Features

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

ICE Technology*

RECOM
DC/DC Converter

RPP20-2412D

20 Watt 2:1 1.6“ x 1“ Ribbed Style Dual Output

3 YEAR warranty

Description

The RPP20 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 RPP20 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]
RPP20-2412D	18-36	940	±12	±830	90	±470

Notes:

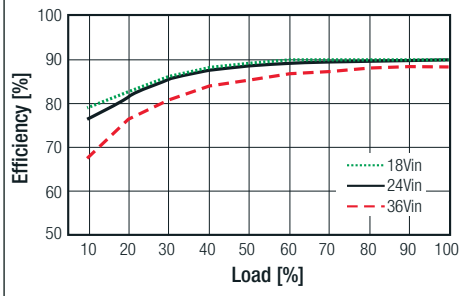
Note1: Typical values at nominal input voltage and full load.

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

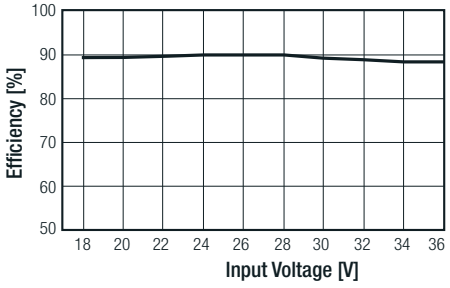
BASIC CHARACTERISTICS

Parameter	Condition	Min.	Typ.	Max.
Input Voltage Range	nom. Vin= 24VDC	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 Remote OFF Input Voltage	ON / high logic OFF / low logic nominal input	Open, 4.5V Short, 0V	 5mA	5.5V 1.2V
Start-up Time	when use CTRL function		5ms	20ms
Internal Operating Frequency		270kHz	300kHz	330kHz
Efficiency	typ. Vin, full load	89%	90%	
Minimum Load		10%		
Output Ripple and Noise	20MHz limited, 1µF output MLCC		120mVp-p	180mVp-p

Efficiency vs. Load



Efficiency vs. Input Voltage



continued on next page

UL-60950-1 Certified
EN-55022 Certified

*** 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.

RPP20-2412D
Series

Specifications (measured @ ta= 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.
Cross Regulation	10% to 100% load	3% typ. / 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.

PROTECTIONS		
Parameter	**Condition**	**Value**
Output Power Protection (OPP)	current limit	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.

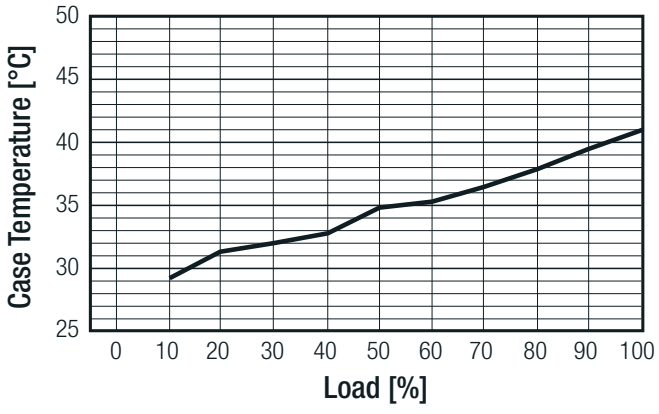
Notes:

Note2: This Power Module is not internally fused. A input fuse must be always used. Recommended Fuse: T1.6A

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	7.2°C/W 7.8°C/W
Operating Temperature Range	start up at -45°C		-45°C to (see calculation)
Maximum Case Temperature			+115°C
MTBF	according to MIL-HDBK-217F (+50°C G.B.) according to BellCore-TR-332 (+50°C G.B.)		768 x 10^3 hours 1572 x 10^3 hours

Derating Graph

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



continued on next page

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

Calculation

$R_{thcase\text{-}ambient}$ = 7.2°C/W (vertical)
$R_{thcase\text{-}ambient}$ = 7.8°C/W (horizontal)

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

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

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
$R_{thcase\text{-}ambient}$ = Thermal Impedance

Practical Example:

Take the RPP20-2412D with 50% load. What is the maximum ambient operating temperature? Use converter vertical in application.

Eff_{min} = 89% @ V_{nom}
P_{OUT} = 20W
P_{OUTapp} = 20 x 0.5 = 10W

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

η = ~88% (from Eff vs Load Graph)

$$P_{dissipation} = \frac{10}{0.89} - 10 = 1.24W$$

$$R_{th} = \frac{T_{casemax} - T_{ambient}}{P_{dissipation}} \text{ --> } 7.2°C/W = \frac{115°C - T_{ambient}}{1.24W}$$

$T_{ambientmax}$ = 106.1°C

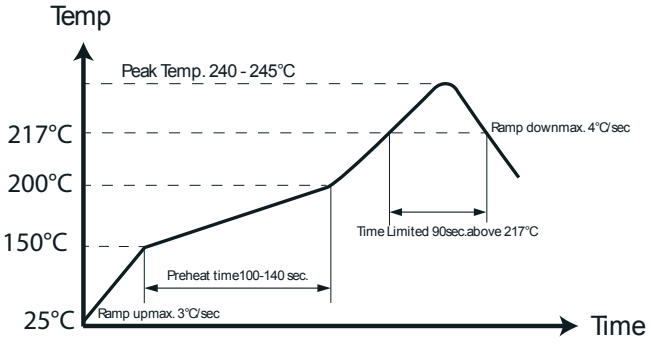
Soldering

Hand 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.

Wave Soldering
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



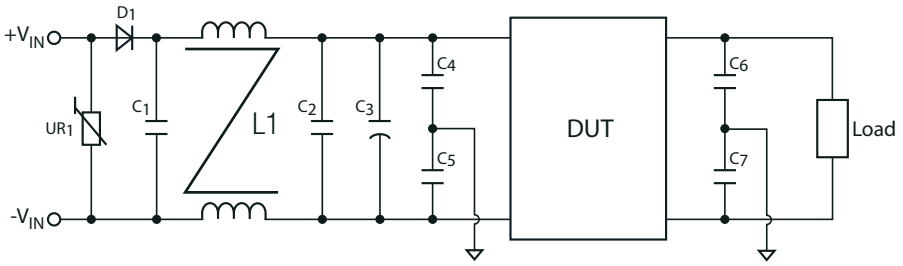
Specifications (measured @ ta= 25°C, nominal input voltage, full load and after warm-up)

SAFETY AND CERTIFICATIONS

Certificate Type (Safety)	Report Number	Standard
Information Technology Equipment, General Requirements for Safety	E224236	UL-60950-1, 1st Edition

Certificate Type (Environmental)	Condition	Standard / Criterion
Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement		EN55022, Class B
ESD Immunity Test	±8kV Air Discharge, ±6kV Contact Discharge	IEC61000-4-2, Criteria B
RF Field Strengh Susceptibility Test	10V/m	IEC61000-4-3, Criteria A
Electrical Fast Transient Test / Burst Immunity Text	±4kV Applied	IEC61000-4-4, Criteria B
Surge Immunity Test	±4kV Applied	IEC61000-4-5, Criteria B
Conducted Disturbance Susceptibility Test	10V rms	IEC61000-4-6, Criteria A
Vibration	50-150Hz, along X, Y and Z	EN60068-2-6
Thermal Cycling (complies with MIL-STD-810F)	12 cycles	EN60068-2-14
Shock	5g / 30ms	EN60068-2-27

EMC Filtering - Suggestions



It is recommended to add UR1, D1 and C1 in railway application. C1, L1, C2 and C3 can be modified for required EMI standards. To meet EN61000-4-2, module case should be earth grounded. We offer independent case pin option on request.

Standard	UR1	D1	C1	L1	C2	C3	C4, C5, C6, C7
EN55022 Class B	MOV 14D361K	50V / 9A	1.5µF / 250V	550µH ±20%	6.8µF / 50V	330µF / 50V	0.47nF Y1-Cap
EN61000-4-2, 3, 4, 5, 6			N/A	N/A	N/A		

DIMENSION AND PHYSICAL CHARACTERISTICS

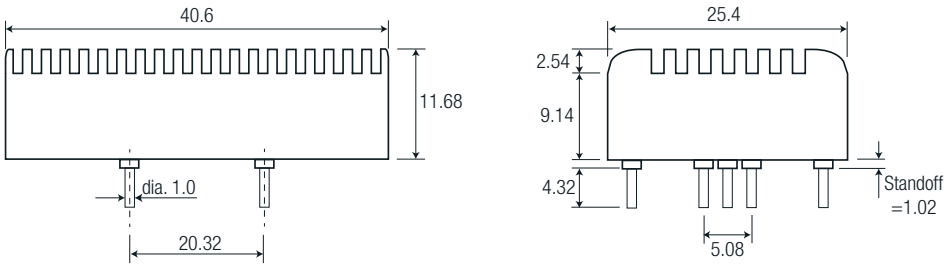
Parameter	Value
Material (3)	Aluminium
Package Dimension (LxWxH)	40.6 x 25.4 x 12.7mm
Package Weight	27g

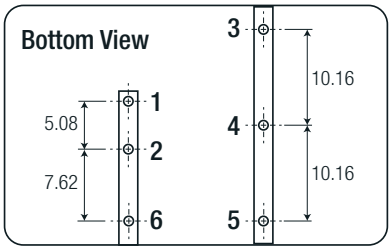
continued on next page

RPP20-2412D
Series

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

Dimension Drawing (mm)





Pin Connections

Pin #	Dual
1	+Vin
2	-Vin
3	+Vout
4	Com
5	-Vout
6	CTRL

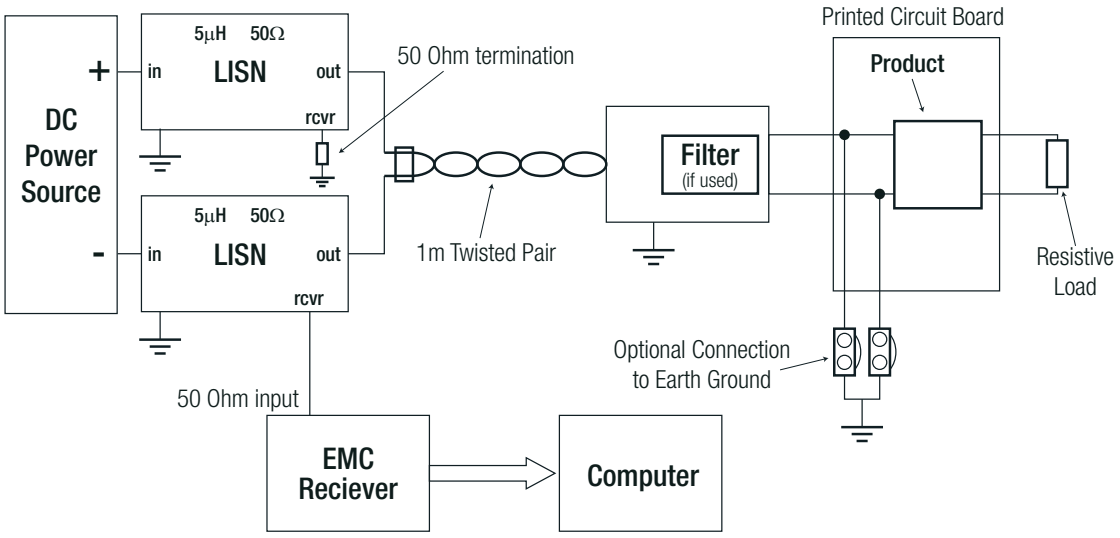
Tolerance: ±0.8mm
Pin pitch tolerance= ±0.25mm

Notes:

Note3: 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.

INSTALLATION and APPLICATION

Test Set-up



PACKAGING INFORMATION

Parameter	Type	Value
Packaging Dimension (LxWxH)	Tube	160.0 x 45.0 x 16.0mm
Packaging Quantity		5pcs
Storage Temperature Range		-55°C to +125°C