# 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 5300$V_{RMS}$
- 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

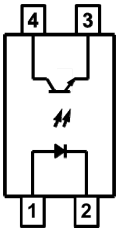
## APPLICATIONS

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

## ORDER INFORMATION

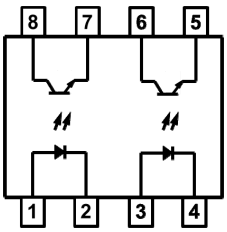
- Add X after PN for VDE Approval
- Add G after PN for 10mm lead spacing
- Add SM after PN for Surface Mount
- Add SMT&R after PN for Surface Mount Tape & Reel (Available for TLP521SM and TLP521-2SM)
- Optional Order Part No. TLP521-1 for TLP521
- Consult Factory for Tape and Reel version of TLP521-4SM

**TLP521**



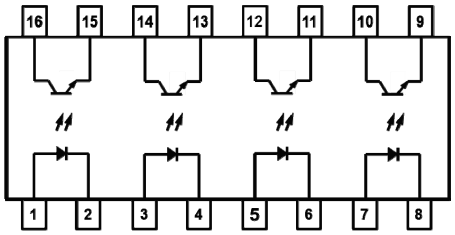

| | |
|---|---|
| 1 | Anode |
| 2 | Cathode |
| 3 | Emitter |
| 4 | Collector |

**TLP521-2**




| | |
|---|---|
| 1, 3 | Anode |
| 2, 4 | Cathode |
| 5. 7 | Emitter |
| 6, 8 | Collector |

**TLP521-4**




| | |
|---|---|
| 1, 3, 5, 7 | Anode |
| 2, 4, 6, 8 | Cathode |
| 9, 11, 13, 15 | Emitter |
| 10, 12, 14, 16 | Collector |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## ABSOLUTE MAXIMUM RATINGS ($T_A$ = 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 $BV_{CEO}$ | 55V |
| Emitter to Collector Voltage $BV_{ECO}$ | 6V |
| Collector Current | 50mA |
| Power Dissipation | 150mW |
| **Total Package** | |
| Isolation Voltage | $5300V_{RMS}$ |
| Total Power Dissipation | 200mW |
| Operating Temperature | -30 to 100 °C |
| Storage Temperature | -55 to 125 °C |
| Junction Temperature | 125 °C |
| Lead Soldering Temperature (10s) | 260°C |

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

### INPUT

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

### OUTPUT

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

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

### COUPLED

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

### ISOLATION

| Parameter | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Input to Output Isolation Voltage | $V_{ISO}$ | R.H. = 40% to 60 %, t = 1 min | 5300 | | | $V_{RMS}$ |
| Input to Output Resistance | $R_{ISO}$ | $V_{IO}$ = 500VDC, R.H. = 40% to 60 %, | $5 \times 10^{10}$ | | | Ω |

Device is considered a two terminal device : Input pins are shorted together and Output pins are shorted together.

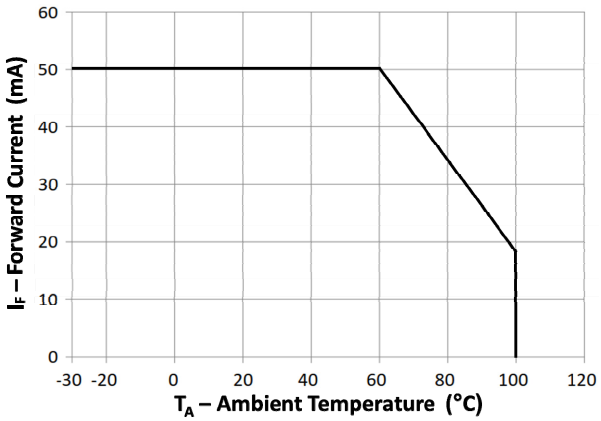



Fig 1 Forward Current vs $T_A$

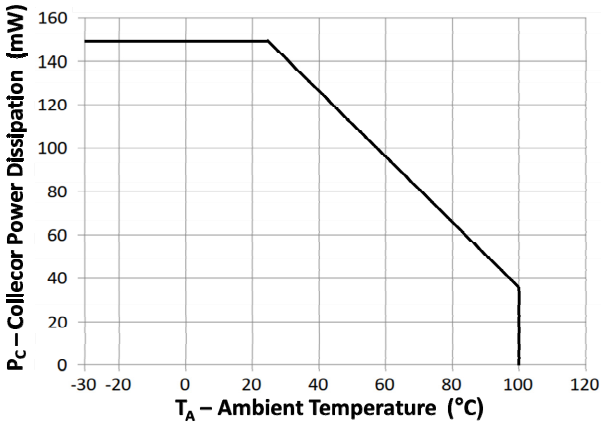



Fig 2 Collector Power Dissipation vs $T_A$

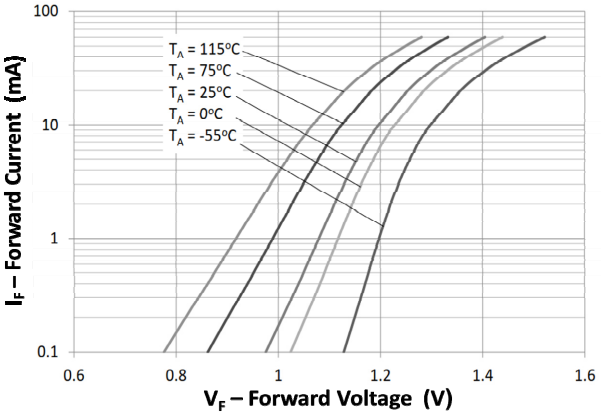



Fig 3 Forward Current vs Forward Voltage

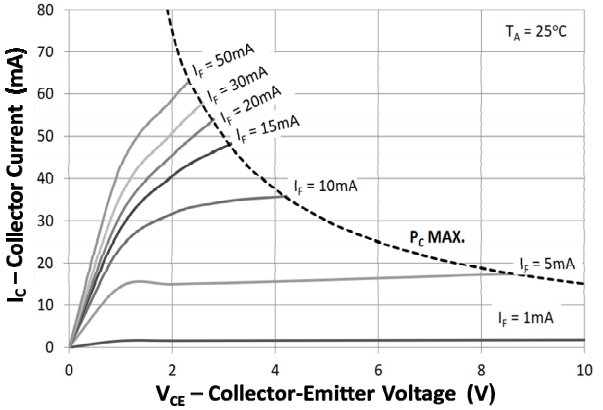



Fig 4 Collector Current vs Collector-Emitter Voltage

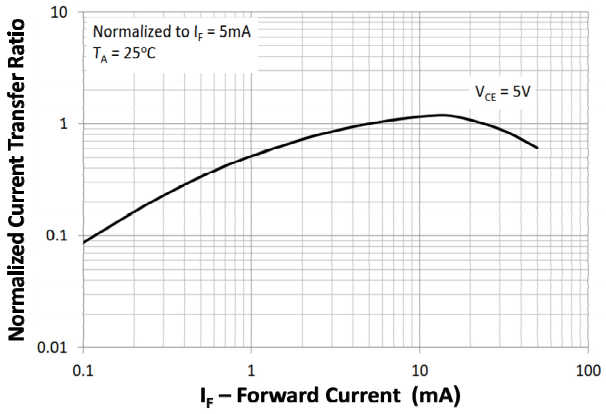



Fig 5 Normalized Current Transfer Ratio vs Forward Current

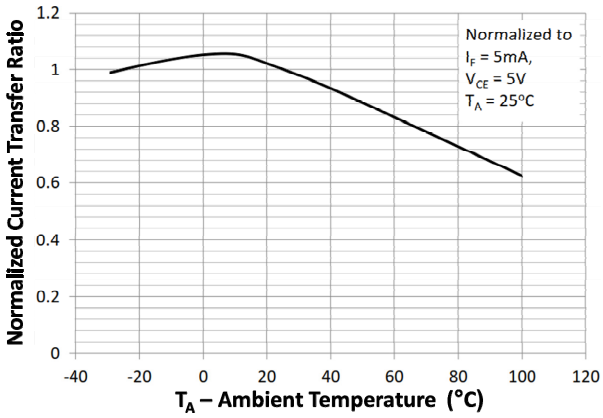



Fig 6 Normalized Current Transfer Ratio vs Ambient Temperature

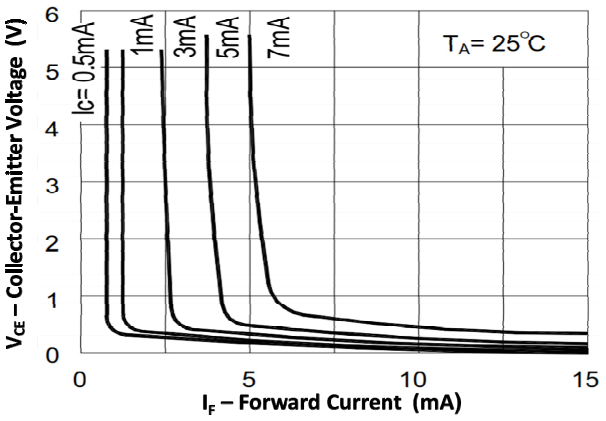



Fig 7 Collector-Emitter Voltage vs Forward Current

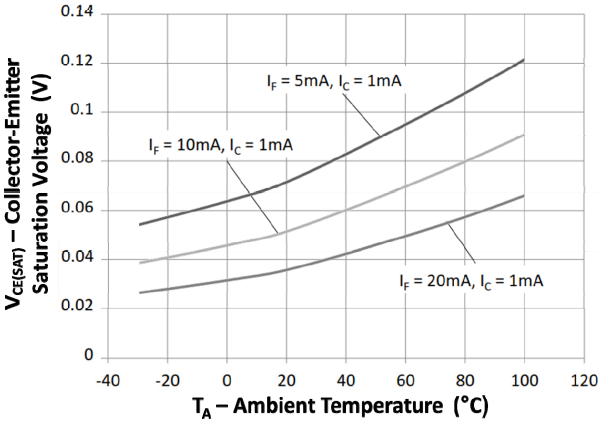



Fig 8 Collector-Emitter Voltage vs Ambient Temperature

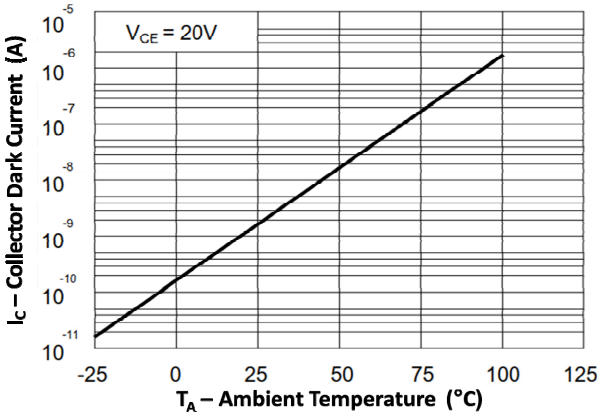



Fig 9 Collector Dark Current vs Ambient Temperture

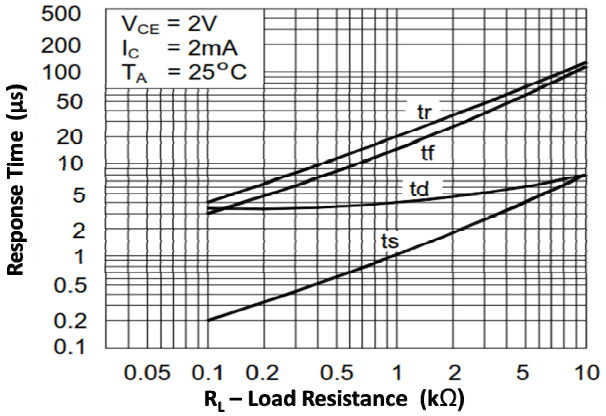
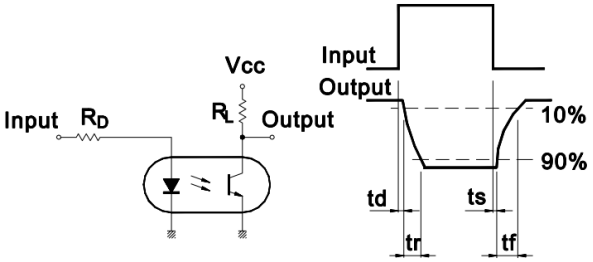



Fig 10 Response Time vs Load Resistance




Response Time Test Circuit

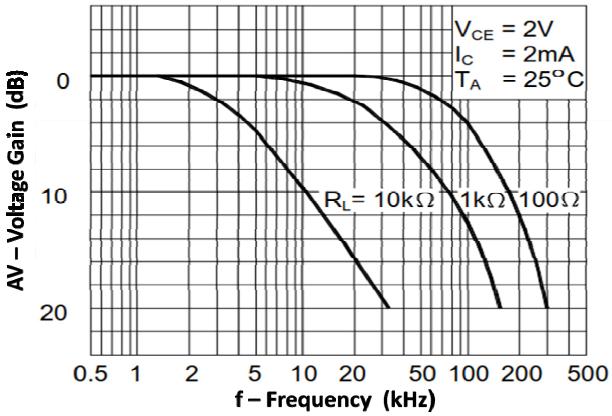
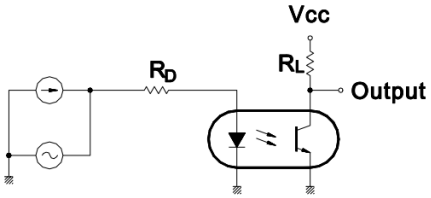



Fig 11 Frequency Response




Frequency Response Test Circuit

## ORDER INFORMATION

| TLP521, TLP521-1 (UL Approval) | | | |
|---|---|---|---|
| **After PN** | **PN** | **Description** | **Packing quantity** |
| 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.

Devices with suffix “X” (UL and VDE approvals) may be supplied when ordering the above Part Numbers (UL approval only).

## ORDER INFORMATION

| TLP521-2 (UL Approval) | | | |
|---|---|---|---|
| **After PN** | **PN** | **Description** | **Packing quantity** |
| None | TLP521-2, TLP521-2GR, TLP521-2BL, TLP521-2GB | Standard DIP8 | 50 pcs per tube |
| G | TLP521-2G, TLP521-2GRG, TLP521-2BLG, TLP521-2GBG | 10mm Lead Spacing | 50 pcs per tube |
| SM | TLP521-2SM, TLP521-2GRSM, TLP521-2BLSM, TLP521-2GBSM | Surface Mount | 50 pcs per tube |
| SMT&R | TLP521-2SMT&R, TLP521-2GRSMT&R, TLP521-2BLSMT&R, 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, TLP521-4BL, TLP521-4GB | Standard DIP16 | 25 pcs per tube |
| G | TLP521-4G, TLP521-4GRG, TLP521-4BLG, TLP521-4GBG | 10mm Lead Spacing | 25 pcs per tube |
| SM | TLP521-4SM, TLP521-4GRSM, TLP521-4BLSM, TLP521-4GBSM | Surface Mount | 25 pcs per tube |

Note : Devices with suffix “X” (UL and VDE approvals) may be supplied when ordering the above Part Numbers (UL approval only).

## 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. TLP521-1X for TLP521X.

## ORDER INFORMATION

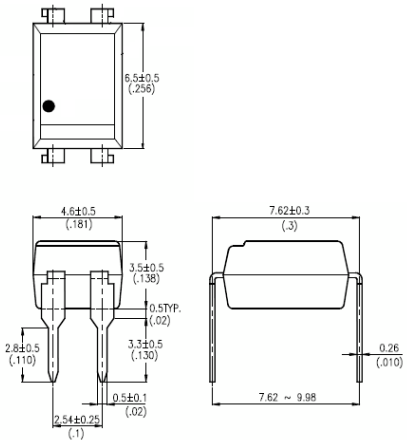
| TLP521-2X (UL and VDE Approvals) | | | |
|---|---|---|---|
| **After PN** | **PN** | **Description** | **Packing quantity** |
| None | TLP521-2X, TLP521-2XGR, TLP521-2XBL, TLP521-2XGB | Standard DIP8 | 50 pcs per tube |
| G | TLP521-2XG, TLP521-2XGRG TLP521-2XBLG, TLP521-2XGBG | 10mm Lead Spacing | 50 pcs per tube |
| SM | TLP521-2XSM, TLP521-2XGRSM, TLP521-2XBLSM, TLP521-2XGBSM | Surface Mount | 50 pcs per tube |
| SMT&R | TLP521-2XSMT&R, TLP521-2XGRSMT&R, TLP521-2XBLSMT&R, 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, TLP521-4XBL, TLP521-4XGB | Standard DIP16 | 25 pcs per tube |
| G | TLP521-4XG, TLP521-4XGRG, TLP521-4XBLG, TLP521-4XGBG | 10mm Lead Spacing | 25 pcs per tube |
| SM | TLP521-4XSM, TLP521-4XGRSM, TLP521-4XBLSM, TLP521-4XGBSM | Surface Mount | 25 pcs per tube |

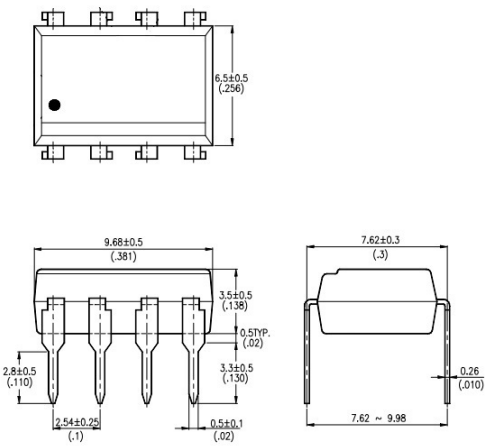
## PACKAGE DIMENSIONS in mm (inch)

### DIP

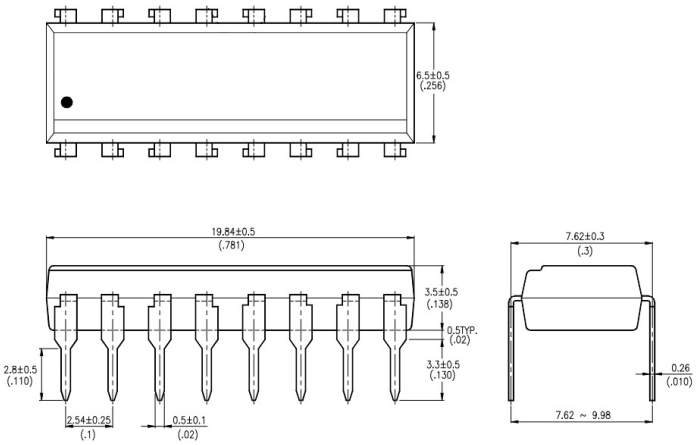
**TLP521**




**TLP521-2**



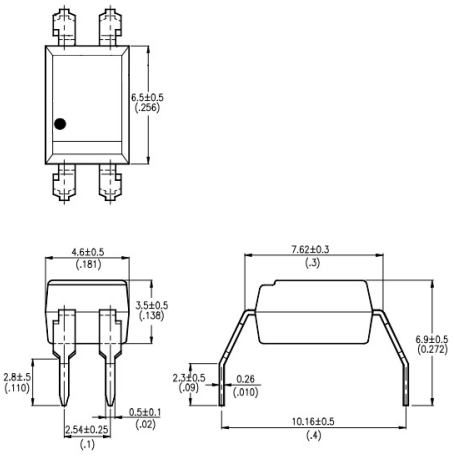

**TLP521-4**



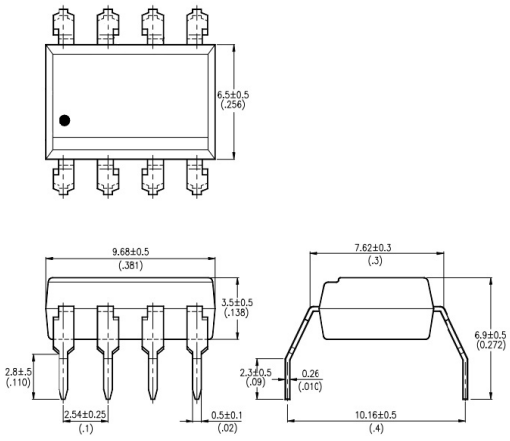
## PACKAGE DIMENSIONS in mm (inch)

### G Form

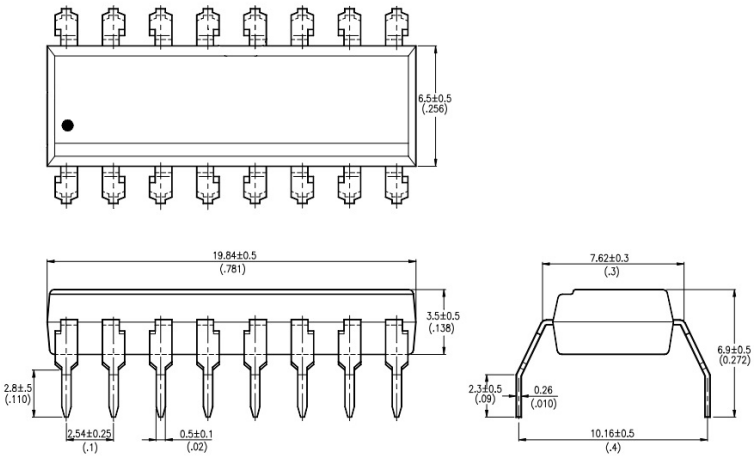
**TLP521G**




**TLP521-2G**



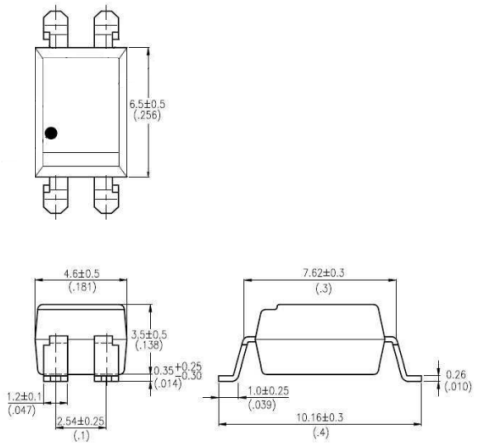

**TLP521-4G**



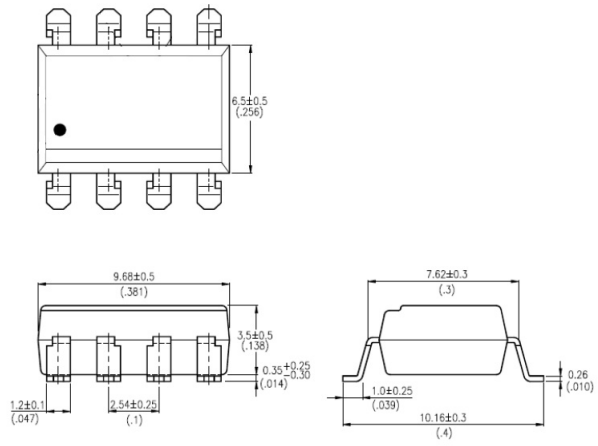
## PACKAGE DIMENSIONS in mm (inch)

### SMD

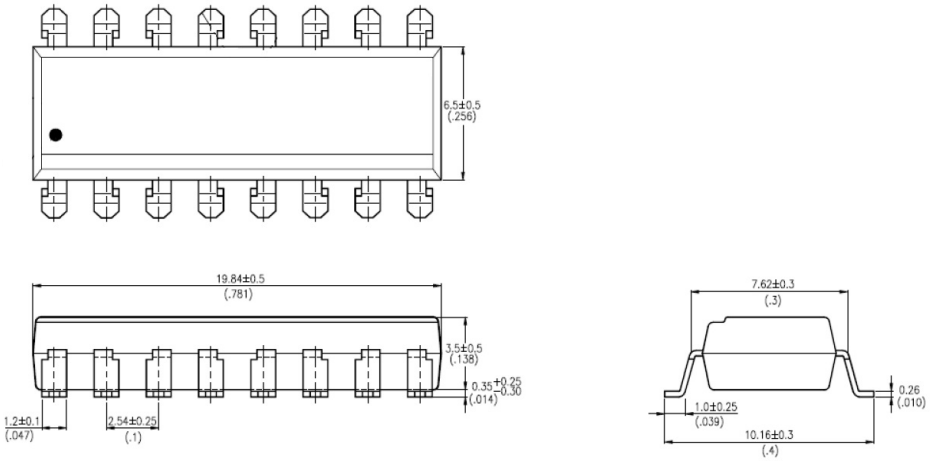
**TLP521SM**




**TLP521-2SM**

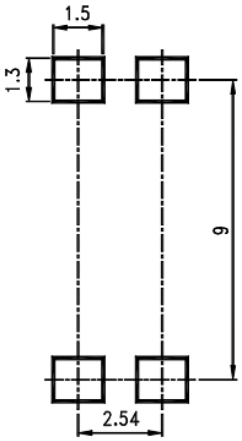



**TLP521-4SM**

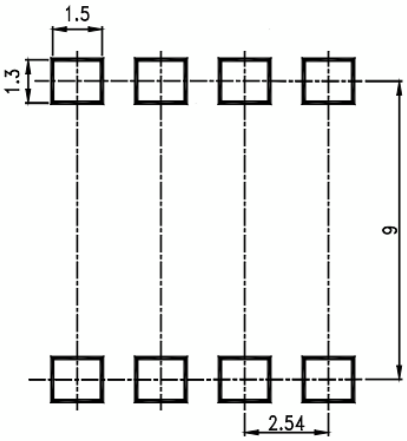


## RECOMMENDED PAD LAYOUT FOR SMD (mm)

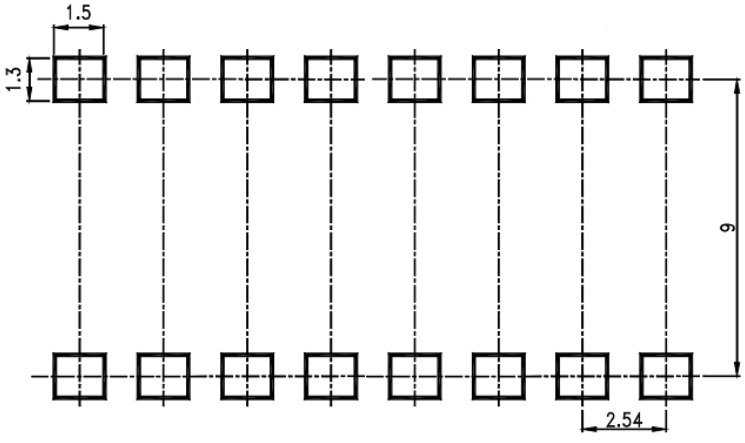
**TLP521SM**



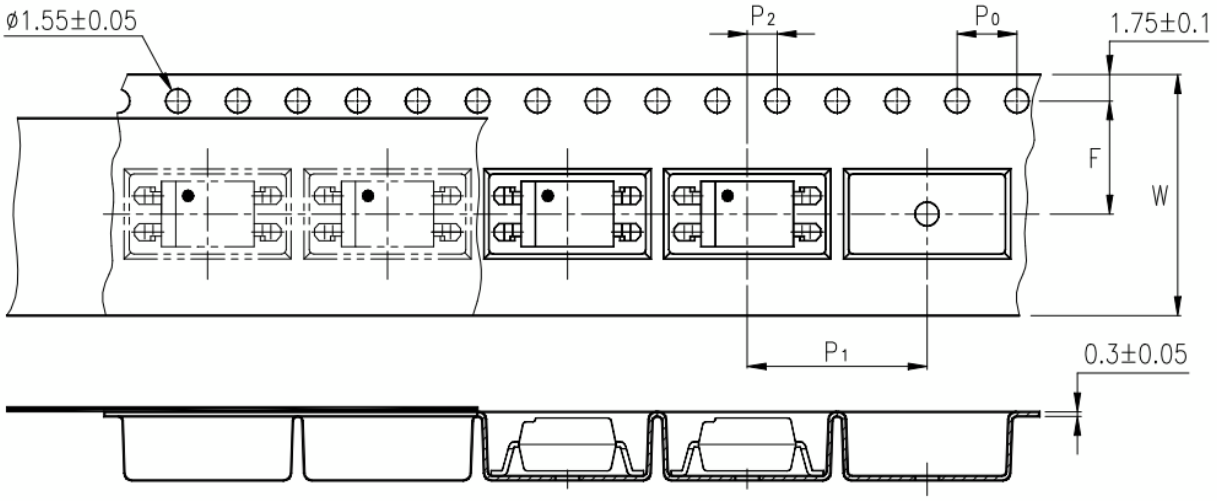

**TLP521-2SM**



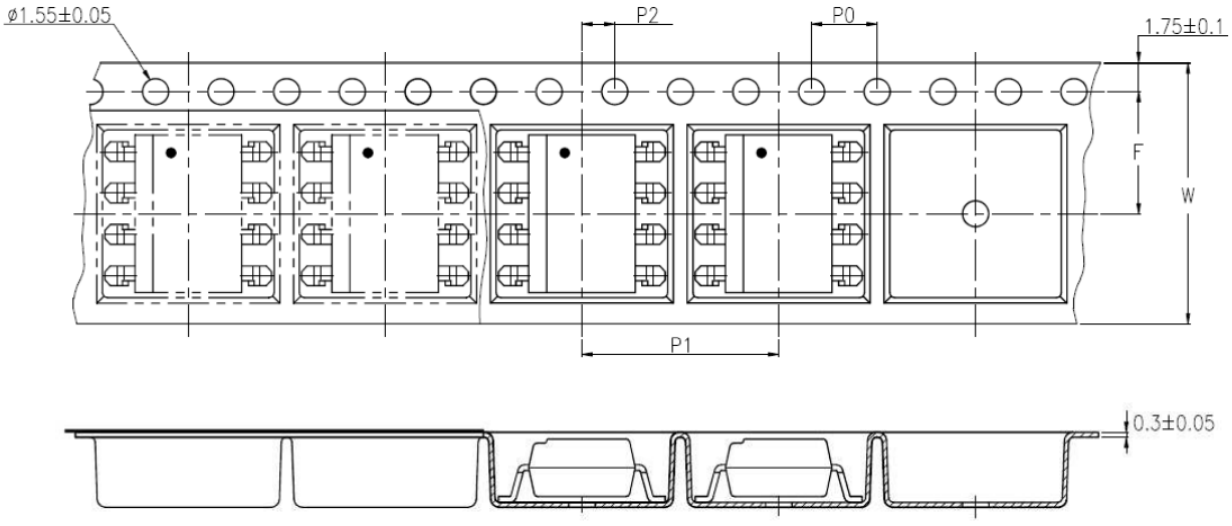

**TLP521-4SM**



## TAPE AND REEL PACKAGING



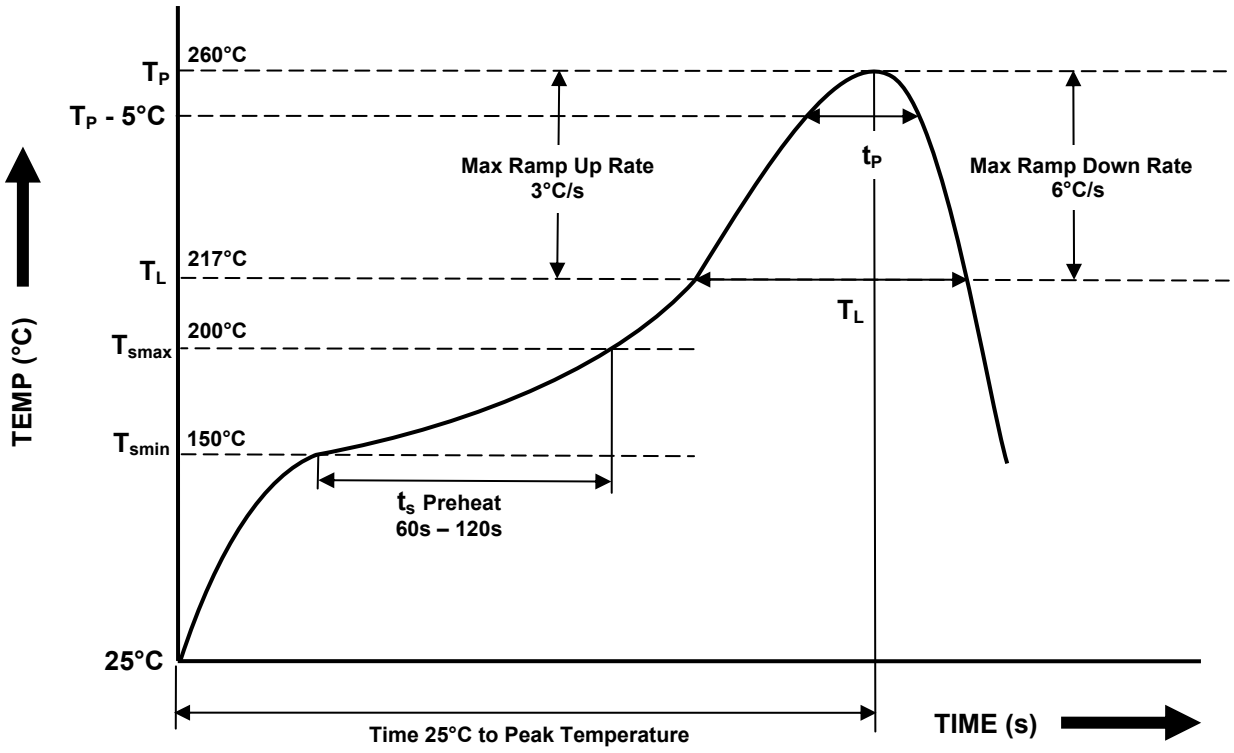

### TLP521SMT&R




### TLP521-2SMT&R

| Description | Symbol | Dimensions in mm ( inches ) |
|---|---|---|
| Tape wide | W | 16 ± 0.3 ( .63 ) |
| Pitch of sprocket holes | $P_0$ | 4 ± 0.1 ( .15 ) |
| Distance of compartment | F<br>$P_2$ | 7.5 ± 0.1 ( .295 )<br>2 ± 0.1 ( .079 ) |
| Distance of compartment to compartment | $P_1$ | 12 ± 0.1 ( .472 ) |

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




| Profile Details | Conditions |
|---|---|
| **Preheat**<br>- Min Temperature ($T_{SMIN}$)<br>- Max Temperature ($T_{SMAX}$)<br>- Time $T_{SMIN}$ to $T_{SMAX}$ ($t_s$) | <br>150°C<br>200°C<br>60s - 120s |
| **Soldering Zone**<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°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 $T_L$) | <br>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 |

ISOCOM COMPONENTS

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