Features & Benefits

- DC/DC Quarter Brick Module
- Galvanic isolation
- Up to 300 W, 11 A continuous
- 93.4% peak efficiency
- Input voltage range 16.1 – 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 +10%[*], -40%

Typical Applications

- Defense
- Aerospace
- Communications Systems
- Medical

Product Ratings	
$V_{IN\_NOM} = 28$ V	$P_{OUT} = 300$ W
$V_{IN\_MIN} = 16.1$ V	$V_{OUT\_NOM} = 28$ V
$V_{IN\_MAX} = 40$ V	$I_{OUT\_MAX} = 10.7$ A

Product Description

KMBM02-DC28-P300-DC28-QB is a 300 W DC/DC converter in quarter brick converter that operates from nominal 28 V input and generates 28 V isolated output. It is designed to meet MIL-STD-461 EMI requirements with the KMFL04 EMI filter module and has superior noise and ripple performance. Converter is fully protected to operate reliably under all kinds of disturbances. Casing is creatively designed to provide efficient cooling to facilitate reliable operation at 100 °C base plate temperature.

Size:

58.4 × 36.8 × 12.9 mm
DOSA compliant quarter brick package

Weight:

80.1 g

[*]: Trim-up capability input voltage range 18-40V

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	16.1	28	40	V	
Under Voltage Turn On		16.10		V	
Under Voltage Turn Off		15.40		V	
Over Voltage Turn Off		41.90		V	
Over Voltage Turn On		37.90		V	
Disabled Input Current			1.5	mA	No-load
No Load Input Current	278		325	mA	No-load
Recommended External Input Capacitance		440		µF	Typical ESR 0.1-0.2 Ω, see Figure 15
Recommended Input Fuse			30	A	Fast acting external fuse is recommended

Module Output Specifications

PARAMETERS	Min	Typical	Max	Unit	Notes
Output Voltage		28.5		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
Load Regulation			±0.2	%	From no load to full load at nominal input
Peak Efficiency			93.43	%	Full load
Output Ripple		200	240	mV	Full load, nominal input
Output Current	0		10.7	A	
Output Current Limit			11	A	Fully electronic against over-load
Output Voltage Trim Range	-40		+10	%	
Output Over Voltage Protection			33.6	V	
Recommended External Output Capacitance		100		µF	Typical ESR 0.1-0.2 Ω, see Figure 15

Feature Characteristics

| PARAMETERS	Min	Typical	Max	Unit	Notes
Switching Frequency		175		kHz	
Over Temperature Shutdown Trip Point		115		°C	Average PCB temperature
Over Temperature Shutdown Restart Window		15		°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					
Non-Operating Input Voltage	-1		60	V	
Operating Input Voltage (Continuous)			40	V	
Operating Input Voltage (Transient)			50	V	1 s transient, square wave
ON/OFF Pin Voltage	-1		50	V	
Isolation Characteristics					
Input to Output Isolation Voltage		2250		Vdc	
Input to Base Plate Isolation Voltage		2250		Vdc	
Output to Base Plate Isolation Voltage		2250		Vdc	
Operating Temperature	-40		+100	°C	Baseplate temperature
Storage Temperature	-40		+125	°C	

Application Characteristics

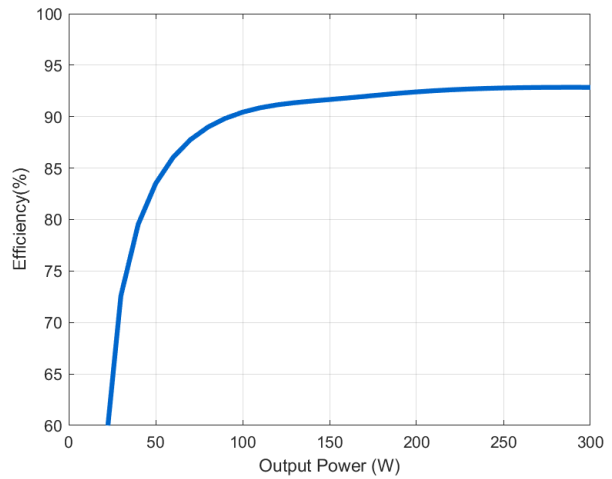Measurements are taken at nominal conditions (25 °C).
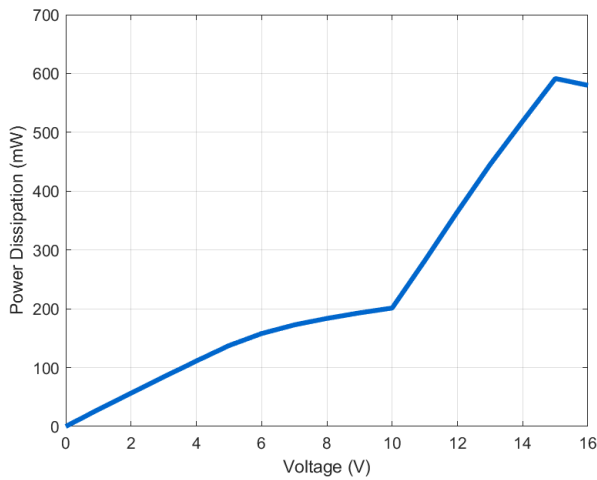
Figure 1. Disabled power dissipation versus input voltage
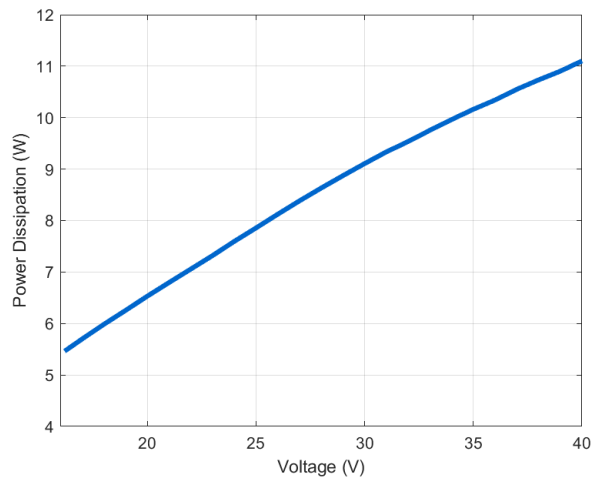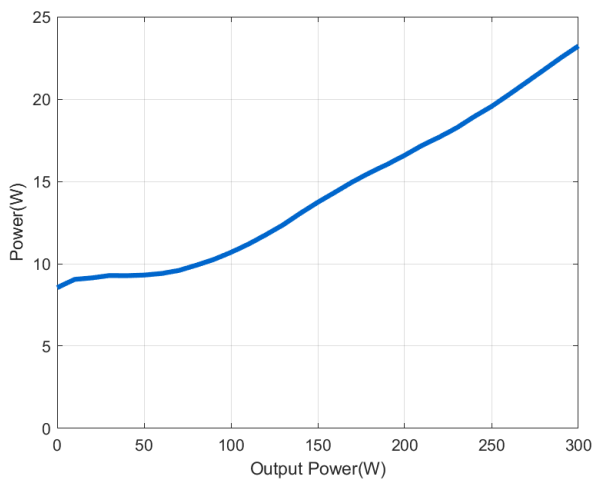

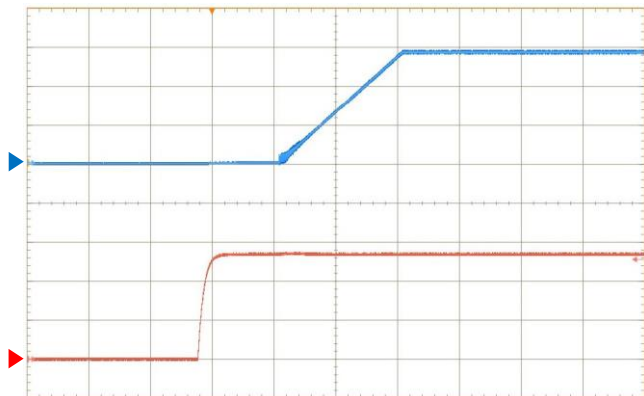**Figure 2**. Enabled power dissipation versus input voltage
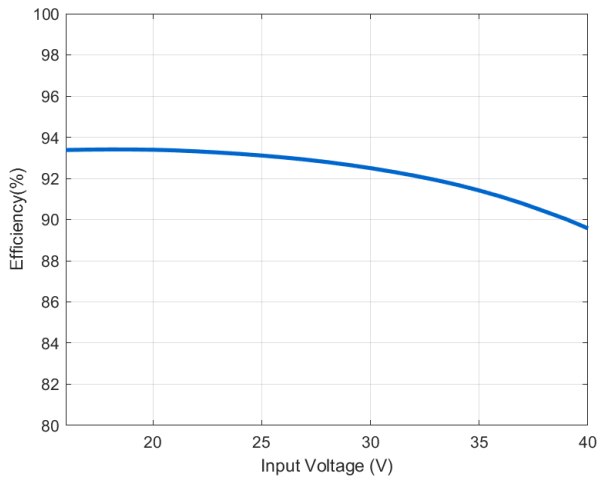
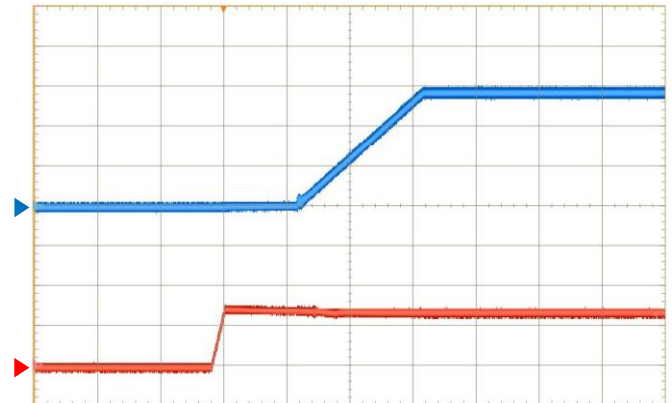**Figure 3**. Full load efficiency versus input voltage

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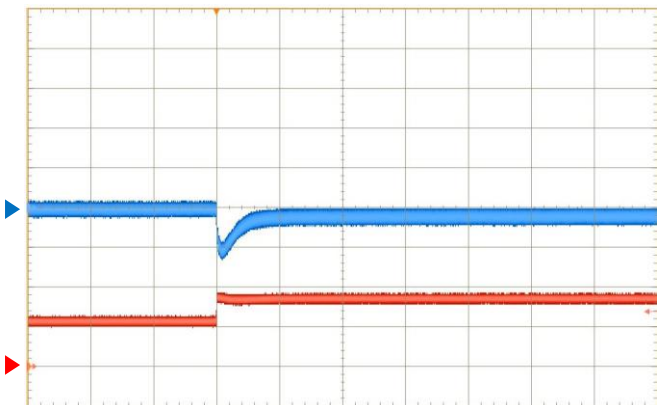

Figure 5. Power dissipation versus output power at nominal input voltage (28 V)
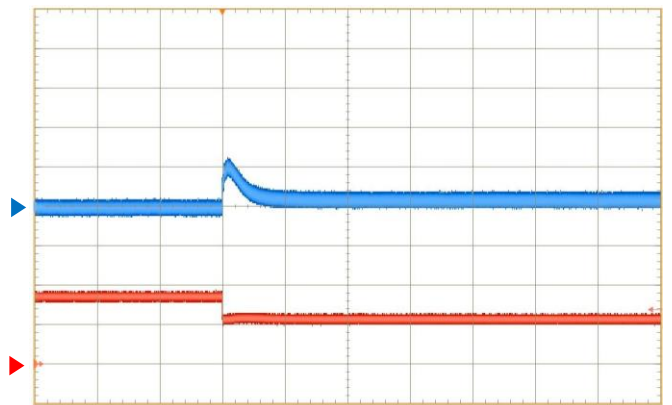
Output voltage (blue) (10 V/div)   Time base : 20 ms/div
Startup initiation signal (red)

**Figure 6.** Converter startup waveforms

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

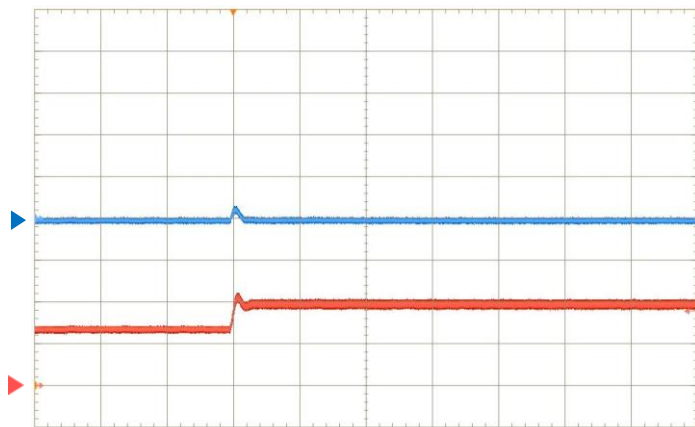**Figure 7.** Turn on transient at full resistive load

Output voltage (blue) (1 V/div)   Time base : 2 ms/div
Output current (red) (5 A/div)

Figure 8. Load transient response: from 50% to 75% with 1 μF ceramic and 100 μF electrolytic capacitors across the load terminals.

Output voltage (blue) (1 V/div)   Time base : 2 ms/div
Output current (red) (5 A/div)

Figure 9. Load transient response: from 75% to 50% with 1 μF ceramic and 100 μF electrolytic capacitors across the load terminals.
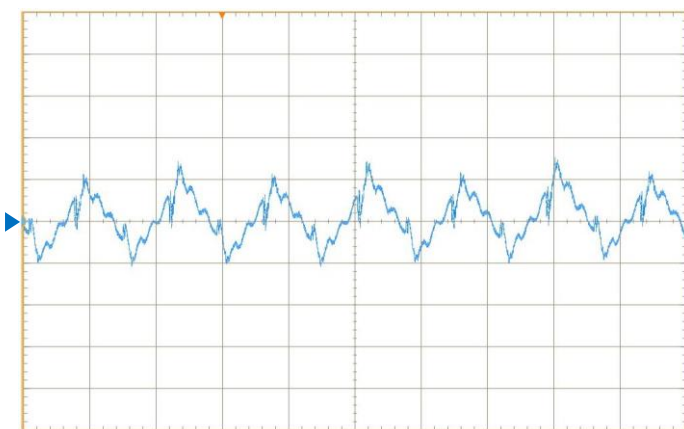

Output voltage ripple (100 mV/div)   Time base : 2 μs/div

Figure 10. Output voltage ripple at nominal input voltage and full load current (10.71 A). With 1 μF ceramic and 100 μF electrolytic capacitor across the load terminals. Bandwidth: 20 MHz (see Figure 15)

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Output voltage (blue) (5 V/div)   Time base : 1 ms/div
Input voltage (red) (20 V/div)

Figure 11. Line (Vin) transient response: from 28 V to 40 V at full resistive load With 1 μF ceramic and 100 μF electrolytic capacitors across the load terminals.
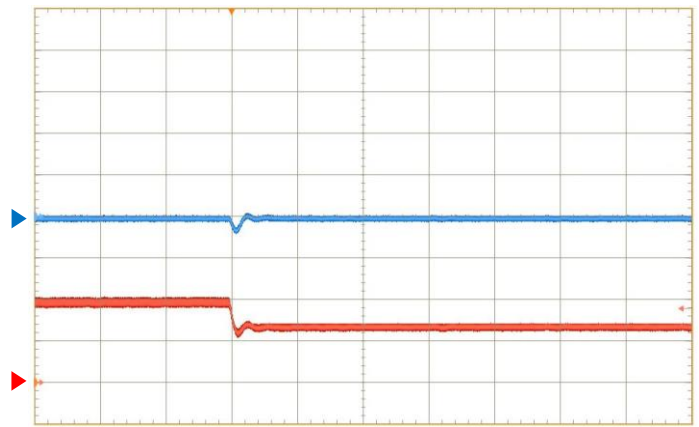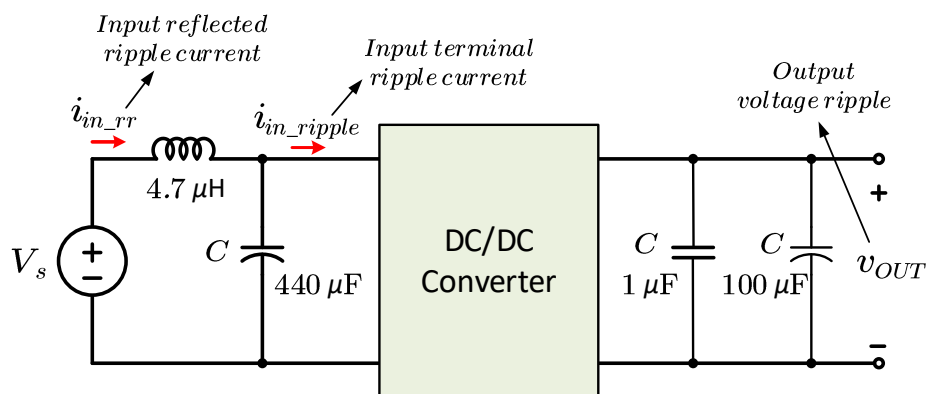

Output voltage (blue) (5 V/div)   Time base: 1 ms/div
Input voltage (red) (20 V/div)

Figure 12. Line (Vin) transient response: from 40 V to 28 V at full resistive load With 1 μF ceramic and 100 μF electrolytic capacitors across the load terminals.

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Figure 15. Test set-up showing the measurement points for the output voltage ripple (Depicted in Figure 10).

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 high. If it is pulled down to ground, converter goes into OFF 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.
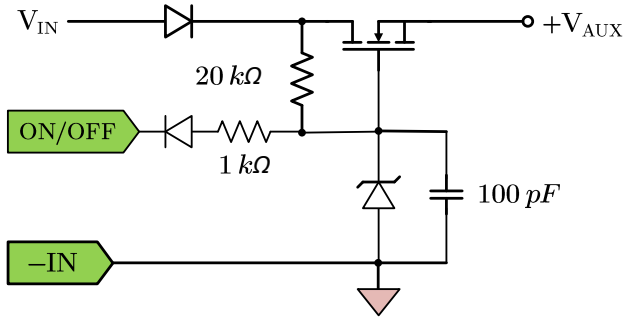

Figure A. Driving ON/OFF Pin

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:

$$R_{TRIM\_DOWN} = \frac{(V_{desired} - 7.97) * 73}{(V_{nominal} - V_{desired})} \, k\Omega$$

To increase the output voltage, the user should connect a resistor between TRIM and -SNS input. For input voltages below 18 V at full-load, converter is not able to regulate output voltage above 28 V. So, for lower than 18 V input voltages, trim-up capability is limited.

Converter is able to regulate output voltage to 28 V at full load, starting 16.2 V input voltage.

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

$$R_{TRIM\_UP} = \frac{(13.93 - V_{desired}) * 40.3}{(V_{desired} - V_{nominal})} \, k\Omega$$
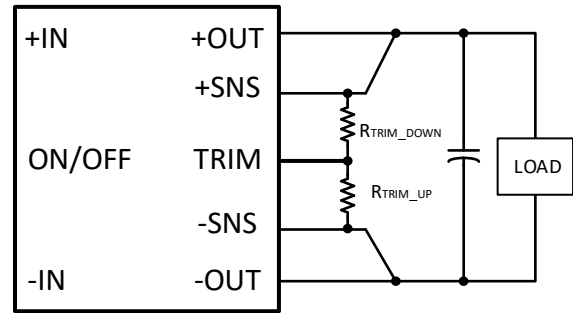
Figure B. Typical Trim Application Circuit

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

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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 25% 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.
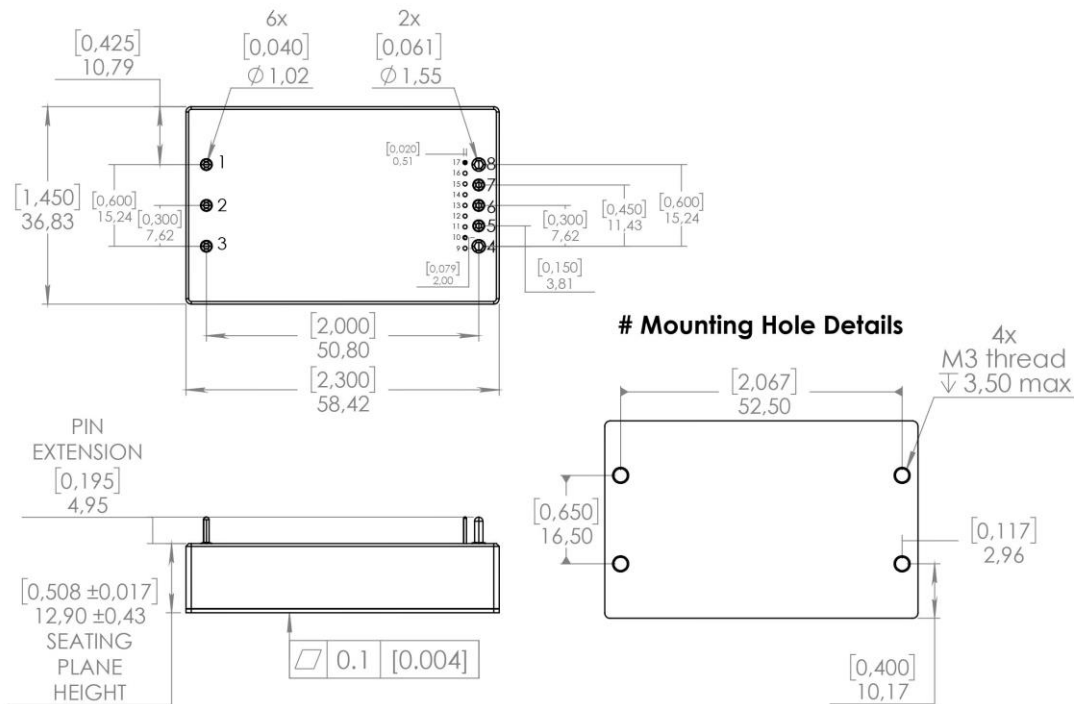
Over Temperature Shutdown

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.

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Mechanical Drawing

Mounting Hole Details

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

Flanged Details

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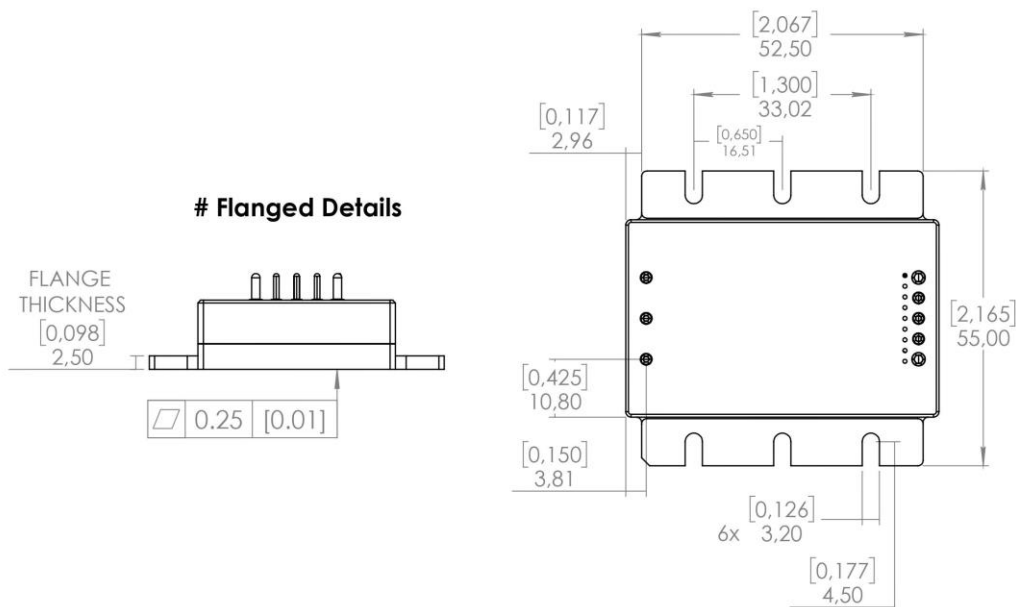
Ordering Information

Part Number	Baseplate	Option Field
KMBM02-DC28-P300-DC28-QB-F	Flanged	No communication capability, PMBUS pins are absent.
KMBM02-DC28-P300-DC28-QB-F-PM	Flanged	With PMBUS communication capability
KMBM02-DC28-P300-DC28-QB-H	Half Threaded	No communication capability, PMBUS pins are absent.
KMBM02-DC28-P300-DC28-QB-H-PM	Half Threaded	With PMBUS communication capability

Family	Input Voltage	Power	Output Voltage	Package	Baseplate	Option
KMBM02	**DC28**: 16-40 V	**P300**: 300 W	**DC28**: 28 V	**QB**: Quarter Brick	**F:** Flanged **H:** Half Threaded	**PM**: PMBUS Communication

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Revision History

Revision	Description
Rev A-PC1	First draft
Rev A-PC2	- Corrected output ripple value (page 2). - Stated load current value in Figure 10.
Rev A-PC3	- Input Voltage Range updated - ON/OFF circuit updated - Efficiency updated

Planned Improvements

Improvement	Description	Resolution Date
Trim-down capability	Trim-down range will be -50% of Output Voltage	2022/ Q4
Efficiency improvement	Peak efficiency will be improved to 95%	2022/ Q4
Transient Response	Line Transient response will be improved	2023/ Q1
Active Current Sharing	Active Current Sharing capability will be implemented for parallel operation	2023/ Q1

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