



**THE DATASHEET OF
REM1-3.33.3S**



Features

Unregulated Converter

- Medical grade DC/DC converter
- 250VAC working, 2MOPP
- 5.2kVDC isolation for 250VAC working voltage
- -40°C up to +90°C operating temperature
- 3rd Ed. safety and 4th. Ed. EMC

REM1

**1 Watt
SIP7
Single Output**



**2MOPP
250VAC**

IEC/EN60601-1 certified
ANSI/AAMI ES60601-1 certified
EN62368-1 certified
IEC/EN60601-1-2
EN55011
CB Report

Description

The REM1 complements the existing board-mount REM3, REM6 and REM10 series by offering a 1W medical grade unregulated DC/DC converter in a more compact SIP7 package. The REM1 features reinforced 5.2kVDC/1 minute isolation and 2MOPP/250VAC working voltage. The REM1 is available with 3.3, 5, 12, 15 or 24V inputs and offers 3.3, 5 or 12V outputs with up to 85% efficiency. The operating temperature range is -40°C up to +90°C. The converter is Class B EMC and 60601-1-2 (4th Ed.) medical EMC certified using a simple external LC filter. The converters are fully certified to CB, IEC/EN and ANSI/AAMI 60601 third edition safety standards, RoHS2+ (10/10) and REACH and come with a 5 year warranty.

Selection Guide

| Part Number | nom. Input Voltage [VDC] | Output Voltage [VDC] | Output Current [mA] | Efficiency typ. ⁽¹⁾ [%] | Max. Capacitive Load ⁽²⁾ [µF] |
|--------------|--------------------------|----------------------|---------------------|------------------------------------|--|
| REM1-3.33.3S | 3.3 | 3.3 | 303 | 78 | 2200 |
| REM1-3.305S | 3.3 | 5 | 200 | 81 | 2200 |
| REM1-3.312S | 3.3 | 12 | 84 | 85 | 470 |
| REM1-053.3S | 5 | 3.3 | 303 | 79 | 2200 |
| REM1-0505S | 5 | 5 | 200 | 80 | 2200 |
| REM1-0512S | 5 | 12 | 84 | 84 | 470 |
| REM1-123.3S | 12 | 3.3 | 303 | 78 | 2200 |
| REM1-1205S | 12 | 5 | 200 | 81 | 2200 |
| REM1-153.3S | 15 | 3.3 | 303 | 77 | 2200 |
| REM1-1505S | 15 | 5 | 200 | 81 | 2200 |
| REM1-243.3S | 24 | 3.3 | 303 | 76 | 2200 |
| REM1-2405S | 24 | 5 | 200 | 80 | 2200 |

Notes:

Note1: Efficiency tested by nominal input and full load at +25°C ambient

Note2: Max Cap Load tested by nominal input and full resistive load

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

| BASIC CHARACTERISTICS | | | | |
|-------------------------|-----------------|------|------|-----------|
| Parameter | Condition | Min. | Typ. | Max. |
| Internal Input Filter | | | | capacitor |
| Input Voltage Range | | | ±10% | |
| Maximum Reverse Voltage | | | | 0VDC |
| Quiescent Current | 3.3VDC | | | 40mA |
| | 5VDC | | | 25mA |
| | nom. Vin= 12VDC | | | 12mA |
| | 15VDC | | | 10mA |
| | 24VDC | | | 7mA |
| continued on next page | | | | |

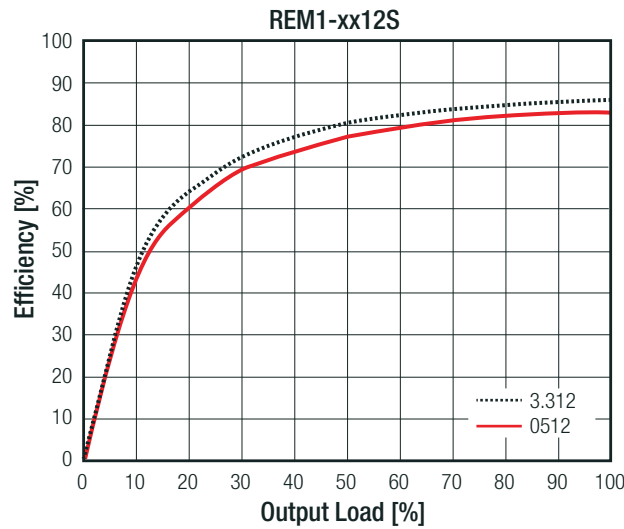
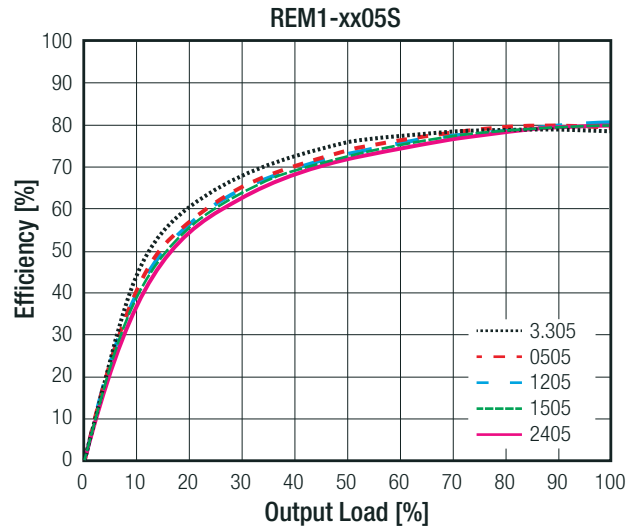
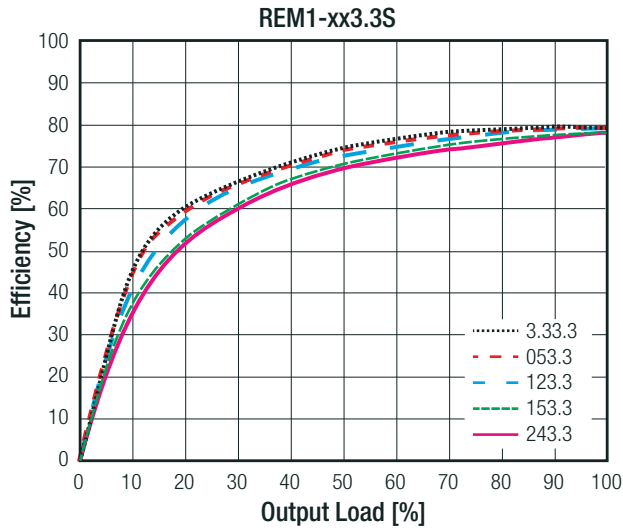
Specifications (measured @ Ta= 25°C, nominal input voltage, full load and after warm-up)

| Parameter | Condition | Min. | Typ. | Max. |
|--|-----------|------|-------|---------|
| Internal Operating Frequency | | | 40kHz | |
| Minimum Load | | | 0% | |
| Output Ripple and Noise ⁽³⁾ | 20MHz BW | | | 75mVp-p |

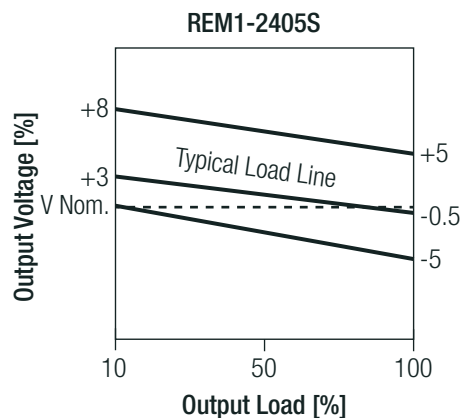
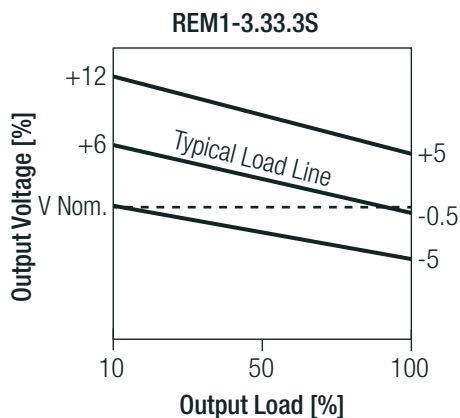
Notes:

Note3: Measurements are made with a 0.1µF MLCC across output. (low ESR)

Efficiency vs. Load



Tolerance Envelope

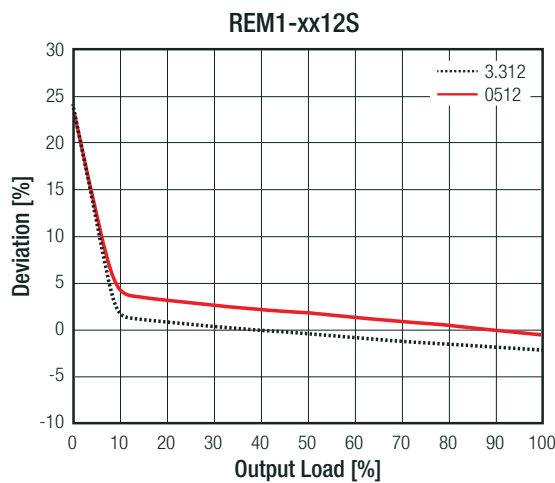
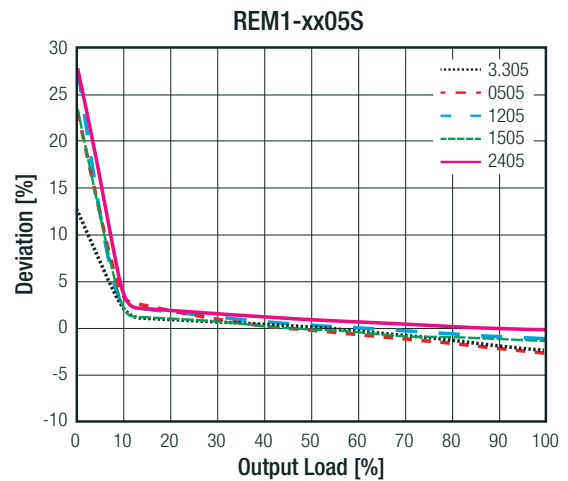
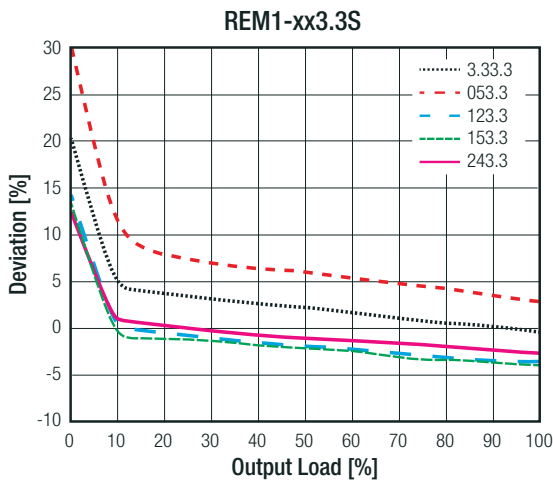


Specifications (measured @ Ta= 25°C, nominal input voltage, full load and after warm-up)

REGULATIONS

| Parameter | Condition | | Value |
|-----------------|----------------------------------|-----------------------------|---|
| Output Accuracy | | | ±5% max. |
| Line Regulation | low line to high line, full load | | ±1.2% typ. @ 1% of Vin |
| Load Regulation | 10% to 100% load | 3.3Vout and 5Vout 12Vout | 8% typ. / 12% max. 5% typ. / 8% max. |

Deviation vs. Load



PROTECTIONS

| Parameter | Type | | Value |
|----------------------------------|------------------------|---------------------|-----------------------|
| Isolation Voltage ⁽⁴⁾ | I/P to O/P | tested for 1 minute | 5.2kVDC 4kVAC |
| Isolation Resistance | | | 10GΩ min. |
| Isolation Capacitance | | | 25pF typ. |
| Insulation Grade | | | reinforced |
| Means of Protection | 250VAC working voltage | | 2MOPP |
| Medical Device Classification | | | built-in power supply |
| Creepage and Clearance | | | ≥8mm |

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: T1A slow blow type

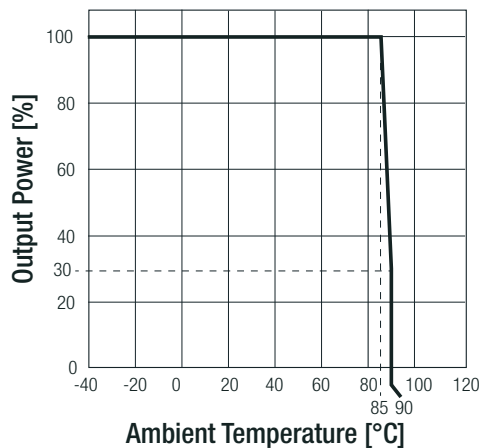
Specifications (measured @ Ta= 25°C, nominal input voltage, full load and after warm-up)

ENVIRONMENTAL

| Parameter | Condition | | Value |
|-----------------------------|--|----------------|---|
| Operating Temperature Range | without derating (see graph) | | -40°C °C to +85°C |
| Maximum Case Temperature | | | 105°C |
| Temperature Coefficient | | | 0.02%/K typ. |
| Operating Altitude | according to IEC/EN60601-1 accroding to IEC/EN62368-1 | | 3000m 5000m |
| Operating Humidity | non-condensing | | 5% - 95% RH max. |
| Pollution Degree | | | PD2 |
| MTBF | according to MIL-HDBK-217F, G.B. | +25°C +85°C | 18200 x 10 ³ hours 7500 x 10 ³ hours |
| Vibration | | | according to MIL-STD-202G standard |

Derating Graph

(@ chamber and natural convection 0.1 m/s)



SAFETY AND CERTIFICATIONS

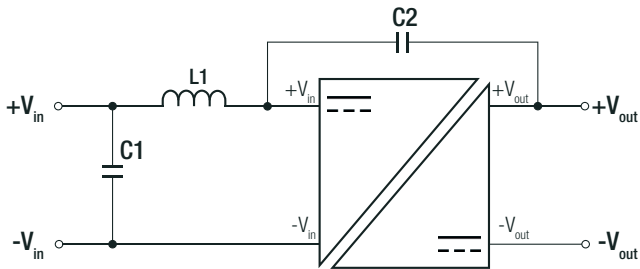
| Certificate Type (Safety) | Report / File Number | Standard |
|--|--------------------------|---|
| Audio/video, information and communication technology equipment. Safety requirements (CB Scheme) | L0339m31-A-L | EN62368-1:2014 |
| Medical Electric Equipment, General Requirements for Safety and Essential Performance | E314885-D1000-1/A0/C0-UL | ANSI/AAMI ES60601-1:2005/®2012 + A1:2012 + C1:2009/®2012 + A2:2010/®2012 CSA C22.2 No. 60601-1:14, 3rd Edition, 2014 |
| Medical Electric Equipment, General Requirements for Safety and Essential Performance | E314885-D1000-1/A0/C0-CB | IEC60601-1:2005 +AM1:2012 EN60601-1:2006 + A12:2014 |
| EAC | RU-AT.49.09571 | TP TC 004/2011 TP TC 004/2011 |
| RoHS2+ | | RoHS-2011/65/EU + AM-2015/863 |

| EMC Compliance | Condition | Standard / Criterion |
|---|---------------------------|---------------------------------------|
| Medical electrical equipment - Part 1-2: General requirements for basic safety and essential performance - Collateral standard: Electromagnetic compatibility | | IEC60601-1-2:2014 EN60601-1-2:2015 |
| Industrial, scientific and medical equipment - Radio frequency disturbance characteristics - Limits and methods of measurement | with external filter | EN55011, 2009+A1:2010, Class B |
| ESD Electrostatic discharge immunity test | Air: ±15kV; Contact: ±8kV | IEC61000-4-2:2008 , 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 Port: ±2kV | IEC61000-4-4:2012, Criteria A |
| Surge Immunity | DC Port: ±1kV | IEC61000-4-5:2014, Criteria B |
| Immunity to conducted disturbances, induced by radio-frequency fields | DC Port: 6V | IEC61000-4-6:2013, Criteria A |
| Power Magnetic Field Immunity | 50Hz, 30A/m | IEC61000-4-8:2009, Criteria A |

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

EMC Filtering Suggestions according to EN55011



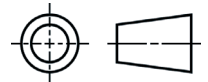
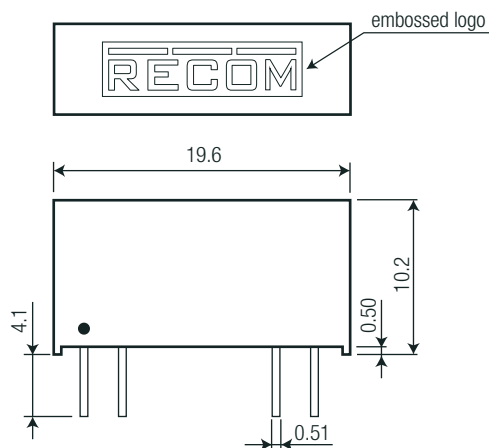
Component List Class B

| Input Voltage | C1 | C2 | L1 |
|---------------|-------|-------------|------------|
| 3.3VDC | 4.7µF | 470pF/6kVDC | 22µH Choke |
| 5VDC | | | |
| 12VDC | | | |
| 15VDC | 2.2µF | | 47µH Choke |
| 24VDC | | | |

DIMENSION and PHYSICAL CHARACTERISTICS

| Parameter | Type | Value |
|-------------------|---------|---------------------------|
| Material | case | black plastic, (UL94 V-0) |
| | potting | silicone (UL94 V-0) |
| | PCB | FR4 (UL94 V-0) |
| Dimension (LxWxH) | | 19.6 x 6.0 x 10.2mm |
| Weight | | 2.6g typ. |

Dimension Drawing (mm)

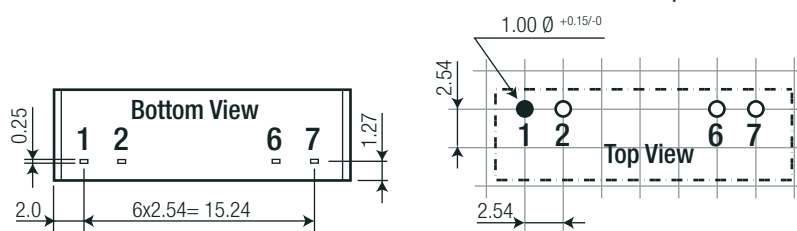


Pin Connections

| Pin # | Single |
|-------|--------|
| 1 | +Vin |
| 2 | -Vin |
| 6 | -Vout |
| 7 | +Vout |

Tolerance: xx.x= ±0.5mm
 xx.xx= ±0.25mm
 Pin dimension: ±0.1mm

Recommended Footprint Detail





PACKAGING INFORMATION

| Parameter | Type | Value |
|-----------------------------|----------------|----------------------|
| Packaging Dimension (LxWxH) | tube | 520.0 x 16.0 x 9.3mm |
| Packaging Quantity | | 25pcs |
| Storage Temperature Range | | -55°C to +125°C |
| Storage Humidity | non-condensing | 95% RH max. |

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