



Wide Input Voltage Range 60 Watt DC-DC Converter



FEATURES:

- 2:1 Wide Input Voltage.
- Efficiency To 90%
- Under Voltage Lockout
- Over Temperature Protection
- Shielded metal Case with insulated Baseplate
- Remote Control: On/Off



APPLICATIONS:

- Industry Control System ● Semiconductor Equipment
- Wireless Network ● Telecom/Datacom ● Measurement

Specifications typical at TA=25°C, nominal input voltage and rated output current unless otherwise specified

Part Number	Input Voltage	Input Current		Output Voltage	Output Current	Efficiency ⁽⁴⁾	Capacitor Load ⁽⁵⁾
	Vdc	No-Load ⁽³⁾ (mA TYP)	Full Load ⁽²⁾ (mA TYP)	Vdc	mA	%TYP	uF MAX
93D-24S03R2NL	18-36	70	2162	3.3	14000	89	28800
93D-24S05R2NL	18-36	120	2777	5	12000	90	15000
93D-24S12R2NL	18-36	30	2777	12	5000	90	2800
93D-24S15R2NL	18-36	30	2777	15	4000	90	1800
93D-48S03R2NL	36-75	60	1081	3.3	14000	89	28800
93D-48S05R2NL	36-75	70	1388	5	12000	90	15000
93D-48S12R2NL	36-75	25	1388	12	5000	90	2800
93D-48S15R2NL	36-75	25	1388	15	4000	90	1800

Input Specifications

Parameters	Conditions	Min	Typ	Max	Units
Voltage Types				2:1	
Start-up voltage /under voltage lockout	24 Vin		17.3 / 16.8	18	VDC
	48 Vin		34 / 32	36	VDC
Surge voltage (100 msec. max.)	24 Vin			50	V
	48 Vin			100	V
Conducted noise⁽⁷⁾		EN 55022 level A, FCC part 15, level A with external capacitor			
Filter	Pi TYPE				

Output Specifications (Temperature Coefficient : ±0.05%/°C)

Parameters	Conditions	Min	Typ	Max	Units
Voltage Tolerance	Normal Vin and full load			±2	%
Output voltage adjustment⁽⁸⁾				±10	%
Line Regulation	Vin min. to Vin max			±0.5	%
Load Regulation (10% -100% Load)	+Vin Short to +Sense, -Vin Short to -Sense			±0.5	%
Ripple and noise⁽⁴⁾	20 MHz Bandwidth			100	mVp-p
Start up time	nominal Vin and constant resistive		25		ms
Transient response time	25% load step change		300		us
Short circuit protection		Hiccup(automatic recovery)			
Over load protection	Iout Max		150		%
Thermal shutdown			110		°C
Over voltage protection	3.3VDC		3.9		V
	5VDC		6.2		V
	12VDC		15		V
	15VDC		18		V
Minimum load	All models	10% of rated max current (operation at lower load condition will not damage)			



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General Specifications					
Parameters	Conditions	Min	Typ	Max	Units
Temperature ranges	Operating	-40		+85	°C
	Case temperature			105	°C
	Storage	-55		+125	°C
Derating		see graphs on page 2			
Humidity	non condensing			95	%
Reliability, calculated MTBF ⁽¹⁾	MIL-HDBK-217 F	110000			Hours
Isolation voltage	For 60 seconds(Input/Output)			1500	VDC
Isolation resistance	Input/Output	1000			MΩ
Isolation capacity	Input/Output			2500	pF
Remote On/Off ⁽⁶⁾	On	Open			
	Off	Short to -Vin			
	Off idle current			2.5	mA
Switching frequency (fixed)			300		KHz
Case material		Black Coated Copper (or Nickel Coated) With Non-Conductive Base			
Baseplate material		none conductive FR4			
Potting material		epoxy (UL 94V-0 -rated)			
Weight		70 g (2.3 oz)			
Soldering temperature		max. 265 °C / 10 sec.			

- Note: 1. BELLCORE TR-NWT-000332. Case 1: 50% Stress, Temperature at 40°C
MIL-STD-217F Notice2 @Ta=25 °C, Full load (Ground, Benign, controlled environment)
2. Maximum value at nominal input voltage and full load.
3. Typical value at nominal input voltage and no load.
4. Typical value at nominal input voltage and full load.
5. Test by nominal Vin constant resistive load.
6. The ON/OFF control pin voltage is referenced to -Vin.(Leave open if not used.)
7. The 93D-R2 series can meet EN55022 Class A with parallel an external capacitor to the input pins.
Recommend : 24Vin : 4.7μF/50V X7R 1812 MLCC.
48Vin : 2.2μF/100V X7R 1812 MLCC.
8. Maximum output deviation is 10% inclusive of remote sense and trim.If remote sense is not being used, the +sense should be connected to its corresponding +OUTPUT and likewise the -sense should be connected to its corresponding -OUTPUT.

Output Voltage Adjustment

Output can be externally trimmed by using the method shown below.

TRIM UP

TRIM DOWN

Control Pin Suggest Circuit

When pin3 short to pin2,D/D ON=>OFF
When pin3 leave open,D/D => ON

Suggest Circuit :

Temperature Derating Graph

Ambient Temperature (°C)	Output Power (%)
-40	100
-25	100
-10	100
0	100
40	100
50	100
60	80
70	60
80	40
90	20
100	0

Part Number

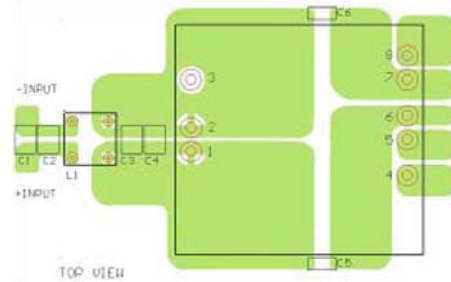
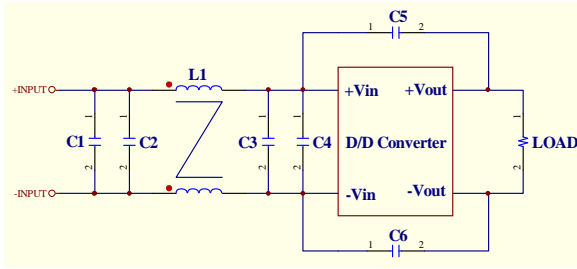
93D - 24 S 03 R 2 NL
A B C D E F G

A : Series
B : Input Voltage
C : Single Output
D : Output Voltage
E : Regulated(R)
F : Output Power Type
G : RoHs Version



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EMC Considerations



Suggested Schematic to comply with Conducted Noise according to EN55022 Class B

Recommended Layout with input Filter

Following components are needed to comply with EN55022 Class B conducted noise:

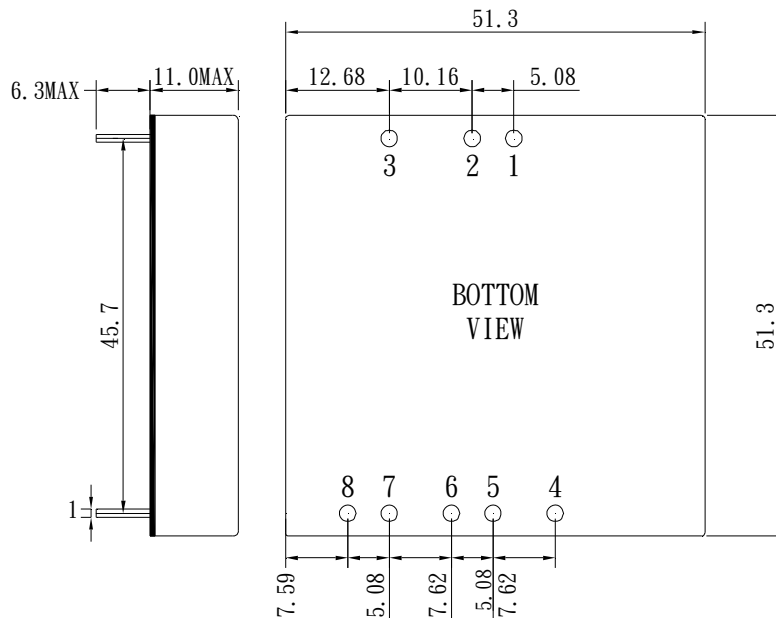
93D-24SxxR2NL

Componet	Value	Voltage	Reference
C1,C3	4.7uF	50V	1812 MLCC
C5,C6	1000pF	2KV	1206 MLCC
L1	450uH		Common Mode Choke

93D-48SxxR2NL

Componet	Value	Voltage	Reference
C1,C2,C3,C4	2.2uF	100V	1812 MLCC
C5,C6	1000pF	2KV	1206 MLCC
L1	830uH		Common Mode Choke

Markings and dimensions



UNIT:mm XX.X±0.5 XX.XX±0.25

Pin Size Tolerance: Φ1.0 ±0.05mm

PIN Connection								
PIN	1	2	3	4	5	6	7	8
SINGLE	+Vin	-Vin	Ctrl	-Sense	+Sense	+Vout	-Vout	Trim