**eFS15 Series – Isolated AC/DC Converters**
**85 – 264Vac Input, Maximum Power: 15W**

Data Sheet
April 05, 2024

# eFS15 Series –small size isolated AC/DC converters

## Features

- Encapsulated, compact case
- High Efficiency
- Low input current at no load
  (0.2W@220VAC)
- Universal input range
- Built in EMI Filter
- Inrush current limit
- Over current protection
- Over voltage protection
- Output short circuit protection
- Input – Output Isolated
- RoHS directive


## Applications

- Telecommunication
- Datacom
- Instrumentation
- Distributed Power System

## Description

eFS15 Series is a High Efficiency AC/DC Converter that provides up to 15 watts of output power in ultra compact size. This module operate a burst mode below a given output power and it offers a high efficiency at light load. This module has an over current and over voltage protection mode and wide operating temperature range from -30℃ to +60℃.

## Absolute Maximum Ratings

| Parameter | Min | Typ | Max | Unit | Notes |
|---|---|---|---|---|---|
| Input Voltage Continuous | 85 | - | 264 | VAC | |
| Operating Ambient Temperature | -30 | - | 60 | ˚C | |
| Storage Temperature | -40 | - | 70 | ˚C | |
| I/O Isolation Voltage | - | - | 3000 | VAC | |

Stresses in excess of the absolute maximum ratings can cause permanent damage to the device

## Electrical Specifications

### Input Characteristics

$T_A$ = +25˚C ,Vin = 85 ~ 264VAC After warm up unless otherwise specified

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Operating voltage Range | | 85 | | 264 | Vac |
| Input current (@ 220V / @110V) | $I_{in}$ | | | | A |
| eFS15-3R3 | | | 0.13(0.21) | | |
| eFS15-5 | | | 0.13(0.20) | | |
| eFS15-12 | | | 0.18(0.30) | | |
| eFS15-15 | | | 0.17(0.28) | | |
| eFS15-24 | | | 0.18(0.29) | | |
| eFS15-1212 | | | 0.18(0.30) | | |
| eFS15-1515 | | | 0.17(0.28) | | |
| No load Input Power | | | | | W |
| eFS15-3R3 | | | 0.2 | | |
| eFS15-5 | | | 0.2 | | |
| eFS15-12 | | | 0.2 | | |
| eFS15-15 | | | 0.2 | | |
| eFS15-24 | | | 0.2 | | |
| eFS15-1212 | | | 0.2 | | |
| eFS15-1515 | | | 0.2 | | |
| Inrush Current@Cold start | | | | 30A max | @110VAC |
| | | | | 60A max | @220VAC |
| Operating Frequency | | 47 | | 63 | Hz |

## Output Characteristics

$T_A$ = +25˚C ,Vin = 85 ~ 264VAC After warm up unless otherwise specified

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Output Voltage tolerance | $V_O$ | - | - | ±2 | % |
| Output Current | Io | | | | |
| eFS15-3R3 | | | | 3 | A |
| eFS15-5 | | | | 3 | A |
| eFS15-12 | | | | 1.3 | A |
| eFS15-15 | | | | 1.0 | A |
| eFS15-24 | | | | 0.65 | A |
| eFD15-1212 | | | | ±0.65 | A |
| eFD15-1515 | | | | ±0.5 | A |
| Output Regulation;<br>- Line Regulation<br>(From minimum input voltage to maximum input voltage, constant load)<br>- Load Regulation<br>(From no load to maximum load, Constant load) | | -<br><br><br><br>- | -<br><br><br><br>- | ±1<br><br><br><br>±1 | %<br><br><br><br>% |
| Output Current Limit<br>(Automatic recovery) | | >105 | | | % |
| Output Ripple and noise<br>(Vin =220Vac, and Io =Max Output Current<br>Bandwidth 20MHz, 1uF Ceramic cap) | mVp-p | - | 1% of Vout | | mV |
| Efficiency | | | | | |
| eFS15-3R3 | | | 75 | | % |
| eFS15-5 | | | 77 | | % |
| eFS15-12 | | | 79 | | % |
| eFS15-15 | | | 81 | | % |
| eFS15-24 | | | 81 | | % |
| eFD15-1212 | | | 78 | | % |

| | | | | | |
|---|---|---|---|---|---|
| eFD15-1515<br>(100% of max Io, Vin = 220VAC) | | | 80 | | % |
| Dynamic Load Response<br>(1uF Ceramic<br>25% to 50 %, 50% to 25%,<br>Slew rate = 0.1A/us) | | | ± | 3% of Output Voltage | mV |
| Start – Up Time | | - | - | 400 | ms |
| Hold – Up Time | | | | 10 | ms |
| Turn – on overshoot | | - | - | 1 | % |
| Maximum output capacitance | | | | | μF |

## Isolation Specifications

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| I/O Isolation Voltage<br>(AC500V, 1 Min)<br>- Input-Output:<br>- Input-Case:<br>- Output-case: | | | <br><br>-<br>-<br>- | <br><br>3000<br>3000<br>1500 | <br><br>VAC<br>VAC<br>VAC |
| Isolation Resistance<br>- Output-Case<br>(at DC500V at 25˚C<br>And 70%RH for 1 min) | RISO | >100 | - | - | MΩ |
| Isolation Capacitance | CISO | | | | pF |

## General Specifications

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Switching Frequency | | | | 100 | KHz |
| MTBF (MiL-HDBK- 217F) | | 6.6 x $10^5$ | | | hrs |
| Dimensions<br>(W.H.L) | | 70 x 45 x 19.5 | | | mm |
| Weight | | | 100 | | Grams |

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## Environmental

| Parameter | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Operating Temperature | | -30 | | 60 | ˚C |
| Operating Humidity (RH non-condensing) | | 5 | | 95 | % |
| Storage Temperature | | -40 | | 70 | ˚C |
| Vibration @10G(98m/s$^2$) | | 10 | | 55 | Hz |

## Characteristic Curves

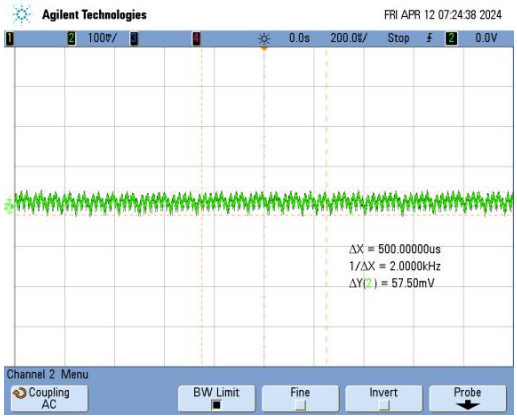
Vin=220VAC, Vo=12V@1.3A , At 25°

### Output Ripple & Noise

**eFS15-3R3**

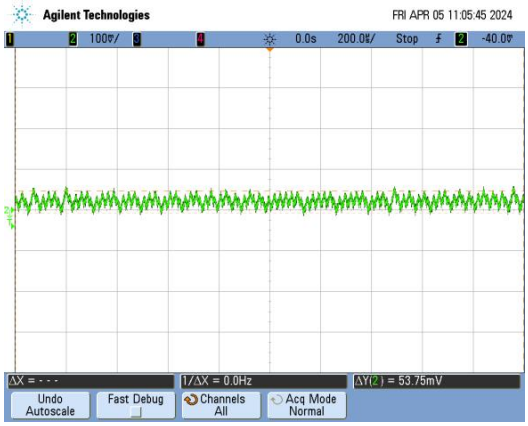

Vin=220VAC, Vo=3.3V@3A , At 25°

**eFS15-5**

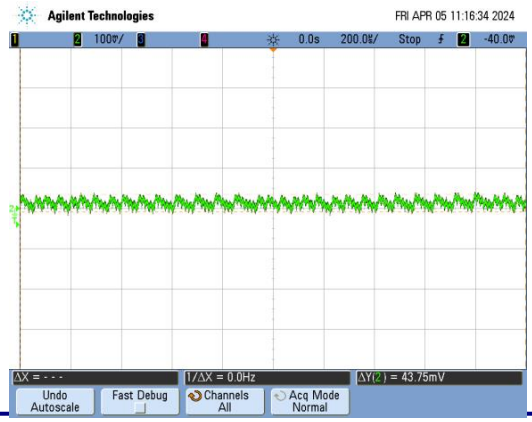



Vin=220VAC, Vo=5V@3A , At 25°

**eFS15-12**




**eFS15-15**



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Vin=220VAC, Vo=15V@1.0A , At 25°

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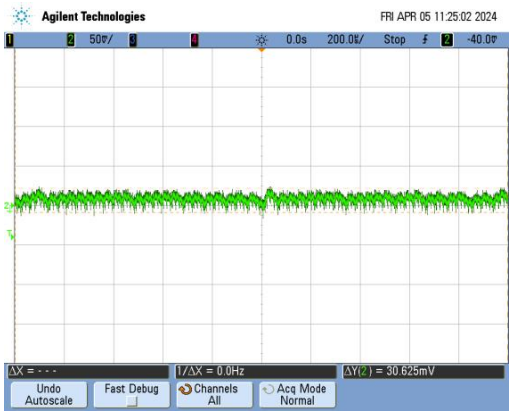
## Output Ripple & Noise

### eFS15-24

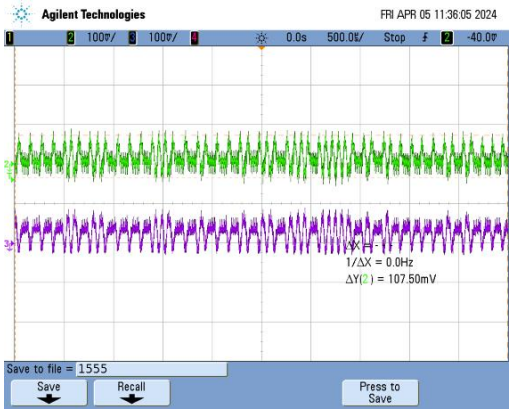



Vin=220VAC, Vo=24V@0.65A , At 25°

### eFD15-1212


Vin=220VAC, Vo=±12V@0.65A , At 25°C

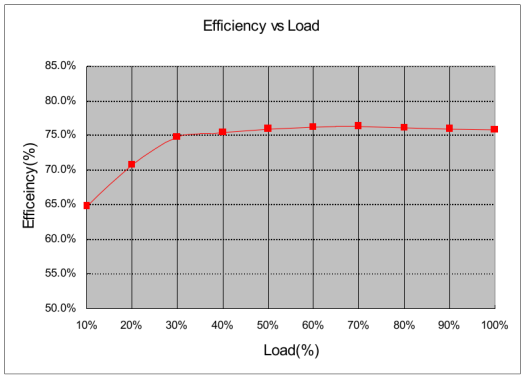
### eFD15-1515



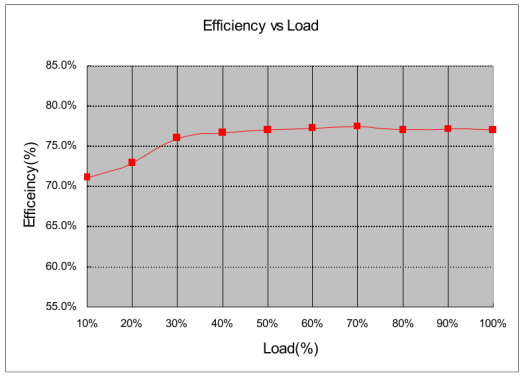

Vin=220VAC, Vo=±15V@0.5A , At 25°C

# Efficiency Curve

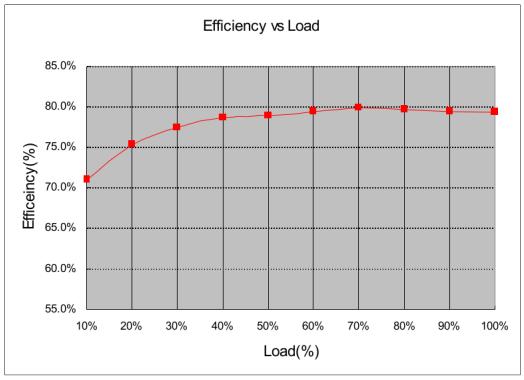
### eFS15-3R3



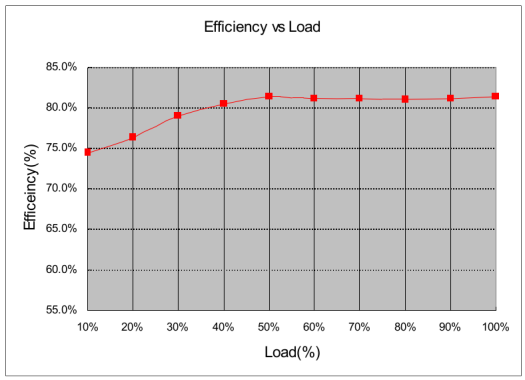

### eFS15-5



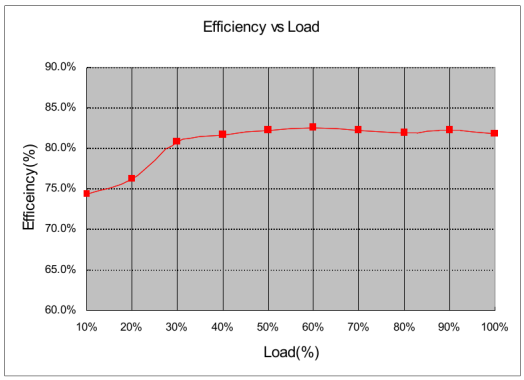

### eFS15-12




### eFS15-15




### eFS15-24




# Efficiency Curve

**eFS15 Series – Isolated AC/DC Converters**
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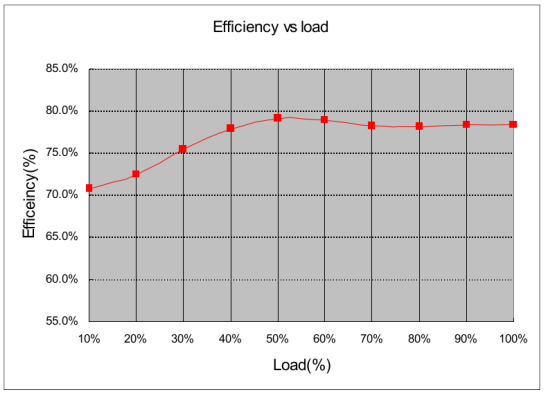
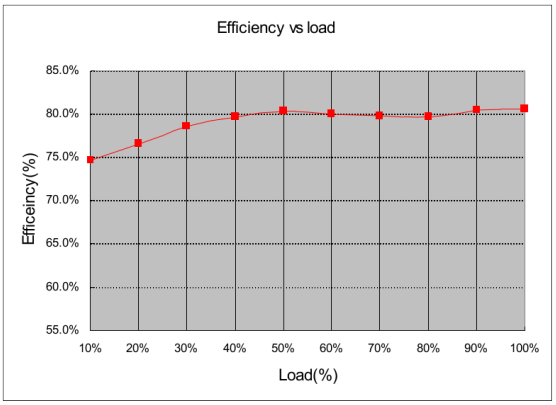
## eFD15-1212




## eFD15-1515




## Instruction manual

**Basic connection**

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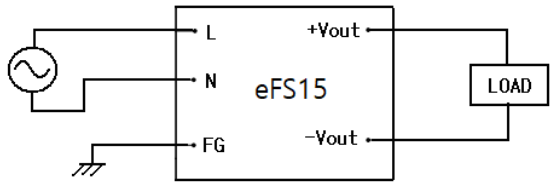
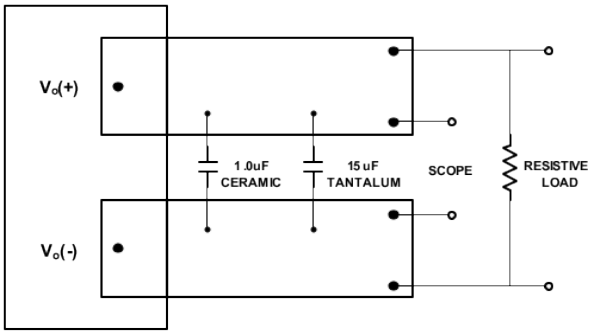


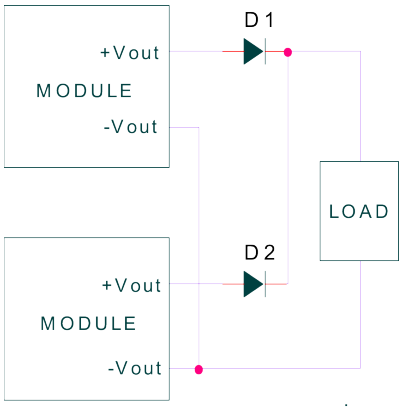

## Output ripple and noise Test




* Conductor from Vout-pins to capacitors = 50mm (1.97in)

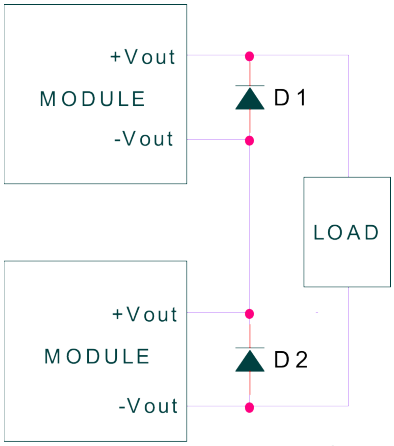
## Parallel operation

Parallel operation is available by connecting the units as shown below.




## Series operation

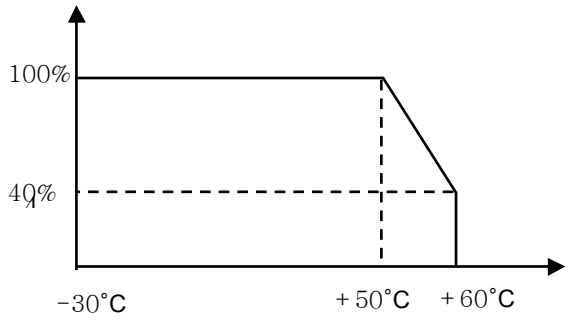
Series operation is available by connecting the outputs of two or more power supplies, as shown below. Output current in series connection should be lower than the lowest current in each unit.(Please use schottky barrier diode)




## Thermal Considerations

eFS10 series has wide operating temperature range from -30˚C to +60˚C.

However, it should be required a enough air flow for more reliable operation. Output derating curve provide designers with a quantity of a current under the desired ambient temperature and velocity of a airflow.




# Feature Description

## Input Fuse

In order to comply with safety requirements, eFS15 series has a fuse built in.

## Input Output Filter

eFS15 series have an internal EMI filter. To reduce conducted noise, additional external input filter is required

To reduce a output ripple and noise, external capacitor is required at the output of the device

## Over current Protection (OCP)

eFS15 series built in over current protection circuit which operates when the output current is over 105% of rating and automatically recovers when over current condition is removed

If the short or overload condition continues, the power module could be damaged.

## Over Voltage Protection (OVP)

eFS15 series built in overvoltage protection circuit. When the OVP trigger, the output will be shut down. The output automatically recovers when over voltage condition is removed.

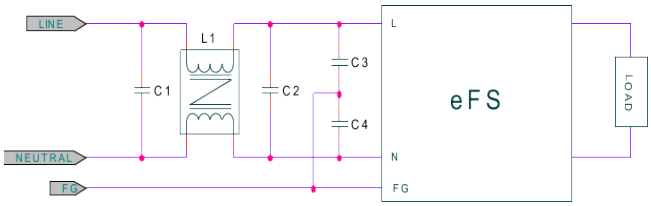
## Soldering Information

The product is intended for through hole mounting in a PCB, When wave soldering is used, the temperature on the pins is specified to maximum 260˚C for maximum 10 seconds

when hand soldering, care should be taken to avoid direct contact between the hot soldering iron tip and the pins for more than a few seconds in order to prevent overheating.

## EMI Characteristic (conducted Emission)

In order to reduce conducted noise install an external input filter as shown in below.

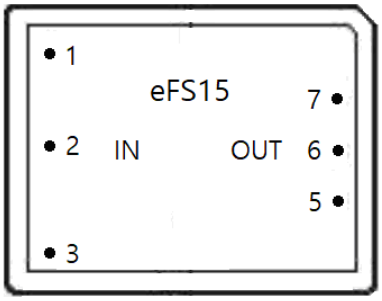



| Model Number | L1 | C1 | C2 | C3,C4 |
|---|---|---|---|---|
| eFS15-12 | 10mH | 330nF | 100nF | x |
| | | | | |

Complies with CISPR 22 CLASS B

## Pin assignments

TOP VIEW




## Single Output

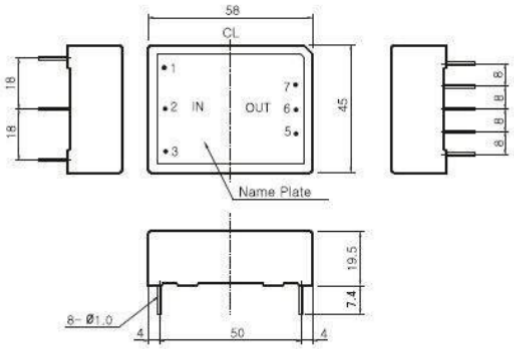
| PIN NO | NAME | FUNCTION |
|---|---|---|
| 1 | FG | Frame Ground |
| 2 | AC(L) | AC Input |
| 3 | AC(N) | AC Input |
| 4 | No pin | No connection |
| 5 | +Vout | Positive side of output voltage |
| 6 | No pin | |
| 7 | GND | |
| 8 | No pin | |

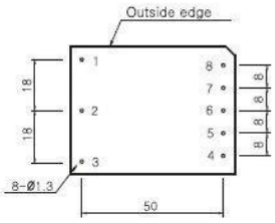
## Dual Output

| PIN NO | NAME | FUNCTION |
|---|---|---|
| 1 | FG | Frame Ground |
| 2 | AC(L) | AC Input |
| 3 | AC(N) | AC Input |
| 4 | No pin | |
| 5 | Output1 | Positive side of output voltage |
| 6 | COM | Common ground |
| 7 | Output2 | Negative side of output voltage |
| 8 | No pin | |

## Mechanical Specification

TOP VIEW

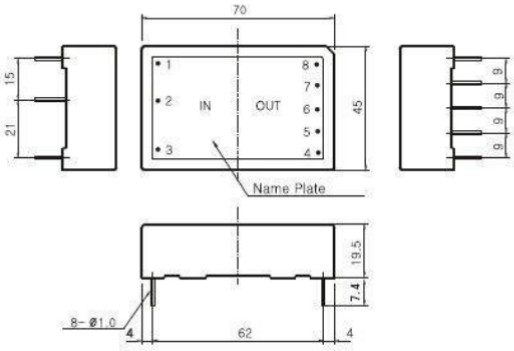


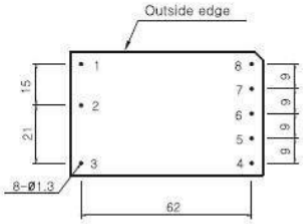




※ Mounting hole top view

NOTES
1. All dimensions are mm.
2. Weight : 90g or less (single, dual)
100g or less (triple)

▶ **Triple Output**



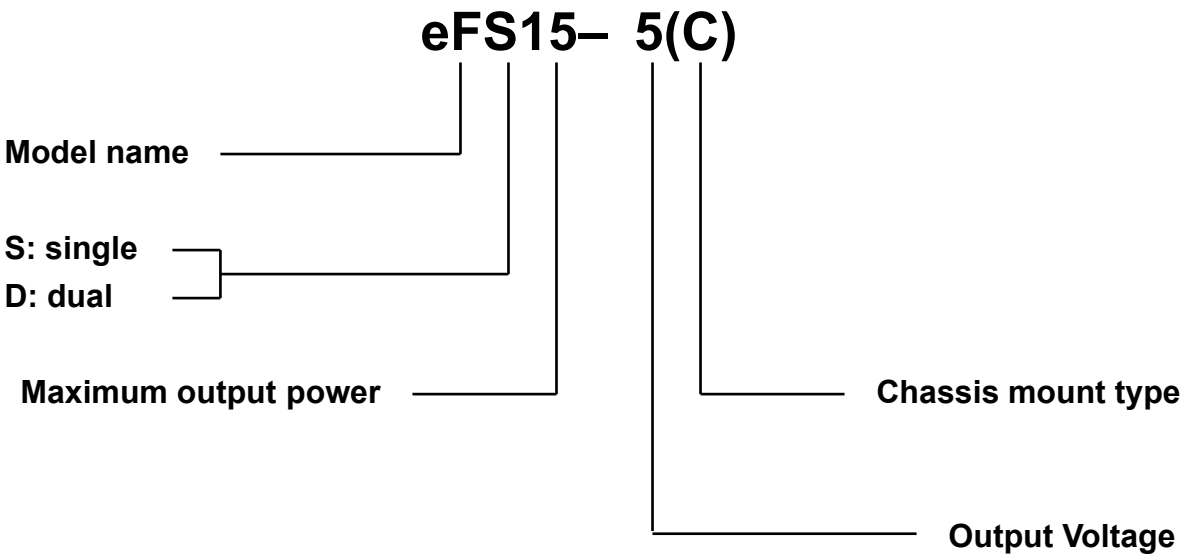

※ Mounting hole top view

## Ordering Information

| Input | Output1, Output2 | Maximum Power | Ripple & Noise Typ. | Efficiency Typ. | Model Number |
|---|---|---|---|---|---|
| 85 – 264V | 3.3V@3A | 9.9W | 80mVp-p | 75% | eFS15-3R3(C) |
| | 5V@3A | 15W | 80mVp-p | 77% | eFS15-5(C) |
| | 12V@1.3A | 15.6W | 120mVp-p | 79% | eFS15-12(C) |
| | 15V@1.0 | 15W | 150mVp-p | 81% | eFS15-15(C) |
| | 24V@0.65A | 15.6W | 240mVp-p | 81% | eFS15-24(C) |
| | +12V@0.65A, -12V@0.65A | 15.6 | 120mVp-p | 78% | eFD15-1212(C) |
| | +15V@0.5A, -15V@0.5A | 15W | 150mVp-p | 80% | eFD15-1515(C) |

* (C): Chassis mount type

### Part number structure



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