

MMT

A decorative graphic consisting of several overlapping, wavy, translucent blue lines that flow across the top of the page.

DC/DC CONVERTER

A decorative graphic featuring a cluster of vibrant green leaves with water droplets on the left side, and several flowing, ribbon-like green shapes that sweep across the bottom of the page.

30 Watt

2019

<http://www.mmtmachrone.com>

FEATURES :

- 30W DIL PACKAGE
- 2:1 WIDE INPUT RANGE
- 100% BURNED IN
- HIGH EFFICIENCY
- UL 94V-0 PACKAGE MATERIAL
- CUSTOMIZED SOLUTIONS AVAILABLE
- RoHS COMPLIANT
- 3 YEARS WARRANTY



DC-DC Converter

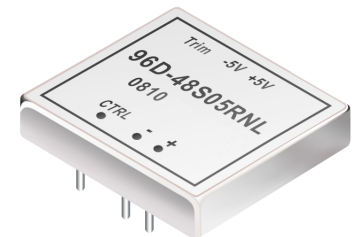
96D SERIES

30Watt 3KV Isolated

2 : 1 Input Voltage Range

Single & Dual Output

2" x 2"

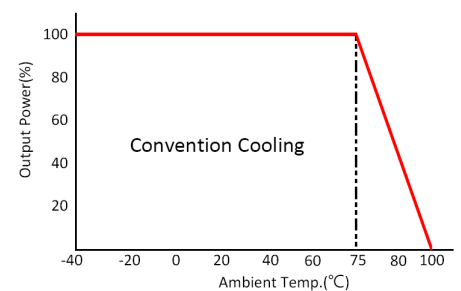


Part Number	Input Voltage	Input Current		Output Voltage	Output Current	Efficiency
	Vdc	No-Load (mA TYP)	Full Load (mA TYP)	Vdc	Full Load (mA)	%TYP
96D-12S03RNL	9-18	30	2179	3.3	6500	82
96D-12S05RNL	9-18	30	3012	5	6000	83
96D-12S12RNL	9-18	30	2941	12	2500	85
96D-12S15RNL	9-18	30	2941	15	2000	85
96D-24S03RNL	18-36	25	1089	3.3	6500	82
96D-24S05RNL	18-36	25	1506	5	6000	83
96D-24S12RNL	18-36	25	1470	12	2500	85
96D-24S15RNL	18-36	25	1470	15	2000	85
96D-48S03RNL	36-72	20	544	3.3	6500	82
96D-48S05RNL	36-72	20	753	5	6000	83
96D-48S12RNL	36-72	20	735	12	2500	85
96D-48S15RNL	36-72	20	735	15	2000	85
96D-12D05RNL	9-18	30	3048	±5	±3000	83
96D-12D12RNL	9-18	30	2941	±12	±1250	85
96D-12D15RNL	9-18	30	2941	±15	±1000	85
96D-24D05RNL	18-36	25	1506	±5	±3000	83
96D-24D12RNL	18-36	25	1470	±12	±1250	85
96D-24D15RNL	18-36	25	1470	±15	±1000	85
96D-48D05RNL	36-72	20	753	±5	±3000	83
96D-48D12RNL	36-72	20	735	±12	±1250	85
96D-48D15RNL	36-72	20	735	±15	±1000	85

Input Specifications

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

Temperature Derating Graph



Output Specifications
(Temperature Coefficient : $\pm 0.05\%/^{\circ}\text{C}$)

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	Single & Dual (H/L to L/L)			± 0.5	%
Load Regulation	Single & Dual,Balance Load (FL-50%FL)			± 0.5	%
Cross Regulation	Dual (25% to 100% load)			± 5	%
Ripple & Noise	BW=DC To 20MHz (with 1uF Cap.)			100	mVp-p
Transient response setting time	50% load step change			350	us
Capacitive load				4800	uF
External Trim Adj. Range	$\pm 10\%$ of Output Voltage				

General Specifications

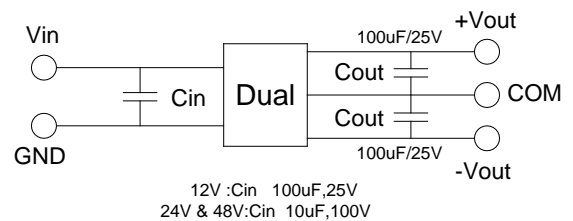
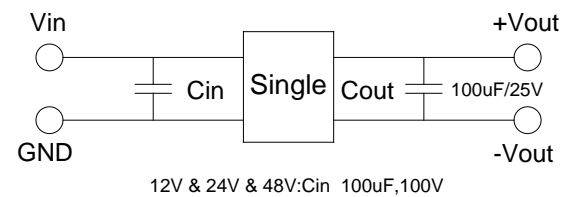
Parameters	Conditions	Min	Typ	Max	Units
Isolation Resistance	500Vdc	1000			M Ω
Switching Frequency			270		KHz
Operating Temperature		-40		100	$^{\circ}\text{C}$
Humidity	Non Condensing			95	%
Cooling	Free air Convection				
Case material	Nickel Coated with Non-Conductive Base				
Weight			65		g
Dimensions			51.0X51.0X10.3		mm
Potting Material	Epoxy (UL94V-0 rated)				
Radiated Emissions	EN55022		CLASS A		
Conducted Emissions	EN55022		CLASS A		
Efficiency		82			%
Isolation Voltage	For 10 seconds			3000	Vdc
MTBF	MIL-HDBK-217F @25 $^{\circ}\text{C}$, Ground Benign	400000			Hours
Storage Temperature		-50		+100	$^{\circ}\text{C}$
Case Temperature				+95	$^{\circ}\text{C}$
Isolation Capacitance				2500	pF

Part Number

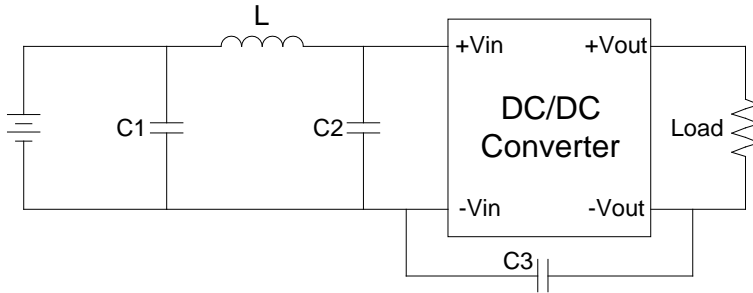
$\frac{96D}{A} - \frac{24}{B} \frac{S}{C} \frac{05}{D} \frac{R}{E} \frac{NL}{F}$

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

Recommended Test Circuit

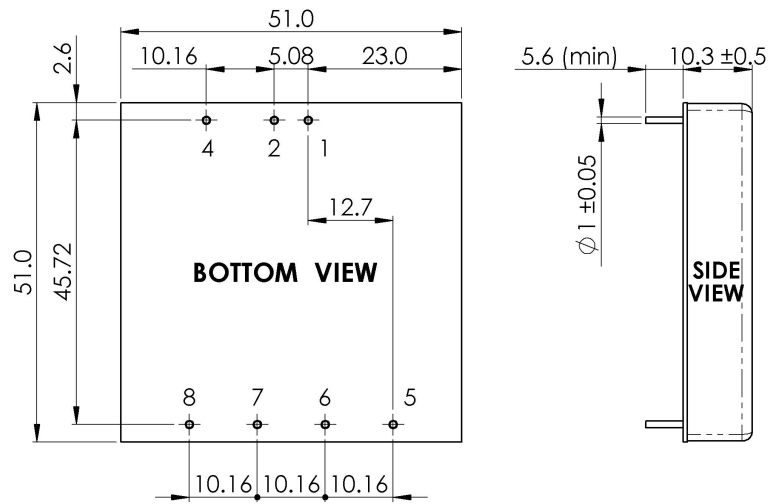


Suggest adding input external filter(C1,C2,L) to meet conducted emissions (EN55022 class A) requirement for the module . These components should be mounted as close as possible to the module; and all leads should be minimized to decrease radiated noise.



- 12V: C1 =330uF/100V
L=12uH
- 12V: C2 =100uF/100V
C3=N/A
- 24V.48V: C1=220uF/100V
L=12uH
- 24V.48V: C2 =100uF/100V
- 24V: C3=N/A
- 48V: C3=1000pF/2KV

Markings and dimensions



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

PIN Connection

Pin	1	2	3	4	5	6	7	8
Single	+Vin	-Vin	No Pin	Ctrl	NO PIN	+Vout	-Vout	Trim
Dual	+Vin	-Vin	No Pin	Ctrl	+Vout	Com	-Vout	Trim

FEATURES :

- 30W DIL PACKAGE
- 100% BURNED IN
- 2:1 WIDE INPUT RANGE
- HIGH EFFICIENCY UP TO 88%
- UL 94V-0 PACKAGE MATERIAL
- CUSTOMIZED SOLUTIONS AVAILABLE
- Remote On/Off
- RoHS COMPLIANT

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		Output Ripple & Noise	Capacitor Load MAX	Efficiency
	Vdc	No-Load (mA TYP)	Full Load (mA TYP)	Vdc	Full Load (mA)	mVp-p	uF	%TYP			
96D-12S03R5NL	9-18	100	2398	3.3	7500	100	20000	86			
96D-12S05R5NL	9-18	100	2841	5.0	6000	100	14400	88			
96D-12S12R5NL	9-18	100	2809	12	2500	100	3000	89			
96D-12S15R5NL	9-18	100	2809	15	2000	100	2000	89			
96D-24S03R5NL	18-36	100	1200	3.3	7500	100	20000	86			
96D-24S05R5NL	18-36	100	1420	5.0	6000	100	14400	88			
96D-24S12R5NL	18-36	100	1404	12	2500	100	3000	89			
96D-24S15R5NL	18-36	100	1404	15	2000	100	2000	89			
96D-48S03R5NL	36-72	100	600	3.3	7500	100	20000	86			
96D-48S05R5NL	36-72	100	710	5.0	6000	100	14400	88			
96D-48S12R5NL	36-72	100	702	12	2500	100	3000	89			
96D-48S15R5NL	36-72	100	702	15	2000	100	2000	89			
96D-12D12R5NL	9-18	100	2873	±12	±1250	100	±2000	89			
96D-12D15R5NL	9-18	100	2873	±15	±1000	100	±1300	89			
96D-24D12R5NL	18-36	100	1437	±12	±1250	100	±2000	89			
96D-24D15R5NL	18-36	100	1437	±15	±1000	100	±1300	89			
96D-48D12R5NL	36-72	100	718	±12	±1250	100	±2000	89			
96D-48D15R5NL	36-72	100	718	±15	±1000	100	±1300	89			

Note:

1. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C. (Ground fixed and controlled environment)
MIL-STD-217F Notice2 @Ta=25 °C, Full load (Ground, Benign, controlled environment)
2. The ON/OFF control pin voltage is referred to -Input. (Leave open if not used.)



DC-DC Converter

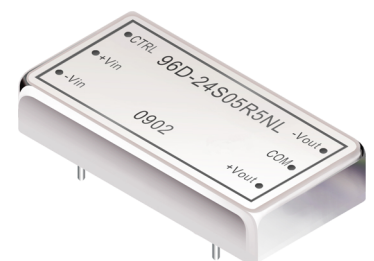
96D-R5 SERIES

30Watt 1.6KV Isolated

2 : 1 Input Voltage Range

Single & Dual Output

2" x 1"



Applications

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

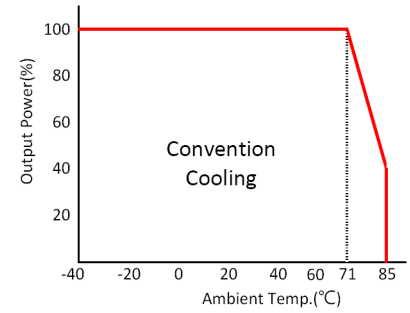
Input Specifications

Parameters	Conditions	Min	Typ	Max	Units
Voltage Types				2:1	
Filter	Pi Type				
Input surge voltage	12V, 24V input		50		Vdc
100mS max	48V input		100		Vdc
Input reflected ripple current	Nominal Vin and full load		20		mAp-p
Start up time	Nominal Vin and constant resistive load	Power up	30		mS
		Remote ON/OFF	30		mS
Start-up voltage	12V input		9		Vdc
Start-up voltage	24V input		18		Vdc
Start-up voltage	48V input		36		Vdc
Shutdown voltage	12V input		8		Vdc
Shutdown voltage	24V input		17		Vdc
Shutdown voltage	48V input		35		Vdc
Protection	Fuse Recommended				
Remote ON/OFF (Note 2)	DC-DC ON		OPEN		
(Negative logic)(Option)	DC-DC OFF		Short to ground		
Input current of Remote control pin	Nominal Vin		-0.5mA ~ +0.5mA		
Remote off state input current	Nominal Vin		3mA		

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	nominal input		150		V
	3.3V Output		3.9		V
Over Voltage Protection (Zener Diode Clamp)	5.0V Output		6.2		V
	12V Output		15 & ±15		V
	15V Output		18 & ±18		V
Line Regulation	LL to HL at Full Load			±0.5	%
Load Regulation	Single			±0.5	%
Load Regulation	Dual, Balance Load,25% to 100% load			±1.0	%
Cross Regulation	Dual (25% to 100% load)			±5.0	%
Ripple & Noise	20MHz bandwidth			100	mVp-p
Transient response recovery time	25% load step change		250	350	us
External Trim Adj. Range			±10% of Output		
Temperature coefficient				±0.05	% / °C

Derating Curve (without Heat-Sink)

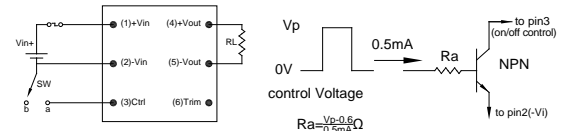


Part Number

96D - 24 S 05 R 5 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

Remote On/Off Note



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

The components used in the above figure, together with the manufacturers' part numbers for these components, are as follows:

Single Output	C1	C2/C3
-24S	4.7µF/50V 1812 MLCC	1000pF/2KV 1808 MLCC
-48S	2.2µF/100V 1812 MLCC	1000pF/2KV 1808 MLCC
Dual Output	C1	C2/C4
-24D	4.7µF/50V 1812 MLCC	1000pF/2KV 1808 MLCC
-48D	2.2µF/100V 1812 MLCC	1000pF/2KV 1808 MLCC

General Specifications

Parameters	Conditions	Min	Typ	Max	Units
Isolation Resistance	500Vdc	1000			MΩ
Switching Frequency			300		KHz
Isolation Capacitance			2200		pF
Case material	Nickel coated copper with no-conductive base				
Potting material	Epoxy (UL94-V0)				
Isolation Voltage	For 10 seconds			1600	VDC
Design meets safety	IEC60950-1, UL60950-1, EN60950-1				
Dimensions	-R5NL		50.8X 25.4 X 10.6		mm
	-R5HSNL		50.8X 25.4 X 15.3		mm
Weight			36.5		g
MTBF (Note 1)	BELLCORE-TR-NWT-000332		3.163 x 10 ⁶		hrs
	MIL-HDBK-217F		4.347 x 10 ⁵		hrs

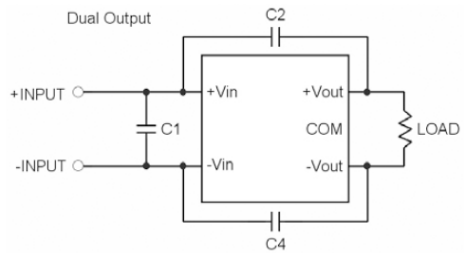
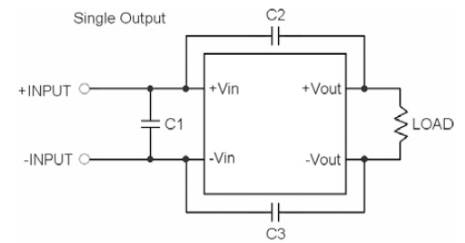
Environmental Specifications

Parameters	Conditions	Min	Typ	Max	Units
Operating Temperature		-40		85	°C
Maximum case temperature				115	°C
Storage Temperature		-55		125	°C
Over temperature			115		°C
Thermal impedance	Convection		12		°C/Watt
	Convection with heat-sink		10		°C/Watt
Thermal shock			MIL-STD-810F		
Vibration			MIL-STD-810F		
Relative humidity			5% to 95% RH		

EMC Characteristics

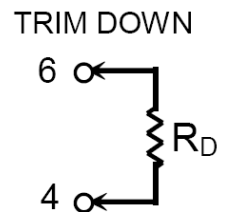
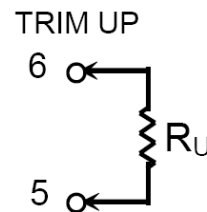
Parameters	Conditions	Min	Typ	Max	Units
EMI	EN55022		Class A		
ESD	EN61000-4-2		Air ±8KV Perf. Criteria A		
			Contact ±6KV Perf. Criteria A		
Radiated immunity	EN61000-4-3		10 V/m Perf. Criteria A		
Fast transient	EN61000-4-4		± 2KV Perf. Criteria A		
Surge	EN61000-4-5		± 1KV Perf. Criteria A		
Conducted immunity	EN61000-4-6		10 Vrms Perf. Criteria A		

Recommended Filter for EN55022 Class A Compliance

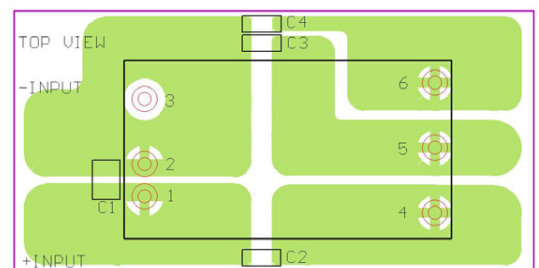


External Output Trimming

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

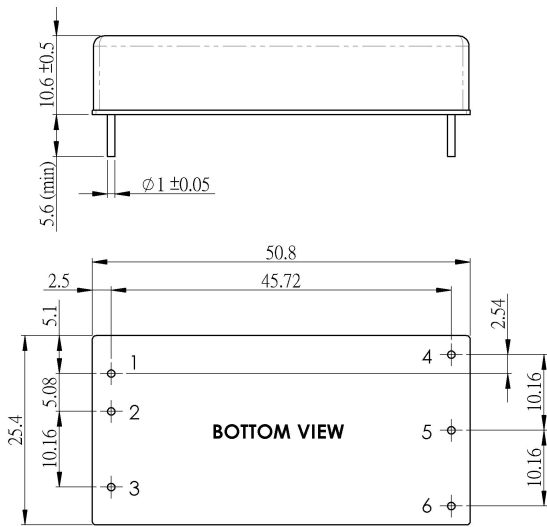


Recommended EN55022 Class A Filter Circuit Layout



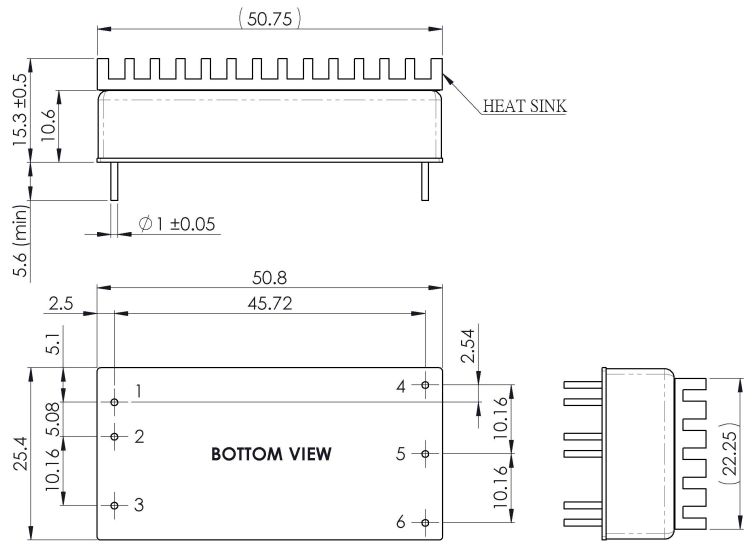
Markings and dimensions

-R5NL



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

-R5HSNL



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

PIN Connection

Pin	1	2	3	4	5	6
Single	+Vin	-Vin	Ctrl	+Vout	-Vout	Trim
Dual	+Vin	-Vin	Ctrl	+Vout	COM	-Vout

FEATURES :

- 30W DIL PACKAGE
- 4:1 WIDE INPUT RANGE
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DC-DC Converter

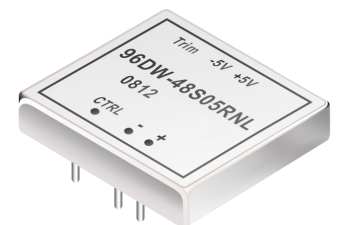
96DW SERIES

30Watt 3KV Isolated

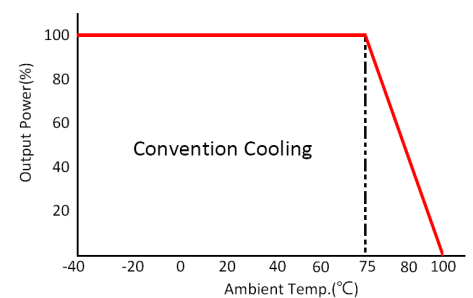
4 : 1 Input Voltage Range

Single & Dual Output

2" x 2"



Temperature Derating Graph



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
96DW-24S03RNL	9-36	25	1103	3.3	6500	81
96DW-24S05RNL	9-36	25	1524	5	6000	82
96DW-24S12RNL	9-36	25	1524	12	2500	82
96DW-24S15RNL	9-36	25	1524	15	2000	82
96DW-48S03RNL	18-72	20	545	3.3	6500	82
96DW-48S05RNL	18-72	20	753	5	6000	83
96DW-48S12RNL	18-72	20	753	12	2500	83
96DW-48S15RNL	18-72	20	753	15	2000	83
96DW-24D05RNL	9-36	25	1524	±5	±3000	82
96DW-24D12RNL	9-36	25	1524	±12	±1250	82
96DW-24D15RNL	9-36	25	1524	±15	±1000	82
96DW-48D05RNL	18-72	20	753	±5	±3000	83
96DW-48D12RNL	18-72	20	753	±12	±1250	83
96DW-48D15RNL	18-72	20	753	±15	±1000	83

Input Specifications

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

Output Specifications (Temperature Coefficient : $\pm 0.05\%/^{\circ}\text{C}$)

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	Single & Dual (H/L to L/L)			± 0.5	%
Load Regulation	Single & Dual,Balance Load (F.L-50%F.L)			± 0.5	%
Cross Regulation	Dual (25% to 100% load)			± 5	%
Ripple & Noise	BW=DC To 20MHz (with 1uF Cap.)			100	mVp-p
Transient response setting time	50% load step change			350	us
Capacitive load				2200	uF
External Trim Adj. Range	$\pm 10\%$ of Output Voltage				

General Specifications

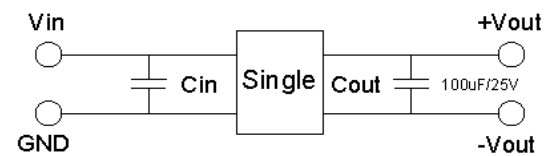
Parameters	Conditions	Min	Typ	Max	Units
Isolation Resistance	500Vdc	1000			M Ω
Switching Frequency			270		KHz
Operating Temperature		-40		100	$^{\circ}\text{C}$
Humidity	Non Condensing			95	%
Cooling	Free air Convection				
Case material	Nickel Coated with Non-Conductive Base				
Weight			65		g
Dimensions			51.0X51.0X10.3		mm
Potting Material	Epoxy (UL94V-0 rated)				
Radiated Emissions	EN55022		CLASS A		
Conducted Emissions	EN55022		CLASS A		
Efficiency		81			%
Isolation Voltage	For 10 seconds			3000	VDC
MTBF	MIL-HDBK-217F @25 $^{\circ}\text{C}$, Ground Benign	400000			Hours
Storage Temperature		-50		+100	$^{\circ}\text{C}$
Case Temperature				+95	$^{\circ}\text{C}$
Isolation Capacitance				2500	pF

Part Number

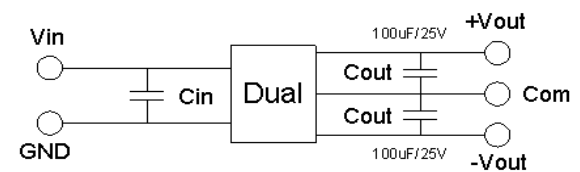
96DW - 24 S 05 R NL
 A B C D E F

- A: Series
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Recommended Test Circuit

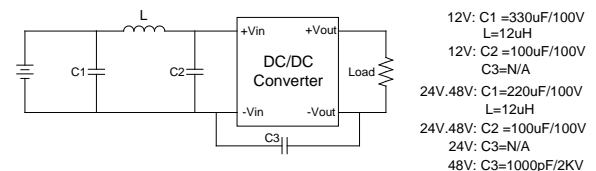


24V&48V: Cin 10uF,100V



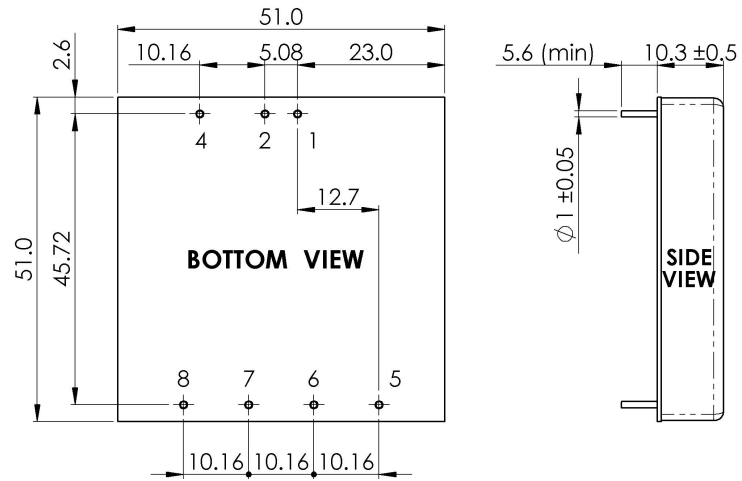
24V & 48V :Cin 10uF,100V

Suggest adding input external filter(C1,C2,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.



12V: C1 =330uF/100V
 L=12uH
 12V: C2 =100uF/100V
 C3=N/A
 24V,48V: C1=220uF/100V
 L=12uH
 24V,48V: C2 =100uF/100V
 24V: C3=N/A
 48V: C3=1000pF/2KV

Markings and dimensions



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

PIN Connection

Pin	1	2	3	4	5	6	7	8
Single	+Vin	-Vin	No Pin	Ctrl	No Pin	+Vout	-Vout	Trim
Dual	+Vin	-Vin	No Pin	Ctrl	+Vout	Com	-Vout	Trim

FEATURES :

- 30W DIL PACKAGE
- 100% BURNED IN
- 4:1 WIDE INPUT RANGE
- HIGH EFFICIENCY UP TO 88%
- UL 94V-0 PACKAGE MATERIAL
- CUSTOMIZED SOLUTIONS AVAILABLE
- Remote On/Off
- RoHS COMPLIANT

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		Output Ripple & Noise	Capacitor Load MAX	Efficiency
	Vdc	No-Load (mA TYP)	Full Load (mA TYP)	Vdc	Full Load (mA)	mVp-p	uF	%TYP			
96DW-24S03R5NL	9-36	100	1265	3.3	7500	100	20000	86			
96DW-24S05R5NL	9-36	100	1488	5.0	6000	100	14400	87			
96DW-24S12R5NL	9-36	100	1471	12	2500	100	3000	88			
96DW-24S15R5NL	9-36	100	1471	15	2000	100	2000	88			
96DW-24D12R5NL	9-36	100	1471	±12	1250	100	±2000	88			
96DW-24D15R5NL	9-36	100	1471	±15	1000	100	±1300	88			
96DW-48S03R5NL	18-75	70	629	3.3	7500	100	20000	86			
96DW-48S05R5NL	18-75	70	744	5.0	6000	100	14400	87			
96DW-48S12R5NL	18-75	70	727	12	2500	100	3000	88			
96DW-48S15R5NL	18-75	70	727	15	2000	100	2000	88			
96DW-48D12R5NL	18-75	70	727	±12	1250	100	±2000	88			
96DW-48D15R5NL	18-75	70	727	±15	1000	100	±1300	88			

Note:
 1. BELLCORE TR-NWT-000332. Case I: 50% Stress, Temperature at 40°C. (Ground fixed and controlled environment)
 MIL-STD-217F Notice2 @Ta=25 °C, Full load (Ground, Benign, controlled environment)
 2. The ON/OFF control pin voltage is referred to -Input. (Leave open if not used.)



DC-DC Converter

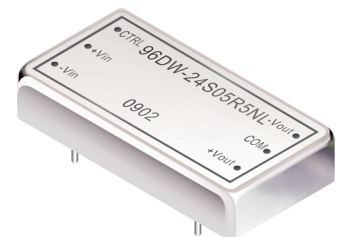
96DW-R5 SERIES

30Watt 1.6KV Isolated

4 : 1 Input Voltage Range

Single & Dual Output

2" x 1"



Applications

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

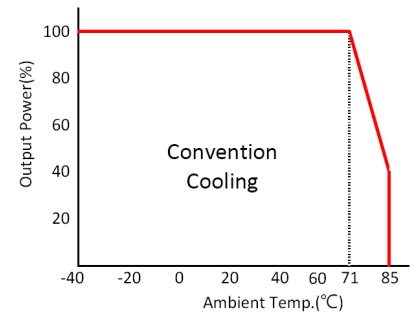
Input Specifications

Parameters	Conditions	Min	Typ	Max	Units
Voltage Types				4:1	
Filter	Pi Type				
Input surge voltage	24V input		50		Vdc
100mS max	48V input		100		Vdc
Input reflected ripple current	Nominal Vin and full load		20		mAp-p
Start up time	Nominal Vin and constant resistive load	Power up	30		mS
		Remote ON/OFF	30		mS
Start-up voltage	24V input		9		Vdc
Start-up voltage	48V input		18		Vdc
Shutdown voltage	24V input		8		Vdc
Shutdown voltage	48V input		16		Vdc
Protection	Fuse Recommended				
Remote ON/OFF (Note 2)	DC-DC ON		OPEN		
(Negative logic)(Option)	DC-DC OFF		Short to ground		
Input current of Remote control pin	Nominal Vin		-0.5mA ~ +0.5mA		
Remote off state input current	Nominal Vin		3mA		

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	nominal input		150		V
	3.3V Output		3.9		V
Over Voltage Protection (Zener Diode Clamp)	5.0V Output		6.2		V
	12V Output	15 & ±15			V
	15V Output	18 & ±18			V
Line Regulation	LL to HL at Full Load			±0.5	%
Load Regulation	Single			±0.5	%
Load Regulation	Dual, Balance Load,25% to 100% load			±1.0	%
Cross Regulation	Dual (25% to 100% load)			±5.0	%
Ripple & Noise	20MHz bandwidth			100	mVp-p
Transient response recovery time	25% load step change		250	350	us
External Trim Adj. Range			±10% of Output		
Temperature coefficient				±0.05	% / °C

Derating Curve (without Heat-Sink)

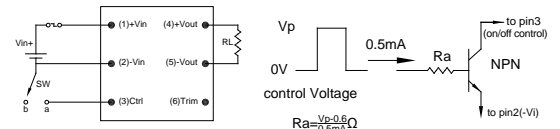


Part Number

96DW - 24 S 05 R 5 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

Remote On/Off Note



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

The components used in the above figure, together with the manufacturers' part numbers for these components, are as follows:

Single Output	C1	C2/C3
-24S	4.7µF/50V 1812 MLCC	1000pF/2KV 1808 MLCC
-48S	2.2µF/100V 1812 MLCC	1000pF/2KV 1808 MLCC
Dual Output	C1	C2/C4
-24D	4.7µF/50V 1812 MLCC	1000pF/2KV 1808 MLCC
-48D	2.2µF/100V 1812 MLCC	1000pF/2KV 1808 MLCC

General Specifications

Parameters	Conditions	Min	Typ	Max	Units
Isolation Resistance	500Vdc	1000			MΩ
Switching Frequency			300		KHz
Isolation Capacitance			2200		pF
Case material	Nickel coated copper with no-conductive base				
Epoxy (UL94-V0)			Epoxy (UL94-V0)		
Isolation Voltage	For 10 seconds			1600	VDC
Design meets safety	IEC60950-1, UL60950-1, EN60950-1				
Dimensions	-R5NL	50.8X 25.4 X 10.6			mm
	-R5HSNL	50.8X 25.4 X 15.3			mm
Weight			36.5		g
MTBF (Note 1)	BELLCORE-TR-NWT-000332		3.163 x 10 ⁶		hrs
	MIL-HDBK-217F		4.347 x 10 ⁵		hrs

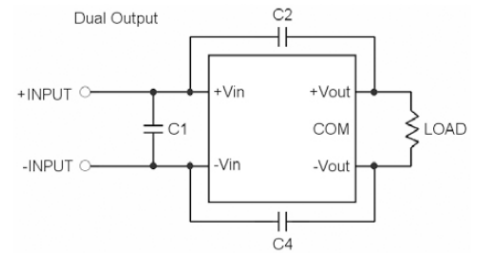
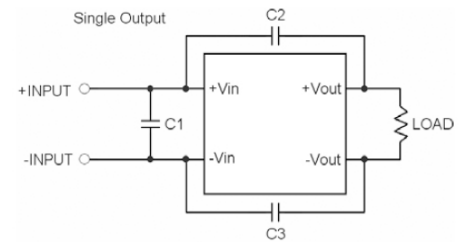
Environmental Specifications

Parameters	Conditions	Min	Typ	Max	Units
Operating Temperature		-40		85	°C
Maximum case temperature				115	°C
Storage Temperature		-55		125	°C
Over temperature			115		°C
Thermal impedance	Convection		12		°C/Watt
	Convection with heat-sink		10		°C/Watt
Thermal shock			MIL-STD-810F		
Vibration			MIL-STD-810F		
Relative humidity			5% to 95% RH		

EMC Characteristics

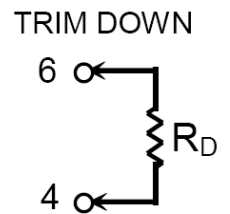
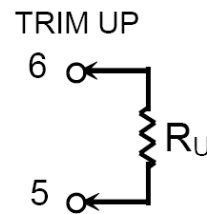
Parameters	Conditions	Min	Typ	Max	Units
EMI	EN55022		Class A		
ESD	EN61000-4-2		Air ±8KV Perf. Criteria A		
			Contact ±6KV Perf. Criteria A		
Radiated immunity	EN61000-4-3	10 V/m Perf. Criteria A			
Fast transient	EN61000-4-4	± 2KV Perf. Criteria A			
Surge	EN61000-4-5	± 1KV Perf. Criteria A			
Conducted immunity	EN61000-4-6	10 Vrms Perf. Criteria A			

Recommended Filter for EN55022 Class A Compliance

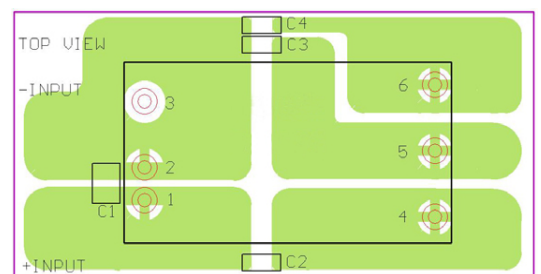


External Output Trimming

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

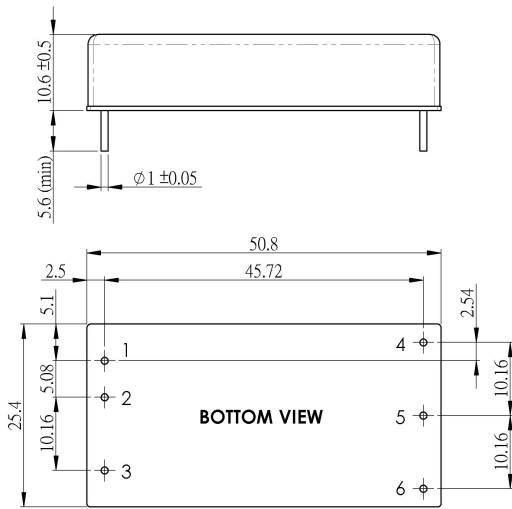


Recommended EN55022 Class A Filter Circuit Layout



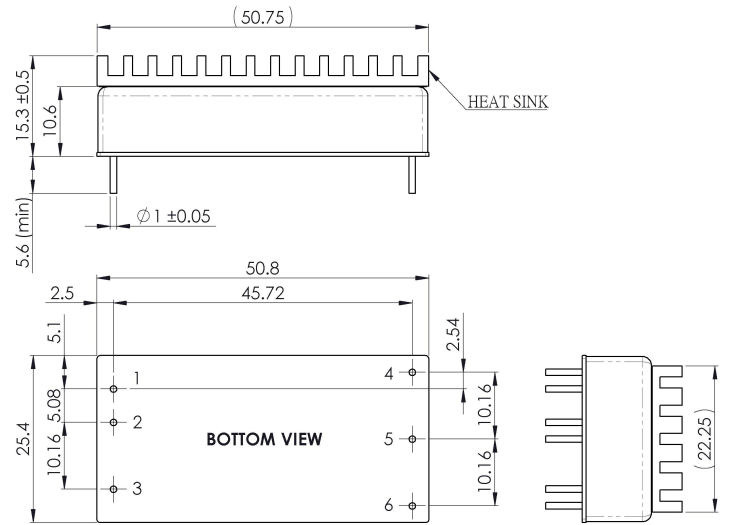
Markings and dimensions

-R5NL



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

-R5HSNL



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

PIN Connection

Pin	1	2	3	4	5	6
Single	+Vin	-Vin	Ctrl	+Vout	-Vout	Trim
Dual	+Vin	-Vin	Ctrl	+Vout	COM	-Vout

FEATURES :

- 4:1Wide Input Voltages Range
- High Efficiency up to 92%
- Regulated Output Types
- 1" X 1" DIL Package
- Operating Temperature:-40°C TO +80°C
- Industry Standard Pinout
- UL/cUL/IEC 60950-1 , 62368-1 Approved (5V/12V Single Output Only)
- EMC Standard of EMI EN55032:2012+AC:2013 (Class B) Approved
- EMC Standard of EMS EN55024:2010 Approved

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

Part Number	Input Voltage Range	Nominal Input Voltage	Output Voltage Range	Output Current	Efficiency
	Vdc	Vdc	Vdc	(mA)	%TYP
96DW-24S03R6NL	9-36	24	3.3	7000	86
96DW-24S05R6NL	9-36		5	6000	88
96DW-24S12R6NL	9-36		12	2500	89
96DW-24S15R6NL	9-36		15	2000	89
96DW-24S24R6NL	9-36		24	1250	90
96DW-48S03R6NL	18-75	48	3.3	7000	87
96DW-48S05R6NL	18-75		5	6000	89
96DW-48S12R6NL	18-75		12	2500	90
96DW-48S15R6NL	18-75		15	2000	91
96DW-48S24R6NL	18-75		24	1250	92
96DW-24D12R6NL	9-36	24	±12	±1250	89
96DW-24D15R6NL	9-36		±15	±1000	91
96DW-24D24R6NL	9-36		±24	±625	91
96DW-48D12R6NL	18-75	48	±12	±1250	91
96DW-48D15R6NL	18-75		±15	±1000	92
96DW-48D24R6NL	18-75		±24	±625	92

Input Specifications

Parameters	Conditions	Min	Typ	Max	Units
Voltage Types				4:1	
Input current at no load (Nominal input voltage)	24V models		10		mA
	48V models		10		
Surge Voltage (1 sec. max.)	24V models			50	Vdc
	48V models			100	



DC-DC Converter

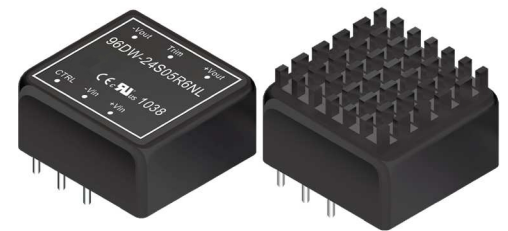
96DW-R6 SERIES

30Watt 1.5KV Isolated

4 : 1 Input Voltage Range

Single & Dual Output

1" x 1"



Part Number

96DW - 48 S 05 R 6 NL
A B C D E F G

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

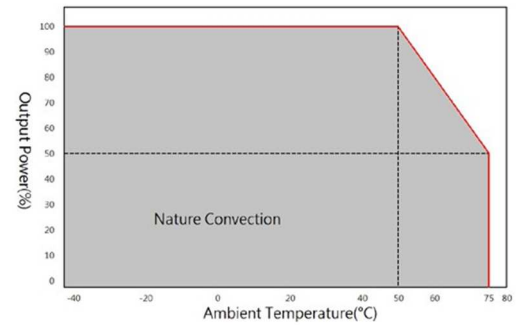
Output Specifications

Parameters	Conditions	Min	Typ	Max	Units
Voltage Tolerance	100% full load			±2	%
Short Circuit Protection	Continuous ,Auto-Recovery				
Output Power Protection	Continuous ,Auto-Recovery	110		170	%
Over Voltage Protection	3.3Vdc	3.7		5.4	Vdc
	5Vdc	5.6		7.0	
	12Vdc	13.5		19.6	
	15Vdc	18.3		22.0	
Line Regulation	24Vdc	29.1		32.5	%
	Nominal Input Voltage			±0.5	
Load Regulation	Single			±0.5	%
	Dual (Balance load)			±1.0	%
Cross Regulation	Dual(25% to 100% load)			±5.0	%
Ripple & Noise	BW=DC To 20MHz				
	Single :				
	3.3V & 5V with 22uF				
	12V & 15V with 2*22uF				
	24V with 2*6.8uF				
Start up time	Dual : (at each output)				
	±12V&±15V with10uF				
	±24V with 4.7uF				
Start up time	Nominal Input Voltage			30	ms
Transient response setting time	25% load step change		350		us

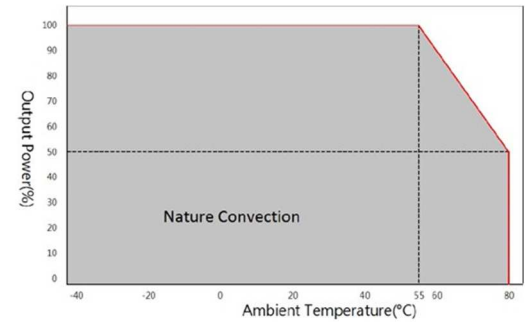
General Specifications

Parameters	Conditions	Min	Typ	Max	Units
Isolation Voltage	Input To Output	1500			Vdc
	Input(Output) To Case	1000			
Isolation Resistance	500Vdc	1000			MΩ
Switching Frequency	Full load, nominal input	275			KHz
Operating Temperature		-40		80	°C
Case Temperature				105	°C
Humidity	Non Condensing	5		95	%
Cooling	Free air Convection				
Case material	Six-side shield case				
MTBF	MIL-HDBK-217F@25°C	1200000			Hours
Weight	without heatsink		22		g
	with heatsink		24.5		
Dimensions		25.4X25.4X10.6			mm

Temperature Derating Graph @20LFM

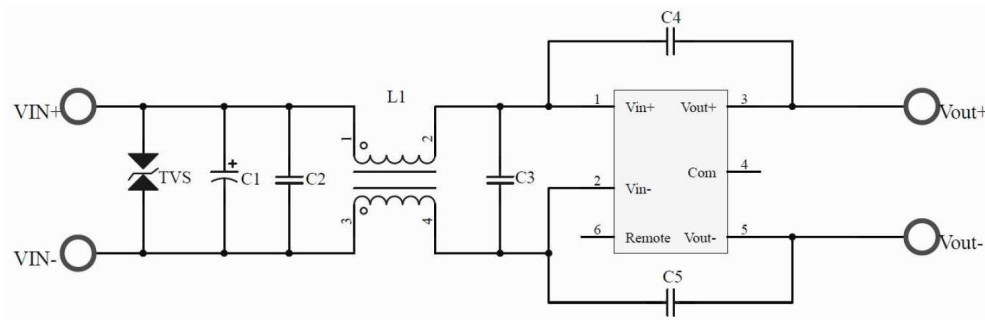


Derating Curve



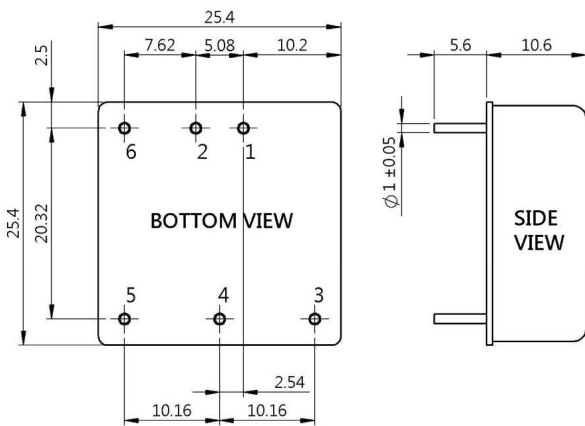
Derating Curve With Heat-sink

Recommended Test Circuit Meets EN55024 Criterion A and EN55032 Class B

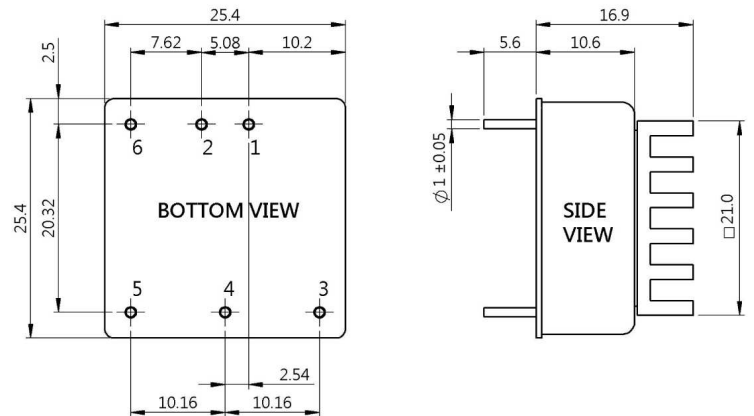


24V C1 220uF/100V&C2&C3 4.7uF/50V C4&C5 2200pF/2kV L1 0.94mH TVS 3.0SMCJ58AG
 48V C1 220uF/100V&C2&C3 4.7uF/100V C4&C5 3200pF/2kV L1 6.20mH TVS 3.0SMCJ120AG

Markings and Dimensions



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



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

PIN Assignment

Pin	1	2	3	4	5	6
Single	+Vin	-Vin	+Vout	Trim	-Vout	Remote ON/OFF
Dual	+Vin	-Vin	+Vout	Com	-Vout	Remote ON/OFF

FEATURES :

- 4:1 Wide Input Voltages Range
- High Efficiency up to 88%
- Regulated Output Types
- No minimum load required
- Operating Temperature:-40°C TO +100°C
- Industry Standard Pinout
- 3KV Isolation
- Design refer to EN50155

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

Part Number	Input Voltage Range	Nominal Input Voltage	Output Voltage Range	Output Current	Efficiency
	Vdc	Vdc	Vdc	A	%TYP
98DW30-24S03R3NL	9-36	24	3.3	7.5	85
98DW30-24S05R3NL	9-36		5	6	86
98DW30-24S12R3NL	9-36		12	2.5	88
98DW30-24S15R3NL	9-36		15	2	88
98DW30-48S03R3NL	18-75	48	3.3	7.5	85
98DW30-48S05R3NL	18-75		5	6	86
98DW30-48S12R3NL	18-75		12	2.5	88
98DW30-48S15R3NL	18-75		15	2	88
98DW30-110S03R3NL	40-160	110	3.3	7.5	85
98DW30-110S05R3NL	40-160		5	6	86
98DW30-110S12R3NL	40-160		12	2.5	88
98DW30-110S15R3NL	40-160		15	2	88
98DW30-24D12R3NL	9-36	24	±12	±1.25	88
98DW30-24D15R3NL	9-36		±15	±1	88
98DW30-48D12R3NL	18-75	48	±12	±1.25	88
98DW30-48D15R3NL	18-75		±15	±1	88
98DW30-110D12R3NL	40-160	110	±12	±1.25	88
98DW30-110D15R3NL	40-160		±15	±1	88

Input Specifications

Parameters	Conditions	Min	Typ	Max	Units
Voltage Types				4:1	
Input current at no load (Nominal input voltage)	24V models		6		mA
	48V models		5		
	110V models		4		
Surge Voltage (1 sec. max.)	24V models			50	Vdc
	48V models			100	
	110 models			170	
Input Filter	PI Type				
Reflected ripple current			30		mAp-p
Remote ON/OFF (Refer to -Vin PIN)	Positive Logic				Vdc
	ON : Open	3		12	
	OFF: Short	0		1.2	
	Input current of Ctrl PIN		0.5		0.5
Remote off input current			3		



DC-DC Converter

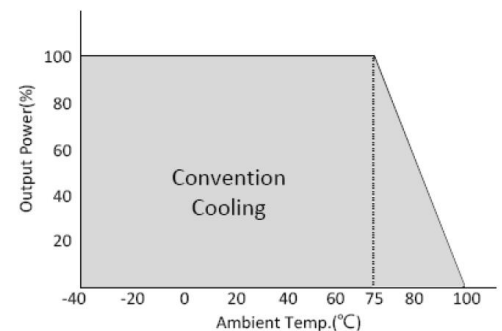
98DW30-R3 SERIES

30Watt 3KV Isolated

4 : 1 Input Voltage Range

Single & Dual Output

DIL

**Temperature Derating Graph**

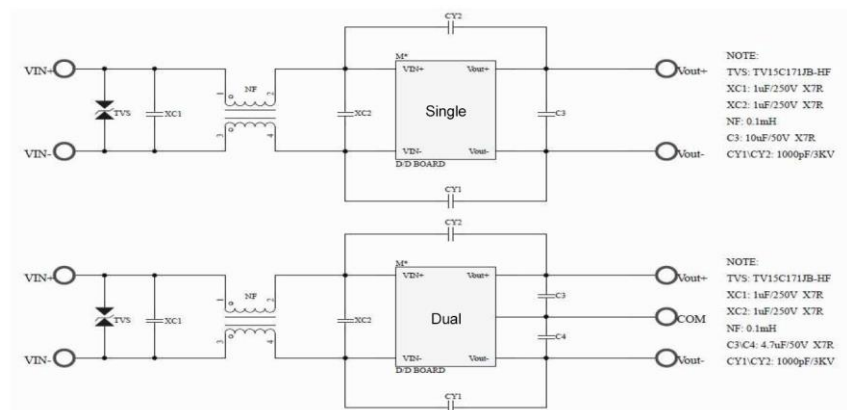
Output Specifications

Parameters	Conditions	Min	Typ	Max	Units
Voltage Tolerance	100% full load			±2	%
Short Circuit Protection	Continuous ,Auto-Recovery				
Output Power Protection	Continuous ,Auto-Recovery	110%		170%	
Over Voltage Protection	3.3Vdc	3.7		5.4	Vdc
	5Vdc	5.6		7.0	
	12Vdc	13.5		19.6	
	15Vdc	16.8		20.5	
Line Regulation	Nominal Input Voltage			±0.5	%
Load Regulation	Single output models			±0.5	%
	Dual output models			±5	
Ripple & Noise (BW=DC To 20MHz Measured with a 10uF MLCC.)	3.3V&5.0V models			75	mVp-p
	Other models			100	
Start up time	Nominal Input Voltage			30	ms
Transient response setting time	50% load step change		350		us

General Specifications

Parameters	Conditions	Min	Typ	Max	Units
Isolation Voltage	Input To Output	3000			Vdc
	Input(Output) To Case	1600			
Isolation Resistance	500Vdc	1000			MΩ
Switching Frequency	Full load, nominal input		330		KHz
Operating Temperature		-40		100	°C
Case Temperature				105	°C
Humidity	Non Condensing	5		95	%
Cooling	Free air Convection				
Case material	Six-side shield case				
MTBF	MIL-HDBK-217F@25°C	1500000			Hours
Weight			40		g
Dimensions		51.0x25.4x13.0			mm

Recommended Test Circuit

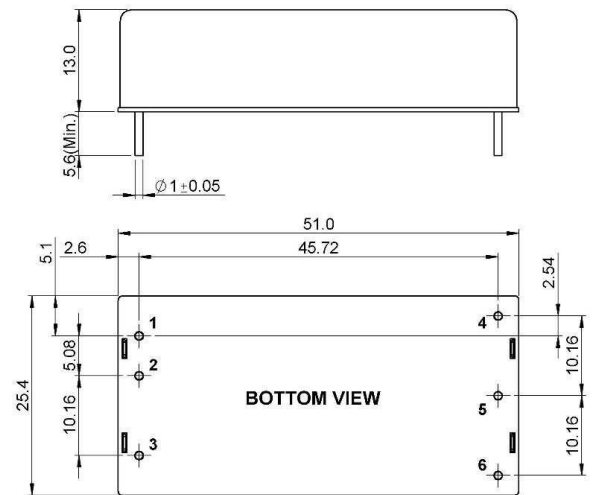


Part Number

98DW30	-	24	S	05	R	3	NL
A		B	C	D	E	F	G

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

Markings and dimensions



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

PIN Assignment

Pin	1	2	3	4	5	6
Single	+Vin	-Vin	Ctrl	+Vout	-Vout	Trim
Dual	+Vin	-Vin	Ctrl	+Vout	Com	-Vout