



■ FEATURES

- DIP 2"x 1" package with standard pinout
- 8:1 Wide input range
- High efficiency up to 90%
- No minimum load required
- No external components required internal filtering
- Over temperature protection
- Overload protection & UVLO
- 3000Vdc I/O isolation

■ APPLICATIONS

- Automation equipment
- Power supplies
- Industrial PC
- Data communications
- Distributed power system

■ DESCRIPTION

FHW-E series is a 50W DC-DC converter product with 2"x1" standard industrial package. It contains 8:1 extra wide input voltage range, and features high efficiency up to 90%, 3000Vdc isolation voltage between input and output. The models meet radiated Class A of EN55032 without external components, and suit all kinds of systems like industrial control, automation field, and so on.

■ MODEL ENCODING

FHW	S	-	24	05	E
Series Name	Output Quantity		Input Voltage	Output Voltage	Input Range
	S : Single	24	: 9~75V	03.3 : 3.3V 05 : 5V 12 : 12V 15 : 15V	E: 8:1 , 3KVdc Isolation



■ 8:1 MODEL SELECTION TABLE

MODEL NUMBER	INPUT				OUTPUT		EFF. (%)	CAPACITOR LOAD (Max.)
	VOLTAGE (VDC)		CURRENT (mA)		VOLTAGE (VDC)	CURRENT (mA)		
	NOMINAL	RANGE	NO LOAD	FULL LOAD				
FHWS-2403.3E	24	9~75	10	1562	3.3	0~10000	88	680uF
FHWS-2405E			10	2367	5	0~10000	88	680uF
FHWS-2412E			10	2315	12	0~4170	90	330uF
FHWS-2415E			10	2315	15	0~3333	90	220uF

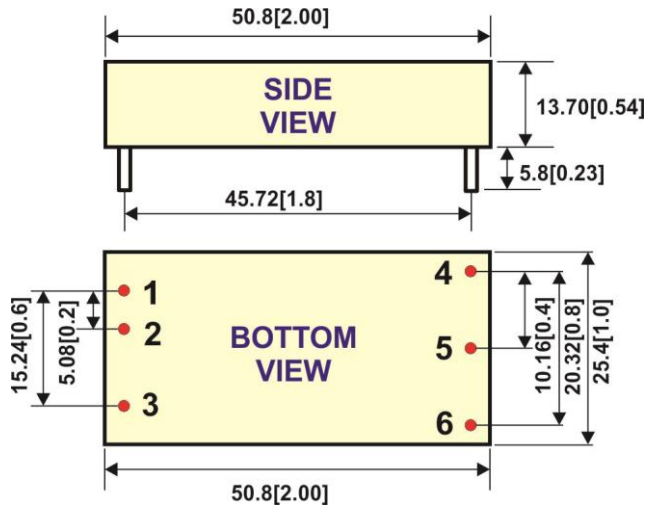
Note: Efficiency and input current are measured at nominal input voltage and full load.

Other input to output voltages may be available. Please contact factory.

■ SPECIFICATION

INPUT	Voltage Range	9~75V		
	Surge Voltage(100ms max.)	24Vin models : 100Vdc		
	Filter	Pi network		
	Under Voltage Lockout	Start-up voltage : 8.8 Vdc Shutdown voltage : 7.5 Vdc		
	Remote Control	See page 4		
	Over Voltage Lockout	See page 5		
	Protection	Fuse recommended (see page 8)		
	OUTPUT	Voltage Accuracy	±2% max.	
Rated Power		33W~50W		
Ripple & Noise ¹		150mVp-p max.		
Line Regulation ²		±0.5%		
Load Regulation ³		±0.5%	±1% for 3.3Vdc output	
Switching Frequency		200KHz typ.(PWM)		
External Trim Adj. Range		±10% typ.		
PROTECTION	Short Circuit	Protection type : continuous, recovery		
	Overload	110%~180% Protection type : recovers automatically after fault condition is removed		
	Over Voltage	Clamp by TVS diode		
	Over Temperature	115°C typ. automatic recovery after cooling down		
ENVIRONMENT	Cooling	Free-air convection		
	Working Temperature	-40~ +65°C (refer to “Derating Curve”)		
	Case Temperature	+110 °C max.		
	Working Humidity	5% ~ 95% RH non-condensing		
	Storage Temp., Humidity	-55 ~ +125°C, 10 ~ 95% RH non-condensing		
	Temperature Coefficient	±0.05% / °C		
	Soldering Temperature	1.5mm from case of 3~5 sec./265°C(max.)		
	Vibration	10~500Hz, 2G 10min./1cycle, period for 60 min. each along X, Y, Z axes		
SAFETY & EMC	Isolation Voltage ⁴	I/P-O/P : 3KVdc		
	Isolation Resistance	I/P-O/P : 1000M Ohms / 500VDC / 25°C / 70% RH		
	Isolation Capacitance	1000pF typ.		
	EMC Emission	Parameter	Standard	Test Level / Note
		Conducted	EN55032(CISPR32)	N/A
		Radiated	EN55032(CISPR32)	Class A
	EMC Immunity	Parameter	Standard	Test Level / Note
		ESD	BS IEC 61000-4-2	Contact ±4KV
		Radiated Susceptibility	BS IEC 61000-4-3	3V/m
		EFT/Burst	BS IEC 61000-4-4	±0.5KV
		Surge	BS IEC 61000-4-5	Line-Line ±0.5KV
		Conducted	BS IEC 61000-4-6	3Vrms
Magnetic field immunity		BS IEC 61000-4-8	1A/m	
OTHERS	MTBF ⁵	>460,000Hours		
	Weight	43.0g typ.		
	Dimension(L*W*H)	50.8mm*25.4mm*13.7mm		
	Case Material	Six-side shielded case		
NOTE	¹ Ripple & noise are measured at 20MHz BW with 1uF ceramic capacitor connect to the output pins.			
	² High line to low line.			
	³ Load regulation is for output load current change from 0% to 100%.			
	⁴ 3000VDC for 1 minute.			
	⁵ MIL-HDBK-217F @25 °C, Ground Benign.			
[*] All specifications are measured at Ta=25°C, humidity < 75%, nominal input voltage, and rated output load unless otherwise specified.				

MECHANICAL SPECIFICATION

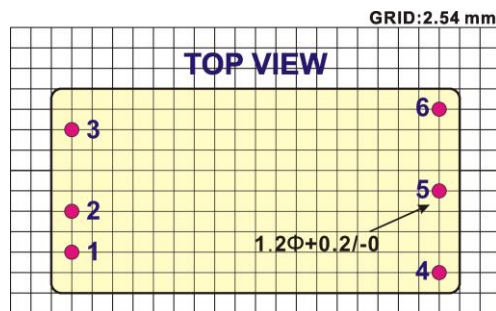


PIN CONNECTION	
PIN	SINGLE
1	+Vin
2	-Vin
3	Remote
4	+Vout
5	-Vout
6	Trim

All dimensions are in mm[Inches]

Pin size is 1.0Φ ±0.10mm

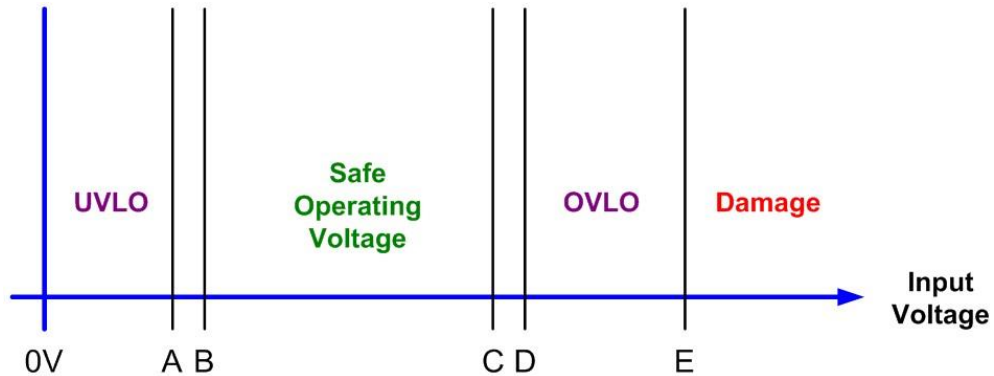
Tolerance .X or .XX= ±0.5mm



REMOTE ON/OFF CONTROL

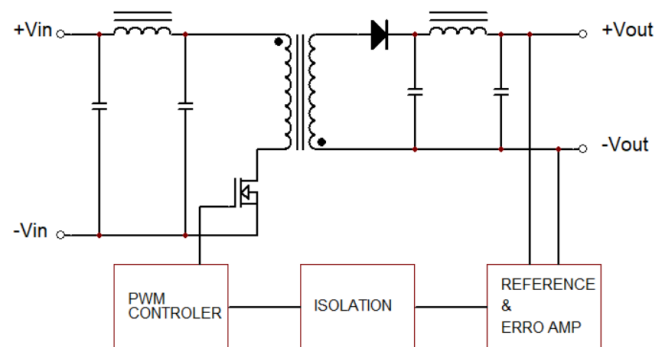
Remote On/Off Control			
Control Input		PIN3	Control Common
Control Voltage			PIN2
ON		Converter Shutdown Idle Current	
OFF		10mA	
> 2.5 ~ 75VDC or Open Circuit		CMOS or Open	
< 1.0VDC or Jumper to PIN2		Collector TTL	

INPUT OPERATING VOLTAGE

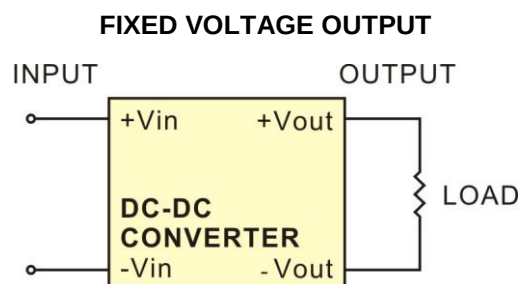


MODEL NUMBER	A	B	C	D	E
FHWS-24XXE	8.8V typ.	9V	75V	87V typ.	100V

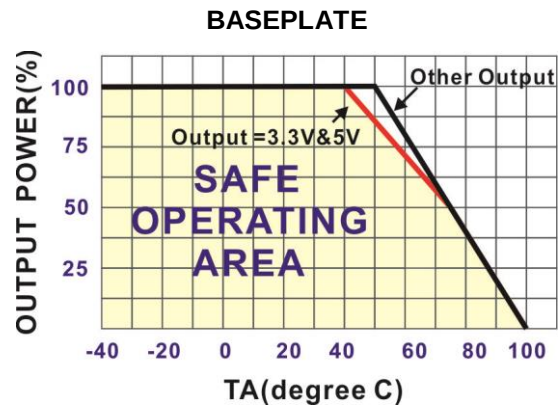
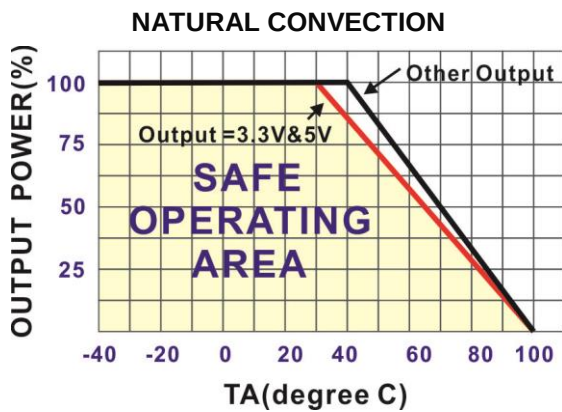
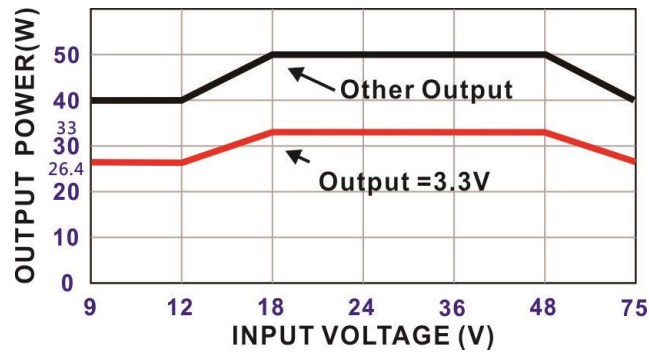
SIMPLIFIED SCHEMATIC



TYPICAL APPLICATIONS

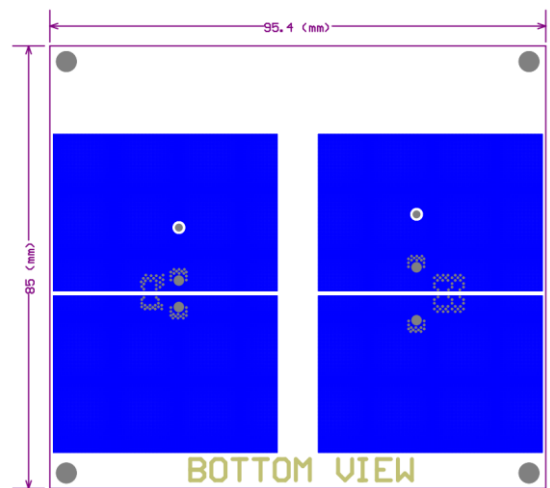
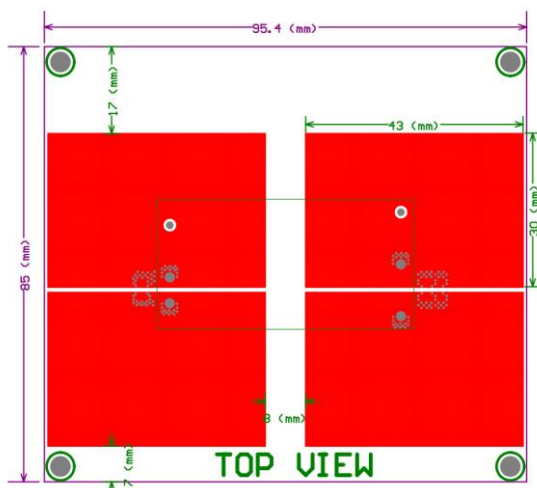


DERATING CURVE



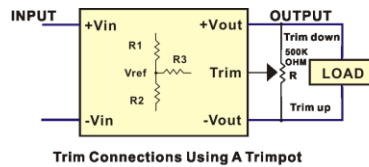
Power Derating Curve

Power module can operate in variety of thermal environments. However, sufficient cooling should be provided to ensure the reliable operation of the unit. Heat can be removed by conduction, convection, and radiation to the surrounding environment. The PCB layout, which to measure FHW-E series thermal performed, the dimension is 95.4 * 85 * 1.6mm, 2 OZ. There copper can help FHW-E series to conduct heat through the body to the PCB.

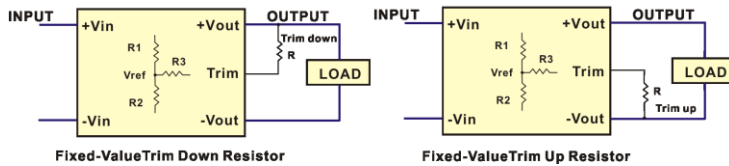


EXTERNAL OUTPUT TRIMMING

Trim up and Trim down resistor values



Vout	R1(KΩ)	R2(KΩ)	R3(KΩ)	Vref
3.3	2.43	1.47	7.5	1.24
5	1	1	3.9	2.5
12	3.83	1	7.5	2.5
15	7.5	1.5	11	2.5



Trim-down:

$$A = [(Vo' - Vref) / Vref] * R2$$

$$RT\text{-down} = [(A * R1) / (R1 - A)] - R3$$

Trim-up:

$$A = [Vref / (Vo' - Vref)] * R1$$

$$RT\text{-up} = [(A * R2) / (R2 - A)] - R3$$

For example :

Vout=12V

Trim=+/-10% (13.2V / 10.8V)=Vo'

trim=-10% (-10.8v)=Vo'

Trim-down:

$$A = [(Vo' - Vref) / Vref] * R2$$

$$= [(10.8 - 2.5) / 2.5] * 1$$

$$= 3.32$$

$$RT\text{-down} = [(A * R1) / (R1 - A)] - R3$$

$$= [(3.32 * 3.83) / (3.83 - 3.32)] - 7.5$$

$$= (12.715 / 0.51) - 7.5$$

$$= 24.931 - 7.5$$

$$= 17.431K\Omega$$

trim=+10% (+13.2V)=Vo'

Trim-up:

$$A = [Vref / (Vo' - Vref)] * R1$$

$$= [2.5 / (13.2 - 2.5)] * 3.83$$

$$= 0.894$$

$$RT\text{-up} = [(A * R2) / (R2 - A)] - R3$$

$$= [(0.894 * 1) / (1 - 0.894)] - 7.5$$

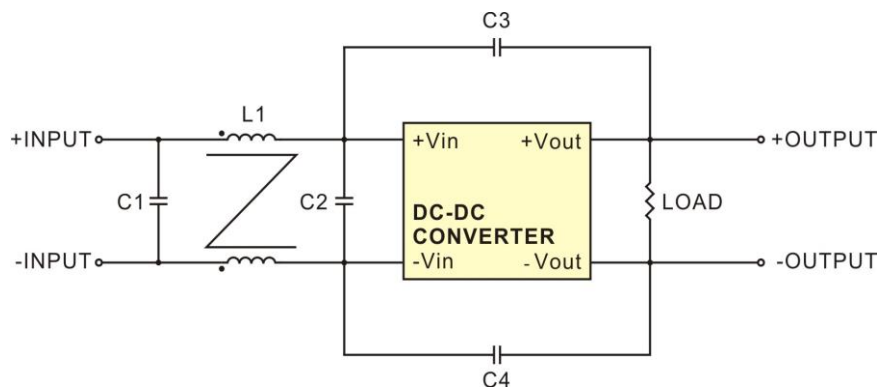
$$= (0.894 / 0.106) - 7.5$$

$$= 8.433 - 7.5$$

$$= 0.933K\Omega$$

RECOMMENDED FILTER FOR EN55032 CLASS B

The components used in the under figure, together with the manufacturer's part numbers for these components, are as follows:



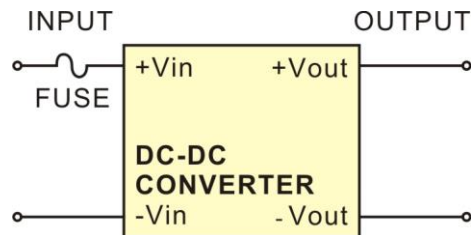
MODEL NUMBER	C1	C2	C3	C4	L1
FHWS-24XXE	47uF/100V	2.2uF/100V MLCC	1000pF/5KV	1000pF/5KV	325uH Common Choke



■ INPUT FUSE SELECTION GUIDE

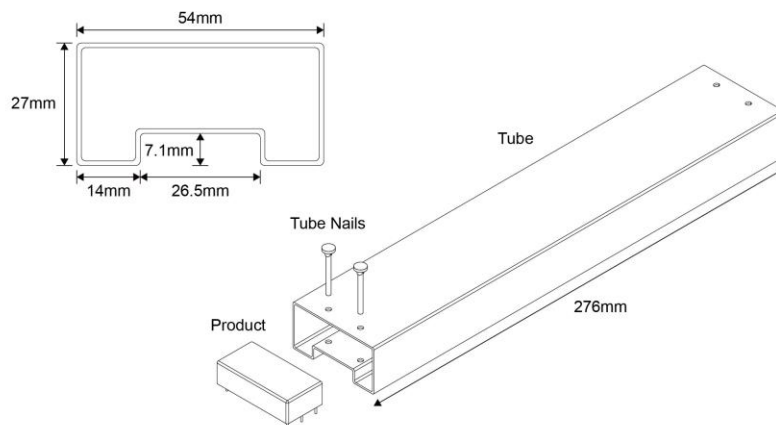
9-75V Input Voltage (Vdc)

8000mA Slow-Blow Type



Note: Certain applications may require the installation of external fuse in front of the input.

■ PACKAGING INFORMATION



Packaging Quantity: 10 pcs converter per tube



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