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: $\varphi = \pm 12^\circ$
- 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, acc. J-STD-020
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

APPLICATIONS

- For remote control
- Punched tape readers
- Encoder
- Photointerrupters

PRODUCT SUMMARY

<table>
<thead>
<tr>
<th>COMPONENT</th>
<th>$I_e$ (mW/sr)</th>
<th>$\varphi$ (deg)</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>
<td>$\pm 12$</td>
<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  

<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 ( t_p/T = 0.5, t_p = 100 \mu s )</td>
<td></td>
<td>( I_{FM} )</td>
<td>200</td>
<td>mA</td>
</tr>
<tr>
<td>Surge forward current ( t_p = 100 \mu s )</td>
<td></td>
<td>( I_{FSM} )</td>
<td>1.0</td>
<td>A</td>
</tr>
<tr>
<td>Power dissipation</td>
<td></td>
<td>( P_V )</td>
<td>190</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>( t \leq 5 ) s</td>
<td>( T_{sd} )</td>
<td>&lt; 260</td>
<td>°C</td>
</tr>
<tr>
<td>Thermal resistance junction/ambient</td>
<td>Soldered on PCB, pad dimensions: 4 mm x 4 mm</td>
<td>( R_{thJA} )</td>
<td>400</td>
<td>°C</td>
</tr>
</tbody>
</table>

Fig. 1 - Power Dissipation Limit vs. Ambient Temperature

Fig. 2 - Forward Current vs. Ambient Temperature

BASIC CHARACTERISTICS  

<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>1.2</td>
<td>1.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>( I_F = 1 ) A, ( t_p = 100 ) \mu s</td>
<td>( V_F )</td>
<td>2.2</td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Temperature coefficient of ( V_F )</td>
<td>( I_F = 1 ) mA</td>
<td>( T_K_{VF} )</td>
<td>-1.8</td>
<td></td>
<td>mV/K</td>
<td></td>
</tr>
<tr>
<td>Reverse current</td>
<td>( V_R = 5 ) V</td>
<td>( I_R )</td>
<td></td>
<td>10</td>
<td>μA</td>
<td></td>
</tr>
<tr>
<td>Junction capacitance</td>
<td>( V_R = 0 ) V, ( f = 1 ) MHz, ( E = 0 )</td>
<td>( C_j )</td>
<td>40</td>
<td></td>
<td>pF</td>
<td></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>( \phi_e )</td>
<td>40</td>
<td></td>
<td>mW</td>
<td></td>
</tr>
<tr>
<td>Temperature coefficient of ( \phi_e )</td>
<td>( I_F = 20 ) mA</td>
<td>( T_K_{\phi_e} )</td>
<td>-0.6</td>
<td></td>
<td>%/K</td>
<td></td>
</tr>
<tr>
<td>Angle of half intensity</td>
<td>( \phi )</td>
<td>( \pm 12 )</td>
<td></td>
<td></td>
<td>deg</td>
<td></td>
</tr>
<tr>
<td>Peak wavelength</td>
<td>( I_F = 100 ) mA</td>
<td>( \lambda_p )</td>
<td>940</td>
<td></td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Spectral bandwidth</td>
<td>( I_F = 100 ) mA</td>
<td>( \Delta \lambda )</td>
<td>30</td>
<td></td>
<td>nm</td>
<td></td>
</tr>
<tr>
<td>Temperature coefficient of ( \lambda_p )</td>
<td>( I_F = 100 ) mA</td>
<td>( T_K_{\lambda_p} )</td>
<td>0.2</td>
<td></td>
<td>nm/K</td>
<td></td>
</tr>
<tr>
<td>Rise time</td>
<td>( I_F = 100 ) mA</td>
<td>( t_r )</td>
<td>15</td>
<td></td>
<td>ns</td>
<td></td>
</tr>
<tr>
<td>Fall time</td>
<td>( I_F = 100 ) mA</td>
<td>( t_f )</td>
<td>15</td>
<td></td>
<td>ns</td>
<td></td>
</tr>
</tbody>
</table>
**BASIC CHARACTERISTICS** \( (T_{amb} = 25 \, ^\circ\text{C}, \text{unless otherwise specified}) \)

**Fig. 3 - Pulse Forward Current vs. Pulse Duration**

- \( t_p \)- Pulse Duration (ms): 0.01, 0.10, 1.00, 10.00, 100.00
- \( I_f \)- Forward Current (mA): 0.1, 0.05, 0.02, 0.01
- \( t_p/T = 0.01 \)

**Fig. 4 - Forward Current vs. Forward Voltage**

- \( V_f \)- Forward Voltage (V): 1, 2, 3
- \( I_f \)- Forward Current (mA): 0.1, 0.02, 0.05, 0.1
- \( t_p = 100 \mu\text{s} \)
- \( I_f/T = 0.001 \)

**Fig. 5 - Radiant Intensity vs. Forward Current**

- \( I_f \)- Forward Current (mA): 1, 10, 100, 1000
- \( I_f \)- Radiant Intensity (mW/sr): 0.1, 1, 10, 100
- \( t_p = 100 \mu\text{s} \)

**Fig. 6 - Radiant Power vs. Forward Current**

- \( I_f \)- Forward Current (mA): 1, 10, 100, 1000
- \( I_f \)- Radiant Power (mW): 0.1, 0.5, 1.0
- \( t_p = 100 \mu\text{s} \)

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

- \( T_{amb} \)- Ambient Temperature (°C): 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 110, 120, 130, 140
- \( I_f = 20 \, mA \)
- \( I_e \text{rel} = I_e/I_e(T=25^\circ\text{C}) \)

**Fig. 8 - Relative Radiant Power vs. Wavelength**

- \( \lambda \)- Wavelength (nm): 840, 880, 920, 960, 1000, 1040
- \( I_f = 30 \, mA \)
- \( \Phi_{e\text{rel}} \)- Relative Radiant Power (%)
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, acc. 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.
**PACKAGE DIMENSIONS** in millimeters: **TSML1000**

![Diagram of TSML1000 package dimensions]

**PACKAGE DIMENSIONS** in millimeters: **TSML1020**

![Diagram of TSML1020 package dimensions]
**REEL DIMENSIONS** in millimeters

Unreel direction

Tape position coming out from reel

Label posted here

Leader and trailer tape:

Parts mounted

Empty leader (400 mm, min.)

Direction of pulling out

Empty trailer (200 mm, min.)

**TAPPING DIMENSIONS** in millimeters: **TSML1000**

Anode

Feed direction

Quantity per reel: 1000 pcs or 5000 pcs

For technical questions, contact: emittertechsupport@vishay.com

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**Taping Dimensions** in millimeters: **TSML1020**

![Taping Dimensions Diagram](image)

**TSML1030**

![Taping Dimensions Diagram](image)
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