

- SIL8 Package Highest Power Density
- Wide Input Range 2:1
- Regulated Output
- Efficiency up to 90 %
- Low Ripple and Noise
- Isolation 1600 VDC
- Continuous Short Circuit Protection
- Operation Temperature Range -40 ~ 85 °C max.
- Metal Case
- Smallest Footprint 9W Converter
- Remote ON OFF Control

RoHS



Picture similar

Number Structure

| RS5              | -             | 48 | 05             | RS             | 90       | A              | 1                 |
|------------------|---------------|----|----------------|----------------|----------|----------------|-------------------|
| Series / Package | Input Voltage |    | Output Voltage | Output Type    | Power    | Int. Code      | Isolation Voltage |
| RS5 = SIL8       | 12 = 12 Vdc   |    | 03 = 3.3 Vdc   | RS = Regulated | 90 = 9 W | Logistics Code | 1 = 1600 Vdc      |
|                  | 24 = 24 Vdc   |    | 05 = 5.0 Vdc   | - Single Out.  |          |                |                   |
|                  | 48 = 48 Vdc   |    | 09 = 9.0 Vdc   | RD = Regulated |          |                |                   |
|                  |               |    | 12 = 12 Vdc    | - Dual Out.    |          |                |                   |
|                  |               |    | 15 = 15 Vdc    |                |          |                |                   |
|                  |               |    | 24 - 24 Vdc    |                |          |                |                   |

Model Selection Guide

| Model Number   | Input Voltage Range (VDC) | Input Current      |                      | Output Voltage (VDC) | Output Current |                | Efficiency @ FL (% , typ.) | Capacitive Load @ FL (µF, max.) |
|----------------|---------------------------|--------------------|----------------------|----------------------|----------------|----------------|----------------------------|---------------------------------|
|                |                           | No-Load (mA, max.) | Full Load (mA, typ.) |                      | Min. Load (mA) | Full Load (mA) |                            |                                 |
| RS5-1203RS90A1 | 9-18                      | 15                 | 688                  | 3.3                  | 0              | 2000           | 80                         | 2600                            |
| RS5-1205RS90A1 | 9-18                      | 15                 | 794                  | 5                    | 0              | 1600           | 84                         | 1300                            |
| RS5-1209RS90A1 | 9-18                      | 15                 | 862                  | 9                    | 0              | 1000           | 87                         | 800                             |
| RS5-1212RS90A1 | 9-18                      | 15                 | 852                  | 12                   | 0              | 750            | 88                         | 560                             |
| RS5-1215RS90A1 | 9-18                      | 15                 | 852                  | 15                   | 0              | 600            | 88                         | 470                             |
| RS5-1224RS90A1 | 9-18                      | 15                 | 843                  | 24                   | 0              | 375            | 89                         | 200                             |
| RS5-2403RS90A1 | 18-36                     | 15                 | 344                  | 3.3                  | 0              | 2000           | 80                         | 2600                            |
| RS5-2405RS90A1 | 18-36                     | 15                 | 397                  | 5                    | 0              | 1600           | 84                         | 1300                            |
| RS5-2409RS90A1 | 18-36                     | 15                 | 431                  | 9                    | 0              | 1000           | 87                         | 800                             |
| RS5-2412RS90A1 | 18-36                     | 15                 | 426                  | 12                   | 0              | 750            | 88                         | 560                             |
| RS5-2415RS90A1 | 18-36                     | 15                 | 421                  | 15                   | 0              | 600            | 89                         | 470                             |
| RS5-2424RS90A1 | 18-36                     | 15                 | 421                  | 24                   | 0              | 375            | 89                         | 200                             |
| RS5-4803RS90A1 | 36-75                     | 10                 | 170                  | 3.3                  | 0              | 2000           | 81                         | 2600                            |
| RS5-4805RS90A1 | 36-75                     | 10                 | 198                  | 5                    | 0              | 1600           | 84                         | 1300                            |
| RS5-4809RS90A1 | 36-75                     | 10                 | 213                  | 9                    | 0              | 1000           | 88                         | 800                             |
| RS5-4812RS90A1 | 36-75                     | 10                 | 213                  | 12                   | 0              | 750            | 88                         | 560                             |
| RS5-4815RS90A1 | 36-75                     | 10                 | 211                  | 15                   | 0              | 600            | 89                         | 470                             |
| RS5-4824RS90A1 | 36-75                     | 10                 | 211                  | 24                   | 0              | 375            | 89                         | 200                             |
|                |                           |                    |                      |                      |                |                |                            |                                 |
| RS5-1205RD90A1 | 9-18                      | 15                 | 794                  | ±5                   | 0              | ±800           | 84                         | ±800                            |
| RS5-1212RD90A1 | 9-18                      | 15                 | 852                  | ±12                  | 0              | ±375           | 88                         | ±390                            |
| RS5-1215RD90A1 | 9-18                      | 15                 | 862                  | ±15                  | 0              | ±300           | 87                         | ±200                            |
| RS5-2405RD90A1 | 18-36                     | 15                 | 402                  | ±5                   | 0              | ±800           | 83                         | ±800                            |
| RS5-2412RD90A1 | 18-36                     | 15                 | 426                  | ±12                  | 0              | ±375           | 88                         | ±390                            |
| RS5-2415RD90A1 | 18-36                     | 15                 | 426                  | ±15                  | 0              | ±300           | 88                         | ±200                            |
| RS5-4805RD90A1 | 36-75                     | 10                 | 194                  | ±5                   | 0              | ±800           | 86                         | ±800                            |
| RS5-4812RD90A1 | 36-75                     | 10                 | 211                  | ±12                  | 0              | ±375           | 89                         | ±390                            |
| RS5-4815RD90A1 | 36-75                     | 10                 | 208                  | ±15                  | 0              | ±300           | 90                         | ±200                            |

ALL SPECIFICATIONS ARE TYPICAL AT 25 °C, NOMINAL INPUT AND FULL LOAD UNLESS OTHERWISE NOTED.

| Input Specifications                                                                                                     |                                         |            |                                        |      |      |         |
|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|------------|----------------------------------------|------|------|---------|
| Parameter                                                                                                                | Conditions                              |            | Min.                                   | Typ. | Max. | Unit    |
| Input Voltage Range                                                                                                      | 12 Vdc Input                            |            | 9                                      | 12   | 18   | VDC     |
|                                                                                                                          | 24 Vdc Input                            |            | 18                                     | 24   | 36   |         |
|                                                                                                                          | 48 Vdc Input                            |            | 36                                     | 48   | 75   |         |
| Under Voltage Protection                                                                                                 | 12 Vdc Input                            | Module ON  |                                        | 8.9  |      | VDC     |
|                                                                                                                          |                                         | Module OFF |                                        | 7.0  |      |         |
|                                                                                                                          | 24 Vdc Input                            | Module ON  |                                        | 16.0 |      |         |
|                                                                                                                          |                                         | Module OFF |                                        | 13.0 |      |         |
|                                                                                                                          | 48 Vdc Input                            | Module ON  |                                        | 33.0 |      |         |
|                                                                                                                          |                                         | Module OFF |                                        | 30.0 |      |         |
| Input Current ( No Load )                                                                                                |                                         |            | See Table                              |      |      | mA      |
| Input Current ( Full Load )                                                                                              |                                         |            | See Table                              |      |      | mA      |
| Input Filter                                                                                                             |                                         |            | Capacitor                              |      |      | -       |
| Input Reflected Ripple Current <sup>(1)</sup>                                                                            |                                         |            |                                        |      | 30   | mApk-pk |
| Start up Time                                                                                                            | Nominal Vin and constant resistive load |            |                                        | 50   |      | ms      |
| Remote ON OFF Control                                                                                                    | Module ON                               |            | open or high impedance                 |      |      |         |
|                                                                                                                          | Module OFF                              |            | 2 mA - 4 mA input current ( via 1 kΩ ) |      |      |         |
|                                                                                                                          | OFF idle current                        |            |                                        | 2.5  |      | mA      |
| Recommended input fuse<br>( slow blow )                                                                                  | 12 Vdc Input                            |            |                                        | 2    |      | A       |
|                                                                                                                          | 24 Vdc Input                            |            |                                        | 1    |      |         |
|                                                                                                                          | 48 Vdc Input                            |            |                                        | 0.5  |      |         |
| Note : 1. Measured with a simulated source inductance of 12 μH and a source capacitor Cin (47 μF, ESR < 1 Ω at 100 kHz). |                                         |            |                                        |      |      |         |

| Output Specifications                                                                                                                     |                                         |                                 |                                   |      |       |         |
|-------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|---------------------------------|-----------------------------------|------|-------|---------|
| Parameter                                                                                                                                 | Conditions                              |                                 | Min.                              | Typ. | Max.  | Unit    |
| Output Voltage Accuracy                                                                                                                   |                                         |                                 | -1.0                              |      | +1.0  | %       |
| Line Regulation                                                                                                                           |                                         |                                 | -0.2                              |      | +0.2  | %       |
| Load Regulation                                                                                                                           | From 0 % to 100 % Load                  | Single Output                   | -0.5                              |      | +0.5  | %       |
|                                                                                                                                           |                                         | 3.3 V Output                    | -1.0                              |      | +1.0  |         |
|                                                                                                                                           |                                         | Dual Output<br>( Balance load ) | -1.0                              |      | +1.0  |         |
| Cross Regulation                                                                                                                          | Asymmetrical Load 25 % / 100 % for Dual |                                 | -5                                |      | +5    | %       |
| Ripple & Noise <sup>(1)</sup>                                                                                                             | 20 MHz Bandwidth                        |                                 |                                   |      | 75    | mVpk-pk |
| Over Voltage Protection                                                                                                                   |                                         |                                 |                                   | 130  |       | %       |
| Over Load Protection                                                                                                                      |                                         |                                 |                                   | 150  |       | %       |
| Short Circuit Protection                                                                                                                  |                                         |                                 | Indefinite ( Automatic Recovery ) |      |       | -       |
| Temperature Coefficient                                                                                                                   |                                         |                                 | -0.02                             |      | +0.02 | %/°C    |
| Maximum Capacitive Load                                                                                                                   | Minimum Vin and constant resistive load |                                 | See Table                         |      |       | -       |
| Transient Recovery Time <sup>(2)</sup>                                                                                                    | see Note 2                              | For All models                  |                                   | 250  |       | µs      |
| Transient Response Deviation <sup>(2)</sup>                                                                                               | see Note 2                              | 3.3V & 5V Output                | -5                                |      | +5    | %       |
|                                                                                                                                           |                                         | Other Output                    | -3                                |      | +3    |         |
| Note : 1. Measured with a 0.1 µF MLCC and 10 µF Electrolytic capacitor<br>2. Nominal Vin and 25% load step change ( 75%-50%-25% of load ) |                                         |                                 |                                   |      |       |         |

| Absolute Maximum Ratings                                                                                                    |                               |      |      |      |      |
|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------|------|------|------|------|
| Parameter                                                                                                                   | Conditions                    | Min. | Typ. | Max. | Unit |
| Input Surge Voltage ( 100 ms )                                                                                              | 12 Vdc Input                  |      |      | 25   | VDC  |
|                                                                                                                             | 24 Vdc Input                  |      |      | 50   |      |
|                                                                                                                             | 48 Vdc Input                  |      |      | 100  |      |
| Soldering Temperature                                                                                                       | 1.5 mm from case 10 sec. max. |      |      | 260  | °C   |
| Note : These are stress ratings. Exposure of devices to any of these conditions may adversely affect long-term reliability. |                               |      |      |      |      |

| General Specifications      |                                     |                  |      |      |         |
|-----------------------------|-------------------------------------|------------------|------|------|---------|
| Parameter                   | Conditions                          | Min.             | Typ. | Max. | Unit    |
| Efficiency                  |                                     | See Table        |      |      | %       |
| Isolation Voltage           | Input-output, and rated for 60 sec. | 1600             |      |      | VDC     |
|                             | Case-I/O, and rated for 60 sec.     | 1000             |      |      |         |
| Isolation Resistance        | Input-output                        | 1000             |      |      | MΩ      |
| Isolation Capacitance       | Input-output                        |                  |      | 50   | pF      |
| Switching Frequency         | 12 Vdc Input                        |                  | 400  |      | kHz     |
|                             | 24 Vdc Input                        |                  | 400  |      |         |
|                             | 48 Vdc Input                        |                  | 500  |      |         |
| Reliability Calculated MTBF | MIL-HDBK-217 F @ 25 °C              | 900              |      |      | k hours |
| Safety Standard             | IEC / EN / UL 62368-1               | Designed to meet |      |      |         |
| Environmental compliance    | RoHS                                | Designed to meet |      |      |         |

| Environmental Specifications  |                        |             |      |      |          |
|-------------------------------|------------------------|-------------|------|------|----------|
| Parameter                     | Conditions             | Min.        | Typ. | Max. | Unit     |
| Operating Ambient Temperature | See the Derating Curve | -40         |      | 85   | °C       |
| Maximum Case Temperature      |                        |             |      | 100  | °C       |
| Thermal Impedance             |                        | 33.2        |      |      | °C/W     |
| Storage Humidity              |                        |             |      | 95   | % rel. H |
| Storage Temperature           |                        | -55         |      | 125  | °C       |
| Cooling                       | Natural Convection     | 30 - 65 LFM |      |      |          |

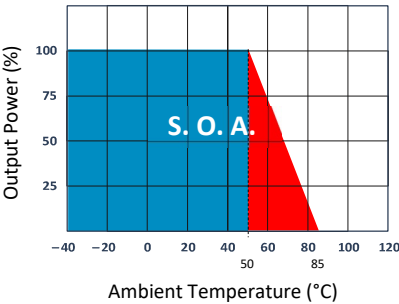
| EMC Specifications  |               |                                |           |
|---------------------|---------------|--------------------------------|-----------|
| Parameter           | Standard      | Condition                      | Criterion |
| Conducted Emissions | EN55032       | with external components       | A         |
| Radiated Emissions  | EN55032       | with external components       | A         |
| ESD                 | IEC 61000-4-2 | Contact: ±6 kV                 | B         |
| RS                  | IEC 61000-4-3 | 20 V/m                         | A         |
| EFT                 | IEC 61000-4-4 | ±2 kV with external components | A         |
| Surge               | IEC 61000-4-5 | ±2 kV with external components | A         |
| CS                  | IEC 61000-4-6 | 10 Vrms                        | A         |
| PFMF                | IEC 61000-4-8 | 100 A/m                        | A         |

| Physical Specifications |                         |
|-------------------------|-------------------------|
| Parameter               | Value                   |
| Case Material           | Copper                  |
| Pin Material            | Tinned copper           |
| Potting Material        | Epoxy ( UL94V-0 rated ) |
| Weight                  | 4.5 g , typ.            |
| Dimensions              | 0.86" x 0.38" x 0.44"   |

Thermal Derating

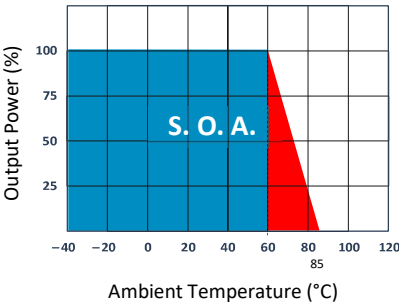
To enhance the system reliability, the power module should always be operated below the maximum operating temperature. If the temperature exceeds the maximum operating temperature, reliability of the unit may be affected.

Temperature Derating Curve



3.3 VDC Models

Temperature Derating Curve

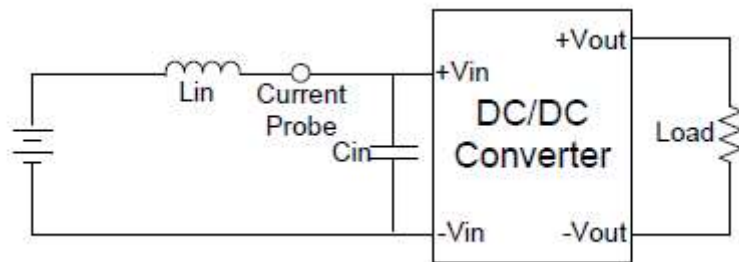


Other Models

## Test Configurations

### Input Reflected Ripple Current Test Step

Input reflected ripple current is measured with a source inductor  $L_{in}$  ( 12  $\mu$ H ) and a source capacitor  $C_{in}$  ( 47  $\mu$ F, ESR < 1.0  $\Omega$  at 100 kHz ) at nominal input and full load.

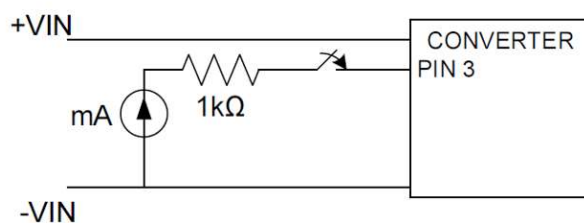


## Remote Module ON / OFF

### Remote Module ON / OFF

ON: Open or high impedance

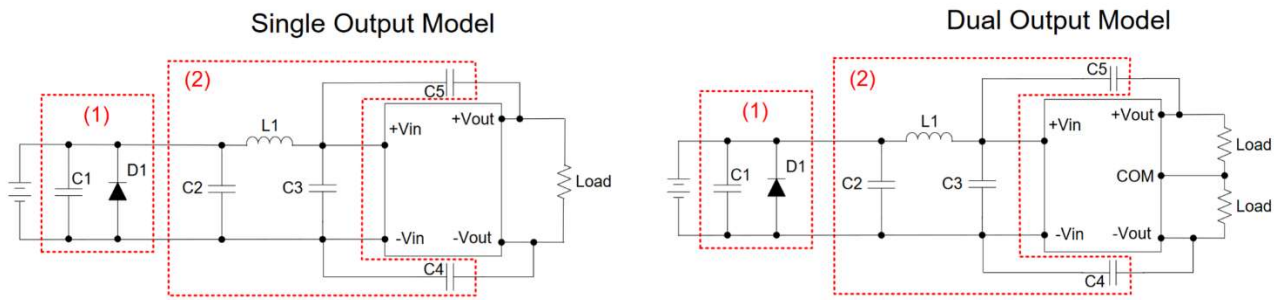
OFF: Input current ( 2 mA ~ 4 mA ) via 1 k $\Omega$  to Pin3



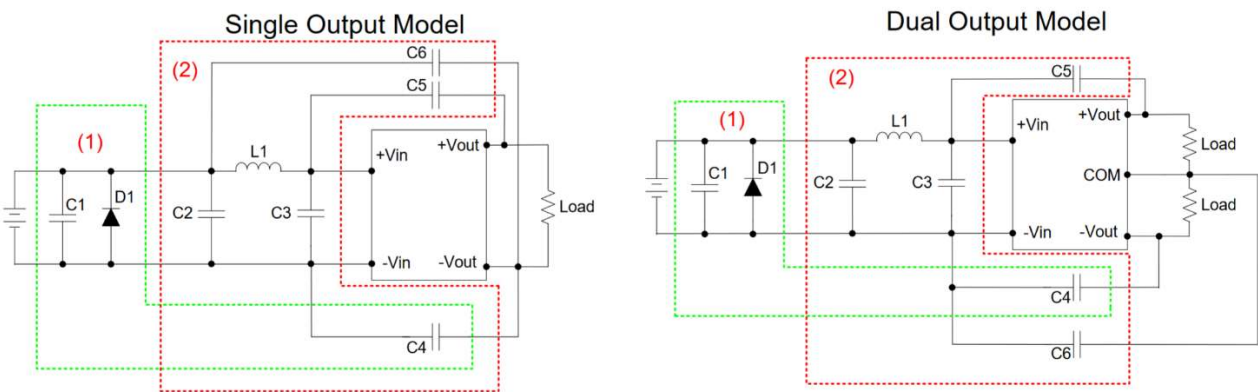
EMC Filter

The part (1) Circuit is used to meet Surge & EFT test, and the part (2) Circuit is used to meet EMI test.

12 Vdc & 24 Vdc Input



48 Vdc Input



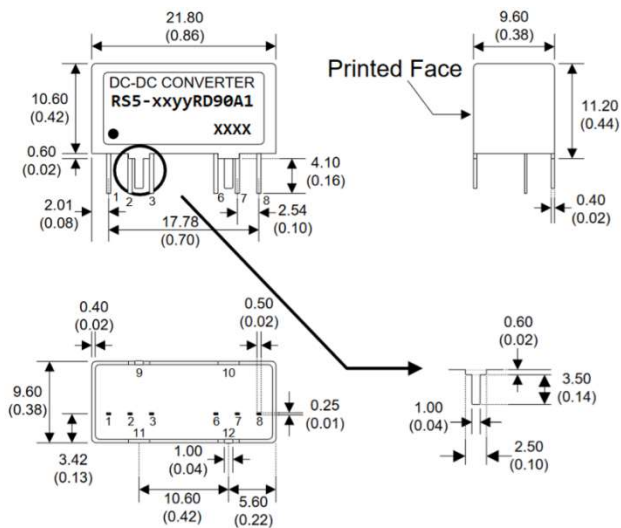
| V in | C1                                               | D1       | C2                   | L1    | C3                   | C4, C5               | C6                  |
|------|--------------------------------------------------|----------|----------------------|-------|----------------------|----------------------|---------------------|
|      |                                                  |          |                      |       |                      |                      |                     |
| 12 V | Nippon<br>Chemi-con<br>KY-Series<br>330μF / 100V | SMDJ26A  | MLCC<br>10μF / 35V   | 3.3μH | /                    | MLCC<br>1000pF / 3kV | /                   |
| 24 V |                                                  | SMDJ70A  | MLCC<br>4.7μF / 100V | 10μH  | MLCC<br>4.7μF / 100V |                      | /                   |
| 48 V |                                                  | SMDJ120A |                      |       |                      |                      | MLCC<br>220pF / 3kV |

Pin Connections

| PIN CONNECTIONS               |           |           |
|-------------------------------|-----------|-----------|
| PIN NUMBER                    | SINGLE    | DUAL      |
| 1                             | -Vin      | -Vin      |
| 2                             | +Vin      | +Vin      |
| 3                             | CTRL      | CTRL      |
| 6                             | +Vout     | +Vout     |
| 7                             | -Vout     | COM       |
| 8                             | N.C.      | -Vout     |
| 9                             | Case      | Case      |
| 10                            | Stand Off | Stand Off |
| 11                            | Stand Off | Stand Off |
| 12                            | Case      | Case      |
| *N.C. : No Connection         |           |           |
| *CTRL : Control Remote ON/OFF |           |           |

Mechanical Specifications

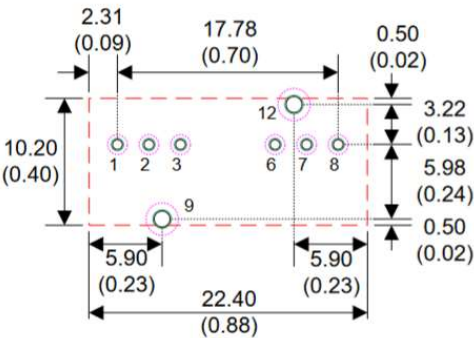
SIL Package



- Notes :
- All dimensions are typical in millimeters ( inches ).
  - 1. Pin dimension tolerance:  $\pm 0.05$  (  $\pm 0.002$  )
  - 2. Pin pitch and length tolerance:  $\pm 0.35$  (  $\pm 0.014$  )
  - 3. Pin to case tolerance:  $\pm 0.5$  (  $\pm 0.02$  )
  - 4. Case Tolerance:  $\pm 0.5$  (  $\pm 0.02$  )
  - 5. Stand-off tolerance:  $\pm 0.1$  (  $\pm 0.004$  )

Recommended Footprint Details

SIL Package



Notes :

- 1. All dimensions are typical in millimeters ( inches ).  
Through hole ( black ) 1 ~ 8: Ø 0.80 ( 0.031 )  
Top view pad ( green ) 1 ~ 8: Ø 1.00 ( 0.039 )  
Bottom view pad ( pink ) 1 ~ 8: Ø 1.60 ( 0.063 )
- 2. All dimensions are typical in millimeters ( inches ).  
Through hole ( black ) 9 & 12: Ø 1.3 ( 0.051 )  
Top view pad ( green ) 9 & 12: Ø 1.5 ( 0.059 )  
Bottom view pad ( pink ) 9 & 12: Ø 2.6 ( 0.102 )

Notes

The information and specification contained in this data sheet are believed to be correct at time of publication. However, Acal BFi accepts no responsibility for consequences arising from printing errors or inaccuracies. Specifications are subject to change without notice.