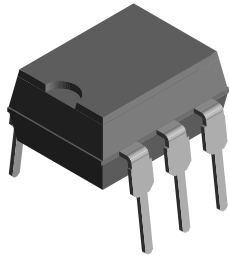
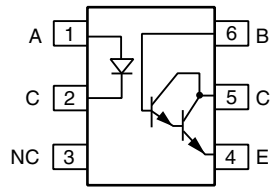




## Optocoupler, Photodarlington Output, High Gain, With Base Connection



1179004-3



1179005\_2

**FEATURES**

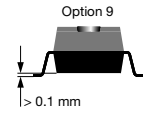
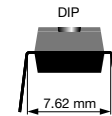
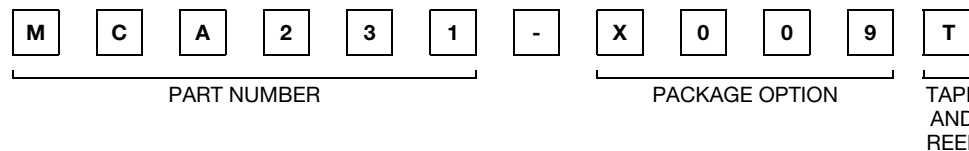
- Isolation test voltage, 5300 V<sub>RMS</sub>
- Coupling capacitance, 0.5 pF
- Fast rise time, 10  $\mu$ s
- Fast fall time, 35  $\mu$ s
- Material categorization:  
for definitions of compliance please see  
[www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

RoHS  
COMPLIANT**AGENCY APPROVALS**

- UL1577, file no. E52744 system code H, double protection
- CSA 93751
- BSI IEC 60950; IEC 60065

**DESCRIPTION**

The MCA231 is an industry standard optocoupler, consisting of a gallium arsenide infrared LED and a silicon photodarlington. These optocouplers are constructed with a high voltage insulation packaging process which offers 7.5 kV withstand test capability.

**ORDERING INFORMATION**

| AGENCY CERTIFIED/PACKAGE | CTR (%)                     |
|--------------------------|-----------------------------|
|                          | 10 mA                       |
| UL, BSI, VDE             | > 200                       |
| DIP-6                    | MCA231                      |
| SMD-6, option 9          | MCA231-X009T <sup>(1)</sup> |

**Note**

- For additional information on the available options refer to option information
- <sup>(1)</sup> Also available in tubes, do not put T on the end

**ABSOLUTE MAXIMUM RATINGS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

| PARAMETER                                  | TEST CONDITION | PART   | SYMBOL     | VALUE | UNIT                   |
|--|----------------|--------|------------|-------|------------------------|
| <b>INPUT</b>                               |                |        |            |       |                        |
| Reverse voltage                            |                |        | $V_R$      | 6     | V                      |
| Forward continuous current                 |                |        | $I_F$      | 60    | mA                     |
| Power dissipation                          |                |        | $P_{diss}$ | 135   | mW                     |
| Derate linearly from 25 $^{\circ}\text{C}$ |                |        |            | 1.8   | mW/ $^{\circ}\text{C}$ |
| <b>OUTPUT</b>                              |                |        |            |       |                        |
| Collector emitter breakdown voltage        |                | MCA231 | $BV_{CEO}$ | 30    | V                      |
| Emitter collector breakdown voltage        |                |        | $BV_{ECO}$ | 7     | V                      |
| Collector base breakdown voltage           |                | MCA231 | $BV_{CBO}$ | 30    | V                      |
| Power dissipation                          |                |        | $P_{diss}$ | 210   | mW                     |
| Derate linearly from 25 $^{\circ}\text{C}$ |                |        |            | 2.8   | mW/ $^{\circ}\text{C}$ |



| ABSOLUTE MAXIMUM RATINGS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |                |      |           |             |       |
|---|----------------|------|-----------|-------------|-------|
| PARAMETER   | TEST CONDITION | PART | SYMBOL    | VALUE       | UNIT  |
| Coupler   |                |      |           |             |       |
| Total package dissipation (LED plus detector)   |                |      | $P_{tot}$ | 260         | mW    |
| Derate linearly from 25 °C  |                |      |           | 3.5         | mW/°C |
| Storage temperature   |                |      | $T_{stg}$ | -55 to +150 | °C    |
| Operating temperature   |                |      | $T_{amb}$ | -55 to +100 | °C    |
| Lead soldering time at 260 °C   |                |      |           | 10          | s     |

**Note**

- 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 ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |  |        |             |      |      |      |               |
|---|--|--------|-------------|------|------|------|---------------|
| PARAMETER   | TEST CONDITION                                       | PART   | SYMBOL      | MIN. | TYP. | MAX. | UNIT          |
| Input   |  |        |             |      |      |      |               |
| Forward voltage   | $I_F = 50\text{ mA}$                                 |        | $V_F$       | -    | 1.1  | 1.5  | V             |
| Reverse current   | $V_R = 3\text{ V}$                                   |        | $I_R$       | -    | -    | 10   | $\mu\text{A}$ |
| Junction capacitance  | $V_R = 3\text{ V}$                                   |        | $C_j$       | -    | 50   | -    | pF            |
| Output  |  |        |             |      |      |      |               |
| Collector emitter breakdown voltage   | $I_C = 100\text{ }\mu\text{A}$ , $I_F = 0\text{ mA}$ | MCA231 | $BV_{CEO}$  | 30   | -    | -    | V             |
| Emitter collector breakdown voltage   | $I_E = 10\text{ }\mu\text{A}$ , $I_F = 0\text{ mA}$  |        | $BV_{ECO}$  | 7    | -    | -    | V             |
| Collector base breakdown voltage  | $I_C = 10\text{ }\mu\text{A}$ , $I_F = 0\text{ mA}$  | MCA231 | $BV_{CBO}$  | 30   | -    | -    | V             |
| Collector emitter leakage current   |  |        | $I_{CEO}$   | -    | -    | 100  | nA            |
| Coupler   |  |        |             |      |      |      |               |
| Collector emitter saturation voltage  | $I_C = 2\text{ mA}$ , $I_F = 16\text{ mA}$           |        | $V_{CEsat}$ | -    | -    | 0.8  | V             |
|   | $I_C = I_F = 50\text{ mA}$                           |        | $V_{CEsat}$ | -    | -    | 1    | V             |
|   | $I_C = 2\text{ mA}$ , $I_F = 1\text{ mA}$            |        | $V_{CEsat}$ | -    | -    | 1    | V             |
|   | $I_C = 10\text{ mA}$ , $I_F = 5\text{ mA}$           |        | $V_{CEsat}$ | -    | -    | 1    | V             |
|   | $I_C = 50\text{ mA}$ , $I_F = 10\text{ mA}$          |        | $V_{CEsat}$ | -    | -    | 1.2  | V             |
| Capacitance (input to output)   |  |        | $C_{iO}$    | -    | 0.5  | -    | pF            |

**Note**

- 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 ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |  |            |      |      |      |      |
|---|--|------------|------|------|------|------|
| PARAMETER   | TEST CONDITION                               | SYMBOL     | MIN. | TYP. | MAX. | UNIT |
| DC current transfer ratio   | $V_{CE} = 5\text{ V}$ , $I_F = 10\text{ mA}$ | $CTR_{DC}$ | 200  | -    | -    | %    |

| SWITCHING CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified) |  |           |      |      |      |               |
|--|--|-----------|------|------|------|---------------|
| PARAMETER  | TEST CONDITION                                     | SYMBOL    | MIN. | TYP. | MAX. | UNIT          |
| Switching times  | $R_L = 100\text{ }\Omega$ , $V_{CE} = 10\text{ V}$ | $t_{on}$  | -    | 10   | -    | $\mu\text{s}$ |
|  |  | $t_{off}$ | -    | 30   | -    | $\mu\text{s}$ |



| SAFETY AND INSULATION RATINGS                |  |            |                |                    |
|--|--|------------|----------------|--------------------|
| PARAMETER                                    | TEST CONDITION   | SYMBOL     | VALUE          | UNIT               |
| Climatic classification                      | According to IEC 68 part 1                                     |            | 55 / 100 / 21  |                    |
| Comparative tracking index                   |  | CTI        | 175            |                    |
| Maximum rated withstanding isolation voltage | t = 1 min  | $V_{ISO}$  | 4420           | $V_{RMS}$          |
| Maximum transient isolation voltage          |  | $V_{IOTM}$ | 10 000         | V                  |
| Maximum repetitive peak isolation voltage    |  | $V_{IORM}$ | 890            | V                  |
| Isolation resistance                         | $V_{IO} = 500\text{ V}, T_{amb} = 25\text{ }^{\circ}\text{C}$  | $R_{IO}$   | $\geq 10^{12}$ | $\Omega$           |
|  | $V_{IO} = 500\text{ V}, T_{amb} = 100\text{ }^{\circ}\text{C}$ | $R_{IO}$   | $\geq 10^{11}$ | $\Omega$           |
| Output safety power                          |  | $P_{SO}$   | 400            | mW                 |
| Input safety current                         |  | $I_{SI}$   | 275            | mA                 |
| Input safety temperature                     |  | $T_{SI}$   | 175            | $^{\circ}\text{C}$ |
| Creepage distance                            |  |            | $\geq 7$       | mm                 |
| Clearance distance                           |  |            | $\geq 7$       | mm                 |
| Insulation thickness                         |  | DTI        | $\geq 0.4$     | mm                 |

**Note**

- As per IEC 60747-5-5, § 7.4.3.8.2, this optocoupler is suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits

**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

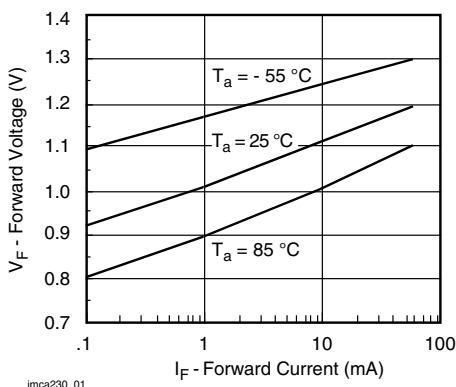


Fig. 1 Forward Voltage vs. Forward Current

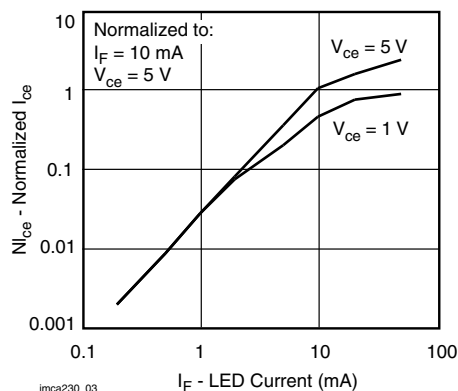


Fig. 2 - Normalized Non-Saturated and Saturated Collector Emitter Current vs. LED Current

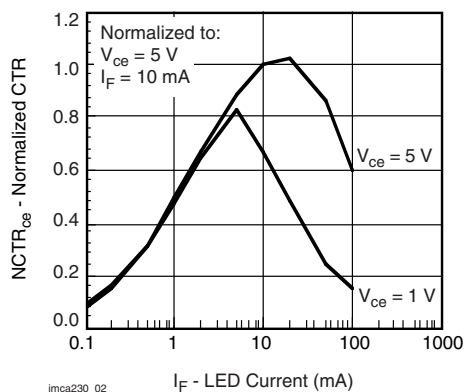


Fig. 1 - Normalized Non-Saturated and Saturated CTR vs. LED Current

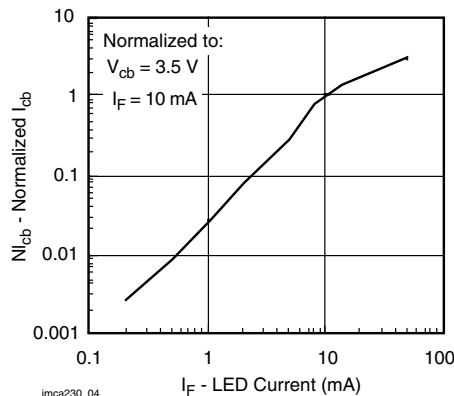


Fig. 3 - Normalized Collector Base Photocurrent vs. LED Current

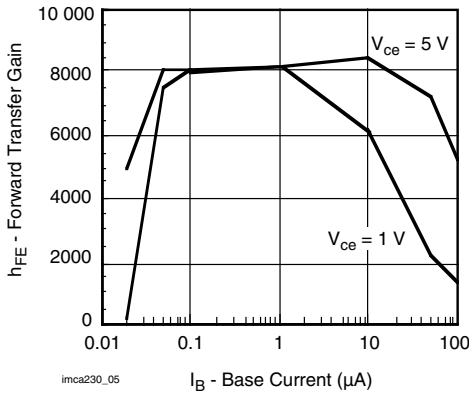


Fig. 4 - Non Saturated and Saturated  $h_{FE}$  vs. Base Current

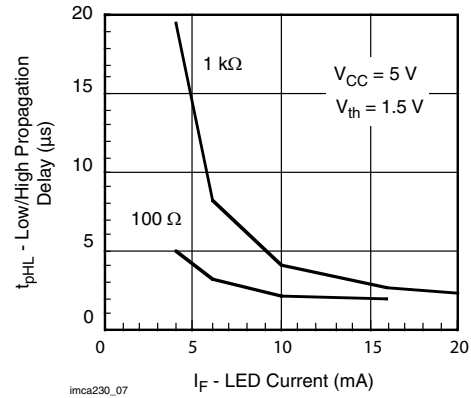


Fig. 6 - High to low Propagation Delay vs. Collector Load Resistance and LED Current

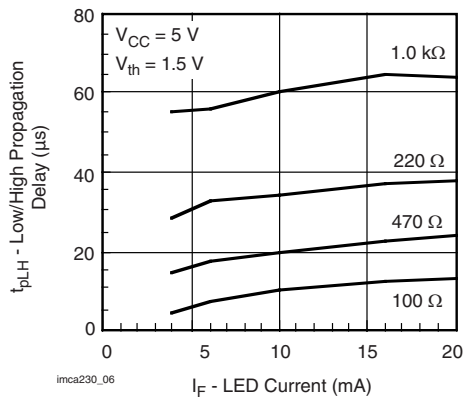


Fig. 5 - Low to High Propagation Delay vs. Collector Load Resistance and LED Current

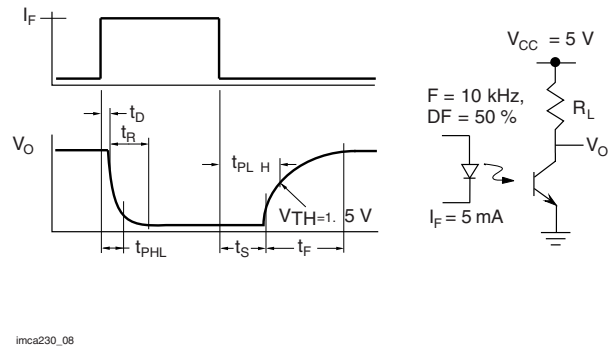
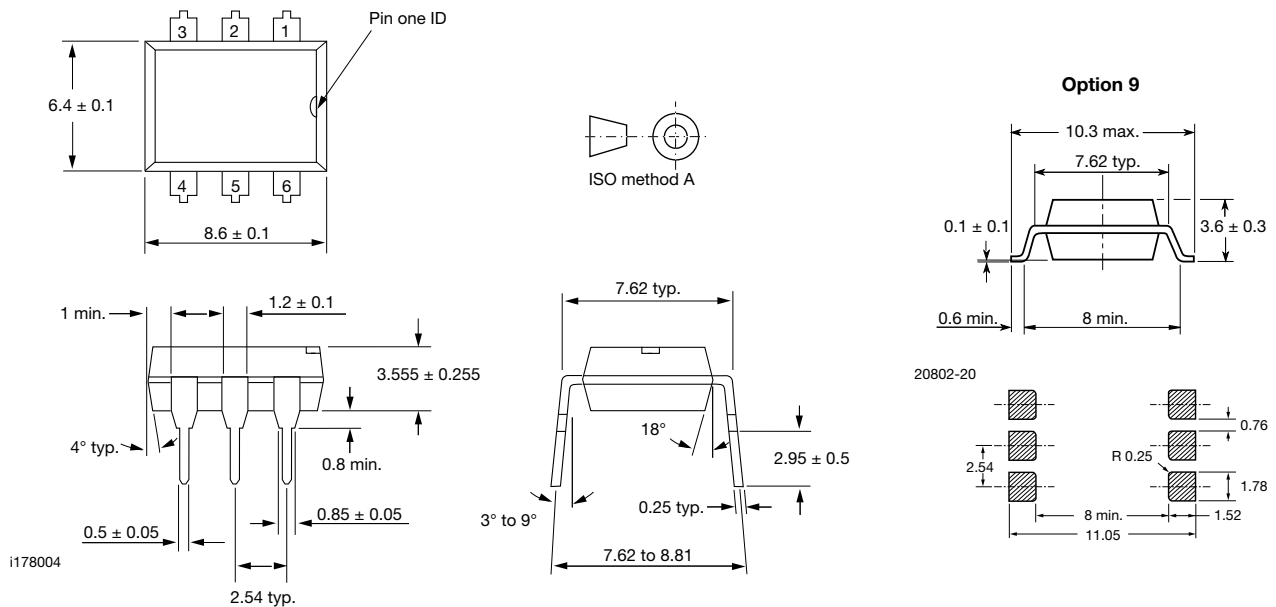


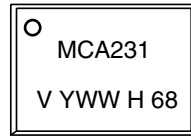
Fig. 7 - Switching Timing Waveform and Schematic

**PACKAGE DIMENSIONS** in millimeters





**PACKAGE MARKING**



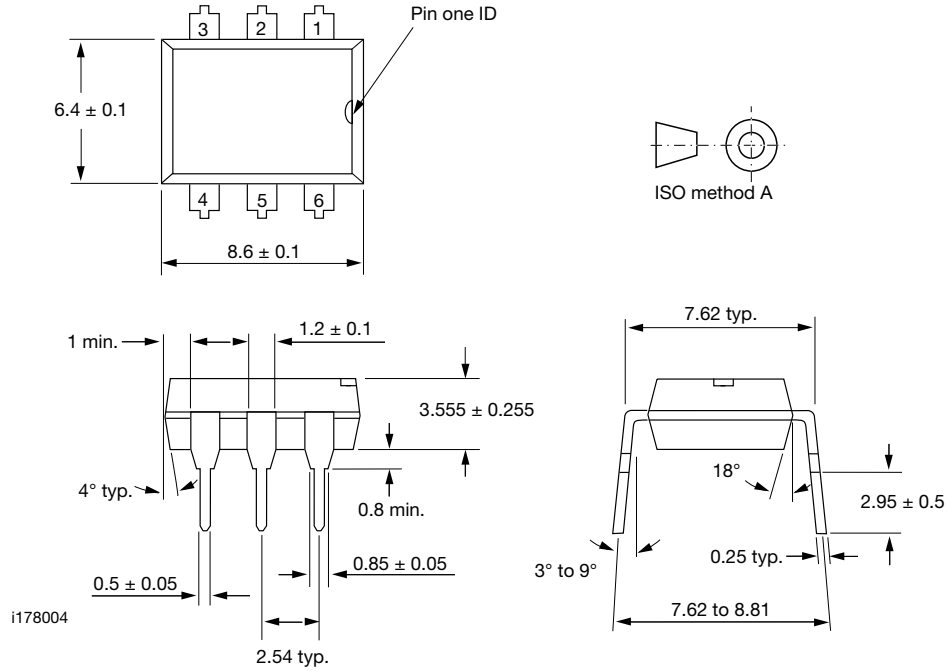
21764-99

**Note**

- Tape and reel suffix (T) is not part of the package marking

# DIP-6A

**PACKAGE DIMENSIONS** in inches (millimeters)



**Note**

The information in this document provides generic information but for specific information on a product the appropriate product datasheet should be used.



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