



48/12V DC/DC converter for commercial and off-highway vehicles

Efficient and robust power conversion

Designed to provide 48V to 12V power conversion for heavy-duty applications, the 41040 DC/DC converter offers reliable system performance and flexibility.

- Wide input voltage range
- Under and over voltage protection
- Reverse voltage protection
- Voltage transient protection
- Overload and short circuit protection
- Thermal overload protection
- Sealed from the elements
- Converter enable signal
- CAN communication (isolated CAN optional)
- Field configurable parallel mode

Applications:

- On-highway class 8 trucks
- Construction
- Agriculture
- Golf carts
- Electric utility vehicles

Operation

The 41040C11 DC/DC converter is designed to step down the input voltage in order to achieve the appropriate output voltage.

The converter uses two buck power stages in parallel. The multiphase buck converter architecture uses interleaved timing to multiply power stage ripple frequency and reduce input and output ripple currents. It provides a fixed output to power 12V loads directly from a 56V or 48V source.



Powering Business Worldwide

41040 DC/DC converter key features

PROTECTION FEATURES:

Feature	Description
Reverse Input Polarity Protection	Reversal of the input polarity is protected with a MOSFET in series with the Input.
Immunity to single point of failure	Back to back input MOSFETs decouple the load in case of Buck MOSFET failure
Parallel Mode	Enabled via CAN, the parallel mode feature will reduce the output voltage when there is an increased load demand to improve current sharing between the parallel converters.
Under/Over Voltage Protection	Input under-voltage and over-voltage conditions cause the unit to safely turn off.
Current Limiting Protection	Current limiting protection is provided by monitoring the buck MOSFET current. A small overload will cause the protection circuit to limit the input power by dropping the output voltage out of regulation.
Overload Protection	If there is a severe overload or short circuit and the output Voltage drops below 5V, the converter will go into hiccup mode to protect itself.
Thermal Protection	Thermal protection is provided by monitoring the unit PCB temperature. Protection circuit will derate the unit's output to keep the heatsink temperature below 100C.
Output back feeding protection	Converter continuously monitors input and output voltage and can decouple Input and output when a back feeding condition is detected



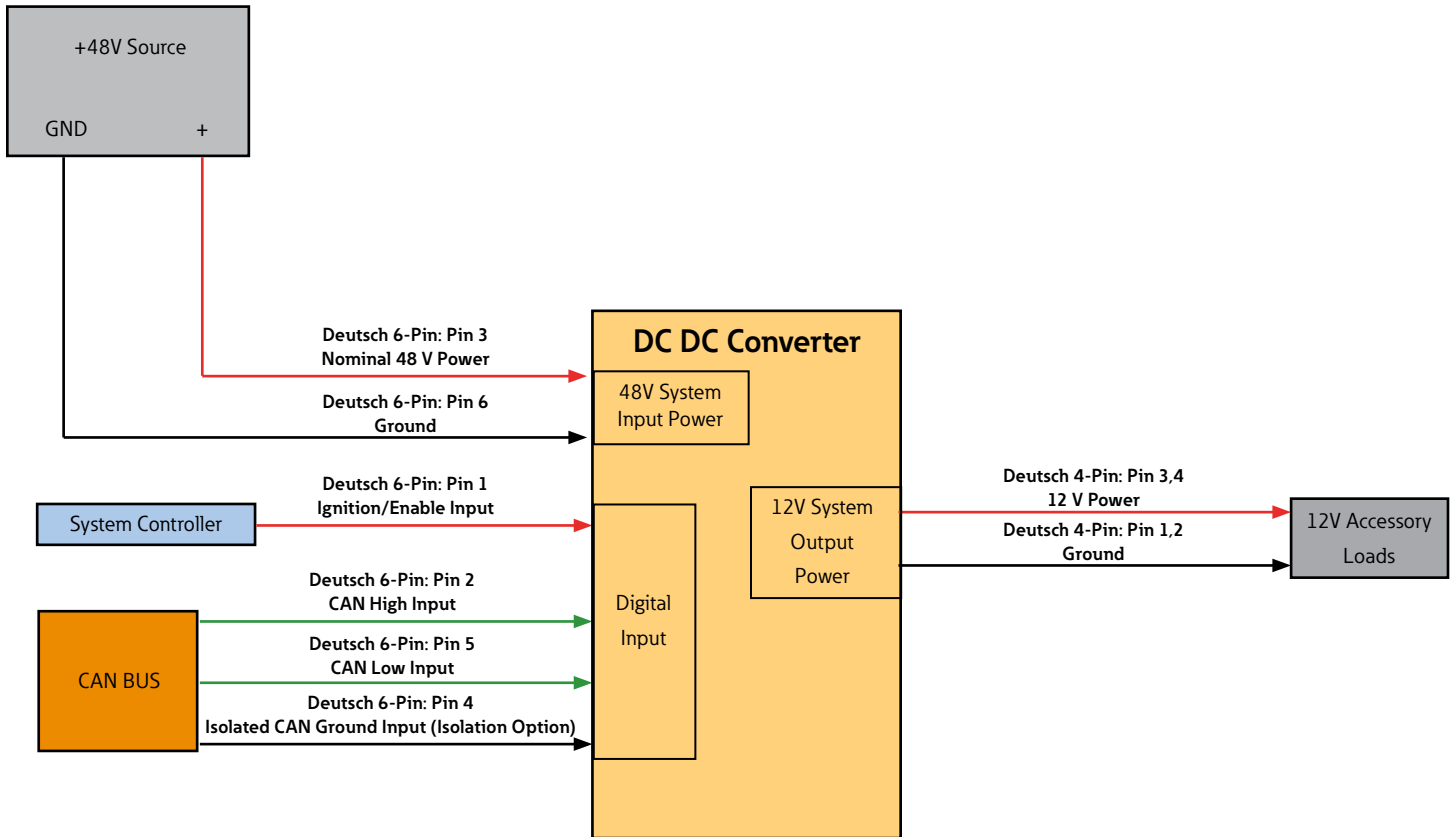
Electrical characteristics

Unless otherwise stated, conditions apply to full temperature range and full input voltage range.

Characteristic	MIN	TYP	MAX	Unit	Notes:
Input under voltage turn on		11.75	12.0	V	
Input under voltage hysteresis		2		V	
Input over voltage turn off	75.0	75.50	76	V	Voltage on INPUT that causes the unit to turn off.
Input over voltage hysteresis		2		V	
Quiescent current enable off (converter)			2	mA	Current draw from the INPUT with Enable off. $V_{IN} = 48V$
Quiescent current enable on (enable pin)		1		mA	Current draw from the Enable pin when applying 48V to that pin at 25C.
Quiescent current Enable on (vin pin)		30		mA	Current draw from the INPUT with no load attached to OUTPUT. $V_{IN} = 48V$
Enable turn on voltage	4.4	4.9	5.4	V	Unit will turn on when input Voltage is within a valid range and Enable voltage is >4.4V
Enable turn off voltage		4.4		V	Unit will turn off If Enable voltage drops below 4.4V
Output voltage (no load)	13.6	13.8	14.0	V	When $75 > V_{in} > 16V$
Output voltage	$V_{in} - 3V$	$V_{in} - 2.5V$		V	When $16 > V_{in} > 10V$
Output voltage (full load)	13.46		14.14	V	
Output voltage (Full load – parallel mode enabled)	12.65		13.05	V	Output voltage when parallel mode is enabled
Line regulation			0.5	%	$V_{in} \geq 16V$
Output current limit	42	45	47	A	$V_{in} \geq 44V$
Maximum output current	50		60	A	If exceeded, converter will go into hiccup mode. Unit will attempt to restart every 500ms and It will latch off after 3 retries
Ripple voltage			0.5	V_{p-p-k}	
Maximum input current		13		A	If $V_{in} < 44V$ the converter will lower the maximum input power to protect the input connector.
Efficiency	90		94	%	With $V_{in} \geq 48V$, 25C 20%-100% load
Over-temp limit		100		°C	Converter will lower its current limit threshold to keep the heatsink temperature below 100°C
Isolation			± 333	V	Test between the power terminals and the enclosure/chassis and between 48V power, enable, and ground.



Typical wiring diagram



CAN Bus Overview

- J1939 Protocol Compliant
- CAN Bus Autobaud
- Default Source/Node Address = 0xD0
- Converter command messages sent with Proprietary A PGN: 0xEF00
- Equalizer status messages sent with Proprietary B PGN: 0xFF00
- Proprietary B PGN Offset Default: 0x00



Electromagnetic compatibility:

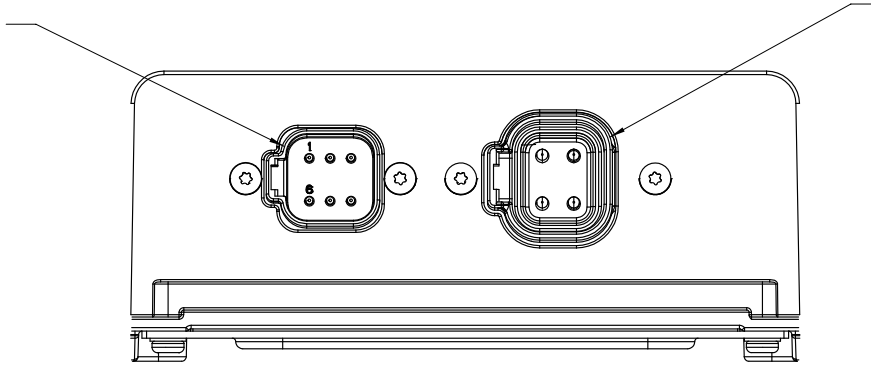
Transient Immunity Tests	Level	Notes:
Starting Profile	12V system	Per ISO 16750-2:2012 (12V system applied to power input), Severity IV, Class B
Superimposed Alternating Voltage	12V system	ISO 16750-2:2012 (12 V System) Severity:3
Load Dump - Clamped	12V system	Per ISO 16750-2:2012, 12V system (Figure 9) I>55A, Class A
Negative switching spikes	12V system	Per ISO 7637-2 ((12 V System,Test Pulse 3a) Severity: II, Class A
Positive switching spikes	12V system	Per ISO 7637-2 (12 V System,Test Pulse 3b) Severity: II, Class A
Parallel Inductive Load Switching	12V system	Severity: IV, Class A
Negative Mutual Coupling	12V system	Per ISO 7637-3 (12 V System, Test Pulse a) Severity: IV, Class C
Positive Mutual Coupling	12V system	Per ISO 7637-3 (12 V System, Test Pulse b) Severity: IV, Class A
Wiring Harness Inductive switching	12V system	ISO 7637-2 (12 V System, Test Pulse 2a) Severity: II, Class A
Electrostatic Discharge Immunity	Level	Notes:
ESD Component Handling	+/-15KV air +/- 8KV contact	ISO1065 (150pF, 2KOhm)
ESD Component Powered Direct Discharge	+/-15KV air +/- 8KV contact	ISO1065 (330pF, 3000hm)
ESD Component Powered Direct Indirect Discharge	+/-15KV air +/- 8KV contact	ISO1065 (330pF, 3000hm)
Emissions	Level	Notes:
Radiated Emissions	Class 2	CISPR 25 Ed. 3 2016
Conducted Emissions	Class 2	CISPR 25 Ed.3 2016
Immunity to Radiated Electromagnetic Fields	Level	Notes:
Conducted immunity (BCI)	120mA	ISO11452-4 (2011), 120mA. 1MHz-400MHz, Status II
Radiated Immunity	100V/m	ISO11452-2, (2019), 80MHz-1GHz,,Status II

Environmental loading

Loading	Parameter	Standard	Level/Description
Thermal Stress	Thermal Cycle	-40°C to +85°C 12 (8hr) Cycles, operational end of cold soak thru end of hot soak.	10 day humidity cycle test, durations of 24 hrs, RH 80-95%, temperatures of -10°C,, 25°C,, & 65°C
	Storage Temperature	Eaton Defined	-40°C - 85°C, 24 hrs at each temp
	Humidity	SAE J1455, Rev Aug 94, Section 4.2.3 Fig. B	0 to 95% RH, -40C to 85C 8hrs/ cycle, 6 cycles
	Storage Temperature	Per SAE J1455, Sec. 4.1.3.2, Fig. 2C	Non-powered. -40°C to +85°C Cold to Hot Transition ~ 1 minute. 2 hr Dwell; 20 cycles
	Immersion	per MIL-STD-810G Method 512.5, Procedure 1	1 meter, 30 min
Corrosion Resistance	Water Ingress	DIN40050 T9, IPX9K	Fan nozzle, sample on turntable at 1 rotation per min., distance of 100 to 150mm at 0, 30, 60 and 90 deg., 30 s per position.
Mechanical	Salt Environment	Per ASTM B 117-07 and IEC60068-2-11, Part 2, Test Ka	96 hrs., 5% solution, 35°C ambient
	Random Vibration	MIL-STD-202G, Method 214A, Fig.214-1, Test Condition 1C	9.26grms, 8hr/axis, 5-2000Hz
	Operating Shock	Per MIL-STD-202G, Method 213B, Test Condition J	30g, 11ms, Half Sine, 3 pulses per direction, all axis
	Bench handling shock	per SAE J1455, Rev. JUN2006, Sec. 4.11.3.1	1 m, one time in each of the three mutually perpendicular planes

Connection diagram

DEUTSCH DT04-6P	
PIN	DESCRIPTION
1	IGNITION
2	CAN_HI
3	VIN
4	CAN_GND
5	CAN_LO
6	GND



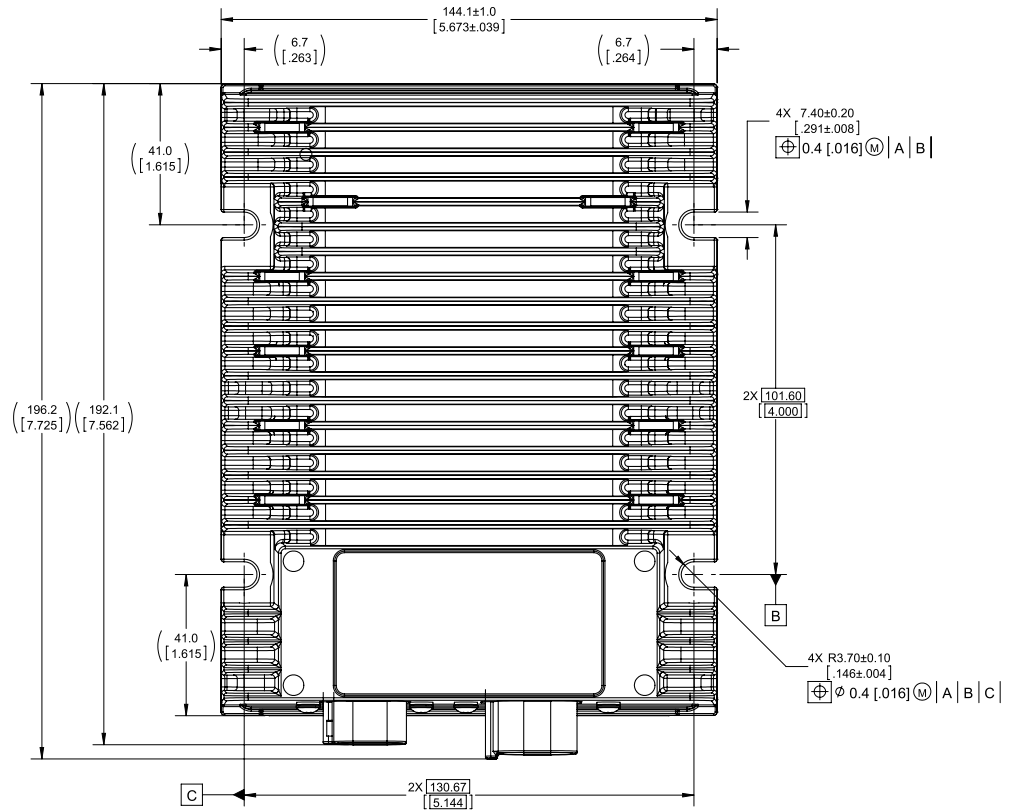
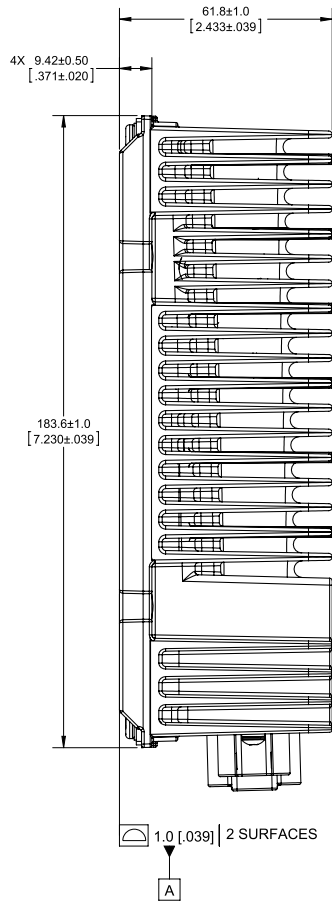
DEUTSCH DTP04-4P	
PIN	DESCRIPTION
1	GND
2	GND
3	VOUT
4	VOUT

41040 DC/DC converter dimensions

Finish: Powder coat

Weight: 1.7 kg

Mounting Slots: 4X, Accepts M6 or 1/4" Hardware (not included)



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