chanhvinh.com

# TDK·Lambda

# QS Series

https://emea.lambda.tdk.com/qs
https://product.tdk.com/en/power/qs

Medical Industrial Test Broadcast Comms Renewable

## Up to 1200W, Single Output, Medical and Industrial Power supply

| Features | Benefits |
|---|---|
| • BF ready medical isolation (MOPP) | Eases design into systems (including BF) |
| • Low speed, low audible noise fan | Enhanced patient / user experience |
| • PMBus™ communication option | Remote monitoring and control |
| • 7 year warranty | Low cost of ownership |




## Multiple output units available, see TDK-Lambda's QM Series

**Standard models.** Select the order code from the table below according to the required output voltage and options.

| Base Unit | Voltage | Adjustment range | Max Current | Max Output power | Ripple and noise 0-70°C >5%load | Ripple and noise 0-70°C ≤5%load | Ripple and noise -20-0°C >5%load | Ripple and noise -20-0°C ≤5%load | Load regulation | Max capacitive load | Transient response deviation[a] | Transient response recovery[b] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| QS4-600-12 | 12 | 12-13.2V | 50A | 600W | 4% | 1% | 4% | 2% | <1% | 1000µF/A | <5% | 1ms |
| QS4-600-24 | 24 | 24-26.4V | 25A | 600W | 4% | 1% | 4% | 2% | <1% | 750µF/A | <5% | 1ms |
| QS4-600-48 | 48 | 48-52.8V | 12.5A | 600W | 4% | 1% | 4% | 2% | <1% | 250µF/A | <5% | 1ms |
| QS5-600-12 | 12 | 12-13.2V | 50A | 600W | 4% | 1% | 4% | 2% | <1% | 1000µF/A | <5% | 1ms |
| QS5-600-24 | 24 | 24-26.4V | 25A | 600W | 4% | 1% | 4% | 2% | <1% | 750µF/A | <5% | 1ms |
| QS5-600-48 | 48 | 48-52.8V | 12.5A | 600W | 4% | 1% | 4% | 2% | <1% | 250µF/A | <5% | 1ms |
| QS5H-1080-12 | 12 | 12-12.8V | 90A | 1080W | 4% | 1% | 4% | 2% | <3.5%[c] | 1000µF/A | <5% | 30ms |
| QS5H-1200-24 | 24 | 24-26.4V | 50A | 1200W | 4% | 1% | 4% | 2% | <1% | 650µF/A | <5% | 1ms |
| QS5H-1200-48 | 48 | 48-52.8V | 25A | 1200W | 4% | 1% | 4% | 2% | <1% | 500µF/A | <5% | 1ms |
| QS7-1080-12 | 12 | 12-12.8V | 90A | 1080W | 4% | 1% | 4% | 2% | <3.5%[c] | 1000µF/A | <5% | 30ms |
| QS7-1200-24 | 24 | 24-26.4V | 50A | 1200W | 4% | 1% | 4% | 2% | <1% | 650µF/A | <5% | 1ms |
| QS7-1200-48 | 48 | 48-52.8V | 25A | 1200W | 4% | 1% | 4% | 2% | <1% | 500µF/A | <5% | 1ms |

a - Transient deviation as a percentage of set voltage for 50% load change above 25% load.
b - For recovery to 1% of set voltage
c - for 1-100% load change

**Order codes for standard models.** See Standby/Signals section for details. Additional variants available - contact sales for details

| Base unit | | 5V / 2A standby | | | 5V / 0.25A standby | |
|---|---|---|---|---|---|---|
| | No standby | PMBus™ (-P5H) | Inhibit (-T5H) | Enable (-E5H) | Inhibit (-T5L) | Enable (-E5L) |
| QS4-600-12 | QS400011 | QS40002K | QS400034 | QS40004N | QS400057 | QS40006S |
| QS4-600-24 | QS40007B | QS40008W | QS40009F | QS4000BD | QS4000CY | QS4000DH |
| QS4-600-48 | QS4000FL | QS4000G5 | QS4000HP | QS4000JT | QS4000KC | QS4000LX |
| QS5-600-12 | QS5000VR | QS5000YW | QS50012N | QS50015M | QS50018X | QS5001C7 |
| QS5-600-24 | QS5000WP | QS50010M | QS50013N | QS50016P | QS50019R | QS5001D2 |
| QS5-600-48 | QS5000XN | QS50011G | QS50014G | QS50017F | QS5001B4 | QS5001F8 |
| QS5H-1080-12 | QS50001M | QS5000GX | QS5000K7 | QS50008F | QS5000ND | QS5000CX |
| QS5H-1200-24 | QS50002N | QS5000HM | QS5000L6 | QS50009G | QS5000PG | QS5000DY |
| QS5H-1200-48 | QS500047 | QS5000JP | QS5000M5 | QS5000BW | QS5000RF | QS5000FY |
| QS7-1080-12 | QS70001G | QS70008D | QS7000C5 | QS7000GW | QS7000KY | QS7000NR |
| QS7-1200-24 | QS700029 | QS70009B | QS7000DL | QS7000HV | QS7000LS | QS7000PP |
| QS7-1200-48 | QS70004B | QS7000BK | QS7000FM | QS7000JT | QS7000M0 | QS7000RN |

chanhvinh.com



| Input | |
|---|---|
| Input voltage | 90-264Vac. QS5H limited to 700W output power below 180Vac input, QS4 limited to 550W below 180Vac input. |
| Frequency | 47 - 63 Hz (440Hz with reduced PFC) |
| Input fuses | 25A (QS5 = 16A) / 250Vac, HBC Fast acting (not user accessible) in both Live and Neutral lines (single fusing optional) |
| Inrush current | QS5 & QS5H <40A, QS7 <45A at 25°C and 264Vac (cold start) |
| Leakage current | <300µA |
| Touch current | <100µA |
| Power factor | > 0.95 (at 230Vac, 100% load) |

| Isolation | | |
|---|---|---|
| Input to output / signals | Reinforced | 2 x MOPPs (3rd edition 60601)<br>4kVac, 5.7kVdc type tested to 4kVac (equivalent to 5.7kVdc), production tested to 4.3kVdc. |
| Input to earth | Basic | 1 x MOPP, 1.5kVac |
| Output / signals to earth | Basic | 1 x MOPP, 1.5kVac |
| Output / signals to output / signals | Basic | 200Vdc |

| Output Specification | QS4/5/5H | QS7 | |
|---|---|---|---|
| Turn on time | 2s max | | at 90Vac and 100% rated output power |
| Efficiency | up to 91% | | 240Vac & above 50% rated power, configuration dependent |
| Minimum hold up | 10ms | 20ms | at maximum output power. |
| Standard signals | Output good, output inhibit | | |
| Rise time | <75ms | | (with resistive load) to 90% of voltage, monotonic rise above 10% |
| Turn on overshoot | <5% | | Load type dependent |
| Voltage setting accuracy | <1% | | of set voltage |
| Remote sense | Yes | | 0.5V (voltage at the output terminals must remain within the adjustment range specified above) |
| Minimum load | 0W | | |
| Temperature coefficient | 0.016% | | of rated voltage per °C |
| Line regulation | <0.1% | | for 90-264Vac input change |
| Over voltage protection | Yes | | Latching, module shuts down, cycle ac to restart. |
| Over current protection | Hiccup | | Auto recovers |
| Short circuit protection | Yes | | Indefinitely protected |
| Over temperature protection | Yes | | Primary side protection shuts down main output and fan, auto restarts.<br>Secondary side protection shuts down main output, cycle ac to restart.<br>Shutdown temperature varies according to ambient, output power and input voltage. |

| Environment | |
|---|---|
| Temperature | -20°C to 70°C operational, -40°C to 70°C storage. |
| Derating | 50°C to 70°C derate total output power and each output current by 2.5% per °C<br>Additionally, the 0.25A standby supply provided with the E5H, E12H, T5H and T12H options derates by 2.4% per °C from 25°C to 50°C when the unit is inhibited (fan not running) |
| Low temperature startup | -40°C |
| Humidity | 5 - 95% RH non condensing |
| Shock | ±3 x 30g shocks in each plane, total 18 shocks (11ms (+/-0.5msec), half sine)<br>Conforms to EN60068-2-27, EN60068-2-47, IEC68-2-27, IEC68-2-47, JIS C0041-1987.<br>Conforms to MIL-STD-810G, Method 516.6, Pro IV |
| Vibration | Single axis 10 - 500 Hz at 2g (sweep and endurance at resonance) in all 3 planes<br>Conforms to EN60068-2-6, IEC68-2-6<br>Conforms to MIL-STD-810G, Method 514.6, Pro I |
| Altitude | 5000 metres operational, 5000 metres storage/transportation |
| Pollution | Degree 2, Material group IIIb |
| IP Rating | IPX0 |

chanhvinh.com



| Immunity EN61000-6-2:2005, EN60601-1-2:2015 - see application notes for best installation practice | | | | Criteria |
|---|---|---|---|---|
| Electrostatic discharge | EN61000-4-2 | Level 4 | F type cooling only | A |
| Electromagnetic field | EN61000-4-3 | Level 3 | Proximity fields, EN60601-1-2, Levels as defined in standard, Criteria A | A |
| Fast / burst transient | EN61000-4-4 | Level 4 | Tested at 5kHz and 100kHz | A |
| Surge immunity | EN61000-4-5 | Level 3 | | A |
| Conducted RF immunity | EN61000-4-6 | Level 3 | | A |
| Power frequency magnetic field | EN61000-4-8 | Level 4 | | A |
| Voltage dips, variations, interruptions | EN61000-4-11 | Class 3 | Criteria B for 5s and 1 cycle interruptions | A |
| Voltage sags | Semi F-47 | compliant | above 180Vac input | |
| Ring wave | EN61000-4-12 | Level 3 | | A |
| | ANSI C62.41 | 3kV | 30Ω Neutral Grounding (0.5µs-100kHz Ring Wave) | A |
| Voltage fluctuations | EN61000-4-14 | Class 3 | See EMC report for full details. | A |

| Emissions EN61000-6-3:2007, EN60601-1-2:2015 - see application notes for best installation practice | | |
|---|---|---|
| Radiated electric field | EN55011, EN55032 | (as per CISPR.11/32) Class B, FCC47 part 15 subpart B - 'L' leakage current variants (Units with 'R' type leakage current option achieve Class A) |
| Conducted emissions | EN55011, EN55032 | (as per CISPR.11/32) Class B, FCC47 part 15 subpart B - 'L' leakage current variants (Units with 'R' type leakage current option achieve Class A) |
| Conducted harmonics | EN61000-3-2 | Class A and Class C |
| Flicker | EN61000-3-3 | Compliant - $d_{max}$ only |

| Approvals / Accreditations | |
|---|---|
| IEC/EN 62368-1, UL62368-1 / CSA 22.2 No 62368-1 | File E135494 |
| IEC/EN 60950-1, UL60950-1 / CSA 22.2 No 60950-1 | File E135494 |
| IEC/EN 60601-1, UL/CSA 60601-1, ANSI/AAMI ES60601-1, CAN/CSA-C22.2 No 60601-1 | File E349607 |
| IEC/EN 61010-1 | Designed to meet |
| CE Mark (EN62368-1) | Low Voltage Directive (LVD), electromagnetic compatibility (EMC) and Restriction of Hazardous Substances (RoHS) |
| UKCA (EN62368-1) | Electrical Equipment (Safety) Regulations, electromagnetic compatibility (EMC) and Restriction of Hazardous Substances (RoHS) |
| CB certificate and Report available on request | |
| Designed and manufactured under the control of ISO9001 and ISO13485 (including risk management). | |

## Other variants (input connection, cooling, etc)

The standard models listed are supplied with 'F' cooling, Screw terminal inputs and outputs, dual ac fuses and 300µA earth leakage current. Other options are possible by selecting from the table below.

| QS7- | 1200- | 24 | | -T5H | |
|---|---|---|---|---|---|

**Unit options** blank for all defaults or all of

| -Cooling -F | Input S | Fuse D | Leakage L |
|---|---|---|---|

| | | |
|---|---|---|
| **Case size** | QS4 | |
| | QS5 | |
| | QS5H | |
| | QS7 | |
| **Output power** | 600 | |
| | 1080 | |
| | 1200 | |
| **Output voltage** | 12 | |
| | 24 | |
| | 48 | |
| **Output Connection** | blank | Screw |

| | | |
|---|---|---|
| **Standby / Signals / Global Option** | blank | none |
| | -E5L | 5V / 250mA, Enable |
| | -E5H | 5V / 2A, 5V / 250mA, Enable |
| | -T5L | 5V / 250mA, Inhibit |
| | -T5H | 5V / 2A, 5V / 250mA, Inhibit |
| | -P5H | 5V / 2A, see PMBus™ app note |
| see specification page for details | | |

| | | |
|---|---|---|
| **Cooling** | F | Variable speed Forward air |
| **Input Connection** | S | Screw (default) |
| | I | IEC320 (QS5 and QS5H only) |
| **Input fuse** | D | Dual AC fuses |
| **Leakage Current** (max at 264Vac, 63Hz) | L | 300µA |

Contact TDK-Lambda to validate configuration and issue a part number.

chanhvinh.com



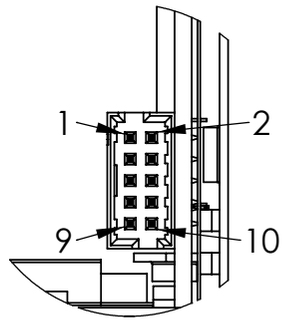
## Standby / Signals / Global Option

| | |
|---|---|
| Maximum power per channel | See table below |
| Available signals (Exx or Txx type) | PSU inhibit (Txx type) or enable (Exx type), AC Good |
| Available signals (Pxx type) | PMBus™ control of power supply<br>fan speed and fail warning<br>Serial number, date of manufacture, run time, on/off power cycles<br>For further details, see the product range application notes, PMBus™ section |
| Additional Leakage Current<br>(max at 264Vac, 63Hz) | xxL = 13.1µA, xxH = 15µA<br>Must also add the leakage current from modules and selected filter option. |

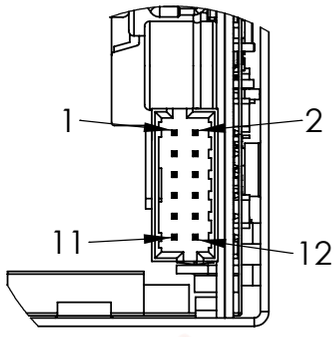
### Available Output Voltages (at PSU signal connector)

| Option type | Standby 1 | | | Standby 2 | | | PSU on/off |
|---|---|---|---|---|---|---|---|
| | V | Max Current | Power | V | Max Current | Power | |
| E5L | 5V | 250mA | 1.25W | not available | | | Enable |
| E5H | 5V | 250mA | 1.25W | 5V | 2A | 10W | Enable |
| T5L | 5V | 250mA | 1.25W | not available | | | Inhibit |
| T5H | 5V | 250mA | 1.25W | 5V | 2A | 10W | Inhibit |
| P5H | 5V | 2A | 10W | not available | | | see PMBus™ application note |

| Txx or Exx option | | |
|---|---|---|
| Pin | 5L | 5H |
| 1 | Do not connect | Standby 2 + |
| 2 | | Standby 2 - |
| 3 | Standby 1 + | Standby 1 + |
| 4 | Standby 1 - | Standby 1 - |
| 5 | PSU on/off+ | PSU on/off+ |
| 6 | PSU on/off- | PSU on/off- |
| 7 | AC fail Out | AC fail Out |
| 8 | AC fail Rtn | AC fail Rtn |
| 9 | Do not connect | |
| 10 | | |




| Pin | P5H or P12H option |
|---|---|
| 1 | Standby + |
| 2 | Standby - |
| 3 | Do not connect |
| 4 | Fan fail |
| 5 | Address 0 |
| 6 | Address 1 |
| 7 | Address 2 |
| 8 | Address 3 |
| 9 | SCL - Clock |
| 10 | SDA - Data |
| 11 | Control line in |
| 12 | GND |



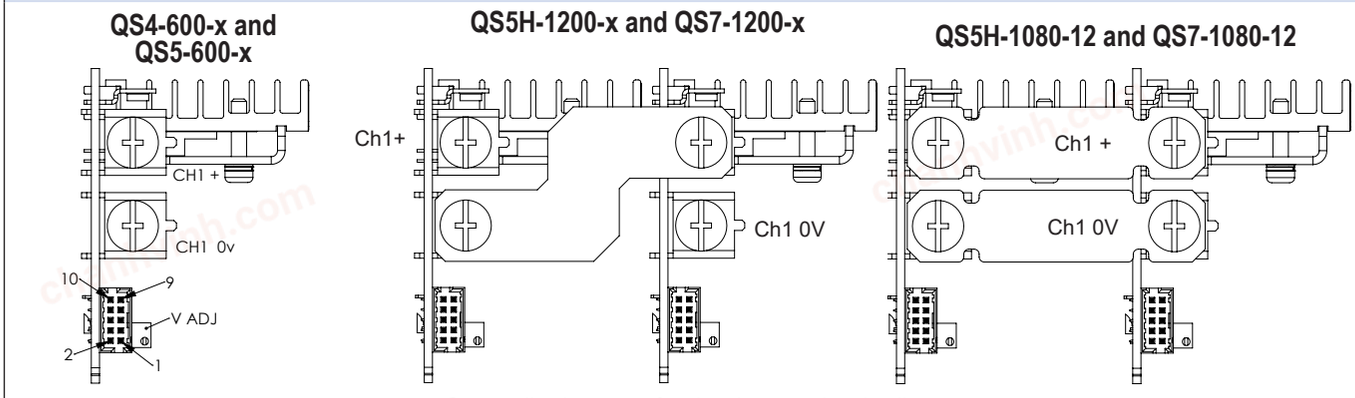

## Output Specification

| | Standby 1 | Standby 2 | |
|---|---|---|---|
| Rise time | <30ms | | (with resistive load) to 90% of voltage, monotonic rise above 10% |
| Ripple and noise | <1% | | pk-pk, using 20MHz bandwidth |
| Voltage setting accuracy | <3% | | of set voltage |
| Remote sense | No | | |
| Minimum load | 0W | | on any output |
| Temperature coefficient | 0.02% | | of rated voltage per °C |
| Load regulation | <1.5% | <1% | for 0-100% load change |
| Line regulation | <0.1% | | for 90-264Vac input change |
| Cross regulation | <0.4% | | for 100% load change on any output |
| Transient deviation | <5% | | of set voltage for 25-50% load change |
| Recovery | 1ms | | for recovery to 1% or 100mV of set voltage |
| Over voltage protection | Yes | | Latching, output shuts down, cycle ac to reset |
| Over current protection | Constant Current | | Auto recovers |
| Short circuit protection | Constant Current | | Auto recovers |

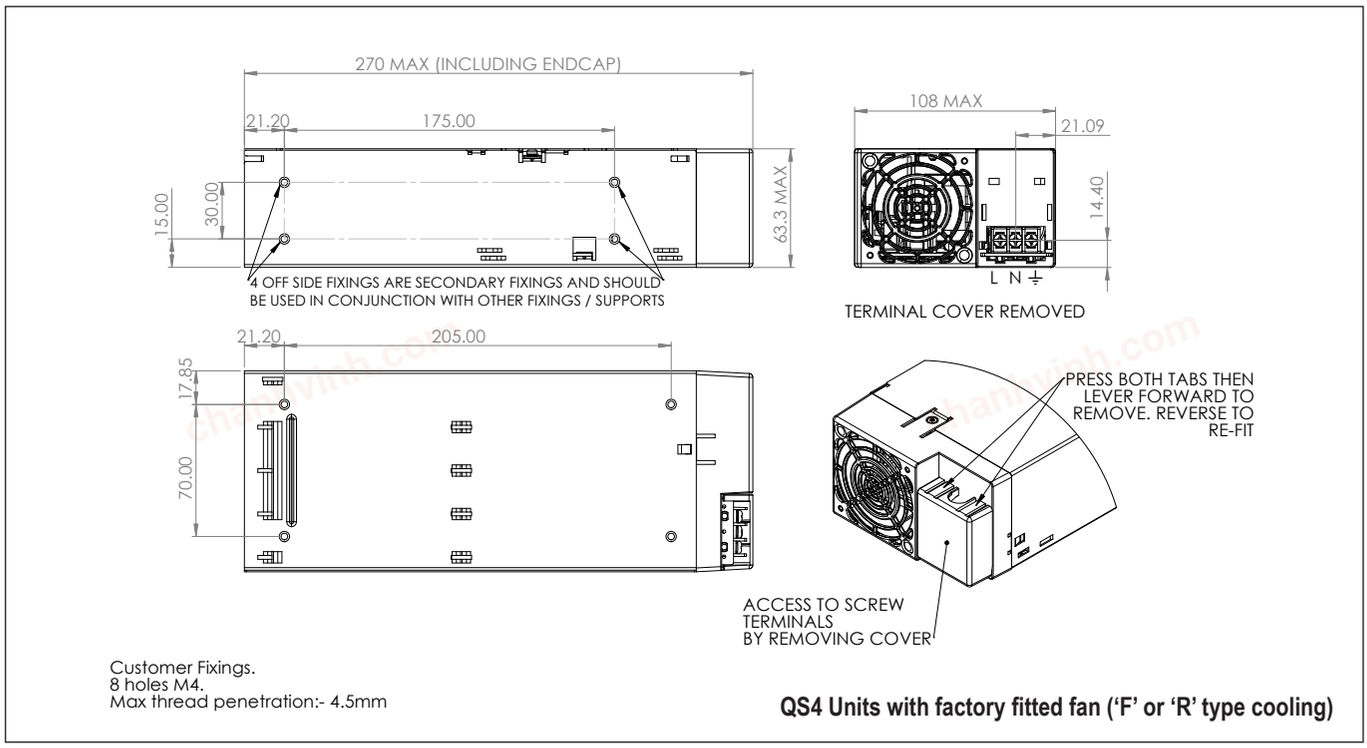
chanhvinh.com



## Output connections



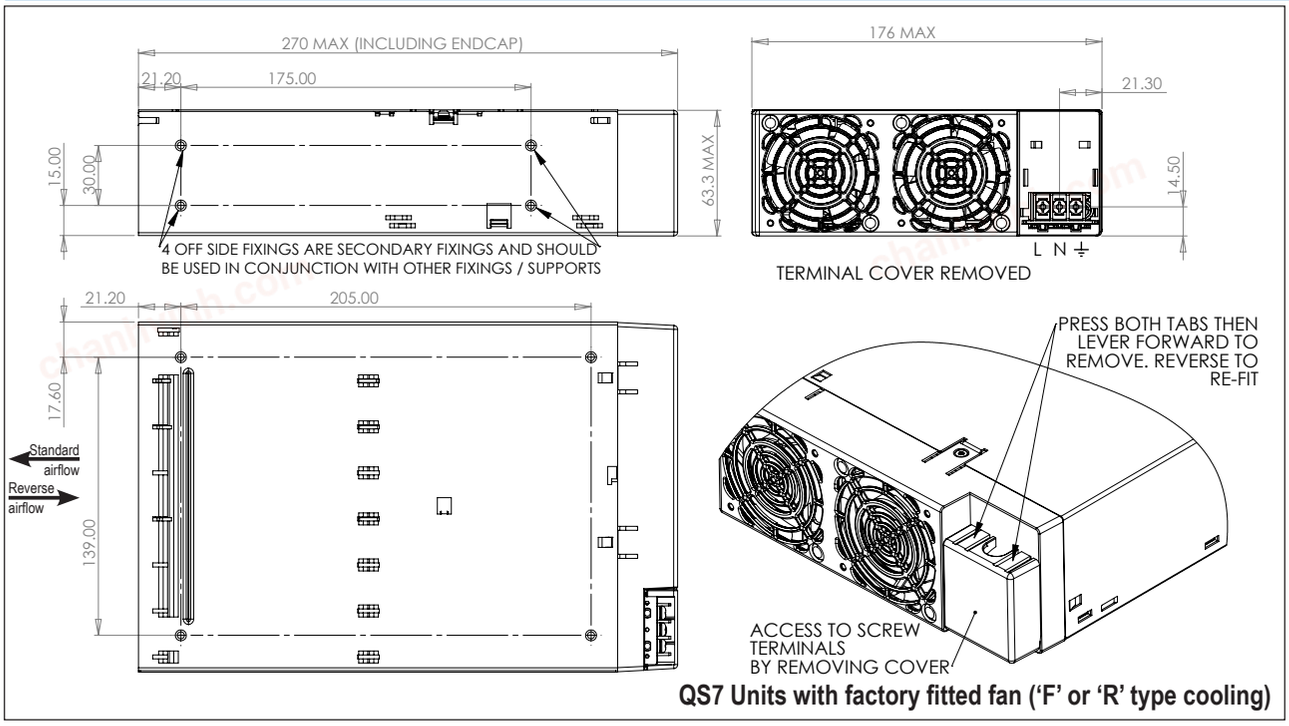

See application notes for signal connection details



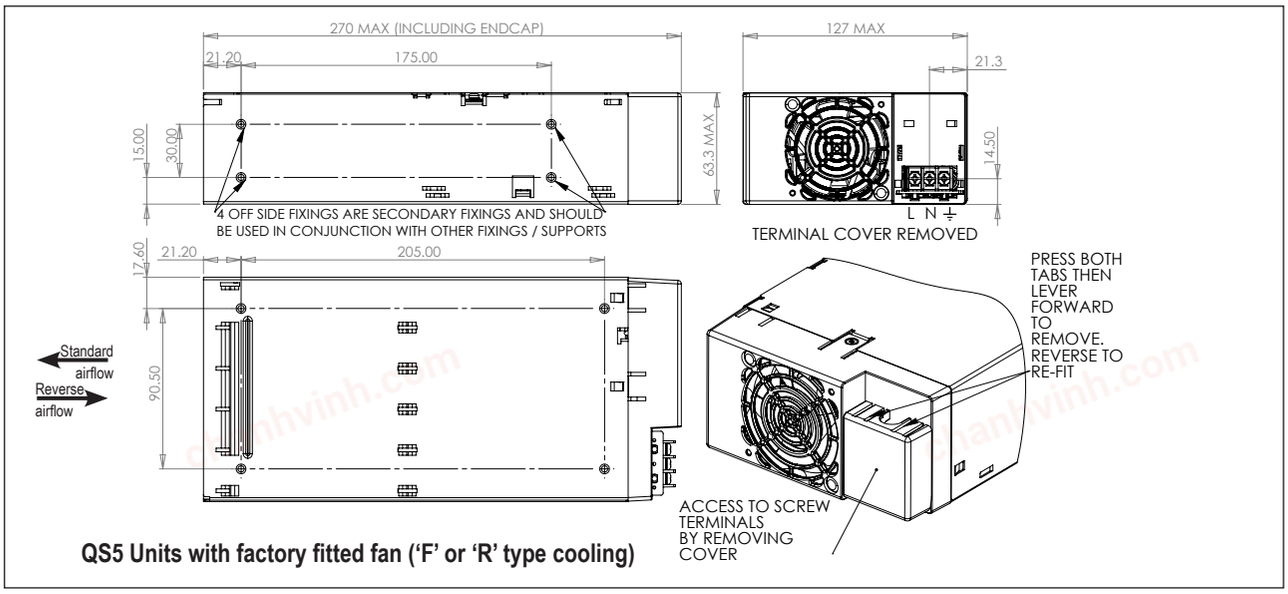

**QS4 Units with factory fitted fan ('F' or 'R' type cooling)**

chanhvinh.com

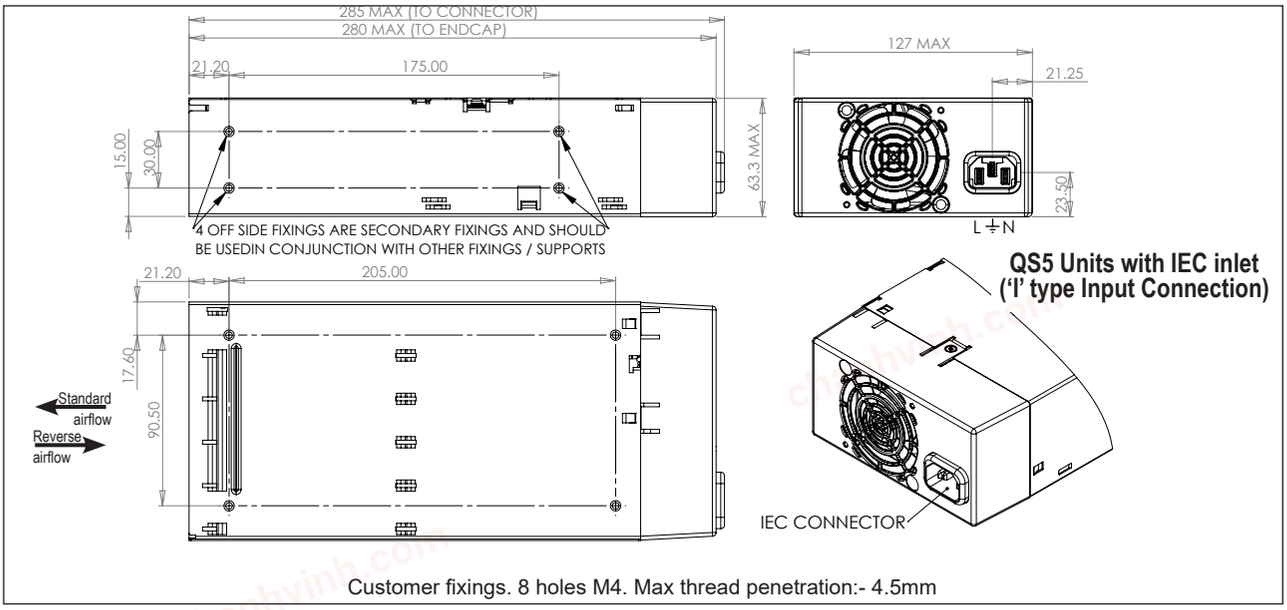





**QS7 Units with factory fitted fan ('F' or 'R' type cooling)**




**QS5 Units with factory fitted fan ('F' or 'R' type cooling)**




Customer fixings. 8 holes M4. Max thread penetration:- 4.5mm

chanhvinh.com

# TDK·Lambda

Trusted • Innovative • Reliable



**TDK-Lambda France SAS**
Tel: +33 1 60 12 71 65
tlf.fr-powersolutions@tdk.com
www.emea.lambda.tdk.com/fr



**Italy Sales Office**
Tel: +39 02 61 29 38 63
tlf.it-powersolutions@tdk.com
www.emea.lambda.tdk.com/it



**Netherlands**
tlf.nl-powersolutions@tdk.com
www.emea.lambda.tdk.com/nl



**TDK-Lambda Germany GmbH**
Tel: +49 7841 666 0
tlg.powersolutions@tdk.com
www.emea.lambda.tdk.com/de



**Austria Sales Office**
Tel: +43 2256 655 84
tlg.at-powersolutions@tdk.com
www.emea.lambda.tdk.com/at



**Switzerland Sales Office**
Tel: +41 44 850 53 53
tlg.ch-powersolutions@tdk.com
www.emea.lambda.tdk.com/ch



**Nordic Sales Office**
Tel: +45 8853 8086
tlg.dk-powersolutions@tdk.com
www.emea.lambda.tdk.com/dk



**TDK-Lambda UK Ltd.**
Tel: +44 (0) 12 71 85 66 66
tlu.powersolutions@tdk.com
www.emea.lambda.tdk.com/uk



**TDK-Lambda Ltd.**
Tel: +9 723 902 4333
tli.powersolutions@tdk.com
www.emea.lambda.tdk.com/il-en



**TDK-Lambda Americas**
Tel: +1 800-LAMBDA-4 or 1-800-526-2324
tla.powersolutions@tdk.com
www.us.lambda.tdk.com



**TDK Electronics do Brasil Ltda**
Tel: +55 11 3289-9599
sales.br@tdk-electronics.tdk.com
www.tdk-electronics.tdk.com/en



**TDK-Lambda Corporation**
Tel: +81-3-6778-1113
www.jp.lambda.tdk.com



**TDK-Lambda (China) Electronics Co. Ltd.**
Tel: +86 21 6485-0777
tlc.powersolutions@tdk.com
www.lambda.tdk.com.cn



**TDK-Lambda Singapore Pte Ltd.**
Tel: +65 6251 7211
tls.marketing@tdk.com
www.sg.lambda.tdk.com



**TDK India Private Limited, Power Supply Division**
Tel: +91 80 4039-0660
mathew.philip@tdk.com
www.sg.lambda.tdk.com

For Additional Information, please visit
https://product.tdk.com/en/power/