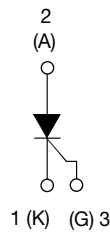


## Thyristor High Voltage, Phase Control SCR, 40 A



TO-220AB 3L



### FEATURES

- Designed and qualified according to JEDEC®-JESD 47
- 140 °C max. operating junction temperature
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

### APPLICATIONS

- Typical usage is in input rectification crowbar (soft start) and AC switch in motor control, UPS, welding, and battery charge

### DESCRIPTION

The VS-40TTS12... high voltage series of silicon controlled rectifiers are specifically designed for medium power switching and phase control applications. The glass passivation technology used has reliable operation up to 140 °C junction temperature.

### PRIMARY CHARACTERISTICS

|                       |                  |
|-----------------------|------------------|
| $I_{T(AV)}$           | 25 A             |
| $V_{DRM}/V_{RRM}$     | 1200 V           |
| $V_{TM}$              | 1.6 V            |
| $I_{GT}$              | 35 mA            |
| $T_J$                 | -40 °C to 140 °C |
| Package               | TO-220AB 3L      |
| Circuit configuration | Single SCR       |

### MAJOR RATINGS AND CHARACTERISTICS

| PARAMETER         | TEST CONDITIONS      | VALUES      | UNITS      |
|-------------------|----------------------|-------------|------------|
| $I_{T(AV)}$       | Sinusoidal waveform  | 25          | A          |
| $I_{RMS}$         |                      | 40          |            |
| $V_{RRM}/V_{DRM}$ |                      | 1200        | V          |
| $I_{TSM}$         |                      | 350         | A          |
| $V_T$             | $T_J = 25\text{ °C}$ | 1.6         | V          |
| $dV/dt$           |                      | 500         | V/ $\mu$ s |
| $dI/dt$           |                      | 150         | A/ $\mu$ s |
| $T_J$             |                      | -40 to +140 | °C         |

### VOLTAGE RATINGS

| PART NUMBER   | $V_{RRM}$ , MAXIMUM PEAK REVERSE VOLTAGE<br>V | $V_{DRM}$ , MAXIMUM PEAK DIRECT VOLTAGE<br>V | $T_J$<br>°C |
|---------------|---|--|-------------|
| VS-40TTS12-M3 | 1200  | 1200   | -25 to +140 |



| ABSOLUTE MAXIMUM RATINGS                             |                   |   |        |                   |
|--|-------------------|---|--------|-------------------|
| PARAMETER  | SYMBOL            | TEST CONDITIONS   | VALUES | UNITS             |
| Maximum average on-state current                     | $I_{T(AV)}$       | $T_C = 93\text{ }^\circ\text{C}$ , 180° conduction half sine wave                         | 25     | A                 |
| Maximum RMS on-state current                         | $I_{RMS}$         |   | 40     |                   |
| Maximum peak, one-cycle non-repetitive surge current | $I_{TSM}$         | 10 ms sine pulse, rated $V_{RRM}$ applied   | 300    |                   |
|  |                   | 10 ms sine pulse, no voltage reapplied  | 350    |                   |
| Maximum $I^2t$ for fusing                            | $I^2t$            | 10 ms sine pulse, rated $V_{RRM}$ applied   | 450    | A <sup>2</sup> s  |
|  |                   | 10 ms sine pulse, no voltage reapplied  | 630    |                   |
| Maximum $I^2\sqrt{t}$ for fusing                     | $I^2\sqrt{t}$     | $t = 0.1$ to 10 ms, no voltage reapplied  | 6300   | A <sup>2</sup> √s |
| Maximum on-state voltage                             | $V_{TM}$          | 80 A, $T_J = 25\text{ }^\circ\text{C}$  | 1.6    | V                 |
| Low level value of on-state slope resistance         | $r_t$             | $T_J = 140\text{ }^\circ\text{C}$   | 11.4   | mΩ                |
| Low level value of threshold voltage                 | $V_{T(TO)}$       |   | 0.96   | V                 |
| Maximum reverse and direct leakage current           | $I_{RRM}/I_{DRM}$ | $T_J = 25\text{ }^\circ\text{C}$  | 0.5    | mA                |
|  |                   | $T_J = 140\text{ }^\circ\text{C}$   | 12     |                   |
| Holding current                                      | $I_H$             | Anode supply = 6 V, resistive load, initial $I_T = 1$ A, $T_J = 25\text{ }^\circ\text{C}$ | 100    | mA                |
| Maximum latching current                             | $I_L$             | Anode supply = 6 V, resistive load, $T_J = 25\text{ }^\circ\text{C}$                      | 200    |                   |
| Maximum rate of rise of off-state voltage            | dV/dt             | $T_J = T_J \text{ max.}$ , linear to 80 °C, $V_{DRM} = R_g - k = \text{Open}$             | 500    | V/μs              |
| Maximum rate of rise of turned-on current            | dI/dt             |   | 150    | A/μs              |

| TRIGGERING                                  |             |  |        |       |
|---|-------------|--|--------|-------|
| PARAMETER                                   | SYMBOL      | TEST CONDITIONS  | VALUES | UNITS |
| Maximum peak gate power                     | $P_{GM}$    |  | 8.0    | W     |
| Maximum average gate power                  | $P_{G(AV)}$ |  | 2.0    |       |
| Maximum peak positive gate current          | + $I_{GM}$  |  | 1.5    | A     |
| Maximum peak negative gate voltage          | - $V_{GM}$  |  | 10     | V     |
| Maximum required DC gate current to trigger | $I_{GT}$    | Anode supply = 6 V, resistive load, $T_J = 25\text{ }^\circ\text{C}$ | 35     | mA    |
| Maximum required DC gate voltage to trigger | $V_{GT}$    | Anode supply = 6 V, resistive load, $T_J = 25\text{ }^\circ\text{C}$ | 1.3    | V     |
| Maximum DC gate voltage not to trigger      | $V_{GD}$    | $T_J = 140\text{ }^\circ\text{C}$ , $V_{DRM} = \text{Rated value}$   | 0.2    |       |
| Maximum DC gate current not to trigger      | $I_{GD}$    |  | 1.5    | mA    |

| SWITCHING                     |          |                                   |        |       |
|-------------------------------|----------|-----------------------------------|--------|-------|
| PARAMETER                     | SYMBOL   | TEST CONDITIONS                   | VALUES | UNITS |
| Typical turn-on time          | $t_{gt}$ | $T_J = 25\text{ }^\circ\text{C}$  | 0.9    | μs    |
| Typical reverse recovery time | $t_{rr}$ | $T_J = 140\text{ }^\circ\text{C}$ | 4      |       |
| Typical turn-off time         | $t_q$    |                                   | 110    |       |

| THERMAL AND MECHANICAL SPECIFICATIONS           |                |                                      |            |                        |
|---|----------------|--------------------------------------|------------|------------------------|
| PARAMETER                                       | SYMBOL         | TEST CONDITIONS                      | VALUES     | UNITS                  |
| Maximum junction and storage temperature range  | $T_J, T_{Stg}$ |                                      | -40 to 140 | °C                     |
| Maximum thermal resistance, junction to case    | $R_{thJC}$     | DC operation                         | 0.8        | °C/W                   |
| Maximum thermal resistance, junction to ambient | $R_{thJA}$     |                                      | 60         |                        |
| Typical thermal resistance, case to heatsink    | $R_{thCS}$     | Mounting surface, smooth and greased | 0.5        |                        |
| Approximate weight                              |                |                                      | 2          | g                      |
|   |                |                                      | 0.07       | oz.                    |
| Mounting torque                                 | minimum        |                                      | 6 (5)      | kgf · cm<br>(lbf · in) |
|   | maximum        |                                      | 12 (10)    |                        |
| Marking device                                  |                | Case style TO-220AB 3L               | 40TTS12    |                        |

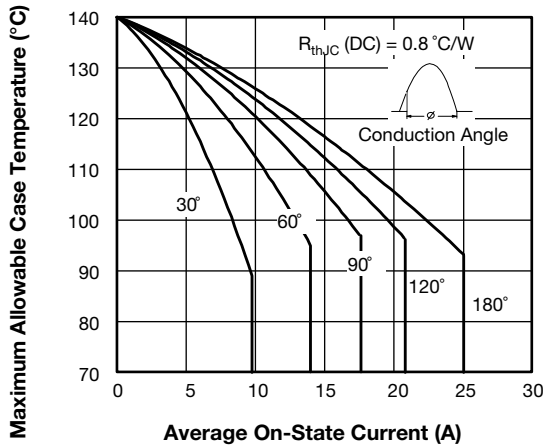


Fig. 1 - Current Rating Characteristics

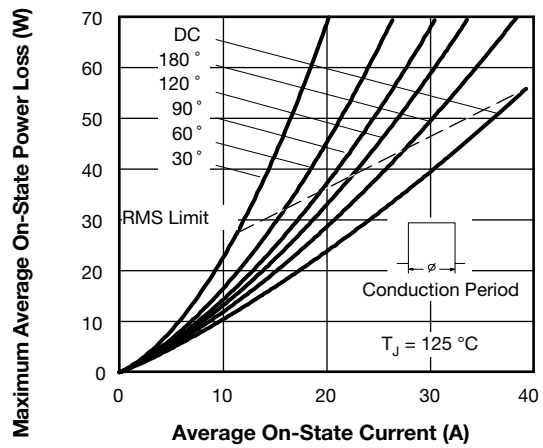


Fig. 4 - On-State Power Loss Characteristics

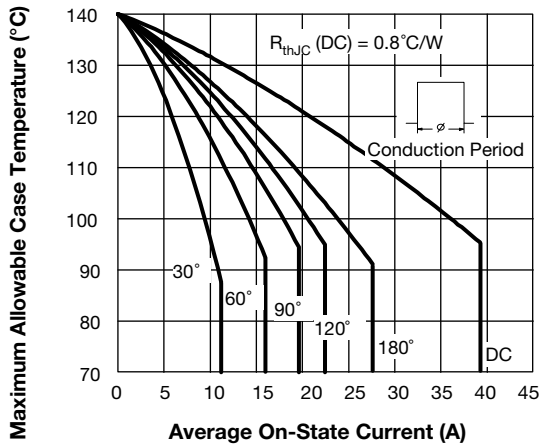


Fig. 2 - Current Rating Characteristics

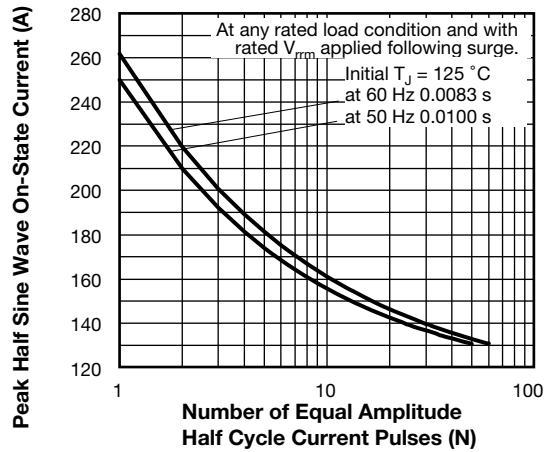


Fig. 5 - Maximum Non-Repetitive Surge Current

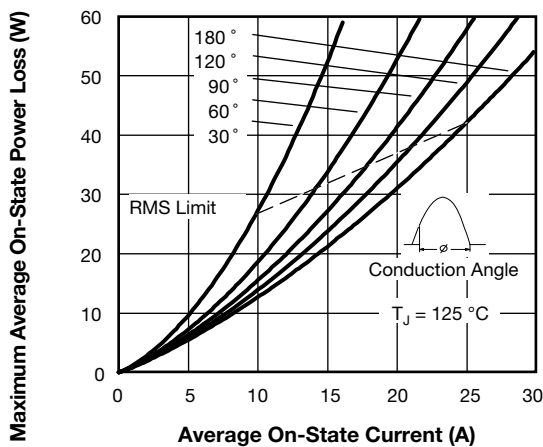


Fig. 3 - On-State Power Loss Characteristics

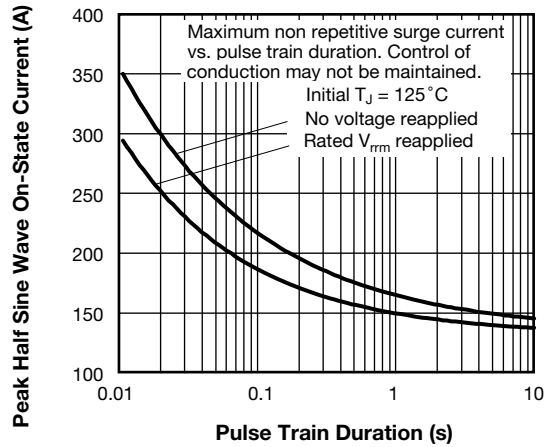


Fig. 6 - Maximum Non-Repetitive Surge Current

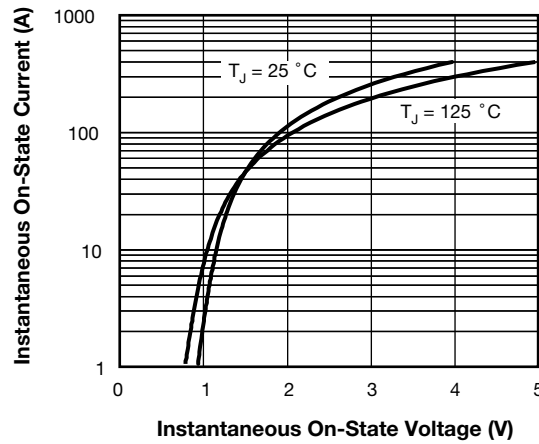


Fig. 7 - On-State Voltage Drop Characteristics

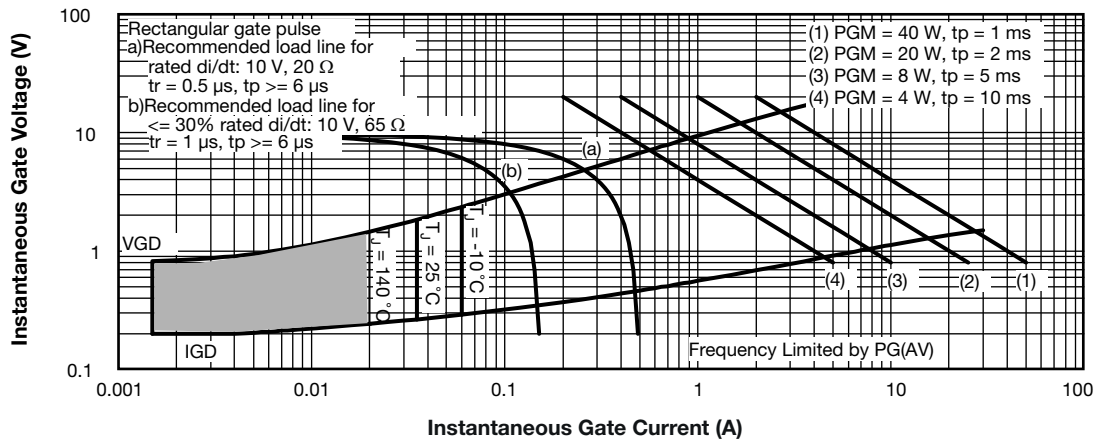


Fig. 8 - Gate Characteristics

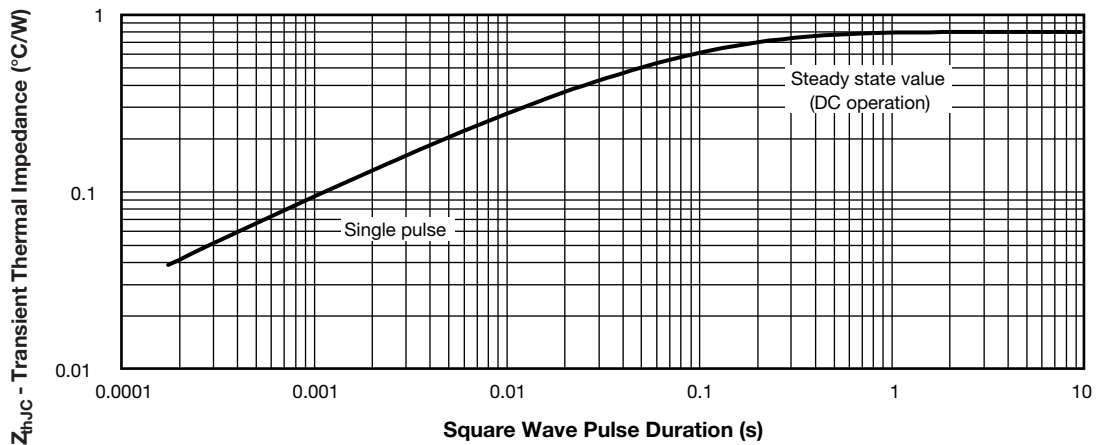
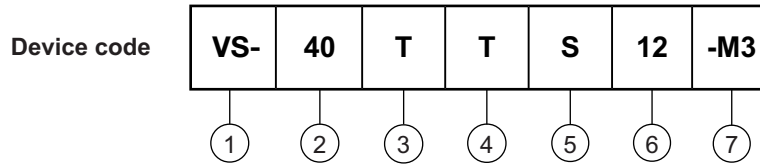


Fig. 9 - Thermal Impedance  $Z_{thJC}$  Characteristics



ORDERING INFORMATION TABLE



- 1** - Vishay Semiconductors product
- 2** - Current rating, RMS value
- 3** - Circuit configuration:  
T = single thyristor
- 4** - Package:  
T = TO-220
- 5** - Type of silicon:  
S = standard recovery rectifier
- 6** - Voltage rating (12 = 1200 V)
- 7** - Environmental digit:  
-M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

| ORDERING INFORMATION (Example) |               |                          |
|--------------------------------|---------------|--------------------------|
| PREFERRED P/N                  | BASE QUANTITY | PACKAGING DESCRIPTION    |
| VS-40TTS12-M3                  | 50            | Antistatic plastic tubes |

| LINKS TO RELATED DOCUMENTS |  |
|----------------------------|--|
| Dimensions                 | <a href="http://www.vishay.com/doc?96154">www.vishay.com/doc?96154</a> |
| Part marking information   | <a href="http://www.vishay.com/doc?95028">www.vishay.com/doc?95028</a> |



## TO-220AB 3L

**DIMENSIONS** in millimeters and inches



Conforms to JEDEC® outline TO-220AB

| SYMBOL | MILLIMETERS |       | INCHES |       | NOTES | SYMBOL | MILLIMETERS |       | INCHES |       | NOTES |
|--------|-------------|-------|--------|-------|-------|--------|-------------|-------|--------|-------|-------|
|        | MIN.        | MAX.  | MIN.   | MAX.  |       |        | MIN.        | MAX.  | MIN.   | MAX.  |       |
| A      | 4.25        | 4.65  | 0.167  | 0.183 |       | D2     | 11.68       | 13.30 | 0.460  | 0.524 | 6, 7  |
| A1     | 1.14        | 1.40  | 0.045  | 0.055 |       | E      | 10.11       | 10.51 | 0.398  | 0.414 | 3, 6  |
| A2     | 2.50        | 2.92  | 0.098  | 0.115 |       | E1     | 6.86        | 8.89  | 0.270  | 0.350 | 6     |
| b      | 0.69        | 1.01  | 0.027  | 0.040 |       | e      | 2.41        | 2.67  | 0.095  | 0.105 |       |
| b1     | 0.38        | 0.97  | 0.015  | 0.038 | 4     | e1     | 4.88        | 5.28  | 0.192  | 0.208 |       |
| b2     | 1.20        | 1.73  | 0.047  | 0.068 |       | H1     | 6.09        | 6.48  | 0.240  | 0.255 | 6     |
| b3     | 1.14        | 1.73  | 0.045  | 0.068 | 4     | L      | 13.52       | 14.02 | 0.532  | 0.552 |       |
| c      | 0.36        | 0.61  | 0.014  | 0.024 |       | L1     | 3.32        | 3.82  | 0.131  | 0.150 | 2     |
| c1     | 0.36        | 0.56  | 0.014  | 0.022 | 4     | ∅ P    | 3.54        | 3.91  | 0.139  | 0.154 |       |
| D      | 14.85       | 15.35 | 0.585  | 0.604 | 3     | Q      | 2.60        | 3.00  | 0.102  | 0.118 |       |
| D1     | 8.38        | 9.02  | 0.330  | 0.355 |       |        |             |       |        |       |       |

**Notes**

- (1) Dimensioning and tolerancing as per ASME Y14.5M-1994
- (2) Lead dimension and finish uncontrolled in L1
- (3) Dimension D, D1, and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outermost extremes of the plastic body
- (4) Dimension b1, b3, and c1 apply to base metal only
- (5) Controlling dimensions: inches
- (6) Thermal pad contour optional within dimensions E, H1, D2, and E1
- (7) Outline conforms to JEDEC® TO-220, except D2



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