



Querom

Power Electronics



DDL4848-48

48V bidirectional DC/DC converter

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Description

The DDL4848-48 is a non-isolated, low voltage, high-power DC/DC Converter handling energy transfer between two ports (Port A and Port B) in either direction. During power transfer from Port A to Port B, the converter operates in buck mode and provides a reduced voltage level at Port B. In the reverse direction, the converter works in boost mode and increases the voltage level on Port A.

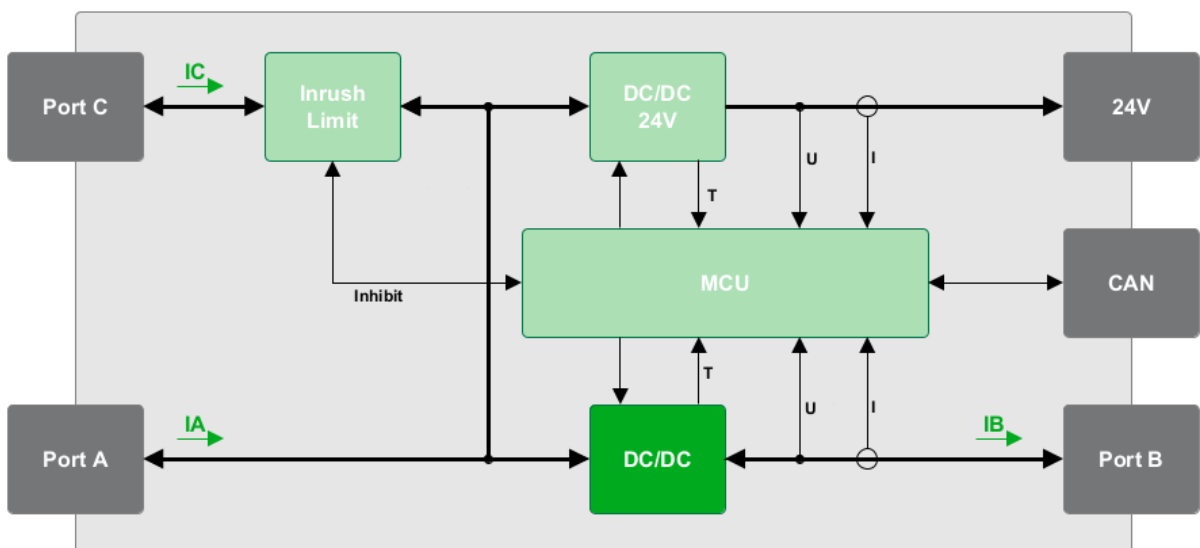
The dedicated input Port C in parallel to Port A is equipped with a circuitry limiting the inrush current. Therefore a connected power supply is prevented from high current load during startup.

An additional +24V constant voltage output features a power supply for a lot of applications. With the CAN interface, a variety of parameters can be set individually. Several safety functions e.g., overvoltage, overcurrent and overtemperature protection are integrated.



- Energy recovery (Recuperation)
- Programmable input/output
- High efficiency
- Remote control (CAN)
- Overload protection
- Low standby power consumption
- Port A input current up to 100A
- Port B input current up to -85A
- Inrush current limitation (Port C)
- Auxiliary 24V output

Technical Data Sheet



Converter basic principle

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Specification

The following parameters are valid for operation at 25°C and under nominal conditions, unless specifically stated otherwise. Nominal condition includes in particular $U_C > U_B$, $U_A > U_B$ and $U_A > 20V$.

General

Parameter	Symbol	Value			Unit	Comment
		min.	typ.	max.		
Overvoltage tol.						
Port A	$U_{A,pk}$	60	-	-	V	10s, No protection against reverse current
Port B	$U_{B,pk}$	60	-	-	V	
Port B Sense	$U_{Bsns,pk}$	60	-	-	V	
Port C	$U_{C,pk}$	60	-	-	V	
24V	$U_{24V,pk}$	27	-	-	V	
Inrush Current						
Port A	$I_{A,Inrush}$	-	-	$I_{A,nom,max}$	A	not actively limited
Port B	$I_{B,Inrush}$	-	-	$I_{B,nom,max}$	A	not actively limited
Dropout	$U_{A,B,Drop}$	-	-	2	V	$(U_{A,C} - U_B)$ at $I_{B,nom,max}$
Efficiency						
Port A to Port B	$\eta_{A,B}$	96	97	-	%	for $I_B > 0.5 \cdot I_{B,nom,max}$
Port B to Port A	$\eta_{B,A}$	94	95	-	%	for $I_{A,C} < 0.5 \cdot I_{A,nom,min}$
24V	η_{24V}	95	97	-	%	for $P_{24V} > 0.3 \cdot P_{24V,nom}$
Withstand Voltage Ports A,B,C to Case	$U_{Iso,wth}$	100	-	-	V	
Impedance Ports A,B,C to Case	Z_{Iso}	-	28		uF	Depending on EMC
Startup time ⁽¹⁾	t_{Setup}	-	-	1.5	s	

(1) Startup time is defined as the timespan between $U_{A,nom,max} > U_A > U_{A,nom,min}$ and start of operation of Ports A,B and 24V outputs.

Port A

Parameter	Symbol	Value			Unit	Comment
		min.	typ.	max.		
Voltage	$U_{A,nom}$	20	-	55	V	pk-pk, 20MHz, 47uF
Ripple&Noise	$U_{A,Ripple}$	-	-	500	mV	
Load Regulation	$dU_{A,Load}$	-1.0	-	1.0	V	
Line Regulation	$dU_{A,Line}$	0.25	-	0.25	V	
Current	$I_{A,min}$	-	-	-	A	$I_{A,min} = \eta \cdot (U_{B,min} \cdot I_{B,Set}) / U_{A,Set}$
Load transient						
Deviation	$d_{A,trans}$	-10	-	10	%	Load Jump 80/20%
Recovery	$t_{A,trans}$	-	-	200	ms	Relative to $U_{A,Set}$

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Port B

Parameter	Symbol	Value			Unit	Comment
		min.	typ.	max.		
Start Voltage	$U_{B,Start}$	14	-	-	V	MCU Wakeup Voltage without previous operation
Voltage	$U_{B,nom}$	0	-	55	V	Fully operational While $U_A > U_{A,nom,min}$ pk-pk, 20MHz, 47 μ F
Input	$U_{B,in,nom}$	22	-	55	V	
Derated Input. ⁽¹⁾	$U_{B,in,min}$	-	2	-	V	
Ripple&Noise	$U_{B,Ripple}$	-	-	200	mV	
Current	$I_{B,nom}$	-85	-	100	A	

(1) Available Power is limited by $U_B \cdot I_{B,nom,min}$

Port C

Parameter	Symbol	Value			Unit	Comment
		min.	typ.	max.		
Voltage	$U_{C,nom}$	20	-	55	V	Fully operational
Current	$I_{C,min}$	-	-	-	A	$I_{C,min} = \eta \cdot (U_{B,min} \cdot I_{B,Set}) / U_{A,Set}$
Inrush Limiter Deactivation Volt.	U_{IL}	-	4	-	V	Voltage differential for inrush current limitation
Resistance	R_{IL}	-	50	-	Ω	Resistor is shorted at inrush current limitation end
End Delay	t_{IL}	-	1	-	s	

24V Output

Parameter	Symbol	Value			Unit	Comment
		min.	typ.	max.		
Voltage	$U_{24V,nom}$	-	24	-	V	Fixed Line + Load + Setpoint pk-pk, 20MHz, 47 μ F
Tolerance	$dU_{24V,all}$	-0.72	-	0.72	V	
Ripple&Noise	U_{24V_Ripple}	-	-	200	mV	
Rise time ⁽¹⁾	t_{24V_rise}	-	-	100	ms	
Current	$I_{24V,cont}$	6.5	-	-	A	
Limit	$I_{24V,lim}$	-	-	8	A	
Power	$P_{24V,nom}$	150	-	-	W	

(1) Rise time is defined from the point of time where $U_A \geq U_{A,nom}$ is applied for $t > t_{Setup}$ and the point of time where $U_{24V} = U_{24V,nom} \pm dU_{24V,all}$

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Port A Control

Parameter	Symbol	Value			Unit	Comment
		min.	typ.	max.		
Voltage Setpoint	$U_{A,Set}$	20	-	53	V	CAN programmable
Tolerance	$dU_{A,Set}$	-1.0	-	1.0	V	
Resolution	$S_{A,Set,nom}$	-	10	-	mV/Bit	

Port B Control

Parameter	Symbol	Value			Unit	Comment
		min.	typ.	max.		
Input Current Setpoint	$I_{B,In,Set}$	-15	-	-85	A	CAN programmable
Tolerance	$dI_{B,In,Set}$	-5	-	5	A	
Resolution	$S_{I_{B,In,Set,nom}}$	-	10	-	mA/Bit	
Input Power Resolution	$P_{In,Set}$ $S_{P,In,nom}$	-3000	-	-300	W W/Bit	CAN programmable
Output Voltage Setpoint	$U_{B,Out,Set}$	6	-	50	V	CAN programmable
Tolerance	$dU_{B,Out,Set}$	-0.5	-	0.5	V	
Resolution	$S_{U_{B,Out,Set,nom}}$	-	10	-	mV/Bit	
Output Current Setpoint	$I_{B,Out,Set}$	15	-	100	A	CAN programmable
Tolerance	$dI_{B,Out,Set}$	-5	-	5	A	
Resolution	$S_{I_{B,Out,Set,nom}}$	-	10	-	mA/Bit	
Output Power Resolution	$P_{Out,Set}$ $S_{P,Out,nom}$	500	-	5000	W W/Bit	CAN programmable
Output Delay Resolution	$t_{Out,del,Set}$ $S_{t,Out,del,nom}$	100	-	5000	ms ms/Bit	CAN programmable

Port C Control

Parameter	Symbol	Value			Unit	Comment
		min.	typ.	max.		
Port C to A threshold Resolution	$U_{CA,thr,Set}$ $S_{UCA,thr,nom}$	900	-	5000	mV mV/Bit	CAN programmable

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Monitoring

Parameter	Symbol	Value			Unit	Comment
		min.	typ.	max.		
Sense Resolution	n_{sns}	-	12	-	Bit	
Sense Bandwidth	f_{sns}	50	-	-	Hz	
Voltage Sense Tolerance	dU_{sns}	-0.5	-	0.5	V	
Slope	$S_{U_{\text{sns}},\text{nom}}$	-	10	-	mV/Bit	
Current Sense Port A tolerance	$dI_{A,\text{sns}}$	-10	-	10	A	for $I_B > 0.2 \cdot I_{B,\text{nom},\text{max}}$ for $I_B > 0.2 \cdot I_{B,\text{nom},\text{max}}$
Port B tolerance	$dI_{B,\text{sns}}$	-5	-	5	A	
Slope	$S_{I_{\text{sns}},\text{nom}}$	-	10	-	mA/Bit	
Temperature Sense Tolerance	dT_{sns}	-5	-	5	°C	
Slope	$S_{T_{\text{sns}},\text{nom}}$	-	1	-	°C/Bit	

Environmental Conditions

Parameter	Symbol	Value			Unit	Comment
		min.	typ.	max.		
Storage Temperature	T_{Stor}	-25	-	60	°C	
Ambient Temperature	$T_{\text{amb},\text{nom}}$	0	-	80	°C	
Baseplate Temperature	$T_{\text{base},\text{nom}}$	0	-	55	°C	
Thermal Protection Limit	$T_{\text{Base,Prot}}$	60	-	-	°C	Converter will be deactivated above 60°C
Humidity	φ_{Nom}	20	-	95	%	Non-condensing
Airflow	V_{Air}	0	-	-	m/s	No Airflow

Mechanical

Parameter	Symbol	Value			Unit	Comment
		min.	typ.	max.		
Size						
Width	W	-	142.1	-	mm	Connectors mounted on short sides (W)
Height	H	-	45	-	mm	
Depth	D	-	183	-	mm	
Weight	M	-	1	-	kg	

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Certification

Parameter	Standard	Comment
Safety	EN62368-1	
Emission	EN61000-6-4	
Immunity	EN61000-6-2	Basic standards: EN61000-4-2, EN61000-4-3, EN61000-4-4, EN61000-4-5, EN61000-4-6, EN61000-4-8, EN61000-4-11

Notice:

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Document history

Version	Date	Author	Reason for change
V1.0	17.04.2024	JS	Initial
V1.1	22.05.2024	JS	CD; Block diagram; Mechanical data
V1.2	31.05.2024	JS	Layout rework, editorial changes
V1.3	16.07.2024	JS	New cover slide

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