

### FEATURES

- RoHS Compliant
- 3.3V & 5.0V Dual Output
- 2.3" x 1.5" x 0.5"
- 90% Efficiency
- Low Output Noise
- Input Filtering
- Remote On/Off, Input Side
- Output Voltage Trim, +/- 10%
- -40C° to +100C° Baseplate Temp.
- Output Current Limit, Self-Start
- 1,500 Vdc Isolation, Input to Output
- UL/CUL 1950, EN60 950
- 18-36 Vdc and 36-75 Vdc Input Models
- Continuous Short Circuit Protection
- Non-latching Protection:
  - Input Undervoltage
  - Input Overvoltage
  - Output Overvoltage
  - Overtemperature
- Output Voltage Tracking at Turn-on and Turn-off
- No Minimum Load Current



VSX60

VSX60-U

### PRODUCT OVERVIEW

The VSX60xD35C Series are dual output converters with 18-36V and 36-75V input models with 3.3Vdc and 5Vdc outputs. The industry quarter-pak size of 2.3" x 1.5" x 0.5" coupled with 90% efficiency is an industry high-density breakthrough.

These converters utilize Vx high density technology. This technology has been featured in our highly efficient VKP and VKA series now successfully in use worldwide. The very high

90% efficiency minimizes the requirement for heat-sinking and the low output ripple minimizes the need for additional filtering. For maximum flexibility, power can be traded between outputs as required. The VSX60xD35C series feature virtually all of the options required by design engineers but not at the competition's typical additional price for each option. This multitude of features are standard on the VSX60xD35C series.

### APPLICATIONS

- Distributed Power Architectures
- Workstations
- EDP Equipment
- Telecommunications

### OPTIONS

- Choice of Remote On/Off logic Configuration
- Heatsink Available for Extended Operation

### ADDITIONAL INFORMATION

- See Application Note DCAN-40 at [www.murata-ps.com](http://www.murata-ps.com)

### ABSOLUTE MAXIMUM RATINGS

| PARAMETER                  | SYMBOL | MIN | MAX  | UNIT |
|----------------------------|--------|-----|------|------|
| Input Voltage:             |        |     |      |      |
| VSX60LD35C                 | $V_i$  |     | 100  | Vdc  |
| VSX60MD35C                 | $V_i$  |     | 75   | Vdc  |
| I/O Isolation Voltage      |        |     | 1500 | Vdc  |
| I/P to case                |        |     | 1500 | Vdc  |
| O/P to case                |        |     | 200  | Vdc  |
| Operating Case Temperature | $T$    | -40 | 100  | °C   |



### SPECIFICATIONS, ALL MODELS

Specifications are at  $T_{CASE} = +40^{\circ}\text{C}$  nominal input voltage unless otherwise specified.

| INPUT | PARAMETER                                                               | SYMBOL    | MIN | TYP | MAX  | UNITS  |
|-------|-------------------------------------------------------------------------|-----------|-----|-----|------|--------|
|       | Operating Input Voltage<br>VSX60LDC                                     | $V_i$     | 18  | 24  | 36   | VDC    |
|       | VSX60MDC                                                                | $V_i$     | 36  | 48  | 75   | VDC    |
|       | Maximum Input Current<br>( $V_i=0\text{V}$ to $V_i$ max, $I_o=I_o$ max) |           |     |     |      |        |
|       | VSX60LDC                                                                | $I_i$ max |     |     | 5.0  | A      |
|       | VSX60MDC                                                                | $I_i$ max |     |     | 2.25 | A      |
|       | I/P Reflected Ripple Current                                            |           |     |     | 400  | mA p-p |
|       | No Load Input Current                                                   | $I_{iNL}$ |     | 50  |      | mA     |
|       | On/Off Activated Input Current                                          | $I_{iQ}$  |     | 17  |      | mA     |

| OUTPUT<br>Under any conditions, the voltage of V1 will always be greater or equal to that of V2. | PARAMETER                                                                                                                                                                                                                                                           | SYMBOL          | MIN  | TYP  | MAX  | UNITS       |
|--------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------|------|------|-------------|
|                                                                                                  | Output voltage (Note 1)<br>Over all conditions of I/P voltage,<br>load and temperature)                                                                                                                                                                             |                 |      |      |      |             |
|                                                                                                  | 3.3 Vout (V2)                                                                                                                                                                                                                                                       | 3.3 $V_o$       | 3.2  | —    | 3.4  | Vdc         |
|                                                                                                  | 5.0 Vout (V1)                                                                                                                                                                                                                                                       | 5.0 $V_o$       | 4.8  | —    | 5.2  | Vdc         |
|                                                                                                  | Output Voltage Setpoint<br>( $V_i=48$ , $I_{o2}=9\text{A}$ , $I_{o3}=6\text{A}$ , $T_c=25^{\circ}\text{C}$ )                                                                                                                                                        |                 |      |      |      |             |
|                                                                                                  | 3.3 Vout (V2)                                                                                                                                                                                                                                                       | 3.3 $V_{o,set}$ | 3.26 | 3.30 | 3.34 | Vdc         |
|                                                                                                  | 5.0 Vout (V1)                                                                                                                                                                                                                                                       | 5.0 $V_{o,set}$ | 4.96 | 5.02 | 5.08 | Vdc         |
|                                                                                                  | Output Ripple and Noise Voltage<br>(peak-to-peak, 100 MHz BW)                                                                                                                                                                                                       |                 |      |      |      |             |
|                                                                                                  | 3.3 Vout (V2)                                                                                                                                                                                                                                                       | —               | —    | —    | 60   | mv p-p      |
|                                                                                                  | 5.0 Vout (V1)                                                                                                                                                                                                                                                       | —               | —    | —    | 80   | mv p-p      |
|                                                                                                  | Output Current<br>(Total module O/P power should<br>not exceed 60 Watts)                                                                                                                                                                                            |                 |      |      |      |             |
|                                                                                                  | 3.3 Vout (V2)                                                                                                                                                                                                                                                       | $I_{o3}$        | —    | —    | 15   | A           |
|                                                                                                  | 5.0 Vout (V1)                                                                                                                                                                                                                                                       | $I_{o5}$        | —    | —    | 12   | A           |
|                                                                                                  | Output Current Limit Inception<br>( $V_o=95\%$ of $V_o$ nom)                                                                                                                                                                                                        |                 |      |      |      |             |
|                                                                                                  | 3.3 Vout (V2)                                                                                                                                                                                                                                                       | $I_{o3,cli}$    | 19.0 | 21.0 | 23.0 | A           |
|                                                                                                  | 5.0 Vout (V1)                                                                                                                                                                                                                                                       | $I_{o5,cli}$    | 12.5 | 13.5 | 15.0 | A           |
|                                                                                                  | Output Short Ckt Current<br>(Max impedance across short circuit = $65\text{m}\Omega$ )                                                                                                                                                                              |                 | 16   | 19   | 22   | A           |
|                                                                                                  | 3.3 $V_o$                                                                                                                                                                                                                                                           |                 | 16   | 19   | 22   | A           |
|                                                                                                  | 5.0 $V_o$                                                                                                                                                                                                                                                           |                 | 11   | 14   | 17   | A           |
|                                                                                                  | Efficiency ( $V_i=48\text{V}$ , $I_{o3}=9\text{A}$ , $I_{o5}=6\text{A}$ , $T_c=70^{\circ}\text{C}$ )                                                                                                                                                                | $\eta$          | 89   | 90   | —    | %           |
|                                                                                                  | Dynamic Response<br>( $\Delta I_o/\Delta t=0.2\text{A}/\mu\text{sec}$ , $V_i=48\text{V}$ , $T_c=25^{\circ}\text{C}$ , either O/P)<br>Load change of 50% $I_o$ max; at any operating<br>load up to $I_{omax}$ or $P_{omax}$ Peak Deviation<br>outside settling point | —               | —    | 2    | —    | % $V_o$ nom |

NOTE: 1. Worst case voltage conditions occur with full load drawn from one output only, zero being drawn from the other.

For worst case voltages at less extreme loading conditions, consult the factory.

| GENERAL | PARAMETER                                                                                                                                                                                                                                                                                              | SYMBOL              | MIN    | TYP    | MAX       | UNITS     |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|--------|--------|-----------|-----------|
|         | <b>Isolation Specifications</b>                                                                                                                                                                                                                                                                        |                     |        |        |           |           |
|         | Isolation Capacitance                                                                                                                                                                                                                                                                                  | —                   | —      | 1000   | —         | pF        |
|         | Isolation Resistance                                                                                                                                                                                                                                                                                   | —                   | 10     | —      | —         | MΩ        |
|         | Remote On/Off (open collector equivalent, signal referenced to -Vin terminal)<br>VSx60xD35 Preferred Logic (negative)<br>Logic Low - Module On<br>Logic High - Module Off<br>VSX60xD35-1 - Optional Logic (positive)<br>Logic Low - Module Off<br>Logic High - Module On<br>Logic Low: At Von/off = 0V | V on/off<br>Ion/off | 0<br>— | —<br>— | 70<br>200 | Vdc<br>μA |
|         | Turn On Time (Vo within 1% of steady state)<br>From Application of Vin                                                                                                                                                                                                                                 | —                   | —      | 7      | 10        | mSecs     |
|         | From Remote On/Off Activation)                                                                                                                                                                                                                                                                         | —                   | —      | 3      | 4         | mSecs     |
|         | Input Undervoltage Lockout<br>(Turn Off & Turn On Voltages Track)<br>Turn On (VSX60LD35)                                                                                                                                                                                                               |                     | 15     | 16.5   | 18        | Vdc       |
|         | Turn On (VSX60MD35)                                                                                                                                                                                                                                                                                    | —                   | 30     | 33     | 36        | Vdc       |
|         | Turn Off (VSX60LD35)                                                                                                                                                                                                                                                                                   |                     | 13.5   | 15     | 16.5      | Vdc       |
|         | Turn Off (VSX60MD35)                                                                                                                                                                                                                                                                                   | —                   | 27     | 30     | 33        | Vdc       |
|         | Input Overvoltage Lockout<br>(Turn Off & Turn On Voltages Track)<br>Turn On (VSX60LD35)                                                                                                                                                                                                                |                     | 37     | 38.5   | 40        | Vdc       |
|         | Turn Off (VSX60MD35)                                                                                                                                                                                                                                                                                   | —                   | 76     | 80     | 84        | Vdc       |
|         | Turn On (VSX60LD35)                                                                                                                                                                                                                                                                                    |                     | 36     | 38.5   | 41        | Vdc       |
|         | Turn On (VSX60MD35)                                                                                                                                                                                                                                                                                    | —                   | 74.5   | 78.5   | 82.5      | Vdc       |
|         | Output Overvoltage Set Point<br>(Non-latching independent control loop)<br>3.3 Vo                                                                                                                                                                                                                      | VO3OV clamp         | 3.8    | 4.0    | 4.3       | Vdc       |
|         | 5.0 Vo                                                                                                                                                                                                                                                                                                 | VO5OV clamp         | 5.85   | 6.1    | 6.35      | Vdc       |
|         | Overtemperature Limiting                                                                                                                                                                                                                                                                               | Tc                  | 105    | 115    | 125       | °C        |
|         | Weight<br>VSX60xD35, VSX60xD35-1                                                                                                                                                                                                                                                                       |                     |        | 67     |           | Grams     |
|         | VSX60xD35-U, VSX60xD35-1U                                                                                                                                                                                                                                                                              |                     |        | 44     |           | Grams     |
|         | Output Trim<br>Tie Trim to +3.3 Vo for trim down 3.3 Vo                                                                                                                                                                                                                                                | VO <sub>3</sub> td  | —      | -10    | —         | %         |
|         | 5.0 Vo                                                                                                                                                                                                                                                                                                 | VO <sub>5</sub> td  | —      | -10    | —         | %         |
|         | Tie Trim to O/P RTN for trim up 3.3 Vo                                                                                                                                                                                                                                                                 | VO <sub>3</sub> td  | —      | 10     | —         | %         |
|         | 5.0 Vo                                                                                                                                                                                                                                                                                                 | VO <sub>5</sub> td  | —      | 10     | —         | %         |

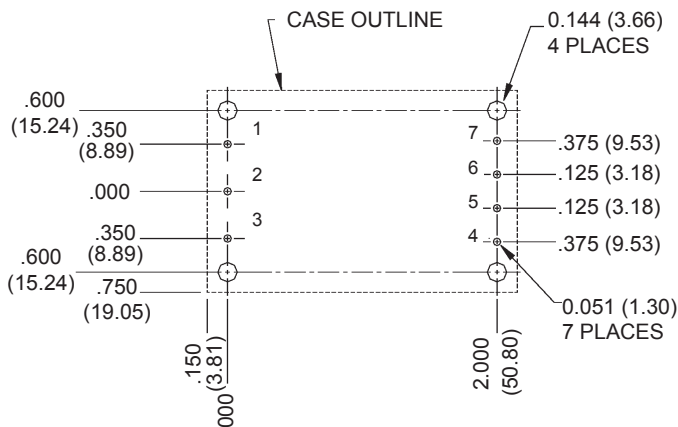
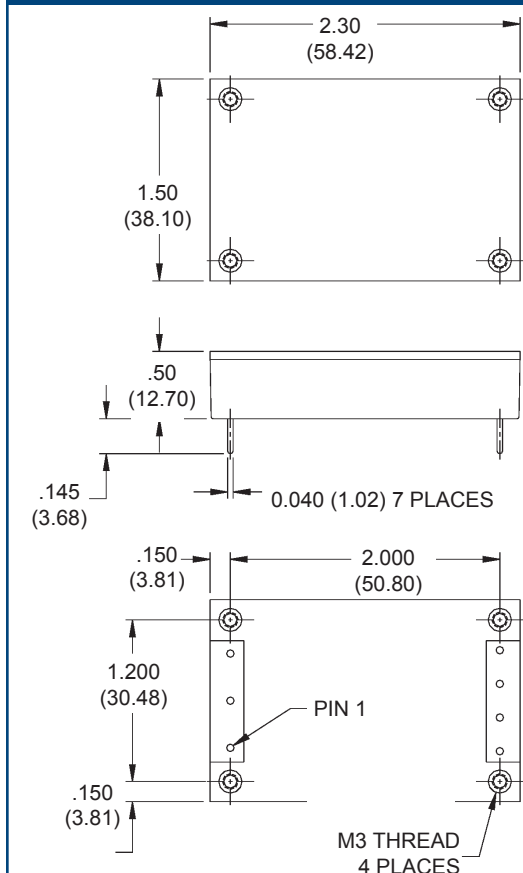
## THROUGH-HOLE SOLDERING INFORMATION

These devices are intended for wave soldering or manual soldering.

**They are not intended to be subject to surface mount processes under any circumstances.**

The normal wave soldering process can be used with these devices where the device is subjected to a maximum wave temperature of 260°C for a period of no more than 10 seconds. Within this time and temperature range, the integrity of the device's plastic body will not be compromised and internal temperatures within the converter will not exceed 175°C. Care should be taken to control manual soldering limits identical to that of wave soldering.

**MECHANICAL**



| Pinout Key |           |
|------------|-----------|
| 1          | +Vin      |
| 2          | On/Off    |
| 3          | -Vin      |
| 4          | +3.3 Vout |
| 5          | O/P RTN   |
| 6          | Trim      |
| 7          | +5.0 Vout |

Dimensions are in inches (millimeters).  
 Tolerances: x.xx in.  $\pm$  0.02 in.  
 x.xxx in.  $\pm$  0.01 in.

**NOTES:**

1. Marked with: specific model ordered, date code, job code.
2. MATERIAL: Units are encapsulated in a low thermal resistance molding compound which has excellent chemical resistance and electrical properties in high humidity environments and over a wide operating temperature range. The encapsulant and outer shell of the unit have UL94V-0 ratings. Lead finish is matte tin 100 micro-inches maximum, over a nickel barrier layer 40-80 micro-inches.
3. IMPORTANT: When utilizing the PEM nuts for board mounting, it is required to follow guidelines in application note DCAN-40 available on the web at [www.murata-ps.com](http://www.murata-ps.com).

**ORDERING INFORMATION**

**To Find Model Number**

Device Family VSX60 xD35 -1 U C  
 VSX60MD23 (Quarter Brick, 60 Watt DC/DC)  
 Where X is Input Range  
 L = 18-36Vdc; M = 36-75 Vdc  
 Logic: No Number = Preferred Logic (Negative);  
 1 = Optional Logic (Positive)  
 Package  
 No Letter = Encapsulated; U = Unencapsulated  
 RoHS-compliant

**Model Numbers\***

|                          |
|--------------------------|
| VSX60LD35C               |
| <del>VSX60LD35-1C</del>  |
| VSX60MD35C               |
| <del>VSX60MD35-1C</del>  |
| VSX60MD35-1C             |
| <del>VSX60MD35-1UC</del> |

\*Strikethrough denotes obsolete models.