

## DESCRIPTION

The TM650 series comprising single and multiple output models for 650-700 watts of continuous output power is specially designed for medical applications not for life support. They operate at 90 to 264VAC input voltage without the need of a selector strap. The units are constructed on a printed circuit board with a U-bracket for mechanical support and heat sinking. A cover-and-fan assembly can be added during manufacturing.

## TM650 SERIES



RoHS

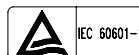
## FEATURES

- EN61000-3-2 class A and D compliant
- Power Factor 0.98 typical
- Overvoltage protection
- Short-circuit protection
- Thermal protection
- Power Fail Detect (PFD)
- 100% burn-in at full rated load
- Remote sense on output #1 and output #2
- Remote inhibit – TTL high disables output
- Compliant with RoHS requirements

## Safety Standard Approvals :



UL 60601-1  
CSA C22.2 No. 601.1



TÜV EN60601-1

## INPUT SPECIFICATIONS

|                         |  |
|-------------------------|--|
| Input voltage :         | 90 to 264VAC   |
| Input frequency :       | 47 to 63Hz   |
| Input current :         | 10A ( rms ) for 115VAC<br>5A ( rms ) for 230VAC        |
| Earth leakage current : | 100µA max. @ 115VAC, 60Hz<br>165µA max. @ 230VAC, 50Hz |

## ENVIRONMENTAL SPECIFICATIONS

|                         |   |
|-------------------------|---|
| Operating temperature : | 0°C to +70°C  |
| Storage temperature :   | -40°C to +85°C  |
| Relative humidity :     | 5% to 95% non-condensing                              |
| Derating :              | Derate from 100% at +50°C<br>linearly to 50% at +70°C |

## OUTPUT SPECIFICATIONS

|                           |  |
|---------------------------|--|
| Output voltage/current :  | See rating chart   |
| Total output power :      | See rating chart   |
| Ripple and noise :        | 2% peak to peak maximum  |
| Overvoltage protection :  | Provided on output #1 only; set at 115 –140% of its nominal output voltage   |
| Overcurrent protection :  | All outputs protected to short circuit conditions  |
| Temperature coefficient : | All outputs ±0.04%/°C maximum  |
| Transient response :      | Maximum excursion of 4% or better on all models, recovering to 1% of final value within 500µs after a 25% step load change   |
| PFD signal :              | TTL logic high for normal operation and TTL logic low upon loss of input power. This signal appears at least 1ms prior to master output dropping 5% below its nominal value. This signal also provides a minimum delay of 100 ms after master output is within regulation. |
| Remote inhibit :          | Requires an external TTL high level signal to inhibit outputs for standard models.   |

## GENERAL SPECIFICATIONS

|                               |  |
|-------------------------------|--|
| Switching frequency :         | 70KHz ±10KHz   |
| Power factor :                | 0.98 typical   |
| Efficiency :                  | 80% minimum on all models  |
| Hold-up time :                | 12 msec minimum at 110VAC  |
| Line regulation :             | ±0.2% maximum at full load   |
| Inrush current :              | 50amps @115VAC or 100 amps @ 230VAC at 25°C cold start                                       |
| Withstand voltage :           | 4000VAC from input to output<br>1500VAC from input to ground<br>500VAC from output to ground |
| MTBF :                        | 300,000 hours minimum at full load at 25°C ambient, calculated per MIL-HDBK- 217F            |
| EMC Performance (EN60601-1-2) |  |
| EN55011:                      | Class B conducted, Class A radiated  |
| EN61000-3-2:                  | Harmonic distortion, Class A and D   |
| EN61000-3-3:                  | Line flicker   |
| EN61000-4-2:                  | ESD, ±8KV air and ±6KV contact   |
| EN61000-4-3:                  | Radiated immunity, 3V/m  |
| EN61000-4-4:                  | Fast transient/burst, ±2KV   |
| EN61000-4-5:                  | Surge, ±1KV diff, ±2KV com.  |
| EN61000-4-6:                  | Conducted immunity, 3Vrms  |
| EN61000-4-8:                  | Magnetic field immunity, 3A/m  |
| EN61000-4-11:                 | Voltage dips, 30% reduction for 500ms, 60% reduction for 100ms and >95% reduction for 10ms   |

## OUTPUT VOLTAGE/CURRENT RATING CHART

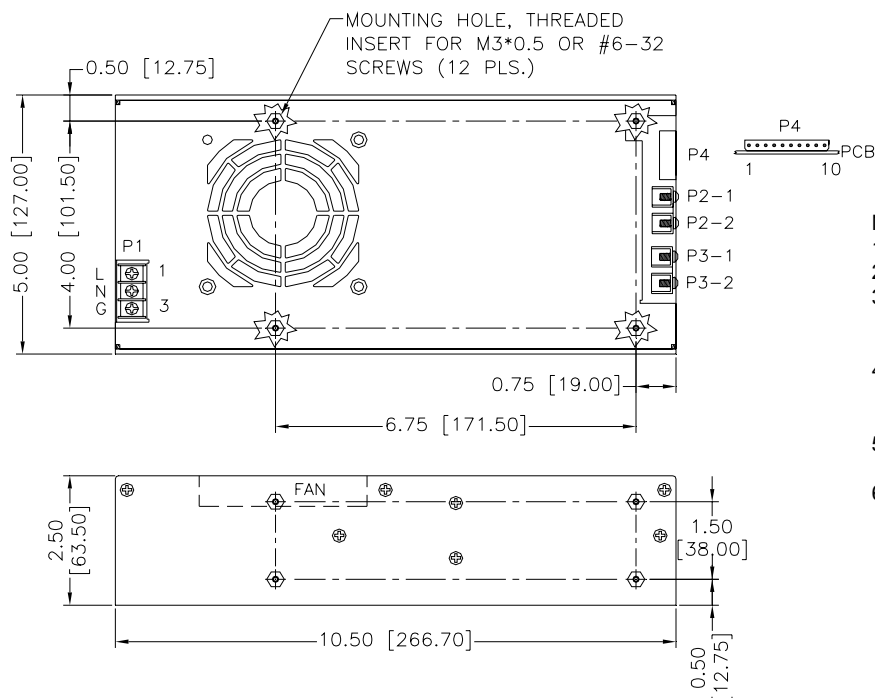
| Product No. | Output # 1 |       |                   |      | Output # 2 |       |                   |      | Output # 3 |       |                   |      | Maximum Output Power |
|-------------|------------|-------|-------------------|------|------------|-------|-------------------|------|------------|-------|-------------------|------|----------------------|
|             | Vnom.      | Imin. | I <sub>max.</sub> | Tol. | Vnom.      | Imin. | I <sub>max.</sub> | Tol. | Vnom.      | Imin. | I <sub>max.</sub> | Tol. |                      |
| TM650-S12   | 12V        | 0A    | 54.2A             | 2%   |            |       |                   |      |            |       |                   |      | 650W                 |
| TM650-S15   | 15V        | 0A    | 43.4A             | 2%   |            |       |                   |      |            |       |                   |      | 650W                 |
| TM650-S24   | 24V        | 0A    | 27.1A             | 2%   |            |       |                   |      |            |       |                   |      | 650W                 |
| TM650-S27   | 27V        | 0A    | 24.1A             | 2%   |            |       |                   |      |            |       |                   |      | 650W                 |
| TM650-S30   | 30V        | 0A    | 21.7A             | 2%   |            |       |                   |      |            |       |                   |      | 650W                 |
| TM650-S36   | 36V        | 0A    | 18.1A             | 2%   |            |       |                   |      |            |       |                   |      | 650W                 |
| TM650-S48   | 48V        | 0A    | 14.6A             | 2%   |            |       |                   |      |            |       |                   |      | 700W                 |
| TM650-D20   | 24V        | 1.5A  | 18A               | 2%   | 12V        | 1.2A  | 22A               | 5%   |            |       |                   |      | 650W                 |
| TM650-D21   | 24V        | 1.5A  | 18A               | 2%   | 15V        | 1.0A  | 18A               | 5%   |            |       |                   |      | 650W                 |
| TM650-D22   | 48V        | 0.75A | 9A                | 2%   | 24V        | 0.6A  | 12A               | 5%   |            |       |                   |      | 650W                 |
| TM650-D23   | 48V        | 0.75A | 9A                | 2%   | 12V        | 1.2A  | 22A               | 5%   |            |       |                   |      | 650W                 |
| TM650-D24   | 48V        | 0.75A | 9A                | 2%   | 15V        | 1.0A  | 18A               | 5%   |            |       |                   |      | 650W                 |
| TM650-T30   | 24V        | 1.5A  | 18A               | 2%   | 12V        | 1.2A  | 22A               | 5%   | 3.3V       | 0A    | 10A               | 3%   | 650W                 |
| TM650-T31   | 24V        | 1.5A  | 18A               | 2%   | 15V        | 1.0A  | 18A               | 5%   | 3.3V       | 0A    | 10A               | 3%   | 650W                 |
| TM650-T32   | 24V        | 1.5A  | 18A               | 2%   | 12V        | 1.2A  | 22A               | 5%   | 5.1V       | 0A    | 10A               | 3%   | 650W                 |
| TM650-T33   | 24V        | 1.5A  | 18A               | 2%   | 15V        | 1.0A  | 18A               | 5%   | 5.1V       | 0A    | 10A               | 3%   | 650W                 |
| TM650-T34   | 48V        | 0.75A | 9A                | 2%   | 12V        | 1.2A  | 22A               | 5%   | 3.3V       | 0A    | 10A               | 3%   | 650W                 |
| TM650-T35   | 48V        | 0.75A | 9A                | 2%   | 15V        | 1.0A  | 18A               | 5%   | 3.3V       | 0A    | 10A               | 3%   | 650W                 |
| TM650-T36   | 48V        | 0.75A | 9A                | 2%   | 12V        | 1.2A  | 22A               | 5%   | 5.1V       | 0A    | 10A               | 3%   | 650W                 |
| TM650-T37   | 48V        | 0.75A | 9A                | 2%   | 15V        | 1.0A  | 18A               | 5%   | 5.1V       | 0A    | 10A               | 3%   | 650W                 |

### NOTES:

1. Add suffix "C" for enclosed format with fan control function, e.g. TM650-S24C.
2. All outputs are floating. It can be connected externally for positive or negative output.
3. Output #1 can be adjusted within +/- 5% of their nominal voltage.
4. Output #3 can be adjusted within +/- 15% of their nominal voltage.
5. 650~700 watts for "C" version with cover-and-fan assembly. 325~350 watts for U-bracket version without moving air (maximum current of output #1 and #2 derated to 70%), or 650 watts with 50 CFM forced air provided by user.
6. All models may operated at no-load. At no-load, output voltage tolerance increases to 10%.

## MECHANICAL SPECIFICATIONS

### Single Output Models

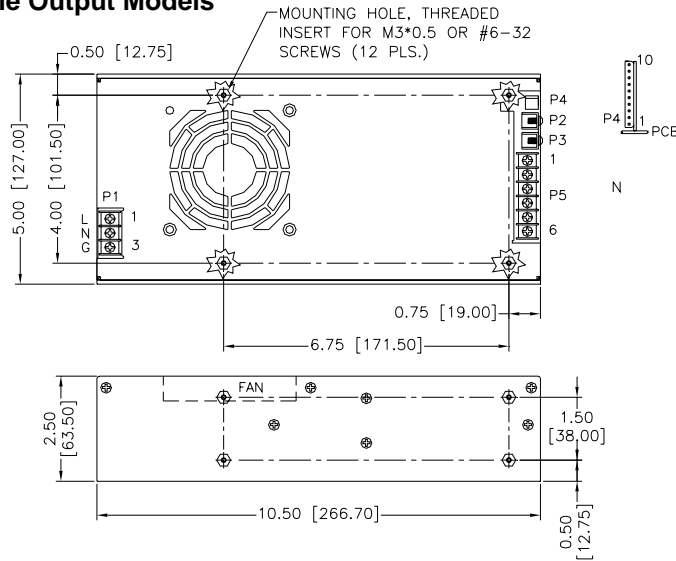


### NOTES:

1. Dimensions shown in inch [mm]
2. Tolerance 0.02 [0.5] maximum.
3. Input connector P1 is Dinkle DT-4C-B01N-03 screws are M3, Nickel plated.
4. Connector P4 mates with Molex housing 50-37-5103 and pins 5263.
5. P2-1, P2-2, P3-1 & P3-2: M3\*0.5 screw connections.
6. Weight: 2,040 gms.

## MECHANICAL SPECIFICATIONS

### Multiple Output Models



#### NOTES:

1. Dimensions shown in inch [mm]
2. Tolerance 0.02 [0.5] maximum
3. Input connector P1 is Dinkle DT-4C-B01N-03 screws are M3, Nickel plated
4. Connector P4 mates with Molex housing 50-37-5103 and pins 5263.
5. P2, P3: M3\*0.05 screw connections.
6. Output connector P5 is Dinkle DT-35-B01W-06 screws are M3, Nickel plated.
7. Weight: 2,140 gms.

### PIN CHART

#### Single Output Models

| Product No.                                      | CONN PIN                            | P1 (AC) |         |        | P2 | P3 | P4                 |        |        |     |
|--|-------------------------------------|---------|---------|--------|----|----|--------------------|--------|--------|-----|
|  |                                     | 1       | 2       | 3      |    |    | 1                  | 2      | 3      | 4   |
| TM650-S12<br>TM650-S24<br>TM650-S30<br>TM650-S48 | TM650-S15<br>TM650-S27<br>TM650-S36 | LIVE    | NEUTRAL | GROUND | +V | -V | SIGNAL GROUND (-V) | +S (V) | -S (V) | PFD |

| Product No.                                      | CONN PIN                            | P4          |             |      |      |          |     |
|--|-------------------------------------|-------------|-------------|------|------|----------|-----|
|  |                                     | 5           | 6           | 7    | 8    | 9        | 10  |
| TM650-S12<br>TM650-S24<br>TM650-S30<br>TM650-S48 | TM650-S15<br>TM650-S27<br>TM650-S36 | INHIBIT +Ve | INHIBIT -Ve | N.C. | N.C. | 0V (FAN) | FAN |

#### Multiple Output Models

| Product No.                                      | CONN PIN   | P1 (AC) |         |        | P2  | P3  | P4                 |         |         |     |
|--|--|---------|---------|--------|-----|-----|--------------------|---------|---------|-----|
|  |  | 1       | 2       | 3      |     |     | 1                  | 2       | 3       | 4   |
| TM650-D20<br>TM650-D22<br>TM650-D24              | TM650-D21<br>TM650-D23                           | LIVE    | NEUTRAL | GROUND | +V1 | -V1 | SIGNAL GROUND (-V) | +S (V1) | -S (V1) | PFD |
| TM650-T31<br>TM650-T33<br>TM650-T35<br>TM650-T37 | TM650-T30<br>TM650-T32<br>TM650-T34<br>TM650-T36 | LIVE    | NEUTRAL | GROUND | +V1 | -V1 | SIGNAL GROUND (-V) | +S (V1) | -S (V1) | PFD |

| Product No.                                      | CONN PIN   | P4          |             |         |         |          |     | P5  |     |     |     |      |      |
|--|--|-------------|-------------|---------|---------|----------|-----|-----|-----|-----|-----|------|------|
|  |  | 5           | 6           | 7       | 8       | 9        | 10  | 1   | 2   | 3   | 4   | 5    | 6    |
| TM650-D20<br>TM650-D22<br>TM650-D24              | TM650-D21<br>TM650-D23                           | INHIBIT +Ve | INHIBIT -Ve | +S (V2) | -S (V2) | 0V (FAN) | FAN | +V2 | +V2 | -V2 | -V2 | N.C. | N.C. |
| TM650-T30<br>TM650-T32<br>TM650-T34<br>TM650-T36 | TM650-T31<br>TM650-T33<br>TM650-T35<br>TM650-T37 | INHIBIT +Ve | INHIBIT -Ve | +S (V2) | -S (V2) | 0V (FAN) | FAN | +V2 | +V2 | -V2 | -V2 | +V3  | -V3  |