ANALOG DEVICES

EVAL-ADM1073MEBZ User Guide
UG-555

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Using the ADM1073 Hot Swap Controller Evaluation Kit

FEATURES

Evaluation kit for the ADM1073 hot swap controller
External FET to control load current
Programmable current limit (default 6 A)
Programmable operating voltage range (UV/OV resistors)
SOA timing values using external TIMER capacitor
LEDs on all logic inputs and outputs
Push-buttons for asserting logic inputs
Drops into a user's system, replacing the current hot swap device

EVALUATION KIT CONTENTS

EVAL-ADM1073MEBZ evaluation board
EVAL-ADM1073MEBZ user guide

GENERAL DESCRIPTION

The EVAL-ADM1073MEBZ is a compact, full feature evaluation board for the ADM1073 device. The layout provides users with a clear visual of all the peripheral components and the hot swap power path. The layout also maximizes the ability of the board to dissipate heat for some of the key components on the power path, allowing evaluation of high current hot swap setups.

One sense resistor footprint and one FET footprint provides users with flexibility and allows them to simulate a wide range of application setups.

Multiple test points allow easy access to all critical points and pins. There is one LED to provide users with a direct visual indication of IC power good output.

This evaluation kit allows the ADM1073 negative-voltage hot swap controller to be easily evaluated. The ADM1073 provides undervoltage and overvoltage protection by monitoring the supply voltage and provides robust current limiting by monitoring the load current. The device uses an FET in the power path to control the load current.

Complete specifications for the ADM1073 can be found in the ADM1073 data sheet, available at www.analog.com, and should be consulted in conjunction with this user guide when using the evaluation board

PHOTOGRAPH OF THE EVALUATION BOARD

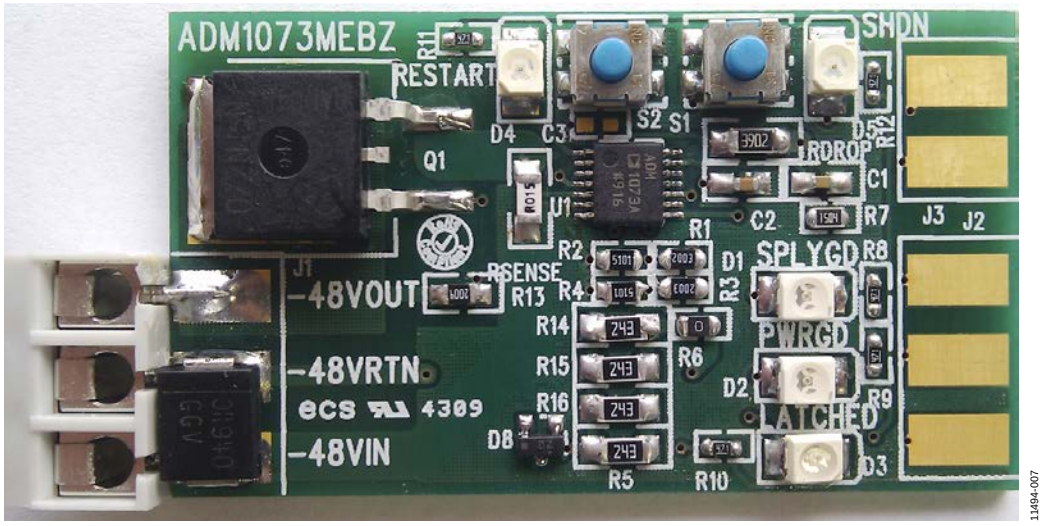


Figure 1.

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REVISION HISTORY

5/13—Revision 0: Initial Version

IMPORTANT SAFETY INFORMATION

Take the following precautions when using the EVAL-ADM1073MEBZ evaluation kit under high voltage conditions:

- Do not work alone.
- Always check the grounding when working with negative voltages.
- Always keep one hand in your pocket or behind your back when around a high voltage system.
- Wear footwear with a rubber sole if possible.
- Wear eye protection (safety goggles).
- Do not wear any jewelry or other articles that could accidentally contact circuitry and conduct current.
- Set up your work area away from possible grounds that you might accidentally contact.
- With the power off and the equipment unplugged, connect/disconnect any test leads. Use clip leads or solder temporary wires to reach locations that are difficult to access.
- Perform as many tests as possible with the power off and the equipment unplugged.
- After performing tests that require the power to be turned on, turn off the power and disconnect the power supply from the board.
- Fully discharge large load capacitors with an appropriate resistor.

EVALUATION BOARD DESCRIPTION

The EVAL-ADM1073MEBZ is designed to demonstrate several features of the ADM1073. It can be used to drop onto a plug-in module or a backplane, replacing the current hot swap device. A simplified drawing of the evaluation board is shown in Figure 2.

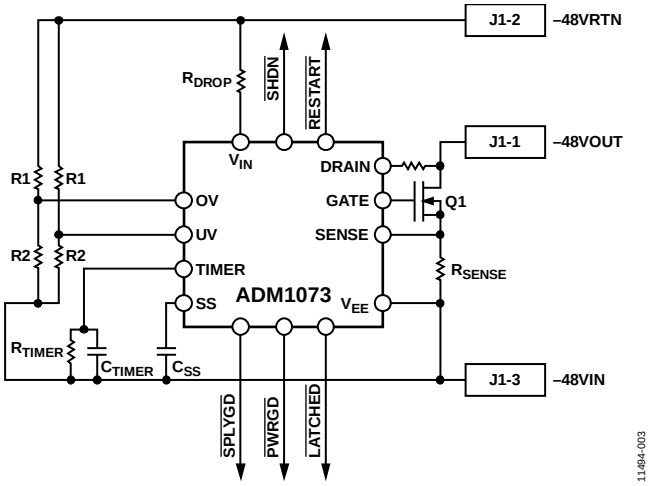


Figure 2. Evaluation Board Functional Block Diagram

The ADM1073 evaluation board consists of the following:

- On-board FET to control load current
- Programmable operating voltage range (R1 to R4 resistors)
- Programmable current-limit levels (value of R_{SENSE})
- Programmable soft start ramp (Capacitor C2)
- Programmable TIMER on-time (Capacitor C1)
- LEDs on all logic I/Os
- Push-button switches for asserting logic inputs

By cutting various tracks around the current hot swap device in a user system and soldering the ADM1073 evaluation board in position above it, the ADM1073 and its external components can be integrated into the system in place of the original hot swap circuitry. This allows the user to evaluate the performance of the ADM1073 in the system.

EVALUATION BOARD CONFIGURATION

You can set up the ADM1073 evaluation board in various configurations, as follows:

1. Choose a shunt resistor. A default R_{DROP} of 39 kΩ is mounted on the ADM1073 evaluation board. A constant voltage of 12.3 V (above V_{EE}) is generated at the V_{IN} pin. This resistor dissipates a maximum of 125 mW at 75 V and allows a minimum power supply of 35 V to be used for operation.
2. Choose values for Resistors R1 to R4 to suit the desired operating voltage range and hysteresis levels. The default resistors values (R1 = 200 kΩ, R2 = 5.1 kΩ, R3 = 200 kΩ, R4 = 5.36 kΩ) give an operating range of ~34.9 V to ~74.0 V with hysteresis levels of ~1 V on the UV and OV pins. See the ADM1073 data sheet for other resistor ratios and their operating ranges. Note that resistors that are accurate to within ±1% should be used for optimum accuracy.
3. Choose the maximum load current that is permitted before the ADM1073 registers a current fault. This is determined by the choice of sense resistor, R_{SENSE}. The evaluation board has a 15 mΩ sense resistor by default, which sets up a maximum inrush current level of 6.8 A and a circuit breaker level between 5.7 A and 6.5 A (~6 A typical). R_{SENSE} can be changed to alter the load current level. See the ADM1073 data sheet for details. Note that resistors that are accurate to within ±1% should be used for optimum accuracy.
4. Choose a value for the soft start capacitor, C_{SS}. This capacitor is connected between the SS and V_{EE} pins. It adjusts the soft start current profile when the FET is enabled. Capacitors of various values can be soldered in this location. See the ADM1073 data sheet for details. The default value of this capacitor is 0.82 nF, which results in a soft start time of ~400 µs.
5. Choose values for the TIMER capacitor, C_{TIMER}, and the TIMER resistor, R_{TIMER}. These components set the on-time of the limited consecutive retry scheme. Capacitors and resistors of various values can be soldered in this location. See the ADM1073 data sheet for details. For the MOSFET used on the board, the default value for the capacitor is 22 nF. This gives a maximum timer of ~3 ms and a minimum timer of ~1.1 ms. This timer depends on the V_{DS} of the MOSFET; however, C_{SS} and R_{DRAIN} also affect this parameter. For example,
   - if V_{DS} = 75 V, then t = 1.1 ms
   - if V_{DS} = 48 V, then t = 1.5 ms
   - if V_{DS} = 35 V, then t = 1.7 ms
   - if V_{DS} = 0 V, then t = 3 ms
6. The default value of the drain resistor is 2 MΩ. This ensures that the maximum drain current of 36 µA is not exceeded while maintaining optimum foldback.
7. The ADM1073 evaluation board has an IPP075N15N3 D2PAK FET mounted by default. If you want to change this FET, remove the component, Q1, and mount a replacement. The footprint can accommodate DPAK and D2PAK packages.

INTEGRATING THE EVALUATION BOARD INTO THE SYSTEM

The current system must be modified to disconnect or remove the existing hot swap circuitry and replace it with the ADM1073 evaluation board. The following steps describe a situation in which the hot swap circuitry resides on a plug-in module. The same method applies when a hot swap system is implemented on the backplane side.

1. Locate the existing hot swap device and its accompanying components, and disconnect this portion of the system by cutting the relevant tracks on the board. Alternatively, you can desolder and remove the relevant components, as shown in Figure 3.

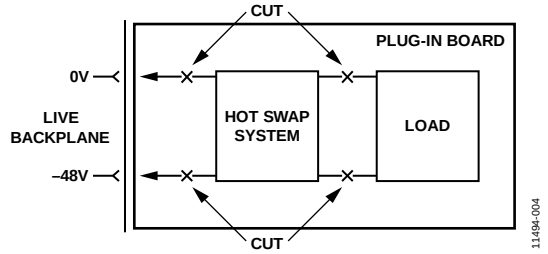


Figure 3. Removing Existing Hot Swap Circuitry from the System

2. To integrate the ADM1073 evaluation board into your system in place of the original hot swap circuitry, clamp three wires into the J1 terminal block of the ADM1073 evaluation board and solder them into position on the board. If you need to access the logic I/Os, there are blank pads on the board that can be used for this purpose. The ADM1073 evaluation board now acts as a substitute for the old hot swap circuitry, as shown in Figure 4.

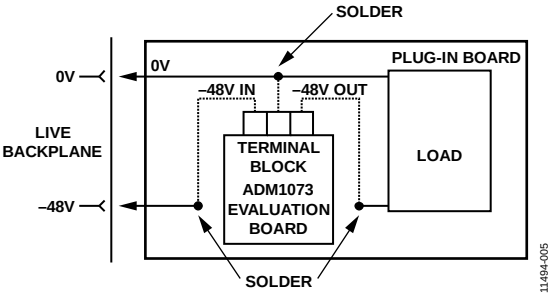


Figure 4. Integrating the ADM1073 Evaluation Board into the System

The ADM1073 evaluation board has an insulating coating on its underside to protect the system. If the underside of the board were not protected, shorts could occur on the module or backplane below it.

LOAD CAPACITANCE

The ADM1073 can accommodate a limited multiple retry scheme to charge up larger load capacitance while keeping the FET within the programmed safe operating area (SOA) limits. There is a maximum of seven attempts allowed. Table 1 can be used as a guide for nominal load capacitance limits for this particular design.

Table 1. Nominal Load Capacitance Limits[1]

V_{IN} (V)	Number of Attempts	~Maximum C_{LOAD} (µF)
48	1	250
48	7	1800
75	1	150
75	7	1000

[1] Excluding tolerances and assuming no dc load current enabled during power-up.

EVALUATION BOARD HARDWARE

SWITCH, JUMPER, AND LED FUNCTIONS

EVAL-ADM1073MEBZ

Table 2. Connector Functions

Connector	Description
−48VRTN, −48VIN	Hot swap line voltage inputs that also power the board components. The input voltage ranges from −18 V to −75 V.
−48VOUT	Hot swap line voltage output.

Table 3. Switch Functions

Switch	Description
S1	Push-button for shutdown.
S2	Push-button for restart.

Table 4. LED Functions

LED	Description
D1	$\overline{\text{SPLYGD}}$, green.
D2	$\overline{\text{PWRGD}}$, green.
D3	$\overline{\text{LATCHED}}$, red.
D4	$\overline{\text{RESTART}}$, yellow.
D5	$\overline{\text{SHDN}}$, yellow.

Table 5. On-Board ICs

IC	Description
U1	ADM1073 main IC.

EVALUATION BOARD SCHEMATICS

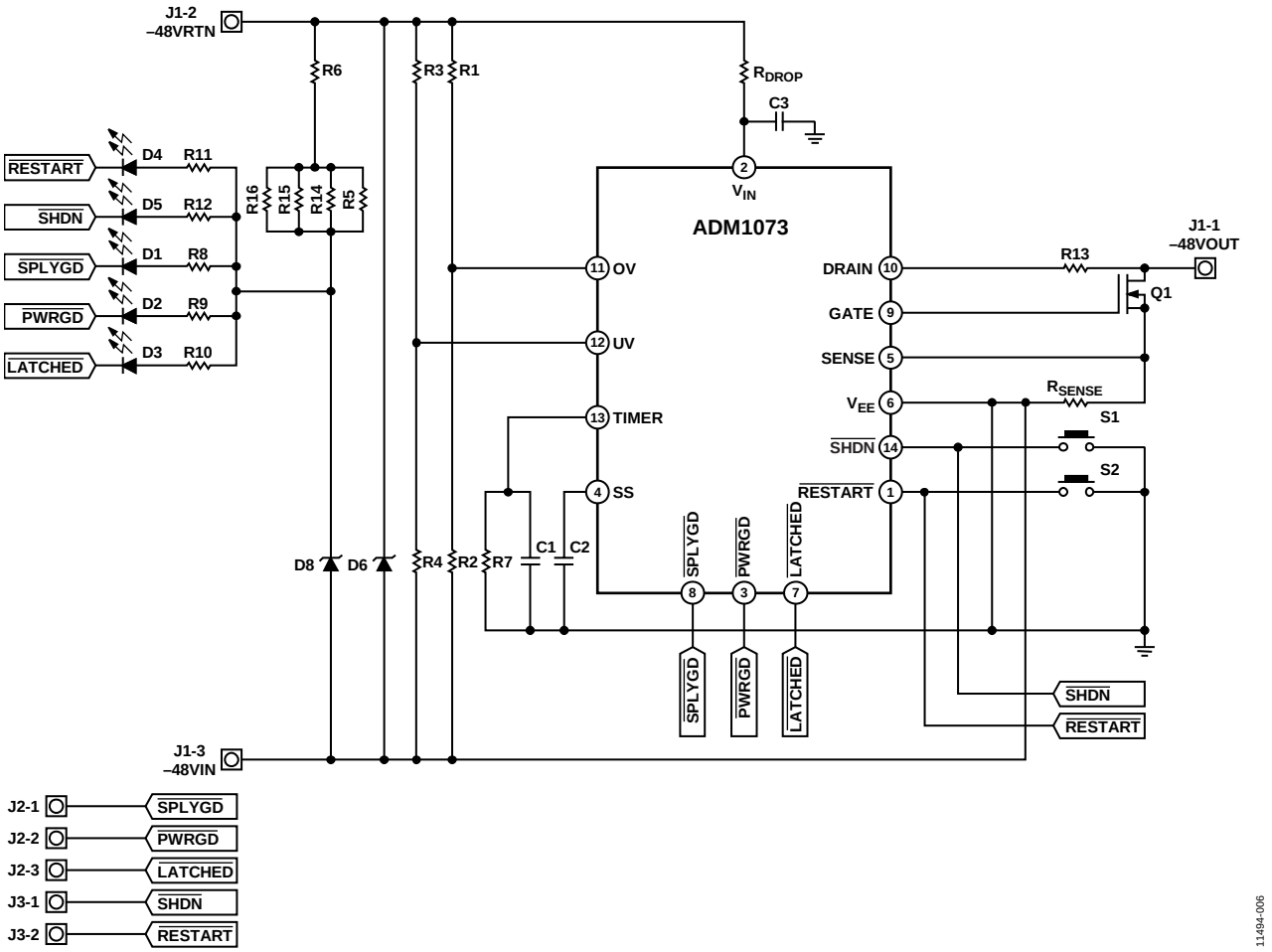


Figure 5. EVAL-ADM1073MEBZ Evaluation Board Circuit Diagram

BILL OF MATERIALS

EVAL-ADM1073MEBZ

Table 2. Bill of Materials

Qty	Reference Designator	Part Type	Value	Part Decal	Part No.	Source
1	U1	Hot swap controller		14-lead TSSOP	ADM1073ARUZ	Analog Devices, Inc.
1	C1	Capacitor (C_{TIMER} nom)	22 nF	0603	881-9998	Farnell
1	C2	Capacitor (C_{SS} nom)	0.82 nF	0603	175-9086	Farnell
1	C3	Capacitor	100 nF	0603	182-8899	Farnell
2	R1, R3	Resistor	200 kΩ	0805	165-2950	Farnell
1	R2	Resistor	5.1 kΩ	0805	146-9937	Farnell
1	R4	Resistor	5.36 kΩ	0805	2305132	Farnell
4	R5, R14, R15, R16	Resistor	24 kΩ	1206	184-1781	Farnell
1	R6	Resistor	0 Ω	0805	9333681	Farnell
1	R7	Resistor (R_{TIMER} nom)			Do not insert	
5	R8 to R12	Resistor	470 Ω	0805	923-3962	Farnell
1	R13	Resistor (R_{DRAIN})	2 MΩ	0805	150-6150	Farnell
1	RDROP	Resistor ($R_{SHUNTNOM}$)	39 kΩ	1206	923-6910	Farnell
1	RSENSE	Resistor	15 mΩ	1206	WSLP1206R0150FEA	Vishay
1	Q1	FET	7.2 mΩ	D2PAK	IPP075N15N3 G	Infineon
2	D4, D5	LED		LED SMT yellow	121-2751	Farnell
2	D1, D2	LED		LED SMT green	122-6375	Farnell
1	D3	LED		LED SMT red	122-6394	Farnell
1	D6	TVS diode	85 V	SMC	SMCJ85A-FDICT-ND	Digi-Key
1	D8	Zener diode		3-pin SOT23	984-4392	Farnell
2	S1, S2	SW-PUSH-SMD		Push-button switch	112-3624	Farnell
1	J1	Connector/power		3-way terminal block	151-786	Farnell
1	J2	Connector/power		3-way terminal block	Do not insert	
1	J3	Connector/power		2-way terminal block	Do not insert	



ESD Caution

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

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