

# MOCD223M

## Dual-channel Phototransistor Small Outline Surface Mount Optocouplers

### Features

- U.L. Recognized (File #E90700, Volume 2)
- VDE Recognized (File #13616) (add option "V" for VDE approval, i.e., MOCD223VM)
- Convenient Plastic SOIC-8 Surface Mountable Package Style
- High Current Transfer Ratio of 500% Minimum at  $I_F = 1 \text{ mA}$
- Minimum  $BV_{CEO}$  of 30 V Guaranteed
- Standard SOIC-8 Footprint, with 0.050" Lead Spacing
- High Input-Output Isolation Voltage of 2500  $V_{AC(rms)}$  Guaranteed

### Applications

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

### Description

The MOCD223M consist of two gallium arsenide infrared emitting diodes optically coupled to two monolithic silicon phototransistor darlington detectors, in a surface mountable, small outline plastic package. It is ideally suited for high density applications that require low input current and eliminates the need for through-the-board mounting.

### Schematic

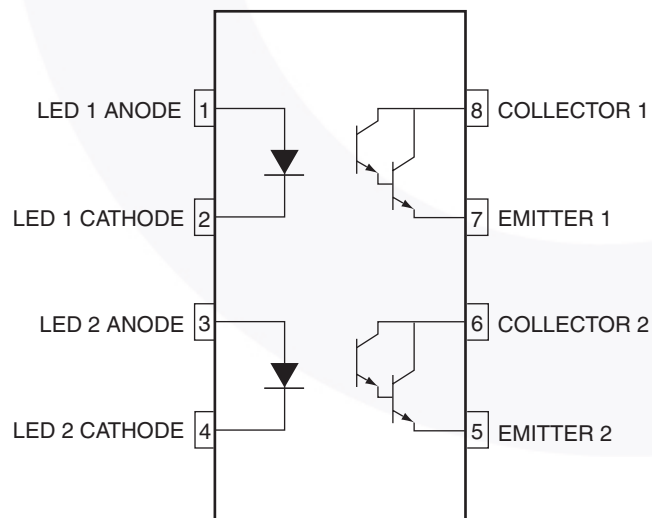


Figure 1. Schematic

### Package Outline

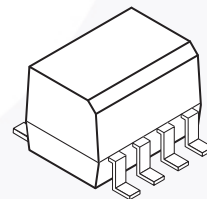


Figure 2. Package Outline

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.  $T_A = 25^\circ\text{C}$  unless otherwise specified.

| Symbol              | Rating   | Value       | Unit                 |
|---------------------|--|-------------|----------------------|
| <b>Emitter</b>      |  |             |                      |
| $I_F$               | Forward Current – Continuous   | 60          | mA                   |
| $I_F$ (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 @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$          | 90          | mW                   |
|                     |  | 0.8         | mW/ $^\circ\text{C}$ |
| <b>Detector</b>     |  |             |                      |
| $V_{CEO}$           | Collector-Emitter Voltage  | 30          | V                    |
| $V_{CBO}$           | Collector-Base Voltage   | 70          | V                    |
| $V_{ECO}$           | Emitter-Collector Voltage  | 7.0         | V                    |
| $I_C$               | Collector Current-Continuous   | 150         | mA                   |
| $P_D$               | Detector Power Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$     | 150         | mW                   |
|                     |  | 1.76        | mW/ $^\circ\text{C}$ |
| <b>Total Device</b> |  |             |                      |
| $V_{ISO}$           | Input-Output Isolation Voltage <sup>(1)(2)(3)</sup><br>(f = 60 Hz, t = 1 minute duration)    | 2500        | Vac(rms)             |
| $P_D$               | Total Device Power Dissipation @ $T_A = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | 250         | mW                   |
|                     |  | 2.94        | mW/ $^\circ\text{C}$ |
| $T_A$               | Ambient Operating Temperature Range  | -40 to +100 | $^\circ\text{C}$     |
| $T_{stg}$           | Storage Temperature Range  | -40 to +150 | $^\circ\text{C}$     |
| $T_L$               | Lead Soldering Temperature<br>(1/16" from case, 10 second duration)                          | 260         | $^\circ\text{C}$     |

## 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                        | $I_F = 1.0 \text{ mA}$  |           | 1.25  | 1.3  | V             |
| $I_R$           | Reverse Leakage Current                      | $V_R = 6.0 \text{ V}$   |           | 0.001 | 100  | $\mu\text{A}$ |
| $C_{IN}$        | Capacitance                                  |   |           | 18    |      | pF            |
| <b>Detector</b> |  |   |           |       |      |               |
| $I_{CEO1}$      | 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          | $I_C = 100 \mu\text{A}$   | 30        | 90    |      | V             |
| $BV_{ECO}$      | Emitter-Collector Breakdown Voltage          | $I_E = 100 \mu\text{A}$   | 7.0       | 10    |      | V             |
| $C_{CE}$        | Collector-Emitter Capacitance                | $f = 1.0 \text{ MHz}, V_{CE} = 0$   |           | 5.5   |      | pF            |
| <b>Coupled</b>  |  |   |           |       |      |               |
| CTR             | Collector-Output Current <sup>(4)</sup>      | $I_F = 1.0 \text{ mA}, V_{CE} = 5 \text{ V}$                                | 500       | 1000  |      | %             |
| $V_{CE(sat)}$   | Collector-Emitter Saturation Voltage         | $I_C = 500 \mu\text{A}, I_F = 1.0 \text{ mA}$                               |           |       | 1.0  | V             |
| $t_{on}$        | Turn-On Time                                 | $I_F = 5.0 \text{ mA}, V_{CC} = 10 \text{ V}, R_L = 100 \Omega$<br>(Fig. 8) |           | 8     |      | $\mu\text{s}$ |
| $t_{off}$       | Turn-Off Time                                | $I_F = 5.0 \text{ mA}, V_{CC} = 10 \text{ V}, R_L = 100 \Omega$<br>(Fig. 8) |           | 55    |      | $\mu\text{s}$ |
| $t_r$           | Rise Time                                    | $I_F = 5.0 \text{ mA}, V_{CC} = 10 \text{ V}, R_L = 100 \Omega$<br>(Fig. 8) |           | 6     |      | $\mu\text{s}$ |
| $t_f$           | Fall Time                                    | $I_F = 5.0 \text{ mA}, V_{CC} = 10 \text{ V}, R_L = 100 \Omega$<br>(Fig. 8) |           | 45    |      | $\mu\text{s}$ |
| $V_{ISO}$       | Isolation Surge Voltage <sup>(1)(2)(3)</sup> | $f = 60 \text{ Hz}, t = 1 \text{ minute}$                                   | 2500      |       |      | Vac(rms)      |
| $R_{ISO}$       | Isolation Resistance <sup>(2)</sup>          | $V_{I-O} = 500 \text{ V}$   | $10^{11}$ |       |      | $\Omega$      |
| $C_{ISO}$       | Isolation Capacitance <sup>(2)</sup>         | $V_{I-O} = 0 \text{ V}, f = 1 \text{ MHz}$                                  |           | 0.2   |      | pF            |

\*Typical values at  $T_A = 25^\circ\text{C}$

### Notes:

1. Isolation Surge Voltage,  $V_{ISO}$ , is an internal device dielectric breakdown rating.
2. For this test, pins 1, 2, 3 and 4 are common and pins 5, 6, 7 and 8 are common.
3.  $V_{ISO}$  rating of  $2500 V_{AC(rms)}$  for  $t = 1 \text{ minute}$  is equivalent to a rating of  $3,000 V_{AC(rms)}$  for  $t = 1 \text{ second}$ .
4. Current Transfer Ratio (CTR) =  $I_C / I_F \times 100\%$

### Typical Performance Curves

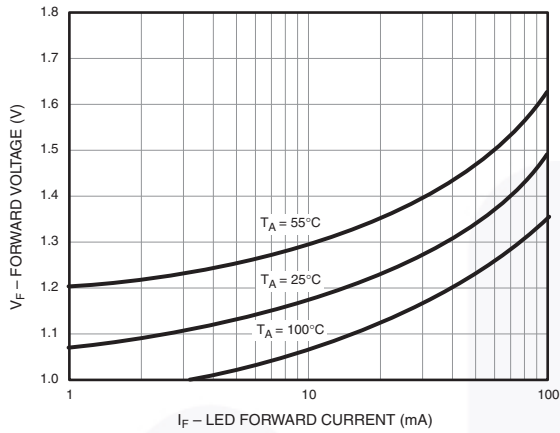


Figure 3. LED Forward Voltage vs. Forward Current

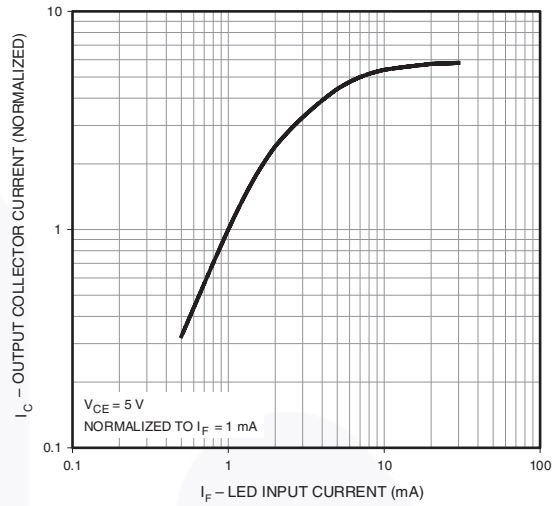


Figure 4. Output Current vs. Input Current

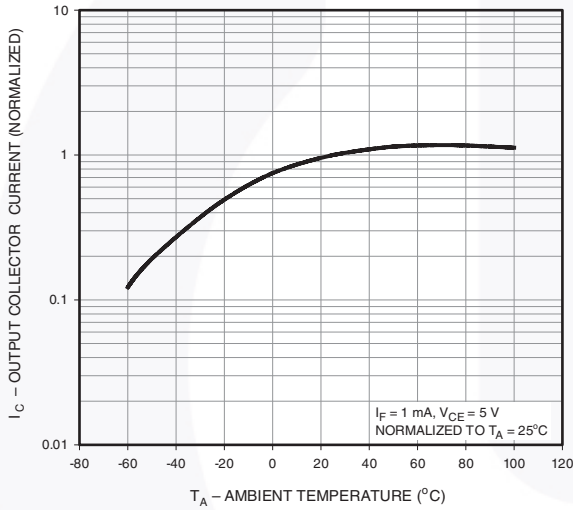


Figure 5. Output Current vs. Ambient Temperature

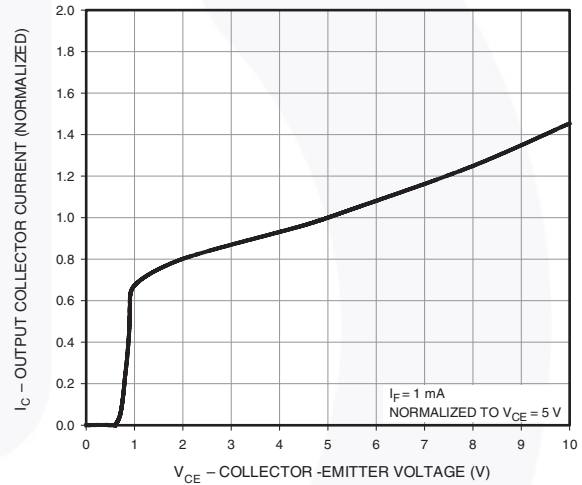


Figure 6. Output Current vs. Collector-Emitter Voltage

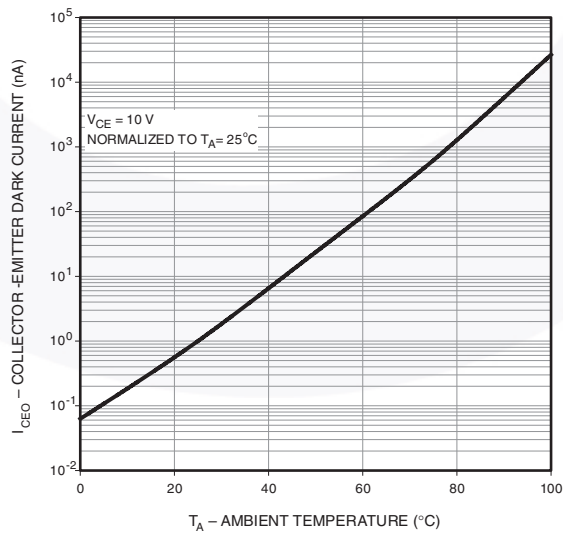


Figure 7. Dark Current vs. Ambient Temperature

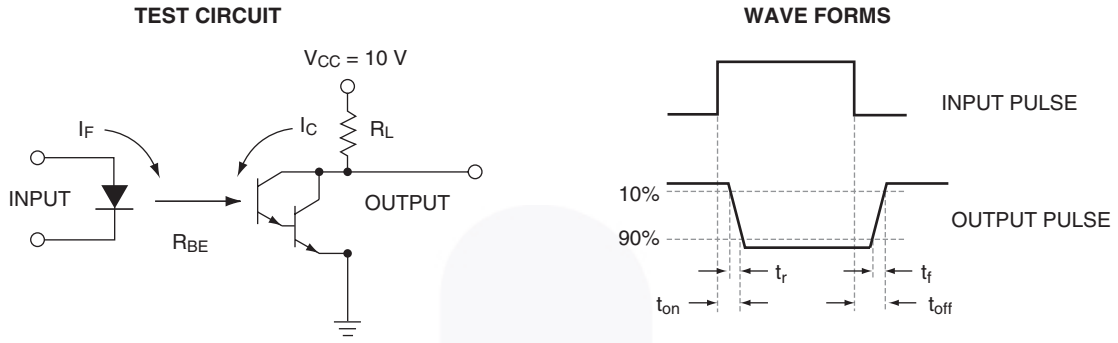
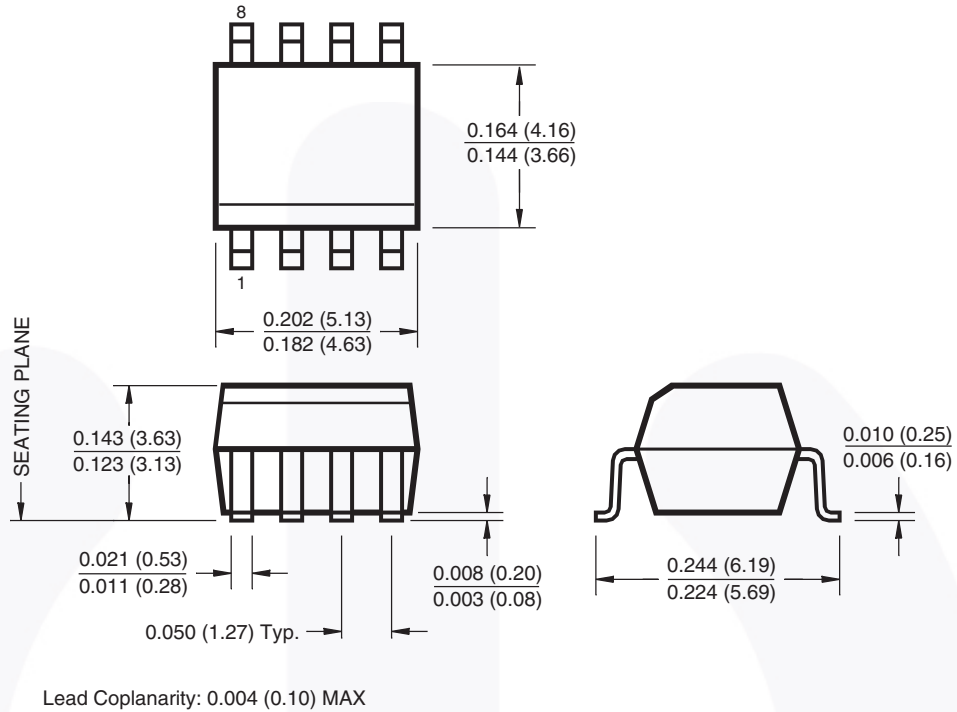


Figure 8. Switching Time Test Circuit and Waveform

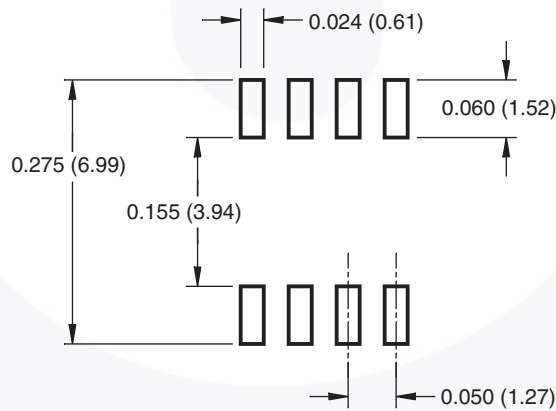


## Package Dimensions

### 8-pin SOIC Surface Mount



### Recommended Pad Layout



Dimensions in inches (mm).

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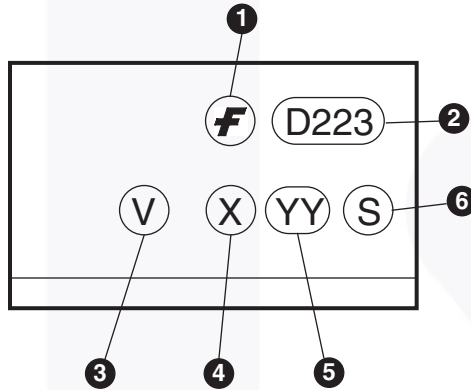
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### Ordering Information

| Option | Order Entry Identifier | Description                                   |
|--------|------------------------|---|
| V      | V                      | VDE 0884                                      |
| R2     | R2                     | Tape and Reel (2500 units per reel)           |
| R2V    | R2V                    | VDE 0884, Tape and Reel (2500 units per reel) |

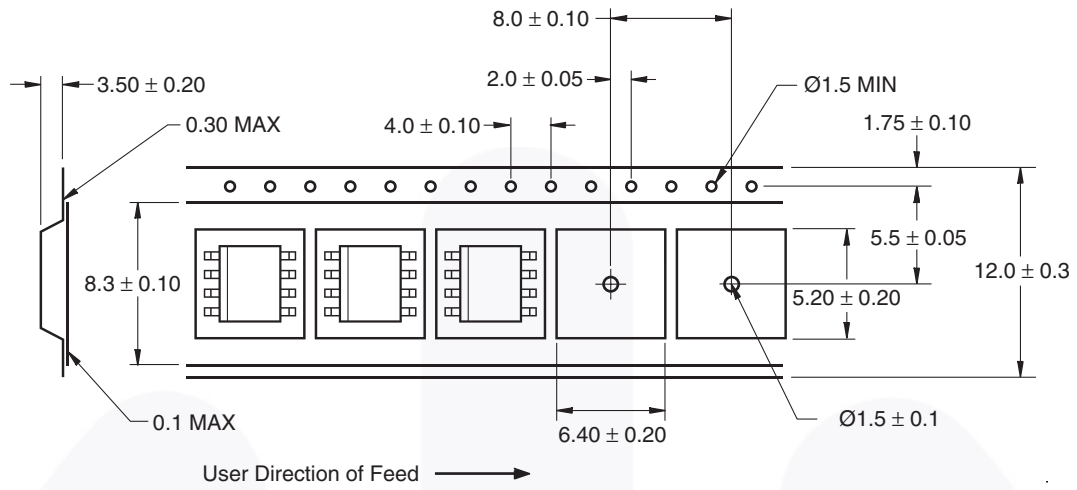
### Marking Information



#### Definitions

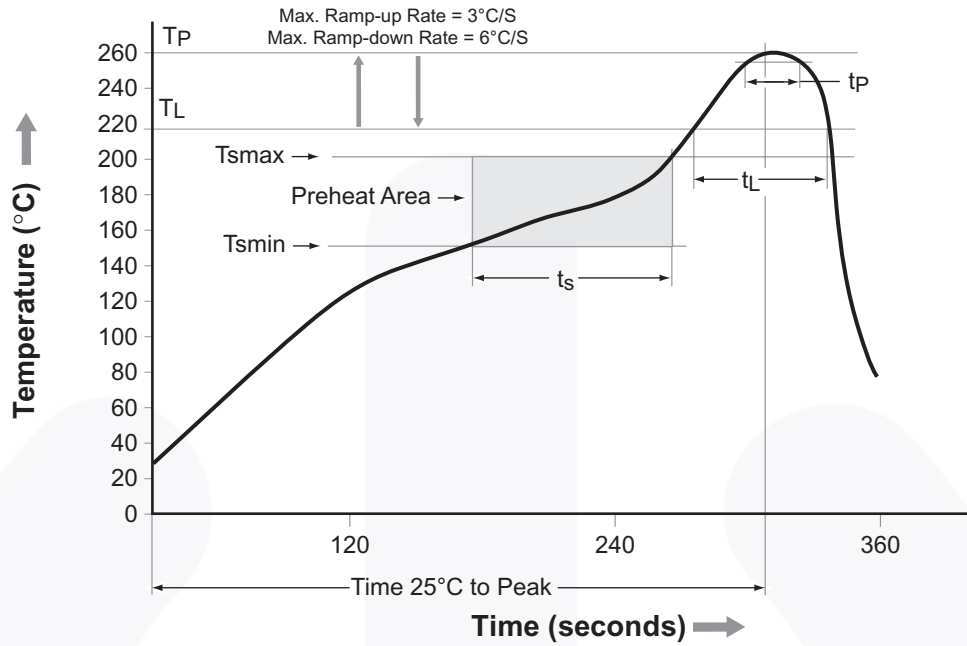
|   |  |
|---|--|
| 1 | Fairchild logo   |
| 2 | Device number  |
| 3 | VDE mark (Note: Only appears on parts ordered with VDE option – See order entry table) |
| 4 | One digit year code, e.g., '3'   |
| 5 | Two digit work week ranging from '01' to '53'  |
| 6 | Assembly package code  |

### Carrier Tape Specifications





## Reflow Profile








| Profile Feature                 | Pb-Free Assembly Profile |
|---------------------------------|--------------------------|
| Temperature Minimum (Tsmín)     | 150°C                    |
| Temperature Maximum (Tsmáx)     | 200°C                    |
| Time (ts) from (Tsmín to Tsmáx) | 60–120 seconds           |
| Ramp-up Rate (tL to tp)         | 3°C/second maximum       |
| Liquidous Temperature (TL)      | 217°C                    |
| Time (tL) Maintained Above (TL) | 60–150 seconds           |
| Peak Body Package Temperature   | 260°C +0°C / -5°C        |
| Time (tp) within 5°C of 260°C   | 30 seconds               |
| Ramp-down Rate (TP to TL)       | 6°C/second maximum       |
| Time 25°C to Peak Temperature   | 8 minutes maximum        |



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| CorePOWER™  | Green FPS™ e-Series™                           | RapidConfigure™   | TINYOPTO™   |
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