

Case Study: Solving the low temperature and rapid temperature change demands on DC/DC converters in aircraft

A very common cause of DC/DC converter failures is heat. The expansion and contraction of potting materials can cause it to crack, which can lead to cracking of addition components inside of a DC/DC converter.



MEGA was tasked by a commercial aviation instrumentation manufacturer to create a converter to handle the rigors of being mounted in the wing of an aircraft. The manufacturer needed a converter that was guaranteed to start up at a -55C and be able to handle rapid increases and decreases in the temperature range that are experienced by an airplane that might be sitting on the runway in Vegas at 120 degrees Fahrenheit and 10 minutes later be at 30,000 feet and at -30F. Rather than reinvent the wheel, MEGA took an existing product line, our CD15IDD series, and made a few modifications, including the use of a high quality silicon potting material, to meet the temperature requirements.

MEGA is now testing each of the converters to confirm the -55C start up temperature is met during our manufacturing process, eliminating failures of completed converters. MEGA's customer had a stringent incoming test for this start up temperature that destroyed half the incoming parts previously being supplied by our competitor and had another 25% failure rate in the field. MEGA's testing before leaving the factory has eliminated the incoming test at the customer, resulting in a 0% defect rate over the past two years. As this is used to run a number of sensors in the wing, this is saving the end user millions of dollars in down time.

Please see attached the spec for MEGA CD15IDD12D4U/X1 and the CD15IDD series on which this modified part is based. For more information contact us at info@megaelectronics.com or 732-249-2656.

DC-DC POWER MODULE FOR HARSH ENVIRONMENTS

15W DUAL OUTPUTS

4:1 Input Range

I/O Isolation

Input Pi Filter

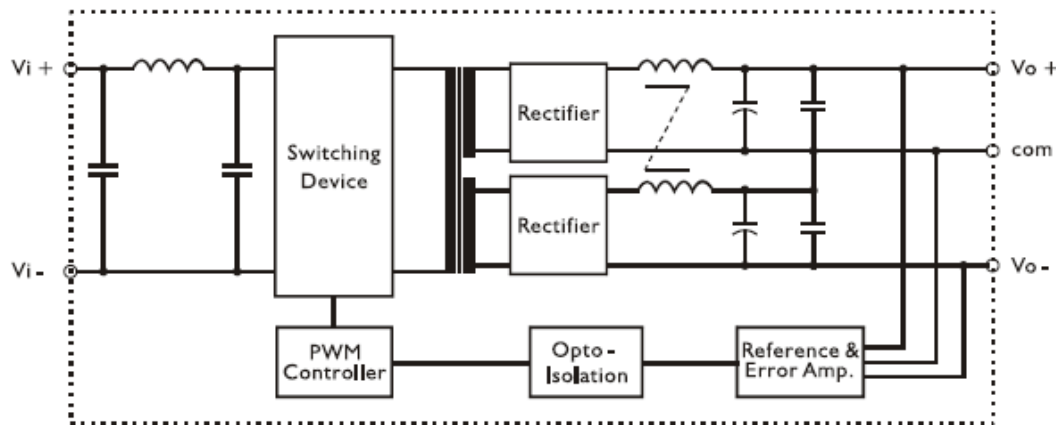
Short Circuit Protection



Each individual converter is tested to a -55C start up temperature before released from production. The converters have Silicon Potting Material. Cover plate material is PPS (GS-40), with case Acrylic coating. The base metal material in copper, pin material is Tin plated on the Nickel plated copper.

DUAL OUTPUT MODELS						
Part Number	Input Voltage	Output Wattage	Output Voltage	Output Current	Efficiency (typical)	Efficiency (minimum)
CD15IDD12D4U/X1	9-36 VDC	15 Watts	+/-12VDC	+/-630mA	82%	80%

CIRCUIT SCHEMATIC



All Specifications Typical at Nominal Line, Full Load, 25 C Unless Noted Otherwise

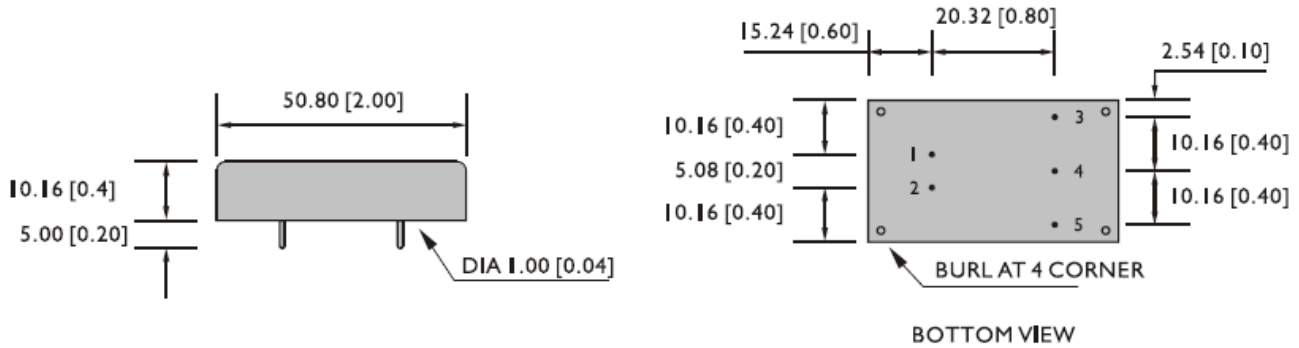
GENERAL					
Characteristics	Conditions	Min	Typ	Max	Unit
Switching frequency	Vi nom, Io nom		200		KHz
Isolation Voltage	Input/Output	1,500			VDC
Isolation Resistance	Input/Output, @500VDC	100			M Ω
Ambient Temp	Operating at Vi nom, Io nom	-55		+71	C
Case Temperature	Operating at Vi nom, Io nom			+100	C
Derating	Vi nom	See derating curve			%/C
Storage Temp.	Non Operational	-55		+100	C
Cooling	Free air convection				

INPUT SPECIFICATIONS					
Characteristics	Conditions	Min	Typ	Max	Unit
Input Voltage Range	Ta min...Ta Max, Io nom	9	24	36	VDC
No load input current	Vi = nom, Io = 0			25	mA
Input voltage w/o damage	Io Nom			40	VDC
Startup voltage	Io Nom		8.5		VDC
Input filter	PI type				

OUTPUT SPECIFICATIONS					
Characteristics	Conditions	Min	Typ	Max	Unit
Output voltage accuracy	Vi nom, Io nom			+/-2	%
Minimum load	Vi nom dual output model (each output)	10			%
Line regulation	Io nom, Vi min ... Vi max			+/-1	%
Load regulation	Vi nom, Io 0 ... Io nom, single output models			+/-2	%
	Vi nom, Io min ... Io nom, dual output models			+/-5	%
Transient recovery time	25% load, step change		500		μ S
Temperature coefficient	Vi nom, Io nom			+/-0.02	%/C
Ripple & Noise	Vi nom, Io nom, BW =20MHz			150	mV

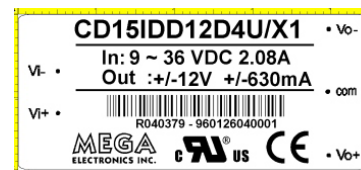
Control & Protection	
Input Reversed	Shunt diode built in, external fuse recommended
Output short circuit	Continuous

mm [inch]



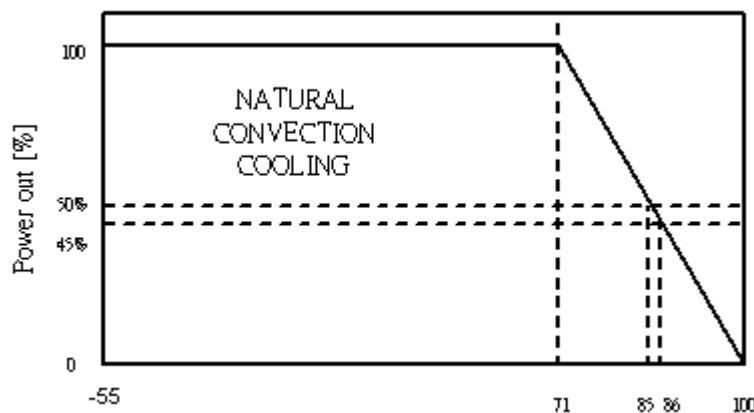
Metal case, weight 33 g

Case Label



PIN ASSIGNMENT					
Pin No	1	2	3	4	5
DUAL	Vi+	Vi-	Vo+	com	Vo-

DERATING @ Ambient Temperature C



DC-DC POWER MODULE
13.2~15W SINGLE & DUAL OUTPUTS
2:1 & 4:1 Input Range
I/O Isolation
Input Pi Filter
Short Circuit Protection



SINGLE OUTPUT MODELS						
Part Number	Input Voltage	Output Wattage	Output Voltage	Output Current	Efficiency (typical)	Efficiency (minimum)
CD15IDD03S1U	9~18 VDC	13.2 Watts	3.3 VDC	4000mA	82%	80%
CD15IDD05S1U	9~18 VDC	15 Watts	5VDC	3000mA	84%	82%
CD15IDD12S1U	9~18 VDC	15 Watts	12VDC	1250mA	87%	85%
CD15IDD15S1U	9~18 VDC	15 Watts	15VDC	1000mA	89%	87%
CD15IDD03S2U	18~36 VDC	13.2 Watts	3.3 VDC	4000mA	83%	81%
CD15IDD05S2U	18~36 VDC	15 Watts	5VDC	3000mA	85%	83%
CD15IDD12S2U	18~36 VDC	15 Watts	12VDC	1250mA	88%	86%
CD15IDD15S2U	18~36 VDC	15 Watts	15VDC	1000mA	89%	87%
CD15IDD03S3U	35~75 VDC	13.2 Watts	3.3 VDC	4000mA	83%	81%
CD15IDD05S3U	35~75 VDC	15 Watts	5VDC	3000mA	85%	83%
CD15IDD12S3U	35~75 VDC	15 Watts	12VDC	1250mA	88%	86%
CD15IDD15S3U	35~75 VDC	15 Watts	15VDC	1000mA	89%	87%

DUAL OUTPUT MODELS						
Part Number	Input Voltage	Output Wattage	Output Voltage	Output Current	Efficiency (typical)	Efficiency (minimum)
CD15IDD05D1U	9~18 VDC	15 Watts	+/-5VDC	+/-1500mA	84%	82%
CD15IDD12D1U	9~18 VDC	15 Watts	+/-12VDC	+/-630mA	87%	85%
CD15IDD15D1U	9~18 VDC	15 Watts	+/-15VDC	+/-500mA	87%	85%
CD15IDD05D2U	18~36 VDC	15 Watts	+/-5VDC	+/-1500mA	86%	84%
CD15IDD12D2U	18~36 VDC	15 Watts	+/-12VDC	+/-630mA	88%	86%
CD15IDD15D2U	18~36 VDC	15 Watts	+/-15VDC	+/-500mA	89%	87%
CD15IDD05D3U	35~75 VDC	15 Watts	+/-5VDC	+/-1500mA	86%	84%
CD15IDD12D3U	35~75 VDC	15 Watts	+/-12VDC	+/-630mA	88%	86%
CD15IDD15D3U	35~75 VDC	15 Watts	+/-15VDC	+/-500mA	89%	87%

All Specifications Typical at Nominal Line, Full Load, 25 C Unless Noted Otherwise

GENERAL					
Characteristics	Conditions	Min	Typ	Max	Unit
Switching frequency	Vi nom, Io nom		200		KHz
Isolation Voltage	Input/Output	1,500			VDC
Isolation Resistance	Input/Output, @500VDC	100			MΩ
Ambient Temp	Operating at Vi nom Io nom	-40		+71	C
Case Temperature	Operating at Vi nom, Io nom			+100	C
Derating	Vi nom	See derating curve			%/C
Storage Temp.	Non Operational	-40		+100	C
Cooling	Free air convection				

INPUT SPECIFICATIONS					
Characteristics	Conditions	Min	Typ	Max	Unit
Input Voltage Range	Ta min... Ta Max, Io nom	9	12	18	VDC
		18	24	36	VDC
		35	48	75	VDC
No load input current	Vi nom, Io = 0	12V models	25		mA
		24V models	20		mA
		48V models	15		mA
Input voltage w/o damage	Io Nom	12V models		20	VDC
		24V models		40	VDC
		48V models		80	VDC
Startup voltage	Io Nom	12V models	8.5		VDC
		24V models	16		VDC
		48V models	33		VDC
Input filter	PI type				

OUTPUT SPECIFICATIONS					
Characteristics	Conditions	Min	Typ	Max	Unit
Output voltage accuracy	Vi nom, Io nom			+/-2	%
Minimum load	Vi nom single output model	0			%
	Vi nom dual output model (each output)	10			%
Line regulation	Io nom, Vi min ... Vi max			+/-1	%
Load regulation	Vi nom, Io 0 ... Io nom, single output models			+/-2	%
	Vi nom, Io min ... Io nom, dual output models			+/-5	%
Transient recovery time	25% load, step change		500		uS
Temperature coefficient	Vi nom, Io nom			+/-0.02	%/C
Ripple & Noise	Vi nom, Io nom, BW =20MHz	3.3V & 5V		100	mV
		12V, 15V & Dual		150	

DC-DC POWER MODULE
13.2W~15WW SINGLE & DUAL OUTPUTS
4:1 Input Range
I/O Isolation
Input Pi Filter
Short Circuit Protection



SINGLE OUTPUT MODELS						
Part Number	Input Voltage	Output Wattage	Output Voltage	Output Current	Efficiency (typical)	Efficiency (minimum)
CD15IDD03S4U	9~36 VDC	13.2 Watts	3.3 VDC	4000mA	80%	78%
CD15IDD05S4U	9~36 VDC	15 Watts	5VDC	3000mA	83%	81%
CD15IDD12S4U	9~36 VDC	15 Watts	12VDC	1250mA	84%	82%
CD15IDD15S4U	9~36 VDC	15 Watts	15VDC	1000mA	84%	82%
CD15IDD03S5U	18~75 VDC	13.2 Watts	3.3 VDC	4000mA	80%	78%
CD15IDD05S5U	18~75 VDC	15 Watts	5VDC	3000mA	83%	81%
CD15IDD12S5U	18~75 VDC	15 Watts	12VDC	1250mA	84%	82%
CD15IDD15S5U	18~75 VDC	15 Watts	15VDC	1000mA	84%	82%

DUAL OUTPUT MODELS						
Part Number	Input Voltage	Output Wattage	Output Voltage	Output Current	Efficiency (typical)	Efficiency (minimum)
CD15IDD05D4U	9~36 VDC	15 Watts	+/-5VDC	+/-1500mA	82%	80%
CD15IDD12D4U	9~36 VDC	15 Watts	+/-12VDC	+/-630mA	82%	80%
CD15IDD15D4U	9~36 VDC	15 Watts	+/-15VDC	+/-500mA	84%	82%
CD15IDD05D5U	18~75 VDC	15 Watts	+/-5VDC	+/-1500mA	83%	81%
CD15IDD12D5U	18~75 VDC	15 Watts	+/-12VDC	+/-630mA	82%	80%
CD15IDD15D5U	18~75 VDC	15 Watts	+/-15VDC	+/-500mA	83%	81%

All Specifications Typical at Nominal Line, Full Load, 25 C Unless Noted Otherwise

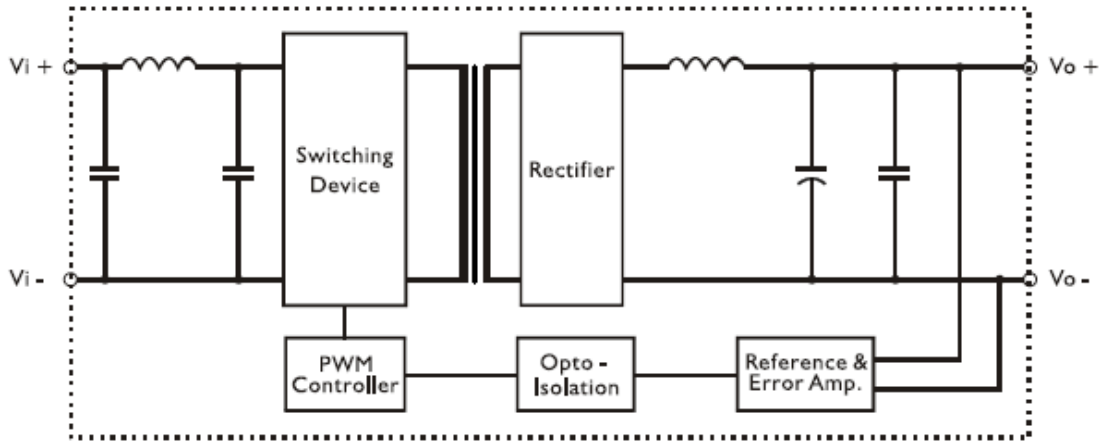
GENERAL					
Characteristics	Conditions	Min	Typ	Max	Unit
Switching frequency	Vi nom, Io nom		200		KHz
Isolation Voltage	Input/Output	1,500			VDC
Isolation Resistance	Input/Output, @500VDC	100			MΩ
Ambient Temp	Operating at Vi nom, Io nom	-40		+71	C
Case Temperature	Operating at Vi nom, Io nom			+100	C
Derating	Vi nom	See derating curve			%/C
Storage Temp.	Non Operational	-40		+100	C
Cooling	Free air convection				

INPUT SPECIFICATIONS					
Characteristics	Conditions	Min	Typ	Max	Unit
Input Voltage Range	Ta min...Ta Max, Io nom	9	24	36	VDC
		18	48	75	VDC
No load input current	Vi = nom, Io = 0	24V models		25	mA
		48V models		15	mA
Input voltage w/o damage	Io Nom	24V models		40	VDC
		48V models		80	VDC
Startup voltage	Io Nom	24V models	8.5		VDC
		48V models	16		VDC
Input filter	PI type				

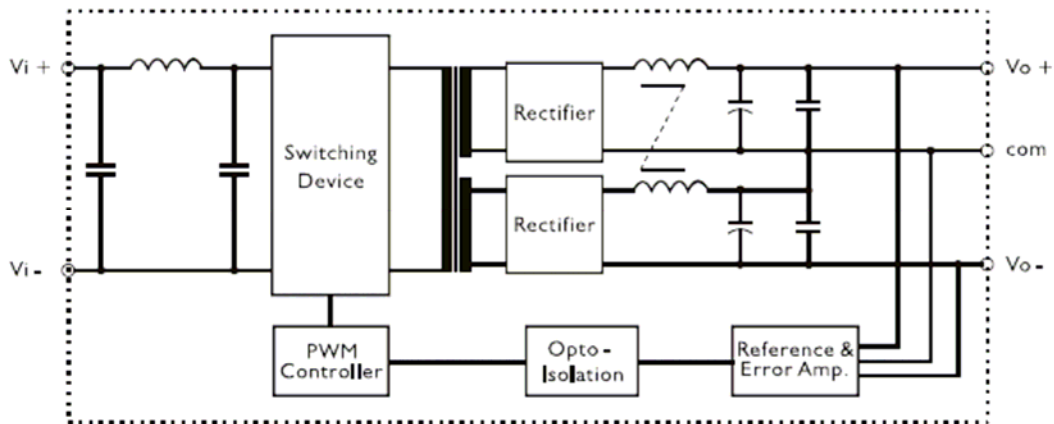
OUTPUT SPECIFICATIONS					
Characteristics	Conditions	Min	Typ	Max	Unit
Output voltage accuracy	Vi nom, Io nom			+/-2	%
Minimum load	Vi nom single output model	0			%
	Vi nom dual output model (each output)	10			%
Line regulation	Io nom, Vi min ... Vi max			+/-1	%
Load regulation	Vi nom, Io 0 ... Io nom, single output models			+/-2	%
	Vi nom, Io min ... Io nom, dual output models			+/-5	%
Transient recovery time	25% load, step change		500		μS
Temperature coefficient	Vi nom, Io nom			+/-0.02	%/C
Ripple & Noise	Vi nom, Io nom, BW =20MHz	3.3V & 5V		100	mV
		12V, 15V & Dual		150	

CIRCUIT SCHEMATIC

Block diagram for CD15IDDxxxxU series with single output 2:1 and 4:1 input

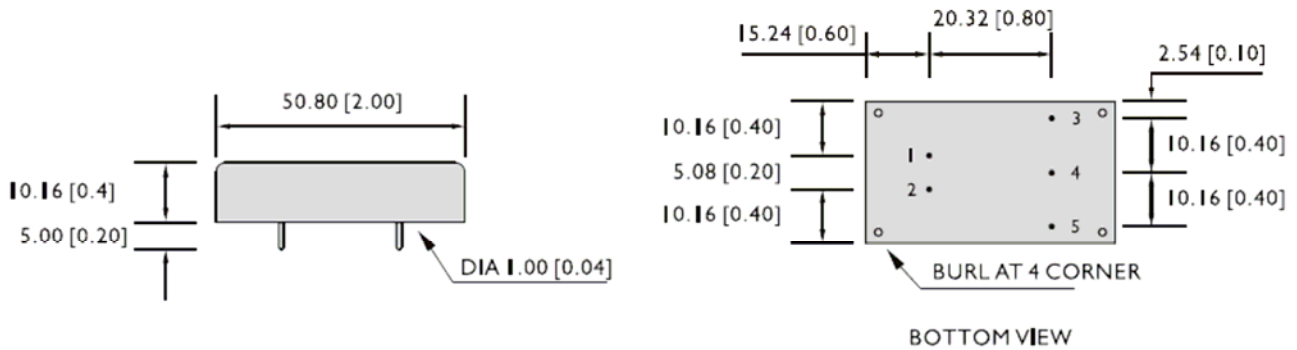


Block diagram for CD15IDDxxxxU series with dual output 2:1 and 4:1 input



Control & Protection	
Input Reversed	Shunt diode built in, external fuse recommended
Output short circuit	Continuous

mm [inch]



Metal case, weight 33 g

PIN ASSIGNMENT					
Pin No	1	2	3	4	5
SINGLE	Vi+	Vi-	Vo+	No Pin	Vo-
DUAL	Vi+	Vi-	Vo+	com	Vo-

DERATING @ Ambient Temperature C

