
Querom
Power Electronics
Preliminary Preliminary
Querom
DDL5096-96
96V bidirectional DC/DC converter

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DDL5096-96

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Description

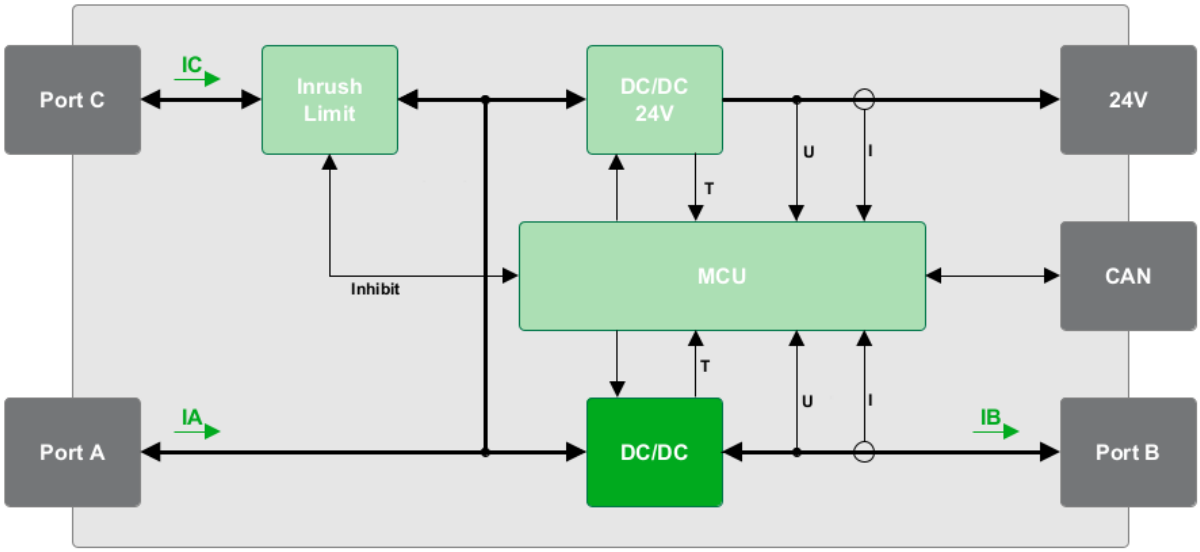
The DDL5096-96 is a non-isolated, low voltage, high-power DC/DC Converter handling energy transfer between two ports (Port A and Port B) in either direction. During power transfer from Port A to Port B, the converter operates in buck mode and provides a reduced voltage level at Port B. In the reverse 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. Therefor 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 50A
- Port B input current up to -40A
- 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 min.	Value typ.	Value max.	Unit	Comment
Overvoltage tol.						
Port A	$U_{A,pk}$	120	-	-	V	
Port B	$U_{B,pk}$	120	-	-	V	
Port B Sense	$U_{Bsns,pk}$	120	-	-	V	
Port C	$U_{C,pk}$	120	-	-	V	
24V	$U_{24V,pk}$	27	-	-	V	10s, No protection against reverse current
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	$U_{Iso,wth}$	200	-	-	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 min.	Value typ.	Value max.	Unit	Comment
Voltage	$U_{A,nom}$	20	-	110	V	
Ripple&Noise	$U_{A,Ripple}$	-	-	500	mV	pk-pk, 20MHz, 47µF
Load Regulation	$dU_{A,Load}$	-2.0	-	2.0	V	
Line Regulation	$dU_{A,Line}$	0.5	-	0.5	V	
Current	$I_{A,min}$	-	-	-	A	$I_{A,min} = \eta \cdot (U_{B,min} \cdot I_{B,Set}) / U_{A,Set}$
Load transient				-		Load Jump 80/20%
Deviation	$d_{A,trans}$	-10	-	10	%	Relative to $U_{A,Set}$
Recovery	$t_{A,trans}$	-	-	200	ms	

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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	-	100	V	
Input	$U_{B,in,nom}$	22	-	110	V	Fully operational
Derated Input.(1)	$U_{B,in,min}$	-	2	-	V	While $U_A > U_{A,nom,min}$
Ripple&Noise	$U_{B,Ripple}$	-	-	400	mV	pk-pk, 20MHz, 47µF
Current	$I_{B,nom}$	-40	-	50	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	$U_{C,nom}$	40	-	110	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	
End Delay	t_{IL}	-	1	-	s	Resistor is shorted at inrush current limitation end

24V Output

Parameter	Symbol	Value			Unit	Comment
		min.	typ.	max.		
Voltage	$U_{24V,nom}$	-	24	-	V	Fixed
Tolerance	$dU_{24V,all}$	-0.72	-	0.72	V	Line + Load + Setpoint
Ripple&Noise	U_{24V_Ripple}	-	-	200	mV	pk-pk, 20MHz, 47µF
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						CAN programmable
Setpoint	$U_{A,Set}$	20	-	106	V	
Tolerance	$dU_{A,Set}$	-2.0	-	2.0	V	
Resolution	$S_{A,Set,nom}$	-	10	-	mV/Bit	

Port B Control

Parameter	Symbol	Value			Unit	Comment
		min.	typ.	max.		
Input Current						CAN programmable
Setpoint	$I_{B,In,Set}$	-7	-	-40	A	
Tolerance	$dI_{B,In,Set}$	-2,5	-	2,5	A	
Resolution	$S_{IB,In,Set,nom}$	-	10	-	mA/Bit	
Input Power	$P_{In,Set}$	-3000	-	-300	W	CAN programmable
Resolution	$S_{P,In,nom}$	-	1	-	W/Bit	
Output Voltage						CAN programmable
Setpoint	$U_{B,Out,Set}$	10	-	100	V	
Tolerance	$dU_{B,Out,Set}$	-1	-	1	V	
Resolution	$S_{UB,Out,Set,nom}$	-	10	-	mV/Bit	
Output Current						CAN programmable
Setpoint	$I_{B,Out,Set}$	7	-	50	A	
Tolerance	$dI_{B,Out,Set}$	-2,5	-	2,5	A	
Resolution	$S_{IB,Out,Set,nom}$	-	10	-	mA/Bit	
Output Power	$P_{Out,Set}$	500	-	5000	W	CAN programmable
Resolution	$S_{P,Out,nom}$	-	1	-	W/Bit	
Output Delay	$t_{Out,del,Set}$	100	-	5000	ms	CAN programmable
Resolution	$S_{t,Out,del,nom}$	-	10	-	ms/Bit	

Port C Control

Parameter	Symbol	Value			Unit	Comment
		min.	typ.	max.		
Port C to A threshold	$U_{CA,thr,Set}$	900	-	5000	mV	CAN programmable
Resolution	$S_{UCA,thr,nom}$	-	10	-	mV/Bit	

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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 Slope	 dU_{sns} $S_{Usns,nom}$	 -0.5 -	 - 10	 0.5 -	 V mV/Bit	
Current Sense Port A tolerance Port B tolerance Slope	 $dI_{A,sns}$ $dI_{B,sns}$ $S_{Isns,nom}$	 -10 -5 -	 - - 10	 10 5 -	 A A mA/Bit	 for $I_B > 0.2 \cdot I_{B,nom,max}$ for $I_B > 0.2 \cdot I_{B,nom,max}$
Temperature Sense Tolerance Slope	 dT_{sns} $S_{Tsns,nom}$	 -5 -	 - 1	 5 -	 °C °C/Bit	

Environmental Conditions

Parameter	Symbol	Value			Unit	Comment
		min.	typ.	max.		
Storage Temperature	T_{Stor}	-25	-	60	°C	
Ambient Temperature	$T_{amb,nom}$	0	-	80	°C	
Baseplate Temperature	$T_{base,nom}$	0	-	55	°C	
Thermal Protection Limit	$T_{Base,Prot}$	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 Height Depth	 W H D	 - - -	 142.1 45 234	 - - -	 mm mm mm	Connectors mounted on short sides (W)
Weight	M	-	1,2	-	kg	

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Certification

Parameter	Standard	Comment
Safety	tbd	
Emission	tbd	
Immunity	tbd	

Notice:

The product information and specifications may be subject to changes even without prior written notice. The product has been designed for various applications; its suitability lies in the responsibility of each customer. The products are not authorized for use in safety-critical applications without Querom's explicit written consent. A safety-critical application is an application where a failure may reasonably be expected to endanger or cause loss of life, inflict bodily harm or damage property. The applicant shall indemnify and hold harmless Querom, its affiliated companies and its representatives against any damage claims in connection with the unauthorized use of Querom products in such safety-critical applications.

Document history

Version	Date	Author	Reason for change
V1.0	04.07.2024	JS	Initial
V1.1	10.07.2024	AM	Preliminary

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