

ST333C..L SERIES

INVERTER GRADE THYRISTORS

Hockey Puk Version

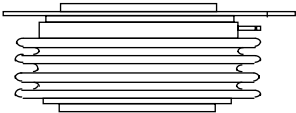
Features

- Metal case with ceramic insulator
- International standard case TO-200AC (B-PUK)
- All diffused design
- Center amplifying gate
- Guaranteed high dV/dt
- Guaranteed high dI/dt
- High surge current capability
- Low thermal impedance
- High speed performance

Typical Applications

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

620A



case style TO-200AC (B-PUK)

Major Ratings and Characteristics

| Parameters | ST333C..L | Units |
|-------------------|-----------------|-------------------|
| $I_{T(AV)}$ | 620 | A |
| $@ T_{hs}$ | 55 | °C |
| $I_{T(RMS)}$ | 1230 | A |
| $@ T_{hs}$ | 25 | °C |
| I_{TSM} | @ 50Hz 11000 | A |
| | @ 60Hz 11500 | A |
| I^2t | @ 50Hz 605 | KA ² s |
| | @ 60Hz 553 | KA ² s |
| V_{DRM}/V_{RRM} | 400 to 800 | V |
| $t_{q range}$ | 10 to 30 | μs |
| T_J | - 40 to 125 | °C |

ST333C..L Series

Bulletin I25187 rev.B 04/00

International
IR 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 |
|-------------|--------------|--|--|--|
| ST333C..L | 04 | 400 | 500 | 50 |
| | 08 | 800 | 900 | |

Current Carrying Capability

| Frequency | | | | | | | Units |
|----------------------------------|--------------|------|--------------|------|--------------|------|-------|
| 50Hz | 1430 | 1250 | 2340 | 1940 | 6310 | 5620 | A |
| 400Hz | 1670 | 1170 | 2310 | 2010 | 3440 | 5030 | |
| 1000Hz | 1080 | 880 | 2090 | 1800 | 2040 | 1750 | |
| 2500Hz | 530 | 400 | 1190 | 990 | 990 | 800 | |
| 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 |
| Heatsink temperature | 40 | 55 | 40 | 55 | 40 | 55 | °C |
| Equivalent values for RC circuit | 10Ω / 0.47µF | | 10Ω / 0.47µF | | 10Ω / 0.47µF | | |

On-state Conduction

| Parameter | ST333C..L | Units | Conditions |
|---|----------------------|---------|---|
| $I_{T(AV)}$ Max. average on-state current @ Heatsink temperature | 620 (305) 55 (75) | A °C | 180° conduction, half sine wave double side (single side) cooled |
| $I_{T(RMS)}$ Max. RMS on-state current | 1230 | A | DC @ 25°C heatsink temperature double side cooled |
| I_{TSM} Max. peak, one half cycle, non-repetitive surge current | 11000 | | t = 10ms No voltage |
| | 11500 | | t = 8.3ms reappplied |
| | 9250 | | t = 10ms 100% V_{RRM} |
| | 9700 | | t = 8.3ms reappplied |
| I^2t Maximum I^2t for fusing | 605 | KA²s | t = 10ms No voltage |
| | 553 | | t = 8.3ms reappplied |
| | 428 | | t = 10ms 100% V_{RRM} |
| | 391 | | t = 8.3ms reappplied |
| $I^2\sqrt{t}$ Maximum $I^2\sqrt{t}$ for fusing | 6050 | KA²√s | t = 0.1 to 10ms, no voltage reappplied |

On-state Conduction

| Parameter | ST333C..L | Units | Conditions |
|---|-----------|-------|---|
| V_{TM} Max. peak on-state voltage | 1.96 | V | $I_{TM} = 1810A$, $T_J = T_J \text{ max}$, $t_p = 10\text{ms}$ sine wave pulse |
| $V_{T(TO)1}$ Low level value of threshold voltage | 0.91 | | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J \text{ max}$. |
| $V_{T(TO)2}$ High level value of threshold voltage | 0.93 | | $(I > \pi \times I_{T(AV)})$, $T_J = T_J \text{ max}$. |
| r_{t1} Low level value of forward slope resistance | 0.58 | mΩ | $(16.7\% \times \pi \times I_{T(AV)} < I < \pi \times I_{T(AV)})$, $T_J = T_J \text{ max}$. |
| r_{t2} High level value of forward slope resistance | 0.58 | | $(I > \pi \times I_{T(AV)})$, $T_J = T_J \text{ max}$. |
| 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 | ST333C..L | Units | Conditions |
|---|------------------------|-------|--|
| di/dt Max. non-repetitive rate of rise of turned-on current | 1000 | A/μs | $T_J = T_J \text{ max}$, $V_{DRM} = \text{rated } V_{DRM}$ $I_{TM} = 2 \times di/dt$ |
| t_d Typical delay time | 1.1 | 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, 5Ω source |
| t_q Max. turn-off time | Min 10 Max 30 | | $T_J = T_J \text{ max}$, $I_{TM} = 550A$, commutating $di/dt = 40A/\mu\text{s}$ $V_R = 50V$, $t_p = 500\mu\text{s}$, dv/dt : see table in device code |

Blocking

| Parameter | ST333C..L | Units | Conditions |
|--|-----------|-------|---|
| dv/dt Maximum critical rate of rise of off-state voltage | 500 | V/μs | $T_J = T_J \text{ max}$. linear to 80% V_{DRM} , higher value available on request |
| I_{RRM} Max. peak reverse and off-state leakage current I_{DRM} | 50 | mA | $T_J = T_J \text{ max}$, rated V_{DRM}/V_{RRM} applied |

Triggering

| Parameter | ST333C..L | Units | Conditions |
|---|-----------|-------|--|
| P_{GM} Maximum peak gate power | 60 | W | $T_J = T_J \text{ max}$, $f = 50\text{Hz}$, $d\% = 50$ |
| $P_{G(AV)}$ Maximum average gate power | 10 | | |
| I_{GM} Max. peak positive gate current | 10 | 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 | V | |
| I_{GD} Max. DC gate current not to trigger | 20 | mA | $T_J = T_J \text{ max}$, rated V_{DRM} applied |
| V_{GD} Max. DC gate voltage not to trigger | 0.25 | V | |

ST333C..L Series

Bulletin I25187 rev. B 04/00

International
IOR Rectifier

Thermal and Mechanical Specification

| Parameter | ST333C..L | Units | Conditions |
|---|--------------------|-----------|--|
| T _J Max. operating temperature range | -40 to 125 | °C | |
| T _{stg} Max. storage temperature range | -40 to 150 | | |
| R _{thJ-hs} Max. thermal resistance, junction to heatsink | 0.11 0.05 | K/W | DC operation single side cooled DC operation double side cooled |
| R _{thC-hs} Max. thermal resistance, case to heatsink | 0.011 0.005 | K/W | DC operation single side cooled DC operation double side cooled |
| F Mounting force, ± 10% | 9800 (1000) | N (Kg) | |
| wt Approximate weight | 250 | g | |
| Case style | TO - 200AC (B-PUK) | | See Outline Table |

ΔR_{thJ-hs} Conduction

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

| Conduction angle | Sinusoidal conduction | | Rectangular conduction | | Units | Conditions |
|------------------|-----------------------|-------------|------------------------|-------------|-------|--------------------------------------|
| | Single Side | Double Side | Single Side | Double Side | | |
| 180° | 0.012 | 0.010 | 0.008 | 0.008 | K/W | T _J = T _J max. |
| 120° | 0.014 | 0.015 | 0.014 | 0.014 | | |
| 90° | 0.018 | 0.018 | 0.019 | 0.019 | | |
| 60° | 0.026 | 0.027 | 0.027 | 0.028 | | |
| 30° | 0.045 | 0.046 | 0.046 | 0.046 | | |

Ordering Information Table

| | | | | | | | | | |
|---|--|--|--|--|--|--|--|--|--|
| Device Code <div style="display: flex; align-items: center; margin-top: 10px;"> <div style="background-color: black; color: white; padding: 5px 10px; margin-right: 5px;">ST</div> <div style="background-color: black; color: white; padding: 5px 10px; margin-right: 5px;">33</div> <div style="background-color: black; color: white; padding: 5px 10px; margin-right: 5px;">3</div> <div style="background-color: black; color: white; padding: 5px 10px; margin-right: 5px;">C</div> <div style="background-color: black; color: white; padding: 5px 10px; margin-right: 5px;">08</div> <div style="background-color: black; color: white; padding: 5px 10px; margin-right: 5px;">L</div> <div style="background-color: black; color: white; padding: 5px 10px; margin-right: 5px;">H</div> <div style="background-color: black; color: white; padding: 5px 10px; margin-right: 5px;">K</div> <div style="background-color: black; color: white; padding: 5px 10px; margin-right: 5px;">1</div> <div style="background-color: black; color: white; padding: 5px 10px; margin-right: 5px;"></div> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> 12345678910 </div> | | | | | | | | | |
| 1 - Thyristor | | | | | | | | | |
| 2 - Essential part number | | | | | | | | | |
| 3 - 3 = Fast turn off | | | | | | | | | |
| 4 - C = Ceramic Puk | | | | | | | | | |
| 5 - Voltage code: Code x 100 = V _{RRM} (See Voltage Rating Table) | | | | | | | | | |
| 6 - L = Puk Case TO-200AC (B-PUK) | | | | | | | | | |
| 7 - Reapplied dv/dt code (for t _q test condition) | | | | | | | | | |
| 8 - t _q code | | | | | | | | | |
| 9 - 0 = Eyelet term. (Gate and Aux. Cathode Unsoldered Leads) | | | | | | | | | |
| 1 = Fast-on term. (Gate and Aux. Cathode Unsoldered Leads) | | | | | | | | | |
| 2 = Eyelet term. (Gate and Aux. Cathode Soldered Leads) | | | | | | | | | |
| 3 = Fast-on term. (Gate and Aux. Cathode Soldered Leads) | | | | | | | | | |
| 10 - Critical dv/dt: | | | | | | | | | |
| None = 500V/μsec (Standard value) | | | | | | | | | |
| L = 1000V/μsec (Special selection) | | | | | | | | | |

| dv/dt - t _q combinations available | | | | | |
|---|----|----|-----|-------------|-----|
| dv/dt (V/μs) | 20 | 50 | 100 | 200 | 400 |
| 10 | CN | DN | EN | -- | -- |
| 12 | CM | DM | EM | FM * | -- |
| 15 | CL | DL | EL | FL * | HL |
| 18 | CP | DP | EP | FP | HP |
| 20 | CK | DK | EK | FK | HK |
| 25 | -- | -- | -- | FJ | HJ |
| 30 | -- | -- | -- | -- | HH |

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

Outline Table

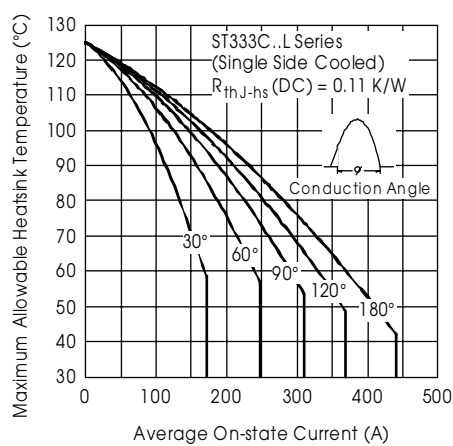
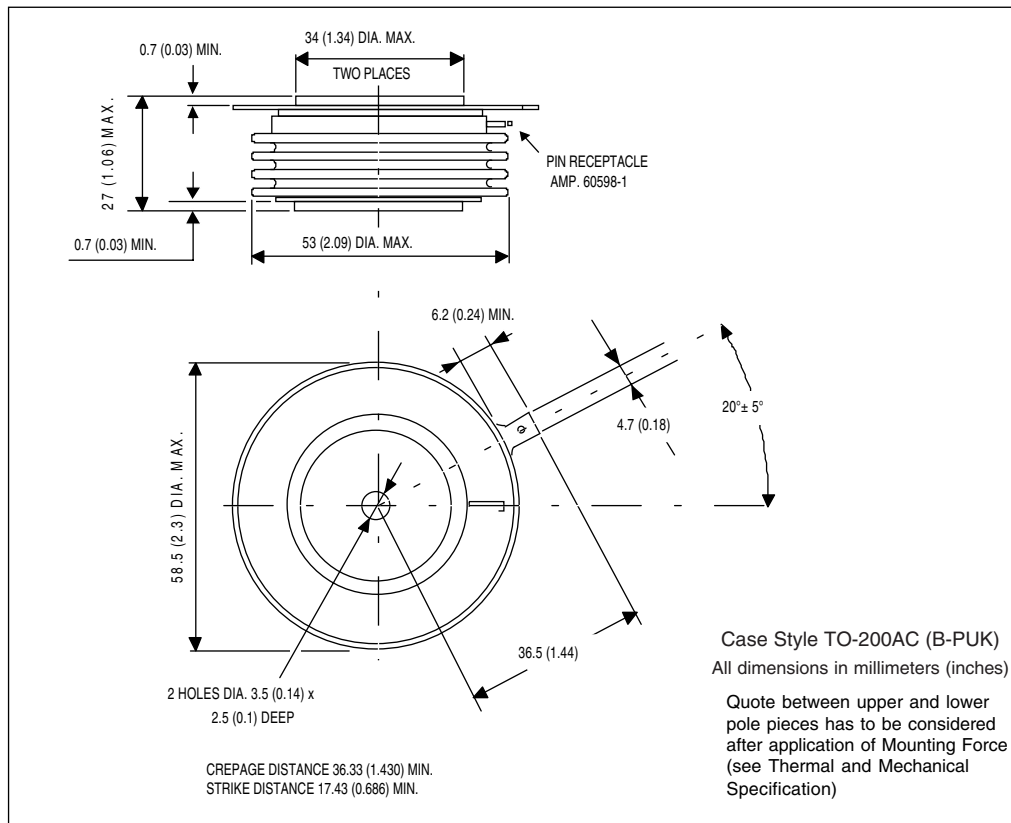


Fig. 1 - Current Ratings Characteristics

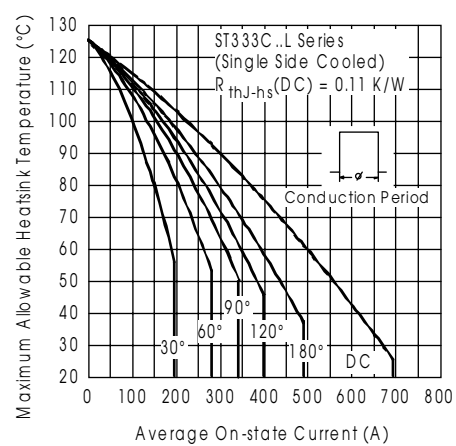


Fig. 2 - Current Ratings Characteristics

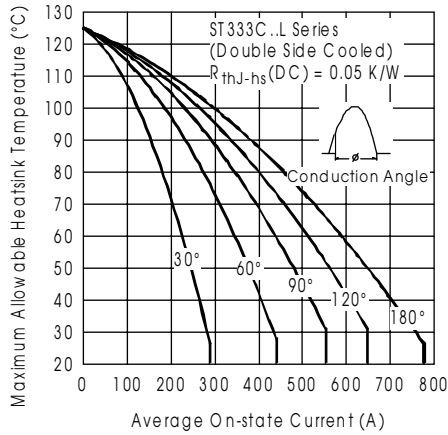


Fig. 3 - Current Ratings Characteristics

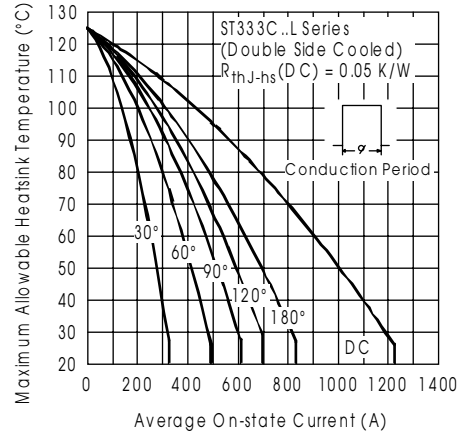


Fig. 4 - Current Ratings Characteristics

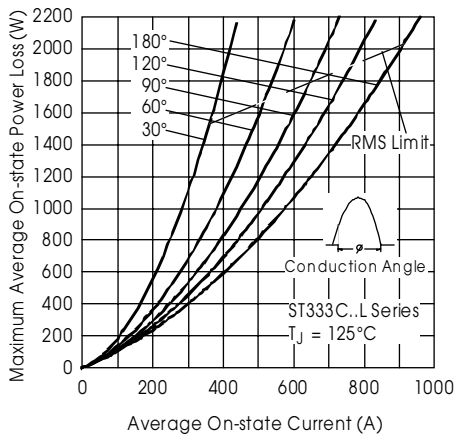


Fig. 5 - On-state Power Loss Characteristics

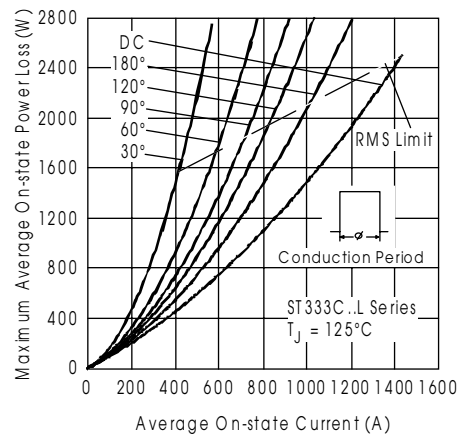


Fig. 6 - On-state Power Loss Characteristics

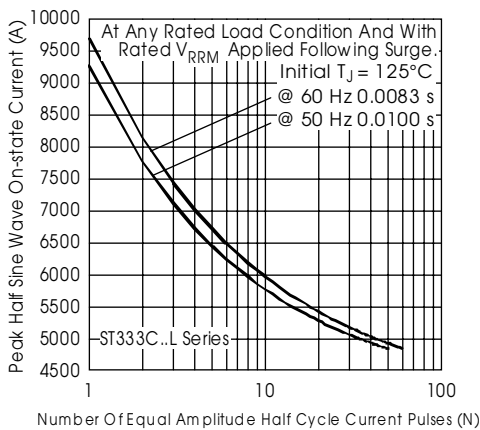


Fig. 7 - Maximum Non-repetitive Surge Current
Single and Double Side Cooled

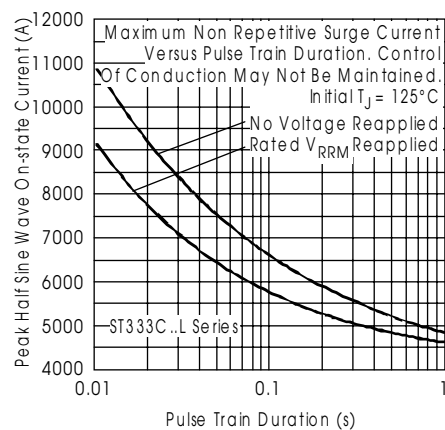


Fig. 8 - Maximum Non-repetitive Surge Current
Single and Double Side Cooled

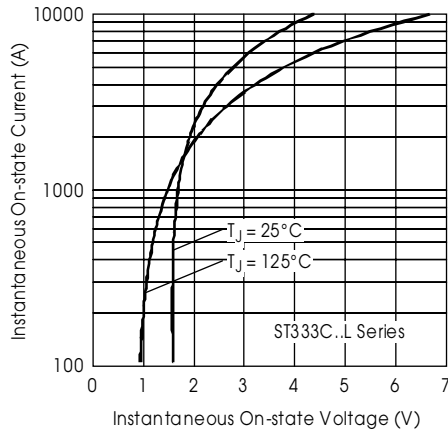


Fig. 9 - On-state Voltage Drop Characteristics

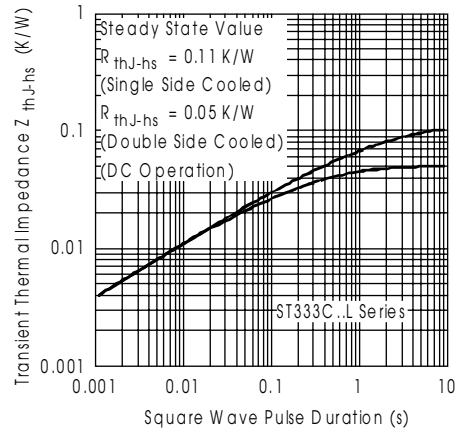


Fig. 10 - Thermal Impedance Z_{thJ-hs} Characteristics

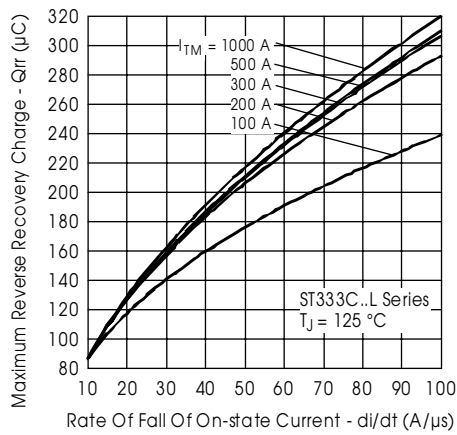


Fig. 11 - Reverse Recovered Charge Characteristics

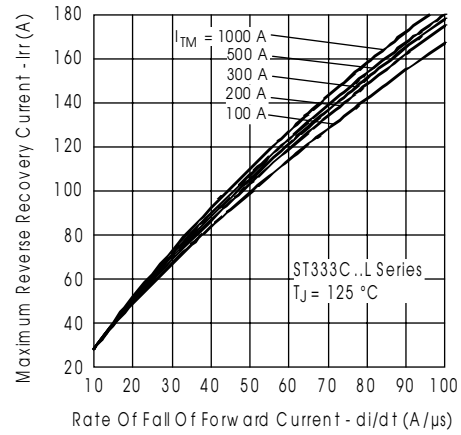


Fig. 12 - Reverse Recovery Current Characteristics

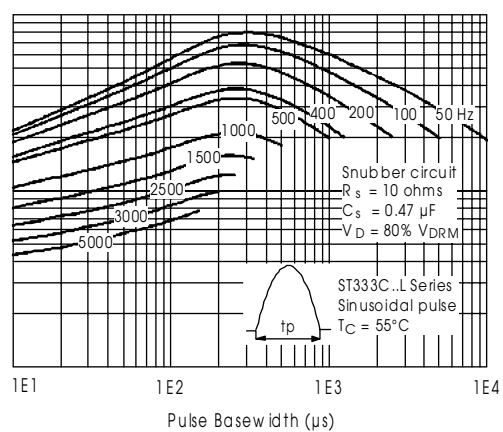
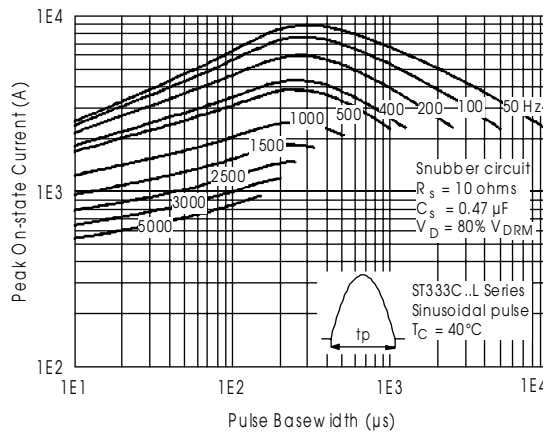


Fig. 13 - Frequency Characteristics

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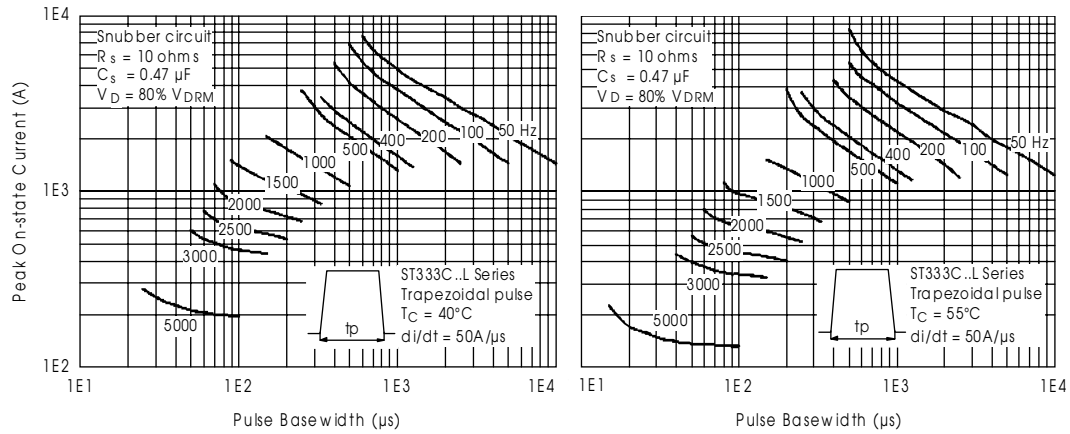


Fig. 14 - Frequency Characteristics

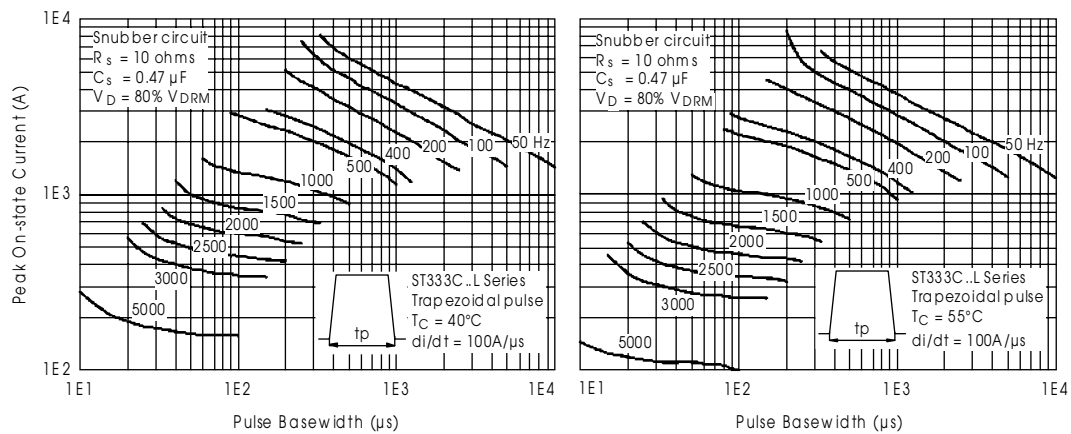


Fig. 15 - Frequency Characteristics

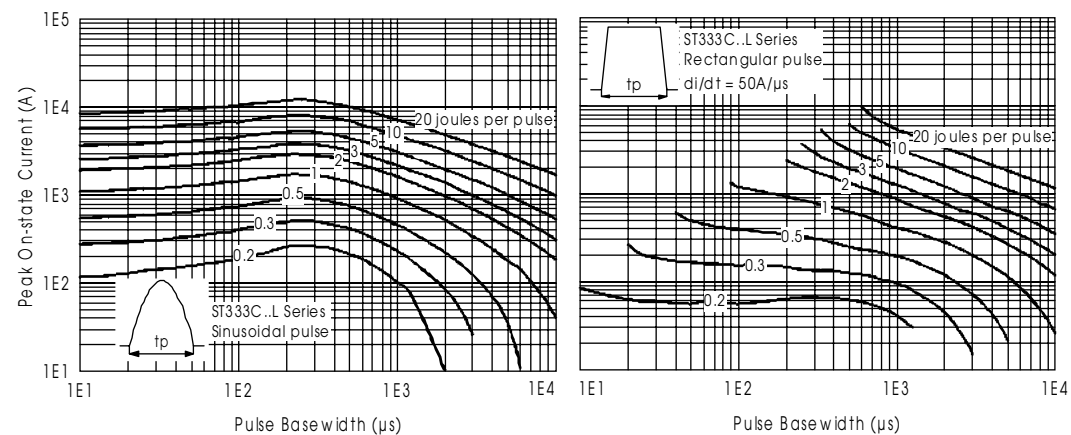


Fig. 16 - Maximum On-state Energy Power Loss Characteristics

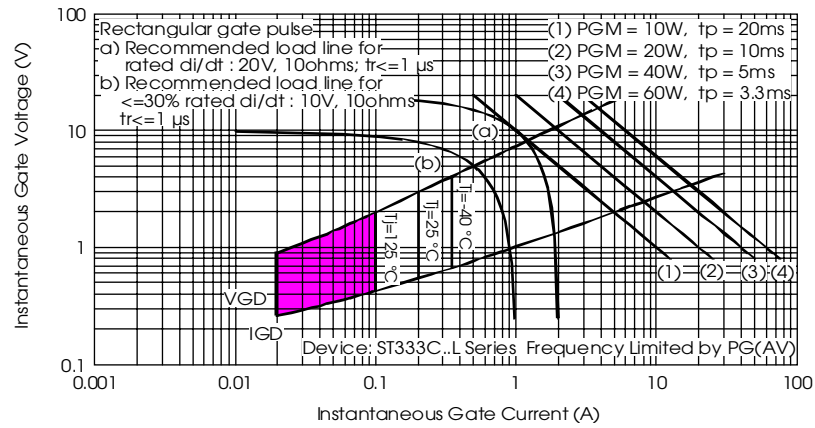


Fig. 17 - Gate Characteristics