KMNB01 1/16 Brick Non Isolated DC-DC Converter

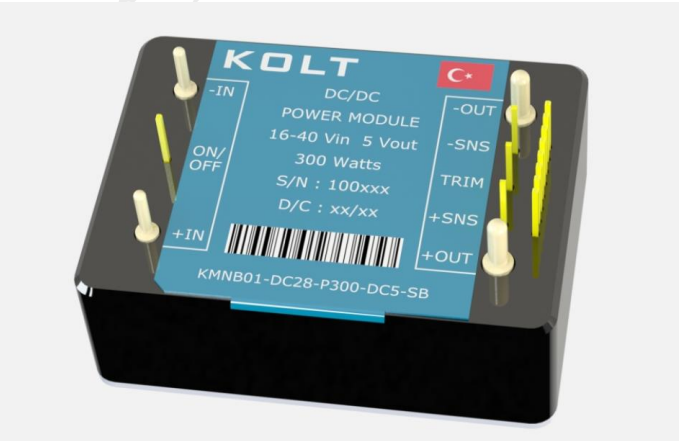
Features & Benefits

- DC/DC Sixteen Brick Module
- Up to 300 W, 60 A continuous
- %93.6 efficiency
- Input voltage range 16 – 40 V
- Input under/over voltage protection
- Output over voltage protection
- Output over current protection
- Output short-circuit protection
- Thermal shutdown
- ON/OFF Control
- Output trim range +20%, -20%

Product Ratings	
V_{IN_NOM} = 28 V	P_{OUT} = 300 W
V_{IN_MIN} = 16 V	V_{OUT_NOM} = 5 V
V_{IN_MAX} = 40 V	I_{OUT_NOM} = 60 A

Product Description

KMNB01-DC28-P300-DC5-SB is a 300 W DC/DC non isolated sixteen brick converter that operates from nominal 28 V input and generates 5 V output. It is designed to meet EMI requirements and has superior noise and ripple performance. Converter is fully protected to operate reliably under all kinds of disturbances. Base plate is creatively designed to provide efficient cooling.



Size:

58.4 × 36.8 × 12.9 mm

Recommended alternative KMNB03-DC28E-P100-DC5-SB

Electrical Characteristics

All data are obtained at nominal line and load unless otherwise specified.

Module Input Specifications

PARAMETERS	Min	Typical	Max	Unit	Notes
Operating Input Voltage	16	28	40	V	
Under Voltage Turn On	15.6	16	16.4	V	
Under Voltage Turn Off	14.8	15	15.2	V	
Over Voltage Turn On	39.8	40	40.2	V	
Over Voltage Turn Off	41	41.3	41.5	V	
Disabled Power Dissipation			17	mW	No-load
Enabled Power Dissipation	1.9		3.2	W	No-load
Recommended External Input Capacitance		220		µF	Typical ESR 0.1-0.2 Ω, see Figure 16
Recommended Input Fuse			65	A	Fast acting external fuse is recommended

Module Output Specifications

PARAMETERS	Min	Typical	Max	Unit	Notes
Output Voltage	4.9	5	5.1	V	
Output Voltage Set Point			±1	%	Full load, 25 °C, nominal input
Rated Output Power			300	W	
Line Regulation			±0.2	%	From low line to high line at full load
Efficiency			93.6	%	Full load
Ripple and Noise		100	150	mV	Full load, nominal input
Load Regulation			±0.2	%	From no load to full load at nominal input
Load Current			60	A	
Current Limit			65	A	Fully electronic against over-load
Trim Range	-20		20	%	Across Pins 7 & 5, see Figure B
Output Over Voltage Protection	6.5	7	7.5	V	
Recommended External Input Capacitance		100		µF	Typical ESR 0.2-0.3 Ω, see Figure 16

Feature Characteristics

PARAMETERS	Min	Typical	Max	Unit	Notes
Switching Frequency		350		kHz	
Over Temperature Shutdown Trip Point		120		°C	Average PCB temperature
Over Temperature Shutdown Restart Window		10		°C	

Absolute Maximum Ratings

The absolute maximum ratings below are stress ratings only. Operation at or beyond these maximum ratings may cause permanent damage to the device.

PARAMETERS	Min	Typical	Max	Unit	Notes
Input Voltage	0	28	65	V	
Output Current			65	A	
Operating Temperature	-40		+100	°C	Baseplate temperature (power derating)
Storage Temperature	-40		+125	°C	

Application Characteristics

Measurements are taken at nominal conditions (25 °C).

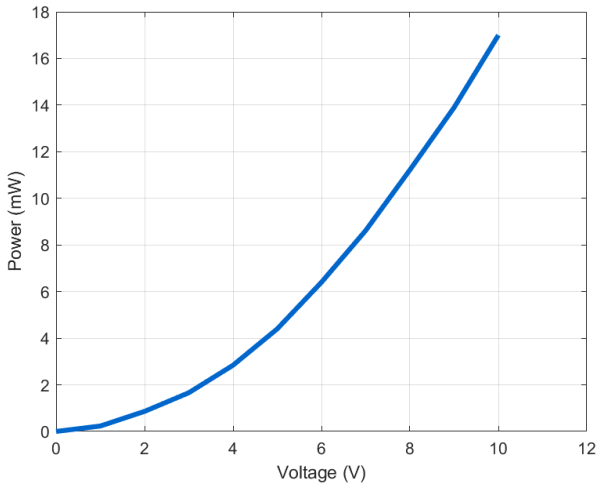


Figure 1. Disabled power dissipation versus input voltage

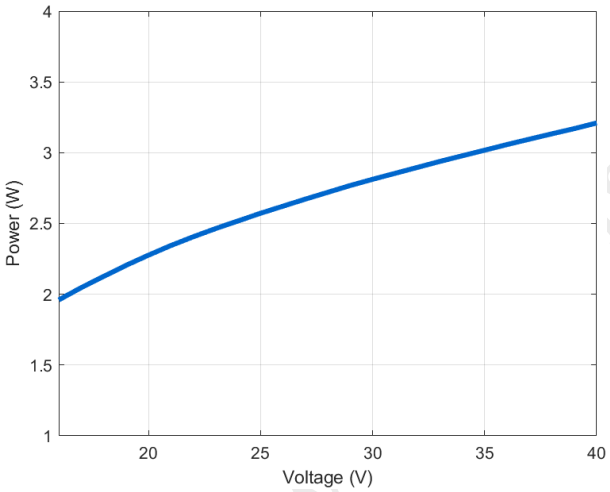


Figure 2. Enabled power dissipation versus input voltage

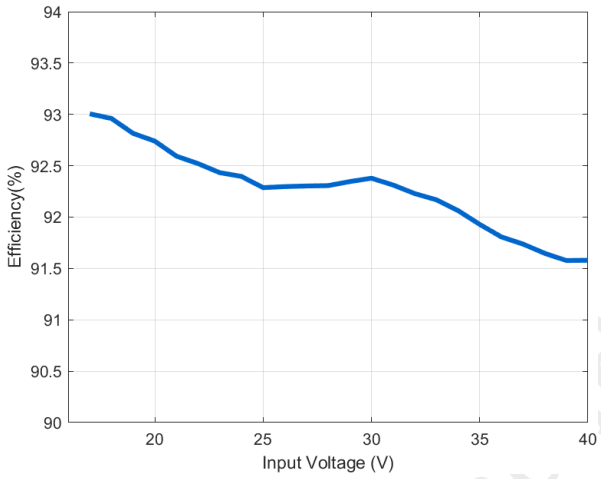


Figure 3. Full load efficiency versus input voltage at full load

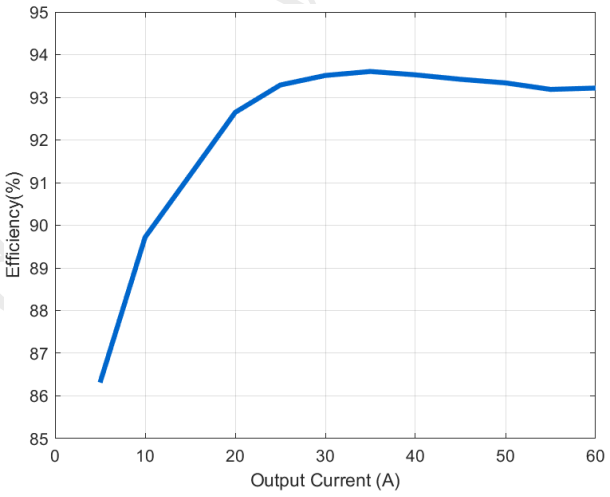


Figure 4. Efficiency versus output current at nominal input voltage (28 V)

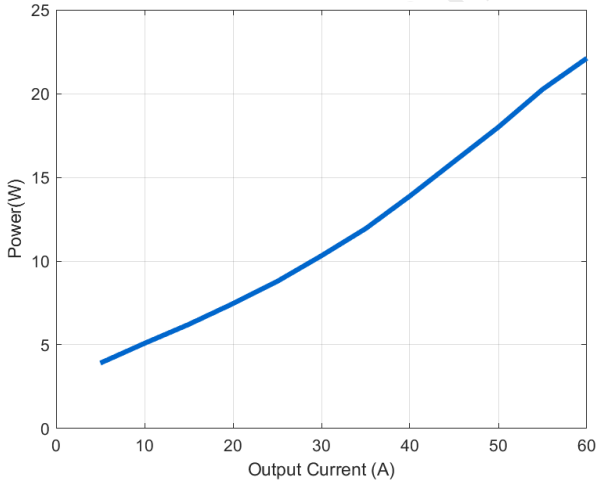
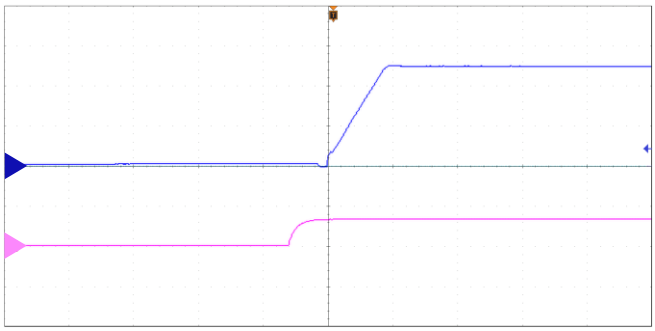
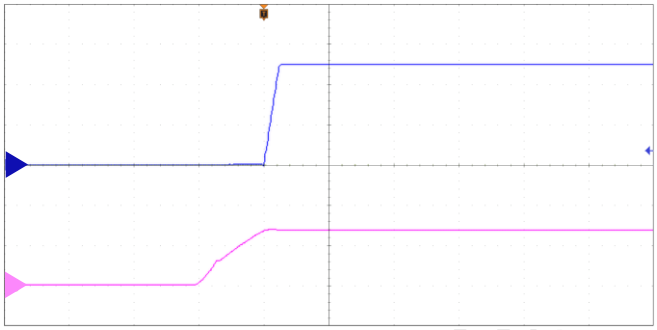


Figure 5. Power dissipation versus output current at nominal input voltage (28 V)



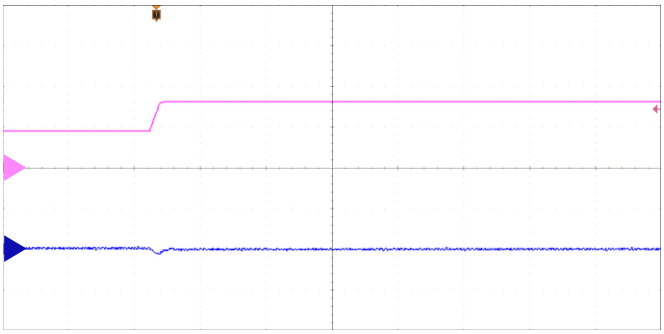
Output voltage (blue) (1 V/div) Time base : 10 ms/div
Startup initiation signal (red)

Figure 6. Converter startup waveforms



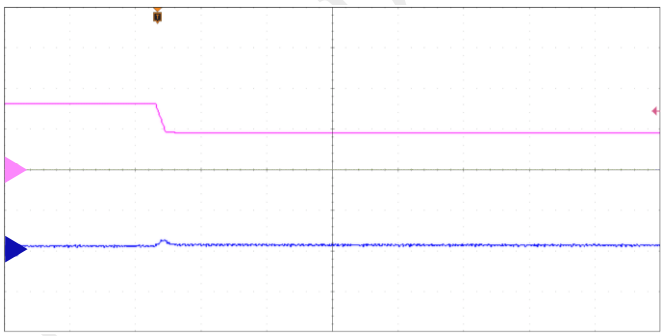
Output voltage (blue) (1 V/div) Time base : 100 ms/div
Input voltage (pink) (20 V/div)

Figure 7. Turn on transient at full resistive load



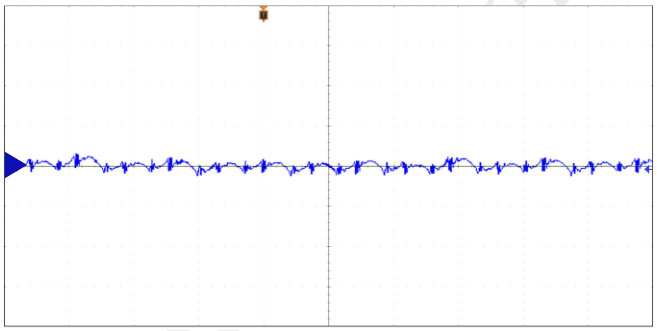
Output current (pink) (5 A/div) Time base : 10 ms/div
Output voltage (blue) (500 mV/div)

Figure 8. Load transient response: from 50% to 75% with 22 µF ceramic and 100 µF electrolytic capacitors across the load terminals



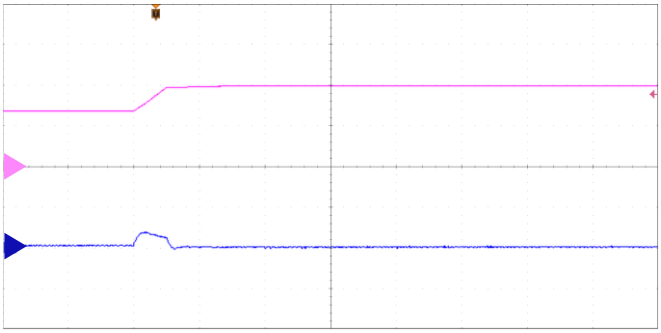
Output current (pink) (5 A/div) Time base : 10 ms/div
Output voltage (blue) (500 mV/div)

Figure 9. Load transient response: from 75% to 50% with 22 µF ceramic and 100 µF electrolytic capacitors across the load terminals



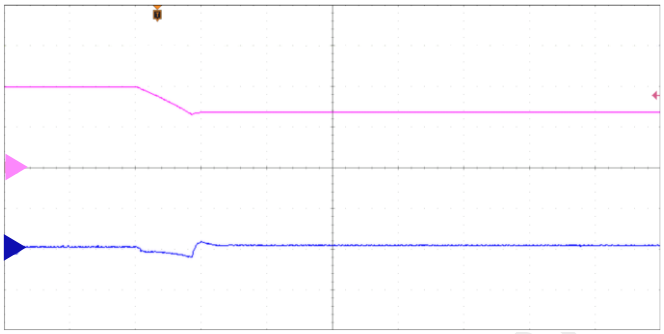
Output voltage ripple (50 mV/div) Time base : 2 µs/div

Figure 10. Output voltage ripple at nominal input voltage and rated load current. With 22 µF ceramic and 100 µF electrolytic capacitor across the load terminals. Bandwidth: 20 MHz (see Figure 15)



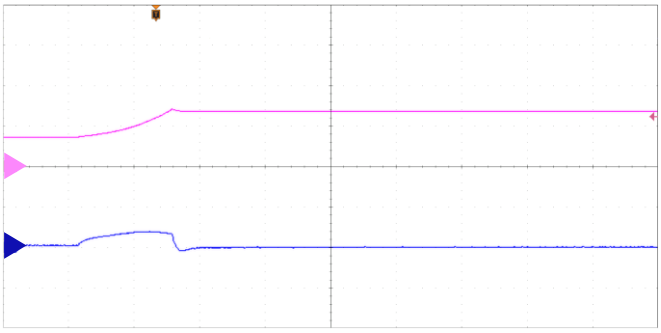
Input voltage (pink) (20 V/div) Time base : 10 ms/div
Output voltage (blue) (1 V/div)

Figure 11. Line (Vin) transient response: from 28 V to 40 V
With 22 µF ceramic and 100 µF electrolytic capacitors across the load terminals.



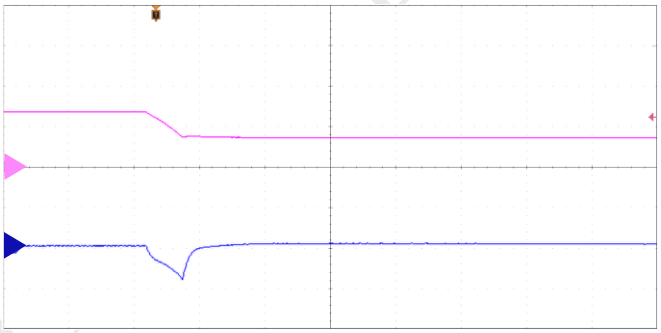
Input voltage (pink) (20 V/div) Time base: 10 ms/div
Output voltage (blue) (1 V/div)

Figure 12. Line (Vin) transient response: from 40 V to 28 V
With 22 µF ceramic and 100 µF electrolytic capacitors across the load terminals.



Input voltage (pink) (20 V/div) Time base : 10 ms/div
Output voltage (blue) (1 V/div)

Figure 13. Line (Vin) transient response: from 16 V to 28 V
With 22 µF ceramic and 100 µF electrolytic capacitors across the load terminals.



Input voltage (pink) (20 V/div) Time base: 10 ms/div
Output voltage (blue) (1 V/div)

Figure 14. Line (Vin) transient response: from 28 V to 16 V
With 22 µF ceramic and 100 µF electrolytic capacitors across the load terminals.

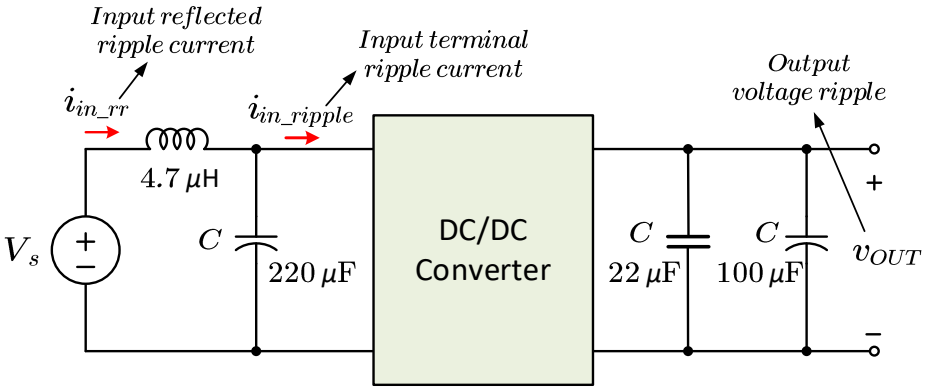


Figure 15. Test set-up showing the measurement points for the input terminal ripple current and the output voltage ripple (Figure 10).

Power Derating

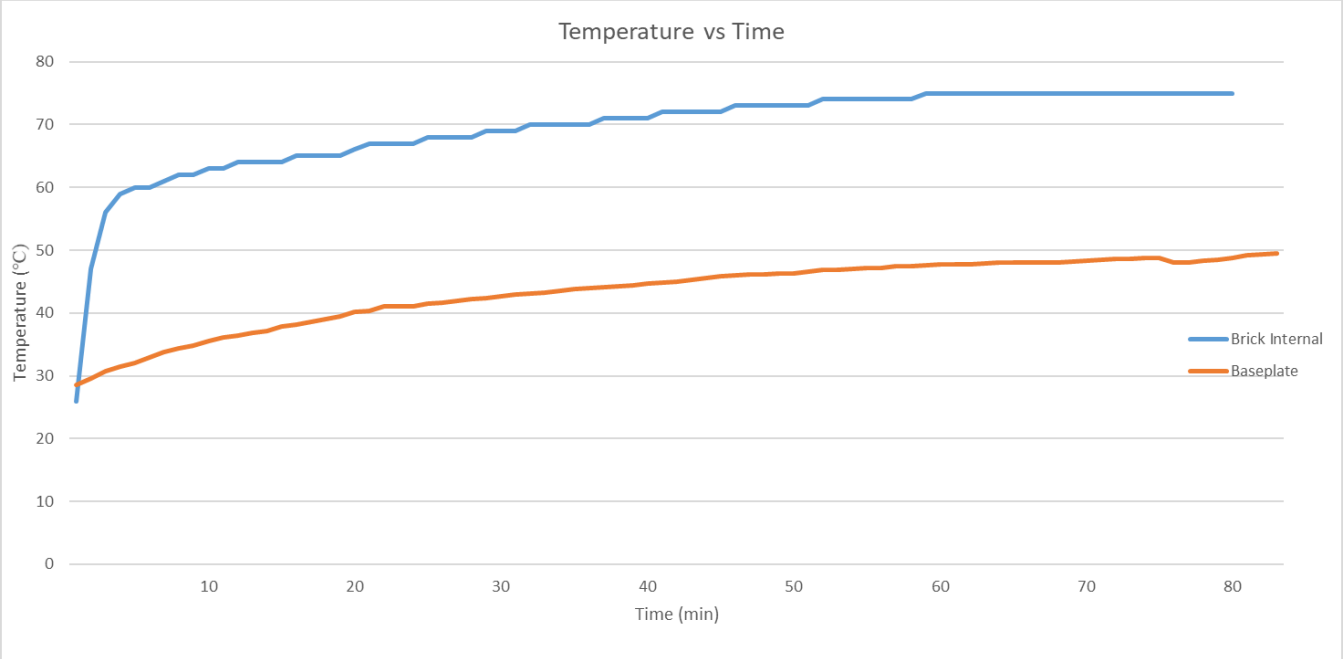


Figure 16. Brick internal temperature vs baseplate temperature at full load

After 80 °C baseplate temperature, output power must be derated 5 W/°C. Output power at 100 °C baseplate temperature is 200 W maximum.

Basic Operation and Features

ON/OFF

The ON/OFF input, Pin 2, allows the user to control the ON and OFF states of the converter. This input is referenced to the return terminal of the input bus, -IN. The ON/OFF signal is active low. If it is pulled down to ground, converter goes into ON state. Moreover, the ON/OFF function allows the product to be turned on/off by an external device like a semiconductor or a mechanical switch.

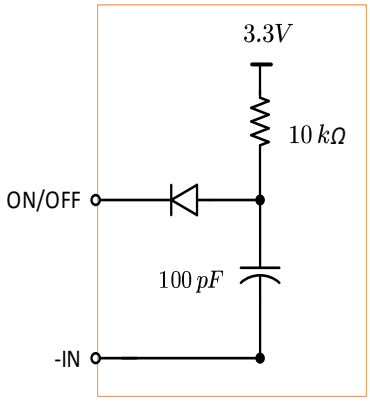


Figure A. Driving ON/OFF Pin

SENSE

Sense terminals are connected at the load side of the converter. Sense inputs are used to tune the output voltage and compensate the errors at the voltage level. If the load is away from the unit connected over a long line, connect +SNS and -SNS to the terminal of the load respectively to compensate for the voltage drop across the line.

OUTPUT VOLTAGE TRIM

The TRIM input permits the user to adjust the output voltage across the sense leads up or down according to the trim range. To decrease the output voltage, the user should connect a resistor between TRIM and +SNS input.

For a desired decrease of the nominal output voltage, the value of the resistor should be:

$$R_{TRIM\_DOWN} = \frac{(V_{desired} - 3.99) * 14.9}{(V_{nominal} - V_{desired})}\ k\Omega$$

To increase the output voltage, the user should connect a resistor between TRIM and -SNS input.

For a desired increase of the nominal output voltage, the value of the resistor should be:

$$R_{TRIM\_UP} = \frac{(6.01 - V_{desired}) * 10}{(V_{desired} - V_{nominal})}\ k\Omega$$

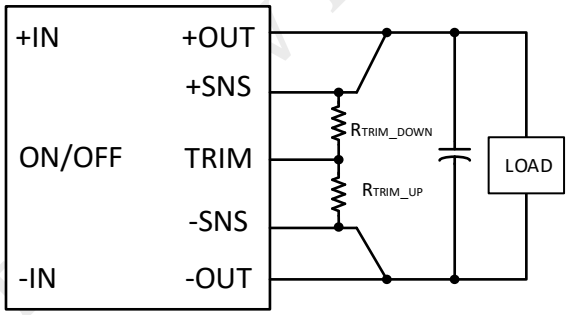


Figure B. Typical Trim Application Circuit

PMBUS

This module offers a PMBUS digital interface that enables the user to configure the protection limits, monitor input voltage, output voltage, output current, and device temperature. The PMBUS interface uses the two-wire I2C or SMBUS standard during communication.

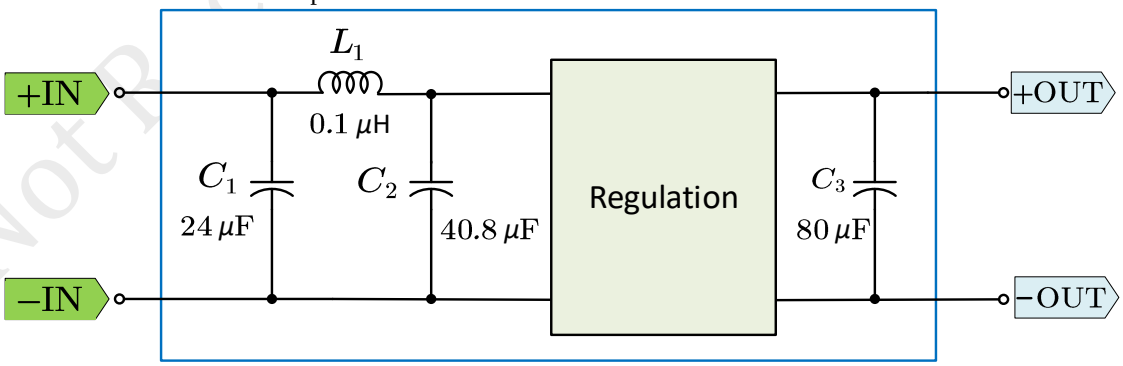


Figure C. Internal input and output filter diagram

Protection Features

Input Under Voltage Lockout

Converter starts operating when input voltage is raised above “Under Voltage Turn On” limit. Once on, turn off is initiated when input falls below “Under Voltage Turn Off" limit. The associated limits are given in “Module Input Specifications” Table.

Input Over Voltage Lockout

Converter protects itself by ceasing operation when input goes above “Over Voltage Turn Off” limit. It resumes operation when input falls below “Over Voltage Turn On” limit. The associated limits are given in “Module Input Specifications” Table.

Output Current Limit

If the output current exceeds the “Output Current Limit” value, the converter will immediately stop operating. The control waits 250 ms and resets fault status automatically and resumes operation with soft start. If the fault condition is still persisting, its shuts off again. This sequence is repeated five times. If the fault is cleared by that time, the normal operation continues, otherwise it shuts itself off and waits for the hard reset.

Output Over Voltage Lockout

The default output OVP limit is set to 40% above the nominal output voltage. When detected, protection control responds immediately by shutting down the converter and disabling the outputs. Start sequence is similar to the output current limit case.

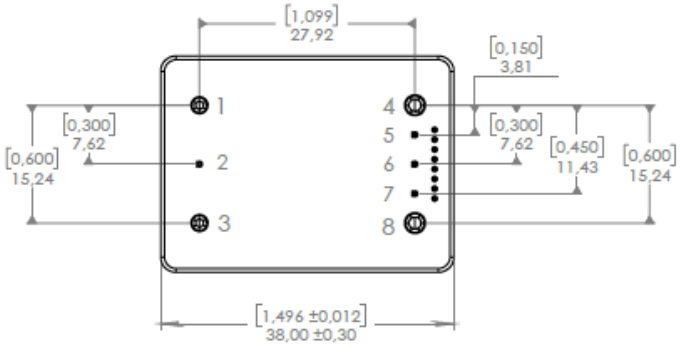
Over Temperature Shutdown

The brick has a thermistor located next to the hottest point, the transformer. The thermal shutdown circuit is designed to turn the converter off when the temperature at the sensed location goes above “Over Temperature Shutdown” limit. Converter resumes operation when the temperature of the sensed location falls by the amount equal to the “Over Temperature Shutdown Restart Window.”

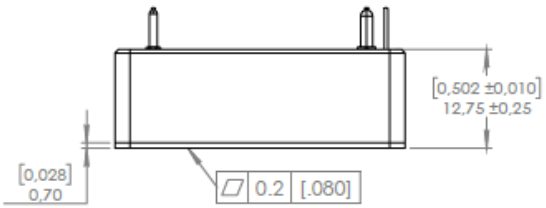
Short Circuit Protection

The short circuit condition is an extreme case of the Output Current Limit condition. When the fast rise of the current during a short circuit condition is detected by the dedicated control, the outputs of the converter are disabled immediately. The sequence of operation after a short circuit detection is similar to hiccup concept described in “Output Current Limit” section.

Mechanical Drawing



PIN	NAME
1	-IN
2	ON/OFF
3	+IN
4	-OUT
5	-SNS
6	TRIM
7	+SNS
8	+OUT
9	PMBUS_ADDRESS
10	PMBUS_SCL
11	PMBUS_SMBALERT
12	PMBUS_SDA
13	GND
14	PMBUS_C2
15	DATA+
16	DATA-



Ordering Information

Part Number	Option Field
KMBM02-DC28-P300-DC12-QB	No communication capability, PMBUS pins are absent.
KMBM02-DC28-P300-DC12-QB-C	With PMBUS communication capability

Family	Input Voltage	Power	Output Voltage	Package	Option
KMNB01	**DC28**: 16-40 V	**P300**: 300 W	**DC5**: 5 V	**SB**: Sixteen Brick	**C**: PMBUS Communication