



# THE DATASHEET OF TLP521-1GB





## TLP521, TLP521-2, TLP521-4



### DESCRIPTION

The TLP521, TLP521-2 and TLP521-4 series of optically coupled isolator consist of an infrared light emitting diode and an NPN silicon photo transistor in a space efficient Dual In Line Plastic Package.

### FEATURES

- AC Isolation Voltage 5300V<sub>RMS</sub>
- CTR Selections Available
- Wide Operating Temperature Range  
-30°C to +100°C
- Lead Free and RoHS Compliant
- UL File E91231 Package Code "EE"
- VDE Approval Certificate No. 40028086

### APPLICATIONS

- Computer Terminals
- Industrial System Controllers
- Measuring Instruments
- Signal Transmission between Systems of Different Potentials and Impedances

### ORDER INFORMATION

- Add X after PN for VDE Approval
- Add G after PN for 10mm lead spacing
- Add SM after PN for Surface Mount
- Add SMT&R after PN for Surface Mount Tape & Reel  
(Available for TLP521SM and TLP521-2SM)
- Optional Order Part No. TLP521-1 for TLP521
- Consult Factory for Tape and Reel version of TLP521-4SM

TLP521



TLP521-2



TLP521-4



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

Stresses exceeding the absolute maximum ratings can cause permanent damage to the device. Exposure to absolute maximum ratings for long periods of time can adversely affect reliability.

#### Input

|                   |      |
|-------------------|------|
| Forward Current   | 50mA |
| Reverse Voltage   | 6V   |
| Power dissipation | 70mW |

#### Output

|  |       |
|--|-------|
| Collector to Emitter Voltage BV <sub>CEO</sub> | 55V   |
| Emitter to Collector Voltage BV <sub>ECO</sub> | 6V    |
| Collector Current                              | 50mA  |
| Power Dissipation                              | 150mW |

#### Total Package

|                                     |                      |
|-------------------------------------|----------------------|
| Isolation Voltage                   | 5300V <sub>RMS</sub> |
| Total Power Dissipation             | 200mW                |
| Operating Temperature               | -30 to 100 °C        |
| Storage Temperature                 | -55 to 125 °C        |
| Lead Soldering Temperature<br>(10s) | 260°C                |

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## TLP521, TLP521-2, TLP521-4

### ELECTRICAL CHARACTERISTICS (Ambient Temperature = 25°C unless otherwise specified)

#### INPUT

| Parameter            | Symbol | Test Condition                   | Min | Typ. | Max | Unit          |
|----------------------|--------|----------------------------------|-----|------|-----|---------------|
| Forward Voltage      | $V_F$  | $I_F = 10\text{mA}$              | 1.0 | 1.15 | 1.3 | V             |
| Reverse Voltage      | $V_R$  | $I_R = 10\mu\text{A}$            | 6.0 |      |     | V             |
| Reverse Leakage      | $I_R$  | $V_R = 4\text{V}$                |     |      | 10  | $\mu\text{A}$ |
| Terminal Capacitance | $C_t$  | $V = 0\text{V}, f = 1\text{KHz}$ |     | 30   | 250 | pF            |

#### OUTPUT

| Parameter                           | Symbol     | Test Condition                           | Min | Typ. | Max | Unit |
|-------------------------------------|------------|--|-----|------|-----|------|
| Collector—Emitter breakdown Voltage | $BV_{CEO}$ | $I_C = 0.5\text{mA}, I_F = 0\text{mA}$   | 55  |      |     | V    |
| Emitter—Collector breakdown Voltage | $BV_{ECO}$ | $I_E = 100\mu\text{A}, I_F = 0\text{mA}$ | 6   |      |     | V    |
| Collector-Emitter Dark Current      | $I_{CEO}$  | $V_{CE} = 20\text{V}, I_F = 0\text{mA}$  |     |      | 100 | nA   |



## TLP521, TLP521-2, TLP521-4

### ELECTRICAL CHARACTERISTICS (Ambient Temperature = 25°C unless otherwise specified)

#### COUPLED

| Parameter                            | Symbol        | Test Condition  | Min | Typ. | Max        | Unit          |
|--------------------------------------|---------------|---|-----|------|------------|---------------|
| Current Transfer Ratio               | CTR           | $I_F = 5\text{mA}$ , $V_{CE} = 5\text{V}$   | 50  |      | 600        | %             |
|                                      |               | Optional CTR Grades   |     |      |            |               |
|                                      |               | GR  | 100 |      | 300        |               |
|                                      |               | BL  | 200 |      | 600        |               |
|                                      |               | GB  | 100 |      | 600        |               |
|                                      |               | GB ( $I_F = 1\text{mA}$ , $V_{CE} = 0.4\text{V}$ )  | 30  |      |            |               |
| Collector—Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_F = 8\text{mA}$ , $I_C = 2.4\text{mA}$<br>GB ( $I_F = 1\text{mA}$ , $I_C = 0.2\text{mA}$ ) |     |      | 0.4<br>0.4 | V             |
| Output Rise Time                     | $t_r$         | $V_{CE} = 2\text{V}$ ,<br>$I_C = 2\text{mA}$ ,<br>$R_L = 100\Omega$                           |     | 4    |            | $\mu\text{s}$ |
| Output Fall Time                     | $t_f$         |   |     | 3    |            |               |
| Turn-on Time                         | $t_{on}$      |   |     | 3    |            |               |
| Turn-off Time                        | $t_{off}$     |   |     | 3    |            |               |
| Turn-on Time                         | $t_{ON}$      | $V_{CC} = 5\text{V}$ ,<br>$I_F = 16\text{mA}$ ,<br>$R_L = 1.9\text{k}\Omega$                  |     | 2    |            | $\mu\text{s}$ |
| Turn-off Time                        | $t_{OFF}$     |   |     | 25   |            |               |

#### ISOLATION

| Parameter                            | Symbol    | Test Condition                        | Min                | Typ. | Max | Unit      |
|--------------------------------------|-----------|---------------------------------------|--------------------|------|-----|-----------|
| Input to Output Isolation Voltage    | $V_{ISO}$ | AC 1 minute, RH = 40 to 60%<br>Note 1 | 5300               |      |     | $V_{RMS}$ |
| Input to Output Isolation Resistance | $R_{ISO}$ | $V_{IO} = 500\text{V}$<br>Note 1      | $5 \times 10^{10}$ |      |     | $\Omega$  |

Note 1 : Measure with input leads shorted together and output leads shorted together.



## TLP521, TLP521-2, TLP521-4



Fig 1 Forward Current vs  $T_A$



Fig 2 Collector Power Dissipation vs  $T_A$

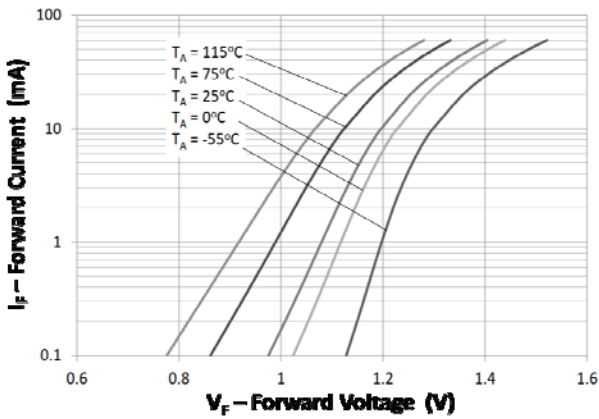


Fig 3 Forward Current vs Forward Voltage



Fig 4 Collector Current vs Collector-Emitter Voltage

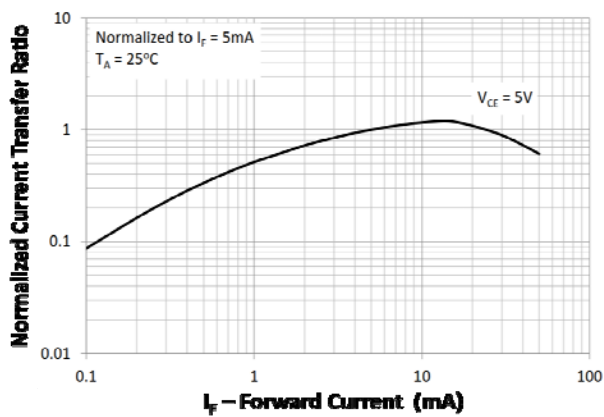


Fig 5 Normalized Current Transfer Ratio vs Forward Current



Fig 6 Normalized Current Transfer Ratio vs Ambient Temperature



## TLP521, TLP521-2, TLP521-4

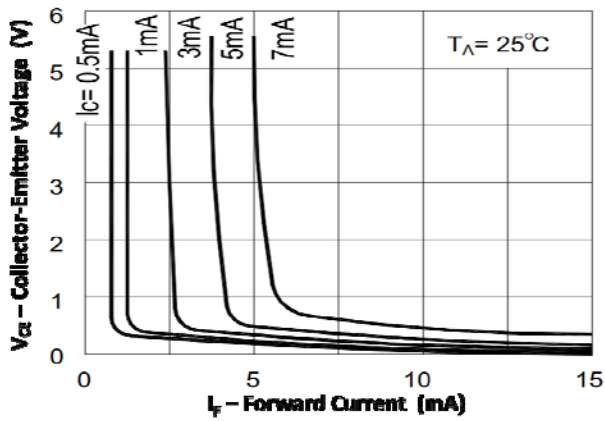


Fig 7 Collector-Emitter Voltage vs Forward Current

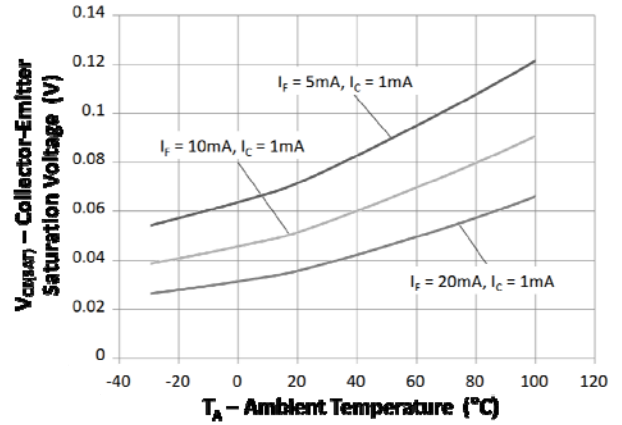


Fig 8 Collector-Emitter Voltage vs Ambient Temperature



Fig 9 Collector Dark Current vs Ambient Temperature



## TLP521, TLP521-2, TLP521-4

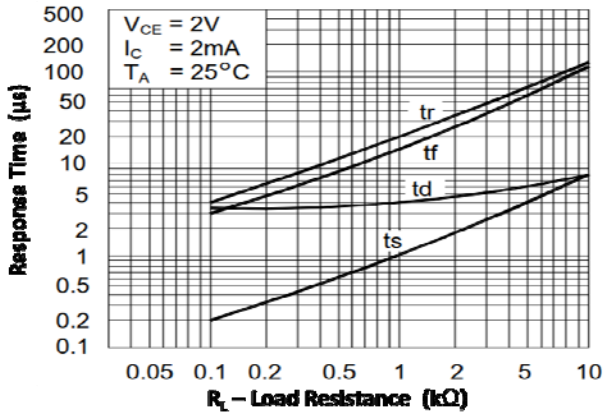
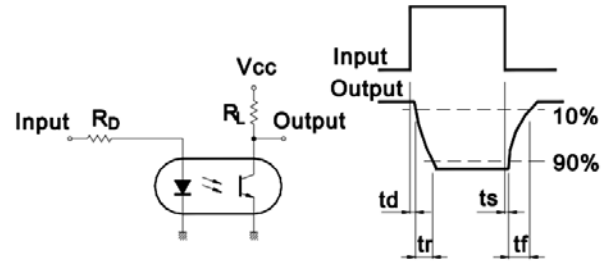


Fig 7 Response Time vs Load Resistance



Response Time Test Circuit

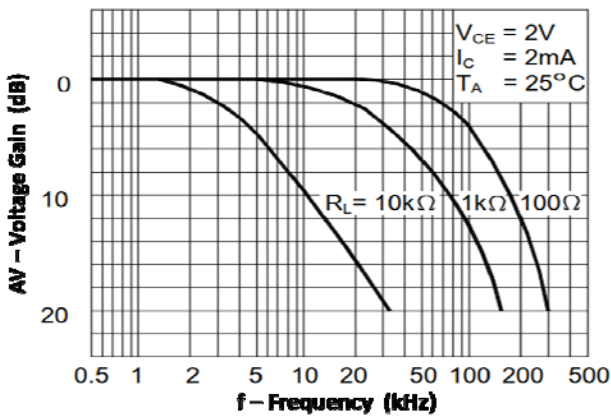


Fig 9 Frequency Response



Frequency Response Test Circuit



**TLP521, TLP521-2, TLP521-4**

**ORDER INFORMATION**

| <b>TLP521, TLP521-1 (UL Approval)</b> |  |                           |                         |
|---------------------------------------|--|---------------------------|-------------------------|
| <b>After PN</b>                       | <b>PN</b>  | <b>Description</b>        | <b>Packing quantity</b> |
| None                                  | TLP521, TLP521-1<br>TLP521GR, TLP521-1GR<br>TLP521BL, TLP521-1BL,<br>TLP521GB, TLP521-1GB  | Standard DIP4             | 100 pcs per tube        |
| G                                     | TLP521G, TLP521-1G,<br>TLP521GRG, TLP521-1GRG,<br>TLP521BLG, TLP521-1BLG<br>TLP521GBG, TLP521-1GBG   | 10mm Lead Spacing         | 100 pcs per tube        |
| SM                                    | TLP521SM, TLP521-1SM,<br>TLP521GRSM, TLP521-1GRSM,<br>TLP521BLSM, TLP521-1BLSM,<br>TLP521GBSM, TLP521-1GBSM                                    | Surface Mount             | 100 pcs per tube        |
| SMT&R                                 | TLP521SMT&R,<br>TLP521-1SMT&R<br>TLP521GRSMT&R,<br>TLP521-1GRSMT&R,<br>TLP521BLSMT&R,<br>TLP521-1BLSMT&R,<br>TLP521GBSMT&R,<br>TLP521-1GBSMT&R | Surface Mount Tape & Reel | 1000 pcs per reel       |

Note : Optional Order Part No. TLP521-1 for TLP521.



## TLP521, TLP521-2, TLP521-4

### ORDER INFORMATION

| TLP521-2 (UL Approval) |   |                           |                   |
|------------------------|---|---------------------------|-------------------|
| After PN               | PN  | Description               | Packing quantity  |
| None                   | TLP521-2, TLP521-2GR,<br>TLP521-2BL, TLP521-2GB                           | Standard DIP8             | 50 pcs per tube   |
| G                      | TLP521-2G, TLP521-2GRG,<br>TLP521-2BLG, TLP521-2GBG                       | 10mm Lead Spacing         | 50 pcs per tube   |
| SM                     | TLP521-2SM, TLP521-2GRSM,<br>TLP521-2BLSM,<br>TLP521-2GBSM                | Surface Mount             | 50 pcs per tube   |
| SMT&R                  | TLP521-2SMT&R,<br>TLP521-2GRSMT&R,<br>TLP521-2BLSMT&R,<br>TLP521-2GBSMT&R | Surface Mount Tape & Reel | 1000 pcs per reel |

| TLP521-4 (UL Approval) |  |                   |                  |
|------------------------|--|-------------------|------------------|
| After PN               | PN   | Description       | Packing quantity |
| None                   | TLP521-4, TLP521-4GR,<br>TLP521-4BL, TLP521-4GB            | Standard DIP16    | 25 pcs per tube  |
| G                      | TLP521-4G, TLP521-4GRG,<br>TLP521-4BLG, TLP521-4GBG        | 10mm Lead Spacing | 25 pcs per tube  |
| SM                     | TLP521-4SM, TLP521-4GRSM,<br>TLP521-4BLSM,<br>TLP521-4GBSM | Surface Mount     | 25 pcs per tube  |



## TLP521, TLP521-2, TLP521-4

### ORDER INFORMATION

| TLP521X, TLP521-1X (UL and VDE Approvals) |  |                           |                   |
|---|--|---------------------------|-------------------|
| After PN                                  | PN   | Description               | Packing quantity  |
| None                                      | TLP521X, TLP521-1X<br>TLP521XGR, TLP521-1XGR<br>TLP521XBL, TLP521-1XBL,<br>TLP521XGB, TLP521-1XGB  | Standard DIP4             | 100 pcs per tube  |
| G   | TLP521XG, TLP521-1XG,<br>TLP521XGRG, TLP521-1XGRG,<br>TLP521XBLG, TLP521-1XBLG<br>TLP521XGBG, TLP521-1XGBG   | 10mm Lead Spacing         | 100 pcs per tube  |
| SM  | TLP521XSM, TLP521-1XSM,<br>TLP521XGRSM,<br>TLP521-1XGRSM,<br>TLP521XBLSM,<br>TLP521-1XBLSM,<br>TLP521XGBSM,<br>TLP521-1XGBSM                           | Surface Mount             | 100 pcs per tube  |
| SMT&R                                     | TLP521XSMT&R,<br>TLP521-1XSMT&R<br>TLP521XGRSMT&R,<br>TLP521-1XGRSMT&R,<br>TLP521XBLSMT&R,<br>TLP521-1XBLSMT&R,<br>TLP521XGBSMT&R,<br>TLP521-1XGBSMT&R | Surface Mount Tape & Reel | 1000 pcs per reel |

Note : Optional Order Part No. TLP521-1 for TLP521.



## TLP521, TLP521-2, TLP521-4

### ORDER INFORMATION

| TLP521-2X (UL and VDE Approvals) |   |                           |                   |
|----------------------------------|---|---------------------------|-------------------|
| After PN                         | PN  | Description               | Packing quantity  |
| None                             | TLP521-2X, TLP521-2XGR,<br>TLP521-2XBL, TLP521-2XGB                           | Standard DIP8             | 50 pcs per tube   |
| G                                | TLP521-2XG, TLP521-2XGRG<br>TLP521-2XB LG, TLP521-2XGBG                       | 10mm Lead Spacing         | 50 pcs per tube   |
| SM                               | TLP521-2XSM,<br>TLP521-2XGRSM,<br>TLP521-2XBLSM,<br>TLP521-2XGBSM             | Surface Mount             | 50 pcs per tube   |
| SMT&R                            | TLP521-2XSMT&R,<br>TLP521-2XGRSMT&R,<br>TLP521-2XBLSMT&R,<br>TLP521-2XGBSMT&R | Surface Mount Tape & Reel | 1000 pcs per reel |

| TLP521-4X (UL and VDE Approvals) |   |                   |                  |
|----------------------------------|---|-------------------|------------------|
| After PN                         | PN  | Description       | Packing quantity |
| None                             | TLP521-4X, TLP521-4XGR,<br>TLP521-4XBL, TLP521-4XGB               | Standard DIP16    | 25 pcs per tube  |
| G                                | TLP521-4XG, TLP521-4XGRG,<br>TLP521-4XB LG, TLP521-4XGBG          | 10mm Lead Spacing | 25 pcs per tube  |
| SM                               | TLP521-4XSM,<br>TLP521-4XGRSM,<br>TLP521-4XBLSM,<br>TLP521-4XGBSM | Surface Mount     | 25 pcs per tube  |

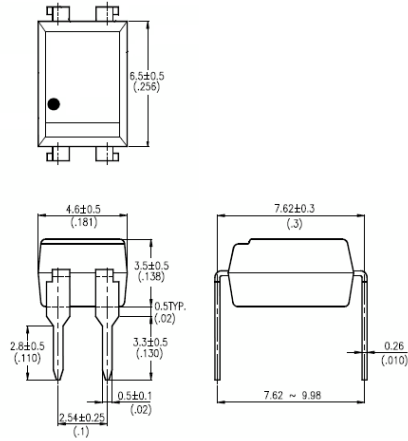


## TLP521, TLP521-2, TLP521-4

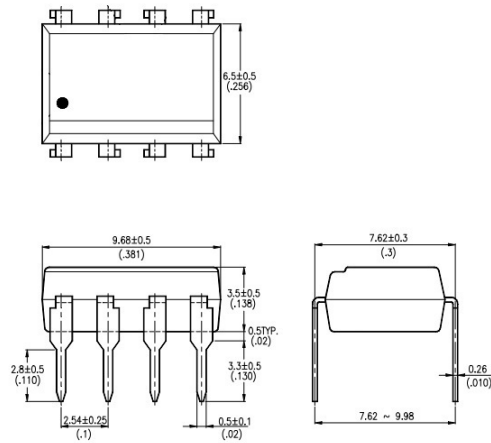
### PACKAGE DIMENSIONS in mm (inch)

#### DIP

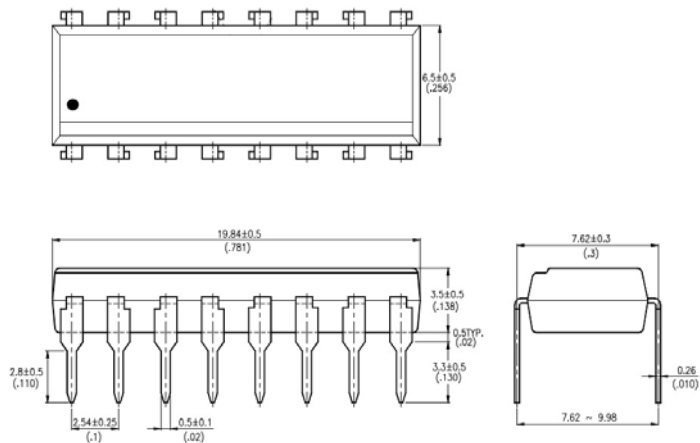
**TLP521**



**TLP521-2**



**TLP521-4**





## TLP521, TLP521-2, TLP521-4

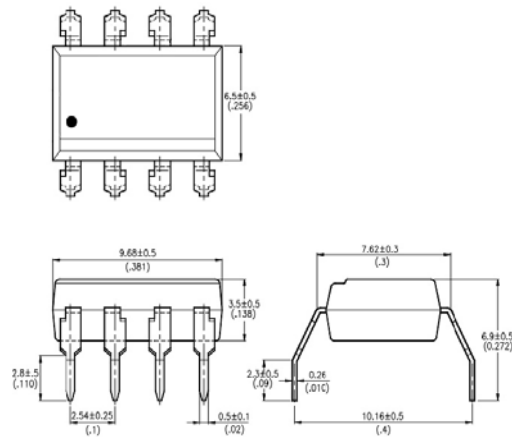
### PACKAGE DIMENSIONS in mm (inch)

#### G Form

**TLP521G**



**TLP521-2G**



**TLP521-4G**





## TLP521, TLP521-2, TLP521-4

### PACKAGE DIMENSIONS in mm (inch)

#### SMD

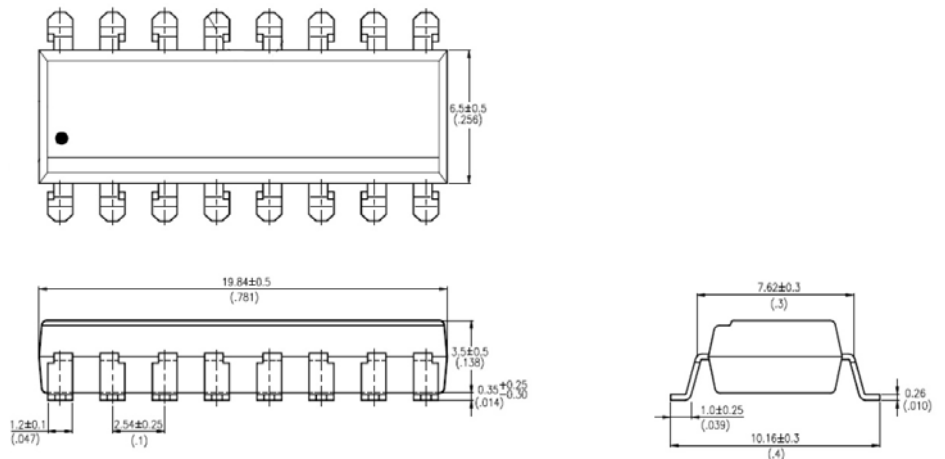
**TLP521SM**



**TLP521-2SM**



**TLP521-4SM**





## TLP521, TLP521-2, TLP521-4

### RECOMMENDED PAD LAYOUT FOR SMD (mm)

**TLP521SM**



**TLP521-2SM**



**TLP521-4SM**





**TLP521, TLP521-2, TLP521-4**

**TAPE AND REEL PACKAGING**



**TLP521SMT&R**



**TLP521-2SMT&R**

| Description                            | Symbol | Dimensions in mm ( inches ) |
|--|--------|-----------------------------|
| Tape wide                              | W      | $16 \pm 0.3$ ( .63 )        |
| Pitch of sprocket holes                | $P_0$  | $4 \pm 0.1$ ( .15 )         |
| Distance of compartment                | F      | $7.5 \pm 0.1$ ( .295 )      |
| Distance of compartment to compartment | $P_1$  | $2 \pm 0.1$ ( .079 )        |
| Distance of compartment to compartment | $P_1$  | $12 \pm 0.1$ ( .472 )       |



**TLP521, TLP521-2, TLP521-4**

**IR REFLOW SOLDERING TEMPERATURE PROFILE FOR SMD  
(One Time Reflow Soldering is Recommended)**





| Profile Details   | Conditions   |
|---|--|
| <b>Preheat</b><br>- Min Temperature ( $T_{SMIN}$ )<br>- Max Temperature ( $T_{SMAX}$ )<br>- Time $T_{SMIN}$ to $T_{SMAX}$ ( $t_s$ )   | 150°C<br>200°C<br>60s - 120s   |
| <b>Soldering Zone</b><br>- Peak Temperature ( $T_P$ )<br>- Time at Peak Temperature<br>- Liquidous Temperature ( $T_L$ )<br>- Time within 5°C of Actual Peak Temperature ( $T_P - 5^\circ C$ )<br>- Time maintained above $T_L$ ( $t_L$ )<br>- Ramp Up Rate ( $T_L$ to $T_P$ )<br>- Ramp Down Rate ( $T_P$ to $T_L$ ) | 260°C<br>10s max<br>217°C<br>30s max<br>60s - 100s<br>3°C/s max<br>6°C/s max |
| Average Ramp Up Rate ( $T_{smax}$ to $T_P$ )  | 3°C/s max  |
| Time 25°C to Peak Temperature   | 8 minutes max  |





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