Features

Regulated Converter

- 2MOPP, 250VAC working voltage isolation
- Clearance and creepage distance >8mm
- Up to 10kVDC reinforced insulation
- IEC/EN/UL 60601 certified with CB Report (3rd Ed. Safety, 4th Ed. EMC)
- -40°C to +80°C operation, no derating
- 2:1 wide input range

RECOM
DC/DC Converter

REM5E

5 Watt 2:1 Input DIP24 or SMD Single & Dual Output

3 YEAR warranty





RoHS compliant 10 from 10 | REACH compliant | MEDICAL APPROVED

2MOPP 250VAC

IECEE CB SCHEME | cULus E314885

CAN/CSA-C22.2 No. 60601-1:14 certified
ANSI/AAMI ES60601-1 certified
EN60601-1 certified
IEC60601-1 certified
IEC60601-1-2 certified
EN55032 certified

Description

The REM5E series of medical grade regulated DC/DC converters feature reinforced 250VAC continuous working isolation with >8mm creepage/clearance. The compact DIP24/SMD package offers industry standard pinouts with tightly regulated single/dual outputs and UVLO, SCP, and OCP. The operating ambient temperature range is from -40°C to +80°C without derating. The converters are UL marked and certified to CB, IEC, EN and ANSI/AAMI 60601 3rd. Ed. Safety and 4th Ed. EMC medical standards. The low 1µA leakage current complies with medical applied part B, BF and CF limits as defined by IEC60601-1.

Selection Guide

Part Number	Input Voltage Range [VDC]	Output Voltage [VDC]	Output Current [mA]	Efficiency typ.(1) [%]	Max. Capacitive Load (2) [µF]
REM5E-xx05S (3,4,5)	4.5-9 / 9-18 / 18-36 / 36-75	5	1000	75 / 80 / 81 / 82	4700
REM5E-xx09S (3,4,5)	4.5-9 / 9-18 / 18-36 / 36-75	9	556	80 / 81 / 82 / 82	4700
REM5E-xx12S (3,4,5)	4.5-9 / 9-18 / 18-36 / 36-75	12	417	81 / 82 / 84 / 82	2200
REM5E-xx15S (3,4,5)	4.5-9 / 9-18 / 18-36 / 36-75	15	333	81 / 83 / 84 / 84	2200
REM5E-xx24S (3,4,5)	4.5-9 / 9-18 / 18-36 / 36-75	24	208	82 / 83 / 84 / 85	1000
REM5E-xx05D (3,4,5)	4.5-9 / 9-18 / 18-36 / 36-75	±5	±500	75 / 80 / 81 / 82	±2200
REM5E-xx09D (3,4,5)	4.5-9 / 9-18 / 18-36 / 36-75	±9	±277	80 / 81 / 82 / 83	±1600
REM5E-xx12D (3,4,5)	4.5-9 / 9-18 / 18-36 / 36-75	±12	±208	81 / 82 / 83 / 84	±1000
REM5E-xx15D (3,4,5)	4.5-9 / 9-18 / 18-36 / 36-75	±15	±166	82 / 82 / 84 / 84	±1000

Notes:

Note1: Efficiency is tested at nominal input and full load at +25°C ambient
Note2: Max Cap Load is tested at nominal input and full resisitive load

Model Numbering

REM5E- ___ ___ /R /A / ___ / ___

- Output Power
- nom. Input Voltage
- Output Voltage
- **S**ingle or **D**ual
- Isolation (3)
- Pinning
- Case Style or CTRL Option (4)
- UVLO Option (5)

Notes:

Note3: add suffix „/R8“ for 8kVDC or „/R10“ for 10kVDC isolation (DIP24 only)
if SMD package is used, always add suffix „/R6“ for 6kVDC isolation
Note4: add suffix „/CTRL“ for fitted CTRL pin (DIP24 only)
if SMD package is used do not add suffix „/CTRL“, CTRL pin is always mounted
Note5: add suffix „/X1“ for Under Voltage Lockout Option

Ordering Examples

REM5E-0505S/R8/A	= 5Vin, 5Vout, Single, 8kVDC Isolation and „A“ pinning, DIP24
REM5E-1205D/R10/A/CTRL	= 12Vin, 5Vout, Dual, 10kVDC Isolation, „A“ pinning, with CTRL pin
REM5E-0505S/R6/A/SMD	= 5Vin, 5Vout, Single, 6kVDC Isolation, „A“ pinning, SMD with CTRL pin
REM5E-2405D/R10/A/CTRL/X1	= 24Vin, 5Vout, Dual, 10kVDC Isolation, „A“ pinning, DIP24, CTRL pin and UVLO Option

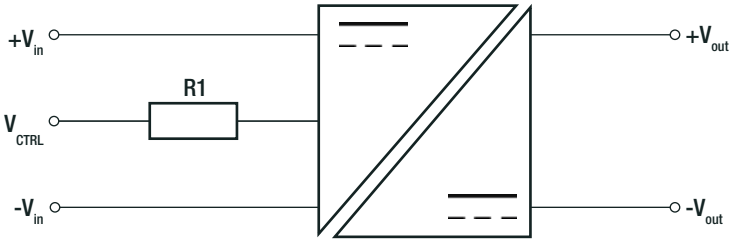
Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

BASIC CHARACTERISTICS					
Parameter	**Condition**		**Min.**	**Typ.**	**Max.**
Internal Input Filter					Pi-type
Input Voltage Range	nom. Vin = 5VDC nom. Vin = 12VDC nom. Vin = 24VDC nom. Vin = 48VDC		4.5VDC 9VDC 18VDC 36VDC	5VDC 12VDC 24VDC 48VDC	9VDC 18VDC 36VDC 75VDC
Under Voltage Lockout (UVLO) (/X1 version)	nom. Vin= 5VDC	DC-DC ON DC-DC OFF		 3.9VDC	4.5VDC
	nom. Vin= 12VDC	DC-DC ON DC-DC OFF		 7.9VDC	9VDC
	nom. Vin= 24VDC	DC-DC ON DC-DC OFF		 16.7VDC	18VDC
	nom. Vin= 48VDC	DC-DC ON DC-DC OFF		 34.3VDC	36VDC
Input Current	nom. Vin = 5VDC nom. Vin = 12VDC nom. Vin = 24VDC nom. Vin = 48VDC			1200mA 520mA 250mA 130mA	
Quiescent Current	nom. Vin = 5VDC nom. Vin = 12VDC nom. Vin = 24VDC nom. Vin = 48VDC				70mA 30mA 7mA 3.5mA
Minimum Load (7)				10%	
Start-up time				0.45ms	
Rise time				35ms	
Hold-up time				0.6ms	
ON/OFF CTRL	DC-DC ON DC-DC OFF				Open or 0VDC<V_{CTRL}<1.2VDC Short or 4.8VDC<V_{CTRL}<12VDC
Input Current of CTRL Pin	V_{CTRL}=5VDC			25mA	
Standby Current	DC-DC OFF				350µA
Internal Operating Frequency			120kHz		
Output Ripple and Noise (6)	20MHz BW				150mVp-p

Notes:

Note6: Measurements are made with a 0.1µF MLCC across output. (low ESR)

ON/OFF CTRL Option



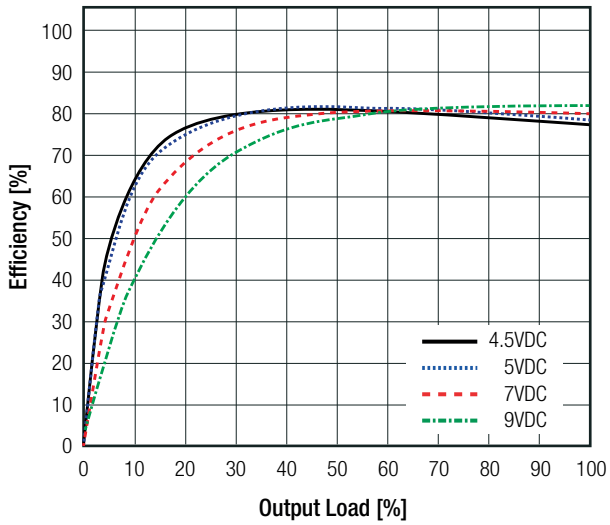
R1
470Ω

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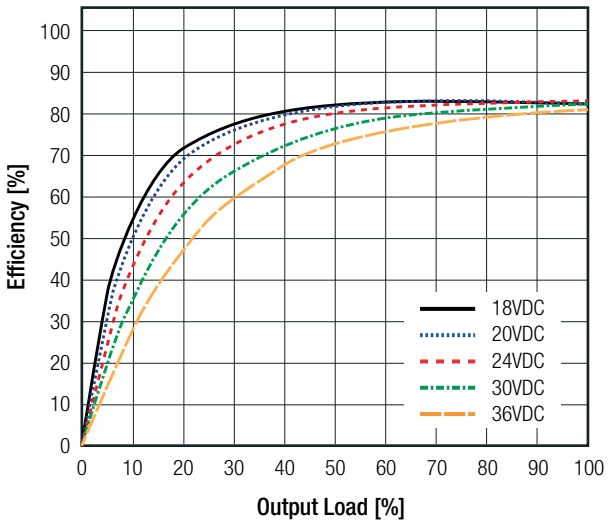
Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

Efficiency vs. Output Load

REM5E-0505S



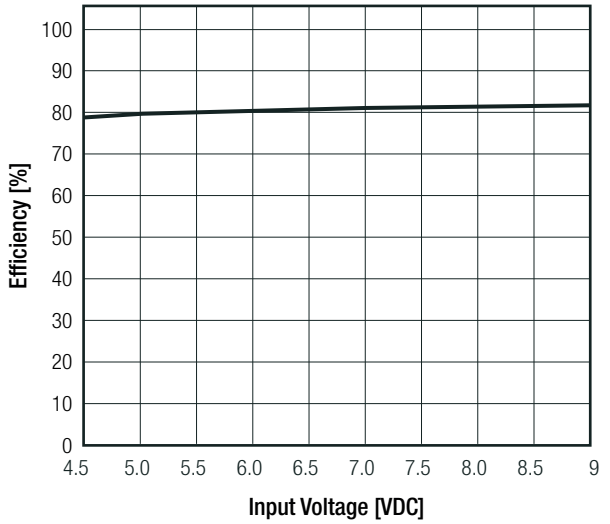
REM5E-2405S



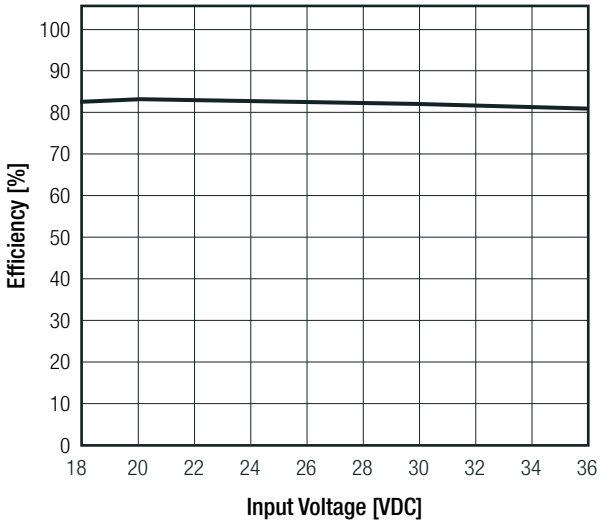
Efficiency vs. Input Voltage

(@ full Load)

REM5E-0505S



REM5E-2405S



REGULATIONS		
Parameter	**Condition**	**Value**
Output Accuracy		±1.5% typ.
Line Regulation	low line to high line, full load	±0.3% max.
Load Regulation (7)	10% to 100% load	0.5% typ.
Cross Regulation	dual output only	±5.0% max.
Transient Response	25% load step change	5ms

Notes:

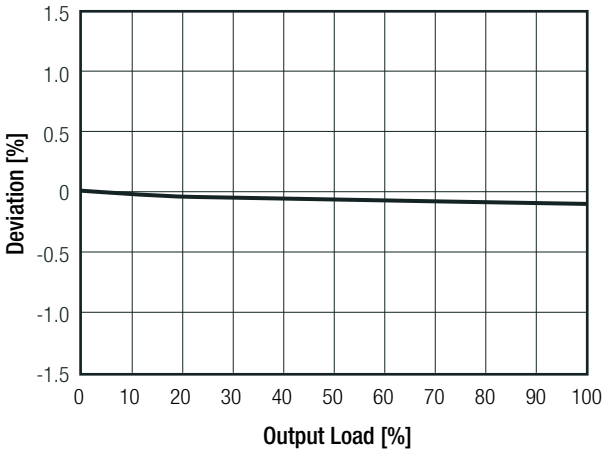
Note7: Operation below 10% load will not harm the converter, but specifications may not be met

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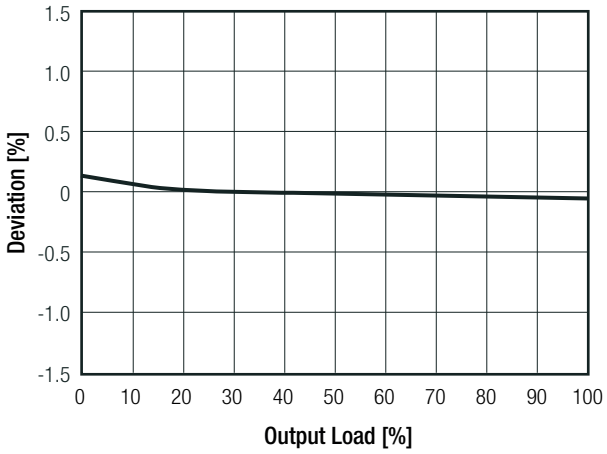
Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

Deviation vs. Load

REM5E-0505S



REM5E-2405S



PROTECTIONS

Parameter	Type			Value
Short Circuit Protection (SCP)	below 100mΩ			continuous, hiccup mode, automatic recovery
Isolation Voltage [8]	I/P to O/P	DIP24	"/R8" suffix	tested for 1 second rated for 1 minute	8kVDC 4kVAC/60Hz
			"/R10" suffix	tested for 1 second rated for 1 minute	10kVDC 5kVAC/60Hz
		SMD	"/R6" suffix	rated for 1 minute	6kVDC
Isolation Resistance					10GΩ min.
Isolation Capacitance					20pF typ.
Insulation Grade					reinforced
Leakage Current					0.8µA typ. / 1µA max.
Means of Protection	250VAC working voltage				2MOPP
Medical Device Classification					built-in power supply
Internal	clearance/creepage				>8mm
External	clearance/creepage				>8mm

Notes:

Note8: For repeat Hi-Pot testing, reduce the time and/or the test voltage

Note9: Refer to local safety regulations if input over-current protection is also required. Recommended fuse: slow blow type

ENVIRONMENTAL

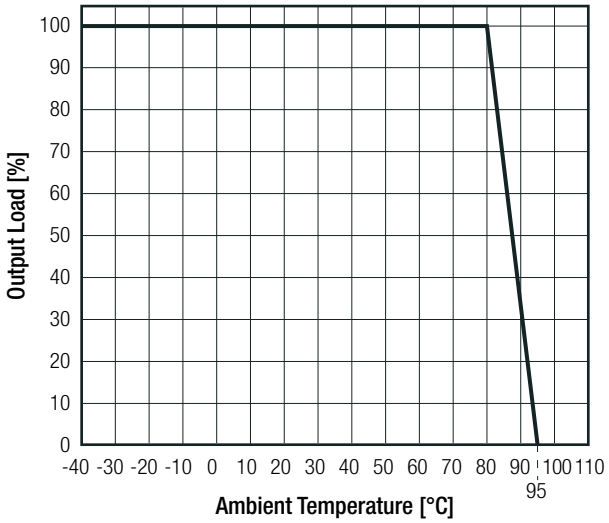
Parameter	Condition		Value
Operating Temperature Range	full load @ natural convection 0.1m/s (see graph)		-40°C to +80°C
Maximum Case Temperature			+105°C
Temperature Coefficient			±0.02%/K typ. / ±0.05%/K max.
Thermal Impedance	0.1m/s, horizontal		20K/W
Operating Altitude			3000m
Operating Humidity	non-condensing		5% - 95% RH max.
Pollution Degree			PD2
MTBF	according to MIL-HDBK-217F, G.B.	+25°C +80°C	2400 x 10^3 hours 510 x 10^3 hours

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Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

Derating Graph

(@ Chamber and natural convection 0.1m/s)



SAFETY AND CERTIFICATIONS		
Certificate Type (Safety)	**Report / File Number**	**Standard**
Medical Electric Equipment, General Requirements for Safety and Essential Performance	E314885	CAN/CSA-C22.2 No. 60601-1:14, 3rd Edition: 2014 ANSI/AAMI ES60601-1:2012
Medical Electric Equipment, General Requirements for Safety and Essential Performance (CB Scheme)	E314885	IEC60601-1:2005, 3rd Edition + AM1:2012
Medical Electric Equipment, General Requirements for Safety and Essential Performance	WD-SE-R-180524-A0	EN60601-1:2006 + A12:2014 IEC60601-1:2005, 3rd Edition + AM1:2012
RoHS 2		RoHS 2011/65/EU + AM2015/863

EMC Compliance	**Condition**	**Standard / Criterion**
Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement	with external filter refer to ***„EMC Filtering“***	EN55032, Class A and B
Information technology equipment - Immunity characteristics - Limits and methods of measurement		EN55024:2010 + A1:2015
ESD Electrostatic discharge immunity test	Air ±8kV, Contact ±4kV	IEC61000-4-2:2009, Criteria A
Radiated, radio-frequency, electromagnetic field immunity test	3V/m	IEC61000-4-3:2006 + A2:2010, Criteria A
Fast Transient and Burst Immunity	DC Power Port: ±1kV	IEC61000-4-4:2012, Criteria A
Surge Immunity	DC Power (Output) Port: ±0.5kV	IEC61000-4-5:2014 + A1:2017, Criteria A
Immunity to conducted disturbances, induced by radio-frequency fields	DC Power (Output) Port: 3V	IEC61000-4-6:2013 + C1:2015, Criteria A
Power Magnetic Field Immunity	50Hz, 1A/m	IEC61000-4-8:2010, Criteria A
Medical electrical equipment Part 1-2: Electromagnetic disturbances – Requirements and tests	with external filter	EN60601-1-2:2015 IEC60601-1-2:2014
Industrial, scientific and medical equipment – Radio frequency disturbance characteristics – Limits and methods of measurement		EN55011:2016+A1:2017, Class B
ESD Electrostatic discharge immunity test	Air ±15kV, Contact ±8kV	IEC61000-4-2:2008, EN61000-4-2:2009
Radiated, radio-frequency, electromagnetic field immunity test	10V/m	IEC61000-4-3:2006+A1:2007+A2:2010 EN61000-4-3:202006+A2:2010
Fast Transient and Burst Immunity	DC Power Port: ±2kV	IEC/EN61000-4-4:2012
Surge Immunity	DC Power (Output) Port: ±1kV	IEC/EN61000-4-5:2014+A1:2017
Immunity to conducted disturbances, induced by radio-frequency fields	DC Power (Output) Port: 3V, 6V	IEC61000-4-6:2013, EN61000-4-6:2014
Power Magnetic Field Immunity	50Hz, 30A/m	IEC61000-4-8:2009, EN61000-4-8:2010

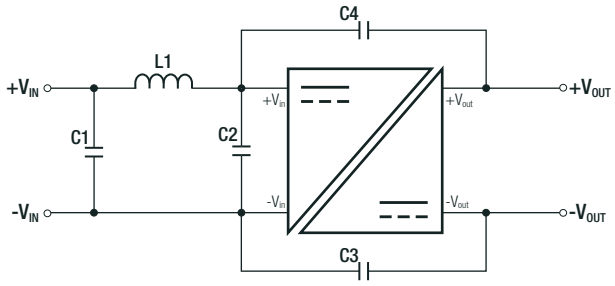
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Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

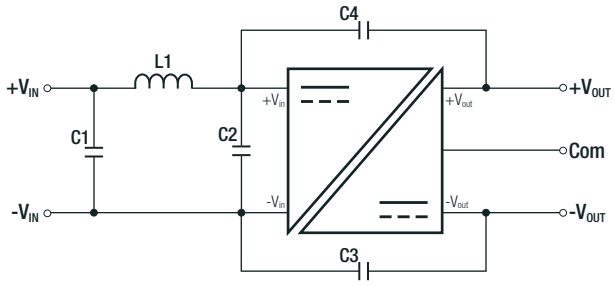
EMC Filtering Suggestions according to EN55032

Class A

Single output



Dual output

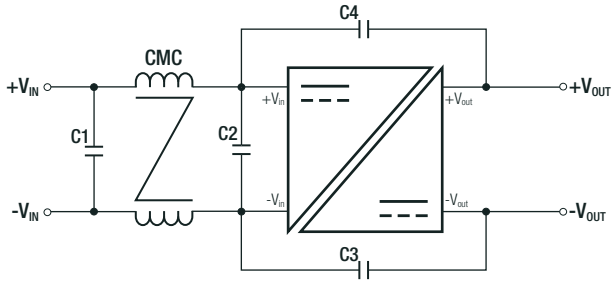


Component List Class A

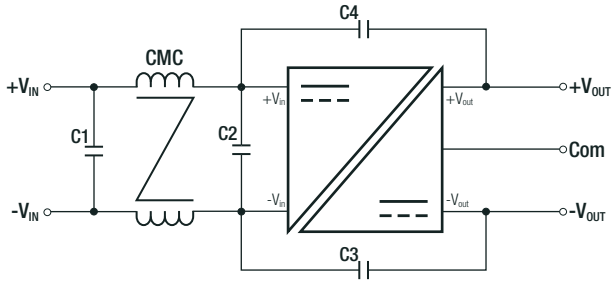
MODEL	C1	C2	C3	C4	L1
REM5E-05xxS/R/A and REM5E-12xxS/R/A	4.7µF/50V	N/A	100pF/12kV	N/A	3.3µH
REM5E-24xxS/R/A and REM5E-48xxS/R/A			150pF/12kV		
REM5E-05xxD/R/A and REM5E-12xxD/R/A	10µF/100V		100pF/12kV	100pF/12kV	
REM5E-24xxD/R/A and REM5E-48xxD/R/A			150pF/12kV	150pF/12kV	

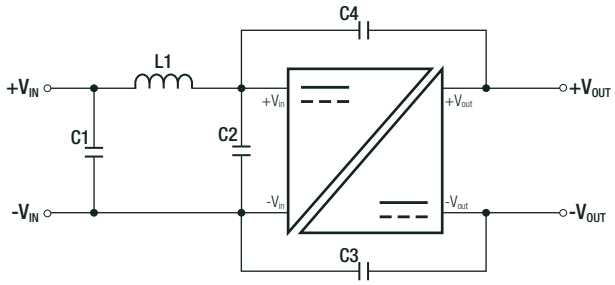
Class B

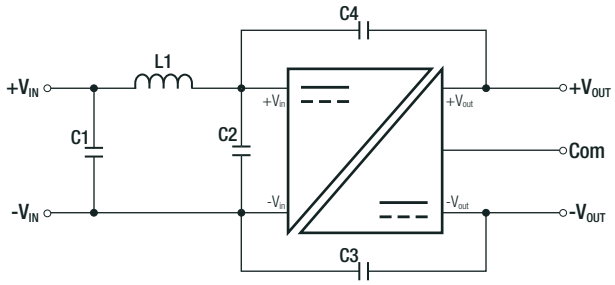
Single output



Dual output







Component List Class B

MODEL	C1	C2	C3	C4	L1	CMC
REM5E-05xxS/R/A	4.7µF/50V	N/A	100pF/12kV	N/A	N/A	0.2mH
REM5E-12xxS/R/A		4.7µF/50V	220pF/12kV		50µH	N/A
REM5E-24xxS/R/A	10µF/100V	10µF/100V	220pF/12kV			
REM5E-48xxS/R/A			330pF/12kV		N/A	1mH
REM5E-05xxD/R/A	4.7µF/50V	N/A	100pF/12kV	100pF/12kV		0.2mH
REM5E-12xxD/R/A		4.7µF/50V	220pF/12kV	220pF/12kV	50µH	N/A
REM5E-24xxD/R/A	10µF/100V	10µF/100V	220pF/12kV	220pF/12kV		
REM5E-48xxD/R/A			330pF/12kV	330pF/12kV	N/A	1mH

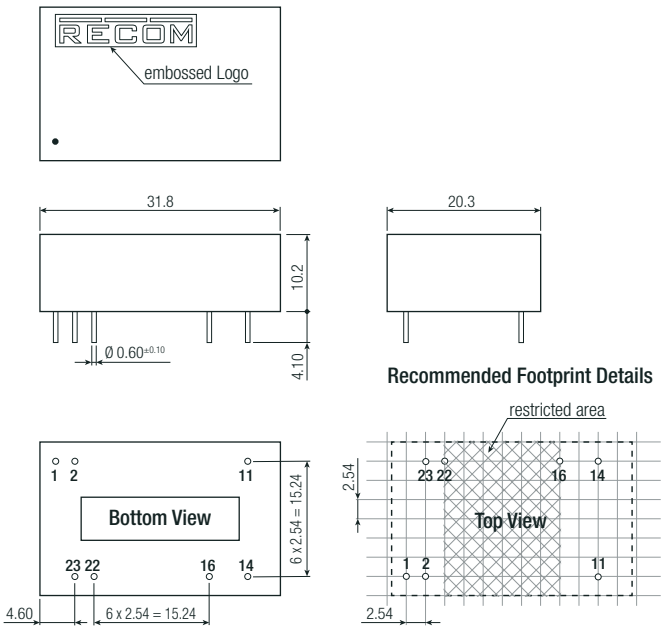
Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

DIMENSION and PHYSICAL CHARACTERISTICS

Parameter	Type	Value
Material	baseplate case potting	non-conductive black plastic, (UL94 V-0) non-conductive black plastic, (UL94 V-0) silicone, (UL94 V-0)
Dimension (LxWxH)	DIP24 SMD	31.8 x 20.3 x 10.2mm 31.8 x 20.3 x 10.9mm
Weight		14g typ.

Dimension Drawing (mm)

DIP24

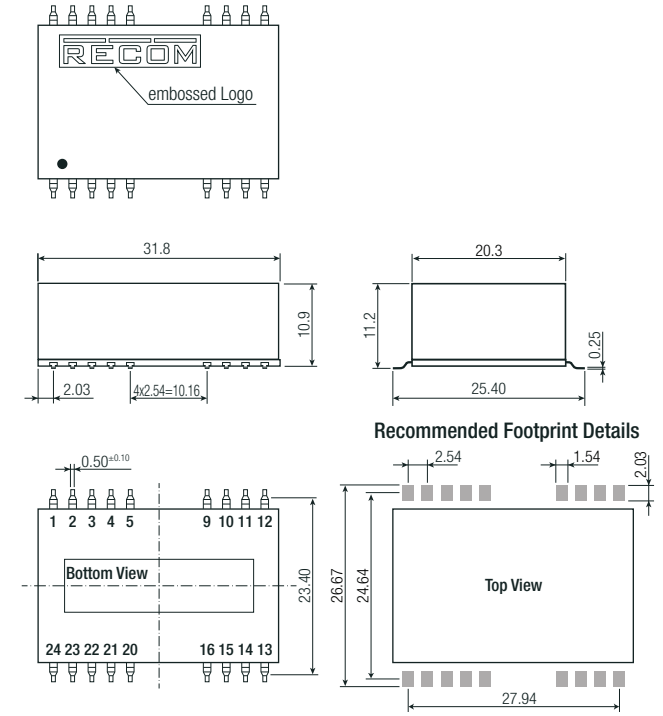


Pin Connections

Pin #	Single	Dual
1	CTRL (4)	CTRL (4)
2	-Vin	-Vin
11	NC	-Vout
14	+Vout	+Vout
16	-Vout	Com
22	+Vin	+Vin
23	+Vin	+Vin

Tolerance:
xx.x ± 0.5mm
xx.xx ± 0.25mm

SMD



Pin Connections

Pin #	Single	Dual
1	CTRL	CTRL
2	-Vin	-Vin
3, 4, 5, 9, 10	NC	NC
11	NC	-Vout
12, 13, 15	NC	NC
14	+Vout	+Vout
16	-Vout	Com
20, 21, 24	NC	NC
22	+Vin	+Vin
23	+Vin	+Vin

Tolerance:
xx.x ± 0.5mm
xx.xx ± 0.35mm

Specifications (measured @ Ta= 25°C, nom. Vin, full load and after warm-up unless otherwise stated)

PACKAGING INFORMATION			
Parameter	**Type**		**Value**
Packaging Dimension (LxWxH)	tube	DIP24	520.0 x 22.7 x 18.3mm
		SMD	530.0 x 30.3 x 19.2mm
Packaging Quantity	tube		15pcs
Storage Temperature Range			-55°C to +125°C
Storage Humidity			95% RH max.

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