

Phase Control Thyristor Types N0676YS120 to N0676YS180

Absolute Maximum Ratings

| | VOLTAGE RATINGS | MAXIMUM LIMITS | UNITS |
|-----------|---|----------------|-------|
| V_{DRM} | Repetitive peak off-state voltage, (note 1) | 1200-1800 | V |
| V_{DSM} | Non-repetitive peak off-state voltage, (note 1) | 1200-1800 | V |
| V_{RRM} | Repetitive peak reverse voltage, (note 1) | 1200-1800 | V |
| V_{RSM} | Non-repetitive peak reverse voltage, (note 1) | 1300-1900 | V |

| | OTHER RATINGS | MAXIMUM LIMITS | UNITS |
|---------------|--|------------------|-------------|
| $I_{T(AV)}$ | Mean on-state current, $T_{sink}=55^{\circ}C$, (note 2) | 676 | A |
| $I_{T(AV)}$ | Mean on-state current. $T_{sink}=85^{\circ}C$, (note 2) | 456 | A |
| $I_{T(AV)}$ | Mean on-state current. $T_{sink}=85^{\circ}C$, (note 3) | 270 | A |
| $I_{T(RMS)}$ | Nominal RMS on-state current, $25^{\circ}C$, (note 2) | 1346 | A |
| $I_{T(d.c.)}$ | D.C. on-state current, $25^{\circ}C$, (note 4) | 1138 | A |
| I_{TSM} | Peak non-repetitive surge $t_p=10ms$, $V_{RM}=0.6V_{RRM}$, (note 5) | 7500 | A |
| I_{TSM2} | Peak non-repetitive surge $t_p=10ms$, $V_{RM}\leq 10V$, (note 5) | 8300 | A |
| I^2t | I^2t capacity for fusing $t_p=10ms$, $V_{RM}=0.6V_{RRM}$, (note 5) | 281×10^3 | A^2s |
| I^2t | I^2t capacity for fusing $t_p=10ms$, $V_{RM}\leq 10V$, (note 5) | 345×10^3 | A^2s |
| di_T/dt | Maximum rate of rise of on-state current (repetitive), (Note 6) | 500 | $A/\mu s$ |
| | Maximum rate of rise of on-state current (non-repetitive), (Note 6) | 1000 | $A/\mu s$ |
| V_{RGM} | Peak reverse gate voltage | 5 | V |
| $P_{G(AV)}$ | Mean forward gate power | 2 | W |
| P_{GM} | Peak forward gate power | 30 | W |
| V_{GD} | Non-trigger gate voltage, (Note 7) | 0.25 | V |
| T_{HS} | Operating temperature range | -40 to +125 | $^{\circ}C$ |
| T_{stg} | Storage temperature range | -40 to +150 | $^{\circ}C$ |

Notes:-

- 1) De-rating factor of 0.13% per $^{\circ}C$ is applicable for T_j below $25^{\circ}C$.
- 2) Double side cooled, single phase; 50Hz, 180° half-sinewave.
- 3) Single side cooled, single phase; 50Hz, 180° half-sinewave.
- 4) Double side cooled.
- 5) Half-sinewave, $125^{\circ}C$ T_j initial.
- 6) $V_D=67\% V_{DRM}$, $I_{TM}=1000A$, $I_{FG}=2A$, $t_r\leq 0.5\mu s$, $T_{case}=125^{\circ}C$.
- 7) Rated V_{DRM} .

Characteristics

| | PARAMETER | MIN. | TYP. | MAX. | TEST CONDITIONS (Note 1) | UNITS |
|------------|--|------|------|-------|---|------------|
| V_{TM} | Maximum peak on-state voltage | - | - | 2.0 | $I_{TM}=1550A$ | V |
| V_0 | Threshold voltage | - | - | 1.09 | | V |
| r_s | Slope resistance | - | - | 0.587 | | m Ω |
| dv/dt | Critical rate of rise of off-state voltage | 1000 | - | - | $V_D=80\% V_{DRM}$ | V/ μ s |
| I_{DRM} | Peak off-state current | - | - | 40 | Rated V_{DRM} | mA |
| I_{RRM} | Peak reverse current | - | - | 40 | Rated V_{RRM} | mA |
| V_{GT} | Gate trigger voltage | - | - | 3.0 | $T_j=25^\circ C$ | V |
| I_{GT} | Gate trigger current | - | - | 150 | $T_j=25^\circ C$. $V_D=10V$, $I_T=3A$ | mA |
| I_H | Holding current | - | - | 500 | $T_j=25^\circ C$ | mA |
| R_θ | Thermal resistance, junction to heatsink | - | - | 0.05 | Double side cooled | K/W |
| | | - | - | 0.1 | Single side cooled | K/W |
| F | Mounting force | 5.3 | - | 10 | | kN |
| W_t | Weight | - | 90 | - | | g |

Notes:-

1) Unless otherwise indicated $T_j=125^\circ C$.

Notes on Ratings and Characteristics

1.0 Voltage Grade Table

| Voltage Grade 'H' | V _{DRM} V _{DSM} V _{RRM} V | V _{RSM} V | V _D V _R DC V |
|-------------------|---|-----------------------|---------------------------------------|
| 12 | 1200 | 1400 | 810 |
| 14 | 1400 | 1500 | 930 |
| 16 | 1600 | 1700 | 1040 |
| 18 | 1800 | 1900 | 1150 |

2.0 Extension of Voltage Grades

This report is applicable to other and higher voltage grades when supply has been agreed by Sales/Production.

3.0 De-rating Factor

A blocking voltage de-rating factor of 0.13%/°C is applicable to this device for T_j below 25°C.

4.0 Repetitive dv/dt

Standard dv/dt is 1000V/μs.

5.0 Computer Modelling Parameters

5.1 Device Dissipation Calculations

$$I_{AV} = \frac{-V_0 + \sqrt{V_0^2 + 4 \cdot ff^2 \cdot r_s \cdot W_{AV}}}{2 \cdot ff^2 \cdot r_s} \quad \text{and:} \quad W_{AV} = \frac{\Delta T}{R_{th}}$$

$$\Delta T = T_{j\max} - T_{Hs}$$

Where V₀=1.09V, r_s=0.587mΩ,

R_{th} = Supplementary thermal impedance, see table below.

ff = Form factor, see table below.

| Supplementary Thermal Impedance | | | | | | | |
|---------------------------------|-------|-------|--------|--------|--------|-------|------|
| Conduction Angle | 30° | 60° | 90° | 120° | 180° | 270° | d.c. |
| Square wave Double Side Cooled | 0.071 | 0.069 | 0.065 | 0.061 | 0.057 | 0.053 | 0.05 |
| Square wave Single Side Cooled | 0.12 | 0.119 | 0.115 | 0.111 | 0.107 | 0.103 | 0.1 |
| Sine wave Double Side Cooled | 0.053 | 0.052 | 0.0516 | 0.0513 | 0.0505 | | |
| Sine wave Single Side Cooled | 0.103 | 0.102 | 0.1017 | 0.1013 | 0.1005 | | |

| Form Factors | | | | | | | |
|------------------|------|------|------|------|------|------|------|
| Conduction Angle | 30° | 60° | 90° | 120° | 180° | 270° | d.c. |
| Square wave | 3.46 | 2.45 | 2 | 1.73 | 1.41 | 1.15 | 1 |
| Sine wave | 3.98 | 2.78 | 2.22 | 1.88 | 1.57 | | |

5.2 Calculating V_T using ABCD Coefficients

The on-state characteristic I_T vs. V_T , on page 7 is represented in two ways;

- (i) the well established V_o and r_s tangent used for rating purposes and
- (ii) a set of constants A, B, C, D, forming the coefficients of the representative equation for V_T in terms of I_T given below:

$$V_T = A + B \cdot \ln(I_T) + C \cdot I_T + D \cdot \sqrt{I_T}$$

The constants, derived by curve fitting software, are given below for both hot and cold characteristics. The resulting values for V_T agree with the true device characteristic over a current range, which is limited to that plotted.

| 25°C Coefficients | | 125°C Coefficients | |
|-------------------|--------------------------|--------------------|-------------------------|
| A | 1.175567 | A | 1.0538816 |
| B | -0.0883931 | B | -0.1096815 |
| C | 2.17593×10^{-4} | C | 2.5239×10^{-4} |
| D | 0.02521394 | D | 0.03456018 |

5.3 D.C. Thermal Impedance Calculation

$$r_t = \sum_{p=1}^{p=n} r_p \cdot \left(1 - e^{-\frac{t}{\tau_p}} \right)$$

Where $p = 1$ to n , n is the number of terms in the series and:

- t = Duration of heating pulse in seconds.
- r_t = Thermal resistance at time t .
- r_p = Amplitude of p_{th} term.
- τ_p = Time Constant of r_{th} term.

| D.C. Double Side Cooled | | | | |
|-------------------------|------------|------------|---------------------------|---------------------------|
| Term | 1 | 2 | 3 | 4 |
| r_p | 0.12000552 | 0.01609235 | 8.812673×10^{-3} | 3.659765×10^{-3} |
| τ_p | 0.3391689 | 0.09405764 | 0.12195269 | 2.196197×10^{-3} |

| D.C. Single Side Cooled | | | | | |
|-------------------------|------------|---------------------------|------------|------------|---------------------------|
| Term | 1 | 2 | 3 | 4 | 5 |
| r_p | 0.06157697 | 8.431182×10^{-3} | 0.01031315 | 0.01613806 | 5.181088×10^{-3} |
| τ_p | 2.136132 | 1.212898 | 0.1512408 | 0.04244 | 2.889595×10^{-3} |

Curves

Figure 1 - On-state current vs. Power dissipation – Double Side Cooled (Sine wave)

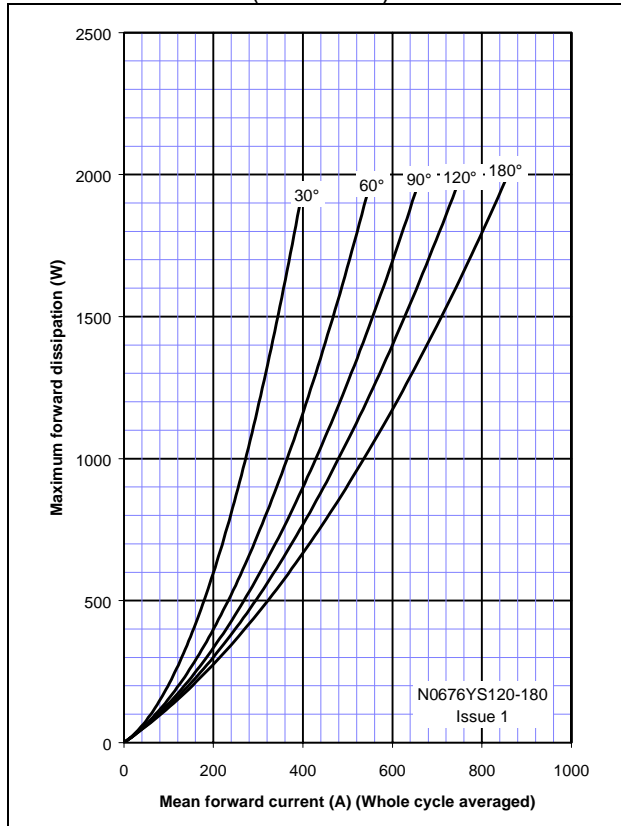


Figure 2 - On-state current vs. Heatsink temperature - Double Side Cooled (Sine wave)

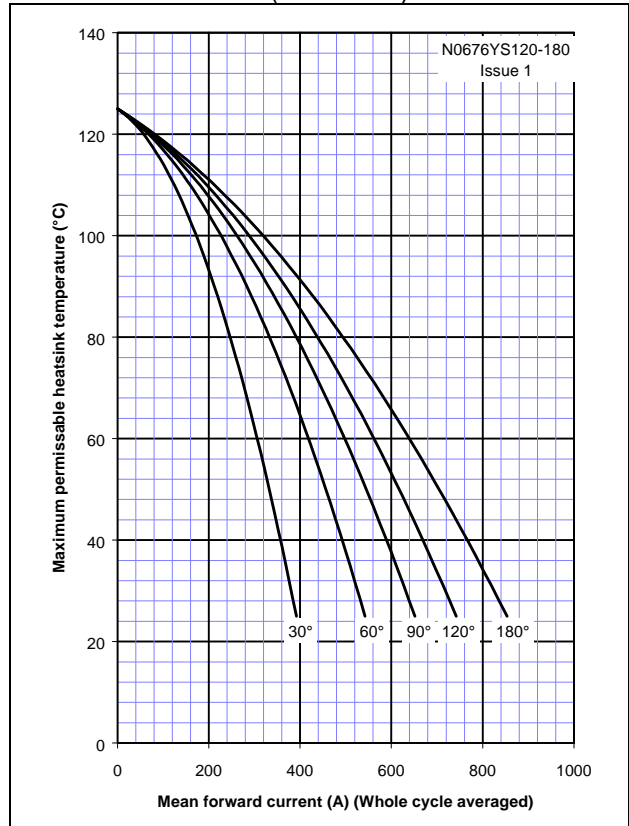


Figure 3 - On-state current vs. Power dissipation – Double Side Cooled (Square wave)

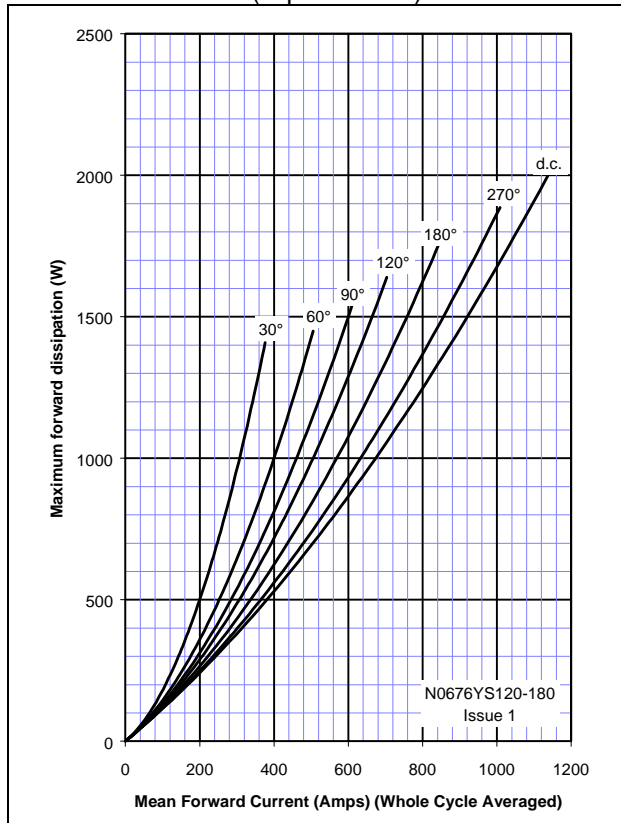


Figure 4 - On-state current vs. Heatsink temperature - Double Side Cooled (Square wave)

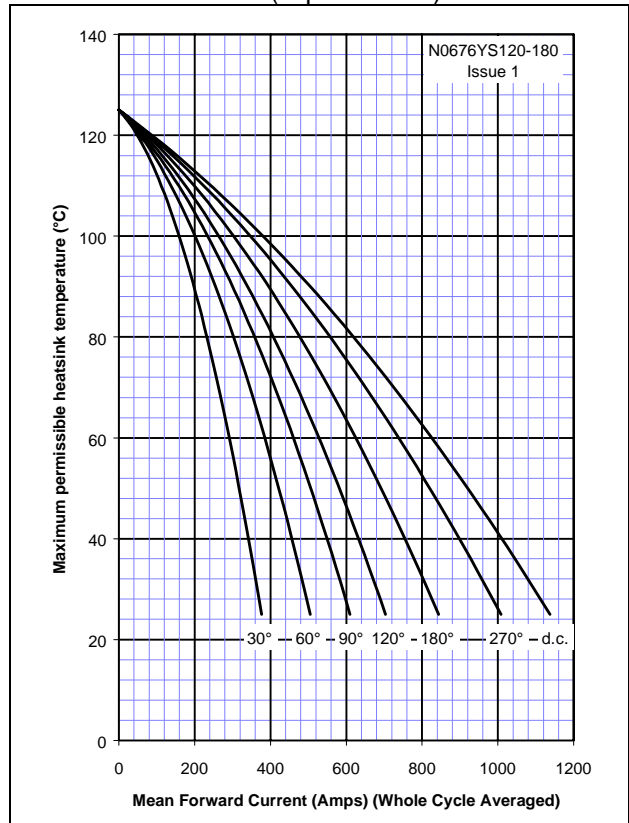


Figure 5 - On-state current vs. Power dissipation – Single Side Cooled (Sine wave)

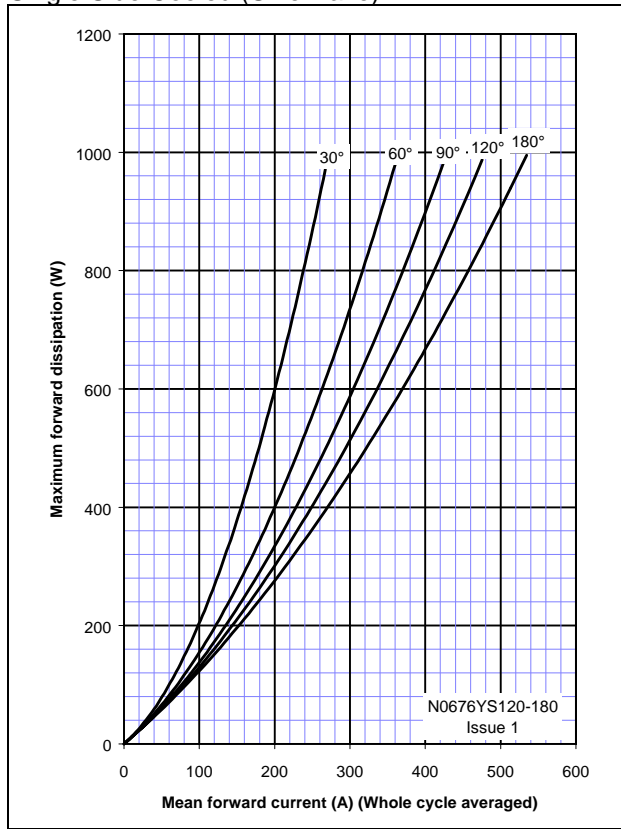


Figure 6 - On-state current vs. Heatsink temperature - Single Side Cooled (Sine wave)

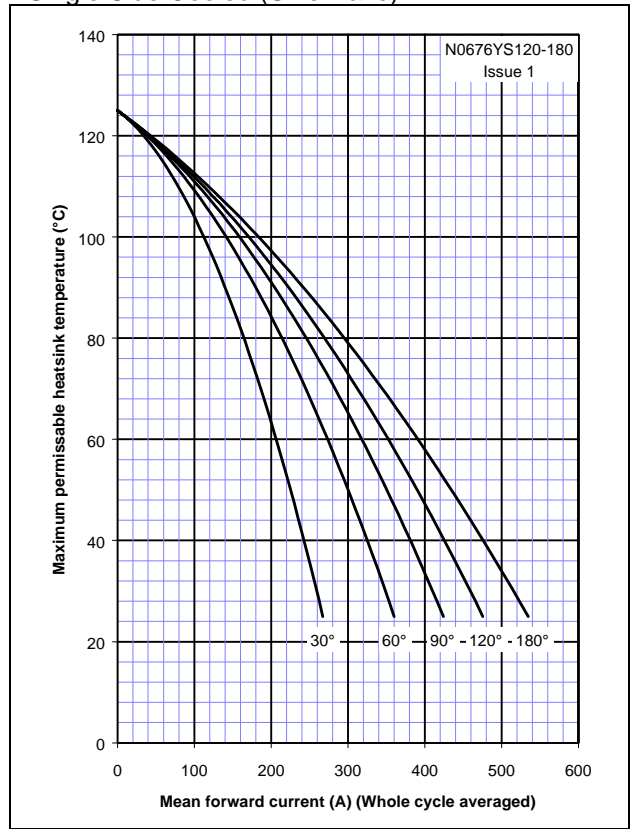


Figure 7 - On-state current vs. Power dissipation – Single Side Cooled (Square wave)

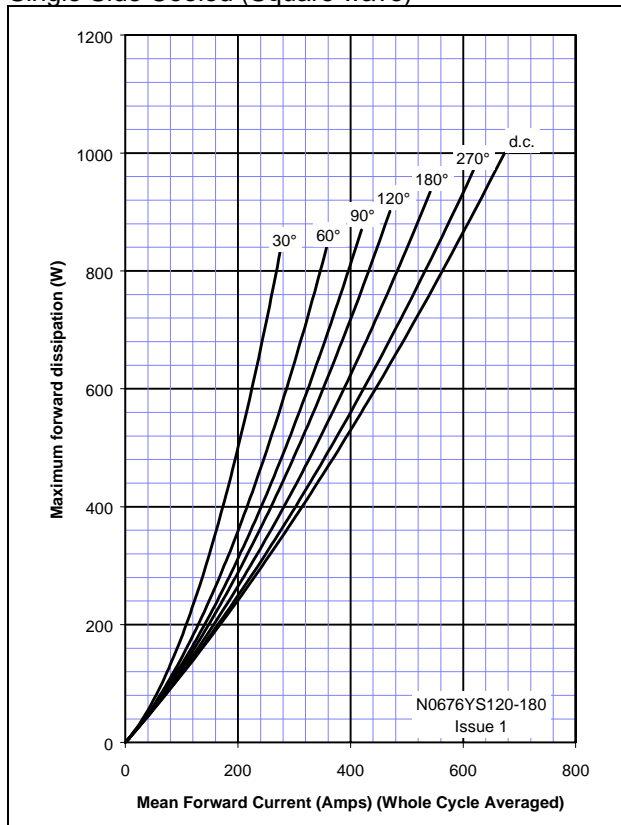


Figure 8 - On-state current vs. Heatsink temperature - Single Side Cooled (Square wave)

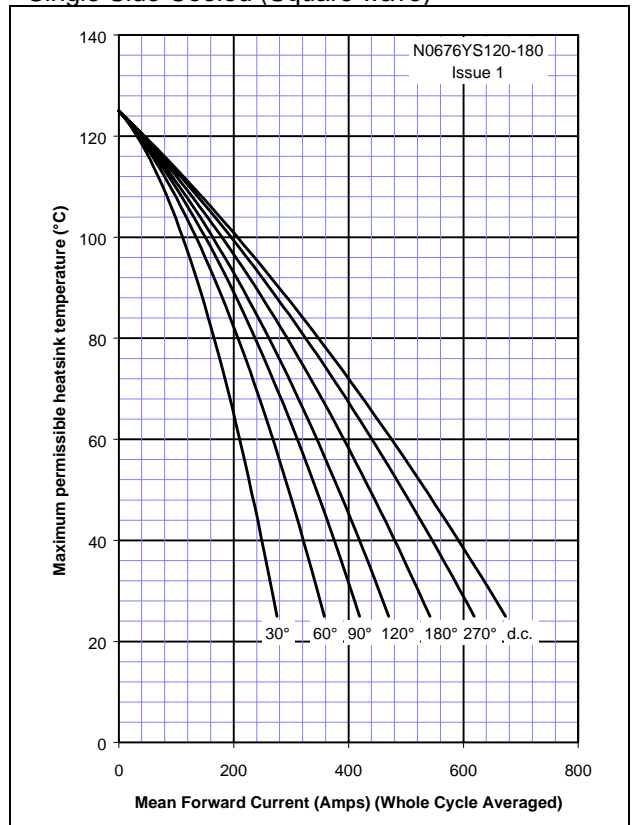


Figure 9 - On-state characteristics of Limit device

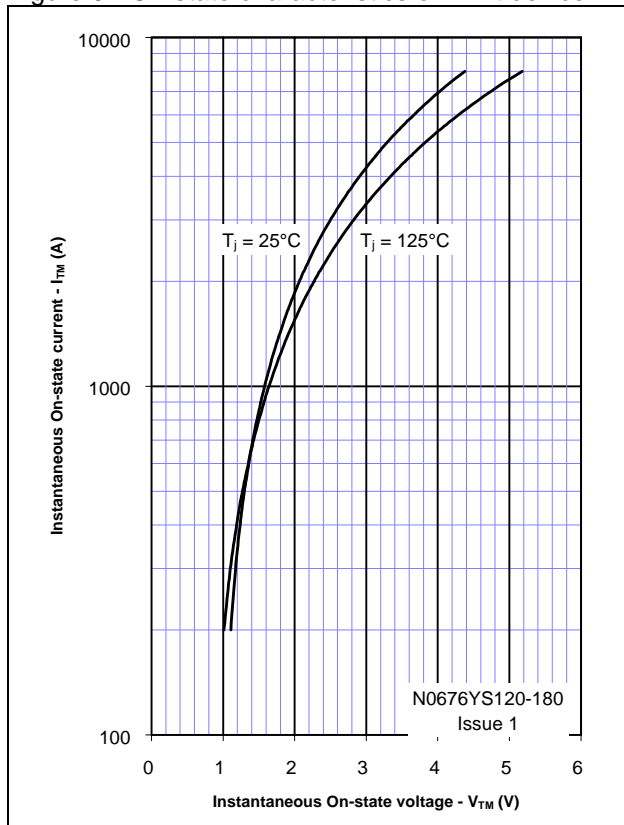


Figure 10 - Transient Thermal Impedance

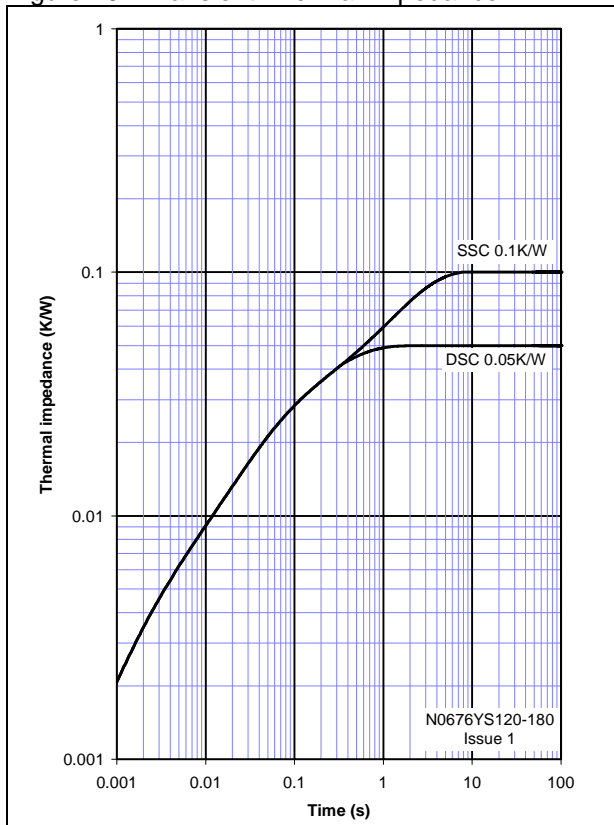


Figure 11 - Gate Characteristics - Trigger Limits

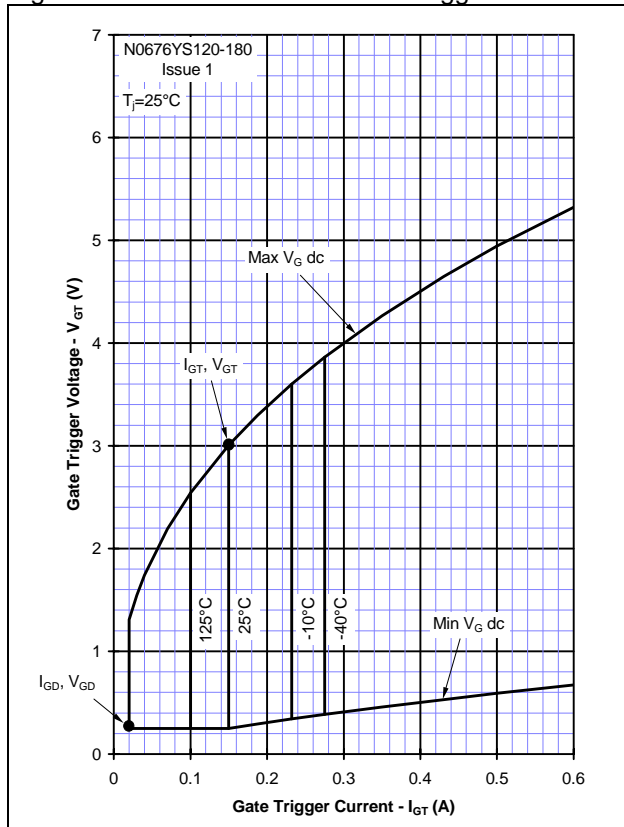


Figure 12 - Gate Characteristics - Power Curves

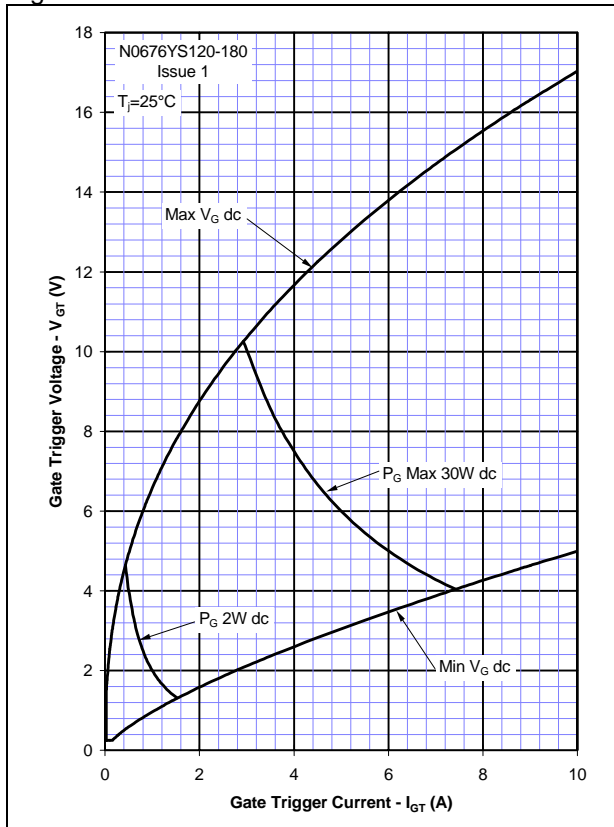
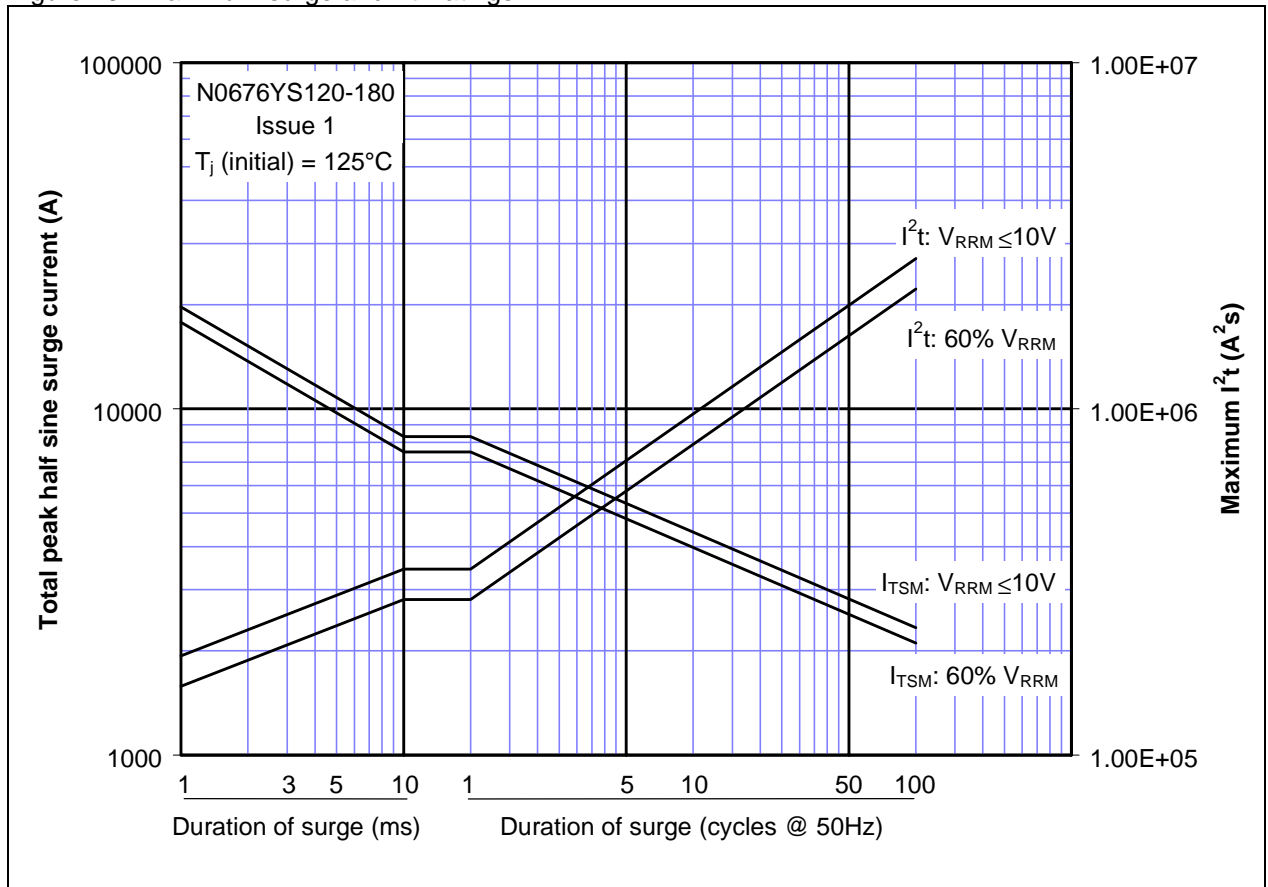
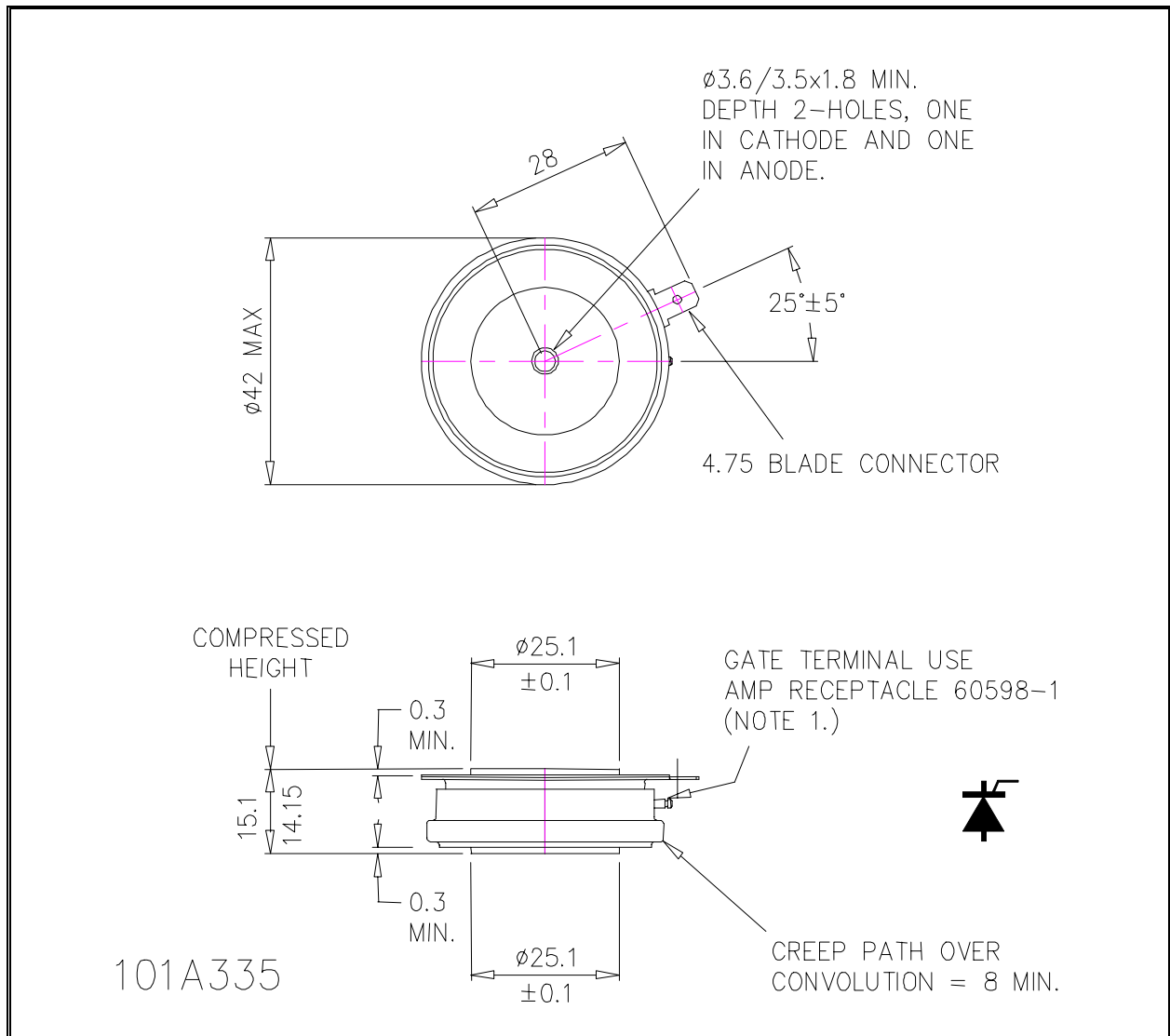


Figure 13 - Maximum surge and I^2t Ratings



Outline Drawing & Ordering Information



ORDERING INFORMATION

(Please quote 10 digit code as below)

| | | | |
|-----------------|--------------------|--------------------|--------------------------|
| N0676 | YS | ◆ ◆ | 0 |
| Fixed Type Code | Fixed Outline Code | Voltage Code 12-18 | Fixed turn-off time code |

Typical order code: N0676YS140 – 1400V V_{DRM} , V_{RRM} , 1000V/ μ s dv/dt, 15.1mm clamp height capsule.

WESTCODE

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