

Sxx55x Series

RoHS



**Main Features**

| Symbol            | Value       | Unit |
|-------------------|-------------|------|
| $I_{T(RMS)}$      | 55          | A    |
| $V_{DRM}/V_{RRM}$ | 400 to 1000 | V    |
| $I_{GT}$          | 40          | mA   |

**Additional Information**



Datasheet



Resources



Samples

**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 650 A

**Applications**

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

**Schematic Symbol**



**Absolute Maximum Ratings**

| Symbol       | Parameter                                 | Test Conditions  | Value      | Unit                   |
|--------------|---|--|------------|------------------------|
| $I_{T(RMS)}$ | RMS on-state current                      | $T_c = 90^\circ\text{C}$   | 55         | A                      |
| $I_{T(AV)}$  | Average on-state current                  | $T_c = 90^\circ\text{C}$   | 35.0       | A                      |
| $I_{TSM}$    | Peak non-repetitive surge current         | single half cycle; $f = 50\text{Hz}$ ;<br>$T_j(\text{initial}) = 25^\circ\text{C}$ | 550        | A                      |
|              |   | single half cycle; $f = 60\text{Hz}$ ;<br>$T_j(\text{initial}) = 25^\circ\text{C}$ | 650        |                        |
| $I^2t$       | $I^2t$ Value for fusing                   | $t_p = 8.3\text{ ms}$  | 1750       | $\text{A}^2\text{s}$   |
| $di/dt$      | Critical rate of rise of on-state current | $f = 60\text{Hz}$ ; $T_j = 125^\circ\text{C}$                                      | 175        | $\text{A}/\mu\text{s}$ |
| $I_{GM}$     | Peak gate current                         | $T_j = 125^\circ\text{C}$<br>$P_W = 10\mu\text{S}$                                 | 4.0        | A                      |
| $P_{G(AV)}$  | Average gate power dissipation            | $T_j = 125^\circ\text{C}$  | 0.8        | 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.  | 40    | mA   |      |
|                 |   | MIN.  | 5     |      |      |
| V <sub>GT</sub> | V <sub>D</sub> = 12V; R <sub>L</sub> = 30 Ω   | MAX.  | 1.5   | 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.  | 60    | 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> = 110A             | TYP.  | 2.5   | μs   |      |

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

### Static Characteristics

| Symbol                              | Test Conditions                               |                        | Value      | Unit     |      |
|-------------------------------------|---|------------------------|------------|----------|------|
| V <sub>TM</sub>                     | I <sub>T</sub> = 110A; t <sub>p</sub> = 380μs |                        | MAX.       | 1.8<br>V |      |
| I <sub>DRM</sub> / I <sub>RRM</sub> | V <sub>DRM</sub> / V <sub>RRM</sub>           | T <sub>J</sub> = 25°C  | 400 – 600V | MAX.     | 10   |
|                                     |   |                        | 800 V      |          | 20   |
|                                     |   |                        | 1000 V     |          | 30   |
|                                     |   | T <sub>J</sub> = 100°C | 400 – 600V |          | 1000 |
|                                     |   |                        | 800V       |          | 1500 |
|                                     |   |                        | 1000V      |          | 5000 |
|                                     |   | T <sub>J</sub> = 125°C | 400 – 600V |          | 2000 |
|                                     |   |                        | 800V       |          | 3000 |

### Thermal Resistances

| Symbol              | Parameter             |                  | Value | Unit |
|---------------------|-----------------------|------------------|-------|------|
| R <sub>θ(J-C)</sub> | Junction to case (AC) | Sxx55R<br>Sxx55N | 0.5   | °C/W |
|                     |                       | Sxx55W<br>Sxx55M | 0.53  |      |
|                     |                       | Sxx55R           | 40    |      |
| R <sub>θ(J-A)</sub> | Junction to ambient   | Sxx55R           | 40    | °C/W |

Note: xx = voltage

**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

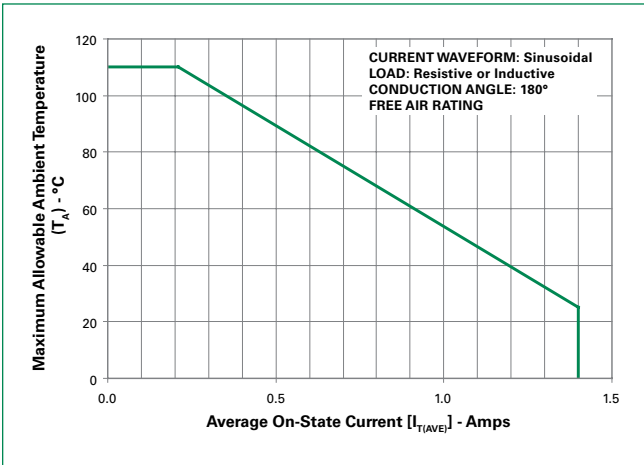
**Figure 7: Maximum Allowable Case Temperature vs. Average On-State Current**



**Figure 8: Maximum Allowable Ambient Temperature vs. RMS On-State Current**



**Figure 9: Maximum Allowable Ambient Temperature vs. Average On-State Current**



**Figure 10: Peak Capacitor Discharge Current**



**Figure 11: Peak Capacitor Discharge Current Derating**



Note: xx = voltage

**Figure 12: Surge Peak On-State Current vs. Number of Cycles**



**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 Material</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

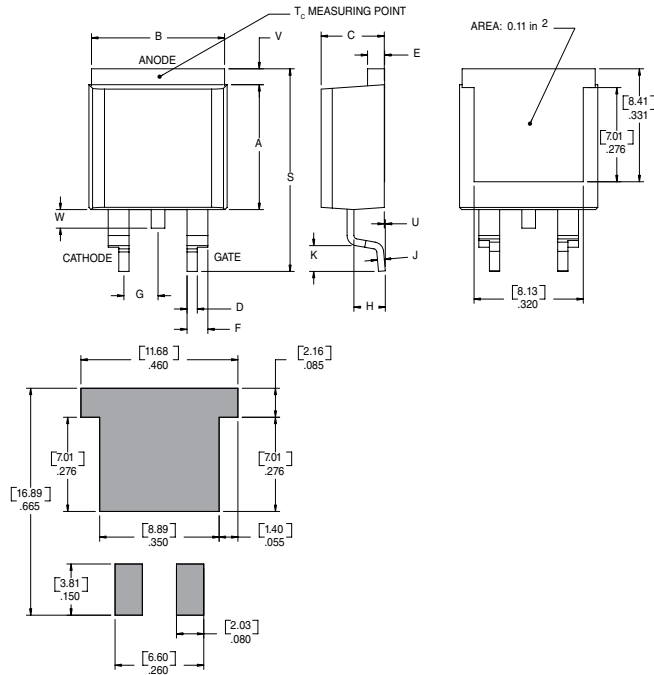
| Test                                 | Specifications and Conditions   |
|--------------------------------------|---|
| <b>AC Blocking</b>                   | MIL-STD-750, M-1040, Cond A Applied<br>Peak AC voltage @ 125°C for 1008 hours |
| <b>Temperature Cycling</b>           | MIL-STD-750, M-1051,<br>100 cycles; -40°C to +150°C;<br>15-min dwell-time     |
| <b>Temperature/<br/>Humidity</b>     | EIA / JEDEC, JESD22-A101<br>1008 hours; 320V - DC: 85°C;<br>85% rel humidity  |
| <b>High Temp Storage</b>             | MIL-STD-750, M-1031,<br>1008 hours; 150°C                                     |
| <b>Low-Temp Storage</b>              | 1008 hours; -40°C   |
| <b>Resistance to<br/>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-220AB (R-Package) — Non-Isolated Mounting Tab Common with Center Lead



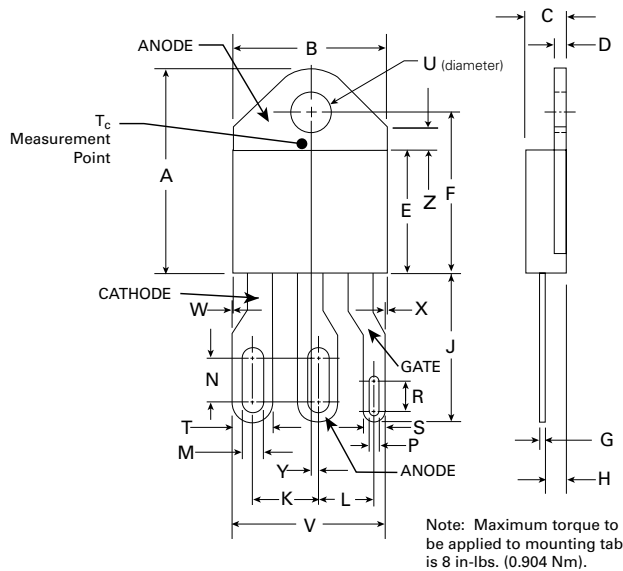
| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.380  | 0.420 | 9.65        | 10.67 |
| B         | 0.105  | 0.115 | 2.67        | 2.92  |
| C         | 0.230  | 0.250 | 5.84        | 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) – D<sup>2</sup>-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 | 0.63        | 0.89  |
| E         | 0.048  | 0.055 | 1.22        | 1.40  |
| F         | 0.060  | 0.075 | 1.52        | 1.91  |
| G         | 0.095  | 0.105 | 2.41        | 2.67  |
| H         | 0.083  | 0.093 | 2.11        | 2.36  |
| 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       | 15.87 |
| 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  |

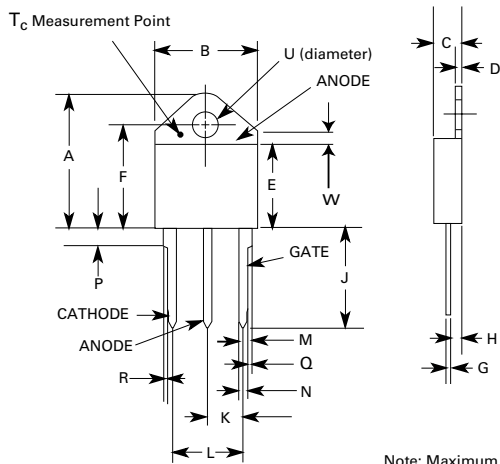
**Dimensions – TO-218X (W Package) – Non-Isolated Mounting Tab Common with Center Lead**



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

| Dimension | Inches |       | Millimeters |       |
|-----------|--------|-------|-------------|-------|
|           | Min    | Max   | Min         | Max   |
| A         | 0.810  | 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 (M 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         | 0.810  | 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  |

**Product Selector**

| Part Number | Voltage |      |      |       | Gate Sensitivity | Type         | Package  |
|-------------|---------|------|------|-------|------------------|--------------|----------|
|             | 400V    | 600V | 800V | 1000V |                  |              |          |
| Sxx55R      | X       | X    | X    | X     | 40mA             | Standard SCR | TO-220R  |
| Sxx55N      | X       | X    | X    | X     | 40mA             | Standard SCR | TO-263   |
| Sxx55W      | X       | X    | X    |       | 40mA             | Standard SCR | TO-218X  |
| Sxx55M      | X       | X    | X    | X     | 40mA             | Standard SCR | TO-218AC |

Note: xx = Voltage

**Packing Options**

| Part Number | Marking | Weight | Packing Mode     | Base Quantity     |
|-------------|---------|--------|------------------|-------------------|
| Sxx55RTP    | Sxx55R  | 2.2g   | Tube             | 500 (50 per tube) |
| Sxx55NTP    | Sxx55N  | 1.6g   | Tube             | 500 (50 per tube) |
| Sxx55NRP    | Sxx55N  | 1.6g   | Embossed Carrier | 500               |
| Sxx55WTP    | Sxx55W  | 5.23g  | Tube             | 250 (25 per tube) |
| Sxx55MTP    | Sxx55M  | 4.40g  | Tube             | 250 (25 per tube) |

Note: xx = Voltage



**TO-263 Embossed Carrier Reel Pack (RP) Specification**

Meets all EIA-481-2 Standards



**Part Numbering System**



**Part Marking System**

