

Regulated Converter

- RECOM**
DC/DC Converter

RPA20-AW

20 Watt

1" x 1"



Single and Dual Output

Selection Guide



UL[®]
C US
E224736



RPA20- **AW/**

nom. Input Voltage _____

nom. Output Voltage _____

Single or Dual _____

“Package” ⁽³⁾ _____

“CTRL Logic” ⁽²⁾ _____

UL60950-1 certified
IEC/EN60950-1 certified
EN50155 certified
CB report

Note2: no suffix for standard part without CTRL pin, trim pin fitted
add suffix "P" for positive CTRL function (1=ON, 0=OFF), trim pin fitted
add suffix "N" for negative CTRL function (0=ON, 1=OFF), trim pin fitted
trim pin is only available for single outputs

Note3: add suffix “-HC” for glued Heat-sink (compatible with all other suffixes)

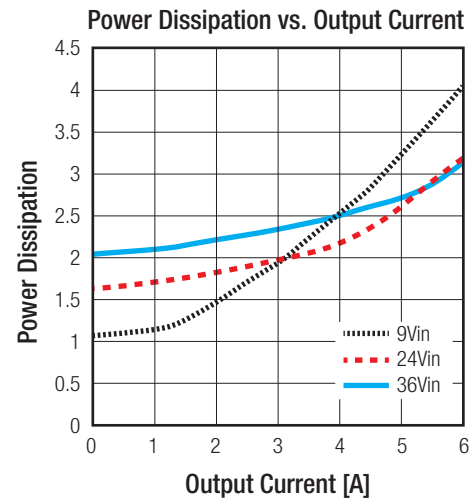
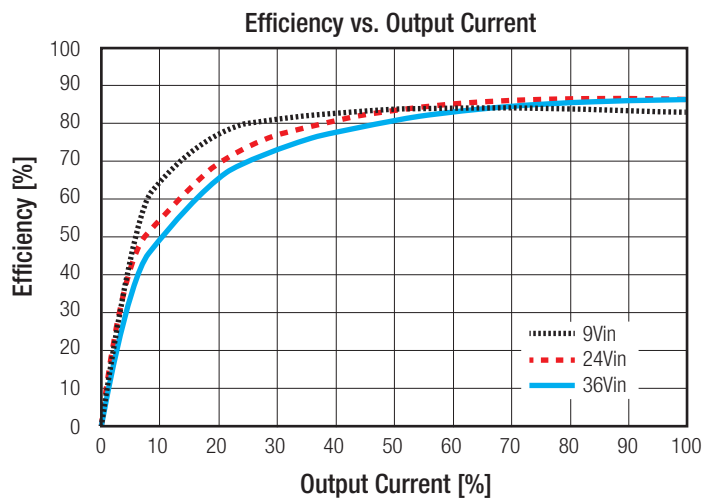
RPA20-243.3SAW = 24V input, 3.3V output, single, no CTRL pin
RPA20-2405DAW/P = 24V input, 5V output, dual, positive CTRL function
RPA20-2415SAW-HC = 24V input, 15V output, single, no CTRL pin, glued Heat-sink
RPA20-2415DAW/N-HC = 24V input, 15V output, dual, negative CTRL function, glued Heat-sink

Specifications (measured @Ta = 25°C, resistive load, nom. Vin and rated Iout unless otherwise noted)

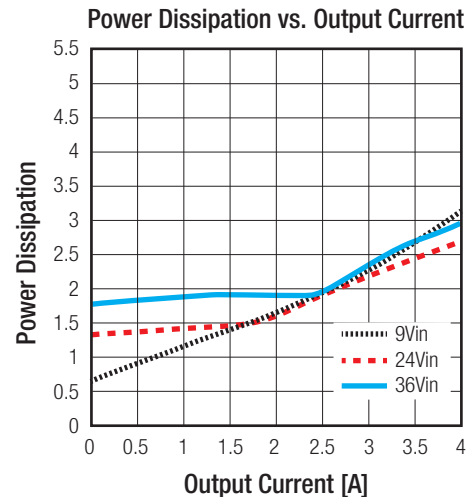
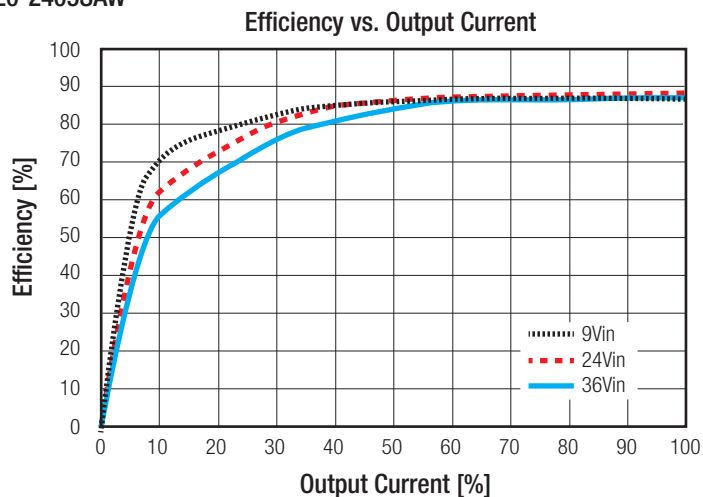
BASIC CHARACTERISTICS

Parameter	Condition	Min.	Typ.	Max.
Internal Input Filter				Pi-Type
Input Voltage Range	nom. Vin = 24VDC	9VDC	24VDC	36VDC
Input Surge Voltage	100ms max.			50VDC
Under Voltage Lockout (UVLO)	DC-DC ON	8VDC	8.5VDC	9VDC
	DC-DC OFF	7VDC	7.5VDC	8VDC
Quiescent Current		20mA		55mA
Output Voltage Trimming	refer to "OUTPUT VOLTAGE TRIMMING"	-10%		+10%
Minimum Load		0%		
Start-up time	Power up ON/OFF CTRL		8ms	16ms
ON/OFF CTRL	Positive Logic	DC-DC ON DC-DC OFF	Open or 2.4VDC < V _{CTRL} < 10VDC Short or 0VDC < V _{CTRL} < 0.8VDC	
	Negative Logic	DC-DC ON DC-DC OFF	Short or 0VDC < V _{CTRL} < 0.8VDC Open or 2.4VDC < V _{CTRL} < 10VDC	
OFF Converter Input Current			6mA	
Internal Operating Frequency			550kHz	
Output Ripple and Noise	20MHz BW, 10µF tantalum capacitor and 1µF ceramic capacitor		50mVp-p	

RPA20-243.3SAW



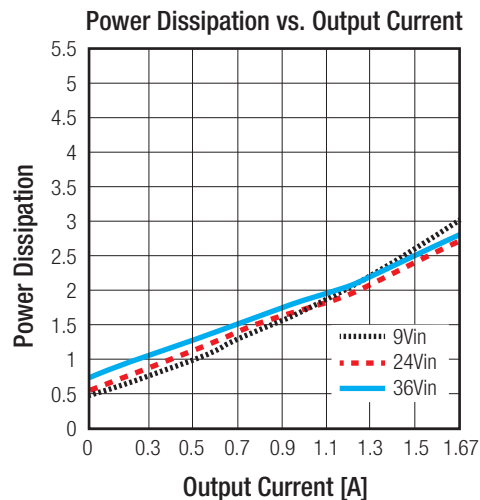
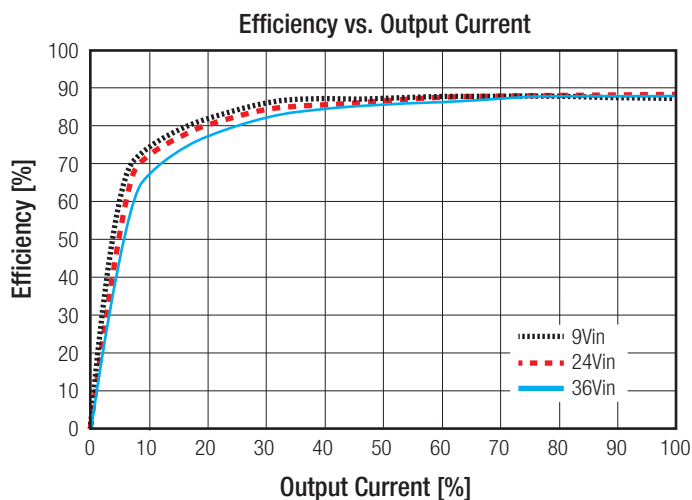
RPA20-2405SAW



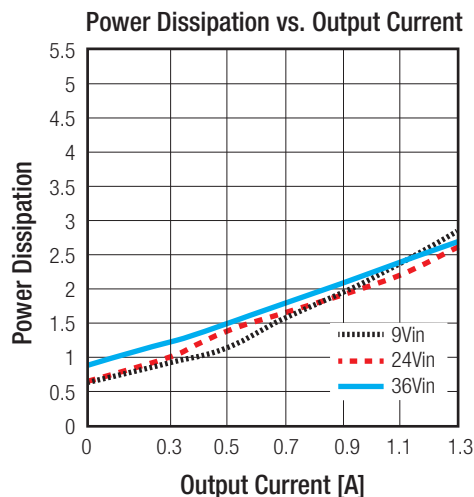
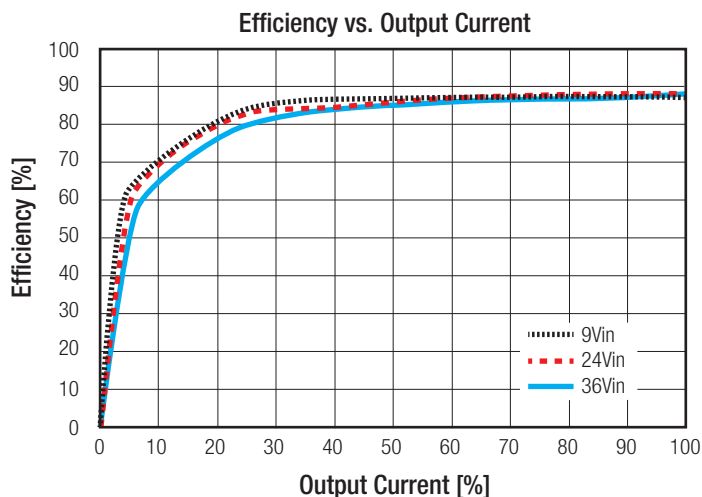
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Specifications (measured @Ta = 25°C, resistive load, nom. Vin and rated Iout unless otherwise noted)

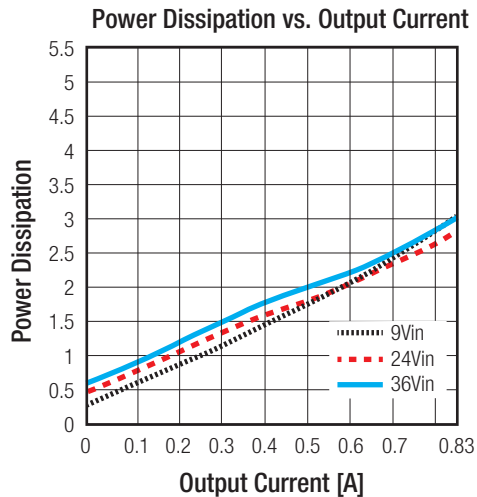
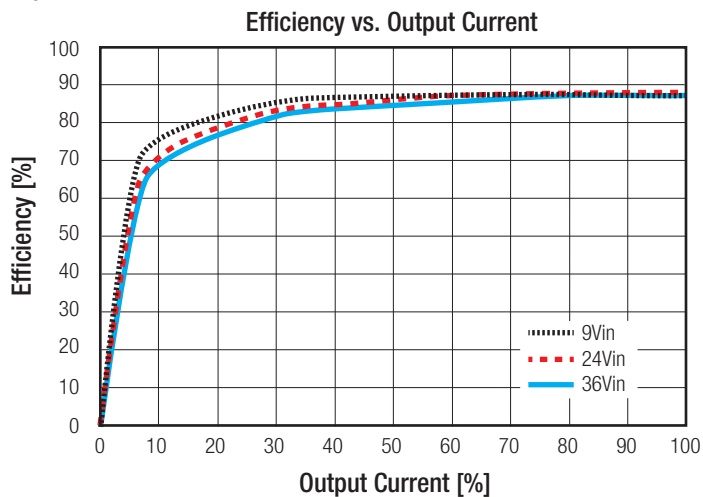
RPA20-2412SAW



RPA20-2415SAW



RPA20-2412DAW

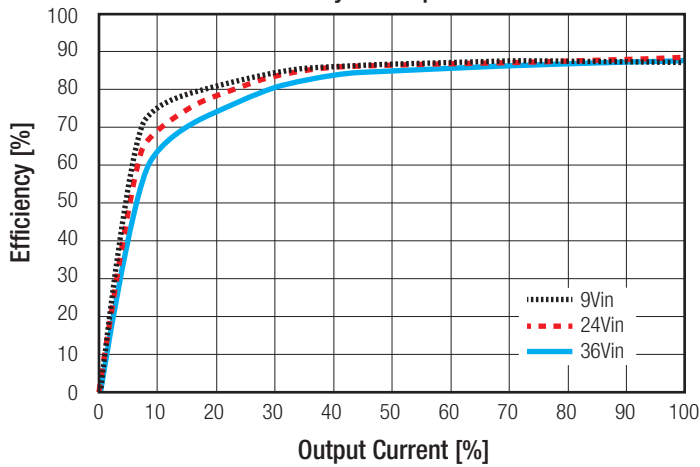


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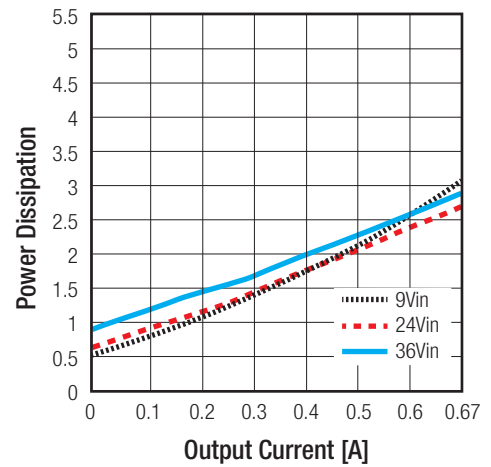
Specifications (measured @Ta = 25°C, resistive load, nom. Vin and rated Iout unless otherwise noted)

RPA20-2415DAW

Efficiency vs. Output Current



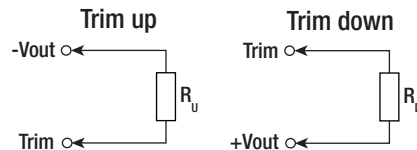
Power Dissipation vs. Output Current



OUTPUT VOLTAGE TRIMMING

Output Voltage Trimming

RPA20-AW 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.



RPA20-243.3SAW

Trim up	1	2	3	4	5	6	7	8	9	10	[%]
Vout =	3.33	3.36	3.39	3.43	3.46	3.49	3.53	3.56	3.59	3.63	[VDC]
R _u =	402	169	100	75	47.5	34.8	26.1	17.8	12.1	8.06	[kΩ]
Trim down	1	2	3	4	5	6	7	8	9	10	[%]
Vout =	3.27	3.23	3.20	3.17	3.14	3.10	3.07	3.04	3.0	2.97	[VDC]
R _d =	402	191	113	75	52.3	39.2	26.7	20	12.1	8.06	[kΩ]

RPA20-2405SAW

Trim up	1	2	3	4	5	6	7	8	9	10	[%]
Vout =	5.05	5.10	5.15	5.20	5.25	5.30	5.35	5.40	5.45	5.50	[VDC]
R _u =	604	243	147	95.3	68.1	39.2	34.8	22.1	15	8.06	[kΩ]
Trim down	1	2	3	4	5	6	7	8	9	10	[%]
Vout =	4.95	4.90	4.85	4.80	4.75	4.70	4.65	4.60	4.55	4.50	[VDC]
R _d =	604	287	169	124	105	78.7	54.9	39.2	15	0.5	[kΩ]

RPA20-2412SAW

Trim up	1	2	3	4	5	6	7	8	9	10	[%]
Vout =	12.12	12.24	12.36	12.48	12.6	12.72	12.84	12.96	13.08	13.20	[VDC]
R _u =	604	267	162	105	75	499	40.2	24.9	18.2	10	[kΩ]
Trim down	1	2	3	4	5	6	7	8	9	10	[%]
Vout =	11.88	11.76	11.64	11.52	11.40	11.28	11.16	11.04	10.92	10.80	[VDC]
R _d =	750	309	200	124	90.9	64.9	45.3	32.4	20	12.1	[kΩ]

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Specifications (measured @Ta = 25°C, resistive load, nom. Vin and rated Iout unless otherwise noted)

RPA20-2415SAW											
Trim up	1	2	3	4	5	6	7	8	9	10	[%]
Vout =	15.15	15.30	15.45	15.60	15.75	15.90	16.05	16.20	16.35	16.50	[VDC]
R _u =	1000	243	200	130	90.9	61.9	40.2	30.1	24.9	10	[kΩ]
Trim down	1	2	3	4	5	6	7	8	9	10	[%]
Vout =	14.85	14.70	14.55	14.40	14.25	14.10	13.95	13.80	13.65	13.50	[VDC]
R _d =	1000	348	210	140	95.3	68.1	45.3	30.1	18.2	8.06	[kΩ]

REGULATION

Parameter	Condition		Value
Output Accuracy			±1.0% typ., ±2.0% max.
Line Regulation	low line to high line, full load	single dual	±0.1% typ., ±0.2% max. ±0.1% typ., ±0.5% max.
Load Regulation	3.3Vout 5Vout 12Vout, 15Vout ±12Vout, ±15Vout		±0.3% ±0.2% ±0.1% ±1.0%
Cross Regulation	asymmetrical 25%<>100% load		±2.0% typ., ±3.0% max.
Transient Response	50-75%, full load, 0.1A/μs		±3.0% typ.
	25% load step change		250μs typ.

PROTECTIONS

Parameter	Condition		Value
Short Circuit Protection (SCP)	below 100mΩ		continuous, auto recovery
Over Voltage Protection (OVP)			115%-150% Output Voltage, Hiccup, auto recovery
Over Current Protection (OCP)			110%-160% Output Current, Hiccup
Over Temperature Protection (OTP)			110°C ±5°C
Isolation Voltage ⁽⁴⁾	I/P to O/P	tested for 1 minute	1.6kVDC
Isolation Resistance			10MΩ min.
Isolation Capacitance			1100pF typ.
Insulation Grade			basic

Notes:

Note4: For repeat Hi-Pot testing, reduce the time and/or the test voltage

Note5: Refer to local safety regulations if input over-current protection is also required. Recommended fuse: 3A slow blow type

ENVIRONMENTAL

Parameter	Condition		Value
Operating Temperature Range ⁽⁶⁾			refer to "Thermal Calculation"
Maximum Case Temperature			+105°C
Temperature Coefficient			0.02%/K
Thermal Impedance			refer to "Table 1: Thermal Impedance"
Operating Altitude			2000m
Operating Humidity	non-condensing		95% RH
Shock			30G, 11ms, 3 times along X,Y and Z axis
Vibration			10-500Hz, 2.4G, 30mins along X,Y and Z axis
MTBF	according to Telcordia SR332 3	+25°C	5800 x 10 ³ hours

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Specifications (measured @Ta = 25°C, resistive load, nom. Vin and rated Iout unless otherwise noted)

Table 1: Thermal Impedance

	without Heatsink		with Heatsink	
airflow [m/s]	Rth without PCB [K/W]	Rth with PCB ⁽⁶⁾ [K/W]	Rth without PCB [K/W]	Rth with PCB ⁽⁶⁾ [K/W]
0.1	17.8	12.5	16.0	11.3
0.2	16.0	11.2	14.4	10.1
0.5	14.0	9.7	12.6	8.7
1.0	10.0	7.1	9.0	6.4
1.5	8.3	5.8	7.5	5.2
2.0	6.3	4.4	5.7	4.0

Notes:

Note6: Test PCB: 160x100mm 105µm (Eurocard), double layer

Thermal Calculation

choose your model:

RPA20-2405SAW (with PCB ⁽⁶⁾)

- Load conditions in application (e.g. 100%)
- Airflow conditions in application (e.g. 0.5m/s)
- use Rth from Table1 (9.7K/W)

Calculation:

$$\begin{aligned} I_{out} &= 100\% \\ R_{th} &= 9.7\text{K/W} \\ P_{DISS} &= 2.8\text{W} \\ T_{CASEmax} &= 105^{\circ}\text{C} \end{aligned}$$

$$\begin{aligned} T_{OVER} &= R_{th} \times P_{Dis} = 9.7\text{K/W} \times 2.8\text{W} = 27.2^{\circ}\text{C} \\ T_{AMBmax} &= T_{CASEmax} - T_{OVER} = 105^{\circ}\text{C} - 27.2^{\circ}\text{C} = 77.8^{\circ}\text{C} \end{aligned}$$

choose your model:

RPA20-2405SAW-HC (with PCB ⁽⁶⁾)

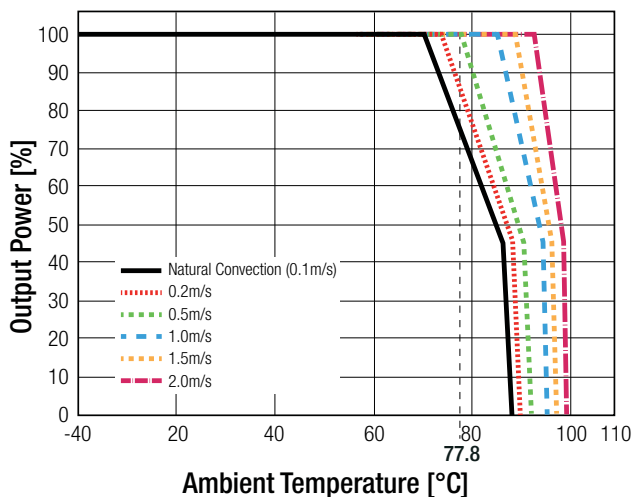
- Load conditions in application (e.g. 100%)
- Airflow conditions in application (e.g. 0.5m/s)
- use Rth from Table1 (8.7K/W)

Calculation:

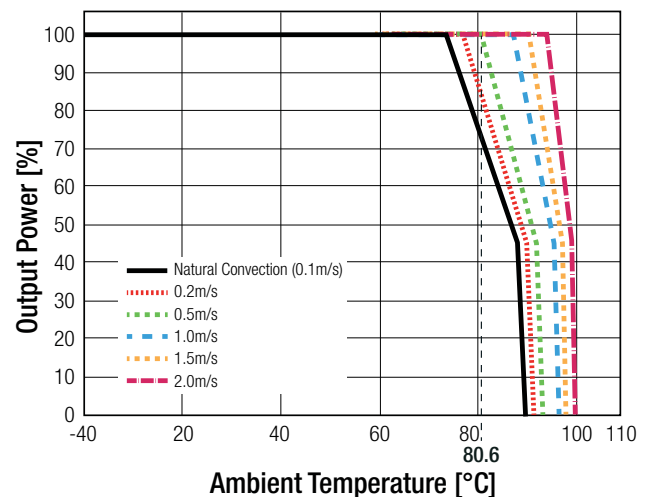
$$\begin{aligned} I_{out} &= 100\% \\ R_{th} &= 8.7\text{K/W} \\ P_{DISS} &= 2.8\text{W} \\ T_{CASEmax} &= 105^{\circ}\text{C} \end{aligned}$$

$$\begin{aligned} T_{OVER} &= R_{th} \times P_{Dis} = 8.7\text{K/W} \times 2.8\text{W} = 24.4^{\circ}\text{C} \\ T_{AMBmax} &= T_{CASEmax} - T_{OVER} = 105^{\circ}\text{C} - 21.3^{\circ}\text{C} = 80.6^{\circ}\text{C} \end{aligned}$$

RPA20-24xxSAW



RPA20-24xxSAW-HC



SAFETY AND CERTIFICATIONS

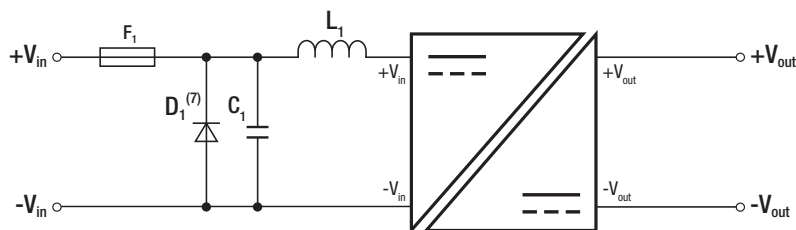
Certificate Type (Safety)	Report / File Number	Standard
Information Technology Equipment - General Requirements for Safety	E224736-A39 + A40	UL60950-1, 2nd Edition, 2014 CSA C22.2 No. 60950-1-07, 2nd Edition, 2014
Information Technology Equipment - General Requirements for Safety (CB Scheme)	E224736-A39-CB + A40-CB	IEC60950-1:2005, 2nd Edition + A2:2013
Information Technology Equipment - General Requirements for Safety		EN60950-1:2006 + A2:2013
Railway applications – Electronic equipment used on rolling stock	15100175 001, 15100176 001	EN50155:2007, Clause 5.4 and 5.5
EAC	RU-AT.49.09571	TP TC 004/2011
RoHS2		RoHS 10/10, 2011/65/EU + AM-2015/863

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Specifications (measured @Ta = 25°C, resistive load, nom. Vin and rated Iout unless otherwise noted)

EMC Compliance	Condition	Standard / Criterion
Electromagnetic compatibility of multimedia equipment - Emission requirements	with external filter (see filter suggestion below)	EN55032, Class A
Railway applications - Electromagnetic compatibility Part 3-2: Rolling stock - Apparatus		EN50121-3-2:2015
Specification for radio disturbance and immunity measuring apparatus and methods Part 2-1: Methods of measurement of disturbances and immunity – Conducted disturbance measurements		EN55016-2-1:2009
Specification for radio disturbance and immunity measuring apparatus and methods Part 2-3: Methods of measurement of disturbances and immunity – Radiated disturbance measurements		EN55016-2-3:2010
ESD Electrostatic discharge immunity test	Air ±8kV, Contact ±6kV	EN61000-4-2:2009, Criteria A
Radiated, radio-frequency, electromagnetic field immunity test	20V/m, 80-1000MHz 10V/m, 1.4-2.0GHz 5V/m, 2.0-2.7GHz 3V/m, 5.1-6.0GHz	EN61000-4-3:2006, Criteria A
Fast Transient and Burst Immunity	DC Power Port ±2kV	IEC61000-4-4:2004, Criteria A
Surge Immunity	DC Power Port ±1kV	EN61000-4-5:2006, Criteria A
Immunity to conducted disturbances, induced by radio-frequency fields	DC Power Port 10V	EN61000-4-6:2009, Criteria A

EMC Filtering according to EN50121-3-2 and EN55032 Class A



Notes:

Note7: Diode is only needed for EN50155

C1	L1
47µF/50V electrolyte capacitor	1µH choke

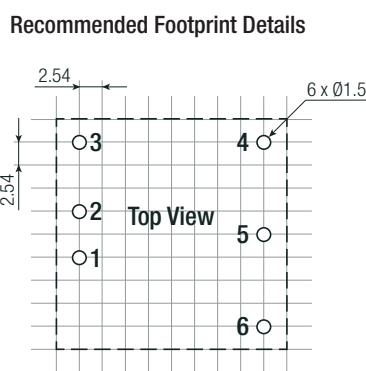
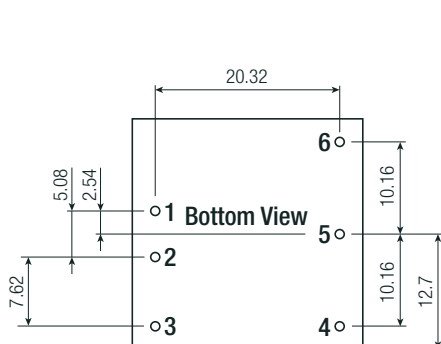
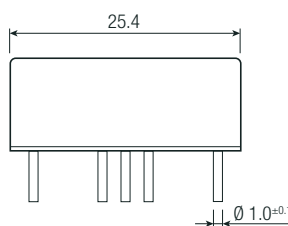
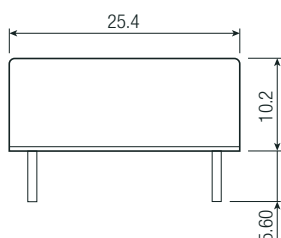
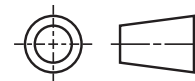
DIMENSIONS and PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	case baseplate potting	al alloy, anodize black non-conductive FR4 silicone (UL94 V-0)
Dimensions (LxWxH)	without Heat-sink with Heat-sink	25.4 x 25.4 x 10.2mm 25.4 x 25.4 x 16.8mm
Weight	without Heat-sink with Heat-sink	17g typ. 21g typ.

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Specifications (measured @Ta = 25°C, resistive load, nom. Vin and rated Iout unless otherwise noted)

Dimension Drawing (mm)



Pin Connections

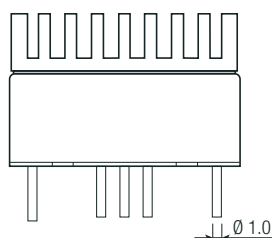
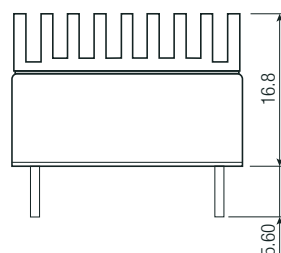
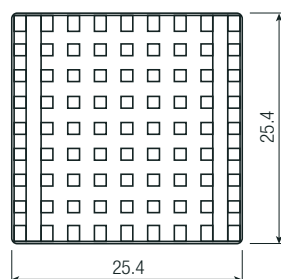
Pin #	Single	Dual
1	+Vin	+Vin
2	-Vin	-Vin
3	CTRL ⁽²⁾	CTRL ⁽²⁾
4	-Vout	-Vout
5	Trim	Com
6	+Vout	+Vout

Pin Pitch Tolerance $\pm 0.25\text{mm}$

xx.x = $\pm 0.5\text{mm}$

xx.xx = $\pm 0.25\text{mm}$

Heat-sink Dimension Drawing (mm)



Specifications (measured @Ta = 25°C, resistive load, nom. Vin and rated Iout unless otherwise noted)

PACKAGING INFORMATION			
Parameter	Type		Value
Packaging Dimensions (LxWxH)	tube	without Heat-sink	285.0 x 27.6 x 19.0mm
		with Heat-sink	285.0 x 27.6 x 25.8mm
Packaging Quantity			10pcs
Storage Temperature Range			-55°C to +125°C
Storage Humidity	non-condensing		5% - 95% RH

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