



## APPLICATIONS

Wireless Network  
Telecom/Datacom  
Industry Control System  
Measurement  
Semiconductor Equipment

## FEATURES

- 6 WATTS MAXIMUM OUTPUT POWER
- OUTPUT CURRENT UP TO 1200mA
- PACKAGE, 1.61 x 1.02 x 0.33 INCH
- HIGH EFFICIENCY UP TO 85%
- 2:1 WIDE INPUT VOLTAGE RANGE
- FIVE-SIDED SHIELD
- SWITCHING FREQUENCY 100K TO 1500KHz.
- NO EXTERNAL INPUT AND OUTPUT CAPACITOR NEEDED
- LOW RIPPLE & NOISE
- OVER CURRENT PROTECTION
- SHORT CIRCUIT PROTECTION
- LONG LIFE WITHOUT ELECTROLYTIC CAPACITOR
- CE MARK MEETS 2006/95/EC, 93/68/EEC AND 2004/108/EC
- DESIGN MEETS J60950-1, UL60950-1, EN60950-1 AND IEC60950-1
- ISO9001 CERTIFIED MANUFACTURING FACILITIES
- COMPLIANT TO RoHS EU DIRECTIVE 2002/95/EC

## DESCRIPTION

The TEN06 series offer 6 watts of output power from a 1.61 x 1.02 x 0.33 inch package without derating to 50°C and without external input/output capacitor. The TEN06 series with 2:1 wide input voltage of 4.5-9, 9-18, 18-36 and 36-75VDC and features 500VAC of isolation, short-circuit protection.

**TECHNICAL SPECIFICATION** All specifications are typical at nominal input, full load and 25°C otherwise noted

| OUTPUT SPECIFICATIONS                              |                                            |                                     |                                                            |
|----------------------------------------------------|--------------------------------------------|-------------------------------------|------------------------------------------------------------|
| Maximum output power                               |                                            |                                     | 6 Watts                                                    |
| Voltage accuracy                                   | Full load and nominal Vin                  |                                     | ± 1%                                                       |
| Minimum load                                       |                                            |                                     | 0%                                                         |
| Line regulation                                    | LL to HL at Full Load                      |                                     | ± 0.2%                                                     |
| Load regulation                                    | No load to Full load                       |                                     | ± 0.5%                                                     |
| Ripple and noise                                   | 50MHz bandwidth                            |                                     | See table                                                  |
| Maximum temperature drift                          |                                            |                                     | ±0.02% / °C                                                |
| Transient response recovery time                   | 25% load step change                       |                                     | 500uS, typ                                                 |
| Short circuit protection                           | Continuous, automatic recovery             |                                     |                                                            |
| Over current protection                            |                                            |                                     | 150%, typ                                                  |
| OUTPUT VOLTAGE ADJUSTMENT TERMINAL(Vset ) (Note 6) |                                            |                                     |                                                            |
| Model number                                       | Open                                       | -Vout shorted                       | +Vout shorted                                              |
| XXS33                                              | 3.3V                                       | 3.67V                               | 2.84V                                                      |
| XXS05                                              | 5V                                         | 6V                                  | 4.3V                                                       |
| XXS12                                              | 12V                                        | 15V                                 | N/A                                                        |
| XXD12                                              | ±12V                                       | ±15V                                | N/A                                                        |
| Model number                                       | Open                                       | -Vout connected with resistance (7) | +Vout connected with resistance (7)                        |
| XXS33                                              | 3.3V                                       | 3.3 to 3.67V (8-1)                  | 3.3 to 2.84V (8-2)                                         |
| XXS05                                              | 5V                                         | 5 to 6V (8-3)                       | 5 to 4.3V (8-4)                                            |
| XXS12                                              | 12V                                        | 12 to 15V (8-5)                     | 12 to 9V (8-6)                                             |
| XXD12                                              | ±12V                                       | ±12 to ±15V (8-7)                   | ±12 to ±9V (8-8)                                           |
| GENERAL SPECIFICATIONS                             |                                            |                                     |                                                            |
| Efficiency                                         |                                            |                                     | See table                                                  |
| Isolation voltage                                  | Input to Output<br>Input (Output) to Case  |                                     | 500 Vac                                                    |
| Isolation resistance                               | Input to Output<br>Input (Output) to Case  |                                     | DC500V 50M ohms                                            |
| Isolation capacitance                              |                                            |                                     | 300 pF, max                                                |
| Safety standard pending                            | IEC60950-1, J60950-1, UL60950-1, EN60950-1 |                                     |                                                            |
| Switching frequency                                | Full load to No load                       |                                     | 100K to 1500K Hz                                           |
| Case material                                      |                                            |                                     | Metal case                                                 |
| Base material                                      |                                            |                                     | None                                                       |
| Weight                                             |                                            |                                     | 20.0g (0.71oz)                                             |
| Dimension                                          |                                            |                                     | 1.61 x 1.02 x 0.33 Inch<br>(41 x 25.8 x 8.5 mm)            |
| MTBF (Note 1)                                      | BELLCORE TR-NWT-000332<br>MIL-HDBK-217F    |                                     | 3.706 x 10 <sup>6</sup> hrs<br>1.679 x 10 <sup>6</sup> hrs |

| INPUT SPECIFICATIONS             |                                                                                                           |                               |
|----------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------------------|
| Input voltage range              | 5V nominal input                                                                                          | 4.5 – 9VDC                    |
|                                  | 12V nominal input                                                                                         | 9 – 18VDC                     |
|                                  | 24V nominal input                                                                                         | 18 – 36VDC                    |
|                                  | 48V nominal input                                                                                         | 36 – 75VDC                    |
| Input filter                     |                                                                                                           | L-C filter                    |
| Input surge voltage<br>100ms max | 5V nominal input                                                                                          | 15VDC                         |
|                                  | 12V nominal input                                                                                         | 36VDC                         |
|                                  | 24V nominal input                                                                                         | 50VDC                         |
|                                  | 48V nominal input                                                                                         | 100VDC                        |
| Remote ON/OFF                    |                                                                                                           | See figure 1                  |
| ENVIRONMENTAL SPECIFICATIONS     |                                                                                                           |                               |
| Operating temperature range      |                                                                                                           | -25°C ~ +85°C (with derating) |
| Maximum case temperature         |                                                                                                           | 100°C                         |
| Storage temperature range        |                                                                                                           | -55°C ~ +105°C                |
| Cooling                          |                                                                                                           | Nature convection             |
| Thermal shock                    |                                                                                                           | MIL-STD-810F                  |
| Vibration                        | At no operation, 10~55~10Hz (sweep for 15min.) amplitude<br>1.5mm constant (maximum 9G X, Y, Z 2hrs each) |                               |
| Shock                            |                                                                                                           | 100G                          |
| Operating humidity range         |                                                                                                           | 20% to 95% RH                 |
| Storage humidity range           |                                                                                                           | 20% to 95% RH                 |
| EMC CHARACTERISTICS              |                                                                                                           |                               |
| EMI (Note 9)                     | EN55022                                                                                                   | Class A                       |





| Model Number | Input Range | Output Voltage | Output Voltage Range | Output Current |           | Output (2)<br>Ripple&Noise | Input Current |               | Eff (4)<br>(%) | Capacitor (5)<br>Load max |
|--------------|-------------|----------------|----------------------|----------------|-----------|----------------------------|---------------|---------------|----------------|---------------------------|
|              |             |                |                      | Min. load      | Full load |                            | No Load (3)   | Full Load (2) |                |                           |
| TEN06-05S33  | 4.5 – 9 VDC | 3.3 VDC        | 2.84 – 3.67 VDC      | 0mA            | 1200mA    | 100mVp-p                   | 80mA          | 1131mA        | 74             | 6600uF                    |
| TEN06-05S05  | 4.5 – 9 VDC | 5 VDC          | 4.3 – 6 VDC          | 0mA            | 1000mA    | 100mVp-p                   | 65mA          | 1370mA        | 77             | 3000uF                    |
| TEN06-05S12  | 4.5 – 9 VDC | 12 VDC         | 9 – 15 VDC           | 0mA            | 500mA     | 100mVp-p                   | 140mA         | 1519mA        | 83             | 1400uF                    |
| TEN06-05D12  | 4.5 – 9 VDC | ±12 VDC        | ±9 – ±15 VDC         | 0mA            | ±250mA    | 100mVp-p                   | 140mA         | 1519mA        | 83             | ±510uF                    |
| TEN06-12S33  | 9 – 18 VDC  | 3.3 VDC        | 2.84 – 3.67 VDC      | 0mA            | 1500mA    | 100mVp-p                   | 45mA          | 573mA         | 76             | 6600uF                    |
| TEN06-12S05  | 9 – 18 VDC  | 5 VDC          | 4.3 – 6 VDC          | 0mA            | 1200mA    | 100mVp-p                   | 55mA          | 658mA         | 80             | 3000uF                    |
| TEN06-12S12  | 9 – 18 VDC  | 12 VDC         | 9 – 15 VDC           | 0mA            | 500mA     | 100mVp-p                   | 60mA          | 617mA         | 85             | 1400uF                    |
| TEN06-12D12  | 9 – 18 VDC  | ±12 VDC        | ±9 – ±15 VDC         | 0mA            | ±250mA    | 100mVp-p                   | 55mA          | 617mA         | 85             | ±510uF                    |
| TEN06-24S33  | 18 – 36 VDC | 3.3 VDC        | 2.84 – 3.67 VDC      | 0mA            | 1500mA    | 100mVp-p                   | 15mA          | 286mA         | 77             | 6600uF                    |
| TEN06-24S05  | 18 – 36 VDC | 5 VDC          | 4.3 – 6 VDC          | 0mA            | 1200mA    | 100mVp-p                   | 20mA          | 321mA         | 82             | 3000uF                    |
| TEN06-24S12  | 18 – 36 VDC | 12 VDC         | 9 – 15 VDC           | 0mA            | 500mA     | 100mVp-p                   | 30mA          | 309mA         | 85             | 1400uF                    |
| TEN06-24D12  | 18 – 36 VDC | ±12 VDC        | ±9 – ±15 VDC         | 0mA            | ±250mA    | 100mVp-p                   | 30mA          | 309mA         | 85             | ±510uF                    |
| TEN06-48S33  | 36 – 75 VDC | 3.3 VDC        | 2.84 – 3.67 VDC      | 0mA            | 1500mA    | 100mVp-p                   | 15mA          | 143mA         | 77             | 6600uF                    |
| TEN06-48S05  | 36 – 75 VDC | 5 VDC          | 4.3 – 6 VDC          | 0mA            | 1200mA    | 100mVp-p                   | 15mA          | 165mA         | 80             | 3000uF                    |
| TEN06-48S12  | 36 – 75 VDC | 12 VDC         | 9 – 15 VDC           | 0mA            | 500mA     | 100mVp-p                   | 20mA          | 155mA         | 85             | 1400uF                    |
| TEN06-48D12  | 36 – 75 VDC | ±12 VDC        | ±9 – ±15 VDC         | 0mA            | ±250mA    | 100mVp-p                   | 15mA          | 155mA         | 85             | ±510uF                    |

**Note:**

1. Bellcore TR-NWT-000332. Case 1:50% Stress, temperature at 40°C.  
MIL-HDBK-217F Notice2 @Ta=25 °C, Full load(Ground, Benign, controlled environment).
2. Maximum value at nominal input voltage and full load.
3. Typical value at nominal input voltage and no load.
4. Typical value at nominal input voltage and full load.
5. Test by minimum Vin and constant resistive load.
6. The following output voltage can be obtained by connecting this terminal to an output + or – terminal. Unless the output voltage is adjusted, this terminal should be open.
7. In addition, the voltage can be adjusted not by shorting these terminals, but by connecting them to resistances as shown below.
8. Arithmetic expression connected resistance: R ( KΩ )
 

|                                                                        |                                                                              |
|------------------------------------------------------------------------|------------------------------------------------------------------------------|
| 8-1 $V_o = (3.3 \cdot R + 36.7) / (R + 10)$                            | 8-2 $V_o = (3.3 \cdot R + 36.7) / (R + 12.92)$                               |
| 8-3 $V_o = 2.5 \cdot [2.7 / (R + 6.8)]$                                | 8-4 $V_o = 2.5 \cdot [2.7 / (R + 9.5)]$                                      |
| 8-5 $V_o = 2.5 + 9.5 \cdot (R + 10.9) / (R + 8.2)$                     | 8-6 $V_o = 2.5 + 0.9 \cdot (11R + 100) / (R + 20.1)$                         |
| 8-7 $V_o = 2.5 + 22 \cdot (R + 12.7) / (R + 10)$ [Between two outputs] | 8-8 $V_o = 2.5 + 0.9 \cdot (24R + 218.4) / (R + 33.1)$ [Between two outputs] |
9. The TEN06 series can meet EN55022 Class A with parallel an external capacitor to the input pins.  
 Recommend : 05Vin : 10μF/25V 1210 MLCC  
 12Vin : 4.7μF/25V 1210 MLCC  
 24Vin : 3.3μF/50V 1210 MLCC  
 48Vin : 1.5μF/100V 1812 MLCC

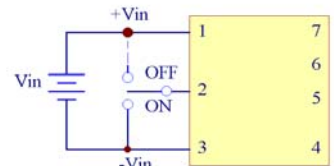
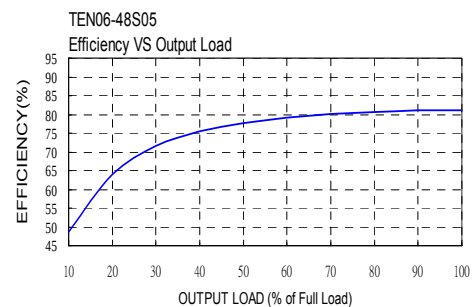
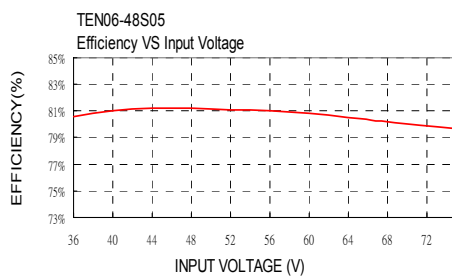
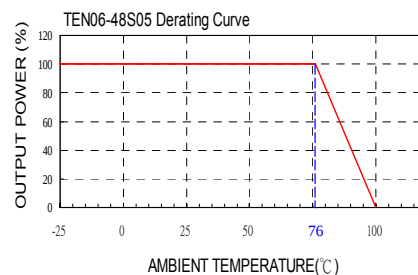
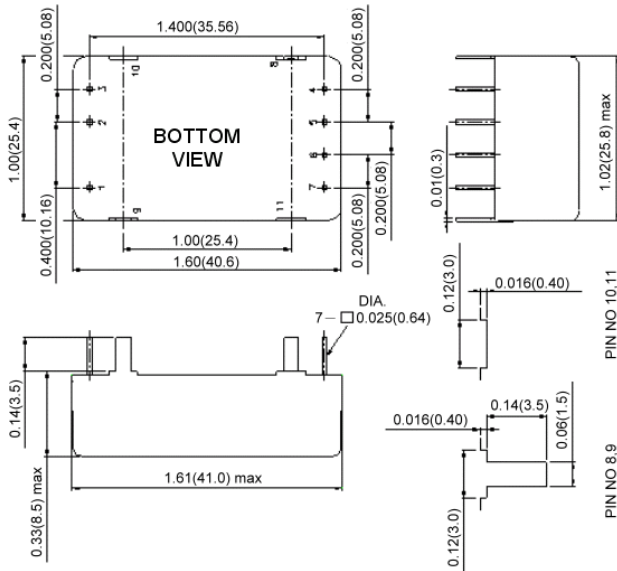


Figure 1



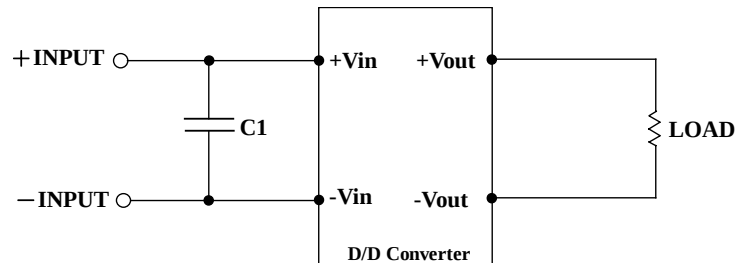
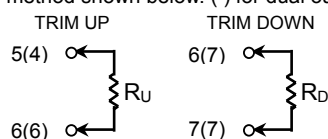


1. All dimensions in Inches (mm)  
Tolerance: X.XX±0.02 (X.X±0.5)  
X.XXX±0.01 (X.XX±0.25)
2. Pin pitch tolerance ±0.01 (0.25)
3. Pin dimension tolerance ±0.004 (0.1)

| PIN CONNECTION |                |                |
|----------------|----------------|----------------|
| PIN            | SINGLE         | DUAL           |
| 1              | + INPUT        | + INPUT        |
| 2              | CTRL           | CTRL           |
| 3              | - INPUT        | - INPUT        |
| 4              | NC             | - OUTPUT       |
| 5              | - OUTPUT       | COMMON         |
| 6              | Vset           | Vset           |
| 7              | + OUTPUT       | + OUTPUT       |
| 8              | CASE           | CASE           |
| 9              | CASE           | CASE           |
| 10             | CASE STAND OFF | CASE STAND OFF |
| 11             | CASE STAND OFF | CASE STAND OFF |

## EXTERNAL OUTPUT TRIMMING

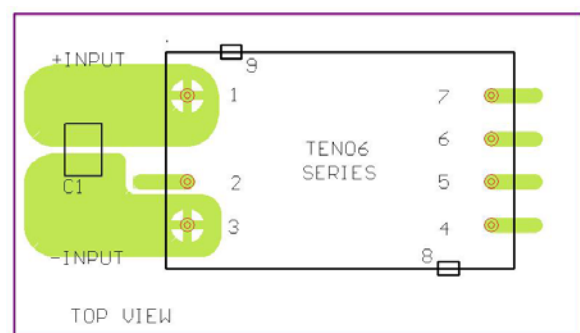
Output voltage setting can be externally trimmed by using the method shown below. ( ) for dual output trim



## Recommended Filter for EN55022 Class B Compliance

The components used in the above figure, together with the manufacturers' part numbers for these components, are as follows:

|             | C1                   |
|-------------|----------------------|
| TEN06-05XXX | 22uF/10V 1210 MLCC   |
| TEN06-12XXX | 22uF/25V 1812 MLCC   |
| TEN06-24XXX | 6.8uF/50V 1812 MLCC  |
| TEN06-48XXX | 2.2uF/100V 1812 MLCC |



## Recommended EN55022 Class B Filter Circuit Layout