

FD-4~6W Series



4~6W 2:1 Regulated Single & Dual output

Features

- Wide 2:1 Input Range
- 4.5V~9V Wide Input Range
- 1500VDC Isolation, Up to 3500VDC
- Continuous Short Circuit Protection
- Efficiency up to 84%
- Operating Temperature Range -40 ~ 95°C max.



PART NUMBER STRUCTURE

FD - **05** **05** **S** **6** **H**
(1) (2) (3) (4) (5) (6)

(1) Series

(2) Input Voltage Range

05 - 4.5-9.0 V

(3) Output Voltage

3R3 - 3.3 V

05 - 5.0 V

12 - 12 V

15 - 15 V

(4) Output Type

S - Single Output

D - Dual Output

(5) Watt

4 - 4 Watt

5 - 5 Watt

6 - 6 Watt

(6) Isolation Voltage

Blank - 1500 VDC

H - 3500 VDC

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

| Model Number | Input Voltage Range (VDC) | Input Current | | Output Voltage (VDC) | Output Current | | Efficiency @FL (% , typ.) | Capacitive Load (µF, max.) |
|--------------|---------------------------|--------------------|----------------------|----------------------|----------------|----------------|---------------------------|----------------------------|
| | | No-Load (mA, max.) | Full Load (mA, typ.) | | Min. load (mA) | Full load (mA) | | |
| FD-053R3S6 | 4.5-9 | 25 | 1216 | 3.3 | 0 | 1400 | 76 | 1000 |
| FD-0505S6 | 4.5-9 | 25 | 1519 | 5 | 0 | 1200 | 79 | 1000 |
| FD-0512S6 | 4.5-9 | 30 | 1446 | 12 | 0 | 500 | 83 | 330 |
| FD-0515S6 | 4.5-9 | 30 | 1412 | 15 | 0 | 400 | 85 | 220 |
| FD-053R3D6 | 4.5-9 | 25 | 1600 | ±3.3 | 0 | ±909 | 75 | ±680 |
| FD-0505D6 | 4.5-9 | 25 | 1500 | ±5 | 0 | ±600 | 80 | ±330 |
| FD-0512D6 | 4.5-9 | 35 | 1429 | ±12 | 0 | ±250 | 84 | ±100 |
| FD-0515D6 | 4.5-9 | 40 | 1429 | ±15 | 0 | ±200 | 84 | ±47 |
| FD-053R3S5 | 4.5-9 | 25 | 1160 | 3.3 | 0 | 1300 | 74 | 1000 |
| FD-0505S5 | 4.5-9 | 25 | 1266 | 5 | 0 | 1000 | 79 | 1000 |
| FD-0512S5 | 4.5-9 | 30 | 1205 | 12 | 0 | 417 | 83 | 330 |
| FD-0515S5 | 4.5-9 | 30 | 1191 | 15 | 0 | 333 | 84 | 220 |
| FD-053R3D5 | 4.5-9 | 25 | 1316 | ±3.3 | 0 | ±750 | 76 | ±680 |
| FD-0505D5 | 4.5-9 | 30 | 1250 | ±5 | 0 | ±500 | 80 | ±330 |
| FD-0512D5 | 4.5-9 | 35 | 1205 | ±12 | 0 | ±208 | 83 | ±100 |
| FD-0515D5 | 4.5-9 | 40 | 1220 | ±15 | 0 | ±167 | 82 | ±47 |
| FD-053R3S4 | 4.5-9 | 25 | 1056 | 3.3 | 0 | 1200 | 75 | 3300 |
| FD-0505S4 | 4.5-9 | 25 | 1039 | 5 | 0 | 800 | 77 | 1000 |
| FD-0512S4 | 4.5-9 | 30 | 976 | 12 | 0 | 333 | 82 | 220 |
| FD-0515S4 | 4.5-9 | 30 | 988 | 15 | 0 | 266 | 81 | 100 |
| FD-053R3D4 | 4.5-9 | 25 | 1039 | ±3.3 | 0 | ±600 | 77 | ±680 |
| FD-0505D4 | 4.5-9 | 30 | 1000 | ±5 | 0 | ±400 | 80 | ±470 |
| FD-0512D4 | 4.5-9 | 35 | 976 | ±12 | 0 | ±166 | 82 | ±100 |
| FD-0515D4 | 4.5-9 | 40 | 976 | ±15 | 0 | ±133 | 82 | ±47 |

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| INPUT SPECIFICATIONS | | | | | |
|--|---|---------|------|------|---------|
| Parameter | Conditions | Min. | Typ. | Max. | Unit |
| Input Voltage Range | 5V Input | 4.5 | 5 | 9 | VDC |
| Input Filter | | LC Type | | | |
| Input Reflected Ripple Current (1) | | | 35 | | mApk-pk |
| Start up Time | Nominal Vin and constant resistive load | | 20 | | ms |
| Recommended input fuse (slow blow) | 4 Watt & 5 Watt | 2.5 | | | A |
| | 6 Watt | 3.15 | | | |
| Note : | | | | | |
| 1. Measured with a simulated source inductance of 12 μ H and a source capacitor Cin (100 μ F, ESR<1.0 Ω at 100kHz). | | | | | |

| OUTPUT SPECIFICATIONS | | | | | |
|--------------------------------------|--|--|------|-------|-----------------|
| Parameter | Conditions | Min. | Typ. | Max. | Unit |
| Output Voltage Accuracy | 3.3V & \pm 3.3V Output | -2.0 | | +2.0 | % |
| | Other Output | -1.0 | | +1.0 | |
| Line Regulation | | -0.5 | | +0.5 | % |
| Load Regulation | From 0% to 100% Load | 3.3V & \pm 3.3V Output | -1.5 | +1.5 | % |
| | | Other Output | -0.5 | +0.5 | |
| Cross Regulation | Asymmetrical Load 25% / 100% for Dual Output | -5 | | +5 | % |
| Ripple & Noise (1) | 20MHz bandwidth | | | 60 | mVpk-pk |
| Over Current Protection | | | 150 | | % of FL |
| Short Circuit Protection | | Indefinite (hiccup) (Automatic Recovery) | | | |
| Temperature Coefficient | | -0.02 | | +0.02 | %/ $^{\circ}$ C |
| Maximum Capacitive Load | Nominal Vin and constant resistive load | See Table | | | |
| Transient Recovery Time | Nominal Vin and 25% load step change (75%-50%-25% of Io) | | 250 | | μ s |
| Transient Response Deviation | | -3 | | +3 | % |
| Note : | | | | | |
| 1. Measured with a 1.0 μ F MLCC. | | | | | |

| ABSOLUTE MAXIMUM RATINGS | | | | | |
|---|----------------------------|------|------|------|--------------|
| Parameter | Conditions | Min. | Typ. | Max. | Unit |
| Input Surge Voltage (100 ms) | 5V Input | | | 15 | VDC |
| Soldering Temperature | 1.5mm from case 10sec max. | | | 260 | $^{\circ}$ 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 |
| Isolation Voltage | Input-output, and rated for 60sec | Standard Type | 1500 | | | VDC |
| | | Suffix "H" | 3500 | | | |
| | Case-I/O, and rated for 60sec | | 1000 | | | |
| Isolation Resistance | Input-output | | 1000 | | | MΩ |
| Isolation Capacitance | Input-output | | | 500 | | pF |
| Switching Frequency | | | | 266 | | kHz |
| MTBF | MIL-HDBK-217 F @ 25°C | | 1121 | | | k hours |
| Safety Approval | IEC / EN / UL 62368-1 | | Designed to meet | | | |
| Environmental compliance | | | RoHS | | | |

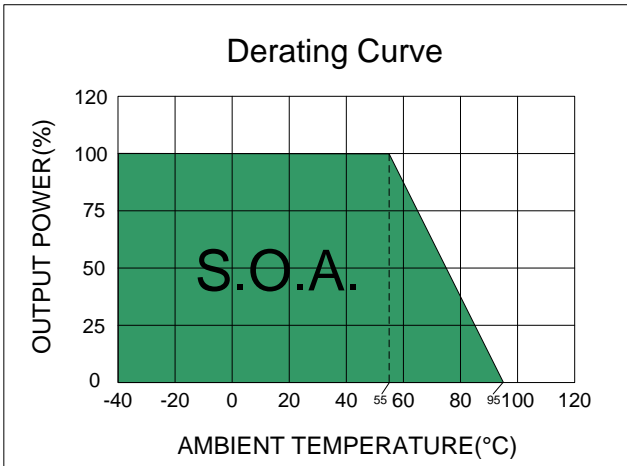
| ENVIRONMENT SPECIFICATIONS | | | | | |
|-------------------------------|------------------------|-----------|------|------|----------|
| Parameter | Conditions | Min. | Typ. | Max. | Unit |
| Operating Ambient Temperature | See the Derating Curve | -40 | | 95 | °C |
| Maximum Case Temperature | | | | 100 | °C |
| Thermal Impedance | | 20 | | | °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 | | A |
| ESD | IEC 61000-4-2 | Air: ±8kV / Contact: ±6kV | A |
| RS | IEC 61000-4-3 | 10V/m | A |
| EFT | IEC 61000-4-4 | ±2kV with external components | A |
| Surge | IEC 61000-4-5 | ±0.5kV with external components | A |
| CS | IEC 61000-4-6 | 10Vrms | A |
| PFMF | IEC 61000-4-8 | 1A/m | A |

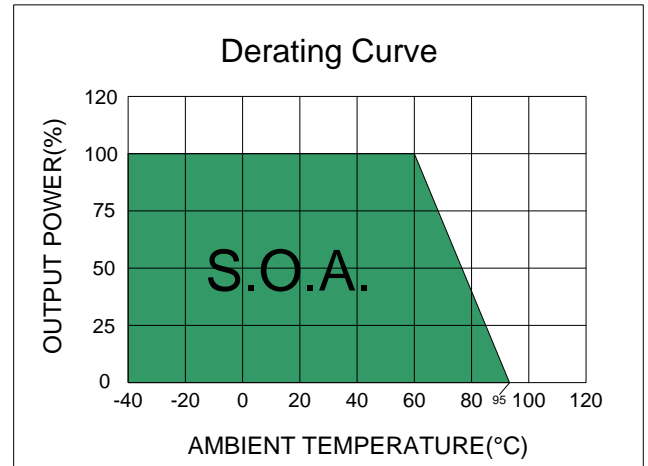
| PHYSICAL SPECIFICATIONS | |
|-------------------------|----------------------------|
| Parameter | Value |
| Case Material | Aluminum |
| Pin Material | Ø0.5mm Brass Solder-coated |
| Potting Material | Epoxy (UL94V-0 rated) |
| Weight | 13.0 g, typ. |
| Dimensions | 1.25" x 0.8" x 0.4" |

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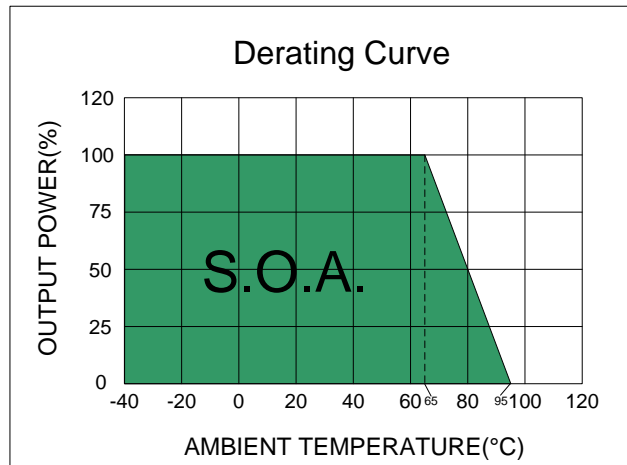
ELECTRICAL CHARACTERISTIC CURVES



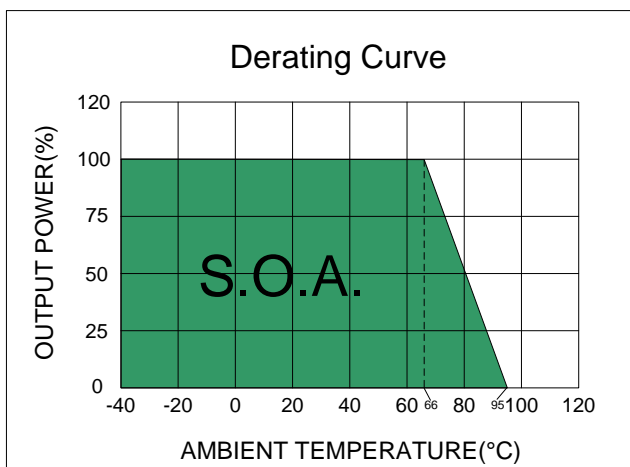
Efficiency 75% ~ 76% 6 Watt Models



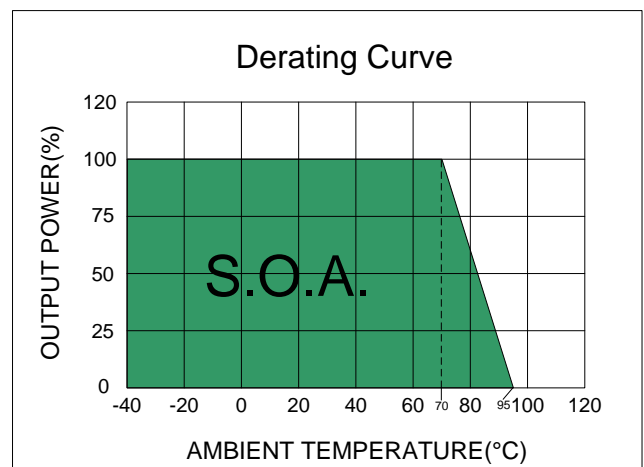
Efficiency 77% ~ 80% 6 Watt Models



Efficiency 83% ~ 85% 6 Watt Models

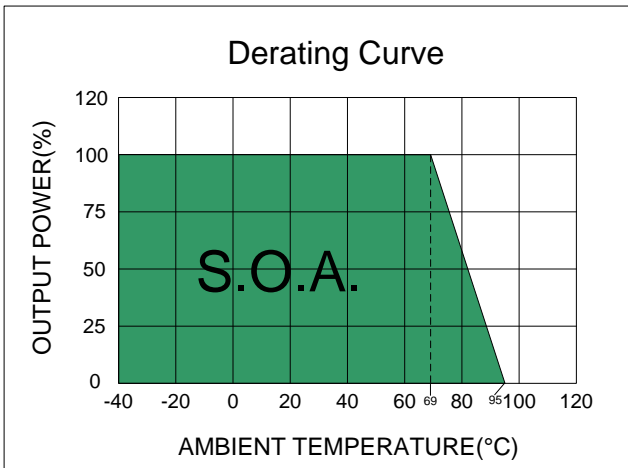


Efficiency 74% ~ 76% 5 Watt Models

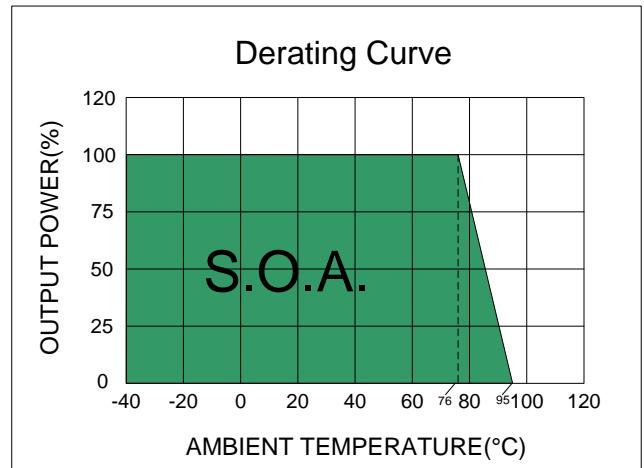


Efficiency 79% ~ 83% 5 Watt Models

ELECTRICAL CHARACTERISTIC CURVES



Efficiency 75% ~ 77% 4 Watt Models

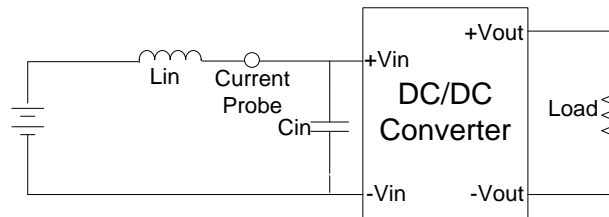


Efficiency 80% ~ 82% 4 Watt Models

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} ($100\mu F$, $ESR < 1.0\Omega$ at $100kHz$) at nominal input and full load.



DESIGN & FEATURE CONFIGURATIONS

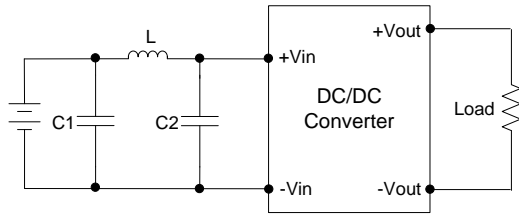
Over Current Protection

The module includes an internal over current protection circuit, which will endure current limiting for an unlimited duration during output over load condition. If the output current exceeds the OCP set point, the module will shut down automatically (hiccup). The module will try to restart after shut down. If the over load condition still exists, the module will shut down again.

DESIGN & FEATURE CONFIGURATIONS

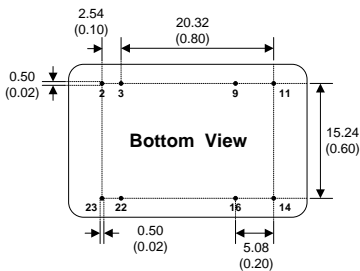
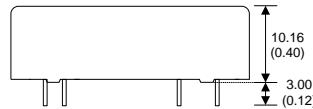
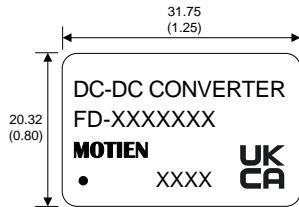
EMC Filter

The Circuit is used to meet Surge & EFT test and EMI test.



| | C1 | L | C2 |
|-----------|---|-------|---|
| FD-05XXXX | NIPPON Chemi-con KY series 330µF, 100V | 1.8µH | NIPPON Chemi-con KY series 470µF, 100V |

MECHANICAL SPECIFICATIONS



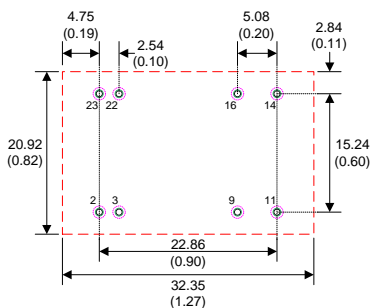
- Notes : All dimensions are typical in millimeters (inches).
1. Pin diameter: 0.5±0.05 (0.02±0.002)
 2. Pin pitch and length tolerance: ±0.35 (±0.014)
 3. Pin to Case tolerance: ±0.5 (±0.02)
 4. Case Tolerance: ±0.5 (±0.02)
 5. Stand-off tolerance: ±0.1 (±0.004)

PIN CONNECTIONS

| PIN NUMBER | SINGLE | DUAL |
|------------|--------|-------|
| 2 | -Vin | -Vin |
| 3 | -Vin | -Vin |
| 9 | N.P. | COM |
| 11 | N.C. | -Vout |
| 14 | +Vout | +Vout |
| 16 | -Vout | COM |
| 22 | +Vin | +Vin |
| 23 | +Vin | +Vin |

*N.P. : No PIN
*N.C. : No Connection

RECOMMENDED FOOTPRINT DETAILS



- Notes : 1. All dimensions are typical in millimeters (inches).
- Through hole (black) 2 ~ 23: Ø0.80 (0.031)
 - Top view pad (green) 2 ~ 23: Ø1.00 (0.039)
 - Bottom view pad (pink) 2 ~ 23: Ø1.60 (0.063)