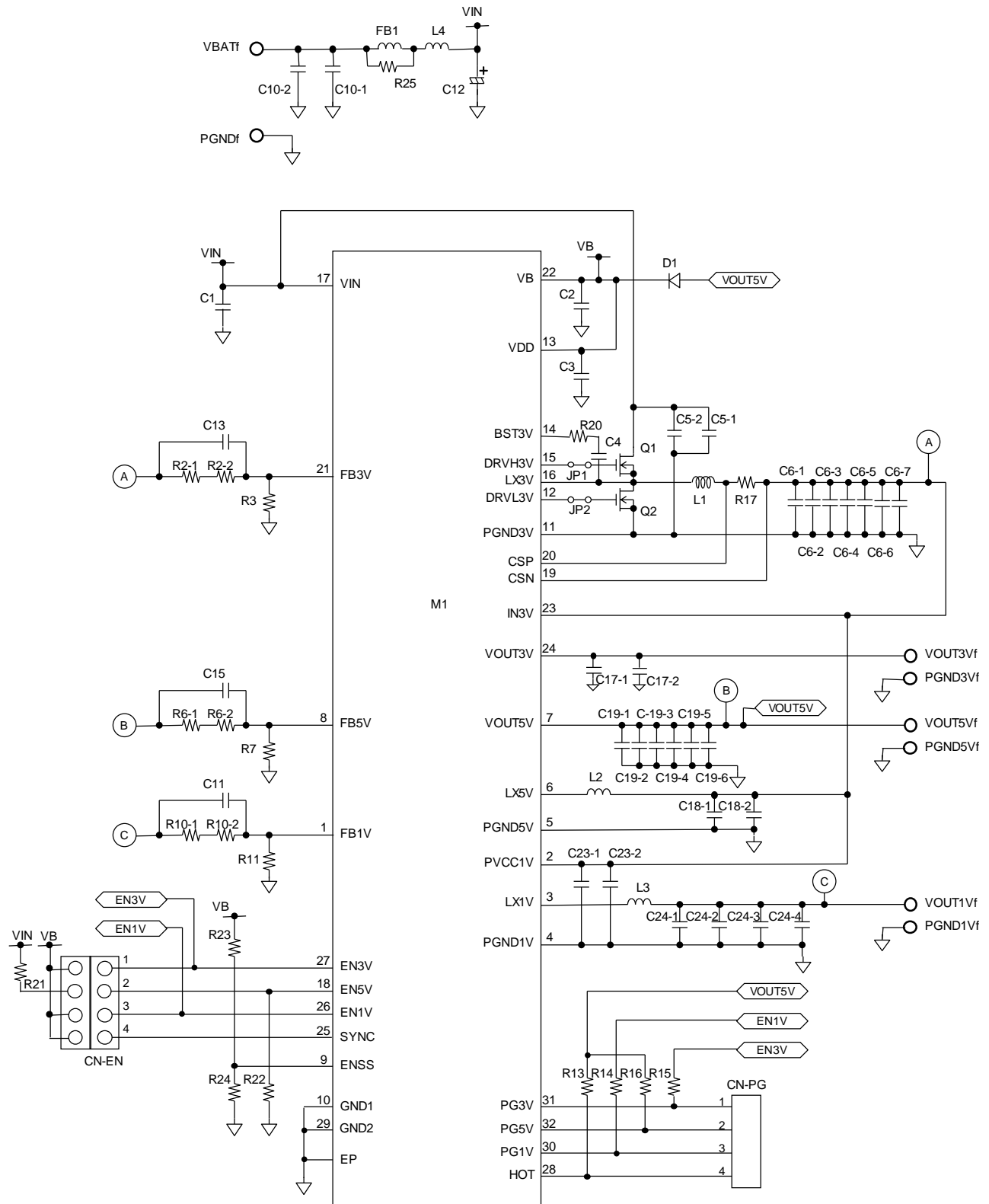
layer 4 Top View



## 6. Circuit Schematic



Figure 6-1. Evaluation Board Circuit Schematic



## 7. Component List



Table 7-1. Evaluation Board Component List

No.	Component	Part Number	Vendor	Value	Rated Voltage (V)	Rated Current (A)	Remarks
1	C1	CGA3E2X7R1H104K080AA	TDK	0.1 $\mu$ F	50	-	-
2	C2	CGA4J3X7R1C475K125AB	TDK	4.7 $\mu$ F	16	-	-
3	C3	CGA3E2X7R1H104K080AA	TDK	0.1 $\mu$ F	50	-	-
4	C4	CGA3E2X7R1H104K080AA	TDK	0.1 $\mu$ F	50	-	-
5	C5-1	CGA6P3X7S1H106M250AB	TDK	10 $\mu$ F	50	-	-
6	C5-2	CGA2B3X7R1H104K050BB	TDK	0.1 $\mu$ F	50	-	-
7	C6-1	CGA6P1X7R1C226M250AC	TDK	22 $\mu$ F	16	-	-
8	C6-2	CGA6P1X7R1C226M250AC	TDK	22 $\mu$ F	16	-	-
9	C6-3	CGA6P1X7R1C226M250AC	TDK	22 $\mu$ F	16	-	-
10	C6-4	CGA6P1X7R1C226M250AC	TDK	22 $\mu$ F	16	-	-
11	C6-5	CGA6P1X7R1C226M250AC	TDK	22 $\mu$ F	16	-	-
12	C6-6	CGA6P1X7R1C226M250AC	TDK	22 $\mu$ F	16	-	-
13	C6-7	CGA2B3X7R1H104K050BB	TDK	0.1 $\mu$ F	50	-	-
14	C10-1	CGA5L3X7R1H475K160AB	TDK	4.7 $\mu$ F	50	-	-
15	C10-2	CGA2B3X7R1H104K050BB	TDK	0.1 $\mu$ F	50	-	-
16	C11	CGA3E2C0G1H120J080AA	TDK	12 pF	50	-	-
17	C12	-	-	-	-	-	NMT
18	C13	CGA3E2C0G1H100D080AA	TDK	10 pF	50	-	-
19	C15	-	-	-	-	-	NMT
20	C17-1	CGA3E1X7R1C105K080AC	TDK	1 $\mu$ F	16	-	-
21	C17-2	CGA2B3X7R1H104K050BB	TDK	0.1 $\mu$ F	50	-	-
22	C18-1	CGA5L1X7R1C106K160AC	TDK	10 $\mu$ F	16	-	-
23	C18-2	CGA2B3X7R1H104K050BB	TDK	0.1 $\mu$ F	50	-	-
24	C19-1	CGA6P1X7R1C226M250AC	TDK	22 $\mu$ F	16	-	-
25	C19-2	CGA6P1X7R1C226M250AC	TDK	22 $\mu$ F	16	-	-
26	C19-3	CGA6P1X7R1C226M250AC	TDK	22 $\mu$ F	16	-	-
27	C19-4	CGA6P1X7R1C226M250AC	TDK	22 $\mu$ F	16	-	-
28	C19-5	CGA2B3X7R1H104K050BB	TDK	0.1 $\mu$ F	50	-	-
29	C19-6	CGA2B3X7R1H104K050BB	TDK	0.1 $\mu$ F	50	-	-

No.	Component	Parts Number	Vendor	Value	Rated Voltage (V)	Rated Current (A)	Remarks
30	C23-1	CGA5L1X7R1C106K160AC	TDK	10 $\mu$ F	16	-	-
31	C23-2	CGA2B3X7R1H104K050BB	TDK	0.1 $\mu$ F	50	-	-
32	C24-1	CGA6P1X7R1C226M250AC	TDK	22 $\mu$ F	16	-	-
33	C24-2	CGA6P1X7R1C226M250AC	TDK	22 $\mu$ F	16	-	-
34	C24-3	CGA2B3X7R1H104K050BB	TDK	0.1 $\mu$ F	50	-	-
35	C24-4	CGA2B3X7R1H104K050BB	TDK	0.1 $\mu$ F	50	-	-
36	D1	RB521S30T1G	ON Semi	-	30	0.2	-
37	FB1	RK73Z2A	KOA	0 $\Omega$	-	2	-
38	L1	CLF12577NIT-4R7N-D	TDK	4.7 $\mu$ H	-	9	-
39	L2	CLF6045NIT-1R5N-D	TDK	1.5 $\mu$ H	-	4.5	-
40	L3	CLF6045NIT-1R5N-D	TDK	1.5 $\mu$ H	-	4.5	-
41	L4	CLF7045T-4R7N	TDK	4.7 $\mu$ H	-	3.6	-
42	M1	S6BP501A00SN2B000	Cypress	-	-	-	S6SBP501A00VA1001
		S6BP502A00SN2B000	Cypress	-	-	-	S6SBP502A00VA1001
43	Q1	NVTF5826NL	ON Semi	-	60	7.6	-
44	Q2	NVTF5826NL	ON Semi	-	60	7.6	-
45	R2-1	RK73H1JTTD2003F	KOA	200 k $\Omega$	-	-	-
46	R2-2	RK73H1JTTD1203F	KOA	120 k $\Omega$	-	-	-
47	R3	RK73H1JTTD1203F	KOA	120 k $\Omega$	-	-	-
48	R6-1	RK73H1JTTD2004F	KOA	2 M $\Omega$	-	-	-
49	R6-2	RK73H1JTTD1804F	KOA	1.8 M $\Omega$	-	-	-
50	R7	RK73H1JTTD1204F	KOA	1.2 M $\Omega$	-	-	-
51	R10-1	RK73Z1J	KOA	0 $\Omega$	-	1	-
52	R10-2	RK73H1JTTD2743F	KOA	274 k $\Omega$	-	-	S6SBP501A00VA1001
		RK73H1JTTD2703F	KOA	270 k $\Omega$	-	-	S6SBP502A00VA1001
53	R11	RK73H1JTTD3013F	KOA	301 k $\Omega$	-	-	S6SBP501A00VA1001
		RK73H1JTTD2703F	KOA	270 k $\Omega$	-	-	S6SBP502A00VA1001
54	R13	RK73H1JTTD1003F	KOA	100 k $\Omega$	-	-	-
55	R14	RK73H1JTTD1003F	KOA	100 k $\Omega$	-	-	-
56	R15	RK73H1JTTD1003F	KOA	100 k $\Omega$	-	-	-
57	R16	RK73H1JTTD1003F	KOA	100 k $\Omega$	-	-	-
58	R17	ERJB2CFR012V	Pana	12 m $\Omega$	-	-	S6SBP501A00VA1001
		KRL3216E-M-R010-F	SSM	10 m $\Omega$	-	-	S6SBP502A00VA1001
59	R20	RK73Z1E	KOA	0 $\Omega$	-	1	-
60	R21	RK73H1ETTD1001F	KOA	1k $\Omega$	-	-	-
61	R22	-	-	-	-	-	NMT
62	R23	-	-	-	-	-	NMT
63	R24	RK73Z1E	KOA	0 $\Omega$	-	1	-

No.	Component	Parts Number	Vendor	Value	Rated Voltage (V)	Rated Current (A)	Remarks
64	R25	RK73Z2A	KOA	0Ω	-	2	-

TDK : TDK Corporation  
 ON Semi : ON Semiconductor  
 Cypress : Cypress Semiconductor Corp  
 KOA : KOA Corporation  
 Pana : Panasonic Corporation  
 SSM : SUSUMU CO., LTD.

NMT: No mount.

These components are compliant with RoHS, and ask each vendor for details if necessary.

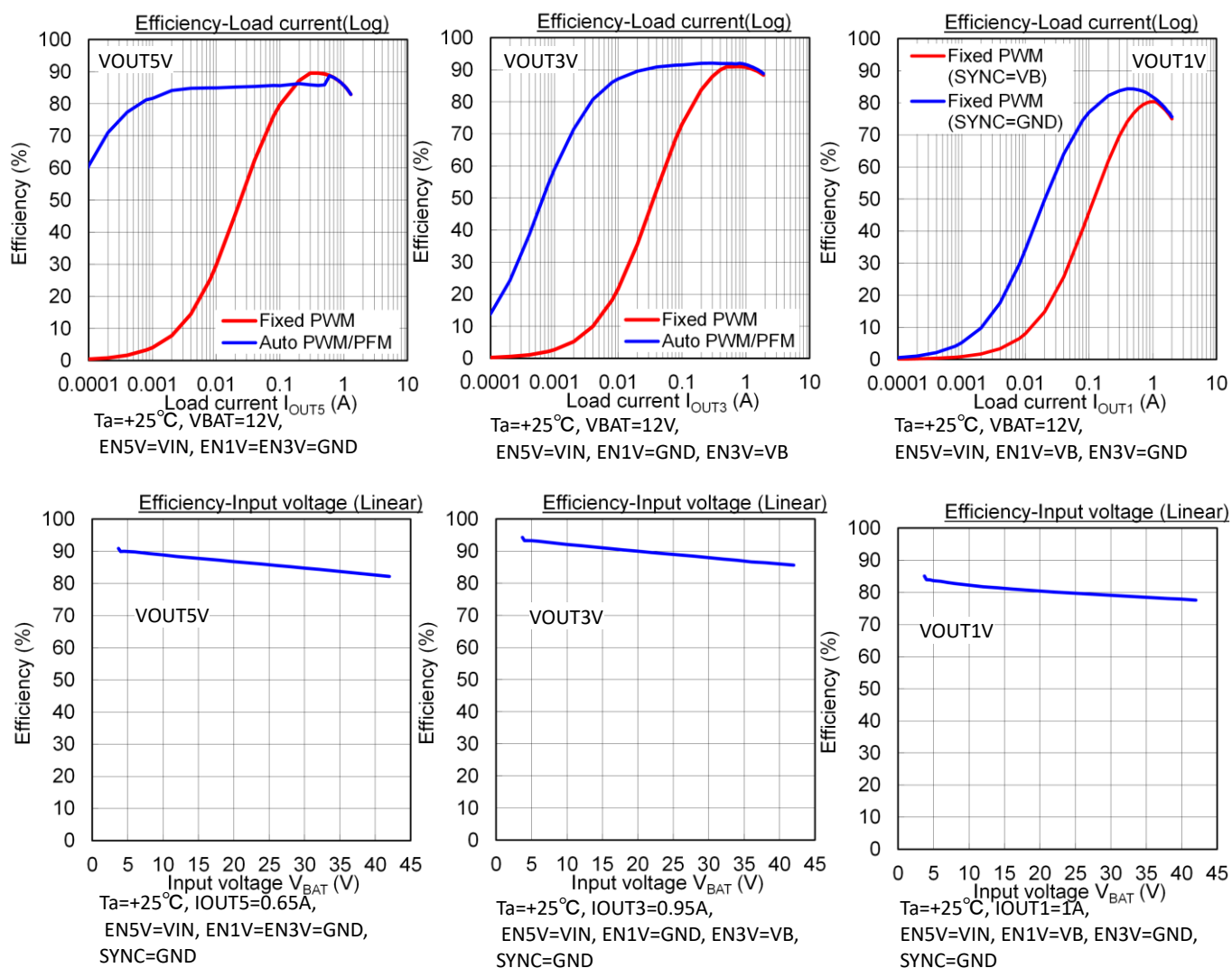
## 8. Reference Data



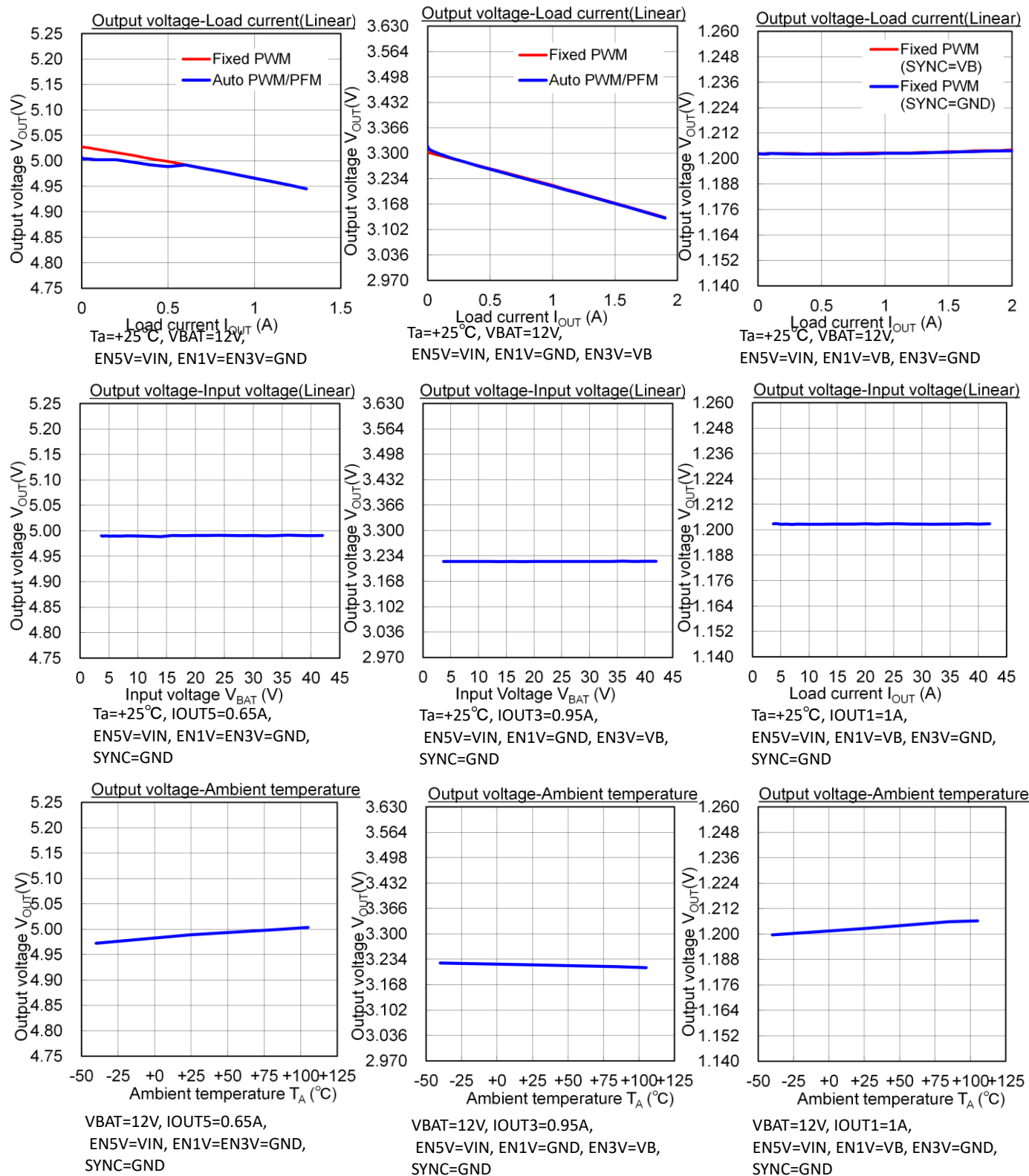
This chapter provides the DC/DC converter characteristics of S6SBP502A00VA1001.

### 8.1 DC Characteristics

#### 8.1.1 Conversion Efficiency

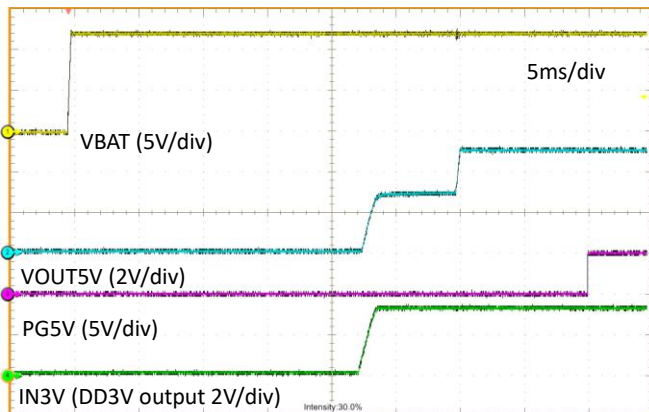


## 8.1.2 Regulations

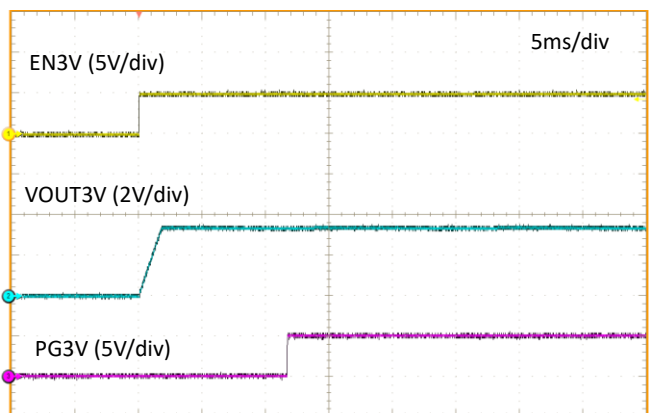
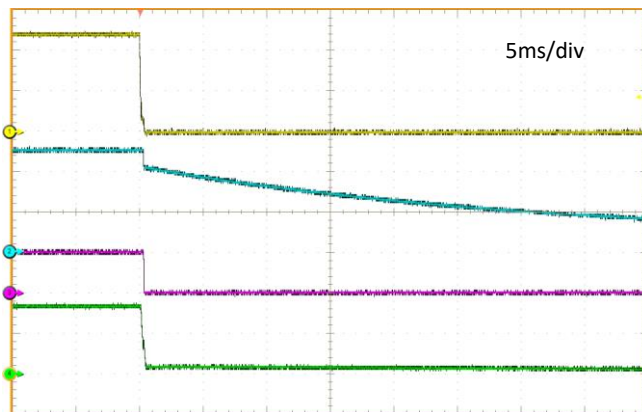


## 8.2 Waveforms

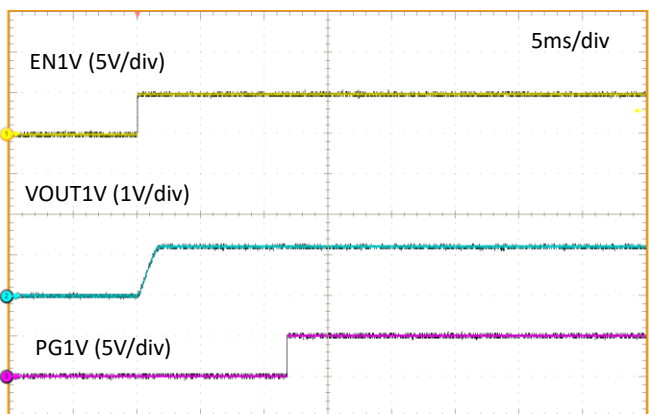
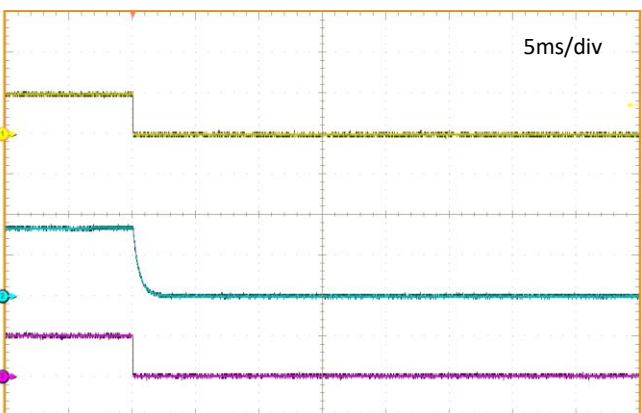
### 8.2.1 Start-up and Stop



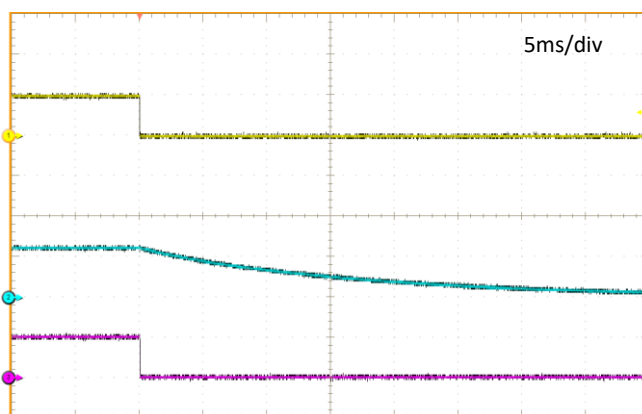
EN5V=VIN, EN3V=EN1V=GND, SYNC=GND, IOUT5=0A



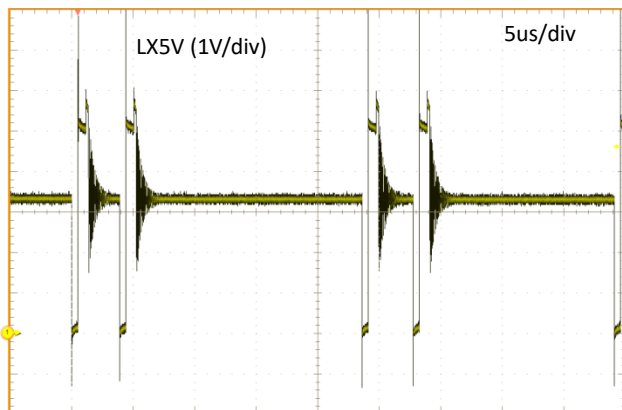
VBAT=12V, EN5V=VIN, EN1V=GND, SYNC=GND, IOUT5=IOUT3=0A



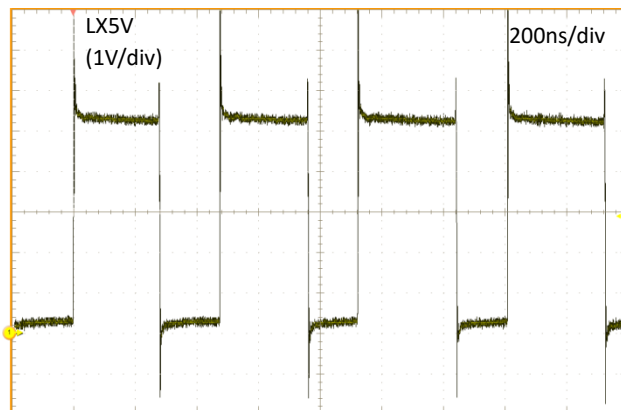
VBAT=12V, EN5V=VIN, EN3V=GND, SYNC=GND, IOUT5=IOUT1=0A



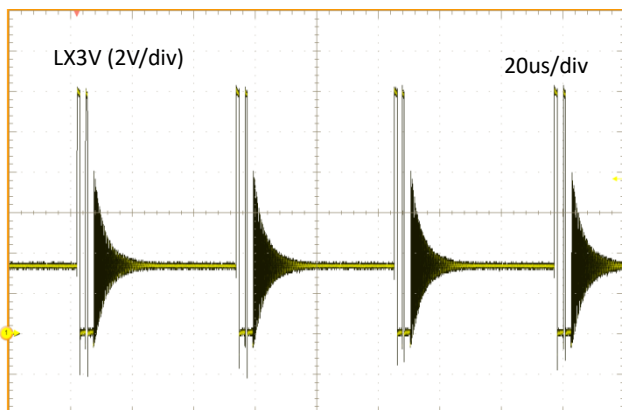
## 8.2.2 Switching Waveform



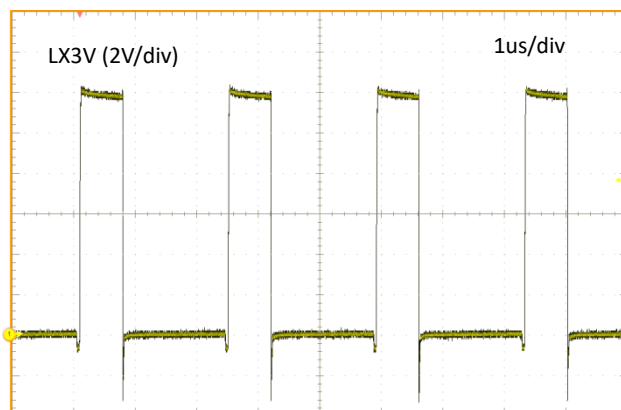
VBAT=12V, EN5V=VIN, EN3V= EN1V=GND,  
 SYNC=GND, IOU5=50mA



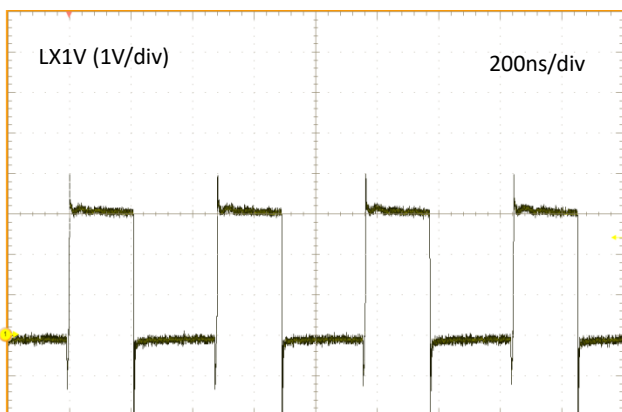
VBAT=12V, EN5V=VIN, EN3V= EN1V=GND,  
 SYNC=GND, IOU5=1.3A



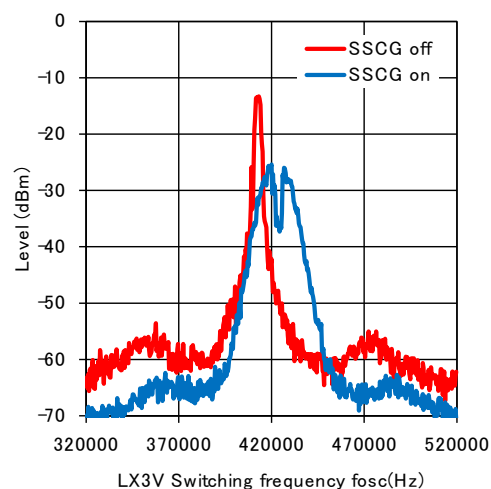
VBAT=12V, EN5V=VIN, EN3V=VB, EN1V=GND,  
 SYNC=GND, IOU5=0A, IOU3=100mA



VBAT=12V, EN5V=VIN, EN3V=VB, EN1V=GND,  
 SYNC=GND, IOU5=0A, IOU3=1.9A

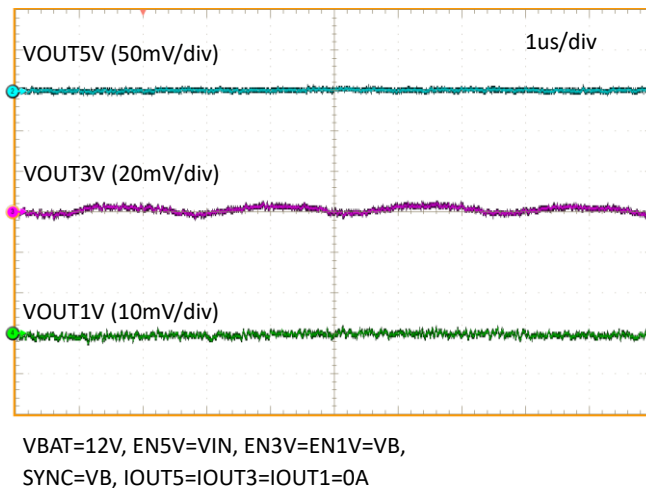
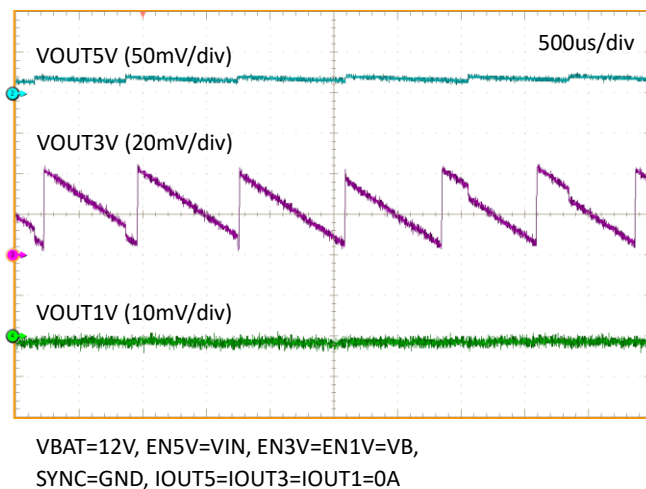
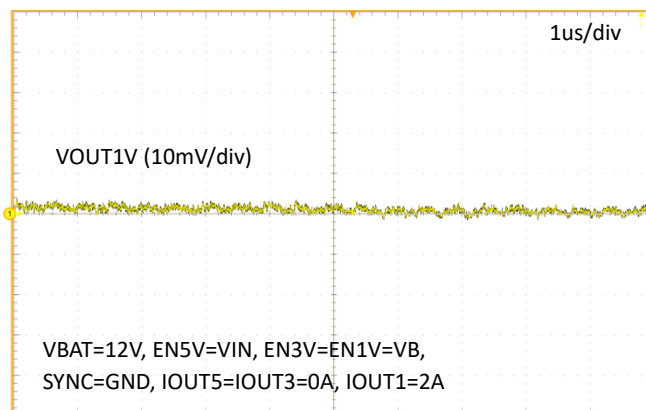
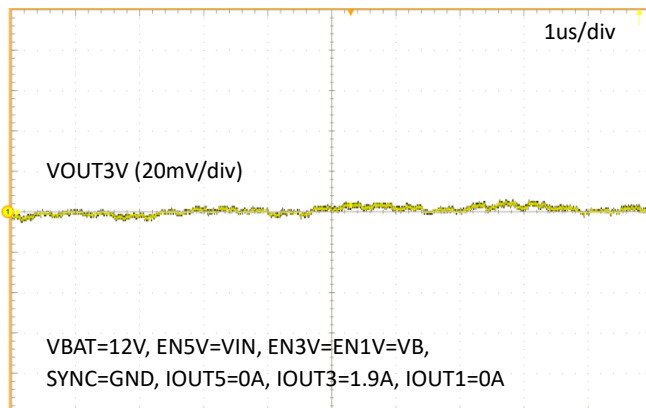
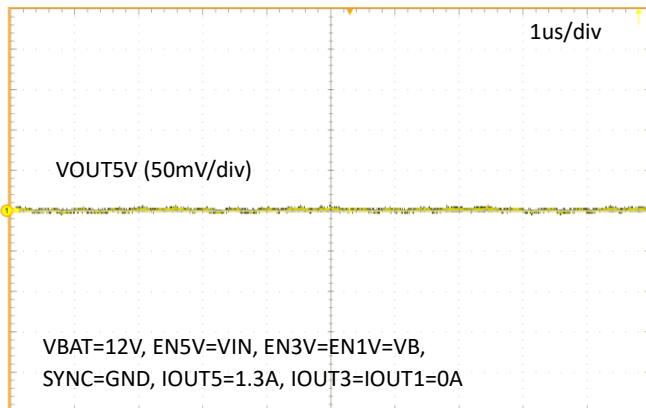


VBAT=12V, EN5V=VIN, EN3V=GND, EN1V=VB,  
 SYNC=GND, IOU5=0A, IOU1=2A



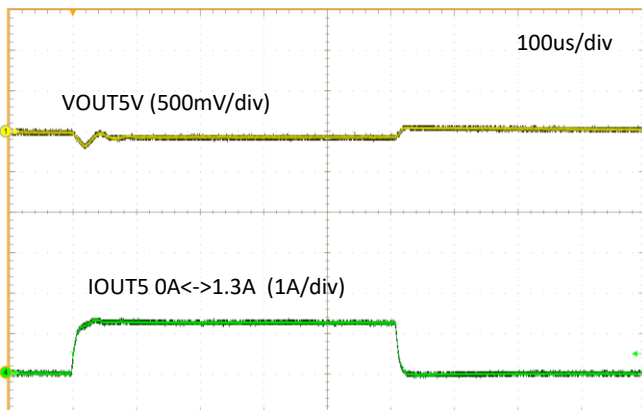
VBAT=12V, EN5V=VIN, EN3V=VB, EN1V=GND,  
 SYNC=GND, IOU5=0A, IOU3=1.9A  
 RBW:1kHz, VBW:100kHz

### 8.2.3 Output Ripple Waveform

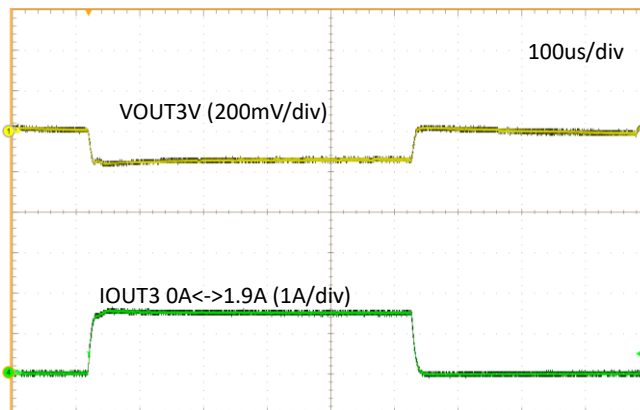


\*The output ripple waveforms were captured with probing on output capacitor terminal of each DC/DC channel.

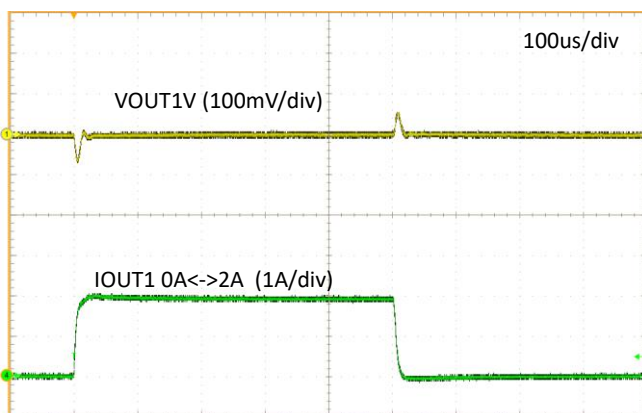
## 8.2.4 Load Transient Waveforms



VBAT=12V, EN5V=VIN, EN3V=EN1V=VB,  
 SYNC=GND, IOUT3=IOUT1=0A

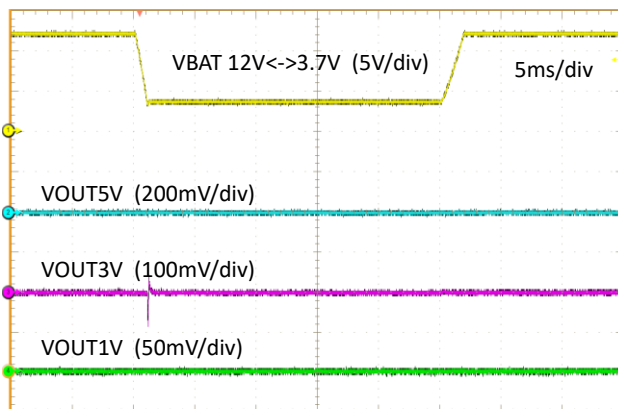


VBAT=12V, EN5V=VIN, EN3V=EN1V=VB,  
 SYNC=GND, IOUT3=IOUT1=0A

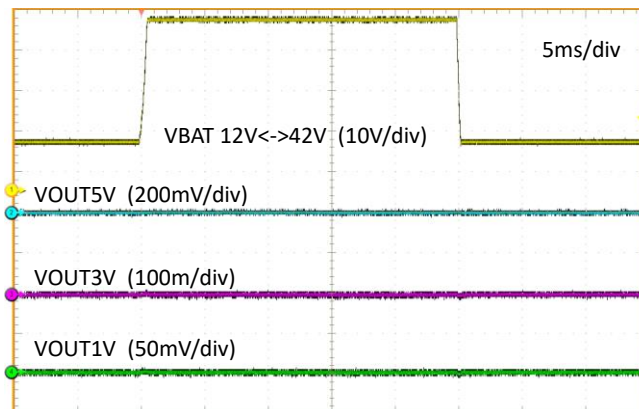


VBAT=12V, EN5V=VIN, EN3V=EN1V=VB,  
 SYNC=GND, IOUT5=IOUT3=0A

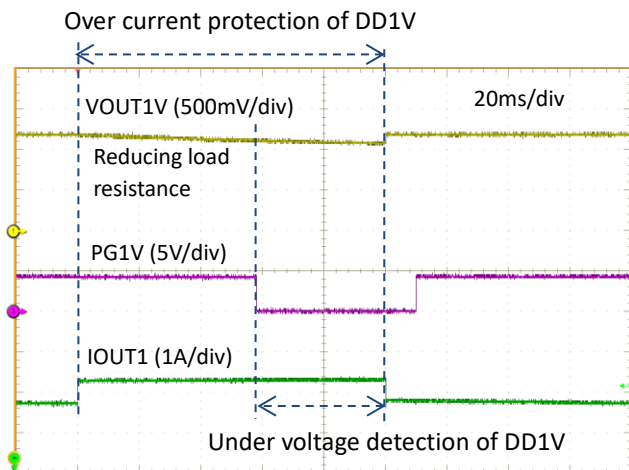
## 8.2.5 Line Transient Waveforms



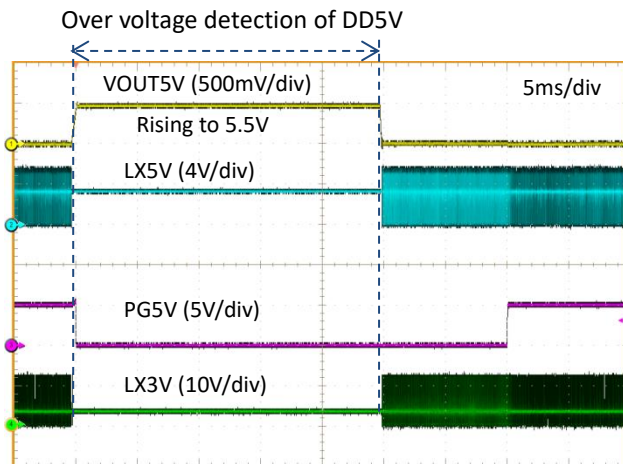
VBAT=12V, EN5V=VIN, EN3V=EN1V=VB, SYNC=GND, IOUT5=0.65A, IOUT3=0.95A, IOUT1=1A



## 8.2.6 Protection and Detection Function Waveforms



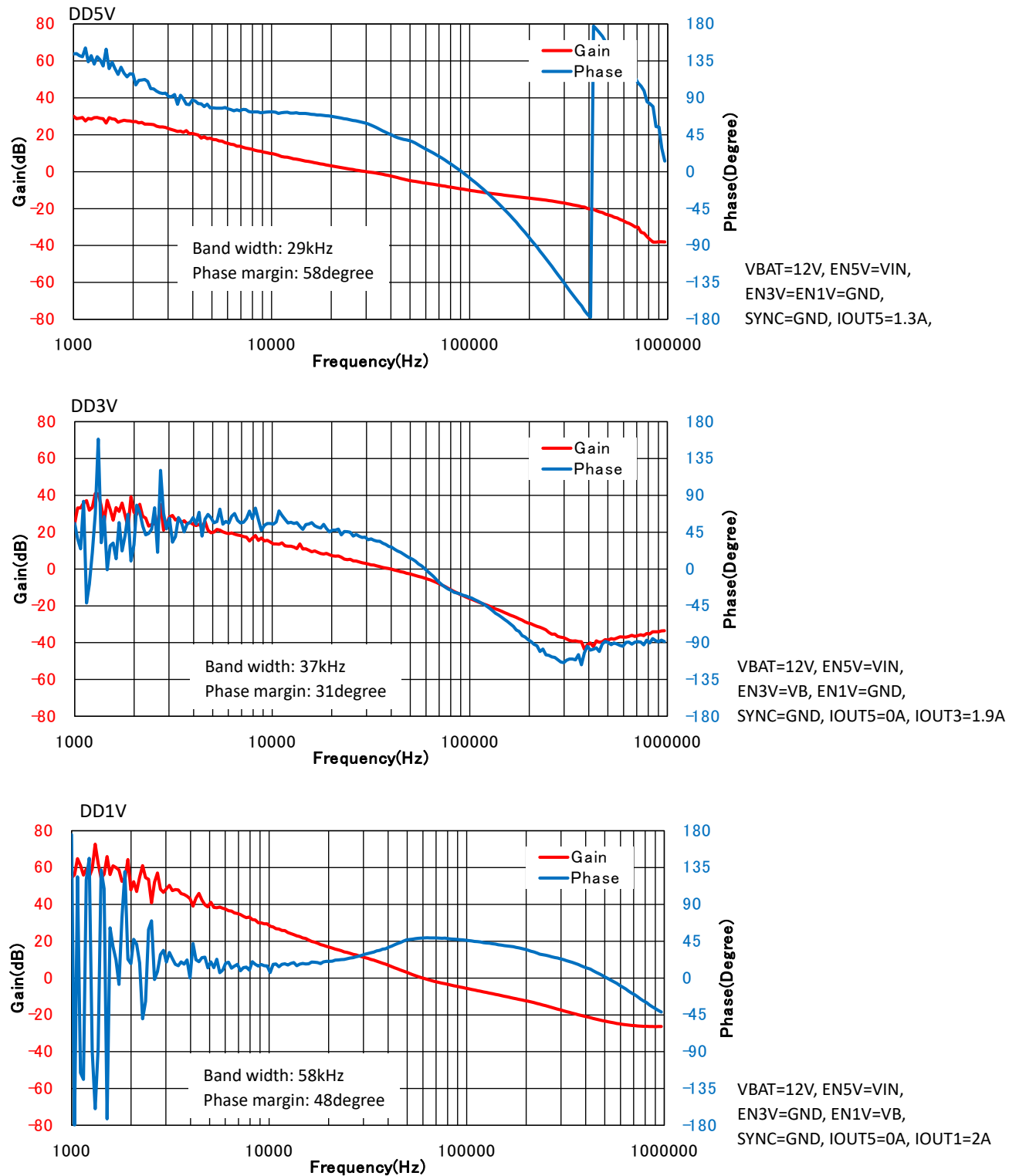
VBAT=12V, EN5V=VIN, EN3V=GND, EN1V=VB,  
 SYNC=GND, IOUT5=0A,  
 VOUT1: Connected to electronic load



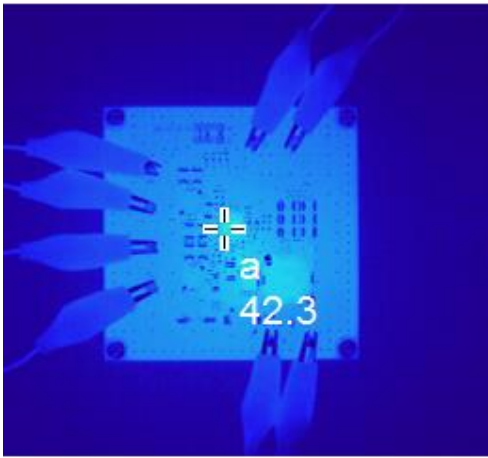
VBAT=12V, EN5V=VIN, EN3V=EN1V=GND, SYNC=GND,  
 IOUT5=100mA

## 8.3 AC Characteristics

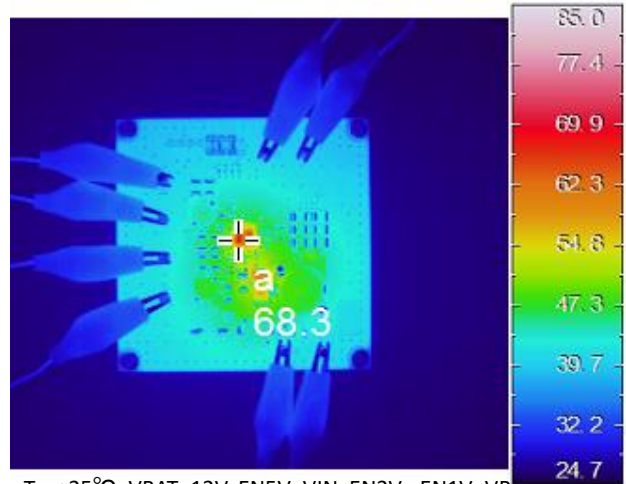
### 8.3.1 Gain-Phase Characteristics



## 8.4 Temperature

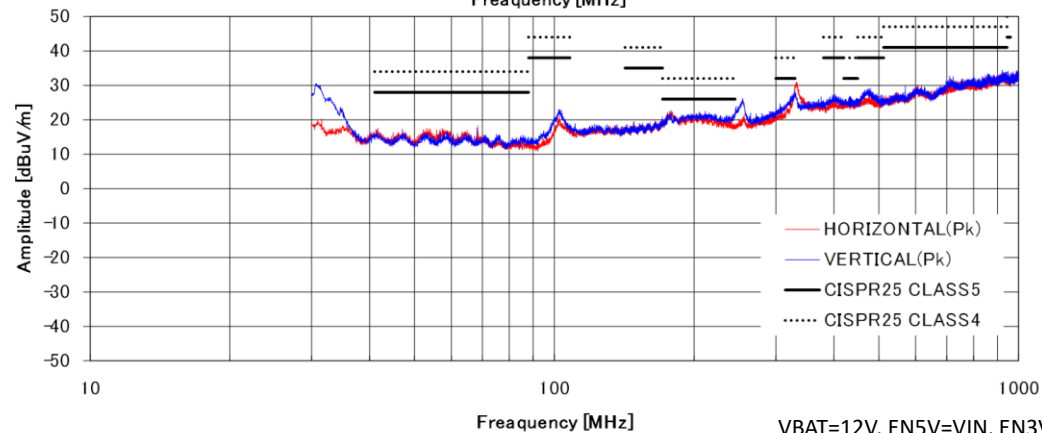
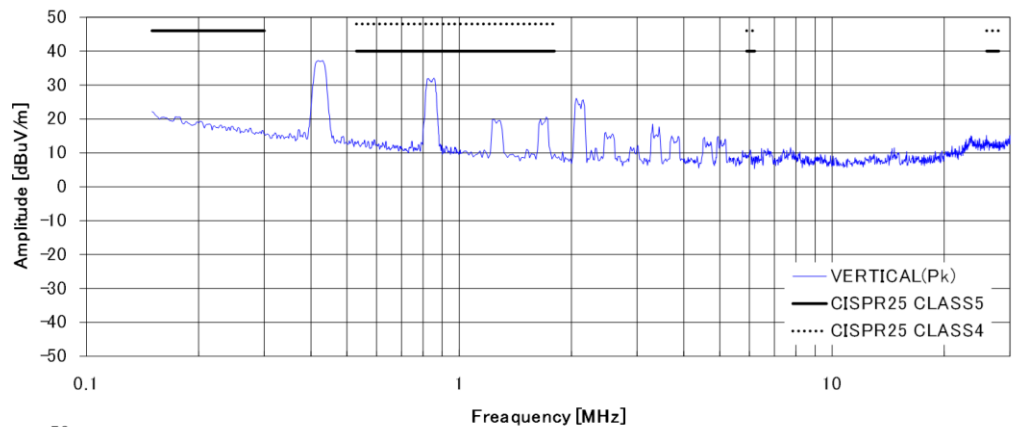


$T_A = +25^\circ\text{C}$ , VBAT=12V, EN5V=VIN, EN3V= EN1V=VB,  
 Half load: IOUT5=0.65A, IOUT3=0.95A, IOUT1=1A,  
 SYNC=GND



$T_A = +25^\circ\text{C}$ , VBAT=12V, EN5V=VIN, EN3V= EN1V=VB,  
 Full load: IOUT5=1.3A, IOUT3=1.9A, IOUT1=2A,  
 SYNC=GND

## 8.5 EMI (Radiated Emissions Example)



VBAT=12V, EN5V=VIN, EN3V= EN1V=VB,  
 IOUT5=1.3A, IOUT3=1.9A, IOUT1=2A,  
 SYNC=GND, SSCG=ON  
 Measured in ALSE

## 9. Ordering Information



Table 9-1. Ordering Information

Part Number	EVN Revision	Note
S6SBP501A00VA1001	S6SBP501A-VA1 S6SBP502A-VA1 Rev 2.0	Mounted IC: S6BP501A00SN2B000
S6SBP502A00VA1001		Mounted IC: S6BP502A00SN2B000

# Revision History



## Document Revision History

Document Title: S6SBP501A00VA1001, S6SBP502A00VA1001 Automotive PMIC Evaluation Kit Operation Guide		
Document Number: 002-08766		
Revision	Issue Date	Description of Change
**	09/25/2015	Initial release
*A	02/04/2016	Migrated Spansion guide from S6SBP501A00VA1001_SS901-00044-1v0-E to Cypress format
*B	12/20/2016	Changed VOUT1f output voltage of S6SBP501A00VA1001 Changed some compoments. Added pin socket Added Reference Data
*C	09/26/2017	Adapted Cypress new logo.
*D	09/12/2018	Sunset Review Fixed waveform names in <a href="#">8.2.4 Load Transient Waveforms</a> and <a href="#">8.2.6 Protection and Detection Function Waveforms</a> .
*E	08/19/2019	Fixed pin numbers in <a href="#">Figure 6-1</a> and C19-6 in <a href="#">Table 7-1</a> .