

EB429 Ideal Diode Specification

Document Number

DS429 Rev 1.0

Description

5-40VDC <40A Ideal Diode Board for Inspired Energy "P" Series Battery Packs

Inspired Energy Part Number

EB429

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Prepared By	NCN
Issue date	4/11/18

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1. REVISION HISTORY

Revision	Release Date	Revisions	Issued By	Approved By
0.1	11/23/16	First draft	WRL	
1.0	4/11/18	Production Release	NCN	JAB, RAH



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2. INTRODUCTION

2.1. Scope

This specification describes the physical, functional and electrical characteristics of an Ideal Diode intended to allow paralleling batteries. This specification is the interface document between Inspired Energy and its customer. It is understood that the customer may create his own internal specification. However, this specification is the master that defines the device's operation. The circuit produced will meet this specification.

2.2. Overview

This specification describes the physical, functional and electrical requirements for the EB429 Ideal Diode assembly. The board allows passing 5-40V up to 40A, in one direction only. The board allows passing through the SCL, SDA and THM pins of the battery. However, these are not otherwise connected to the Ideal Diode.

2.3. General Precautions

2.3.1. Handling

- Avoid shorting.
- Do not immerse in water.
- Do not disassemble or deform.
- Avoid excessive physical shock or vibration.
- Never cover or obstruct the airflow, as this will cause overheating.

2.3.2. Charge & Discharge

- Never use a modified or damaged Ideal Diode, battery or charger.
- Specified product use only.
- Caution – during use the Ideal Diode may become warm.

2.3.3. Storage

- Store in a cool, dry and well-ventilated area.

3. REQUIREMENTS

3.1. General Requirements

3.1.1. Input Voltage and Current

The input voltage should be between 5 and 40VDC. The overvoltage clamp will turn on above 60VDC (or 30V in reverse polarity direction). The unit is designed to handle up to 40ADC. Reverse voltage should not exceed



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30VDC. Be aware of high voltage transients when switching high currents. Applying less than 5V at high currents may cause the Ideal Diode to overheat.

3.1.2. Operation

Operational Temperature Limits: 0°C to +50°C, ≤ 80%RH

3.1.3. Storage

Storage Temperature Limits: -20°C to +80°C, ≤ 80%RH

The Ideal Diode should be stored in an environment with low humidity, free from corrosive gas.

3.1.4. Terminal Specifications

J1 (Diode Input) pin assignments (refer to the mechanical drawing for additional details).

Terminal	Legend	Description
J1-A1	(+BAT)	5-40V Positive battery input
J1-1	(1)	(connected to J2-1)
J1-2	(C)	SMB serial clock
J1-3	(D)	SMB serial data
J1-4	(T)	Battery ID/THM (often 300 or 10K ohms to ground)
J1-5	(5)	(connected to J2-5)
J1-A2	(GND)	Battery negative input

J2 (Diode Output) pin assignments (refer to the mechanical drawing for additional details).

Terminal	Legend	Description
J2-A1	(+BAT)	5-40V Positive battery output
J2-1	(1)	(connected to J1-1)
J2-2	(C)	SMB serial clock
J2-3	(D)	SMB serial data
J2-4	(T)	Battery ID/THM (often 300 or 10K ohms to ground)
J2-5	(5)	(connected to J1-5)
J2-A2	(GND)	Battery negative output.



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3.2. Ideal Diode Electronics

3.2.1. DC Specifications

Parameter	Limits	Remarks
Input active current consumption	<200uA	5VDC input voltage is applied.
Input active current consumption	<250uA	40VDC input voltage is applied.
Output current leakage (input shorted)	<15uA	5VDC output voltage is applied
Output current leakage (input shorted)	<90uA	40VDC output voltage is applied
Input reverse polarity leakage	<250uA	-5VDC input reverse polarity
Input reverse polarity leakage	<2mA	-40VDC input reverse polarity
Max rated forward current	40A	5-40VDC
Max instantaneous forward current (10mS)	800A	5-40VDC
Max rated forward voltage drop	40mV	At 40A forward current
Min forward voltage drop	20mV	At 0.1A forward current

3.2.2. Forward Voltage Drop

The forward voltage drop consists of three components:

1. The resistance to the copper connections, less than 1 milliohm
2. A voltage drop required to sense the current direction, 20-45mV, typically 30mV. This includes the voltage drop across the transistors.

There is a minimum forward drop of 20mV, even at minimum current. At 40A, the max voltage drop is 45mV plus 30mV copper losses, totaling 75mV. Only the copper losses increase with current. Note at 40A this small board could be dissipating up to 3W, and therefore the board mounting, wire gauge and air flow will affect performance.

In the case of a shorted output, the Ideal Diode must be able to handle very high currents for a short time. Going from none to high current, diodes rated at 400A will conduct initially, while the switches turn on hard over 5 mSec. After that, the limit is thermal, dropping from 400A to 40A over the course of about 1 second.

3.2.3. Reverse Current

The Ideal Diode will be powered from the highest voltage present, 250uA max. The current passing through the diode in the reverse direction is primarily the leakage current of the semiconductors.

3.2.3.1. Overvoltage Protection

Typically, several batteries will be connected in parallel, which can deliver very high current. When this current is interrupted, the inductance of connecting cables can cause high voltage ringing, which will be applied to all connected Ideal Diodes. 60V forward, 30V negative, overvoltage clamping and snubbers are provided, however, the transients are application dependent, and must be considered in overall system design.

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3.2.3.2. Multi-Board Wiring

Each Ideal Diode board is individually capable of passing up to 40A. “Daisy-chaining” the current from one board to another is not recommended, because the board closest to the load must handle the sum of all the battery currents, which could exceed the 40A max rating of the board and the connectors.

If several batteries are connected in parallel with intent to get more current than one battery is capable of, it is important that the batteries all be at the same voltage (state of charge). If the battery voltages differ by more than about 50mV, the highest voltage battery will attempt to supply the load by itself, then shut off on overcurrent, shifting the load to the next highest voltage battery, which may also shut off. This ripple effect can cause all batteries to shut off one by one, rather than share the required load current. Once the load is on, the batteries will automatically distribute the current to equalize the load current.

3.3. Mechanical Specifications

3.3.1. Weight

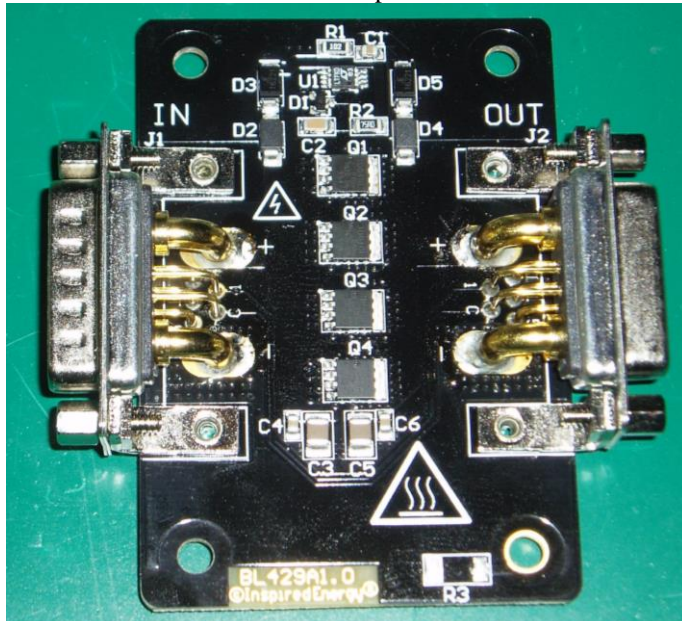
Approximately 1 ounce (30 gm).

3.3.2. Mating Connectors

The Ideal Diode board is furnished with only the IN (battery, male) connector installed. The board is intended for use with any of:

- IE 619040 40A male right-angle PCB-mount connector for the INPUT (battery) side
- IE 619041 40A female right-angle PCB-mount connector for the OUTPUT (load) side

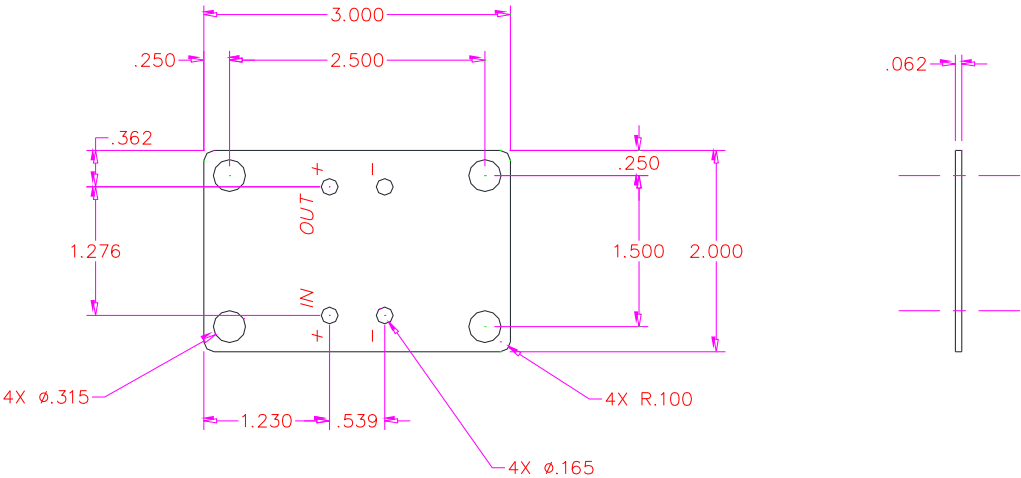
Ideal Diode is shown below with optional female OUPUT connector also installed:



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3.3.3. Mechanical Drawing



3.4. Environmental/Safety Specifications

3.4.1. Warranty

A high quality standard is maintained by Inspired Energy. All products are warranted against defects in workmanship, material and construction. The warranty period is one (1) year from the date of shipment from Inspired Energy.