

REM2A Series ◊ Regulated DIP16 & SMD

2W ◊ Isolated Single & Dual Output ◊ 2:1 Input

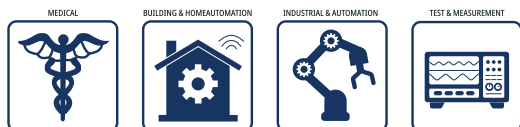
FEATURES

- 2MOPP, 250VAC working voltage isolation
- Clearance and creepage distance $\geq 8\text{mm}$
- Up to 5kVAC/1min reinforced insulation
- IEC/EN/UL 60601 and 62368-1 certified
- -40°C to $+90^{\circ}\text{C}$ operation, no derating
- 2:1 wide input range
- Compact 24.3x14.4mm footprint
- 3 year warranty



Dimensions (LxWxH): 24.3 x 14.4 x 10.2mm (0.95 x 0.57 x 0.40 inch)
7.0g (0.015 lbs)

APPLICATIONS



SAFETY & EMC



DESCRIPTION

The REM2A series of medical grade regulated DC/DC converters feature reinforced 250VAC continuous working isolation with $\geq 8\text{mm}$ creepage/clearance. The compact DIP16/SMD package offers industry standard pinouts with tightly regulated single/dual outputs and UVLO, SCP, and OVP. The operating ambient temperature range is from -40°C to $+90^{\circ}\text{C}$ without derating. The converters are UL marked and certified to IEC, EN, and ANSI/AAMI 60601 3rd. Ed. Safety and 4th Ed. EMC medical standards as well as IEC, EN, UL 62368-1 industrial standards. The low $2\mu\text{A}$ leakage current complies with medical applied part for B, BF, and CF rating limits as defined by IEC60601-1.

SELECTION GUIDE

Part Number	Input Voltage	Output Voltage	Output Current	Efficiency	max. Capacitive
	Range [VDC]	nom. [VDC]	max. [mA]	typ. ⁽¹⁾ [%]	Load ⁽²⁾ [μF]
REM2A-053.3S ⁽³⁾	4.5-12	3.3	600	75	1000
REM2A-0505S ⁽³⁾	4.5-12	05	400	78	1000
REM2A-0509S ⁽³⁾	4.5-12	09	222	78	430
REM2A-0512S ⁽³⁾	4.5-12	12	167	82	220
REM2A-0515S ⁽³⁾	4.5-12	15	134	82	170
REM2A-0524S ⁽³⁾	4.5-12	24	83	82	100
REM2A-0512D ⁽³⁾	4.5-12	± 12	± 83	82	± 170
REM2A-0515D ⁽³⁾	4.5-12	± 15	± 67	80	± 100

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REM2A-123.3S ⁽³⁾	9-18	3.3	600	76	1000
REM2A-1205S ⁽³⁾	9-18	05	400	78	1000
REM2A-1209S ⁽³⁾	9-18	09	222	79	430
REM2A-1212S ⁽³⁾	9-18	12	167	82	220
REM2A-1215S ⁽³⁾	9-18	15	134	82	170
REM2A-1224S ⁽³⁾	9-18	24	83	81	100
REM2A-1212D ⁽³⁾	9-18	±12	±83	81	±170
REM2A-1215D ⁽³⁾	9-18	±15	±67	81	±100
REM2A-243.3S ⁽³⁾	18-36	3.3	600	76	1000
REM2A-2405S ⁽³⁾	18-36	05	400	79	1000
REM2A-2409S ⁽³⁾	18-36	09	222	80	430
REM2A-2412S ⁽³⁾	18-36	12	167	81	220
REM2A-2415S ⁽³⁾	18-36	15	134	81	170
REM2A-2424S ⁽³⁾	18-36	24	83	81	100
REM2A-2412D ⁽³⁾	18-36	±12	±83	81	±170
REM2A-2415D ⁽³⁾	18-36	±15	±67	81	±100
REM2A-483.3S ⁽³⁾	36-75	3.3	600	76	1000
REM2A-4805S ⁽³⁾	36-75	05	400	78	1000
REM2A-4809S ⁽³⁾	36-75	09	222	79	430
REM2A-4812S ⁽³⁾	36-75	12	167	80	220
REM2A-4815S ⁽³⁾	36-75	15	134	82	170
REM2A-4824S ⁽³⁾	36-75	24	83	81	100
REM2A-4812D ⁽³⁾	36-75	±12	±83	81	±170
REM2A-4815D ⁽³⁾	36-75	±15	±67	81	±100

Note1: Efficiency is tested at minimum input and full load at +25°C ambient

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

MODEL NUMBERING



Note3: without suffix (THT)= DIP16 type
with suffix "/SMD"= for SMD package

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

Parameter	Condition	Min.	Typ.	Max.
Internal Input Filter				capacitor
Input Voltage Range	nom. V _{IN} = 5VDC	4.5VDC	5VDC	12VDC
	nom. V _{IN} = 12VDC	9VDC	12VDC	18VDC
	nom. V _{IN} = 24VDC	18VDC	24VDC	36VDC
	nom. V _{IN} = 48VDC	36VDC	48VDC	75VDC
Input Surge Voltage	1 sec. max	nom. V _{IN} = 5VDC		15VDC
		nom. V _{IN} = 12VDC		25VDC
		nom. V _{IN} = 24VDC		50VDC
		nom. V _{IN} = 48VDC		100VDC

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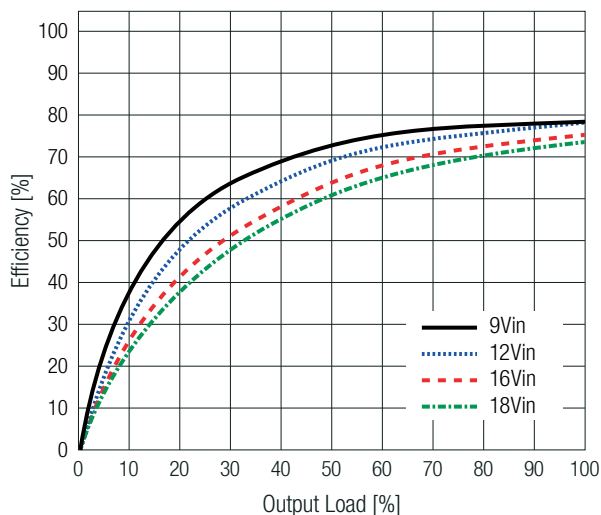
BASIC CHARACTERISTICS (measured @ $T_{AMB}= 25^{\circ}C$, nom. V_{IN} , full load and after warm-up unless otherwise stated)

Parameter	Condition		Min.	Typ.	Max.
Under Voltage Lockout (UVLO)	nom. $V_{IN}= 5VDC$	DC-DC ON			4.5VDC
		DC-DC OFF	2VDC	3VDC	4VDC
	nom. $V_{IN}= 12VDC$	DC-DC ON			9VDC
		DC-DC OFF	6VDC	7VDC	8VDC
	nom. $V_{IN}= 24VDC$	DC-DC ON			18VDC
		DC-DC OFF	13VDC	15VDC	17VDC
nom. $V_{IN}= 48VDC$	DC-DC ON			36VDC	
	DC-DC OFF	29VDC	32VDC	35VDC	
Start-up Time	power up / CTRL ON/OFF		10ms		20ms
ON/OFF CTRL ⁽⁴⁾	DC-DC ON		open or high impedance		
	DC-DC OFF		2mA	3mA	4mA
Input Current on CTRL Pin	DC-DC OFF			2.5mA	
Internal Operating Frequency			100kHz		
Output Ripple and Noise	measured by 20MHz BW			50mVp-p	

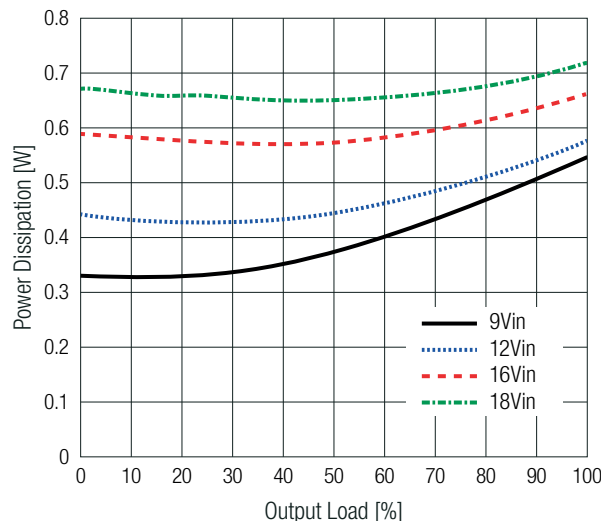
Note4: The pin voltage is referenced to -Vin pin and CTRL pin applied current

REM2A-1205S

Efficiency vs. Load

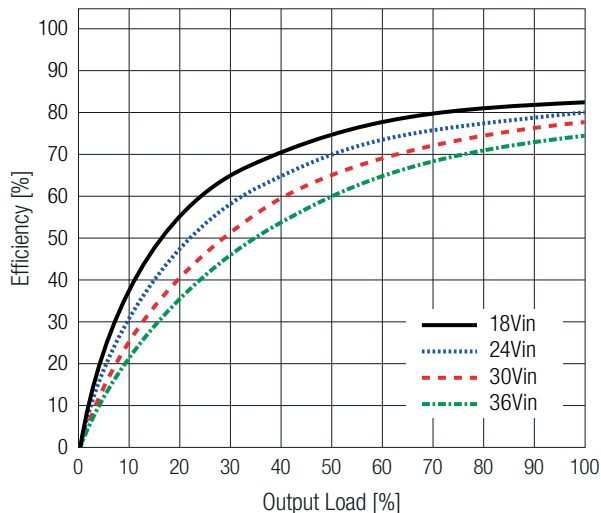


Power Dissipation vs Load

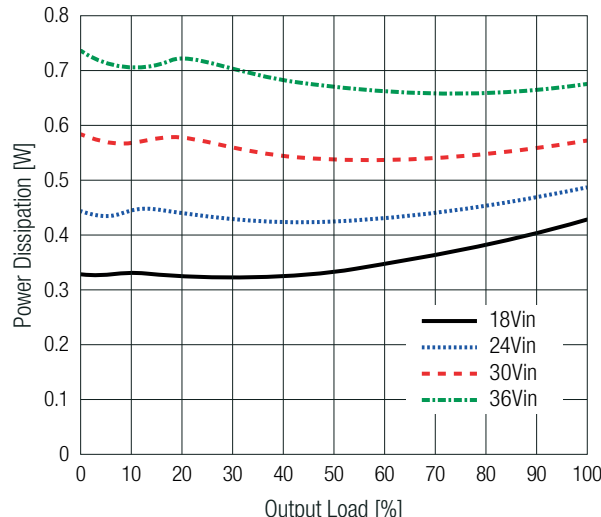


REM2A-2412S

Efficiency vs. Load



Power Dissipation vs Load



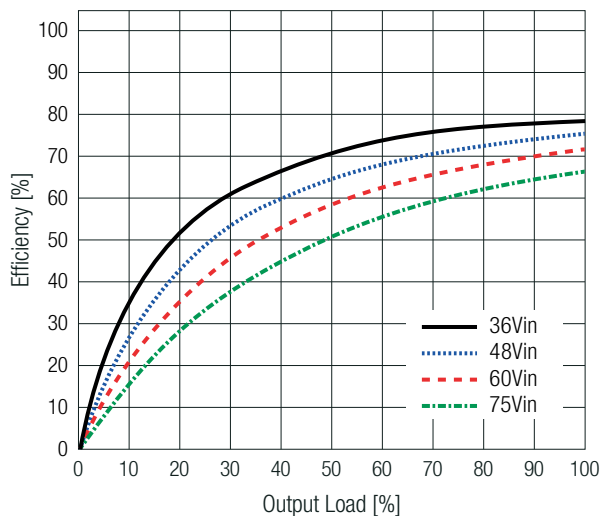
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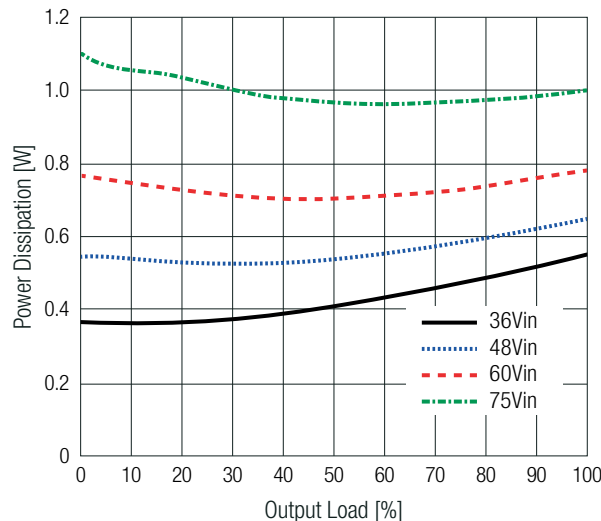
BASIC CHARACTERISTICS (measured @ $T_{AMB} = 25^{\circ}C$, nom. V_{IN} , full load and after warm-up unless otherwise stated)

REM2A-4805S

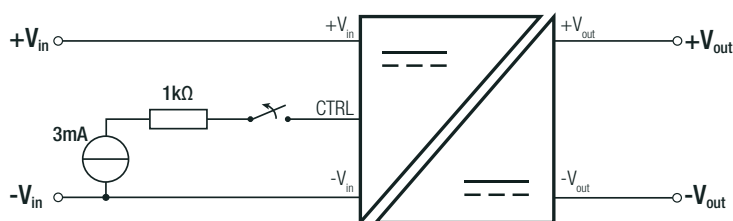
Efficiency vs. Load



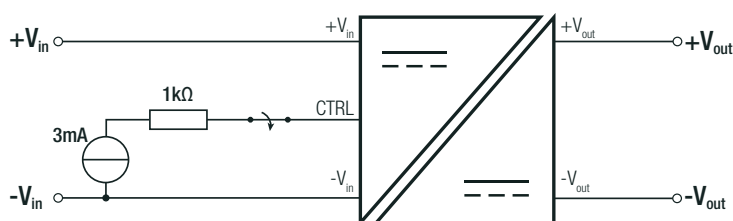
Power Dissipation vs Load



ON/OFF CTRL



DC-DC ON: Open or high impedance



DC-DC OFF: 2mA min. / 3mA typ. / 4mA max.

REGULATIONS

Parameter	Condition		Value
Output Accuracy			$\pm 1.0\%$ max.
Line Regulation	low line to high line, full load		$\pm 0.2\%$ max.
Load Regulation	0-100% load	single	$\pm 1.0\%$ max.
		dual	$\pm 1.0\%$ max.
	10-90% load	single	$\pm 0.5\%$ max.
		dual	$\pm 0.8\%$ max.
Cross Regulation	asymmetrical load 25% / full load	dual output only	$\pm 5.0\%$ max.
Transient Response	recovery time		500 μ s max.

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PROTECTIONS

Parameter	Condition		Value
Input Fuse ⁽⁶⁾	external		refer to below table
Short Circuit Protection (SCP)			continuous, auto recovery
Over Voltage Protection (OVP)	clamping mode	$V_{OUT} = 3.3VDC$	4-6.5VDC
		$V_{OUT} = 5VDC$	6-8VDC
		$V_{OUT} = 9VDC$	10-14VDC
		$V_{OUT} = 12VDC$	13-19VDC
		$V_{OUT} = 15VDC$	16-22VDC
		$V_{OUT} = 24VDC$	25-35VDC
Isolation Voltage ⁽⁷⁾	I/P to O/P, according to 60601-1, 62368-1	1 minute	5kVAC
Isolation Resistance	I/P to O/P, $V_{ISO} = 500VDC$		10GΩ min.
Isolation Capacitance	I/P to O/P		16pF typ. / 20pF max.
Insulation Grade			reinforced
Leakage Current	240VAC/60Hz		2μA max.
Means of Protection	250VAC working voltage		2MOPP
Medical Device Classification			built-in power supply
Internal Clearance and Creepage	I/P to O/P		≥8mm

Note7: For repeat Hi-Pot testing, reduce the time and/or the test voltage

Note8: Refer to local safety regulations if input over-current protections is also required. Recommended fuse:

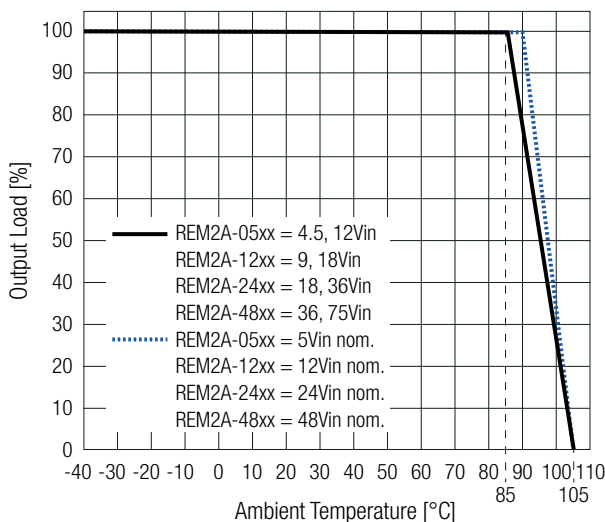
Modules	Fuse Rating [A]	Fuse Type
REM2A-05xx	1	slow-blow
REM2A-12xx	0.5	
REM2A-24xx	0.315	
REM2A-48xx	0.16	

ENVIRONMENTAL

Parameter	Condition		Value
Operating Temperature Range	with derating and natural convection 0.1 m/s	refer to „Derating Graph“	-40°C to +105°C
Maximum Case Temperature			+105°C
Temperature Coefficient			±0.02%/°C
Operating Altitude			5000m
Operating Humidity	non-condensing		5-95% RH max.
Pollution Degree			PD2
Shock, Thermal Shock, Vibration			MIL-STD-810F
MTBF	according to MIL-HDBK-217F, G.B.	$T_{AMB} = 25°C$	6809 x 10 ³ hours

Derating Graph

(@ Chamber and natural convection 0.1m/s)



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SAFETY AND CERTIFICATION

Certificate Type (Safety)	Report Number	Standard
Audio/video, information and communication technology equipment. Safety requirements	T02-2402024	IEC62368-1:2018 3rd Edition
Audio/video, information and communication technology equipment. Safety requirements (LVD)		EN IEC 62368-1:2020+A11:2020
Audio/video, information and communication technology equipment-Part1: Safety requirements	pending	UL62368-1:2019 3rd Edition CAN/CSA-C22.2 No. 62368-1-19 3rd Edition
Medical electrical equipment Part 1: General requirements for basic safety and essential performance	E314885	ANSI/AAMI ES60601-1:2005+A2:2010/(R)2012 CAN/CSA-C22.2 No. 60601-1:14 3rd Ed.
Medical electrical equipment Part 1: General requirements for basic safety and essential performance	T02-2402025	IEC60601-1:2005+AM1:2012 3rd Edition
		EN60601-1:2006+A12:2014
RoHS2		RoHS 2011/65/EU + AM2015/863

EMC Compliance according to EN60601-1-2	Condition	Standard / Criterion
Medical electrical equipment Part 1-2: General requirements for basic safety and essential performance		EN60601-1-2:2015+A1:2020
Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement	with external filter	EN55011:2016+A11:2020, Class B
ESD Electrostatic discharge immunity test	Air: ±2, 4, 8, 15kV, Contact: ±2, 4, 8kV	IEC61000-4-2:2008 EN61000-4-2:2009
Radiated, radio-frequency, electromagnetic field immunity test	10V/m (80-2700MHz)	EN IEC 61000-4-3:2020
Fast Transient and Burst Immunity ⁽⁹⁾	DC Power Port: ±2kV	IEC/EN61000-4-4:2012
Surge Immunity ⁽⁹⁾	DC Power Port: ±0.5, 1kV	IEC/EN61000-4-5:2014+A1:2017
Immunity to conducted disturbances, induced by radio-frequency fields	3, 6V (0.15-80MHz) 6V (ISM bands) 6V (amateur radio bands)	IEC61000-4-6:2013 EN61000-4-6:2014+AC:2015
Power Magnetic Field Immunity	30A/m, 100A/m	IEC61000-4-8:2009 EN61000-4-8:2010
Testing and measurement techniques - Radiated fields in close proximity - Immunity test	30kHz, 8A/m 134.2kHz, 65A/m 13.56MHz, 7.5A/m	IEC61000-4-39

EMC Compliance according to EN55032/35	Condition	Standard / Criterion
Electromagnetic compatibility of multimedia equipment – Emission Requirements	with external filter	EN55032:2015+A11:2020, Class A, B
Electromagnetic compatibility of multimedia equipment – Immunity requirements		EN55035:2017+A11:2020
ESD Electrostatic discharge immunity test	Air: ±2, 4, 8, 15kV, Contact: ±2, 4, 6, 8kV	IEC61000-4-2:2008, Criteria A EN61000-4-2:2009, Criteria A
Radiated, radio-frequency, electromagnetic field immunity test	10V/m (80-1000MHz) 10V/m (1800, 2600, 3500, 5000MHz)	EN IEC 61000-4-3:2020, Criteria A
Fast Transient and Burst Immunity ⁽⁹⁾	DC Power Port: ±2kV	IEC/EN61000-4-4:2012, Criteria A
Surge Immunity ⁽⁹⁾	DC Power Port: ±1kV	IEC/EN61000-4-5:2014+A1:2017, Criteria A
Immunity to conducted disturbances, induced by radio-frequency fields	3Vrms (0.15-10MHz) 3-1Vrms (10-30MHz) 1Vrms (30-80MHz)	IEC61000-4-6:2013, Criteria A EN61000-4-6:2014, Criteria A
Power Magnetic Field Immunity	50/60Hz, 100A/m 50Hz, 1000A/m	IEC61000-4-8:2009, Criteria A EN61000-4-8:2010, Criteria A

EMC Compliance according to EN61204-3	Condition	Standard / Criterion
Low voltage power supplies, d.c. output Part 3: Electromagnetic compatibility	with external filter	EN61204-3:2000, Class A, B
ESD Electrostatic discharge immunity test	Air: ±2, 4, 8, 15kV, Contact: ±2, 4, 6, 8kV	IEC61000-4-2:2008 EN61000-4-2:2009
Radiated, radio-frequency, electromagnetic field immunity test	10V/m (80-1000MHz)	EN IEC 61000-4-3:2020, Criteria A
Fast Transient and Burst Immunity ⁽⁹⁾	DC Power Port: ±2kV	IEC/EN61000-4-4:2012, Criteria A
Surge Immunity ⁽⁹⁾	DC Power Port: ±1kV	IEC/EN61000-4-5:2014+A1:2017, Criteria A
Immunity to conducted disturbances, induced by radio-frequency fields	3Vrms (0.15-10MHz) 3-1Vrms (10-30MHz) 1Vrms (30-80MHz)	IEC61000-4-6:2013; EN61000-4-6:2014

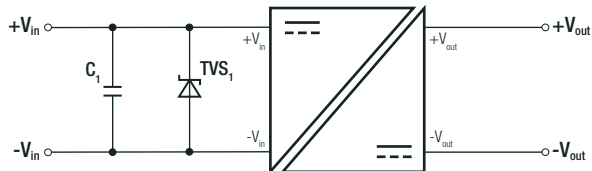
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SAFETY AND CERTIFICATION

Fast Transient / Surge

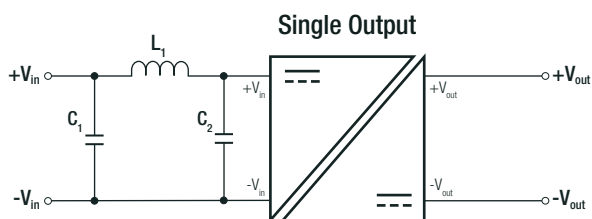
Note9: An external input filter capacitor is required if the module has to meet EN61000-4-4 and EN61000-4-5



Component List

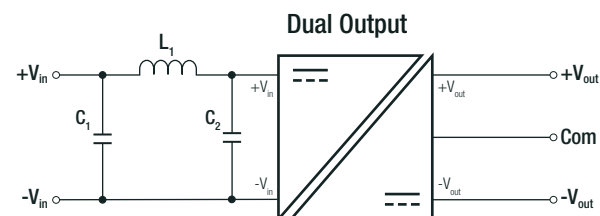
Model	C1	TVS
REM2A-05xx	1000 μ F/25V	18V/400W
REM2A-12xx	470 μ F/50V	N/A
REM2A-24xx	470 μ F/50V	N/A
REM2A-48xx	220 μ F/100V	N/A

EMC Filtering Suggestions



Component List Class A

Model	C1	L1	C2
REM2A-05xx	22 μ F	3.3 μ H	N/A
REM2A-12xx	10 μ F	10 μ H	N/A
REM2A-24xx	10 μ F	15 μ H	N/A
REM2A-48xx	2.2 μ F	68 μ H	N/A



Component List Class B

Model	C1	L1	C2
REM2A-05xx	22 μ F	6.8 μ H	22 μ F
REM2A-12xx	10 μ F	10 μ H	10 μ F
REM2A-24xx	10 μ F	15 μ H	10 μ F
REM2A-48xx	2.2 μ F	68 μ H	2.2 μ F

DIMENSION & PHYSICAL CHARACTERISTICS

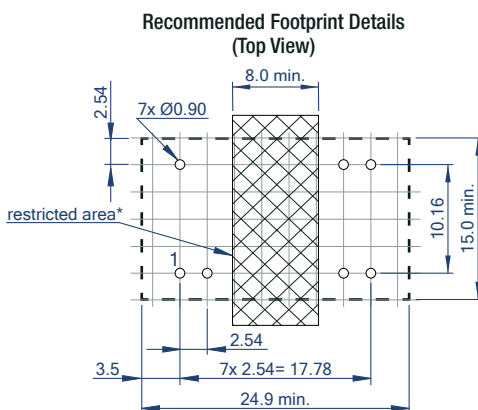
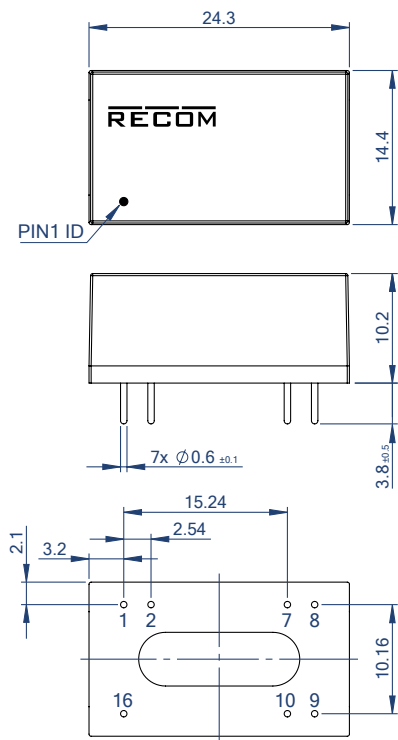
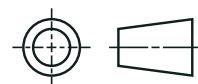
Parameter	Type	Value
Materials	case/ baseplate	non-conductive black plastic, (UL94 V-0)
	PCB	FR4, (UL94 V-1)
	potting	silicone, (UL94 V-0)
Dimension (LxWxH)		24.3 x 14.4 x 10.2mm 0.95 x 0.57 x 0.40inch
Weight		7g typ. 0.015lbs

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DIMENSION & PHYSICAL CHARACTERISTICS

Dimension Drawing DIP16



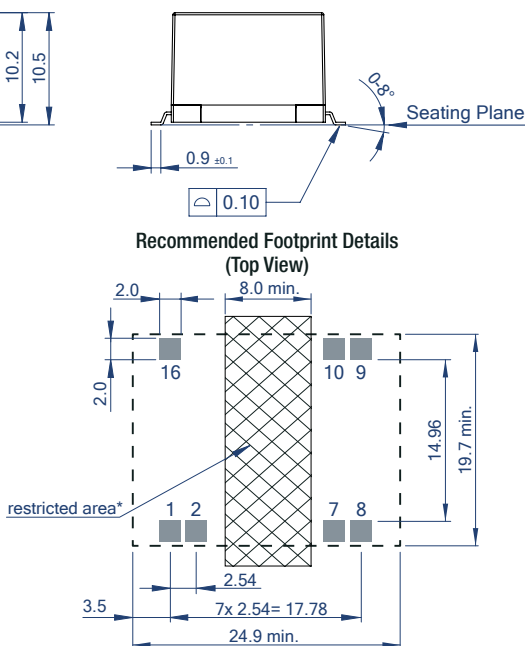
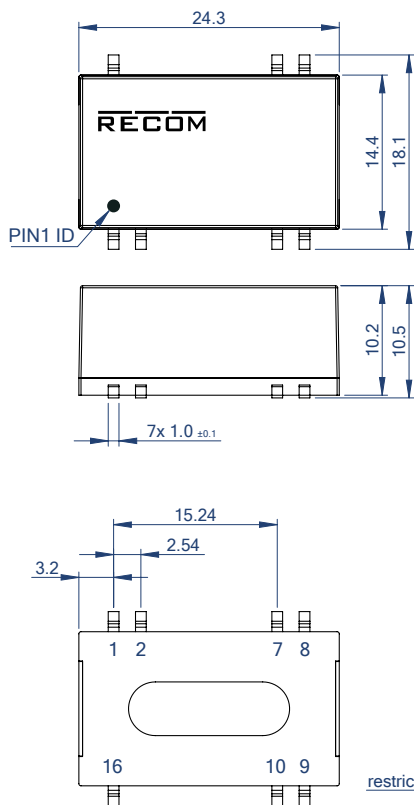
Pinning information

Pin #	Single	Dual
1	-Vin	-Vin
2	CTRL	CTRL
7	NC	NC
8	NC	Com
9	+Vout	+Vout
10	-Vout	-Vout
16	+Vin	+Vin

NC= not connected

*There should be at least 8mm distance between primary and secondary circuit

Dimension Drawing SMD



Pinning information

Pin #	Single	Dual
1	-Vin	-Vin
2	CTRL	CTRL
7	NC	NC
8	NC	Com
9	+Vout	+Vout
10	-Vout	-Vout
16	+Vin	+Vin

NC= not connected

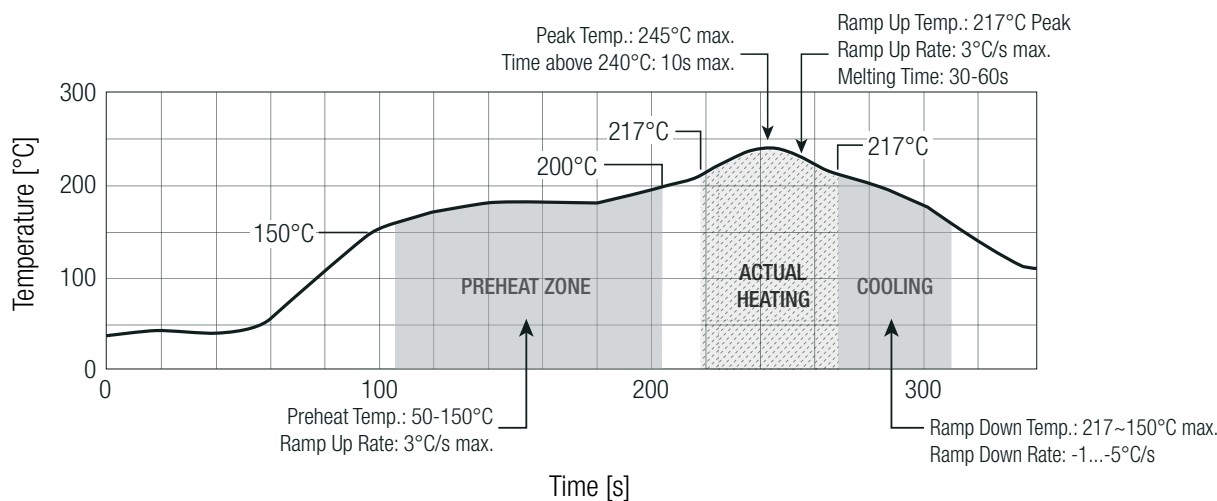
*There should be at least 8mm distance between primary and secondary circuit

Tolerances:
 x.x= $\pm 0.5\text{mm}$
 x.xx= $\pm 0.25\text{mm}$

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SOLDER PROFILE FOR SMD TYPE



PACKAGING INFORMATION

Parameter	Type	Value
Packaging Dimension (LxWxH)	tube	290.0 x 17.35 x 25.6mm
Packaging Quantity		10pcs
Storage Temperature Range		-55°C to +125°C
Storage Humidity	non-condensing	5-95% RH max.
Moisture Sensitivity Level (MSL)	only for SMD type verification according to IPC J-STD-020E	IPC J-STD-033C, Level 2

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[RSH2-2405S/H3](#) [MGN1S0508MC-R7](#) [UCC14130QDWRQ1](#) [PESE1-S3-S24-M](#) [MGN1D050603MC-R7](#) [R05C1TF05S-CT](#) [R2M-](#)
[2412D/SMD](#) [R3M-2415D/SMD](#) [R3M-2415S/SMD](#) [R5M-2412D/SMD](#) [RA3-241503D/SMD](#) [R05C1TF05S-R](#) [R24C2T25-CT](#) [R24C2T25-R](#)
[R24C2T25/R-CT](#) [R24C2T25/R-R](#) [R12C2T12/R-R](#) [R12C2T25/R-R](#) [R15C2T25/R-R](#) [R9C1T18/R-R](#) [R12C2T12/R-CT](#) [R12C2T25/R-CT](#)
[R15C2T25/R-CT](#) [R9C1T18/R-CT](#) [REM2A-1212S/SMD](#) [REM2A-0505S/SMD](#) [REM2A-0512S/SMD](#) [REM2A-1205S/SMD](#) [REM2A-](#)
[2405S/SMD](#) [REM4A-2405S/SMD](#)