Switching Regulator Series

BD7Fx00xxx-LB Series Reference Circuit

IC Product Name	BD7F100EFJ-LB BD7F100HFN-LB BD7F200EFJ-LB BD7F200HFN-LB
Topology	Flyback DC/DC converter
Type	Isolation

	Input	Output
1	12.0V	12.0V, 0.4A
2	12.0V	12.0V, 0.15A
3	24.0V	24.0V, 0.4A
4	24.0V	24.0V, 0.18A
5	24.0V	15.0V, 0.15A ×4ch
6	24.0V	±15.0V, 0.165A
7	24.0V	15.0V, 0.6A
8	24.0V	12.0V, 0.75A

No. 62AN142E Rev.002
Jun.2020

Lineup Table

Part No.	Output Power [W]	Input Voltage [V]	Switch Current Limit(Typ) [A]	Package
BD7F100EFJ-LB	1W at VIN=5V 5W at VIN=24V	3 to 40	1.25	HTSOP-J8
BD7F100HFN-LB				HSON8
BD7F200EFJ-LB	5W at VIN=12V 10W at VIN=24V	8 to 40	2.75	HTSOP-J8
BD7F200HFN-LB				HSON8

Application Examples

1. V_{IN}=12.0V / V_{OUT}=12.0V, I_{OUTMAX}=0.4A

Table.1 Specification of Application 1

Parameter	Symbol	Specification Value
Input Voltage	V_{IN}	12.0V
Output Voltage	V_{OUT}	12.0V
Maximum Output Current	I_{OUTMAX}	0.4A
Maximum Output Power	W_{OUTMAX}	4.8W

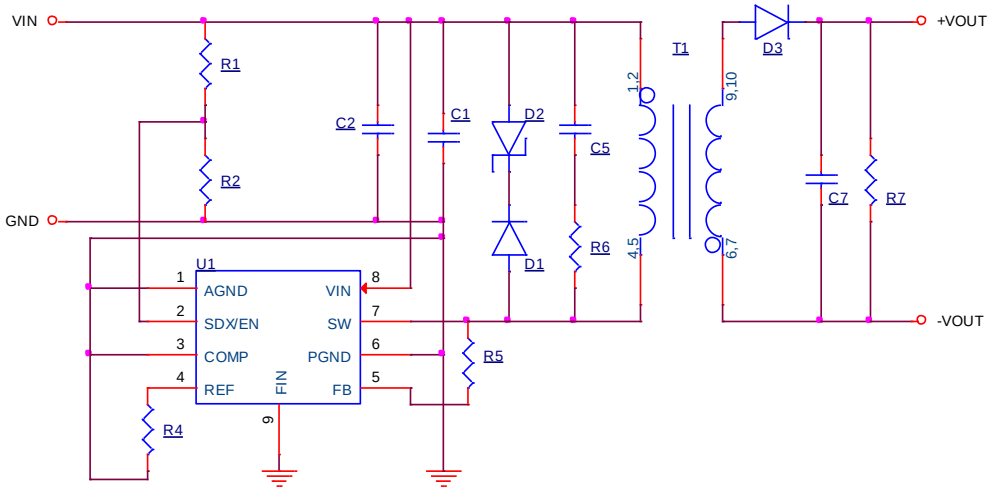

Figure 1. Application Circuit

(V_{IN}=12.0V / V_{OUT}=12.0V, I_{OUTMAX}=0.4A)

ELECTRICAL SPECIFICATIONS @ 25° C unless otherwise noted:

PARAMETER		TEST CONDITIONS	VALUE
D.C. RESISTANCE	1-4	tie(1+2,4+5), @20ºC	0.030 ohms max.
D.C. RESISTANCE	6-10	tie(6+7,9+10), @20ºC	0.067 ohms max.
INDUCTANCE	1-4	tie(1+2,4+5),10kHz, 100mV, Ls	10.00µH ±10%
LEAKAGE INDUCTANCE	1-4	tie(1+2,4+5,6+7+9+10),100kHz, 100mV, Ls	0.1µH max.
DIELECTRIC	1-10	tie(1+2,9+10), 625VAC, 1 second	500VAC, 1 minute
TURNS RATIO		(6-9):(2-4)	2:1, ±2%
TURNS RATIO		(6-9):(7-10)	1:1, ±2%
TURNS RATIO		(6-9):(1-5)	2:1, ±2%

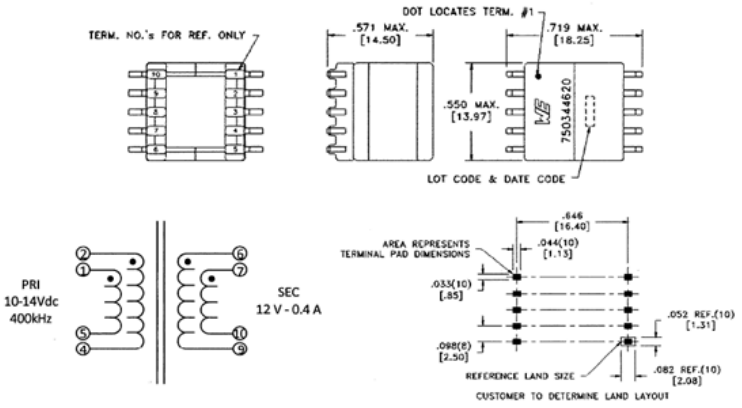

Figure 2. Specification of Transformer

(Wurth Elektronik 750344620)

Table.2 Bill of Materials

(V_{IN}=12.0V / V_{OUT}=12.0V, I_{OUTMAX}=0.4A)

No.	Value	Description	Size	Part Number / Series	Manufactuer
C1	1μF	Capacitor, Chip, 50V	-	-	-
C2	4.7μF	Capacitor, Chip, 50V	-	-	-
C5	1000pF	Capacitor, Chip, 50V	-	-	-
C7	22μF	Capacitor, Chip, 25V	-	-	-
D1	RBR1MM40A	Diode, Schottky	PMDU	RBR1MM40A	ROHM
D2	TFZVTR10B	Diode, Zener	TUMD2M	TFZVTR10B	ROHM
D3	RB160LAM-90	Diode, Schottky	PMDTM	RB160LAM-90	ROHM
R1	1MΩ	Resistor, Chip, 1/16W	-	-	-
R2	270kΩ	Resistor, Chip, 1/16W	-	-	-
R4	3.9kΩ	Resistor, Chip, 1/16W	-	-	-
R5	31.6kΩ	Resistor, Chip, 1/16W	-	-	-
R6	1kΩ	Resistor, Chip, 1/4W	-	-	-
R7	1.2kΩ	Resistor, Chip, 1/4W	-	-	-
T1	10μH	Transformer, Np:Ns=1:2, Lp±10%	13.97 x 18.25 x 14.5mm	750344620	Wurth Elektronik
U1	BD7F200EFJ	I.C. BD7F200EFJ	HTSOP-J8	BD7F200EFJ	ROHM
	BD7F200HFN	I.C. BD7F200HFN	HSON8	BD7F200HFN	ROHM

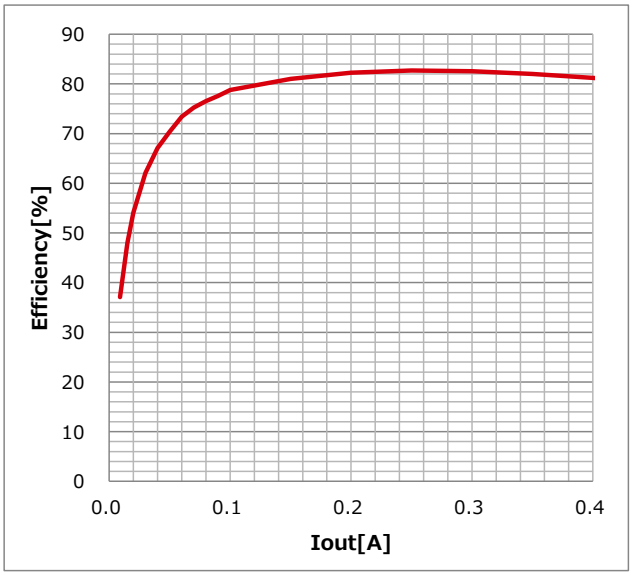

Figure 3. Efficiency vs Load Current

(V_{IN}=12.0V)

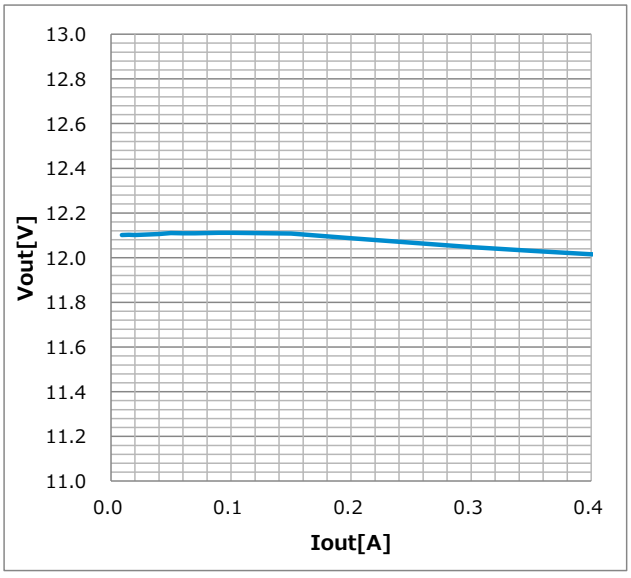

Figure 4. Load Regulation

(V_{IN}=12.0V)

2. V_{IN}=12.0V / V_{OUT}=12.0V, I_{OUTMAX}=0.15A

Table.3 Specification of Application 2

Parameter	Symbol	Specification Value
Input Voltage	V_{IN}	12.0V
Output Voltage	V_{OUT}	12.0V
Maximum Output Current	I_{OUTMAX}	0.15A
Maximum Output Power	W_{OUTMAX}	1.8W

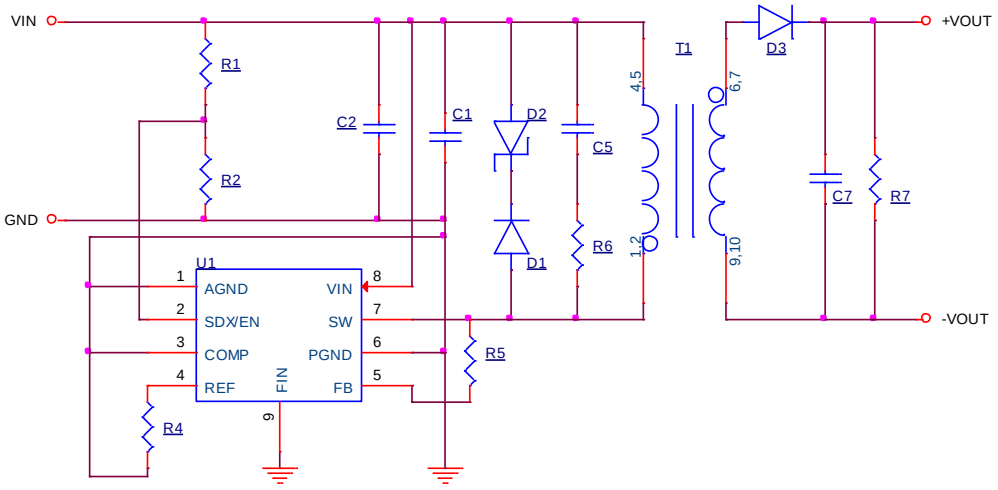

Figure 5. Application Circuit

(V_{IN}=12.0V / V_{OUT}=12.0V, I_{OUTMAX}=0.15A)

ELECTRICAL SPECIFICATIONS @ 25° C unless otherwise noted:

PARAMETER		TEST CONDITIONS	VALUE
D.C. RESISTANCE	1-4	tie(1+2,4+5), @20°C	0.05 ohms max.
D.C. RESISTANCE	6-10	tie(6+7,9+10), @20°C	0.14 ohms max.
INDUCTANCE	1-4	tie(1+2,4+5),1kHz, 1V, Ls	25.00µH ±10%
LEAKAGE INDUCTANCE	1-4	tie(1+2,4+5,6+7+9+10),100kHz, 100mV, Ls	0.1µH typ., 0.2µH max.
DIELECTRIC	1-10	tie(1+2,9+10), 625VAC, 1 second	500VAC, 1 minute
TURNS RATIO		(6-9):(2-4)	2:1, ±2%
TURNS RATIO		(7-10):(2-4)	2:1, ±2%
TURNS RATIO		(1-5):(2-4)	1:1, ±2%

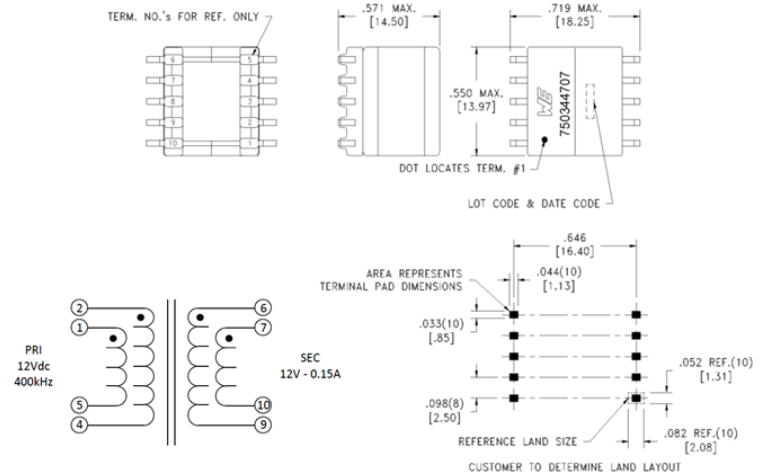

Figure 6. Specification of Transformer

(Wurth Elektronik 750344707)

Table.4 Bill of Materials

(V_{IN}=12.0V / V_{OUT}=12.0V, I_{OUTMAX}=0.15A)

No.	Value	Description	Size	Part Number / Series	Manufactuer
C1	1μF	Capacitor, Chip, 50V	-	-	-
C2	4.7μF	Capacitor, Chip, 50V	-	-	-
C5	1000pF	Capacitor, Chip, 50V	-	-	-
C7	22μF	Capacitor, Chip, 25V	-	-	-
D1	RBR1MM40A	Diode, Schottky	PMDU	RBR1MM40A	ROHM
D2	TFZVTR10B	Diode, Zener	TUMD2M	TFZVTR10B	ROHM
D3	RB160LAM-90	Diode, Schottky	PMDTM	RB160LAM-90	ROHM
R1	1MΩ	Resistor, Chip, 1/16W	-	-	-
R2	270kΩ	Resistor, Chip, 1/16W	-	-	-
R4	3.9kΩ	Resistor, Chip, 1/16W	-	-	-
R5	31.6kΩ	Resistor, Chip, 1/16W	-	-	-
R6	1kΩ	Resistor, Chip, 1/4W	-	-	-
R7	3.3kΩ	Resistor, Chip, 1/10W	-	-	-
T1	25μH	Transformer, Np:Ns=1:2, Lp±10%	13.97 x 18.25 x 14.5mm	750344707	Wurth Elektronik
U1	BD7F100EFJ	I.C. BD7F100EFJ	HTSOP-J8	BD7F100EFJ	ROHM
	BD7F100HFN	I.C. BD7F100HFN	HSON8	BD7F100HFN	ROHM

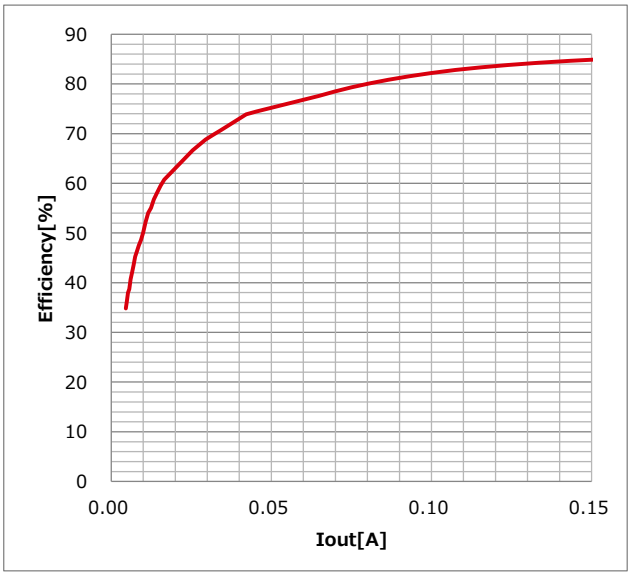

Figure 7. Efficiency vs Load Current

(V_{IN}=12.0V)

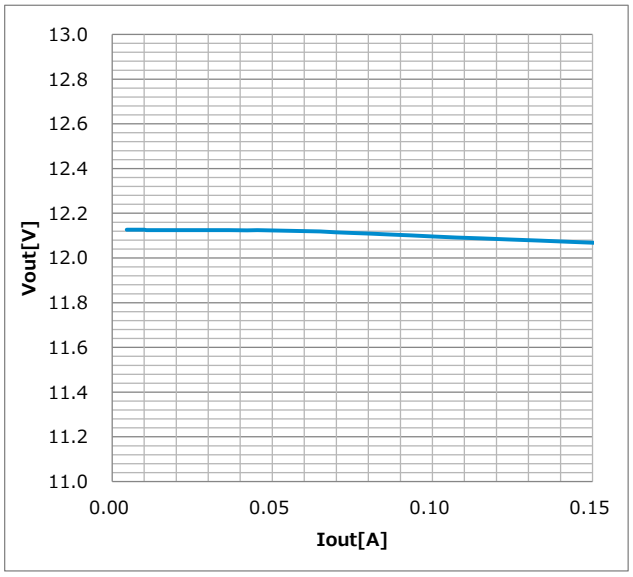

Figure 8. Load Regulation

(V_{IN}=12.0V)

3. V_{IN}=24.0V / V_{OUT}=24.0V, I_{OUTMAX}=0.4A

Table.5 Specification of Application 3

Parameter	Symbol	Specification Value
Input Voltage	V_{IN}	24.0V
Output Voltage	V_{OUT}	24.0V
Maximum Output Current	I_{OUTMAX}	0.4A
Maximum Output Power	W_{OUTMAX}	9.6W

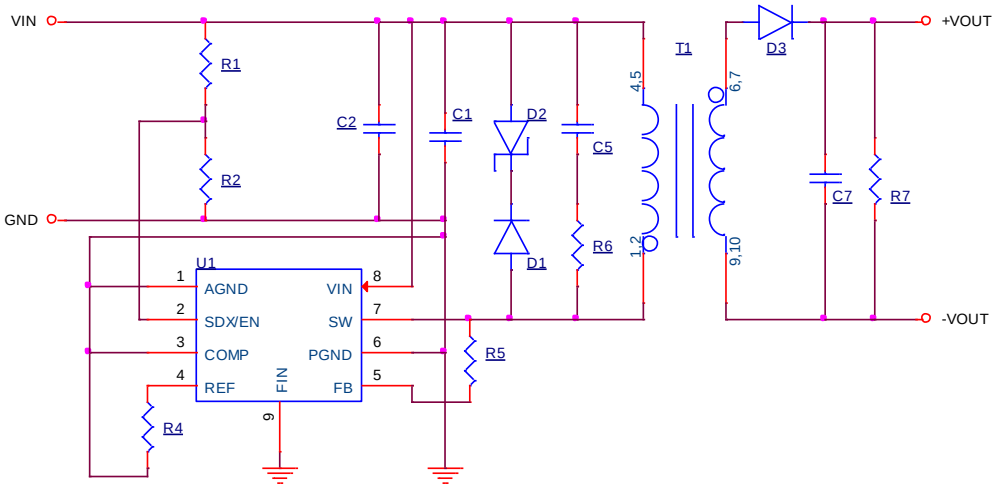

Figure 9. Application Circuit

(V_{IN}=24.0V / V_{OUT}=24.0V, I_{OUTMAX}=0.4A)

ELECTRICAL SPECIFICATIONS @ 25° C unless otherwise noted:

PARAMETER		TEST CONDITIONS	VALUE
D.C. RESISTANCE	1-4	tie(1+2,4+5), @20°C	0.05 ohms max.
D.C. RESISTANCE	6-10	tie(6+7,9+10), @20°C	0.11 ohms max.
INDUCTANCE	1-4	tie(1+2,4+5),1kHz, 1V, Ls	20.00µH ±10%
LEAKAGE INDUCTANCE	1-4	tie(1+2,4+5,6+7+9+10),100kHz, 100mV, Ls	50nH typ., 100nH max.
DIELECTRIC	1-10	tie(1+2,9+10), 625VAC, 1 second	500VAC, 1 minute
TURNS RATIO		(6-9):(2-4)	2:1, ±2%
TURNS RATIO		(7-10):(2-4)	2:1, ±2%
TURNS RATIO		(1-5):(2-4)	1:1, ±2%

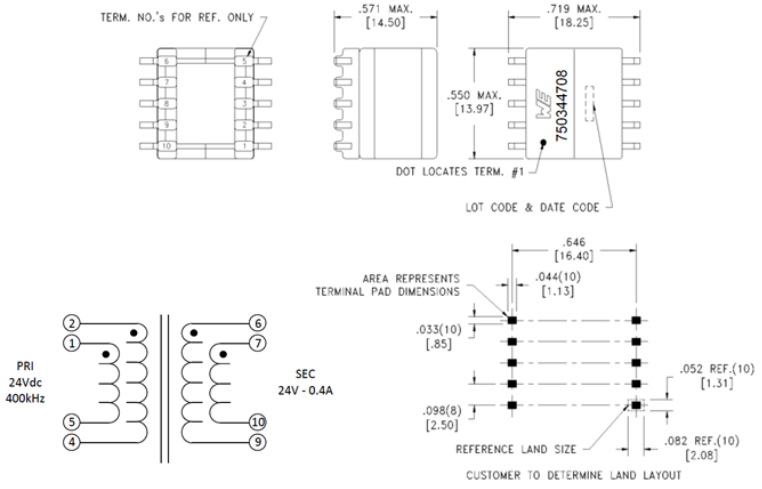

Figure 10. Specification of Transformer

(Wurth Elektronik 750344708)

Table.6 Bill of Materials

(V_{IN}=24.0V / V_{OUT}=24.0V, I_{OUTMAX}=0.4A)

No.	Value	Description	Size	Part Number / Series	Manufactuer
C1	1μF	Capacitor, Chip, 50V	-	-	-
C2	4.7μF	Capacitor, Chip, 50V	-	-	-
C5	1000pF	Capacitor, Chip, 50V	-	-	-
C7	10μF	Capacitor, Chip, 50V	-	-	-
D1	RBR1MM40A	Diode, Schottky	PMDU	RBR1MM40A	ROHM
D2	TFZVTR16B	Diode, Zener	TUMD2M	TFZVTR16B	ROHM
D3	RB168MM150	Diode, Schottky	PMDU	RB168MM150	ROHM
R1	1MΩ	Resistor, Chip, 1/16W	-	-	-
R2	120kΩ	Resistor, Chip, 1/16W	-	-	-
R4	3.9kΩ	Resistor, Chip, 1/16W	-	-	-
R5	62kΩ	Resistor, Chip, 1/16W	-	-	-
R6	1kΩ	Resistor, Chip, 2/5W	-	-	-
R7	2.7kΩ	Resistor, Chip, 1/4W	-	-	-
T1	20μH	Transformer, Np:Ns=1:2, Lp±10%	13.97 x 18.25 x 14.5mm	750344708	Wurth Elektronik
U1	BD7F200EFJ	I.C. BD7F200EFJ	HTSOP-J8	BD7F200EFJ	ROHM
	BD7F200HFN	I.C. BD7F200HFN	HSON8	BD7F200HFN	ROHM

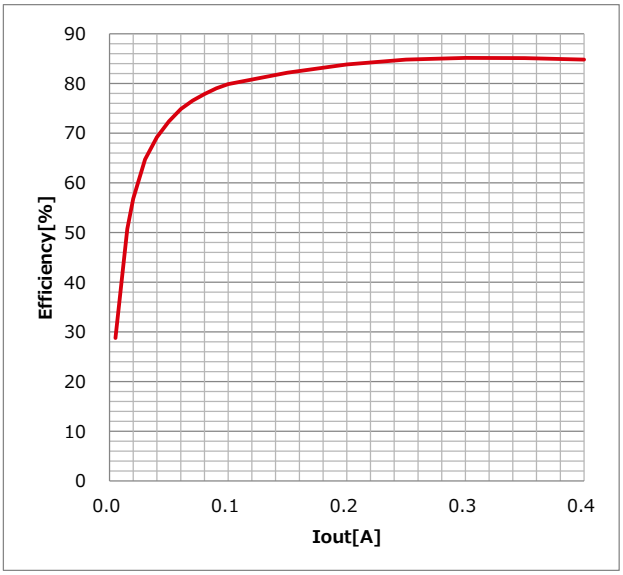

Figure 11. Efficiency vs Load Current

(V_{IN}=24.0V)

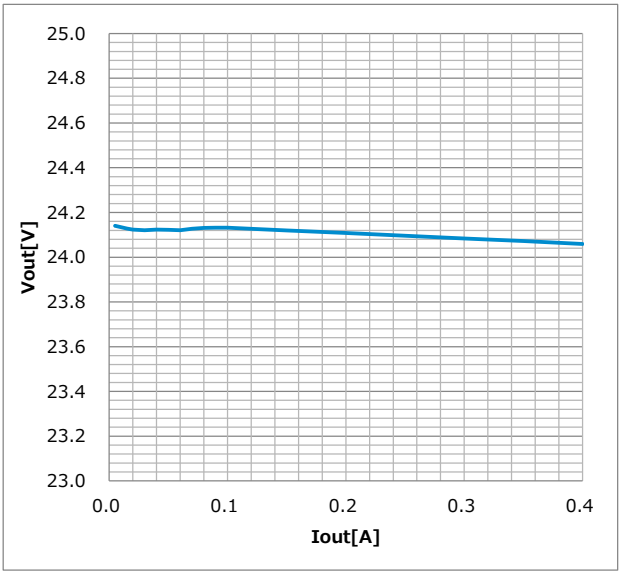

Figure 12. Load Regulation

(V_{IN}=24.0V)

4. V_{IN}=24.0V / V_{OUT}=24.0V, I_{OUTMAX}=0.18A

Table.7 Specification of Application 4

Parameter	Symbol	Specification Value
Input Voltage	V_{IN}	24.0V
Output Voltage	V_{OUT}	24.0V
Maximum Output Current	I_{OUTMAX}	0.18A
Maximum Output Power	W_{OUTMAX}	4.3W

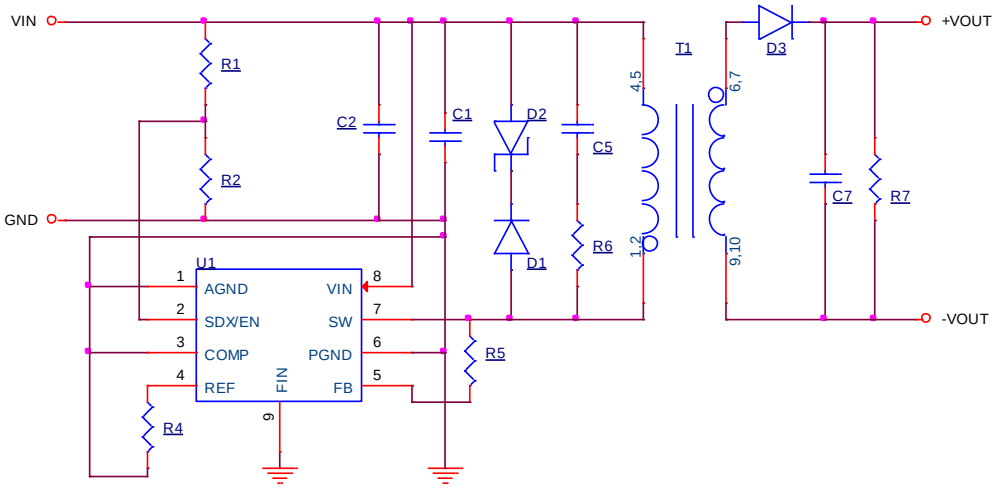

Figure 13. Application Circuit

(V_{IN}=24.0V / V_{OUT}=24.0V, I_{OUTMAX}=0.18A)

ELECTRICAL SPECIFICATIONS @ 25° C unless otherwise noted:

PARAMETER		TEST CONDITIONS	VALUE
D.C. RESISTANCE	1-4	tie(1+2,4+5), @20°C	0.06 ohms max.
D.C. RESISTANCE	6-10	tie(6+7,9+10), @20°C	0.19 ohms max.
INDUCTANCE	1-4	tie(1+2,4+5),1kHz, 1V, Ls	45.00µH ±10%
LEAKAGE INDUCTANCE	1-4	tie(1+2,4+5,6+7+9+10),100kHz, 100mV, Ls	0.09µH typ., 0.18µH max.
DIELECTRIC	1-10	tie(1+2,9+10), 625VAC, 1 second	500VAC, 1 minute
TURNS RATIO		(6-9):(2-4)	2:1, ±2%
TURNS RATIO		(7-10):(2-4)	2:1, ±2%
TURNS RATIO		(1-5):(2-4)	1:1, ±2%

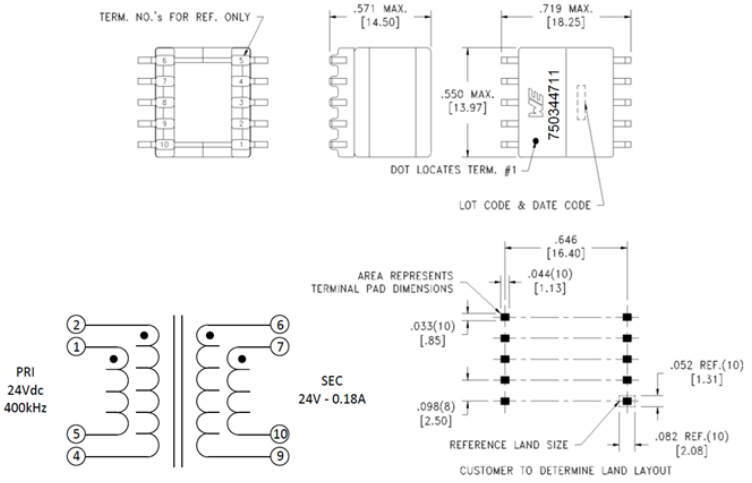

Figure 14. Specification of Transformer

(Wurth Elektronik 750344711)

Table.8 Bill of Materials

(V_{IN}=24.0V / V_{OUT}=24.0V, I_{OUTMAX}=0.18A)

No.	Value	Description	Size	Part Number / Series	Manufactuer
C1	1μF	Capacitor, Chip, 50V	-	-	-
C2	4.7μF	Capacitor, Chip, 50V	-	-	-
C5	1000pF	Capacitor, Chip, 50V	-	-	-
C7	10μF	Capacitor, Chip, 50V	-	-	-
D1	RBR1MM40A	Diode, Schottky	PMDU	RBR1MM40A	ROHM
D2	TFZVTR16B	Diode, Zener	TUMD2M	TFZVTR16B	ROHM
D3	RB168MM150	Diode, Schottky	PMDU	RB168MM150	ROHM
R1	1MΩ	Resistor, Chip, 1/16W	-	-	-
R2	120kΩ	Resistor, Chip, 1/16W	-	-	-
R4	3.9kΩ	Resistor, Chip, 1/16W	-	-	-
R5	62kΩ	Resistor, Chip, 1/16W	-	-	-
R6	1kΩ	Resistor, Chip, 2/5W	-	-	-
R7	5.6kΩ	Resistor, Chip, 1/4W	-	-	-
T1	45μH	Transformer, Np:Ns=1:2, Lp±10%	13.97 x 18.25 x 14.5mm	750344711	Wurth Elektronik
U1	BD7F100EFJ	I.C. BD7F100EFJ	HTSOP-J8	BD7F100EFJ	ROHM
	BD7F100HFN	I.C. BD7F100HFN	HSON8	BD7F100HFN	ROHM

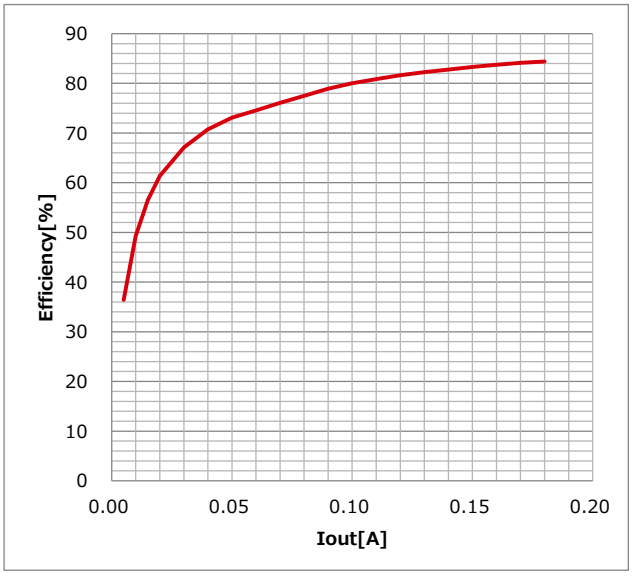

Figure 15. Efficiency vs Load Current

(V_{IN}=24.0V)

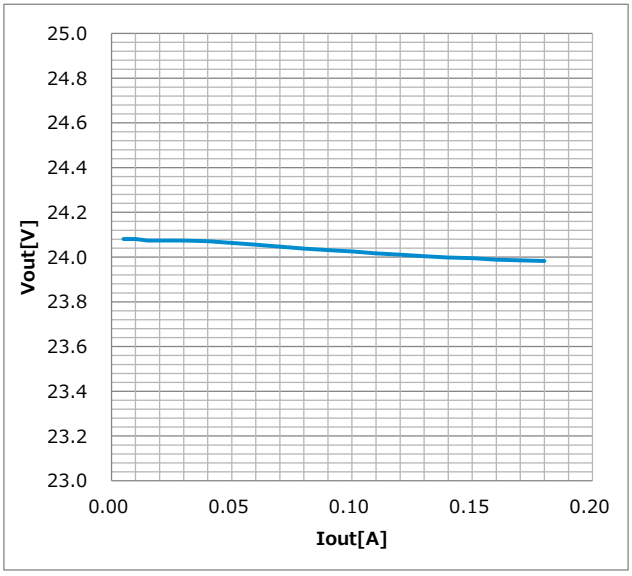

Figure 16. Load Regulation

(V_{IN}=24.0V)

5. V_{IN}=24.0V / V_{OUT1-4}=15.0V, $I_{OUT1-4MAX}$=0.15A

Table.9 Specification of Application 5

Parameter	Symbol	Specification Value
Input Voltage	V_{IN}	24.0V
Output Voltage 1-4	V_{OUT1-4}	15.0V
Maximum Output Current 1-4	$I_{OUT1-4MAX}$	0.15A
Maximum Output Power	W_{OUTMAX}	9.0W

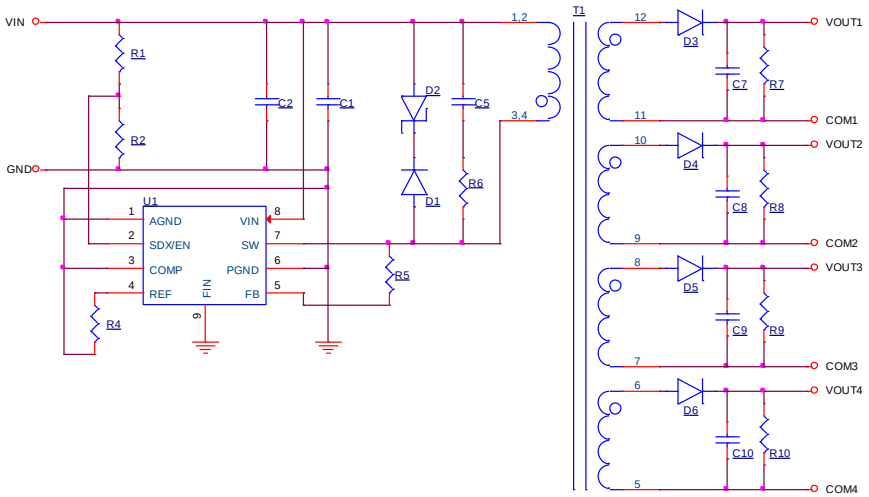

Figure 17. Application Circuit

(V_{IN}=24.0V / V_{OUT1-4}=15.0V, $I_{OUT1-4MAX}$=0.15A)

ELECTRICAL SPECIFICATIONS @ 25° C unless otherwise noted:

PARAMETER		TEST CONDITIONS	VALUE
D.C. RESISTANCE	4-1	tie(1+2,3+4), @20℃	0.105 ohms max.
D.C. RESISTANCE	12-11	@20℃	0.385 ohms max.
D.C. RESISTANCE	10-9	@20℃	0.385 ohms max.
D.C. RESISTANCE	8-7	@20℃	0.410 ohms max.
D.C. RESISTANCE	6-5	@20℃	0.425 ohms max.
INDUCTANCE	4-1	tie(1+2,3+4),10kHz, 100mV, Ls	27μH ±10%
SATURATION CURRENT	4-1	tie(1+2,3+4), 20% rolloff from initial	3A
LEAKAGE INDUCTANCE	4-1	tie(1+2,3+4,5+6+7+8+9+10+11+12),100kHz, 100mV, Ls	0.4μH max.
DIELECTRIC	1-12	tie(1+2,6+7+8+9+10+11), 625VAC, 1 second	500VAC, 1 minute
TURNS RATIO		(4-1):(12-11), tie(1+2,3+4)	1:1, ±2%
TURNS RATIO		(4-1):(10-9), tie(1+2,3+4)	1:1, ±2%
TURNS RATIO		(4-1):(8-7), tie(1+2,3+4)	1:1, ±2%
TURNS RATIO		(4-1):(6-5), tie(1+2,3+4)	1:1, ±2%

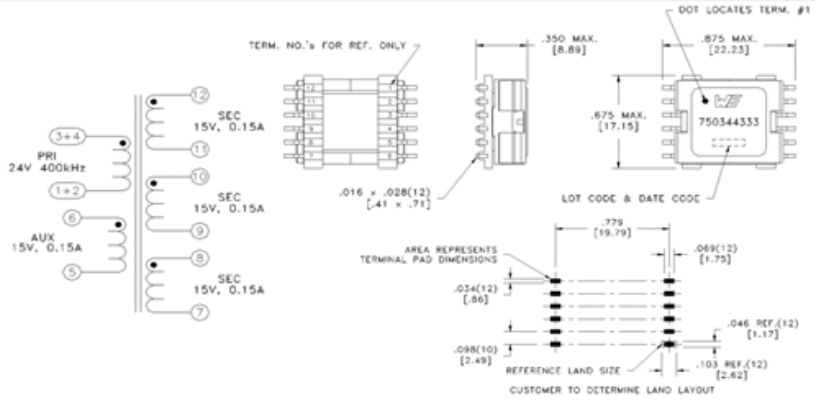

Figure 18. Specification of Transformer

(Wurth Elektronik 750344333)

Table.10 Bill of Materials

(V_{IN}=24.0V / V_{OUT1-4}=15.0V, $I_{OUT1-4MAX}$=0.15A)

No.	Value	Description	Size	Part Number / Series	Manufactuer
C1	1μF	Capacitor, Chip, 50V	-	-	-
C2	4.7μF	Capacitor, Chip, 50V	-	-	-
C5	470pF	Capacitor, Chip, 50V	-	-	-
C7	22μF	Capacitor, Chip, 25V	-	-	-
C8	22μF	Capacitor, Chip, 25V	-	-	-
C9	22μF	Capacitor, Chip, 25V	-	-	-
C10	22μF	Capacitor, Chip, 25V	-	-	-
D1	RBR1MM40A	Diode, Schottky	PMDU	RBR1MM40A	ROHM
D2	TFZVTR18B	Diode, Zener	TUMD2M	TFZVTR18B	ROHM
D3	RB160LAM-90	Diode, Schottky	PMDTM	RB160LAM-90	ROHM
D4	RB160LAM-90	Diode, Schottky	PMDTM	RB160LAM-90	ROHM
D5	RB160LAM-90	Diode, Schottky	PMDTM	RB160LAM-90	ROHM
D6	RB160LAM-90	Diode, Schottky	PMDTM	RB160LAM-90	ROHM
R1	1MΩ	Resistor, Chip, 1/16W	-	-	-
R2	120kΩ	Resistor, Chip, 1/16W	-	-	-
R4	3.9kΩ	Resistor, Chip, 1/16W	-	-	-
R5	78.7kΩ	Resistor, Chip, 1/16W	-	-	-
R6	1kΩ	Resistor, Chip, 2/5W	-	-	-
R7	3.3kΩ	Resistor, Chip, 1/10W	-	-	-
R8	3.3kΩ	Resistor, Chip, 1/10W	-	-	-
R9	3.3kΩ	Resistor, Chip, 1/10W	-	-	-
R10	3.3kΩ	Resistor, Chip, 1/10W	-	-	-
T1	27μH	Transformer, Lp±10% Np:Ns1:Ns2:Ns3:Ns4=1:1:1:1:1	17.15 x 22.23 x 8.89mm	750344333	Wurth Elektronik
U1	BD7F200EFJ	I.C. BD7F200EFJ	HTSOP-J8	BD7F200EFJ	ROHM
	BD7F200HFN	I.C. BD7F200HFN	HSON8	BD7F200HFN	ROHM

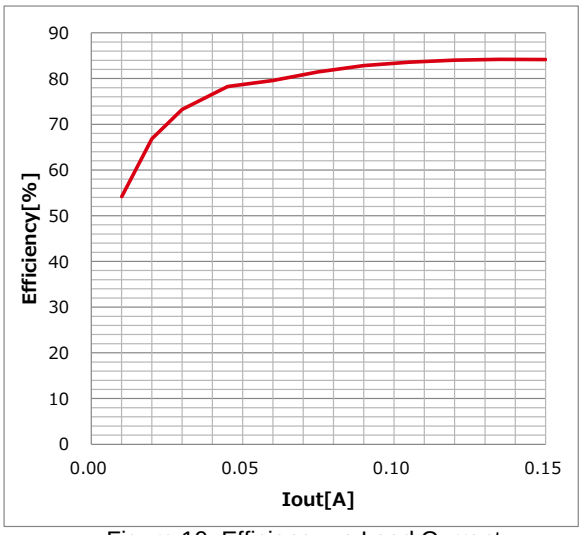

Figure 19. Efficiency vs Load Current

(V_{IN}=24.0V, I_{OUT}=I_{OUT1}=I_{OUT2}=I_{OUT3}=I_{OUT4})

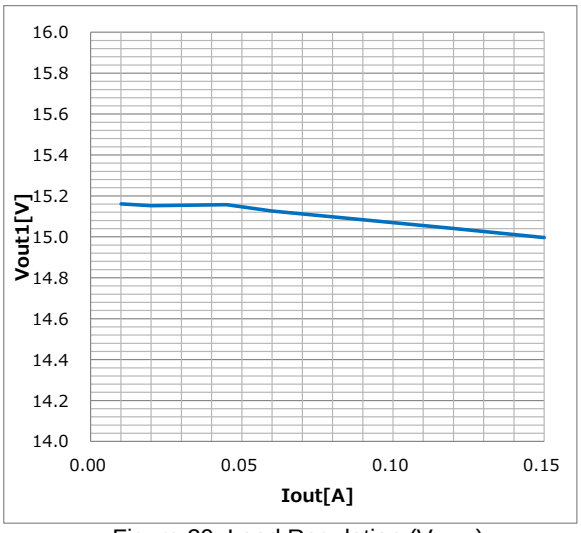

Figure 20. Load Regulation (V_{OUT1})

(V_{IN}=24.0V, I_{OUT}=I_{OUT1}=I_{OUT2}=I_{OUT3}=I_{OUT4})

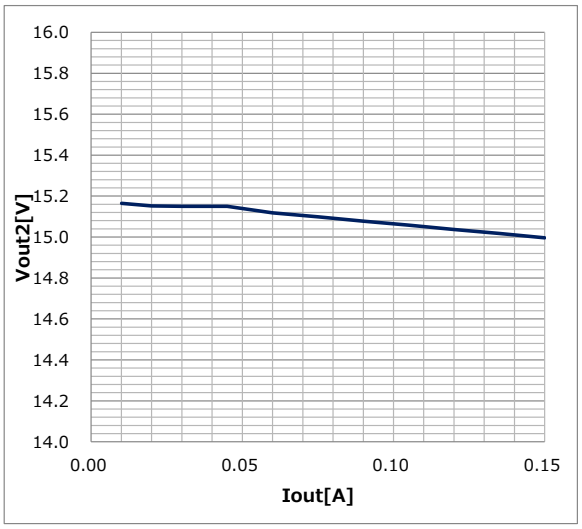

Figure 21. Load Regulation (V_{OUT2})

(V_{IN}=24.0V, I_{OUT}=I_{OUT1}=I_{OUT2}=I_{OUT3}=I_{OUT4})

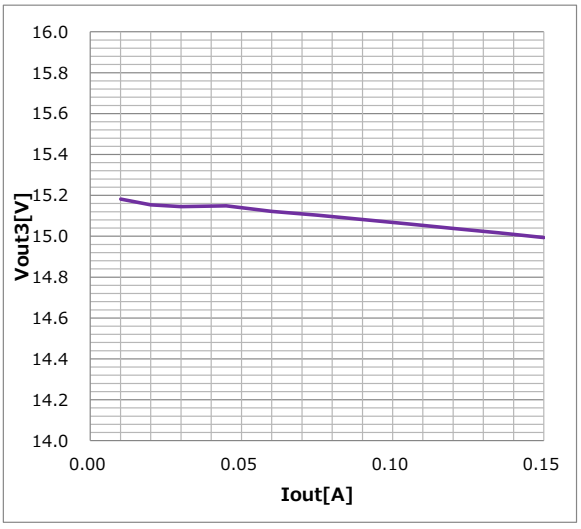

Figure 22. Load Regulation (V_{OUT3})

(V_{IN}=24.0V, I_{OUT}=I_{OUT1}=I_{OUT2}=I_{OUT3}=I_{OUT4})

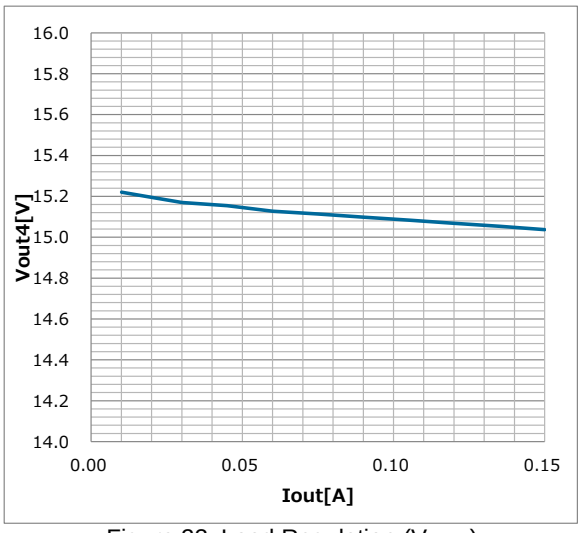

Figure 23. Load Regulation (V_{OUT4})

(V_{IN}=24.0V, I_{OUT}=I_{OUT1}=I_{OUT2}=I_{OUT3}=I_{OUT4})

6. V_{IN}=24.0V / V_{OUT1}=15.0V, $I_{OUT1MAX}$=0.165A, V_{OUT2}=-15.0V, $I_{OUT2MAX}$=0.165A

Table.11 Specification of Application 6

Parameter	Symbol	Specification Value
Input Voltage	V_{IN}	24.0V
Output Voltage 1	V_{OUT1}	15.0V
Output Voltage 2	V_{OUT2}	-15.0V
Maximum Output Current 1	$I_{OUT1MAX}$	0.165A
Maximum Output Current 2	$I_{OUT2MAX}$	0.165A
Maximum Output Power	W_{OUTMAX}	5.0W

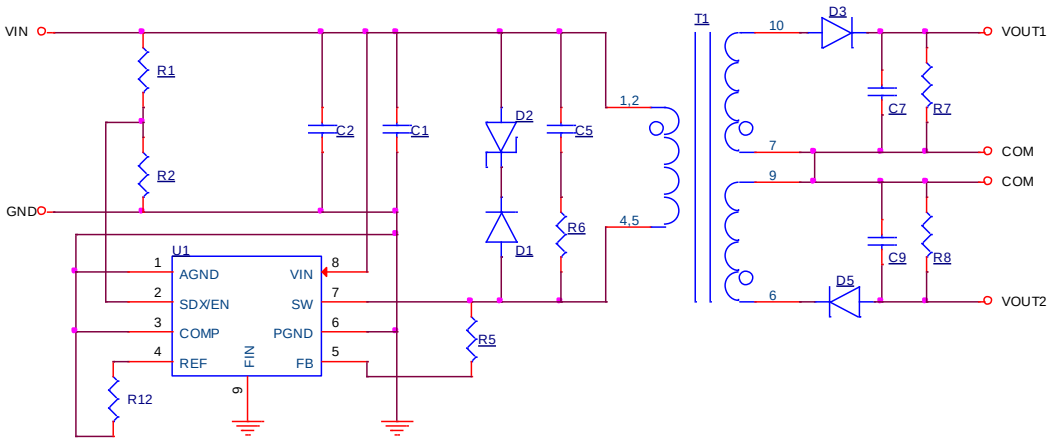

Figure 24. Application Circuit

(V_{IN}=24.0V / V_{OUT1}=15.0V, $I_{OUT1MAX}$=0.165A, V_{OUT2}=-15.0V, $I_{OUT2MAX}$=0.165A)

ELECTRICAL SPECIFICATIONS @ 25°C unless otherwise noted:

PARAMETER		TEST CONDITIONS	VALUE
D.C. RESISTANCE	1–4	tie(1+2, 4+5), @20°C	0.123 ohms max.
D.C. RESISTANCE	6–9	@20°C	0.250 ohms max.
D.C. RESISTANCE	7–10	@20°C	0.250 ohms max.
INDUCTANCE	1–4	tie(1+2, 4+5), 1kHz, 1VAC, Ls	50.00uH ±20%
LEAKAGE INDUCTANCE	1–4	tie(1+2, 4+5, 6+7+9+10), 100kHz, 100mVAC, Ls	0.8uH max.
DIELECTRIC	1–10	tie(1+2, 9+10), 625VAC, 2 seconds	500VAC, 1 minute
TURNS RATIO		(2–4):(6–9)	1:1, ±2%
TURNS RATIO		(2–4):(7–10)	1:1, ±2%
TURNS RATIO		(2–4):(1–5)	1:1, ±2%

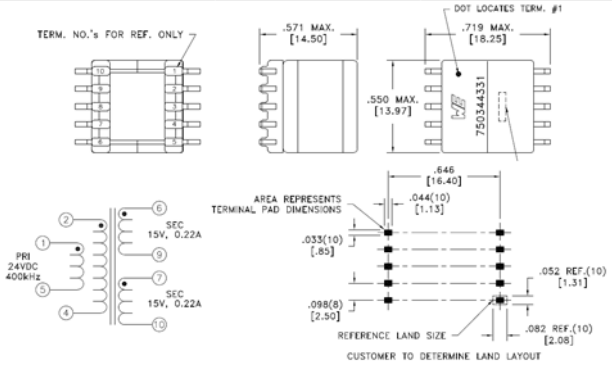

Figure 25. Specification of Transformer

(Wurth Elektronik 750344331)

Table.12 Bill of Materials

(V_{IN}=24.0V / V_{OUT1}=15.0V, $I_{OUT1MAX}$=0.165A, V_{OUT2}=-15.0V, $I_{OUT2MAX}$=0.165A)

No.	Value	Description	Size	Part Number / Series	Manufactuer
C1	1μF	Capacitor, Chip, 50V	-	-	-
C2	4.7μF	Capacitor, Chip, 50V	-	-	-
C5	4700pF	Capacitor, Chip, 50V	-	-	-
C7	10μF	Capacitor, Chip, 25V	-	-	-
C9	10μF	Capacitor, Chip, 25V	-	-	-
D1	RBR1MM40A	Diode, Schottky	PMDU	RBR1MM40A	ROHM
D2	TFZVTR18B	Diode, Zener	TUMD2M	TFZVTR18B	ROHM
D3	RB160LAM-90	Diode, Schottky	PMDTM	RB160LAM-90	ROHM
D5	RB160LAM-90	Diode, Schottky	PMDTM	RB160LAM-90	ROHM
R1	1MΩ	Resistor, Chip, 1/16W	-	-	-
R2	120kΩ	Resistor, Chip, 1/16W	-	-	-
R4	3.9kΩ	Resistor, Chip, 1/16W	-	-	-
R5	76.8kΩ	Resistor, Chip, 1/16W	-	-	-
R6	1kΩ	Resistor, Chip, 2/5W	-	-	-
R7	4.7 kΩ	Resistor, Chip, 1/10W	-	-	-
R8	4.7 kΩ	Resistor, Chip, 1/10W	-	-	-
T1	50μH	Transformer, Np:Ns=1:1:1, Lp±20%	13.97 x 18.25 x 14.5mm	750344331	Wurth Elektronik
U1	BD7F100EFJ	I.C. BD7F100EFJ	HTSOP-J8	BD7F100EFJ	ROHM
	BD7F100HFN	I.C. BD7F100HFN	HSON8	BD7F100HFN	ROHM

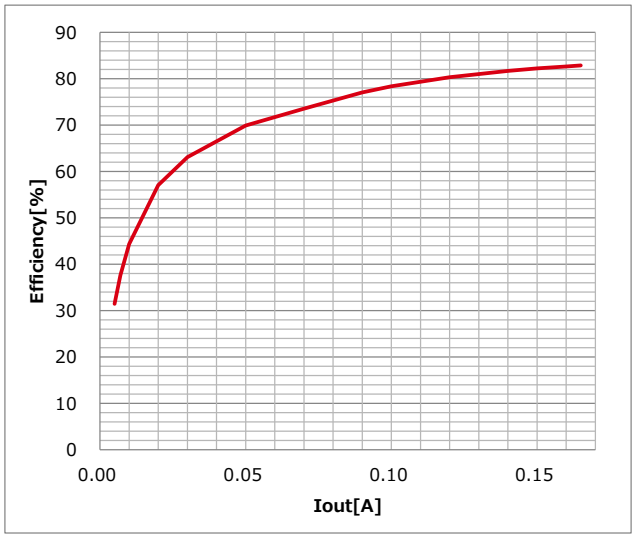

Figure 26. Efficiency vs Load Current
(V_{IN}=24.0V, I_{OUT}=I_{OUT1}=I_{OUT2})

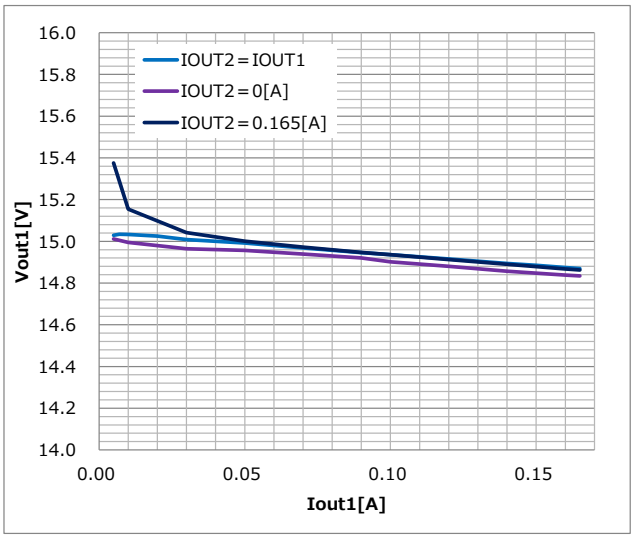

Figure 27. Load Regulation (V_{OUT1})
(V_{IN}=24.0V)

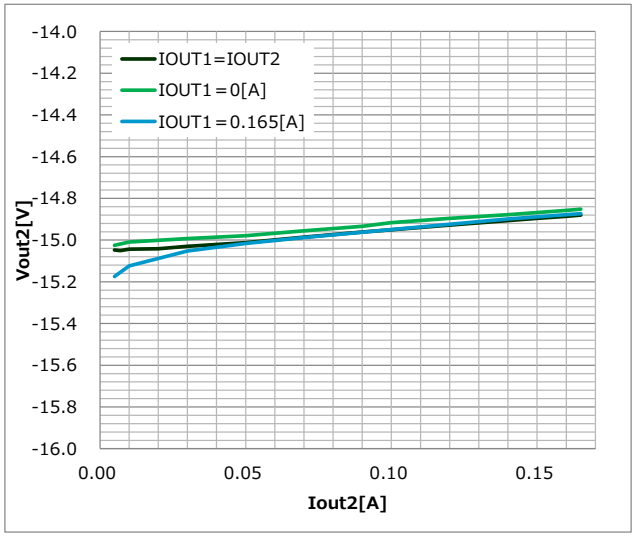

Figure 28. Load Regulation (V_{OUT2})
(V_{IN}=24.0V)

7. V_{IN}=24.0V / V_{OUT}=15.0V, I_{OUTMAX}=0.6A

Table.13 Specification of Application 7

Parameter	Symbol	Specification Value
Input Voltage	V_{IN}	24.0V
Output Voltage	V_{OUT}	15.0V
Maximum Output Current	I_{OUTMAX}	0.6A
Maximum Output Power	W_{OUTMAX}	9.0W

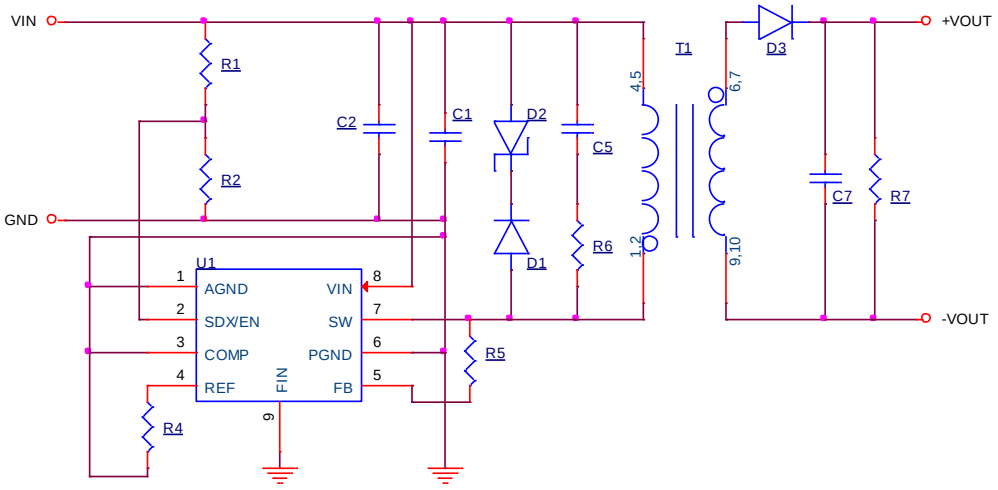

Figure 29. Application Circuit

(V_{IN}=24.0V / V_{OUT}=15.0V, I_{OUTMAX}=0.6A)

ELECTRICAL SPECIFICATIONS @ 25° C unless otherwise noted:

PARAMETER		TEST CONDITIONS	VALUE
D.C. RESISTANCE	1-4	tie(1+2,4+5), @20°C	0.05 ohms max.
D.C. RESISTANCE	6-10	tie(6+7,9+10), @20°C	0.05 ohms max.
INDUCTANCE	1-4	tie(1+2,4+5),1kHz, 1V, Ls	25.00µH ±10%
LEAKAGE INDUCTANCE	1-4	tie(1+2,4+5,6+7+9+10),100kHz, 100mV, Ls	0.1µH typ., 0.2µH max.
DIELECTRIC	1-10	tie(1+2,9+10), 625VAC, 1 second	500VAC, 1 minute
TURNS RATIO		(6-9):(2-4)	1:1, ±2%
TURNS RATIO		(7-10):(2-4)	1:1, ±2%
TURNS RATIO		(1-5):(2-4)	1:1, ±2%

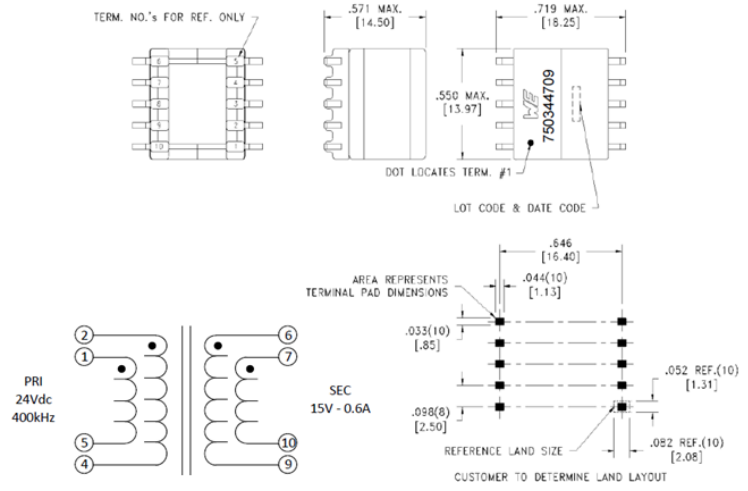

Figure 30. Specification of Transformer

(Wurth Elektronik 750344709)

Table.14 Bill of Materials

(V_{IN}=24.0V / V_{OUT}=15.0V, I_{OUTMAX}=0.6A)

No.	Value	Description	Size	Part Number / Series	Manufactuer
C1	1μF	Capacitor, Chip, 50V	-	-	-
C2	10μF	Capacitor, Chip, 50V	-	-	-
C5	1000pF	Capacitor, Chip, 50V	-	-	-
C7	22μF	Capacitor, Chip, 50V	-	-	-
D1	RBR1MM40A	Diode, Schottky	PMDU	RBR1MM40A	ROHM
D2	TFZVTR18B	Diode, Zener	TUMD2M	TFZVTR18B	ROHM
D3	RB160LAM-90	Diode, Schottky	PMDTM	RB160LAM-90	ROHM
R1	1MΩ	Resistor, Chip, 1/16W	-	-	-
R2	120kΩ	Resistor, Chip, 1/16W	-	-	-
R4	3.9kΩ	Resistor, Chip, 1/16W	-	-	-
R5	78.7kΩ	Resistor, Chip, 1/16W	-	-	-
R6	1kΩ	Resistor, Chip, 2/5W	-	-	-
R7	1.2kΩ	Resistor, Chip, 1/4W	-	-	-
T1	25μH	Transformer, Np:Ns=1:1, Lp±10%	13.97 x 18.25 x 14.5mm	750344709	Wurth Elektronik
U1	BD7F200EFJ	I.C. BD7F200EFJ	HTSOP-J8	BD7F200EFJ	ROHM
	BD7F200HFN	I.C. BD7F200HFN	HSON8	BD7F200HFN	ROHM

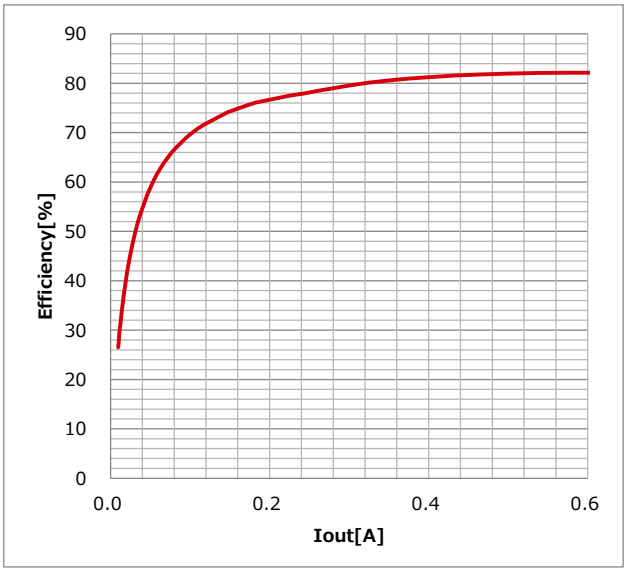

Figure 31. Efficiency vs Load Current

(V_{IN}=24.0V)

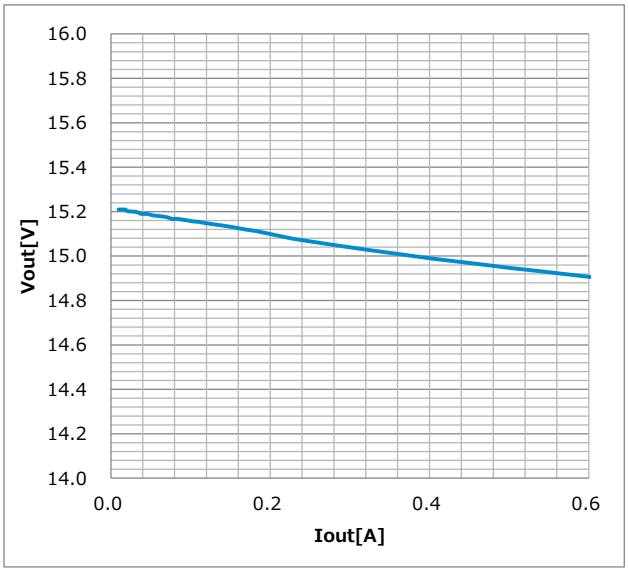

Figure 32. Load Regulation

(V_{IN}=24.0V)

8. V_{IN}=24.0V / V_{OUT}=12.0V, I_{OUTMAX}=0.75A

Table.15 Specification of Application 8

Parameter	Symbol	Specification Value
Input Voltage	V_{IN}	24.0V
Output Voltage	V_{OUT}	12.0V
Maximum Output Current	I_{OUTMAX}	0.75A
Maximum Output Power	W_{OUTMAX}	9.0W

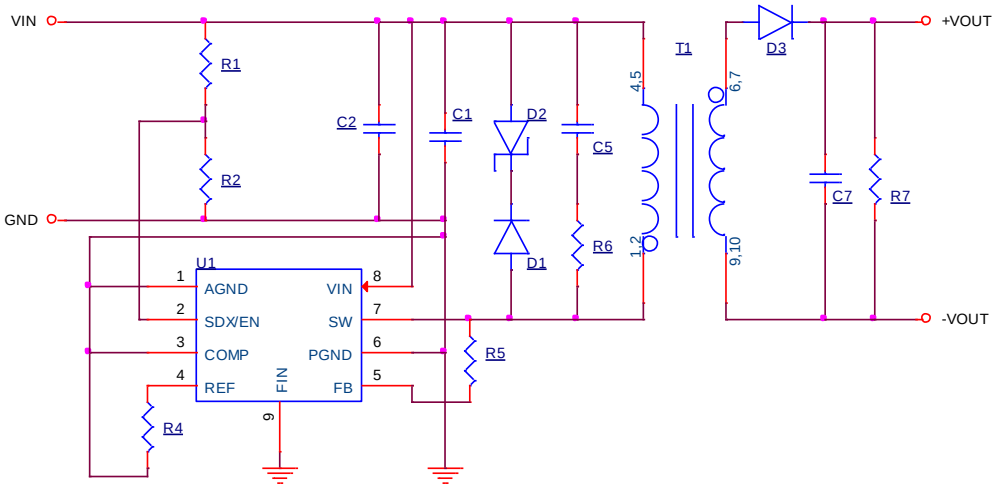

Figure 33. Application Circuit

(V_{IN}=24.0V / V_{OUT}=12.0V, I_{OUTMAX}=0.75A)

ELECTRICAL SPECIFICATIONS @ 25° C unless otherwise noted:

PARAMETER		TEST CONDITIONS	VALUE
D.C. RESISTANCE	1-4	tie(1+2,4+5), @20°C	0.05 ohms max.
D.C. RESISTANCE	6-10	tie(6+7,9+10), @20°C	0.05 ohms max.
INDUCTANCE	1-4	tie(1+2,4+5),1kHz, 1V, Ls	20.00µH ±10%
LEAKAGE INDUCTANCE	1-4	tie(1+2,4+5,6+7+9+10),100kHz, 100mV, Ls	0.06µH typ., 0.15µH max.
DIELECTRIC	1-10	tie(1+2,9+10), 625VAC, 1 second	500VAC, 1 minute
TURNS RATIO		(6-9):(2-4)	1:1, ±2%
TURNS RATIO		(7-10):(2-4)	1:1, ±2%
TURNS RATIO		(1-5):(2-4)	1:1, ±2%

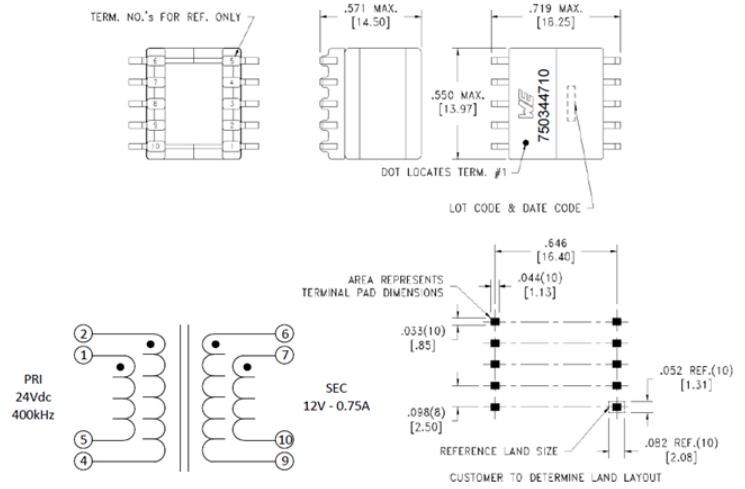

Figure 34. Specification of Transformer

(Wurth Elektronik 750344710)

Table.16 Bill of Materials

(V_{IN}=24.0V / V_{OUT}=12.0V, I_{OUTMAX}=0.75A)

No.	Value	Description	Size	Part Number / Series	Manufactuer
C1	1μF	Capacitor, Chip, 50V	-	-	-
C2	10μF	Capacitor, Chip, 50V	-	-	-
C5	1000pF	Capacitor, Chip, 50V	-	-	-
C7	22μF	Capacitor, Chip, 25V	-	-	-
D1	RBR1MM40A	Diode, Schottky	PMDU	RBR1MM40A	ROHM
D2	TFZVTR18B	Diode, Zener	TUMD2M	TFZVTR18B	ROHM
D3	RB160LAM-90	Diode, Schottky	PMDTM	RB160LAM-90	ROHM
R1	1MΩ	Resistor, Chip, 1/16W	-	-	-
R2	120kΩ	Resistor, Chip, 1/16W	-	-	-
R4	3.9kΩ	Resistor, Chip, 1/16W	-	-	-
R5	63.4kΩ	Resistor, Chip, 1/16W	-	-	-
R6	1kΩ	Resistor, Chip, 2/5W	-	-	-
R7	680Ω	Resistor, Chip, 1/4W	-	-	-
T1	20μH	Transformer, Np:Ns=1:1, Lp±10%	13.97 x 18.25 x 14.5mm	750344710	Wurth Elektronik
U1	BD7F200EFJ	I.C. BD7F200EFJ	HTSOP-J8	BD7F200EFJ	ROHM
	BD7F200HFN	I.C. BD7F200HFN	HSON8	BD7F200HFN	ROHM

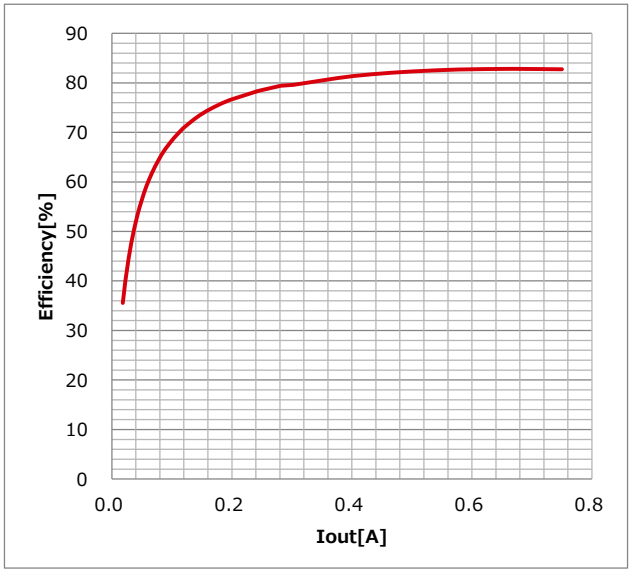

Figure 35. Efficiency vs Load Current

(V_{IN}=24.0V)

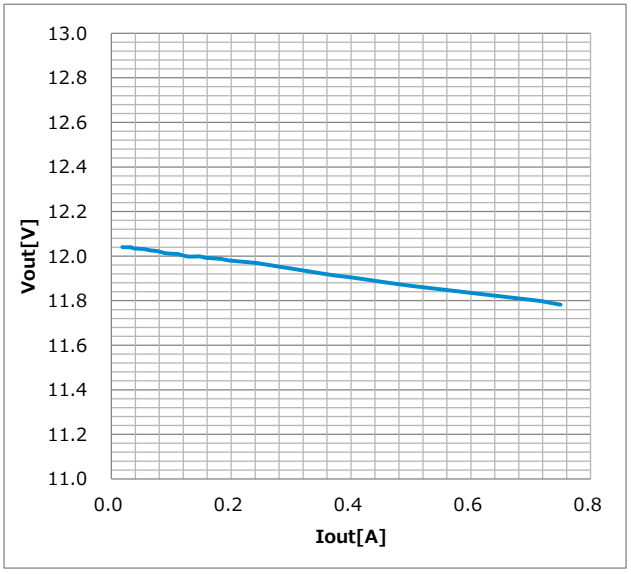

Figure 36. Load Regulation

(V_{IN}=24.0V)

Precautions for use

(1) This document provides the BOM for evaluation boards. Small parts can also be selected for resistor, capacitor, and transformer.

(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 transformer, 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 transformer when outputting a large current, which may deteriorate efficiency or make it impossible to obtain the desired output current.

(6) 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.

Revision History

Date	Revision Number	Description
12. Mar. 2020	001	Initial release
9. Jun. 2020	002	Added the application circuit 2. V_{IN}=12.0V / V_{OUT}=12.0V, I_{OUTMAX}=0.15A 3. V_{IN}=24.0V / V_{OUT}=24.0V, I_{OUTMAX}=0.4A 4. V_{IN}=24.0V / V_{OUT}=24.0V, I_{OUTMAX}=0.18A 5. V_{IN}=24.0V / V_{OUT1-4}=15.0V, $I_{OUT1-4MAX}$=0.15A 7. V_{IN}=24.0V / V_{OUT}=15.0V, I_{OUTMAX}=0.6A 8. V_{IN}=24.0V / V_{OUT}=12.0V, I_{OUTMAX}=0.75A

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