ISOLATED DC-DC CONVERTER
ECB40W18 SERIES
APPLICATION NOTE

Approved By:

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Contents

1. Introduction

The ECB40W18 series of DC-DC converters offers 40 watts of output power @ output voltages of 5, 12, 15, 24, 48, 54VDC with industry 2”x1”x0.5” package. It has an ultra wide (18:1) input voltage range of 8.5 to 160VDC (72VDC nominal) and 3000VAC reinforced isolation.

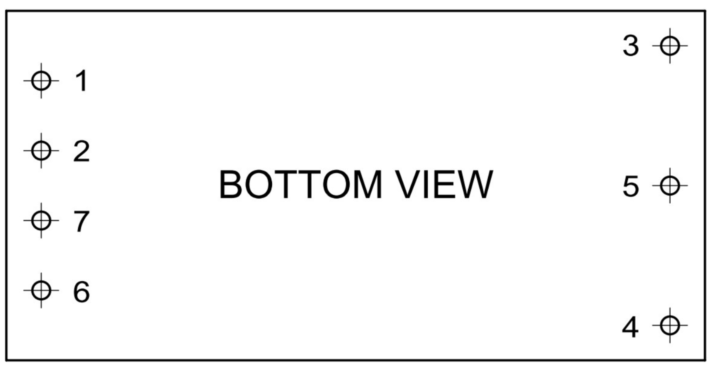
Compliant with EN 55032, EN 55035, EN 50155, EN 45545, EN 50121-3-2. High efficiency up to 90%, allowing case operating temperature range of -40℃ to 105℃. An optional heat sink is available to extend the full power range of the unit. Very low no load power consumption (10mA), an ideal solution for energy critical systems.

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

The standard control functions include remote on/off (positive or negative) and +15% to -20%, except 48 and 54Vout are +10% to -20% adjustable output voltage.

ECB40W18 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.

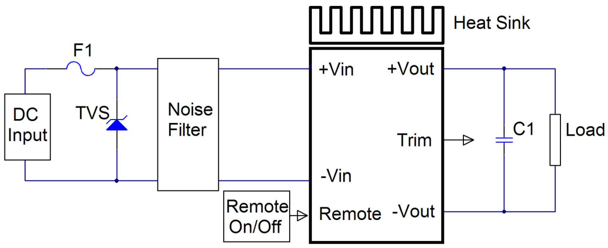
2. Pin Function Description



No	Label	Function	Description	Reference
1	+Vin	+V Input	Positive Supply Input	**Section 7.1/7.2/7.3**
2	-Vin	-V Input	Negative Supply Input	**Section 7.1/7.2/7.3**
3	+Vout	+V Output	Positive Power Output	**Section 7.4/7.5**
4	Trim	Trim	External Output Voltage Adjustment	**Section 6.6**
5	-Vout	-V Output	Negative Power Output	**Section 7.4/7.5**
6	Remote	Remote On/Off	External Remote On/Off Control	**Section 6.5**
7	Bus	Bus	Pre-Regulator Voltage Output (Option)	**Section 7.2**

3. Connection for Standard Use

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



Symbol	Component	Reference
F1, TVS	Input fuse, TVS	**Section 9.1**
C1	External capacitor on the output side	**Section 7.4**
Noise Filter	External input noise filter	**Section 9.2**
Remote On/Off	External remote on/off control	**Section 6.5**
Trim	External output voltage adjustment	**Section 6.6**
Heat Sink	External heat sink	**Section 5/8.1/8.2/8.3/8.4/8.5**

4. 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:

$$\eta = \frac{V_o \times I_o}{V_{in} \times I_{in}} \times 100\%$$

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:

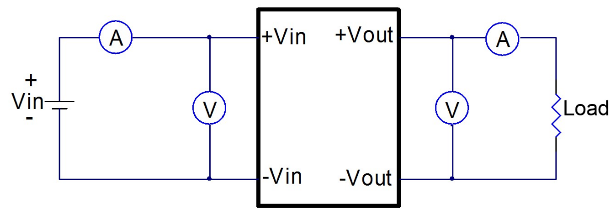
V_{FL} is the output voltage at full load
V_{NL} is the output voltage at no load

The value of line regulation is defined as:

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

Where:

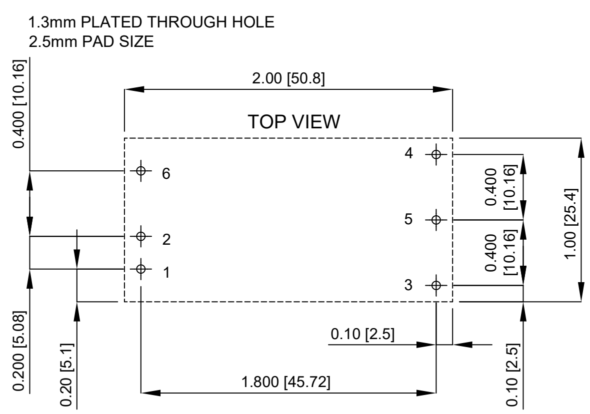
V_{HL} is the output voltage of maximum input voltage at full load
V_{LL} is the output voltage of minimum input voltage at full load



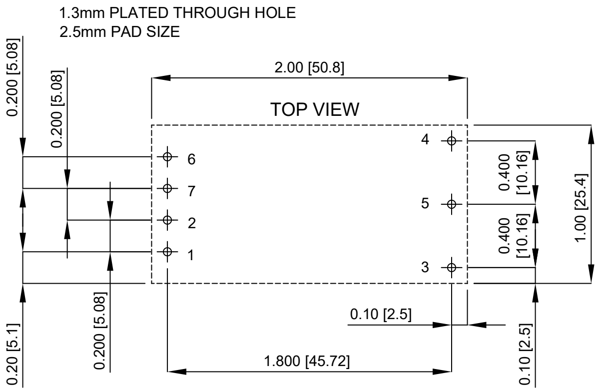
ECB40W18 Series Test Setup

5. 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.

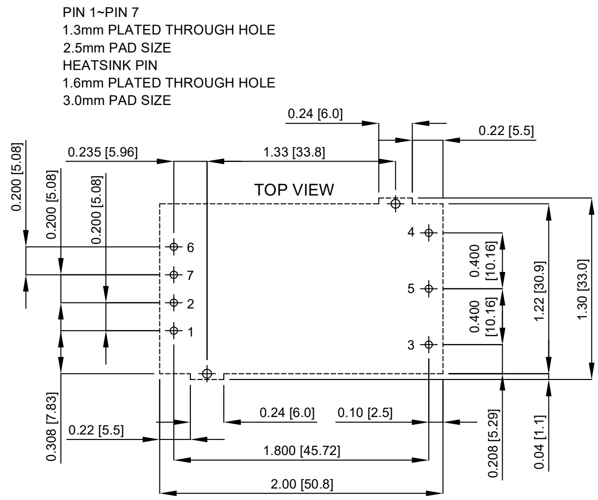


Standard Module



Option -B Module

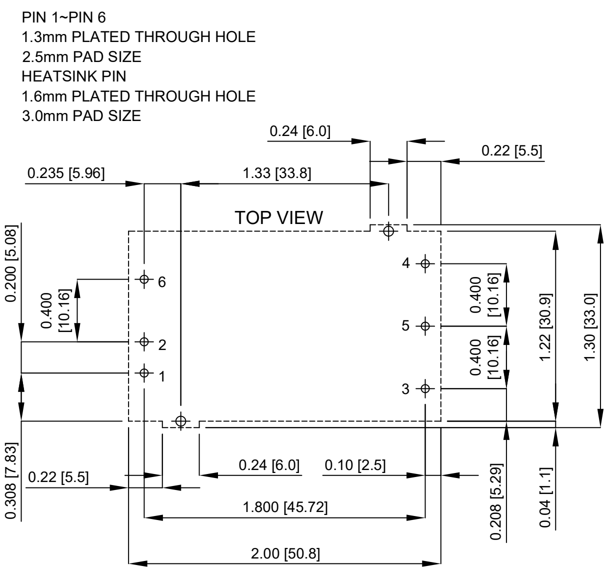
Note: Dimensions are in inches (millimeters)



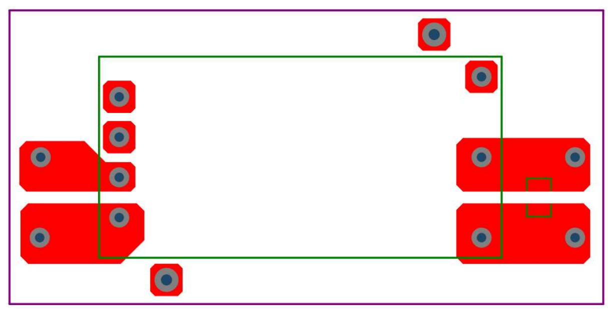
Option -B Module

Note: Dimensions are in inches (millimeters)

DC/DC module with heatsink recommended footprints and soldering profiles are shown below.
The PCB layout for distance between heatsink pins and the primary or secondary side traces should be at least 2mm, and heatsink pins recommended floating.



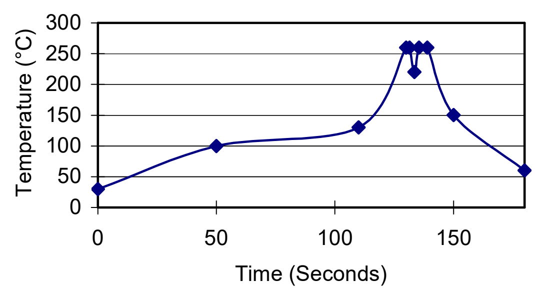
Standard Module



Clean the soldered side of the module with a brush, prevent liquid from getting into the module. Do not clean by soaking the module into liquid. Do not allow solvent to come in contact with product labels or resin case as this may change the color of the resin case or cause deletion of the letters printed on the product label. After cleaning, dry the modules well.

The suggested soldering iron is 420±10℃ for up to 4~15seconds (less than 90W). Furthermore, the recommended soldering profile is shown below.

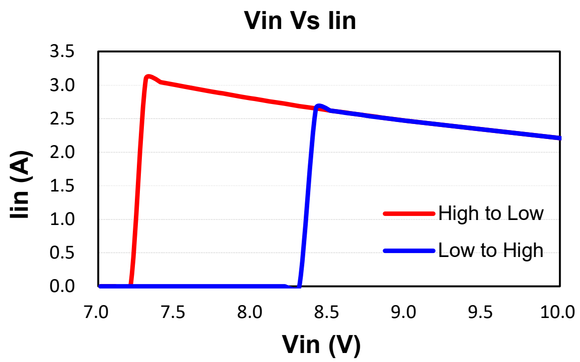
Lead Free Wave Soldering Profile



6. Features and Functions

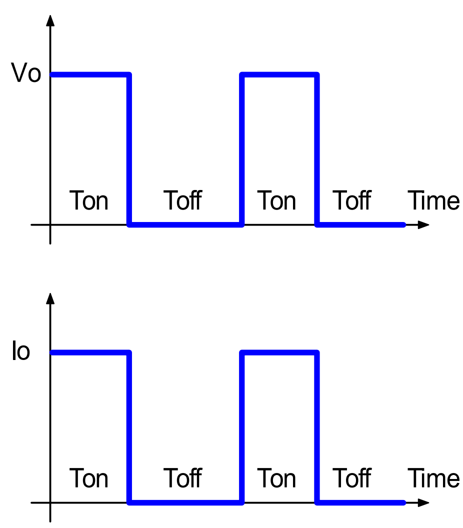
6.1 UVLO (Under Voltage Lock Out)

Input under voltage lockout is standard on the ECB40W18 series unit. The unit will shut down when the input voltage drops below a lower threshold, and the unit will operate when the input voltage goes above the upper threshold.



6.2 Over Current/Short Circuit 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.

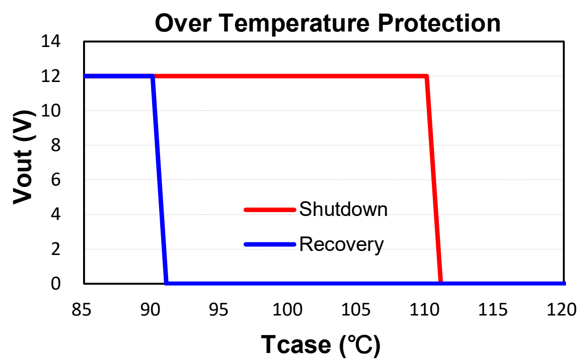


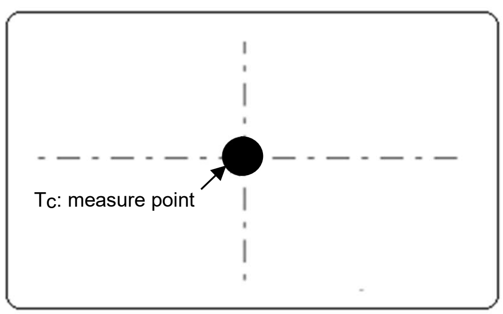
6.3 Output Over Voltage Protection

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

6.4 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. Please measure case temperature of the center part of aluminum base plate.





6.5 Remote On/Off

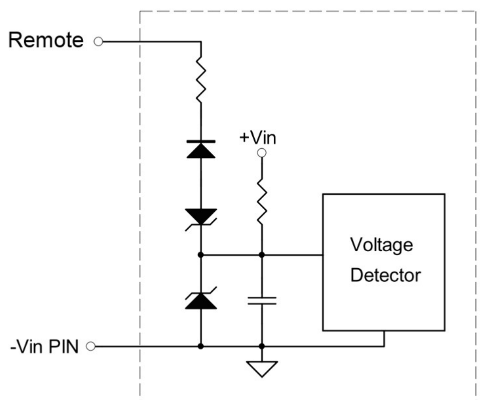
The ECB40W18 series allows the user to switch the module on and off electronically with the remote **on/off** feature. All models are available in “positive logic” and “negative logic” (optional) versions. The converter turns on if the remote **on/off** pin is high (>3.5Vdc to 160Vdc or open circuit). 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). Converter will be turn on in positive mode.

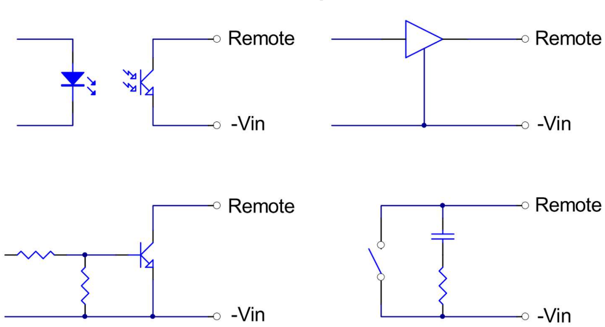
Models with part number suffix “N” are the “negative logic” remote **on/off** version. The unit turns off if the remote **on/off** pin is high (>3.5Vdc to 160Vdc or open circuit). The converter turns on if the **on/off** pin input is low (0 to<1.2Vdc). Note that the converter is off by default.

Logic State (Pin 6)	Negative Logic	Positive Logic
Logic Low	Module on	Module off
Logic High	Module off	Module on

The converter remote **on/off** circuit built-in on input side. The ground pin of input side remote **on/off** circuit is -Vin pin. Inside connection sees below.



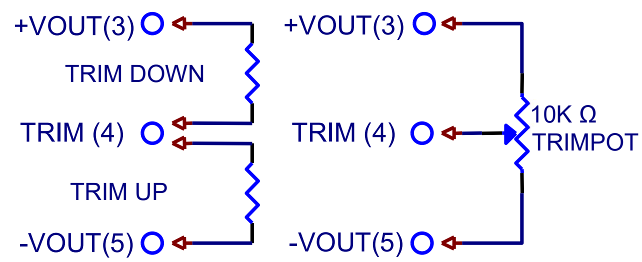
Connection Examples See Below



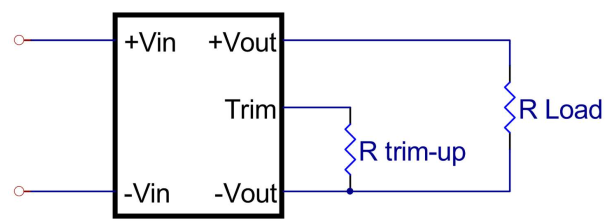
Remote On/Off Connection Examples

6.6 Output Voltage Adjustment

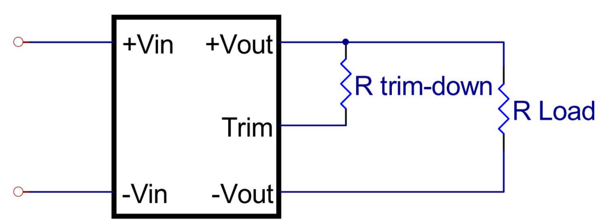
Output may be externally trimmed +15% to -20%, except 48 and 54V_{out} are +10% to -20% with a fixed resistor or an external trim pot as shown (optional). Model specific formulas for calculating trim resistors are available upon request as a separate document.



In order to trim the voltage up or down, one needs to connect the trim resistor either between the trim pin and -V_{out} for trim-up or between trim pin and +V_{out} for trim-down. The output voltage trim range is +15% to -20%, except 48 and 54V_{out} are +10% to -20%. This is shown:



Trim-up Voltage Setup



Trim-down Voltage Setup

The ECB40W18-72S05 value of R_{trim_up} defined as:

$$R_{trim\_up} = \frac{22.13 - 3.97 \times (V_o - V_{o,nom})}{7.012 \times (V_o - V_{o,nom})} - 3.3\ (K\Omega)$$

The ECB40W18-72S12 value of R_{trim_up} defined as:

$$R_{trim\_up} = \frac{120.774}{3 \times (V_o - V_{o,nom})} - 18\ (K\Omega)$$

The ECB40W18-72S15 value of R_{trim_up} defined as:

$$R_{trim\_up} = \frac{104.764}{2.285 \times (V_o - V_{o,nom})} - 18\ (K\Omega)$$

The ECB40W18-72S24 value of R_{trim_up} defined as:

$$R_{trim\_up} = \frac{297.435}{2.43 \times (V_o - V_{o,nom})} - 30\ (K\Omega)$$

The ECB40W18-72S48 value of R_{trim_up} defined as:

$$R_{trim\_up} = \frac{1235.605}{2.42 \times (V_o - V_{o,nom})} - 56\ (K\Omega)$$

The ECB40W18-72S54 value of R_{trim_up} defined as:

$$R_{trim\_up} = \frac{1478.43}{2.427 \times (V_o - V_{o,nom})} - 68\ (K\Omega)$$

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 (ECB40W18-72S05) by 5% to 5.25V, R_{trim_up} is calculated as follows:

$$R_{trim\_up} = \frac{22.13 - 3.97 \times (5.25 - 5)}{7.012 \times (5.25 - 5)} - 3.3 = 8.758\ (K\Omega)$$

The typical value of R_{trim_up}

Trim up %	5V	12V	15V	24V	48V	54V
	R_{trim_up} (KΩ)					
1%	59.254	317.484	287.656	480.005	1007.710	1060.073
2%	27.694	149.742	134.828	225.003	475.855	496.037
3%	17.174	93.828	83.885	140.002	298.570	308.024
4%	11.914	65.871	58.414	97.501	209.927	214.018
5%	8.758	49.097	43.131	72.001	156.742	157.615
6%	6.654	37.914	32.943	55.001	121.285	120.012
7%	5.151	29.926	25.665	42.858	95.959	93.153
8%	4.024	23.936	20.207	33.751	76.964	73.009
9%	3.147	19.276	15.962	26.667	62.190	57.341
10%	2.446	15.548	12.566	21.001	50.371	44.807
11%	1.872	12.499	9.787	16.364		
12%	1.394	9.957	7.471	12.500		
13%	0.989	7.806	5.512	9.231		
14%	0.643	5.963	3.833	6.429		
15%	0.342	4.366	2.377	4.000		

The ECB40W18-72S05 value of R_{trim_down} defined as:

$$R_{trim\_down} = \frac{41.995 - 16.792 \times (V_{o,nom} - V_o)}{7.012 \times (V_{o,nom} - V_o)} - 3.3\ (K\Omega)$$

The ECB40W18-72S12 value of R_{trim_down} defined as:

$$R_{trim\_down} = \frac{206.151}{3 \times (V_{o,nom} - V_o)} - 27.081\ (K\Omega)$$

The ECB40W18-72S15 value of R_{trim_down} defined as:

$$R_{trim\_down} = \frac{207.025}{2.285 \times (V_{o,nom} - V_o)} - 27.1\ (K\Omega)$$

The ECB40W18-72S24 value of R_{trim_down} defined as:

$$R_{trim\_down} = \frac{624.1}{2.43 \times (V_{o,nom} - V_o)} - 45.8\ (K\Omega)$$

The ECB40W18-72S48 value of R_{trim_down} defined as:

$$R_{trim\_down} = \frac{2265.025}{2.42 \times (V_{o,nom} - V_o)} - 86.1\ (K\Omega)$$

The ECB40W18-72S54 value of R_{trim_down} defined as:

$$R_{trim\_down} = \frac{3240}{2.427 \times (V_{o,nom} - V_o)} - 104\ (K\Omega)$$

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

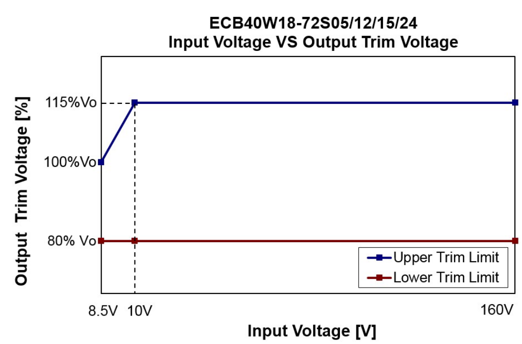
For example: to trim-down the output voltage of 12V module (ECB40W18-72S12) by 5% to 11.4V, R_{trim_down} is calculated as follows:

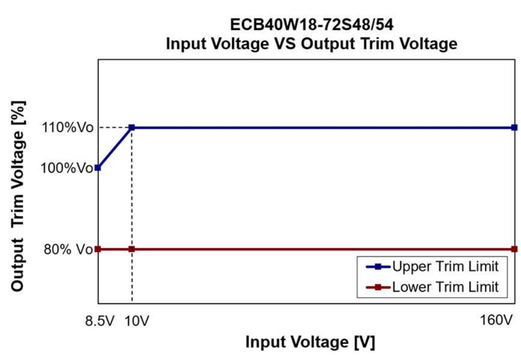
$$R_{trim\_down} = \frac{206.151}{3 \times (12 - 11.4)} - 27.081 = 87.448\ (K\Omega)$$

The typical value of R_{trim_down}

Trim down%	5V	12V	15V	24V	48V	54V
	R_{trim_down} (KΩ)					
1%	114.089	545.562	576.912	1024.330	1863.818	2368.188
2%	54.197	259.241	274.906	489.265	888.859	1132.094
3%	34.233	163.800	174.237	310.910	563.873	720.063
4%	24.251	116.080	123.903	221.733	401.380	514.047
5%	18.262	87.448	93.702	168.226	303.884	390.438
6%	14.269	68.360	73.569	132.555	238.886	308.031
7%	11.417	54.725	59.187	107.076	192.460	249.170
8%	9.278	44.500	48.401	87.966	157.640	205.023
9%	7.614	36.546	40.012	73.103	130.558	170.688
10%	6.284	30.184	33.301	61.213	108.892	143.219
11%	5.195	24.978	27.810	51.485	91.165	120.744
12%	4.287	20.639	23.234	43.378	76.393	102.016
13%	3.519	16.969	19.362	36.518	63.894	86.168
14%	2.861	13.822	16.044	30.638	53.180	72.585
15%	2.291	11.095	13.167	25.542	43.895	60.813
16%	1.792	8.709	10.651	21.083	35.770	50.512
17%	1.351	6.604	8.430	17.149	28.601	41.423
18%	0.960	4.733	6.456	13.652	22.229	33.344
19%	0.610	3.058	4.690	10.523	16.527	26.115
20%	0.294	1.551	3.101	7.707	11.396	19.609

ECB40W18 series input range and output trim voltage curve are shown below.

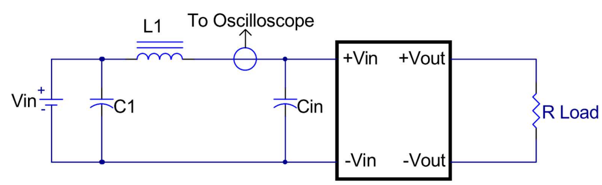




7. Input / Output Considerations

7.1 Input Capacitance at the Power Module

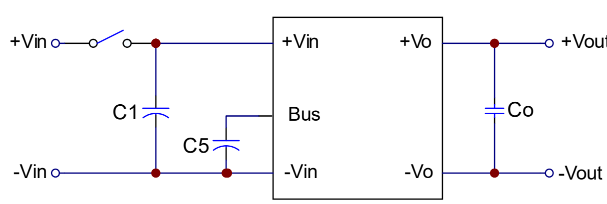
The converters must be connected to low AC source impedance. To avoid problems with loop stability source inductance should be low. Also, the input capacitors (Cin) should be placed close to the converter input pins to de-couple distribution inductance. However, the external input capacitors are chosen 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: 120uF ESR<0.2ohm @100KHz

7.2 Hold Up Time

Hold up time is defined as the duration of time that the DC/DC converter output will remain active following a loss of input power. The Bus pin is for hold up time function. It is designed to work with an external circuit comprises C5. When input power supply is interrupted, the ECB40W18 series use the energy stored in C5 to support operation. A typical configuration shows as below.



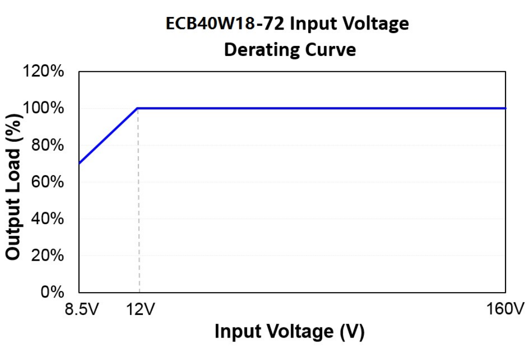
C1: None

If hold up time function is not needed, please remove the component (C5). This function provides energy that maintains the DC-DC converter in operation for 10mS and 30mS hold up time. The capacity (C5) in the application is recommended as below.

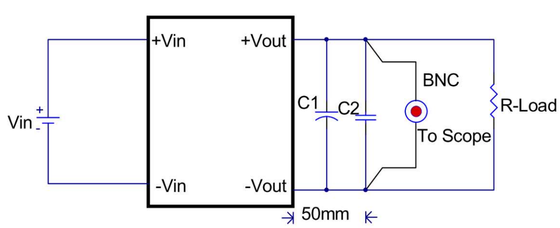
C5 \ Vin		24V	36V	48V	72V	96V	110V
For 10 mS	C5	2600uF	1900uF	1900uF	1900uF	1900uF	1900uF
For 30 mS		7700uF	5700uF	5700uF	5700uF	5700uF	5700uF

7.3 Input Derating Curve

ECB40W18 series has derating by Input Voltage is required shown below.



7.4 Output Ripple and Noise



Note:

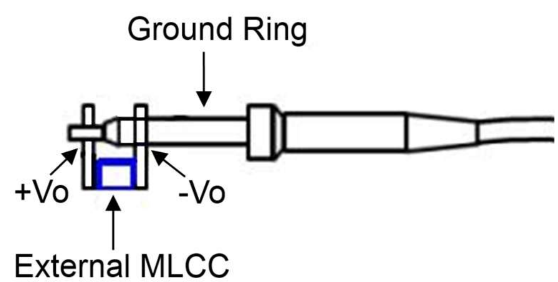
C1: None

C2: 1uF ceramic capacitor

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.



7.5 Output Capacitance

The ECB40W18 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.

8. Thermal Design

8.1 Operating Temperature Range

The ECB40W18 series converters can be operated within a wide case temperature range of -40℃ to 105℃. 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

8.2 Convection Requirements for Cooling

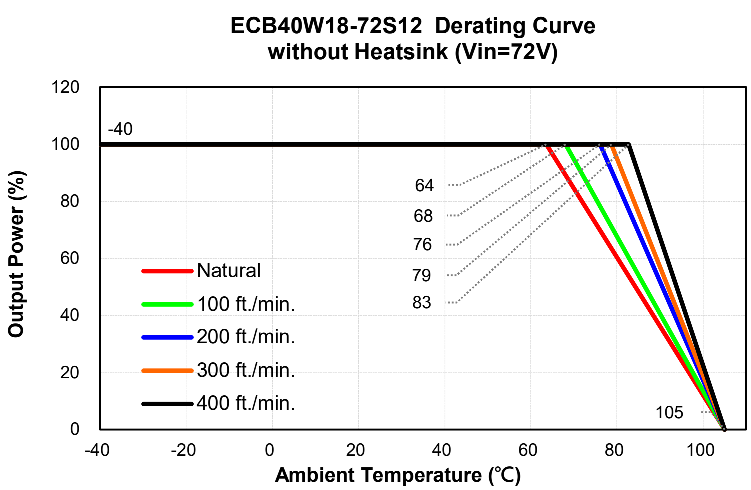
To predict the approximate cooling needed for the 2"×1" module, refer to the power derating curves in **section 8.4**. These derating curves are approximations of the ambient temperatures and airflows required to keep the power module temperature below its maximum rating. Once the module is assembled in the actual system, the module's temperature should be monitored to ensure it does not exceed 105℃ as measured at the center of the top of the case (thus verifying proper cooling).

8.3 Thermal Considerations

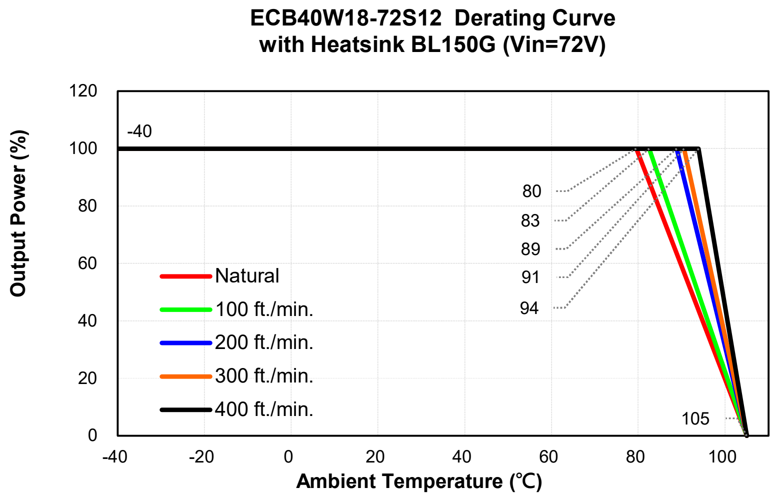
The power module operates in a variety of thermal environments; however, sufficient cooling should be provided to help ensure reliable operation of the unit. Heat is removed by conduction, convection, and radiation to the surrounding environment. The example is presented in **section 8.4**. The power output of the module should not be allowed to exceed rated power (V_{o_set} x $I_{o\_max.}$).

8.4 Power Derating

The operating case temperature range of ECB40W18 series is -40℃ to +105℃. When operating the ECB40W18 series, proper derating or cooling is needed. The maximum case temperature under any operating condition should not exceed 105℃.
The following de-rating curves of ECB40W18-72S12 without heat sink and with heat sink.



AIR FLOW RATE	TYPICAL R_{ca}
Natural Convection 20ft./min. (0.1m/s)	9.2 ℃/W
100 ft./min. (0.5m/s)	8.2 ℃/W
200 ft./min. (1.0m/s)	6.4 ℃/W
300 ft./min. (1.5m/s)	5.8 ℃/W
400 ft./min. (2.0m/s)	4.9 ℃/W



AIR FLOW RATE	TYPICAL R_{ca}
Natural Convection 20ft./min. (0.1m/s)	5.62 ℃/W
100 ft./min. (0.5m/s)	4.94 ℃/W
200 ft./min. (1.0m/s)	3.52 ℃/W
300 ft./min. (1.5m/s)	3.14 ℃/W
400 ft./min. (2.0m/s)	2.38 ℃/W

Example:

The ECB40W18-72S12 operating at nominal line voltage, an output current of 3.333A, and a maximum ambient temperature of 70℃.

Solution:

Given: V_{in}=72V_{dc}, V_o=12V_{dc}, I_o=3.333A

Determine Power dissipation (P_d): $P_d= P_i-P_o= P_o(1-\eta)/\eta$, P_d=12×3.333×(1-0.90)/0.90=4.45Watts

Determine airflow: Airflow: Airflow=200 ft./min.

Check *Power Derating* curve: Given: P_d= 4.45W and T_a=70℃

Verify:

Maximum temperature rise is $\Delta T=P_d \times R_{ca}$=4.45×6.4=28.48℃

Maximum case temperature is $T_c=T_a+\Delta T$=98.48℃<105℃

Where:

The R_{ca} is thermal resistance from case to ambient environment.

T_a is ambient temperature and T_c is case temperature.

Example with heat sink BL150G (M-C1677):

The ECB40W18-72S12 operating at nominal line voltage, an output current of 3.333A, and a maximum ambient temperature of 80℃.

Solution:

Given: V_{in}=72Vdc, V_o=12Vdc, I_o=3.333A

Determine Power dissipation (P_d): $P_d= P_i-P_o=P_o(1-\eta)/\eta$, P_d=12×3.333×(1-0.90)/0.90=4.45Watts

Determine airflow: Airflow=200 ft./min

Check above Power de-rating curve: Given: P_d=4.45W and T_a=80℃

Verify:

Maximum temperature rise is $\Delta T= P_d \times R_{ca}$=4.45×3.52=15.66℃

Maximum case temperature is $T_c=T_a+\Delta T$=95.66℃<105℃

Where:

The R_{ca} is thermal resistance from case to ambient environment.

T_a is ambient temperature and T_c is case temperature.

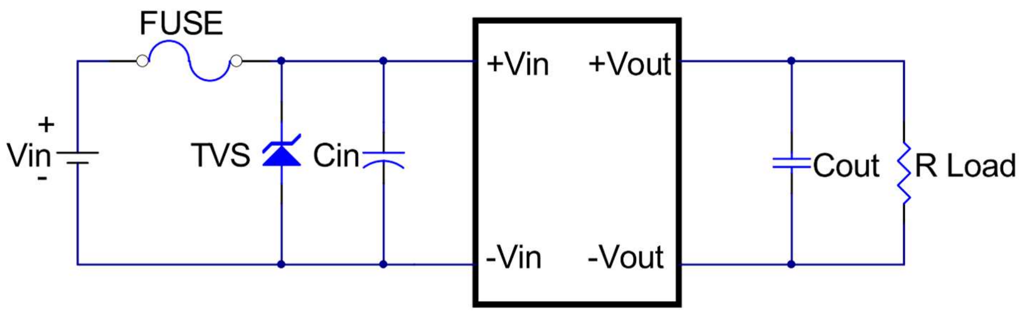
8.5 2"x1" Case Heat Sink:

Heat sinks assembly **refer to Datasheet-Thermal**

9. Safety & EMC

9.1 Input Fusing and Safety Considerations

The ECB40W18 series converters have no internal fuse. In order to achieve maximum safety and system protection, always use an input line fuse. We recommended a 6.3A time delay fuse for all models. It is recommended that the circuit has 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 input capacitor (Cin) and transient voltage suppressor diode (TVS) are required if ECB40W18 series has to meet EN61000-4-4, EN61000-4-5.

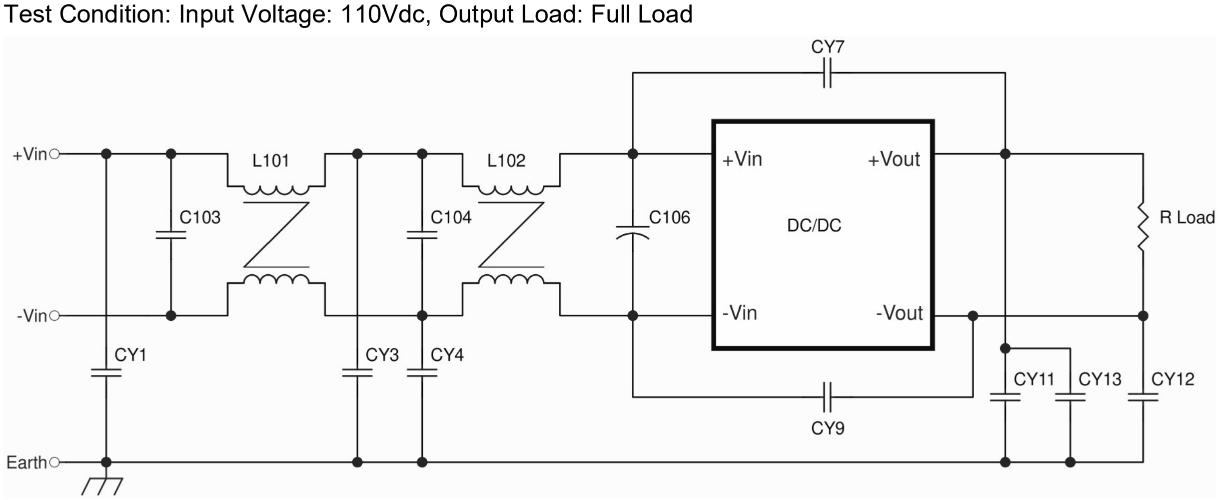
Cin: 150uF/200V (RUBYCON BXW series) aluminum capacitor is recommended.

TVS: SMDJ180A transient voltage suppressor is recommended.

9.2 EMC Considerations

EMI Test standard: EN55032 Class A, EN50121-3-2

Test Condition: Input Voltage: 110Vdc, Output Load: Full Load



Model Number	ECB40W18-72S05	ECB40W18-72S12	ECB40W18-72S15	ECB40W18-72S24	ECB40W18-72S48	ECB40W18-72S54
C103	2.2uF/450V	1uF/450V				
C104	1uF/450V					
C106	150uF/200V					
CY1	220pF					
CY3, CY4	2200pF	1000pF	2200pF	2200pF	2200pF	2200pF
CY7, CY9	4700pF					
CY11, CY12	2200pF	1500pF	4700pF	4700pF	4700pF	4700pF
CY13	NC				4700pF	4700pF
L101	1mH (F1407-102BL-G)					
L102	5mH (SP21030T-LF)					

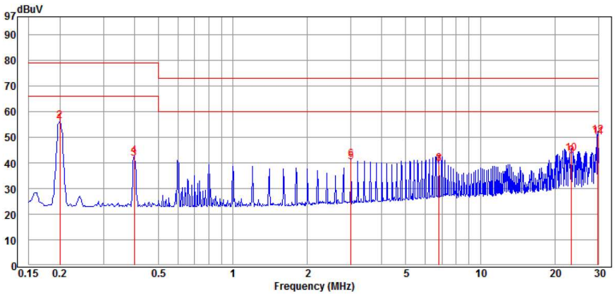
Note:

C103, C104: Metallized polypropylene film capacitor, FPS4 series or equivalent
C106: RUBYCON BXW series aluminum capacitor or equivalent
CY1: TDK Y1 or Y2 capacitor or equivalent
CY3, CY4, CY7, CY9, CY11, CY12, CY13: TDK Y1 capacitor or equivalent
L101: F1407-102BL-G, SENDPOWER or equivalent
L102: SP21030T-LF, SENDPOWER or equivalent

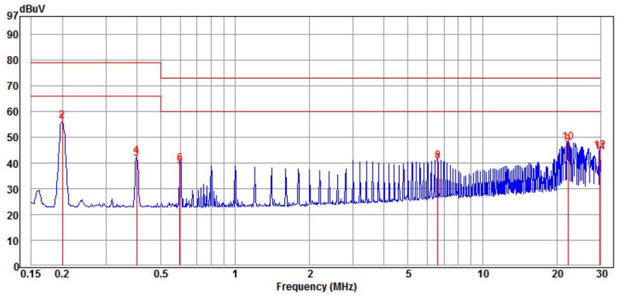
Input Conducted Emission (EN55032 Class A):

ECB40W18-72S05

Line

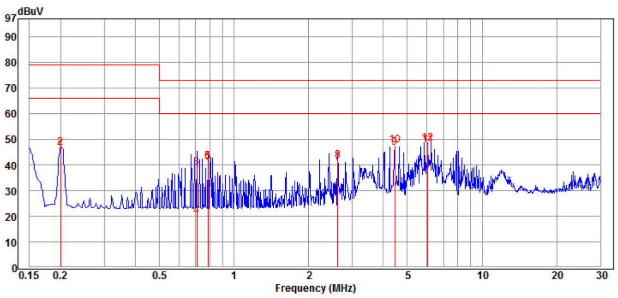


Neutral

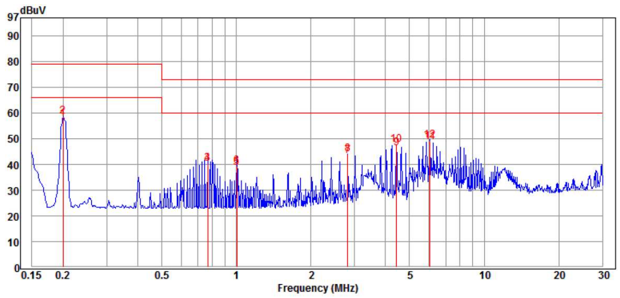


ECB40W18-72S12

Line

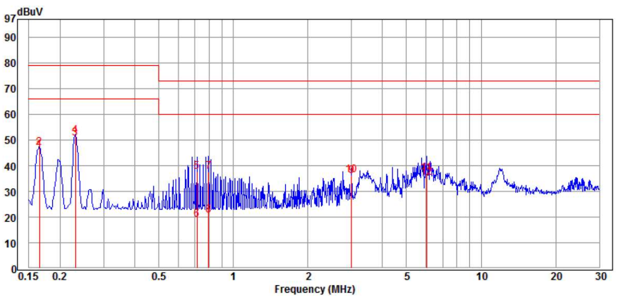


Neutral

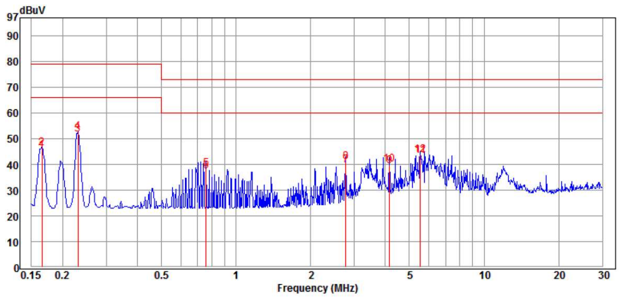


ECB40W18-72S15

Line

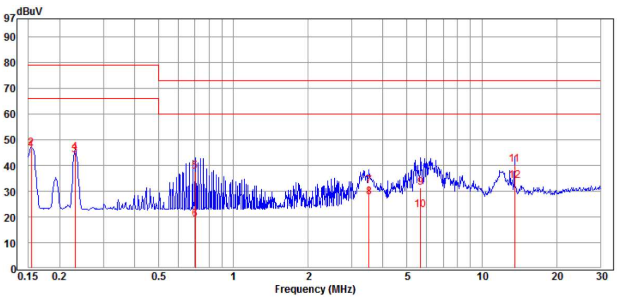


Neutral

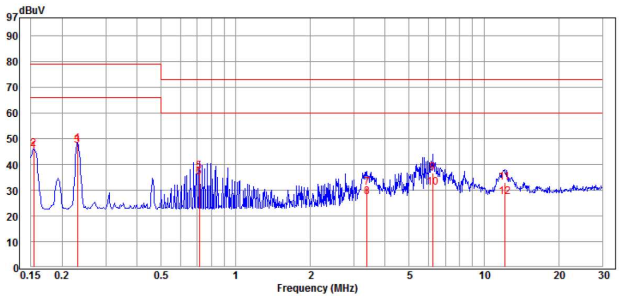


ECB40W18-72S24

Line

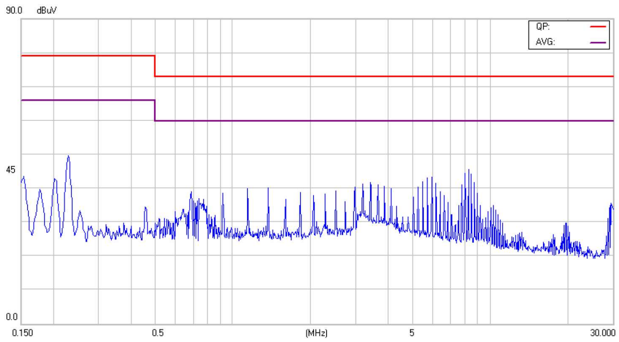


Neutral

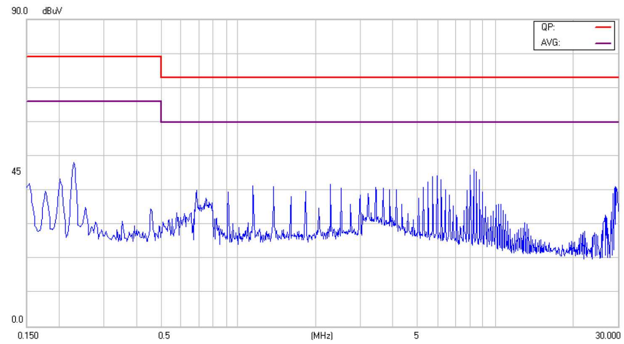


ECB40W18-72S48

Line

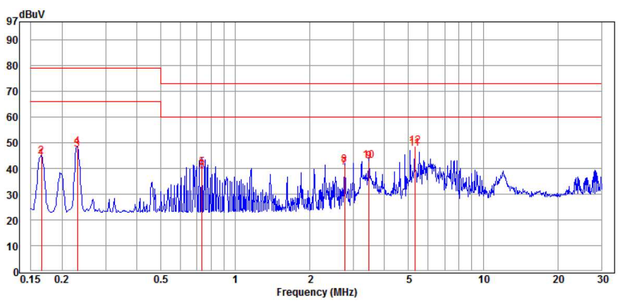


Neutral

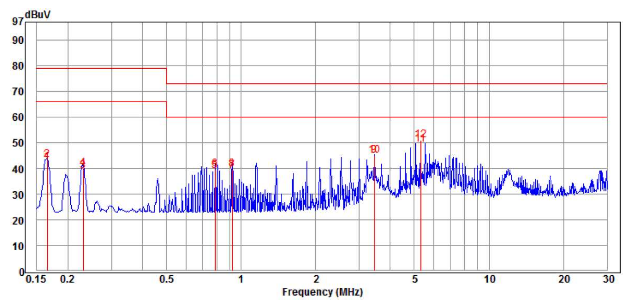


ECB40W18-72S54

Line



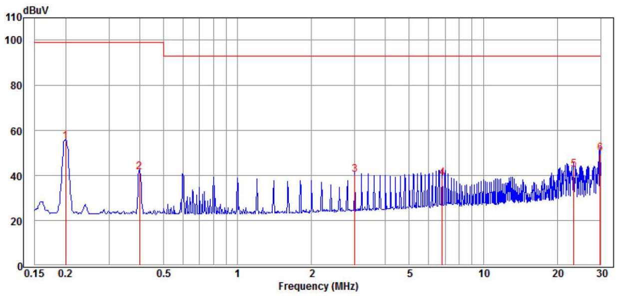
Neutral



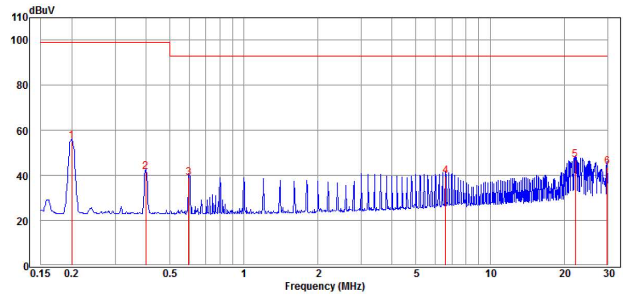
Input Conducted Emission (EN50121-3-2):

ECB40W18-72S05

Line

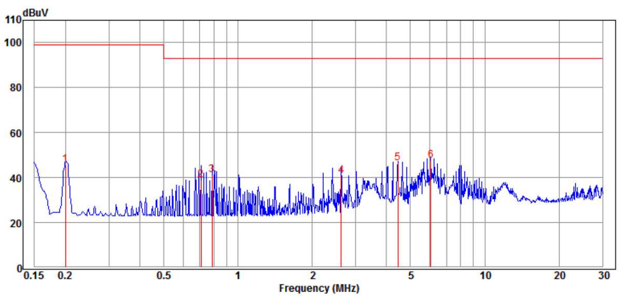


Neutral

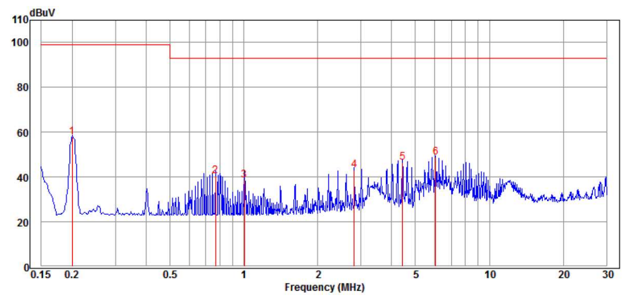


ECB40W18-72S12

Line

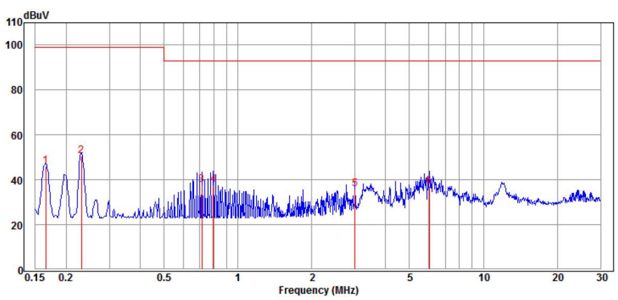


Neutral



ECB40W18-72S15

Line



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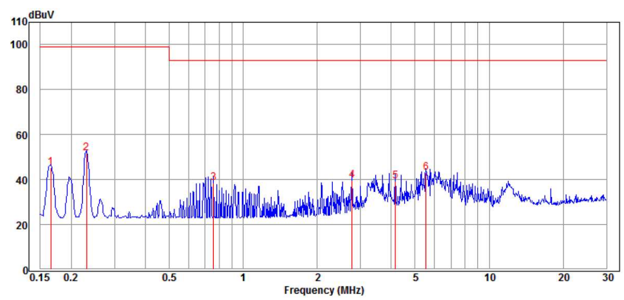
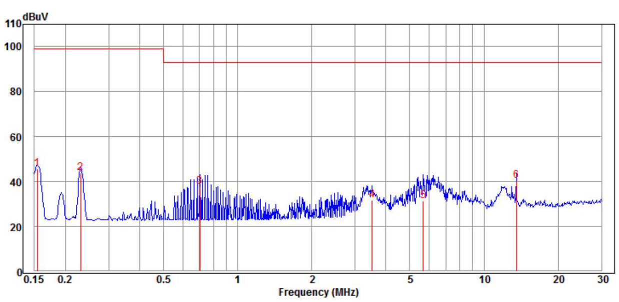
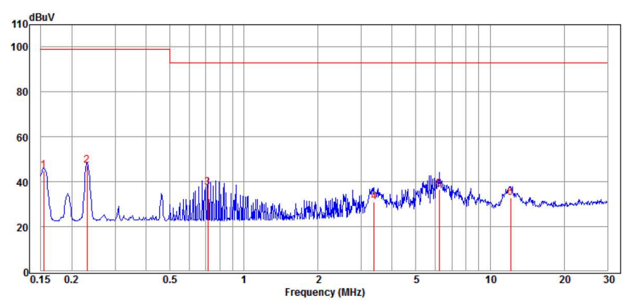


ECB40W18-72S24

Line

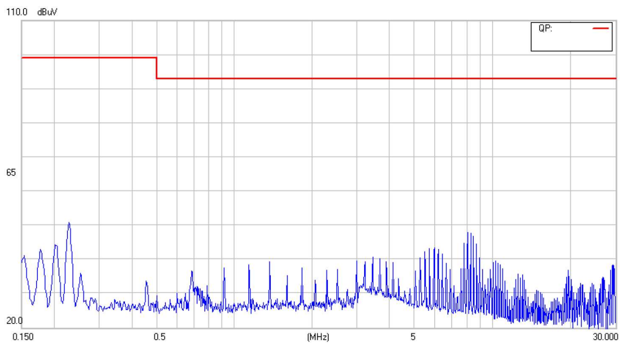


Neutral



ECB40W18-72S48

Line



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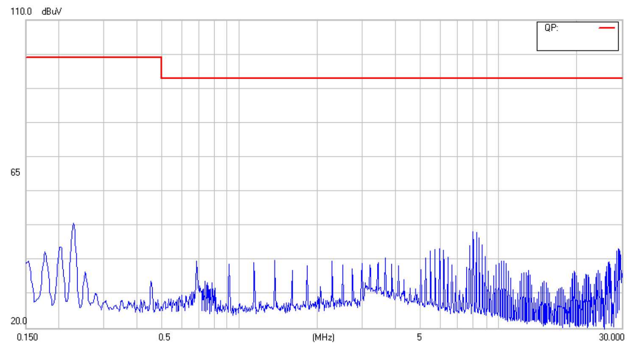
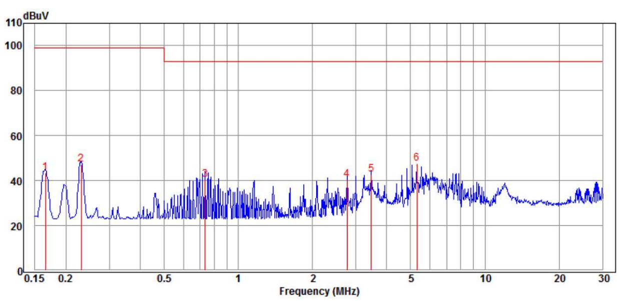
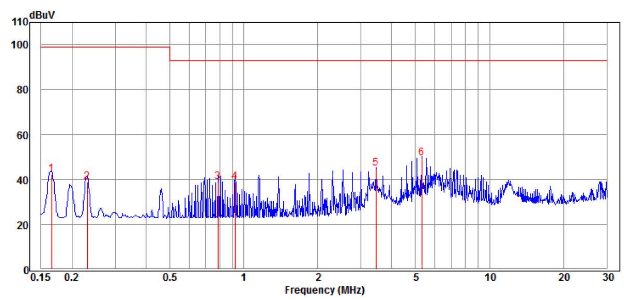


ECB40W18-72S54

Line



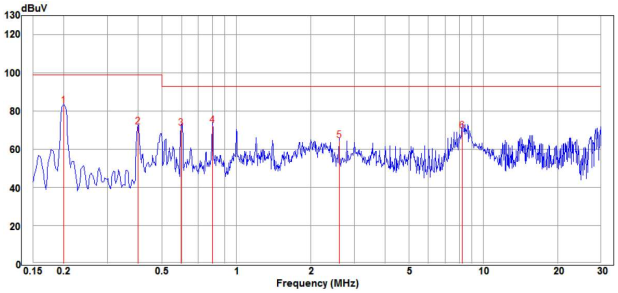
Neutral



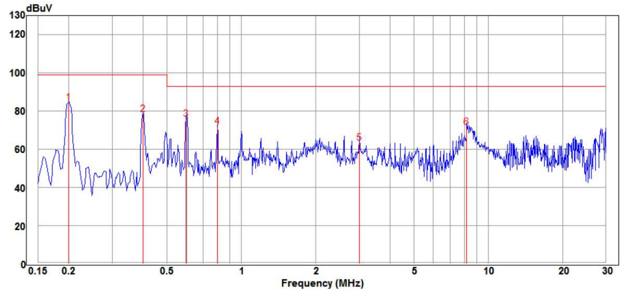
Output Conducted Emission (EN50121-3-2):

ECB40W18-72S05

Positive

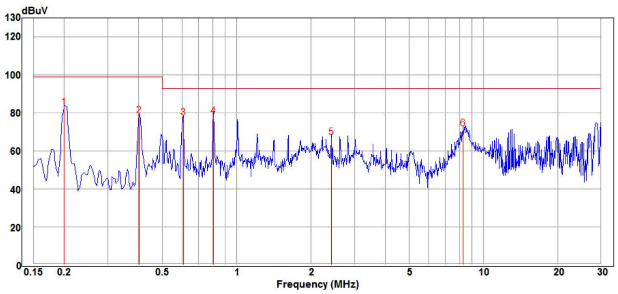


Negative

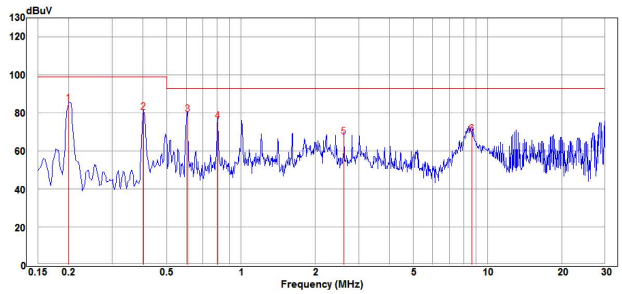


ECB40W18-72S12

Positive

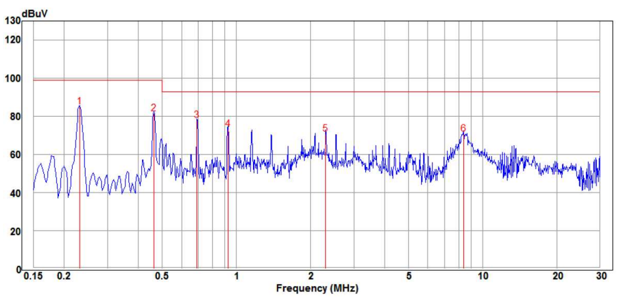


Negative



ECB40W18-72S15

Positive



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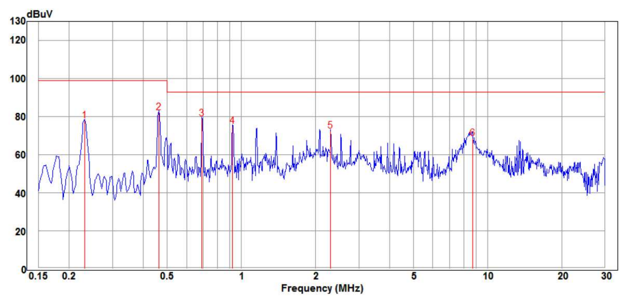
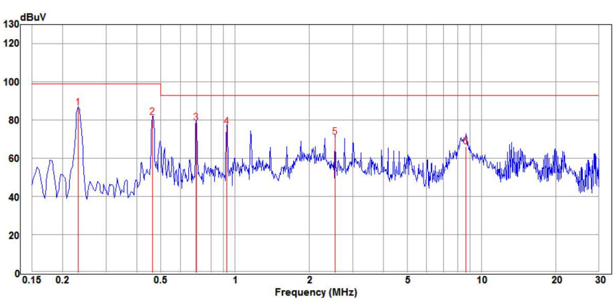
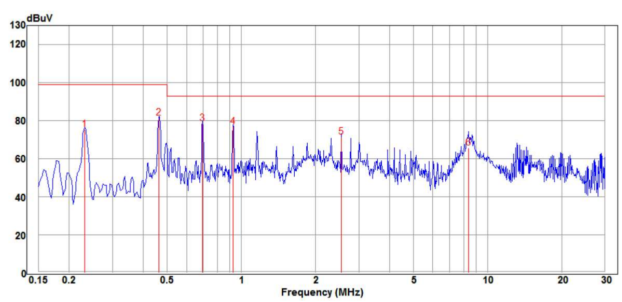


ECB40W18-72S24

Positive

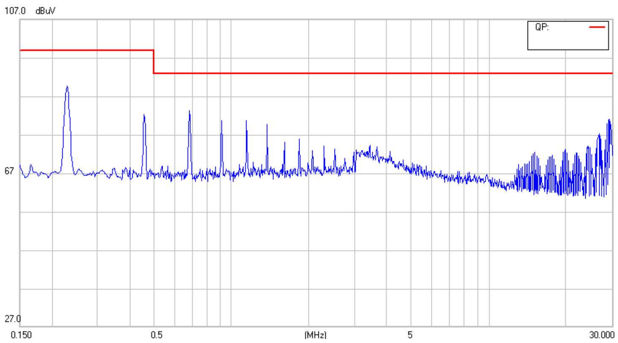


Negative

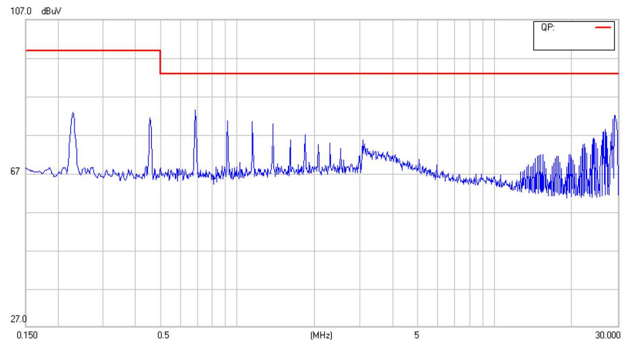


ECB40W18-72S48

Positive

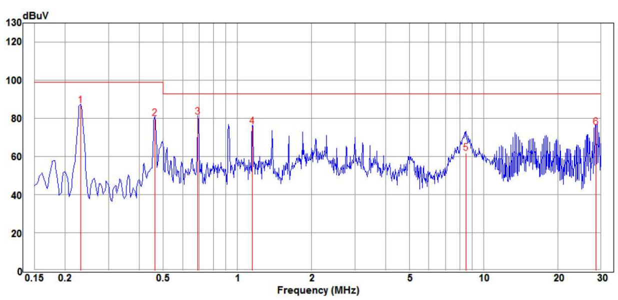


Negative



ECB40W18-72S54

Positive



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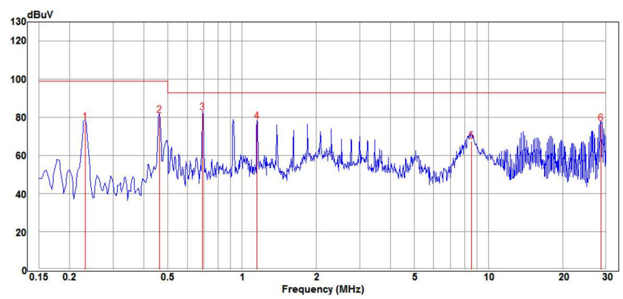
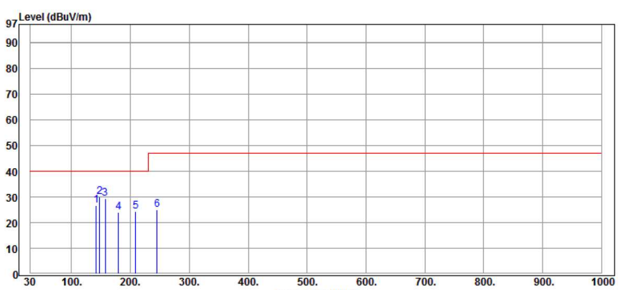


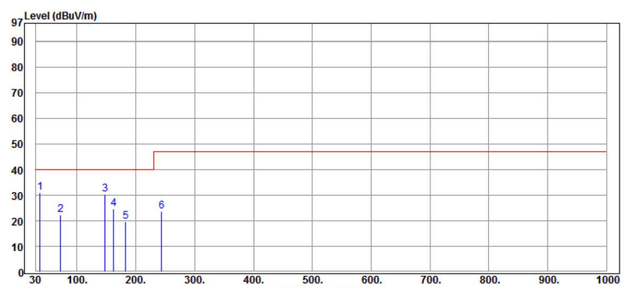
Radiated Emission (EN55032 Class A / EN50121-3-2):

ECB40W18-72S05

Horizontal

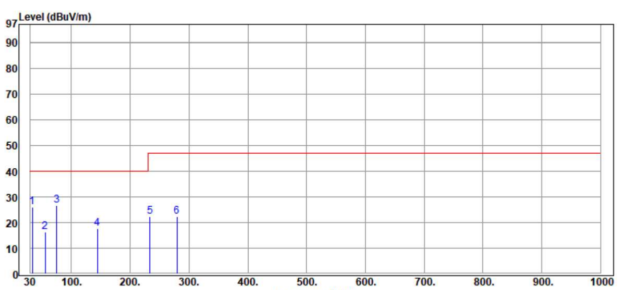


Vertical

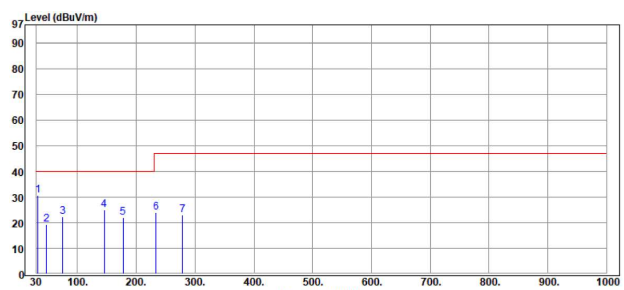


ECB40W18-72S12

Horizontal

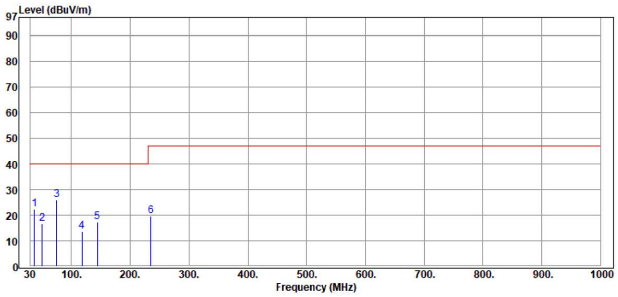


Vertical

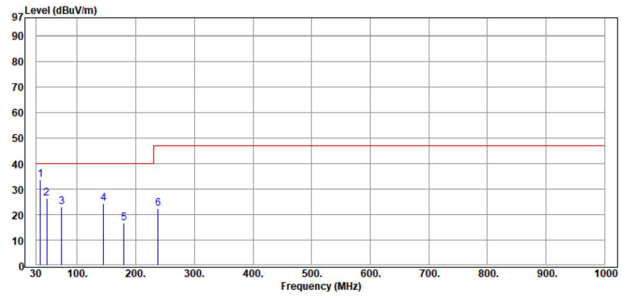


ECB40W18-72S15

Horizontal

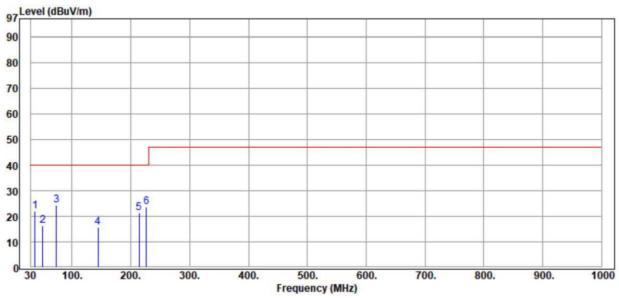


Vertical

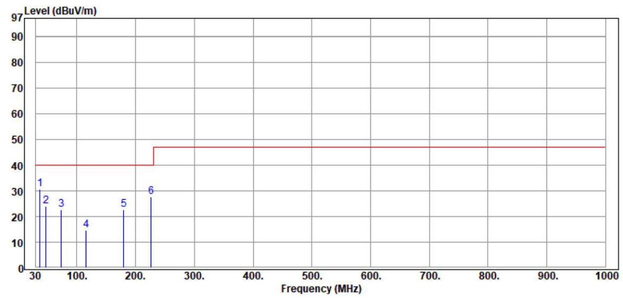


ECB40W18-72S24

Horizontal



Vertical



ECB40W18-72S48

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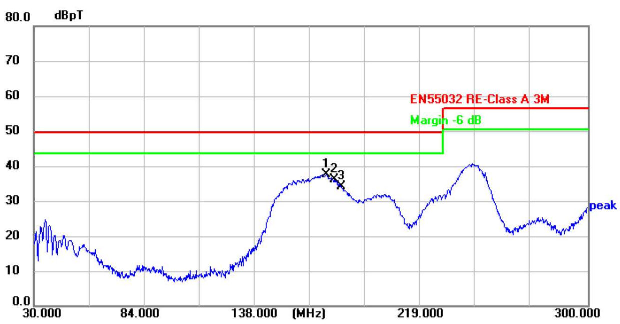
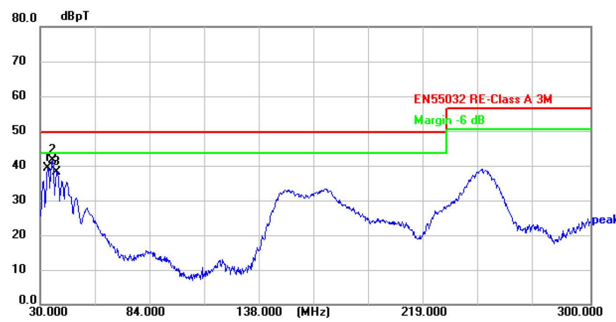
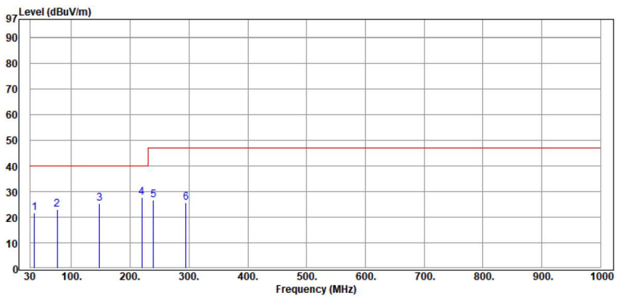


Vertical

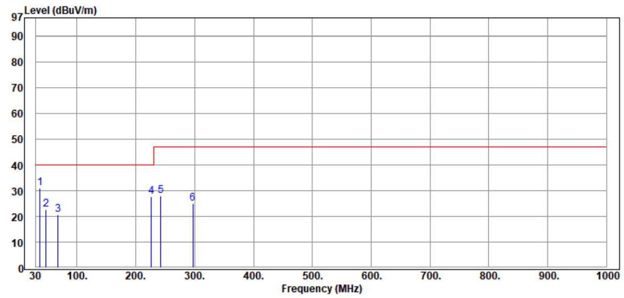


ECB40W18-72S54

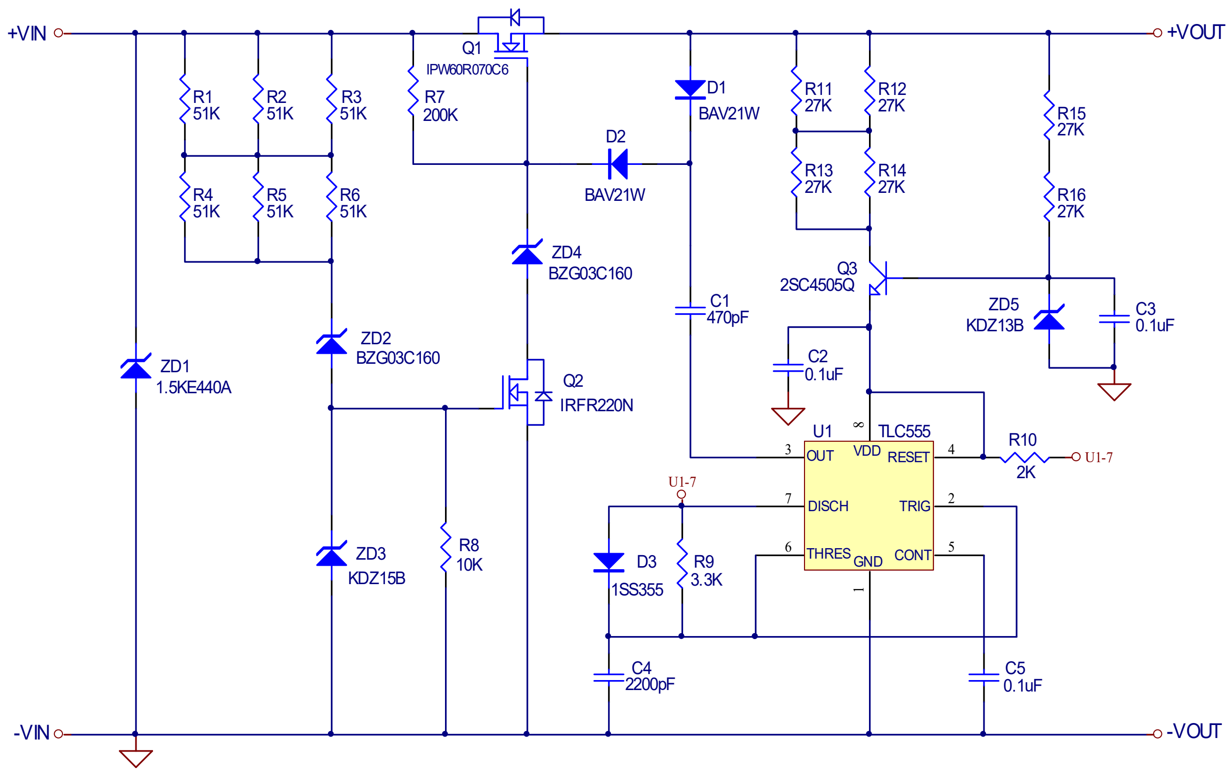
Horizontal



Vertical



9.3 Suggested Configuration for RIA12 Surge Test



Note: Q1 suggest use IPW60R070C6 or equivalent and provide good heat dissipation condition

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ChangHua Hsien, Taiwan
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