

# 8-pin SOIC Darlington Output Optocouplers

## MOC223M, MOCD223M

### Description

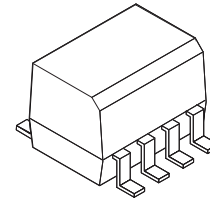
The MOC223M consists of a gallium arsenide infrared emitting diode optically coupled to a monolithic silicon photodarlington detector, in a surface mountable, small outline, plastic package. The MOCD223M is a dual-channel version of the MOC223M. They are ideally suited for high density applications, and eliminates the need for through the board mounting.

### Features

- High Current Transfer Ratio of 500% Minimum at  $I_F = 1 \text{ mA}$
- Minimum  $BV_{CEO}$  of 30 V Guaranteed
- Convenient Plastic SOIC-8 Surface Mountable Package Style, with 0.050" Lead Spacing
- Safety and Regulatory Approvals:
  - ♦ UL2688, 2,500  $V_{AC_{RMS}}$  for 1 Minute
  - ♦ DIN-EN/IEC60747-5-5, 565 V Peak Working Insulation Voltage
- These Devices are Pb-Free and Halogen Free

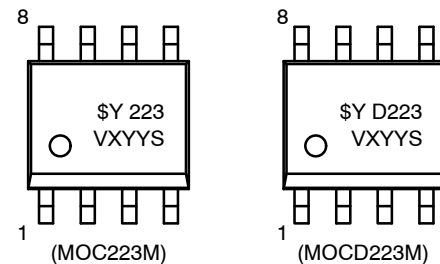
### Applications

- Low Power Logic Circuits
- Interfacing and Coupling Systems of Different Potentials and Impedances
- Telecommunications Equipment
- Portable Electronics
- Solid State Relays



SOIC8  
CASE 751DZ

### MARKING DIAGRAMS



|          |                              |
|----------|------------------------------|
| \$Y      | = onsemi Logo                |
| 223/D223 | = Specific Device Code       |
| V        | = DIN EN/IEC60747-5-5 Option |
| X        | = One-Digit Year Code        |
| YY       | = Digit Work Week            |
| S        | = Assembly Package Code      |

### ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

# MOC223M, MOCD223M

## SCHEMATICS

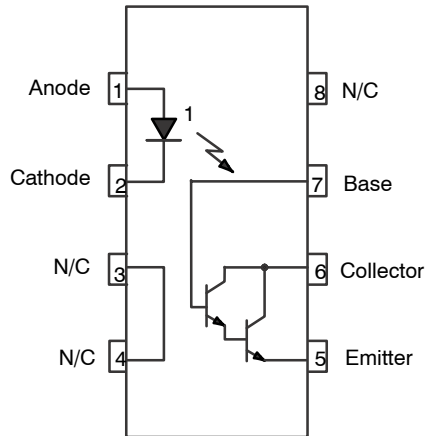


Figure 1. Schematic – MOC223M

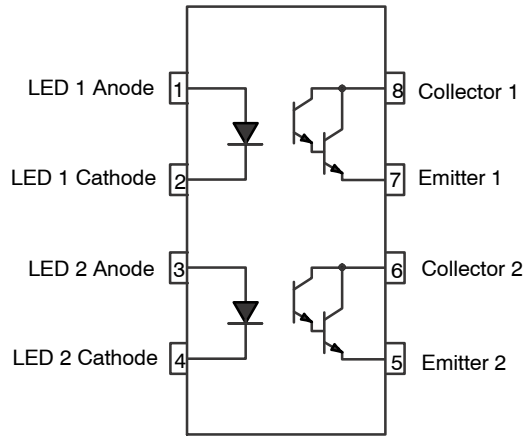


Figure 2. Schematic – MOCD223M

## SAFETY AND INSULATION RATINGS

| Parameter                                                                           |                        | Characteristics |
|-------------------------------------------------------------------------------------|------------------------|-----------------|
| Installation Classifications per DIN VDE 0110/1.89 Table 1, For Rated Mains Voltage | < 150 V <sub>RMS</sub> | I–IV            |
|                                                                                     | < 300 V <sub>RMS</sub> | I–III           |
| Climatic Classification                                                             |                        | 55/100/21       |
| Pollution Degree (DIN VDE 0110/1.89)                                                |                        | 2               |
| Comparative Tracking Index                                                          |                        | 175             |

| Symbol                | Parameter                                                                                                                                                      | Value             | Unit              |
|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------|
| V <sub>PR</sub>       | Input-to-Output Test Voltage, Method A, V <sub>IORM</sub> × 1.6 = V <sub>PR</sub> , Type and Sample Test with t <sub>m</sub> = 10 s, Partial Discharge < 5 pC  | 904               | V <sub>peak</sub> |
|                       | Input-to-Output Test Voltage, Method B, V <sub>IORM</sub> × 1.875 = V <sub>PR</sub> , 100% Production Test with t <sub>m</sub> = 1 s, Partial Discharge < 5 pC | 1060              |                   |
| V <sub>IORM</sub>     | Maximum Working Insulation Voltage                                                                                                                             | 565               |                   |
| V <sub>IOTM</sub>     | Highest Allowable Over-Voltage                                                                                                                                 | 4000              |                   |
|                       | External Creepage                                                                                                                                              | ≥ 4               | mm                |
|                       | External Clearance                                                                                                                                             | ≥ 4               |                   |
| DTI                   | Distance Through Insulation (Insulation Thickness)                                                                                                             | ≥ 0.4             |                   |
| T <sub>S</sub>        | Case Temperature (Note 1)                                                                                                                                      | 150               | °C                |
| I <sub>S,INPUT</sub>  | Input Current (Note 1)                                                                                                                                         | 200               | mA                |
| P <sub>S,OUTPUT</sub> | Output Power (Note 1)                                                                                                                                          | 300               | mW                |
| R <sub>IO</sub>       | Insulation Resistance at T <sub>S</sub> , V <sub>IO</sub> = 500 V (Note 1)                                                                                     | > 10 <sup>9</sup> | Ω                 |

As per DIN EN/IEC 60747–5–5, this optocoupler is suitable for “safe electrical insulation” only within the safety limit data. Compliance with the safety ratings shall be ensured by means of protective circuits.

1. Safety limit values – maximum values allowed in the event of a failure.

# MOC223M, MOCD223M

**ABSOLUTE MAXIMUM RATINGS**  $T_A = 25^\circ\text{C}$  unless otherwise specified.

| Symbol              | Parameter                                                 | Value        | Unit                 |
|---------------------|-----------------------------------------------------------|--------------|----------------------|
| <b>TOTAL DEVICE</b> |                                                           |              |                      |
| $T_{STG}$           | Storage Temperature                                       | -40 to +125  | $^\circ\text{C}$     |
| $T_A$               | Ambient Operating Temperature                             | -40 to +100  |                      |
| $T_J$               | Junction Temperature                                      | -40 to +125  |                      |
| $T_{SOL}$           | Lead Solder Temperature                                   | 260 for 10 s |                      |
| $P_D$               | Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$ | 240          | mW                   |
|                     | Derate Above $25^\circ\text{C}$                           | 2.94         | mW/ $^\circ\text{C}$ |

## EMITTER

|                  |                                                           |     |                      |
|------------------|-----------------------------------------------------------|-----|----------------------|
| $I_F$            | Continuous Forward Current                                | 60  | mA                   |
| $I_F(\text{pk})$ | Forward Current – Peak (PW = 100 $\mu\text{s}$ , 120 pps) | 1.0 | A                    |
| $V_R$            | Reverse Voltage                                           | 6.0 | V                    |
| $P_D$            | LED Power Dissipation @ $T_A = 25^\circ\text{C}$          | 90  | mW                   |
|                  | Derate Above $25^\circ\text{C}$                           | 0.8 | mW/ $^\circ\text{C}$ |

## DETECTOR

|           |                                                       |      |                      |
|-----------|-------------------------------------------------------|------|----------------------|
| $I_C$     | Continuous Collector Current                          | 150  | mA                   |
| $V_{CEO}$ | Collector–Emitter Voltage                             | 30   | V                    |
| $V_{CBO}$ | Collector–Base Voltage, MOC223M                       | 70   |                      |
| $V_{ECO}$ | Emitter–Collector Voltage                             | 7    |                      |
| $P_D$     | Detector Power Dissipation @ $T_A = 25^\circ\text{C}$ | 150  | mW                   |
|           | Derate Above $25^\circ\text{C}$                       | 1.76 | mW/ $^\circ\text{C}$ |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

**ELECTRICAL CHARACTERISTICS**  $T_A = 25^\circ\text{C}$  unless otherwise specified.

| Symbol         | Parameter               | Test Conditions       | Min | Typ   | Max | Unit          |
|----------------|-------------------------|-----------------------|-----|-------|-----|---------------|
| <b>EMITTER</b> |                         |                       |     |       |     |               |
| $V_F$          | Input Forward Voltage   | $I_F = 1.0\text{ mA}$ | –   | 1.08  | 1.3 | V             |
| $I_R$          | Reverse Leakage Current | $V_R = 6.0\text{ V}$  | –   | 0.001 | 100 | $\mu\text{A}$ |
| $C_{IN}$       | Input Capacitance       |                       | –   | 18    | –   | pF            |

## DETECTOR

|            |                                     |                                                  |    |     |    |               |
|------------|-------------------------------------|--------------------------------------------------|----|-----|----|---------------|
| $I_{CEO1}$ | Collector–Emitter Dark Current      | $V_{CE} = 5.0\text{ V}, T_A = 25^\circ\text{C}$  | –  | 1.0 | 50 | nA            |
| $I_{CEO2}$ |                                     | $V_{CE} = 5.0\text{ V}, T_A = 100^\circ\text{C}$ | –  | 1.0 | –  | $\mu\text{A}$ |
| $BV_{CEO}$ | Collector–Emitter Breakdown Voltage | $I_C = 100\text{ }\mu\text{A}$                   | 30 | 100 | –  | V             |
| $BV_{CBO}$ | Collector–Base Breakdown Voltage    | $I_C = 100\text{ }\mu\text{A}$                   | 70 | 120 | –  |               |
| $BV_{ECO}$ | Emitter–Collector Breakdown Voltage | $I_E = 100\text{ }\mu\text{A}$                   | 7  | 10  | –  |               |
| $C_{CE}$   | Collector–Emitter Capacitance       | $f = 1.0\text{ MHz}, V_{CE} = 0$                 | –  | 5.5 | –  | pF            |

## COUPLED

|                      |                                      |                                                                                 |     |      |     |               |
|----------------------|--------------------------------------|---------------------------------------------------------------------------------|-----|------|-----|---------------|
| CTR                  | Current Transfer Ratio               | $I_F = 1.0\text{ mA}, V_{CE} = 5.0\text{ V}$                                    | 500 | 1000 | –   | %             |
| $V_{CE(\text{sat})}$ | Collector–Emitter Saturation Voltage | $I_C = 500\text{ }\mu\text{A}, I_F = 1.0\text{ mA}$                             | –   | –    | 1.0 | V             |
| $t_{on}$             | Turn–On Time                         | $I_F = 5.0\text{ mA}, V_{CC} = 10\text{ V}, R_L = 100\text{ }\Omega$ (Figure 8) | –   | 10   | –   | $\mu\text{s}$ |
| $t_{off}$            | Turn–Off Time                        |                                                                                 | –   | 55   | –   |               |
| $t_r$                | Rise Time                            |                                                                                 | –   | 8    | –   |               |
| $t_f$                | Fall Time                            |                                                                                 | –   | 45   | –   |               |

# MOC223M, MOCD223M

## ELECTRICAL CHARACTERISTICS $T_A = 25^\circ\text{C}$ unless otherwise specified. (continued)

| Symbol                           | Parameter                      | Test Conditions                                                  | Min       | Typ | Max | Unit               |
|----------------------------------|--------------------------------|------------------------------------------------------------------|-----------|-----|-----|--------------------|
| <b>ISOLATION CHARACTERISTICS</b> |                                |                                                                  |           |     |     |                    |
| $V_{\text{ISO}}$                 | Input-Output Isolation Voltage | $t = 1 \text{ min}$                                              | 2500      | –   | –   | $V_{\text{ACRMS}}$ |
| $C_{\text{ISO}}$                 | Isolation Capacitance          | $V_{\text{I-O}} = 0, f = 1 \text{ MHz}$                          | –         | 0.2 | –   | pF                 |
| $R_{\text{ISO}}$                 | Isolation Resistance           | $V_{\text{I-O}} = \pm 500 V_{\text{DC}}, T_A = 25^\circ\text{C}$ | $10^{11}$ | –   | –   | $\Omega$           |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## TYPICAL PERFORMANCE CURVES

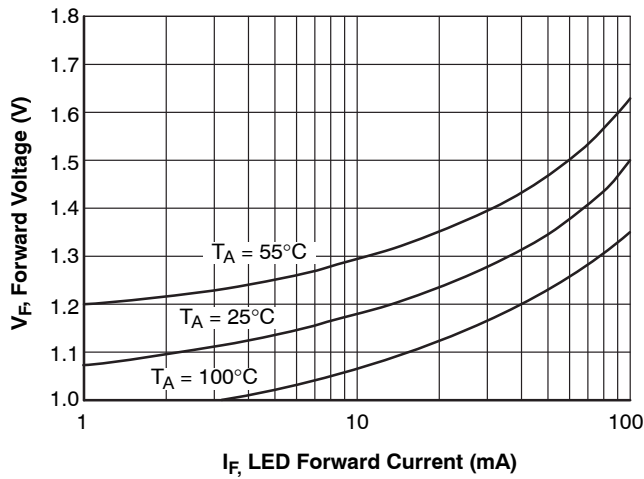


Figure 3. LED Forward Voltage vs. Forward Current

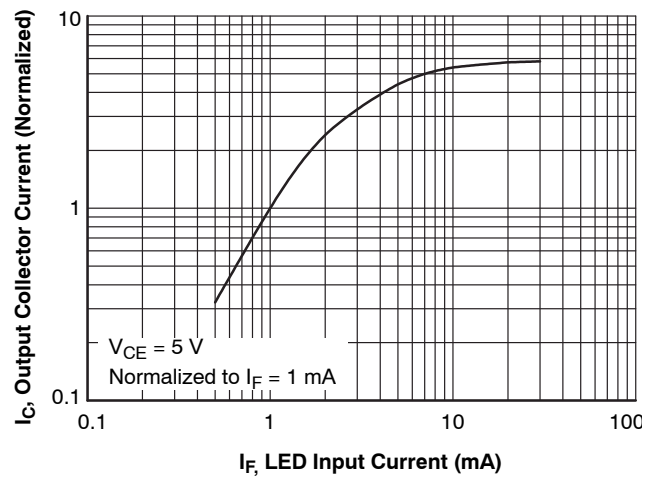


Figure 4. Output Current vs. Input Current

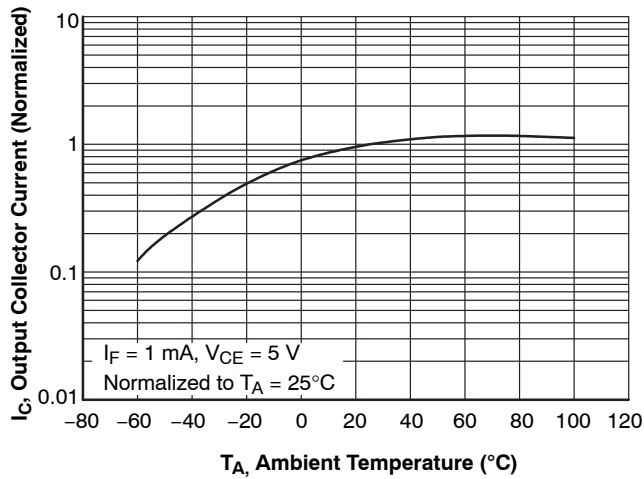


Figure 5. LED Forward Voltage vs. Forward Current

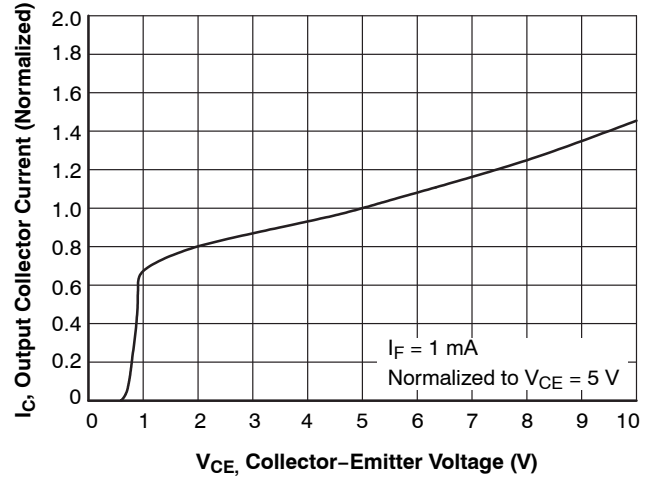


Figure 6. Output Current vs. Collector-Emitter Voltage

TYPICAL PERFORMANCE CURVES

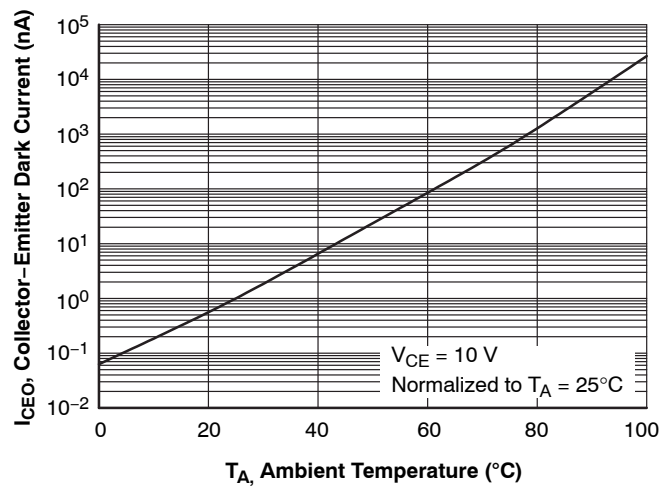


Figure 7. Dark Current vs. Ambient Temperature

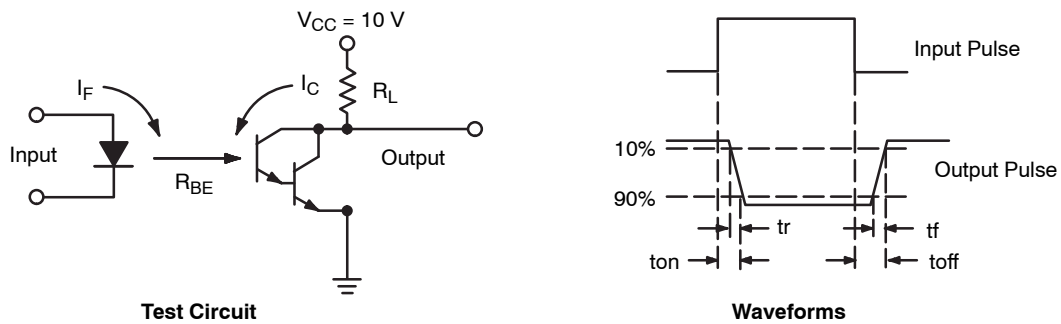


Figure 8. Switching Time Test Circuit and Waveforms

## REFLOW PROFILE

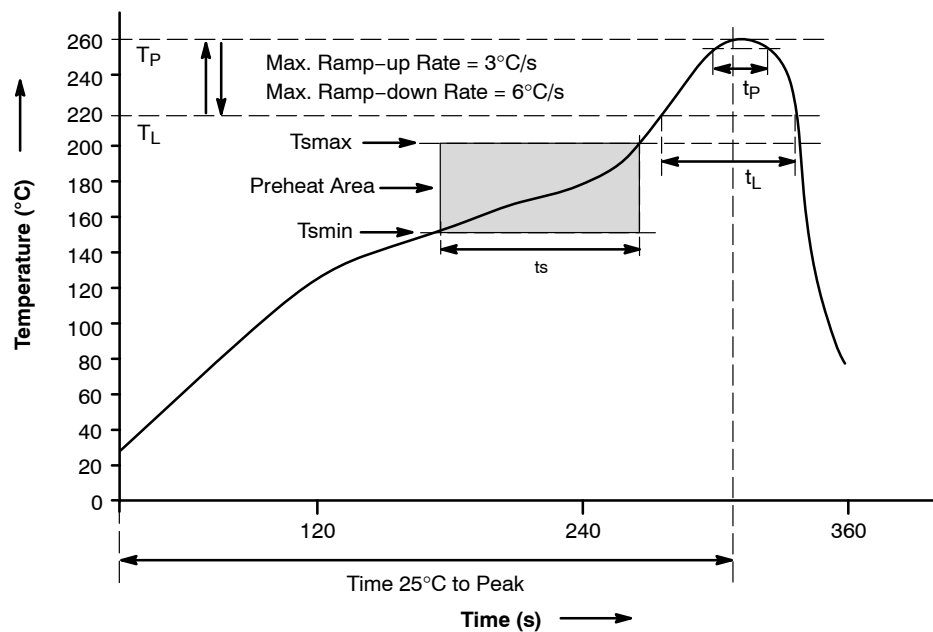


Figure 9. Reflow Profile

## REFLOW PROFILE

| Profile Feature                                                     | Pb-Free Assembly Profile |
|---------------------------------------------------------------------|--------------------------|
| Temperature Min. (T <sub>min</sub> )                                | 150°C                    |
| Temperature Max. (T <sub>max</sub> )                                | 200°C                    |
| Time (t <sub>s</sub> ) from (T <sub>min</sub> to T <sub>max</sub> ) | 60–120 s                 |
| Ramp-up Rate (t <sub>L</sub> to t <sub>P</sub> )                    | 3°C/s max.               |
| Liquidous Temperature (T <sub>L</sub> )                             | 217°C                    |
| Time (t <sub>L</sub> ) Maintained Above (T <sub>L</sub> )           | 60–150 s                 |
| Peak Body Package Temperature                                       | 260°C +0°C / -5°C        |
| Time (t <sub>P</sub> ) within 5°C of 260°C                          | 30 s                     |
| Ramp-down Rate (T <sub>P</sub> to T <sub>L</sub> )                  | 6°C/s max.               |
| Time 25°C to Peak Temperature                                       | 8 min max.               |

## MOC223M, MOCD223M

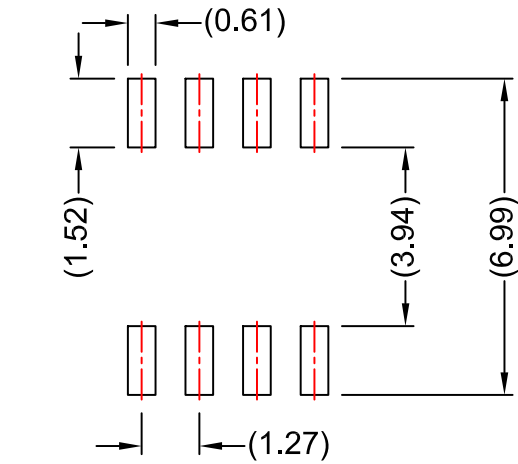
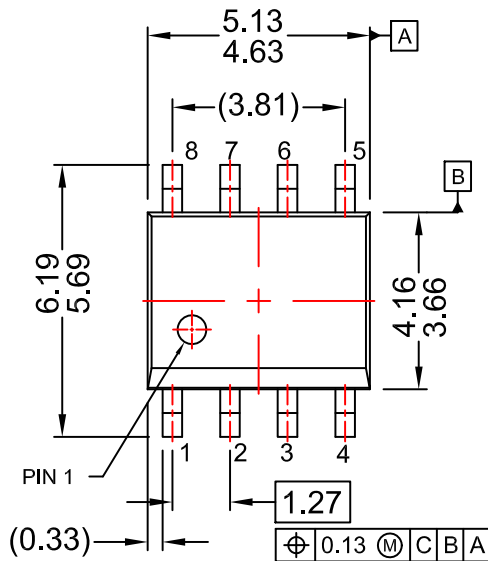
### ORDERING INFORMATION

| Part Number | Package                                         | Shipping†                  |
|-------------|-------------------------------------------------|----------------------------|
| MOC223M     | Small Outline 8-Pin                             | 50 Units / Tube            |
| MOC223R2M   | Small Outline 8-Pin                             | 2500 Units / Tape and Reel |
| MOC223VM    | Small Outline 8-Pin, DIN EN/IEC60747-5-5 Option | 50 Units / Tube            |
| MOC223R2VM  | Small Outline 8-Pin, DIN EN/IEC60747-5-5 Option | 2500 Units / Tape and Reel |
| MOCD223M    | Small Outline 8-Pin                             | 50 Units / Tube            |
| MOCD223R2M  | Small Outline 8-Pin                             | 2500 Units / Tape and Reel |
| MOCD223VM   | Small Outline 8-Pin, DIN EN/IEC60747-5-5 Option | 50 Units / Tube            |
| MOCD223R2VM | Small Outline 8-Pin, DIN EN/IEC60747-5-5 Option | 2500 Units / Tape and Reel |

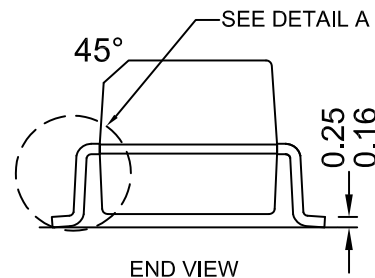
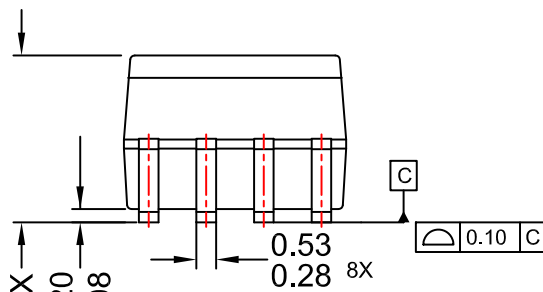
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

### SOIC8 CASE 751DZ ISSUE O

DATE 30 SEP 2016



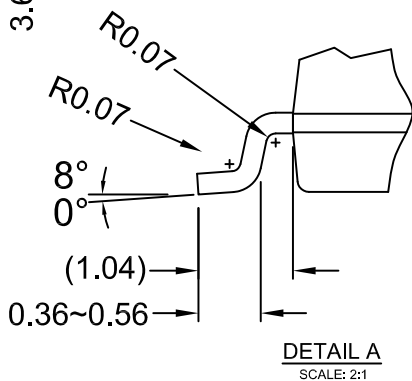
LAND PATTERN RECOMMENDATION



END VIEW

#### NOTES:

- A) NO STANDARD APPLIES TO THIS PACKAGE
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) LANDPATTERN STANDARD: SOIC127P600X175-8M.



DETAIL A  
SCALE: 2:1

|                  |             |                                                                                                                                                                                  |
|------------------|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DOCUMENT NUMBER: | 98AON13733G | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION:     | SOIC8       | PAGE 1 OF 1                                                                                                                                                                      |

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. ON Semiconductor does not convey any license under its patent rights nor the rights of others.



**onsemi**, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

## ADDITIONAL INFORMATION

### TECHNICAL PUBLICATIONS:

Technical Library: [www.onsemi.com/design/resources/technical-documentation](http://www.onsemi.com/design/resources/technical-documentation)  
onsemi Website: [www.onsemi.com](http://www.onsemi.com)

### ONLINE SUPPORT: [www.onsemi.com/support](http://www.onsemi.com/support)

For additional information, please contact your local Sales Representative at  
[www.onsemi.com/support/sales](http://www.onsemi.com/support/sales)