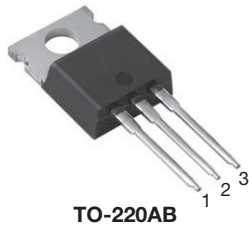
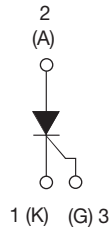


Thyristor High Voltage, Phase Control SCR, 40 A



TO-220AB



FEATURES

- Easy control peak current at charger power up to reduce passive / electromechanical components
- Flexible solution for reliable AC power rectification
- Meets JESD 201 class 1A whisker test
- AEC-Q101 qualified
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- On-board and off-board EV/HEV battery chargers
- Renewable energy inverters

DESCRIPTION

The VS-40TTS12HM3 high voltage series of silicon controlled rectifiers are specifically designed for medium power switching and phase control applications.

| 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 |
| 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/μs |
| dI/dt | | 150 | A/μs |
| T_J | | -40 to +140 | °C |

| VOLTAGE RATINGS | | | |
|-----------------|---|--|-------------|
| PART NUMBER | V_{RRM} , MAXIMUM PEAK REVERSE VOLTAGE V | V_{DRM} , MAXIMUM PEAK DIRECT VOLTAGE V | T_J °C |
| VS-40TTS12HM3 | 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^2s | |
| | | 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 | $A^2\sqrt{s}$ | |
| 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 | $m\Omega$ | |
| Low level value of threshold voltage | $V_{T(TO)}$ | | 0.96 | V | |
| Maximum reverse and direct leakage current | I_{RRM}/I_{DRM} | $V_R = \text{Rated } V_{RRM}/V_{DRM}$ | $T_J = 25\text{ }^\circ\text{C}$ | 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 | | |
| 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 $80\text{ }^\circ\text{C}$, $V_{DRM} = R_g - k = \text{Open}$ | 500 | $V/\mu s$ | |
| Maximum rate of rise of turned-on current | dI/dt | | 150 | $A/\mu s$ | |

| 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 | $^{\circ}\text{C}$ |
| Maximum thermal resistance, junction to case | R_{thJC} | DC operation | 0.8 | $^{\circ}\text{C}/\text{W}$ |
| 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 (lbf · in) |
| | maximum | | 12 (10) | |
| Marking device | | Case style TO-220AB | 40TTS12H | |

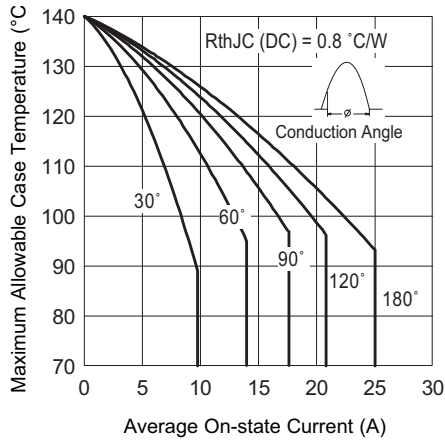


Fig. 1 - Current Rating Characteristics

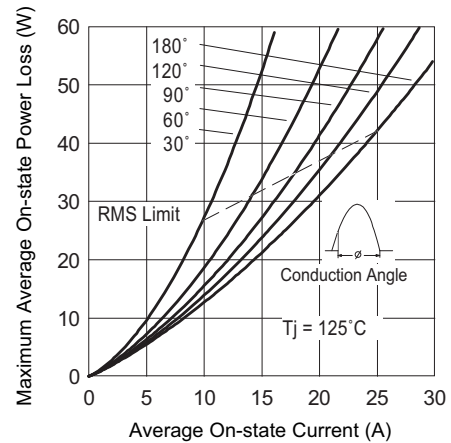


Fig. 3 - On-State Power Loss Characteristics

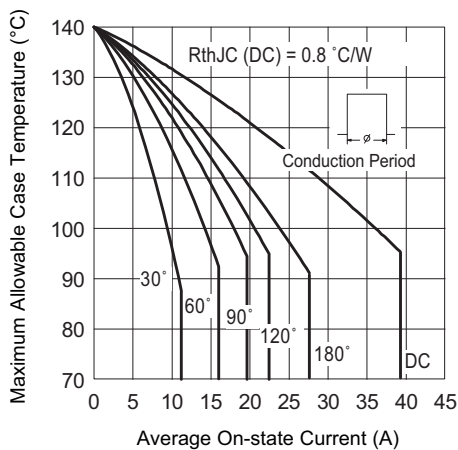


Fig. 2 - Current Rating Characteristics

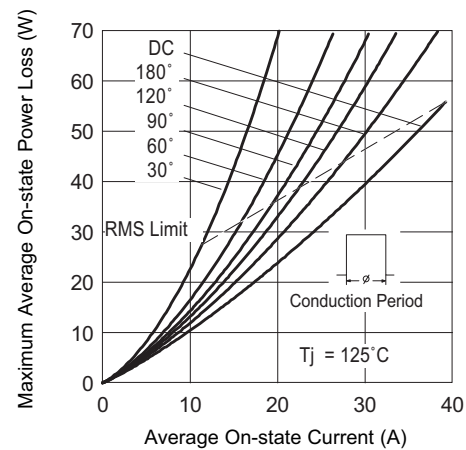


Fig. 4 - On-State Power Loss Characteristics

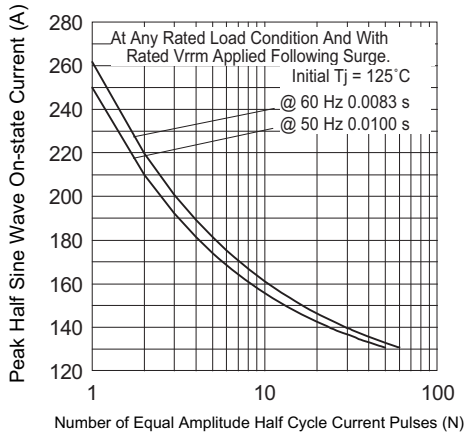


Fig. 5 - Maximum Non-Repetitive Surge Current

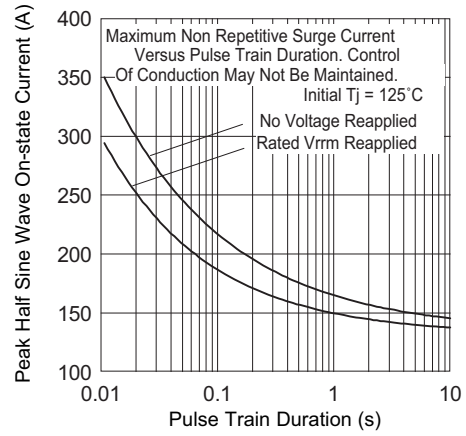


Fig. 6 - Maximum Non-Repetitive Surge Current

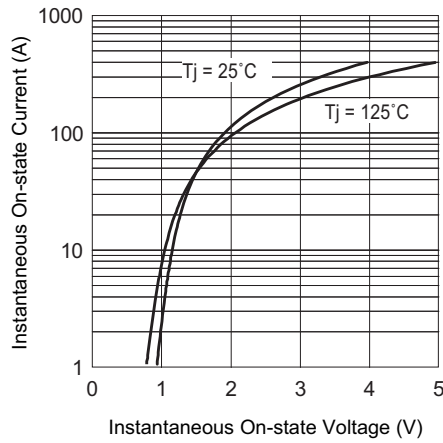


Fig. 7 - On-State Voltage Drop Characteristics

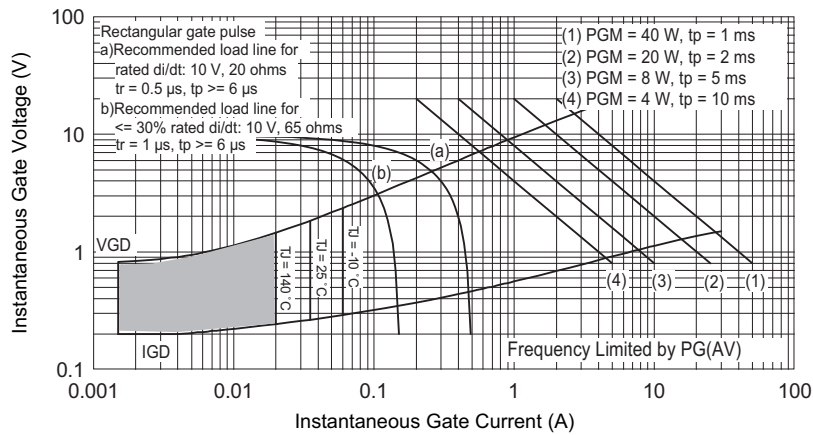


Fig. 8 - Gate Characteristics

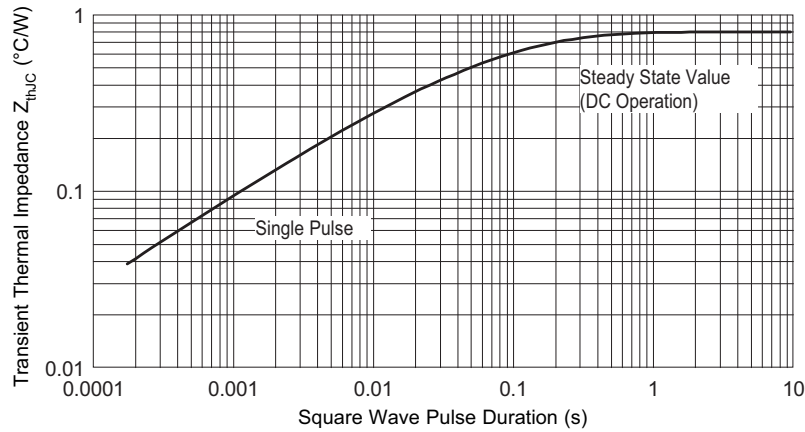


Fig. 9 - Thermal Impedance Z_{thJC} Characteristics

ORDERING INFORMATION TABLE

| | | | | | | | | |
|-------------|------------|-----------|----------|----------|----------|-----------|----------|-----------|
| Device code | VS- | 40 | T | T | S | 12 | H | M3 |
| | ① | ② | ③ | ④ | ⑤ | ⑥ | ⑦ | ⑧ |

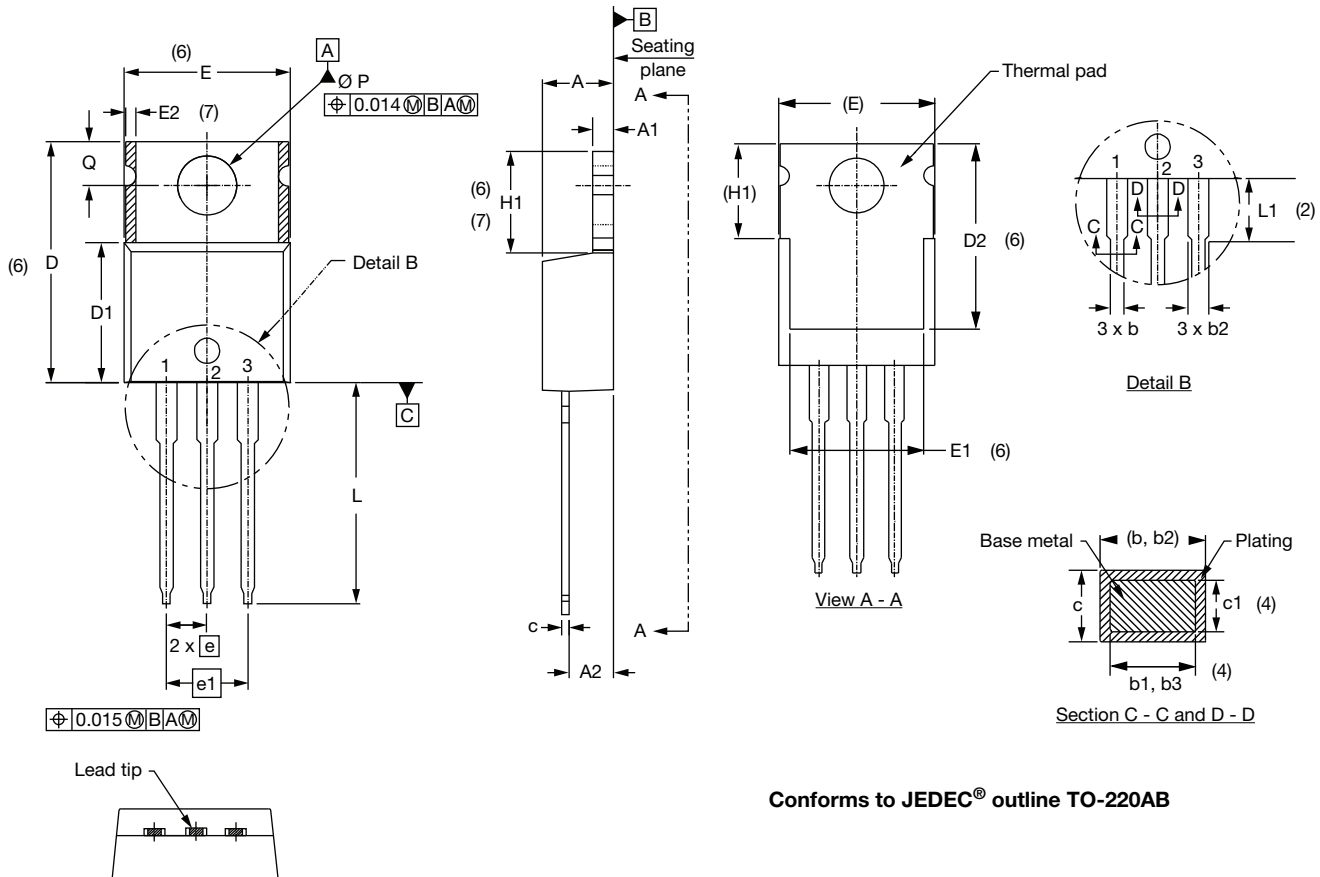
- 1** - Vishay Semiconductors product
- 2** - Current rating, RMS value
- 3** - Circuit configuration:
T = single thyristor
- 4** - Package:
T = TO-220
- 5** - Type of silicon:
S = standard recovery rectifier
- 6** - Voltage rating (12 = 1200 V)
- 7** - H = AEC-Q101 qualified
- 8** - Environmental digit:
M3 = halogen-free, RoHS-compliant, and terminations lead (Pb)-free

| ORDERING INFORMATION (Example) | | | |
|---------------------------------------|-------------------|------------------------|--------------------------|
| PREFERRED P/N | QUANTITY PER TUBE | MINIMUM ORDER QUANTITY | PACKAGING DESCRIPTION |
| VS-40TTS12HM3 | 50 | 1000 | Antistatic plastic tubes |

| LINKS TO RELATED DOCUMENTS | |
|-----------------------------------|---|
| Dimensions | www.vishay.com/doc?95222 |
| Part marking information | TO-220AB www.vishay.com/doc?95028 |

TO-220AB

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 | 12.88 | 0.460 | 0.507 | 6 |
| A1 | 1.14 | 1.40 | 0.045 | 0.055 | | E | 10.11 | 10.51 | 0.398 | 0.414 | 3, 6 |
| A2 | 2.56 | 2.92 | 0.101 | 0.115 | | E1 | 6.86 | 8.89 | 0.270 | 0.350 | 6 |
| b | 0.69 | 1.01 | 0.027 | 0.040 | | E2 | - | 0.76 | - | 0.030 | 7 |
| b1 | 0.38 | 0.97 | 0.015 | 0.038 | 4 | e | 2.41 | 2.67 | 0.095 | 0.105 | |
| b2 | 1.20 | 1.73 | 0.047 | 0.068 | | e1 | 4.88 | 5.28 | 0.192 | 0.208 | |
| b3 | 1.14 | 1.73 | 0.045 | 0.068 | 4 | H1 | 5.84 | 6.86 | 0.230 | 0.270 | 6, 7 |
| c | 0.36 | 0.61 | 0.014 | 0.024 | | L | 13.52 | 14.02 | 0.532 | 0.552 | |
| c1 | 0.36 | 0.56 | 0.014 | 0.022 | 4 | L1 | 3.32 | 3.82 | 0.131 | 0.150 | 2 |
| D | 14.85 | 15.25 | 0.585 | 0.600 | 3 | ∅ P | 3.54 | 3.73 | 0.139 | 0.147 | |
| D1 | 8.38 | 9.02 | 0.330 | 0.355 | | Q | 2.60 | 3.00 | 0.102 | 0.118 | |

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) Dimensions E2 x H1 define a zone where stamping and singulation irregularities are allowed
- (8) Outline conforms to JEDEC® TO-220, except A2 (maximum) and D2 (minimum) where dimensions are derived from the actual package outline



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