Description
The ISOM8110 opto-emulator offers significant reliability and performance advantages compared to optocouplers, including high bandwidth, low turn-off delay, low power consumption, wider temperature ranges, tight CTR and process controls resulting in small part-to-part skew. Since there is no aging effect or temperature variation to compensate for, the emulated diode-input stage consumes less power than optocouplers.

Features
- Platform for complete evaluation of the ISOM8110DFG
- Test points and jumper options
- Passives and footprints for basic modifications included
- Drop-in upgradable and pin-compatible for popular phototransistor optocouplers
- 1 channel diode-emulator input
- Current transfer ratio (CTR): at IF = 5 mA, VCE = 5 V – ISOM8110: 100% to 155%
- High collector-emitter voltage: VCEO (max) = 80 V
- Robust isolation barrier
1 Evaluation Module Overview

1.1 Introduction

The ISOM8110DFGEVM user’s guide describes the functionality of the ISOM810 Single-Channel Opto-Emulator with Analog Transistor Output Evaluation Module (EVM). The ISOM8110DFGEVM supports evaluation of TI's ISOM8110 Opto-Emulator in a 4-pin DFG SOIC package. This user’s guide describes EVM operation with respect to the ISOM8110 under 5 V operation. The EVM can be reconfigured for evaluation with a larger input signal or other applications by changing the EVM configuration and component values. The user's guide also covers the channel configuration of the ISOM8110, EVM schematic, and typical setup.

**CAUTION**

This evaluation module is made available for isolator parameter performance evaluation only and is not intended for isolation voltage testing. To prevent damage to the EVM, any voltage applied as a supply or digital input/output must be maintained within the recommended operating conditions of the device.

1.2 Kit Contents

This evaluation module contains one PCB evaluation board containing one ISOM8110DFG device. The major components of the ISOM8110 evaluation board are:

- ISOM8110DFG Opto-Emulator
- Multiple on-board test points

To demonstrate functionality of the ISOM8110DFG, TI recommends the following (not included):

- Oscilloscope
- Signal Generator

1.3 Specification

The ISOM8110 device is capable of being pin-compatible and drop-in replaceable with many opto-coupler devices with transistor outputs. Opto-emulators offer significant reliability and performance advantages compared to traditional opto-couplers, including tighter current transfer ratio (CTR), low input current, and wider temperature ranges.

The ISOM8110 Opto-Emulator replicates the characteristics of traditional opto-couplers without the drawbacks of aging and thermal drift by using a input-diode emulator and output stage separated by a silicon oxide (SiO2) insulation barrier. When used with isolated power supplies, these devices block high voltages, isolate grounds, and prevent noise currents from interfering with or damaging sensitive circuitry.

1.4 Device Information

The ISOM8110DFGEVM contains one ISOM8110 and all other passive components required for operation. The various components included in the evaluation module directly control the operation and functionality of the ISOM8110. If necessary, then components can be removed, added, or replaced to modify the behavior of the ISOM8110 accordingly for any given application.
2 Hardware

2.1 EVM Setup and Operation

Basic EVM Setup

This section describes the setup and operation of the EVM for parameter performance evaluation. Figure 2-1 shows a typical test configuration of the ISOM8110 Opto-Emulator EVM using a current source.

![Figure 2-1. Basic EVM Operation](image)

ISOM8110DFGEVM has do not populate (DNP) footprints for components which can be populated to apply different test conditions to the device. Section 2.1 lists and describes possible test configurations that can be achieved by modifying different components on the EVM.

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>R1 is sized for 5 V operation. If a larger supply is needed, then select a resistor that provides the proper IF current to the anode.</td>
</tr>
<tr>
<td>J3</td>
<td>Shunt J3 to use the output as a high side output (emitter pin). Never shunt J3 and J4 at the same time.</td>
</tr>
<tr>
<td>J4</td>
<td>Shunt J4 to use the output as a low side output (collector pin). Never shunt J3 and J4 at the same time.</td>
</tr>
<tr>
<td>C1, C2</td>
<td>C1 and C2 can be used to add capacitance to the input diode or collector output, respectively.</td>
</tr>
</tbody>
</table>

2.2 Pin Configuration of the ISOM8110 Single-Channel Opto-Emulator with Analog Transistor Output

Figure 2-2 shows the ISOM8110 Single-Channel Opto-Emulator with Analog Transistor Output pin configuration.

![Figure 2-2. ISOM8110 Single-Channel Opto-Emulator with Analog Transistor Output Pin Configuration](image)
3 Hardware Design Files
3.1 Schematics

The ISOM8110DFGEVM has additional footprints that gives the user flexibility to test a variety of common applications.

Other positions on the board can be modified as well. For example, R1 can be changed to accommodate different current requirements, and C2 can be added to test the device with resistive or capacitive loading. See ISOM8110DFGEVM for the EVM schematic and see Table 2-1 for more information on alternate EVM configurations.

![ISOM8110DFGEVM Schematic](image)

Figure 3-1. ISOM8110DFGEVM Schematic
3.2 PCB Layout and 3D Diagram

Figure 3-2 and Figure 3-3 show the printed-circuit board (PCB) layout top and bottom, respectively, and Figure 3-4 shows a 3D diagram of the EVM PCB.
3.3 Bill of Materials

Table 3-1 lists the bill of materials (BOM) for the ISOM8110DFGEVM.

<table>
<thead>
<tr>
<th>Item #</th>
<th>Designator</th>
<th>Manufacturer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C3</td>
<td>TDK</td>
<td>CAP, CERM, 1 uF, 50 V, +/- 10%, X5R, 0603</td>
</tr>
<tr>
<td>2</td>
<td>H1, H2, H3, H4</td>
<td>3M</td>
<td>Bumpon, Hemisphere, 0.44 X 0.20, Clear</td>
</tr>
<tr>
<td>3</td>
<td>J1</td>
<td>Phoenix Contact</td>
<td>Conn Term Block, 2POS, 3.5mm, TH</td>
</tr>
<tr>
<td>4</td>
<td>J2, J3, J4</td>
<td>Samtec</td>
<td>Connector Header Surface Mount 2 position 0.100” (2.54mm)</td>
</tr>
<tr>
<td>5</td>
<td>J5</td>
<td>Samtec</td>
<td>Connector Header Surface Mount 4 position 0.100” (2.54mm)</td>
</tr>
<tr>
<td>6</td>
<td>J6</td>
<td>Phoenix Contact</td>
<td>Terminal Block, 4x1, 2.54 mm, Green, TH</td>
</tr>
<tr>
<td>7</td>
<td>Q1</td>
<td>Texas Instruments</td>
<td>3.75-kVRMS, Single-Channel Opto-Emulator with Transistor Output</td>
</tr>
<tr>
<td>8</td>
<td>R1, R3, R4</td>
<td>Panasonic</td>
<td>RES, 1.00 k, 1%, 0.25 W, 0805</td>
</tr>
<tr>
<td>9</td>
<td>R2</td>
<td>Yageo America</td>
<td>RES, 0, 5%, 0.125 W, 0805</td>
</tr>
<tr>
<td>10</td>
<td>SH-J1</td>
<td>Samtec</td>
<td>Shunt, 100mil, Gold plated, Black</td>
</tr>
<tr>
<td>11</td>
<td>TP1, TP2, TP3, TP4, TP5, TP6, TP7, TP8</td>
<td>Keystone</td>
<td>Test Point, Miniature, SMT</td>
</tr>
<tr>
<td>12</td>
<td>C1</td>
<td>Yageo America</td>
<td>CAP, CERM, 15 pF, 50 V, +/- 5%, CDG/NP0, 0805</td>
</tr>
<tr>
<td>13</td>
<td>C2</td>
<td>MuRata</td>
<td>CAP, CERM, 15 pF, 50 V, +/- 5%, CDG/NP0, AEC-Q200 Grade 1, 0603</td>
</tr>
</tbody>
</table>

4 Additional Information

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2.3 TI's sole liability shall be at its option to repair or replace EVMs that fail to conform to the warranty set forth above, or credit User's account for such EVM. TI's liability under this warranty shall be limited to EVMs that are returned during the warranty period to the address designated by TI and that are determined by TI not to conform to such warranty. If TI elects to repair or replace such EVM, TI shall have a reasonable time to repair such EVM or provide replacements. Repaired EVMs shall be warranted for the remainder of the original warranty period. Replaced EVMs shall be warranted for a new full ninety (90) day warranty period.

WARNING

Evaluation Kits are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems.

User shall operate the Evaluation Kit within TI's recommended guidelines and any applicable legal or environmental requirements as well as reasonable and customary safeguards. Failure to set up and/or operate the Evaluation Kit within TI’s recommended guidelines may result in personal injury or death or property damage. Proper set up entails following TI’s instructions for electrical ratings of interface circuits such as input, output and electrical loads.

NOTE:
EXPOSURE TO ELECTROSTATIC DISCHARGE (ESD) MAY CAUSE DEGREDATION OR FAILURE OF THE EVALUATION KIT; TI RECOMMENDS STORAGE OF THE EVALUATION KIT IN A PROTECTIVE ESD BAG.
3 Regulatory Notices:

3.1 United States

3.1.1 Notice applicable to EVMs not FCC-Approved:

FCC NOTICE: This kit is designed to allow product developers to evaluate electronic components, circuitry, or software associated with the kit to determine whether to incorporate such items in a finished product and software developers to write software applications for use with the end product. This kit is not a finished product and when assembled may not be resold or otherwise marketed unless all required FCC equipment authorizations are first obtained. Operation is subject to the condition that this product not cause harmful interference to licensed radio stations and that this product accept harmful interference. Unless the assembled kit is designed to operate under part 15, part 18 or part 95 of this chapter, the operator of the kit must operate under the authority of an FCC license holder or must secure an experimental authorization under part 5 of this chapter.

3.1.2 For EVMs annotated as FCC – FEDERAL COMMUNICATIONS COMMISSION Part 15 Compliant:

CAUTION
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

FCC Interference Statement for Class A EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Interference Statement for Class B EVM devices

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

3.2 Canada

3.2.1 For EVMs issued with an Industry Canada Certificate of Conformance to RSS-210 or RSS-247

Concerning EVMs Including Radio Transmitters:

This device complies with Industry Canada license-exempt RSSs. Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Concernant les EVMs avec appareils radio:

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Concerning EVMs Including Detachable Antennas:

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication. This radio transmitter has been approved by Industry Canada to operate with the antenna types listed in the user guide with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.
Concernant les EVMs avec antennes détachables
Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante. Le présent émetteur radio a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés dans le manuel d'usage et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

3.3 Japan

3.3.1 Notice for EVMs delivered in Japan: Please see [http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page](http://www.tij.co.jp/lsds/ti_ja/general/eStore/notice_01.page) 日本国内に輸入される評価用キット、ボードについては、次のところをご覧ください。


3.3.2 Notice for Users of EVMs Considered “Radio Frequency Products” in Japan: EVMs entering Japan may not be certified by TI as conforming to Technical Regulations of Radio Law of Japan.

If User uses EVMs in Japan, not certified to Technical Regulations of Radio Law of Japan, User is required to follow the instructions set forth by Radio Law of Japan, which includes, but is not limited to, the instructions below with respect to EVMs (which for the avoidance of doubt are stated strictly for convenience and should be verified by User):

1. Use EVMs in a shielded room or any other test facility as defined in the notification #173 issued by Ministry of Internal Affairs and Communications on March 28, 2006, based on Sub-section 1.1 of Article 6 of the Ministry’s Rule for Enforcement of Radio Law of Japan,
2. Use EVMs only after User obtains the license of Test Radio Station as provided in Radio Law of Japan with respect to EVMs, or
3. Use of EVMs only after User obtains the Technical Regulations Conformity Certification as provided in Radio Law of Japan with respect to EVMs. Also, do not transfer EVMs, unless User gives the same notice above to the transferee. Please note that if User does not follow the instructions above, User will be subject to penalties of Radio Law of Japan.

3.4 European Union

3.4.1 For EVMs subject to EU Directive 2014/30/EU (Electromagnetic Compatibility Directive):

This is a class A product intended for use in environments other than domestic environments that are connected to a low-voltage power-supply network that supplies buildings used for domestic purposes. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.
EVM Use Restrictions and Warnings:

4.1 EVMS ARE NOT FOR USE IN FUNCTIONAL SAFETY AND/OR SAFETY CRITICAL EVALUATIONS, INCLUDING BUT NOT LIMITED TO EVALUATIONS OF LIFE SUPPORT APPLICATIONS.

4.2 User must read and apply the user guide and other available documentation provided by TI regarding the EVM prior to handling or using the EVM, including without limitation any warning or restriction notices. The notices contain important safety information related to, for example, temperatures and voltages.

4.3 Safety-Related Warnings and Restrictions:

4.3.1 User shall operate the EVM within TI's recommended specifications and environmental considerations stated in the user guide, other available documentation provided by TI, and any other applicable requirements and employ reasonable and customary safeguards. Exceeding the specified performance ratings and specifications (including but not limited to input and output voltage, current, power, and environmental ranges) for the EVM may cause personal injury or death, or property damage. If there are questions concerning performance ratings and specifications, User should contact a TI field representative prior to connecting interface electronics including input power and intended loads. Any loads applied outside of the specified output range may also result in unintended and/or inaccurate operation and/or possible permanent damage to the EVM and/or interface electronics. Please consult the EVM user guide prior to connecting any load to the EVM output. If there is uncertainty as to the load specification, please contact a TI field representative. During normal operation, even with the inputs and outputs kept within the specified allowable ranges, some circuit components may have elevated case temperatures. These components include but are not limited to linear regulators, switching transistors, pass transistors, current sense resistors, and heat sinks, which can be identified using the information in the associated documentation. When working with the EVM, please be aware that the EVM may become very warm.

4.3.2 EVMs are intended solely for use by technically qualified, professional electronics experts who are familiar with the dangers and application risks associated with handling electrical mechanical components, systems, and subsystems. User assumes all responsibility and liability for proper and safe handling and use of the EVM by User or its employees, affiliates, contractors or designers. User assumes all responsibility and liability to ensure that any interfaces (electronic and/or mechanical) between the EVM and any human body are designed with suitable isolation and means to safely limit accessible leakage currents to minimize the risk of electrical shock hazard. User assumes all responsibility and liability for any improper or unsafe handling or use of the EVM by User or its employees, affiliates, contractors or designers.

4.4 User assumes all responsibility and liability to determine whether the EVM is subject to any applicable international, federal, state, or local laws and regulations related to User's handling and use of the EVM and, if applicable, User assumes all responsibility and liability for proper disposal and recycling of the EVM consistent with all applicable international, federal, state, and local requirements.

5. Accuracy of Information: To the extent TI provides information on the availability and function of EVMs, TI attempts to be as accurate as possible. However, TI does not warrant the accuracy of EVM descriptions, EVM availability or other information on its websites as accurate, complete, reliable, current, or error-free.
8. **Limitations on Damages and Liability:**

8.1 **General Limitations.** IN NO EVENT SHALL TI BE LIABLE FOR ANY SPECIAL, COLLATERAL, INDIRECT, PUNITIVE, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES IN CONNECTION WITH OR ARISING OUT OF THESE TERMS OR THE USE OF THE EVM(S), REGARDLESS OF WHETHER TI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. EXCLUDED DAMAGES INCLUDE, BUT ARE NOT LIMITED TO, COST OF REMOVAL OR REINSTALLATION, ANCILLARY COSTS TO THE PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES, RETESTING, OUTSIDE COMPUTER TIME, LABOR COSTS, LOSS OF GOODWILL, LOSS OF PROFITS, LOSS OF SAVINGS, LOSS OF USE, LOSS OF DATA, OR BUSINESS INTERRUPTION. NO CLAIM, SUIT OR ACTION SHALL BE BROUGHT AGAINST TI MORE THAN TWELVE (12) MONTHS AFTER THE EVENT THAT GAVE RISE TO THE CAUSE OF ACTION HAS OCCURRED.

8.2 **Specific Limitations.** IN NO EVENT SHALL TI’S AGGREGATE LIABILITY FROM ANY USE OF AN EVM PROVIDED HEREUNDER, INCLUDING FROM ANY WARRANTY, INDEMNITY OR OTHER OBLIGATION ARISING OUT OF OR IN CONNECTION WITH THESE TERMS, EXCEED THE TOTAL AMOUNT PAID TO TI BY USER FOR THE PARTICULAR EVM(S) AT ISSUE DURING THE PRIOR TWELVE (12) MONTHS WITH RESPECT TO WHICH LOSSES OR DAMAGES ARE CLAIMED. THE EXISTENCE OF MORE THAN ONE CLAIM SHALL NOT ENLARGE OR EXTEND THIS LIMIT.

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