

SJxx16xx Series



Description

This SJxx16xx high junction temperature SCR series is ideal for uni-directional switch applications such as phase control in heating, motor speed controls, converters/rectifiers and inrush current controllers.

These SCRs offer low gate current trigger levels of 6 mA, 10 mA, or 30 mA at approximately 1.5V.

Features & Benefits

- Halogen free and RoHS compliant
- Surge capability up to 225A at 60 Hz half cycle
- 150°C maximum junction temperature

Applications

Typical applications include AC Generator (ACG) rectifiers, battery voltage regulators, generic converters and inrush current controller in various AC and DC applications. Additional applications include controls for power tools, home/brown good and white goods appliances.

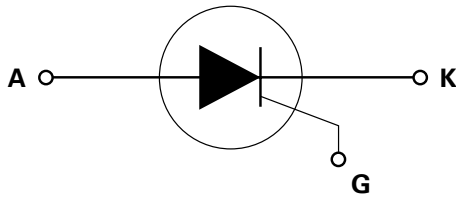
Internally constructed isolated packages are offered for ease of heat sinking with high isolation voltage.

Agency Approvals

| AGENCY | AGENCY FILE NUMBER |
|--------|--------------------|
| | E71639* |

* - L Package Only

Schematic Symbol



Main Features

| Symbol | Value | Unit |
|-------------------|-------------|------|
| $I_{T(RMS)}$ | 16 | A |
| V_{DRM}/V_{RRM} | 400 or 600 | V |
| I_{GT} | 6, 10 or 30 | mA |

Absolute Maximum Ratings – Standard SCRs

| Symbol | Parameter | Test Conditions | Value | Unit |
|-------------------|---|--|-------------------------|------------------|
| V_{DRM}/V_{RSM} | Peak non-repetitive blocking voltage | Pw=100 μ s | $V_{DRM}/V_{RRM} + 100$ | V |
| $I_{T(RMS)}$ | RMS on-state current | SJxx16Lx $T_c = 110^\circ\text{C}$ | 16 | A |
| | | SJxx16Rx SJxx16Nx $T_c = 135^\circ\text{C}$ | 16 | |
| $I_{T(AV)}$ | Average on-state current | SJxx16Lx $T_c = 110^\circ\text{C}$ | 10 | A |
| | | SJxx16Rx SJxx16Nx $T_c = 135^\circ\text{C}$ | 10 | |
| I_{TSM} | Peak non-repetitive surge current | single half cycle; f = 50Hz; T_J (initial) = 25°C | 188 | A |
| | | single half cycle; f = 60Hz; T_J (initial) = 25°C | 225 | |
| I^2t | I^2t Value for fusing | $t_p = 8.3$ ms | 210 | A ² s |
| di/dt | Critical rate of rise of on-state current | f = 60 Hz ; $T_J = 150^\circ\text{C}$ | 125 | A/ μ s |
| I_{GM} | Peak gate current | $T_J = 150^\circ\text{C}$ | 3 | A |
| $P_{G(AV)}$ | Average gate power dissipation | $T_J = 150^\circ\text{C}$ | 0.6 | W |
| T_{stg} | Storage temperature range | | -40 to 150 | °C |
| T_J | Operating junction temperature range | | -40 to 150 | °C |

Note: xx=voltage/10, x=sensitivity

Electrical Characteristics ($T_J = 25^\circ\text{C}$, unless otherwise specified)

| Symbol | Test Conditions | | SJxx16x | SJxx16x1 | SJxx16x2 | Unit |
|----------|---|------|---------|----------|----------|------------------|
| I_{GT} | $V_D = 12\text{V}; R_L = 60\ \Omega$ | MIN. | 8 | 2 | 5 | mA |
| | | MAX. | 30 | 6 | 10 | |
| V_{GT} | | MAX. | 1.5 | 1.5 | 1.5 | V |
| dv/dt | $V_D = 67\% V_{DRM};$ gate open; $T_J = 125^\circ\text{C}$ | MIN. | 800 | 70 | 500 | V/ μs |
| | $V_D = 67\% V_{DRM};$ gate open; $T_J = 150^\circ\text{C}$ | | 400 | - | 200 | |
| V_{GD} | $V_D = V_{DRM}$ $R_L = 3.3\ \text{k}\Omega$ $T_J = 110^\circ\text{C}$ | MIN. | 0.2 | 0.2 | 0.2 | V |
| I_H | $I_T = 200\text{mA}$ (initial) | MAX. | 75 | 15 | 35 | mA |
| t_q | $I_T = 2\text{A}; t_p = 50\ \mu\text{s}; dv/dt = 5\text{V}/\mu\text{s}; di/dt = 30\text{A}/\mu\text{s}$ | MAX. | 40 | 40 | 40 | μs |
| t_{gt} | $I_G = 2 \times I_{GT}$ $PW = 15\ \mu\text{s}$ $I_T = 32\text{A}$ | TYP. | 2 | 2 | 2 | μs |

Note: xx=voltage/10, x=package

Static Characteristics

| Symbol | Test Conditions | | Value | Unit | |
|---------------------|--|---------------------------|-------|------|---------------|
| V_{TM} | Component $I_T = 32\text{A}; t_p = 380\ \mu\text{s}$ | MAX. | 1.6 | V | |
| I_{DRM} / I_{RRM} | $V_{DRM} = V_{RRM}$ | $T_J = 25^\circ\text{C}$ | MAX. | 10 | μA |
| | | $T_J = 125^\circ\text{C}$ | | 1000 | |
| | | $T_J = 150^\circ\text{C}$ | | 3000 | |

Thermal Resistances

| Symbol | Parameter | | Value | Unit |
|------------------|-----------------------|----------------------|-------|---------------------------|
| $R_{\theta(jc)}$ | Junction to case (AC) | SJxx16Rx SJxx16Nx | 1.0 | $^\circ\text{C}/\text{W}$ |
| | | SJxx16Lx | 2.5 | |

Note: xx=voltage/10, x=sensitivity

Figure 1: Normalized DC Gate Trigger Current vs. Junction Temperature

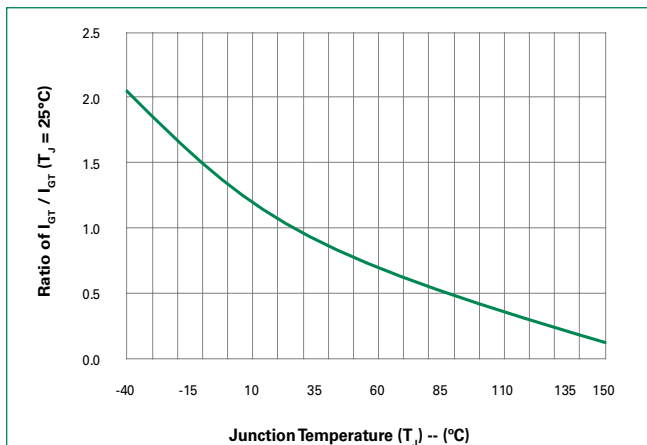


Figure 2: Normalized DC Gate Trigger Voltage vs. Junction Temperature



Figure 3: Normalized DC Holding Current vs. Junction Temperature

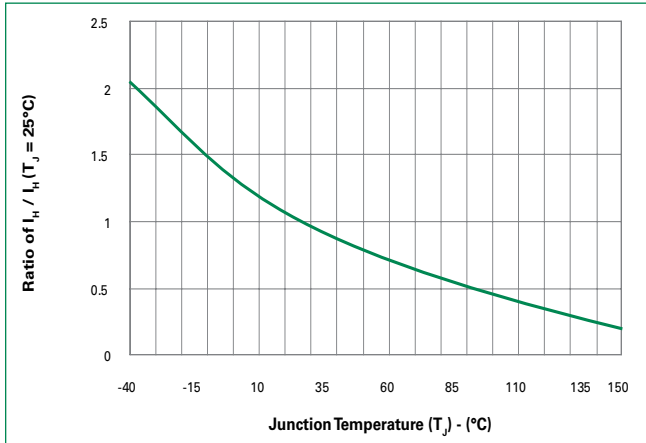


Figure 4: On-State Current vs. On-State Voltage (Typical)

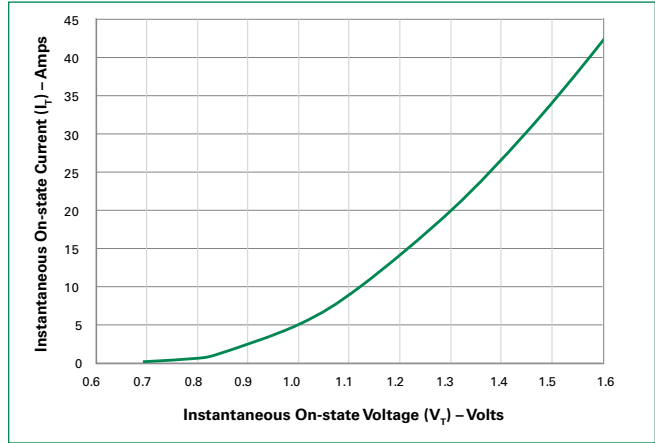


Figure 5: Power Dissipation (Typical) vs. RMS On-State Current

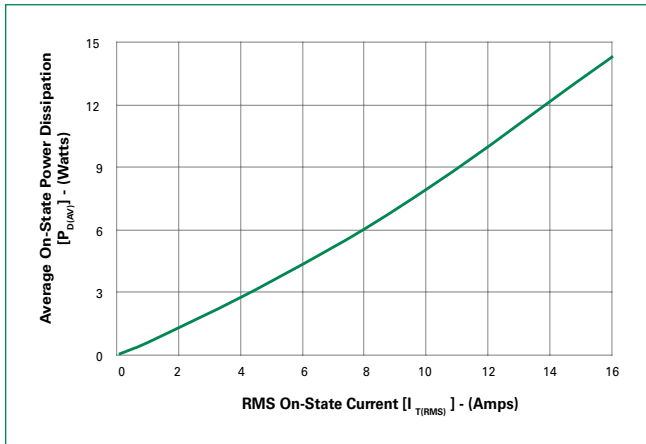


Figure 6: Maximum Allowable Case Temperature vs. RMS On-State Current

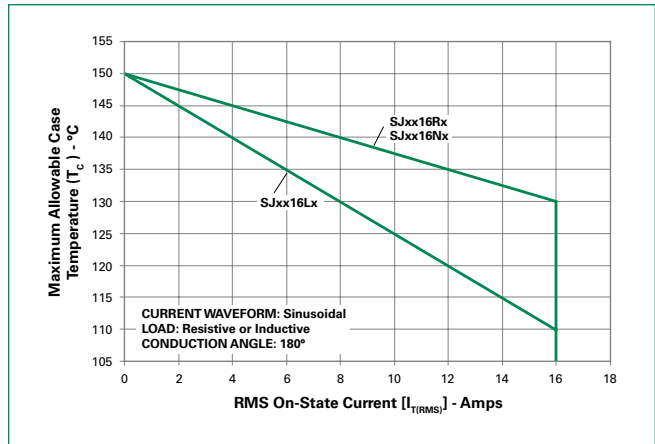


Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current

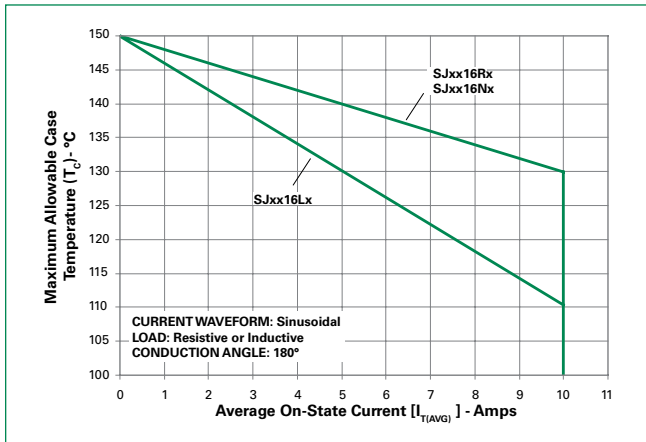


Figure 8: Peak Capacitor Discharge Current

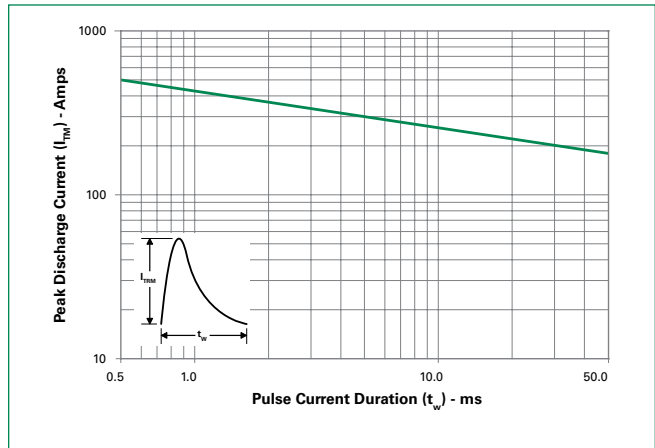


Figure 9: Peak Capacitor Discharge Current Derating



Figure 10: Surge Peak On-State Current vs. Number of Cycles



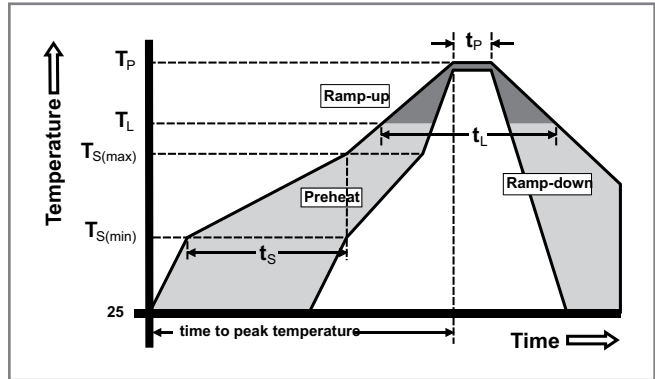
SUPPLY FREQUENCY: 60 Hz Sinusoidal
 LOAD: Resistive
 RMS On-State Current: [$I_{T(RMS)}$]: Maximum Rated Value at Specified Case Temperature

Notes:
 1. Gate control may be lost during and immediately following surge current interval.
 2. Overload may not be repeated until junction temperature has returned to steady-state rated value.

SJxx16xx Series

Soldering Parameters

| | | |
|--|------------------------------------|-------------------------|
| Reflow Condition | | Pb – Free assembly |
| Pre Heat | - Temperature Min ($T_{s(min)}$) | 150°C |
| | - Temperature Max ($T_{s(max)}$) | 200°C |
| | - Time (min to max) (t_s) | 60 – 180 secs |
| Average ramp up rate (Liquidus Temp) (T_L) to peak | | 5°C/second max |
| $T_{s(max)}$ to T_L - Ramp-up Rate | | 5°C/second max |
| Reflow | - Temperature (T_L) (Liquidus) | 217°C |
| | - Time (t_L) | 60 – 150 seconds |
| Peak Temperature (T_p) | | 260 ^{+0/-5} °C |
| Time within 5°C of actual peak Temperature (t_p) | | 20 – 40 seconds |
| Ramp-down Rate | | 5°C/second max |
| Time 25°C to peak Temperature (T_p) | | 8 minutes Max. |
| Do not exceed | | 280°C |



Physical Specifications

| | |
|------------------------|---|
| Terminal Finish | 100% Matte Tin-plated |
| Body Material | UL recognized compound meeting flammability rating V-0. |
| Lead Material | Copper Alloy |

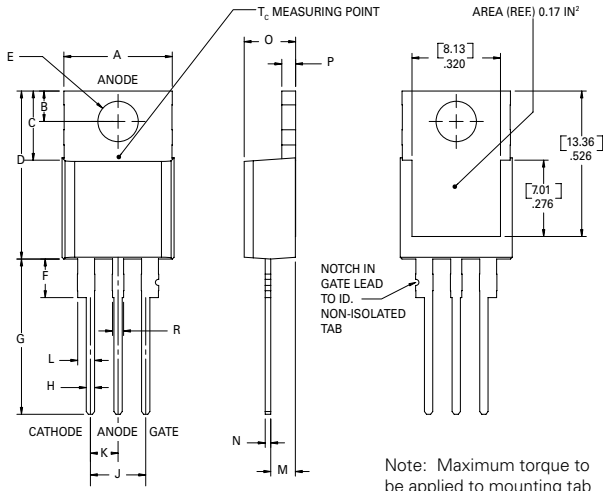
Design Considerations

Careful selection of the correct component for the application’s operating parameters and environment will go a long way toward extending the operating life of the Thyristor. Good design practice should limit the maximum continuous current through the main terminals to 75% of the component rating. Other ways to ensure long life for a power discrete semiconductor are proper heat sinking and selection of voltage ratings for worst case conditions. Overheating, overvoltage (including dv/dt), and surge currents are the main killers of semiconductors. Correct mounting, soldering, and forming of the leads also help protect against component damage.

Environmental Specifications

| Test | Specifications and Conditions |
|-----------------------------------|--|
| AC Blocking | MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 150°C for 1008 hours |
| Temperature Cycling | MIL-STD-750, M-1051, 100 cycles; -55°C to +150°C; 15-min dwell-time |
| Temperature/Humidity | EIA / JEDEC, JESD22-A101 1008 hours; 160V - DC: 85°C; 85% rel humidity |
| High Temp Storage | MIL-STD-750, M-1031, 1008 hours; 150°C |
| Low-Temp Storage | 1008 hours; -40°C |
| Resistance to Solder Heat | MIL-STD-750 Method 2031 |
| Solderability | ANSI/J-STD-002, category 3, Test A |
| Lead Bend | MIL-STD-750, M-2036 Cond E |
| Moisture Sensitivity Level | Level 1, JEDEC-J-STD-020D |

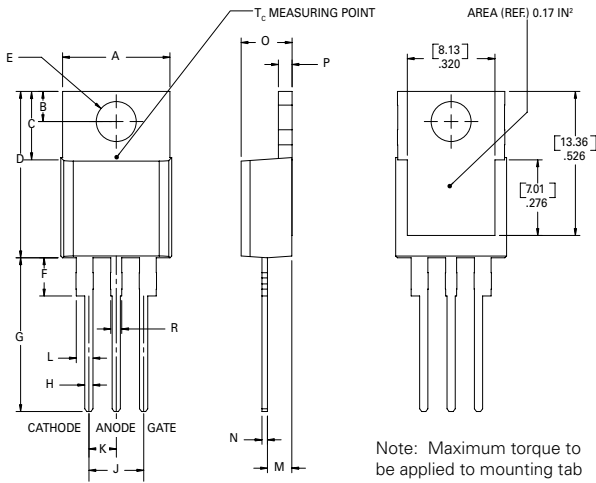
Dimensions — TO-220AB (R-Package) — Non-Isolated Mounting Tab Common with Center Lead



Note: Maximum torque to be applied to mounting tab is 8 in-lbs. (0.904 Nm).

| Dimension | Inches | | Millimeters | |
|-----------|--------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.380 | 0.420 | 9.65 | 10.67 |
| B | 0.105 | 0.115 | 2.67 | 2.92 |
| C | 0.230 | 0.250 | 5.84 | 6.35 |
| D | 0.590 | 0.620 | 14.99 | 15.75 |
| E | 0.142 | 0.147 | 3.61 | 3.73 |
| F | 0.110 | 0.130 | 2.79 | 3.30 |
| G | 0.540 | 0.575 | 13.72 | 14.61 |
| H | 0.025 | 0.035 | 0.64 | 0.89 |
| J | 0.195 | 0.205 | 4.95 | 5.21 |
| K | 0.095 | 0.105 | 2.41 | 2.67 |
| L | 0.060 | 0.075 | 1.52 | 1.91 |
| M | 0.085 | 0.095 | 2.16 | 2.41 |
| N | 0.018 | 0.024 | 0.46 | 0.61 |
| O | 0.178 | 0.188 | 4.52 | 4.78 |
| P | 0.045 | 0.060 | 1.14 | 1.52 |
| R | 0.038 | 0.048 | 0.97 | 1.22 |

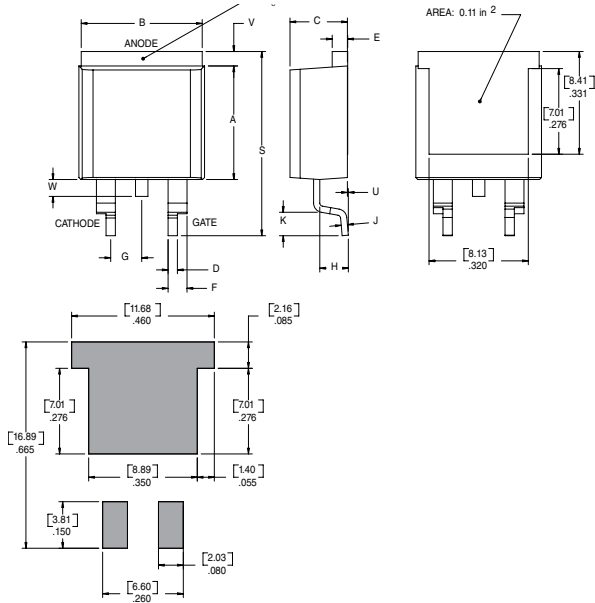
Dimensions — TO-220AB (L-Package) — Isolated Mounting Tab



Note: Maximum torque to be applied to mounting tab is 8 in-lbs. (0.904 Nm).

| Dimension | Inches | | Millimeters | |
|-----------|--------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.380 | 0.420 | 9.65 | 10.67 |
| B | 0.105 | 0.115 | 2.67 | 2.92 |
| C | 0.230 | 0.250 | 5.84 | 6.35 |
| D | 0.590 | 0.620 | 14.99 | 15.75 |
| E | 0.142 | 0.147 | 3.61 | 3.73 |
| F | 0.110 | 0.130 | 2.79 | 3.30 |
| G | 0.540 | 0.575 | 13.72 | 14.61 |
| H | 0.025 | 0.035 | 0.64 | 0.89 |
| J | 0.195 | 0.205 | 4.95 | 5.21 |
| K | 0.095 | 0.105 | 2.41 | 2.67 |
| L | 0.060 | 0.075 | 1.52 | 1.91 |
| M | 0.085 | 0.095 | 2.16 | 2.41 |
| N | 0.018 | 0.024 | 0.46 | 0.61 |
| O | 0.178 | 0.188 | 4.52 | 4.78 |
| P | 0.045 | 0.060 | 1.14 | 1.52 |
| R | 0.038 | 0.048 | 0.97 | 1.22 |

Dimensions – TO-263AB (N-package) – D²-Pak Surface Mount



| Dimension | Inches | | Millimeters | |
|-----------|--------|-------|-------------|-------|
| | Min | Max | Min | Max |
| A | 0.360 | 0.370 | 9.14 | 9.40 |
| B | 0.380 | 0.420 | 9.65 | 10.67 |
| C | 0.178 | 0.188 | 4.52 | 4.78 |
| D | 0.025 | 0.035 | 0.64 | 0.89 |
| E | 0.045 | 0.060 | 1.14 | 1.52 |
| F | 0.060 | 0.075 | 1.52 | 1.91 |
| G | 0.095 | 0.105 | 2.41 | 2.67 |
| H | 0.092 | 0.102 | 2.34 | 2.59 |
| J | 0.018 | 0.024 | 0.46 | 0.61 |
| K | 0.090 | 0.110 | 2.29 | 2.79 |
| S | 0.590 | 0.625 | 14.99 | 15.88 |
| V | 0.035 | 0.045 | 0.89 | 1.14 |
| U | 0.002 | 0.010 | 0.05 | 0.25 |
| W | 0.040 | 0.070 | 1.02 | 1.78 |

Product Selector

| Part Number | Voltage | | Gate Sensitivity | Type | Package |
|-------------|---------|------|------------------|--------------|---------|
| | 400V | 600V | | | |
| SJxx16L | X | X | 30mA | Standard SCR | TO-220L |
| SJxx16R | X | X | 30mA | Standard SCR | TO-220R |
| SJxx16N | X | X | 30mA | Standard SCR | TO-263 |
| SJxx16L1 | X | X | 6mA | Standard SCR | TO-220L |
| SJxx16R1 | X | X | 6mA | Standard SCR | TO-220R |
| SJxx16N1 | X | X | 6mA | Standard SCR | TO-263 |
| SJxx16L2 | X | X | 10mA | Standard SCR | TO-220L |
| SJxx16R2 | X | X | 10mA | Standard SCR | TO-220R |
| SJxx16N2 | X | X | 10mA | Standard SCR | TO-263 |

Note: xx = Voltage/10

Packing Options

| Part Number | Marking | Weight | Packing Mode | Base Quantity |
|-------------|----------|--------|------------------|-------------------|
| SJxx16LxTP | SJxx16Lx | 2.2g | Tube | 500 (50 per tube) |
| SJxx16RxTP | SJxx16Rx | 2.2g | Tube | 500 (50 per tube) |
| SJxx16NxTP | SJxx16Nx | 1.6g | Tube | 500 (50 per tube) |
| SJxx16NxRP | SJxx16Nx | 1.6g | Embossed Carrier | 500 |

Note: xx=voltage/10, x=sensitivity

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JONHON

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