

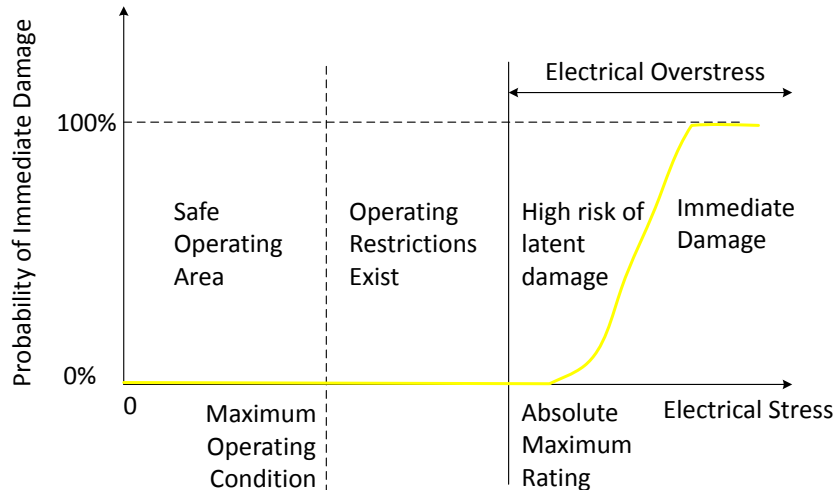
# AN1225: Understanding Absolute Maximum Rating and Electrical Overstress Failure in ISODrivers

This application note demystifies Absolute Maximum Rating (AMR) and Electrical Over-Stress (EOS) and describes the difference between Maximum Operating Condition (MOC) voltage and absolute maximum voltage on VDD. It also addresses the failure mode when an EOS violation voltage event occurs on VDD.

In the JEDEC JEP147 standard, EOS is defined as, “An electrical device suffers an electrical overstress event when a maximum limit for either the voltage across, the current through, or power dissipated in the device is exceeded and causes immediate damage or malfunction, or latent damage resulting in an unpredictable reduction of its lifetime” as illustrated below.

## KEY POINTS

- An EOS event is defined as an exceedance of a specified AMR.
- ISODriver has its own specified AMR table; designers must be careful to avoid any violations.
- The specified AMR does not mean the MOC under which the device can operate; designers must be aware of the difference and keep the device operating within recommended operating conditions.



The graphical depiction shown in the above figure clearly interprets the difference between AMR and MOC. The safe operating area under MOC is the robust operation region in which the device is designed to operate properly. Beyond the AMR is the region of EOS with either latent or immediate damage as a result of exceeding AMR. Between MOC and the AMR is the restriction region in which the device is not guaranteed to function as specified and may degrade lifetime reliability.

## 1. Si823x Family

In regard to the [Si823x family](#), the MOC is specified as a “Max” parameter in Table 1.1, and the AMR is specified in Table 1.2.

**Table 1.1. Electrical Characteristics (Recommended Operation)**

| Parameter                       | Symbol     | Test Condition                                   | Min | Typ | Max | Unit |
|---------------------------------|------------|--------------------------------------------------|-----|-----|-----|------|
| Input-side Power Supply Voltage | VDDI       | Si8230/1/2/3/4/5                                 | 4.5 | —   | 5.5 | V    |
|                                 |            | Si8237/8                                         | 2.7 | —   | 5.5 | V    |
| Driver Supply Voltage           | VDDA, VDDB | Voltage between VDDA and GNDA, and VDDB and GNDB | 6.5 | —   | 24  | V    |

**Table 1.2. Absolute Maximum Ratings**

| Parameter                  | Symbol     | Min  | Max | Unit |
|----------------------------|------------|------|-----|------|
| Input-side Supply Voltage  | VDDI       | -0.6 | 6   | V    |
| Driver-side Supply Voltage | VDDA, VDDB | -0.6 | 30  | V    |

Operating Si823x with VDDA/VDDB from 24 to 30 V can degrade the product's lifetime if subjected to such voltages. The extent of the product's degradation in this region is not completely predictable.

Operating Si823x with VDDA/VDDB greater than 30 V is an EOS event which can further impact lifetime reliability, can cause latent product damage, or even immediate, catastrophic damage. For example, at these voltage extremes, a protective ESD clamp on the product can engage. If enough current is allowed to flow through the clamp for a sufficient duration, the ESD clamp can be permanently damaged. A common signature of this EOS event is a low impedance path between VDDA/VDDB and GNDA/GNDB.

### References

- JEDEC, JEP174 Understanding Electrical Overstress – EOS, September 2016

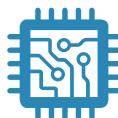


**Connecting Everyone  
and Everything,  
All the Time**



**Portfolio**

[www.skyworksinc.com](http://www.skyworksinc.com)



**Quality**

[www.skyworksinc.com/quality](http://www.skyworksinc.com/quality)



**Support & Resources**

[www.skyworksinc.com/support](http://www.skyworksinc.com/support)

**Copyright © 2021 Skyworks Solutions, Inc. All Rights Reserved.**

Information in this document is provided in connection with Skyworks Solutions, Inc. ("Skyworks") products or services. These materials, including the information contained herein, are provided by Skyworks as a service to its customers and may be used for informational purposes only by the customer. Skyworks assumes no responsibility for errors or omissions in these materials or the information contained herein. Skyworks may change its documentation, products, services, specifications or product descriptions at any time, without notice. Skyworks makes no commitment to update the materials or information and shall have no responsibility whatsoever for conflicts, incompatibilities, or other difficulties arising from any future changes.

No license, whether express, implied, by estoppel or otherwise, is granted to any intellectual property rights by this document. Skyworks assumes no liability for any materials, products or information provided hereunder, including the sale, distribution, reproduction or use of Skyworks products, information or materials, except as may be provided in Skyworks' Terms and Conditions of Sale.

THE MATERIALS, PRODUCTS AND INFORMATION ARE PROVIDED "AS IS" WITHOUT WARRANTY OF ANY KIND, WHETHER EXPRESS, IMPLIED, STATUTORY, OR OTHERWISE, INCLUDING FITNESS FOR A PARTICULAR PURPOSE OR USE, MERCHANTABILITY, PERFORMANCE, QUALITY OR NON-INFRINGEMENT OF ANY INTELLECTUAL PROPERTY RIGHT; ALL SUCH WARRANTIES ARE HEREBY EXPRESSLY DISCLAIMED. SKYWORKS DOES NOT WARRANT THE ACCURACY OR COMPLETENESS OF THE INFORMATION, TEXT, GRAPHICS OR OTHER ITEMS CONTAINED WITHIN THESE MATERIALS. SKYWORKS SHALL NOT BE LIABLE FOR ANY DAMAGES, INCLUDING BUT NOT LIMITED TO ANY SPECIAL, INDIRECT, INCIDENTAL, STATUTORY, OR CONSEQUENTIAL DAMAGES, INCLUDING WITHOUT LIMITATION, LOST REVENUES OR LOST PROFITS THAT MAY RESULT FROM THE USE OF THE MATERIALS OR INFORMATION, WHETHER OR NOT THE RECIPIENT OF MATERIALS HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.

Skyworks products are not intended for use in medical, lifesaving or life-sustaining applications, or other equipment in which the failure of the Skyworks products could lead to personal injury, death, physical or environmental damage. Skyworks customers using or selling Skyworks products for use in such applications do so at their own risk and agree to fully indemnify Skyworks for any damages resulting from such improper use or sale.

Customers are responsible for their products and applications using Skyworks products, which may deviate from published specifications as a result of design defects, errors, or operation of products outside of published parameters or design specifications. Customers should include design and operating safeguards to minimize these and other risks. Skyworks assumes no liability for applications assistance, customer product design, or damage to any equipment resulting from the use of Skyworks products outside of Skyworks' published specifications or parameters.

Skyworks, the Skyworks symbol, Sky5®, SkyOne®, SkyBlue™, Skyworks Green™, Clockbuilder®, DSPLL®, ISOModem®, ProSLIC®, and SiPHY® are trademarks or registered trademarks of Skyworks Solutions, Inc. or its subsidiaries in the United States and other countries. Third-party brands and names are for identification purposes only and are the property of their respective owners. Additional information, including relevant terms and conditions, posted at [www.skyworksinc.com](http://www.skyworksinc.com), are incorporated by reference.

Skyworks Solutions, Inc. | Nasdaq: SWKS | [sales@skyworksinc.com](mailto:sales@skyworksinc.com) | [www.skyworksinc.com](http://www.skyworksinc.com)

USA: 781-376-3000 | Asia: 886-2-2735 0399 | Europe: 33 (0)1 43548540 |    