Features

ICE Technology*

- +115°C Maximum Case Temperature
- -45°C Minimum Case Temperature
- Built-in EMC Filter
- Ribbed Case Style
- 2250VDC Isolation
- Built-in EMC Filter, EN-55022 Class B

RECOM

DC/DC Converter

RPP30-2405S

30 Watt 2:1
2" x 1.2"
Ribbed Style
Single Output

Description

The RPP30 series 2:1 input range DC/DC converters are ideal for high end industrial applications and COTS Military applications where a very wide operating temperature range of -45°C to +115°C is required. Although the case size is very compact, the converter contains a built-in EMC filter EN-55022 Class B without the need for any external components. The RPP30 is available in a ribbed case style for active cooling. They are UL-60950-1 certified.

Selection Guide

Part Number	Input Voltage Range (VDC)	Input Current (mA)	Output Voltage (VDC)	Output Current (mA)	Efficiency typ. (%)	Max. Capacitive Load (µF)
RPP30-2405S	18-36	1390	5	6000	91	2200

Notes:

Note1: Typical values at nominal input voltage and full load.

c US E224736

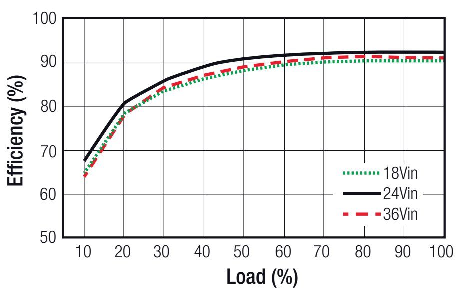
UL-60950-1 Certified
EN-55022 Certified

Specifications (measured at T_A= 25°C, nominal input voltage, full load and after warm-up)

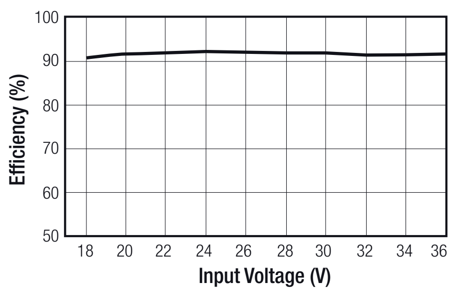
BASIC CHARACTERISTICS

Parameter	Condition	Min.	Typ.	Max.
Input Voltage Range		18VDC	24VDC	36VDC
Transient Input Voltage	≤100ms			50VDC
Inrush Current	with EMC Filter without EMC Filter			20A 40A
Under Voltage Lockout	DC-DC ON DC-DC OFF	17.5VDC		 17VDC
Remote ON/OFF	ON / high logic OFF / low logic	Open, 4.5V Short, 0V		5.5V 1.2V
Remote OFF Input Voltage	nominal input		5mA	
Start-up Time	when use CTRL function		5ms	20ms
Operating Frequency		270kHz	300kHz	330kHz
Efficiency	typ. Vin, full load	90%	91%	
Minimum Load		0%		
Output Ripple and Noise	20MHz limited, 1µF output MLCC		50mVp-p	100mVp-p

Efficiency VS. Load



Efficiency VS. Input Voltage



*** ICE Technology**
ICE (Innovation in Converter Excellence) uses state-of-the-art techniques to minimise internal power dissipation and to increase the internal temperature limits to extend the ambient operating temperature range to the maximum.

Refer to Applications Notes

RPP30-2405S Series

DC/DC Converter

Specifications (measured at T_A= 25°C, nominal input voltage, full load and after warm-up)

REGULATIONS

Parameter	Condition	Value
Output Voltage Accuracy	50% load	±1.5% max.
Line Voltage Regulation	low line to high line	±0.3% max.
Load Voltage Regulation	10% to 100% load	±0.5% max.
Transient Response	25% load step change, ΔIo/Δt=2.5A/us	800µs typ.
Transient Peak Deviation	25% load step change, ΔIo/Δt=2.5A/us	±2%Vout max.
Trimming Output Voltage		±10% typ.

Trimming Output Voltage

Only the single output converters have a trim function that allows users to adjust the output voltage from +10% to -10%, please refer to the trim table that follow for details. Adjustment to the output voltage can be used with a simple fixed resistor as shown in Figures 1 and 2. A single fixed resistor can increase or decrease the output voltage depending on its connection. Resistor should be located close to the converter. If the trim function is not used, leave the trim pin open.

Trim adjustments higher than the specified range can have an adverse effect on the converter´s performance and are not recommended. Excessive voltage differences between output voltage sense voltage, in conjunction with trim adjustment of the output voltage; can cause the OVP circuitry to activate. Thermal derating is based on maximum output current and voltage at the converter´s output pins. Use of the trim and sense function can cause output voltages to increase, thereby increasing output power beyond the converter´s specified rating. Therefore: (Vout at Pins) X (Iout) ≤ rated output power.

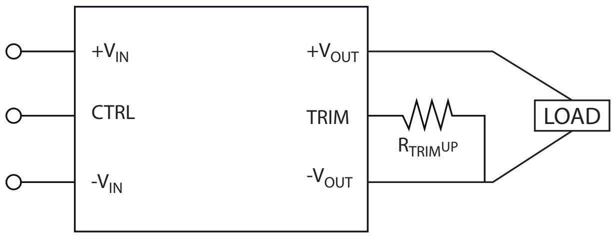


Figure 1. Trim connections to increase output voltage using fixed resistors

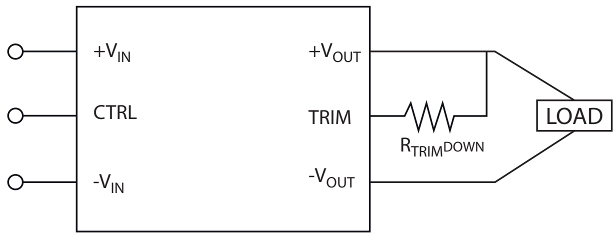


Figure 2. Trim connections to decrease output voltage using fixed resistors

	Trim up resistor value (KΩ)									
Vout	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
5VDC	109.7	51	31.2	20.3	14.2	9.87	7.1	5.0	3.38	2.08

	Trim down resistor value (KΩ)									
Vout	-1%	-2%	-3%	-4%	-5%	-6%	-7%	-8%	-9%	-10%
5VDC	127.6	55.8	32.96	20.2	14.2	9.46	5.97	3.6	1.77	0.28

PROTECTIONS

Parameter	Condition	Value
Output Power Protection (OPP) (2)	Hiccup Mode	120% typ.
Over Voltage Protection (OVP)	10% load	120% typ.
Over Temperature Protection (OTP)	case temperature	120°C, auto-recovery
Isolation Voltage	I/P to O/P, at 70% RH I/P to Case, O/P to Case	2250VDC / 1 Minute 1500VDC / 1 Minute
Isolation Resistance	I/P to O/P , at 70% RH	100MΩ min.
Isolation Capacitance	I/P to O/P	1500pF typ.

Notes:

Note2:	combines Over Load Protection and Short Circuit Protection
Note3:	This Power Module is not internally fused. A input fuse must be always used. Recommended Fuse: T2.5A

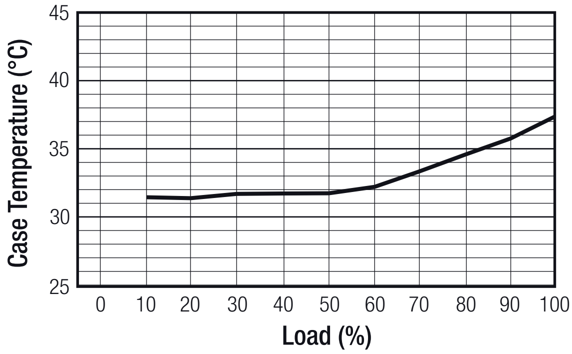
Specifications (measured at TA= 25°C, nominal input voltage, full load and after warm-up)

ENVIRONMENTAL

Parameter	Condition		Value
Relative Humidity			95%, non condensing
Temperature Coefficient			±0.04% / °C max.
Thermal Impedance	natural convection, mounting at FR4 (254x254mm) PCB	vertical horizontal	4.6°C/W 6.4°C/W
Operating Temperature Range	start up at -45°C		-45°C to (see calculation)
Maximum Case Temperature			+115°C
Storage Temperature Range			-55°C to +125°C
MTBF	according to MIL-HDBK-217F (+50°C G.B.) according to BellCore-TR-332 (+50°C G.B.)		609 x 10³ hours 1541 x 10³ hours

Derating Graph

(Ta= +25°C, natural convection, typ. Vin and vertical mounting)



Calculation

$R_{thcase-ambient} = 4.6°C/W$ (vertical)

$R_{thcase-ambient} = 6.4°C/W$ (horizontal)

$$R_{thcase-ambient} = \frac{T_{case} - T_{ambient}}{P_{dissipation}}$$

$$P_{dissipation} = P_{IN} - P_{OUT} = \frac{P_{OUTapp}}{\eta} - P_{OUTapp}$$

T_{case} = Case Temperature

$T_{ambient}$ = Environment Temperature

$P_{dissipation}$ = Internal losses

P_{IN} = Input Power

P_{OUT} = Output Power

η = Efficiency under given Operating Conditions

$R_{thcase-ambient}$ = Thermal Impedance

Practical Example:

Take the RPP30-2405S with 50% load. What is the maximum ambient operating temperature? Use converter vertical in application.

$Eff_{min} = 90\% @ V_{nom}$

$P_{OUT} = 30W$

$P_{OUTapp} = 30 \times 0.5 = 15W$

$$P_{dissipation} = \frac{P_{OUTapp}}{\eta} - P_{OUTapp}$$

η = ~91% (from Eff vs Load Graph)

$$P_{dissipation} = \frac{15}{0.91} - 15 = 1.48W$$

$$R_{th} = \frac{T_{casemax} - T_{ambient}}{P_{dissipation}} \text{ --> } 4.6°C/W = \frac{115°C - T_{ambient}}{1.48W}$$

$T_{ambientmax}$ = 108.2°C

continued on next page

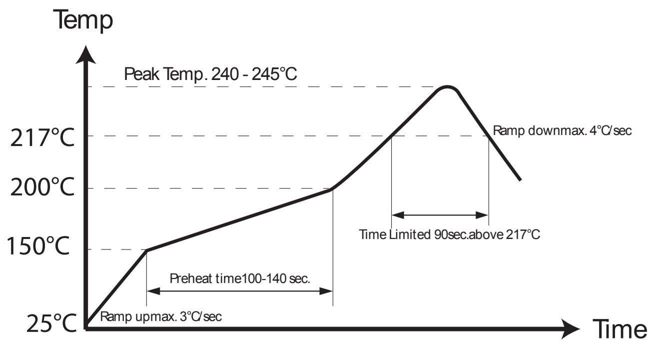
Specifications (measured at TA= 25°C, nominal input voltage, full load and after warm-up)

Soldering

Hand Soldering	Wave Soldering
Hand Soldering is the least preferred method because the amount of solder applied, the time the soldering iron is held on the joint, the temperature of the iron and the temperature of the solder joint are variable. The recommended hand soldering guideline is listed in Table 1. The suggested soldering process must keep the power module's internal temperature below the critical temperature of 217°C continuously.	High temperature and long soldering time will result in IMC layer increasing in thickness and thereby shorten the solder joint lifetime. Therefore the peak temperature over 245°C is not suggested due to the potential reliability risk of components under continuous high-temperature. In the meanwhile, the soldering time of temperature above 217°C should be less than 90 seconds. Please refer to the soldering profile below for recommended temperature profile parameters.

Table 1 Hand-Soldering Guideline

Parameter	Single-side Circuit Boad	Double-side Circuit Board	Multi-layers Circuit Board
Soldering Iron Wattage	90W	90W	90W
Tip Temperature	385 ±10°C	420 ±10°C	420 ±10°C
Soldering Time	2-6 seconds	4-10 seconds	4-10 seconds

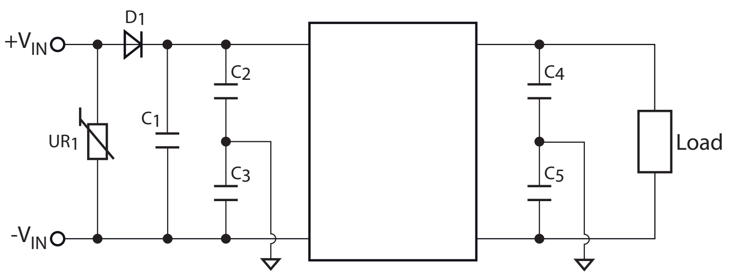


SAFETY AND CERTIFICATIONS

Certificate Type	Report / File Number	Standard / Edition
UL General Safety	E224236	UL-60950-1, 1st Edition

Certificate Type (Environmental)	Conditions	Standard / Criterion
EMI		EN-55022, Class B
ESD	±8kV Air Discharge, ±6kV Contact Discharge	EN-61000-4-2, Criteria B
Radiated Immunity	Level 3, 10V/m	EN-61000-4-3, Criteria A
Fast Transient	±4kV Applied	EN-61000-4-4, Criteria B
Surge	±4kV Applied	EN-61000-4-5, Criteria B
Conducted Immunity	Level 3, 10V rms	EN-61000-4-6, Criteria A
Vibration	50-150Hz, along X,Y and Z	EN-60068-2-6
Thermal Cycling (complies with MIL-STD-810F)	12 cycles	EN-60068-2-14
Shock	5g / 30ms	EN-60068-2-27

EMC Filtering - Suggestions



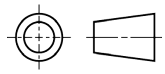
It is recommended to add UR1, D1 and C1 in railway application. To meet EN61000-4-2, module case should be earth grounded. We offer independent case pin option on request, the location is upon pin 1.

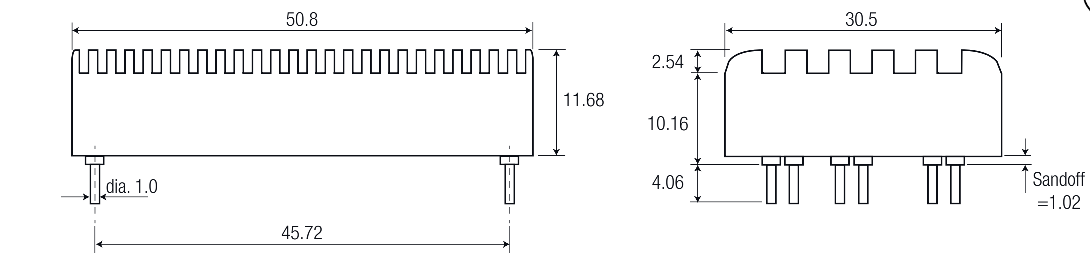
RPP	Standard	UR1	D1	C1	C2, C3, C4, C5
	EN61000-4-2, 3, 4, 5, 6	MOV 14D361K	100V / 3A	680µF / 250V	471pF / 3kV

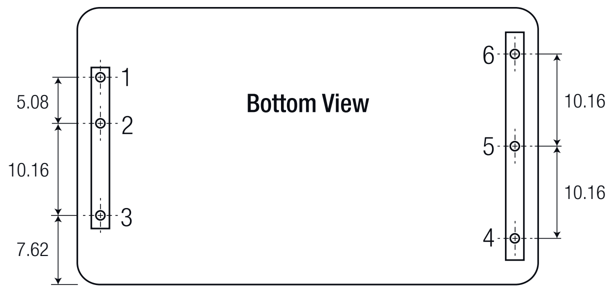
Specifications (measured at T_A= 25°C, nominal input voltage, full load and after warm-up)

DIMENSIONS AND PHYSICAL CHARACTERISTICS	
Parameter	**Value**
Material [4]	Aluminium
Dimensions (LxWxH)	50.8 x 30.5 x 12.7mm
Weight	39g
Packaging Dimensions (LxWxH)	160 x 55 x 20mm
Packaging Quantity	4pcs / Tube

Mechanical Dimensions (mm)







Pin Connections

Pin #	Single
1	+Vin
2	-Vin
3	CTRL
4	Trim
5	-Vout
6	+Vout

Tolerance: ±0.5mm

Notes:

Note4: To ensure a good all-round electrical contact, the bottom plate is pressed firmly into place into the aluminium case.The hydraulic press can leave tooling marks and deformations to both the case and plate. The case is anodised aluminium, so there will be natural variations in the case colour and the aluminium is not scratch resistant. Any resultant marks, scratches and colour varations are cosmetic only and do not affect the operation or performance of the converters.

Test Set-up