

# MMT

A decorative blue wavy graphic that flows across the top of the page, starting from the left and curving towards the right.

## DC/DC CONVERTER

A green leafy branch with several leaves and water droplets, positioned on the left side of the page.

# 60 Watt

A large green ribbon graphic that loops and flows across the bottom of the page, starting from the left and curving towards the right.

2019

<http://www.mmtmachrone.com>

**FEATURES :**

- 60W DIL PACKAGE
- INDUSTRY STANDARD PACKAGE
- 2:1 WIDE INPUT RANGE
- 100% BURNED IN
- HIGH EFFICIENCY
- UL94V-0 PACKAGE MATERIAL
- CUSTOM SOLUTIONS AVAILABLE
- RoHS COMPLIANT
- 3 YEARS WARRANTY



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
	Vdc	No-Load (mA TYP)	Full Load (mA TYP)	Vdc	Full Load (mA)	%TYP		
93D-12S05RNL	9-18	40	5208	5	10000	80		
93D-12S12RNL	9-18	40	5882	12	5000	85		
93D-12S15RNL	9-18	40	5814	15	4000	86		
93D-12D05RNL	9-18	40	5144	±5	±5000	81		
93D-12D12RNL	9-18	40	5747	±12	±2500	87		
93D-12D15RNL	9-18	40	5747	±15	±2000	87		
93D-24S05RNL	18-36	30	2572	5	10000	81		
93D-24S12RNL	18-36	30	2841	12	5000	88		
93D-24S15RNL	18-36	30	2841	15	4000	88		
93D-24D05RNL	18-36	30	2572	±5	±5000	81		
93D-24D12RNL	18-36	30	2874	±12	±2500	87		
93D-24D15RNL	18-36	30	2841	±15	±2000	88		
93D-48S05RNL	36-72	20	1270	5	10000	82		
93D-48S12RNL	36-72	20	1420	12	5000	88		
93D-48S15RNL	36-72	20	1420	15	4000	88		
93D-48D05RNL	36-72	20	1270	±5	±5000	82		
93D-48D12RNL	36-72	20	1437	±12	±2500	87		
93D-48D15RNL	36-72	20	1437	±15	±2000	87		

**Input Specifications**

Parameters	Conditions	Min	Typ	Max	Units
Voltage Types				2:1	
Filter	Pi Network				
Protection	Fuse Recommended				

DC-DC Converter

93D SERIES

60Watt 3KV Isolated

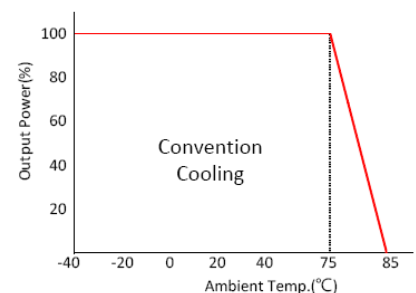
2 : 1 Input Voltage Range

Single & Dual Output

2.6" x 3"



Temperature Derating Graph



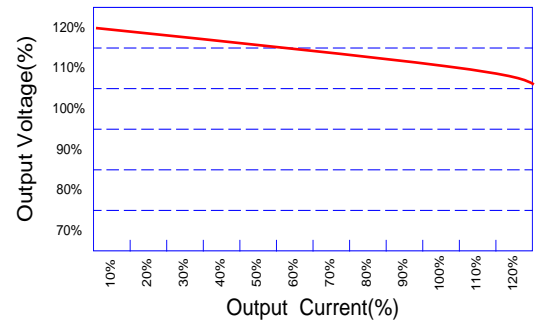
**Output Specifications**

Parameters	Conditions	Min	Typ	Max	Units
Voltage Tolerance	Full load@Vin(nom.)			±2	%
Short Circuit/Restart Protection	Hiccup, automatic recovery				
Over Load Protection		120	150	180	%
Line Regulation	Single & Dual (H/L to L/L)			±0.5	%
Load Regulation	Single & Dual (Balance Load), 25% TO 100% load			±0.5	%
Cross Regulation	Dual (25% to 100% load)			±5	%
Ripple & Noise	BW=DC To 20MHz (with 1uF Cap.)			150	mVp-p
Transient response setting time	50% load step change			400	us
Capacitive load				1500	uF
External Trim Adj. Range				±10	%

**General Specifications**

Parameters	Conditions	Min	Typ	Max	Units
Isolation Resistance	500Vdc	1000			MΩ
Switching Frequency			50		KHz
Operating Temperature	With derating	-40		85	°C
Humidity	Non Condensing			95	%
Cooling	Free air Convection				
Case material	Six-Side Shielded Case	Nickel Coated with Non-Conductive Base			
Weight			227		g
Dimensions			76.7X66.5X21.6		mm
Potting Material	Epoxy (UL94V-0 rated)				
Radiated Emissions	EN55022		CLASS A		
Conducted Emissions	EN55022		CLASS A		
Isolation Voltage	For 10 seconds			3000	VDC
MTBF	MIL-HDBK-217F @25°C , Ground Benign	299424			Hours
Storage Temperature		-55		+100	°C
Case Temperature				+90	°C
Isolation Capacitance				2500	pF

**Tolerance Envelope Graph**

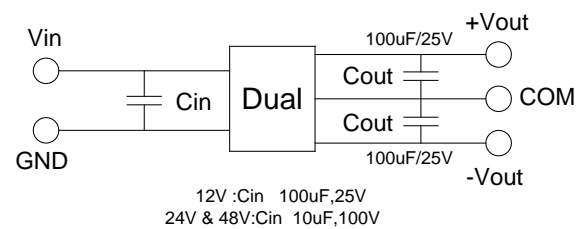
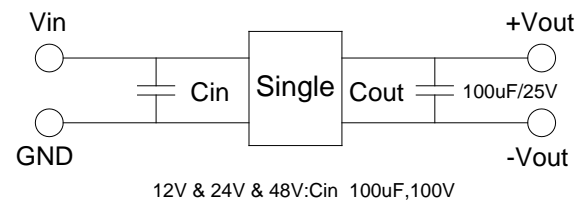


**Part Number**

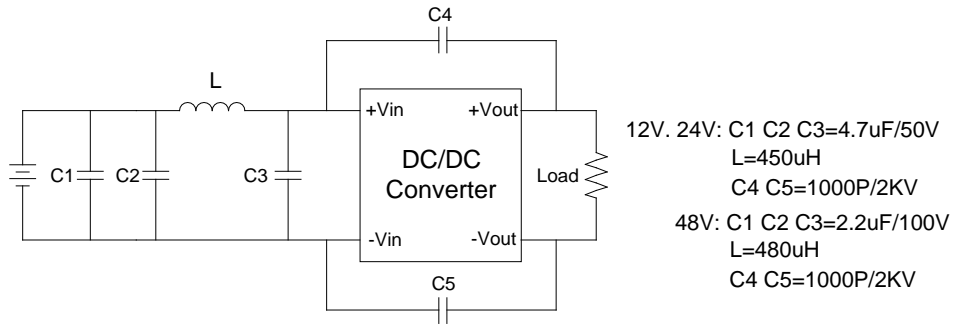
93D - 12 S 05 R NL  
A B C D E F

- A: Series
- B: Input Voltage
- C: Single Output (S),Dual (D)
- D: Output Voltage
- E: Regulated(R)
- F: RoHs Version

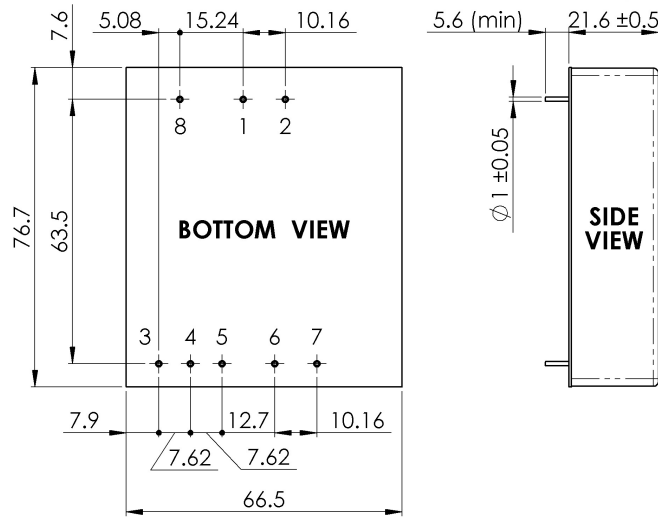
**Recommended Test Circuit**



Suggest adding input external filter(C1,C2,C3,C4,C5,L) to meet conducted emissions (EN55022 class A) requirement for the module . These components should be mounted as close as possible to the module; and all leads should be minimized to decrease radiated noise.



Markings and dimensions



Unit : mm  
 Tolerance : XX.X±0.5 , XX.XX±0.25

PIN Assignment

Pin	1	2	3	4	5	6	7	8
Single	+Vin	-Vin	No Pin	Trim	No Pin	+Vout	-Vout	Remote On/Off
Dual	+Vin	-Vin	+Vout	Com	-Vout	No Pin	No Pin	Remote On/Off

**FEATURES :**

- 2:1 WIDE INPUT RANGE
- 100% BURNED IN
- HIGH EFFICIENCY UP TO 90%
- Under Voltage Lockout
- Over Temperature Protection
- Remote Control ON/OFF
- UL94V-0 Package Material



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	Capacitor Load
	Vdc	No-Load (mA TYP)	Full Load (mA TYP)	Vdc	Full Load (mA)	%TYP	uF max.
93D-24S03R2NL	18-36	150	2162	3.3	14000	89	28800
93D-24S05R2NL	18-36	150	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	36-72	75	1081	3.3	14000	89	28800
93D-48S05R2NL	36-72	75	1388	5	12000	90	15000
93D-48S12R2NL	36-72	30	1388	12	5000	90	2800
93D-48S15R2NL	36-72	30	1388	15	4000	90	1800

**Input Specifications**

Parameters	Conditions	Min	Typ	Max	Units
Voltage Types				2:1	
Filter	Pi Network				
Protection	Fuse Recommended				

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

Parameters	Conditions	Min	Typ	Max	Units
Voltage Tolerance	Full load@Vin(nom.)			±2	%
Short Circuit/Restart Protection	Hiccup, automatic recovery				
Over Load Protection			150		%
Line Regulation				±0.5	%
Load Regulation	10% to 100% load			±0.5	%
Ripple & Noise	BW=DC To 20MHz			100	mVp-p
Transient response setting time	25% load step change		300		us
Thermal Shutdown			110		°C
External Trim Adj. Range				±10	%

DC-DC Converter

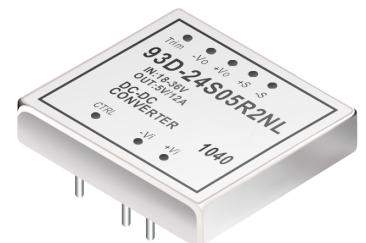
**93D-R2 SERIES**

60Watt 1.5KV Isolated

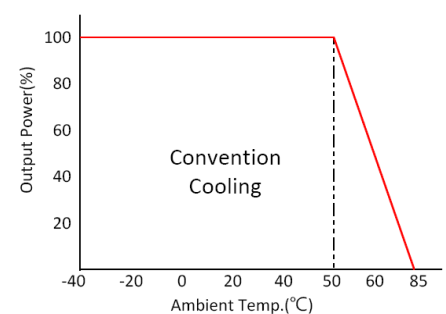
2 : 1 Input Voltage Range

Single Output

2" x 2"



**Temperature Derating Graph**



General Specifications

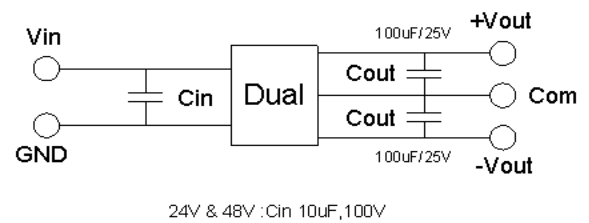
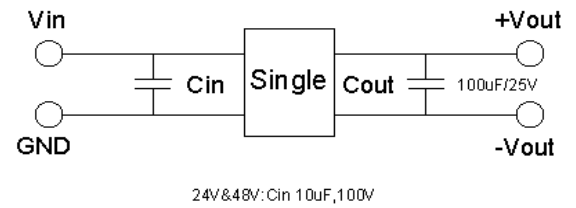
Parameters	Conditions	Min	Typ	Max	Units
Isolation Resistance	500Vdc	1000			MΩ
Switching Frequency			300		KHz
Operating Temperature	With derating	-40		85	°C
Humidity	Non Condensing			95	%
Cooling	Free air Convection				
Case material	Nickel Coated with Non-Conductive Base				
Weight			70		g
Dimensions			51.0X51.0X10.3		mm
Potting Material	Epoxy (UL94V-0 rated)				
Remote ON/OFF	ON		Open		
	OFF		Short to -Vin		
Isolation Voltage				1500	VDC
MTBF	MIL-HDBK-217F @25°C , Ground Benign	110000			Hours
Storage Temperature				+125	°C
Case Temperature				+105	°C
Isolation Capacitance				2500	pF

Part Number

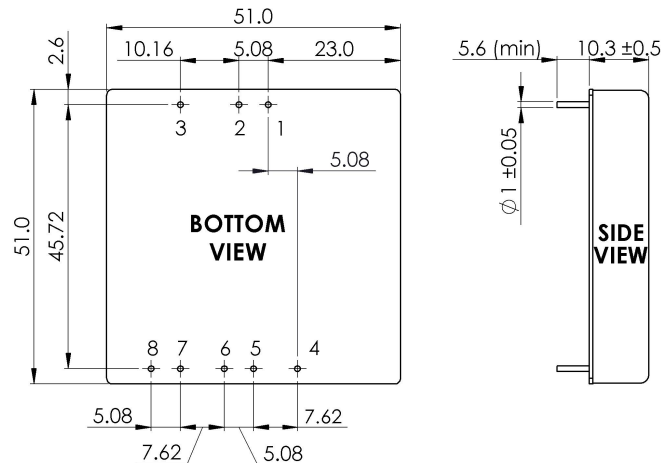
93D - 24 S 05 R 2 NL  
 A B C D E F G

- A: Series
- B: Input Voltage
- C: Single Output (S),Dual (D)
- D: Output Voltage
- E: Regulated(R)
- F: Package
- G: RoHS Version

Recommended Test Circuit



Markings and dimensions



Unit : mm  
 Tolerance : XX.X ± 0.5 , XX.XX ± 0.25

PIN Assignment

Pin	1	2	3	4	5	6	7	8
Function	+Vin	-Vin	Ctrl	-Sense	+Sense	+Vout	-Vout	Trim

**FEATURES :**

- 2"X1" DIL Package
- 2:1 Wide Input Range
- 100% Burned In
- High Efficiency Up To 91%
- Customized Solutions Available
- Over Temperature Protection
- Remote Control ON/OFF
- UL94V-0 Package Material



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	Capacitor Load
	Vdc	No-Load (mA TYP)	Full Load (mA TYP)	Vdc	(mA)	%TYP	uF max.
93D-24S03R3NL	18-36	90	2160	3.3	14000	87	16500
93D-24S05R3NL	18-36	90	2760	5	12000	88	16500
93D-24S12R3NL	18-36	40	2780	12	5000	89	3300
93D-24S15R3NL	18-36	40	2780	15	4000	89	2200
93D-48S03R3NL	36-72	60	1010	3.3	14000	88	16500
93D-48S05R3NL	36-72	60	1360	5	12000	89	16500
93D-48S12R3NL	36-72	30	1380	12	5000	90	3300
93D-48S15R3NL	36-72	30	1370	15	4000	91	2200

DC-DC Converter

**93D-R3 SERIES**

60Watt 1.6KV Isolated

2 : 1 Input Voltage Range

Single Output

2" x 1"



**Input Specifications**

Parameters	Conditions	Min	Typ	Max	Units
Voltage Types				2:1	
Filter	Pi Network				
Protection	Fuse Recommended				

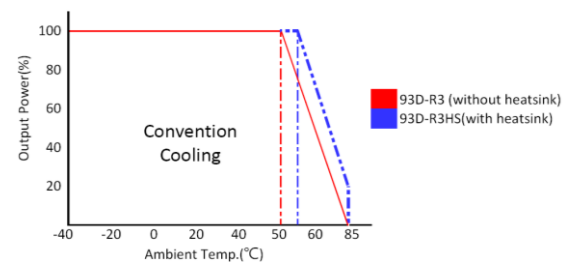
**Output Specifications**

(Temperature Coefficient : ±0.05%/°C)

Parameters	Conditions	Min	Typ	Max	Units
Voltage Tolerance	Full load@Vin(nom.)			±2	%
Short Circuit/Restart Protection	Hiccup, automatic recovery				
Over Load Protection			150		%
Line Regulation				±0.5	%
Load Regulation	10% to 100% load			±0.5	%
Ripple & Noise	BW=DC To 20MHz			100	mVp-p
Transient response setting time	25% load step change		250		us
External Trim Adj. Range				±10	%



**Temperature Derating Graph**



General Specifications

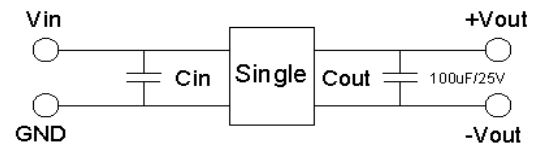
Parameters	Conditions	Min	Typ	Max	Units
Isolation Resistance	500Vdc	1000			MΩ
Switching Frequency			300		KHz
Operating Temperature	Refer to temperature derating graph (with derating)	-40		85	°C
Humidity	Non Condensing	5		95	%
Cooling	Free air Convection				
Case material	Nickel Coated with Non-Conductive Base				
Weight			48.6		g
Dimensions	93D-R3 Model	50.8X25.4X13.1			mm
	93D-R3HS Model	50.8X25.4X17.8			
Potting Material	Epoxy (UL94V-0 rated)				
Remote ON/OFF	ON	Open			
	OFF	Short to -Vin			
Isolation Voltage				1600	VDC
MTBF	MIL-HDBK-217F @25°C , Ground Benign	109600			Hours
Storage Temperature		-55		+125	°C
Case Temperature				+110	°C
Isolation Capacitance				2200	pF

Part Number

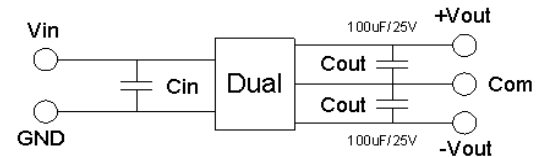
93D - 24 S 05 R 3 NL  
 A B C D E F G

- A: Series
- B: Input Voltage
- C: Single Output(S),Dual(D)
- D: Output Voltage
- E: Regulated (R)
- F: Package(3 or 3HS)
- G: RoHs Version

Recommended Test Circuit



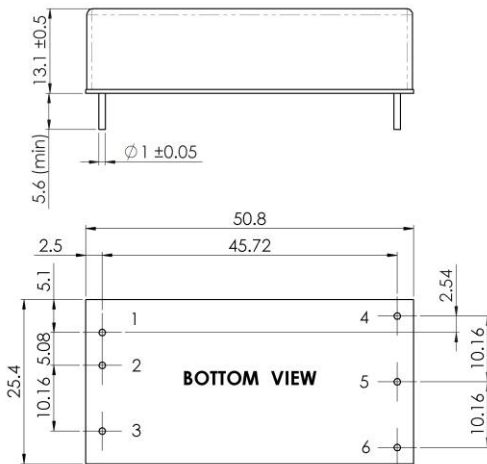
24V & 48V : Cin 10uF, 100V



24V & 48V : Cin 10uF, 100V

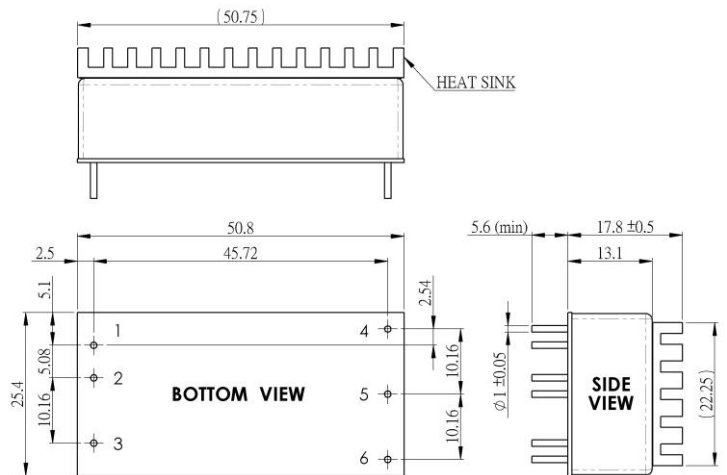
Markings and dimensions

93D-R3 Outline



Unit : mm  
 Tolerance : XX.X ± 0.5 , XX.XX ± 0.25

93D-R3HS Outline



Unit : mm  
 Tolerance : XX.X ± 0.5 , XX.XX ± 0.25

PIN Assignment

Pin	1	2	3	4	5	6
Function	+Vin	-Vin	Ctrl	+Vout	-Vout	Trim



**FEATURES :**

- 60W DIL PACKAGE
- INDUSTRY STANDARD PACKAGE
- 4:1 WIDE INPUT RANGE
- 100% BURNED IN
- HIGH EFFICIENCY
- UL94V-0 PACKAGE MATERIAL
- CUSTOM SOLUTIONS AVAILABLE
- RoHS COMPLIANT
- 3 YEARS WARRANTY



DC-DC Converter

**93DW SERIES**

60Watt 3KV Isolated

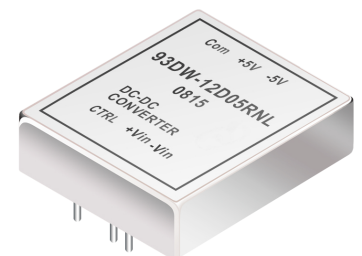
4 : 1 Input Voltage Range

Single & Dual Output

2.6" x 3"

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

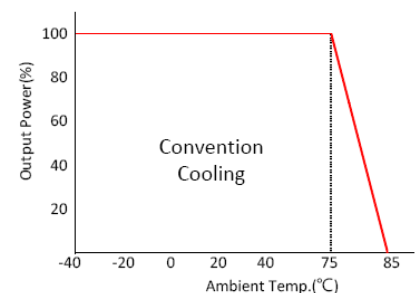
Part Number	Input Voltage	Input Current		Output Voltage	Output Current	Efficiency
	Vdc	No-Load (mA TYP)	Full Load (mA TYP)	Vdc	Full Load (mA)	%TYP
93DW-24S05RNL	9-36	30	2480	5	10000	84
93DW-24S12RNL	9-36	30	2941	12	5000	85
93DW-24S15RNL	9-36	30	2941	15	4000	85
93DW-24D05RNL	9-36	30	2480	±5	±5000	84
93DW-24D12RNL	9-36	30	2941	±12	±2500	85
93DW-24D15RNL	9-36	30	2941	±15	±2000	85
93DW-48S05RNL	18-72	20	1225	5	10000	85
93DW-48S12RNL	18-72	20	1453	12	5000	86
93DW-48S15RNL	18-72	20	1453	15	4000	86
93DW-48D05RNL	18-72	20	1225	±5	±5000	85
93DW-48D12RNL	18-72	20	1453	±12	±2500	86
93DW-48D15RNL	18-72	20	1453	±15	±2000	86



**Input Specifications**

Parameters	Conditions	Min	Typ	Max	Units
Voltage Types				4:1	
Filter	Pi Network				
Protection	Fuse Recommended				

**Temperature Derating Graph**



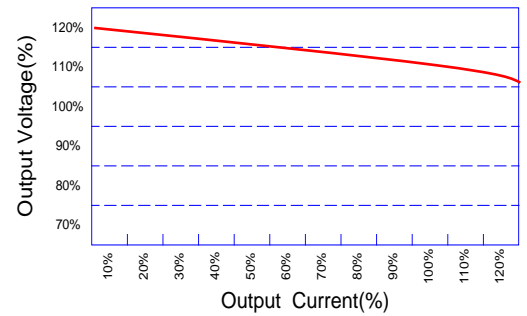
**Output Specifications**

Parameters	Conditions	Min	Typ	Max	Units
Voltage Tolerance	Full load@Vin(nom.)			±2	%
Short Circuit/Restart Protection	Hiccup, automatic recovery				
Over Load Protection		120	150	180	%
Line Regulation	Single & Dual (H/L to L/L)			±0.5	%
Load Regulation	Single & Dual (Balance Load), 25% TO 100% load			±0.5	%
Cross Regulation	Dual (25% to 100% load)			±5	%
Ripple & Noise	BW=DC To 20MHz (with 1uF Cap.)			150	mVp-p
Transient response setting time	50% load step change			400	us
Capacitive load				4800	uF
External Trim Adj. Range				±10	%

**General Specifications**

Parameters	Conditions	Min	Typ	Max	Units
Isolation Resistance	500Vdc	1000			MΩ
Switching Frequency			50		KHz
Operating Temperature	With derating	-40		85	°C
Humidity	Non Condensing			95	%
Cooling	Free air Convection				
Case material	Six-Side Shielded Case		Nickel Coated with Non-Conductive Base		
Weight			227		g
Dimensions			76.7X66.5X21.6		mm
Potting Material			Epoxy (UL94V-0 rated)		
Radiated Emissions	EN55022		CLASS A		
Conducted Emissions	EN55022		CLASS A		
Isolation Voltage	For 10 seconds			3000	VDC
MTBF	MIL-HDBK-217F @25°C , Ground Benign	299424			Hours
Storage Temperature		-55		+100	°C
Case Temperature				+90	°C
Isolation Capacitance				2500	pF

**Tolerance Envelope Graph**

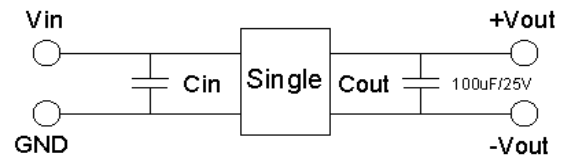


**Part Number**

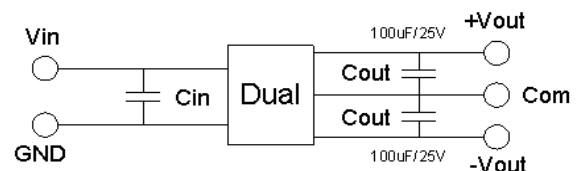
93DW - 24 S 05 R NL  
 A B C D E F

- A: Series
- B: Input Voltage
- C: Single Output (S),Dual (D)
- D: Output Voltage
- E: Regulated(R)
- F: RoHs Version

**Recommended Test Circuit**

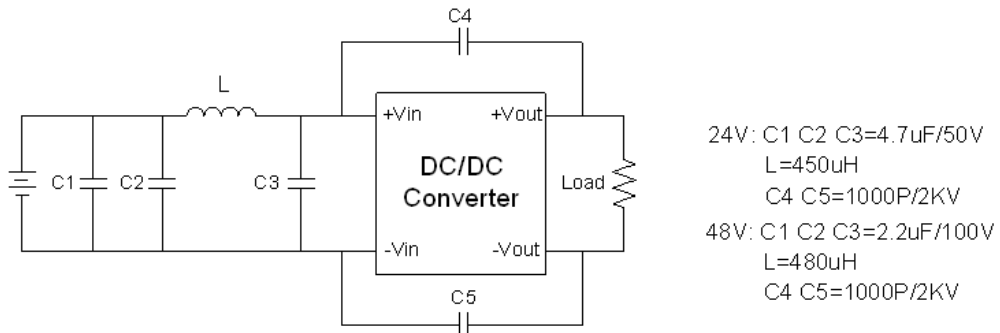


24V&48V: Cin 10uF,100V

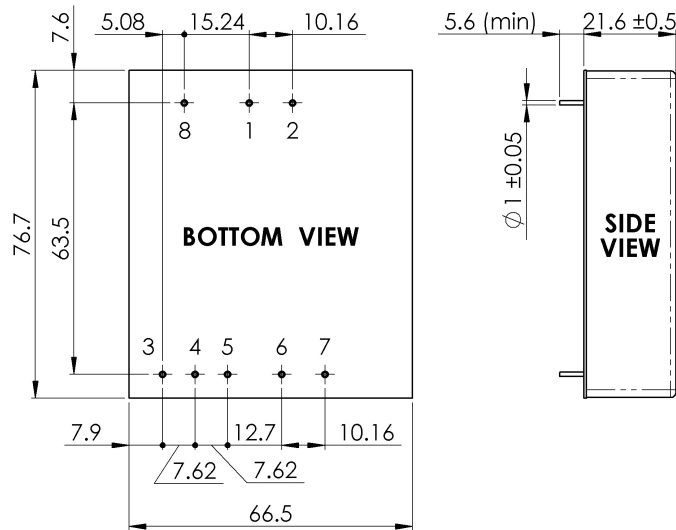


24V & 48V :Cin 10uF,100V

Suggest adding input external filter(C1,C2,C3,C4,C5,L) to meet conducted emissions (EN55022 class A) requirement for the module . These components should be mounted as close as possible to the module; and all leads should be minimized to decrease radiated noise.



Markings and dimensions



Unit : mm  
 Tolerance : XX.X ± 0.5 , XX.XX ± 0.25

PIN Assignment

Pin	1	2	3	4	5	6	7	8
Single	+Vin	-Vin	No Pin	Trim	No Pin	+Vout	-Vout	Remote On/Off
Dual	+Vin	-Vin	+Vout	Com	-Vout	No Pin	No Pin	Remote On/Off