

LEVEL VI
EFFICIENCY
EMI & EMC



Features

- Meets DoE Efficiency Level VI Requirements
 - No load input power
 - Average Efficiency
- Up to 60W of AC-DC Power
- Universal Input 90-264Vac Input Range
- IP22 Rated Enclosure
- Meets “Heavy Industrial” Levels of EN61000 EMC Requirements
- Meets EN55011/CISPR11, FCC Part 15.109 Class B Conducted & Radiated Emissions, with 6db margin
- Approved to EN/IEC/UL60950-1, 2nd Edition, Am. 2
- E-cap life of >8 years
- >900,000 hours MTBF
- 3 Year Warranty
- IP22 Rated Enclosure

Description

A high performance AC to DC external power supply family designed for test & measurement and industrial applications. Fully compliant with Efficiency Level VI requirements per U.S. Dept. of Energy, and also compliant to the Heavy Industrial levels of various EN61000-4-x standards for EMC. The TE60A series models also meet Class B conducted and radiated EMI per FCC Part 15, EN55022, CISPR22. Designed to allow easy integration with test and measurement equipment and other industrial applications.

Model Selection

| Model Number | Volts | Output Current | Output Power | Ripple & Noise ¹ | Line Regulation | Load Regulation | Output Cable & Connector | Input Configuration |
|--------------|-------|----------------|--------------|-----------------------------|-----------------|-----------------|-------------------------------|---------------------|
| TE60A0551F01 | 5.0V | 7.00A | 35W | 75mV pk-pk | ±1% | ±5% | 6 pin Molex Type ² | |
| TE60A0903F01 | 9.0V | 6.00A | 54W | 90mV pk-pk | ±1% | ±5% | | |
| TE60A1203F01 | 12.0V | 5.00A | 60W | 120mV pk-pk | ±1% | ±5% | | |
| TE60A1503F01 | 15.0V | 4.00A | 60W | 150mV pk-pk | ±1% | ±5% | | |
| TE60A1803F01 | 18.0V | 3.40A | 60W | 180mV pk-pk | ±1% | ±5% | | |
| TE60A2403F01 | 24.0V | 2.70A | 60W | 240mV pk-pk | ±1% | ±5% | | |
| TE60A4803F01 | 48.0V | 1.35A | 60W | 480mV pk-pk | ±1% | ±5% | | |
| TE60A0551N01 | 5.0V | 7.00A | 35W | 75mV pk-pk | ±1% | ±5% | 6 pin Molex Type ² | |
| TE60A0903N01 | 9.0V | 6.00A | 54W | 90mV pk-pk | ±1% | ±5% | | |
| TE60A1203N01 | 12.0V | 5.00A | 60W | 120mV pk-pk | ±1% | ±5% | | |
| TE60A1503N01 | 15.0V | 4.00A | 60W | 150mV pk-pk | ±1% | ±5% | | |
| TE60A1803N01 | 18.0V | 3.40A | 60W | 180mV pk-pk | ±1% | ±5% | | |
| TE60A2403N01 | 24.0V | 2.70A | 60W | 240mV pk-pk | ±1% | ±5% | | |
| TE60A4803N01 | 48.0V | 1.35A | 60W | 480mV pk-pk | ±1% | ±5% | | |
| TE60A0551Q01 | 5.0V | 7.00A | 60W | 75mV pk-pk | ±1% | ±5% | 6 pin Molex Type ² | |
| TE60A0903Q01 | 9.0V | 6.00A | 54W | 90mV pk-pk | ±1% | ±5% | | |
| TE60A1203Q01 | 12.0V | 5.00A | 60W | 120mV pk-pk | ±1% | ±5% | | |
| TE60A1503Q01 | 15.0V | 4.00A | 60W | 150mV pk-pk | ±1% | ±5% | | |
| TE60A1803Q01 | 18.0V | 3.40A | 60W | 180mV pk-pk | ±1% | ±5% | | |
| TE60A2403Q01 | 24.0V | 2.70A | 60W | 240mV pk-pk | ±1% | ±5% | | |
| TE60A4803Q01 | 48.0V | 1.35A | 60W | 480mV pk-pk | ±1% | ±5% | | |

Notes: 1. Measured at the output connector, with noise probe directly across output and load, terminated with 0.1µF ceramic and 47µF low ESR capacitors. For 5V and 6V models, values listed are typical, 100mV pk-pk maximum.
 2. Molex p/n 39-01-2060 or equivalent. See outline drawing for pinout information.
 3. For Input Class I models: For AC GND connected to output common (-), insert a “B” in the part number where the “A” is located (TE60B1203F01).
 4. All specifications are typical at nominal input, full load, at 25°C ambient unless noted.

General Specifications

| | | | |
|------------------------------|--|-----------------------------------|---|
| AC Input | 100-240Vac, ±10%, 47-63Hz, 1Ø | Turn On Time | Less than 1 sec @115Vac, full load |
| Input Current | 115Vac: 1.5A, 230Vac: 0.75A | Hold-up Time | 20mS min., at full Load, 100Vac input |
| Inrush Current | 264Vac, cold start: will not exceed 40A | Overtemperature Protection | Will shutdown upon an over-temperature condition, auto-recovery. |
| Input Fuses | F1, F2: 2A, 250Vac fuses (line & neutral lines) provided on all models | Overload Protection | 130 to 180% of rating, Hiccup Mode |
| Earth Leakage Current | Input-GND: <500µA@264Vac, 60Hz, NC Output-GND: <4mA@264Vac, 60Hz, NC | Short Circuit Protection | Hiccup Mode, auto recovery. |
| Efficiency | Meets US DoE Efficiency Level VI average efficiency levels | Overvoltage Protection | 130 to 150% of output voltage (max. 60V on 48V model), hiccup mode |
| Output Power | 60W continuous – See models chart for specific voltage model ratings. | Isolation | Input-Output: 4000Vac Input-Ground: 1500Vac Output-Ground: 1500Vac |
| No Load Input Power | <0.210W per DoE Efficiency Level VI Requirements | Safety Standards | EN/CSA/UL/IEC 60950-1, 2nd Edition, Am 2 |
| Ripple and Noise | See models chart on pg 1. | Operating Temperature | -20°C to +70°C. Derate above 40°C. Start Up at -40°C, full load, (warmup period before all parameters are within published specifications). |
| Output Voltage | See models chart on pg 1. | Case Temperature | Case Temperatures are within regulatory guidelines. Care should be taken to avoid prolonged contact with skin or other heat sensitive surfaces. |
| Transient Response | 500µs response time for return to within 0.5% of final value for any 50% load step over the range of 5% to 100% of rated load, $\Delta i/\Delta t < 0.2A/\mu s$. Max. voltage deviation is +/-3.5%. >7 year life based on calculations at 115Vac/60Hz & 230Vac/50Hz, ambient 25°C at 24 hrs per day, 365 days/year, 6 power up cycles per day. (80% load on 12V model) | Temperature Derating | See derating curve below. |
| E-Cap Life | >7 year life based on calculations at 115Vac/60Hz & 230Vac/50Hz, ambient 25°C at 24 hrs per day, 365 days/year, 6 power up cycles per day. (80% load on 12V model) | MTBF | >250,000 hours, full load, 110 & 220Vac input, 25°C amb., per Telcordia 332 Issue 6. |
| Weight | 400g | Storage Temperature | -40°C to +85°C |
| Safety Drop Test | 1.4m from table top to wooden platform, 6 faces. | Altitude | Operating: to 5000m Non-operating: -500 to 40,000 ft. |
| Dimensions | W: 2.67" x L: 4.25" x H: 1.29" W: 67.9mm x L: 108mm x H: 32.7mm | Relative Humidity | 5% to 95%, non-condensing |
| Vibration | Operating: 0.003g/Hz, 1.5grms overall, 3 axes, 10 min/axis, 1-500Hz. Non-Oper.: random waveform, 3 minutes per axis, 3 axes and Sine waveform, Vib. frequency/acceleration: 10-500Hz/1g, sweep rate of 1 octave / minutes, Vibration time of 10 sweeps / axes, 3 axes | Shock | Operating: Half-sine, 20gpk, 10mS, 3 axes, 6 shocks total Non-Operating: Half-sine waveform, impact acceleration of 100G, Pulse duration of 6 mS, Number of shocks: 3 for each of the three axis |

All specifications are typical at nominal input, full load, at 25°C ambient unless noted.

EMI/EMC Compliance

| | |
|--|---|
| Conducted Emissions: | EN55011/CISPR22 Class B, FCC Part 15.107, Class B: 6db margin typ, at 115 and 230Vac |
| Radiated Emissions: | EN55022/CISPR22 Class B, FCC Part 15.109, Class B: 3db margin typ, at 115 and 230Vac |
| Common Mode Noise: | High Frequency (100kHz-20MHz): <40mA pk-pk |
| Electro-Static Discharge (ESD) Immunity on Power ports: | EN55024/IEC61000-4-2, Level 4: +/- 8kV contact, +/- 15kV air, Criteria A |
| Radiated RF EM Fields Susceptibility | EN55022/EN61000-4-3, 10V/m, 80MHz-2.7GHz, 80% AM at 1kHz |
| Electrical Fast Transients (EFT) /Bursts: | EN55024/IEC61000-4-4, Level 4, +/- 4kV, 100Khz rep rate, 40A, Criteria A |
| Surges, Line to Line (Diff Mode) and Line to GND (CMN Mode) | EN55024/IEC61000-4-5, Level 4, +/-1kV DM, +/-4kV CM, Criteria A |
| Conducted Disturbances induced by RF Fields | EN55022/IEC61000-4-6, 10Vrms – Level 4, in ISM and amateur radio bands between 0.15Mhz and 80Mhz, 80% AM at 1KHz |
| Rated Power frequency magnetic fields | EN55024/IEC1000-4-8, Level 4: 30 A/m, 50/60 Hz |
| Voltage Interruptions, Dips, Sags & Surges | EN55024/IECEN61000-4-11: --100% dip for 20mS, Criteria A --100% dip for 5000mS (250/300 cycles), Criteria B --60% dip for 100mS, Criteria B --30% dip for 500mS, Criteria A |
| Harmonic Current Emissions | EN55011/EN61000-3-2, Class A |
| Flicker Test | EN61000-3-3 |

All specifications are typical at nominal input, full load, at 25°C ambient unless noted.

MTE60 Series Output Power Derating Curve:



Mechanical Drawing:



- Notes:**
- 1) All dimensions in (mm).
 - 2) 2.5mm barrel connector shown, other options are available.
 - 3) The unit should not be covered or enclosed to protect against excessive case temperature rise.

Connector Information

Standard models include a 2.5 x 5.5 x 9.5mm straight barrel type connector (Ault #3), center positive. Other standard options are listed below. The "03" in the standard model number is replaced by the applicable digits below:

| Connector No. | Description | Connector No. | Description |
|---------------|--|---------------|---|
| 02 | 2.1 x 5.5 x 9.5mm straight barrel plug - Center Positive | 44 | 2.1 x 5.5 x 9.5mm straight barrel plug, locking - Center Positive |
| 03 | 2.5 x 5.5 x 9.5mm straight barrel plug - Center Positive (Standard Models) | 45 | 2.5 x 5.5 x 9.5mm straight barrel plug, locking - Center Positive |
| 12 | 5 pin DIN-180 male connector (Pins 3, 5 = (+), pins 1, 2, 4 = (-)) | 48 | 3 pin Snap n Lock, Kycon Kpp-3P or equivalent (Pin 1 = (+), pin 2 = (-)) |
| 22 | 6 pin DIN male connector (Pins 1, 2 = (+), pins 4, 5 = (-)) | 49 | 4 pin Snap n Lock, Kycon Kpp-4P or equivalent (Pins 1, 3 = (+), pins 2, 4 = (-)) |
| 23 | 8 pin DIN male connector (Pins 3, 7 = (+), pins 1, 4, 6, 8 = (-), shell = FG)) | 51 | 6 pin Minifit - Molex 39-01-2060 or equivalent (Pins 1, 4 = (+), pins 3, 6 = (-)) |
| 32 | 9 pin "D" type, female (Pin 8 = (+), pin 5 = (-), all others = NC) | 65 | Stripped and Tinned Leads |
| 33 | 2.5 x 5.5 x 12.5mm straight barrel plug - Center Positive | 70 | 2.1 x 5.5 x 11mm right angle barrel plug (high retention) - Center Positive |
| 40 | 2.1 x 5.5 x 9.5mm right angle barrel plug (high retention) - Center Positive | 71 | 2.5 x 5.5 x 11mm right angle barrel plug (high retention) - Center Positive |
| 41 | 2.5 x 5.5 x 9.5mm right angle barrel plug (high retention) - Center Positive | 72 | 2.1 x 5.5 x 9.5mm straight barrel plug (high retention, no spark) - Center Positive |
| 42 | 2.1 x 5.5 x 11mm straight barrel plug (high retention) - Center Positive | 73 | 2.5 x 5.5 x 9.5mm straight barrel plug (high retention, no spark) - Center Positive |
| 43 | 2.5 x 5.5 x 11mm straight barrel plug (high retention) - Center Positive | 74 | EIAJ#5 style connector - Center Positive |

Efficiency Level VI Information:

| Single-Voltage External AC-DC Power Supply, Basic-Voltage | | |
|---|---|-----------------------------------|
| Nameplate Output Power (P_{out}) | Minimum Average Efficiency in Active Mode (expressed as a decimal) | Maximum Power in No-Load Mode [W] |
| $P_{out} \leq 1$ W | $\geq 0.5 \times P_{out} + 0.16$ | ≤ 0.100 |
| 1 W < $P_{out} \leq 49$ W | $\geq 0.071 \times \ln(P_{out}) - 0.0014 \times P_{out} + 0.67$ | ≤ 0.100 |
| 49 W < $P_{out} \leq 250$ W | ≥ 0.880 | ≤ 0.210 |
| $P_{out} > 250$ W | ≥ 0.875 | ≤ 0.500 |
| Single-Voltage External AC-DC Power Supply, Low-Voltage | | |
| Nameplate Output Power (P_{out}) | Minimum Average Efficiency in Active Mode (expressed as a decimal) | Maximum Power in No-Load Mode [W] |
| $P_{out} \leq 1$ W | $\geq 0.517 \times P_{out} + 0.087$ | ≤ 0.100 |
| 1 W < $P_{out} \leq 49$ W | $\geq 0.0834 \times \ln(P_{out}) - 0.0014 \times P_{out} + 0.609$ | ≤ 0.100 |
| 49 W < $P_{out} \leq 250$ W | ≥ 0.870 | ≤ 0.210 |
| $P_{out} > 250$ W | ≥ 0.875 | ≤ 0.500 |

TE60A 12V-48V

TE60A 5V

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