# TDK·Lambda

## 600W Conduction Cooled Modular Power Supply

**Medical**  **Industrial**  **Test**  **Comm**  **Broadcast**  **Renewable**  **Cots**

| Features | Benefits |
|---|---|
| • Conduction cooled | • No audible noise |
| • Wide output adjustment | • Suits non-standard voltages |
| • Compact 4 x 7 inch size | • Space saving in end equipment |
| • MIL-STD-461F compliant | • Suitable for COTS applications |
| • 5 year warranty | • Low cost of ownership |
| • External voltage control | • Remote programming of voltage and current |
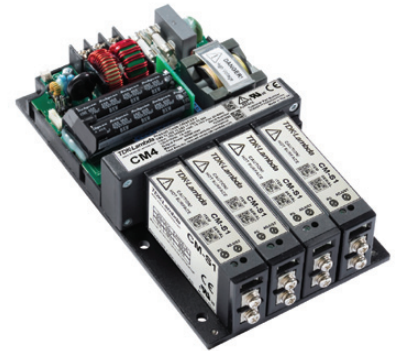


## Specification

| Model | | | CM4 Series | |
|---|---|---|---|---|
| Output power (1) | W | | 425W | 600W (750W for 5s) |
| Input voltage | Vac | | 85 - 264Vac | 120-264Vac |
| Frequency | - | | 47 - 63Hz (Contact factory for operation on 400Hz) | |
| Input fuses | - | | 8A / 250Vac HBC Fast acting (not user accessible) in both Live and Neutral lines | |
| Input current at 120Vac, 600W load | A | | 6A | |
| Inrush current | - | | <20A at 25 and 264Vac (cold start) | |
| Leakage current | A | | 200µA maximum at 264Vac 63Hz | |
| Power factor | - | | 0.99 typical | |
| Hold up | ms | | Typically 20ms | |
| Over temperature protection | - | | All outputs are turned off.  After unit cools down, recycle AC or toggle global remote on/off | |
| Cooling | - | | Conduction, convection or forced air | |
| Standby power consumption | W | | Less than 1W with global on/off activated | |
| No load power consumption | W | | 10 to 21W | |
| Efficiency | - | | Up to 90% (see application note on website) | |
| **Isolation** | - | | | |
| Input to output | - | | Reinforced: 2 x MOPPs (3rd edition 60601), 4kVac | |
| Input to earth | - | | Basic: 1 x MOPP 1.5kVac | |
| Output to earth | - | | 500Vdc | |
| Output to output | - | | 500Vdc | |
| **General** | - | | | |
| Weight | g | | 650 + 100 for each output module fitted | |
| Size (L x W x H) | mm | | 177.8 x 101.6 x 41 | |
| Warranty | yrs | | 5 | |

**Notes:**  (1) Converter and module power must be de-rated by 2.5% for every 3 volts below 120Vac, down to a minimum of 85Vac

## How To Create A Product Description

The extensive range of output modules and options make it possible to achieve almost any combination of Volts and Amps.
You can create your own CM configuration online at https://config.emea.tdk-lambda.com/. This method checks your configuration and offers the optimum solution.Alternatively, you can do this manually by using the guide below.

1. Select Output Modules from the table, based on output voltage and current.  Ensure that the maximum number of slots does not exceed 4

2. For an S1 module set at 5V, S2 set at 12V, S3 set at 24V and a S4 set at 48V, please use the following nomenclature style: CM4 5S1 12S2 24S3 48S4

3. Contact TDK-Lambda to validate configuration

## Output Modules

| Module Name | Slots used | Module | Output Voltage Minimum | Output Voltage Vnominal | Output Voltage Maximum | Maximum Output Current | Maximum Output | Maximum Peak Power (5 sec) |
|---|---|---|---|---|---|---|---|---|
| S1 | 1 | - | 1.5V | 5V | 7.5V | 25A | 125W | 187.5W |
| Z1 | 2 | 2 x S1 in parallel | 1.5V | 5V | 7.5V | 50A | 250W | 375W |
| ZA | 3 | 3 x S1 in parallel | 1.5V | 5V | 7.5V | 75A | 375W | 562.5W |
| ZN | 4 | 4 x S1 in parallel | 1.5V | 5V | 7.5V | 100A | 500W | 750W |
| Y1 | 2 | 2 x S1 in series | 3V | 10V | 15V | 25A | 250W | 375W |
| HA | 4 | 4 x S1 in series/parallel | 3V | 10V | 15V | 50A | 500W | 750W |
| S2 | 1 | - | 4.5V | 12V | 15V | 15A | 150W | 225W |
| Z2 | 2 | 2 x S2 in parallel | 4.5V | 12V | 15V | 30A | 300W | 450W |
| YA | 3 | 3 x S1 in series | 4.5V | 15V | 22.5V | 25A | 375W | 562.5W |
| ZB | 3 | 3 x S2 in parallel | 4.5V | 12V | 15V | 45A | 450W | 675W |
| ZP | 4 | 4 x S2 in parallel | 4.5V | 12V | 15V | 60A | 600W | 750W |
| YN | 4 | 4 x S1 in series | 6V | 20V | 30V | 25A | 500W | 750W |
| S3 | 1 | - | 9V | 24V | 30V | 7.5A | 150W | 225W |
| Y2 | 2 | 2 x S2 in series | 9V | 24V | 30V | 15A | 300W | 450W |
| ZC | 3 | 3 x S3 in parallel | 9V | 24V | 30V | 22.5A | 450W | 675W |
| HB | 4 | 4 x S2 in series/parallel | 9V | 24V | 30V | 30A | 600W | 750W |
| ZQ | 4 | 4 x S3 in parallel | 9V | 24V | 30V | 30A | 600W | 750W |
| YB | 3 | 3 x S2 in series | 13.5V | 36V | 45V | 15A | 450W | 675W |
| S4 | 1 | - | 18V | 48V | 58V | 3.75A | 150W | 217.5W |
| Y3 | 2 | 2 x S3 in series | 18V | 48V | 60V | 7.5A | 300W | 450W |
| ZD | 3 | 3 x S4 in parallel | 18V | 48V | 58V | 11.25A | 450W | 652.5W |
| ZR | 4 | 4 x S4 in parallel | 18V | 48V | 58V | 15A | 600W | 750W |
| YP | 4 | 4 x S2 in series | 18V | 48V | 60V | 15A | 600W | 750W |
| YC | 3 | 3 x S3 in series | 27V | 72V | 90V | 7.5A | 450W | 675W |
| Y4 | 2 | 2 x S4 in series | 36V | 96V | 116V | 3.75A | 300W | 435W |
| YQ | 4 | 4 x S3 in series | 36V | 96V | 120V | 7.5A | 600W | 750W |
| YD | 3 | 3 x S4 in series | 54V | 144V | 174V | 3.75A | 450W | 652.5W |
| YR | 4 | 4 x S4 in series | 72V | 192V | 232V | 3.75A | 600W | 750W |

## Global Signals Specifications

| Parameter | Details | Minimum | Typical | Maximum | Units |
|---|---|---|---|---|---|
| Bias Voltage | | 4.8 | 5 | 5.2 | Volts |
| Bias Current | | | | 1 | Amps |
| AC_OK Voltage | Low output level/High output level | 0/4.8 | 0.03/5 | 0.1/5.2 | Volts |
| AC_OK Current | | | | 10 | mA |
| Power Good Voltage | Open collector output. Low output level. All slots. Absolute maximum = 6V | 0.1 | | 0.3 | Volts |
| Power Good Current | Open collector output. Current sink only. All slots | | | 50 | mA |
| Tsns Voltage | Typical at 0°C internal temperature, 19.5mV/°C | 0 | 0.4 | 5 | Volts |
| Tsns Current | | | | 100 | uA |
| Inhibit Voltage | Low input level/High input level. All slots | 0/2.5 | | 0.8/6 | Volts |
| Inhibit Current | 10k input impedance. All slots | | | 1 | mA |

## Environment (see installation manual for more details) - Conduction Cooling
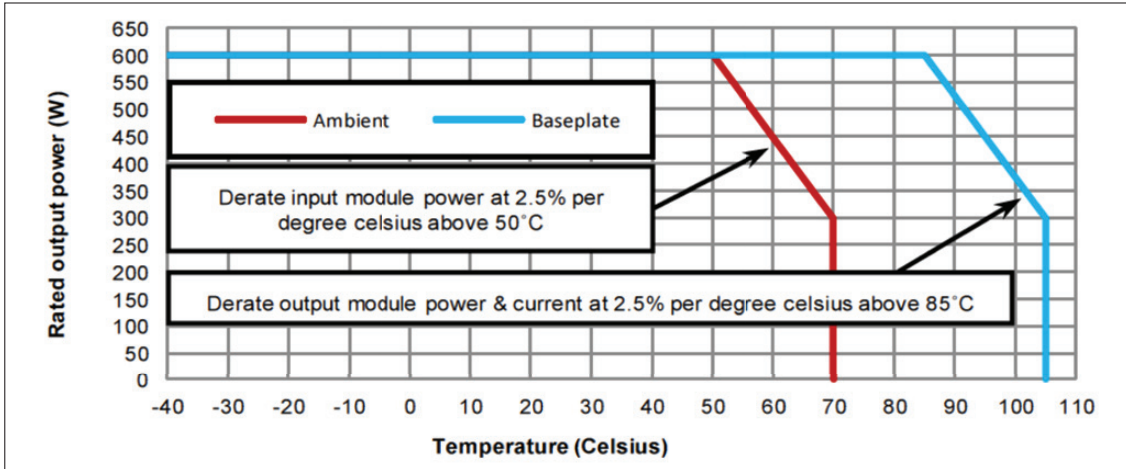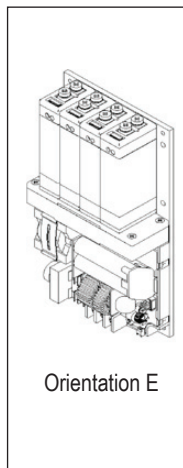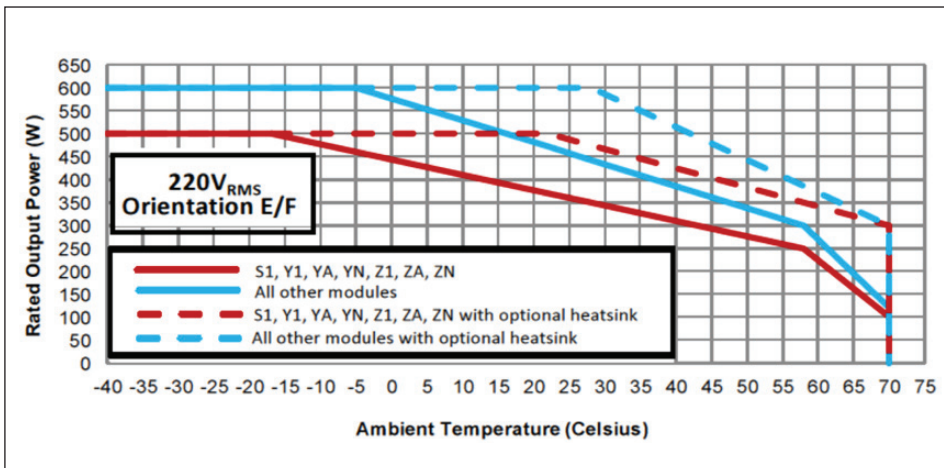


Apply appropriate derating to converter and modules for both ambient and baseplate temperatures
**See Note 1:**

## Environment (see installation manual for more details) - Forced Air Cooling



Orientation A
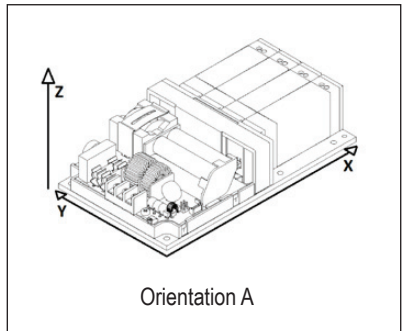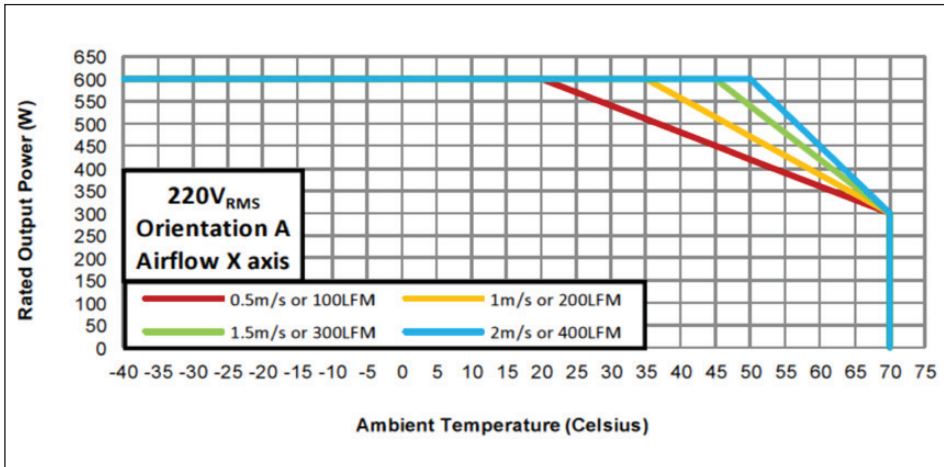
**See Note 1:**

## Environment (see installation manual for more details) - Convection Cooling



Orientation E

Orientation F
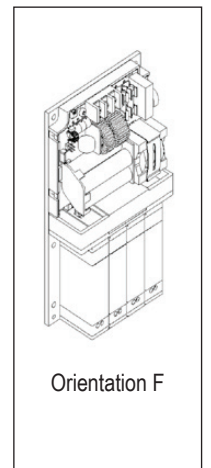
**See Note 1:**

**Note 1:** To ensure reliability, component temperatures must be maintained below recommended levels in the end application.
The System cooling section of the user manual should be reviewed in detail and temperatures verified in the end application

## Specification

**Note: Actual ratings must be determined in the user application**

| | | |
|---|---|---|
| Humidity (non condensing) | | 5 - 95%RH |
| Altitude | | Operational: 3000m, storage: 5000m |
| Shock | EN 60068-2-27 | 30g 18ms operating, MIL-STD-810G: Method 516.6, Procedure IV |
| Vibration | EN 60068-2-6 | Sine,10 – 500 Hz, 3 axes, 1 oct/min., 10 cycles each axis |
| | EN 60068-2-64 | Random, 5 – 500 Hz, 3 axes, 30 min. |
| | MIL-STD-810G | Method 514.6, Procedure I (General Vibration) |
| | | Category 4 (Trucks & Trailers, Composite wheeled vehicle), Figure 514.6C-3. |
| | | Category 7 (Aircraft, Jet cargo), Figure 514.6C-5 General exposure |
| | | Category 24, (All, Minimum integrity) Figure 514.6E-1 |
| Thermal shock (non operating) | MIL-STD-810G | Method 503.5 Procedure I-C. Multi-cycle. 3 shocks -51 to +85oC |
| **Emissions** | | |
| Radiated electric field | EN55011/32 | Class B |
| Radiated  electric field, 30Hz-18GHz | MIL-STD-461F | RE102 (Ground, Fixed) when mounted in an enclosure |
| Conducted emissions | EN55011/32 | FCC part 15, CISPR 22/11, Class B |
| Harmonic Distortion (PFC) | IEC61000-3-2 | |
| Flicker & Fluctuation | IEC61000-3-3 | |
| **Immunity** | | |
| Electrostatic discharge | IEC61000-4-2 | Test level 4: 15kV air, 8kV contact, IEC60601-1-2:2014 |
| Radiated RF EM fields | IEC61000-4-3 | Test Level 3: (10V/m, 80MHz-2.7GHz) sine wave AM 80% 1kHz |
| Proximity fields from RF | IEC61000-4-3 | Test levels as per IEC60601-1-2:2014 Table 9 |
| Radiated susceptibility, electric field | MIL-STD-461F | RS103 2 MHz to 40 GHz, 20V |
| Conducted susceptibility | MIL-STD-461F | CS115 |
| Surge IEC61000-4-5 | | Test Level 3: 1kV L-N, 2kV L-E. As per IEC60601-1-2:2014 |
| Conducted susceptibility | MIL-STD-461F | CS116 |
| Shipboard electric power, voltage spike | MIL-STD-1399 | "SECTION 300A, Type 1, 115V 60Hz single phase" |
| Conducted disturbances induced by RF fields | IEC61000-4-6 | Test Level 3: 10V, 0.15 to 80MHz sine wave AM 80% 1kHz |
| Conducted susceptibility, power leads | MIL-STD-461F | CS101, 30Hz-150kHz |
| Conducted susceptibility, Bulk cable injection | MIL-STD-461F | CS114, 10kHz to 200MHz |
| Power Frequency Magnetic Fields | IEC61000-4-8 | Test level 4: 30A/m 50Hz |
| Radiated susceptibility, Magnetic field | MIL-STD-461F | RS101 |
| Voltage Dips | IEC61000-4-11 | 0% 10ms, 0% 20ms, 70% 0.5s (Criterion A) |
| | | 40% 200mS (Criterion A at 240V and Criterion C at 100V) |
| Voltage Sag Immunity | SEMI-F47-0706 | 0% 20mS, 70% 0.5s, 80% 1s,80% 10s,90% continuous (Criterion A) |
| | | 50% 200mS (Criterion A at 240V and Criterion C at 100V) |
| | | Criterion A is achieved for full power when Vin >=160V |
| | | Criterion A is achieved at all input voltages when Pout <= 350W |
| Voltage interruptions | IEC61000-4-11 | 0% 250/300 cycle as per IEC60601-1-2:2014 (Criterion C) |
| Aircraft Electric Power Characteristic | MIL-STD-704F | SAC102,104,105,109,110 (MIL-HDBK-704-2) |
| | | SXF102,104,105,109,110 (MIL-HDBK-704-6) |
| **Safety certifications / accreditations** | | IEC/UL/CSA/EN62368-1, 60950-1 |
| | | IEC/EN 60601-1, UL/CSA 60601-1, ANSI/AAMI ES60601-1 |
| | | CAN/CSA-C22.2 No 60601-1  CE Mark |
| | | Manufactured under the control of ISO9001 and ISO13485 |
| | | (including risk management) |
| **Global signals** | | |
| Global bias supply | | 4.8 - 5.2V 1A |
| AC_OK signal | | Open collector, high on fail |
| Global DC power good | | Open collector, high on fail if any module is <90% of set voltage |
| Global inhibit/enable | | Turns off or on all modules and the converter |
| Internal temperature sensor | | 0 to ~3V signal proportionate to converter transformer temperature |

# Output Specification

| Module | S1 | S2 | S3 | S4 |
|---|---|---|---|---|
| Vnom | 5V | 12V | 24V | 48V |
| Adjustment range | 1.5 - 7.5V | 4.5 - 15V | 9 - 30V | 18 - 58V |
| Turn on time | 2s typical, 3s maximum | | | |
| Turn on rise time | <3.5ms (with resistive load) to 90% of voltage, monotonic rise above 10% | | | |
| Turn on overshoot | <0.1% of set voltage | | | |
| Ripple and noise | 1% pk-pk of Vnom, using 20MHz bandwidth | | | |
| Voltage setting accuracy | +/-0.5% of factory set voltage | | | |
| Remote sense | Yes | | | |
| Minimum load | None | | | |
| Temperature coefficient | +/-0.02%/°C | | | |
| Load regulation (0-100% change) | +/-50mV | +/-100mV | +/-150mV | +/-300mV |
| Line regulation | +/-0.1% of Vnom for an 85-264Vac input change | | | |
| Cross regulation | +/-0.2% of Vnom | | | |
| Maximum transient deviation (25-75% change) | 1V at 1A/µs | 1.5V at 0.5A/µs | 3V at 0.25A/µs | 3V at 0.25A/µs |
| Transient recovery time | 100µs recovery to within 10% of the output voltage set point | | | |
| Over voltage protection (typical) | 9.5V | 18V | 36V | 66V |
| Over current protection | 105 - 125% | | | |
| Short circuit protection | Hiccup with auto recovery | | | |
| Over temperature protection | All outputs are turned off.  After unit cools down, recycle AC or toggle global remote on/off | | | |

| Module | Y1/HA | Y2/HB | Y3 | Y4 |
|---|---|---|---|---|
| Vnom | 10V | 24V | 48V | 96V |
| Adjustment range | 3 - 15V | 9 - 30V | 18 - 60V | 36 - 116V |
| Turn on time | 2s typical, 3s maximum | | | |
| Turn on rise time | <3.5ms (with resistive load) to 90% of voltage, monotonic rise above 10% | | | |
| Turn on overshoot | <0.1% of set voltage | | | |
| Ripple and noise | 1% pk-pk of Vnom, using 20MHz bandwidth | | | |
| Voltage setting accuracy | +/-0.5% of factory set voltage | | | |
| Remote sense | Yes | | | |
| Minimum load | None | | | |
| Temperature coefficient | +/-0.02%/°C | | | |
| Load regulation (0-100% change) | +/-100mV | +/-200mV | +/-300mV | +/-600mV |
| Line regulation | +/-0.1% of Vnom for an 85-264Vac input change | | | |
| Cross regulation | +/-0.2% of Vnom | | | |
| Maximum transient deviation (25-75% change) | 2V at 1A/µs | 3V at 0.5A/µs | 6V at 0.25A/µs | 6V at 0.25A/µs |
| Transient recovery time | 100µs recovery to within 10% of the output voltage set point | | | |
| Over voltage protection (typical) | 19V | 36V | 72V | 132V |
| Over current protection | 105 - 125% | | | |
| Short circuit protection | Hiccup with auto recovery | | | |
| Over temperature protection | All outputs are turned off.  After unit cools down, recycle AC or toggle global remote on/off | | | |

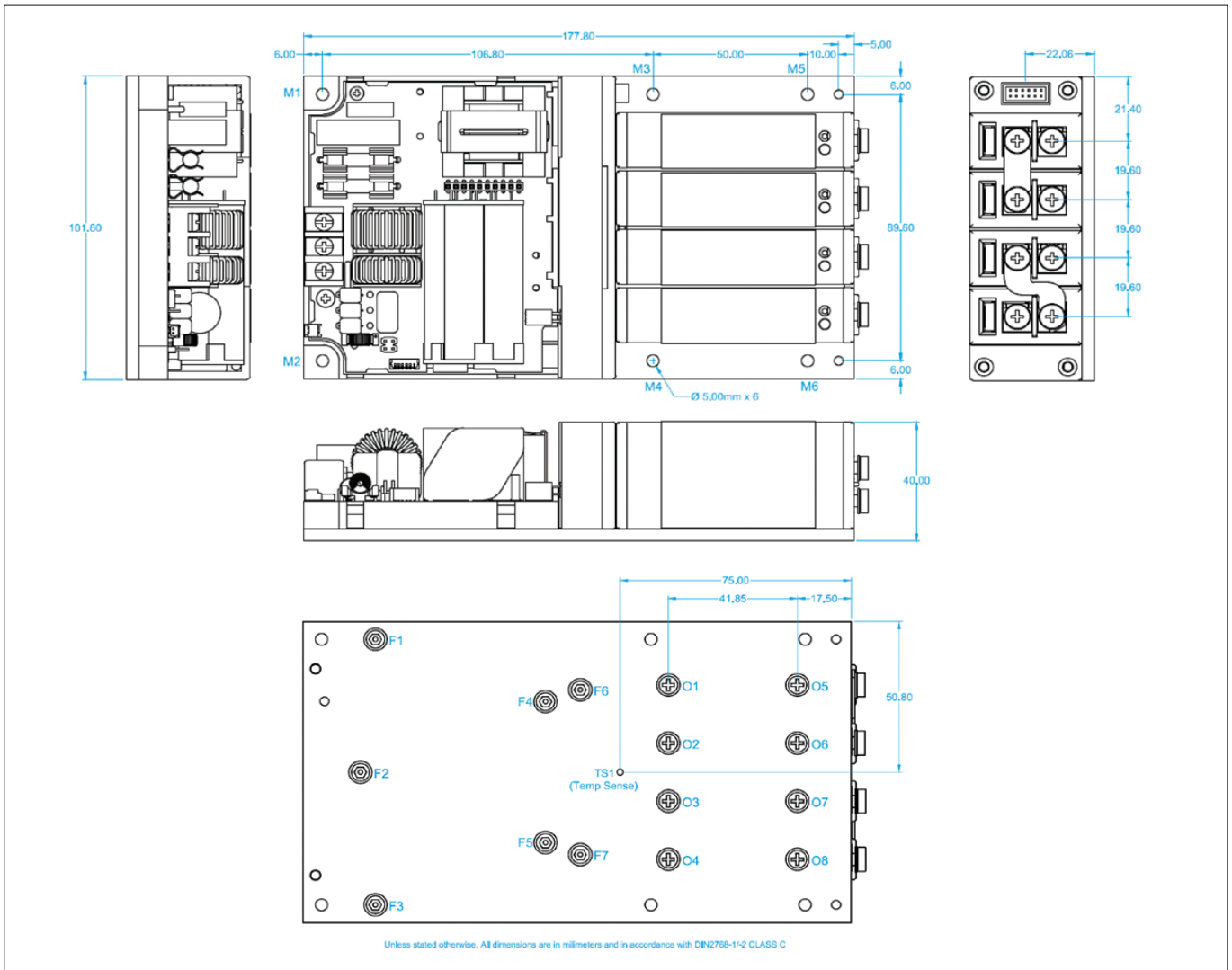| Module | YA | YB | YC | YD |
|---|---|---|---|---|
| Vnom | 15V | 36V | 72V | 144V |
| Adjustment range | 4.5 - 22.5V | 13.5 - 45V | 27 - 90V | 54 - 174V |
| Turn on time | 2s typical, 3s maximum | | | |
| Turn on rise time | <3.5ms (with resistive load) to 90% of voltage, monotonic rise above 10% | | | |
| Turn on overshoot | <0.1% of set voltage | | | |
| Ripple and noise | 1% pk-pk of Vnom, using 20MHz bandwidth | | | |
| Voltage setting accuracy | +/-0.5% of factory set voltage | | | |
| Remote sense | Yes | | | |
| Minimum load | None | | | |
| Temperature coefficient | +/-0.02%/°C | | | |
| Load regulation (0-100% change) | +/-150mV | +/-300mV | +/-450mV | +/-900mV |
| Line regulation | +/-0.1% of Vnom for an 85-264Vac input change | | | |
| Cross regulation | +/-0.2% of Vnom | | | |
| Maximum transient deviation (25-75% change) | 3V at 1A/µs | 4.5V at 0.5A/µs | 9V at 0.25A/µs | 9V at 0.25A/µs |
| Transient recovery time | 100µs recovery to within 10% of the output voltage set point | | | |
| Over voltage protection (typical) | 28.5V | 54V | 108V | 198V |
| Over current protection | 105 - 125% | | | |
| Short circuit protection | Hiccup with auto recovery | | | |
| Over temperature protection | All outputs are turned off.  After unit cools down, recycle AC or toggle global remote on/off | | | |

## Output Specification continued

| Module | YN | YP | YQ | YR |
|---|---|---|---|---|
| Vnom | 20V | 48V | 96V | 192V |
| Adjustment range | 6 - 30V | 18 - 60V | 36 - 120V | 72 - 232V |
| Turn on time | 2s typical, 3s maximum | | | |
| Turn on rise time | <3.5ms (with resistive load) to 90% of voltage, monotonic rise above 10% | | | |
| Turn on overshoot | <0.1% of set voltage | | | |
| Ripple and noise | 1% pk-pk of Vnom, using 20MHz bandwidth | | | |
| Voltage setting accuracy | +/-0.5% of factory set voltage | | | |
| Remote sense | Yes | | | |
| Minimum load | None | | | |
| Temperature coefficient | +/-0.02%/°C | | | |
| Load regulation (0-100% change) | +/-200mV | +/-400mV | +/-600mV | +/-1200mV |
| Line regulation | +/-0.1% of Vnom for an 85-264Vac input change | | | |
| Cross regulation | +/-0.2% of Vnom | | | |
| Maximum transient deviation (25-75% change) | 1V at 1A/μs | 1.5V at 0.5A/μs | 3V at 0.25A/μs | 3V at 0.25A/μs |
| Transient recovery time | 100μs recovery to within 10% of the output voltage set point | | | |
| Over voltage protection (typical) | 38V | 72V | 144V | 264V |
| Over current protection | 105 - 125% | | | |
| Short circuit protection | Hiccup with auto recovery | | | |
| Over temperature protection | All outputs are turned off. After unit cools down, recycle AC or toggle global remote on/off | | | |

| Module | Z1 / ZA / ZN | Z2 / ZB / ZP | ZC / ZQ | ZD / ZR |
|---|---|---|---|---|
| Vnom | 5V | 12V | 24V | 48V |
| Adjustment range | 1.5 - 7.5V | 4.5 - 15V | 9 - 30V | 18 - 58V |
| Turn on time | 2s typical, 3s maximum | | | |
| Turn on rise time | <3.5ms (with resistive load) to 90% of voltage, monotonic rise above 10% | | | |
| Turn on overshoot | <0.1% of set voltage | | | |
| Ripple and noise | 1% pk-pk of Vnom, using 20MHz bandwidth | | | |
| Voltage setting accuracy | +/-0.5% of factory set voltage | | | |
| Remote sense | Yes | | | |
| Minimum load | None | | | |
| Temperature coefficient | +/-0.02%/°C | | | |
| Load regulation (0-100% change) | +/-50mV | +/-100mV | +/-150mV | +/-300mV |
| Line regulation | +/-0.1% of Vnom for an 85-264Vac input change | | | |
| Cross regulation | +/-0.2% of Vnom | | | |
| Maximum transient deviation (25-75% change) | 1V at 1A/μs | 1.5V at 0.5A/μs | 3V at 0.25A/μs | 3V at 0.25A/μs |
| Transient recovery time | 100μs recovery to within 10% of the output voltage set point | | | |
| Over voltage protection (typical) | 9.5V | 18V | 36V | 66V |
| Over current protection | 105 - 125% | | | |
| Short circuit protection | Hiccup with auto recovery | | | |
| Over temperature protection | All outputs are turned off. After unit cools down, recycle AC or toggle global remote on/off | | | |

## Output signal, programming & bias supply

| | |
|---|---|
| Module good threshold | Open collector, off when output is below 90% of set point |
| Current monitor | The output current of the module can be measured using the ICONTROL signal |
| Remote Voltage Programming (S & Z modules only) | Adjusts the module set voltage by 0% to 131.5% with external 0 - 5V |
| Remote Current Programming (S & Z modules only) | Adjusts the module current limit point by 0% to 100% with external 0 to 4.5V |
| Current share accuracy | +/-5% for loads >20% of rating |
| Local bias supply | +4.2 - 5.V 10mA |

CM4 Series

# TDK·Lambda

## Screws

| Location | Details | Penetration | Torque |
|---|---|---|---|
| Baseplate Mount: M1 – M6 | Hole diameter = 5.00mm | 4mm Baseplate thickness | 0.55NM |
| Output Module Connection | M4 | - | 0.5NM |
| Input Module Connection | 6 - 32 | - | 0.8NM |

## Outline Drawing CM4 Series



Unless stated otherwise, All dimensions are in millimeters and in accordance with DIN2768-1/-2 CLASS C

## Pinouts

| Circuit | Details |
|---|---|
| **J1 – Mains Input** | |
| 1 | Live |
| 2 | Neutral |
| 3 | Earth |
| **J2 – Standby control** | |
| 1 | Standby control negative |
| 2 | Standby control positive |
| **J3 – Global Signals** | |
| 1 | Slot 4 - Power Good |
| 2 | Slot 4 - Inhibit |
| 3 | Slot 3 - Power Good |
| 4 | Slot 3 - Inhibit |
| 5 | Slot 2 - Power Good |
| 6 | Slot 2 - Inhibit |
| 7 | Slot 1 - Power Good |
| 8 | Slot 1 - Inhibit |
| 9 | Temperature sense (TSNS) |
| 10 | AC OK |
| 11 | +5V (Bias Supply 1A) |
| 12 | COM |
| **J4 – Output Signals** | |
| 1 | - Sense |
| 2 | + Sense |
| 3 | COM |
| 4 | I Control |
| 5 | V Control |
| 6 | +5V (Bias Supply 10mA) |

## Pinout CM4 Series

**TDK·Lambda**
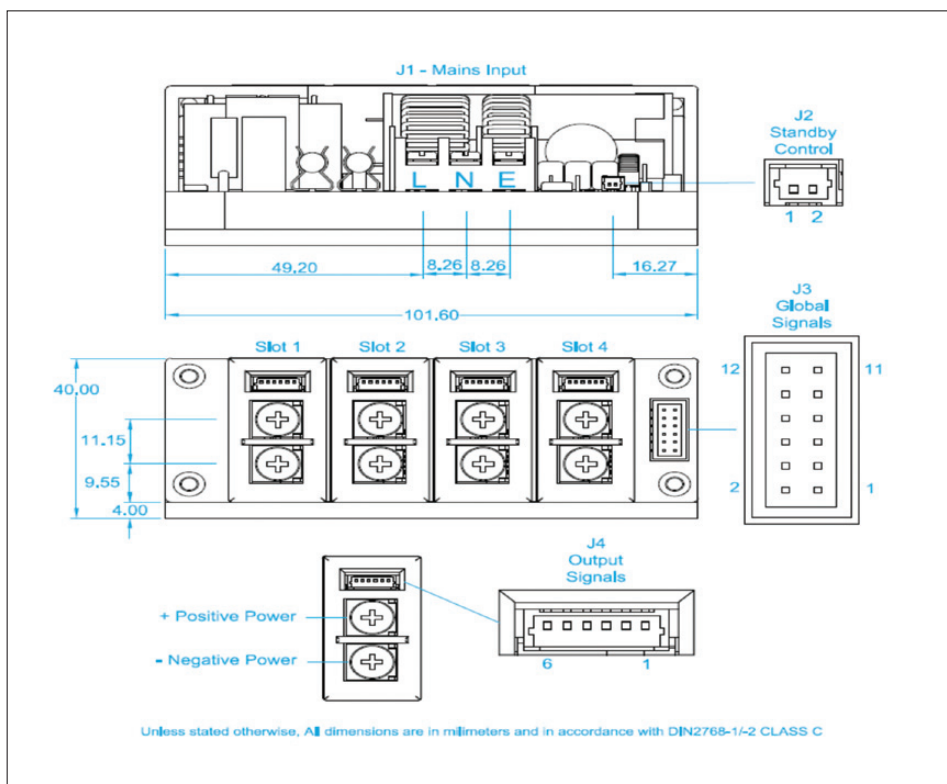
### Mating Connectors

| Ref. | Details | Manufacturer | Housing | Terminal |
|---|---|---|---|---|
| J1 - Mains Input | 3 Pin, Barrier, 6-32 Steel Screws, 0.8 Nm or 7 Lb-In Torque (1) | | | |
| J2 - Standby control | 2 Pin, 1.25mm, with Friction Lock, 28-30AWG | MOLEX | 510210200 | 500588000 |
| J3 - Global Signals | 12 Pin, 2mm, with Friction Lock, 24-30 AWG, WIRE TO BOARD | MOLEX | 511101260 | 503948051 |
| | 12 Pin, 2mm, with Friction Lock, 24-30 AWG, IDT CABLE TO BOARD | MOLEX | 875681273 | |
| J4 - Output Signals | 6 PIN, 1.25mm, with Friction Lock, 28-30AWG | MOLEX | 510210600 | 500588000 |
| Output Power | Positive/Negative, M4 terminal, use appropriately rated crimp terminal | | | |

**Notes:**

**1.** Cable 14-18AWG, 300V, 16A, 105°C, use appropriately rated crimp terminal.

**2.** Direct equivalents may be used for any connector parts.

**3.** All cables must be rated 105°C min, equivalent to UL1015

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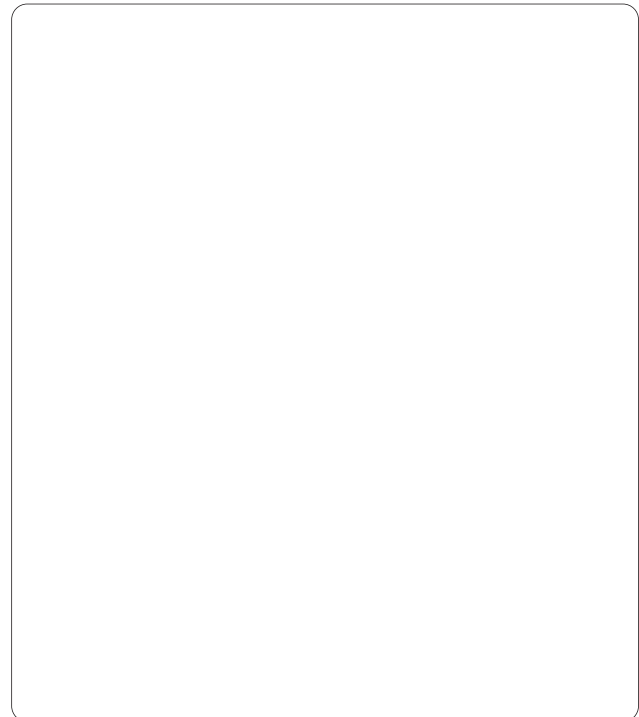
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