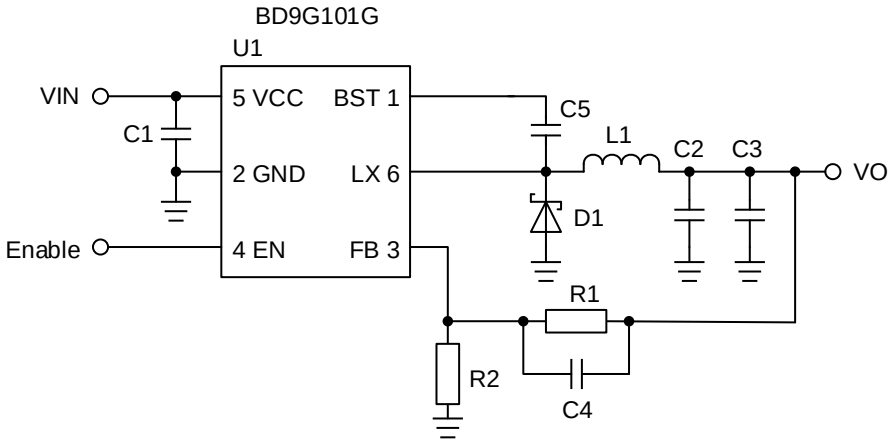
AEY59-D1-0007

DC/DC Converter Application Information

IC Product Name	BD9G101G
Topology	Buck (Step-Down) Switching Regulator
Type	Non-Isolation

	Input	Output
1	24V to 40V	3.3V, 500mA
2	20V to 30V	6.0V, 500mA
3	13V to 33V	9.0V, 500mA
4	16V to 36V	13V, 200mA
5	23V to 40V	15V, 500mA
6	28V to 42V	24V, 120mA
7	12V to 20V	-8V, 400mA
8	18V to 32V	-12V, 400mA

■ Typical Application Circuit 1



■ EN terminal setting (4-pin)

Terminal state	IC operation
2.0V to VIN	Normal operation
-0.3V to 0.8V	Power down

■ Output voltage setting

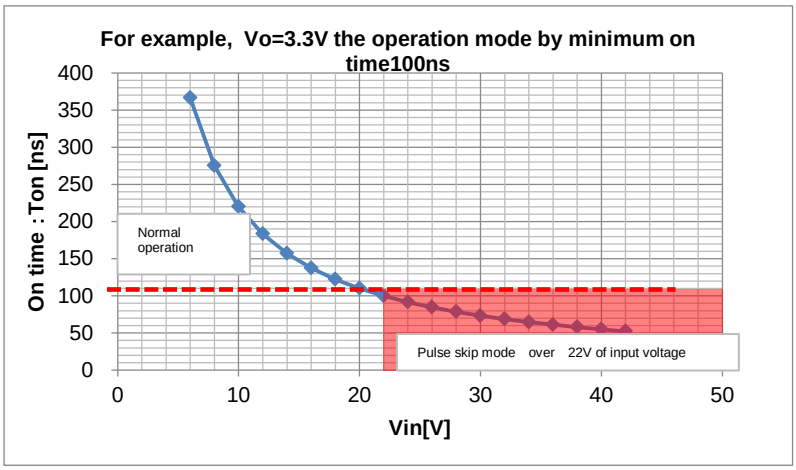
$$V_{OUT} = \frac{R_1 + R_2}{R_2} \times 0.75\ [V]$$

$$R_1 + R_2 \leq V_{OUT} \times 10^3$$

Input/output voltage conditions are required to satisfy the following equations:

$$V_{OUT} = 1V\ to\ (V_{IN} \times 0.7)V$$

The available minimum output voltage is restricted by minimum on pulse typ. 100nsec.



The available maximum output voltage is restricted by maxduty, Ron. and BST-UVLO.
BST-UVLO function restricts the maximum output voltage lower than Vin - 3V.

Bill of Materials 1

BD9G101G BOM Rev.001 V_{IN}=6.0V to 42V, I_O=0.5A October 14, 2015

1. V_O=3.3V, I_O=500mA (V_{IN}=24V to 40V)

Count	Reference Designator	Type	Value	Description	Manufacturer Part Number	Manufacturer	Configuration (mm)
1	C1	Ceramic Capacitor	4.7µF	50V, B, ±10%	GRM21BB31H475KE51	MURATA	2012
2	C2, C3	Ceramic Capacitor	47µF	10V, X5R, ±20%	GRM21BR61A476ME15	MURATA	2012
1	C4	Ceramic Capacitor	0.1µF	25V, B, ±10%	GRM155B31E104KA87	MURATA	1005
1	C5	Ceramic Capacitor	0.015µF	50V, B, ±10%	GRM188B11H153KA01	MURATA	1608
1	D1	Schottky Barrier Diode	-	VR=60V, Io=1A	RB160L-60	ROHM	5026
1	L1	Inductor	4.7µH	±20%, DCR=57.4mΩmax, 2.7A	XFL4020-472ME	Coilcraft	4040
				±20%, DCR=96.6mΩmax, 1.7A	LQH44PN4R7MP0	Murata	4040
				±30%, DCR=186mΩmax, 1.6A	LQH32PN4R7NNC	Murata	3225
				±20%, DCR=63mΩmax, 1.65A	CDRH40D28NP-4R7NC	Sumida	4040
				±20%, DCR=84mΩmax, 2.0A	NRS4018T4R7MDGJV	TAIYO YUDEN	4040
				±20%, DCR=210mΩmax, 1.1A	VLS252012CX-4R5M	TDK	2520
				±20%, DCR=126mΩmax, 1.1A	1229AS-H-4R7N=P3 (DEM3512C)	TOKO	3739
				±20%, DCR=105mΩmax, 1.75A	IHLP1616BZER4R7M1A	VISHAY	4541
				±20%, DCR=120mΩmax, 1.7A	744025004 (WE-TPC SMD)	WÜRTH	2828
1	R1	Resistor	1.6kΩ	0.063W, 50V, 1%	MCR01MZPF1601	ROHM	1005
1	R2	Resistor	470Ω	0.063W, 50V, 1%	MCR01MZPF4700	ROHM	1005
1	U1	IC	-	Buck DC/DC Converter	BD9G101G	ROHM	SSOP6

2. V_O=6.0V, I_O=500mA (V_{IN}=20V to 30V)

Count	Reference Designator	Type	Value	Description	Manufacturer Part Number	Manufacturer	Configuration (mm)
1	C1	Ceramic Capacitor	4.7µF	50V, B, ±10%	GRM32EB31H475KA87	MURATA	3225
1	C2	Ceramic Capacitor	22µF	25V, B, ±20%	GRM32EB31E226ME15	MURATA	3225
0	C3	-	n/a	-	-	-	-
1	C4	Ceramic Capacitor	0.22µF	25V, B, ±10%	GRM188B31E224KA87	MURATA	1608
1	C5	Ceramic Capacitor	0.015µF	50V, B, ±10%	GRM188B11H153KA01	MURATA	1608
1	D1	Schottky Barrier Diode	-	VR=60V, Io=1A	RB162L-60	ROHM	5026
1	L1	Inductor	6.8µH	±20%, DCR=150mΩmax, 1.3A	LPS4018-682MR	Coilcraft	4040
				±20%,DCR=186mΩmax, 0.83A	LQH3NPN6R8MMR	Murata	3030
				±20%,DCR=470mΩmax, 0.83A	LQH2HPN6R8MGR	Murata	2520
				±25%, DCR=136mΩmax, 1.52A	CDRH3D23HPNP-6R8PC	Sumida	3838
				±20%, DCR=117.6mΩmax, 1.6A	NRS4018T6R8MDGJ	TAIYO YUDEN	4040
				±20%, DCR=192mΩmax, 0.87A	NRS3015T6R8MNGH	TAIYO YUDEN	3030
				±20%, DCR=156mΩmax, 1.0A	VLS4012ET-6R8M	TDK	4040
				±20%, DCR=106mΩmax, 1.7A	1235AS-H-6R8M=P3 (DEM4518C)	TOKO	4745
				±20%, DCR=115mΩmax, 1.5A	IFSC1515AHER6R8M01	VISHAY	3838
				±20%, DCR=165mΩmax, 1.3A	744025006 (WE-TPC SMD)	WÜRTH	2828
1	R1	Resistor	2.4kΩ	R1=2.4kΩ+120Ω 0.063W, 50V, 1%	MCR01MZPF2401	ROHM	1005
1		Resistor	120Ω		MCR01MZPF1200	ROHM	1005
1	R2	Resistor	360Ω	0.063W, 50V, 1%	MCR01MZPF3600	ROHM	1005
1	U1	IC	-	Buck DC/DC Converter	BD9G101G	ROHM	SSOP6

■ Bill of Materials 1 (continued)

3. V_O=9.0V, I_O=500mA (V_{IN}=13V to 33V)

Count	Reference Designator	Type	Value	Description	Manufacturer Part Number	Manufacturer	Configuration (mm)
1	C1	Ceramic Capacitor	4.7µF	50V, B, ±10%	GRM31CB31H475KA12	MURATA	3216
1	C2	Ceramic Capacitor	22µF	16V, B, ±20%	GRM32EB31C226ME16	MURATA	3225
0	C3	-	n/a	-	-	-	-
1	C4	Ceramic Capacitor	0.22µF	25V, B, ±10%	GRM188B31E224KA87	MURATA	1608
1	C5	Ceramic Capacitor	0.015µF	50V, B, ±10%	GRM188B11H153KA01	MURATA	1608
1	D1	Schottky Barrier Diode	-	VR=60V, Io=1A	RB162L-60	ROHM	5026
1	L1	Inductor	15µH	±20%, DCR=260mΩmax, 0.94A	LPS4018-153MR	Coilcraft	4040
				±20%, DCR=96mΩmax, 1.8A	LQH5BPN150M38	Murata	4949
				±20%, DCR=133mΩmax, 3.6A	CDMC50D38T150NP-150MC	Sumida	5450
				±20%, DCR=104mΩmax, 2A	NRS5040T150MMGJV	TAIYO YUDEN	4949
				±20%, DCR=98mΩmax, 3.1A	VLS6045EX-150M	TDK	6060
				±20%, DCR=142mΩmax, 1.05A	#A915AY-150M=P3 (D53LC)	TOKO	5050
				±20%, DCR=208mΩmax, 1.6A	IHLP2020CZER150M5A	VISHAY	5552
				±20%, DCR=136.2mΩmax, 1.7A	74408943150 (WE-SPC SMD)	WÜRTH	4848
1	R1	Resistor	3.3kΩ	0.063W, 50V, 1%	MCR01MZPF3301	ROHM	1005
1	R2	Resistor	300Ω	0.063W, 50V, 1%	MCR01MZPF3000	ROHM	1005
1	U1	IC	-	Buck DC/DC Converter	BD9G101G	ROHM	SSOP6

4. V_O=13V, I_O=200mA (V_{IN}=16V to 36V)

Count	Reference Designator	Type	Value	Description	Manufacturer Part Number	Manufacturer	Configuration (mm)
1	C1	Ceramic Capacitor	4.7µF	50V, B, ±10%	GRM32EB31H475KA87	MURATA	3225
1	C2	Ceramic Capacitor	22µF	25V, B, ±10%	GRM32EB31E226KE15	MURATA	3225
0	C3	-	n/a	-	-	-	-
1	C4	Ceramic Capacitor	0.1µF	25V, B, ±10%	GRM155B31E104KA87	MURATA	1005
1	C5	Ceramic Capacitor	0.015µF	50V, B, ±10%	GRM188B11H153KA01	MURATA	1608
1	D1	Schottky Barrier Diode	-	VR=60V, Io=1A	RB162L-60	ROHM	5026
1	L1	Inductor	6.8µH	±20%, DCR=150mΩmax, 1.3A	LPS4018-682MR	Coilcraft	4040
				±20%,DCR=186mΩmax, 0.83A	LQH3NPN6R8MMR	Murata	3030
				±20%,DCR=470mΩmax, 0.83A	LQH2HPN6R8MGR	Murata	2520
				±25%, DCR=136mΩmax, 1.52A	CDRH3D23HPNP-6R8PC	Sumida	3838
				±20%, DCR=117.6mΩmax, 1.6A	NRS4018T6R8MDGJ	TAIYO YUDEN	4040
				±20%, DCR=192mΩmax, 0.87A	NRS3015T6R8MNGH	TAIYO YUDEN	3030
				±20%, DCR=156mΩmax, 1.0A	VLS4012ET-6R8M	TDK	4040
				±20%, DCR=106mΩmax, 1.7A	1235AS-H-6R8M=P3 (DEM4518C)	TOKO	4745
				±20%, DCR=115mΩmax, 1.5A	IFSC1515AHER6R8M01	VISHAY	3838
				±20%, DCR=165mΩmax, 1.3A	744025006 (WE-TPC SMD)	WÜRTH	2828
1	R1	Resistor	3.6kΩ	0.063W, 50V, 1%	MCR01MZPF3601	ROHM	1005
1	R2	Resistor	220Ω	0.063W, 50V, 1%	MCR01MZPF2200	ROHM	1005
1	U1	IC	-	Buck DC/DC Converter	BD9G101G	ROHM	SSOP6

■Bill of Materials 1 (continued)

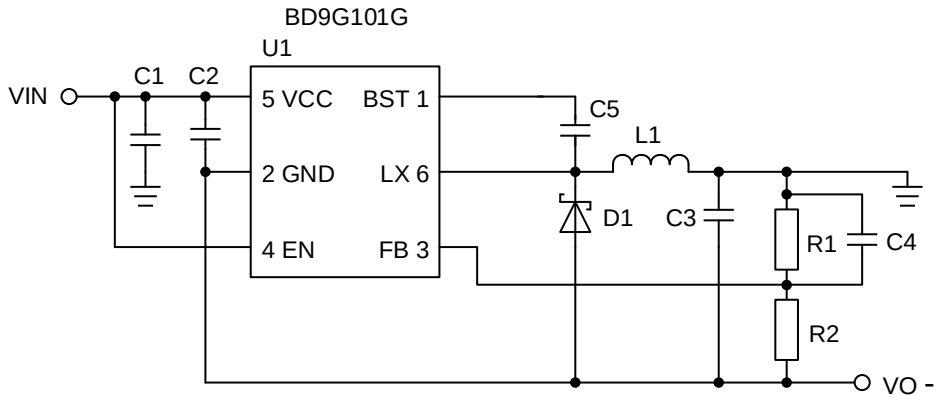
5. V_O=15V, I_O=500mA (V_{IN}=23V to 40V)

Count	Reference Designator	Type	Value	Description	Manufacturer Part Number	Manufacturer	Configuration (mm)
1	C1	Ceramic Capacitor	4.7µF	50V, B, ±10%	GRM31CB31H475KA12	MURATA	3216
1	C2	Ceramic Capacitor	22µF	25V, B, ±20%	GRM32EB31E226ME15	MURATA	3225
0	C3	-	n/a	-	-	-	-
1	C4	Ceramic Capacitor	0.1µF	25V, B, ±10%	GRM155B31E104KA87	MURATA	1005
1	C5	Ceramic Capacitor	0.015µF	50V, B, ±10%	GRM188B11H153KA01	MURATA	1608
1	D1	Schottky Barrier Diode	-	VR=60V, Io=1A	RB162L-60	ROHM	5026
1	L1	Inductor	10µH	±20%, DCR=200mΩmax, 1.3A	LPS4018-103MR	Coilcraft	4040
				±20%,DCR=354mΩmax , 1.0A	LQH32PB100MNC	Murata	3225
				±20%, DCR=252mΩmax, 0.59A	LQH3NPN100MMR	Murata	3030
				±20%, DCR=672mΩmax, 0.7A	LQH2HPN100MGR	Murata	2520
				±20%, DCR=198mΩmax, 1.28A	CDRH3D23HPNP-100MC	Sumida	3838
				±20%, DCR=180mΩmax, 1.3A	NRS4018T100MDGJ	TAIYO YUDEN	4040
				±20%, DCR=228mΩmax, 0.89A	VLS4012ET-100M	TDK	4040
				±20%, DCR=132mΩmax, 1.3A	1235AS-H-100M=P3 (DEM4518C)	TOKO	4745
				±20%, DCR=135mΩmax, 1.3A	IFSC1515AHER100M01	VISHAY	3838
				±20%, DCR=148mΩmax, 2.1A	74408942100 (WE-SPC SMD)	WÜRTH	4848
1	R1	Resistor	8.2kΩ	0.063W, 50V, 1%	MCR01MZPF8201	ROHM	1005
1	R2	Resistor	430Ω	0.063W, 50V, 1%	MCR01MZPF4300	ROHM	1005
1	U1	IC	-	Buck DC/DC Converter	BD9G101G	ROHM	SSOP6

6. V_O=24V, I_O=120mA (V_{IN}=28V to 42V)

Count	Reference Designator	Type	Value	Description	Manufacturer Part Number	Manufacturer	Configuration (mm)
1	C1	Ceramic Capacitor	4.7µF	50V, B, ±10%	GRM32EB31H475KA87	MURATA	3225
1	C2	Ceramic Capacitor	10µF	50V, B, ±10%	GRM32EB31H106KA12	MURATA	3225
0	C3	-	n/a	-	-	-	-
1	C4	Ceramic Capacitor	0.047µF	50V, B, ±10%	GRM188B11H473KA61	MURATA	1608
1	C5	Ceramic Capacitor	0.015µF	50V, B, ±10%	GRM188B11H153KA01	MURATA	1608
1	D1	Schottky Barrier Diode	-	VR=60V, Io=1A	RB160M-60	ROHM	3516
1	L1	Inductor	10µH	±20%, DCR=200mΩmax, 1.3A	LPS4018-103MR	Coilcraft	4040
				±20%,DCR=354mΩmax , 1.0A	LQH32PB100MNC	Murata	3225
				±20%, DCR=252mΩmax, 0.59A	LQH3NPN100MMR	Murata	3030
				±20%, DCR=672mΩmax, 0.7A	LQH2HPN100MGR	Murata	2520
				±20%, DCR=198mΩmax, 1.28A	CDRH3D23HPNP-100MC	Sumida	3838
				±20%, DCR=180mΩmax, 1.3A	NRS4018T100MDGJ	TAIYO YUDEN	4040
				±20%, DCR=228mΩmax, 0.89A	VLS4012ET-100M	TDK	4040
				±20%, DCR=132mΩmax, 1.3A	1235AS-H-100M=P3 (DEM4518C)	TOKO	4745
				±20%, DCR=135mΩmax, 1.3A	IFSC1515AHER100M01	VISHAY	3838
				±20%, DCR=148mΩmax, 2.1A	74408942100 (WE-SPC SMD)	WÜRTH	4848
1	R1	Resistor	22kΩ	R1=22kΩ+1.2kΩ 0.063W, 50V, 1%	MCR01MZPF2202	ROHM	1005
1		Resistor	1.2kΩ		MCR01MZPF1201	ROHM	1005
1	R2	Resistor	750Ω	0.063W, 50V, 1%	MCR01MZPF7500	ROHM	1005
1	U1	IC	-	Buck DC/DC Converter	BD9G101G	ROHM	SSOP6

■ Typical Application Circuit 2



■ Output voltage setting

$$V_{OUT} = -\frac{R_1 + R_2}{R_2} \times 0.75\ [V]$$

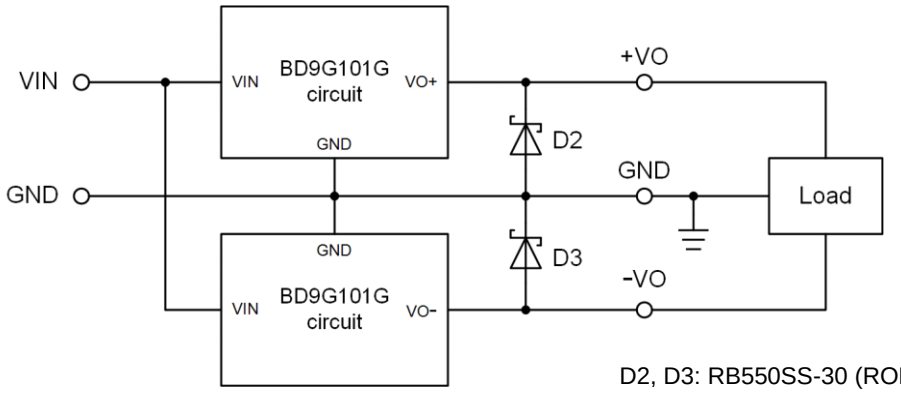
$$R_1 + R_2 \leq V_{OUT} \times 10^3$$

Input/output voltage conditions are required to satisfy the following equations:

$$V_{OUT} = -(V_{IN} \times 0.7)V\ to\ -(V_{IN} \times 0.15)V$$

$$-(V_{IN} \times 0.15) \leq -1.0V$$

$$(V_{IN} - V_{OUT}) \leq 42\text{V}$$



D2, D3: RB550SS-30 (ROHM)

If you want to use in the positive and negative power supply, Schottky barrier diode D2 and D3 is absolutely necessary. If not used, there is a possibility that the power of one side dose not rise by latching down when the power is rising.

Bill of Materials 2

7. V_O= -8.0V, I_O=400mA (V_{IN}=12V to 20V)

Count	Reference Designator	Type	Value	Description	Manufacturer Part Number	Manufacturer	Configuration (mm)
2	C1, C2	Ceramic Capacitor	4.7µF	50V, B, ±10%	GRM32EB31H475KA87	MURATA	3225
1	C3	Ceramic Capacitor	10µF	50V, B, ±10%	GRM32EB31H106KA12	MURATA	3225
1	C4	Ceramic Capacitor	0.1µF	25V, B, ±10%	GRM155B31E104KA87	MURATA	1005
1	C5	Ceramic Capacitor	0.015µF	50V, B, ±10%	GRM188B11H153KA01	MURATA	1608
1	D1	Schottky Barrier Diode	-	VR=60V, Io=1A	RB160M-60	ROHM	3516
1	L1	Inductor	15µH	±20%, DCR=260mΩmax, 0.94A	LPS4018-153MR	Coilcraft	4040
				±20%, DCR=96mΩmax, 1.8A	LQH5BPN150M38	Murata	4949
				±20%, DCR=132mΩmax, 0.95A	CDRH58D18RNP-150MC	Sumida	6060
				±20%, DCR=104mΩmax, 2A	NRS5040T150MMGJV	TAIYO YUDEN	4949
				±20%, DCR=98mΩmax, 3.1A	VLS6045EX-150M	TDK	6060
				±20%, DCR=142mΩmax, 1.05A	#A915AY-150M=P3 (D53LC)	TOKO	5050
				±20%, DCR=208mΩmax, 1.6A	IHLP2020CZER150M5A	VISHAY	5552
				±20%, DCR=136.2mΩmax, 1.7A	74408943150 (WE-SPC SMD)	WÜRTH	4848
1	R1	Resistor	6.8kΩ	R1=6.8kΩ+470Ω 0.063W, 50V, 1%	MCR01MZPF6801	ROHM	1005
1		Resistor	470Ω		MCR01MZPF4700	ROHM	1005
1	R2	Resistor	750Ω	0.063W, 50V, 1%	MCR01MZPF7500	ROHM	1005
1	U1	IC	-	Buck DC/DC Converter	BD9G101G	ROHM	SSOP6

8. V_O= -12V, I_O=400mA (V_{IN}=18V to 32V)

Count	Reference Designator	Type	Value	Description	Manufacturer Part Number	Manufacturer	Configuration (mm)
2	C1, C2	Ceramic Capacitor	4.7µF	50V, B, ±10%	GRM32EB31H475KA87	MURATA	3225
1	C3	Ceramic Capacitor	10µF	50V, B, ±10%	GRM32EB31H106KA12	MURATA	3225
1	C4	Ceramic Capacitor	0.1µF	25V, B, ±10%	GRM155B31E104KA87	MURATA	1005
1	C5	Ceramic Capacitor	0.015µF	50V, B, ±10%	GRM188B11H153KA01	MURATA	1005
1	D1	Schottky Barrier Diode	-	VR=60V, Io=1A	RB162L-60	ROHM	5026
1	L1	Inductor	15µH	±20%, DCR=260mΩmax, 0.94A	LPS4018-153MR	Coilcraft	4040
				±20%, DCR=96mΩmax, 1.8A	LQH5BPN150M38	Murata	4949
				±20%, DCR=132mΩmax, 0.95A	CDRH58D18RNP-150MC	Sumida	6060
				±20%, DCR=104mΩmax, 2A	NRS5040T150MMGJV	TAIYO YUDEN	4949
				±20%, DCR=98mΩmax, 3.1A	VLS6045EX-150M	TDK	6060
				±20%, DCR=142mΩmax, 1.05A	#A915AY-150M=P3 (D53LC)	TOKO	5050
				±20%, DCR=208mΩmax, 1.6A	IHLP2020CZER150M5A	VISHAY	5552
				±20%, DCR=136.2mΩmax, 1.7A	74408943150 (WE-SPC SMD)	WÜRTH	4848
1	R1	Resistor	7.5kΩ	R1=7.5kΩ+150Ω 0.063W, 50V, 1%	MCR01MZPF7501	ROHM	1005
1		Resistor	150Ω		MCR01MZPF1500	ROHM	1005
1	R2	Resistor	510Ω	0.063W, 50V, 1%	MCR01MZPF5100	ROHM	1005
1	U1	IC	-	Buck DC/DC Converter	BD9G101G	ROHM	SSOP6

■ Precautions for use

(1) This document provides the BOM for evaluation boards. Small parts can also be selected for resistor, capacitor, and coil.
(2) When miniaturizing a resistor, consider decrease in rated power and withstand voltage.
(3) When miniaturizing a ceramic capacitor, consider decrease in withstand voltage. In addition, the capacity may be decreased by DC bias characteristics, and the desired characteristics may not be obtained.
(4) If ceramic capacitor models differ even when they have the same capacity and withstand voltage, the capacity may be decreased by DC bias characteristics depending on the model, and desired characteristics may not be obtained. Be sure to check the DC bias characteristics.
(5) When miniaturizing a coil, consider increase in direct current resistance and decrease in rated current. An increase in DC resistance can cause a deterioration of power conversion efficiency. A decrease in rated current can saturate the coil when outputting a large current, which may deteriorate efficiency or make it impossible to obtain the desired output current.
(6) If there is a possibility that the output will short-circuit, use a coil with a rated current that is larger than the maximum IC output current. For example, even when up to 100 mA is actually used for an IC that can output 1 A, select a coil whose rated current is larger than 1 A. If a coil with a small rated current is used, it will be saturated by a large current in the event of output short-circuiting, resulting in a steep increase in output voltage. The IC may be broken down because the processing speed of the overcurrent protecting function of the IC cannot keep up with the increase in voltage.
(7) This circuit constant is the value for our evaluation board. It may be necessary to adjust the constant for the actual board. Carry out suitable evaluations.