Technical Specification

EKC6W24/48 Series

4:1 Wide Input, Isolated 6Watts DC/DC Converters

FEATURES

- Cost-effective
- 4:1 wide input range: 9-36/18-75VDC
- Single & bipolar outputs: 3.3, 5, 9, 12, 15, 24, ±5, ±9, ±12, ±15, ±24Volts DC
- 6W isolated outputs
- Efficiency up to 86%
- Fixed switching frequency
- 1500VDC I/O isolation
- Standard 1.25"×0.8"×0.4" footprint, Din-rail & wall mount type options
- Extensive self-protection, UVLO, OTP, OVP, OCP and short protection
- Operation temperature range: -40°C to +105°C
- Fully encapsulated, high reliability
- MTBF ⩾ 1 MHrs
- Compliance with RoHS

PRODUCT OVERVIEW

The EKC6W24/48 series are highly reliable, and efficient isolated DC/DC converter. Wide input range of 9-36V (24V nominal)/18-75V (48V nominal) is ideal for automation, power grid, semiconductor equipment, instrumentation, test and measurement, and distribution power system.

A wealth of self-protection features included input under-voltage lockout, over temperature shutdown; overcurrent protection with "hiccup" autorestart technique, provides short-circuit protection, along with output OVP.

Advanced fully encapsulated package technology provides outstanding EMC and thermal performance, which is ideal for ruggedized applications involving harsh environments. Wall mount and Din-rail mount type are available for maximum design-in flexibility.

The EKC6W24/48 series are designed to safety standards IEC/EN 62368-1.

Models Selections

Basic Models	Input Voltage [VDC]	Input Voltage Range [VDC]	Output Voltage [VDC]	Output Current [A]	Efficiency Typ. [%]	Capacitive Load Max. [μF]	Package [inch]
EKC6W24S03	24	9-36	3.3	1.5	77	1800	1.25"×0.8"×0.4" DIP
EKC6W24S05	24	9-36	5	1.2	81	1000	
EKC6W24S09	24	9-36	9	0.667	82	1000	
EKC6W24S12	24	9-36	12	0.5	85	470	
EKC6W24S15	24	9-36	15	0.4	86	220	
EKC6W24S24	24	9-36	24	0.25	85	100	
EKC6W24B05	24	9-36	±5	±0.6	81	±680	
EKC6W24B09	24	9-36	±9	±0.333	84	±220	
EKC6W24B12	24	9-36	±12	±0.25	85	±330	

Technical Specification

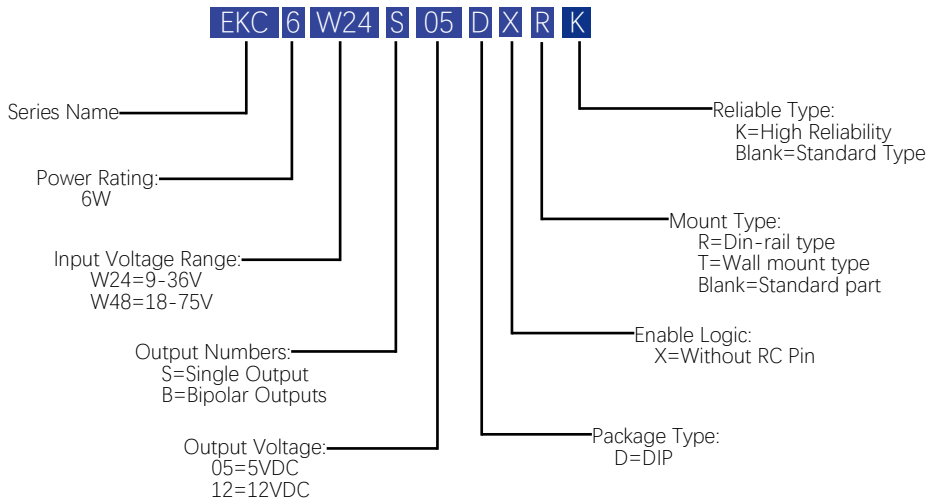
EKC6W24/48 Series

4:1 Wide Input, Isolated 6Watts DC/DC Converters

Models Selections

Basic Models	Input Voltage [VDC]	Input Voltage Range [VDC]	Output Voltage [VDC]	Output Current [A]	Efficiency Typ. [%]	Capacitive Load Max. [μF]	Package [inch]
EKC6W24B15	24	9-36	±15	±0.2	86	±220	1.25"×0.8"×0.4" DIP
EKC6W24B24	24	9-36	±24	±0.125	85	±100	
EKC6W48S03	48	18-75	3.3	1.5	78	1800	
EKC6W48S05	48	18-75	5	1.2	82	1000	
EKC6W48S09	48	18-75	9	0.667	83	680	
EKC6W48S12	48	18-75	12	0.5	85	470	
EKC6W48S15	48	18-75	15	0.4	86	220	
EKC6W48S24	48	18-75	24	0.25	85	100	
EKC6W48B05	48	18-75	±5	±0.6	81	±680	
EKC6W48B12	48	18-75	±12	±0.25	85	±330	
EKC6W48B15	48	18-75	±15	±0.2	86	±220	

Model Numbering



Absolute Maximum Ratings					
Parameters	Conditions	Min.	Typ.	Max.	Units
Input Voltage Continuous	24V type	-0.7		40	VDC
	48V type	-0.7		80	VDC
Input Voltage Transient	<100ms, 24V type			50	VDC
	<100ms, 48V type			100	VDC
Operating Case Temperature		-40		100	°C
Operating Environment Temperature	>71℃ with derating	-40		85	°C
Storage Temperature Range		-55		125	°C
Soldering Temperature	Wave soldering < 10s			260	°C
Cooling	Free air convection				
Safety and EMC Compliance					
Conducted Emission	EN55032	Class B (With external filter)			
Radiated Emission	EN55032	Class B (With external filter)			
Conducted Susceptibility	IEC6100-4-6	3Vrms Criteria A			
Radiated Susceptibility	IEC6100-4-3	10V/m Criteria A			
EFT	IEC6100-4-4	±2KV Criteria B (With external filter)			
Surge	IEC6100-4-5	±2KV Criteria B (With external filter)			
ESD	IEC6100-4-2	Contact: ±4KV Air: ±6KV Criteria B			
Isolation Safety Rating	Basic insulation				

Input Specifications					
Parameters	Conditions	Min.	Typ.	Max.	Units
Operating Voltage Range	24V type	9	24	36	VDC
	48V type	18	48	75	VDC
Start-up Threshold	24V type			9	VDC
	48V type			18	VDC
Under Voltage Shutdown	24V type	5.5	6.5		VDC
	48V type	12	15.5		VDC
Input Current @ No Load	24V type		5	12	mA
	48V type		4	8	mA
Input Current @ Min. Line	24V type		0.85		A
	48V type		0.43		A
Reflected Ripple Current			20		mA
Recommended Input Fuse	24V type		1.5		A
	48V type		1		A
Recommended External Input Capacitance	1μF CBB and 100μF E-cap used in combination		100		μF

General Specifications

Parameters	Conditions	Min.	Typ.	Max.	Units
Isolation Voltage (1 minute, 1mA)	Input to output	1500			VDC
	Input to case	1000			VDC
	Output to case	1000			VDC
Isolation Resistance	Input to output, Viso=500VDC	1000			MΩ
Isolation Capacitance	Input to output		1000		pF
Switching Frequency			310		KHz
Start-up Delay	From undervoltage shutdown recovery to 10% Vout		30		mS
Rise Time	From 10% Vout to 90% Vout capacitive load		30		mS
Vibration	IEC 60068-2-64, Environmental testing - Part 2				
Shock (Operational)	IEC 60068-2-27, Environmental Testing- Part 2.27				

Output Specifications

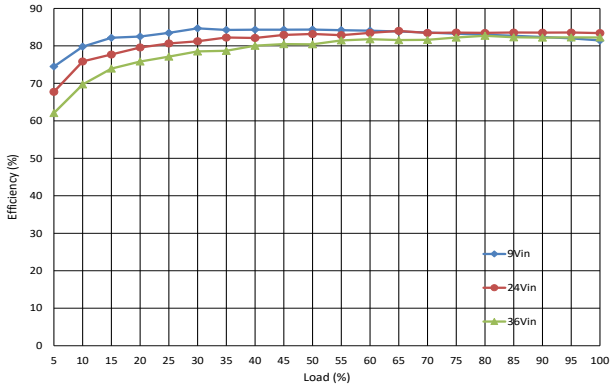
Parameters	Conditions	Min.	Typ.	Max.	Units
Vout Accuracy		-1		+1	%
Line Regulation (Min. line to max. line, Full load)	Positive output	-1.5		+1.5	%
	Negative output	-1		+1	%
Load Regulation (5%-100% load, Vin=nom.line)	Positive output	-1		+1	%
	Negative output	-1.5		+1.5	%
Temperature Coefficient	From -40℃ to 85℃	-0.03		+0.03	% of Vout /℃
Over Current Protection	Hiccup, auto-recover	110		190	%
Over Voltage Protection		110		160	%
Output Short Protection	Hiccup, auto-recover				
Ripple & Noise Max. ①			60	85	mV Pk-Pk
Dynamic Load Peak Deviation ②	3.3V/5V/±5V outputs	-8		+8	% of Vout
	Other outputs	-5		+5	% of Vout
Dynamic Load Response	Within 1% band of Vout deviation		300	500	μS
Minimum Load	No minimum load required				

Notes
① Ripple & noise is tested with certain filter parameters, please see output ripple & noise intechnical notes on page 9 for more details.
② Load is set from 50%-75%-50% of full load, di/dt=0.1A/μS.

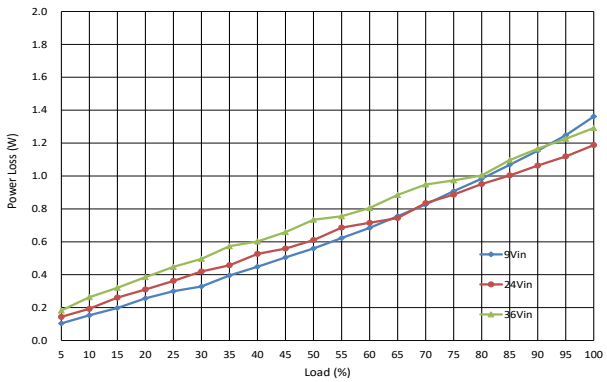
All specifications are tested at 25 ℃ ambient temperature, nominal input voltage, rated output current conditions unless otherwise specified.

Performance Data (EKC6W24S05 Model)

EFFICIENCY VS LOAD

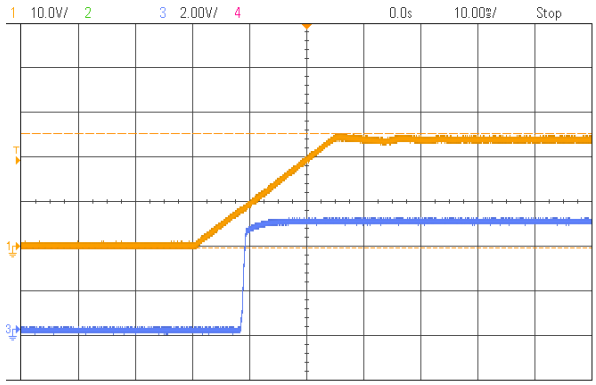


POWER LOSS VS LOAD



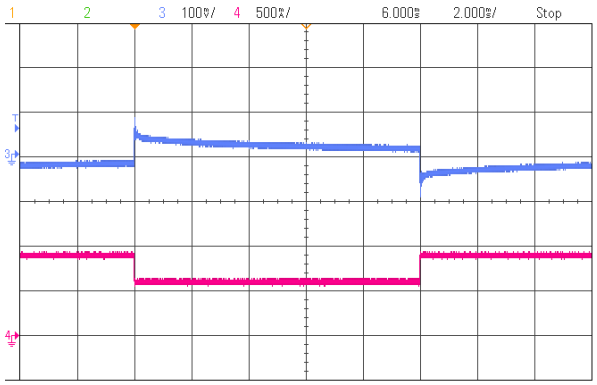
START UP

Ch1:Vin Ch3: Vout



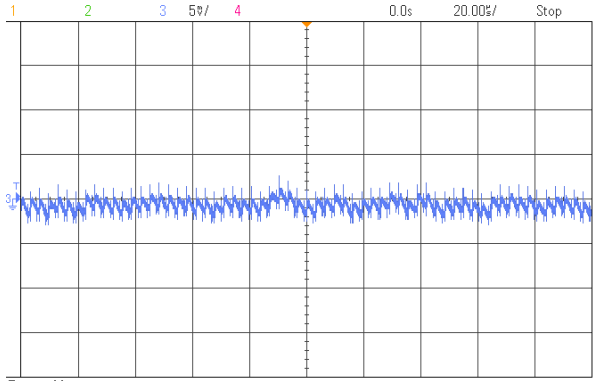
DYNAMIC RESPONSE Ch3: Vout Ch4: Iout

50%~75%~50% of $I_{max,}$ di/dt=0.1A/μs

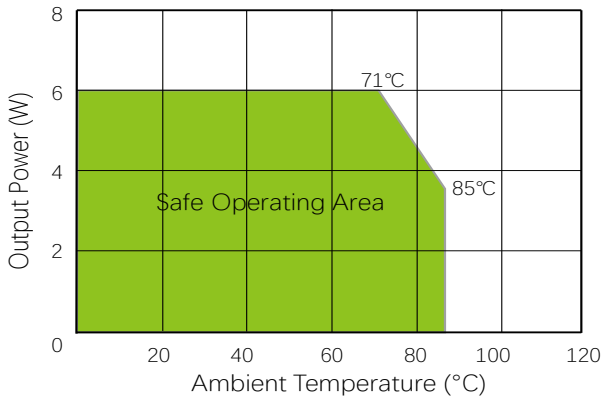


RIPPLE & NOISE 20MHz BANDWITH

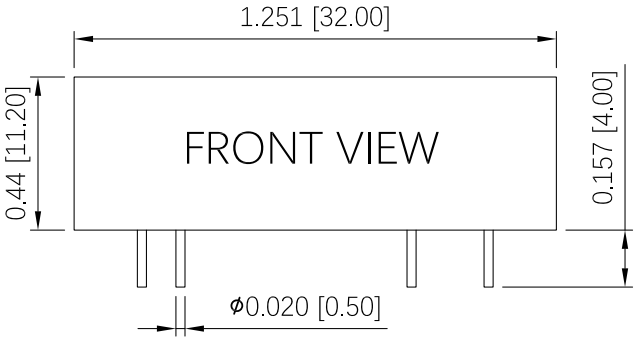
Ch3:Vout

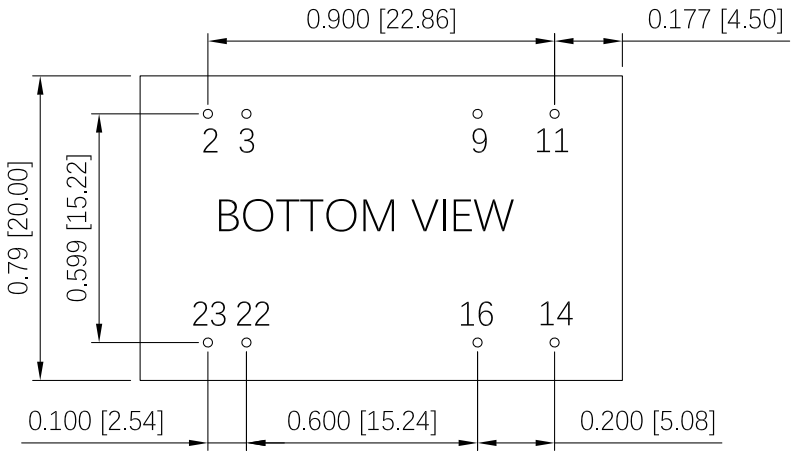


THERMAL DERATING



Mechanical Specifications





PIN:
PIN2, PIN3, PIN9, PIN11, PIN14, PIN16, PIN22, PIN23: Φ0.020inch
Force: Applied force not exceed 4.9N
Material: Copper alloy
Finish: Tin over nickel

Tolerance:
X.XXX=±0.02 (0.5)

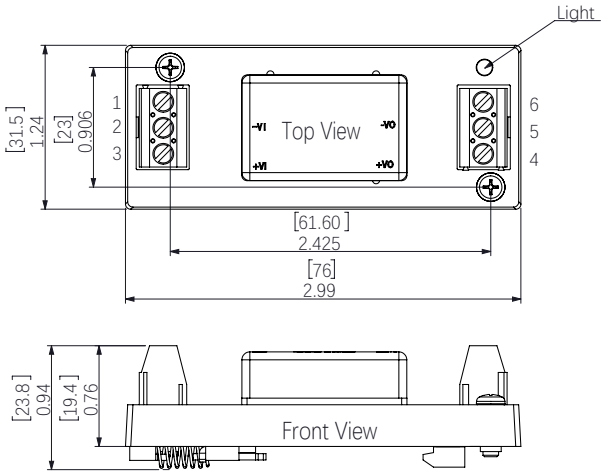
Dimensions are in inches [mm]
Weight: ~13g.

*Note: Pin marked with NC means the module is equipped with Pin, but the Pin has no electrical function and is not allowed to connect any circuit.

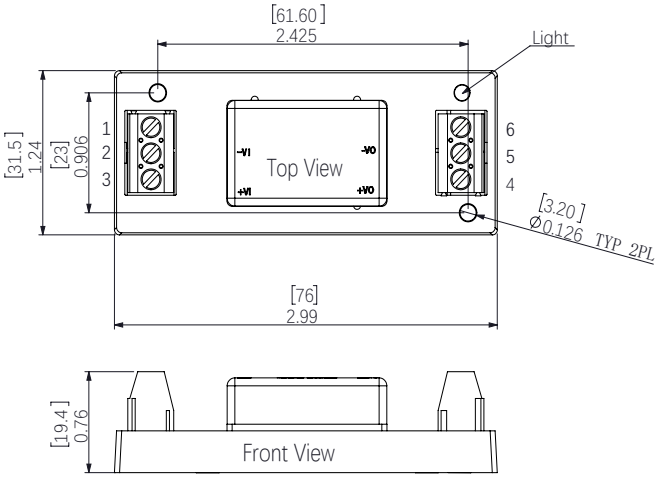
PIN CONNECTIONS			
Single Output		Bipolar Outputs	
Pin	Function	Pin	Function
2	-Vin	2	-Vin
3	-Vin	3	-Vin
9	No Pin	9	Common
11	NC*	11	-Vout
14	+Vout	14	+Vout
16	-Vout	16	Common
22	+Vin	22	+Vin
23	+Vin	23	+Vin

Mechanical Specifications

EKC6W24 SERIES: DIN-RAIL TYPE



EKC6W24 SERIES: WALL MOUNT TYPE



Hole screw locked torque: 0.4N·m Max
Terminal screw locked torque: 0.25N·m Max

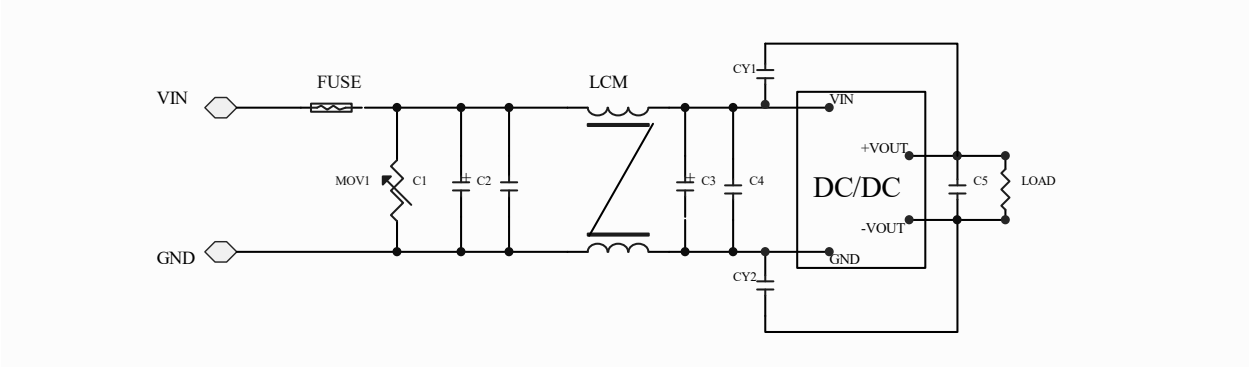
Tolerance:
X.XX=±0.02 (0.5)
X.XXX= ±0.010 (0.25)

Dimensions are in inches [mm]
Weight:
Din-rail type: ~58g
Wall mount type: ~38g

PIN CONNECTIONS			
Single Output		Bipolar Outputs	
Pin	Function	Pin	Function
1	NC	1	NC
2	-Vi	2	-Vi
3	+Vi	3	+Vi
4	+Vo	4	+Vo
5	-Vo	5	-Vo
6	No Pin	6	Common

Emissions Performance

Density Power measures its products for conducted emissions against the EN50121-3-2 standards. The common mode filter is added at the output of the module, and the maximum output power of the module is 6W. Input voltage is 24/48VDC, EMI filter is added outside the modules and the conduction limit can meet standards.



Conducted Emissions Test Circuit

Recommended Filter Parameters

Reference	Description For 24 Vin	Description For 48 Vin
Mov1	20D470K	14D101K
C1	680μF/50V	680μF/100V
C2	1μF/50V	1μF/100V
C3	330μF/50V	330μF/100V
C4	4.7μF/50V	4.7μF/100V
C5	10μF	10μF
LCM	4.7mH	
CY1, CY2	1nF/2KV	

Technical Notes

INPUT FUSING

Certain applications may require fuse at the inputs of power conversion components. Fuses should also be used when there is possibility of sustained input voltage reversal which is not current limited. The EKC6W24 modules are not internally fused. We strongly recommend a slow-blown fuse to be used in the ungrounded input supply line.
For safety agency approvals, the installer must install the converter in compliance with the end user safety standard.

TYPICAL APPLICATION CONNECTION

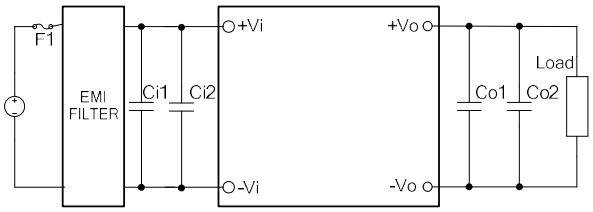


Figure 1· Typical Application Connection Single Output

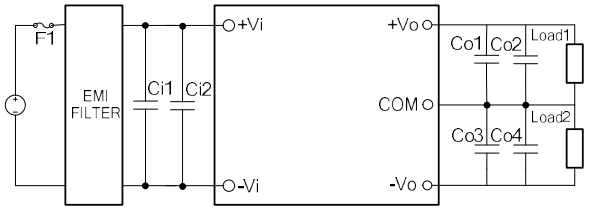


Figure 2· Typical Application Connection Bipolar Outputs

In order to prevent the input line from causing the input oscillation, it is recommended to add the input capacitor close to the input of the module. Similarly, the output capacitor is added to the output of the module. Specific recommended parameters: input capacitance Ci1=100μF electrolytic capacitor, Ci2 = 1uF CBB capacitor. Output Capacitance Co1=10uF tantalum capacitor, Co2 ESR <0.1Ω. For bipolar outputs, Co3 & Co4 are the same as Co1 & Co2. Please refer to capacitive load for details.

REFLECTED RIPPLE CURRENT

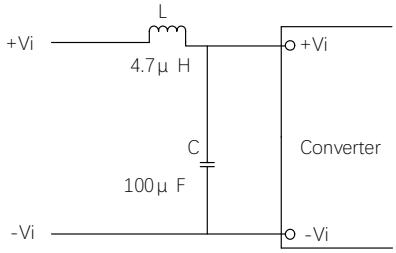


Figure 3· Reflected Ripple Current

Add LC filter at the front of the power module to reduce the interference of reflected ripple current on the DC bus, recommended value of L and C with appropriate current and voltage rating as below: L=4.7μH; C=100μF.

THERMAL SHUTDOWN

These EKC6W24 converters are equipped with thermal-shutdown circuitry. If environmental conditions cause the internal temperature of the converter to rise above the designed operating temperature, a precision temperature sensor will power down the unit. When the internal temperature decreases below the threshold of the temperature sensor, the unit will auto restart.

OUTPUT RIPPLE & NOISE

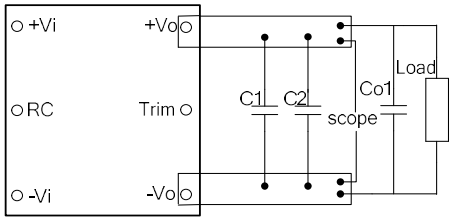


Figure 4· Output Ripple & Noise

These EKC6W24 modules' output ripple and noise is measured at the rated input voltage and output current, along with 10uF and 0.1uF MLCC used in parallel with appropriate voltage ratings and placed as C1&C2 shown in the figure above. The scope's bandwidth is set to 20MHz.

Technical Notes

External output capacitors are required to reduce the ripple & noise. The output capacitors should be low ESR and appropriate frequency response with appropriate voltage ratings, and must be located as close to the converters as possible, also PCB layout must be taken into consideration.

INPUT UNDERVOLTAGE SHUTDOWN AND START-UP THRESHOLD

Once operating, module will not turn off until the input voltage drops below the Undervoltage Shutdown threshold. Subsequent re-start will not occur until the input is brought back up to the Start-Up Threshold. This built in hysteresis prevents any unstable on/off situations from occurring at a single input voltage.

CURRENT LIMITING

The output voltage remains constant as the output current increases. However, once the output current is over the specified Output DC Current Limit, the converter turns off.
The converter then enters into “hiccup mode” where it repeatedly turns on and off until the short circuit condition is removed. This prevents excessive heating of the converter or the load board.

SHORT CIRCUIT CONDITION

When the converter is in current-limit mode, the output voltage will drop as the output current demand increases and then the converter will be shut down. If the short-circuit condition persists, another shutdown cycle will be initiated. This on/off cycling is referred to as "hiccup" mode. The hiccup cycling reduces the average output current, thereby preventing internal temperatures from rising to excessive levels. The module is capable of enduring an indefinite short circuit output condition.

OUTPUT OVERVOLTAGE PROTECTION

EKC6W24 output voltages are monitored for an overvoltage condition via magnetic feedback. The signal is coupled to the primary side and if the output voltage rises to a level which could be damaging to the load, the sensing circuitry will power down the PWM controller causing the output voltages to decrease. Following a time-out period the PWM will restart, causing the output voltages to ramp to their appropriate values. If the fault condition persists, and the output voltages again climb to excessive levels, the overvoltage circuitry will initiate another shutdown cycle.

This product is subject to the following operating requirements and the Life and Safety Critical Application Sales Policy:
Refer to: http://www.densitypower.com