# ISP817, ISP827, ISP847

## DESCRIPTION

The ISP817, ISP827 and ISP847 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
  -55°C to +110°C ISP817
  -30°C to +100°C ISP827 / ISP847
- Lead Free and RoHS Compliant
- UL File E91231 Package Code “EE”
- VDE Approval Certificate No. 40028086

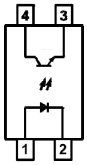
## APPLICATIONS

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

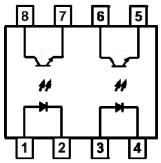
## ORDER INFORMATION

- 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 ISP817SM and ISP827SM)
- Consult Factory for Tape and Reel version of ISP847SM

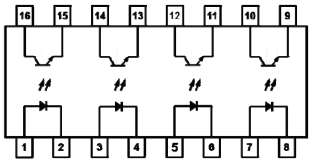
**ISP817**




**ISP827**




**ISP847**




## 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 |
| Peak Forward Current (100µs, 100Hz) | 1A |
| Reverse Voltage | 6V |
| Power dissipation | 70mW |

### Output

| | | |
|---|---|---|
| Collector to Emitter Voltage $V_{CEO}$ | | |
| | ISP817 | 80V |
| | ISP827 / ISP847 | 35V |
| Emitter to Collector Voltage $V_{ECO}$ | | 6V |
| Collector Current | | 50mA |
| Power Dissipation | | 150mW |

### Total Package

| | | |
|---|---|---|
| Isolation Voltage | | 5300$V_{RMS}$ |
| Total Power Dissipation | | 200mW |
| Operating Temperature | ISP817 | -55 to 110 °C |
| | ISP827 / ISP847 | -30 to 100 °C |
| Junction Temperature | | 125 °C |
| Storage Temperature | | -55 to 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 | $V_F$ | $I_F$ = 20mA | | 1.2 | 1.4 | 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 | $BV_{CEO}$ | $I_C$ = 0.1mA, $I_F$ = 0mA<br>ISP817<br>ISP827 / ISP847 | <br>80<br>35 | | | V |
| Emitter−Collector Breakdown Voltage | $BV_{ECO}$ | $I_E$ = 10µA, $I_F$ = 0mA | 6 | | | V |
| Collector−Emitter Dark Current | $I_{CEO}$ | $V_{CE}$ = 20V, $I_F$ = 0mA | | | 100 | nA |



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## 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 | | | | |
| | | GB | 100 | | 600 | |
| | | BL | 200 | | 600 | |
| | | GR | 100 | | 300 | |
| | | A | 80 | | 160 | |
| | | B | 130 | | 260 | |
| | | C | 200 | | 400 | |
| | | D | 300 | | 600 | |
| Collector−Emitter Saturation Voltage | $V_{CE(sat)}$ | $I_F$ = 20mA, $I_C$ = 1mA | | 0.1 | 0.2 | V |
| Floating Capacitance | $C_f$ | V = 0V, f = 1MHz | | 0.6 | 1 | pF |
| Cut-Off Frequency | fc | $V_{CE}$ = 5V, $I_C$ = 2mA, $R_L$ = 100Ω, -3dB | | 80 | | kHz |
| Output Rise Time | $t_r$ | $V_{CE}$ = 2V, Ic = 2mA, $R_L$ = 100Ω | | 4 | 18 | µs |
| Output Fall Time | $t_f$ | | | 3 | 18 | |

### ISOLATION

| Parameter | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Input to Output Isolation Voltage | $V_{ISO}$ | AC 1 minute, RH = 40% to 60% Note 1 | 5300 | | | $V_{RMS}$ |
| Input to Output Isolation Resistance | $R_{ISO}$ | $V_{IO}$= 500V, RH = 40% to 60% Note 1 | $5x10^{10}$ | $1x10^{11}$ | | Ω |

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



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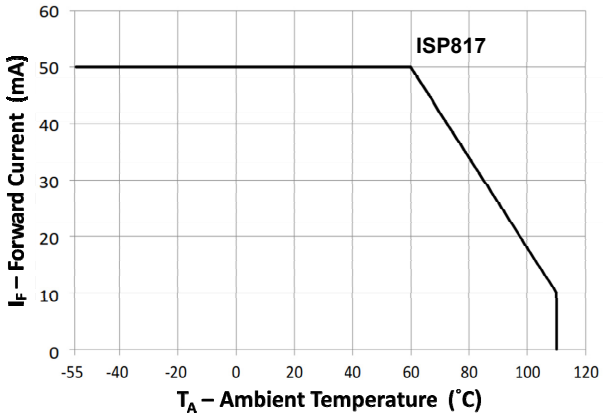


Fig 1 Forward Current vs Ambient Temperature (1)

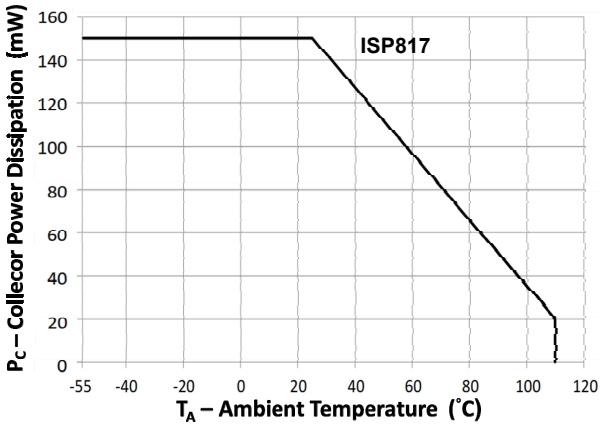


Fig 2 Collector Power Dissipation vs Ambient Temperature (1)

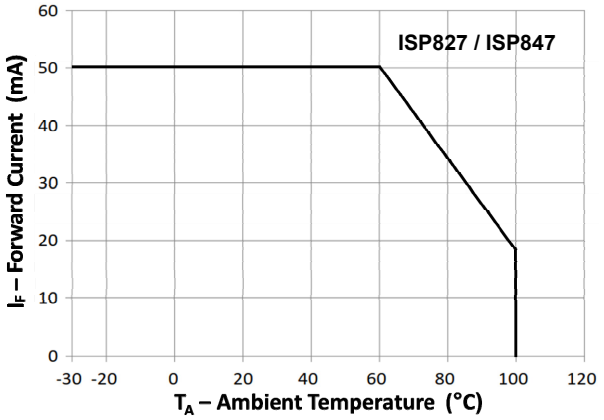


Fig 3 Forward Current vs Ambient Temperature (2)

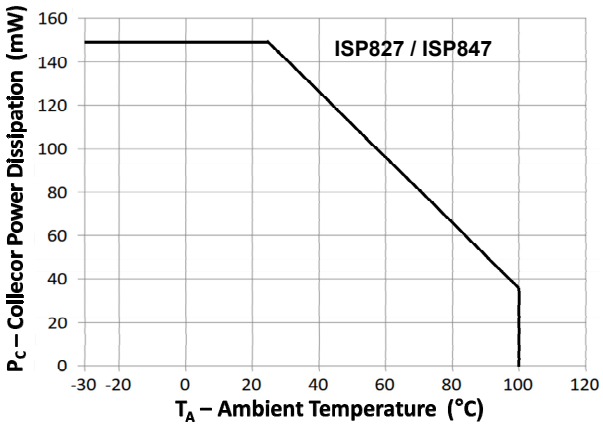


Fig 4 Collector Power Dissipation vs Ambient Temperature (2)

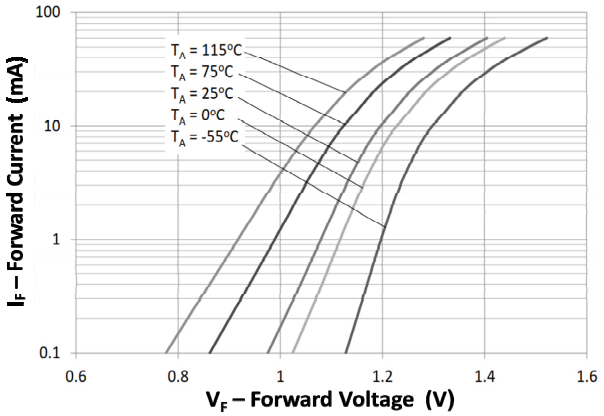


Fig 5 Forward Current vs Forward Voltage

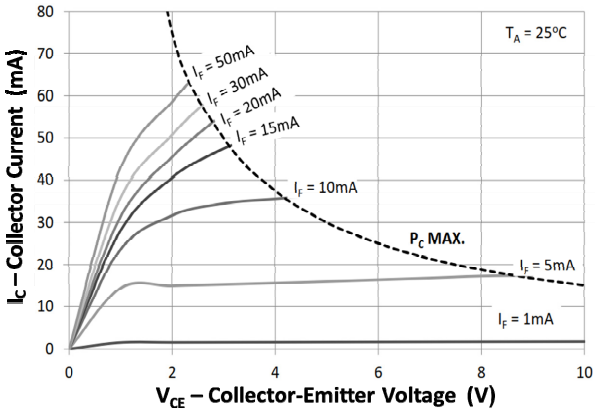


Fig 6 Collector Current vs Collector-Emitter Voltage



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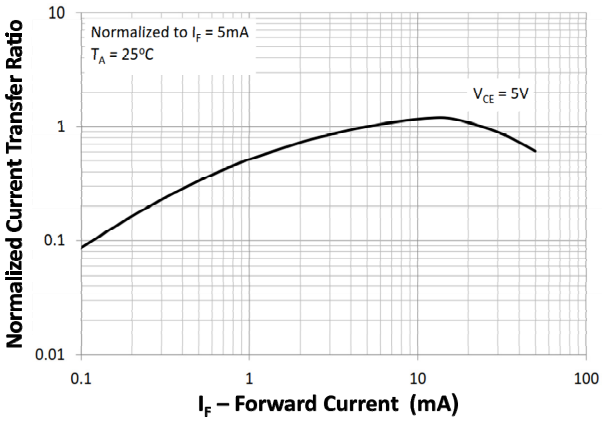


Fig 7 Normalized Current Transfer Ratio vs Forward Current

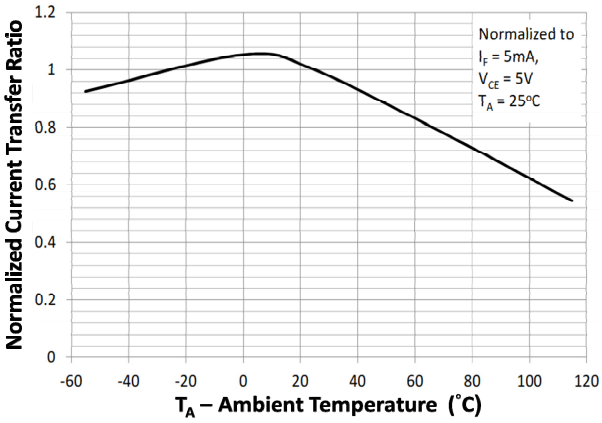


Fig 8 Normalized Current Transfer Ratio vs Ambient Temperature

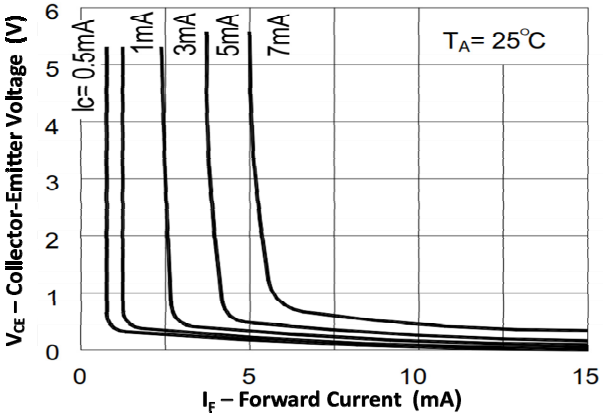


Fig 9 Collector-Emitter Voltage vs Forward Current

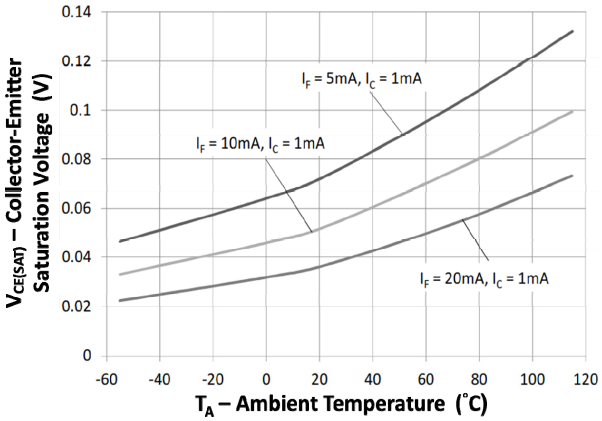


Fig 10 Collector-Emitter Saturation Voltage vs Ambient Temperature

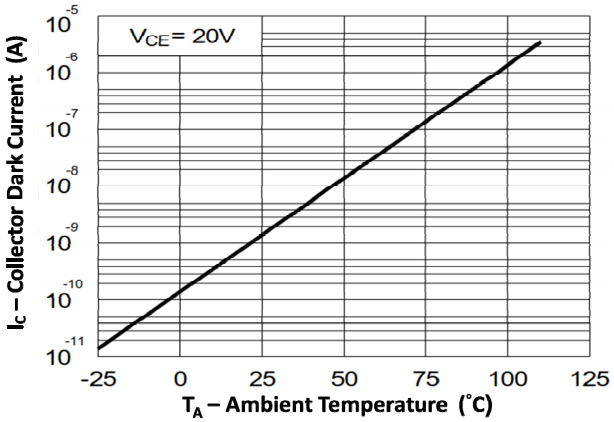


Fig 11 Collector Dark Current vs Ambient Temperature



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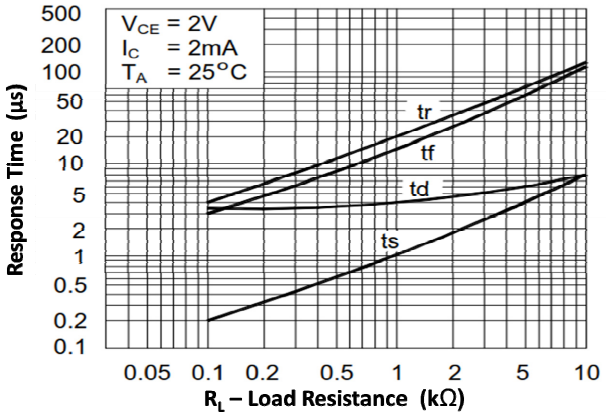
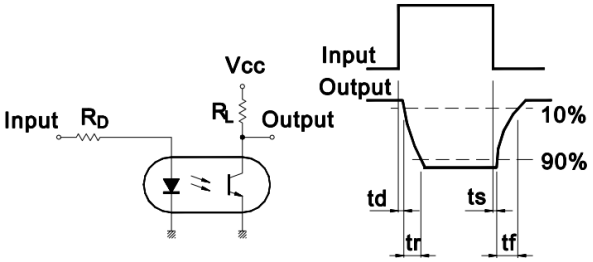



Fig 12 Response Time vs Load Resistance




Response Time Test Circuit

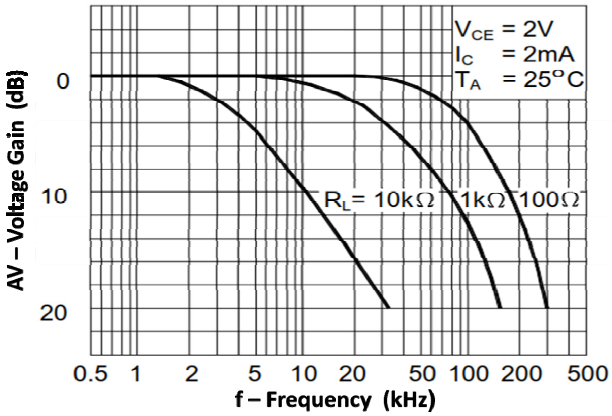
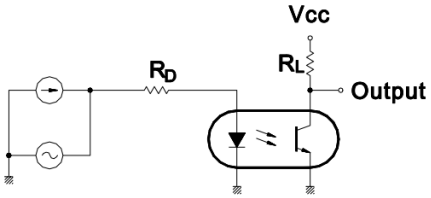



Fig 13 Frequency Response




Frequency Response Test Circuit



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## ORDER INFORMATION

| ISP817 (UL Approval) | | | |
|---|---|---|---|
| **After PN** | **PN** | **Description** | **Packing quantity** |
| None | ISP817, ISP817GB, ISP817BL, ISP817GR, ISP817A, ISP817B, ISP817C, ISP817D | Standard DIP4 | 100 pcs per tube |
| G | ISP817G, ISP817GBG, ISP817BLG, ISP817GRG, ISP817AG, ISP817BG, ISP817CG, ISP817DG | 10mm Lead Spacing | 100 pcs per tube |
| SM | ISP817SM, ISP817GBSM, ISP817BLSM, ISP817GRSM, ISP817ASM, ISP817BSM, ISP817CSM, ISP817DSM | Surface Mount | 100 pcs per tube |
| SMT&R | ISP817SMT&R, ISP817GBSMT&R, ISP817GRSMT&R, ISP817BLSMT&R, ISP817ASMT&R, ISP817BSMT&R, ISP817CSMT&R, ISP817DSMT&R | Surface Mount Tape & Reel | 1000 pcs per reel |

| ISP827 (UL Approval) | | | |
|---|---|---|---|
| **After PN** | **PN** | **Description** | **Packing quantity** |
| None | ISP827, ISP827GB, ISP827BL, ISP827GR, ISP827A, ISP827B, ISP827C, ISP827D | Standard DIP8 | 50 pcs per tube |
| G | ISP827G, ISP827GBG, ISP827BLG, ISP827GRG, ISP827AG, ISP827BG, ISP827CG, ISP827DG | 10mm Lead Spacing | 50 pcs per tube |
| SM | ISP827SM, ISP827GBSM, ISP827BLSM, ISP827GRSM, ISP827ASM, ISP827BSM, ISP827CSM, ISP827DSM | Surface Mount | 50 pcs per tube |
| SMT&R | ISP827SMT&R, ISP827GBSMT&R, ISP827GRSMT&R, ISP827BLSMT&R, ISP827ASMT&R, ISP827BSMT&R, ISP827CSMT&R, ISP827DSMT&R | Surface Mount Tape & Reel | 1000 pcs per reel |

| ISP847 (UL Approval) | | | |
|---|---|---|---|
| **After PN** | **PN** | **Description** | **Packing quantity** |
| None | ISP847, ISP847GB, ISP847BL, ISP847GR, ISP847A, ISP847B, ISP847C, ISP847D | Standard DIP16 | 25 pcs per tube |
| G | ISP847G, ISP847GBG, ISP847BLG, ISP847GRG, ISP847AG, ISP847BG, ISP847CG, ISP847DG | 10mm Lead Spacing | 25 pcs per tube |
| SM | ISP847SM, ISP847GBSM, ISP847BLSM, ISP847GRSM, ISP847ASM, ISP847BSM, ISP847CSM, ISP847DSM | Surface Mount | 25 pcs per tube |



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## ORDER INFORMATION

| ISP817X (UL and VDE Approvals) | | | |
|---|---|---|---|
| **After PN** | **PN** | **Description** | **Packing quantity** |
| None | ISP817X, ISP817XGB, ISP817XBL, ISP817XGR, ISP817XA, ISP817XB, ISP817XC, ISP817XD | Standard DIP4 | 100 pcs per tube |
| G | ISP817XG, ISP817XGBG, ISP817XBLG, ISP817XGRG, ISP817XAG, ISP817XBG, ISP817XCG, ISP817XDG | 10mm Lead Spacing | 100 pcs per tube |
| SM | ISP817XSM, ISP817XGBSM, ISP817XGRSM, ISP817XBLSM, ISP817XASM, ISP817XBXSM, ISP817XCSM, ISP817XDSM | Surface Mount | 100 pcs per tube |
| SMT&R | ISP817XSMT&R, ISP817XGBSMT&R, ISP817XGRSMT&R, ISP817XBLSMT&R, ISP817XASMT&R, ISP817XBSMT&R, ISP817XCSMT&R, ISP817XDSMT&R | Surface Mount Tape & Reel | 1000 pcs per reel |

| ISP827X (UL and VDE Approvals) | | | |
|---|---|---|---|
| **After PN** | **PN** | **Description** | **Packing quantity** |
| None | ISP827X, ISP827XGB, ISP827XBL, ISP827XGR, ISP827XA, ISP827XB, ISP827XC, ISP827XD | Standard DIP8 | 50 pcs per tube |
| G | ISP827XG, ISP827XGBG, ISP827XBLG, ISP827XGRG, ISP827XAG, ISP827XBG, ISP827XCG, ISP827XDG | 10mm Lead Spacing | 50 pcs per tube |
| SM | ISP827XSM, ISP827XGBSM, ISP827XGRSM, ISP827XBLSM, ISP827XASM, ISP827XBSM, ISP827XCSM, ISP827XDSM | Surface Mount | 50 pcs per tube |
| SMT&R | ISP827XSMT&R, ISP827XGBSMT&R, ISP827XGRSMT&R, ISP827XBLSMT&R, ISP827XASMT&R, ISP827XBSMT&R, ISP827XCSMT&R, ISP827XDSMT&R | Surface Mount Tape & Reel | 1000 pcs per reel |

| ISP847 (UL and VDE Approvals) | | | |
|---|---|---|---|
| **After PN** | **PN** | **Description** | **Packing quantity** |
| None | ISP847X, ISP847XGBL, ISP847XBL, ISP847XGR, ISP847XA, ISP847XB, ISP847XC, ISP847XD | Standard DIP16 | 25 pcs per tube |
| G | ISP847XG, ISP847XGBG, ISP847XBLG, ISP847XGRG, ISP847XAG, ISP847XBG, ISP847XCG, ISP847XDG | 10mm Lead Spacing | 25 pcs per tube |
| SM | ISP847XSM, ISP847XGBSM, ISP847XGRSM, ISP847XBLSM, ISP847XASM, ISP847XBSM, ISP847XCSM, ISP847XDSM | Surface Mount | 25 pcs per tube |



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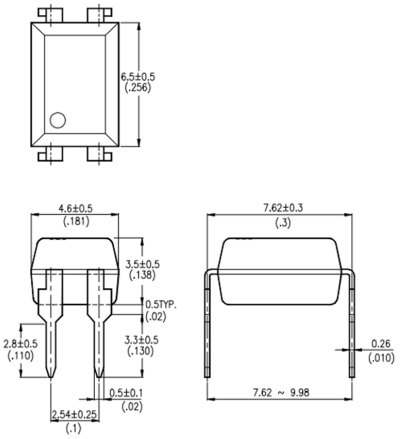
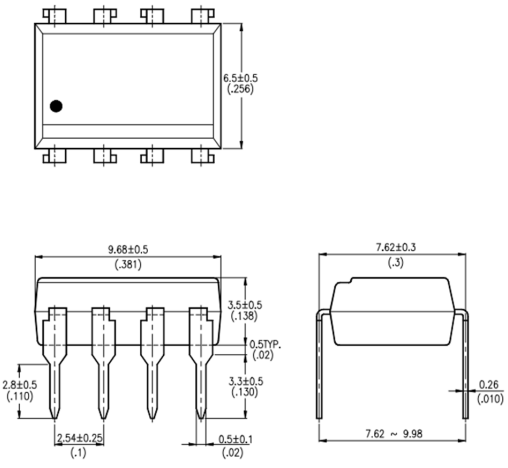
## PACKAGE DIMENSIONS in mm (inch)

### DIP

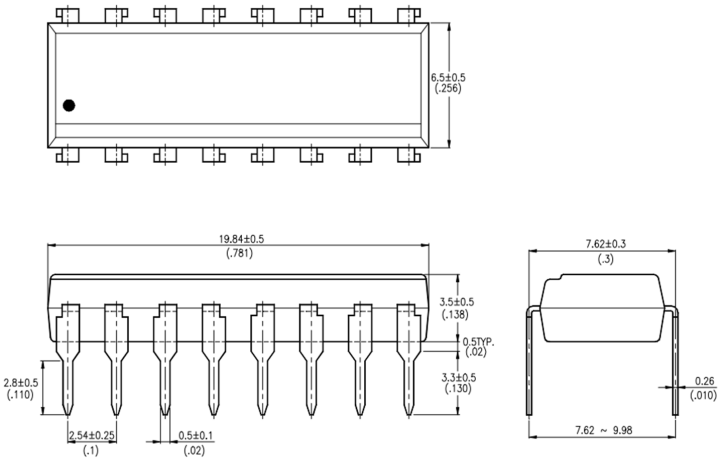
**ISP817**




**ISP827**




**ISP847**



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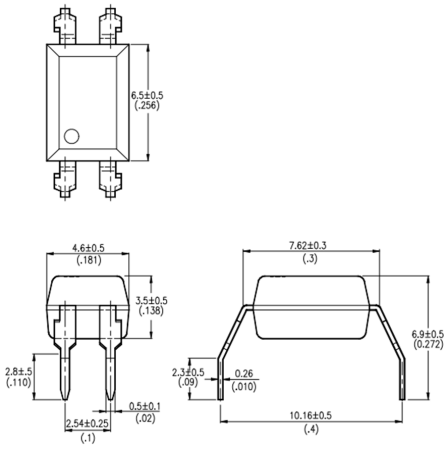
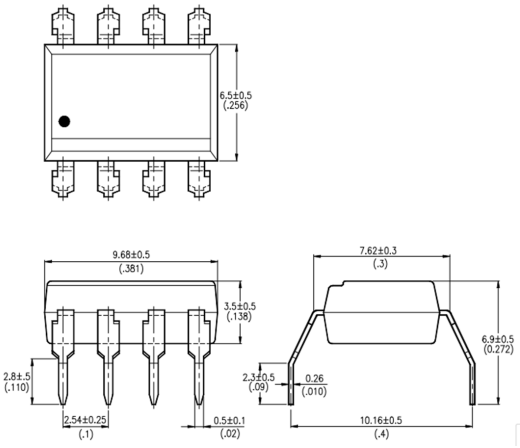
## PACKAGE DIMENSIONS in mm (inch)

### G Form

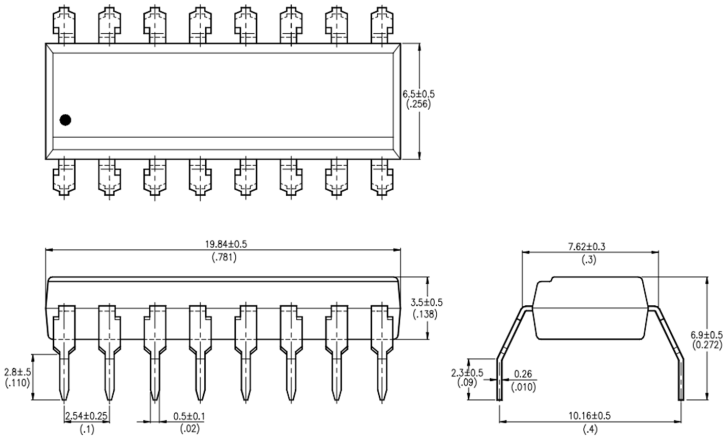
**ISP817G**




**ISP827G**




**ISP847G**



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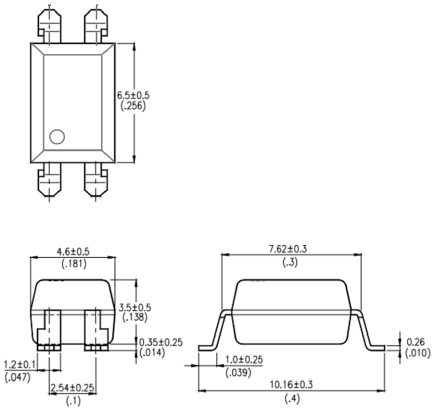
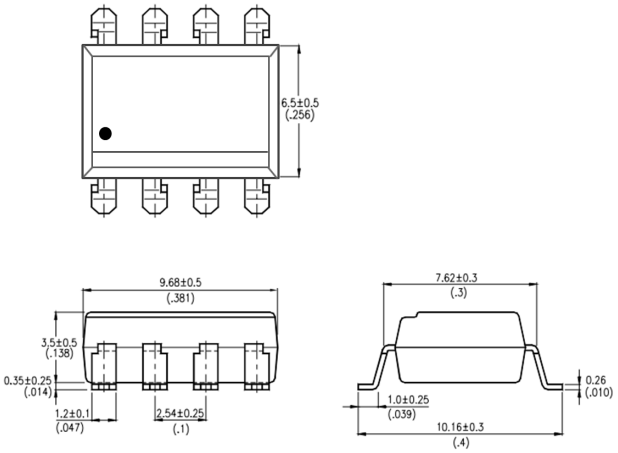
## PACKAGE DIMENSIONS in mm (inch)

### SMD

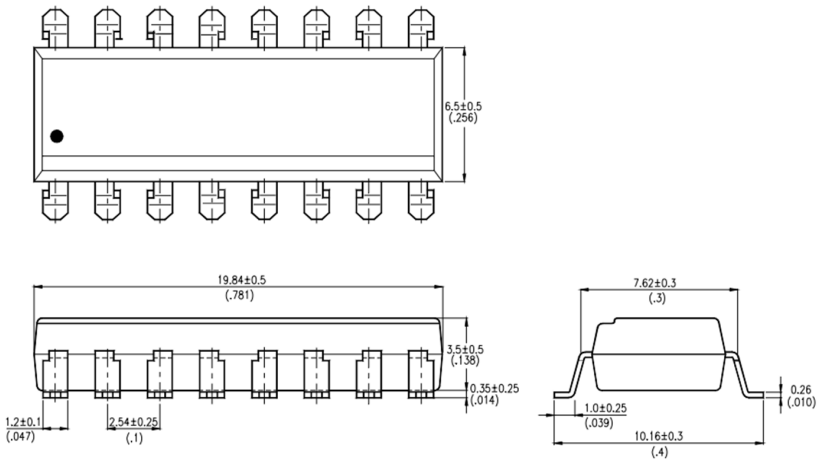
**ISP817SM**




**ISP827SM**




**ISP847SM**



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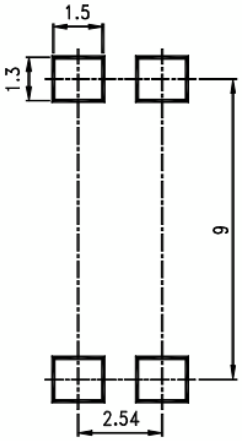
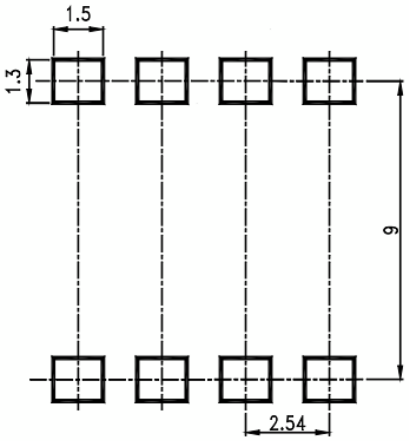
## RECOMMENDED PAD LAYOUT FOR SMD (mm)

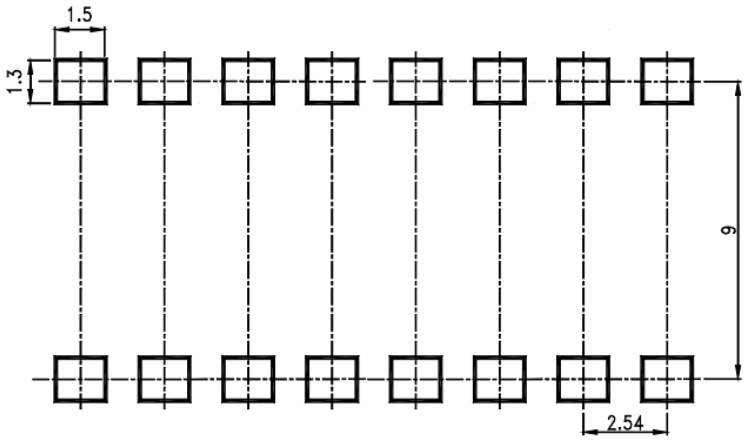
**ISP817SM**




**ISP827SM**




**ISP847SM**



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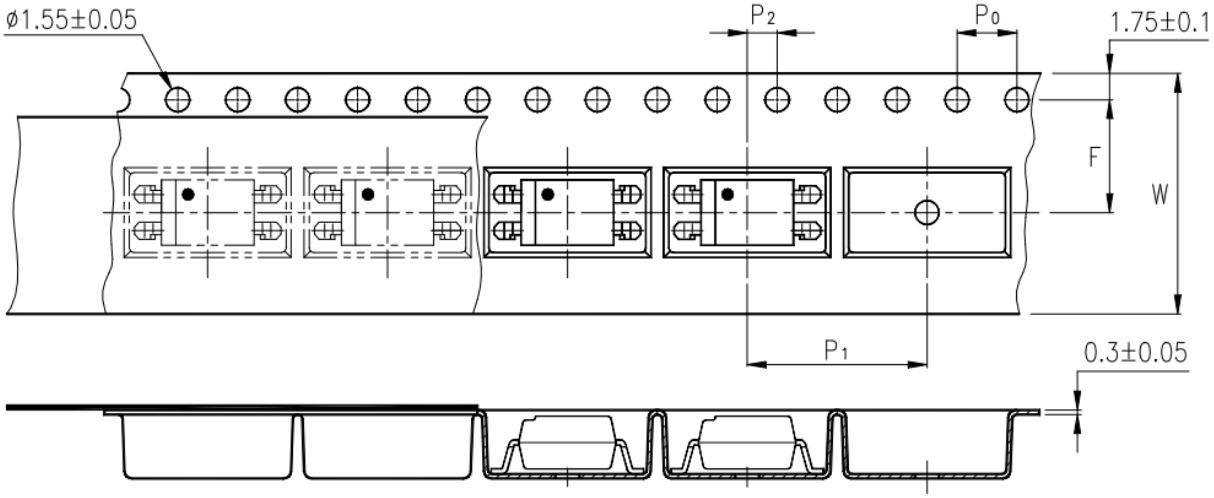
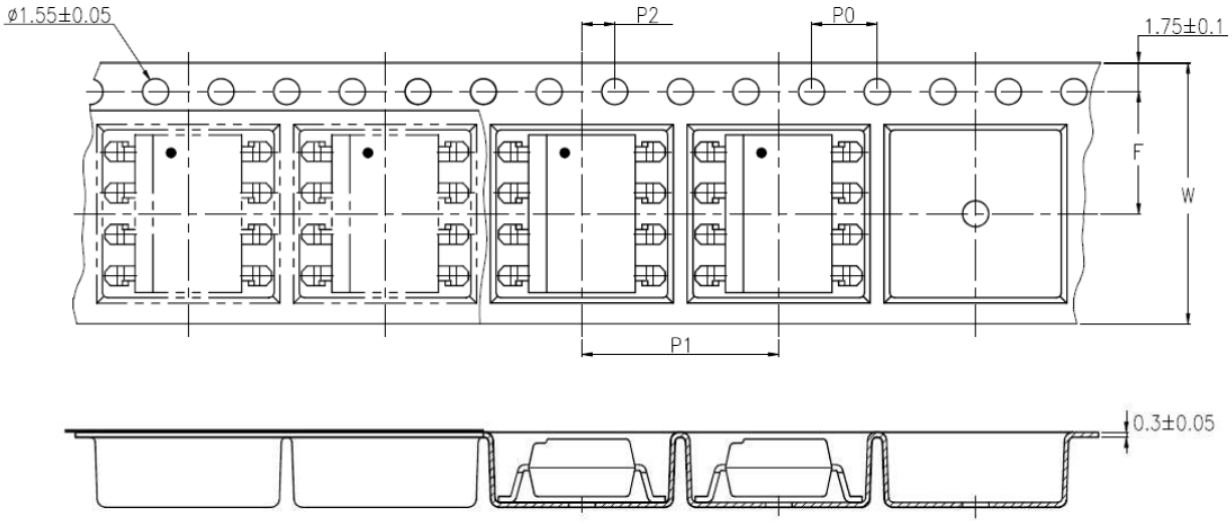
## TAPE AND REEL PACKAGING

### ISP817SMT&R




### ISP827SMT&R




| Description | Symbol | Dimension mm (inch) |
|---|---|---|
| Tape Width | W | 16 ± 0.3 (0.63) |
| Pitch of Sprocket Holes | $P_0$ | 4 ± 0.1 (0.15) |
| Distance of Compartment to Sprocket Holes | F | 7.5 ± 0.1 (0.295) |
| | $P_2$ | 2 ± 0.1 (0.079) |
| Distance of Compartment to Compartment | $P_1$ | 12 ± 0.1 (0.472) |



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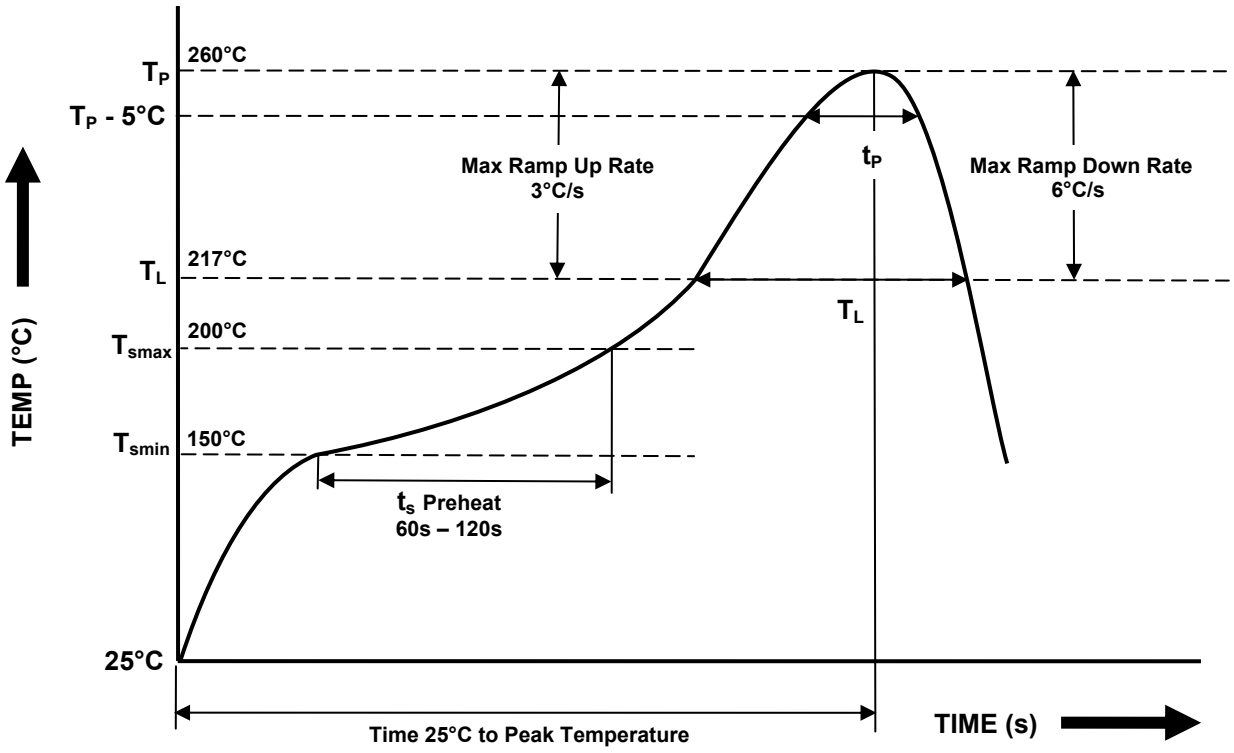
**IR REFLOW SOLDERING TEMPERATURE PROFILE FOR SMD**
**One Time Reflow Soldering is Recommended.**
**Do not immerse device body in solder paste.**




| 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 |



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