

# FDD03(U) SERIES

DC - DC CONVERTER  
2 ~ 3W SINGLE & DUAL OUTPUT



## FDD03 - 05S4 x

BLANK : w/o SAFETY APPROVALS  
U : SAFETY APPROVALS

### FEATURES

- EFFICIENCY UP TO 79%
- 4:1 & 3:1 & 2:1 WIDE INPUT RANGE
- I/O ISOLATION
- SHORT CIRCUIT PROTECTION
- HIGH PERFORMANCE
- 3 YEARS WARRANTY



EN 60950-1

### MODEL LIST

MODEL NO.	INPUT VOLTAGE	INPUT CURRENT		OUTPUT WATTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	EFF. (min.)	EFF. (typ.)	CAPACITOR LOAD (max.)
		(typ.)	(max.)						

#### Single Output Models

FDD03 - 05S(U)	20~60 VDC	70 mA	180 mA	2.5 WATTS	+ 5 VDC	500 mA	72%	74%	1000 $\mu$ F
FDD03 - 12S(U)	20~60 VDC	80 mA	200 mA	3 WATTS	+ 12 VDC	250 mA	77%	79%	470 $\mu$ F
FDD03 - 15S(U)	20~60 VDC	80 mA	200 mA	3 WATTS	+ 15 VDC	200 mA	77%	79%	330 $\mu$ F
FDD03 - 05S1(U)	9~18 VDC	265 mA	340 mA	2 WATTS	+ 5 VDC	400 mA	63%	65%	1000 $\mu$ F
FDD03 - 12S1(U)	9~18 VDC	310 mA	380 mA	2.4 WATTS	+ 12 VDC	200 mA	65%	67%	470 $\mu$ F
FDD03 - 15S1(U)	9~18 VDC	285 mA	380 mA	2.4 WATTS	+ 15 VDC	160 mA	65%	67%	330 $\mu$ F
FDD03 - 05S2(U)	18~36 VDC	155 mA	200 mA	2.5 WATTS	+ 5 VDC	500 mA	67%	69%	1000 $\mu$ F
FDD03 - 12S2(U)	18~36 VDC	175 mA	230 mA	3 WATTS	+ 12 VDC	250 mA	70%	72%	470 $\mu$ F
FDD03 - 15S2(U)	18~36 VDC	175 mA	230 mA	3 WATTS	+ 15 VDC	200 mA	70%	72%	330 $\mu$ F
FDD03 - 05S3(U)	36~72 VDC	70 mA	100 mA	2.5 WATTS	+ 5 VDC	500 mA	72%	74%	1000 $\mu$ F
FDD03 - 12S3(U)	36~72 VDC	80 mA	110 mA	3 WATTS	+ 12 VDC	250 mA	77%	79%	470 $\mu$ F
FDD03 - 15S3(U)	36~72 VDC	80 mA	110 mA	3 WATTS	+ 15 VDC	200 mA	77%	79%	330 $\mu$ F
FDD03 - 05S4(U)	9~36 VDC	155 mA	440 mA	2.5 WATTS	+ 5 VDC	500 mA	67%	69%	1000 $\mu$ F
FDD03 - 12S4(U)	9~36 VDC	175 mA	510 mA	3 WATTS	+ 12 VDC	250 mA	70%	72%	470 $\mu$ F
FDD03 - 15S4(U)	9~36 VDC	175 mA	510 mA	3 WATTS	+ 15 VDC	200 mA	70%	72%	330 $\mu$ F
FDD03 - 05S5(U)	18~72 VDC	70 mA	200 mA	2.5 WATTS	+ 5 VDC	500 mA	72%	74%	1000 $\mu$ F
FDD03 - 12S5(U)	18~72 VDC	80 mA	225 mA	3 WATTS	+ 12 VDC	250 mA	77%	79%	470 $\mu$ F
FDD03 - 15S5(U)	18~72 VDC	80 mA	225 mA	3 WATTS	+ 15 VDC	200 mA	77%	79%	330 $\mu$ F

#### Dual Output Models

FDD03 - 05D(U)	20~60 VDC	70 mA	180 mA	2.5 WATTS	$\pm$ 5 VDC	$\pm$ 250 mA	73%	75%	$\pm$ 100 $\mu$ F
FDD03 - 12D(U)	20~60 VDC	80 mA	200 mA	3 WATTS	$\pm$ 12 VDC	$\pm$ 125 mA	75%	77%	$\pm$ 47 $\mu$ F
FDD03 - 15D(U)	20~60 VDC	80 mA	200 mA	3 WATTS	$\pm$ 15 VDC	$\pm$ 100 mA	75%	77%	$\pm$ 22 $\mu$ F
FDD03 - 05D1(U)	9~18 VDC	265 mA	340 mA	2 WATTS	$\pm$ 5 VDC	$\pm$ 200 mA	63%	65%	$\pm$ 100 $\mu$ F
FDD03 - 12D1(U)	9~18 VDC	310 mA	380 mA	2.4 WATTS	$\pm$ 12 VDC	$\pm$ 100 mA	65%	67%	$\pm$ 47 $\mu$ F
FDD03 - 15D1(U)	9~18 VDC	310 mA	380 mA	2.4 WATTS	$\pm$ 15 VDC	$\pm$ 80 mA	65%	67%	$\pm$ 22 $\mu$ F
FDD03 - 05D2(U)	18~36 VDC	155 mA	200 mA	2.5 WATTS	$\pm$ 5 VDC	$\pm$ 250 mA	66%	68%	$\pm$ 100 $\mu$ F
FDD03 - 12D2(U)	18~36 VDC	180 mA	230 mA	3 WATTS	$\pm$ 12 VDC	$\pm$ 125 mA	68%	70%	$\pm$ 47 $\mu$ F

# FDD03(U) SERIES

SINGLE & DUAL OUTPUT

## MODEL LIST

MODEL NO.	INPUT VOLTAGE	INPUT CURRENT		OUTPUT WATTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	EFF. (min.)	EFF. (typ.)	CAPACITOR LOAD (max.)
		(typ.)	(max.)						

### Dual Output Models

FDD03 - 15D2(U)	18~36 VDC	180 mA	230 mA	3 WATTS	± 15 VDC	± 100 mA	68%	70%	± 22 $\mu$ F
FDD03 - 05D3(U)	36~72 VDC	70 mA	100 mA	2.5 WATTS	± 5 VDC	± 250 mA	73%	75%	± 100 $\mu$ F
FDD03 - 12D3(U)	36~72 VDC	80 mA	110 mA	3 WATTS	± 12 VDC	± 125 mA	75%	77%	± 47 $\mu$ F
FDD03 - 15D3(U)	36~72 VDC	80 mA	110 mA	3 WATTS	± 15 VDC	± 100 mA	75%	77%	± 22 $\mu$ F
FDD03 - 05D4(U)	9~36 VDC	155 mA	440 mA	2.5 WATTS	± 5 VDC	± 250 mA	66%	68%	± 100 $\mu$ F
FDD03 - 12D4(U)	9~36 VDC	180 mA	510 mA	3 WATTS	± 12 VDC	± 125 mA	68%	70%	± 47 $\mu$ F
FDD03 - 15D4(U)	9~36 VDC	180 mA	510 mA	3 WATTS	± 15 VDC	± 100 mA	68%	70%	± 22 $\mu$ F
FDD03 - 05D5(U)	18~72 VDC	70 mA	200 mA	2.5 WATTS	± 5 VDC	± 250 mA	73%	75%	± 100 $\mu$ F
FDD03 - 12D5(U)	18~72 VDC	80 mA	225 mA	3 WATTS	± 12 VDC	± 125 mA	75%	77%	± 47 $\mu$ F
FDD03 - 15D5(U)	18~72 VDC	80 mA	225 mA	3 WATTS	± 15 VDC	± 100 mA	75%	77%	± 22 $\mu$ F

## SPECIFICATION

All Specifications Typical At Nominal Line, Full Load, 25°C Unless Otherwise Noticed

### GENERAL

Characteristics	Conditions	min.	typ.	max.	unit
Switching frequency	Vi nom, Io nom	50			KHz
Isolation voltage	Input - Output	1,500			VDC
Isolation resistance	Input - Output, @ 500VDC	100			M $\Omega$
Ambient temperature	Operating at Vi nom, Io nom	-40		+ 71	°C
Case temperature	Operating at Vi nom, Io nom			+ 90	°C
Derating	Vi nom	See derating curve			
Storage temperature	Non operational	-40		+ 100	°C
Relative humidity	Vi nom, Io nom	20		95	% RH
Temperature coefficient	Vi nom, Io min			± 0.02	% / °C
Dimension		L31.8 x W20.3 x H12.7			mm
MTBF	Bellcore issue 6@40°C, GB		1,640,000		Hours
Cooling	Free air convection				

### INPUT SPECIFICATIONS

Characteristics	Conditions	min.	typ.	max.	unit	
Input voltage range	Ta min ... Ta max, Io nom	2 : 1	9	12	18	VDC
			18	24	36	VDC
			36	48	72	VDC
		3 : 1	20	48	60	VDC
		4 : 1	9	24	36	VDC
			18	48	72	VDC
No load input current	Vi nom, Io = 0	12V		18	mA	
		24V		15	mA	
		48V		8	mA	
Input voltage w/o damage	Io nom	12V		20	VDC	
		24V		40	VDC	
		48V		75	VDC	
Startup voltage	Io nom	12V	7.2		VDC	
		24V	7.2		VDC	
		48V	16.1		VDC	

### OUTPUT SPECIFICATIONS

Characteristics	Conditions	min.	typ.	max.	unit
Output voltage accuracy	Vi nom, Io nom			± 2	%
Minimum load	Vi nom				
	single output models	0			%
	dual output models (each output)	20			%

### SPECIFICATION

All Specifications Typical At Nominal Line, Full Load, 25°C Unless Otherwise Noticed

### OUTPUT SPECIFICATIONS

Characteristics	Conditions	min.	typ.	max.	unit
Line regulation	Io nom, Vi min ...Vi max			± 1	%
Load regulation	Vi nom, Io 0 ...Io nom, single output models			± 2	%
	Vi nom, Io min ...Io nom, dual output models			± 5	%
Cross regulation (Dual model)	Aymmetrical load 20% - 100% FL			± 10	%
Startup time	Vi nom, Io nom			30	ms
Transient recovery time	Vi nom, I ~0.5 Io nom			3	ms
Ripple & noise	Vi nom, Io nom, BW = 20MHz			300	mV
Efficiency	Vi nom, Io nom, Po / Pi	Up to 79%, See model list and efficiency curve			

### CONTROL AND PROTECTION

Input reversed	External shunt diode, external fuse recommended ( 12Vin : 0.75A, 24Vin : 0.75A, 48Vin : 0.5A )
Output short circuit	Current limited (Auto-recovery)

### APPROVALS AND STANDARD

cTUVus	UL 60950-1
TUV	EN 60950-1
CE I)	EN 61204-3, EN 55022 Class B, EN 61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-6, EN 61000-4-8
Vibration	meet IEC 60068-2-6 (10-500 Hz, 2G, along X, Y, Z each Axis, 60 min for each Axis)

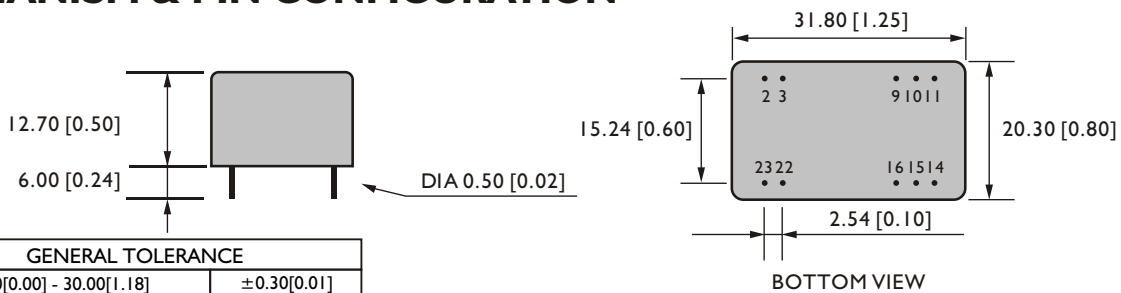
NOTE 1 : Pls refer to recommended circuit .

### PHYSICAL CHARACTERISTICS

Case size	31.8 x 20.3 x 12.7 mm (1.25 x 0.8 x 0.5 inches)
Case material	Plastic
Weight	15 g
Potting material	Epoxy

### MECHANISM & PIN CONFIGURATION

mm [inch]



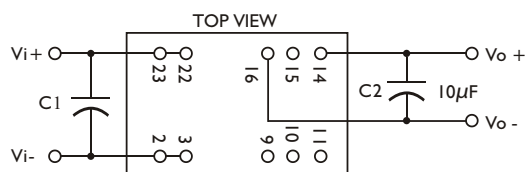
### PIN ASSIGNMENT

#### GENERAL

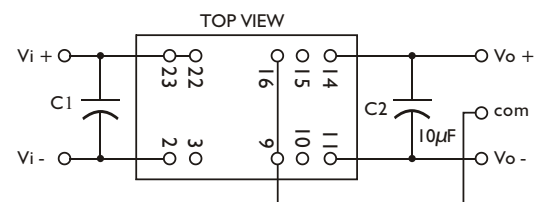
PIN NO.	2&3	9	10&15	11	14	16	22&23
SINGLE	Vi -	N. C.	N. C.	N. C.	Vo +	Vo -	Vi +
DUAL	Vi -	com	N. C.	Vo -	Vo +	com	Vi +

### APPLICATION CIRCUIT

a. SINGLE OUTPUT MODELS :



b. DUAL OUTPUT MODELS :



#### NOTE:

a. C1 = 4.7µF / 100V, C2 = 10µF

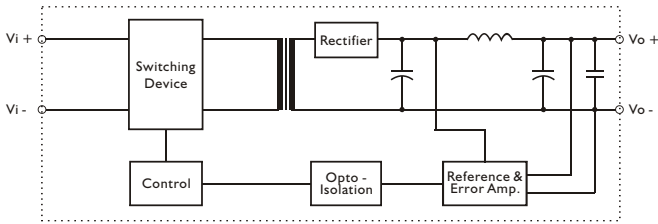
b. C1 MUST BE ADDED WHEN APPLICATION .

c. C2 OPTIONAL TO MINIMIZE THE R & N < 100mV .

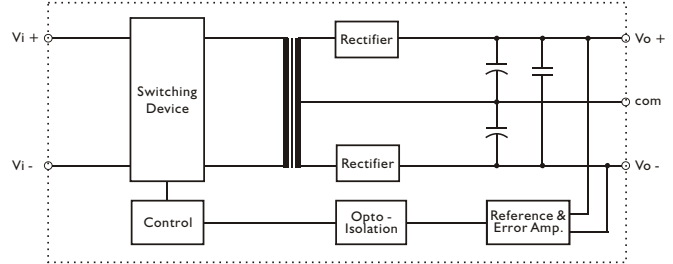
d. MAX. 80% LOAD WHEN INPUT VOLTAGE AT 9-11VDC FOR 9-36VDC INPUT MODELS & 18-21VDC FOR 18-72VDC INPUT MODELS .

### CIRCUIT SCHEMATIC

- Block diagram for FDD03(U) series with single output



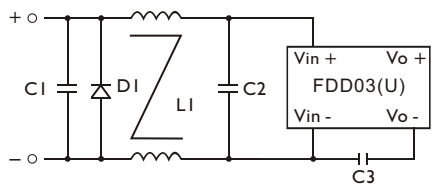
- Block diagram for FDD03(U) series with dual output



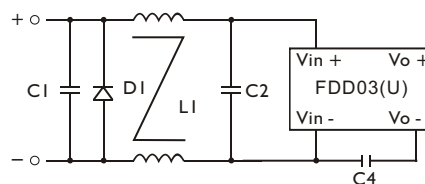
### RECOMMENDED CIRCUIT

- Recommended filter for EN55022 Class B compliance

SINGLE OUTPUT MODELS



DUAL OUTPUT MODELS

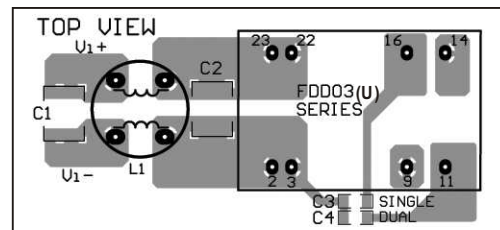


Note: D1 - Reverse Diode (1A/100V)

- The components used in the above figure, together with the manufacturer part numbers for these components, are as follows.

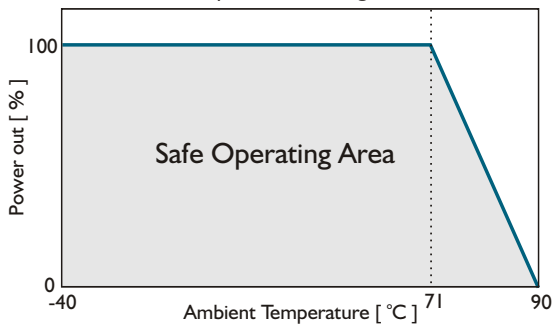
	C1	C2	C3	C4	L1
FDD03- XXSX(U)	6.8 $\mu$ F / 100V MLCC	4.7 $\mu$ F / 100V MLCC	InF/2KV MLCC		3mH Common Choke
FDD03- XXDX(U)	6.8 $\mu$ F / 100V MLCC	4.7 $\mu$ F / 100V MLCC		InF/2KV MLCC	3mH Common Choke

- Recommended EN 55022 Class B filter circuit layout.

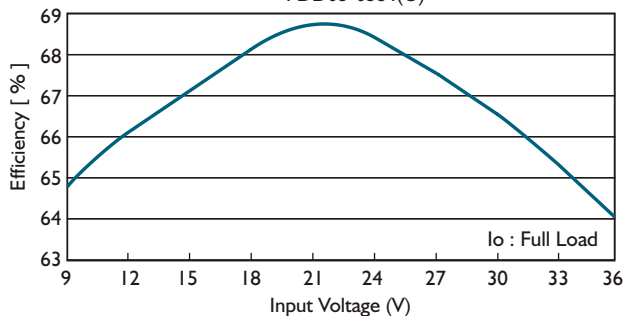


### DERATING AND EFFICIENCY CURVE

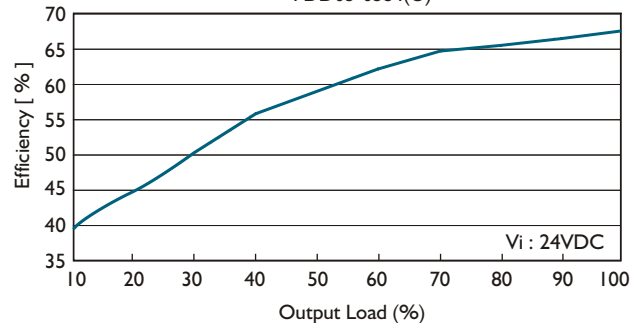
Temperature derating curve



Efficiency Vs Input Voltage  
FDD03-05S4(U)



Efficiency Vs Output Load  
FDD03-05S4(U)



# FDD03A(U) SERIES

DC - DC CONVERTER  
2.5 ~ 3W SINGLE & DUAL OUTPUT



## FDD03 - 05S4A x

BLANK : w/o SAFETY APPROVALS  
U : SAFETY APPROVALS

### FEATURES

- 4:1 WIDE INPUT RANGE
- DIP24 PACKAGE
- I/O, O/O ISOLATION
- SHORT CIRCUIT PROTECTION
- HIGH PERFORMANCE
- 3 YEARS WARRANTY



EN 60950-1

### MODEL LIST

MODEL NO.	INPUT VOLTAGE	INPUT CURRENT (typ.)   (max.)		OUTPUT WATTAGE	OUTPUT VOLTAGE	OUTPUT CURRENT	EFF. (min.)	EFF. (typ.)	CAPACITOR LOAD (max.)
<b>Single Output Models</b>									
FDD03 - 05S4A(U)	9~36 VDC	160 mA	440 mA	2.5 WATTS	+ 5 VDC	500 mA	65%	67%	1000 $\mu$ F
FDD03 - 12S4A(U)	9~36 VDC	180 mA	530 mA	3 WATTS	+ 12 VDC	250 mA	68%	70%	470 $\mu$ F
FDD03 - 15S4A(U)	9~36 VDC	180 mA	530 mA	3 WATTS	+ 15 VDC	200 mA	68%	70%	330 $\mu$ F
FDD03 - 05S5A(U)	18~72 VDC	75 mA	205 mA	2.5 WATTS	+ 5 VDC	500 mA	70%	72%	1000 $\mu$ F
FDD03 - 12S5A(U)	18~72 VDC	80 mA	235 mA	3 WATTS	+ 12 VDC	250 mA	75%	77%	470 $\mu$ F
FDD03 - 15S5A(U)	18~72 VDC	80 mA	235 mA	3 WATTS	+ 15 VDC	200 mA	75%	77%	330 $\mu$ F
<b>Dual Output Models</b>									
FDD03 - 05D4A(U)	9~36 VDC	155 mA	440 mA	2.5 WATTS	$\pm$ 5 VDC	$\pm$ 250 mA	66%	68%	$\pm$ 100 $\mu$ F
FDD03 - 12D4A(U)	9~36 VDC	180 mA	530 mA	3 WATTS	$\pm$ 12 VDC	$\pm$ 125 mA	68%	70%	$\pm$ 47 $\mu$ F
FDD03 - 15D4A(U)	9~36 VDC	180 mA	530 mA	3 WATTS	$\pm$ 15 VDC	$\pm$ 100 mA	68%	70%	$\pm$ 22 $\mu$ F
FDD03 - 05D5A(U)	18~72 VDC	70 mA	205 mA	2.5 WATTS	$\pm$ 5 VDC	$\pm$ 250 mA	72%	74%	$\pm$ 100 $\mu$ F
FDD03 - 12D5A(U)	18~72 VDC	80 mA	235 mA	3 WATTS	$\pm$ 12 VDC	$\pm$ 125 mA	75%	77%	$\pm$ 47 $\mu$ F
FDD03 - 15D5A(U)	18~72 VDC	80 mA	235 mA	3 WATTS	$\pm$ 15 VDC	$\pm$ 100 mA	75%	77%	$\pm$ 22 $\mu$ F
<b>Double Output Models</b>									
FDD03 - 0505D4A(U)	9~36 VDC	160 mA	440 mA	2.5 WATTS	5 / 5 VDC	250 / 250 mA	66%	68%	100 $\mu$ F
FDD03 - 1212D4A(U)	9~36 VDC	180 mA	530 mA	3 WATTS	12 / 12 VDC	125 / 125 mA	68%	70%	47 $\mu$ F
FDD03 - 1515D4A(U)	9~36 VDC	180 mA	530 mA	3 WATTS	15 / 15 VDC	100 / 100 mA	68%	70%	22 $\mu$ F
FDD03 - 0505D5A(U)	18~72 VDC	70 mA	205 mA	2.5 WATTS	5 / 5 VDC	250 / 250 mA	72%	74%	100 $\mu$ F
FDD03 - 1212D5A(U)	18~72 VDC	80 mA	235 mA	3 WATTS	12 / 12 VDC	125 / 125 mA	75%	77%	47 $\mu$ F
FDD03 - 1515D5A(U)	18~72 VDC	80 mA	235 mA	3 WATTS	15 / 15 VDC	100 / 100 mA	75%	77%	22 $\mu$ F

#### NOTE :

MAX. 80% LOAD WHEN INPUT VOLTAGE AT 9-11VDC FOR 9-36VDC INPUT MODELS & 18-21VDC FOR 18-72VDC INPUT MODELS.

# FDD03A(U) SERIES

SINGLE & DUAL OUTPUT

## SPECIFICATION

All Specifications Typical At Nominal Line, Full Load, 25°C Unless Otherwise Noticed

### GENERAL

Characteristics	Conditions	min.	typ.	max.	unit
Switching frequency	Vi nom, Io nom	50			KHz
Isolation voltage	Input - Output	1,500			VDC
Isolation resistance	Input - Output, @ 500VDC	100			MΩ
Ambient temperature	Operating at Vi nom, Io nom	-40		+ 71	°C
Case temperature	Operating at Vi nom, Io nom			+90	°C
Derating	Vi nom	See derating curve			
Storage temperature	Non operational	-40		+ 100	°C
Relative humidity	Vi nom, Io nom	20		95	% RH
Temperature coefficient	Vi nom, Io min			± 0.02	% / °C
Dimension		L31.8 x W20.3 x H12.7			mm
MTBF	Bellcore issue 6@40°C, GB		1,640,000		Hours
Cooling	Free air convection				

### INPUT SPECIFICATIONS

Characteristics	Conditions	min.	typ.	max.	unit
Input voltage range	Ta min ... Ta max, Io nom	9	24	36	VDC
		18	48	72	VDC
No load input current	Vi nom, Io = 0	24V		15	mA
		48V		8	mA
Input voltage w/o damage	Io nom	24V		40	VDC
		48V		75	VDC
Startup voltage	Io nom	24V	7.2		VDC
		48V	16.1		VDC

### OUTPUT SPECIFICATIONS

Characteristics	Conditions	min.	typ.	max.	unit
Output voltage accuracy	Vi nom, Io nom			± 2	%
Minimum load	Vi nom single output models	0			%
	Vi nom dual output models (each output)	20			%
Line regulation	Io nom, Vi min ... Vi max			± 1	%
Load regulation	Vi nom, Io 0 ... Io nom, single output models			± 2	%
	Vi nom, Io min ... Io nom, dual output models			± 5	%
Cross regulation (Dual model)	Aymmetrical load 20% - 100% FL			± 10	%
Startup time	Vi nom, Io nom			30	ms
Transient recovery time	Vi nom, I ~ 0.5 Io nom			3	ms
Ripple & noise	Vi nom, Io nom, BW = 20MHz			150	mV
Efficiency	Vi nom, Io nom, Po / Pi	Up to 77%, See model list and efficiency curve			

### CONTROL AND PROTECTION

Remote ON / OFF	ON: opened or 5~10 VDC applied, reference to input GND OFF: -0.3~2 VDC applied, reference to input GND
Input reversed	External shunt diode, external fuse recommended ( 24Vin : 0.75A, 48Vin : 0.5A )
Output short circuit	Current limited (Auto-recovery)

### APPROVALS AND STANDARD

cTUVus	UL 60950-1
TUV	EN 60950-1
CE I)	EN 61204-3, EN 55022 Class B, EN 61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-6, EN 61000-4-8
Vibration	meet IEC 60068-2-6 (10-500 Hz, 2G, along X, Y, Z each Axis, 60 min for each Axis)

NOTE 1 : Pls refer to recommended circuit .

# FDD03A(U) SERIES

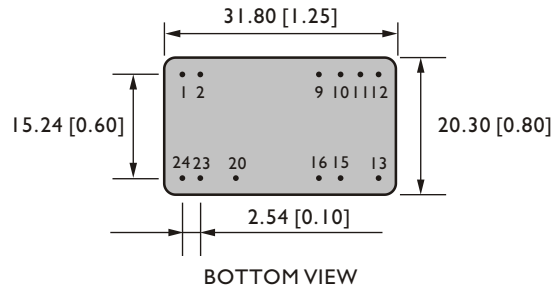
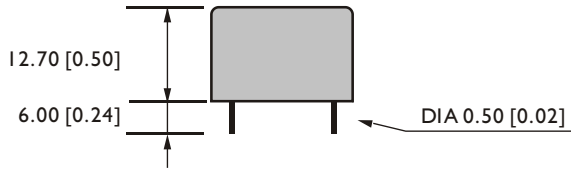
SINGLE & DUAL OUTPUT

## PHYSICAL CHARACTERISTICS

Case size	31.8 × 20.3 × 12.7 mm (1.25 × 0.8 × 0.5 inches)
Case material	Plastic
Weight	15 g
Potting material	Epoxy

## MECHANISM & PIN CONFIGURATION

mm [inch]



GENERAL TOLERANCE	
0.00[0.00] - 30.00[1.18]	±0.30[0.01]
30.00[1.18] - 120.00[4.72]	±0.50[0.02]

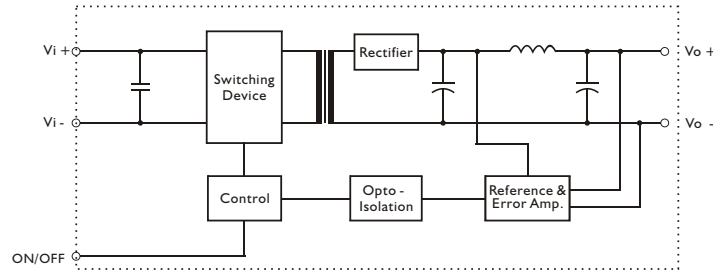
## PIN ASSIGNMENT

### GENERAL

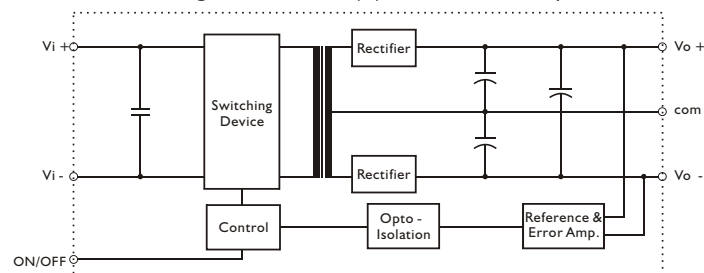
PIN NO.	1&2	9	10&11	12	13	15	16	20	23&24
SINGLE	Vi+	NO PIN	NO PIN	Vo-	Vo+	NO PIN	NO PIN	ON/OFF	Vi-
DUAL	Vi+	NO PIN	com	NO PIN	Vo-	Vo+	NO PIN	ON/OFF	Vi-
DOUBLE	Vi+	Vo1-	NO PIN	Vo1+	Vo2+	NO PIN	Vo2-	ON/OFF	Vi-

## CIRCUIT SCHEMATIC

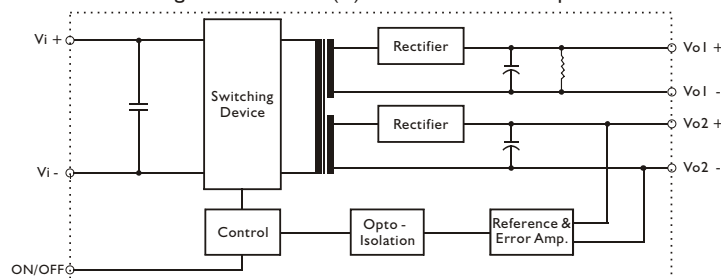
• Block diagram for FDD03A(U) series with single output



• Block diagram for FDD03A(U) series with dual output



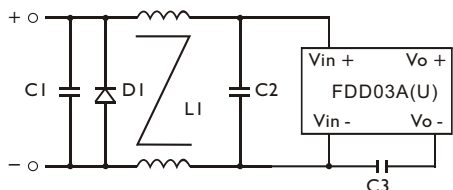
• Block diagram for FDD03A(U) series with double output



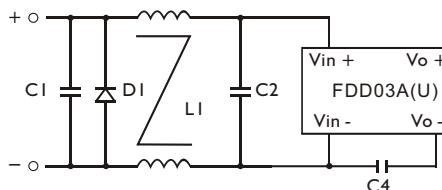
### RECOMMENDED CIRCUIT

- Recommended filter for EN55022 Class B compliance

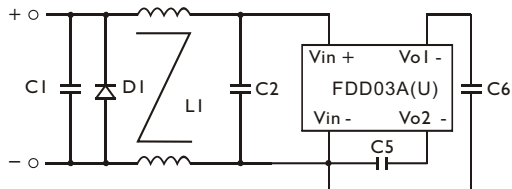
SINGLE OUTPUT MODELS



DUAL OUTPUT MODELS



DOUBLE OUTPUT MODELS

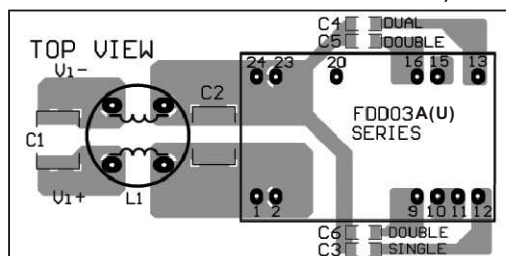


Note: D1 - Reverse Diode (1A / 100V)

- The components used in the above figure, together with the manufacturer part numbers for these components, are as follows.

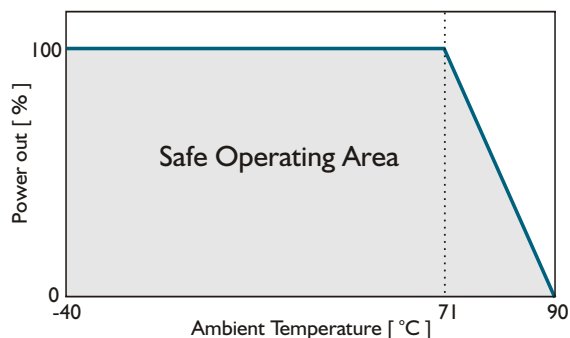
	C1	C2	C3	C4	C5	C6	L1
FDD03-XXSXA(U)	6.8μF / 100V MLCC	4.7μF / 100V MLCC	InF/2KV MLCC	/	/	/	3mH Common Choke
FDD03-XXDXA(U)	6.8μF / 100V MLCC	4.7μF / 100V MLCC	/	InF/2KV MLCC	/	/	3mH Common Choke
FDD03-XXXXXA(U)	6.8μF / 100V MLCC	4.7μF / 100V MLCC	/	/	InF/2KV MLCC	InF/2KV MLCC	3mH Common Choke

- Recommended EN 55022 Class B filter circuit layout.

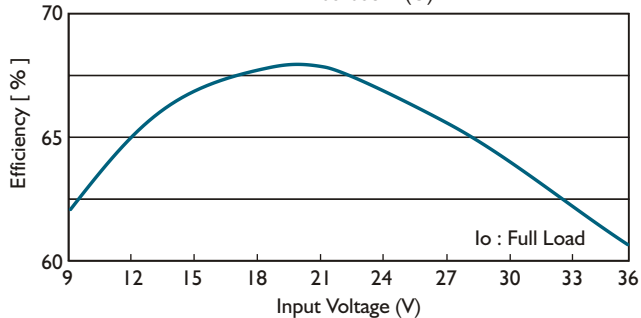


### DERATING AND EFFICIENCY CURVE

Temperature derating curve



Efficiency Vs Input Voltage  
FDD03-05S4A(U)



Efficiency Vs Output Load  
FDD03-05S4A(U)

