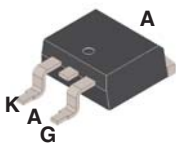
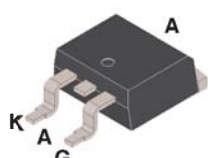
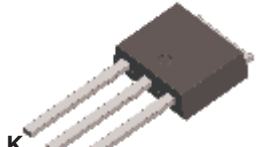
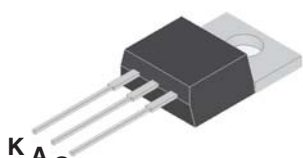
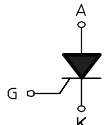


## STANDARD & SENSITIVE 12A SCR

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                   |                                                    |                                           |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|----------------------------------------------------|-------------------------------------------|--|
| <div> <p><b>TO-252AA (DPAK)</b><br/>(FS12xxxD)</p>  </div> <div> <p><b>TO-263AB (D2PAK)</b><br/>(FS12xxxG)</p>  </div> <div> <p>(FULLY ISOLATED CASE)</p> <p><b>TO-220F</b><br/>(FS12xxxW)</p>  </div> <div> <p><b>TO-251AA (IPAK)</b><br/>(FS12xxxI)</p>  </div> <div> <p><b>TO-220AB</b><br/>(FS12xxxH)</p>  </div> <div>  </div> | <table> <tr> <td><b>On-State Current</b><br/>12 Amp</td><td><b>Gate Trigger Current</b><br/>200 <math>\mu</math>A to 25mA</td></tr> <tr> <td colspan="2"><b>Off-State Voltage</b><br/>400 V ÷ 800 V</td></tr> </table> <div> <p><b>FEATURES</b></p> <ul style="list-style-type: none"> <li>• Glass/passivated die junctions</li> <li>• Low current SCR</li> <li>• Low thermal resistance</li> <li>• High surge current capability</li> <li>• Low forward voltage drop</li> <li>• Solder dip 260°C, 10s</li> <li>• Component in accordance to RoHS 2011/65/EU and WEEE 2002/96/EC</li> <li>• Meets MSL level 3, per J-STD-020, LF maximum peak of 260°C</li> </ul> </div> <div> <p><b>MECHANICAL DATA</b></p> <ul style="list-style-type: none"> <li>• <b>Case:</b> (DPAK) / (D2PAK) / (IPAK) / (TO-220F) / (TO-220AB). Epoxy meets UL 94V-0 flammability rating.</li> <li>• <b>Polarity:</b> As marked on the body.</li> <li>• <b>Terminals:</b> Matte tin plated leads, solderable per MIL-STD-750 Method 2026, J-STD-002 and JESD22-B102. Consumer grade, meets JESD 201 class 1A whisker test.</li> </ul> </div> <div> <p><b>TYPICAL APPLICATIONS</b></p> <p>The <b>standard</b> gate SCR FS1208, FS1209 and FS1210 series is suitable for a wide range of applications, e.g., Overvoltage Crowbar protection, Motor Control circuits in Power Tools and domestic appliances, inrush current limiting circuits, capacitive discharge ignition and voltage regulation circuits.</p> <p>The <b>sensitive</b> gate SCR FS1202 series is suitable for applications where the available gate current is limited, e.g., Ground Fault Interruptors, Solid State Relays, Stand-by mode power supplies, smoke and alarm detectors.</p> </div> | <b>On-State Current</b><br>12 Amp | <b>Gate Trigger Current</b><br>200 $\mu$ A to 25mA | <b>Off-State Voltage</b><br>400 V ÷ 800 V |  |
| <b>On-State Current</b><br>12 Amp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>Gate Trigger Current</b><br>200 $\mu$ A to 25mA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                   |                                                    |                                           |  |
| <b>Off-State Voltage</b><br>400 V ÷ 800 V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                   |                                                    |                                           |  |

### Maximun Ratings and Electrical Characteristics at 25°C

| SYMBOL       | PARAMETER                                                              | CONDITIONS                                                                                            | Value         | Unit             |
|--------------|------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|---------------|------------------|
| $I_{T(RMS)}$ | On-state Current                                                       | 180 ° Conduction Angle,<br>TO-220F $T_C = 70^\circ C$<br>DPAK/D2PAK/IPAK/TO-220AB $T_C = 105^\circ C$ | 12            | A                |
| $I_{T(AV)}$  | Average On-state Current                                               | 180 ° Conduction Angle,<br>TO-220F $T_C = 70^\circ C$<br>DPAK/D2PAK/IPAK/TO-220AB $T_C = 105^\circ C$ | 8             | A                |
| $I_{TSM}$    | Non-repetitive On-State Current                                        | Half Cycle, 60 Hz                                                                                     | 145           | A                |
| $I_{TSM}$    | Non-repetitive On-State Current                                        | Half Cycle, 50 Hz                                                                                     | 140           | A                |
| $I^2t$       | Fusing Current                                                         | $t_p = 10$ ms, Half Cycle                                                                             | 98            | A <sup>2</sup> s |
| $I_{GM}$     | Peak Gate Current                                                      | 20 $\mu$ s max.                                                                                       | 4             | A                |
| $P_{GM}$     | Peak Gate Dissipation                                                  | 20 $\mu$ s max.                                                                                       | 10            | W                |
| $P_{G(AV)}$  | Gate Dissipation                                                       | 20ms max.                                                                                             | 1             | W                |
| $T_j$        | Operating Temperature                                                  |                                                                                                       | (-40 to +125) | °C               |
| $T_{stg}$    | Storage Temperature                                                    |                                                                                                       | (-40 to +150) | °C               |
| $T_{sld}$    | Soldering Temperature                                                  | 10s max.                                                                                              | 260           | °C               |
| $V_{RGM}$    | Max. Peak Reverse Gate Voltage<br>(For FS1208, FS1209 and FS1210 only) |                                                                                                       | 5             | V                |
| $V_{iso}$    | R.M.S. isolation voltage 50/60 Hz sinusoidal waveform                  |                                                                                                       | 2500          | Vac              |

| SYMBOL                 | PARAMETER                         | VOLTAGE |     |     | Unit |
|------------------------|-----------------------------------|---------|-----|-----|------|
|                        |                                   | D       | M   | N   |      |
| $V_{DRM}$<br>$V_{RRM}$ | Repetitive Peak Off State Voltage | 400     | 600 | 800 | V    |

## STANDARD & SENSITIVE 12A SCR

### Electrical Characteristics at Tamb = 25 °C

| SYMBOL              | PARAMETER                     | CONDITIONS                                                                               | SG  | STANDARD |          |          |          | Unit       |
|---------------------|-------------------------------|------------------------------------------------------------------------------------------|-----|----------|----------|----------|----------|------------|
|                     |                               |                                                                                          |     | 02       | 08       | 09       | 10       |            |
| $I_{GT}$            | Gate Trigger Current          | $V_D = 12 V_{DC}$<br>$R_L = 140\Omega$<br>$R_L = 33\Omega$                               | MAX | 200      | -        | -        | -        | $\mu A$    |
|                     |                               |                                                                                          | MIN | -        | 0.5      | 2        | 2        | mA         |
|                     |                               |                                                                                          | MAX | -        | 5        | 15       | 25       | mA         |
| $V_{GT}$            | Gate Trigger Voltage          | $V_D = 12 V_{DC}$<br>$R_L = 140\Omega$<br>$R_L = 33\Omega$                               | MAX | 0.8<br>- | -<br>1.3 |          |          | V          |
| $V_{GD}$            | Gate Non Trigger Voltage      | $V_D = V_{DRM}, T_j = 125^\circ C, R_L = 33k\Omega$<br>$R_{GK} = 220\Omega$<br>Gate open | MIN | 0.1<br>- | -<br>0.2 |          |          | V          |
| $V_{RGM}$           | Reverse Gate Voltage          | $I_{RG} = 10\mu A$                                                                       | MIN | 8        | -        |          |          | V          |
| $I_H$               | Holding Current               | $I_T = 500 mA$<br>$R_{GK} = 1k\Omega$<br>Gate open                                       | MAX | 5<br>-   | -<br>15  | -<br>30  | -<br>40  | mA         |
| $I_L$               | Latching Current              | $I_G = 1.2 I_{GT}$<br>$R_{GK} = 1k\Omega$<br>Gate open                                   | MAX | 6<br>-   | -<br>30  | -<br>60  | -<br>60  | mA         |
| $dV / dt$           | Critical Rate of Voltage Rise | $V_D = 0.67 V_{DRM}, T_j = 125^\circ C$<br>$R_{GK} = 220\Omega$<br>Gate open             | MIN | 5<br>-   | -<br>40  | -<br>200 | -<br>400 | V/ $\mu s$ |
| $dI / dt$           | Critical Rate of Current Rise | $I_G = 2 \times I_{GT}, tr \leq 100 ns, f = 60 Hz, T_j = 125^\circ C$                    | MIN | 50       |          |          |          | A/ $\mu s$ |
| $V_{TM}$            | On-state Voltage              | at $I_T = 24 Amp, tp = 380 \mu s, T_j = 25^\circ C$                                      | MAX | 1.6      |          |          |          | V          |
| $V_{t(o)}$          | Threshold Voltage             | $T_j = 125^\circ C$                                                                      | MAX | 0.85     |          |          |          | V          |
| $r_d$               | Dynamic resistance            | $T_j = 125^\circ C$                                                                      | MAX | 30       |          |          |          | m $\Omega$ |
| $I_{DRM} / I_{RRM}$ | Off-State Leakage Current     | $V_{DRM} = V_{RRM}, R_{GK} = 220\Omega$<br>$T_j = 125^\circ C$<br>$T_j = 25^\circ C$     | MAX | 1        | 2        |          |          | mA         |
|                     |                               |                                                                                          | MAX | 5        | 5        |          |          | $\mu A$    |

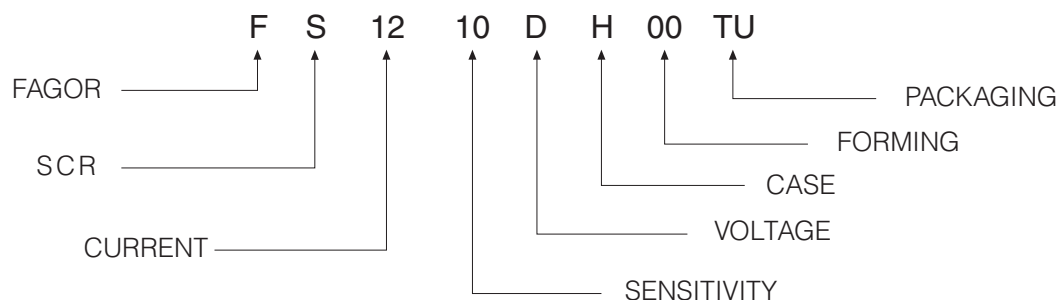
### Thermal resistance

| SYMBOL        | PARAMETER                               | CONDITIONS     |                             | Value | Unit         |
|---------------|-----------------------------------------|----------------|-----------------------------|-------|--------------|
| $R_{th(j-c)}$ | Thermal Resistance Junction-Case for DC |                | DPAK, IPAK, D2PAK, TO-220AB | 1.3   | $^\circ C/W$ |
|               |                                         |                | TO-220F                     | 4.6   |              |
| $R_{th(j-a)}$ | Thermal Resistance Junction-Amb for DC  | $S = 0.5 cm^2$ | DPAK                        | 70    | $^\circ C/W$ |
|               |                                         | $S = 1 cm^2$   | D2PAK                       | 45    |              |
|               |                                         |                | IPAK                        | 100   |              |
|               |                                         |                | TO-220F                     | 60    |              |
|               |                                         |                | TO-220AB                    | 60    |              |

S = Copper surface under tab

## STANDARD & SENSITIVE 12A SCR

### Part Number Information



### Ordering information

| PREFERRED P/N | PACKAGE CODE | DELIVERY MODE              | BASE QUANTITY | UNIT WEIGHT (g) |
|---------------|--------------|----------------------------|---------------|-----------------|
| FS1209DD 00TR | TR           | 13" diameter tape and reel | 2500          | 0.30            |

| PREFERRED P/N | PACKAGE CODE | DELIVERY MODE              | BASE QUANTITY | UNIT WEIGHT (g) |
|---------------|--------------|----------------------------|---------------|-----------------|
| FS1209DG 00TR | TR           | 13" diameter tape and reel | 800           | 1.50            |

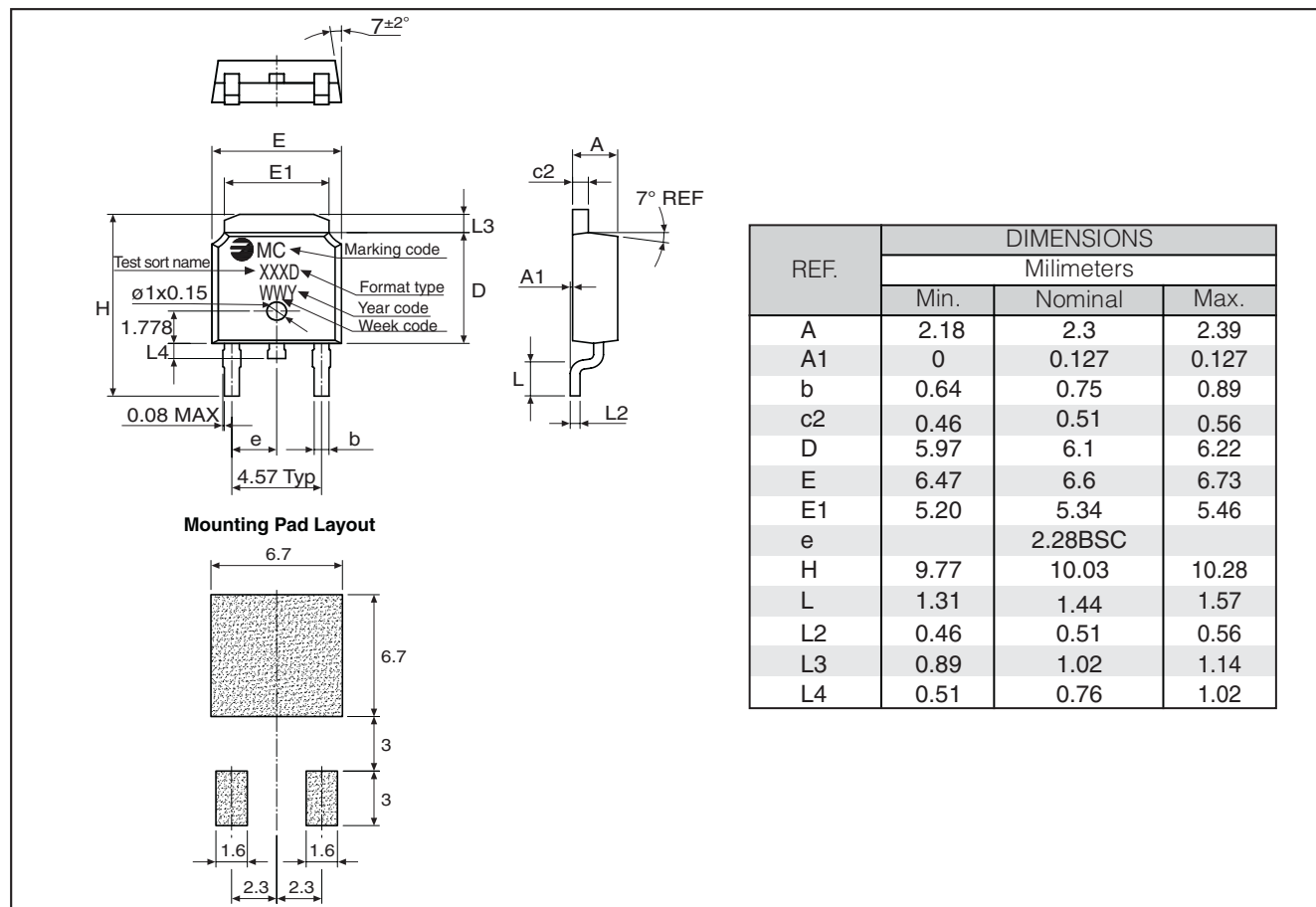
| PREFERRED P/N | PACKAGE CODE | DELIVERY MODE | BASE QUANTITY | UNIT WEIGHT (g) |
|---------------|--------------|---------------|---------------|-----------------|
| FS1209DW 00TU | TU           | TUBE          | 1000          | 2.00            |

| PREFERRED P/N | PACKAGE CODE | DELIVERY MODE | BASE QUANTITY | UNIT WEIGHT (g) |
|---------------|--------------|---------------|---------------|-----------------|
| FS1209DI 00TU | TU           | TUBE          | 4000          | 0.40            |

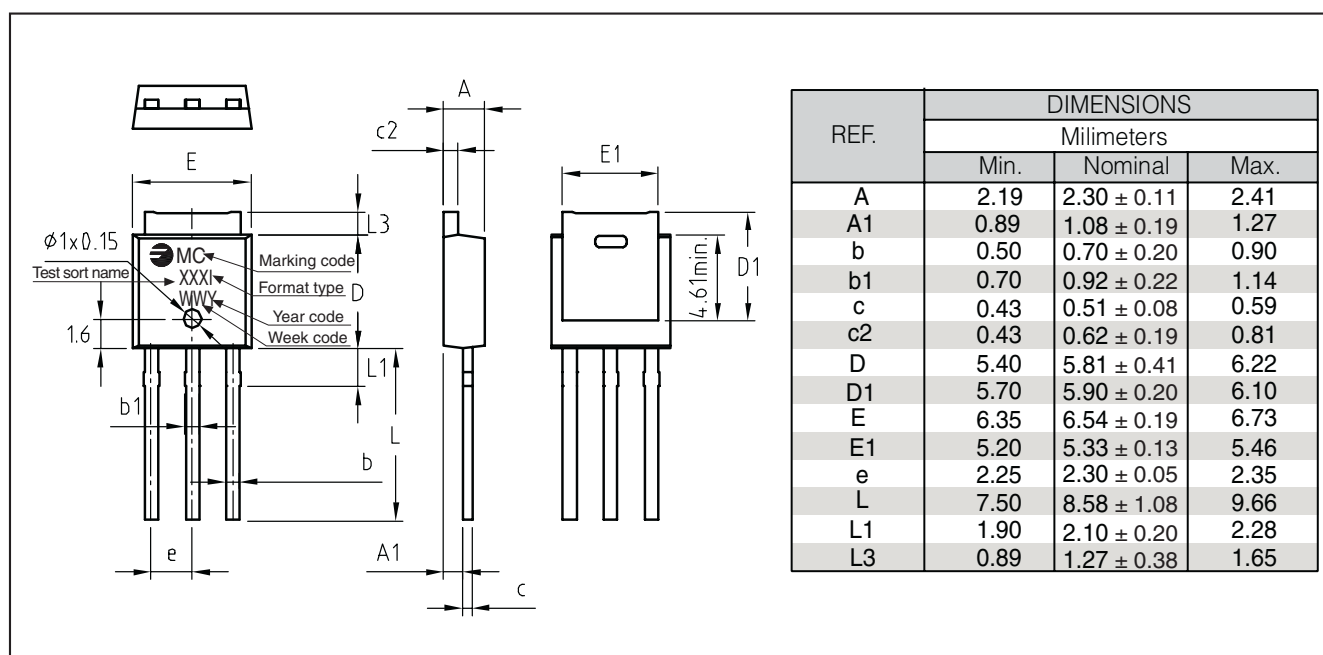
| PREFERRED P/N | PACKAGE CODE | DELIVERY MODE | BASE QUANTITY | UNIT WEIGHT (g) |
|---------------|--------------|---------------|---------------|-----------------|
| FS1209DH 00TU | TU           | TUBE          | 1000          | 2.30            |

## STANDARD & SENSITIVE 12A SCR

### Package Outline Dimensions: (mm) TO-252AA (DPAK)

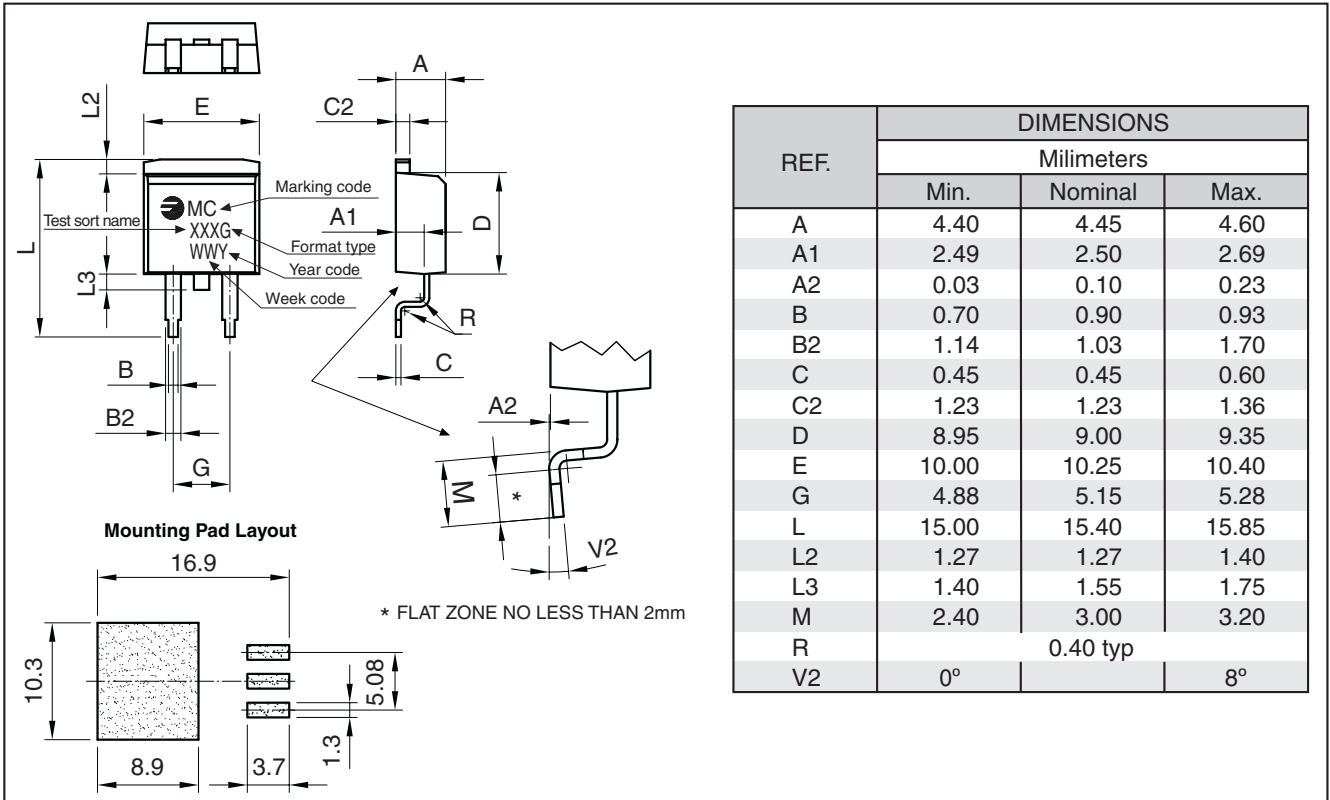


### Package Outline Dimensions: (mm) TO-251AA (IPAK)

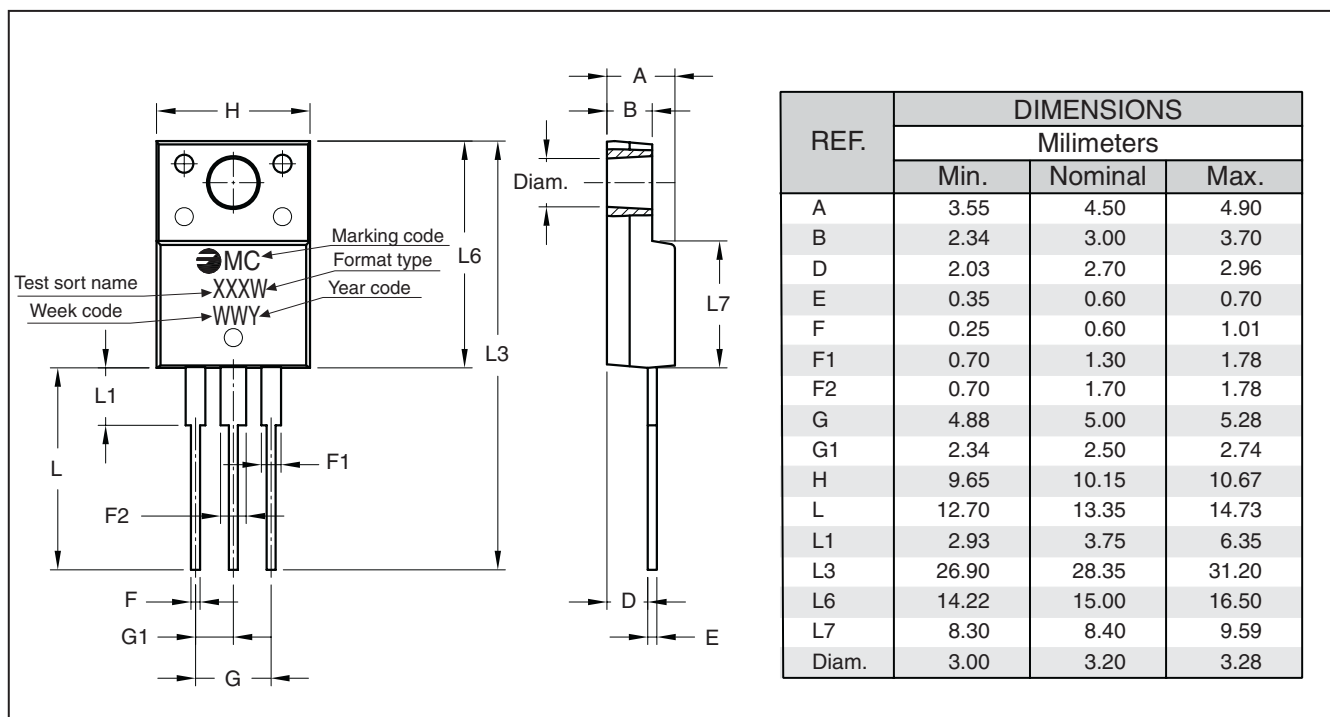


## STANDARD & SENSITIVE 12A SCR

### Package Outline Dimensions: (mm) TO-263AB (D2PAK)

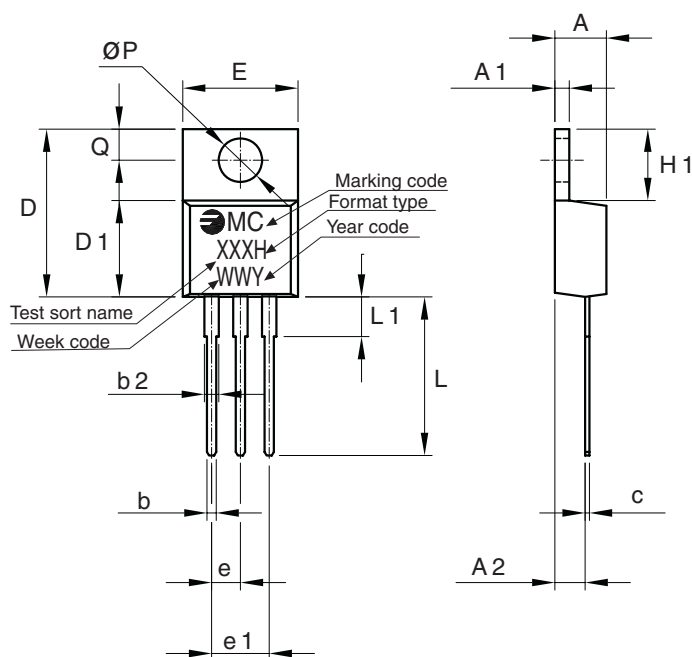


### Package Outline Dimensions: (mm) TO-220F



# STANDARD & SENSITIVE 12A SCR

## Package Outline Dimensions: (mm) TO-220AB



| REF. | DIMENSIONS |       |
|------|------------|-------|
|      | Milimeters |       |
|      | Min.       | Max.  |
| A    | 4.47       | 4.67  |
| A1   | 1.17       | 1.37  |
| A2   | 2.52       | 2.82  |
| b    | 0.71       | 0.91  |
| b2   | 1.17       | 1.37  |
| c    | 0.31       | 0.53  |
| D    | 14.65      | 15.35 |
| D1   | 8.50       | 8.90  |
| E    | 10.01      | 10.36 |
| e    | 2.51       | 2.57  |
| e1   | 4.98       | 5.18  |
| H1   | 6.15       | 6.45  |
| L    | 13.40      | 13.96 |
| L1   | 3.56       | 3.96  |
| P    | 3.735      | 3.935 |
| Q    | 2.59       | 2.89  |

## STANDARD & SENSITIVE 12A SCR

### Ratings and Characteristics (Ta 25 °C unless otherwise noted)

Fig. 1: Maximum average power dissipation versus average on-state current.

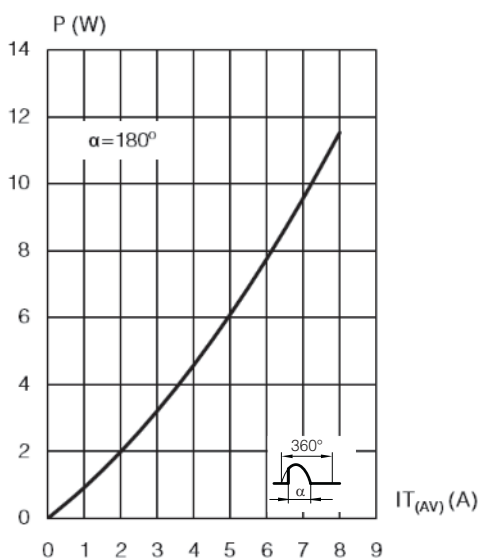


Fig. 2: Average and D.C. on-state current versus case temperature.

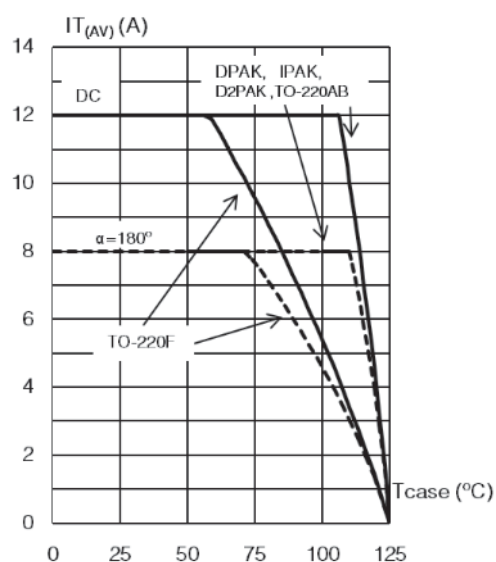


Fig. 3: Relative variation of thermal impedance junction to case versus pulse duration.

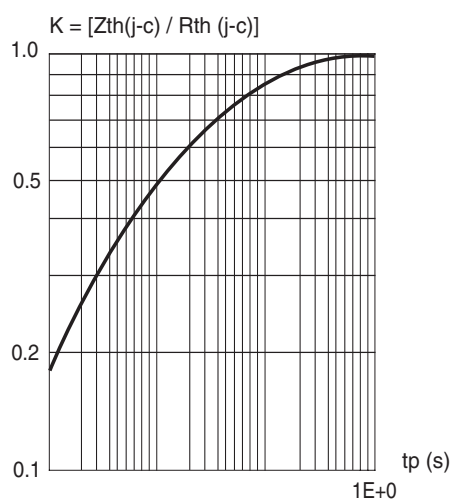
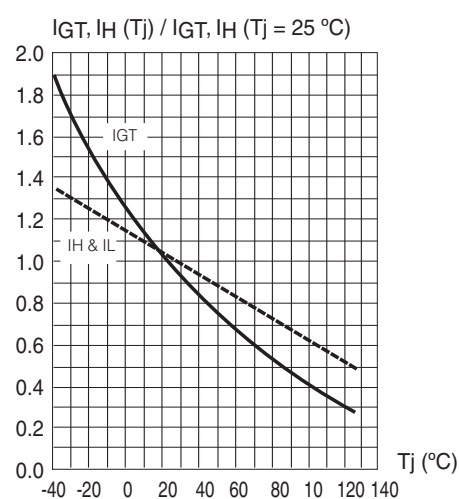


Fig. 4: Relative variation of gate trigger current, holding and latching current versus junction temperature for Sensitive Gate SCR (02).



# STANDARD & SENSITIVE 12A SCR

## Ratings and Characteristics (Ta 25 °C unless otherwise noted)

Fig. 5: Relative variation of gate trigger current, holding and latching current versus junction temperature for Standard Gate SCRs (08,09,10).

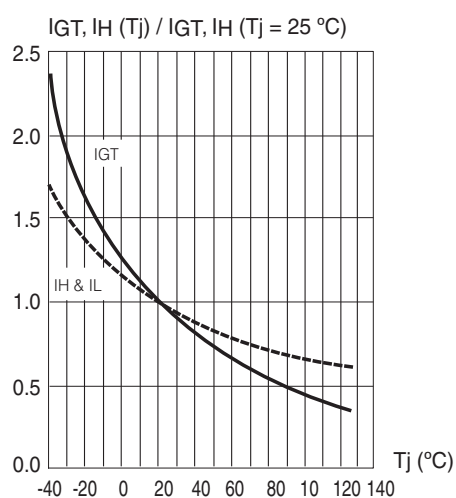


Fig. 6: Non repetitive surge peak on-state current versus number of cycles.

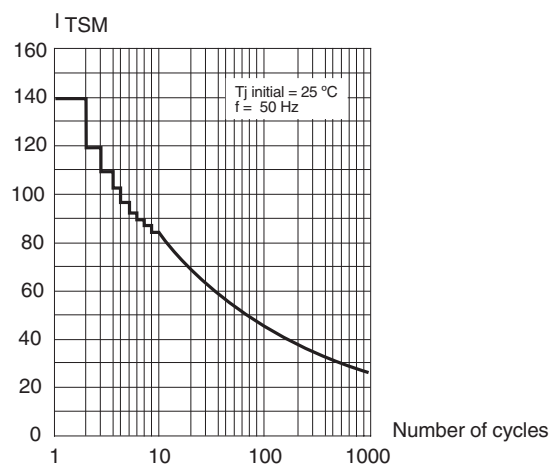


Fig. 7: Non repetitive surge peak on-state current for a sinusoidal pulse with width:  $t_p < 10 \text{ ms}$ , and corresponding value of  $I^2 t$ .

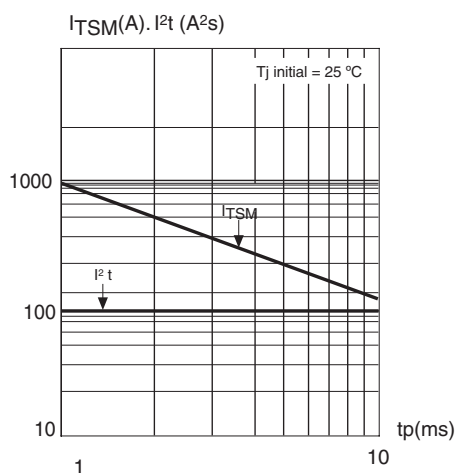
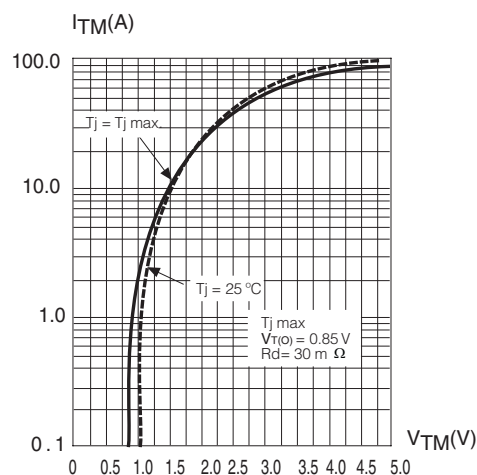


Fig. 8: On-state characteristics (maximum values).



**STANDARD & SENSITIVE 12A SCR****Revision History**

| Date        | Revision | Description of Changes                              |
|-------------|----------|-----------------------------------------------------|
| 14-Oct-2014 | 0        | Original Data Sheet                                 |
| 16-Dec-2014 | 1        | Modified Typical Applications Description and Title |

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