VKP60xT/VKP100MT APPLICATION NOTES

Output Configurations

The VKP60xT/VKP100MT series DC/DC converters provide three outputs to match the needs of many popular multi-output and multi-channel applications. Because each of the three channels is individually isolated and current limited, these devices may be easily configured in a wide variety of ways. The full rated output power may be drawn from the primary output (V1) or from the combination of the two secondary outputs (V2 and V3). The auxiliary channels are each current-limited to approximately 45/70 Watts total power, although they may be connected in parallel to achieve a single 60/100 Watts channel at the same voltage. Figure 1 illustrates the connections for a single channel configuration using only the primary output.

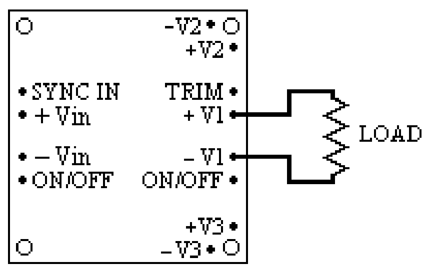


Figure 1: Single Channel, Single Output

Figure 2 illustrates the connections for a single channel, bipolar output configuration using only the auxiliary channels.

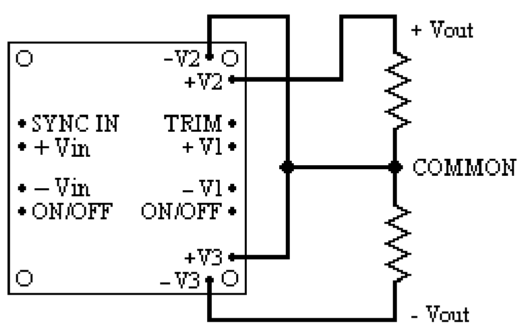


Figure 2: Single Channel, Dual Output

If two isolated auxiliary channels are necessary, the device should be connected as shown in figure 3. In this configuration, each channel can be either positive or negative in polarity.

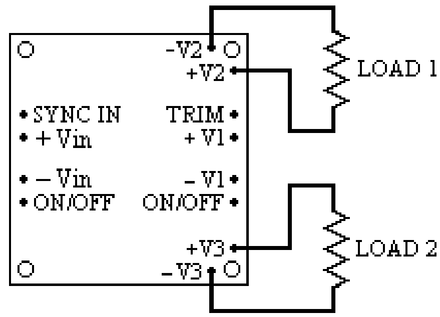


Figure 3: Dual Channel, Single Output

The most common configuration will be as a dual channel, triple output device with the auxiliary channels connected in a bipolar configuration as shown in figure 4.

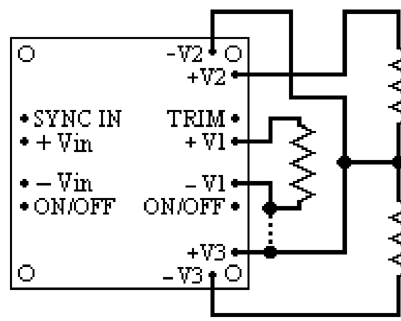


Figure 4: Triple Channel, Bipolar Auxiliary Channel

If the application requires the primary channel and only one of the auxiliary channels, the unit can be configured in this manner either by leaving one of the auxiliary channels unterminated or by connecting both auxiliary channels in parallel. The second option is preferable in this scenario, as each of the auxiliary channels will be operating at a lower output current. This will result in lower stress on each channel, increasing the reliability and efficiency of the device. Figure 5 illustrates the necessary connections for operation in this scheme.

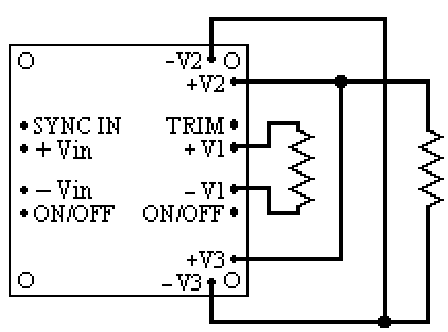


Figure 5: Dual Channel, Paralleled Auxiliary Channels

For additional information concerning output configurations, please consult the applications department.

Output Voltage Adjust

This feature allows the user to accurately adjust the module's output voltage set point to a specified level. This is achieved by connecting a resistor or potentiometer from the TRIM terminal to either the +V1 or the -V1 pin. If an increased output voltage is desired, connect the resistor between the TRIM and -V1 pins. In the case that an decreased output voltage is desired, the external resistor should be connected between the TRIM and +V1 pins. Figure 6 shows the required connections in order to implement this feature.

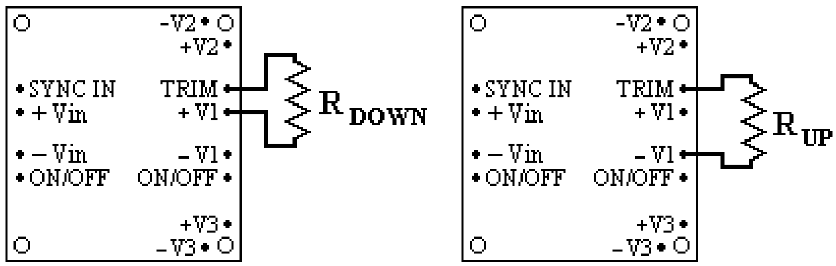


Figure 6: Output Adjustment Connections

The resistor value will be a function of the model as well as the amount of trim required. Table 1 outlines the trim resistor values required to achieve the desired output adjustment. The VKP60xT3yy/VKP100MT3yy models will allow adjustment from 3.15V to 4.0V output to accommodate specialized devices that require unique operating voltages. Some specialized devices covered by the VKP60xT3yy/VKP100MT3yy models are Pentium™ P54C-VRE (3.525V); PowerPC™ (3.6V) and Cyrix™ (4.0V). The VKP60xT5yy/ VKP100MT5yy models typically will accommodate ±10% change in the output. Please note all values are approximate and may vary with individual applications.

Connect the TRIM lead to the -V1 pin to achieve the maximum positive trim adjustment. Conversely, connect the TRIM lead directly to the +V1 pin to achieve the minimum trim adjustment. **For Example:** The output voltage at the +V1 pin will equal 4.0V for a VKP60MT3yy/VKP100MT3yy if the TRIM lead is tied directly to the -V1 pin.

OVP Note: Special attention to the peak voltage deviation during a dynamic load step should be taken when trimming the main output above the set point voltage to avoid tripping the overvoltage protection circuit. Should a OVP condition occur, the converter will go into a latch condition and must be externally reset before it will return to normal operation.

RESISTOR VALUES (OHMS) NEEDED TO INCREASE THE OUTPUT VOLTAGE (%)

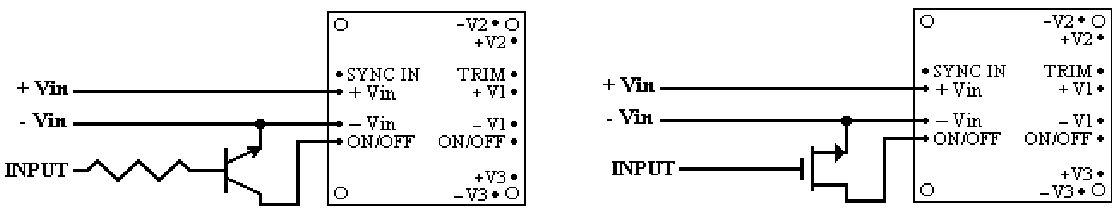
MODEL	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	20%
VKPxxxT312	117K	55.5K	35.1K	25K	18.8K	14.7K	11.8K	9.7K	8K	6.6K	220
VKPxxxT315	117K	55.5K	35.1K	25K	18.8K	14.7K	11.8K	9.7K	8K	6.6K	220
VKPxxxT512	224K	99K	57.5K	36.8K	24.3K	16K	10.1K	5.6K	2.2K		
VKPxxxT515	224K	99K	57.5K	36.8K	24.3K	16K	10.1K	5.6K	2.2K		

RESISTOR VALUES (OHMS) NEEDED TO DECREASE THE OUTPUT VOLTAGE (%)

MODEL	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	20%
VKPxxxT312	32.6K	12.7K	6K	2.7K	722						
VKPxxxT315	32.6K	12.7K	6K	2.7K	722						
VKPxxxT512	219K	945K	52.8K	32K	19.5K	11.2K	5.2K	750			
VKPxxxT515	219K	945K	52.8K	32K	19.5K	11.2K	5.2K	750			

Remote On/Off Control

The VKP60xT/VKP100MT Series modules are equipped with both primary and secondary on/off control pins for increased system flexibility. Both inputs are TTL open-collector and/or CMOS open-drain compatible. The primary on/off pin uses positive logic, which turns the unit off when a logic low signal is applied (see general specifications for threshold voltage levels). Figure 7 illustrates the typical external connections to enable this function. If no connection is made to the primary on/off terminal, the module will operate normally.



Open Collector **Open Drain**

Figure 7: Primary On/Off Connections

Unlike the primary control pin, the secondary on/off feature uses negative logic circuitry. For continuous operation, the secondary on/off pin must be connected to the -V1 pin. If user-controlled operation is desired, an external circuit similar to that of figure 8 can be installed. Figure 8 illustrates the connections necessary to implement this feature. **If no connection is made to the secondary on/off pin, the unit will fail to produce any output** (although the input and internal control circuitry will be operational and will draw minimal current).

Because both control pins are available, two different standby modes are available to the user. Disabling the primary control will allow the unit to dissipate slightly less internal power than if the secondary control was disabled, although under either condition, the unit will typically dissipate less than 0.5 watts.

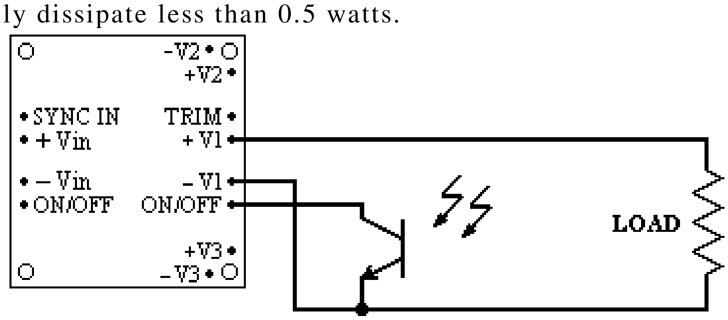


Figure 8: Secondary On/Off Connections

External Clock Synchronization

The VKP60xT/VKP100MT series modules are equipped with a SYNC IN terminal to allow synchronization to an external clock source or to the SYNC OUT pin of a single-output VKP module. Although the modules operate at a fixed frequency of 480 KHz, the clock signal can be varied from 390 to 520 KHz (see general specifications for details). The clock signal should be kept as close to the nominal 480 KHz operating frequency to optimize overall efficiency and output power capacity. The external clock should be a low impedance source.

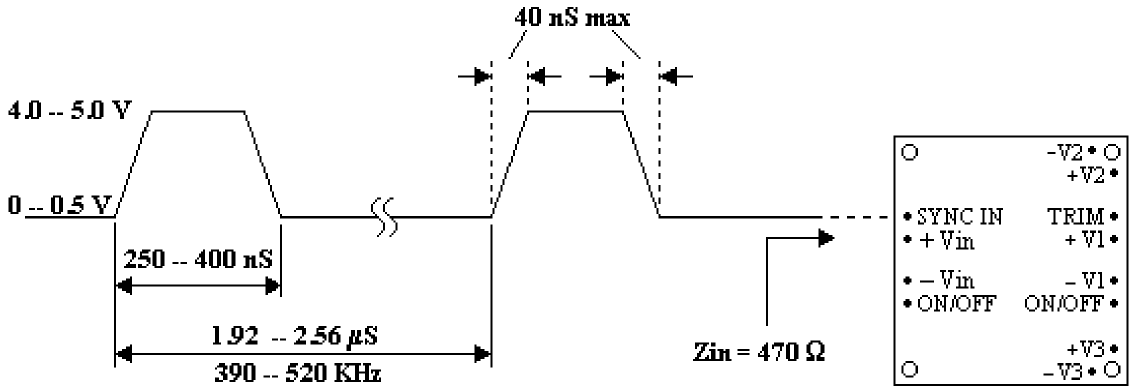


Figure 9: External Synchronization Requirements

When using an external clock source, a specific pulse shape and duty cycle is required, as illustrated in figure 9. The clock pulse must also be monotonic on leading and trailing edges as well as symmetrical in periodicity, width and amplitude. Please consult the factory for additional details and considerations.

Current Limiting

To protect against fault or short-circuit conditions, the VKP60xT/VKP100MT Series outputs are individually current limited. The primary channel will enter current limit at approximately 75 watts total device output power. The auxiliary channels will each start to limit at approximately 40-45 watts total channel output. Once a short-circuit condition is reached, the output current will be typically 80 to 100% of the rated nominal value. Once the short-circuit has been removed, the output voltage(s) will return to the nominal value(s) without cycling the input power.

Safety

The VKP60xT/VKP100MT series is designed in conformance with UL1950, EN 60950 and CSA 22.2 #234. When the supply to the converter meets SELV requirements (VIN < 60 VDC), the output is considered as level 3. For input voltages above 60 VDC, the baseplate must be connected to earth ground for the device to be considered within SELV limits (level 3).

Fusing Requirements

The VKP60xT/VKP100MT series converters are not internally fused. In order to maintain maximum safety and overall system protection, an input line fuse should always be included. A Buss PC-Tron, PCB 10A fuse or equivalent should be used in series with the converter input.

Input Source Impedance

The converter should always be connected to a low AC impedance input source to ensure system stability. A small tantalum or computer-grade electrolytic capacitor with low ESR (e.g. 33 μF, 0.1Ω) must be placed across the input terminals as close to the module to maintain unit stability.

Test Circuit Configurations

(NOTE: For normal operation on a VKP100MT Series power supply, a minimum rate of change of applied input voltage should be 40volts/msec.)

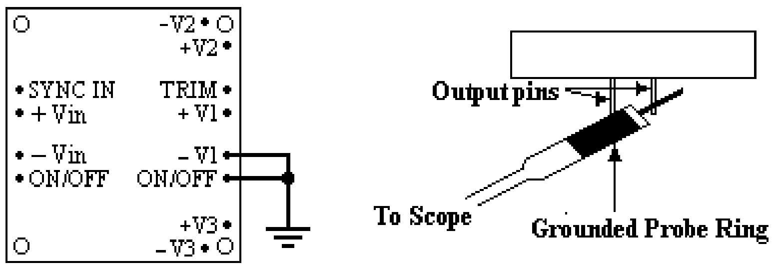


Figure 10: Measurement of Peak-Peak Output Noise

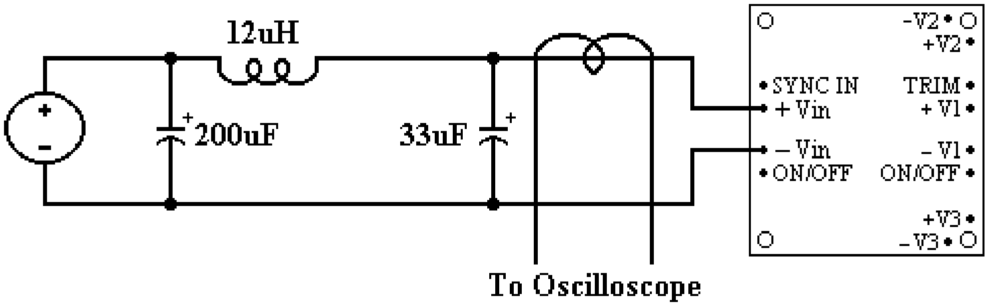


Figure 11: Measurement of Input Reflected Ripple

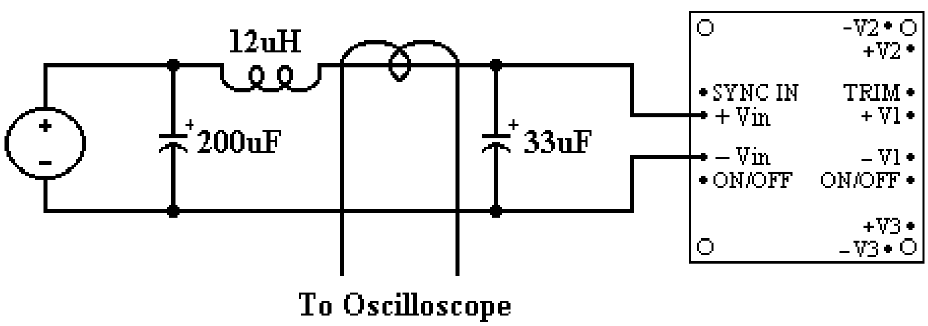


Figure 12: Measurement of Input Reflected Ripple with Input Noise Reduction Filter

Thermal Equations

1) Efficiency = $\eta = P_{OUT} / P_{IN}$
2) Dissipated Power = $P_D = P_{OUT}\ \{(1-\eta)/\eta\}$
3) Temperature Rise = $P_D \times \Theta_{BA} = P_{OUT} \times \Theta_{BA}\ \{(1-\eta)/\eta\}$
4) Maximum Output Power
   $= \{T_{CASE}\ (max) - T_A\}\ /[\Theta_{BA}\{(1-\eta)/\eta\}]$
5) Minimum Thermal Impedance
   $= \{T_{CASE}\ (max) - T_A\}/[P_{OUT}\{(1-\eta)/\eta\}]$

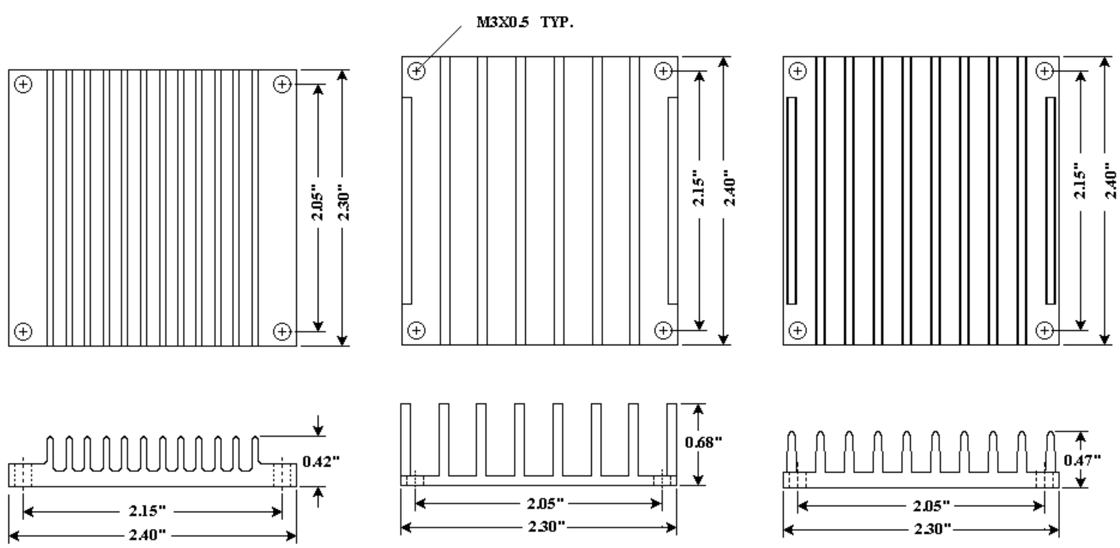
To ensure reliable, consistent operation of the VKP60xT/VKP100MT Series converters at extended temperatures, the use of a heatsink and/or forced convection is recommended. C&D Technologies maintains stock on heatsink kits suitable for vertical or horizontal converter mounting. All heatsinks match the VKP60xT/VKP100MT Series' package outline and have four pre-tapped holes to simplify the installation. The complete kits also include four mounting screws and a precut thermal interface material to provide improved thermal conductivity from the converter to the heatsink. Please refer to the chart below for appropriate heatsink selection.

THERMAL IMPEDANCE CHART

	θ_{BA} * (C/W)			
AIR FLOW	**NO HEATSINK**	**NOTE (1)**	**NOTE (2)**	**NOTE (3)**
Free Air	8.2	7.4	5.1	6.7
200 LFM	5.5	5.0	3.2	4.4
400 LFM	4.0	3.6	2.3	3.2
600 LFM	3.2	2.9	1.9	2.6
800 LFM	2.8	2.5	1.6	2.2
1000 LFM	2.5	2.3	1.5	2.1

(1) With heatsink Kit #HSK-W4
(2) With heatsink Kit #HSK-L7
(3) With heatsink Kit #HSK-L4
* Values of θ_{BA} for modules with added heatsinks have included a baseplate-to-heatsink thermal impedance of 0.1 degree C/W using a thermally conductive interface material.

Drawings of Available Heatsinks



HSK-W4 HSK-L7 HSK-L4

KIT/PART #	HEATSINK INCLUDED IN KIT	OVERALL PACKAGE HEIGHT*
HSK-W4	HS-2324W4	0.905"
HSK-L7	HS-2324L7	1.165"
HSK-L4	HS-2324L4	0.955"

*The overall package height includes a 0.01" height for the interface pad.

For answers to questions on information contained in this application note, please contact C & D Technologies, DC to DC Applications Group, by phone at (520) 741-4585, by Fax at (520) 295-4197, Email at pgharpure@cdtechno.com or write us at the address shown below.