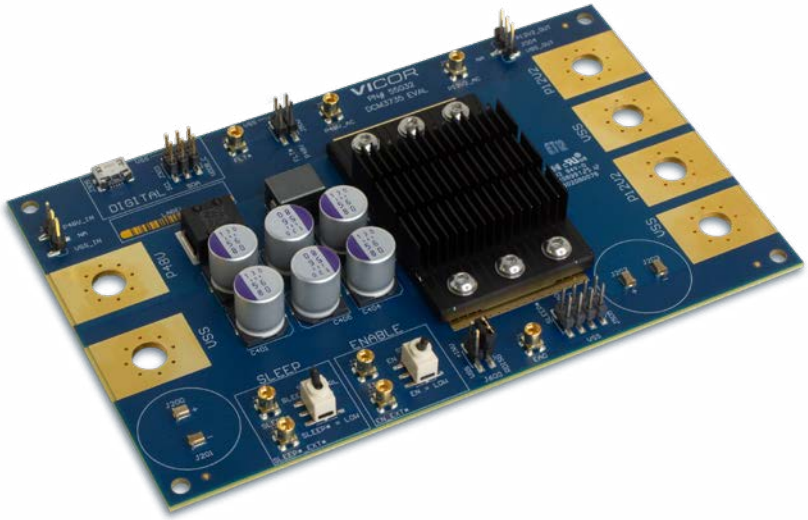
DCM3735 SM-ChiP Evaluation Board

48V to Point-of-Load Non-Isolated, Regulated DC-DC Converter

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Introduction

The DCM3735 is a non-isolated, regulated DC-DC converter module that operates from a semi-regulated 40 – 60V input to generate a regulated point-of-load output voltage with a range of 10.0 – 12.5V depending on the model. The DCM3735 in the SM-ChiP package configuration utilizes the Vicor patented zero-voltage switching (ZVS) buck-boost regulator stage followed by the Sine Amplitude Converter (SAC™).

The focus of this document is to assist the user in evaluating the DCM3735 SM-ChiP™ family.

The DCM™ evaluation board can be configured for various enabling and fault monitoring schemes, as well as to exercise various load conditions depending on the application requirements. The evaluation board can be used to evaluate DCMs in stand-alone configuration.

IMPORTANT NOTICE:

Read the precautions below entirely BEFORE using the DCM™ Evaluation Board. Do not operate the evaluation board unless you have the appropriate safety precautions in place on your bench to guarantee safety.

The list below is not comprehensive and is not a substitute for common sense and good practice.

- During operation, the power devices and surrounding structures can be operated safely at high temperatures.
- Remove power and use caution when connecting and disconnecting test probes and interface lines to avoid inadvertent short circuits and contact with hot surfaces.
- When testing electronic products always use approved safety glasses. Follow good laboratory practice and procedures.
- Care should be taken to protect the user from accidental contact when under power.
- Care should be taken to avoid reversing polarities if connecting to the opposite (solder) side of the board.
- The product evaluation boards described in this document are designed for general laboratory evaluation and are not suitable for installation in end-user equipment.
- Refer to the specific DCM module data sheet for electrical, thermal and mechanical product details.

Contents

The evaluation board demo assembly ships with the following contents:

- 1 x DCM evaluation board
- 1 x heat sink and mounting hardware

Features

The DCM evaluation board has the following features:

1. DCM3735 SM-ChiP
2. PMBus interface using a micro USB port.
3. Basic input and output filtering using low ESR ceramic caps and an input LC filter.
4. Test points for DCM signal terminals.
5. Kelvin voltage test points for all power terminals for input and output voltage measurements

Table 1
Evaluation boards

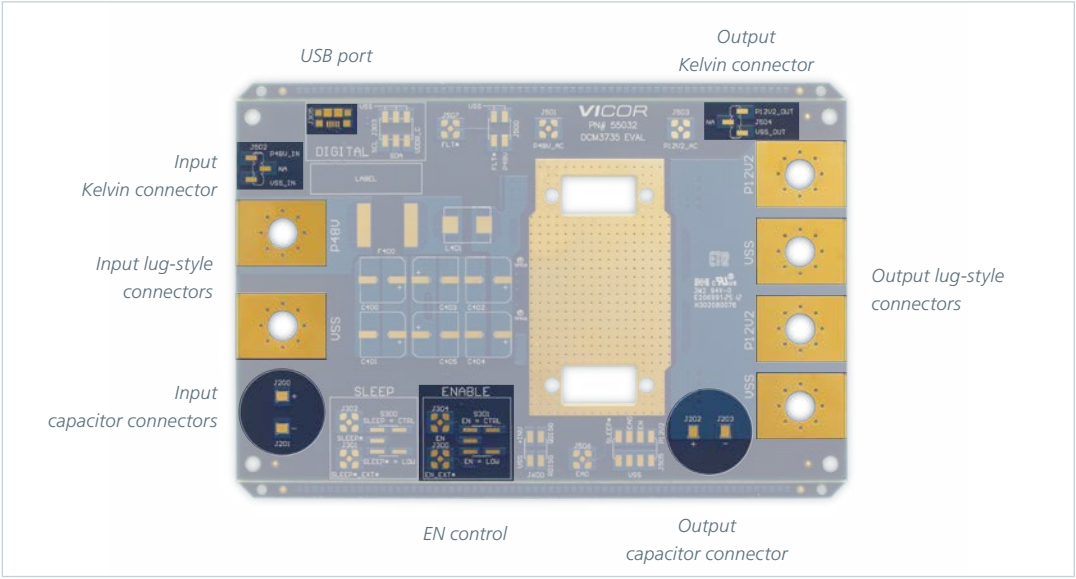
Part Number	Description
DCM3735**E**60D13L0TN1	DCM3735S60D13L0TN1 evaluation board

Board Description

This board provides a convenient way to evaluate or demonstrate the performance of the Vicor DCM3735 SM-ChiP™ products. Kelvin connections are provided for accurate voltage measurements on power nodes and signals. The evaluation board also provides lugs for input / output connections and test points for easy connection to standard test equipment.

The following section provides a detailed description of the evaluation board components and test points. The evaluation board includes sockets for adding a bulk capacitors on the input and output.

Figure 1
Unpopulated evaluation board



General Components

1. ***DCM (PS400):*** DCM3735 SM-ChiP 48V to Point-of-Load Non-Isolated, Regulated DC-DC Converter.
2. ***Fuse (F400):*** Input Fuse.
3. ***Input lugs (H200 and H205):*** H200 is labeled as P48V and H205 is labeled as VSS. Use these lugs for making connections to the input source. J502 provides kelvin connections to the input lugs. Use this connector to terminate the sense lines from the input source. This will ensure that the full programmed source voltage appears at the input lugs. Check for proper polarity before applying the power.
4. ***Input and output filtering:*** The DCM operates at switching frequencies that can exceed 1MHz. Low ESR ceramic capacitors are included on the board to minimize the switching voltage ripple. The evaluation board contains ceramic capacitors on the output and input. Additionally, an input LC filter is also provided.
5. ***Signal Test points:*** Test points are provided for all DCM signals with headers as well as MMCX connectors. Most test points using the headers consist of a signal / VSS pair with S_VSS located on the opposite row of the header. Both the signal and S_VSS are sense lines which are terminated locally at the DCM terminals.
   - ***Positive input power terminal (+IN)*** – Input to the DCM. Use J500: S_P48V_FILT/VSS or MMCX connector J501.
   - ***Positive output power terminal (+OUT)*** – Output of the DCM. Use J505: S_P12V2/VSS or MMCX connector J503.
   - ***Intermediate power terminal (+INV)*** – J600: P+INV / VSS
   - ***Transconductance error amplifier output and powertrain modulator control node (EAO)*** – J505: EAO / VSS header and J506 MMCX connector.
   - ***DCM enable control (EN)*** – J505: EN / VSS header and J304 MMCX connector. When driving the EN externally, J300 MMCX connector should be used. Note that the externally applied EN signal at this connector is inverted.
   - ***Digital serial communication clock terminal (SCL)*** – J303: SCL/VSS.
   - ***Fault Flag; pulled low when a fault is detected (FLT)*** – J500: $\overline{\text{FLT}}$ / VSS header and J507 MMCX connector.
   - ***Digital serial communication data terminal (SDA)*** – J303: SDA/VSS.

6. ***Enable / Disable Function***: There are two methods of controlling the enable / disable function:

- ***Using switch S301:*** When the switch is in the EN = CTRL position shown on the silk screen, the switch is in the "ON-state" and the DCM will be enabled. When the switch is in the EN = LOW position, the EN terminal will be connected to VSS and the DCM will be disabled.
- ***Using external control:*** Switch S301 must be in the EN = CTRL position. Use an external voltage source or function generator to control the EN state though the MMCX connector, J300.

7. ***Output lugs (H201 – H204):*** H201, H203 are labeled as P12V2. H202, H204 are labeled as VSS. Use these lugs for making connection to the output load. J504 should be used for terminating the kelvin lines from the electronic load. Check for proper polarity before applying the power.

8. ***Power node test points:*** Dedicated test points are provided for making accurate measurements of the input and output voltage and voltage ripple. MMCX connector J501 should be used for measuring the voltage directly at the input to the DCM. It is the best point to measure the input voltage ripple. Likewise, J503 should be used for measuring the output voltage ripple.

9. ***Input / output bulk capacitance:*** The board contains sockets J200, J201 on the input, and J202, J203 on the output for installation of bulk capacitors. Please note polarity indication on silk screen.

11. ***Micro USB port (J305):*** For use only with PMBus® signals and/or compatible devices such as Vicor PN: I2C-ADAPTER-A04.
Do not plug directly into a PC via a standard USB-A-to-Micro-B cable as this may damage the evaluation board.

Test Point Description

All test nodes are labeled and include a test point for attaching probes, clips or hooks.

Table 2
Test point descriptions

Name	Connector	Description
S_P48V_IN / S_VSS_IN	J502	Input voltage kelvin connection test point
S_P12V2_OUT / S_VSS_OUT	J504	Output voltage kelvin connection test point
EN_EXT	J300	Function generator input for external EN control
EN	J304 / J505.3	Enable MMCX
EAO_SENSE	J506 / J505.5	Error amplifier output MMCX
FLT_SENSE	J507 / J500.1	Fault MMCX
S_P48V_FILT_AC	J501	DCM3735 input voltage MMCX
S_P12V2_AC	J503	DCM3735 output voltage MMCX
SGND	J303.1	Signal ground
VDDB	J303.2	USB Port VDD output
SDA	J303.4	DCM3735 serial data line
SCL	J303.6	DCM3735 serial clock line
S_P48V_FILT	J500.3	DCM3735 input voltage
S_P12V2	J505.1	DCM3735 output voltage
P+INV	J600.2	DCM3735 +INV voltage
RDISG	J600.3	Discharge circuit pull-down
QDISG	J600.4	Discharge circuit gate

Bill of Materials

The following table describes the design-specific components of the DCM™ evaluation boards.

Table 3
DCM3735E60D13L0TN1 evaluation board components

Reference Designator	Description	Manufacturer	Manufacturer Part Number	Notes
C300	CAP X7R 0.01µF 10% 100V 0603	Samsung Electro-Mechanics	CL10B103KC8NNND	
C301	CAP X7R 0.10µF 10% 50V 0603 0.35 MAX HT	TDK	C1608X7R1H-104K080AA	
C400, C401, C402, C403, C404, C405	CAP ALEL POLY 56µF 20% 80V 10x12.7	Panasonic	80SXV56M	
C406, C407, C408, C409, C418, C419, C420, C421	CAP X7S 4.7µF 10% 100V 1206	Murata Manufacturing	GRM31CC72A475KE11L	
C410, C411, C412, C413, C414, C415, C416, C417, C422, C423, C424, C425, C426, C427, C428, C429	CAP X6S 22µF 10% 25V 1206	Samsung Electro-Mechanics	CL31X226KAHN3NE	
D300	DZEN 5.6V 5% 6Wpk ESD SOD-353	Nexperia	BZA856AVL,115	
D301	DSCH 45V 0.1A SOD523	Diodes Incorporated	SDM10U45-7-F	
D302	DZEN 5.1V 5% 830mW AUTO SOD-123F	Nexperia	BZT52H-C5V1	
D600	ZENER 4.7V 5% 5µA	Onsemi	MMSZ4688T1G	
F400	FUSE FAST 75V 70A 10x11.2mm	Littelfuse	0881070.URF	
J200, J201, J202, J203	CONN 1 POS RT ANGLE SMD 0.79mm LEAD	Mill-Max	8806-0-58-15-47-27-4	
J300, J304, J501, J503, J506, J507	CONN 50Ω MMCX Jack Surface Mount	Samtec	MMCX-J-P-H-ST-SM1-K-TR	
J301, J302, L400, Q301, R301, R302, S300	NOT APPLIED			
J303	HEADER 6 PIN STRAIGHT SMT	FCI	95278-101A06LF	
J305	CONN MICRO-B USB SMD	TE Connectivity Ltd	2174507-2	
J500, J600	HEADER 4 PIN STRAIGHT SMT	Amphenol Communications Soluti	95278-101A04LF	
J502, J504	CONN 3 POS 2.54mm SINGLE ROW	Harwin	M20-877034R	
J505	CONN 8 POS DUAL ROW	Molex	15-91-6080	
L401	IND 100nH 10% 100A 10.8x8.2mm	Eaton	FP1008R7-R100-R	
PCB	PCB Duemila DCM3735 1-up Board B	Vicor	DCM3735E60D13L0TN1	For use with module: DCM3735S60D13L0TN1
PS400	DCM3735 54V_{IN} / 12.2V_{OUT} / 2000W K = 1/4			
Q300	FET 2N7002 SOT-23	Onsemi	2N7002LT1G	
Q600	QMOS N 100V 385mΩ 1.5A SC-73	Nexperia	PMT280ENEAX	
Q601	40V 200mA NPN SMALL SWTCHG TRANS SOT-523	Diodes Incorporated	MMBT3904T-7-F	

Bill of Materials (Cont.)

Table 3 (Cont.)
DCM3735E60D13L0TN1 evaluation board components

The following table describes the design-specific components of the DCM™ evaluation boards.

Reference Designator	Description	Manufacturer	Manufacturer Part Number	Notes
R300	RES 10kΩ 1/10W 1% 0603	KOA Speer Electronics	RK73H1JTTD1002F	
R303, R304	RES 2.05kΩ 1/10W 1% 0603	Panasonic	ERJ-3EKF2051V	
R305	RES 200Ω 1/10W 1% 0603	KOA Speer Electronics	RK73H1JTTD2000F	
R306, R600	RES 100kΩ 1/10W 1% 0603	KOA Speer Electronics	RK73H1JTTD1003F	
R400	RES 0Ω JUMPER 2A 1206	Vishay	CRCW12060000Z0EC	
R401	RES 0.51Ω 1/4W 5% 1206	KOA Speer Electronics	SR732BTTDR51J	
R402, R403	RES I SENSE 20mΩ 3W 1% 2512	Bourns	CRA2512-FZ-R020ELF	
R601	RES 2.7kΩ 3/4W 5% 2010	Vishay	CRCW20102K70JNEF	
R602	RES 140kΩ 1/10W 1% 0603	KOA Speer Electronics	RK73H1JTTD1403F	
R603	RES 274Ω 1/4W 1% 1206	KOA Speer Electronics	RK73H2BTTD2740F	
S301	SW TOGGLE SPDT 1 POS SMD	C&K Components	GT11MSCBE	

Recommended Test Equipment

The following is a list of recommended test equipment:

1. Safety glasses
2. DC power supply: Refer to the specific DCM™ model data sheet to ensure the supply has sufficient power and current capability.
3. Electronic load: Refer to the specific DCM model data sheet to ensure the load has sufficient power handling and current capability for testing
4. Fans with placement as shown in Figure 2
5. Digital multi-meters (DMMs)
6. Oscilloscope and probes
7. Interconnect wires, cables and fastening hardware

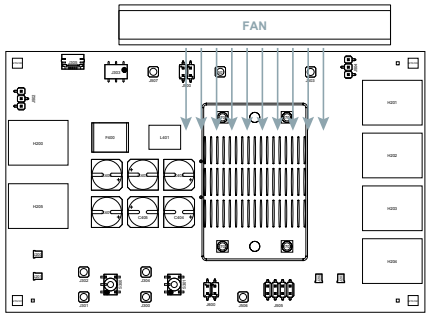
PCB Set Up

1. Install the jumper provided at the following location:
   J600.3 to J600.4, to enable the discharge function. ("QDISG to "RDISG").
2. Install the coldplate / heat sink provided as per instructions in section "Heat Sink Installation."

Basic Connections and Operation

1. Confirm bench equipment is powered off.
2. Connect the input DC power supply positive lead to the positive input lug of the evaluation board: H200 – P48V. Connect the input power supply negative lead to H205 – VSS input lug of the evaluation board. Sense lines from the DC power supply should be terminated at J502.
   The power supply's positive sense line should be tied to S_P48V_IN and the negative sense line should be tied to S_VSS_IN.
3. Use of twisted pair cables of a suitable wire gauge is recommended to minimize the inductance of the cables to the power source.
4. Verify proper polarity of the connections.
5. Connect the positive output lugs H201, H203 of the evaluation board to the electronic-load's positive input. Connect the VSS output lugs H202, H204 of the evaluation board to the electronic-load's negative input. Sense lines from the electronic load should be terminated at J504. The electronic load's positive sense line should be tied to S_P12V2_OUT and the negative sense line should be tied to S_VSS_OUT.
6. Verify proper polarity of the connections.
7. Verify all electrical termination fasteners are securely tightened to ensure a proper, low-impedance connection is made between the DCM evaluation board and the external power source and load. The connectors and fasteners should be kept within the exposed copper.
8. Direct airflow from the cooling fans across the DCM. The airflow should be in the same direction as the fins on the heat sink as shown in Figure 2.
9. Have the latest DCM data sheet on hand for reference.

Figure 2
Fan location with respect to heat sink



Power Up

Start up From V_{IN}:

1. Select an Enable Option:

- Switch Control: Set S301 in the ON-state as described in "Board Description, 6 - Enable / Disable Function"
- External Drive: Set S301 in the ON-state then externally drive EN through J300.

2. Set state of EN = 1 using one of the options above.

3. V_{IN} is ramped past V_{IN_UVLO+}. The DCM will pull up the voltage on its EN terminal with an internal current source and start up itself.

Start up from EN:

1. Set state of EN = 0 using one of the options above

2. V_{IN} is ramped up past V_{IN_UVLO+} with the EN signal driven low.

3. Once V_{IN} is at the desired steady state voltage, set state of EN = 1.

Note: When ramping up VIN, the user must limit the slew rate of VIN as specified in the product data sheet.

Power Down

The DCM may be powered down by ramping V_{IN} to 0V or setting the state of EN = 0.

Heat Sink Installation

Utilize the hardware components provided in the heat sink assembly kit. Coldplate not included in assembly kit.

Table 4
Component list

Item Reference	Name	Description	Manufacturer	Part Number	Qty
Included in Assembly Kit					
1	Evaluation PCB	DCM EVAL Board / PCB	Vicor	DCM3735E60D13L0TN1	1
2	Heat sink	Heatsink 54X36X12	Alpha Novatech	UB3654-12BM-09J	1
3	Thermal saddle	THERMAL SADDLE	Armstrong	54214 [a]	1
4	TIM pad	TIM PAD 36X40X0.5THK SILTEL SG-TC6	Timtel	SG.50-TC6.0-157-142	1
5	Screw M3x12	SCREW M3 X 10 BH 18-8 SS HEX DRIVE	McMaster	92095A183	4
6	Washer	WASHER BELLEVILLE M3 197N FLAT LOAD	Lee Spring	125-013-250	6
7	TIM gel	GREASE THERMAL 4gm PLASTIC PAK	Parker Hannifin	120-SA	1
8	Screw M3x22	SCREW M3 x 22 BHMS SS HEX DRIVE	McMaster	92095A473	2
9	Standoffs	STANDOFF M-F 6MM HEX M3 THREAD 8MM LG	McMaster	93655A095	4
10	Screw M3x5	SCREW M3 x 5 BH 18-8 SS HEX DRIVE	McMaster	94868A176	4
Not Included in Assembly Kit					
11	Coldplate	COLDPLATE 152 X 178 X 15 [b]	DigiKey	ATS-TCP-1003	1

[a] Custom component; this is a Vicor part number.
[b] The recommended off-the-shelf coldplate is supplied un-drilled and requires custom machining. Drill the mounting holes according to the pattern in Figure 5 to ensure proper component installation.

Figure 3 depicts the exploded view of the heat sink and hardware components along with the product evaluation board.

Step 1: Place the TIM on the top surface of the SM-ChiP™ DCM3735.

- Remove the thin protective plastic sheets from both sides of the TIM before installing TIM on the top surface of the SM-ChiP.
- Cover the entire top surface of the SM-ChiP with the TIM to avoid short circuit of the power/signal castellations of the DCM with the heat sink. TIM provides electrical isolation between the DCM surface and the heat sink surface.

Step 2: Place the thermal saddle on top of the TIM material.

Step 3: Apply a thin layer of TIM gel on to the surface of the heat sink.

Step 4: Apply TIM gel on the project surface of the thermal saddle that will contact the heat sink through the cutouts in the PCB.

Step 5: Using screws and washers, screw the heat sink to the saddle capturing the PCB in between.

Step 6: Apply a thin layer of TIM gel between the thermal saddle and coldplate.

Step 7: Assemble the PCB with the thermal management hardware on to the coldplate using screws and standoffs as shown.

Figure 3
Thermal assembly exploded view

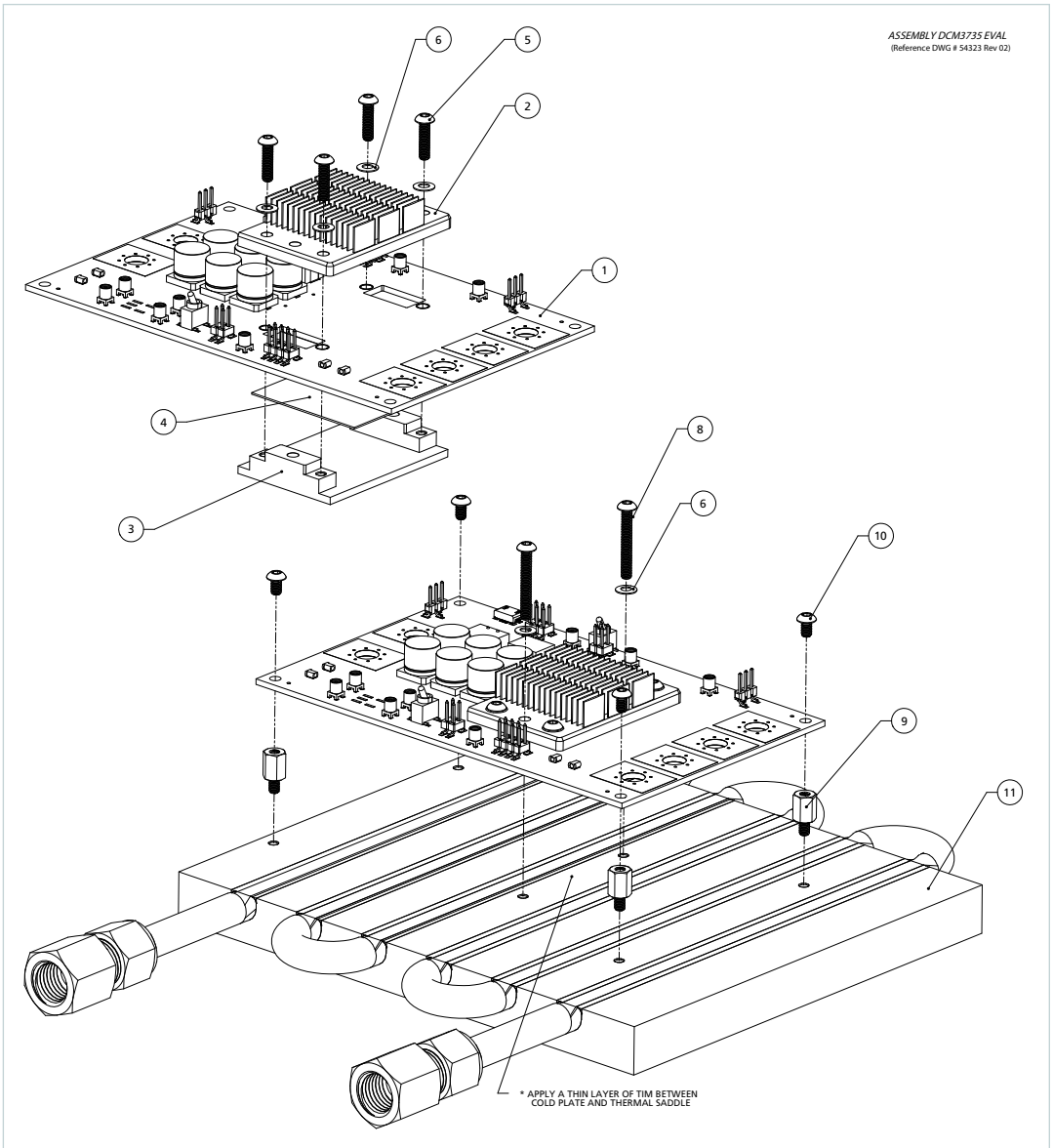


Figure 4
Thermal saddle mechanical drawing

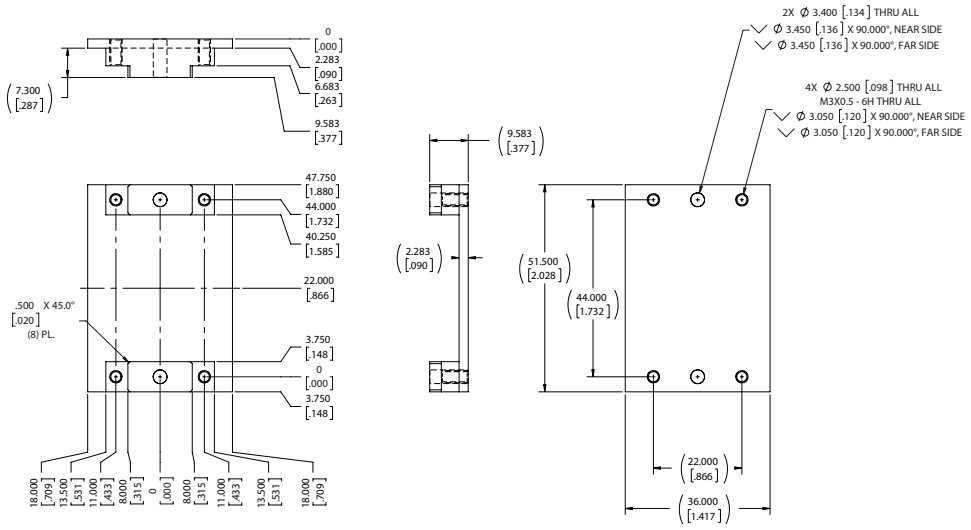
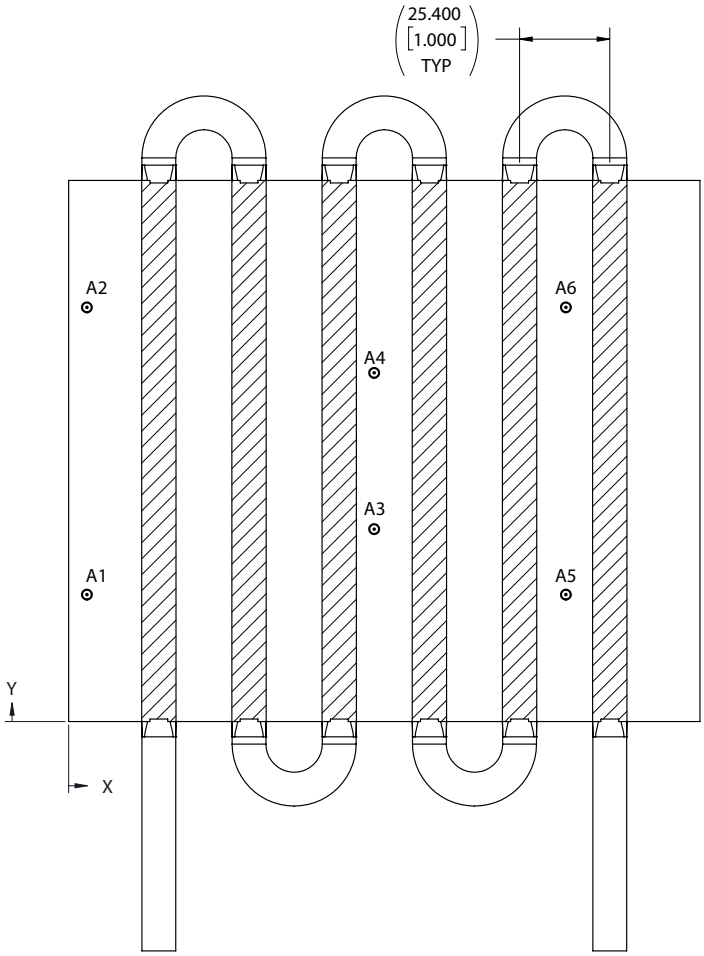


Figure 5
Coldplate hole pattern

COLDPLATE 152 X 178
(Reference DWG # 542189 Rev 02)



TAG	X LOC	Y LOC	SIZE
A1	5.13	35.75	∅ 2.500 THRU ALL M3X0.5 - 6H ↧ 6.000 ⌵ ∅ 3.050 X 90.000°, NEAR SIDE ⌵ ∅ 3.050 X 90.000°, FAR SIDE
A2	5.13	116.65	∅ 2.500 THRU ALL M3X0.5 - 6H ↧ 6.000 ⌵ ∅ 3.050 X 90.000°, NEAR SIDE ⌵ ∅ 3.050 X 90.000°, FAR SIDE
A3	86.04	54.20	∅ 2.500 THRU ALL M3X0.5 - 6H ↧ 6.000 ⌵ ∅ 3.050 X 90.000°, NEAR SIDE ⌵ ∅ 3.050 X 90.000°, FAR SIDE
A4	86.04	98.20	∅ 2.500 THRU ALL M3X0.5 - 6H ↧ 6.000 ⌵ ∅ 3.050 X 90.000°, NEAR SIDE ⌵ ∅ 3.050 X 90.000°, FAR SIDE
A5	140.03	35.75	∅ 2.500 THRU ALL M3X0.5 - 6H ↧ 6.000 ⌵ ∅ 3.050 X 90.000°, NEAR SIDE ⌵ ∅ 3.050 X 90.000°, FAR SIDE
A6	140.03	116.65	∅ 2.500 THRU ALL M3X0.5 - 6H ↧ 6.000 ⌵ ∅ 3.050 X 90.000°, NEAR SIDE ⌵ ∅ 3.050 X 90.000°, FAR SIDE

Revision History

Revision	Date	Description	Page Number(s)
1.0	09/18/26	Initial release	n/a

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