

# FGR3000FX-90DA

HIGH POWER INVERTER USE  
PRESS PACK TYPE

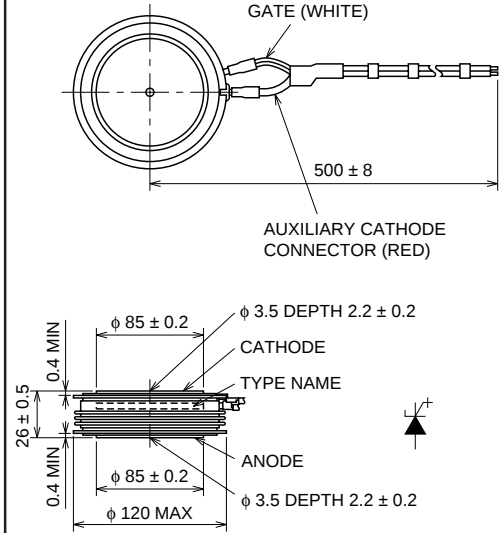
## FGR3000FX-90DA



- ITQRM Repetitive controllable on-state current ..... 3000A
- IT(AV) Average on-state current ..... 780A
- VDRM Repetitive peak off state voltage ..... 4500V
- Reverse conducting type

## OUTLINE DRAWING

Dimensions in mm



## APPLICATION

Inverters, D.C. choppers, Induction heaters, D.C. to D.C. converters.

## MAXIMUM RATINGS

| Symbol | Parameter                              | Voltage class | Unit |
|--------|----------------------------------------|---------------|------|
|        |                                        | 90DA          |      |
| VDRM   | Repetitive peak off-state voltage*     | 4500          | V    |
| VDSM   | Non-repetitive peak off-state voltage* | 4500          | V    |
| VD(DC) | DC off-state voltage*                  | 3600          | V    |
| VLTD   | Long term DC stability voltage*        | 3000          | V    |

\* : VGK = -2V

| Symbol                       | Parameter                                 | Conditions                                                                                      | Ratings               | Unit             |
|------------------------------|-------------------------------------------|-------------------------------------------------------------------------------------------------|-----------------------|------------------|
| ITQRM                        | Repetitive controllable on-state current  | V <sub>DM</sub> = 4500V, T <sub>J</sub> = 125°C, C <sub>s</sub> = 6.0μF, L <sub>s</sub> = 0.2μH | 3000                  | A                |
| IT(RMS)                      | RMS on-state current                      |                                                                                                 | 1220                  | A                |
| IT(AV)                       | Average on-state current                  | f = 60Hz, sine wave θ = 180°, T <sub>f</sub> = 70°C                                             | 780                   | A                |
| ITSM                         | Surge (non-repetitive) on-state current   | One half cycle at 60Hz                                                                          | 16                    | kA               |
| IT <sup>2</sup> <sub>t</sub> | I <sup>2</sup> t for fusing               | One cycle at 60Hz                                                                               | 1.0 × 10 <sup>6</sup> | A <sup>2</sup> s |
| IR(RMS)                      | RMS Reverse current                       |                                                                                                 | 940                   | A                |
| IR(AV)                       | Average reverse current                   | f = 60Hz, sine wave θ = 180°C, T <sub>f</sub> = 75°C                                            | 600                   | A                |
| IRSM                         | Surge (non-repetitive) reverse current    | One half cycle at 60Hz                                                                          | 16                    | kA               |
| IR <sup>2</sup> <sub>t</sub> | Current-squared, time integration         | One cycle at 60Hz                                                                               | 1.0 × 10 <sup>6</sup> | A <sup>2</sup> s |
| diT/dt                       | Critical rate of rise of on-state current | V <sub>D</sub> = 3000V, I <sub>GM</sub> = 75A, T <sub>J</sub> = 75°C                            | 500                   | A/μs             |
| VFGM                         | Peak forward gate voltage                 |                                                                                                 | 10                    | V                |
| VRGM                         | Peak reverse gate voltage                 |                                                                                                 | 18                    | V                |
| IFGM                         | Peak forward gate current                 |                                                                                                 | 100                   | A                |
| IRGM                         | Peak gate reverse current                 |                                                                                                 | 900                   | A                |
| PFGM                         | Peak forward gate power dissipation       |                                                                                                 | 400                   | W                |
| PRGM                         | Peak reverse gate power dissipation       |                                                                                                 | 27                    | kW               |
| PFG(AV)                      | Average forward gate power dissipation    |                                                                                                 | 100                   | W                |
| PRG(AV)                      | Average reverse gate power dissipation    |                                                                                                 | 230                   | W                |
| T <sub>J</sub>               | Junction temperature                      |                                                                                                 | -40 ~ +125            | °C               |
| T <sub>stg</sub>             | Storage temperature                       |                                                                                                 | -40 ~ +150            | °C               |
| —                            | Mounting force required                   | Recommended value 37                                                                            | 31 ~ 43               | kN               |
| —                            | Weight                                    | Standard value                                                                                  | 1450                  | g                |

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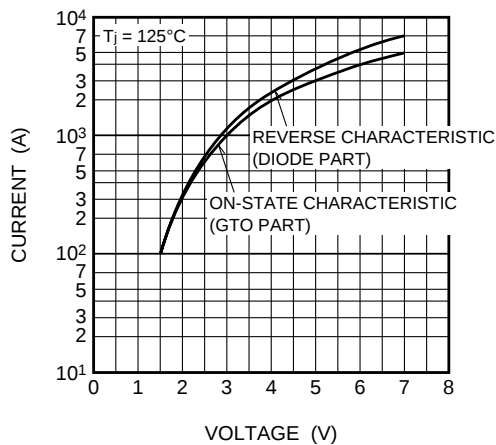
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## ELECTRICAL CHARACTERISTICS

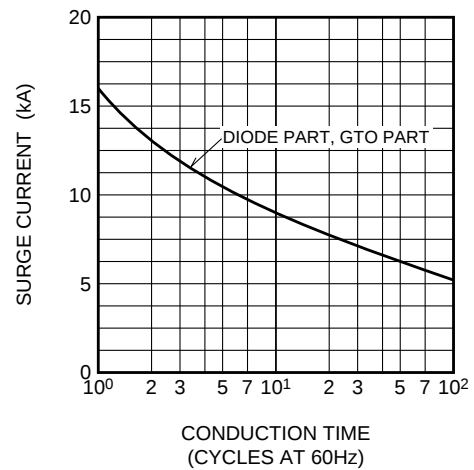
| Symbol               | Parameter                                  | Test conditions                                                                                                                                                      | Limits |     |       | Unit |
|----------------------|--------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-----|-------|------|
|                      |                                            |                                                                                                                                                                      | Min    | Typ | Max   |      |
| V <sub>TM</sub>      | On-state voltage                           | T <sub>J</sub> = 125°C, I <sub>TM</sub> = 3000A, Instantaneous measurment                                                                                            | —      | —   | 5.0   | V    |
| V <sub>RM</sub>      | Peak reverse voltage drop                  | T <sub>J</sub> = 125°C, I <sub>RM</sub> = 3000A, Instantaneous measurment                                                                                            | —      | —   | 4.5   | V    |
| I <sub>DRM</sub>     | Repetitive peak off-state current          | T <sub>J</sub> = 125°C, V <sub>DRM</sub> Applied, V <sub>GK</sub> = -2V                                                                                              | —      | —   | 250   | mA   |
| I <sub>RG</sub>      | Reverse gate current                       | T <sub>J</sub> = 125°C, V <sub>RG</sub> = 17V                                                                                                                        | —      | —   | 500   | mA   |
| dv/dt                | Critical rate of rise of off-state voltage | T <sub>J</sub> = 125°C, V <sub>D</sub> = 3000V, V <sub>GK</sub> = -2V                                                                                                | 1000   | —   | —     | V/μs |
| t <sub>gt</sub>      | Turn-on time                               | T <sub>J</sub> = 125°C, I <sub>TM</sub> = 3000A, I <sub>GM</sub> = 75A, V <sub>D</sub> = 3000V                                                                       | —      | —   | 10    | μs   |
| t <sub>gq</sub>      | Turn-off time                              | T <sub>J</sub> = 125°C, I <sub>TM</sub> = 3000A, V <sub>DM</sub> = 4500V, diGQ/dt = -30A/μs<br>V <sub>RG</sub> = 17V, C <sub>S</sub> = 6.0μF, L <sub>S</sub> = 0.2μH | —      | —   | 30    | μs   |
| I <sub>GQM</sub>     | Peak gate turn-off current                 |                                                                                                                                                                      | —      | 720 | —     | A    |
| V <sub>GT</sub>      | Gate trigger voltage                       | DC METHOD : V <sub>D</sub> = 24V, R <sub>L</sub> = 0.1Ω, T <sub>J</sub> = 25°C                                                                                       | —      | —   | 1.5   | V    |
| I <sub>GT</sub>      | Gate trigger current                       |                                                                                                                                                                      | —      | —   | 3000  | mA   |
| R <sub>th(j-f)</sub> | Thermal resistance                         | GTO Side (Junction to fin)                                                                                                                                           | —      | —   | 0.016 | °C/W |
|                      |                                            | Diode Side (Junction to fin)                                                                                                                                         | —      | —   | 0.025 |      |

## PERFORMANCE CURVES

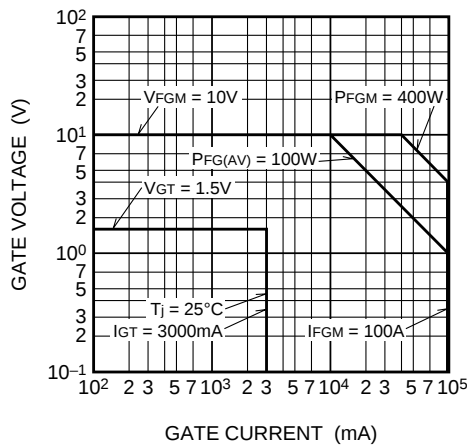
MAXIMUM ON-STATE AND MAXIMUM  
REVERSE CHARACTERISTICS



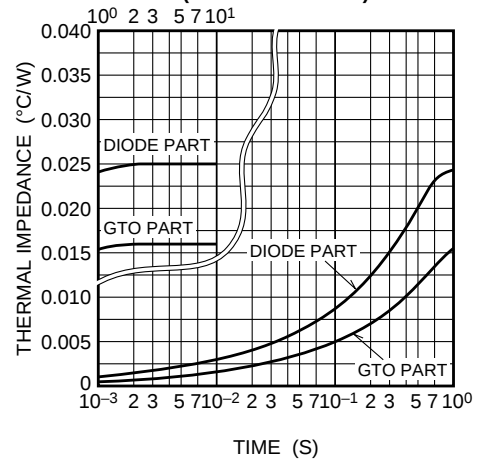
RATED ON-STATE AND REVERSE  
SURGE CURRENT



GATE CHARACTERISTICS



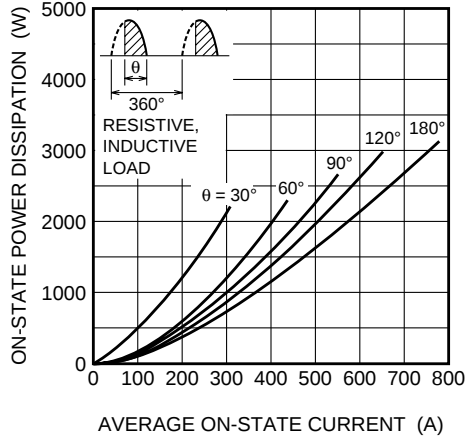
MAXIMUM THERMAL IMPEDANCE  
CHARACTERISTICS  
(JUNCTION TO FIN)



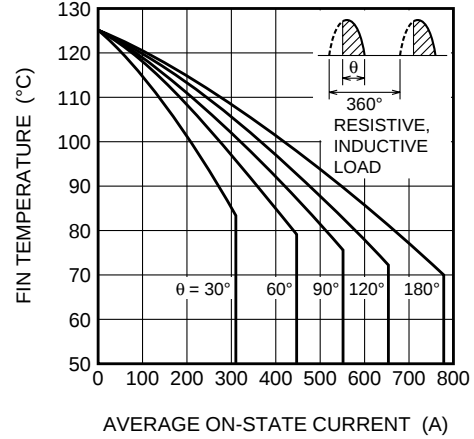
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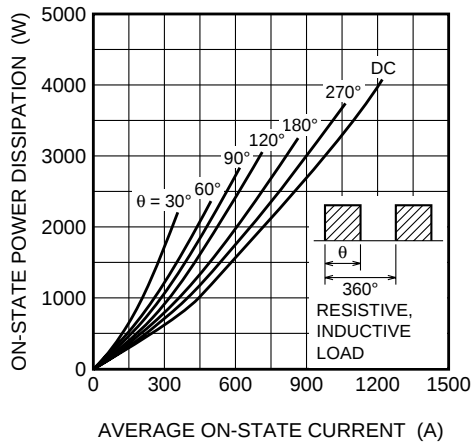
**MAXIMUM ON-STATE POWER DISSIPATION CHARACTERISTICS (GTO PART, SINGLE-PHASE HALF WAVE)**



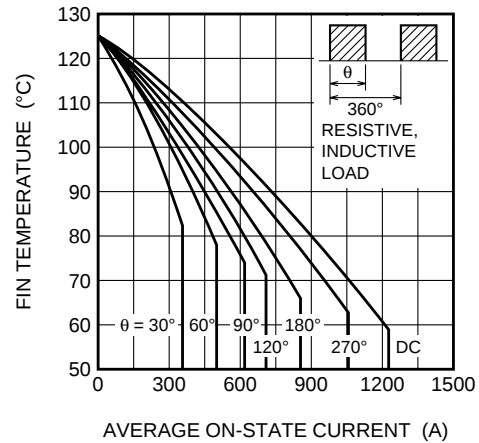
**ALLOWABLE FIN TEMPERATURE VS. AVERAGE ON-STATE CURRENT (GTO PART, SINGLE-PHASE HALF WAVE)**



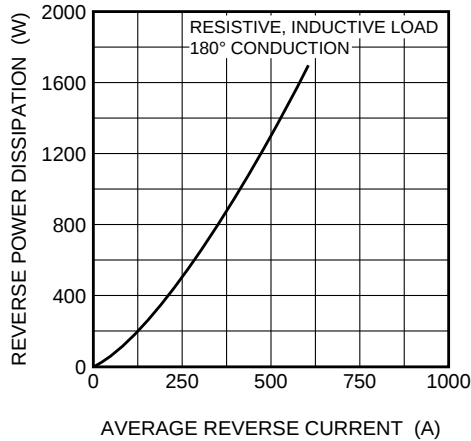
**MAXIMUM ON-STATE POWER DISSIPATION CHARACTERISTICS (GTO PART, RECTANGULAR WAVE)**



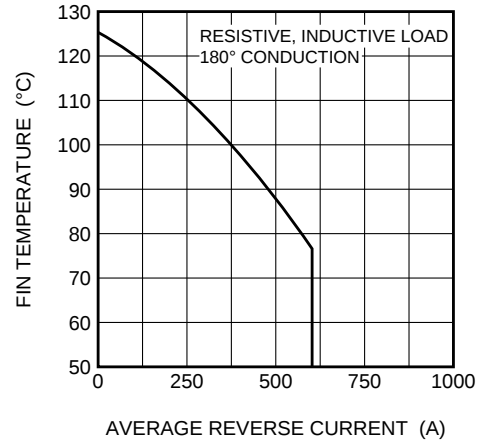
**ALLOWABLE FIN TEMPERATURE VS. AVERAGE ON-STATE CURRENT (GTO PART, RECTANGULAR WAVE)**



**MAXIMUM REVERSE POWER DISSIPATION CHARACTERISTICS (DIODE PART, SINGLE PHASE WAVE)**



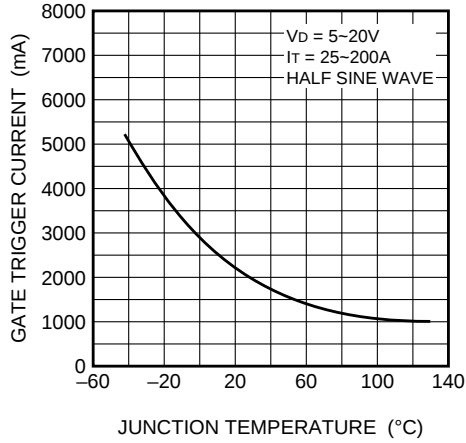
**ALLOWABLE FIN TEMPERATURE VS. AVERAGE REVERSE CURRENT (DIODE PART, SINGLE PHASE HALF WAVE)**



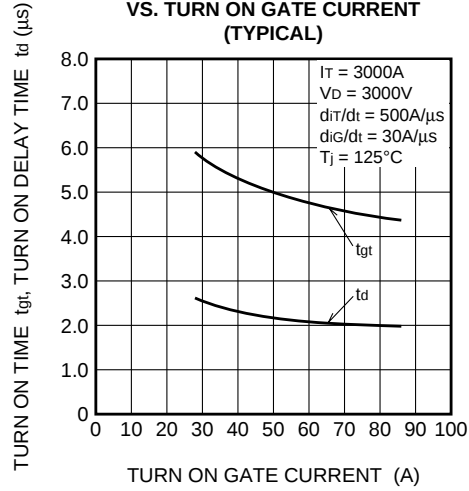
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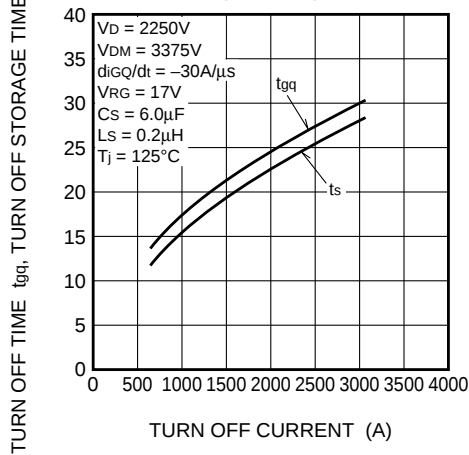
**GATE TRIGGER CURRENT VS.  
JUNCTION TEMPERATURE  
(TYPICAL)**



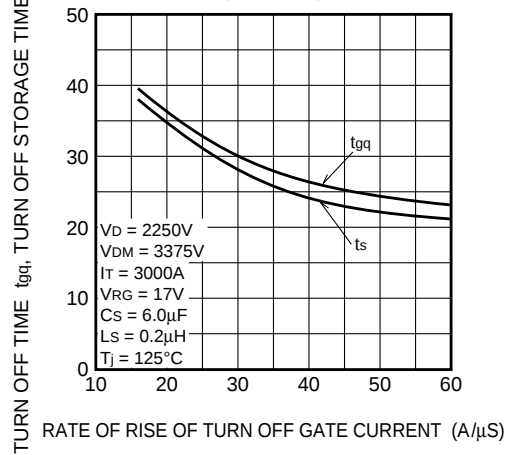
**TURN ON TIME, TURN ON DELAY TIME  
VS. TURN ON GATE CURRENT  
(TYPICAL)**



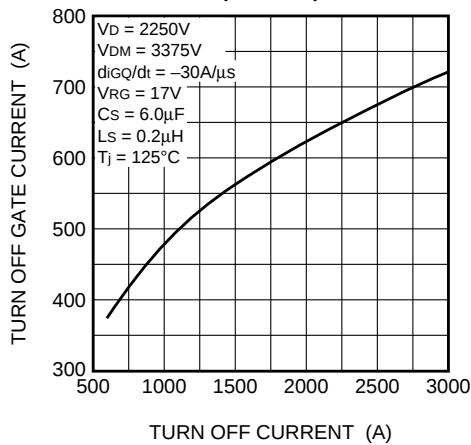
**TURN OFF TIME, TURN OFF STORAGE TIME  
VS. TURN OFF GATE CURRENT  
(TYPICAL)**



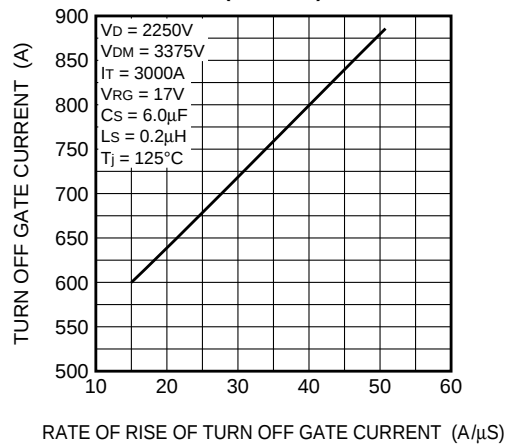
**TURN OFF TIME, TURN OFF STORAGE TIME  
VS. RATE OF RISE OF TURN OFF GATE CURRENT  
(TYPICAL)**



**TURN OFF GATE CURRENT  
VS. TURN OFF CURRENT  
(TYPICAL)**



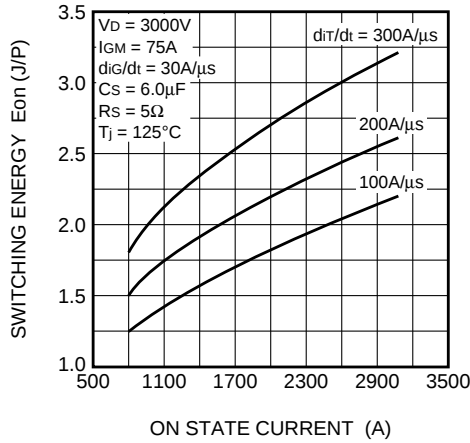
**TURN OFF GATE CURRENT VS.  
RATE OF RISE OF GATE CURRENT  
(TYPICAL)**



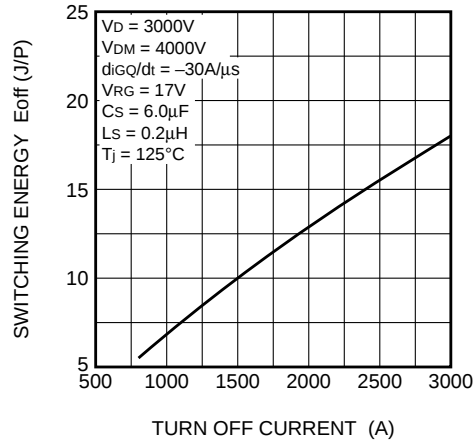
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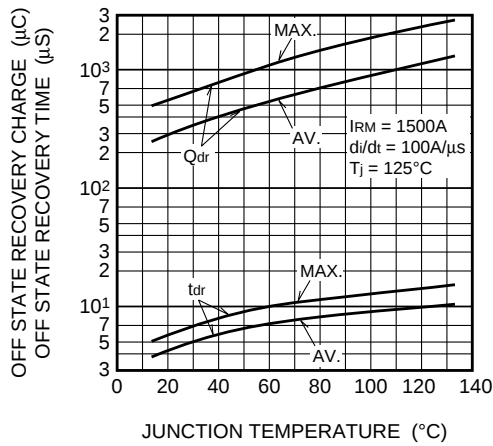
TURN ON SWITCHING ENERGY  
(MAXIMUM)



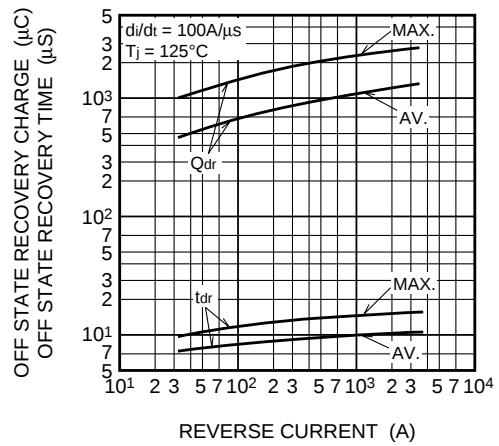
TURN OFF SWITCHING ENERGY  
(MAXIMUM)



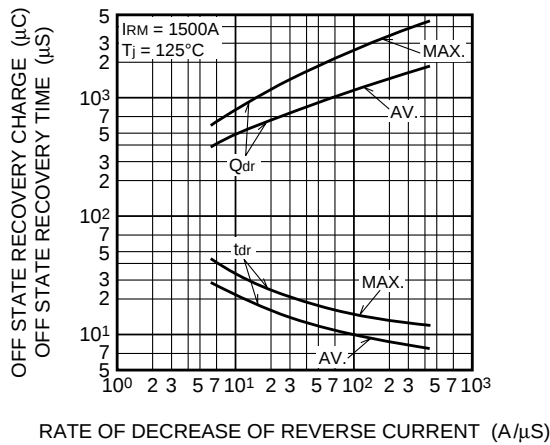
OFF STATE RECOVERY CHARGE,  
OFF STATE RECOVERY TIME  
VS. JUNCTION TEMPERATURE



OFF STATE RECOVERY CHARGE,  
OFF STATE RECOVERY TIME  
VS. REVERSE CURRENT



OFF STATE RECOVERY CHARGE,  
OFF STATE RECOVERY TIME  
VS. RATE OF DECREASE OF REVERSE CURRENT



OFF STATE RECOVERY LOSS(DIODE PART)  
VS. REVERSE CURRENT  
(TYPICAL)

