High Power Infrared Emitting Diode, 940 nm, GaAlAs, MQW

**DESCRIPTION**

TSML1000 is an infrared, 940 nm emitting diode in GaAlAs multi quantum well (MQW) technology with high radiant power and high speed molded in a clear, untinted plastic package (with lens) for surface mounting (SMD).

**FEATURES**

- Package type: surface-mount
- Package form: GW, RGW, yoke, axial
- Dimensions (L x W x H in mm): 2.5 x 2 x 2.7
- Peak wavelength: $\lambda_p = 940$ nm
- High radiant power
- High radiant intensity
- Angle of half intensity: $\phi = \pm 12^\circ$
- Low forward voltage
- Suitable for high pulse current operation
- Good spectral matching with Si photodetectors
- Versatile terminal configurations
- Package matches with detector TEMT1000
- Floor life: 168 h, MSL 3, according to J-STD-020

**APPLICATIONS**

- For remote control
- Encoder
- Photointerrupters

**PRODUCT SUMMARY**

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>$I_c$ (mW/sr) at $I_F = 20$ mA</th>
<th>$\phi$ (°)</th>
<th>$\lambda_p$ (nm)</th>
<th>$t_r$ (ns)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSML1000</td>
<td>11</td>
<td>$\pm 12$</td>
<td>940</td>
<td>15</td>
</tr>
<tr>
<td>TSML1020</td>
<td>11</td>
<td>$\pm 12$</td>
<td>940</td>
<td>15</td>
</tr>
<tr>
<td>TSML1030</td>
<td>11</td>
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<td>940</td>
<td>15</td>
</tr>
<tr>
<td>TSML1040</td>
<td>11</td>
<td>$\pm 12$</td>
<td>940</td>
<td>15</td>
</tr>
</tbody>
</table>

Note

- Test conditions see table “Basic Characteristics”

**ORDERING INFORMATION**

<table>
<thead>
<tr>
<th>ORDERING CODE</th>
<th>PACKAGING</th>
<th>REMARKS</th>
<th>PACKAGE FORM</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSML1000</td>
<td>Tape and reel</td>
<td>MOQ: 1000 pcs, 1000 pcs/reel</td>
<td>Reverse gullwing</td>
</tr>
<tr>
<td>TSML1020</td>
<td>Tape and reel</td>
<td>MOQ: 1000 pcs, 1000 pcs/reel</td>
<td>Gullwing</td>
</tr>
<tr>
<td>TSML1030</td>
<td>Tape and reel</td>
<td>MOQ: 1000 pcs, 1000 pcs/reel</td>
<td>Yoke</td>
</tr>
<tr>
<td>TSML1040</td>
<td>Bulk</td>
<td>MOQ: 1000 pcs, 1000 pcs/bulk</td>
<td>Axial leads</td>
</tr>
</tbody>
</table>

Note

- MOQ: minimum order quantity
# ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
<th>SYMBOL</th>
<th>VALUE</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reverse voltage</td>
<td></td>
<td>V_{R}</td>
<td>5</td>
<td>V</td>
</tr>
<tr>
<td>Forward current</td>
<td></td>
<td>I_{F}</td>
<td>100</td>
<td>mA</td>
</tr>
<tr>
<td>Peak forward current</td>
<td>t_{p}/T = 0.5, t_{p} = 100 μs</td>
<td>I_{FM}</td>
<td>200</td>
<td>mA</td>
</tr>
<tr>
<td>Surge forward current</td>
<td>t_{p} = 100 μs</td>
<td>I_{SFM}</td>
<td>1.0</td>
<td>A</td>
</tr>
<tr>
<td>Power dissipation</td>
<td></td>
<td>P_{V}</td>
<td>160</td>
<td>mW</td>
</tr>
<tr>
<td>Junction temperature</td>
<td></td>
<td>T_{J}</td>
<td>100</td>
<td>°C</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td></td>
<td>T_{amb}</td>
<td>-40 to +85</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature range</td>
<td></td>
<td>T_{stg}</td>
<td>-40 to +100</td>
<td>°C</td>
</tr>
<tr>
<td>Soldering temperature</td>
<td>According to Fig. 10, J-STD-020</td>
<td>T_{sd}</td>
<td>260</td>
<td>°C</td>
</tr>
<tr>
<td>Thermal resistance junction to ambient</td>
<td>EIA / JESD51</td>
<td>R_{thJA}</td>
<td>400</td>
<td>K/W</td>
</tr>
</tbody>
</table>

![Fig. 1 - Power Dissipation Limit vs. Ambient Temperature](image1.png)

![Fig. 2 - Forward Current vs. Ambient Temperature](image2.png)

# BASIC CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
<th>SYMBOL</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward voltage</td>
<td>I_{F} = 20 mA, t_{p} = 20 ms</td>
<td>V_{F}</td>
<td>-</td>
<td>1.2</td>
<td>1.5</td>
<td>V</td>
</tr>
<tr>
<td>Temperature coefficient of V_{F}</td>
<td>I_{F} = 1 mA, t_{p} = 100 μs</td>
<td>K_{VF}</td>
<td>-</td>
<td>-1.8</td>
<td>-</td>
<td>mV/K</td>
</tr>
<tr>
<td>Reverse current</td>
<td>V_{R} = 5 V,</td>
<td>I_{R}</td>
<td>-</td>
<td>-</td>
<td>10</td>
<td>μA</td>
</tr>
<tr>
<td>Temperature coefficient of I_{R}</td>
<td>V_{R} = 0 V, F = 1 MHz, E = 0</td>
<td>K_{IR}</td>
<td>-</td>
<td>-</td>
<td>40</td>
<td>pF</td>
</tr>
<tr>
<td>Radiant intensity</td>
<td>I_{F} = 20 mA, t_{p} = 20 ms</td>
<td>I_{e}</td>
<td>3</td>
<td>11</td>
<td>15</td>
<td>mW/sr</td>
</tr>
<tr>
<td>Radiant power</td>
<td>I_{F} = 100 mA, t_{p} = 20 ms</td>
<td>Φ_{e}</td>
<td>-</td>
<td>40</td>
<td>-</td>
<td>mW</td>
</tr>
<tr>
<td>Temperature coefficient of Φ_{e}</td>
<td>I_{F} = 20 mA</td>
<td>K_{Φe}</td>
<td>-</td>
<td>-0.6</td>
<td>-</td>
<td>%/K</td>
</tr>
<tr>
<td>Angle of half intensity</td>
<td></td>
<td>θ_e</td>
<td>±12</td>
<td>-</td>
<td>-</td>
<td>°</td>
</tr>
<tr>
<td>Peak wavelength</td>
<td>I_{F} = 100 mA</td>
<td>λ_{p}</td>
<td>-</td>
<td>940</td>
<td>-</td>
<td>nm</td>
</tr>
<tr>
<td>Spectral bandwidth</td>
<td>I_{F} = 100 mA</td>
<td>Δλ</td>
<td>-</td>
<td>30</td>
<td>-</td>
<td>nm</td>
</tr>
<tr>
<td>Temperature coefficient of Δλ</td>
<td>I_{F} = 100 mA</td>
<td>K_{Δλ}</td>
<td>-</td>
<td>0.2</td>
<td>-</td>
<td>nm/K</td>
</tr>
<tr>
<td>Rise time</td>
<td>I_{F} = 100 mA</td>
<td>t_{r}</td>
<td>-</td>
<td>15</td>
<td>-</td>
<td>ns</td>
</tr>
<tr>
<td>Fall time</td>
<td>I_{F} = 100 mA</td>
<td>t_{f}</td>
<td>-</td>
<td>15</td>
<td>-</td>
<td>ns</td>
</tr>
</tbody>
</table>
BASIC CHARACTERISTICS ($T_{amb} = 25 \, ^\circ C$, unless otherwise specified)

Fig. 3 - Pulse Forward Current vs. Pulse Duration

Fig. 4 - Forward Current vs. Forward Voltage

Fig. 5 - Radiant Intensity vs. Forward Current

Fig. 6 - Radiant Power vs. Forward Current

Fig. 7 - Relative Radiant Intensity/Power vs. Ambient Temperature

Fig. 8 - Relative Radiant Power vs. Wavelength
**PRECAUTIONS FOR USE**

1. **Over-current-proof**
   Customer must apply resistors for protection, otherwise slight voltage shift will cause big current change (burn out will happen).

2. **Storage**
   - Storage temperature and rel. humidity conditions are: 5 °C to 35 °C, R.H. 60 %.
   - Floor life must not exceed 168 h, according to JEDEC® level 3, J-STD-020.
     Once the package is opened, the products should be used within a week. Otherwise, they should be kept in a damp proof box with desiccant.
     Considering tape life, we suggest to use products within one year from production date.
   - If opened more than one week in an atmosphere 5 °C to 35 °C, R.H. 60 %, devices should be treated at 60 °C ± 5 °C for 15 h.
   - If humidity indicator in the package shows pink color (normal blue), then devices should be treated with the same conditions as 2.3.

**REFLOW SOLDER PROFILE**

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**Fig. 9 - Relative Radiant Intensity vs. Angular Displacement**

**Fig. 10 - Lead (Pb)-Free Reflow Solder Profile According to J-STD-020**
PACKAGE DIMENSIONS in millimeters: **TSML1000**

![TSML1000 package dimensions diagram]

Technical drawings according to DIN specifications

Drawing-No.: 6.544-5326.02-4
Issue: 5; 15.09.2021

PACKAGE DIMENSIONS in millimeters: **TSML1020**

![TSML1020 package dimensions diagram]

Technical drawings according to DIN specifications

Drawing-No.: 6.544-5325.02-4
Issue: 5; 15.09.2021
PACKAGE DIMENSIONS in millimeters: **TSML1030**

![Technical drawings according to DIN specifications](image1)

Drawing-No.: 6.544-5329.01-4
Issue: 6; 15.09.2021

PACKAGE DIMENSIONS in millimeters: **TSML1040**

![Technical drawings according to DIN specifications](image2)

Drawing-No.: 6.544-5339.02-4
Issue: 4; 04.08.2021
TSML1000, TSML1020, TSML1030, TSML1040

Vishay Semiconductors

REEL DIMENSIONS in millimeters

Leader and trailer tape:

Parts mounted
Empty leader (400 mm, min.)

Direction of pulling out
Empty trailer (200 mm, min.)

Taping Dimensions in millimeters: TSML1000

Technical drawings according to DIN specifications

Technical drawings according to DIN specifications

Top tape
Push pin through hole

Quantity per reel: 1000 pcs.

Drawing-No.: 9.700-5268.01-4
Issue: 3; 28.09.2021

Drawing-No.: 9,800-5080.01-4
Issue: 3; 11.06.08

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For technical questions, contact: emittertechsupport@vishay.com

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Taping Dimensions

**TSML1020**

Polarity and orientation in the tape:

- Top tape
- Push pin through hole
- Anode
- Feed direction
- Quantity per reel: 1000 pcs.

Drawing-No.: 9.700-5269.01-4
Issue: 3; 28.09.2021

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**TSML1030**

Polarity and orientation in the tape:

- Top tape
- Push pin through hole
- Anode
- Feed direction
- Quantity per reel: 1000 pcs.

Drawing-No.: 9.700-5270.01-4
Issue: 3; 28.09.2021
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