

Regulated Converters

- 4:1 Wide input range
- 3kVAC Reinforced insulation for 110Vin
2.25kVDC Basic insulation for 24Vin & 48Vin
- Efficiency up to 91%
- No minimum load required
- UL60950-1, EN50155 & IEC/EN60950-1 Certified



RP75H-RW

**75 Watt
Half Brick
Single Output**



EN50155 Certified
IEC/EN60950-1 Certified
UL60950-1 Certified

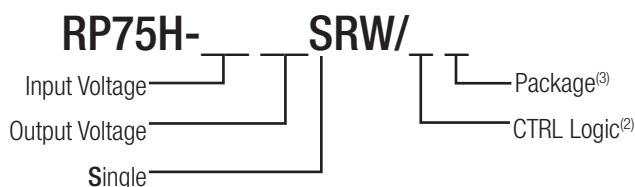
Selection Guide

Part Number	Input Voltage Range [VDC]	Output Voltage [VDC]	Output Current [mA]	Input ⁽¹⁾ Current [mA]	Output Power [W]	Efficiency ⁽¹⁾ typ. [%]	Max. Capacitive Load [μF]
RP75H-2405SRW	9-36	5	15000	3551	75	88	30000
RP75H-2412SRW	9-36	12	6300	3579	75	88	5250
RP75H-2415SRW	9-36	15	5000	3551	75	88	3330
RP75H-2424SRW	9-36	24	3200	3678	76	87	1330
RP75H-2448SRW	9-36	48	1600	3678	77	87	330
RP75H-4805SRW	18-75	5	15000	1736	75	90	30000
RP75H-4812SRW	18-75	12	6300	1750	75	90	5250
RP75H-4815SRW	18-75	15	5000	1755	75	89	3330
RP75H-4824SRW	18-75	24	3200	1818	76	88	1330
RP75H-4848SRW	18-75	48	1600	1839	77	87	330
RP75H-11005SRW	43-160	5	15000	749	75	91	30000
RP75H-11012SRW	43-160	12	6300	755	75	91	5250
RP75H-11015SRW	43-160	15	5000	749	75	91	3330
RP75H-11024SRW	43-160	24	3200	775	76	90	1330
RP75H-11048SRW	43-160	48	1600	775	77	90	330

Notes:

Note1: Efficiency is tested by nominal Vin, full load and at 25°C.

Model Numbering



Ordering Examples

RP75H-2405SRW/N = 24V Input, 5V Output, Single, Neg. CTRL function

RP75H-11012SRW/P = 110V Input, 12V Output, Single, Pos. CTRL function

RP75H-11012SRW/P-HC = 110V Input, 12V Output, Single, Pos. CTRL function, with premounted Heat-sink

Notes:

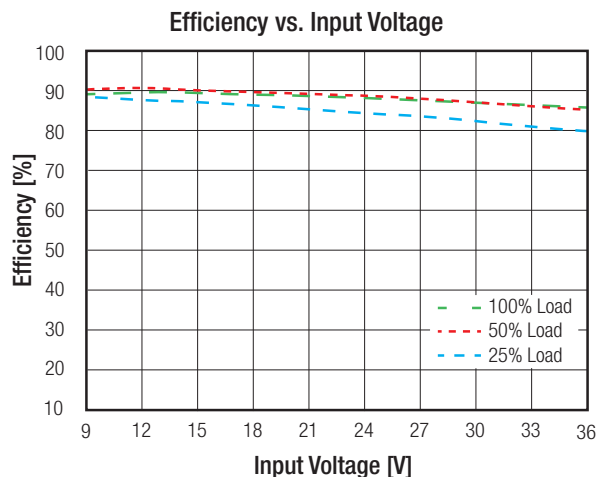
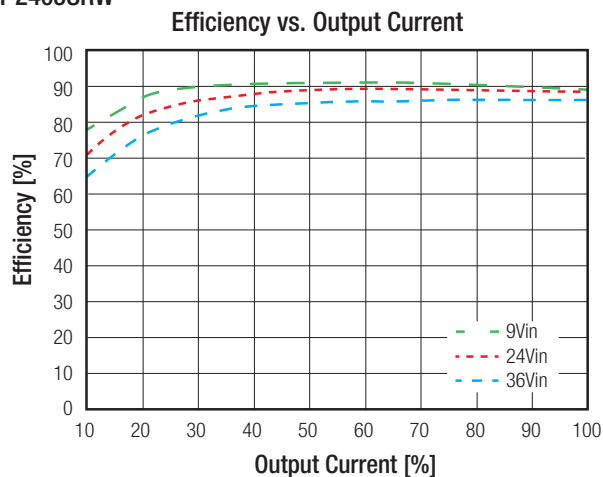
Note2: standard part is with suffix "P" for positive logic (1=ON, 0=OFF)
or add suffix "N" instead for negative logic (0=ON, 1=OFF)

Note3: add suffix "-HC" for premounted Heat-sink
(compatible with all other suffixes)

Specifications measured @ $t_a = 25^{\circ}\text{C}$, resistive load, nominal V_{in} and rated I_{out} unless otherwise noted

BASIC CHARACTERISTICS					
Parameter	Condition		Min.	Typ.	Max.
Internal Input Filter	Pi-Type				
Input Voltage Range	nom Vin = 24V nom Vin = 48V nom Vin = 110V		9VDC 18VDC 43VDC	24VDC 48VDC 110VDC	36VDC 75VDC 160VDC
Input Surge Voltage	Vin = 24V, 1s max. Vin = 48V, 1s max. Vin = 110V, 1s max.				50VDC 100VDC 185VDC
Quiescent Current	Vin = 24V Vin = 48V Vin = 110V		85mA 50mA	10mA	185mA 90mA
Start-up time	Power up	Vin = 110V Vin = 24V, Vin = 48V		60ms 25ms	
	Remote ON/OFF	Vin = 110V Vin = 24V, Vin = 48V		60ms 25ms	
Internal Operating Frequency			270kHz	300kHz	330kHz
Minimum Load			0%		
Ripple and Noise	Measured by 20MHz BW with a 4.7μF/50V X7R MLCC with a 4.7μF/50V X7R MLCC with a 4.7μF/50V X7R MLCC with a 2.2μF/100V X7R MLCC	5 Vout 12, 15Vout 24Vout 48Vout		75mVp-p 100mVp-p 200mVp-p 300mVp-p	100mVp-p 125mVp-p 250mVp-p 350mVp-p
Under Voltage Lockout (UVLO)	Vin = 24V	DC-DC ON DC-DC OFF		7.5VDC	9VDC
	Vin = 48V	DC-DC ON DC-DC OFF		16VDC	18VDC
	Vin = 110V	DC-DC ON DC-DC OFF		36VDC	43VDC
ON/OFF Control	Positive Logic	DC-DC ON DC-DC OFF	Open or 3.0V < Vr < 12V Short or 0V < Vr < 1.2V		
	Negative Logic	DC-DC ON DC-DC OFF	Short or 0V < Vr < 1.2V Open or 3.0V < Vr < 12V		
Input Current of CTRL pin			-0.5mA		1mA
Standby Current				3mA	
Output Trim			-20%		+10%
Remote Sense	% of set Vout				10%

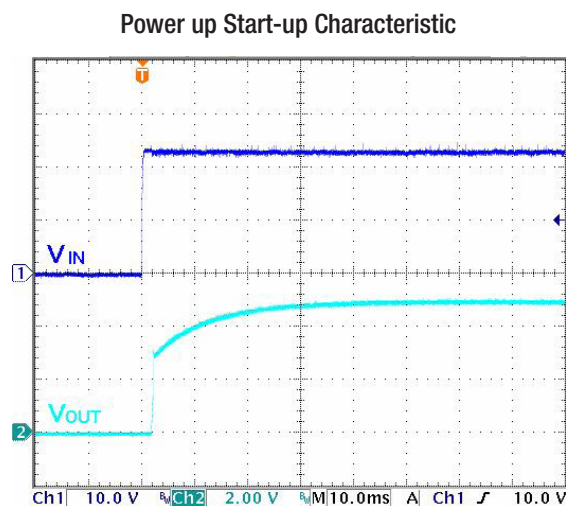
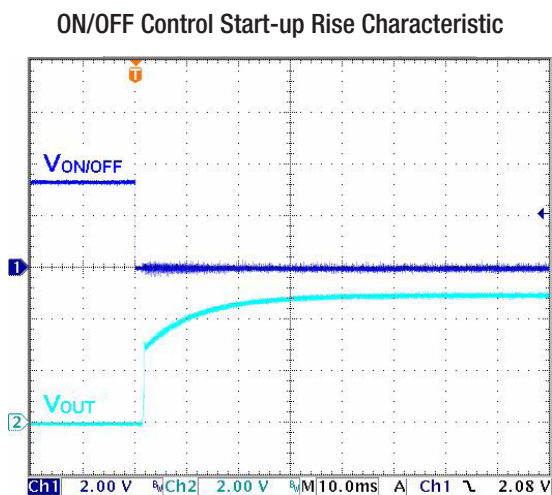
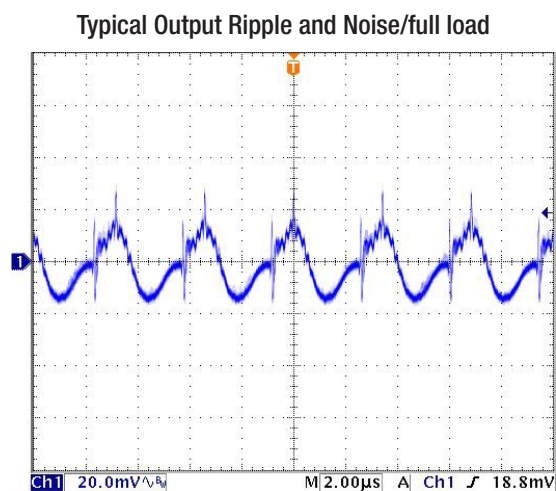
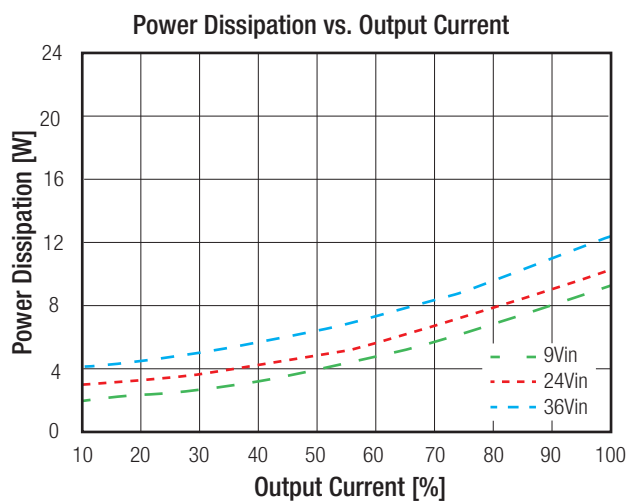
RP75H-2405SRW



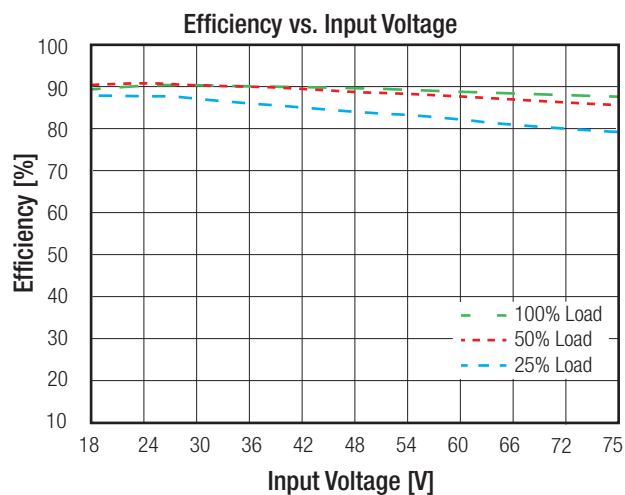
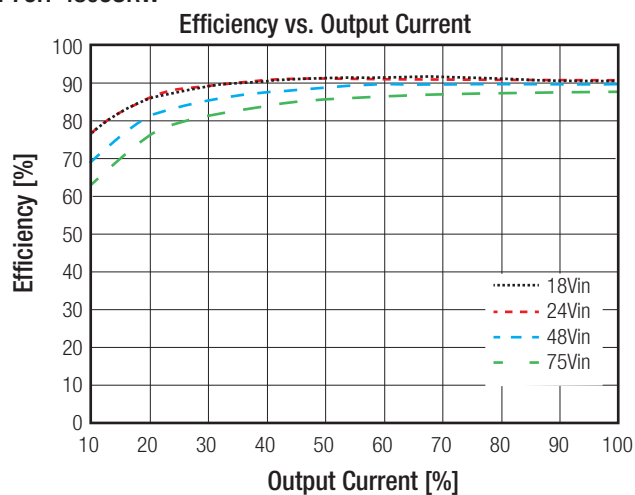
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Specifications measured @ $t_a = 25^\circ\text{C}$, resistive load, nominal V_{in} and rated I_{out} unless otherwise noted

RP75H-2405SRW



RP75H-4805SRW

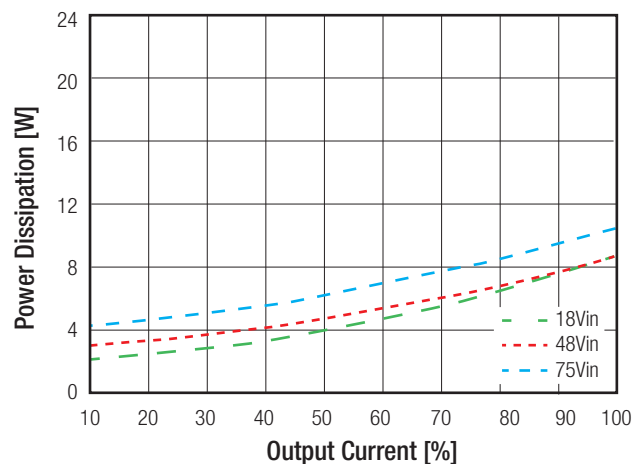


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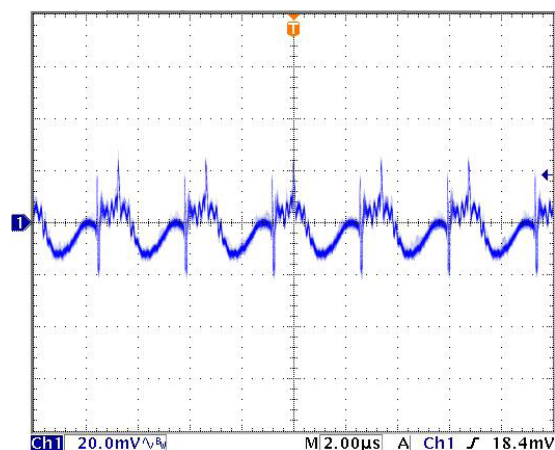
Specifications measured @ $t_a = 25^\circ\text{C}$, resistive load, nominal V_{in} and rated I_{out} unless otherwise noted

RP75H-4805SRW

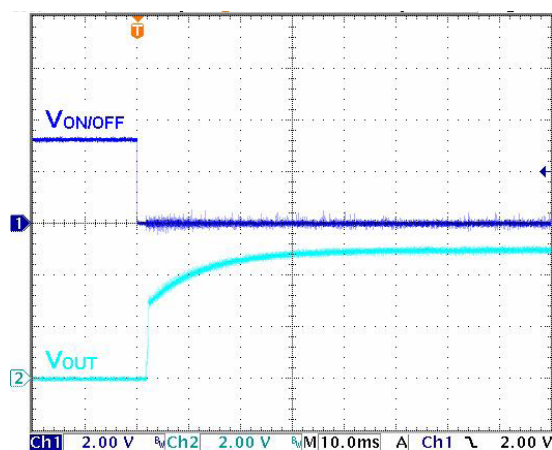
Power Dissipation vs. Output Current



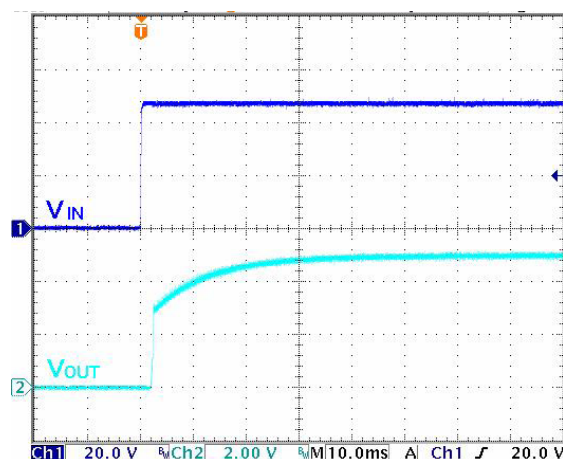
Typical Output Ripple and Noise/full load



ON/OFF Control Start-up Rise Characteristic

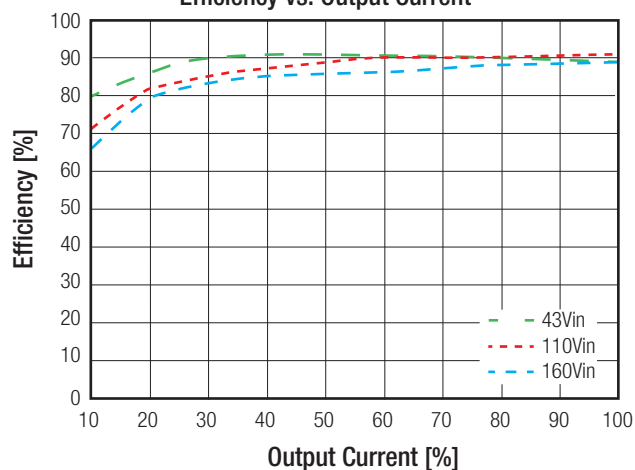


Power up Start-up Characteristic

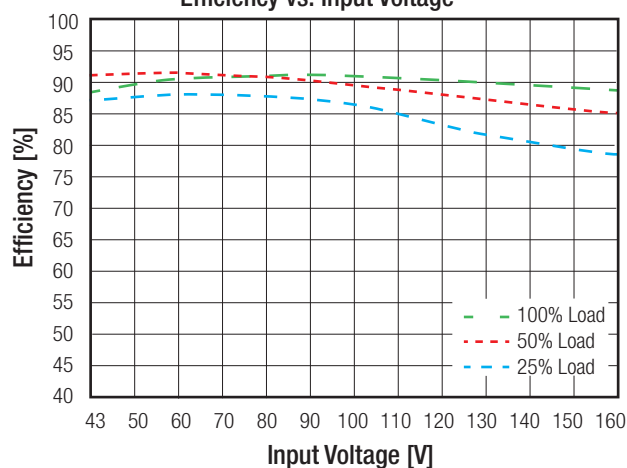


RP75H-11005SRW

Efficiency vs. Output Current



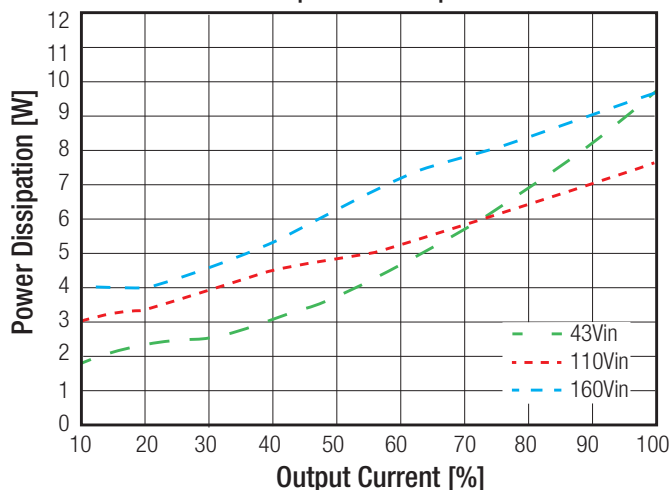
Efficiency vs. Input Voltage



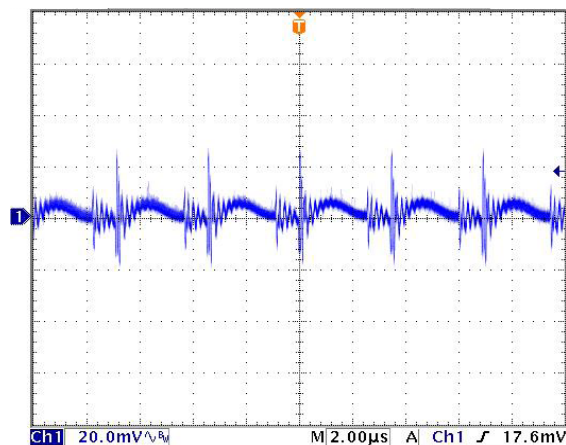
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RP75H-11005SRW

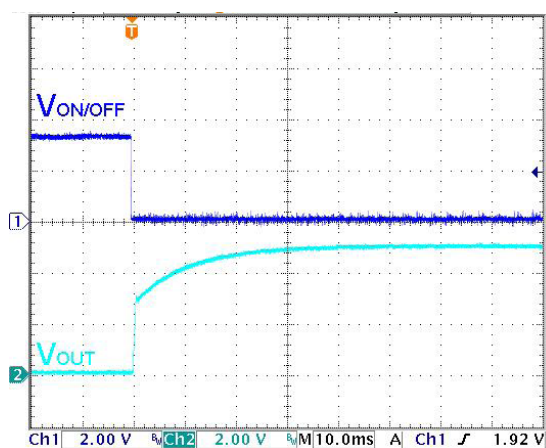
Power Dissipation vs. Output Current



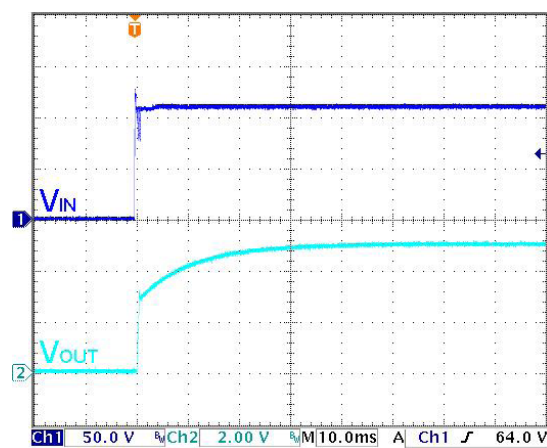
Typical Output Ripple and Noise/full load



ON/OFF Control Start-up Rise Characteristic



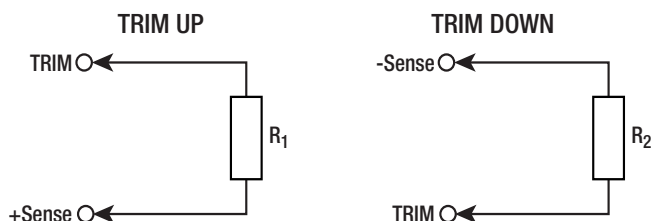
Power up Start-up Characteristic



OUTPUT TRIM

Output Voltage Trimming

RP75H-RW converters offer the feature of trimming the output voltage over a certain range around the nominal value by using external trim resistors. The values for trim resistors shown in trim tables below are according to standard E96 values; therefore, the specified voltage may slightly vary; they also can be calculated with below shown equation.



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

OUTPUT TRIM

Trim Calculation

$$R_1 = \left[\frac{100 \cdot V_{out} + \Delta V_{out} \cdot V_{out}}{1.225 \cdot \Delta V_{out}} - \frac{(100 + 2 \Delta V_{out})}{\Delta V_{out}} \right] k\Omega$$

$$R_2 = \left[\frac{100}{\Delta V_{out}} - 2 \right] k\Omega$$

V_{out} = Output Voltage
 ΔV_{out} = Output Voltage Trim in %
 R₁ = trim up resistor
 R₂ = trim down resistor

Practical Example:

Trim Up:

V_{out} = 5V, ΔV_{out} = 10% (5.5V)

$$R_1 = \left[\frac{100 \cdot V_{out} + \Delta V_{out} \cdot V_{out}}{1.225 \cdot \Delta V_{out}} - \frac{(100 + 2 \Delta V_{out})}{\Delta V_{out}} \right] k\Omega = \left[\frac{100 \cdot 5 + 10 \cdot 5}{1.225 \cdot 10} - \frac{100 + 2 \cdot 10}{10} \right] = 44.89 - 12 = 33.2 k\Omega$$

Trim down:

V_{out} = 5V, ΔV_{out} = -10% (4.5V)

$$R_2 = \left[\frac{100}{\Delta V_{out}} - 2 \right] k\Omega = \left[\frac{100}{10} - 2 \right] = 8.06 k\Omega$$

RP75H-xx05SRW

Trim up	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	5.05	5.10	5.15	5.20	5.25	5.30	5.35	5.4	5.45	5.50	Volts
R ₁ =	309	158	105	78.7	63.4	53.6	46.4	40.2	36.5	33.2	KOhms

RP75H-xx12SRW

Trim up	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	12.12	12.24	12.36	12.48	12.60	12.72	12.84	12.96	13.08	13.20	Volts
R ₁ =	887	453	301	226	182	154	133	118	105	95.3	KOhms

RP75H-xx15SRW

Trim up	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	15.15	15.30	15.45	15.60	15.75	15.90	16.05	16.20	16.35	16.50	Volts
R ₁ =	1130	576	383	294	237	196	169	150	137	124	KOhms

RP75H-xx24SRW

Trim up	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	24.24	24.48	24.72	24.96	25.20	25.44	25.68	25.92	26.16	26.40	Volts
R ₁ =	1870	953	634	487	392	324	280	249	226	205	KOhms

RP75H-xx48SRW

Trim up	1	2	3	4	5	6	7	8	9	10	%
V _{out} =	48.48	48.96	49.44	49.92	50.40	50.88	51.36	51.84	52.32	52.80	Volts
R ₁ =	3830	1960	1300	988	806	681	576	511	464	422	KOhms

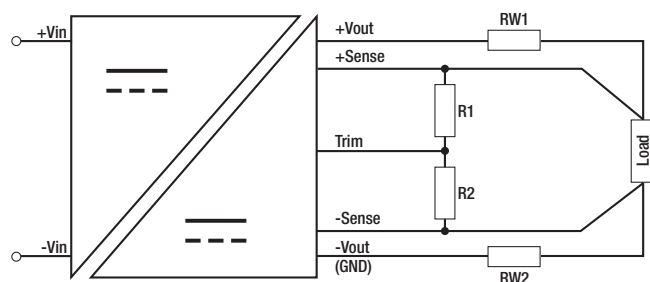
Trim Down all Vout's

Trim down	1	2	3	4	5	6	7	8	9	10	%
R ₂ =	97.6	47.5	31.6	23.2	17.8	14.7	12.1	10.5	9.09	8.06	KOhms
Trim down	11	12	13	14	15	16	17	18	19	20	%
R ₂ =	7.15	6.34	5.76	5.11	4.64	4.22	3.92	3.57	3.24	3.01	KOhms

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Specifications (measured @ $t_a = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Remote Sense



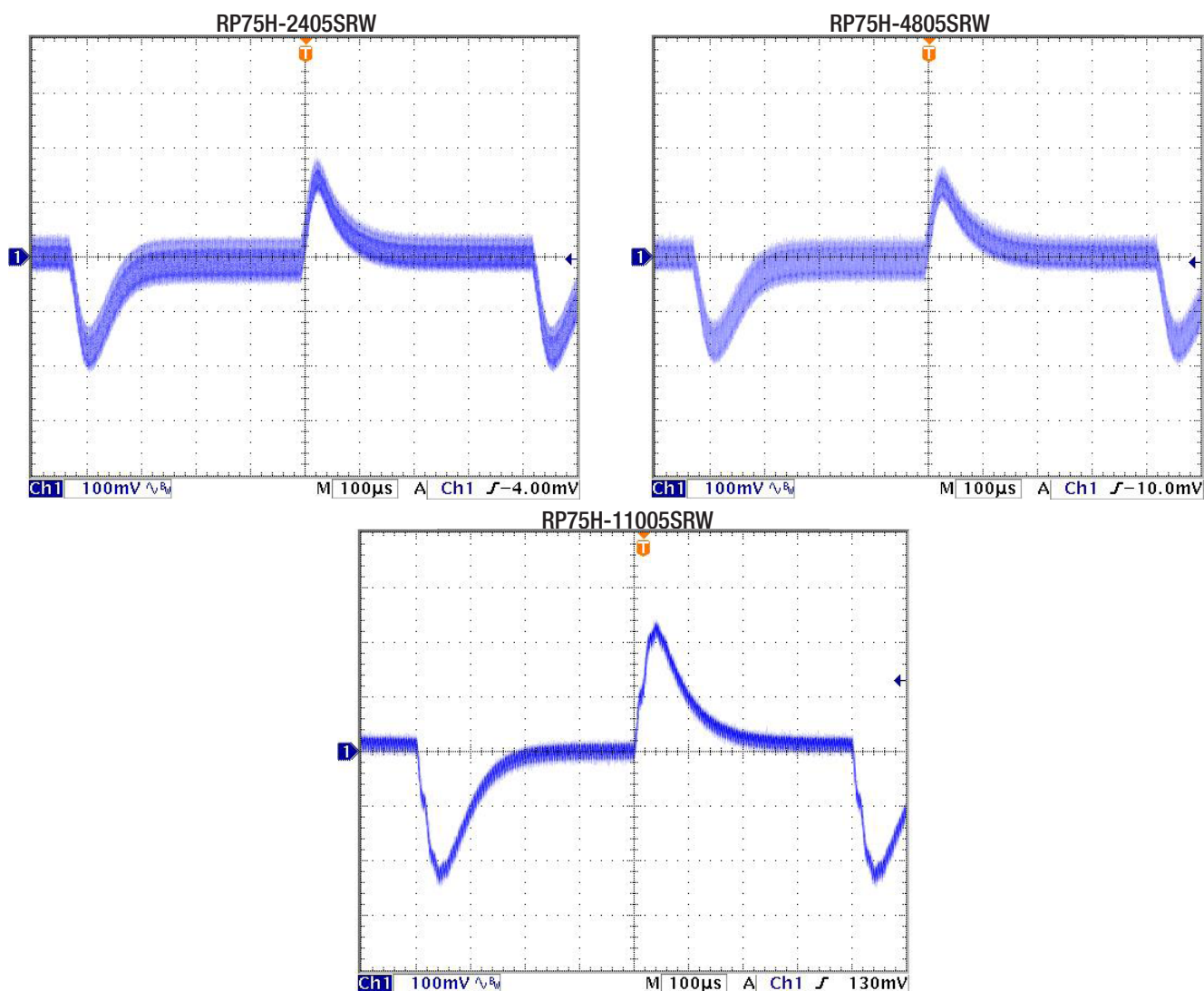
The output voltage can be adjusted by both trim and remote sense. The maximum combined adjustment range $\pm 10\%$. Derate the maximum output power if using the trim or sense function.

R_{W1} ... wire losses +
 R_{W2} ... wire losses -
 R_1 ... trim up resistor
 R_2 ... trim down resistor

REGULATIONS

Parameter	Condition	Value
Output Accuracy		$\pm 1.0\%$
Line Regulation	low line to high line at full load	$\pm 0.1\%$
Load Regulation	0% to 100% load	$\pm 0.1\%$
Transient Response	25% load step change	200 μs typ.; 250 μs max.

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



Specifications (measured @ $t_a = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

PROTECTIONS		
Parameter	Condition	Value
Short Circuit Protection (SCP)	below 100mΩ	continuous, automatic recovery
Over Voltage Protection (OVP)	% of nom. Vout	115%-130%, Hiccup Mode
Over Load Protection (OLP)	% Iout rated	24Vin, 48Vin 110Vin 120%-150%, Hiccup Mode 150% typ., Hiccup Mode
Over Temperature Protection (OTP)		+115°C
Isolation Voltage	110Vin	I/P to O/P I/P or O/P to Baseplate 3kVAC/1minute 1.5kVAC/1minute
	24Vin, 48Vin	I/P to O/P I/P or O/P to Baseplate 2.25kVDC/1minute 1.6kVDC/1minute
Isolation Resistance	500 VDC	1GΩ min.
Isolation Capacitance		2500pF max.
Isolation Grade	24Vin, 48 Vin 110Vin	Basic Insulation Reinforced Insulation
Notes: Note4: An input fuse is required if the mains supply isn't over-current protected. Recommended fuse: T30A slow blow.		

ENVIRONMENTAL		
Parameter	Condition	Value
Operating Case Temperature Range	Baseplate	-40°C to +105°C
Maximum Case Temperature		105°C
Temperature Coefficient		±0.02%/°C max.
Thermal Impedance	vertical direction by natural convection (0.1m/s) without Heat-sink vertical direction by natural convection (0.1m/s) with Heat-sink	6.7°C/W 4.7°C/W
Operating Humidity		5% - 95% RH
Pollution Degree	24Vin, 48Vin 110Vin	PD1 PD2
Shock		according to EN61373 standard
Thermal Shock		according to MIL-STD-810F standard
Vibration		according to EN61373 standard
Fire protection on railway vehicles		according to EN45545-2, 2013 standard
MTBF	according to MIL-HDBK-217F standard, 25°C	336.2 x 10 ³ hours

Thermal Calculation

$$R_{th\text{case-ambient}} = 6.7^\circ\text{C/W (vertical)}$$

$$R_{th\text{case-ambientHC}} = 4.7^\circ\text{C/W (vertical)}$$

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

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

T_{case}	=	Case Temperature
T_{ambient}	=	Environment Temperature
$P_{\text{dissipation}}$	=	Internal losses
P_{IN}	=	Input Power
P_{OUT}	=	Output Power
η	=	Efficiency under given Operating Conditions
$R_{th\text{case-ambient}}$	=	Thermal Impedance

Practical Example:

Take the RP75H-2405SRW with 9V input Voltage and 50% load. What is the maximum ambient operating temperature? Use converter vertical in application without airflow.

$$\text{Eff}_{\text{min}} = 90\% @ V_{\text{nom}}$$

$$P_{\text{OUT}} = 75\text{W}$$

$$P_{\text{OUTapp}} = 75 \times 0.5 = 37.5\text{W}$$

$$\eta = 92\% \text{ (Efficiency vs. Load Graph)}$$

$$P_{\text{dissipation}} = \frac{37.5}{0.92} - 37.5 = 3.26\text{W}$$

without Heat-sink

$$R_{th} = \frac{T_{\text{casemax}} - T_{\text{amb}}}{P_{\text{dissipation}}} \rightarrow 6.7^\circ\text{C/W} = \frac{105 - T_{\text{amb}}}{3.26\text{W}}$$

$$T_{\text{amb}} = 83^\circ\text{C}$$

with Heat-sink

$$R_{thHC} = \frac{T_{\text{casemax}} - T_{\text{amb}}}{P_{\text{dissipation}}} \rightarrow 4.7^\circ\text{C/W} = \frac{105 - T_{\text{amb}}}{3.26\text{W}}$$

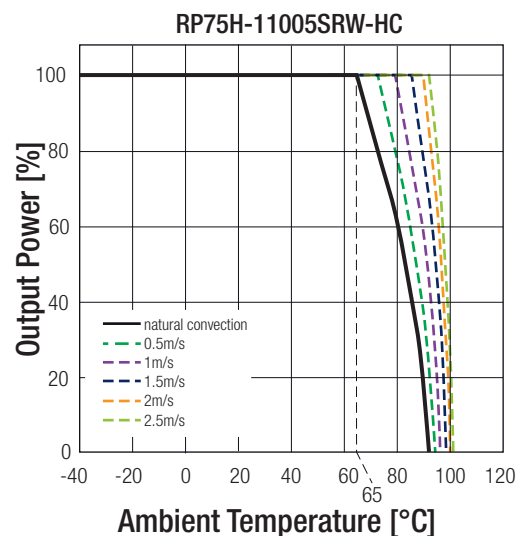
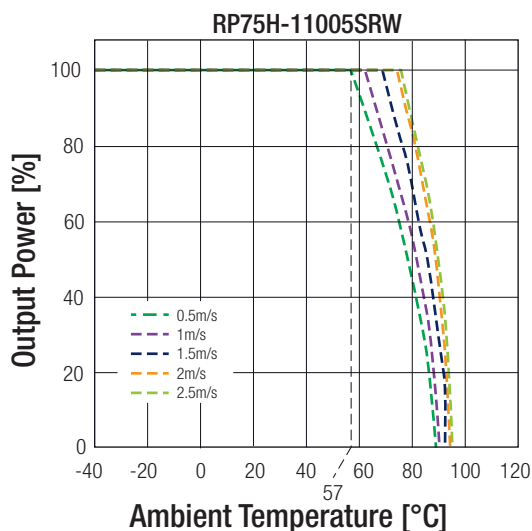
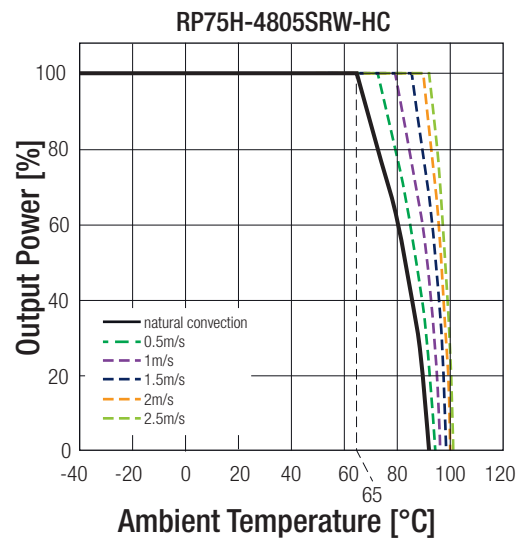
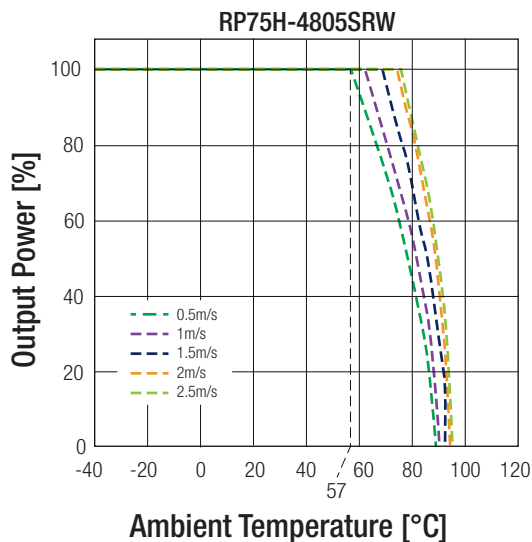
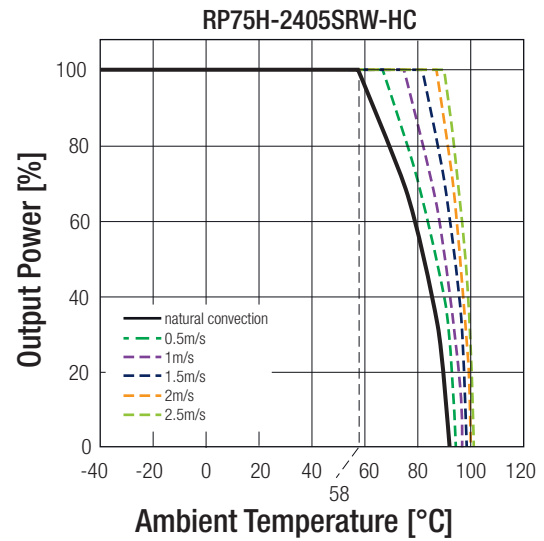
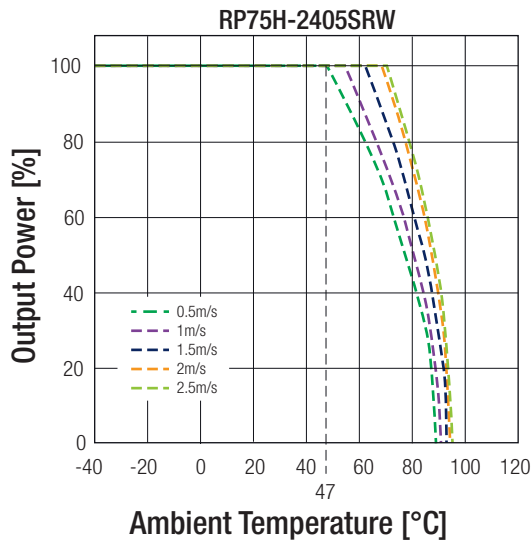
$$T_{\text{ambHC}} = 89^\circ\text{C}$$

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Specifications (measured @ $t_a = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

Derating Graph⁽⁵⁾

(@ Chamber and natural convection 0.1 m/s)



Notes:

Note5: Derating graphs are valid only for the shown part numbers. If you need detailed derating-information about a part-number not shown here please contact our technical support service at techsupportAT@recom-power.com

Specifications (measured @ $t_a = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

SAFETY AND CERTIFICATIONS

Certificate Type (Safety)	Report / File Number	Standard
Information Technology Equipment, General Requirements for Safety	E196683	UL60950-1, 2nd Edition, 2014 CSA C22.2 No. 60950-1-07, 2nd Edition, 2014
IEC/EN Information Technology Equipment - General Requirements for Safety	TW1608034-001, TW1608035-001	IEC60950-1, 2nd Edition, 2005 EN60950-1, 2nd Edition, 2006
Railway Applications - Electrical Equipment used on rolling stock	16A081501E-C	EN50155, 2007

EMI Compliance	Condition	Standard / Criterion
Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement	110Vin with external components	EN55022, Class A and Class B
Industrial, scientific and medical equipment - Radio frequency disturbance characteristics - Limits and methods of measurement		EN55011, Class A and Class B
Low-voltage power supplies DC output - Part 3: Electromagnetic compatibility (EMC)	24Vin, 48Vin with external components	EN61204-3, Class B
ESD Electrostatic discharge immunity test	Air $\pm 8\text{kV}$ and Contact $\pm 6\text{kV}$ 20V/m (110Vin), 10V/m (24Vin, 48Vin) $\pm 2\text{kV}$ EN55024 & EN50155 $\pm 2\text{kV}$ ($\pm 1\text{kV}$, 24Vin, 48Vin) 10 Vr.m.s	EN61000-4-2, Criteria A
Radiated, radio-frequency, electromagnetic field immunity test		EN61000-4-3, Criteria A
Fast Transient and Burst Immunity ⁽⁶⁾		EN61000-4-4, Criteria A
Surge Immunity ⁽⁶⁾		EN61000-4-5, Criteria A
Immunity to conducted disturbances, induced by radio-frequency fields		EN61000-4-6, Criteria A

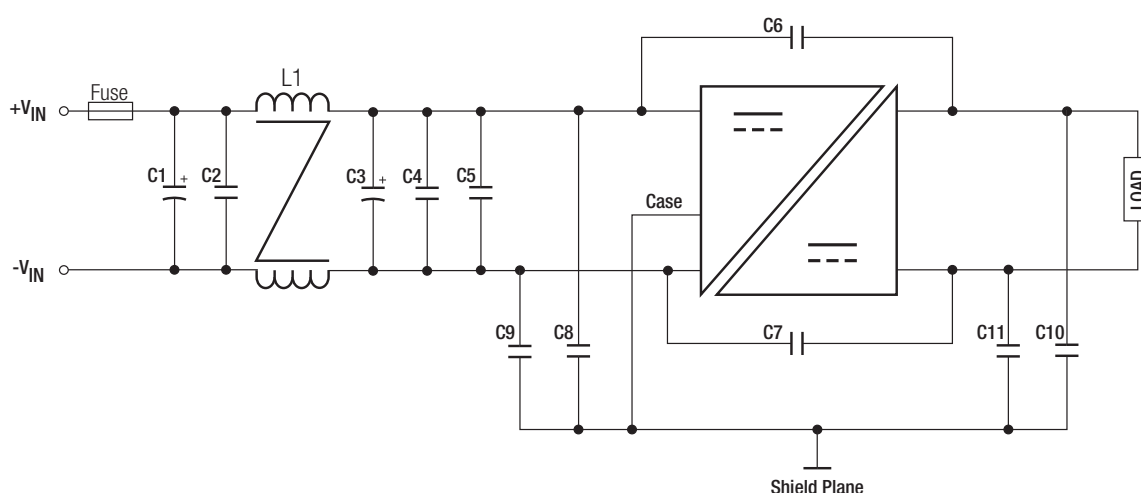
Notes:

Note6: An external input filter capacitor is required if the module has to meet EN61000-4-4 and EN61000-4-5.

The **24Vin** and **48Vin** version recommend 2pcs of aluminium electrolytic capacitor to connect in parallel.
Recom suggest: 220 μF /100V.

The **110Vin** version recommend 2pcs of aluminium electrolytic capacitor to connect in parallel.
Recom suggest: 150 μF /200V

EMI Filtering according to EN61204-3 Class A and EN50121-1 (24Vin and 48Vin)

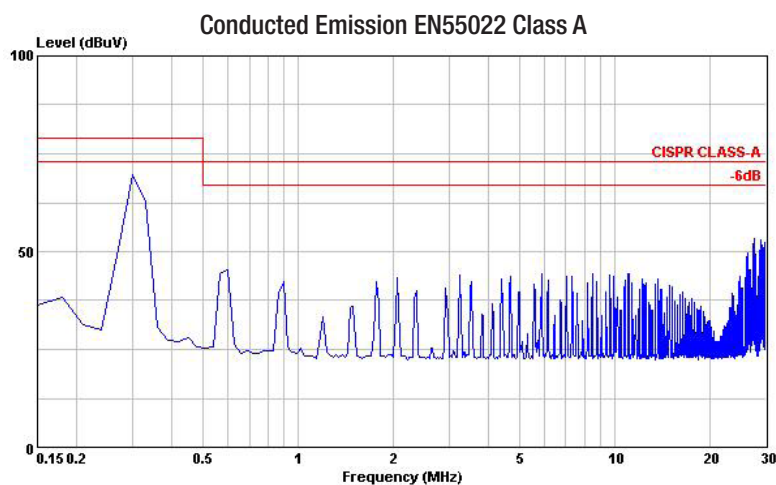


MODEL	C1, C3	C2, C4, C5	C6 to C11	L1
RP75H-24xxSRW	100 μF , 50V Al Cap. Chemi-con KY Series	4.7 μF , 50V 1812 MLCC	1000pF, 3kV 1808 MLCC	156 μH CMC
RP75H-48xxSRW	100 μF , 100V Al Cap. Chemi-con KY Series	2.2 μF , 100V 1812 MLCC	1000pF, 3kV 1808 MLCC	620 μH CMC

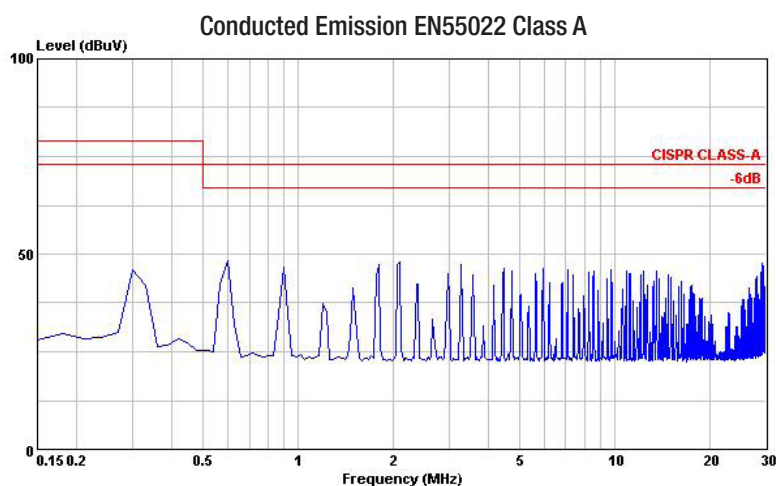
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Specifications (measured @ $t_a = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

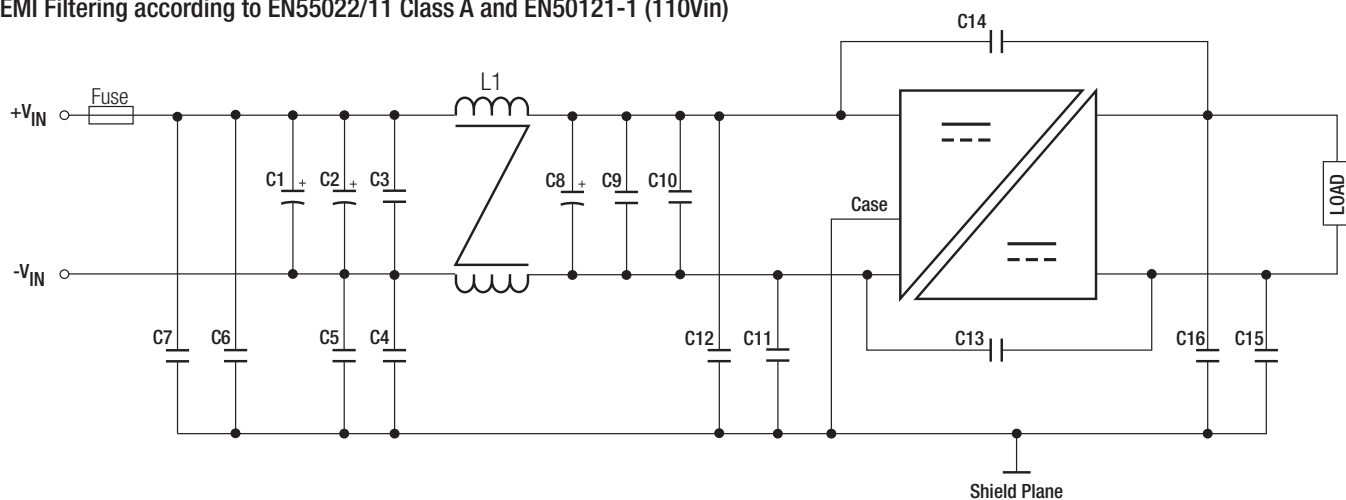
RP75H-2405SRW



RP75H-4805SRW



EMI Filtering according to EN55022/11 Class A and EN50121-1 (110Vin)

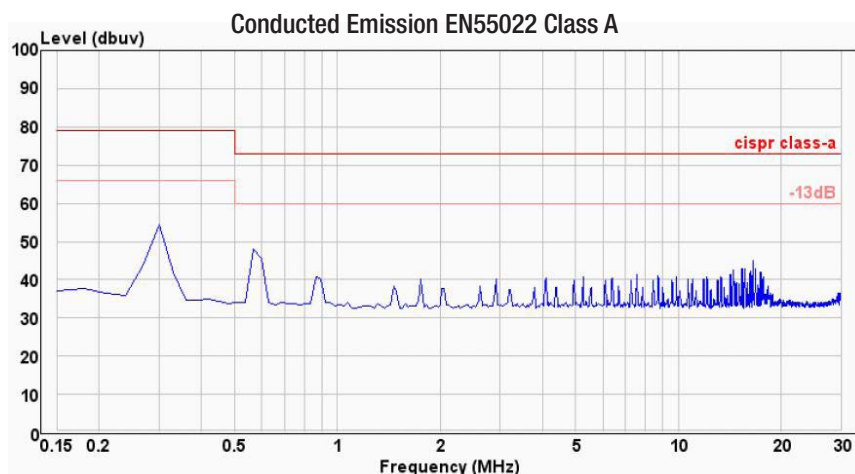


MODEL	C1, C8	C10	C13, C14	C5, C15, C16	L1
RP75H-110xxSRW	150 μF , 200V Al Capacitor (lie down) Chemi-con KXJ	1 μF , 250V 1812 MLCC	1000pF, 400VAC TDK CD Series	1000pF, 5kV 1808 MLCC	521 μH CMC
C2, C3, C4, C6, C7, C9, C11, C12: N/A					

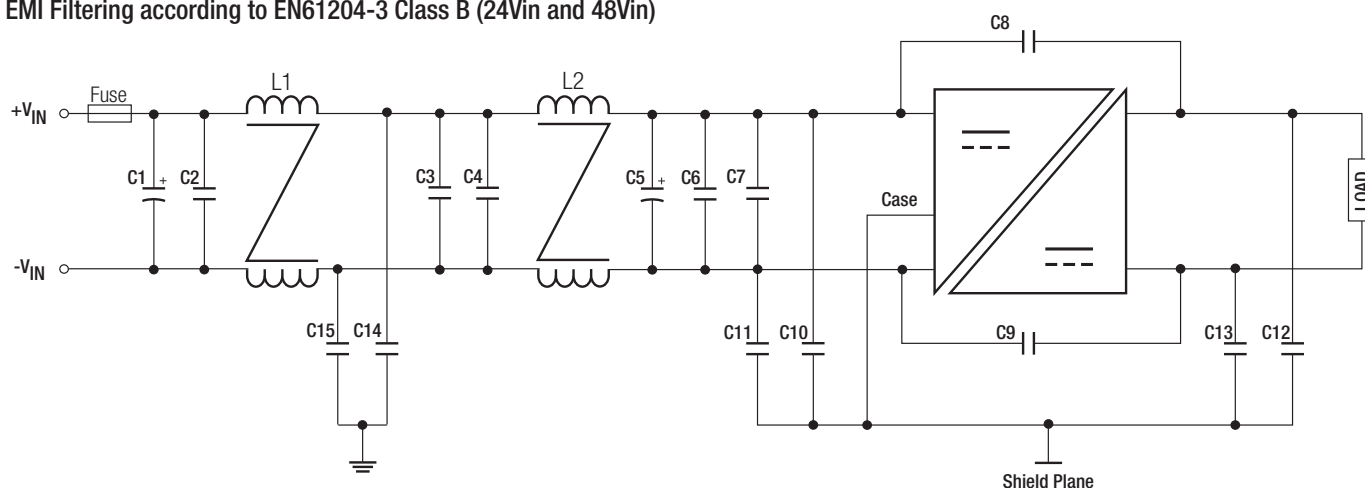
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Specifications (measured @ $t_a = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

RP75H-11005SRW

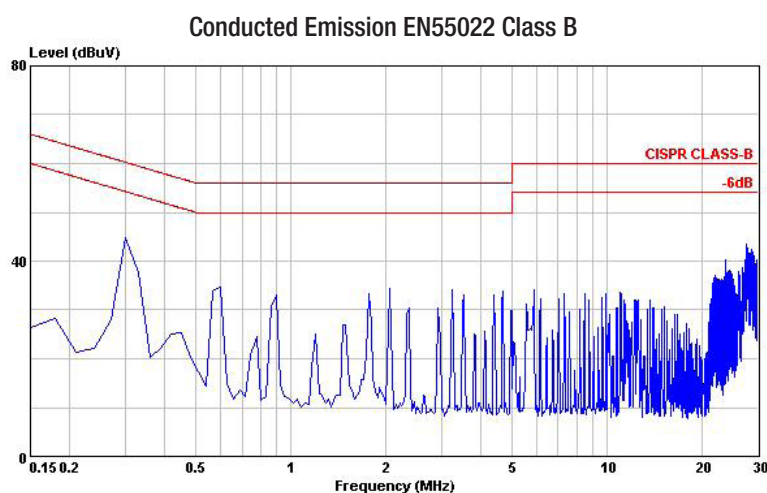


EMI Filtering according to EN61204-3 Class B (24Vin and 48Vin)



MODEL	C1, C5	C2, C3, C4, C6, C7	C8, C14, C15	C9	C10 to C13	L1	L2
RP75H-24xxSRW	100 μF , 50V Al Cap. (lie down) Chemi-con KY	4.7 μF , 50V 1812 MLCC	1000pF, 3kV 1808 MLCC	1000pF, 3kV 1808 MLCC	10nF, 2kV 1812 MLCC	305 μH CMC	305 μH CMC
RP75H-48xxSRW	100 μF , 100V Al Cap. (lie down) Chemi-con KY	2.2 μF , 100V 1812 MLCC	1000pF, 3kV 1808 MLCC	4700pF, 3kV 1812 MLCC	10nF, 2kV 1812 MLCC	1186 μH CMC	156 μH CMC

RP75H-2405SRW

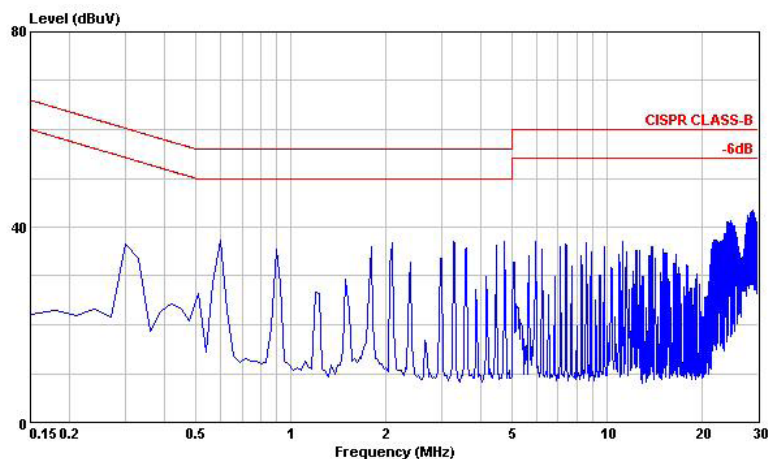


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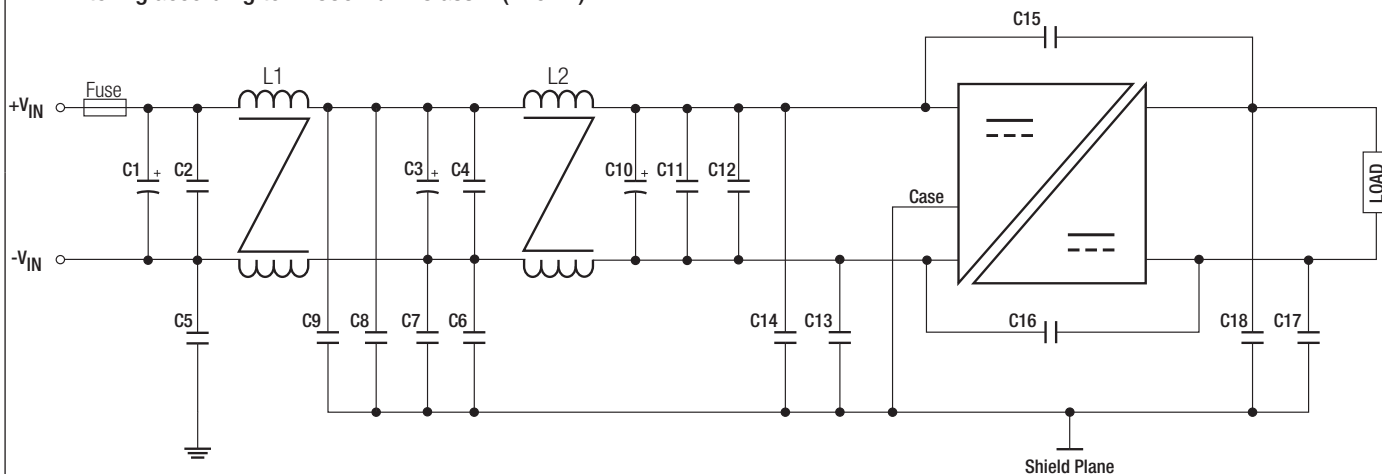
Specifications (measured @ $t_a = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

RP75H-4805SRW

Conducted Emission EN55022 Class B



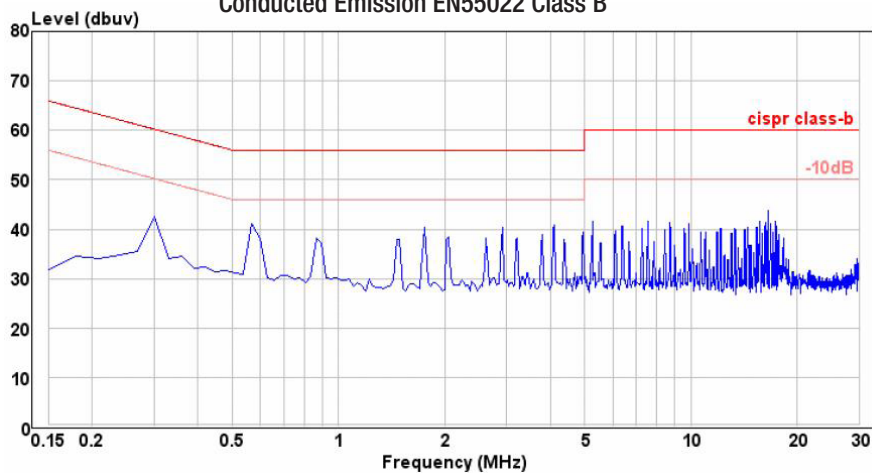
EMI Filtering according to EN55022/11 Class B (110Vin)



MODEL	C1, C3, C10	C11, C12	C13	C15, C16	C6, C7, C8, C9, C17, C18	L1	L2
RP75H-110xxSRW	150 μF , 200V Al Cap. (lie down) Chemi-con KXJ	1 μF , 250V 1812 MLCC	330pF, 5kV 1808 MLCC	1000pF, 400VAC TDK CD Series	1000pF, 5kV 1808MLCC	305 μH CMC	806 μH CMC
C2, C4, C5, C14: N/A							

RP75H-11005SRW

Conducted Emission EN55022 Class B



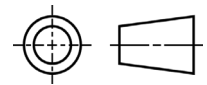
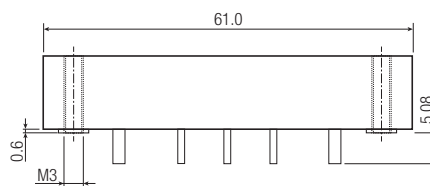
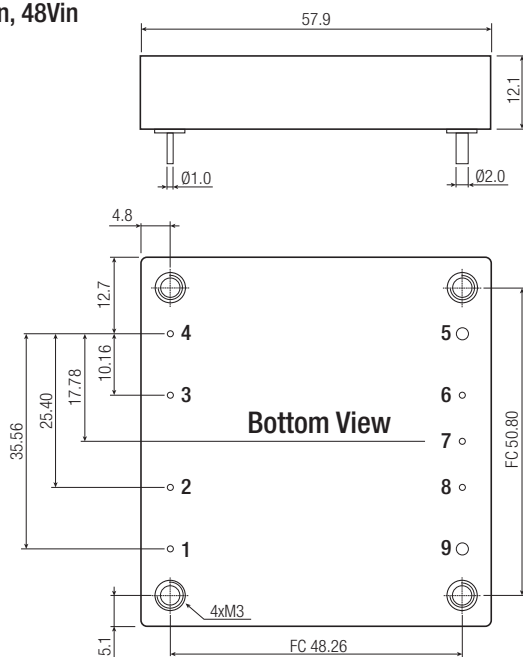
Specifications (measured @ $t_a = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

DIMENSIONS and PHYSICAL CHARACTERISTICS

Parameter	Type		Value
Material	Case	24Vin, 48Vin 110Vin	Metal Plastic
	Baseplate	24Vin, 48Vin 110Vin	FR4 PCB Aluminium
	Potting		Silicone (UL94 V-0)
Packaging Dimension (LxWxH)	without Heat-sink with Heat-sink		61.0 x 57.9 x 12.7mm 61.0 x 57.9 x 24.13mm
Packaging Weight	without Heat-sink with Heat-sink		105g 157g

Dimension Drawing (mm)

24Vin, 48Vin

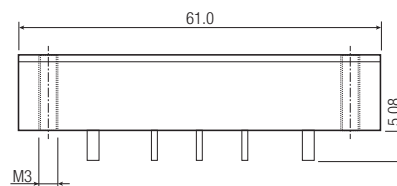
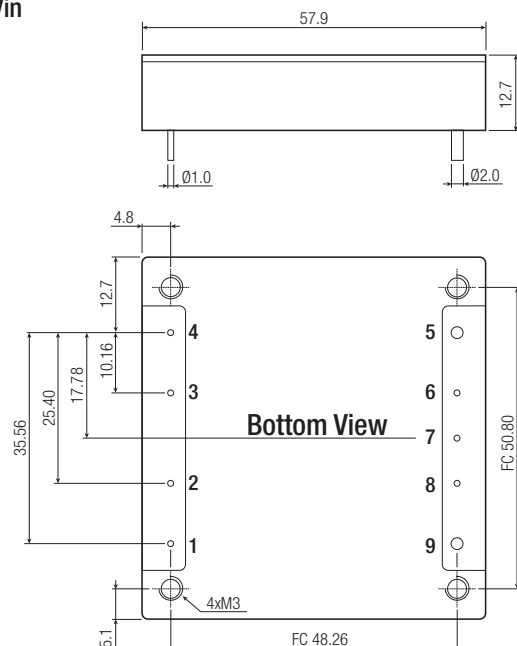


Pin Connections

Pin #	Single
1	+Vin
2	CTRL
3	Case
4	-Vin
5	-Vout
6	-Sense
7	Trim
8	+Sense
9	+Vout

FC= Fixing Centers for Heat-sink
Pin Pitch Tolerance $\pm 0.25\text{mm}$
Pin Dimension Tolerance $\pm 0.1\text{mm}$
XX.X $\pm 0.5\text{mm}$
XX.XX $\pm 0.25\text{mm}$

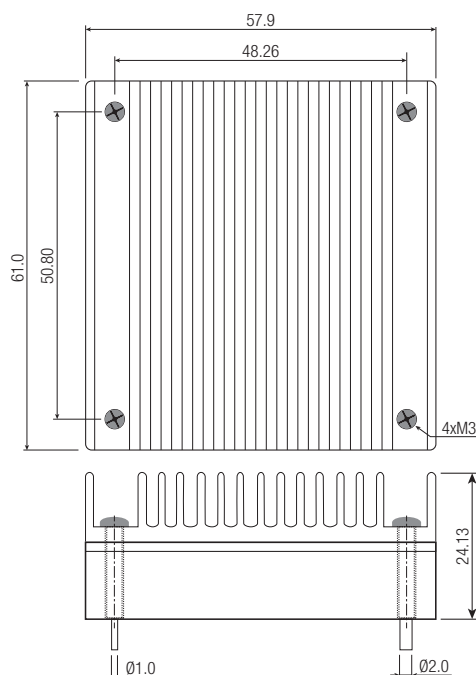
110Vin



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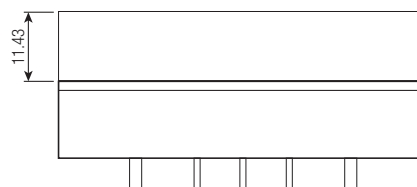
Specifications (measured @ $t_a = 25^\circ\text{C}$, nominal input voltage, full load and after warm-up)

110Vin with Heat-sink



Notes:

Note7: Max. tightening torque for Heat-sink: 0.34Nm



PACKAGING INFORMATION

Parameter	Type		Value
Packaging Dimension	Tray	without Heat-sink	157.0 x 88.0 x 12.8mm
		with Heat-sink	157.0 x 88.0 x 24.8mm
Packaging Quantity			2pcs.
Storage Temperature Range			-55°C to +125°C
Storage Humidity			5% - 95% RH

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