



## SERIES: VSK-S20-T | DESCRIPTION: AC-DC POWER SUPPLY

### FEATURES

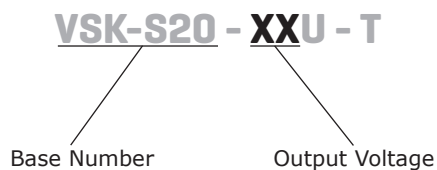
- up to 20W continuous power
- compact chassis mount design
- universal input (85~264 Vac / 100~370 Vdc)
- single, regulated output from 3.3~24 Vdc
- over voltage, over current, and short circuit protections
- UL/cUL safety approvals
- efficiency up to 85%



| MODEL          | output voltage | output current | output power | ripple and noise <sup>1</sup> | efficiency |
|----------------|----------------|----------------|--------------|-------------------------------|------------|
|                | (Vdc)          | max (A)        | max (W)      | typ (mVp-p)                   | typ (%)    |
| VSK-S20-3R3U-T | 3.3            | 4.1            | 13.5         | 50                            | 74         |
| VSK-S20-5U-T   | 5              | 3.5            | 17.5         | 50                            | 78         |
| VSK-S20-9U-T   | 9              | 2.1            | 20           | 50                            | 80         |
| VSK-S20-12U-T  | 12             | 1.6            | 20           | 50                            | 82         |
| VSK-S20-15U-T  | 15             | 1.3            | 20           | 50                            | 83         |
| VSK-S20-24U-T  | 24             | 0.85           | 20           | 50                            | 85         |

Notes: 1. Ripple and noise are measured at 20 MHz BW by "parallel cable" method with 1 uF ceramic and 10 uF electrolytic capacitors on the output.

### PART NUMBER KEY



**INPUT**

| parameter       | conditions/description                             | min | typ | max | units |
|-----------------|----------------------------------------------------|-----|-----|-----|-------|
| voltage         |                                                    | 85  |     | 264 | Vac   |
|                 |                                                    | 100 |     | 370 | Vdc   |
| frequency       |                                                    | 47  |     | 63  | Hz    |
| current         | at 115 Vac                                         |     |     | 600 | mA    |
|                 | at 230 Vac                                         |     |     | 340 | mA    |
| inrush current  | at 115 Vac                                         |     | 16  |     | A     |
|                 | at 230 Vac                                         |     | 30  |     | A     |
| leakage current | at 230 Vac, 50 Hz (RMS)                            |     | 0.1 |     | mA    |
| input fuse      | 3.15 A/250 V, slow-blow type (included on chassis) |     |     |     |       |

**OUTPUT**

| parameter               | conditions/description | min | typ   | max    | units |
|-------------------------|------------------------|-----|-------|--------|-------|
| capacitive load         | 3.3 Vdc output model   |     |       | 48,000 | μF    |
|                         | 5 Vdc output model     |     |       | 12,000 | μF    |
|                         | 9 Vdc output model     |     |       | 7,200  | μF    |
|                         | 12 Vdc output model    |     |       | 5,400  | μF    |
|                         | 15 Vdc output model    |     |       | 2,700  | μF    |
|                         | 24 Vdc output model    |     |       | 1,800  | μF    |
| line regulation         | at full load           |     | ±0.5  |        | %     |
| load regulation         | at 10~100% load        |     | ±1    |        | %     |
| voltage set accuracy    |                        |     | ±2    |        | %     |
| adjustability           |                        |     | ±10   |        | %     |
| hold-up time            | at 115 Vac             |     | 15    |        | ms    |
|                         | at 230 Vac             |     | 80    |        | ms    |
| switching frequency     |                        |     | 65    |        | kHz   |
| temperature coefficient |                        |     | ±0.02 |        | %/°C  |

**PROTECTIONS**

| parameter                | conditions/description   | min | typ | max | units |
|--------------------------|--------------------------|-----|-----|-----|-------|
| over current protection  | auto restart             | 110 |     |     | %     |
| short circuit protection | continuous, auto restart |     |     |     |       |
| over voltage protection  | 3.3 Vdc output model     |     |     | 7.5 | Vdc   |
|                          | 5 Vdc output model       |     |     | 7.5 | Vdc   |
|                          | 9 Vdc output model       |     |     | 12  | Vdc   |
|                          | 12 Vdc output model      |     |     | 20  | Vdc   |
|                          | 15 Vdc output model      |     |     | 20  | Vdc   |
|                          | 24 Vdc output model      |     |     | 30  | Vdc   |

**SAFETY & COMPLIANCE**

| parameter           | conditions/description                                                   | min   | typ | max | units |
|---------------------|--------------------------------------------------------------------------|-------|-----|-----|-------|
| isolation voltage   | input to output for 1 minute                                             | 3,000 |     |     | Vac   |
|                     | input to ground for 1 minute                                             | 2,000 |     |     | Vac   |
| safety approvals    | UL60950-1, CE                                                            |       |     |     |       |
| safety class        | class I                                                                  |       |     |     |       |
| conducted emissions | CISPR22/EN55022, Class B                                                 |       |     |     |       |
| radiated emissions  | CISPR22/EN55022, Class B                                                 |       |     |     |       |
| ESD                 | IEC/EN61000-4-2 Class B, contact ±6 kV/air ±8 kV                         |       |     |     |       |
| radiated immunity   | IEC/EN61000-4-3 Class A, 10V/m                                           |       |     |     |       |
| EFT/burst           | IEC/EN61000-4-4 Class B, ±2 kV                                           |       |     |     |       |
|                     | IEC/EN61000-4-4 Class B, ±4 kV (external circuit required, see figure 2) |       |     |     |       |

## SAFETY & COMPLIANCE (CONTINUED)

| parameter                    | conditions/description                                                                                                                       | min     | typ | max | units |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|---------|-----|-----|-------|
| surge                        | IEC/EN61000-4-5 Class B, $\pm 1$ kV/ $\pm 2$ kV<br>IEC/EN61000-4-5 Class B, $\pm 2$ kV/ $\pm 4$ kV (external circuit required, see figure 2) |         |     |     |       |
| conducted immunity           | IEC/EN61000-4-6 Class A, 10 Vr.m.s                                                                                                           |         |     |     |       |
| PFM                          | IEC/EN61000-4-8 Class A, 10 A/m                                                                                                              |         |     |     |       |
| voltage dips & interruptions | IEC/EN61000-4-11 Class B, 0%-70%                                                                                                             |         |     |     |       |
| MTBF                         | as per MIL-HDBK-217F at 25°C                                                                                                                 | 300,000 |     |     | hrs   |
| RoHS                         | 2011/65/EU                                                                                                                                   |         |     |     |       |

## ENVIRONMENTAL

| parameter             | conditions/description | min | typ | max | units |
|-----------------------|------------------------|-----|-----|-----|-------|
| operating temperature | see derating curves    | -40 |     | 70  | °C    |
| storage temperature   |                        | -40 |     | 105 | °C    |
| storage humidity      | non-condensing         |     |     | 95  | %     |

## DERATING CURVES

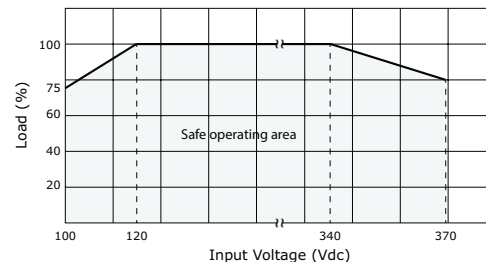
load vs. ambient temperature  
(at 100~240 Vac)



load vs. input voltage (Vac)  
(at 25°C)



load vs. input voltage (Vdc)  
(at 25°C)



## MECHANICAL

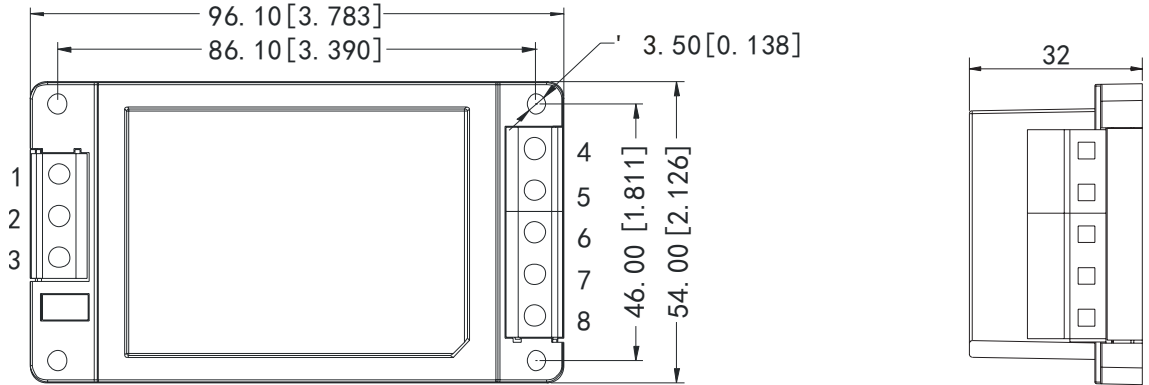
| parameter     | conditions/description                             | min | typ | max | units |
|---------------|----------------------------------------------------|-----|-----|-----|-------|
| dimensions    | 96.10 x 54.00 x 32.00 (3.783 x 2.126 x 1.259 inch) |     |     |     | mm    |
| case material | UL94V-0                                            |     |     |     |       |
| weight        |                                                    |     | 170 |     | g     |
| cooling       | convection cooling                                 |     |     |     |       |

## MECHANICAL DRAWING

units: mm[inches]  
tolerance:  $\pm 0.50[\pm 0.020]$

wire range: 24~12 AWG

| PIN CONNECTIONS |             |
|-----------------|-------------|
| PIN             | FUNCTION    |
| 1               | GND $\perp$ |
| 2               | AC(N)       |
| 3               | AC(L)       |
| 4               | -Vo         |
| 5               | NC          |
| 6               | TRIM        |
| 7               | NC          |
| 8               | +Vo         |



Top View



Side View

## TYPICAL APPLICATION CIRCUIT



**Table 1**

| Recommended External Circuit Components |                   |         |           |             |          |
|-----------------------------------------|-------------------|---------|-----------|-------------|----------|
| MODEL                                   | FUSE <sup>1</sup> | MOV1    | C1        | C2          | TVS      |
| VSK-S20-3R3U-T                          | 3.15A/250V        | S14K350 | 1 $\mu$ F | 330 $\mu$ F | SMBJ7.0A |
| VSK-S20-5U-T                            | 3.15A/250V        | S14K350 | 1 $\mu$ F | 330 $\mu$ F | SMBJ7.0A |
| VSK-S20-9U-T                            | 3.15A/250V        | S14K350 | 1 $\mu$ F | 220 $\mu$ F | SMBJ12A  |
| VSK-S20-12U-T                           | 3.15A/250V        | S14K350 | 1 $\mu$ F | 220 $\mu$ F | SMBJ20A  |
| VSK-S20-15U-T                           | 3.15A/250V        | S14K350 | 1 $\mu$ F | 220 $\mu$ F | SMBJ20A  |
| VSK-S20-24U-T                           | 3.15A/250V        | S14K350 | 1 $\mu$ F | 220 $\mu$ F | SMBJ30A  |

Note: 1. Fuse included on chassis

## EMC RECOMMENDED CIRCUIT



**Table 2**

| Recommended External Circuit Components |                    |
|-----------------------------------------|--------------------|
| MOV1                                    | S14K350            |
| CY1, CY2                                | 1000pF/400Vac      |
| CX                                      | 0.1 $\mu$ F/275Vac |
| LCM                                     | 10mH               |
| LDM                                     | 4.7 $\mu$ H/2A     |

Note: Also refer to Table 1

## APPLICATION NOTES

### 1. Output voltage trimming

Leave open if not used.

**Figure 3**

Application Circuit for Trim pin  
(part in broken line is the interior of models)



Formula for Trim Resistor

$$\begin{aligned} \text{up: } R_T &= \frac{aR_2}{R_2-a} - R_3 & a &= \frac{V_{ref}}{V_o' - V_{ref}} \cdot R_1 \\ \text{down: } R_T &= \frac{aR_1}{R_1-a} - R_3 & a &= \frac{V_o' - V_{ref}}{V_{ref}} \cdot R_2 \end{aligned}$$

Note: Value for R1, R2, R3, and Vref refer to Table 3  
 RT: Trim Resistor  
 a: User-defined parameter, no actual meanings  
 Vo': The trim up/down voltage

**Table 3**

| Vout (Vdc) | R1 (kΩ) | R2 (kΩ) | R3 (kΩ) | Vref (V) |
|------------|---------|---------|---------|----------|
| 3.3        | 3.3     | 1.98    | 1       | 1.24     |
| 5          | 3.3     | 3.3     | 1       | 2.5      |
| 9          | 7.5     | 2.87    | 1       | 2.5      |
| 12         | 3.83    | 1       | 1       | 2.5      |
| 15         | 7.5     | 1.5     | 1       | 2.5      |
| 24         | 8.66    | 1       | 1       | 2.5      |

Notes: 1. Output filtering capacitor C2 is an electrolytic capacitor, It is recommended to use high frequency and low impedance electrolytic capacitors. For capacitance and current of capacitor please refer to manufacture's datasheet. Voltage derating of capacitor should be 80% or above. C1 is used to filter high frequency noise. TVS is recommended component to protect post-circuits (when converter fails).  
 2. All specifications measured at Ta=25C, humidity <75%, nominal input voltage, and rated output load, unless otherwise specified.

## REVISION HISTORY

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| rev. | description                                              | date       |
|------|----------------------------------------------------------|------------|
| 1.0  | initial release                                          | 09/06/2012 |
| 1.01 | updated spec                                             | 01/08/2014 |
| 1.02 | updated operating and storage temperatures, updated spec | 06/11/2015 |

The revision history provided is for informational purposes only and is believed to be accurate.

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