

INVERTER GRADE THYRISTORS

Stud Version

Features

- All diffused design
- Center amplifying gate
- Guaranteed high dv/dt
- Guaranteed high di/dt
- High surge current capability
- Low thermal impedance
- High speed performance

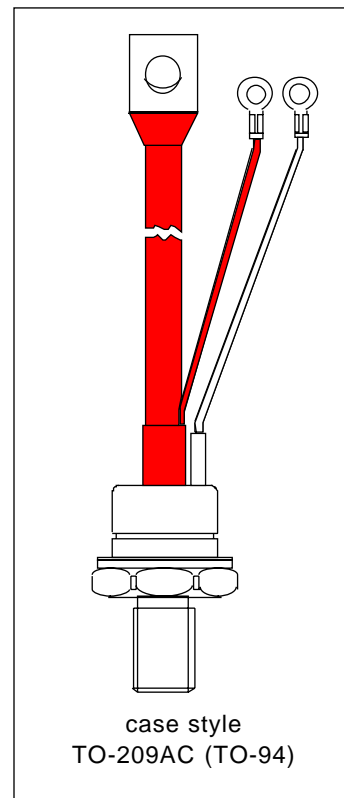
105A

Typical Applications

- Inverters
- Choppers
- Induction heating
- All types of force-commutated converters

Major Ratings and Characteristics

| Parameters | ST103S | Units |
|-------------------|-------------|-------------------|
| $I_{T(AV)}$ | 105 | A |
| @ T_C | 85 | °C |
| $I_{T(RMS)}$ | 165 | A |
| I_{TSM} @ 50Hz | 3000 | A |
| @ 60Hz | 3150 | A |
| I^2t @ 50Hz | 45 | KA ² s |
| @ 60Hz | 41 | KA ² s |
| V_{DRM}/V_{RRM} | 400 to 800 | V |
| t_q range | 10 to 25 | μs |
| T_J | - 40 to 125 | °C |



ST103S Series

Bulletin I25183 rev. B 03/94

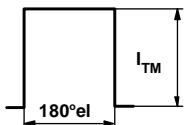
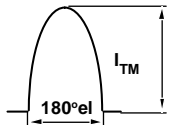
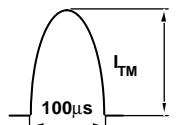
International
 TOR Rectifier

ELECTRICAL SPECIFICATIONS

Voltage Ratings

| Type number | Voltage Code | V_{DRM}/V_{RRM} , maximum repetitive peak voltage V | V_{RSM} , maximum non-repetitive peak voltage V | I_{DRM}/I_{RRM} max. @ $T_J = T_J$ max. mA |
|-------------|--------------|--|--|--|
| ST103S | 04 | 400 | 500 | 30 |
| | 08 | 800 | 900 | |

Current Carrying Capability

| Frequency |  | |  | |  | | Units |
|----------------------------------|---|----------|---|----------|---|----------|-------|
| | I_{TM} | I_{TM} | I_{TM} | I_{TM} | I_{TM} | I_{TM} | |
| 50Hz | 280 | 180 | 440 | 330 | 4730 | 3630 | A |
| 400Hz | 310 | 200 | 470 | 300 | 2500 | 1850 | |
| 1000Hz | 320 | 200 | 480 | 310 | 1530 | 1090 | |
| 2500Hz | 340 | 210 | 490 | 320 | 840 | 580 | |
| Recovery voltage Vr | 50 | 50 | 50 | 50 | 50 | 50 | V |
| Voltage before turn-on Vd | V_{DRM} | | V_{DRM} | | V_{DRM} | | |
| Rise of on-state current di/dt | 50 | 50 | - | - | - | - | A/µs |
| Case temperature | 60 | 85 | 60 | 85 | 60 | 85 | °C |
| Equivalent values for RC circuit | 22Ω / 0.15µF | | 22Ω / 0.15µF | | 22Ω / 0.15µF | | |

On-state Conduction

| Parameter | ST103S | Units | Conditions | | |
|---|--------|--------------------|--|-----------------------|-----------------------|
| $I_{T(AV)}$ Max. average on-state current @ Case temperature | 105 | A | 180° conduction, half sine wave | | |
| | 85 | °C | | | |
| $I_{T(RMS)}$ Max. RMS on-state current | 165 | A | DC @ 76°C case temperature | | |
| I_{TSM} Max. peak, one half cycle, non-repetitive surge current | 3000 | | t = 10ms | No voltage reappplied | |
| | 3150 | | t = 8.3ms | reappplied | |
| | 2530 | | t = 10ms | 100% V_{RRM} | |
| | 2650 | | t = 8.3ms | reappplied | |
| I^2t Maximum I^2t for fusing | 45 | | KA ² s | t = 10ms | No voltage reappplied |
| | 41 | | | t = 8.3ms | reappplied |
| | 32 | | | t = 10ms | 100% V_{RRM} |
| | 29 | t = 8.3ms | | reappplied | |
| $I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing | 450 | KA ² √s | t = 0.1 to 10ms, no voltage reappplied | | |

On-state Conduction

| Parameter | ST103S | Units | Conditions |
|---|--------|------------|--|
| V_{TM} Max. peak on-state voltage | 1.73 | V | $I_{TM} = 300A, T_J = T_J \text{ max}, t_p = 10\text{ms sine wave pulse}$ |
| $V_{T(TO)1}$ Low level value of threshold voltage | 1.32 | | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}, T_J = T_J \text{ max.}$ |
| $V_{T(TO)2}$ High level value of threshold voltage | 1.35 | | $(I > \pi \times I_{T(AV)}, T_J = T_J \text{ max.}$ |
| r_{t1} Low level value of forward slope resistance | 1.40 | m Ω | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)}, T_J = T_J \text{ max.}$ |
| r_{t2} High level value of forward slope resistance | 1.30 | | $(I > \pi \times I_{T(AV)}, T_J = T_J \text{ max.}$ |
| I_H Maximum holding current | 600 | mA | $T_J = 25^\circ\text{C}, I_T > 30A$ |
| I_L Typical latching current | 1000 | | $T_J = 25^\circ\text{C}, V_A = 12V, R_a = 6\Omega, I_G = 1A$ |

Switching

| Parameter | ST103S | Units | Conditions |
|---|------------------|------------------|---|
| di/dt Max. non-repetitive rate of rise of turned-on current | 1000 | A/ μs | $T_J = T_J \text{ max}, V_{DRM} = \text{rated } V_{DRM}$ $I_{TM} = 2 \times \text{di/dt}$ |
| t_d Typical delay time | 0.80 | μs | $T_J = 25^\circ\text{C}, V_{DM} = \text{rated } V_{DRM}, I_{TM} = 50A \text{ DC}, t_p = 1\mu\text{s}$ Resistive load, Gate pulse: 10V, 5 Ω source |
| t_q Max. turn-off time | Min 10 Max 25 | | $T_J = T_J \text{ max}, I_{TM} = 100A, \text{commutating di/dt} = 10A/\mu\text{s}$ $V_R = 50V, t_p = 200\mu\text{s}, \text{dv/dt: see table in device code}$ |

Blocking

| Parameter | ST103S | Units | Conditions |
|--|--------|------------------|--|
| dv/dt Maximum critical rate of rise of off-state voltage | 500 | V/ μs | $T_J = T_J \text{ max.}, \text{linear to } 80\% V_{DRM}, \text{higher value available on request}$ |
| I_{RRM} I_{DRM} Max. peak reverse and off-state leakage current | 30 | mA | $T_J = T_J \text{ max}, \text{rated } V_{DRM}/V_{RRM} \text{ applied}$ |

Triggering

| Parameter | ST103S | Units | Conditions |
|---|--------|-------|--|
| P_{GM} Maximum peak gate power | 40 | W | $T_J = T_J \text{ max}, f = 50\text{Hz}, d\% = 50$ |
| $P_{G(AV)}$ Maximum average gate power | 5 | | |
| I_{GM} Max. peak positive gate current | 5 | A | $T_J = T_J \text{ max}, t_p \leq 5\text{ms}$ |
| $+V_{GM}$ Maximum peak positive gate voltage | 20 | V | $T_J = T_J \text{ max}, t_p \leq 5\text{ms}$ |
| $-V_{GM}$ Maximum peak negative gate voltage | 5 | | |
| I_{GT} Max. DC gate current required to trigger | 200 | mA | $T_J = 25^\circ\text{C}, V_A = 12V, R_a = 6\Omega$ |
| V_{GT} Max. DC gate voltage required to trigger | 3 | | |
| I_{GD} Max DC gate current not to trigger | 20 | mA | $T_J = T_J \text{ max}, \text{rated } V_{DRM} \text{ applied}$ |
| V_{GD} Max. DC gate voltage not to trigger | 0.25 | | |

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Thermal and Mechanical Specifications

| Parameter | ST103S | Units | Conditions |
|---|------------------|----------------|--|
| T _J Max. junction operating temperature range | -40 to 125 | °C | |
| T _{stg} Max. storage temperature range | -40 to 150 | | |
| R _{thJC} Max. thermal resistance, junction to case | 0.195 | K/W | DC operation |
| R _{thCS} Max. thermal resistance, case to heatsink | 0.08 | | Mounting surface, smooth, flat and greased |
| T Mounting torque, ± 10% | 15.5 (137) | Nm (lbf-in) | Non lubricated threads |
| | 14 (120) | Nm (lbf-in) | Lubricated threads |
| wt Approximate weight | 130 | g | |
| Case style | TO-209AC (TO-94) | | See Outline Table |

ΔR_{thJC} Conduction

(The following table shows the increment of thermal resistance R_{thJC} when devices operate at different conduction angles than DC)

| Conduction angle | Sinusoidal conduction | Rectangular conduction | Units | Conditions |
|------------------|-----------------------|------------------------|-------|--------------------------------------|
| 180° | 0.034 | 0.025 | K/W | T _J = T _J max. |
| 120° | 0.040 | 0.042 | | |
| 90° | 0.052 | 0.056 | | |
| 60° | 0.076 | 0.079 | | |
| 30° | 0.126 | 0.127 | | |

Ordering Information Table

Device Code

| | | | | | | | | |
|----|----|---|---|----|---|---|---|---|
| ST | 10 | 3 | S | 08 | P | F | N | 0 |
| 1 | 2 | - | 3 | 4 | 5 | 6 | 7 | 8 |

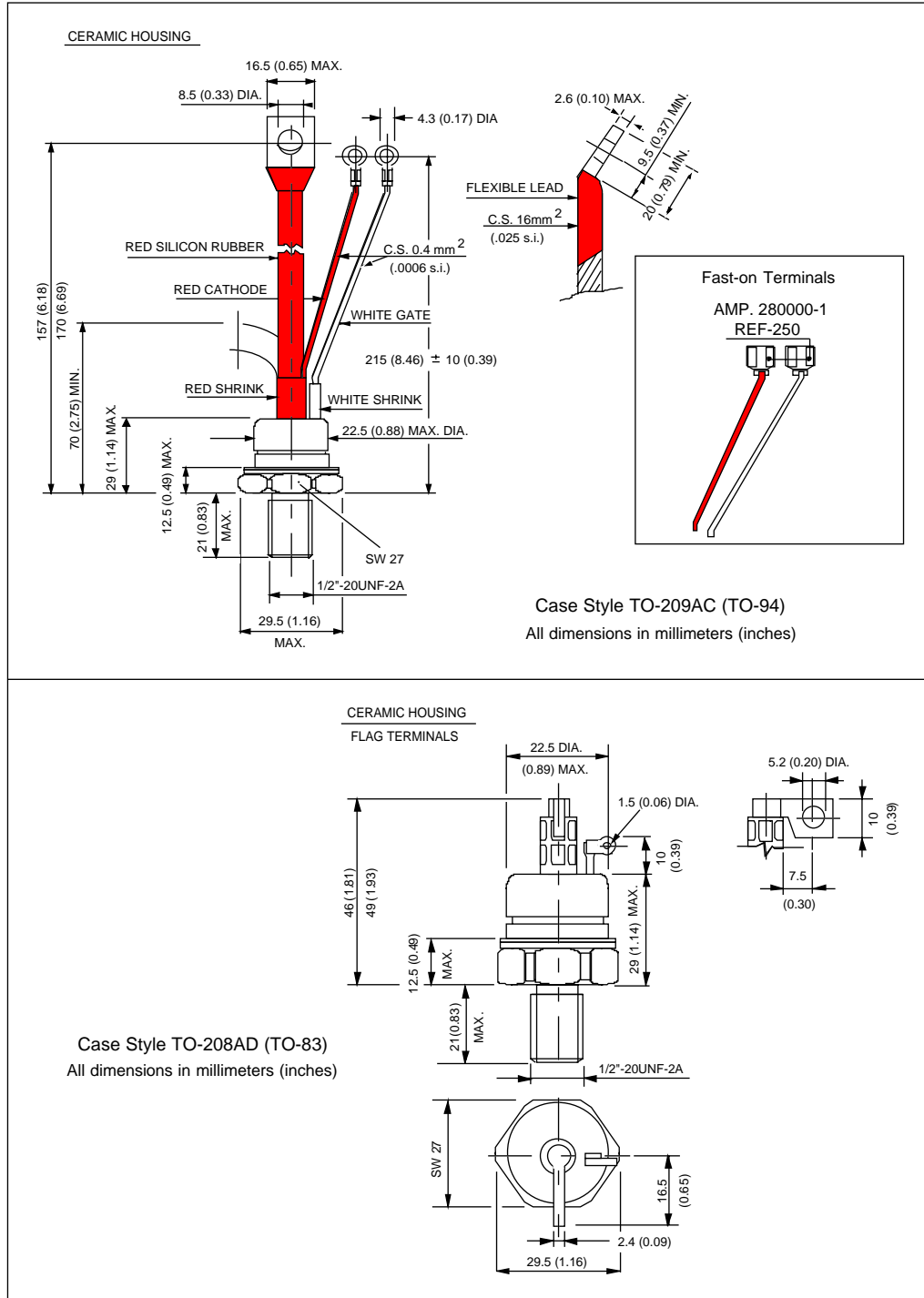
$\frac{dV}{dt}$ (See Pulse Section)
 RRM² (See Pulse Section)
 q (See Pulse Section)

-est condition)
 Eyelet terminals (Gate and Aux. Cathode Leads)
 1 = Fast-on terminals (Gate and Aux. Cathode Leads)
 2 = Flag terminals (For Cathode and Gate Terminals)
 - Critical dv/dt:
 None = 500V/μsec (Standard value)
 L = 1000V/μsec (Special selection)

| combinations available | | | | | |
|------------------------|----|----|-----|-------------|-----|
| dv/dt (V/μs) | 20 | 50 | 100 | 200 | 400 |
| 10 | CN | DN | EN | FN * | -- |
| 12 | CM | DM | EM | FM | HM |
| 15 | CL | DL | EL | FL * | HL |
| 18 | CP | DP | EP | FP | HP |
| 20 | CK | DK | EK | FK | HK |
| 25 | -- | -- | -- | -- | HJ |

*Standard part number.
 All other types available only on request.

Outline Table



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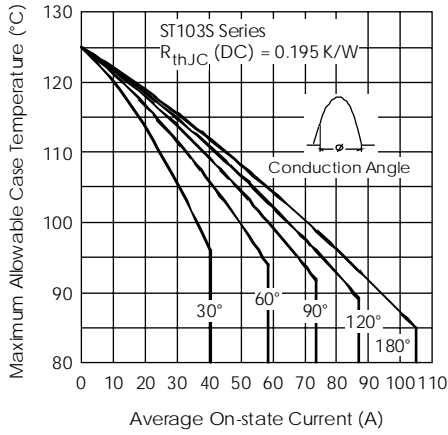


Fig. 1 - Current Ratings Characteristics

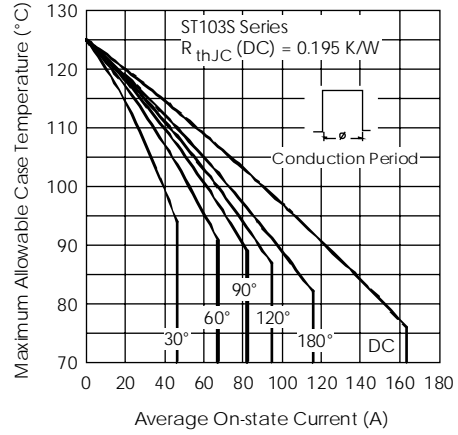


Fig. 2 - Current Ratings Characteristics

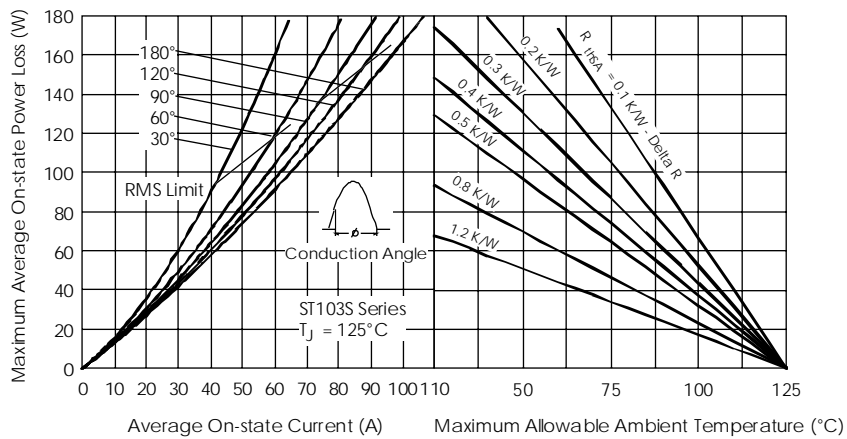


Fig. 3 - On-state Power Loss Characteristics

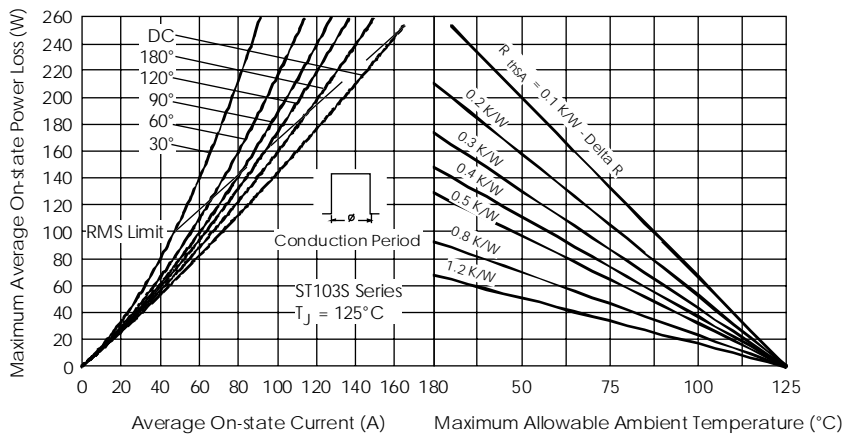


Fig. 4 - On-state Power Loss Characteristics

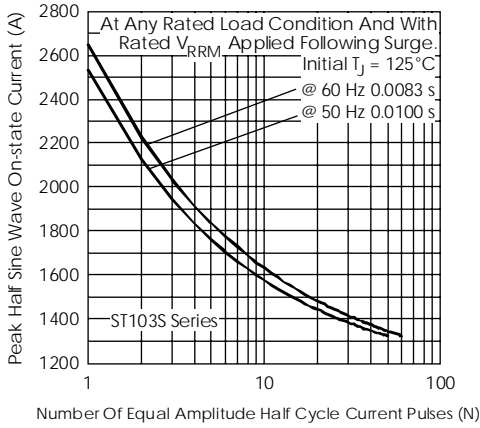


Fig. 5 - Maximum Non-repetitive Surge Current

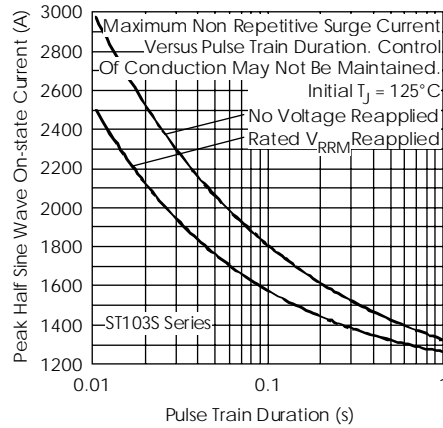


Fig. 6 - Maximum Non-repetitive Surge Current

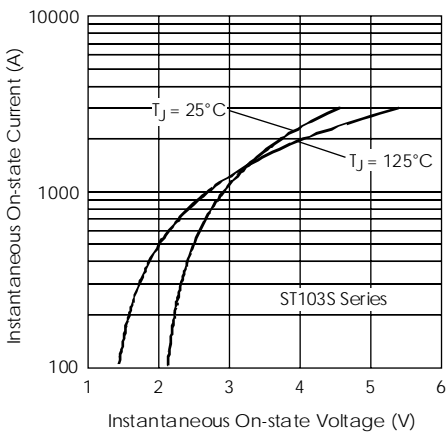


Fig. 7 - On-state Voltage Drop Characteristics

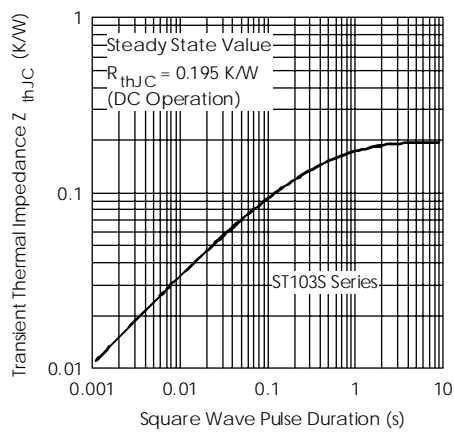


Fig. 8 - Thermal Impedance Z_{thJC} Characteristic

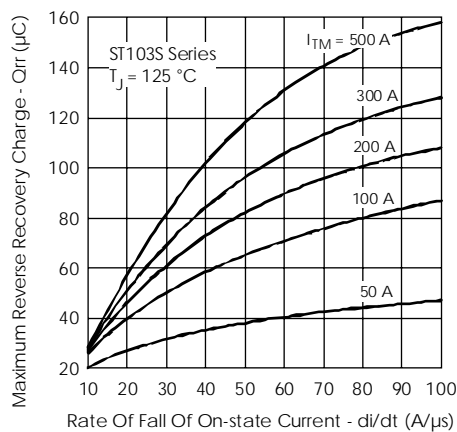


Fig. 9 - Reverse Recovered Charge Characteristics

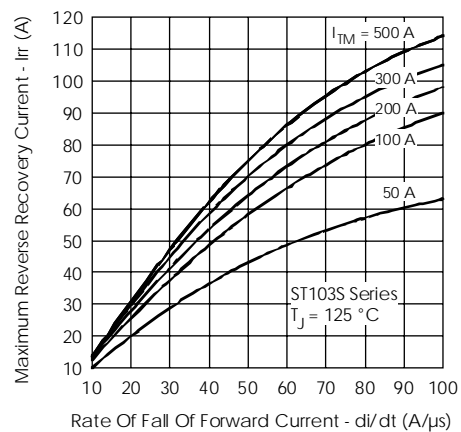
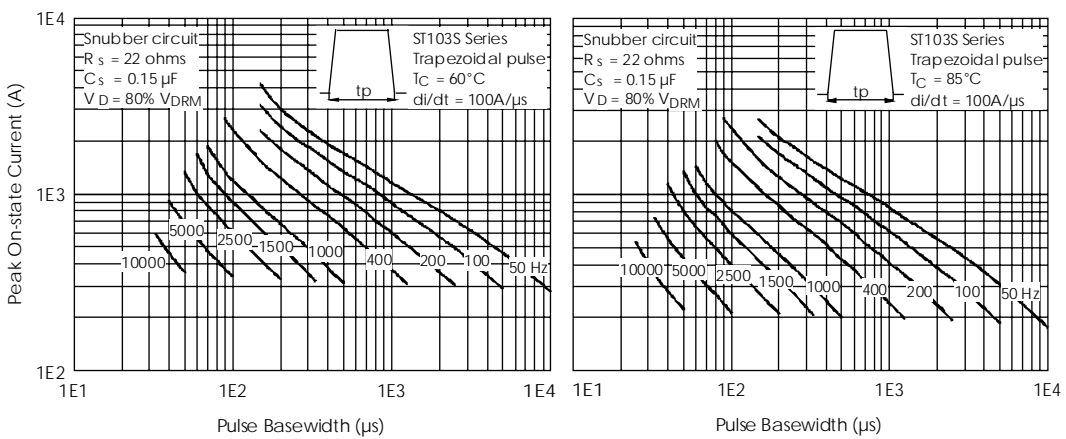
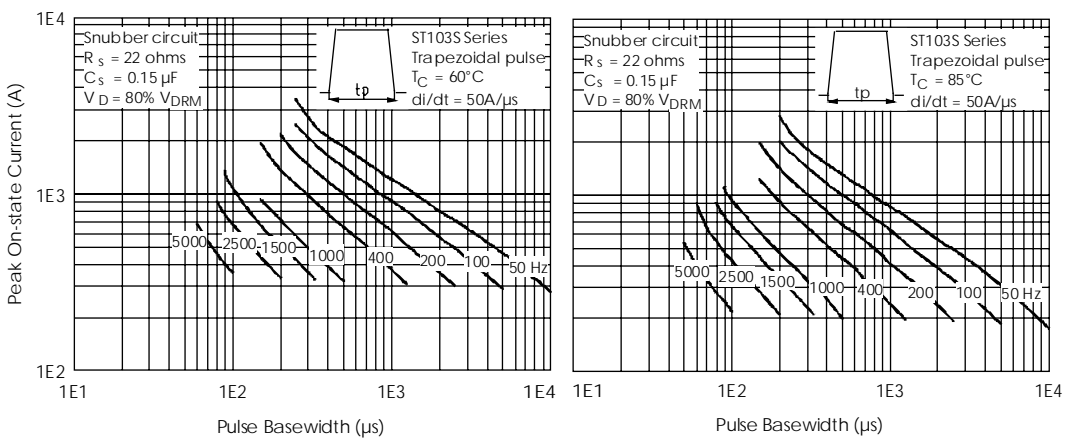
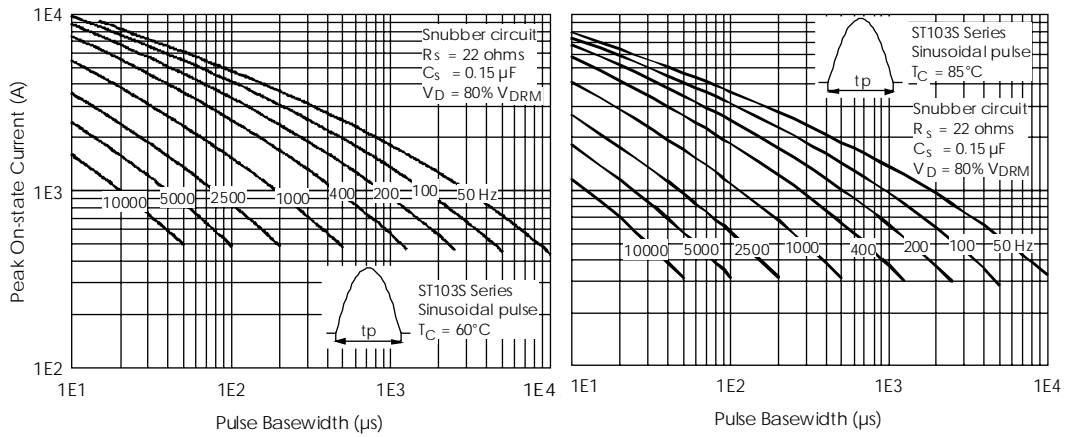


Fig. 10 - Reverse Recovery Current Characteristics

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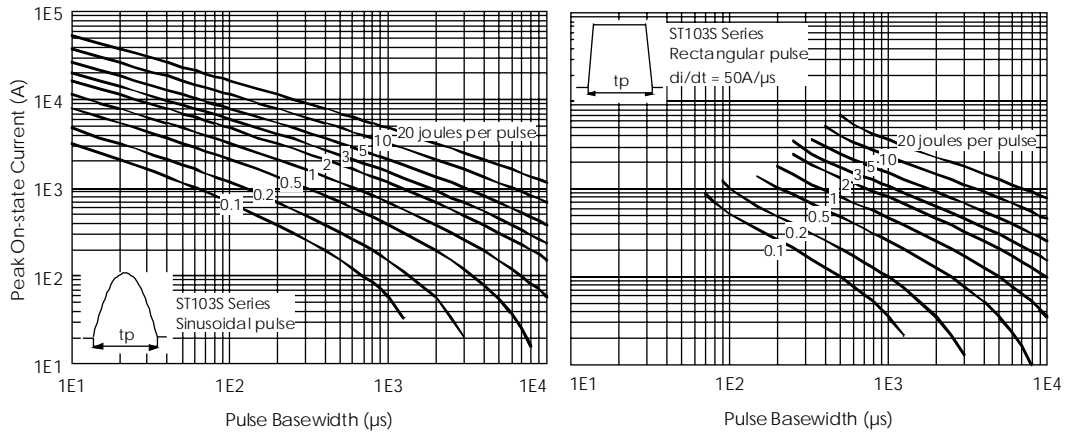


Fig. 14 - Maximum On-state Energy Power Loss Characteristics

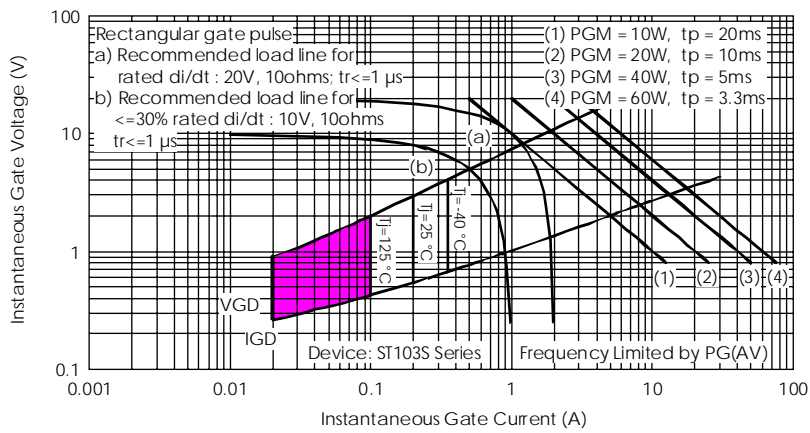


Fig. 15 - Gate Characteristics



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