

**RP40Q-RUW Series** ◇ Quarter Brick

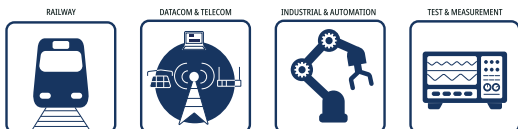
40W ◇ Ultra-Wide Input: 14-160VDC

**FEATURES**

- 12:1 ultra wide input voltage range
- 3kVAC/1 minute reinforced insulation
- High efficiency over entire input voltage range
- -40°C to +85°C temperature range without derating
- Output voltage sense and trim
- CE marked
- 3 year warranty



Dimensions (LxWxH): 57.9 x 36.8 x 12.7mm (2.28 x 1.45 x 0.5 inch)  
64.0g (0.141 lbs)

**APPLICATIONS****SAFETY & EMC****DESCRIPTION**

The quarter brick RP40Q series DC/DC converter is designed for railway rolling stock and high voltage battery applications. It has a 12:1 input voltage range to cover all input voltages from nominal 24VDC up to 110VDC in a single product (including EN50155 transients) and offers isolated and regulated 5V, 12V, 15V, 24V or 48VDC outputs with sense and trim pins. Programmable undervoltage-lockout and external bus pin for simplified compliance to challenging hold-up requirements is optional. The converter has a consistently high efficiency over the entire input voltage range and has an operating temperature range from -40°C to +85°C without forced air cooling or derating. The case is fitted with threaded inserts for secure mounting in high shock and vibration environments. The converter is CE marked and comes with a three year warranty.

**SELECTION GUIDE**

| Part Number                         | Input Voltage Range [VDC] | nom. Output Voltage [VDC] | Output Current max. [A] | Efficiency typ. <sup>(1)</sup> [%] | Max. Capacitive Load <sup>(2)</sup> [μF] |
|-------------------------------------|---------------------------|---------------------------|-------------------------|------------------------------------|------------------------------------------|
| RP40Q-11005RUW/N <sup>(3,4,5)</sup> | 14-160                    | 5                         | 8                       | 89                                 | 16000                                    |
| RP40Q-11012RUW/N <sup>(3,4,5)</sup> | 14-160                    | 12                        | 3.33                    | 91                                 | 2800                                     |
| RP40Q-11015RUW/N <sup>(3,4,5)</sup> | 14-160                    | 15                        | 2.67                    | 91                                 | 1800                                     |
| RP40Q-11024RUW/N <sup>(3,4,5)</sup> | 14-160                    | 24                        | 1.67                    | 90                                 | 720                                      |
| RP40Q-11048RUW/N <sup>(3,4,5)</sup> | 14-160                    | 48                        | 0.83                    | 90                                 | 180                                      |

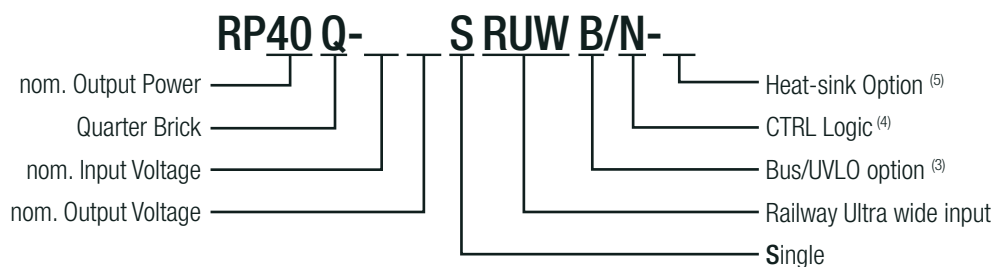
Note1: Efficiency is tested at 72Vin and full load at +25°C ambient

Note2: Max. Cap Load is tested at nominal input and full resistive load

# RP40Q-RUW Series ◇ Quater Brick

## 40W ◇ Ultra-Wide Input: 14V-160VDC

### MODEL NUMBERING



Note3: without "B" = without Bus function & UVP adjustability (pin 8 and 10 omitted)

with "B" = with Bus & UVP adjustability (pin 8 and 10 present)

Note4: standard part is with suffix "/N" for negative logic (0=ON, 1=OFF)

or add suffix "/P" for positive logic (1=ON, 0=OFF), for more details refer to „ON/OFF CTRL“

Note5: add suffix "-HC" for screwed Heat-sink (refer to „Dimension Drawing pre-mounted Heat-sink (mm)“)

### ACCESSIBLE PART

| Part Number     | Description                                                         | Datasheet Link                    |
|-----------------|---------------------------------------------------------------------|-----------------------------------|
| R-REF04-RIA12-1 | RIA12 reference board                                               | <a href="#">R-REF04-RIA12.pdf</a> |
| RSP150-168      | Surge protector (voltage clamp) for RIA12 and NF F01-510 transients | <a href="#">RSP150-168.pdf</a>    |

### BASIC CHARACTERISTICS (measured @ $T_{AMB} = 25^{\circ}\text{C}$ , nom. $V_{IN}$ , full load and after warm-up unless otherwise stated)

| Parameter                              | Condition                          |                | Min.      | Typ.                                              | Max.   |
|----------------------------------------|------------------------------------|----------------|-----------|---------------------------------------------------|--------|
| Internal Input Filter                  |                                    |                |           | Pi-Type                                           |        |
| Input Voltage Range                    |                                    |                | 14VDC     | 110VDC                                            | 160VDC |
| Input Surge Voltage                    | nom. $V_{IN} = 110\text{VDC}$      | below 1 second |           |                                                   | 185VDC |
| Under Voltage Lockout (UVLO)           | nom. $V_{IN} = 110\text{VDC}$      | DC/DC ON       |           |                                                   | 14VDC  |
|                                        |                                    | DC/DC OFF      | 10VDC     | 11VDC                                             | 12VDC  |
| Input Current                          | $V_{IN} = 16\text{VDC}$            |                |           | 2.75A                                             | 3.5A   |
|                                        | $V_{IN} = 110\text{VDC}$           |                |           | 0.4A                                              |        |
|                                        | $V_{IN} = 160\text{VDC}$           |                |           | 0.27A                                             |        |
| Quiescent current                      | nom. $V_{IN} = 110\text{VDC}$      |                |           | 10mA                                              |        |
| Output Voltage Trimming                | refer to „Output Voltage Trimming“ |                | -20%      |                                                   | +10%   |
| Minimum Load                           |                                    |                | 0%        |                                                   |        |
| Start-up Time                          | constant resistive load            |                |           | 75ms                                              | 100ms  |
| Rise Time                              |                                    |                |           | 40ms                                              |        |
| ON/OFF CTRL <sup>(6)</sup>             | refer to „ON/OFF CTRL“             | Positive Logic | DC/DC ON  | Open or $3\text{VDC} < V_{CTRL} < 12\text{VDC}$   |        |
|                                        |                                    |                | DC/DC OFF | Short or $0\text{VDC} < V_{CTRL} < 1.2\text{VDC}$ |        |
|                                        |                                    | Negative Logic | DC/DC ON  | Short or $0\text{VDC} < V_{CTRL} < 1.2\text{VDC}$ |        |
|                                        |                                    |                | DC/DC OFF | Open or $3\text{VDC} < V_{CTRL} < 12\text{VDC}$   |        |
| Input Current on CTRL pin              | drive current                      | $I_{CTRL}$     | -0.5mA    |                                                   | 1mA    |
| Standby Current                        | DC/DC OFF                          | $I_{IN}$       |           | 1mA                                               |        |
| Internal Operating Frequency           |                                    |                | 160kHz    | 180kHz                                            | 200kHz |
| Output Ripple and Noise <sup>(7)</sup> | measured at 20MHz BW               | 5Vout          |           | 75mVp-p                                           |        |
|                                        |                                    | 12, 15Vout     |           | 100mVp-p                                          |        |
|                                        |                                    | 24Vout         |           | 200mVp-p                                          |        |
|                                        |                                    | 48Vout         |           | 300mVp-p                                          |        |
| Remote Sense <sup>(8)</sup>            |                                    |                |           |                                                   | 10%    |

Note6: The ON/OFF control function can be positive or negative logic. The pin voltage is referenced to -Vin

Note7: Measurements are made for 5Vout with a 1μF/25V X7R MLCC and a 22μF/25V E-Cap; for 15Vout with a 22μF/25V X7R MLCC, for 24Vout with a 4.7μF/50V X7R MLCC and for 48Vout with a 2.2μF/100V X7R MLCC

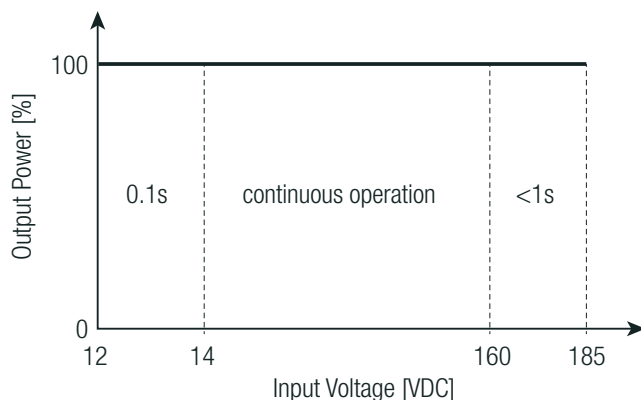
Note8: If not used connect Remote Sense pins to corresponding output pins

# RP40Q-RUW Series ◇ Quater Brick

## 40W ◇ Ultra-Wide Input: 14V-160VDC

**BASIC CHARACTERISTICS** (measured @  $T_{AMB}=25^{\circ}\text{C}$ , nom.  $V_{IN}$ , full load and after warm-up unless otherwise stated)

### Input Voltage Range

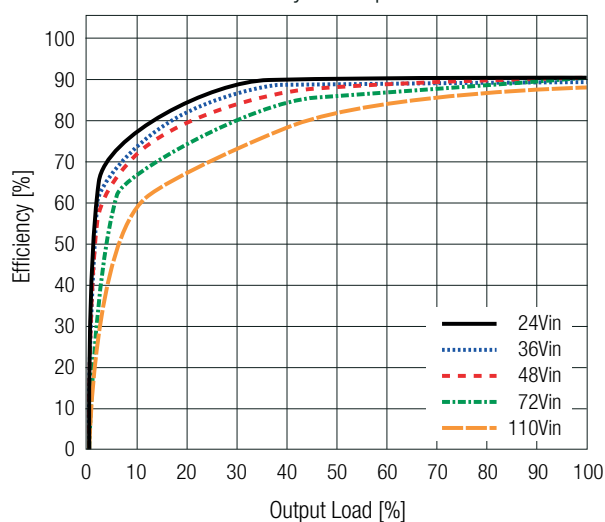


Continuous full power operation is rated between 14V and 160V, including full load start-up.

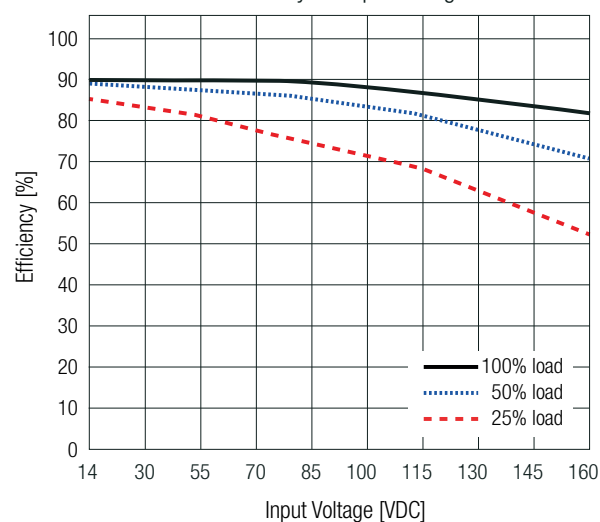
Once running, the converter will operate for short periods of time over an extended input voltage range down to 12V and up to 185V, thus covering all EN50155 under-voltage and over-voltage transient conditions.

### RP40Q-11005SRUW

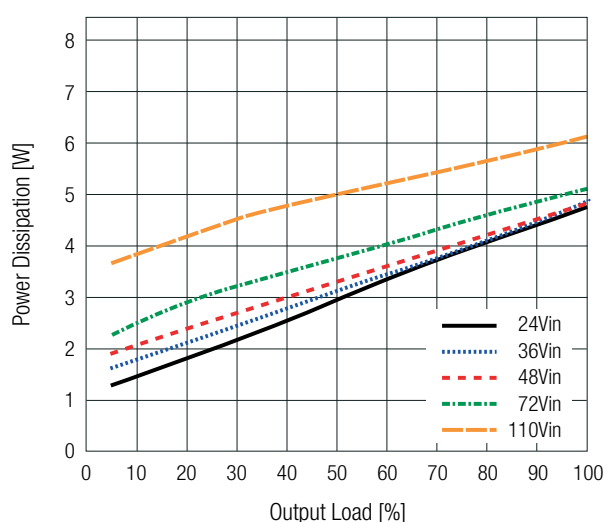
Efficiency vs. Output Load



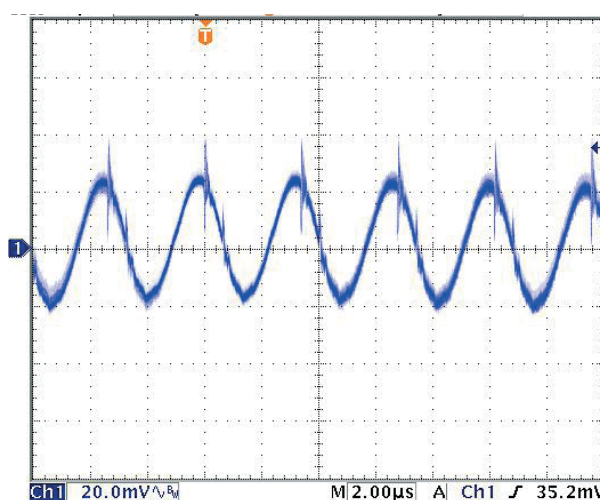
Efficiency vs. Input Voltage



Power Dissipation vs. Output Current



Typical Output Ripple and Noise (full load)

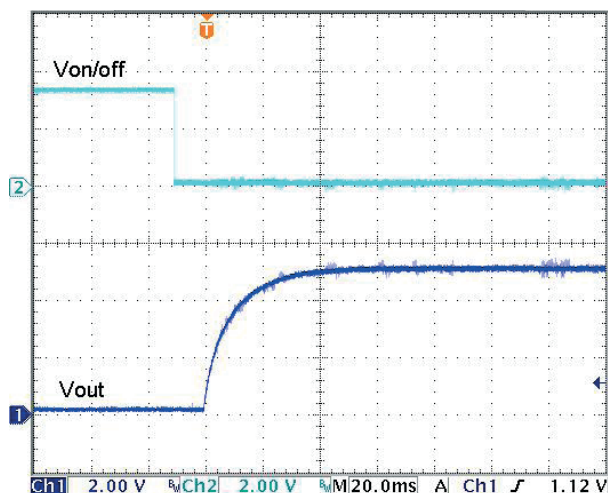


# RP40Q-RUW Series ◇ Quater Brick

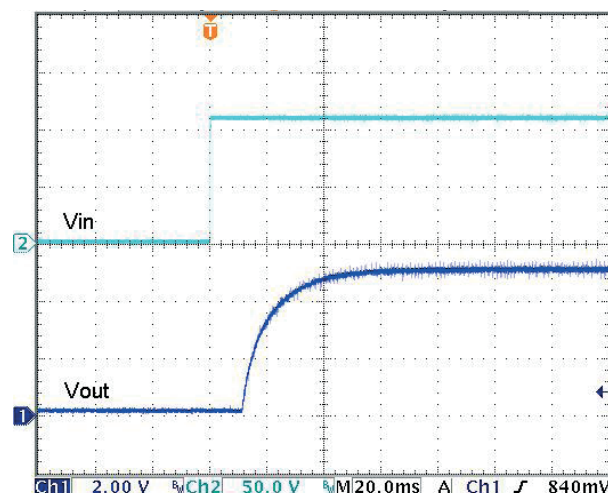
## 40W ◇ Ultra-Wide Input: 14V-160VDC

 BASIC CHARACTERISTICS (measured @  $T_{AMB} = 25^{\circ}\text{C}$ , nom.  $V_{IN}$ , full load and after warm-up unless otherwise stated)

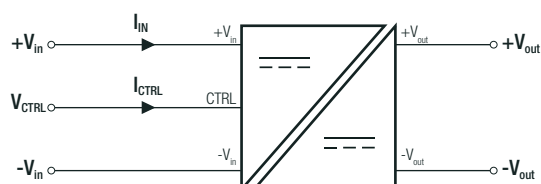
ON/OFF Control Start-up Rise Characteristic



Power up Start-up Rise Characteristic



### ON/OFF CTRL



Positive Logic

 DC-DC ON  
 DC-DC OFF

 Open or  $3.0\text{VDC} < V_{CTRL} < 12\text{VDC}$   
 Short or  $0\text{VDC} < V_{CTRL} < 1.2\text{VDC}$ 

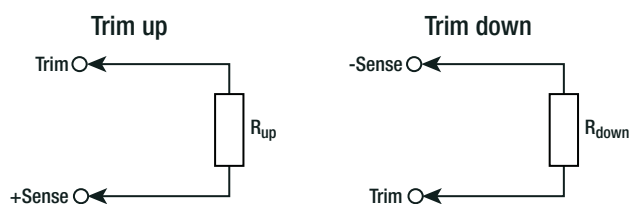
Negative Logic

 DC-DC ON  
 DC-DC OFF

 Short or  $0\text{VDC} < V_{CTRL} < 1.2\text{VDC}$   
 Open or  $3.0\text{VDC} < V_{CTRL} < 12\text{VDC}$ 

### OUTPUT VOLTAGE TRIMMING

It allows the user to increase or decrease the output voltage of the module. This is accomplished by connecting an external resistor between the Trim pin and either the +Sense or -Sense pins. With an external resistor between the Trim and +Sense pin, the output voltage increases. With an external resistor between the Trim and -Sense pin, the output voltage decreases. The external Trim resistor needs to be at least 1/8W of rated. The values for trim resistors shown in trim tables below are according to standard E96 values; therefore, the specified voltage may slightly vary.



$V_{out_{nom}}$  = nominal output voltage [VDC]  
 $\Delta V_{out}$  = output voltage change [%]  
 $V_{ref}$  = reference voltage [VDC]  
 $R_{up}$  = trim up resistor [ $\Omega$ ]  
 $R_{down}$  = trim down resistor [ $\Omega$ ]  
 $R_3, R_4, R_5$  = internal resistors [ $\Omega$ ]

| Model            | $R_1$ [ $\Omega$ ] | $R_2$ [ $\Omega$ ] | $R_3$ [ $\Omega$ ] | $V_{REF}$ [VDC] |
|------------------|--------------------|--------------------|--------------------|-----------------|
| RP40Q-11005RUW/N | 10k2               | 511k               | 5k11               | 1.225VDC        |
| RP40Q-11012RUW/N |                    |                    |                    |                 |
| RP40Q-11015RUW/N |                    |                    |                    |                 |
| RP40Q-11024RUW/N |                    |                    |                    |                 |
| RP40Q-11048RUW/N |                    |                    |                    |                 |

Calculation:

$$R_{up} = \left[ \frac{R_3 \times V_{out_{nom}} \times (100 + \Delta V_{out})}{V_{ref} \times \Delta V_{out}} \right] - \left[ \frac{(R_1 \times \Delta V_{out}) + R_2}{\Delta V_{out}} \right]$$

$$R_{down} = \left[ \frac{R_2}{\Delta V_{out}} \right] - R_1$$

# RP40Q-RUW Series ◇ Quater Brick

## 40W ◇ Ultra-Wide Input: 14V-160VDC

### OUTPUT VOLTAGE TRIMMING

Practical Example RP40Q-xx05SRW +10% / -10%

$$R_{up} = \left[ \frac{5k11 \times 5 \times (100 + 10)}{1.225 \times 10} \right] - \left[ \frac{(10k2 \times 10) + 511k}{10} \right] = 168k\Omega$$

$R_{up}$  according to E96  $\approx 169k\Omega$

$$R_{down} = \left[ \frac{511k}{10} \right] - 10k2 = 40k9\Omega$$

$R_{down}$  according to E96  $\approx 41k2\Omega$

#### RP40Q-xx05SRW

| Trim up               | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | [%]   |
|-----------------------|------|------|------|------|------|------|------|------|------|------|-------|
| $V_{out\_set} =$      | 5.05 | 5.10 | 5.15 | 5.20 | 5.25 | 5.30 | 5.35 | 5.4  | 5.45 | 5.50 | [VDC] |
| $R_{up}(E96) \approx$ | 1M58 | 806k | 536k | 402k | 324k | 247k | 237k | 205k | 187k | 169k | [Ω]   |

#### RP40Q-xx12SRW

| Trim up               | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | [%]   |
|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| $V_{out\_set} =$      | 12.12 | 12.24 | 12.36 | 12.48 | 12.60 | 12.72 | 12.84 | 12.96 | 13.08 | 13.20 | [VDC] |
| $R_{up}(E96) \approx$ | 4M53  | 2M26  | 1M54  | 1M15  | 931k  | 787k  | 681k  | 604k  | 536k  | 487k  | [Ω]   |

#### RP40Q-xx15SRW

| Trim up               | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | [%]   |
|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| $V_{out\_set} =$      | 15.15 | 15.30 | 15.45 | 15.60 | 15.75 | 15.90 | 16.05 | 16.20 | 16.35 | 16.50 | [VDC] |
| $R_{up}(E96) \approx$ | 5M76  | 2M94  | 1M96  | 1M47  | 1M21  | 1M02  | 866k  | 768k  | 698k  | 619k  | [Ω]   |

#### RP40Q-xx24SRW

| Trim up               | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | [%]   |
|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| $V_{out\_set} =$      | 24.24 | 24.48 | 24.72 | 24.96 | 25.20 | 25.44 | 25.68 | 25.92 | 26.16 | 26.40 | [VDC] |
| $R_{up}(E96) \approx$ | 9M53  | 4M7   | 3M24  | 2M94  | 2M    | 1M69  | 1M47  | 1M27  | 1M15  | 1M05  | [Ω]   |

#### RP40Q-xx48SRW

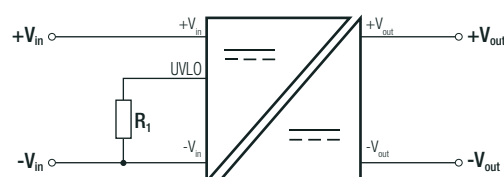
| Trim up               | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 10    | [%]   |
|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| $V_{out\_set} =$      | 48.48 | 48.96 | 49.44 | 49.92 | 50.40 | 50.88 | 51.36 | 51.84 | 52.32 | 52.80 | [VDC] |
| $R_{up}(E96) \approx$ | 19M6  | 9M94  | 6M65  | 5M11  | 4M12  | 3M4   | 3M01  | 2M61  | 2M37  | 2M15  | [Ω]   |

#### Trim Down all Vout's

| Trim down               | 1    | 2    | 3    | 4    | 5    | 6   | 7    | 8    | 9    | 10   | [%] |
|-------------------------|------|------|------|------|------|-----|------|------|------|------|-----|
| $R_{down}(E96) \approx$ | 499k | 243k | 162k | 118k | 90k9 | 75k | 63k4 | 53k6 | 46k4 | 41k2 | [Ω] |

| Trim down               | 11   | 12   | 13   | 14   | 15   | 16   | 17   | 18   | 19   | 20   | [%] |
|-------------------------|------|------|------|------|------|------|------|------|------|------|-----|
| $R_{down}(E96) \approx$ | 36k5 | 32k4 | 28k7 | 26k1 | 23k7 | 21k5 | 19k6 | 18k2 | 16k5 | 15k4 | [Ω] |

### UNDER VOLTAGE LOCKOUT ADJUSTABILITY



The RP40Q-RUWB series has an adjustable under voltage lockout which will shut down the converter according to following settings.

|                    |       |       |      |      |      |      |       |
|--------------------|-------|-------|------|------|------|------|-------|
| Nom. Input Voltage | 24    | 36    | 48   | 72   | 96   | 110  | [VDC] |
| Turn Off Threshold | 12.4  | 19.6  | 26.8 | 41.2 | 55.6 | 64   | [VDC] |
| Turn On Threshold  | 14.8  | 22    | 29.2 | 43.6 | 58   | 66.4 | [VDC] |
| Resistor $R_1$     | 96.77 | 17.14 | 9.40 | 4.94 | 3.35 | 2.82 | [kΩ]  |

Technical Data Sheet

# RP40Q-RUW Series ◇ Quater Brick

## 40W ◇ Ultra-Wide Input: 14V-160VDC

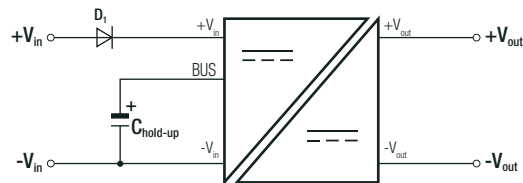


HOLD UP TIME SETTING

An additional BUS pin (version with suffix -B) supplies a fixed voltage for capacitor charging. Meeting S2, S3, and C2 conditions as described in EN50155 requires numerous aluminum electrolytic capacitors for ample energy. High voltage capacitors occupy significant space, posing challenges for limited specifications. To address varying system voltages, different capacitance values and withstand-voltage capacitors are needed.

The enhanced hold-up function resolves this by using the same capacitors for various system voltages and interruptions. This innovation is ideal for railway system power boards. Unlike conventional hold-up capacitors, the BUS pin consistently provides 21.4V, compatible with 25V rated capacitors for both 24V and 110V systems, ensuring a uniform solution in terms of capacitance value and quantity.

By connecting capacitors to the BUS pin, the inrush current is restricted effectively via the internal charging path that could reduce the extra external components of the whole system.



The formula provided below allows for the calculation of capacitor capacitance, with the potential for adjusting the margin based on practical application requirements.

$$C_{\text{hold-up}} = 0.0096 \times P_{\text{IN}} \times t$$

$P_{\text{IN}}$  = Input Power

$t$  = interruption durrantion

$C_{\text{hold-up}}$  = calculated capacitor

[W]

[s]

[μF]

Practical Example:

$P_{\text{OUT}}$  = 40W

$P_{\text{IN}}$  = 44.5W

$V_{\text{IN}}$  = 110VDC

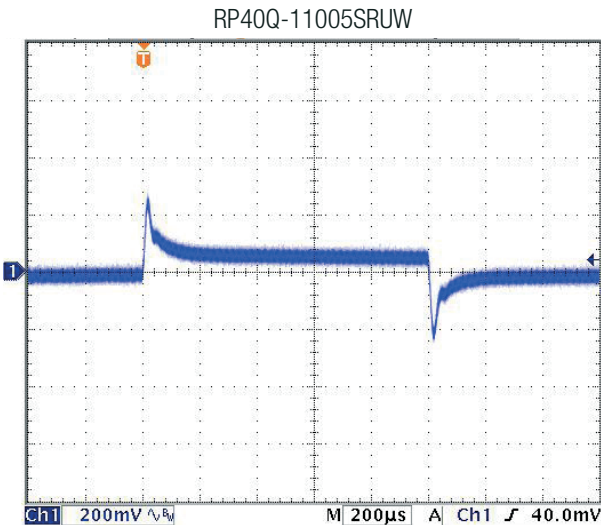
$t$  = 0.01s

$$C_{\text{hold-up}} = 0.0096 \times 44.5 \times 0.01 = 0.004272 \text{ F}$$
$$C_{\text{hold-up}} \text{ according to E96} \approx 4220\mu\text{F}$$

REGULATIONS

| Parameter          | Condition                        | Value      |
|--------------------|----------------------------------|------------|
| Output Accuracy    |                                  | ±1.0% max. |
| Line Regulation    | low line to high line, full load | ±0.1% max. |
| Load Regulation    | 0% to 100% load                  | 0.1% max.  |
| Transient Response | 25% load step change             | 250μs typ. |

Transient Response to Dynamic Load change from 100% to 75% to 100% of Full Load at nom. Vin



# RP40Q-RUW Series ◇ Quater Brick

## 40W ◇ Ultra-Wide Input: 14V-160VDC

### PROTECTIONS

| Parameter                         | Condition                     |                       |                    | Value                                        |
|-----------------------------------|-------------------------------|-----------------------|--------------------|----------------------------------------------|
| Short Circuit Protection (SCP)    | below 100mΩ                   |                       |                    | continuous, hiccup mode, automatic recovery  |
| Over Voltage Protection (OVP)     |                               |                       |                    | 120-135%, hiccup mode                        |
| Over Current Protection (OCP)     |                               |                       |                    | 120-140%, hiccup mode                        |
| Over Temperature Protection (OTP) |                               |                       |                    | +115°C ±5°C                                  |
| Isolation Voltage <sup>(9)</sup>  | nom. V <sub>IN</sub> = 110VDC | I/P to O/P            | rated for 1 minute | 3kVAC                                        |
|                                   |                               | I/P, O/P to Baseplate | rated for 1 minute | 1.5kVAC                                      |
| Isolation Resistance              | tested with 500VDC            |                       |                    | 1GΩ min.                                     |
| Isolation Capacitance             |                               |                       |                    | 1000pF max.                                  |
| Leakage Current                   |                               |                       |                    | 2250μA                                       |
| Insulation Grade                  | <2000m                        |                       |                    | reinforced (based on Electric Strength Test) |
|                                   | >2000m up to 5000m            |                       |                    | functional isolation                         |

Note9: For repeat Hi-Pot testing, reduce the time and/or the test voltage

Note10: Refer to local safety regulations if input over-current protection is also required. Recommended fuse: T5A slow blow type

### ENVIRONMENTAL

| Parameter                           | Condition                                         |                   | Value                         |
|-------------------------------------|---------------------------------------------------|-------------------|-------------------------------|
| Operating Temperature Range         | refer to „Thermal Calculation“                    |                   | -40°C to +105°C               |
| Maximum Baseplate Temperature       |                                                   |                   | +110°C                        |
| Temperature Coefficient             |                                                   |                   | ±0.02%/K                      |
| Thermal Impedance                   | vertical direction by natural convection (0.1m/s) | without Heat-sink | 6.3K/W                        |
|                                     |                                                   | with Heat-sink    | 5.0K/W                        |
| Operating Humidity                  |                                                   |                   | 5%-95% RH                     |
| Thermal Shock                       |                                                   |                   | according to EN61373 standard |
| Vibration                           |                                                   |                   | according to EN61373 standard |
| Fire Protection on Railway Vehicles |                                                   |                   | according to EN61373 standard |
| MTBF                                | according to MIL-HDBK-217F standard, G.B.         | +25°C             | 880 x 10 <sup>3</sup> hours   |
|                                     |                                                   | +85°C             | 150 x 10 <sup>3</sup> hours   |

### Thermal Calculation

$$R_{th} = \left[ \frac{T_{baseplate\ max} - T_{amb}}{P_{diss}} \right]$$

$$P_{diss} = \left[ \frac{P_{out\ set}}{\eta} \right] - P_{out\ set}$$

T<sub>baseplate max.</sub> = baseplate temperature [°C]

T<sub>amb</sub> = ambient temperature [°C]

P<sub>out nom.</sub> = nom. output power [W]

P<sub>out set</sub> = output power set [W]

P<sub>diss</sub> = internal losses [W]

R<sub>th</sub> = thermal impedance [K/W]

η = efficiency under given operating conditions [%]

### Practical Example:

Take the **RP40Q-11005SRUW** with 48V Input Voltage and 50% load, natural convection 0.1m/s, in vertical application. What is the maximum ambient operating temperature?

$$T_{baseplate\ max.} = 110^{\circ}\text{C}$$

$$P_{out\ nom.} = 40\text{W}$$

$$P_{out\ set} = 40 \times 0.5 = 20\text{W}$$

$$R_{th} = 6.3\text{K/W (vertical)}$$

$$\eta = 91\% \text{ (Graph)}$$

$$P_{diss} = \left[ \frac{20}{0.91} \right] - 20 = 1.98\text{W}$$

$$6.3 = \frac{110 - T_{amb}}{1.98}$$

$$R_{th} = \left[ \frac{T_{baseplate\ max} - T_{amb}}{P_{diss}} \right]$$

$$T_{amb} = 97.5^{\circ}\text{C}$$

Technical Data Sheet

# RP40Q-RUW Series ⬠ Quater Brick

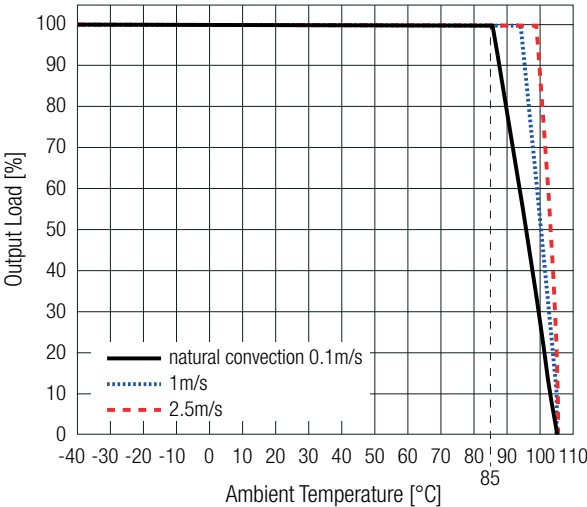
## 40W ⬠ Ultra-Wide Input: 14V-160VDC



ENVIRONMENTAL

Derating Graph

(@ Chamber - tested with double layer PCB: 160x100mm 105µm Eurocard)



Derating Graph

(@ Chamber - tested with double layer PCB: 160x100mm 105µm Eurocard)

Take the **RP40Q-11005SRUW-HC** with 48V Input Voltage, 50% load, natural convection 0.1m/s, in vertical application and Heat-sink.  
What is the maximum ambient operating temperature?

$T_{\text{baseplate max.}}$

$P_{\text{out nom.}}$

$P_{\text{out set}}$

$R_{\text{th}}$

$\eta$

= 110°C

= 40W

= 40 x 0.5 = 20W

= 5.0K/W (vertical)

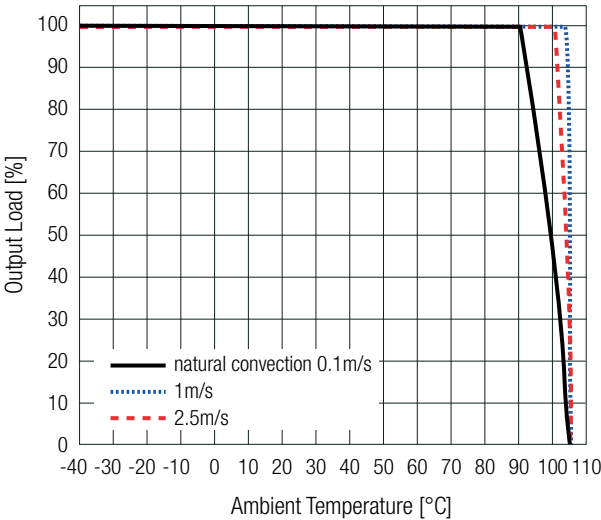
= 91% (Graph)

$P_{\text{diss}} = \left[ \frac{20}{0.91} \right] - 20 = 1.98\text{W}$

$R_{\text{th}} = \left[ \frac{T_{\text{baseplate max}} - T_{\text{amb}}}{P_{\text{diss}}} \right]$

$5.0 = \frac{110 - T_{\text{amb}}}{1.98}$

$T_{\text{amb}} = \underline{100^{\circ}\text{C}}$



SAFETY AND CERTIFICATION

| Certificate Type (Safety)                                                                  | Report / File Number           | Standard                                                       |
|--------------------------------------------------------------------------------------------|--------------------------------|----------------------------------------------------------------|
| Audio/video, information and communication technology equipment. Safety requirements       | LVD1809046-1 + LVD1903037-1-M1 | EN62368-1:2014 + A11:2017<br>IEC62368-1:2014, 2nd Edition      |
| Railway applications - Electrical equipment used on rolling stock                          | T181022L06-RL                  | EN50155:2017                                                   |
| Environmental testing Part 2-1: Tests – Test A: Cold                                       |                                | DIN EN60068-2-1:2008-01                                        |
| Environmental testing Part 2-2: Tests – Test B: Dry heat                                   |                                | DIN EN60068-2-2:2008-05                                        |
| Environmental testing Part 2-30: Tests - Test Db: Damp heat, cyclic                        |                                | DIN EN60068-2-30:2006-06                                       |
| Railway applications – Rolling stock equipment – Shock and vibration tests                 | E196683                        | EN61373:2010                                                   |
| Audio/video, information and communication technology equipment-Part1: Safety requirements |                                | UL62368-1:2014                                                 |
| RoHS2                                                                                      |                                | CAN/CSA-C22.2 No. 62368-1:2014<br>RoHS 2011/65/EU + AM2015/863 |

# RP40Q-RUW Series ◇ Quater Brick

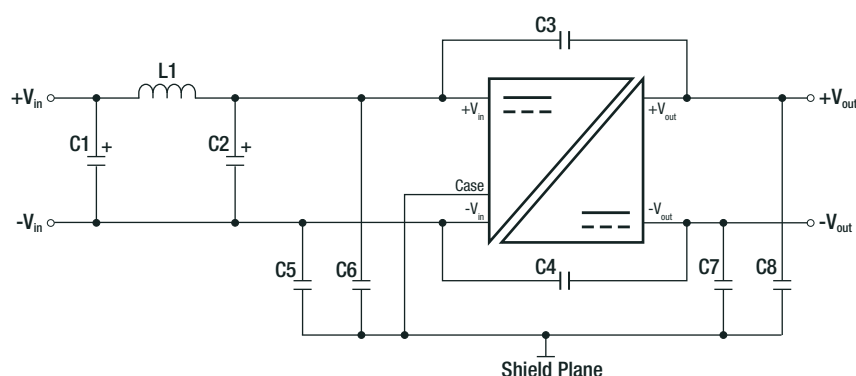
## 40W ◇ Ultra-Wide Input: 14V-160VDC

### SAFETY AND CERTIFICATION

| EMC Compliance (Railway)                                                                                 | Condition                                                                                                     | Standard / Criterion                    |
|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| Railway applications - Electromagnetic compatibility                                                     |                                                                                                               | EN50121-3-2:2016                        |
| Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement |                                                                                                               | EN55032:2010                            |
| ESD Electrostatic discharge immunity test                                                                | Air: $\pm 2, 4, 8\text{kV}$ ,<br>Contact: $\pm 2, 4, 6\text{kV}$                                              | EN61000-4-2:2009, Criteria A            |
| Radiated, radio-frequency, electromagnetic field immunity test                                           | 20V/m (80-1000MHz)<br>10V/m (1400-2000MHz)<br>5V/m (2000-2700MHz)<br>3V/m (5100-6000MHz)                      | EN61000-4-3:2006 + A2:2010, Criteria A  |
| Fast Transient and Burst Immunity                                                                        | DC Power Port: $\pm 2\text{kV}$                                                                               | EN61000-4-4:2012, Criteria A            |
| Surge Immunity                                                                                           | DC Power Port: $\pm 2\text{kV}$                                                                               | EN61000-4-5:2014, Criteria A            |
| Immunity to conducted disturbances, induced by radio-frequency fields                                    | DC Power Port: 10V                                                                                            | EN61000-4-6:2014, Criteria A            |
| Power Magnetic Field Immunity                                                                            | 50Hz, 100A/m, 1000A/m                                                                                         | EN61000-4-8:2009, Criteria A            |
| Electromagnetic compatibility of multimedia equipment - Emission requirements                            | with external filter<br>(see filter suggestion below)                                                         | EN55032:2015 + AC:2016-07, Class A      |
| EMC Compliance (Multimedia)                                                                              | Condition                                                                                                     | Standard / Criterion                    |
| Information technology equipment - Immunity characteristics - Limits and methods of measurement          |                                                                                                               | EN55024:2010 + A1:2015                  |
| ESD Electrostatic discharge immunity test                                                                | Air: $\pm 2, 4, 8\text{kV}$ ,<br>Contact: $\pm 2, 4, 6\text{kV}$                                              | IEC61000-4-2:2008, Criteria A           |
| Radiated, radio-frequency, electromagnetic field immunity test                                           | 3V/m (80-1000MHz)<br>20V/m (80-1000MHz)<br>10V/m (1400-2000MHz)<br>5V/m (2000-2700MHz)<br>3V/m (5100-6000MHz) | IEC61000-4-3:2006 + A2:2010, Criteria A |
| Fast Transient and Burst Immunity                                                                        | DC Power Port: $\pm 0.5, 2\text{kV}$                                                                          | IEC61000-4-4:2012, Criteria A           |
| Surge Immunity                                                                                           | DC Power Port: L-N $\pm 0.5, 1\text{kV}$                                                                      | IEC61000-4-5:2014, Criteria A           |
| Immunity to conducted disturbances, induced by radio-frequency fields                                    | DC Power Port: 3V, 10V                                                                                        | IEC61000-4-6:2013, Criteria A           |
| Power Magnetic Field Immunity                                                                            | 50/60Hz, 1, 100, 1000A/m                                                                                      | IEC61000-4-8:2009, Criteria A           |

Note11: An external input filter capacitor is required if the module has to meet EN61000-4-4 and EN61000-4-5  
 Recom suggests: 2 pcs. 150 $\mu\text{F}$ /200V connected in parallel

### EMC Filtering according to EN55032 Class A



### Component List Class A

| C1                      | L1                | C2                      | C3, C4         | C5, C6, C7, C8              |
|-------------------------|-------------------|-------------------------|----------------|-----------------------------|
| 47 $\mu\text{F}$ , 200V | 8.2 $\mu\text{H}$ | 47 $\mu\text{F}$ , 200V | 1000pF, 400VAC | 1000pF, 250VAC<br>1808 MLCC |

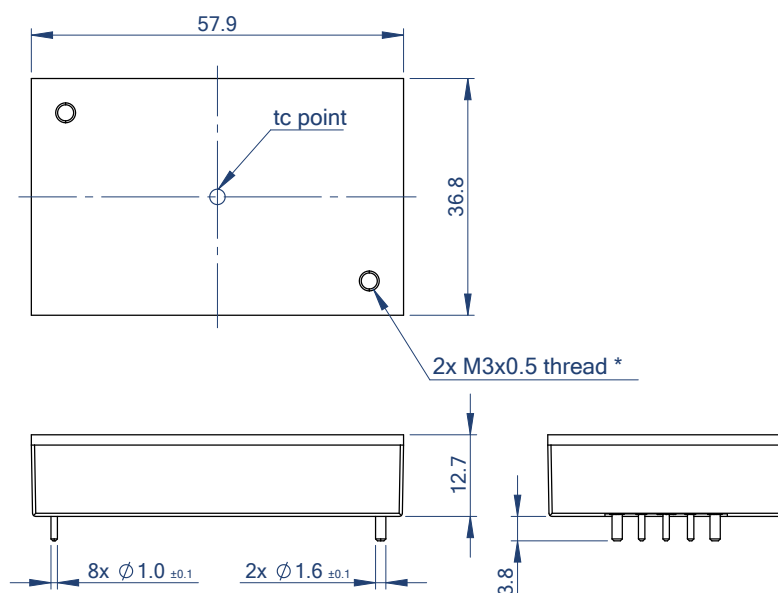
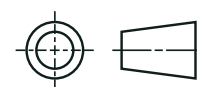
# RP40Q-RUW Series ◇ Quater Brick

## 40W ◇ Ultra-Wide Input: 14V-160VDC

### DIMENSION & PHYSICAL CHARACTERISTICS

| Parameter         | Type              | Value                                          |
|-------------------|-------------------|------------------------------------------------|
| Material          | baseplate         | aluminum                                       |
|                   | case              | plastic, (UL94 V-0)                            |
|                   | potting           | low smoke silicone, (UL94 V-0)                 |
|                   | PCB               | FR4, (UL94 V-1)                                |
| Dimension (LxWxH) | without Heat-sink | 57.9 x 36.8 x 12.7mm<br>2.28 x 1.45 x 0.5 inch |
|                   | with Heat-sink    | 57.9 x 36.8 x 25.4mm<br>2.28 x 1.45 x 1.0 inch |
| Weight            | without Heat-sink | 64.0g typ.<br>0.141 lbs                        |
|                   | with Heat-sink    | 88.0g typ.<br>0.194 lbs                        |

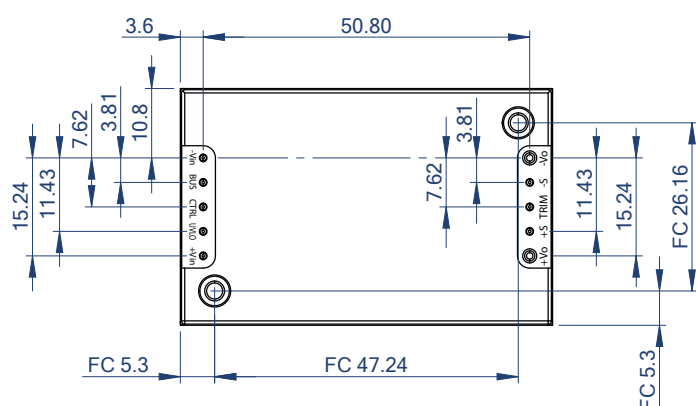
Dimension Drawing (mm)



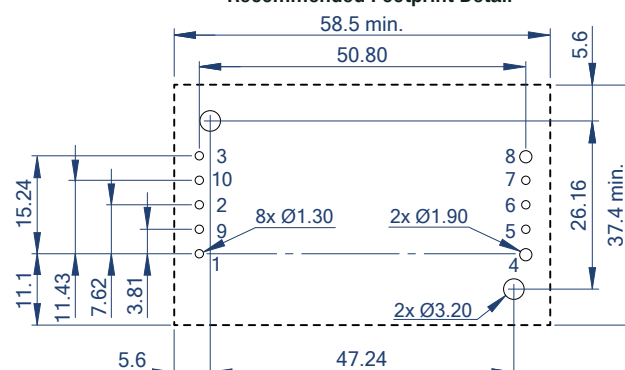
### Pinning Information

| Pin # | Function | Pin Ø |
|-------|----------|-------|
| 1     | +Vin     | 1.0mm |
| 2     | CTRL     | 1.0mm |
| 3     | -Vin     | 1.0mm |
| 4     | -Vout    | 1.6mm |
| 5     | -Sense   | 1.0mm |
| 6     | Trim     | 1.0mm |
| 7     | +Sense   | 1.0mm |
| 8     | +Vout    | 1.6mm |
| 9     | BUS      | 1.0mm |
| 10    | UVLO     | 1.0mm |

FC= Fixing Centers for Heat-sink  
\*recommended tightening torque: 0.34Nm



### Recommended Footprint Detail



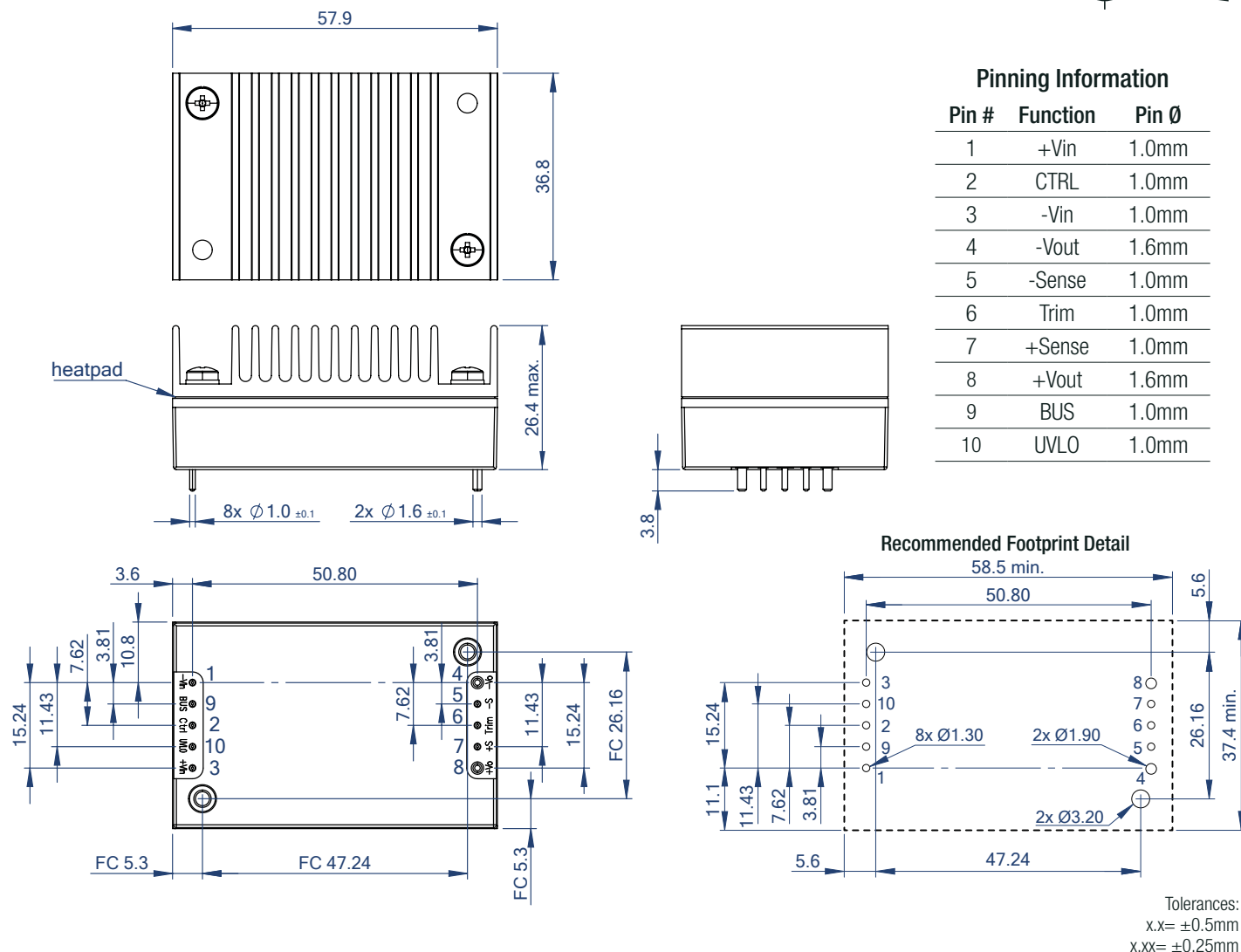
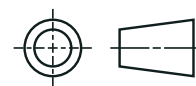
Tolerances:  
x.x= ±0.5mm  
x.xx= ±0.25mm

# RP40Q-RUW Series ◇ Quater Brick

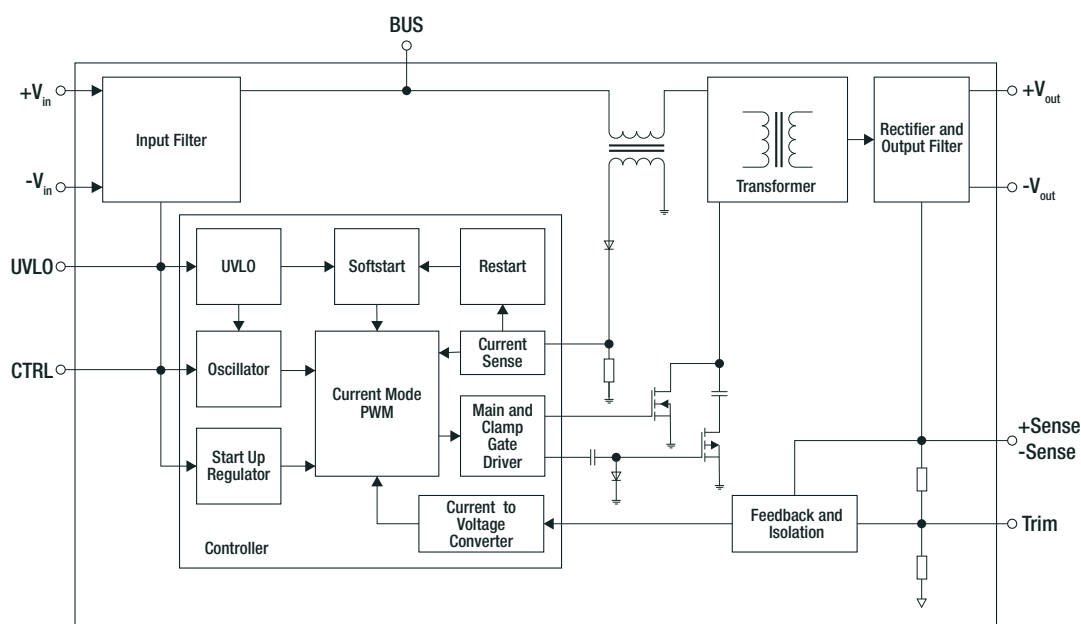
## 40W ◇ Ultra-Wide Input: 14V-160VDC

### DIMENSION & PHYSICAL CHARACTERISTICS

Dimension Drawing pre-mounted Heat-sink (mm)



### BLOCK DIAGRAM



# RP40Q-RUW Series ◇ Quater Brick

## 40W ◇ Ultra-Wide Input: 14V-160VDC

### PACKAGING INFORMATION

| Parameter                   | Type           |                   | Value                 |
|-----------------------------|----------------|-------------------|-----------------------|
| Packaging Dimension (LxWxH) | tray           | without Heat-sink | 157.0 x 88.0 x 23.0mm |
|                             |                | with Heat-sink    | 157.0 x 88.0 x 35.0mm |
| Packaging Quantity          |                |                   | 2pcs                  |
| Storage Temperature Range   |                |                   | -55°C to +125°C       |
| Storage Humidity            | non-condensing |                   | 5% - 95% RH           |

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