

Sxx65x & Sxx70x Series



**Description**

Excellent unidirectional switches for phase control applications such as heating and motor speed controls. Standard phase control SCRs are triggered with few milliamperes of current at less than 1.5V potential.

**Features & Benefits**

- RoHS compliant
- Glass – passivated junctions
- Voltage capability up to 1000 V
- Surge capability up to 950 A

**Applications**

Typical applications are AC solid-state switches, industrial power tools, exercise equipment, white goods and commercial appliances.

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

**Agency Approval**

| Agency | Agency File Number     |
|--------|------------------------|
|        | J & K Packages: E71639 |

**Main Features**

| Symbol            | Value       | Unit |
|-------------------|-------------|------|
| $I_{T(RMS)}$      | 65 & 70     | A    |
| $V_{DRM}/V_{RRM}$ | 400 to 1000 | V    |
| $I_{GT}$          | 50          | mA   |

**Schematic Symbol**



**Absolute Maximum Ratings**

| Symbol       | Parameter                                 | Test Conditions  |                          | Value      | Unit                   |
|--------------|---|--|--------------------------|------------|------------------------|
|              |   | Part   | Temp                     |            |                        |
| $I_{T(RMS)}$ | RMS on-state current                      | Sxx65J<br>Sxx65K   | $T_c = 75^\circ\text{C}$ | 65         | A                      |
|              |   | Sxx70W   | $T_c = 80^\circ\text{C}$ | 70         |                        |
| $I_{T(AV)}$  | Average on-state current                  | Sxx65J<br>Sxx65K   | $T_c = 75^\circ\text{C}$ | 41.0       | A                      |
|              |   | Sxx70W   | $T_c = 80^\circ\text{C}$ | 45.0       | A                      |
| $I_{TSM}$    | Peak non-repetitive surge current         | single half cycle; $f = 50\text{Hz}$ ;<br>$T_j$ (initial) = $25^\circ\text{C}$ |                          | 800        | A                      |
|              |   | single half cycle; $f = 60\text{Hz}$ ;<br>$T_j$ (initial) = $25^\circ\text{C}$ |                          | 950        |                        |
| $I^2t$       | $I^2t$ Value for fusing                   | $t_p = 8.3 \text{ ms}$   |                          | 3745       | $\text{A}^2\text{s}$   |
| $di/dt$      | Critical rate of rise of on-state current | $f = 60\text{Hz}$ ; $T_j = 125^\circ\text{C}$                                  |                          | 200        | $\text{A}/\mu\text{s}$ |
| $I_{GM}$     | Peak gate current                         | $T_j = 125^\circ\text{C}$<br>$P_w = 15 \mu\text{S Max}$                        |                          | 5.0        | A                      |
| $P_{G(AV)}$  | Average gate power dissipation            | $T_j = 125^\circ\text{C}$  |                          | 1.0        | W                      |
| $T_{stg}$    | Storage temperature range                 |  |                          | -40 to 150 | $^\circ\text{C}$       |
| $T_j$        | Operating junction temperature range      |  |                          | -40 to 125 | $^\circ\text{C}$       |

**Electrical Characteristics (T<sub>J</sub> = 25°C, unless otherwise specified)**

| Symbol          | Test Conditions   |      | Value | Unit |      |
|-----------------|---|------|-------|------|------|
| I <sub>GT</sub> | V <sub>D</sub> = 12V; R <sub>L</sub> = 30 Ω   |      | MAX.  | 50   | mA   |
|                 |   |      | MIN.  | 5    |      |
| V <sub>GT</sub> |   |      | MAX.  | 2.0  | V    |
| dv/dt           | V <sub>D</sub> = V <sub>DRM</sub> ; gate open; T <sub>J</sub> = 100°C               | 400V | MIN.  | 650  | V/μs |
|                 |   | 600V |       | 600  |      |
|                 |   | 800V |       | 500  |      |
|                 | 1000V   | 250  |       |      |      |
|                 | V <sub>D</sub> = V <sub>DRM</sub> ; gate open; T <sub>J</sub> = 125°C               | 400V |       | 550  |      |
|                 |   | 600V |       | 500  |      |
| 800V            |   | 475  |       |      |      |
| V <sub>GD</sub> | V <sub>D</sub> = V <sub>DRM</sub> ; R <sub>L</sub> = 3.3 kΩ; T <sub>J</sub> = 125°C |      | MIN.  | 0.2  | V    |
| I <sub>H</sub>  | I <sub>T</sub> = 400mA (initial)  |      | MAX.  | 80   | mA   |
| t <sub>q</sub>  | (1)   |      | MAX.  | 35   | μs   |
| t <sub>gt</sub> | I <sub>G</sub> = 2 × I <sub>GT</sub> ; PW = 15μs; I <sub>T</sub> = 140A             |      | TYP.  | 2.5  | μs   |

Note :

(1) I<sub>T</sub>=2A; t<sub>p</sub>=50μs; dv/dt=5V/μs; di/dt=30A/μs

**Static Characteristics**

| Symbol                              | Test Conditions  |                        | Value       | Unit |      |    |
|-------------------------------------|--|------------------------|-------------|------|------|----|
| V <sub>TM</sub>                     | 65A Device I <sub>T</sub> = 130A; t <sub>p</sub> = 380μs |                        | MAX.        | 1.8  | V    |    |
|                                     | 70A Device I <sub>T</sub> = 140A; t <sub>p</sub> = 380μs |                        |             |      |      |    |
| I <sub>DRM</sub> / I <sub>RRM</sub> | V <sub>DRM</sub> / V <sub>RRM</sub>                      | T <sub>J</sub> = 25°C  | 400 – 800V  | MAX. | 20   | μA |
|                                     |  |                        | 1000 V      |      | 30   |    |
|                                     |  | T <sub>J</sub> = 100°C | 400 – 600V  |      | 1500 |    |
|                                     |  |                        | 800V        |      | 2000 |    |
|                                     |  |                        | 1000V       |      | 5000 |    |
|                                     |  |                        | 400V – 600V |      | 3000 |    |
|                                     |  | T <sub>J</sub> = 125°C | 800V        |      | 5000 |    |

**Thermal Resistances**

| Symbol              | Parameter             | Value            | Unit |      |
|---------------------|-----------------------|------------------|------|------|
| R <sub>θ(J-C)</sub> | Junction to case (AC) | Sxx65J<br>Sxx65K | 0.86 | °C/W |
|                     |                       | Sxx70W           | 0.6  |      |

Note: xx = voltage

**Additional Information**



**Datasheet**



**Resources**



**Samples**

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



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



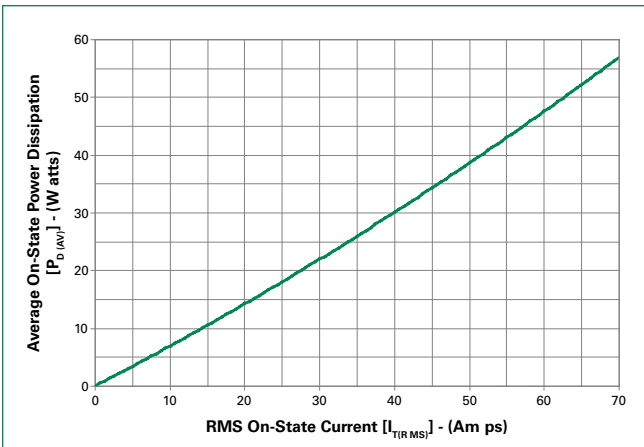
**Figure 3: Normalized DC Holding Current vs. Junction Temperature**



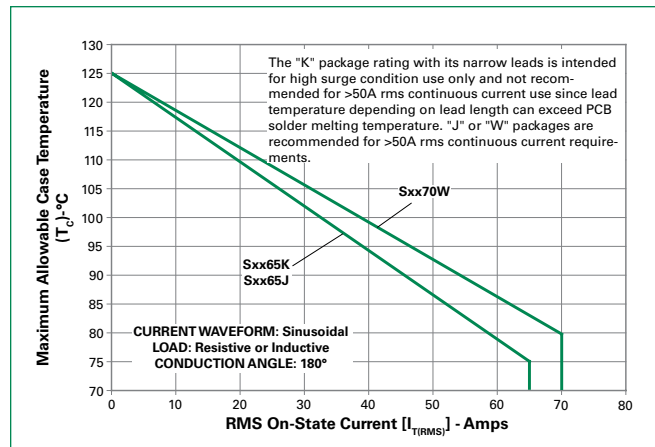
**Figure 4: On-State Current vs. On-State Voltage (Typical)**



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



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



Note: xx = voltage

**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

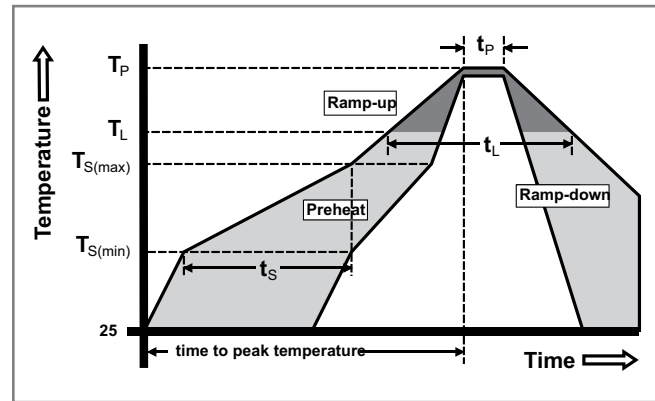
**Notes:**

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.

Note: xx = Voltage

**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                   |
|  | - Temperature ( $t_l$ )            | 60 – 150 seconds        |
| Peak Temperature ( $T_p$ )                             |                                    | 260 <sup>+0/-5</sup> °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**

|                        |   |
|------------------------|---|
| <b>Terminal Finish</b> | 100% Matte Tin-plated   |
| <b>Body</b>            | UL recognized epoxy meeting flammability classification 94V-0 |
| <b>Lead Material</b>   | Copper Alloy  |

**Design Considerations**

Careful selection of the correct device 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 device 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**

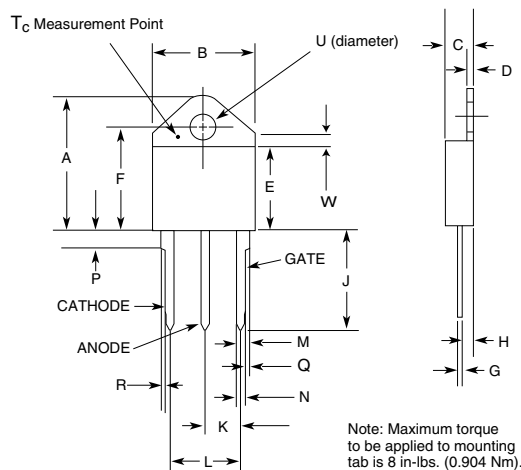
| Test                             | Specifications and Conditions  |
|----------------------------------|--|
| <b>AC Blocking</b>               | MIL-STD-750, M-1040, Cond A Applied Peak AC voltage @ 125°C for 1008 hours |
| <b>Temperature Cycling</b>       | MIL-STD-750, M-1051, 100 cycles; -40°C to +150°C; 15-min dwell-time        |
| <b>Temperature/Humidity</b>      | EIA / JEDEC, JESD22-A101 1008 hours; 320V - DC; 85°C; 85% rel humidity     |
| <b>High Temp Storage</b>         | MIL-STD-750, M-1031, 1008 hours; 150°C                                     |
| <b>Low-Temp Storage</b>          | 1008 hours; -40°C  |
| <b>Resistance to Solder Heat</b> | MIL-STD-750 Method 2031  |
| <b>Solderability</b>             | ANSI/J-STD-002, category 3, Test A   |
| <b>Lead Bend</b>                 | MIL-STD-750, M-2036 Cond E   |

**Dimensions – TO-218X (W Package) – Non-Isolated Mounting Tab common with Center Lead**



| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.810  | 0.835 | 20.57       | 21.21 |
| B         | 0.610  | 0.630 | 15.49       | 16.00 |
| C         | 0.178  | 0.188 | 4.52        | 4.78  |
| D         | 0.055  | 0.070 | 1.40        | 1.78  |
| E         | 0.487  | 0.497 | 12.37       | 12.62 |
| F         | 0.635  | 0.655 | 16.13       | 16.64 |
| G         | 0.022  | 0.029 | 0.56        | 0.74  |
| H         | 0.075  | 0.095 | 1.91        | 2.41  |
| J         | 0.575  | 0.625 | 14.61       | 15.88 |
| K         | 0.256  | 0.264 | 6.50        | 6.71  |
| L         | 0.220  | 0.228 | 5.58        | 5.79  |
| M         | 0.080  | 0.088 | 2.03        | 2.24  |
| N         | 0.169  | 0.177 | 4.29        | 4.49  |
| P         | 0.034  | 0.042 | 0.86        | 1.07  |
| R         | 0.113  | 0.121 | 2.87        | 3.07  |
| S         | 0.086  | 0.096 | 2.18        | 2.44  |
| T         | 0.156  | 0.166 | 3.96        | 4.22  |
| U         | 0.164  | 0.165 | 4.10        | 4.20  |
| V         | 0.603  | 0.618 | 15.31       | 15.70 |
| W         | 0.000  | 0.005 | 0.00        | 0.13  |
| X         | 0.003  | 0.012 | 0.07        | 0.30  |
| Y         | 0.028  | 0.032 | 0.71        | 0.81  |
| Z         | 0.085  | 0.095 | 2.17        | 2.42  |

**Dimensions – TO-218AC (K Package) – Isolated Mounting Tab**



| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.810  | 0.835 | 20.57       | 21.21 |
| B         | 0.610  | 0.630 | 15.49       | 16.00 |
| C         | 0.178  | 0.188 | 4.52        | 4.78  |
| D         | 0.055  | 0.070 | 1.40        | 1.78  |
| E         | 0.487  | 0.497 | 12.37       | 12.62 |
| F         | 0.635  | 0.655 | 16.13       | 16.64 |
| G         | 0.022  | 0.029 | 0.56        | 0.74  |
| H         | 0.075  | 0.095 | 1.91        | 2.41  |
| J         | 0.575  | 0.625 | 14.61       | 15.88 |
| K         | 0.211  | 0.219 | 5.36        | 5.56  |
| L         | 0.422  | 0.437 | 10.72       | 11.10 |
| M         | 0.058  | 0.068 | 1.47        | 1.73  |
| N         | 0.045  | 0.055 | 1.14        | 1.40  |
| P         | 0.095  | 0.115 | 2.41        | 2.92  |
| Q         | 0.008  | 0.016 | 0.20        | 0.41  |
| R         | 0.008  | 0.016 | 0.20        | 0.41  |
| U         | 0.164  | 0.165 | 4.10        | 4.20  |
| W         | 0.085  | 0.095 | 2.17        | 2.42  |

**Dimensions – TO-218X (J Package) – Isolated Mounting Tab**



| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.810  | 0.835 | 20.57       | 21.21 |
| B         | 0.610  | 0.630 | 15.49       | 16.00 |
| C         | 0.178  | 0.188 | 4.52        | 4.78  |
| D         | 0.055  | 0.070 | 1.40        | 1.78  |
| E         | 0.487  | 0.497 | 12.37       | 12.62 |
| F         | 0.635  | 0.655 | 16.13       | 16.64 |
| G         | 0.022  | 0.029 | 0.56        | 0.74  |
| H         | 0.075  | 0.095 | 1.91        | 2.41  |
| J         | 0.575  | 0.625 | 14.61       | 15.88 |
| K         | 0.256  | 0.264 | 6.50        | 6.71  |
| L         | 0.220  | 0.228 | 5.58        | 5.79  |
| M         | 0.080  | 0.088 | 2.03        | 2.24  |
| N         | 0.169  | 0.177 | 4.29        | 4.49  |
| P         | 0.034  | 0.042 | 0.86        | 1.07  |
| R         | 0.113  | 0.121 | 2.87        | 3.07  |
| S         | 0.086  | 0.096 | 2.18        | 2.44  |
| T         | 0.156  | 0.166 | 3.96        | 4.22  |
| U         | 0.164  | 0.165 | 4.10        | 4.20  |
| V         | 0.603  | 0.618 | 15.31       | 15.70 |
| W         | 0.000  | 0.005 | 0.00        | 0.13  |
| X         | 0.003  | 0.012 | 0.07        | 0.30  |
| Y         | 0.028  | 0.032 | 0.71        | 0.81  |
| Z         | 0.085  | 0.095 | 2.17        | 2.42  |

**Product Selector**

| Part Number | Voltage |      |      |       | Gate Sensitivity | Type         | Package  |
|-------------|---------|------|------|-------|------------------|--------------|----------|
|             | 400V    | 600V | 800V | 1000V |                  |              |          |
| Sxx65K      | X       | X    | X    | X     | 50mA             | Standard SCR | TO-218AC |
| Sxx65J      | X       | X    | X    |       | 50mA             | Standard SCR | TO-218X  |
| Sxx70W      | X       | X    | X    |       | 50mA             | Standard SCR | TO-218X  |

Note: xx = Voltage

**Packing Options**

| Part Number | Marking | Weight | Packing Mode | Base Quantity     |
|-------------|---------|--------|--------------|-------------------|
| Sxx65KTP    | Sxx65K  | 4.40g  | Tube         | 250 (25 per tube) |
| Sxx65JTP    | Sxx65J  | 5.23g  | Tube         | 250 (25 per tube) |
| Sxx70WTP    | Sxx70W  | 5.23g  | Tube         | 250 (25 per tube) |

Note: xx = Voltage

**Part Numbering System**



**Part Marking System**

- TO-218AC - (K Package)
- TO-218X - (J Package)
- TO-218X - (W Package)



**Date Code Marking**  
Y: Year Code  
M: Month Code  
L: Location Code  
XX: Lot Serial Code



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