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Technical Data Sheet

REM4A Series ◊ Regulated DIP16 & SMD

4W ◊ Isolated Single & Dual Output ◊ 2:1 Input

RECOM DC/DC Converter

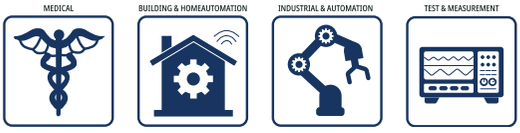
FEATURES

- 2MOPP, 250VAC working voltage isolation
- Clearance and creepage distance ≥8mm
- Up to 5kVAC/1min reinforced insulation
- IEC/EN/UL 60601 and 62368-1 certified
- -40°C to +80°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

RoHS² compliant 10 from 10 | Reach compliant | c UL us E314885 | IECEE CB SCHEME

DESCRIPTION

The REM4A series of medical grade regulated DC/DC converters feature reinforced 250VAC continuous working isolation with ≥8mm 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 +80°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 2µA 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 Range [VDC]	Output Voltage nom. [VDC]	Output Current max. [mA]	Efficiency typ. (1) [%]	max. Capacitive Load (2) [µF]
REM4A-0505S (3)	4.5-12	05	700	77	1470
REM4A-0509S (3)	4.5-12	09	389	78	680
REM4A-0512S (3)	4.5-12	12	292	82	470
REM4A-0515S (3)	4.5-12	15	234	82	330
REM4A-0524S (3)	4.5-12	24	146	82	170
REM4A-0512D (3)	4.5-12	±12	±146	82	±220
REM4A-0515D (3)	4.5-12	±15	±117	81	±160

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SELECTION GUIDE

Part Number	Input Voltage Range [VDC]	Output Voltage nom. [VDC]	Output Current max. [mA]	Efficiency typ. (1) [%]	max. Capacitive Load (2) [µF]
REM4A-1205S (3)	9-18	05	700	79	1470
REM4A-1209S (3)	9-18	09	389	79	680
REM4A-1212S (3)	9-18	12	292	82	470
REM4A-1215S (3)	9-18	15	234	82	330
REM4A-1224S (3)	9-18	24	146	82	170
REM4A-1212D (3)	9-18	±12	±146	82	±220
REM4A-1215D (3)	9-18	±15	±117	82	±160
REM4A-2405S (3)	18-36	05	700	79	1470
REM4A-2409S (3)	18-36	09	389	80	680
REM4A-2412S (3)	18-36	12	292	83	470
REM4A-2415S (3)	18-36	15	234	83	330
REM4A-2424S (3)	18-36	24	146	82	170
REM4A-2412D (3)	18-36	±12	±146	82	±220
REM4A-2415D (3)	18-36	±15	±117	82	±160
REM4A-4805S (3)	36-75	05	700	79	1470
REM4A-4809S (3)	36-75	09	389	80	680
REM4A-4812S (3)	36-75	12	292	82	470
REM4A-4815S (3)	36-75	15	234	82	330
REM4A-4824S (3)	36-75	24	146	82	170
REM4A-4812D (3)	36-75	±12	±146	82	±220
REM4A-4815D (3)	36-75	±15	±117	82	±160

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

REM4A-__ __ S/SMD

- nom. Input Voltage
- nom. Output Voltage
- Package (3)
- **S**ingle/**D**ual

Note3: without suffix = 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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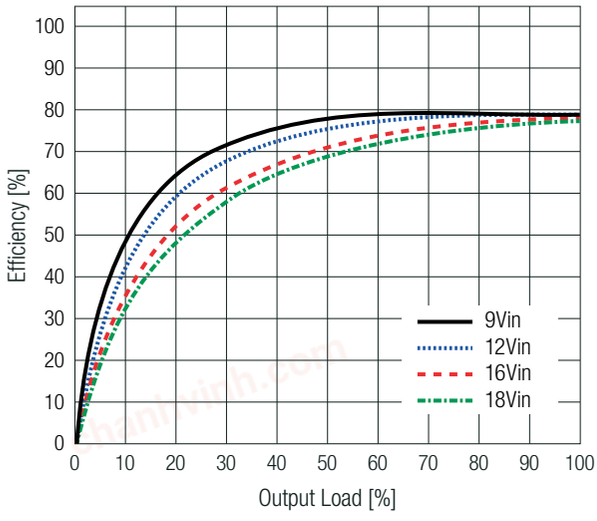
BASIC CHARACTERISTICS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

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 of CTRL Pin	DC-DC OFF			2.5mA	
Internal Operating Frequency			100kHz		
Output Ripple and Noise	measured by 20MHz BW	V_{OUT}= 5, 12, 15, 24VDC		50mVp-p	
		V_{OUT}= 48, ±12, ±15VDC		75mVp-p	

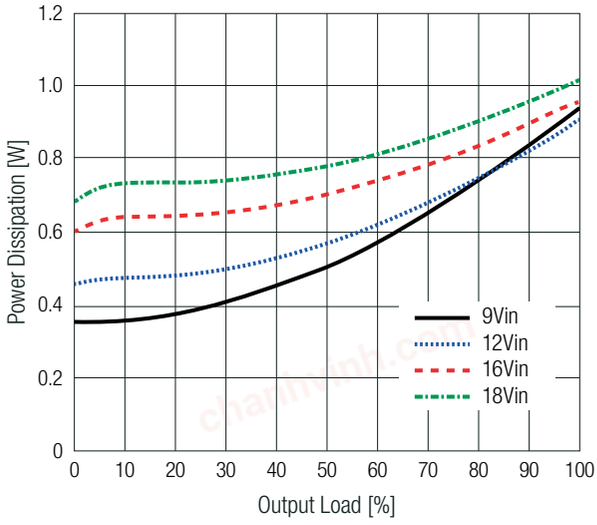
Note4: The pin voltage is referenced to -Vin pin and CTRL pin applied current

REM4A-1205S

Efficiency vs. Load

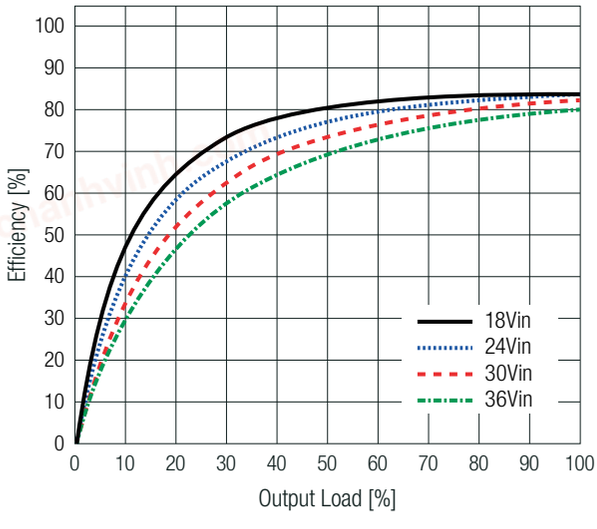


Power Dissipation vs Load

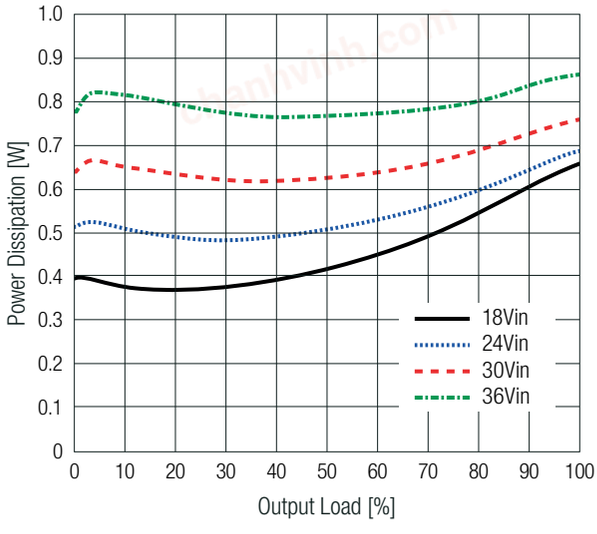


REM4A-2412S

Efficiency vs. Load



Power Dissipation vs Load



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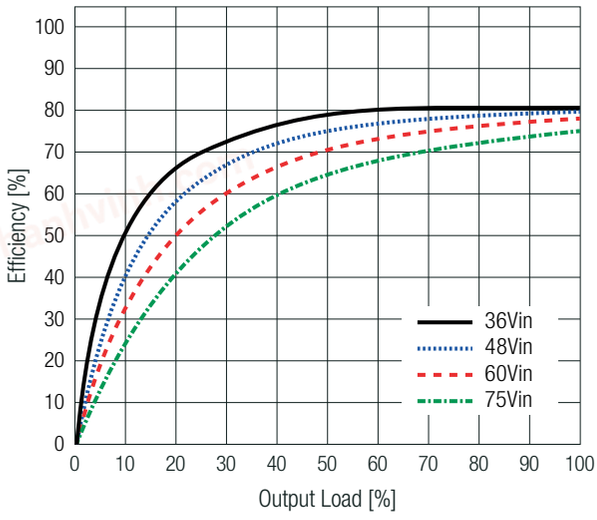
4W ◊ Isolated Single & Dual Output ◊ 2:1 Input

RECOM DC/DC Converter

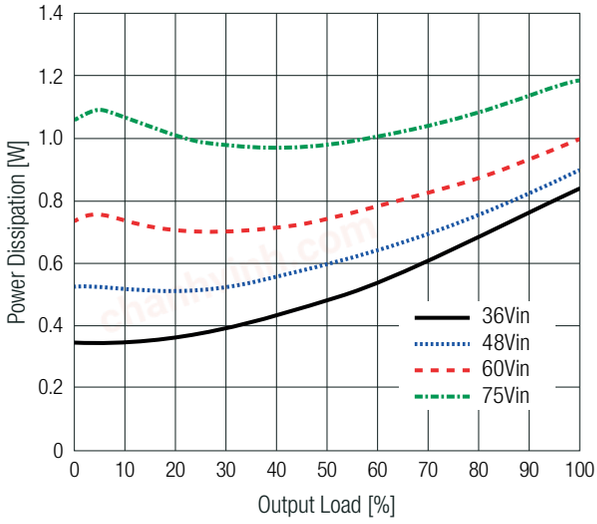
BASIC CHARACTERISTICS (measured @ T_{AMB}= 25°C, nom. V_{IN}, full load and after warm-up unless otherwise stated)

REM4A-4805S

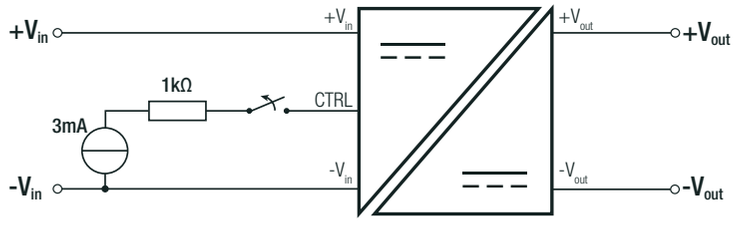
Efficiency vs. Load



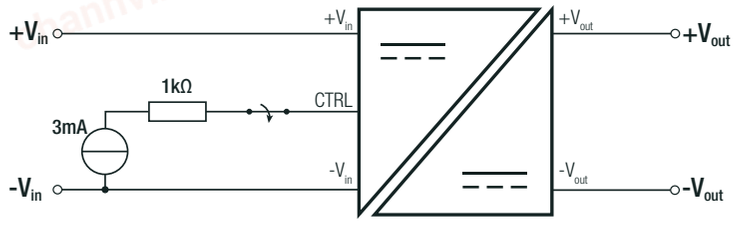
Power Dissipation vs Load



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			±1.0% max.
Line Regulation	low line to high line, full load		±0.2% max.
Load Regulation	0-100% load	single	±1.0% max.
		dual	±1.0% max.
	10-90% load	single	±0.5% max.
		dual	±0.8% max.
Cross Regulation	asymmetrical load 25% / full load	dual output only	±5.0% max.
Transient Response	recovery time		500µs max.

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PROTECTIONS

Parameter	Condition		Value
Input Fuse [8]	external		refer to below table
Short Circuit Protection (SCP)			continuous, auto recovery
Over Voltage Protection (OVP)	clamping mode	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:

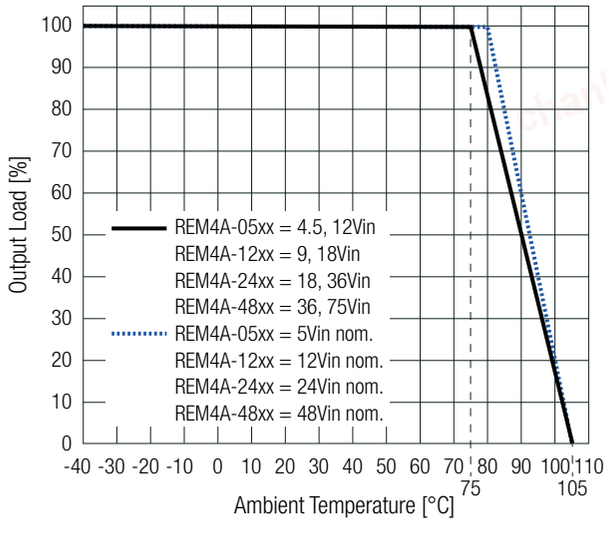
Modules	Fuse Rating [A]	Fuse Type
REM4A-05xx	1.6	slow blow
REM4A-12xx	0.8	
REM4A-24xx	0.5	
REM4A-48xx	0.315	

ENVIRONMENTAL

Parameter	Condition		Value
Operating Temperature Range	with derating and natural convection 0.1m/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	5041 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

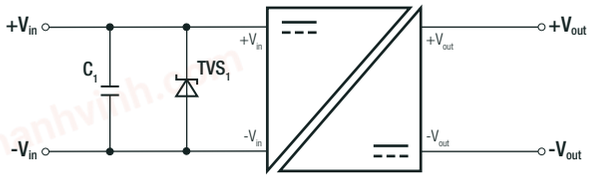
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SAFETY AND CERTIFICATION

Fast Transient / Surge

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

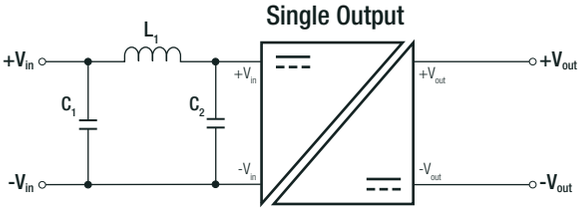


Component List

Model	C1	TVS
REM4A-05xx	1000µF/25V	18V/400W
REM4A-12xx	470µF/50V	N/A
REM4A-24xx	470µF/50V	N/A
REM4A-48xx	220µF/100V	N/A

EMC Filtering Suggestions

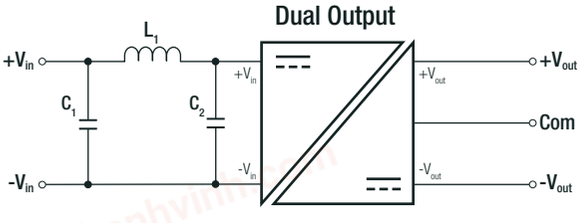
Single Output



Component List Class A

Model	C1	L1	C2
REM4A-05xx	22µF	3.3µH	N/A
REM4A-12xx	10µF	10µH	N/A
REM4A-24xx	10µF	15µH	N/A
REM4A-48xx	2.2µF	68µH	N/A

Dual Output



Component List Class B

Model	C1	L1	C2
REM4A-05xx	22µF	6.8µH	22µF
REM4A-12xx	10µF	10µH	10µF
REM4A-24xx	10µF	15µH	10µF
REM4A-48xx	2.2µF	68µH	2.2µF

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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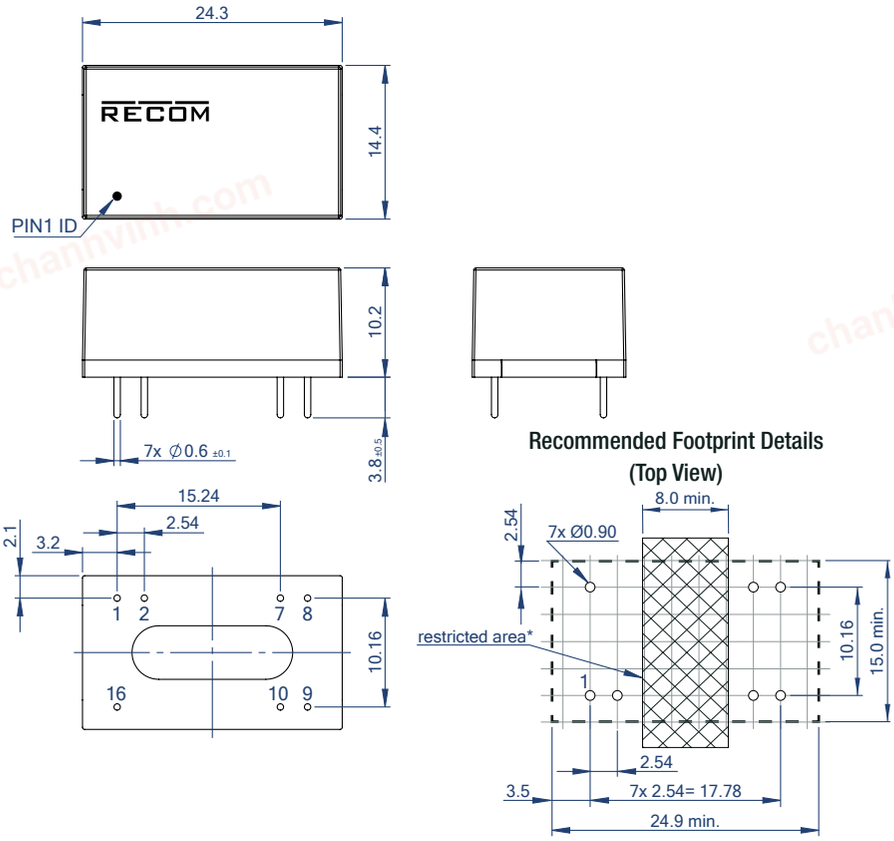
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DIMENSION & PHYSICAL CHARACTERISTICS

Dimension Drawing DIP16



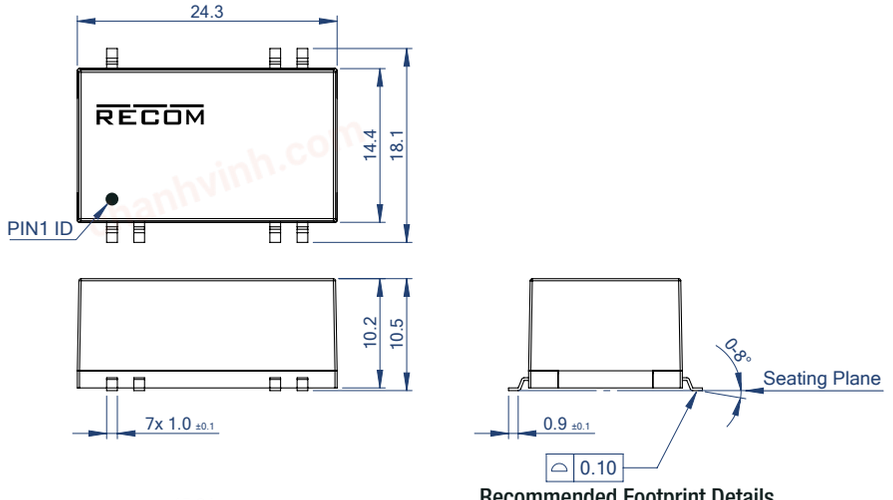
Recommended Footprint Details
(Top View)

Pinning information

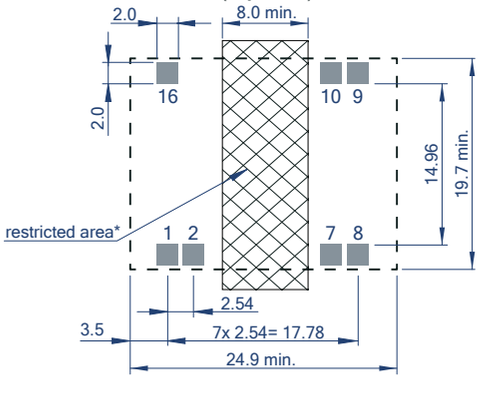
Pin #	Single	Dual
1	-Vin	-Vin
2	CTRL	CTRL
7	NC	NC
8	NC	Com
9	+Vout	+Vout
10	-Vout	-Vout
16	+Vin	+Vin
NC= not connected		

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

Dimension Drawing SMD



Recommended Footprint Details
(Top View)



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		

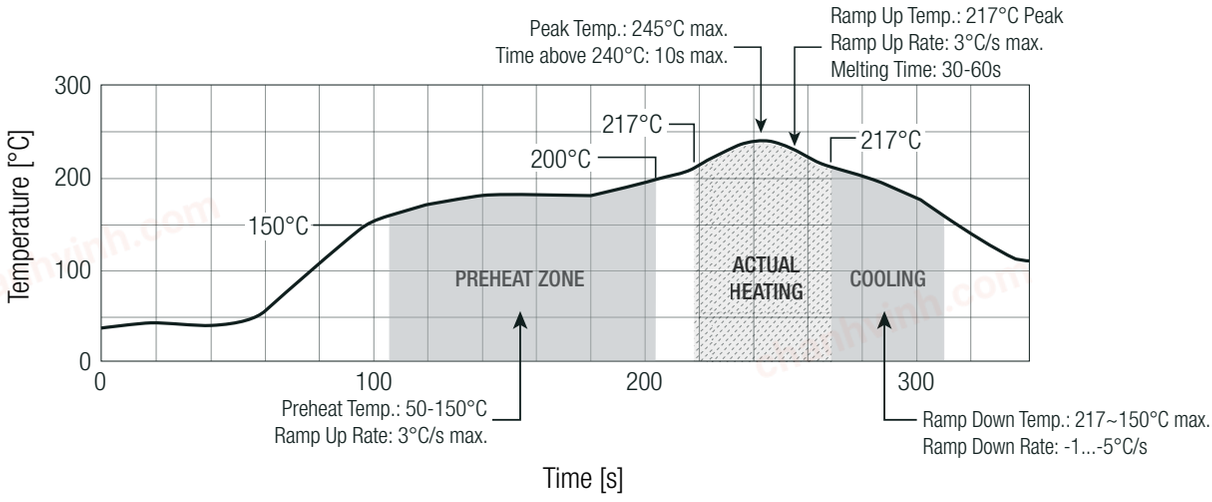
*There should be at least 8mm distance between primary and secondary circuit

Tolerances:
x.x= ±0.5mm
x.xx= ±0.25mm

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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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