ISOLATED DC-DC CONVERTER
EC7BW18-72 SERIES
APPLICATION NOTE

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EC7BW18-72 Series
Application Note V10 November 2019

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1. Introduction

The EC7BW18-72 series of DC-DC converters offers 20 watts of output power @ output voltages of 5, 12, 15, ±12, ±15, ±24VDC with industry standard 2”×1” ×0.4” package. It has a ultra wide (18:1) input voltage range of 8.5 to 160VDC (72VDC nominal) and reinforced with a 3000VAC isolation.

Compliant with EN50155, EN45545, EN50121-3-2. High efficiency up to 90%, allowing case operating temperature range of –40°C to 105°C. An optional heat sink is available to extend the full power range of the unit. Very low no load power consumption (8mA), an ideal solution for energy critical systems.

The standard control functions include remote on/off (positive or negative) and +15%, -20% adjustable output voltage (single output only).

Fully protected against input UVLO (under voltage lock out), output over-current, output over-voltage and over-temperature and continuous short circuit conditions.

EC7BW18-72 series is designed primarily for common railway applications of 24V, 36V, 48V, 72V, 96V, 110V nominal voltage and also suitable for distributed power architectures, telecommunications, battery operated equipment and industrial applications.

2. DC-DC Converter Features

- 20W Isolated Output
- Efficiency up to 90%
- Fixed Switching Frequency
- 18:1 Input Range
- Regulated Outputs
- Remote On/Off
- Low No Load Power Consumption
- Over Temperature Protection
- Over Voltage/Current Protection
- Continuous Short Circuit Protection
- 2” ×1” ×0.4” Size meet industrial standard
- 5000m Operating Altitude
- CB Test Certificate IEC62368-1
- Fire & Smoke Meet EN45545-2
- Shock & Vibration Meet EN 50155 (EN 61373)
- Meet EN50155 with External Circuits
- UL62368-1 2nd (Reinforce Insulation) Approval

3. Electrical Block Diagram

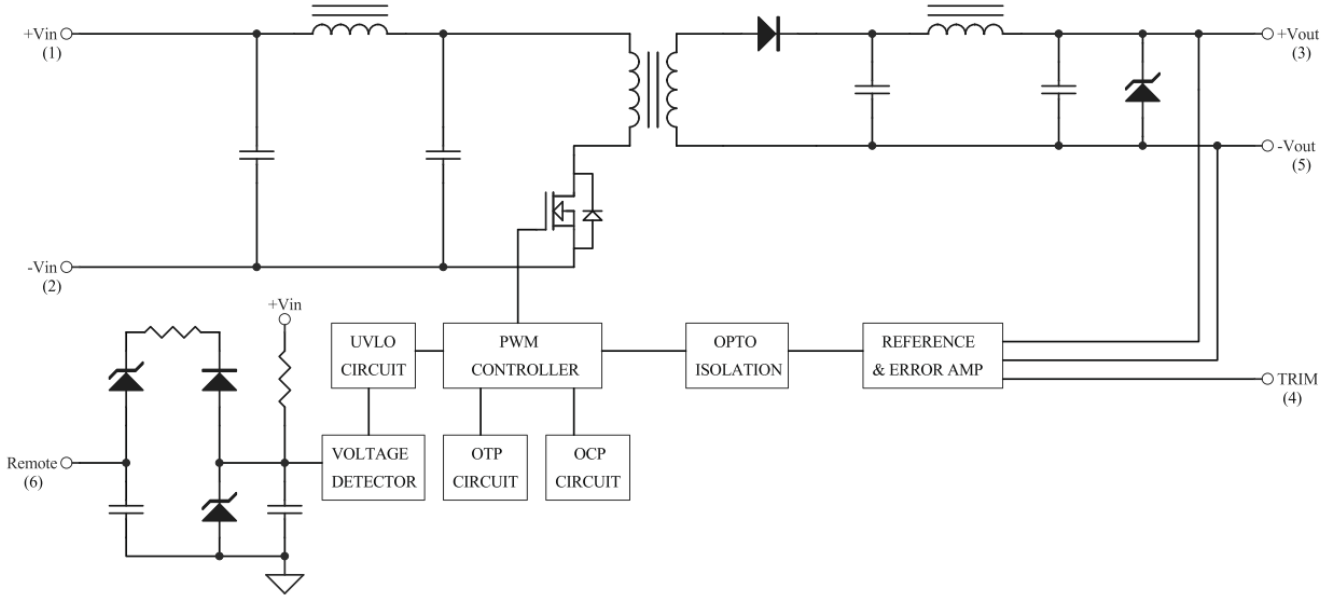


Figure 1 Electrical Block Diagram for Single Output Modules

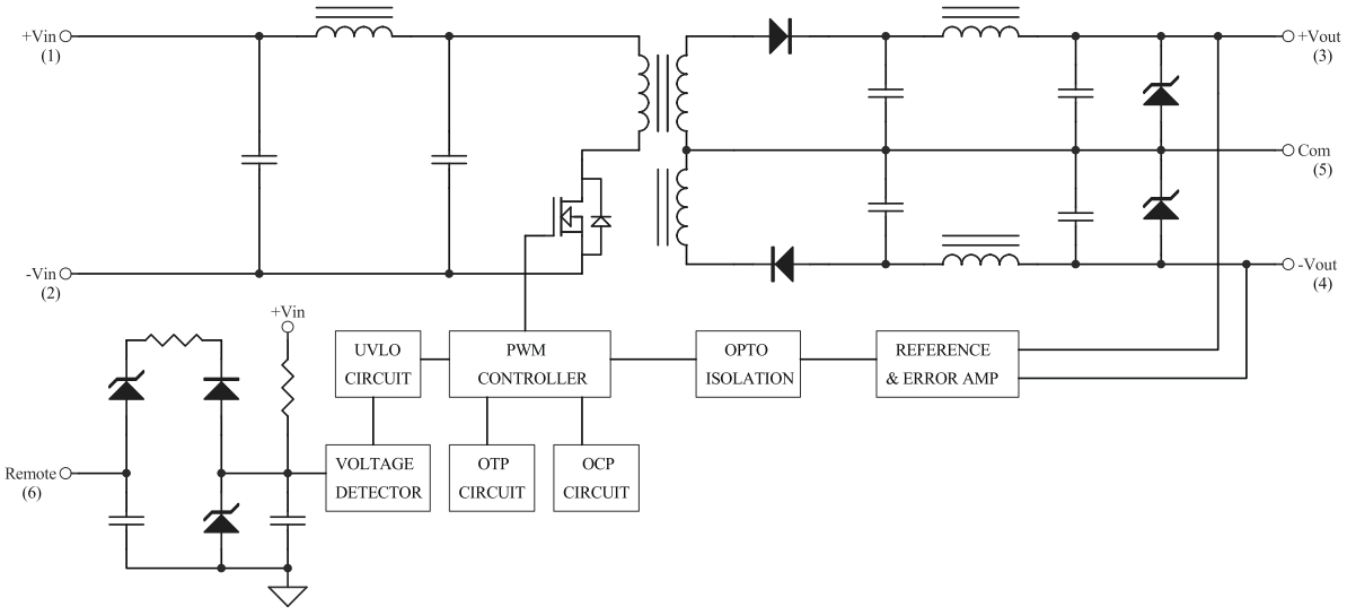


Figure 2 Electrical Block Diagram for Dual Output Module

4. Technical Specifications

(All specifications are typical at nominal input, full load at 25°C unless otherwise noted.)

ABSOLUTE MAXIMUM RATINGS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Input Voltage						
Continuous		All	-0.3		160	V_{dc}
Transient	100ms	All			200	V_{dc}
Operating Case Temperature		All	-40		105	°C
Storage Temperature		All	-55		125	°C
Isolation Voltage	1 minute; input/output	All			3000	V_{ac}

INPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Operating Input Voltage		All	8.5	72	160	V_{dc}
Input Under Voltage Lockout						
Turn-On Voltage Threshold	70% Load	All	8.5	9	9.5	V_{dc}
Turn-Off Voltage Threshold	70% Load	All	7	7.5	8	V_{dc}
Lockout Hysteresis Voltage	70% Load	All		1.5		V_{dc}
Maximum Input Current	100% Load, V_{in}=12V 70% Load, V_{in}=8.5V	All		2		A
No-Load Input Current		Vo=5.0V Vo=12V Vo=15V Vo=±12V Vo=±15V Vo=±24V		5 8 8 8 8 8		mA mA mA mA mA mA
Input Filter	Pi filter.	All				
Inrush Current (I^2t)	As per ETS300 132-2.	All			0.1	A^2s
Input Reflected Ripple Current	P-P thru 12uH inductor, 5Hz to 20MHz **See 6.3**	All		30		mA

OUTPUT CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Output Voltage Set Point	V_{in}=Nominal V_{in}, I_o = I_{o_max}, Tc=25°C	Vo=5.0V Vo=12V Vo=15V Vo=±12V Vo=±15V Vo=±24V	4.95 11.88 14.85 ±11.88 ±14.85 ±23.76	5 12 15 ±12 ±15 ±24	5.05 12.12 15.15 ±12.12 ±15.15 ±24.24	V_{dc}
Output Voltage Balance	V_{in}=Nominal V_{in}, I_o = I_{o_max}	Dual			±1.0	%

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Output Voltage Regulation						
Load Regulation	I_o=I_{o_min} to I_{o_max}	Single			±0.2	%
		Dual			±1.0	
Line Regulation	V_{in}=12V_{dc} to 160V_{dc}	All			±0.2	%
Cross Regulation	Load cross variation 10%/100%	Dual			±5	%
Temperature Coefficient	Tc=-40°C to 105°C	All			±0.02	%/°C
Output Voltage Ripple and Noise (5Hz to 20MHz bandwidth)						
Peak-to-Peak	V_{in}=Nominal V_{in}, I_o = I_{o_max}, with 1uF ceramic capacitors. **See 6.14**	Vo=5.0V			75	mV
		Other			100	
RMS.		All			40	
Operating Output Current Range	V_{in}=8.5V_{dc} , **See 6.6**	Vo=5.0V	0		2800	mA
		Vo=12V	0		1169	
		Vo=15V	0		931	
		Vo=±12V	0		±583	
		Vo=±15V	0		±467	
		Vo=±24V	0		±291	
	V_{in}=12V_{dc} to 160V_{dc} , **See 6.6**	Vo=5.0V	0		4000	
		Vo=12V	0		1670	
		Vo=15V	0		1330	
		Vo=±12V	0		±833	
		Vo=±15V	0		±667	
		Vo=±24V	0		±417	
Output DC Current Limit Inception	Hiccup Mode. Auto Recovery. **See 5.3**	All	110	150	180	%
Maximum Output Capacitance	Full load (resistive)	Vo=5.0V	0		6800	uF
		Vo=12V	0		3300	
		Vo=15V	0		2200	
		Vo=±12V	0		820	
		Vo=±15V	0		680	
		Vo=±24V	0		330	
Output Voltage Trim Range	P_{out}=max rated power, **See 6.12**	All	-20		+15	%
Output Over Voltage Protection	Zener clamp, **See 5.4**	Vo=5.0V		6.2		V_{dc}
		Vo=12V		15		
		Vo=15V		18		
		Vo=±12V		±15		
		Vo=±15V		±18		
		Vo=±24V		±30		

DYNAMIC CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Output Voltage Current Transient						
Error Band	75% to 100% of I_{o_max} step load change d_i/d_t=0.1A/us (within 1% Vout nominal)	All			±5	%
Recovery Time		All			250	us

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Turn-On Delay and Rise Time	Full load (Constant resistive load)					
Turn-On Delay Time, From On/Off Control	$V_{on/off}$ to 10%V_{o_set}	All		5		ms
Turn-On Delay Time, From Input	V_{in_min} to 10%V_{o_set}	All		5		ms
Output Voltage Rise Time	10%V_{o_set} to 90%V_{o_set}	Vo=5.0V		10		ms
		Other		5		

EFFICIENCY

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
100% Load	Vin=72V, **See 6.9**	Vo=5.0V		86		%
		Vo=12V		89		
		Vo=15V		89		
		Vo=±12V		89		
		Vo=±15V		89		
		Vo=±24V		90		
	Vin=110V, **See 6.9**	Vo=5.0V		85		
		Vo=12V		88		
		Vo=15V		88		
		Vo=±12V		88		
		Vo=±15V		88		
		Vo=±24V		89		

ISOLATION CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Isolation Voltage	1 minute; Input/Output	All	3000			V_{ac}
Isolation Resistance	Input/Output	All	1000			MΩ
Isolation Capacitance	Input/Output, (10KHz,0.25V)	All		20		pF

FEATURE CHARACTERISTICS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Switching Frequency	Pulse wide modulation (PWM), Fixed	All	180	200	220	KHz
On/Off Control, Positive Remote On/Off Logic, Refer to –Vin Pin.						
Logic Low (Module Off)	$V_{on/off}$ at $I_{on/off}$=1.0mA	All	0		1.2	V
Logic High (Module On)	$V_{on/off}$ at $I_{on/off}$=0.0uA	All	4.0 or Open Circuit		160	V
On/Off Control, Negative Remote On/Off Logic, Refer to –Vin Pin						
Logic High (Module Off)	$V_{on/off}$ at $I_{on/off}$=0.0uA	All	4.0 or Open Circuit		160	V
Logic Low (Module On)	$V_{on/off}$ at $I_{on/off}$=1.0mA	All	0		1.2	V
On/Off Current (for Both Remote On/Off Logic)	$I_{on/off}$ at $V_{on/off}$=0.0V	All		0.4	1	mA
Leakage Current (for Both Remote On/Off Logic)	Logic High, $V_{on/off}$=15V	All			30	uA

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
Off Converter Input Current	Shutdown Input Idle Current	All		3	5	mA
Over Temperature Shutdown	V_{in}=12V_{dc} ,Plastic Case temperature, **See 5.7**	All		110		°C
Over Temperature Recovery		All		92		°C

GENERAL SPECIFICATIONS

PARAMETER	NOTES and CONDITIONS	Device	Min.	Typical	Max.	Units
MTBF	I_o=100% of I_{o_max}, MIL - HDBK - 217F_Notice 1, GB, 25°C	Vo=5.0V		1242		K hours
		Vo=12V		1397		
		Vo=15V		1631		
		Vo=±12V		1341		
		Vo=±15V		1571		
		Vo=±24V		1622		
Weight		All		28.5		grams
Case Material	Plastic, DAP					
Baseplate Material	FR-4					
Potting Material	UL 94V-0					
Pin Material	Base: Copper, Plating: Nickel with Matte Tin					
Shock/Vibration	MIL-STD-810F/EN61373					
Humidity	95% RH max. Non Condensing					
Altitude	5000m Operating Altitude, 12000m Transport Altitude					
Thermal Shock	MIL-STD-810F					
Fire & Smoke	Meets EN45545-2					

EN45545-2 FIRE & SMOKE TEST CONDITIONS

Item		Standard	Hazard Level
R22	Oxygen Index Test	EN 45545-2: 2013 EN ISO 4589-2: 2006	HL1, HL2, HL3
	Smoke Density Test	EN 45545-2: 2013 EN ISO 5659-2: 2013	HL1, HL2, HL3
	Smoke Toxicity Test	EN 45545-2: 2013 NF X70-100: 2006	HL1, HL2, HL3
R23	Oxygen Index Test	EN 45545-2: 2013 EN ISO 4589-2: 2006	HL1, HL2, HL3
	Smoke Density Test	EN 45545-2: 2013 EN ISO 5659-2: 2013	HL1, HL2, HL3
	Smoke Toxicity Test	EN 45545-2: 2013 NF X70-100: 2006	HL1, HL2, HL3
R24	Oxygen Index Test	EN 45545-2: 2013 EN ISO 4589-2	HL1, HL2, HL3
R25	Glow - Wire Test	EN 45545-2:2013 EN 60695-2-11:2001	HL1, HL2, HL3
R26	Vertical Flame Test	EN 45545-2: 2013 EN 60695-11-10: 2013	HL1, HL2, HL3

5. Main Features and Functions

5.1 Operating Temperature Range

The EC7BW18-72 series converters can be operated within a wide case temperature range of -40°C to 105°C. Consideration must be given to the derating curves when ascertaining maximum power that can be drawn from the converter. The maximum power drawn from models is influenced by usual factors, such as:

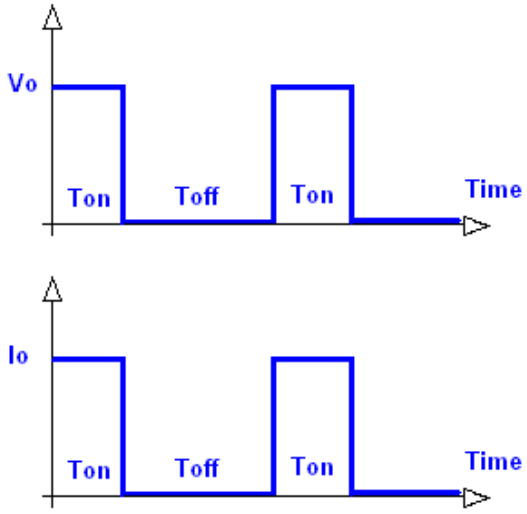
- Input voltage range
- Output load current
- Forced air or natural convection
- Heat sink optional

5.2 Output Voltage Adjustment

Section 6.12 describes in detail how to trim the output voltage with respect to its set point. The output voltage on single output models is adjustable within the range of -20% to +15%.

5.3 Over Current Protection

All models have internal over current and continuous short circuit protection. The unit operates normally once the fault condition is removed. At the point of current limit inception, the converter will go into hiccup mode protection.



5.4 Output Over Voltage Protection

The over-voltage protection consists of a zener diode to limiting the out voltage.

5.5 Remote On/Off

The EC7BW18-72 series allows the user to switch the module on and off electronically with the remote on/off feature. All models are available in “positive logic” and “negative logic” (optional) versions. The converter turns on if the remote on/off pin is high (>4.0Vdc to 160Vdc or open circuit). Setting the pin low (0 to <1.2Vdc) will turn the converter off. The signal level of the remote on/off input is defined with respect to ground. If not using the remote on/off pin, leave the pin open (converter will be on). Models with part number suffix “N” are the “negative logic” remote on/off version. The unit turns off if the remote on/off pin is high (>4.0Vdc to 160Vdc or open circuit). The converter turns on if the on/off pin input is low (0 to<1.2Vdc). Note that the converter is off by default. **See 6.15**

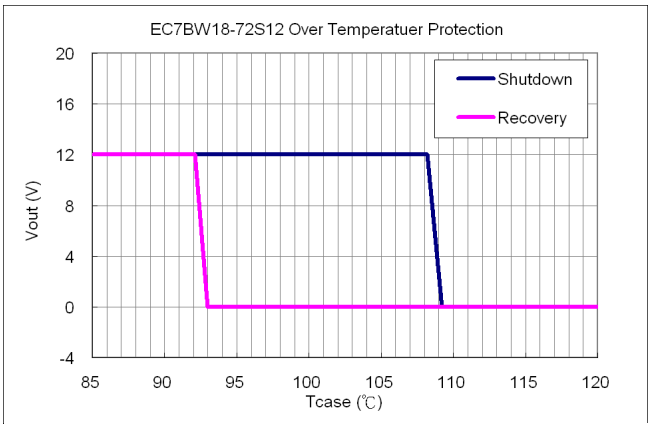
Logic State (Pin 6)	Negative Logic	Positive Logic
Logic Low – Switch Closed	Module on	Module off
Logic High – Switch Open	Module off	Module on

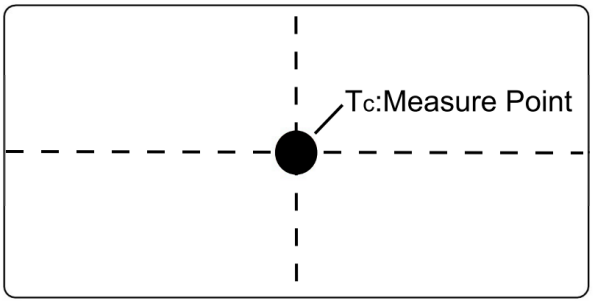
5.6 UVLO (Under Voltage Lock Out)

Input under voltage lockout is standard on the EC7BW18-72 series unit. The unit will shut down when the input voltage drops below a threshold, and the unit will operate when the input voltage goes above the upper threshold.

5.7 Over Temperature Protection

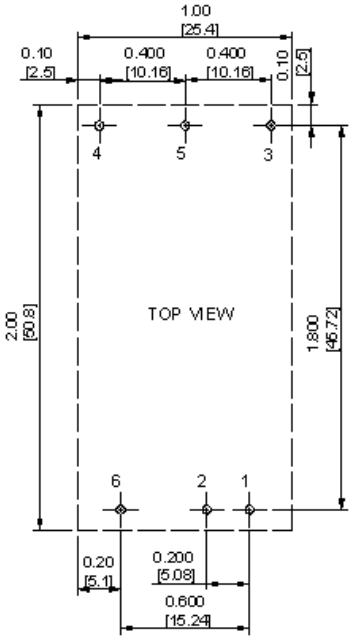
These modules have an over temperature protection circuit to safeguard against thermal damage. Shutdown occurs with the maximum case reference temperature is exceeded. The module will restart when the case temperature falls below over temperature recovery threshold. Different input voltage the over temperature protection turn on/off points will drift. Please measure temperature of the center part of plastic case.





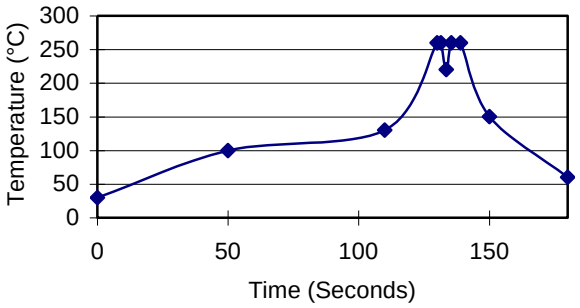
TOP VIEW

1.3mm PLATED THROUGH HOLE
2.5mm PAD SIZE



Note: Dimensions are in inches (millimeters)

Lead Free Wave Soldering Profile



Note：

1. Soldering Materials: Sn/Cu/Ni
2. Ramp up rate during preheat: 1.4 ℃/Sec (From 50℃ to 100℃)
3. Soaking temperature: 0.5 ℃/Sec (From 100℃ to 130℃), 60±20 seconds
4. Peak temperature: 260℃, above 250℃ 3~6 Seconds
5. Ramp up rate during cooling: -10.0 ℃/Sec (From 260℃ to 150℃)

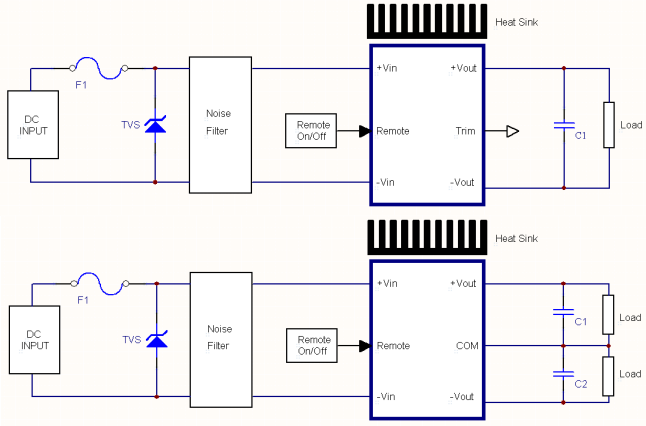
6. Applications

6.1 Recommend Layout, PCB Footprint and Soldering Information

The system designer or end user must ensure that metal and other components in the vicinity of the converter meet the spacing requirements for which the system is approved. Low resistance and inductance PCB layout traces are the norm and should be used where possible. Due consideration must also be given to proper low impedance tracks between power module, input and output grounds. The recommended footprints and soldering profiles are shown below.

6.2 Connection for Standard Use

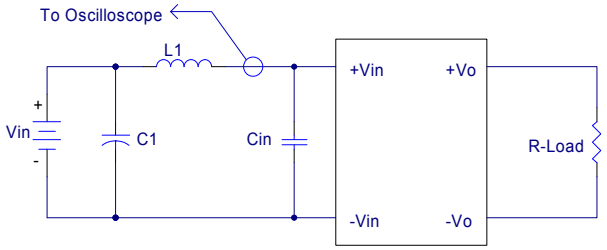
The connection for standard use is shown below. External output capacitors (C1, C2) are recommended to reduce output ripple and noise, 1uF ceramic capacitor for all models.



Symbol	Component	Reference
F1, TVS	Input fuse, TVS	**Section 7.1**
C1,C2	External capacitor on the output side	**Section 6.13/6.14**
Noise Filter	External input noise filter	**Section 7.2**
Remote On/Off	External remote on/off control	**Section 6.15**
Trim	External output voltage adjustment	**Section 6.12**
Heat sink	External heat sink	**Section 6.4/6.5/6.6/6.7/6.8**

6.3 Input Capacitance at the Power Module

The converters must be connected to low AC source impedance. To avoid problems with loop stability source inductance should be low. Also, the input capacitors (Cin) should be placed close to the converter input pins to de-couple distribution inductance. However, the external input capacitors are chosen for suitable ripple handling capability. Low ESR capacitors are good choice. Circuit as shown as below represents typical measurement methods for reflected ripple current. C1 and L1 simulate a typical DC source impedance. The input reflected-ripple current is measured by current probe to oscilloscope with a simulated source Inductance (L1).



L1: 12uH
C1: None
Cin: 68uF ESR<0.7ohm @100KHz

6.4 Convection Requirements for Cooling

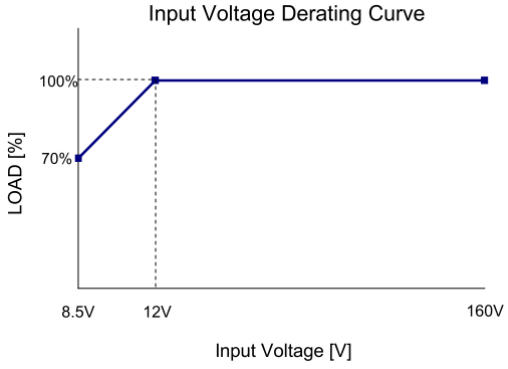
To predict the approximate cooling needed for the 2"×1" module, refer to the power derating curves in **section 6.7**. These derating curves are approximations of the ambient temperatures and airflows required to keep the power module temperature below its maximum rating. Once the module is assembled in the actual system, the module's temperature should be monitored to ensure it does not exceed 105°C as measured at the center of the top of the case (thus verifying proper cooling).

6.5 Thermal Considerations

The power module operates in a variety of thermal environments; however, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding environment. The example is presented in **section 6.7**. The power output of the module should not be allowed to exceed rated power (V_{o_set} x I_{o_max}).

6.6 Input Derating Curve

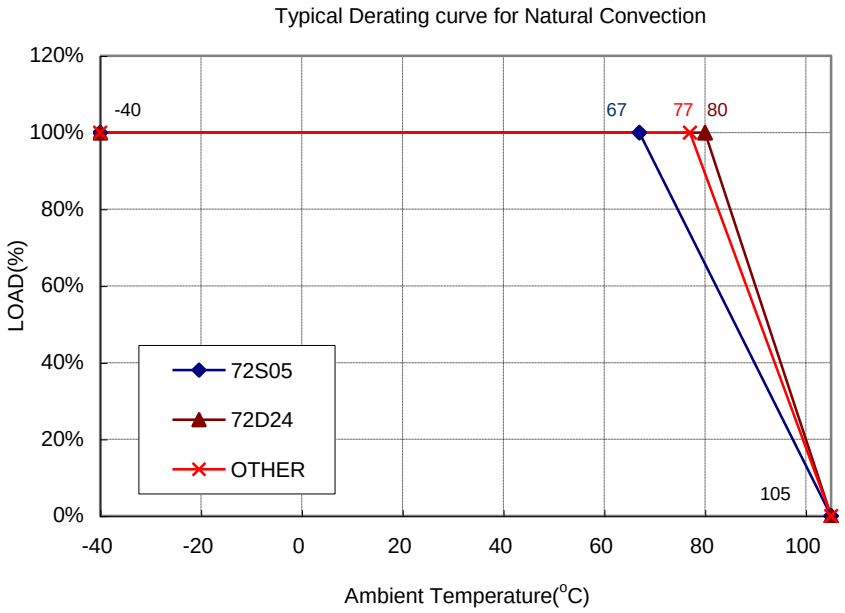
EC7BW18-72 series has Derating by Input Voltage is required shown below.



6.7 Power Derating

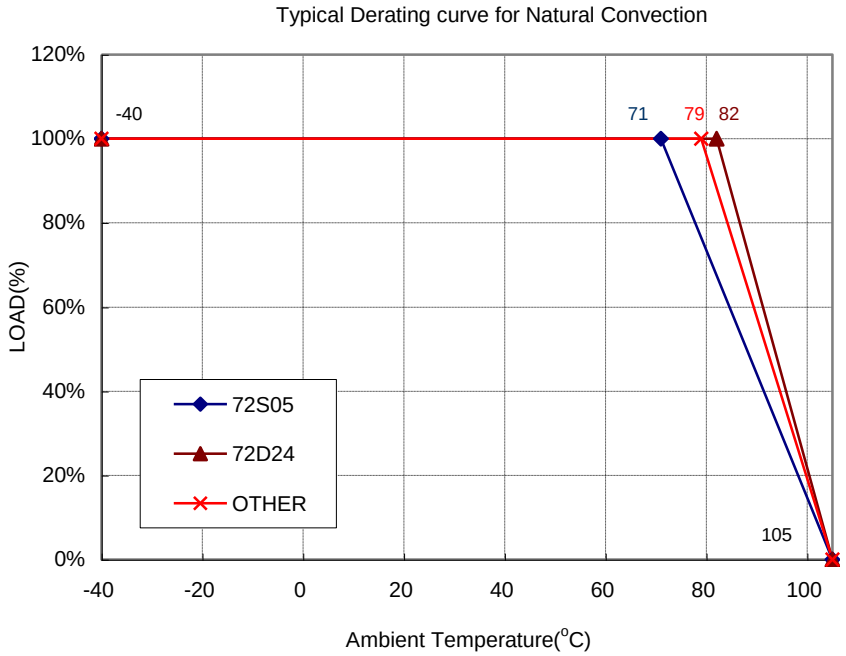
The operating case temperature range of EC7BW18-72 series is -40°C to +105°C. When operating the EC7BW18-72 series, proper derating or cooling is needed. The maximum case temperature under any operating condition should not exceed 105°C.

The following curve is the de-rating curve of EC7BW18-72 series without heat sink.



AIR FLOW RATE	TYPICAL R_{ca}
Natural Convection 20ft./min. (0.1m/s)	11.3 ℃/W

The following curve is the de-rating curve of EC7BW18-72 series with heat sink BC100 (K-C088)

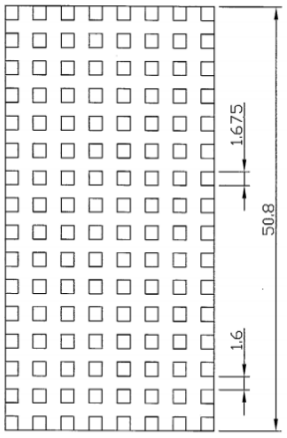


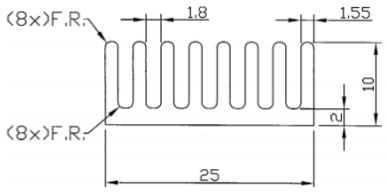
AIR FLOW RATE	TYPICAL R_{ca}
Natural Convection 20ft./min. (0.1m/s)	10.2 ℃/W

6.8 B 2”×1” Case Heat Sinks Kit

Cross Cut Heat Sink: BC100 (K-C088)

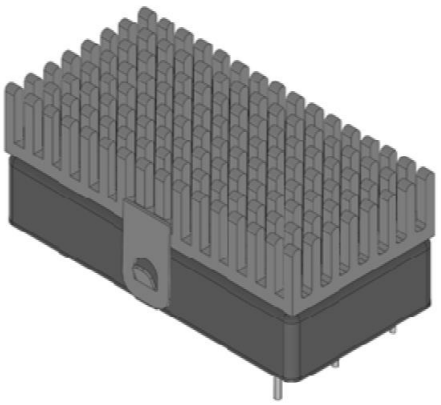
All Dimensions in mm
Rca: 10.2°C/W (typ.), at natural convection



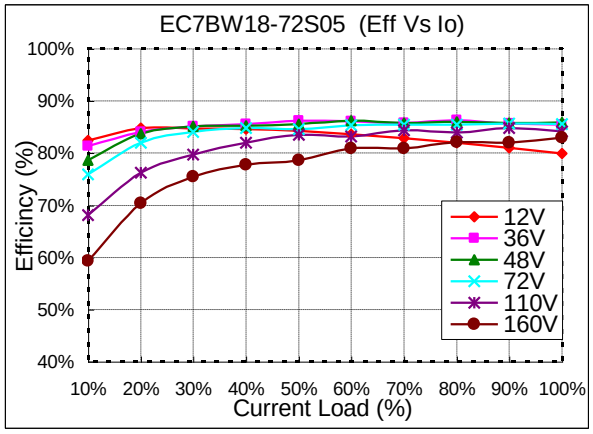


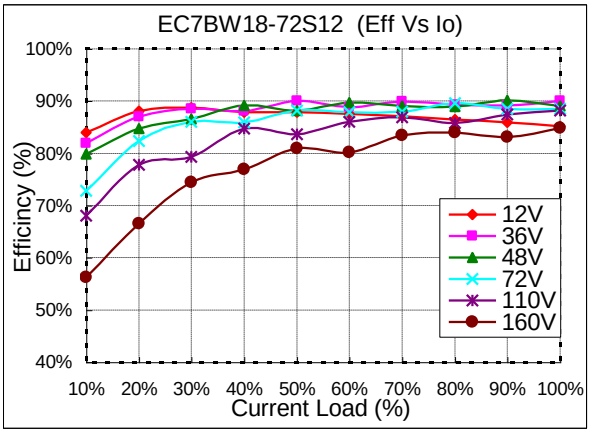
Assembly:

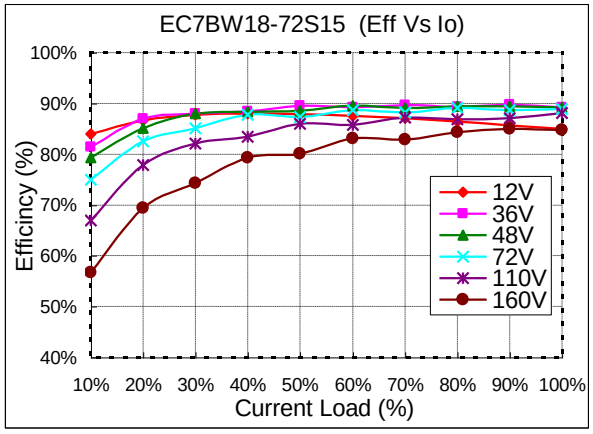
Heat Sink: BC100
Clip: HC01

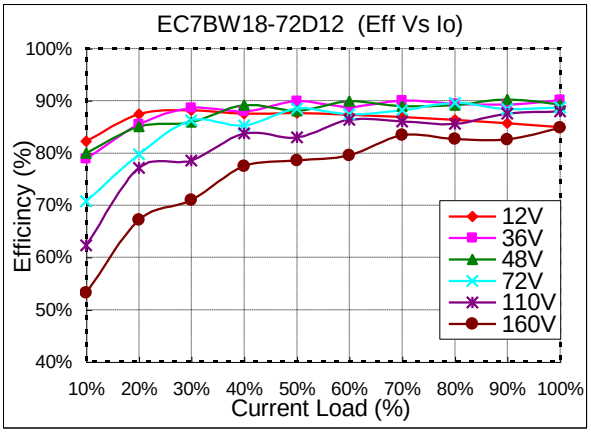


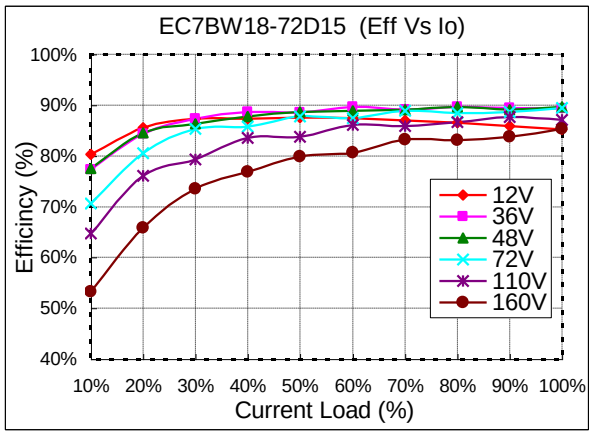
6.9 Efficiency VS. Load

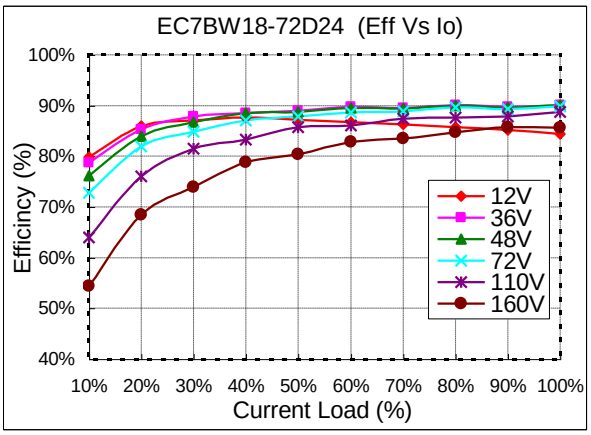




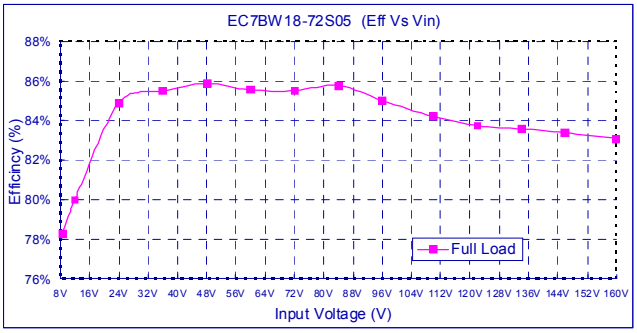


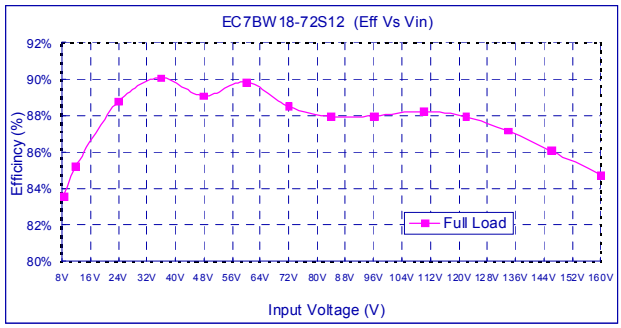


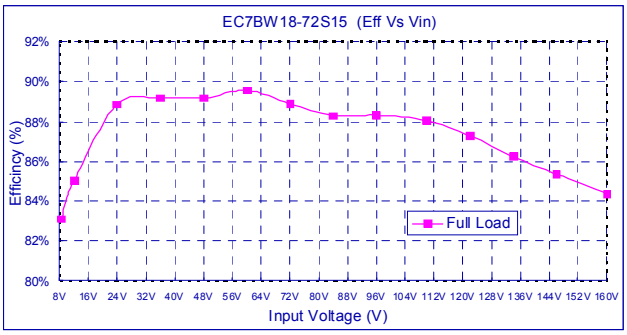


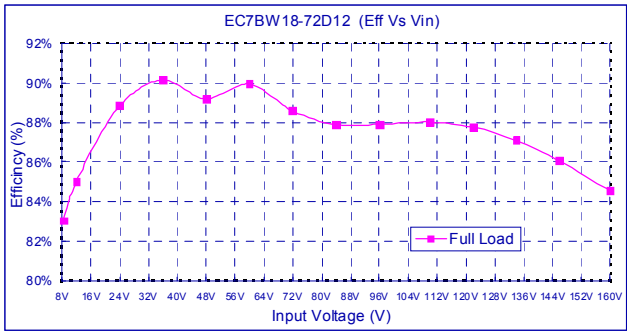


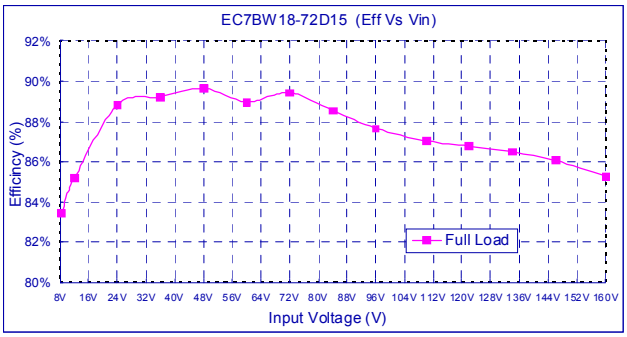
6.10 Efficiency VS. Vin

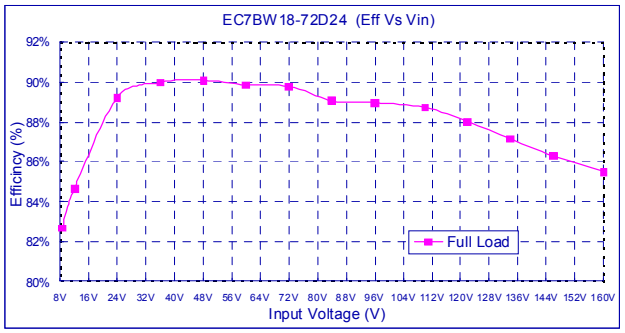












Note: 8.5Vin Efficiency at 70% Full Load

6.11 Test Set-Up

The basic test set-up to measure parameters such as efficiency and load regulation is shown below. When testing the modules under any transient conditions please ensure that the transient response of the source is sufficient to power the equipment under test. We can calculate:

- Efficiency
- Load regulation and line regulation.

The value of efficiency is defined as:

$$\eta = \frac{Vo \times Io}{Vin \times Iin} \times 100\%$$

Where:

V_o is output voltage,

I_o is output current,

V_{in} is input voltage,

I_{in} is input current.

The value of load regulation is defined as:

$$Load.reg = \frac{V_{FL} - V_{NL}}{V_{NL}} \times 100\%$$

Where:

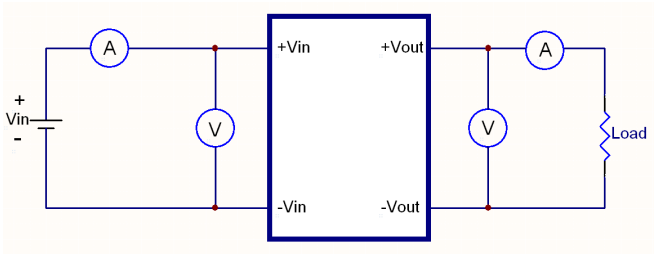
V_{FL} is the output voltage at full load

V_{NL} is the output voltage at no load

The value of line regulation is defined as:

$$Line.reg = \frac{V_{HL} - V_{LL}}{V_{LL}} \times 100\%$$

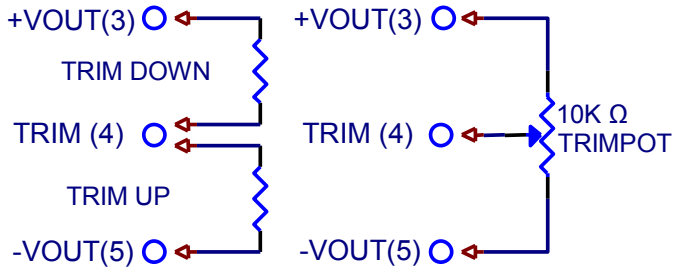
Where: V_{HL} is the output voltage of maximum input voltage at full load. V_{LL} is the output voltage of minimum input voltage at full load.



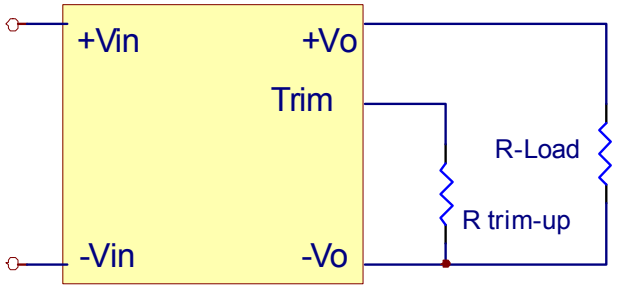
EC7BW18-72 Series Test Setup

6.12 Output Voltage Adjustment

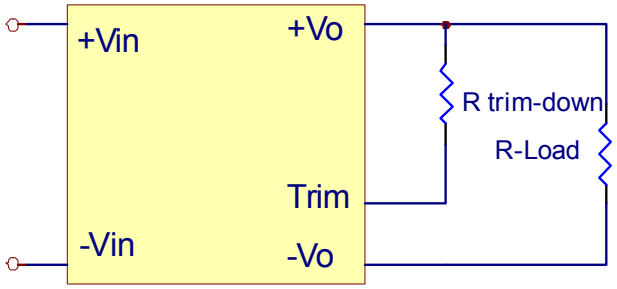
Output may be externally trimmed -20% to +15% (single output models only) with a fixed resistor or an external trim pot as shown (optional). Model specific formulas for calculating trim resistors are available upon request as a separate document.



In order to trim the voltage up or down, one needs to connect the trim resistor either between the trim pin and -Vout for trim-up or between trim pin and +Vout for trim-down. The output voltage trim range is -20% to +15%. This is shown:



Trim-up Voltage Setup



Trim-down Voltage Setup

The EC7BW18-72S05 value of R_{trim_up} defined as:

$$R_{trim\_up} = \frac{22.13 - 3.976 \times (Vo - Vo,nom)}{7.017 \times (Vo - Vo,nom)} - 3.3 \quad (K\Omega)$$

The EC7BW18-72S12 value of R_{trim_up} defined as:

$$R_{trim\_up} = \frac{120.76}{3 \times (Vo - Vo,nom)} - 18 \quad (K\Omega)$$

The EC7BW18-72S15 value of R_{trim_up} defined as:

$$R_{trim\_up} = \frac{104.42}{2.28 \times (Vo - Vo,nom)} - 18 \quad (K\Omega)$$

Where:

R_{trim_up} is the external resistor in KΩ.

$V_{o,nom}$ is the nominal output voltage.

V_o is the desired output voltage.

For example, to trim-up the output voltage of 5V module (EC7BW18-72S05) by 5% to 5.25V, R_{trim_up} is calculated as follows:

$$R_{trim\_up} = \frac{22.13 - 3.976 \times (5.25 - 5)}{7.017 \times (5.25 - 5)} - 3.3 = 8.75 \quad (K\Omega)$$

The typical value of Rtrim_up

Trim up %	5V	12V	15V
	R_{trim_up} (KΩ)		
1%	59.21	317.46	287.32
2%	27.67	149.73	134.66
3%	17.16	93.82	83.77
4%	11.90	65.86	58.33
5%	8.75	49.09	43.06
6%	6.65	37.91	32.89
7%	5.14	29.92	25.62
8%	4.02	23.93	20.17
9%	3.14	19.27	15.92
10%	2.44	15.55	12.53
11%	1.87	12.50	9.76
12%	1.39	9.95	7.44
13%	0.99	7.80	5.49
14%	0.64	5.96	3.81
15%	0.34	4.36	2.35

The EC7BW18-72S05 value of R_{trim_down} defined as:

$$R_{trim\_down} = \frac{42 - 16.803 \times (Vo, nom - Vo)}{7.017 \times (Vo, nom - Vo)} - 3.3 \quad (K\Omega)$$

The EC7BW18-72S12 value of R_{trim_down} defined as:

$$R_{trim\_down} = \frac{206.116}{3 \times (Vo, nom - Vo)} - 27.08 \quad (K\Omega)$$

The EC7BW18-72S15 value of R_{trim_down} defined as:

$$R_{trim\_down} = \frac{206.116}{2.28 \times (Vo, nom - Vo)} - 27.08 \quad (K\Omega)$$

Where:

R_{trim_down} is the external resistor in KΩ.

V_{o_nom} is the nominal output voltage.

V_o is the desired output voltage.

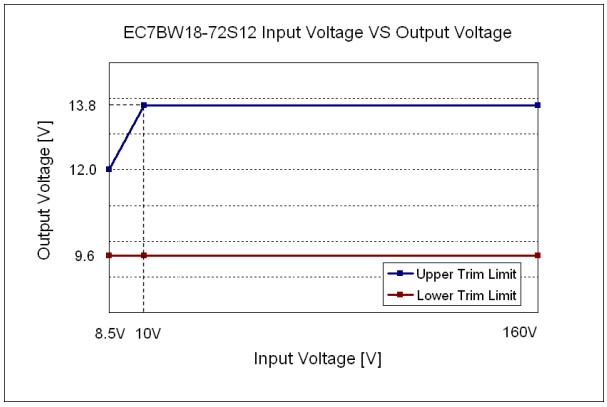
For example: to trim-down the output voltage of 12V module (EC7BW18-72S12) by 5% to 11.4V, R_{trim_down} is calculated as follows:

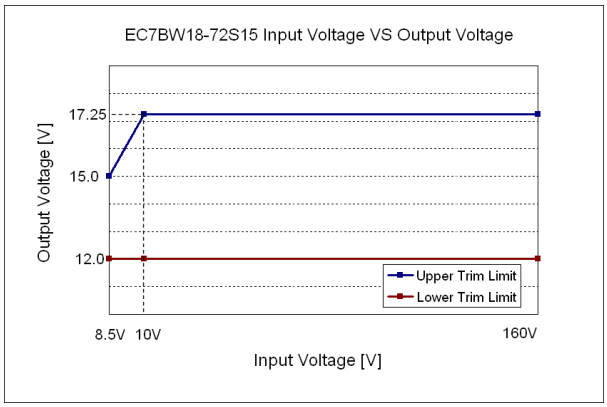
$$R_{trim\_down} = \frac{206.116}{3 \times (12 - 11.4)} - 27.08 = 87.43 \quad (K\Omega)$$

The typical value of R_{trim_down}

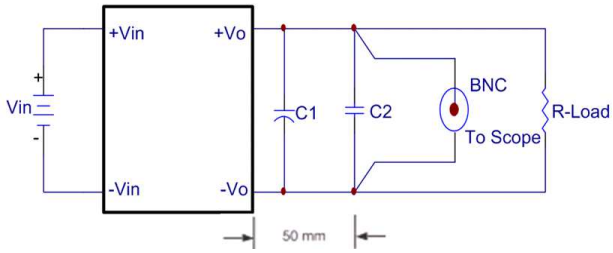
Trim down %	5V	12V	15V
	R_{trim_down} (KΩ)		
1%	114.03	545.46	575.60
2%	54.17	259.19	274.26
3%	34.21	163.77	173.81
4%	24.24	116.06	123.59
5%	18.25	87.43	93.46
6%	14.26	68.34	73.37
7%	11.41	54.71	59.02
8%	9.27	44.49	48.25
9%	7.61	36.54	39.88
10%	6.28	30.17	33.19
11%	5.19	24.97	27.71
12%	4.28	20.63	23.14
13%	3.52	16.96	19.28
14%	2.86	13.82	15.97
15%	2.29	11.09	13.10
16%	1.79	8.70	10.59
17%	1.35	6.60	8.37
18%	0.96	4.73	6.40
19%	0.61	3.05	4.64
20%	0.29	1.55	3.05

The EC7BW18-72S05 models is adjustable within the range of -20% to +15%. For EC7BW18-72S12 and EC7BW18-72S15 models, see input& output trim curves for trim up and trim down ranges.

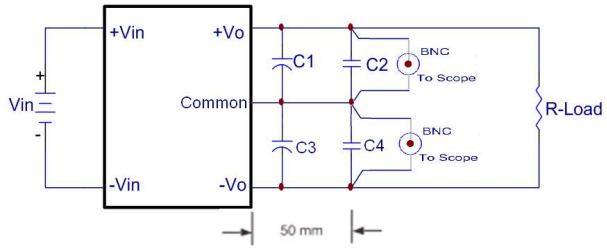




6.13 Output Ripple and Noise



Note: C1: None, C2: 1uF ceramic capacitor.
EC7BW18-72 single output module

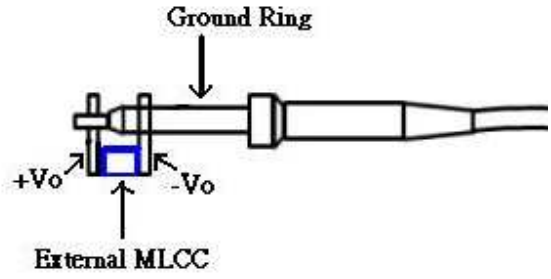


Note: C1 & C3: None, C2 & C4: 1uF ceramic capacitor.
EC7BW18-72 dual output module

Output ripple and noise measured with 1uF ceramic capacitor across output, A 20 MHz bandwidth oscilloscope is normally used for the measurement.

The conventional ground clip on an oscilloscope probe should never be used in this kind of measurement. This clip, when placed in a field of radiated high frequency energy, acts as an antenna or inductive pickup loop, creating an extraneous voltage that is not part of the output noise of the converter.

Another method is shown in below, in case of coaxial-cable/BNC is not available. The noise pickup is eliminated by pressing scope probe ground ring directly against the -Vout terminal while the tip contacts the +Vout terminal. This makes the shortest possible connection across the output terminals.

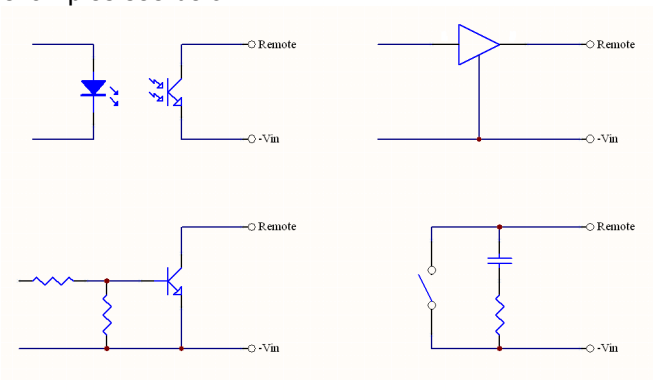


6.14 Output Capacitance

The EC7BW18-72 series converters provide unconditional stability with or without external capacitors. For good transient response, low ESR output capacitors should be located close to the point of load (<100mm). PCB design emphasizes low resistance and inductance tracks in consideration of high current applications. Output capacitors with their associated ESR values have an impact on loop stability and bandwidth. Cincon's converters are designed to work with load capacitance to see technical specifications.

6.15 Remote On/Off Circuit

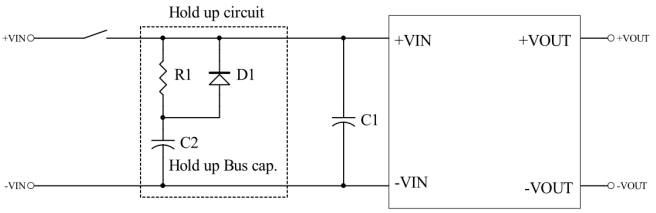
The converter remote On/Off circuit built-in on input side. The ground pin of input side Remote On/Off circuit is –Vin pin. **Refer to 5.5** for more details. Connection examples see below.



Remote On/Off Connection Example

6.16 Hold up Time

Hold up time is defined as the duration of time that DC/DC converter output will remain active following a loss of input power. To meet power supply interruptions, an external circuit is required, shown below.



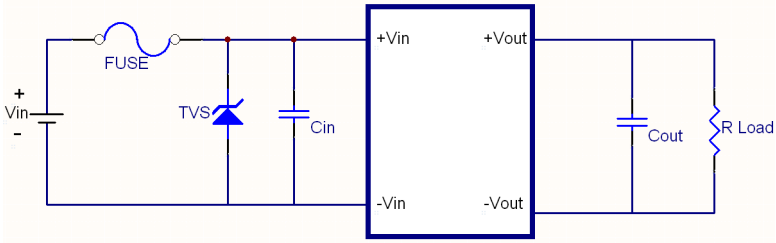
D1:200V/10A
R1:100Ω/10W
C1: None
C2 (Hold up Bus Cap.): See below table

Input Voltage	24Vdc	36Vdc	48Vdc
Hold up time for 10ms	1100uF	460uF	250uF
Hold up time for 30ms	3300uF	1400uF	750uF
Input Voltage	72Vdc	96Vdc	110Vdc
Hold up time for 10ms	110uF	68uF	50uF
Hold up time for 30ms	330uF	200uF	150uF

7. Safety & EMC

7.1 Input Fusing and Safety Considerations

The EC7BW18-72 series converters have no internal fuse. In order to achieve maximum safety and system protection, always use an input line fuse. We recommended a 4A fast acting fuse for all models. It is recommended that the circuit have a transient voltage suppressor diode (TVS) across the input terminal to protect the unit against surge or spike voltage and input reverse voltage (as shown).



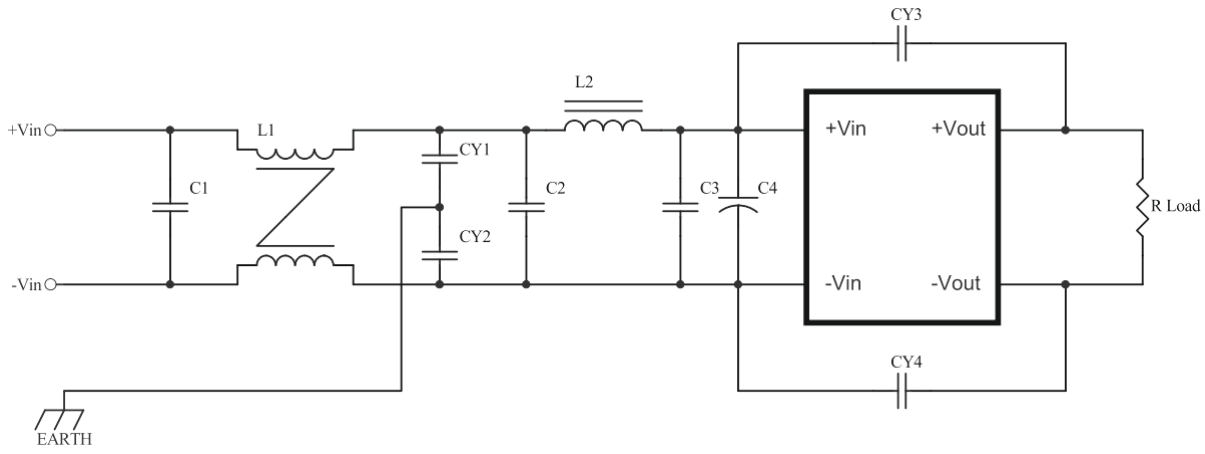
The external TVS & input capacitor (Cin) is required if EC7BW18-72 series has to meet EN61000-4-4 & EN61000-4-5

The EC7BW18-72 series recommended a TVS (Littelfuse 1.5KE180A) & aluminum capacitor (82uF/200V) to connect parallel.

7.2 EMC Considerations

EMI Test standard: EN55032 Conducted & Radiated Emission,EN50121-3-2:2016 Output Conducted Emission
Test Condition: Input Voltage: 110Vdc, Output Load: Full Load

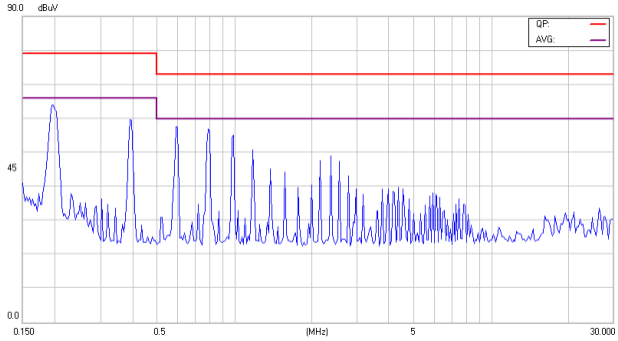
(1) EMI meet EN55011 / EN55032 / EN50121-3-2:2016



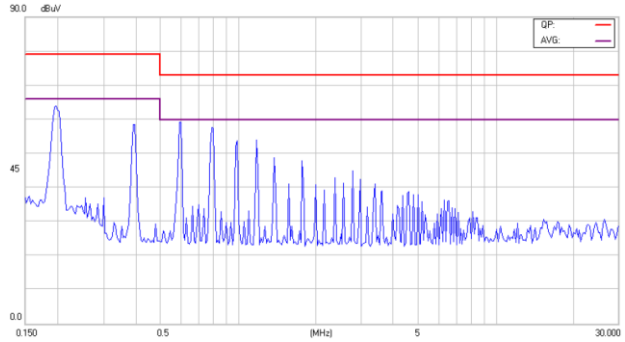
Model Number	C1,C2,C3	C4	CY1,CY2	CY3,CY4	L1	L2
EC7BW18-72S05	1uF/250V 1812 Ceramic capacitor	120uF/220V KXJ Series Aluminum capacitor	1500pF/400VAC Y1 capacitor	2200pF/400VAC Y1 capacitor	VAKOS R10K T10x6x5C 1.4mH Ø0.4mmx1/12T	10uH/7A 2525CZ Vishay
EC7BW18-72S12						
EC7BW18-72S15						
EC7BW18-72D12						
EC7BW18-72D15						
EC7BW18-72D24						

Conducted Emission:

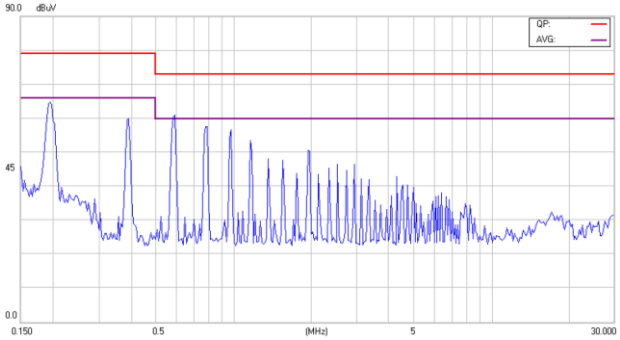
EC7BW18-72S05
Line



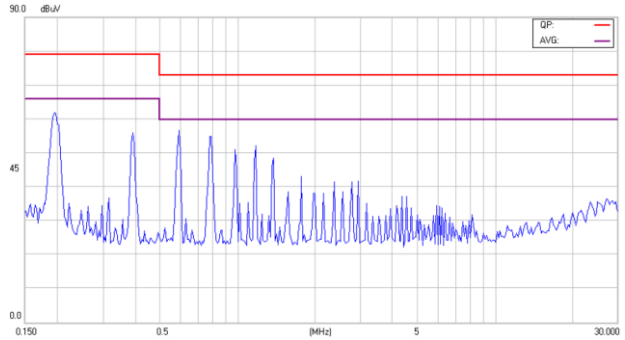
EC7BW18-72S12
Line



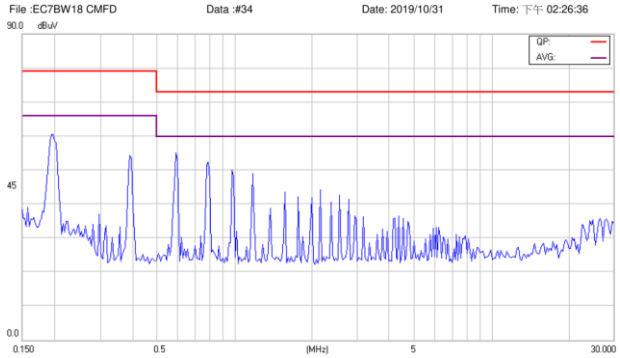
EC7BW18-72S15
Line



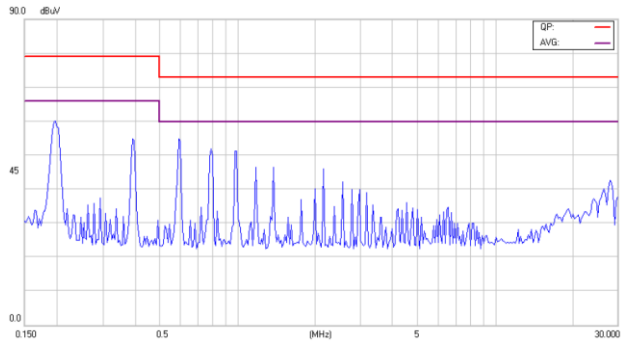
EC7BW18-72D12
Line



EC7BW18-72D15
Line

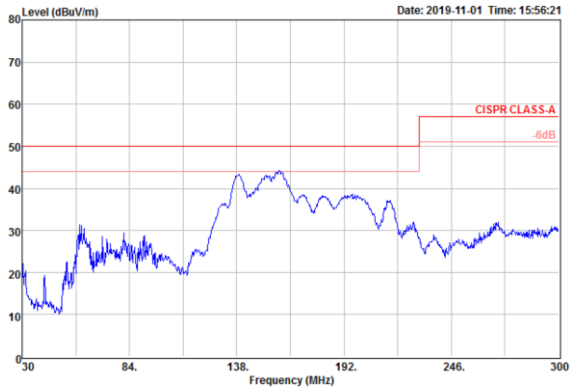


EC7BW18-72D24
Line

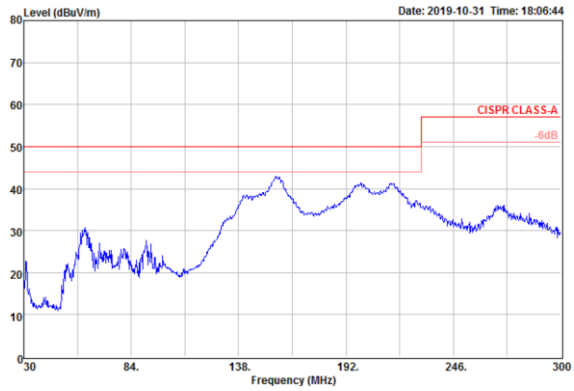


Radiated Emission:

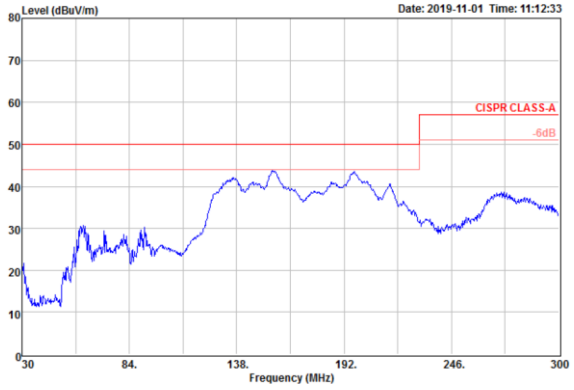
EC7BW18-72S05
Vertical



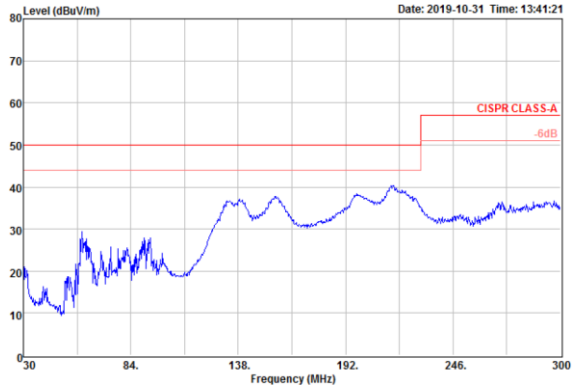
EC7BW18-72S12
Vertical



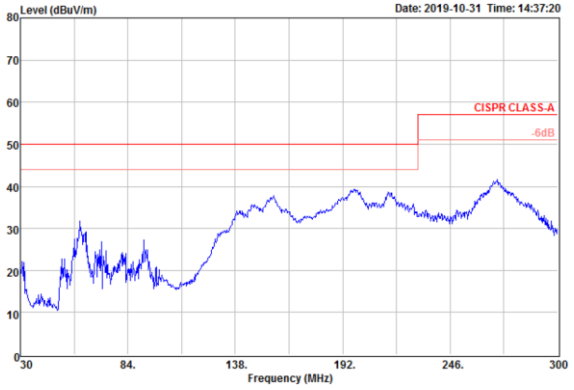
EC7BW18-72S15
Vertical



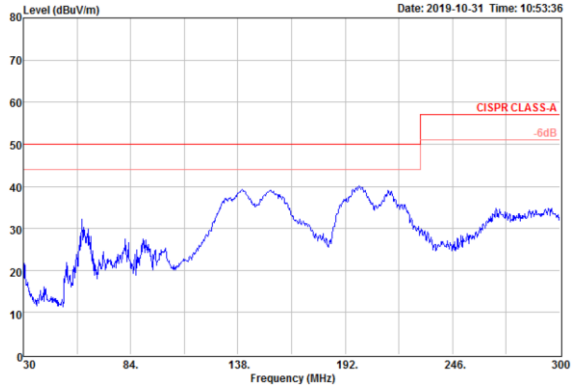
EC7BW18-72D12
Vertical



EC7BW18-72D15
Vertical

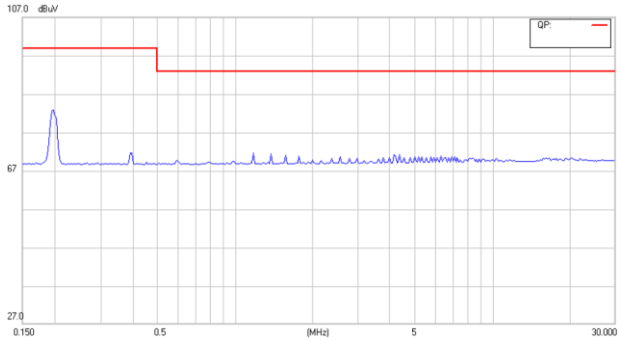


EC7BW18-72D24
Vertical

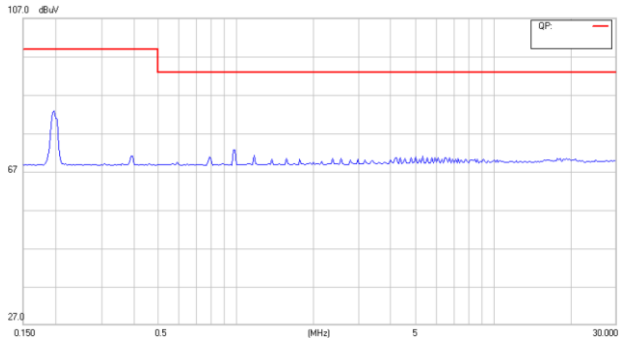


Output Conducted Emission:

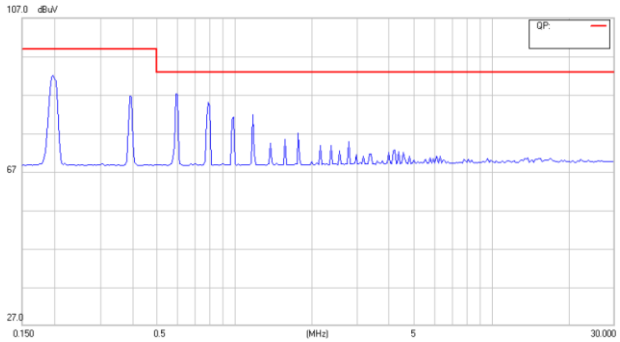
EC7BW18-72S05
Pos



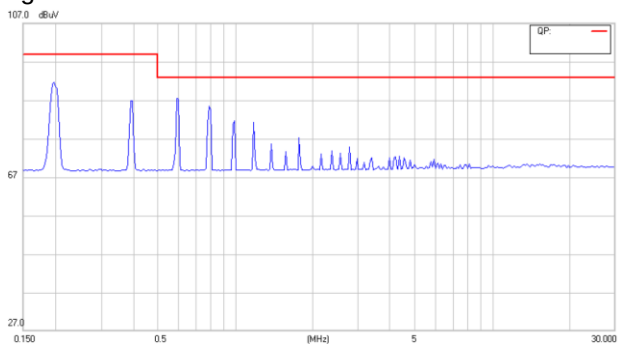
EC7BW18-72S05
Neg



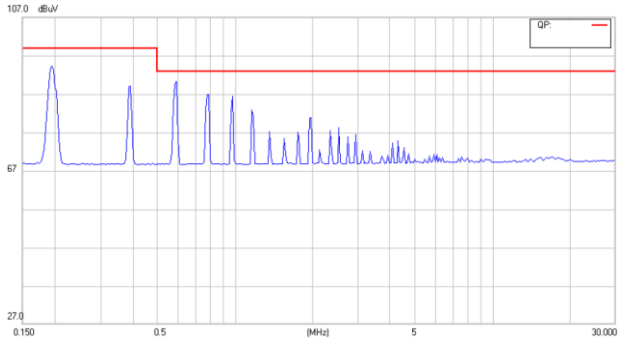
EC7BW18-72S12
Pos



EC7BW18-72S12
Neg



EC7BW18-72S15
Pos



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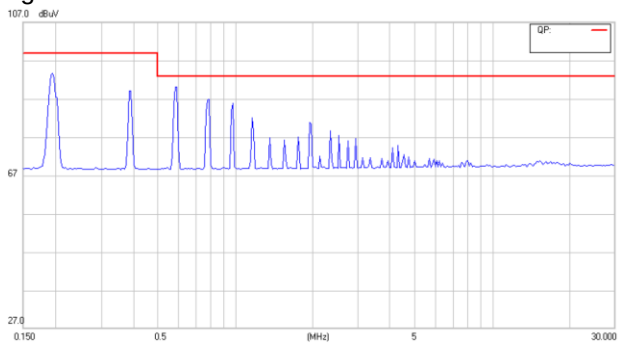

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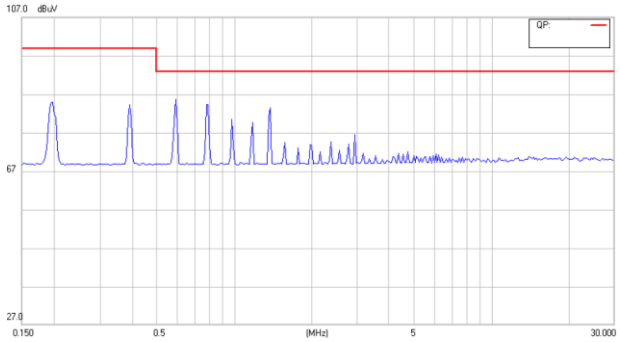

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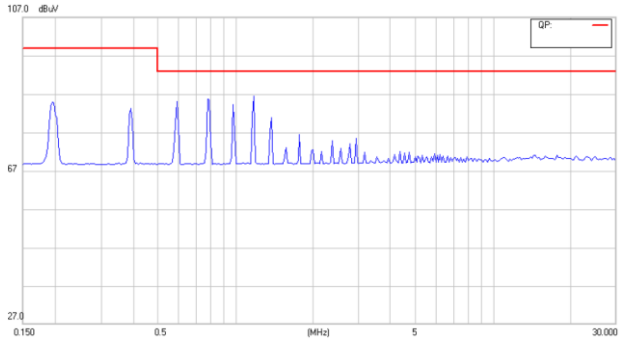

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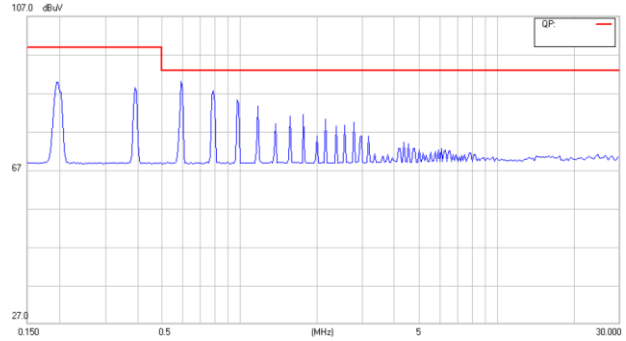
Pos



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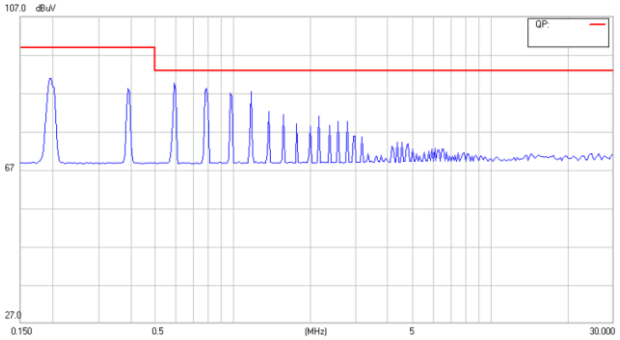
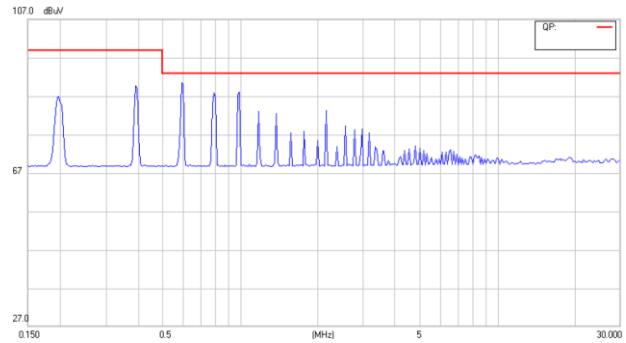


EC7BW18-72D24
Pos



EC7BW18-72D24
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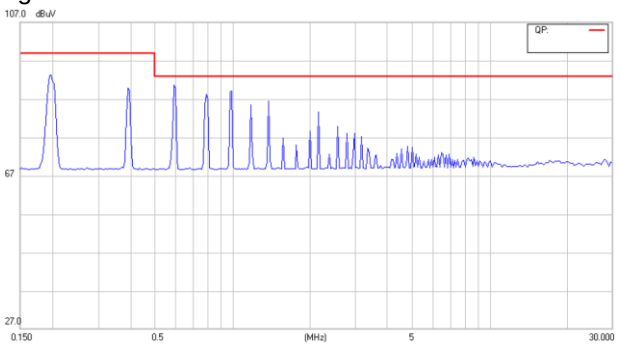
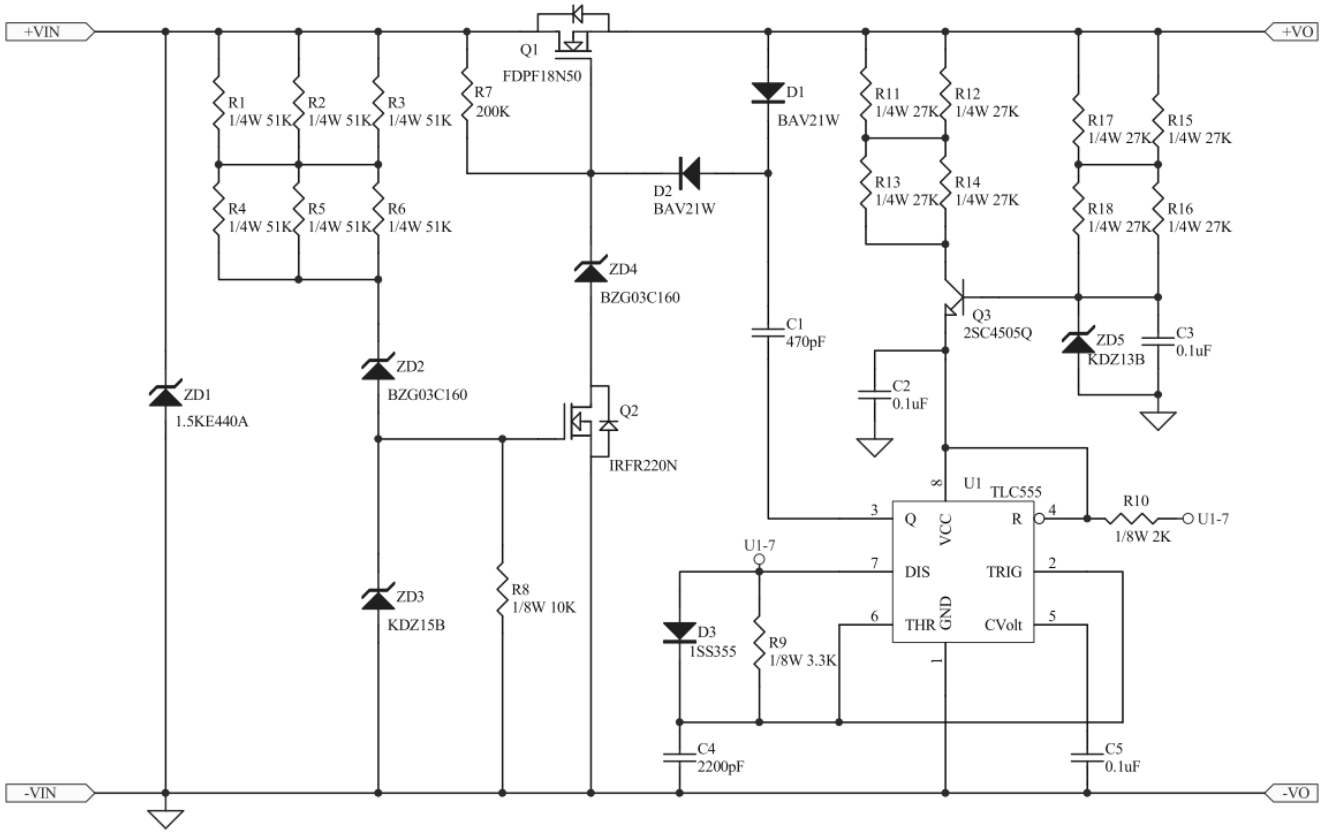


7.3 Suggested Configuration for RIA12 Surge Test



Note: Q1 suggest use FDPF18N50 or equivalent, and provide good heat dissipation conditions

8. Part Number

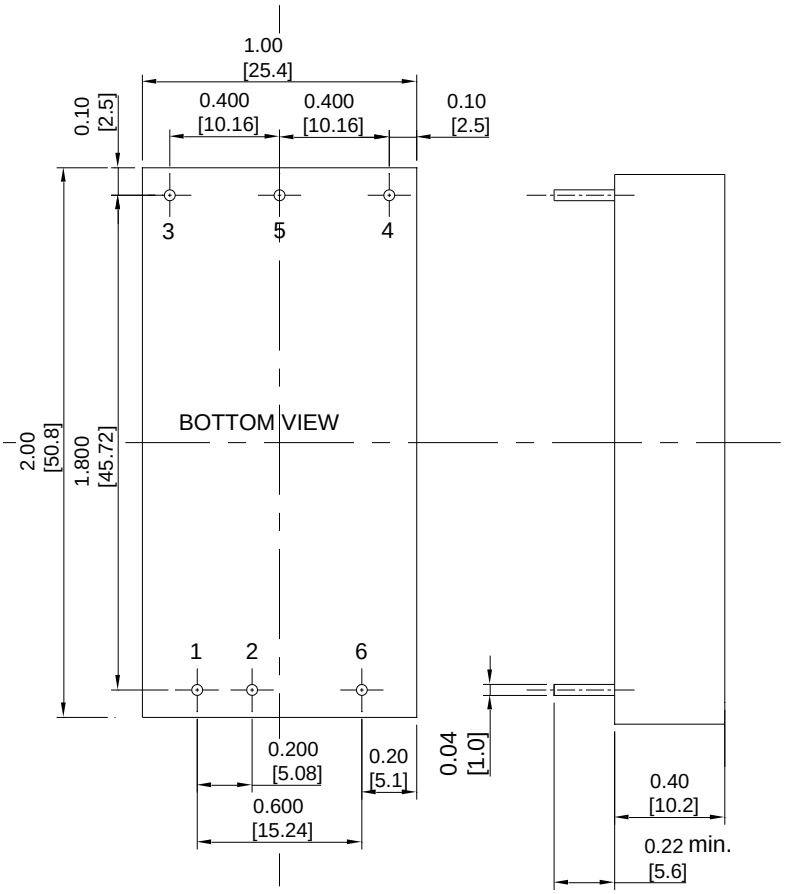
Format: EC7BW18 – II O XX L

Parameter	Series	Nominal Input Voltage	Number of Outputs	Output Voltage	Remote On/Off Logic
Symbol	EC7BW18	II	O	XX	L
Value	EC7BW18	72: 72 Volts	S: Single D: Dual	05: 5.0 Volts 12: 12 Volts 15: 15 Volts 24: 24 Volts	None: Positive N: Negative

9. Mechanical Specifications

9.1 Mechanical Outline Diagrams

NOTE: Pin Size is 0.04±0.004 Inch (1.0±0.1 mm)DIA
All Dimensions In Inches (mm)
Tolerances Inches: X.XX= ±0.02 , X.XXX= ±0.010
Millimeters: X.X= ±1.0, X.XX= ±0.25



PIN CONNECTION		
Pin	Single	Dual
1	+V Input	+V Input
2	-V Input	-V Input
3	+V Output	+V Output
4	Trim	-V Output
5	-V Output	Common
6	Remote On/Off	

EC7BW18-72 Series Mechanical Outline Diagram

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