



RDT-6Y Series

6 W Isolated DC-DC Converter

The RDT-6Y Series is a high-performance product, specifically designed for a variety of railway applications. The DC-DC converters feature 6 W single output voltage, wide input voltage from 14 - 160 VDC and extended operating temperature range from -40 to 105°C.

Additional product features include input under-voltage protection, output over-voltage, short-circuit and over-current protection.

The products are widely used in railway systems and associated equipment.



Key Features & Benefits

- Ultra-wide 12:1 input voltage range: 14 – 160 VDC
- High efficiency up to 83%
- Reinforced insulation, I/O isolation test voltage 3 kVAC
- Operating ambient temperature range -40 °C to +105 °C
- Input under-voltage protection, output over-voltage, over-current, short-circuit protection
- Industry standard DIP-24 package and pin-out
- Meets EN 50155 and AREMA standard
- Safety approved according to IEC 62368-1 & UL/CSA 62368-1

Applications

- Railway related equipment



1. MODEL SELECTION

PART NUMBER	INPUT VOLTAGE RANGE [VDC]	OUTPUT VOLTAGE [VDC]	MAX. OUTPUT CURRENT [mA]	TYPICAL EFFICIENCY [%]	MAX. CAPACITIVE LOAD [μ F]
RDT-6Y03	14 – 160	3.3	1454	75	1000
RDT-6Y05	14 – 160	5	1200	80	1000
RDT-6Y12	14 – 160	12	500	83	470
RDT-6Y15	14 – 160	15	400	83	470
RDT-6Y24	14 – 160	24	250	83	220

2. INPUT SPECIFICATIONS

PARAMETER	DESCRIPTION / CONDITIONS	MIN.	TYP.	MAX.	UNIT
Input Voltage Range	Nominal	–	110	–	
	Continuous operation	16.8	–	160	VDC
	For ≤ 100 ms	14	–	–	
Input Current	24 V input, full load	–	0.27	0.33	
	72 V input, full load	–	0.09	0.10	A
	110 V input, full load	–	0.06	0.07	
No-Load Power Consumption	Full input range	–	0.6	1.3	W
Reflected Ripple Current	Nominal input voltage	–	50	–	mA
Surge Voltage	1 sec. max.	–	–	200	VDC
Input Under-Voltage Protection		9	11.5	–	VDC
Start-up Time		–	10	120	ms

3. OUTPUT SPECIFICATIONS

PARAMETER	DESCRIPTION / CONDITIONS	MIN	TYP.	MAX.	UNIT
Voltage Accuracy	Nominal input voltage, full load	–	± 1	± 2	%
Linear Regulation	Input voltage variation from min. to max. at full load	–	–	± 0.5	%
Load Regulation	Nominal input voltage, 10% - 100% load	–	± 0.5	± 1	%
Transient Recovery Time	25% load step change @ 25°C	–	–	500	μ s
Transient Response Deviation		–	± 3	± 8	%
Temperature Coefficient	Nominal input voltage, full load	–	–	± 0.03	% / °C
Ripple & Noise ¹	20 MHz bandwidth, full load @ 25°C	–	80	150	mVp-p
Over-Voltage Protection	Input voltage range	110	–	160	% Vo
Over-Current Protection	Input voltage range	110	–	260	% Io
Short-Circuit Protection	Input voltage range	Hiccup, continuous, self-recovery			

¹ For ripple and noise measuring method, please refer to Figure 3.

4. GENERAL SPECIFICATIONS

PARAMETER	DESCRIPTION / CONDITIONS	MIN	TYP.	MAX.	UNIT
Isolation	Electric Strength Test Input-output	3000	–	–	VAC
Insulation Resistance	Input-output resistance at 500 VDC	1000	–	–	MΩ
Isolation Capacitance	Input-output capacitance at 100 kHz / 0.1 V	–	500	–	pF
Operating Temperature	Linear derating >85°C	-40	–	105	°C
Storage Temperature		-55	–	125	°C
Pin Soldering Resistance Temperature	Soldering spot is 1.5 mm away from case for 10 seconds	–	–	300	°C
Storage Humidity	Non-condensing	5	–	95	%RH
Switching Frequency	PWM mode	–	170	–	KHz
MTBF	IEC 61709 @ 25 °C	1000	–	–	kh
Dry Heat Test	Ta +85°C (conduction cooling)	EN 60068-2-2, Be			
Shock and Vibration Test		IEC/EN 61373 Category 1, Class B AREMA Part 11.5.1 Class C, D, E, I, J			
Pollution Level		PD 3			
Fire & Smoke Compliance		EN 45545-2, HL3			
Salt Mist Test	Duration 48 h	EN 60068-2-11, Ka			
Cyclic Damp Heat Test	2 cycles @ +55 °C	EN 60068-2-30, Db variant 2			
Altitude ¹		5000 m			
Low Temperature Start-Up & Storage Test	Ta -40 °C	EN 60068-1, Ad and Ab			

¹ Derating is needed for altitudes above 2000 m.

5. MECHANICAL SPECIFICATIONS

PARAMETER	DESCRIPTION	VALUE
Case Material		Black plastic bottom cover (UL94 V-0)
Dimension		31.6 x 20.3 x 12.5 mm
Weight		17 g (Typ.)
Cooling Method		Free air convection cooling



6. ELECTROMAGNETIC COMPATIBILITY (EN50121-3-2)

PARAMETER	DESCRIPTION	CLASS / CRITERIA	
Emission ¹	CE EN 55016-2-1	150 kHz – 500 kHz; 79 dBuV (see Fig. 4 for recommended circuit) 500 kHz – 30 MHz; 73 dBuV (see Fig. 4 for recommended circuit)	CLASS A
	RE CISPR16-2-3	30 MHz – 230 MHz; 40 dBuV/m at 10 m (see Fig. 4 for recommended circuit) 230 MHz – 6 GHz; 47 dBuV/m at 10 m (see Fig. 4 for recommended circuit)	CLASS A
Immunity	ESD EN 61000-4-2	Contact ± 6 kV/Air ± 8 kV	perf. Criteria A
	RS EN 61000-4-3	80 – 800 MHz; 20 V/m 800 – 1000 MHz; 20 V/m 1400 – 2000 MHz; 10 V/m 2000 – 2700 MHz; 5 V/m 5100 – 6000 MHz; 3 V/m	perf. Criteria A
	EFT EN 61000-4-4	± 2 kV; 5/50 ns; 5 kHz (see Fig. 4 for recommended circuit)	perf. Criteria A
	Surge EN 61000-4-5	Line to line ± 1 kV (42 Ω , 0.5 μ F) (see Fig. 4 for recommended circuit) Line to line ± 1 kV (2 Ω , 18 μ F) (see Fig. 4 for recommended circuit)	perf. Criteria A
	CS EN 61000-4-6	0.15 MHz – 80 MHz 10 V r.m.s	perf. Criteria A

¹ Corresponds or exceeds EN50121-3-2

7. ELECTROMAGNETIC COMPATIBILITY (AREMA)

PARAMETER	DESCRIPTION	CLASS / CRITERIA	
Emissions	CE CISPR16-2-1 CISPR16-1-2	150 kHz – 500 kHz; 79 dBuV (see Fig. 4 for recommended circuit) 500 kHz – 30 MHz; 73 dBuV (see Fig. 4 for recommended circuit)	CLASS A
	RE CISPR16-2-3	30 MHz – 230 MHz; 40 dBuV/m at 10 m (see Fig. 4 for recommended circuit) 230 MHz – 1 GHz; 47 dBuV/m at 10 m (see Fig. 4 for recommended circuit)	CLASS A
Immunity	ESD IEC 61000-4-2	Contact ± 6 kV/Air ± 8 kV	perf. Criteria A
	RS IEC 61000-4-3	80 – 1000 MHz; 10 V/m 160 – 165 MHz; 20 V/m 450 – 470 MHz; 20 V/m 800 – 960 MHz; 20 V/m 1400 – 2000 MHz; 20 V/m 2100 – 2500 MHz; 5 V/m	perf. Criteria A
	EFT IEC 61000-4-4	± 2 kV 5/50 ns; 5 kHz (see Fig. 4 for recommended circuit)	perf. Criteria A
	Surge IEC 61000-4-5	Line to line ± 2 kV (2 Ω , 18 μ F) (see Fig. 4 for recommended circuit)	perf. Criteria A
	CS IEC 61000-4-6	0.15 MHz-80 MHz; 10 V r.m.s	perf. Criteria A
	MS IEC 61000-4-8 IEC 61000-4-8	60 Hz; 100 A/m (see Fig. 4 for recommended circuit) 60 Hz; 300 A/m (see Fig. 4 for recommended circuit)	perf. Criteria A

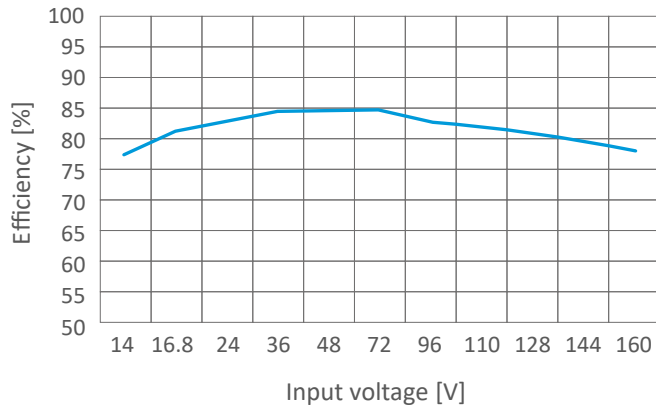


Figure 1. Efficiency vs. Input Voltage

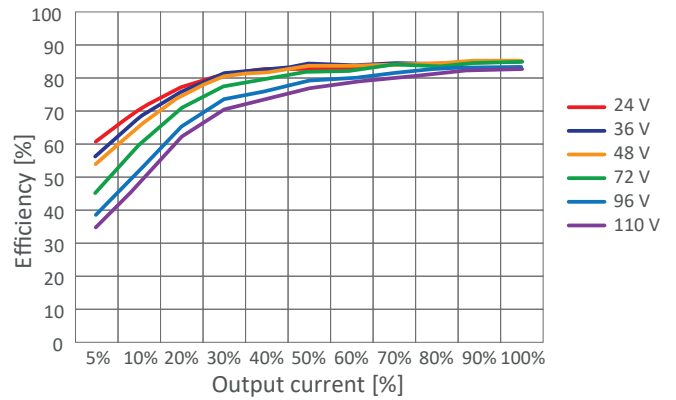


Figure 2. Efficiency vs. Output Load

9. DESIGN REFERENCE

9.1 RIPPLE & NOISE

All the DC-DC converters of this series are tested before delivery using the recommended circuit shown in Fig. 3.

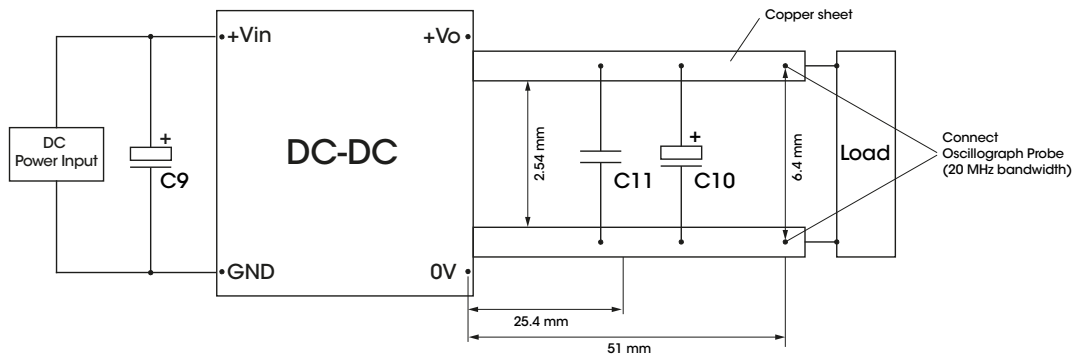


Figure 3. Recommended Test Circuit

Capacitor value		C9 [μF]	C10 [μF]	C11 [μF]
Output Voltage	3.3 / 5 VDC	100 Voltage ≥ 250 V	10 Voltage ≥ 1.2* Vo	1 Voltage ≥ 1.2* Vo
	12 VDC			
	15 VDC			
	24 VDC			

9.2 TYPICAL APPLICATION

1. Please ensure that at least a 100 μF electrolytic capacitor is connected at the input in order to ensure adequate voltage surge suppression and protection.
2. Output ripple can be further reduced by appropriately increasing the output capacitor values C10 and/or by selecting capacitors with a low ESR (equivalent series resistance). Also make sure that the capacitance is not exceeding the specified max. capacitive load value of the product.

9.4 EMC COMPLIANCE CIRCUIT

1. External circuit breaker and diode D1 form an anti-reverse circuit, and the diode withstand voltage requirement is above 250 V;
2. EMC Filter will be provided in a modular form, here is a recommended circuit and parameters, as shown in Fig. 4. Users can also build it themselves.

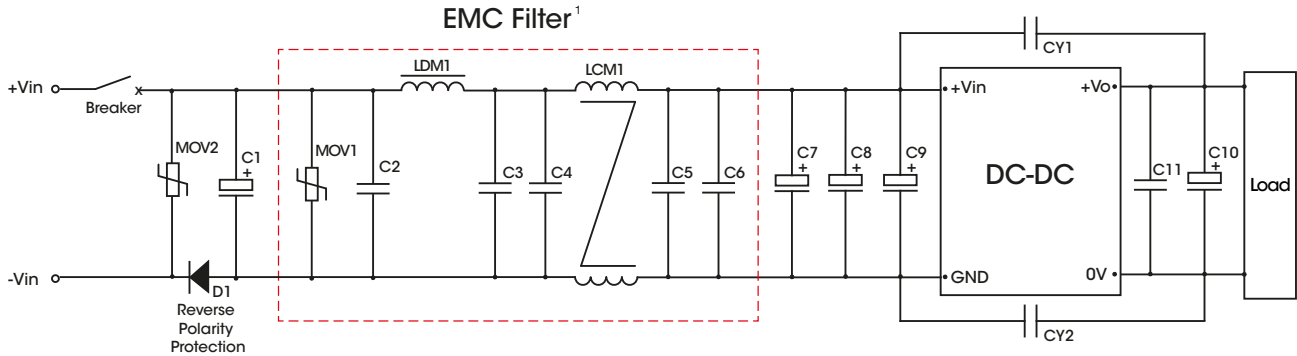


Figure 4. Recommended EMC Filtering

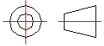
COMPONENTS	VALUE	RECOMMENDED COMPONENT
C1	330 μ F	ELECTROLYTIC; Al, WET; RADIAL; 330 μ F; 20%; 250 V; \varnothing 18 x 30 mm; PITCH 7.5 mm; -40 to +105°C
C2	2.2 μ F	CERAMIC; 2.2 μ F; 10%; 250 V; X7R; 2220; -55 to +125°C
C3, C4, C5, C6	0.1 μ F	CERAMIC; 0.1 μ F; 10%; 250 V; X7R; 1206; -55 to +125°C
C7, C8, C9	100 μ F	ELECTROLYTIC; Al, WET; RADIAL; 100 μ F; 20%; 250 V; \varnothing 16 x 20 mm; PITCH 7.5 mm; -40 to +105°C
CY1, CY2	2.2 nF	CERAMIC; X1/Y1; 2.2 nF; 10%; 400 V; PITCH 10 mm; -40 to +125°C
LDM1	10 μ H	POWER CHOKE; 10 μ H; 20%; 2.35 A; 83.2 mOhm; -40 to +125°C
LCM1	1.5 mH	COMMON MODE; TOROIDAL; FERRITE; THT; 1.5 mH; 2.5 A; 100 mOhm; -40 to +115°C
D1	2 A	SCHOTTKY; DUAL; 600 V; 2 A; Vf 1.1 V; DO-15; -50 to +150°C; COMMON CATHODE
MOV1	220 V / 19 J	VDR; 220 V; 1.8 kA; 19 J; THT; PITCH 5 mm; -40 to +105°C
MOV2	220 V / 58 J	VDR; 220 V; 4 kA; 58 J; THT; PITCH 7.5 mm; -40 to +85°C
Fuse or Breaker ²	2 A	Type C

¹ Use of EMC Filter Bel Power P/N: FRD6-00 is recommended.

² Type of fuse / circuit breaker to be selected according to the application requirements. The current rating shall be above the maximum working input current and below rated working current of reverse polarity diode.

11. MECHANICAL SPECIFICATIONS

11.1 MECHANICAL DIMENSIONS AND RECOMMENDED LAYOUT

THIRD ANGLE PROJECTION 

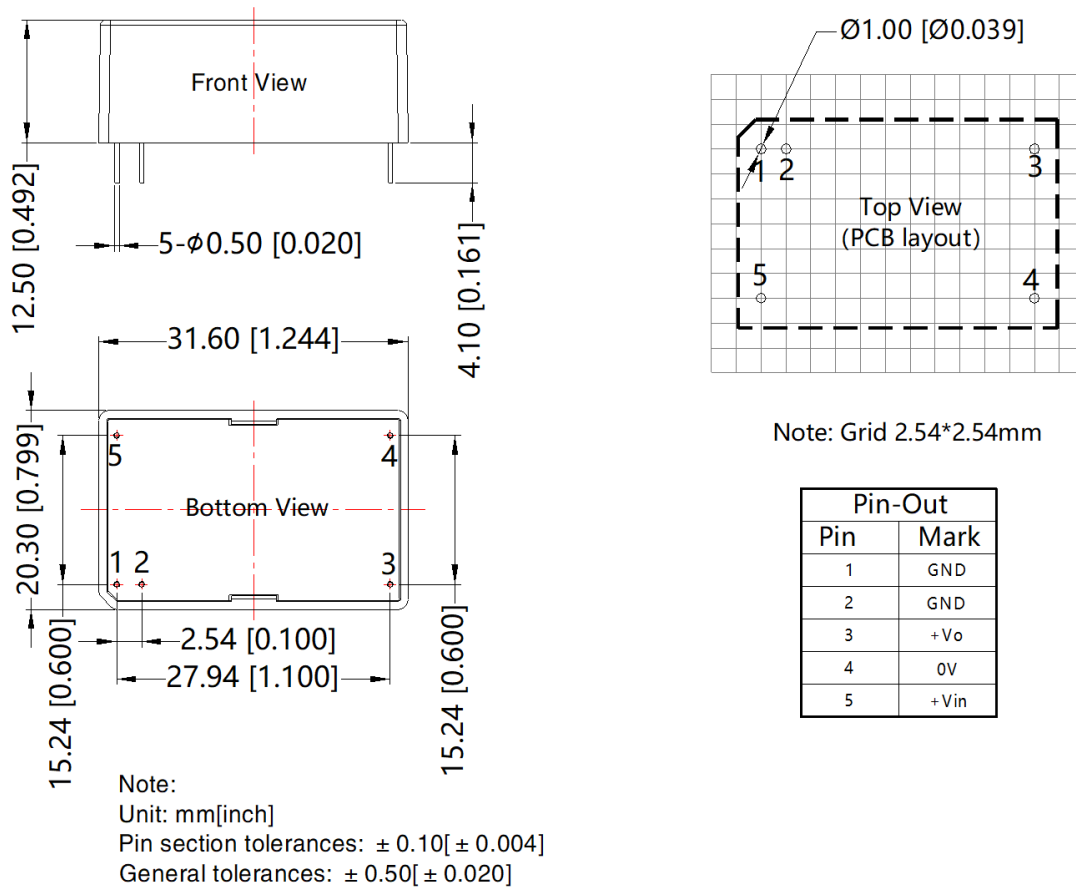


Figure 5. Mechanical Drawing of Standard Model

For more information on these products consult: tech.support@psbel.com

NUCLEAR AND MEDICAL APPLICATIONS - Products are not designed or intended for use as critical components in life support systems, equipment used in hazardous environments, or nuclear control systems.

TECHNICAL REVISIONS - The appearance of products, including safety agency certifications pictured on labels, may change depending on the date manufactured. Specifications are subject to change without notice.



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