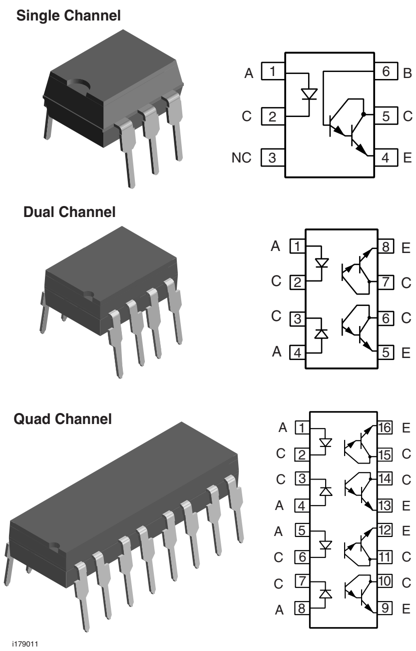
# Optocoupler, Photodarlington Output (Single, Dual, Quad Channel)




## FEATURES

- 125 mA load current rating
- Fast rise time, 10 µs
- Fast fall time, 35 µs
- Single, dual and quad channel
- Solid state reliability
- Standard DIP packages
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

Pb-free
e3
RoHS
COMPLIANT

## AGENCY APPROVALS

- UL1577, file no. E52744 system code H or J, double protection
- DIN EN 60747-5-2 (VDE 0884)/DIN EN 60747-5-5 pending available with option 1
- BSI IEC 60950 IEC 60065
- FIMKO

## DESCRIPTION

The IL30/IL31/IL55 single, ILD30/ILD31/ILD55 dual, and ILQ30/ILQ31/ILQ55 quad are optically coupled isolators with gallium arsenide infrared emitters and silicon photodarlington sensors. Switching can be achieved while maintaining a high degree of isolation between driving and load circuits, with no crosstalk between channels. These optocouplers can be used to replace reed and mercury relays with advantages of long life, high speed switching and elimination of magnetic fields.

The IL30/IL31/IL55 are equivalent to MCA230/MCA231/MCA255. The ILD30/ILD31/ILD55 are designed to reduce board space requirements in high density applications.

## ORDER INFORMATION

| PART | REMARKS |
|---|---|
| IL30 | CTR > 100 %, single channel DIP-6 |
| IL31 | CTR > 200 %, single channel DIP-6 |
| IL55 | CTR > 100 %, single channel DIP-6 |
| ILD30 | CTR > 100 %, dual channel DIP-8 |
| ILD31 | CTR > 200 %, dual channel DIP-8 |
| ILD55 | CTR > 100 %, dual channel DIP-8 |
| ILQ30 | CTR > 100 %, quad channel DIP-16 |
| ILQ31 | CTR > 200 %, quad channel DIP-16 |
| ILQ55 | CTR > 100 %, quad channel DIP-16 |
| IL55-X009 | CTR > 100 %, single channel SMD-6 (option 9) |
| ILD30-X009 | CTR > 100 %, dual channel SMD-8 (option 9) |
| ILD31-X007 | CTR > 200 %, dual channel SMD-8 (option 7) |
| ILD31-X009 | CTR > 200 %, dual channel SMD-8 (option 9) |

| ORDER INFORMATION | |
|---|---|
| PART | REMARKS |
| ILD55-X007 | CTR > 100 %, dual channel SMD-8 (option 7) |
| ILD55-X009 | CTR > 100 %, dual channel SMD-8 (option 9) |
| ILQ30-X009 | CTR > 100 %, quad channel SMD-16 (option 9) |
| ILQ55-X007 | CTR > 100 %, quad channel SMD-16 (option 7) |
| ILQ55-X009 | CTR > 100 %, quad channel SMD-16 (option 9) |

**Note**
For additional information on the available options refer to option information.

| ABSOLUTE MAXIMUM RATINGS | | | | | |
|---|---|---|---|---|---|
| PARAMETER | TEST CONDITION | PART | SYMBOL | VALUE | UNIT |
| **INPUT** | | | | | |
| Peak reverse voltage | | | $V_{RM}$ | 3.0 | V |
| Forward continuous current | | | $I_F$ | 60 | mA |
| Power dissipation | | | $P_{diss}$ | 100 | mW |
| Derate linearly from 25 °C | | | | 1.33 | mW/°C |
| **OUTPUT** | | | | | |
| Collector emitter breakdown voltage | | IL30 | $BV_{CEO}$ | 30 | V |
| | | ILD30 | $BV_{CEO}$ | 30 | V |
| | | ILQ30 | $BV_{CEO}$ | 30 | V |
| | | IL55 | $BV_{CEO}$ | 55 | V |
| | | ILD55 | $BV_{CEO}$ | 55 | V |
| | | ILD55 | $BV_{CEO}$ | 55 | V |
| Collector (load) current | | | $I_C$ | 125 | mA |
| Power dissipation | | | $P_{diss}$ | 150 | mW |
| Derate linearly from 25 °C | | | | 2.0 | mW/°C |
| **COUPLER** | | | | | |
| Total package power dissipation | | IL30 | $P_{tot}$ | 250 | mW |
| | | IL31 | $P_{tot}$ | 250 | mW |
| | | IL55 | $P_{tot}$ | 250 | mW |
| | | ILD30 | $P_{tot}$ | 400 | mW |
| | | ILD31 | $P_{tot}$ | 400 | mW |
| | | ILD55 | $P_{tot}$ | 400 | mW |
| | | ILQ30 | $P_{tot}$ | 500 | mW |
| | | ILQ31 | $P_{tot}$ | 500 | mW |
| | | ILQ55 | $P_{tot}$ | 500 | mW |
| Derate linearly from 25 °C | | IL30 | | 3.3 | mW/°C |
| | | IL31 | | 3.3 | mW/°C |
| | | IL55 | | 3.3 | mW/°C |
| | | ILD30 | | 5.33 | mW/°C |
| | | ILD31 | | 5.33 | mW/°C |
| | | ILD55 | | 5.33 | mW/°C |
| | | ILQ30 | | 6.67 | mW/°C |
| | | ILQ31 | | 6.67 | mW/°C |
| | | ILQ55 | | 6.67 | mW/°C |
| Isolation test voltage | | | $V_{ISO}$ | 5300 | $V_{RMS}$ |
| Creepage distance | | | | ≥ 7.0 | mm |
| Clearance distance | | | | ≥ 7.0 | mm |
| Comparative tracking index | | | CTI | 175 | |
| Storage temperature | | | $T_{stg}$ | - 55 to + 125 | °C |

| ABSOLUTE MAXIMUM RATINGS | | | | | |
|---|---|---|---|---|---|
| PARAMETER | TEST CONDITION | PART | SYMBOL | VALUE | UNIT |
| COUPLER | | | | | |
| Operating temperature | | | $T_{amb}$ | - 55 to + 100 | °C |
| Lead soldering time at 260 °C | | | | 10 | s |

**Note**

$T_{amb}$ = 25 °C, unless otherwise specified.
Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.

| ELECTRICAL CHARACTERISTICS | | | | | | |
|---|---|---|---|---|---|---|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| INPUT | | | | | | |
| Forward voltage | $I_F$ = 20 mA | $V_F$ | | 1.25 | 1.5 | V |
| Reverse current | $V_R$ = 3.0 V | $I_R$ | | 0.1 | 10 | µA |
| Capacitance | $V_R$ = 0 V | $C_O$ | | 25 | | pF |
| OUTPUT | | | | | | |
| Collector emitter breakdown voltage | $I_C$ = 100 µA | $BV_{CEO}$ | 30/55 | | | V |
| Collector emitter leakage current | $V_{CE}$ = 10 V, $I_F$ = 0 A | $I_{CEO}$ | | 1.0 | 100 | nA |
| Collector emitter capacitance | $V_{CE}$ = 10 V, f = 1.0 MHz | $C_{CE}$ | | 3.4 | | pF |
| COUPLER | | | | | | |
| Collector emitter saturation voltage | $I_C$ = 50 mA, $I_F$ = 50 mA | $V_{CEsat}$ | | 0.9 | 1.0 | V |
| Isolation test voltage | | | 5300 | | | $V_{RMS}$ |
| Isolation resistance | | $R_{IO}$ | | $10^{12}$ | | Ω |
| Capacitance (input to output) | | $C_{IO}$ | | 0.5 | | pF |

**Note**

$T_{amb}$ = 25 °C, unless otherwise specified.
Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.

| CURRENT TRANSFER RATIO | | | | | | | |
|---|---|---|---|---|---|---|---|
| PARAMETER | TEST CONDITION | PART | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| Current transfer ratio | $I_F$ = 10 mA, $V_{CE}$ = 5.0 V | IL30 | CTR | 100 | 400 | | % |
| | | IL55 | CTR | 100 | 400 | | % |
| | | ILD30 | CTR | 100 | 400 | | % |
| | | ILD55 | CTR | 100 | 400 | | % |
| | | ILQ30 | CTR | 100 | 400 | | % |
| | | ILQ55 | CTR | 100 | 400 | | % |
| | | IL31 | CTR | 200 | 400 | | % |
| | | ILD31 | CTR | 200 | 400 | | % |
| | | ILQ31 | CTR | 200 | 400 | | % |

| SWITCHING CHARACTERISTICS | | | | | | |
|---|---|---|---|---|---|---|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| Rise time | $V_{CC}$ = 13.5 V, $I_F$ = 50 mA, $R_L$ = 100 Ω | $t_r$ | | 10 | | µs |
| Fall time | $V_{CC}$ = 13.5 V, $I_F$ = 50 mA, $R_L$ = 100 Ω | $t_f$ | | 35 | | µs |

## TYPICAL CHARACTERISTICS

$T_{amb}$ = 25 °C, unless otherwise specified

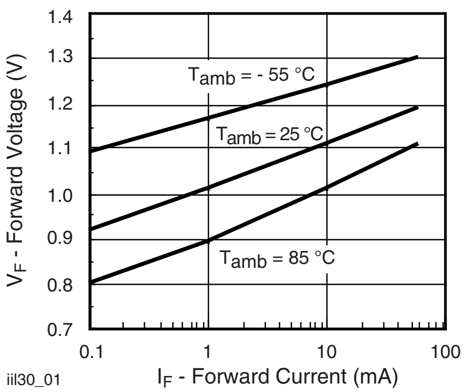



Fig. 1 - Forward Voltage vs. Forward Current

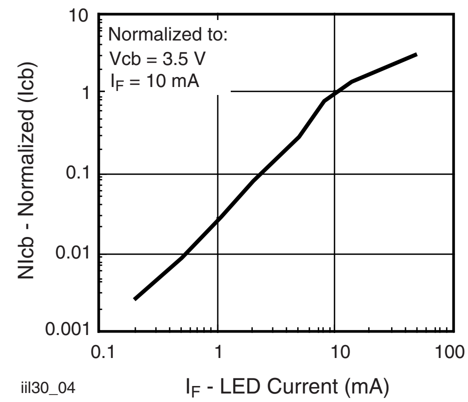



Fig. 4 - Normalized Collector Base Photocurrent vs. LED Current

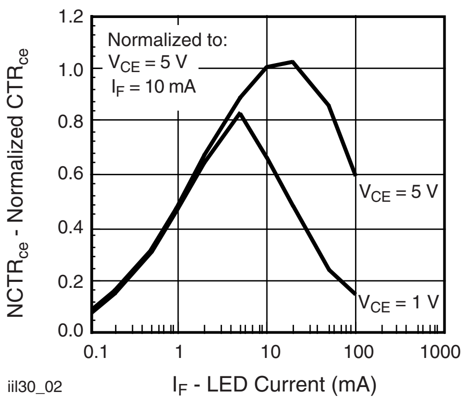



Fig. 2 - Normalized Non-Saturated and Saturated $CTR_{CE}$ vs. LED Current

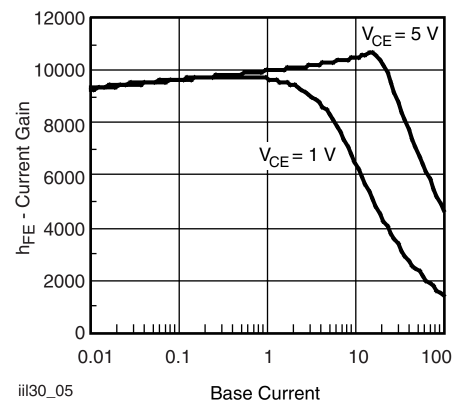



Fig. 5 - $h_{FE}$ Current Gain vs. Base Current

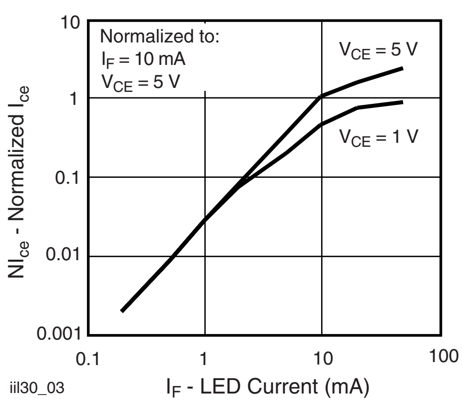



Fig. 3 - Normalized Non-Saturated and Saturated Collector Emitter Current vs. LED Current

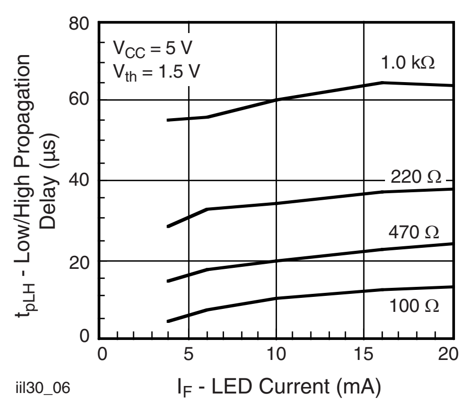



Fig. 6 - Low to High Propagation Delay vs. Collector Load Resistance and LED Current

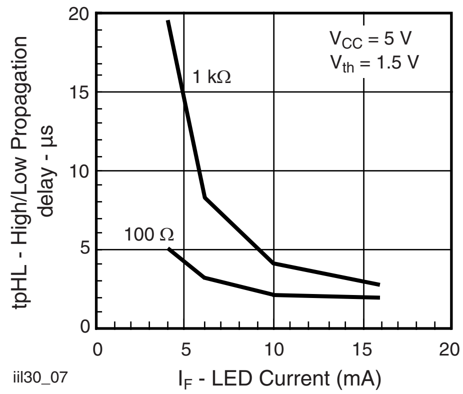



Fig. 7 - High to Low Propagation Delay vs. Collector Load Resistance and LED Current

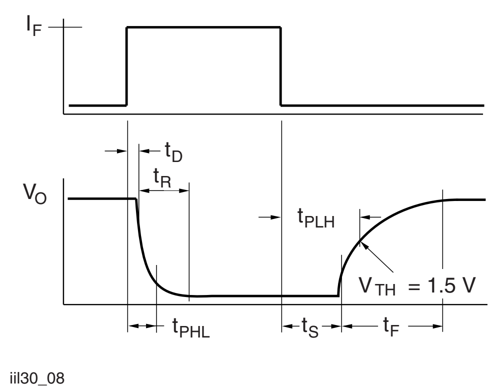



Fig. 8 - Switching Waveform

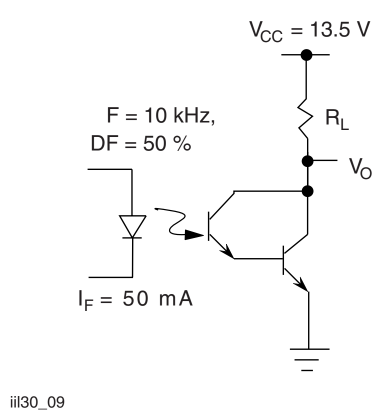
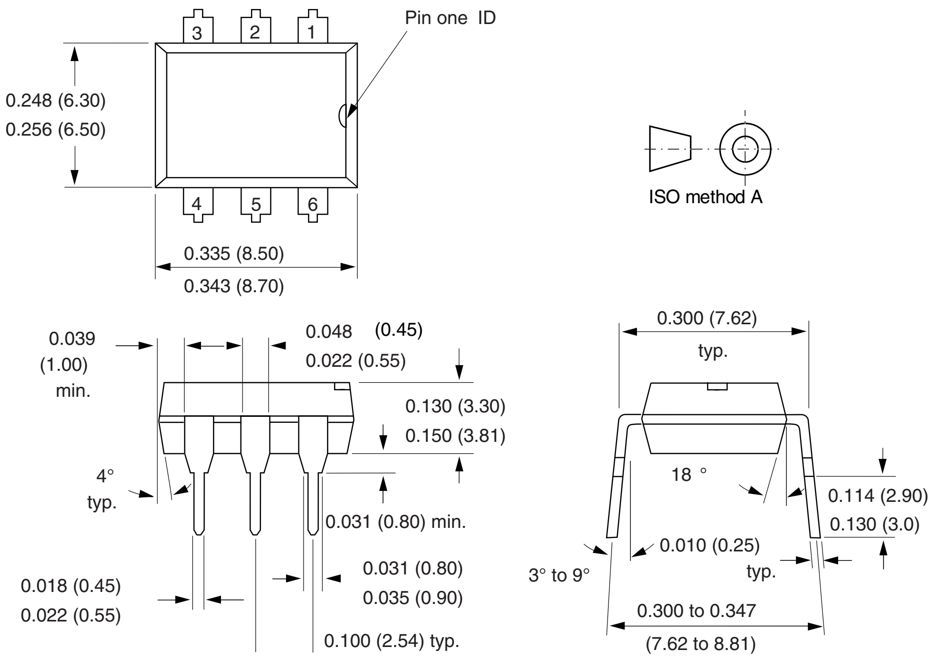
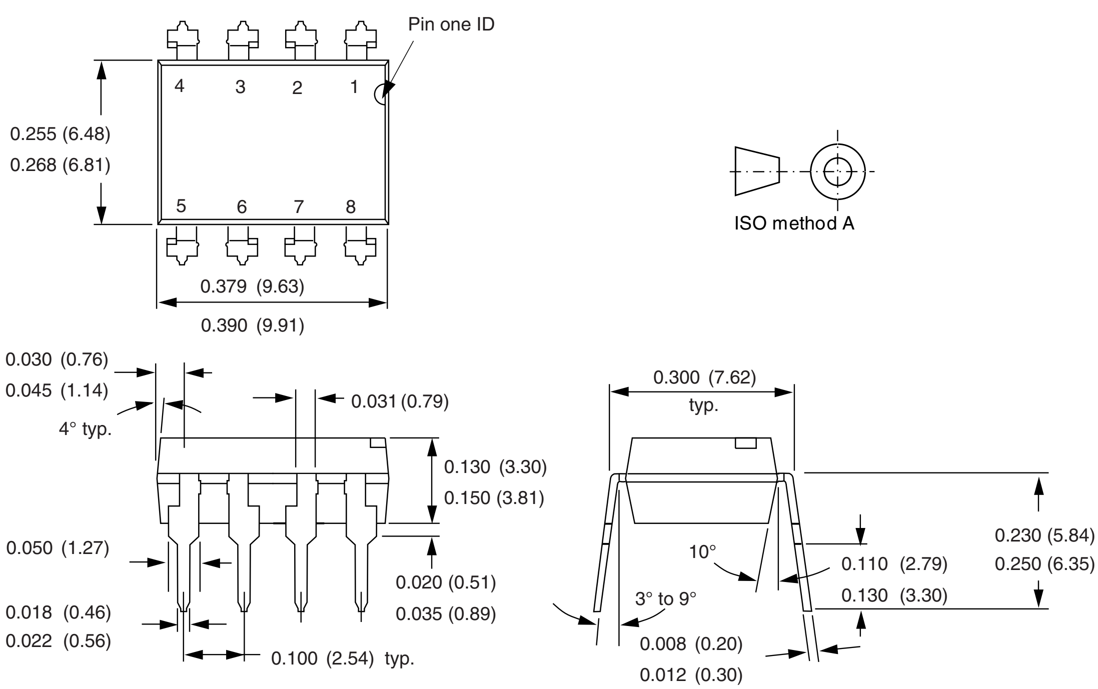



Fig. 9 - Switching Schematic

**PACKAGE DIMENSIONS** in inches (millimeters)

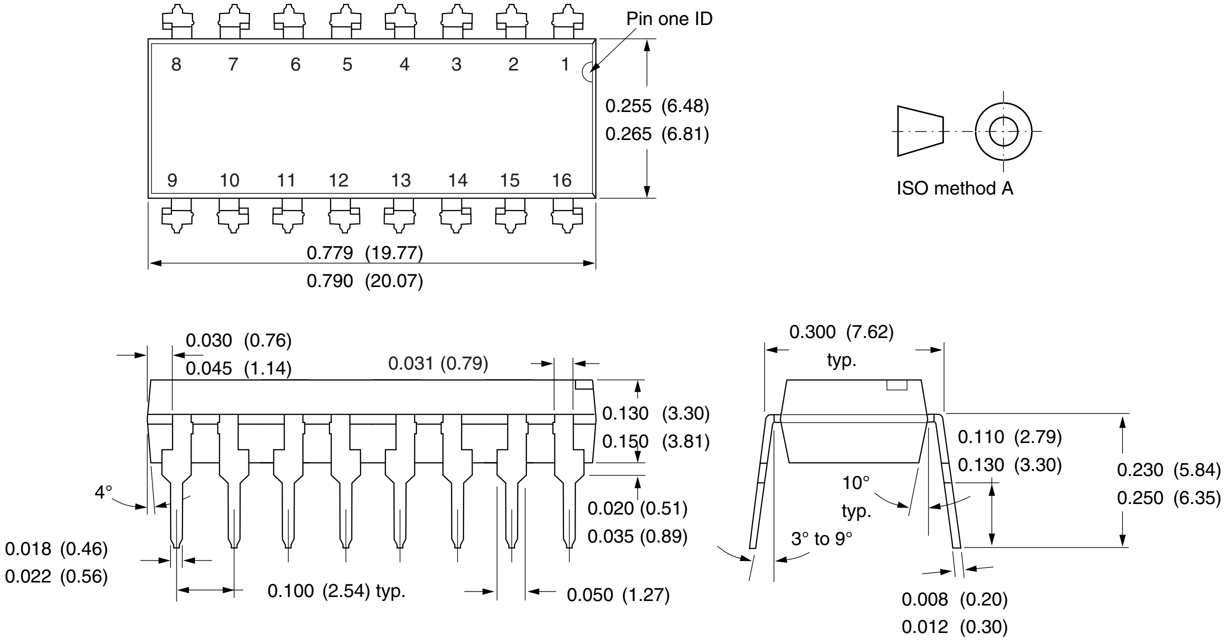



i178004



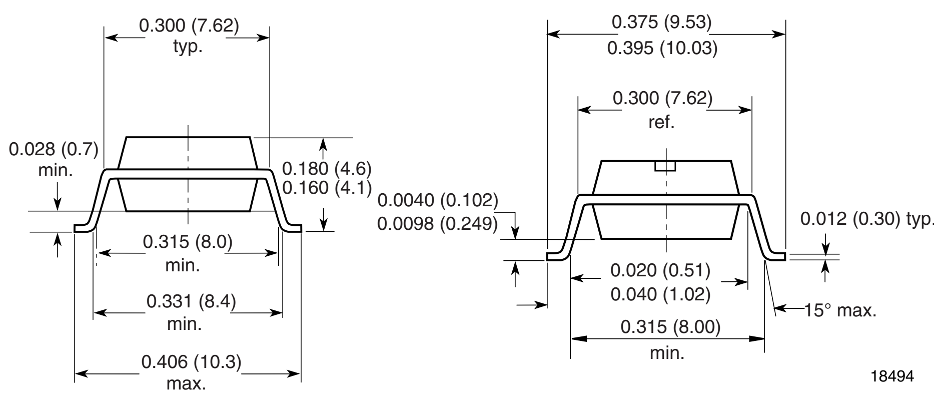

i178006

**PACKAGE DIMENSIONS** in inches (millimeters)




i178007

**Option 7** **Option 9**




18494

## OZONE DEPLETING SUBSTANCES POLICY STATEMENT

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively.
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA.
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.



Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany

# Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay’s knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer’s responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and/or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer’s technical experts. Product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk and agree to fully indemnify and hold Vishay and its distributors harmless from and against any and all claims, liabilities, expenses and damages arising or resulting in connection with such use or sale, including attorneys fees, even if such claim alleges that Vishay or its distributor was negligent regarding the design or manufacture of the part. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.