

# 8-pin SOIC Single-Channel Phototransistor Output Optocoupler

**MOC205M, MOC206M,  
MOC207M, MOC211M,  
MOC212M, MOC213M,  
MOC216M, MOC217M**

## Description

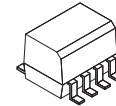
These devices consist of a gallium arsenide infrared emitting diode optically coupled to a monolithic silicon phototransistor detector, in a surface mountable, small outline, plastic package. They are ideally suited for high-density applications, and eliminate the need for through-the-board mounting.

## Features

- Closely Matched Current Transfer Ratios Minimum  $BV_{CEO}$  of 70 V Guaranteed
  - ♦ MOC205M, MOC206M, MOC207M
- Minimum  $BV_{CEO}$  of 30 V Guaranteed
  - ♦ MOC211M, MOC212M, MOC213M, MOC216M, MOC217M
- Low LED Input Current Required for Easier Logic Interfacing
  - ♦ MOC216M, MOC217M
- Convenient Plastic SOIC-8 Surface Mountable Package Style, with 0.050" Lead Spacing
- Safety and Regulatory Approvals:
  - ♦ UL1577, 2,500 VAC<sub>RMS</sub> for 1 Minute
  - ♦ DIN-EN/IEC60747-5-5, 565 V Peak Working Insulation Voltage
- These are Pb-Free Devices

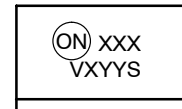
## Applications

- Feedback Control Circuits
- Interfacing and Coupling Systems of Different Potentials and Impedances
- General Purpose Switching Circuits
- Monitor and Detection Circuits



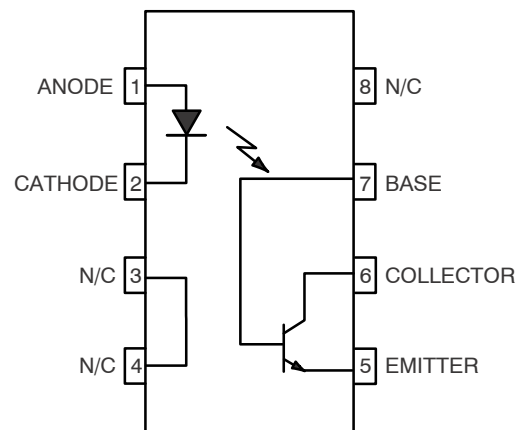
SOIC8  
CASE 751DZ

## MARKING DIAGRAM



- XXX = Specific Device Code  
 V = DIN EN/IEC60747-5-5 Option (only appears on component ordered with this option)  
 X = Year Code  
 YY = Work Week  
 S = Assembly Package Code

## SCHEMATIC



## ORDERING INFORMATION

See detailed ordering and shipping information on page 6 of this data sheet.

# MOC205M, MOC206M, MOC207M, MOC211M, MOC212M, MOC213M, MOC216M, MOC217M

**SAFETY AND INSULATION RATINGS** (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.)

| 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>peak</sub> |
| V <sub>IORM</sub>     | Maximum Working Insulation Voltage   | 565              | V <sub>peak</sub> |
| V <sub>IOTM</sub>     | Highest Allowable Over-Voltage   | 4000             | V <sub>peak</sub> |
|                       | External Creepage  | ≥4               | mm                |
|                       | External Clearance   | ≥4               | mm                |
| DTI                   | Distance Through Insulation (Insulation Thickness)   | ≥0.4             | mm                |
| 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                 |

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

## ABSOLUTE MAXIMUM RATINGS (T<sub>A</sub> = 25°C unless otherwise noted)

| Symbol | Rating | Value | Unit |
|--------|--------|-------|------|
|--------|--------|-------|------|

### TOTAL DEVICE

|                  |  |                    |       |
|------------------|--|--------------------|-------|
| T <sub>STG</sub> | Storage Temperature                                    | –40 to +125        | °C    |
| T <sub>A</sub>   | Ambient Operating Temperature                          | –40 to +100        | °C    |
| T <sub>J</sub>   | Junction Temperature                                   | –40 to +125        | °C    |
| T <sub>SOL</sub> | Lead Solder Temperature                                | 260 for 10 seconds | °C    |
| P <sub>D</sub>   | Total Device Power Dissipation @ T <sub>A</sub> = 25°C | 240                | mW    |
|                  | Derate above 25°C                                      | 2.94               | mW/°C |

### EMITTER

|                     |   |     |       |
|---------------------|---|-----|-------|
| I <sub>F</sub>      | Continuous Forward Current                    | 60  | mA    |
| I <sub>F</sub> (pk) | Forward Current – Peak (PW = 100 μs, 120 pps) | 1.0 | A     |
| V <sub>R</sub>      | Reverse Voltage                               | 6.0 | V     |
| P <sub>D</sub>      | LED Power Dissipation @ T <sub>A</sub> = 25°C | 90  | mW    |
|                     | Derate above 25°C                             | 0.8 | mW/°C |

### DETECTOR

|                  |  |      |       |
|------------------|--|------|-------|
| I <sub>C</sub>   | Continuous Collector Current                       | 150  | mA    |
| V <sub>CEO</sub> | Collector–Emitter Voltage                          | 30   | V     |
| V <sub>ECO</sub> | Emitter–Collector Voltage                          | 7    | V     |
| P <sub>D</sub>   | Detector Power Dissipation @ T <sub>A</sub> = 25°C | 150  | mW    |
|                  | Derate above 25°C                                  | 1.76 | mW/°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.

# MOC205M, MOC206M, MOC207M, MOC211M, MOC212M, MOC213M, MOC216M, MOC217M

## ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25°C unless otherwise noted)

| Symbol          | Parameter               | Test Condition                                       | Min                    | Typ   | Max  | Unit  |
|-----------------|-------------------------|--|------------------------|-------|------|-------|
| <b>EMITTER</b>  |                         |  |                        |       |      |       |
| V <sub>F</sub>  | Input Forward Voltage   | MOC216M, MOC217M                                     | I <sub>F</sub> = 1 mA  | –     | 1.07 | 1.3 V |
|                 |                         | MOC205M, MOC206M, MOC207M, MOC211M, MOC212M, MOC213M | I <sub>F</sub> = 10 mA | –     | 1.15 | 1.5 V |
| I <sub>R</sub>  | Reverse Leakage Current | V <sub>R</sub> = 6 V                                 | –                      | 0.001 | 100  | μA    |
| C <sub>IN</sub> | Input Capacitance       |  | –                      | 18    | –    | pF    |

## DETECTOR

|                   |                                     |   |  |    |     |    |    |
|-------------------|-------------------------------------|---|--|----|-----|----|----|
| I <sub>CEO1</sub> | Collector–Emitter Dark Current      |   | V <sub>CE</sub> = 10 V, T <sub>A</sub> = 25°C  | –  | 1.0 | 50 | nA |
| I <sub>CEO2</sub> |                                     |   | V <sub>CE</sub> = 10 V, T <sub>A</sub> = 100°C | –  | 1.0 | –  | μA |
| BV <sub>CEO</sub> | Collector–Emitter Breakdown Voltage | MOC205M, MOC206M, MOC207M                   | I <sub>C</sub> = 100 μA                        | 70 | 100 | –  | V  |
|                   |                                     | MOC211M, MOC212M, MOC213M, MOC216M, MOC217M | I <sub>C</sub> = 100 μA                        | 30 | 100 | –  | V  |
| BV <sub>CBO</sub> | Collector–Base Breakdown Voltage    |   | I <sub>C</sub> = 10 μA                         | 70 | 120 | –  | V  |
| BV <sub>ECO</sub> | Emitter–Collector Breakdown Voltage |   | I <sub>E</sub> = 100 μA                        | 7  | 10  | –  | V  |
| C <sub>CE</sub>   | Collector–Emitter Capacitance       |   | f = 1.0 MHz, V <sub>CE</sub> = 0 V             | –  | 7   | –  | pF |

## COUPLED

|                      |                                      |  |   |     |     |     |    |
|----------------------|--------------------------------------|--|---|-----|-----|-----|----|
| CTR                  | Collector–Output Current             | MOC205M  | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10 V                                    | 40  | –   | 80  | %  |
|                      |                                      | MOC206M  | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10 V                                    | 63  | –   | 125 | %  |
|                      |                                      | MOC207M  | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10 V                                    | 100 | –   | 200 | %  |
|                      |                                      | MOC211M  | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10 V                                    | 20  | –   | –   | %  |
|                      |                                      | MOC212M  | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10 V                                    | 50  | –   | –   | %  |
|                      |                                      | MOC213M  | I <sub>F</sub> = 10 mA, V <sub>CE</sub> = 10 V                                    | 100 | –   | –   | %  |
|                      |                                      | MOC216M  | I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 5 V                                      | 50  | –   | –   | %  |
|                      |                                      | MOC217M  | I <sub>F</sub> = 1 mA, V <sub>CE</sub> = 5 V                                      | 100 | –   | –   | %  |
| V <sub>CE(SAT)</sub> | Collector–Emitter Saturation Voltage | MOC205M, MOC206M, MOC207M, MOC211M, MOC212M, MOC213M | I <sub>C</sub> = 2 mA, I <sub>F</sub> = 10 mA                                     | –   | –   | 0.4 | V  |
|                      |                                      | MOC216M, MOC217M                                     | I <sub>C</sub> = 100 μA, I <sub>F</sub> = 1 mA                                    | –   | –   | 0.4 | V  |
| t <sub>on</sub>      | Turn–On Time                         |  | I <sub>C</sub> = 2 mA, V <sub>CC</sub> = 10 V, R <sub>L</sub> = 100 Ω (Figure 12) | –   | 7.5 | –   | μs |
| t <sub>off</sub>     | Turn–Off Time                        |  | I <sub>C</sub> = 2 mA, V <sub>CC</sub> = 10 V, R <sub>L</sub> = 100 Ω (Figure 12) | –   | 5.7 | –   | μs |
| t <sub>r</sub>       | Rise Time                            |  | I <sub>C</sub> = 2 mA, V <sub>CC</sub> = 10 V, R <sub>L</sub> = 100 Ω (Figure 12) | –   | 3.2 | –   | μs |
| t <sub>f</sub>       | Fall Time                            |  | I <sub>C</sub> = 2 mA, V <sub>CC</sub> = 10 V, R <sub>L</sub> = 100 Ω (Figure 12) | –   | 4.7 | –   | μs |

## ISOLATION CHARACTERISTICS

|                  |                                |  |                  |     |   |                    |
|------------------|--------------------------------|--|------------------|-----|---|--------------------|
| V <sub>ISO</sub> | Input–Output Isolation Voltage | t = 1 Minute                                       | 2500             | –   | – | VAC <sub>RMS</sub> |
| C <sub>ISO</sub> | Isolation Capacitance          | V <sub>I-O</sub> = 0 V, f = 1 MHz                  | –                | 0.2 | – | pF                 |
| R <sub>ISO</sub> | Isolation Resistance           | V <sub>I-O</sub> = ±500 VDC, T <sub>A</sub> = 25°C | 10 <sup>11</sup> | –   | – | Ω                  |

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.

# MOC205M, MOC206M, MOC207M, MOC211M, MOC212M, MOC213M, MOC216M, MOC217M

## TYPICAL PERFORMANCE CURVES

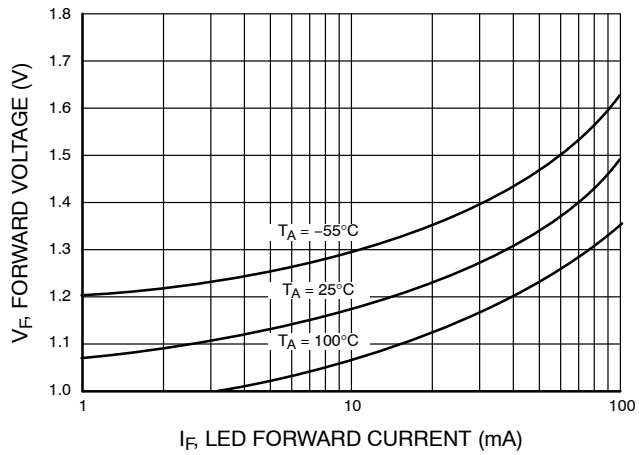


Figure 1. LED Forward Voltage vs. Forward Current

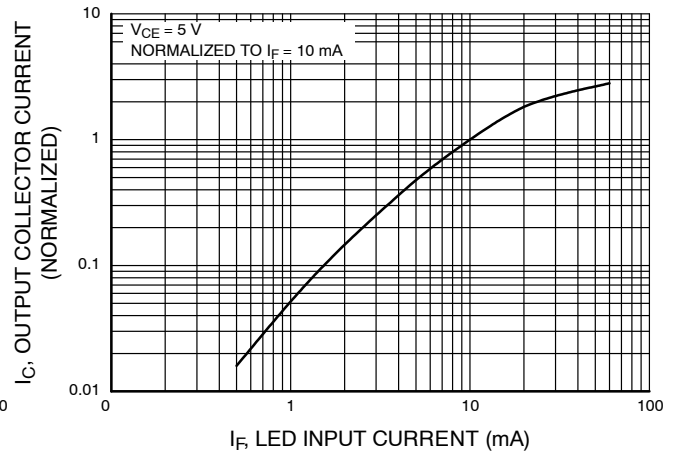


Figure 2. Output Current vs. Input Current

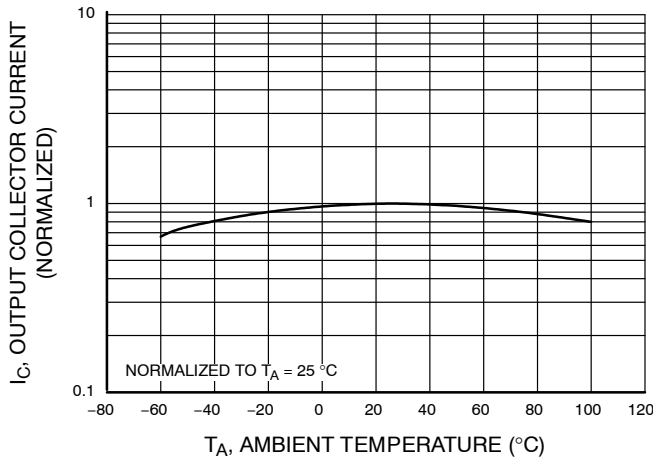


Figure 3. Output Current vs. Ambient Temperature

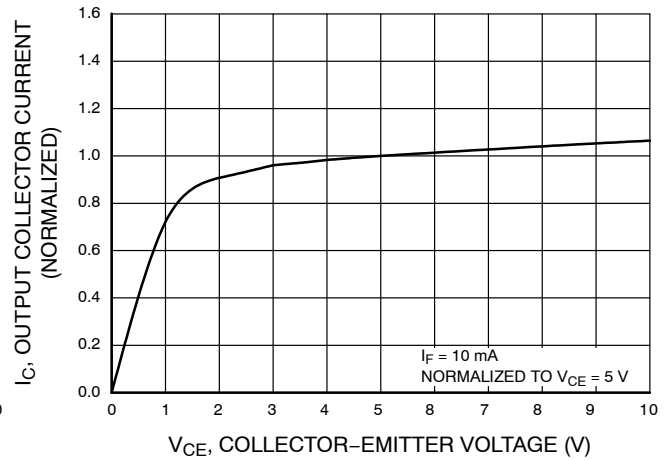


Figure 4. Output Current vs. Collector-Emitter Voltage

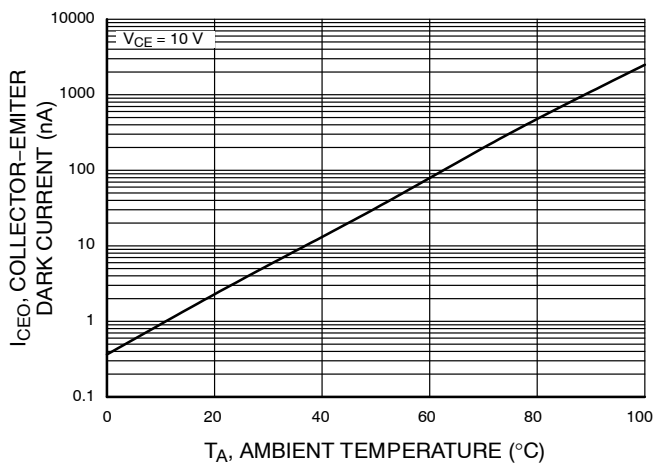


Figure 5. Dark Current vs. Ambient Temperature

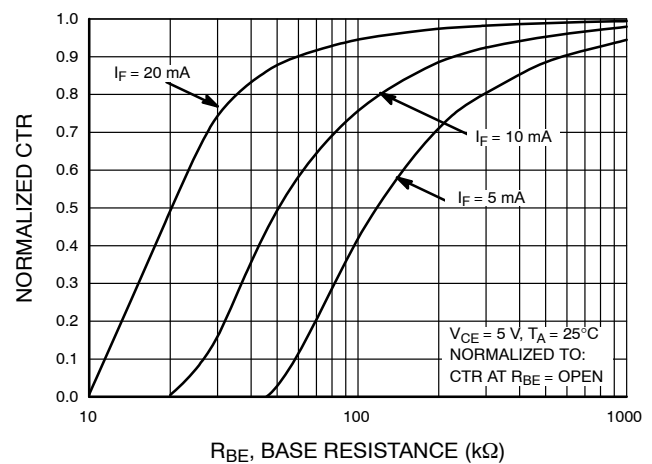


Figure 6. CTR vs.  $R_{BE}$  (Unsaturated)

# MOC205M, MOC206M, MOC207M, MOC211M, MOC212M, MOC213M, MOC216M, MOC217M

## TYPICAL PERFORMANCE CURVES (continued)

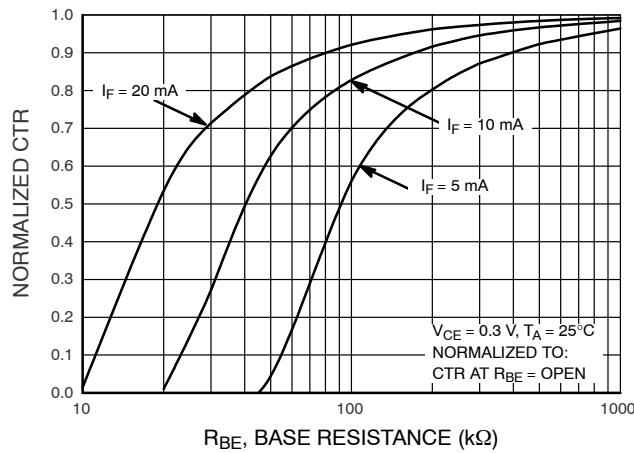


Figure 7. CTR vs.  $R_{BE}$  (Saturated)

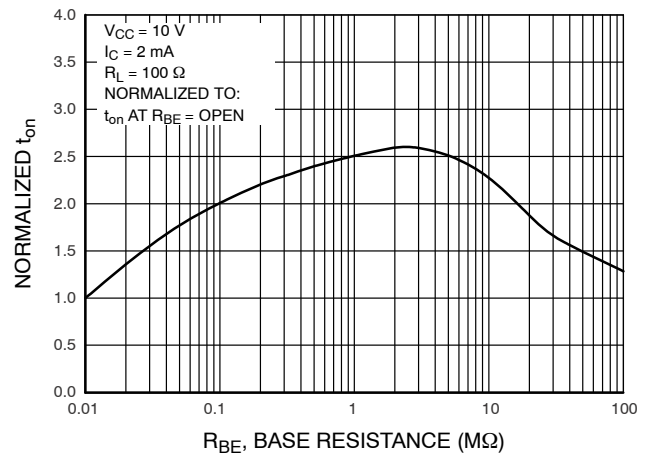


Figure 8. Normalized  $t_{on}$  vs.  $R_{BE}$

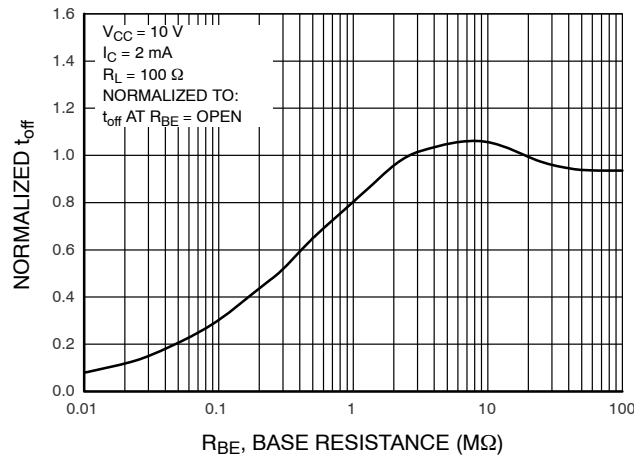


Figure 9. Normalized  $t_{off}$  vs.  $R_{BE}$

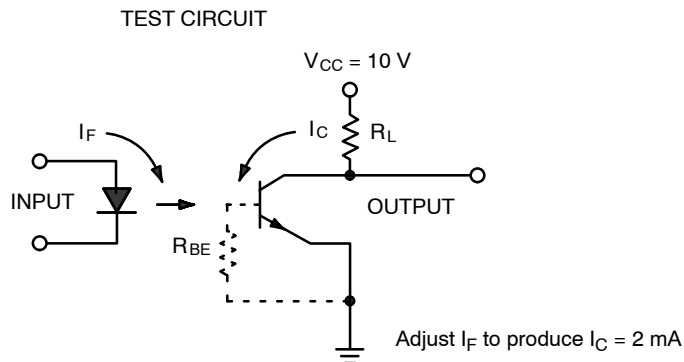


Figure 10. Switching Time Test Circuit and Waveforms

# MOC205M, MOC206M, MOC207M, MOC211M, MOC212M, MOC213M, MOC216M, MOC217M

## REFLOW PROFILE

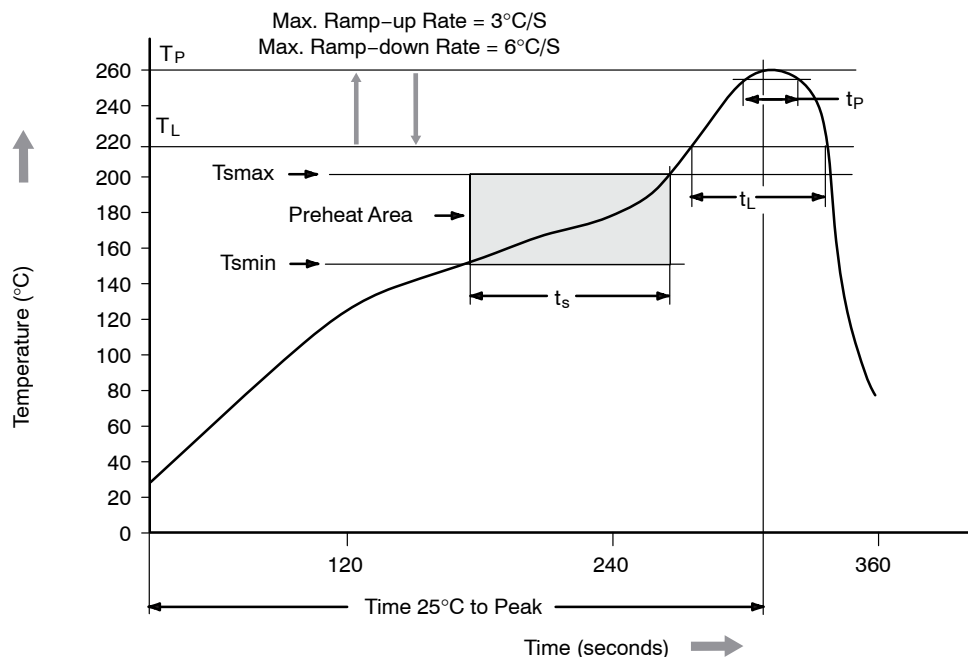


Figure 11. Reflow Profile

Table 1.

| Profile Feature                                  | Pb-Free Assembly Profile |
|--|--------------------------|
| Temperature Minimum ( $T_{smin}$ )               | 150°C                    |
| Temperature Maximum ( $T_{smax}$ )               | 200°C                    |
| Time ( $t_s$ ) from ( $T_{smin}$ to $T_{smax}$ ) | 60 – 120 seconds         |
| Ramp-up Rate ( $t_L$ to $t_p$ )                  | 3°C/second maximum       |
| Liquidous Temperature ( $T_L$ )                  | 217°C                    |
| Time ( $t_L$ ) Maintained Above ( $T_L$ )        | 60 – 150 seconds         |
| Peak Body Package Temperature                    | 260°C +0°C / -5°C        |
| Time ( $t_p$ ) within 5°C of 260°C               | 30 seconds               |
| Ramp-down Rate ( $T_P$ to $T_L$ )                | 6°C/second maximum       |
| Time 25°C to Peak Temperature                    | 8 minutes maximum        |

### ORDERING INFORMATION (Note 2)

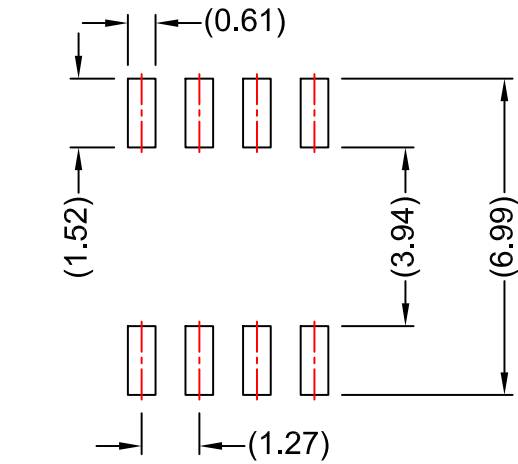
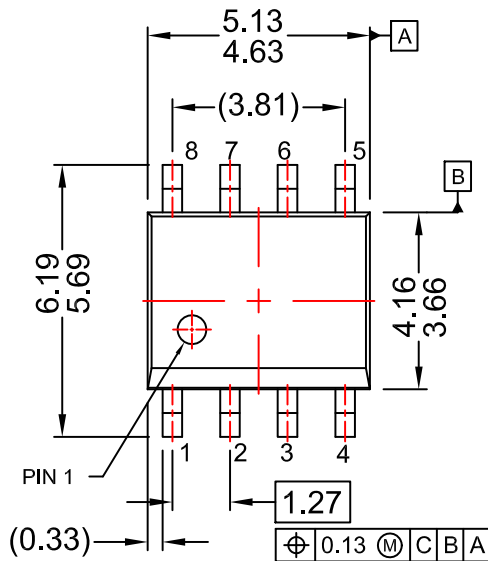
| Part Number | Package   | Shipping <sup>†</sup> |
|-------------|---|-----------------------|
| MOC205M     | Small Outline 8-Pin                             | 50 Units / Tube       |
| MOC205R2M   | Small Outline 8-Pin                             | 2500 / Tape & Reel    |
| MOC205VM    | Small Outline 8-Pin, DIN EN/IEC60747-5-5 Option | 50 Units / Tube       |
| MOC205R2VM  | Small Outline 8-Pin, DIN EN/IEC60747-5-5 Option | 2500 / Tape & Reel    |

<sup>†</sup>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.

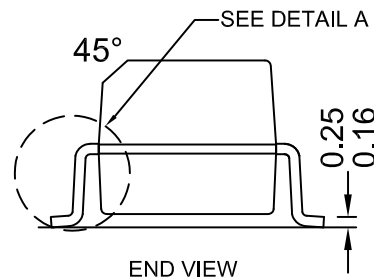
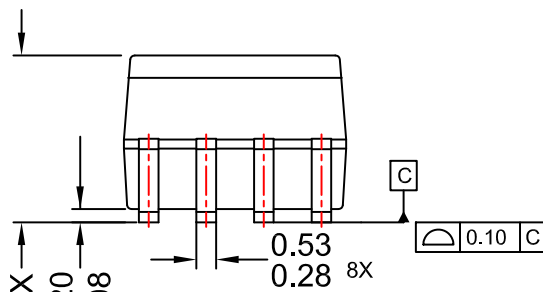
2. The product orderable part number system listed in this table also applies to the MOC20XM and MOC21XM products.

**SOIC8**  
**CASE 751DZ**  
**ISSUE O**

DATE 30 SEP 2016



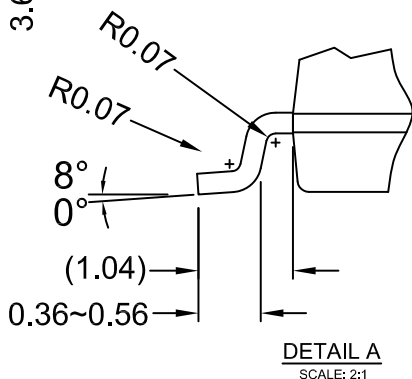
LAND PATTERN RECOMMENDATION



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

|                         |                    |  |
|-------------------------|--------------------|--|
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