SERIES: DQD20 | **DESCRIPTION:** DC-DC CONVERTER

FEATURES

- up to 20 W isolated output
- single and dual regulated outputs
- over voltage, input under voltage, short circuit, and over current protections
- remote on/off control
- 1,500 Vdc isolation
- -40 ~ 85°C temperature range, with derating
- certified to IEC/EN 62368-1
- PCB, chassis and DIN-rail mount options

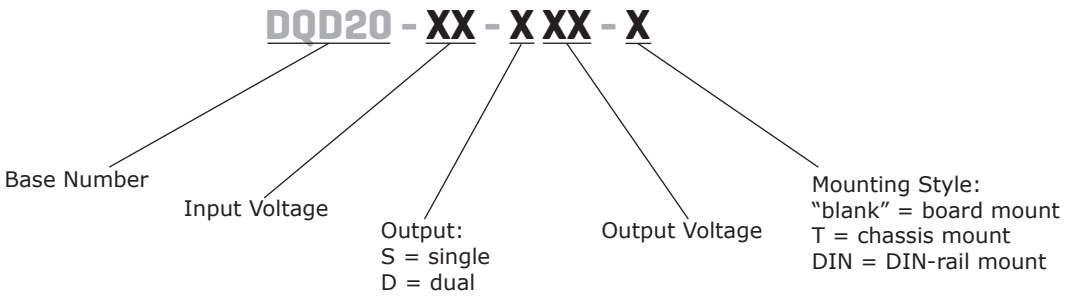
RoHS CE UKCA

MODEL

MODEL	input voltage		output voltage	output current	output power	ripple & noise[1]	efficiency[2]
	typ (Vdc)	range (Vdc)	typ (Vdc)	max (mA)	max (W)	max (mVp-p)	typ (%)
DQD20-24-S3	24	9~36	3.3	5,000	16.5	100	88
DQD20-24-S5	24	9~36	5	4,000	20	100	90
DQD20-24-S9	24	9~36	9	2,222	20	100	90
DQD20-24-S12	24	9~36	12	1,667	20	100	90
DQD20-24-S15	24	9~36	15	1,333	20	100	90
DQD20-24-S24	24	9~36	24	1,111	20	100	89
DQD20-24-S28	24	9~36	28	714	20	100	91
DQD20-24-D5	24	9~36	±5	±2,000	20	200	87
DQD20-24-D9	24	9~36	±9	±1,111	20	200	87
DQD20-24-D12	24	9~36	±12	±833	20	200	90
DQD20-24-D15	24	9~36	±15	±667	20	200	90
DQD20-24-D24	24	9~36	±24	±416	20	200	88
DQD20-48-S3	48	18~75	3.3	5,000	16.5	100	88
DQD20-48-S5	48	18~75	5	4,000	20	100	90
DQD20-48-S9	48	18~75	9	2,222	20	100	90
DQD20-48-S12	48	18~75	12	1,667	20	100	91
DQD20-48-S15	48	18~75	15	1,333	20	100	91
DQD20-48-S24	48	18~75	24	833	20	100	91
DQD20-48-D5	48	18~75	±5	±2,000	20	200	86
DQD20-48-D9	48	18~75	±9	±1,111	20	200	87
DQD20-48-D12	48	18~75	±12	±833	20	200	89
DQD20-48-D15	48	18~75	±15	±667	20	200	89
DQD20-48-D24	48	18~75	±24	±416	20	200	90

Notes:
1. The ripple and noise is measured at 10%~100% load and 20MHz bandwidth. 0% ~10% load ripple & noise is less than or equal to 5%Vo; the ripple & noise test adopts the parallel line test method, see the ripple & noise test instructions for details.
2. The efficiency is tested at full load.
3. Unless otherwise specified, all values or indicators in this manual are tested at Ta=25°C, humidity<75%RH, rated input voltage and rated load (pure resistance load).

PART NUMBER KEY



INPUT

parameter	conditions/description	min	typ	max	units
input voltage range	24 Vdc input models	9	24	36	Vdc
	48 Vdc input models	18	48	75	Vdc
input current (full load/no load)	24 Vdc input; 3.3 Vdc output model		781/33		mA
	24 Vdc input; 5, 9 Vdc output model		926/33		mA
	24 Vdc input; 12, 15 Vdc output models		926/5		mA
	24 Vdc input; 24, 28 Vdc output models		915/5		mA
	48 Vdc input; 3.3 Vdc output models		390/17		mA
	48 Vdc input; 5, 9 Vdc output models		463/17		mA
	48 Vdc input; 12, 15, 24 Vdc output models		457/5		mA
	24 Vdc input; ±5 Vdc output model		957/33		mA
	24 Vdc input; ±9 Vdc output model		946/6		mA
	24 Vdc input; ±12, ±15 Vdc output model		926/5		mA
	24 Vdc input; ±24 Vdc output model		947/5		mA
	48 Vdc input; ±5 Vdc output model		484/17		mA
	48 Vdc input; ±9 Vdc output model		472/5		mA
	48 Vdc input; ±12, ±15 Vdc output model		468/5		mA
	48 Vdc input; ±24 Vdc output model		463/5		mA
surge voltage	1 second max 24 Vdc input models	-0.7		50	Vdc
	48 Vdc input models	-0.7		100	Vdc
turn-off voltage threshold	at full load 24 Vdc input models	5	7	9	Vdc
	48 Vdc input models	11	13	18	Vdc
filter	Pi filter				
no load power consumption			0.1		W
remote on/off[4]	module on	single outputs dual outputs	CTRL pin suspended or pulled high (2.5~12 Vdc) CTRL pin suspended or pulled high (3.3~12 Vdc)		
	module off	CTRL pin connected to -Vin or pulled low (0~1.2 Vdc)			
input current when off			3		mA

Notes: 4. The voltage of CTRL pin is relative to -Vin pin.

OUTPUT

parameter	conditions/description	min	typ	max	units
maximum capacitive load	3.3 Vdc output models			10,000	µF
	5, ±5 Vdc output models			5,000	µF
	9 Vdc output models			3,000	µF
	±9 Vdc output models			2,000	µF
	12, ±12 Vdc output models			1,000	µF
	15, ±15 Vdc output models			800	µF
	18 Vdc output models			600	µF
	24, ±24, 28 Vdc output models			500	µF

OUTPUT

parameter	conditions/description		min	typ	max	units
voltage accuracy	single outputs			±1	±2	%
	dual outputs	Vo1 Vo2		±1 ±.5	±2 ±3	% %
voltage regulation	full voltage range, nominal load			±0.2	±0.5	%
load regulation	5% ~ 100% load			±0.5	±1	%
transient response recovery	25% rated load step change single outputs dual outputs			 250 300	 500 500	 µs µs
transient response deviation	25% rated load step change 3.3, 5, ±5 Vdc output models all other models			 ±5 ±3	 ±8 ±5	 % %
start-up time	at rated input voltage and constant resistance load			10		ms
switching frequency	PWM mode			280		kHz
adjustability	single outputs	via trim	90		110	%
	dual outputs	unavailable				

PROTECTIONS

parameter	conditions/description	min	typ	max	units
over current protection		110		220	%
over voltage protection	single outputs dual outputs	110 120		200 200	% %
short circuit protection	continuous, auto recovery, hiccup				
output overshoot				10	%

SAFETY AND COMPLIANCE

parameter	conditions/description	min	typ	max	units
isolation voltage	input to output for 1 minute, 0.5 mA max input/output to case for 1 minute, 0.5 mA max	1,500 1,000			Vdc Vdc
isolation capacitance	input to output, (100 kHz, 0.1V)		1,000		pF
safety approvals[5]	certified to 62368-1: IEC, EN				
conducted emissions	CISPR32/EN55032 Class B (see recommended circuit)				
radiated emissions	CISPR32/EN55032 Class B (see recommended circuit)				
ESD	IEC/EN61000-4-2 Contact ±6 kV, Air ±8 kV, Perf. Criteria B				
radiated immunity	IEC/EN61000-4-3 10 V/m, Perf. Criteria A (see recommended circuit)				
conducted immunity	IEC/EN61000-4-6 3 Vrms, Perf. Criteria A (see recommended circuit)				
MTBF	as per MIL-HDBK-217F at 25 °C	1,000,000			hours
RoHS	yes				

Notes: 5. Output is only considered as ES1 if the input source meets reinforced insulation requirements from primary AC source or any hazardous voltage source. Unit maintains only functional insulation from input to output

ENVIRONMENTAL

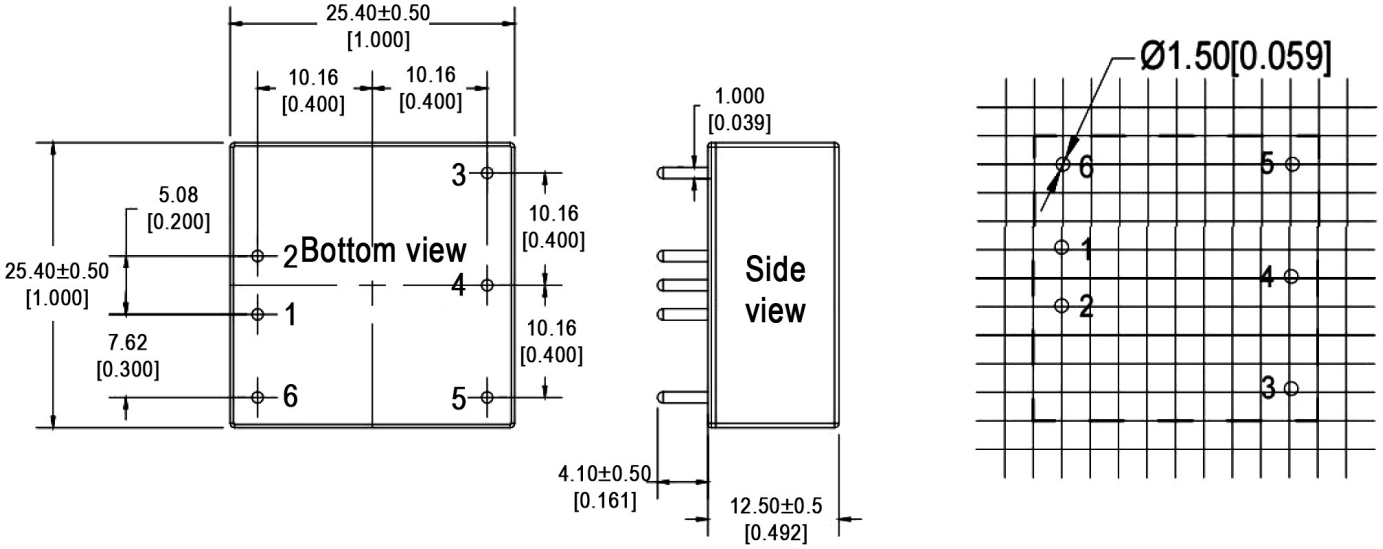
parameter	conditions/description	min	typ	max	units
operating temperature	see derating curve	-40		85	°C
max case temperature				105	°C
storage temperature		-55		125	°C
operating humidity	non condensing	5		95	%

MECHANICAL

parameter	conditions/description		min	typ	max	units
dimensions	board mount: 25.4 x 25.4 x 12.5 [1.000 x 1.000 x 0.492 inches] chassis mount: 76.0 x 31.5 x 21.3 [2.990 x 1.240 x 0.838 inches] DIN-rail mount: 76.0 x 31.5 x 26.0 [2.990 x 1.240 x 1.023 inches]					mm mm mm
case material	aluminum					
weight	single output models	board mount		15		g
		chassis mount		37		g
		DIN-rail mount		57		g
	dual output models	board mount		18		g
		chassis mount		39		g
		DIN-rail mount		59		g
cooling	natural convection					

MECHANICAL DRAWING

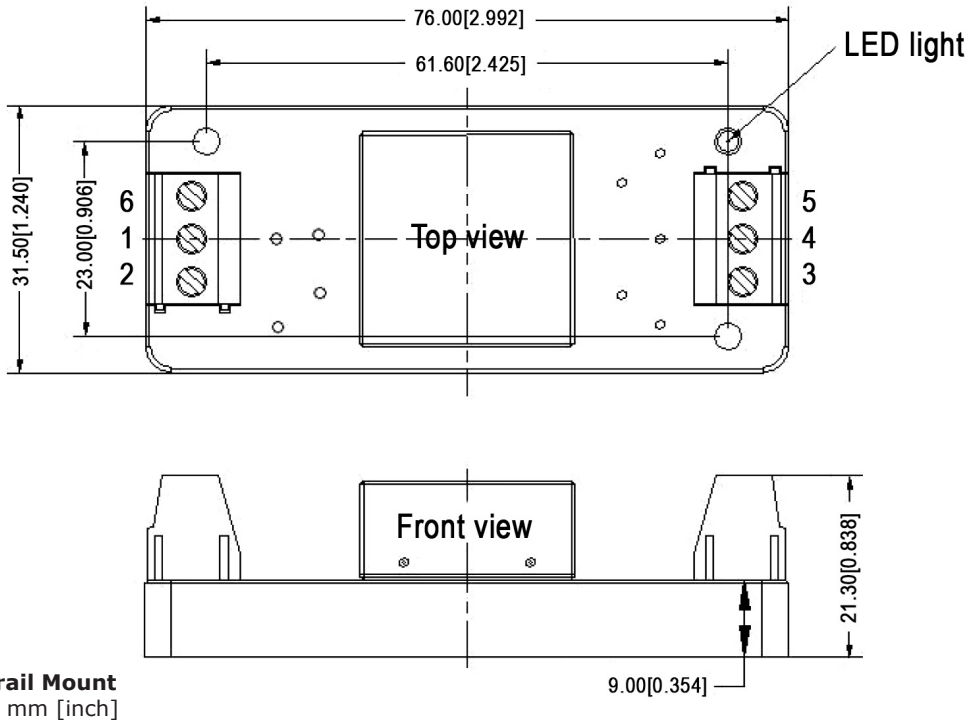
Board Mount
units: mm [inch]
pin diameter tolerance: ±0.10 [±0.004]
general tolerance: ±0.50 [±0.020]



PIN CONNECTIONS		
PIN	Single	Dual
1	-Vin	-Vin
2	+Vin	+Vin
3	+Vout	+Vout
4	Trim	COM
5	GND	-Vout
6	Ctrl	Ctrl

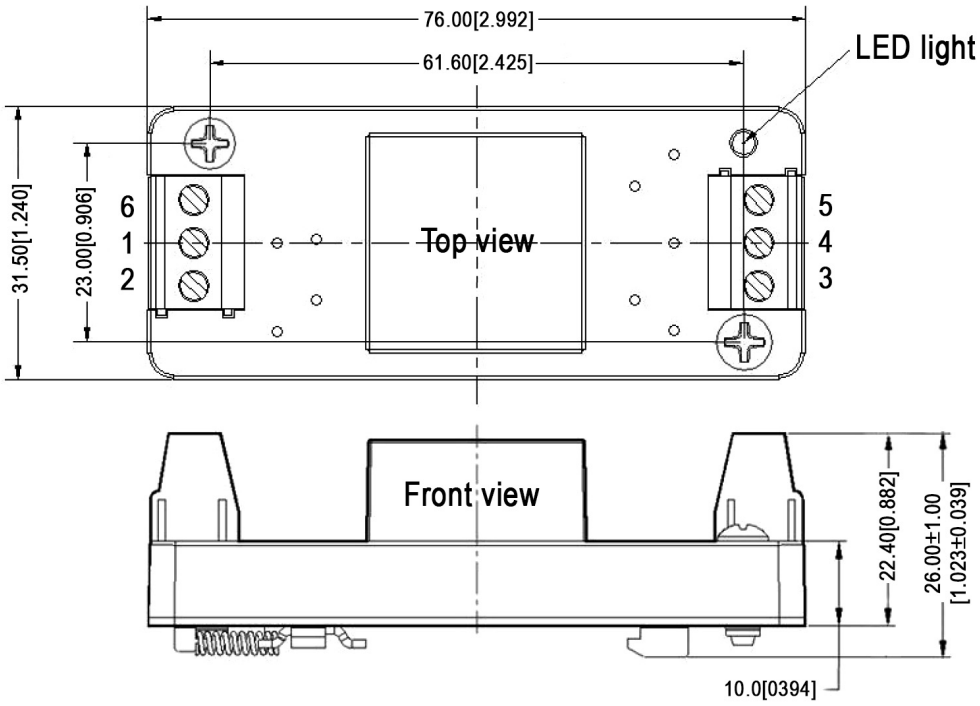
MECHANICAL DRAWING (CONTINUED)

Chassis Mount
units: mm [inch]
pin diameter tolerance: ±0.10 [±0.004]
general tolerance: ±0.50 [±0.02]
wire range: 24~12 AWG
tightening torque: max 0.4 N·m



PIN CONNECTIONS		
PIN	Single	Dual
1	-Vin	-Vin
2	+Vin	+Vin
3	+Vout	+Vout
4	Trim	COM
5	GND	-Vout
6	Ctrl	Ctrl

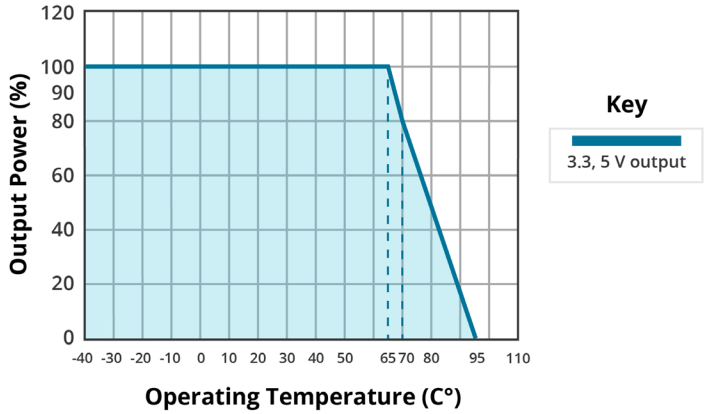
DIN-rail Mount
units: mm [inch]
pin diameter tolerance: ±0.10 [±0.004]
general tolerance: ±0.50 [±0.02]
wire range: 24~12 AWG
tightening torque: max 0.4 N·m



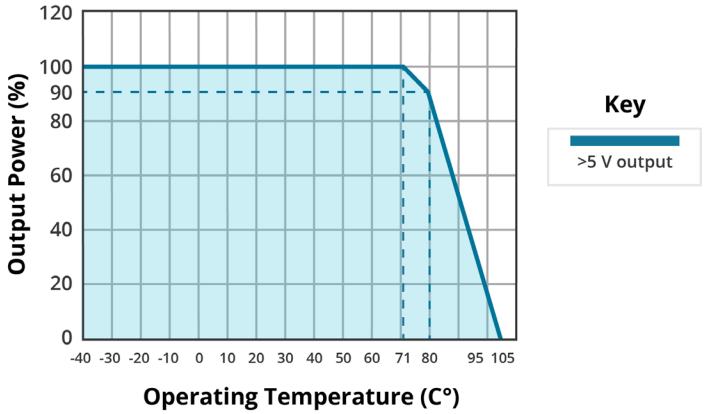
PIN CONNECTIONS		
PIN	Single	Dual
1	-Vin	-Vin
2	+Vin	+Vin
3	+Vout	+Vout
4	Trim	COM
5	GND	-Vout
6	Ctrl	Ctrl

DERATING CURVES

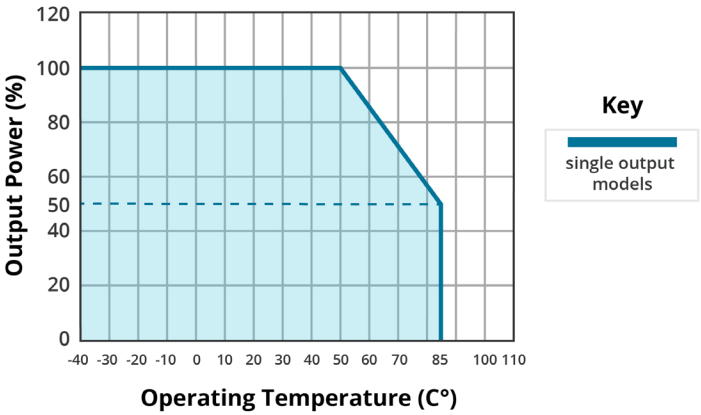
TEMPERATURE DERATING CURVE
single output models
(nominal input voltage)



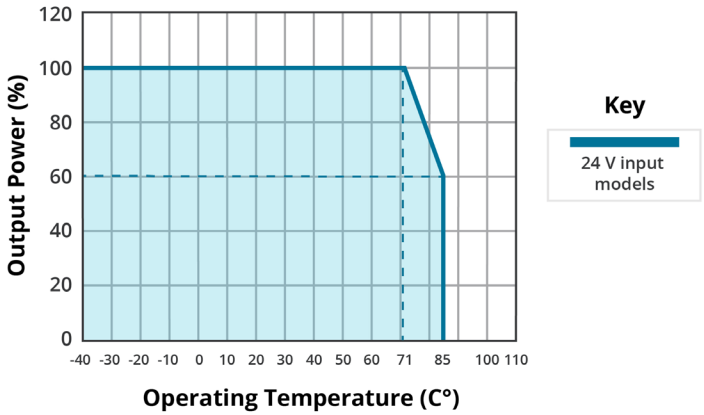
TEMPERATURE DERATING CURVE
single output models
(nominal input voltage)



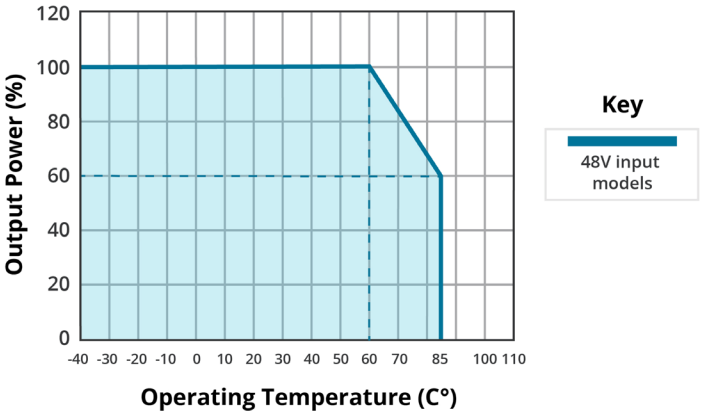
TEMPERATURE DERATING CURVE
single output models
(full input voltage)



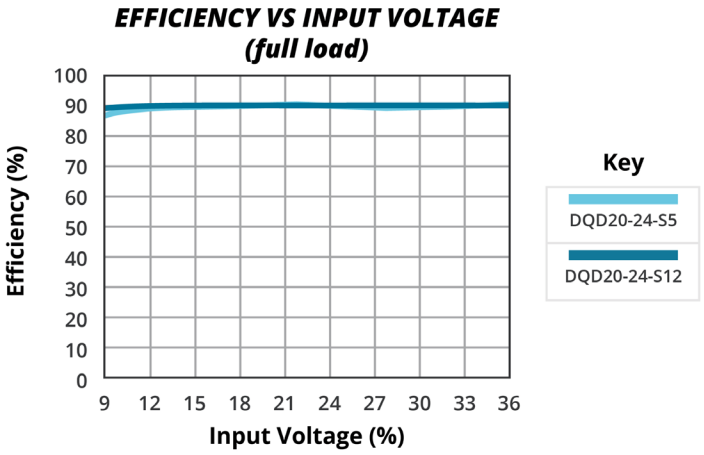
TEMPERATURE DERATING CURVE
dual output models
(full input voltage)

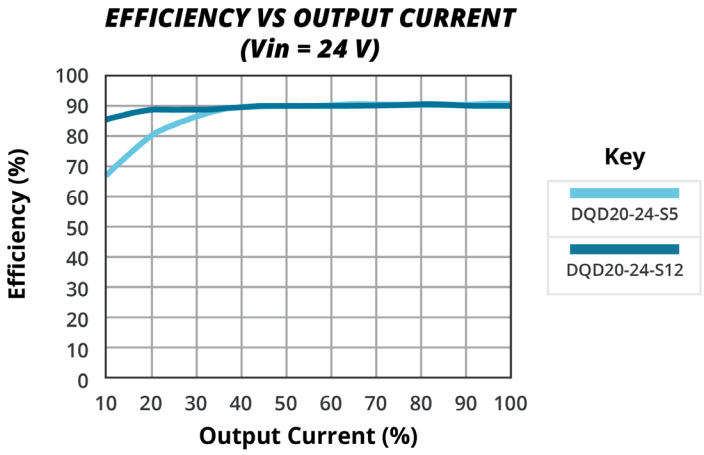


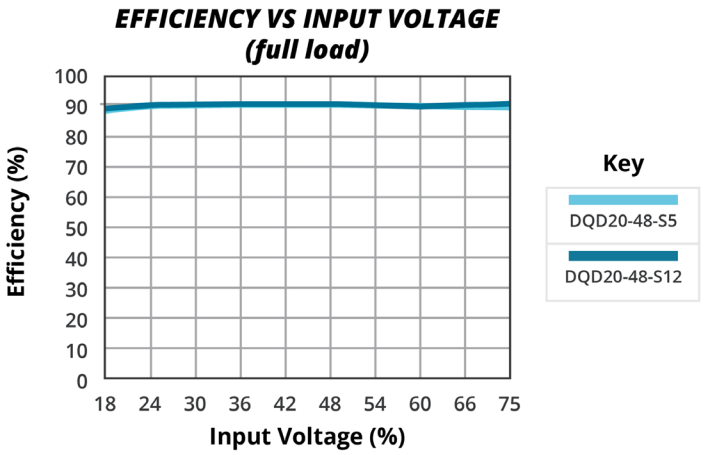
TEMPERATURE DERATING CURVE
dual output models
(full input voltage)

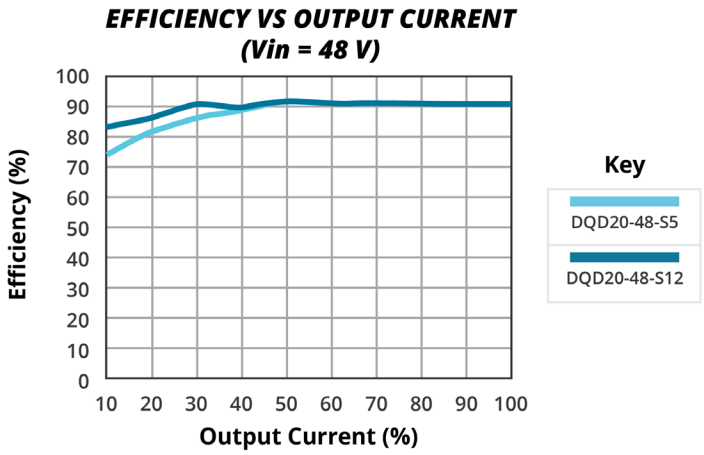


EFFICIENCY CURVES









RIPPLE AND NOISE TEST INSTRUCTION

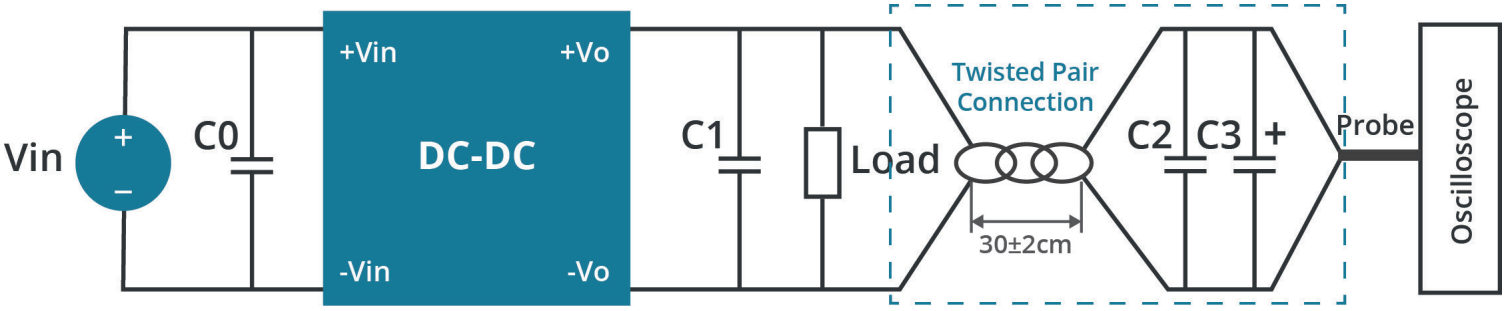
1. The ripple noise test requires the following setup:
- 12 twisted pair cables.
- An oscilloscope configured to Sample Mode with a bandwidth of 20 MHz.
- A 100 MHz bandwidth probe with the capacitor and ground removed.
- Capacitors C2 (0.1 µF), a polypropylene capacitor, and C3 (10 µF), a high-frequency, low-resistance electrolytic capacitor, connected in parallel to the probes and one side of the twisted pair.
- C0 and C1 refer to the application circuit as per the recommended specifications.

2. The ripple noise procedure:
Connect the module input terminal (INPUT) to the input power supply.
Attach the power output terminal to the electronic load (LOAD) using the power line.
Sample the output from the power output port using a 30 ± 2 cm twisted pair cable.
Ensure the cable is connected exclusively to the oscilloscope probe, maintaining proper polarity alignment.

3. It is recommended to operate with a minimum 5% load or to connect an electrolytic capacitor with a high-frequency resistance of at least 470 µF. Failure to do so may result in an increased output voltage ripple.

4. For dual-channel output products, it is advised to maintain a load imbalance within ±5%.

Figure 1



RIPPLE AND NOISE TEST CIRCUIT

Figure 2

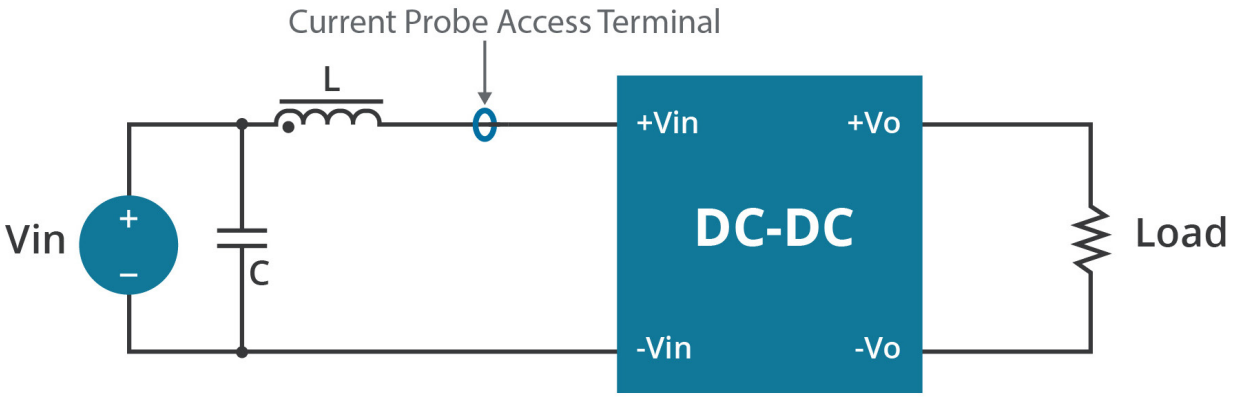


Table 1

COMPONENT	PARAMETER
C	220 µF/ 100 V
L	4.7 µH / 15 A

APPLICATION NOTES

Figure 3
Single output

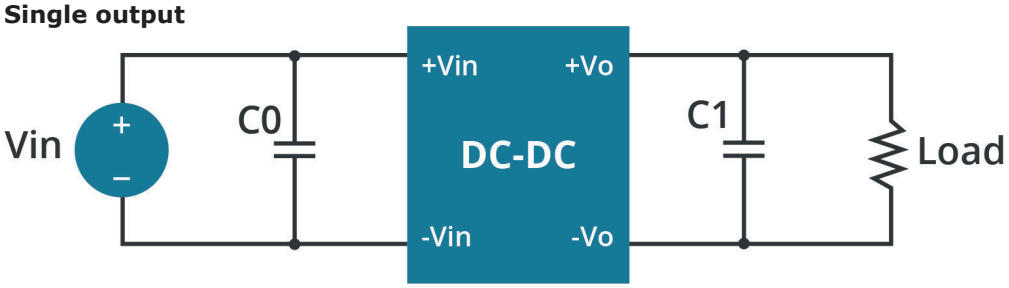


Table 2

COMPONENT	PARAMETER
C0	100 µF / 100 V
C1	22 µF / 100 V

Figure 4
Dual output

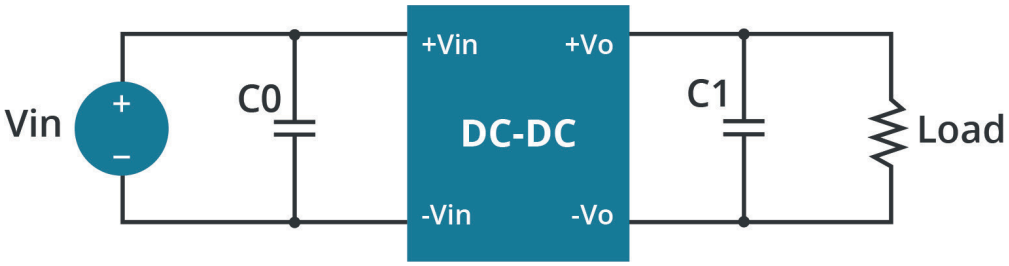


Table 3

COMPONENT	PARAMETER
C0	47-100 µF/ 100 V
C1	100 µF/ 100 V

EMC RECOMMENDED CIRCUIT

Figure 5
Single output

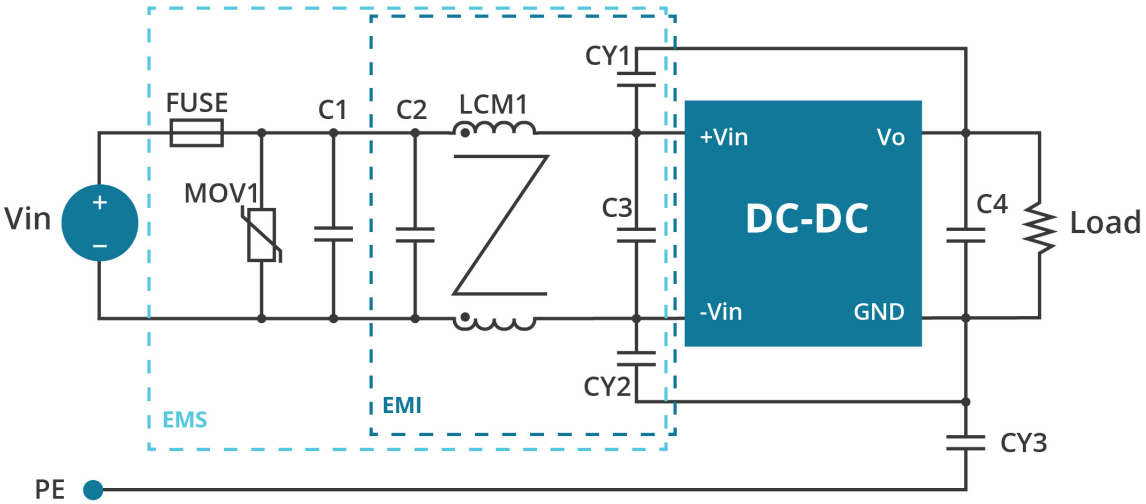


Table 4

COMPONENT	24 Vdc	48 Vdc
Fuse	TBD by customer	
MOV1	14D560K	14D101K
LCM1	5 mH	
C1, C2, C3	330 µF/50 V	330 µF/100 V
C4	47 µF/50 V	47 µF/50 V
CY1, CY2	2.2 nF/2 kV	

EMC RECOMMENDED CIRCUIT (CONTINUED)

Figure 6
Dual output

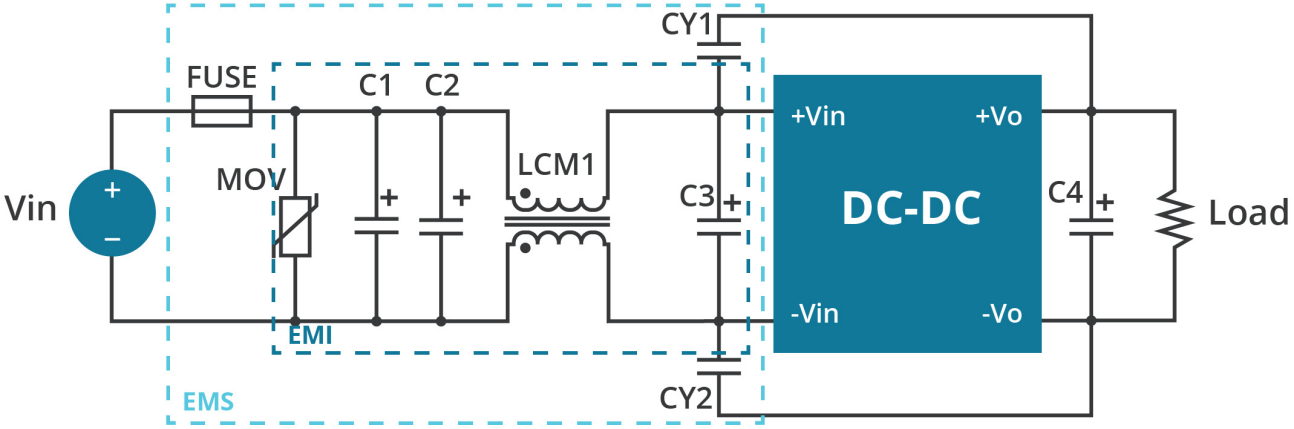


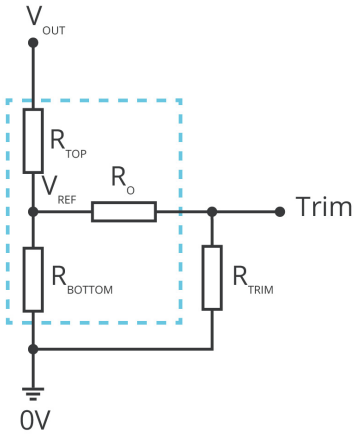
Table 5

COMPONENT	24 Vdc	48 Vdc
Fuse	TBD by customer	
MOV1	14D560K	14D101K
LCM1	5 mH	
C1, C2, C3	330 µF/50 V	330 µF/100 V
C4	47 µF/50 V	47 µF/50 V
CY1, CY2	2.2 nF/2 kV	

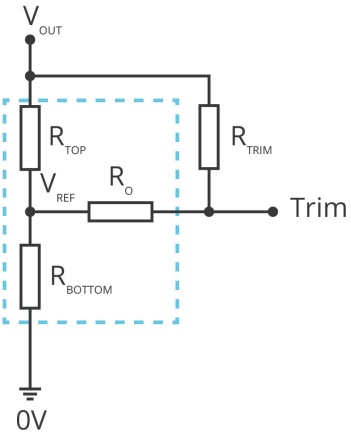
TRIM RESISTOR AND CALCULATION (SINGLE OUTPUT MODELS ONLY)

Figure 7

Trim up



Trim down



$$R_{TRIM} = \frac{a \cdot R_{BOTTOM}}{R_{BOTTOM} - a} - R_O \qquad a = \frac{V_{REF}}{V_{OUT} - V_{REF}} \cdot R_{TOP}$$

Formula for Trim up

$$R_{TRIM} = \frac{a \cdot R_{TOP}}{R_{TOP} - a} - R_O \qquad a = \frac{V_{OUT} - V_{REF}}{V_{REF}} \cdot R_{BOTTOM}$$

Formula for Trim down

Table 6

V_{NOM}	R_{TOP}	R_{BOTTOM}	R_O	V_{REF}
(Vdc)	(kΩ)	(kΩ)	(kΩ)	(V)
3.3	4.22	2.55	18	1.25
5	5.10	5.10	20	2.50
9	9.31	3.58	24	2.50
12	18.0	4.75	33	2.50
15	18.0	3.60	30	2.50
24	30.0	3.48	30	2.50
28	20.0	2.94	30	2.50

Note: Value for R_{TOP}, R_{BOTTOM}, R_O, and V_{REF} refer to Table 6 (fixed internal values).
R_{TRIM}: Trim resistance
a: User-defined parameter, no actual meanings
V_{NOM}: Nominal output voltage
V_{OUT}: Target output voltage

REVISION HISTORY

rev.	description	date
1.0	initial release	05/29/2025

The revision history provided is for informational purposes only and is believed to be accurate.

CUI INC
a bel group

15575 SW Sequoia Pkwy #100
Portland, OR 97224
800.275.4899

Fax 503.612.2383
belfuse.com
powersupport@belf.com