

# HiPerFET™

## Power MOSFETs

### Q-Class

IXFK 60N55Q2

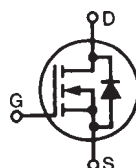
IXFX 60N55Q2

$$\begin{aligned} V_{DSS} &= 550 \text{ V} \\ I_{D25} &= 60 \text{ A} \\ R_{DS(on)} &= 88 \text{ m}\Omega \end{aligned}$$

$$t_{rr} \leq 250 \text{ ns}$$

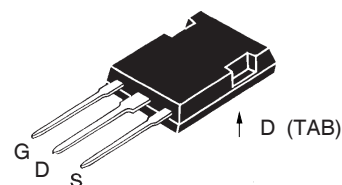
N-Channel Enhancement Mode  
Avalanche Rated, High dv/dt, Low  $Q_g$   
Low intrinsic  $R_g$ , low  $t_{rr}$

Preliminary Data Sheet

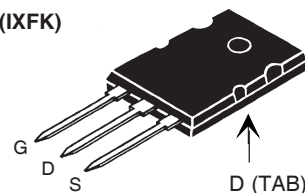


| Symbol    | Test Conditions                                                                                                                         | Maximum Ratings |                  |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------|
| $V_{DSS}$ | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$                                                                                         | 550             | V                |
| $V_{DGR}$ | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ ; $R_{GS} = 1 \text{ M}\Omega$                                                          | 550             | V                |
| $V_{GS}$  | Continuous                                                                                                                              | $\pm 30$        | V                |
| $V_{GSM}$ | Transient                                                                                                                               | $\pm 40$        | V                |
| $I_{D25}$ | $T_C = 25^\circ\text{C}$                                                                                                                | 60              | A                |
| $I_{DM}$  | $T_C = 25^\circ\text{C}$ , pulse width limited by $T_{JM}$                                                                              | 240             | A                |
| $I_{AR}$  | $T_C = 25^\circ\text{C}$                                                                                                                | 60              | A                |
| $E_{AR}$  | $T_C = 25^\circ\text{C}$                                                                                                                | 75              | mJ               |
| $E_{AS}$  | $T_C = 25^\circ\text{C}$                                                                                                                | 4.0             | J                |
| $dv/dt$   | $I_S \leq I_{DM}$ , $di/dt \leq 100 \text{ A}/\mu\text{s}$ , $V_{DD} \leq V_{DSS}$ ,<br>$T_J \leq 150^\circ\text{C}$ , $R_g = 2 \Omega$ | 20              | V/ns             |
| $P_D$     | $T_C = 25^\circ\text{C}$                                                                                                                | 735             | W                |
| $T_J$     |                                                                                                                                         | -55 ... +150    | $^\circ\text{C}$ |
| $T_{JM}$  |                                                                                                                                         | 150             | $^\circ\text{C}$ |
| $T_{stg}$ |                                                                                                                                         | -55 ... +150    | $^\circ\text{C}$ |
| $T_L$     | 1.6 mm (0.063 in) from case for 10 s                                                                                                    | 300             | $^\circ\text{C}$ |
| $M_d$     | Mounting torque                                                                                                                         | TO-264          | 0.9/6 Nm/lb.in.  |
| Weight    |                                                                                                                                         | PLUS-247        | 6 g              |
|           |                                                                                                                                         | TO-264          | 10 g             |

PLUS247™ (IXFX)



TO-264 AA (IXFK)



G = Gate  
S = Source

D = Drain  
TAB = Drain

| Symbol       | Test Conditions                                                                                                        | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |                          |
|--------------|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|--------------------------|
|              |                                                                                                                        | min.                                                                              | typ. | max.                     |
| $V_{DSS}$    | $V_{GS} = 0 \text{ V}$ , $I_D = 3 \text{ mA}$                                                                          | 550                                                                               |      | V                        |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 8 \text{ mA}$                                                                               | 2.0                                                                               |      | 4.5 V                    |
| $I_{GSS}$    | $V_{GS} = \pm 30 \text{ V}_{DC}$ , $V_{DS} = 0$                                                                        |                                                                                   |      | $\pm 200 \text{ nA}$     |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0 \text{ V}$                                                                            |                                                                                   |      | 50 $\mu\text{A}$<br>2 mA |
| $R_{DS(on)}$ | $V_{GS} = 10 \text{ V}$ , $I_D = 0.5 \cdot I_{D25}$<br>Pulse test, $t \leq 300 \mu\text{s}$ , duty cycle $d \leq 2 \%$ |                                                                                   |      | 88 m $\Omega$            |

## Features

- Double metal process for low gate resistance
- International standard packages
- Epoxy meet UL 94 V-0, flammability classification
- Avalanche energy and current rated
- Fast intrinsic Rectifier

## Advantages

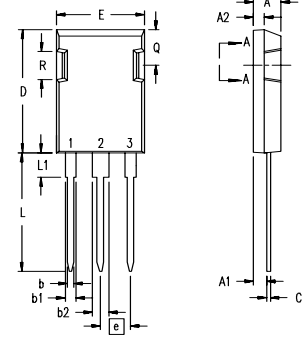
- Easy to mount
- Space savings
- High power density

| Symbol       | Test Conditions                                                                                                | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |          |
|--------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|----------|
|              |                                                                                                                | min.                                                                              | typ. | max.     |
| $g_{fs}$     | $V_{DS} = 10\text{ V}; I_D = 0.5 \cdot I_{D25}$ , pulse test                                                   | 30                                                                                | 44   | S        |
| $C_{iss}$    | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$                                                  |                                                                                   | 7300 | pF       |
| $C_{oss}$    |                                                                                                                |                                                                                   | 1150 | pF       |
| $C_{rss}$    |                                                                                                                |                                                                                   | 340  | pF       |
| $t_{d(on)}$  | $V_{GS} = 10\text{ V}, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$<br>$R_G = 1.0\ \Omega$ (External), |                                                                                   | 22   | ns       |
| $t_r$        |                                                                                                                |                                                                                   | 14   | ns       |
| $t_{d(off)}$ |                                                                                                                |                                                                                   | 57   | ns       |
| $t_f$        |                                                                                                                |                                                                                   | 9    | ns       |
| $Q_{g(on)}$  | $V_{GS} = 10\text{ V}, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$                                    |                                                                                   | 200  | nC       |
| $Q_{gs}$     |                                                                                                                |                                                                                   | 42   | nC       |
| $Q_{gd}$     |                                                                                                                |                                                                                   | 100  | nC       |
| $R_{thJC}$   | TO-264                                                                                                         |                                                                                   |      | 0.17 K/W |
| $R_{thCK}$   |                                                                                                                |                                                                                   | 0.15 | K/W      |

## Source-Drain Diode

| Symbol   | Test Conditions                                                                                       | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |               |
|----------|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|---------------|
|          |                                                                                                       | min.                                                                              | typ. | max.          |
| $I_S$    | $V_{GS} = 0\text{ V}$                                                                                 |                                                                                   |      | 60 A          |
| $I_{SM}$ | Repetitive; pulse width limited by $T_{JM}$                                                           |                                                                                   |      | 240 A         |
| $V_{SD}$ | $I_F = I_S, V_{GS} = 0\text{ V}$ ,<br>Pulse test, $t \leq 300\ \mu\text{s}$ , duty cycle $d \leq 2\%$ |                                                                                   |      | 1.5 V         |
| $t_{rr}$ | $I_F = 25\text{ A}, -di/dt = 100\text{ A}/\mu\text{s}, V_R = 100\text{ V}$                            |                                                                                   |      | 250 ns        |
| $Q_{RM}$ |                                                                                                       |                                                                                   | 1    | $\mu\text{C}$ |
| $I_{RM}$ |                                                                                                       |                                                                                   | 10   | A             |

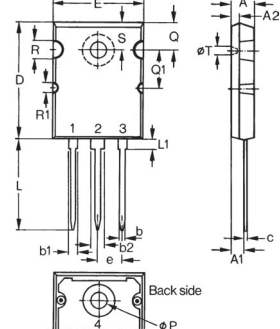
## PLUS 247™ Outline



Terminals: 1 - Gate  
2 - Drain (Collector)  
3 - Source (Emitter)  
4 - Drain (Collector)

| Dim.           | Millimeter<br>Min. | Max.  | Inches<br>Min. | Max. |
|----------------|--------------------|-------|----------------|------|
| A              | 4.83               | 5.21  | .190           | .205 |
| A <sub>1</sub> | 2.29               | 2.54  | .090           | .100 |
| A <sub>2</sub> | 1.91               | 2.16  | .075           | .085 |
| b              | 1.14               | 1.40  | .045           | .055 |
| b <sub>1</sub> | 1.91               | 2.13  | .075           | .084 |
| b <sub>2</sub> | 2.92               | 3.12  | .115           | .123 |
| C              | 0.61               | 0.80  | .024           | .031 |
| D              | 20.80              | 21.34 | .819           | .840 |
| E              | 15.75              | 16.13 | .620           | .635 |
| e              | 5.45 BSC           |       | .215 BSC       |      |
| L              | 19.81              | 20.32 | .780           | .800 |
| L <sub>1</sub> | 3.81               | 4.32  | .150           | .170 |
| Q              | 5.59               | 6.20  | .220           | .244 |
| R              | 4.32               | 4.83  | .170           | .190 |

## TO-264 AA Outline



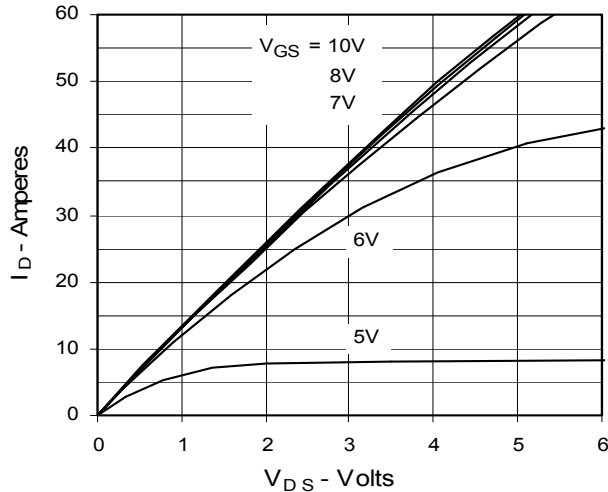
| Dim.           | Millimeter<br>Min. | Max.  | Inches<br>Min. | Max.  |
|----------------|--------------------|-------|----------------|-------|
| A              | 4.82               | 5.13  | .190           | .202  |
| A <sub>1</sub> | 2.54               | 2.89  | .100           | .114  |
| A <sub>2</sub> | 2.00               | 2.10  | .079           | .083  |
| b              | 1.12               | 1.42  | .044           | .056  |
| b <sub>1</sub> | 2.39               | 2.69  | .094           | .106  |
| b <sub>2</sub> | 2.90               | 3.09  | .114           | .122  |
| c              | 0.53               | 0.83  | .021           | .033  |
| D              | 25.91              | 26.16 | 1.020          | 1.030 |
| E              | 19.81              | 19.96 | .780           | .786  |
| e              | 5.46 BSC           |       | .215 BSC       |       |
| J              | 0.00               | 0.25  | .000           | .010  |
| K              | 0.00               | 0.25  | .000           | .010  |
| L              | 20.32              | 20.83 | .800           | .820  |
| L <sub>1</sub> | 2.29               | 2.59  | .090           | .102  |
| P              | 3.17               | 3.66  | .125           | .144  |
| Q              | 6.07               | 6.27  | .239           | .247  |
| Q <sub>1</sub> | 8.38               | 8.69  | .330           | .342  |
| R              | 3.81               | 4.32  | .150           | .170  |
| R <sub>1</sub> | 1.78               | 2.29  | .070           | .090  |
| S              | 6.04               | 6.30  | .238           | .248  |
| T              | 1.57               | 1.83  | .062           | .072  |

IXYS reserves the right to change limits, test conditions, and dimensions.

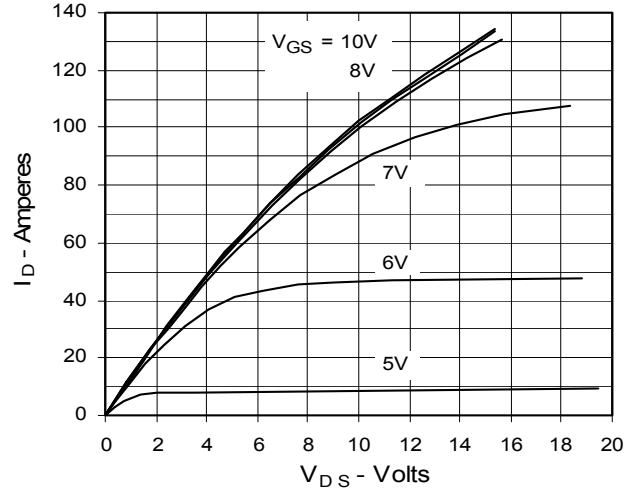
IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents:

|           |           |           |           |           |           |             |             |             |           |
|-----------|-----------|-----------|-----------|-----------|-----------|-------------|-------------|-------------|-----------|
| 4,850,072 | 4,931,844 | 5,034,796 | 5,063,307 | 5,237,481 | 5,381,025 | 6,404,065B1 | 6,162,665   | 6,534,343   | 6,583,505 |
| 4,835,592 | 4,881,106 | 5,017,508 | 5,049,961 | 5,187,117 | 5,486,715 | 6,306,728B1 | 6,259,123B1 | 6,306,728B1 | 6,683,344 |

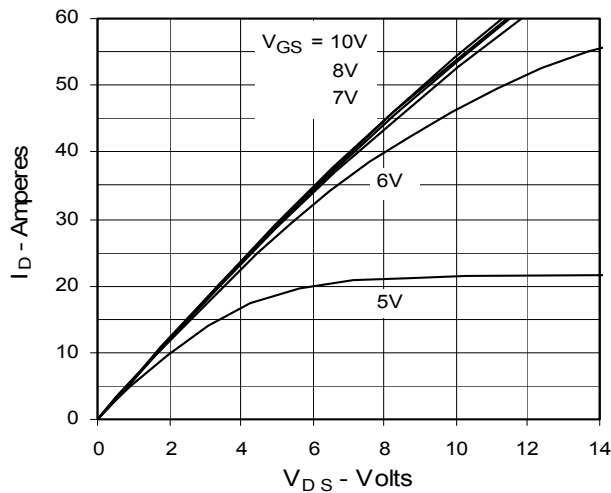
**Fig. 1. Output Characteristics**  
**@ 25°C**



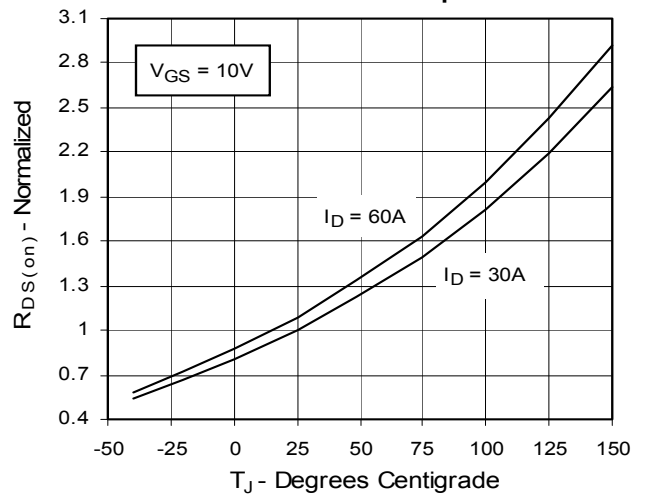
**Fig. 2. Extended Output Characteristics**  
**@ 25°C**



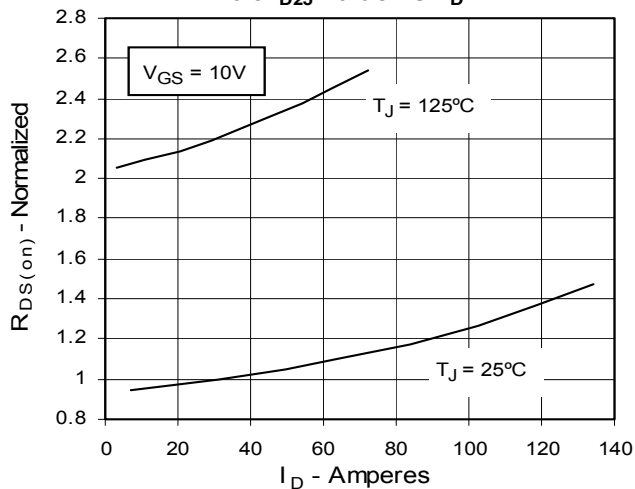
**Fig. 3. Output Characteristics**  
**@ 125°C**



**Fig. 4.  $R_{DS(on)}$  Normalized to 0.5  $I_{D25}$  Value vs. Junction Temperature**



**Fig. 5.  $R_{DS(on)}$  Normalized to 0.5  $I_{D25}$  Value vs.  $I_D$**



**Fig. 6. Drain Current vs. Case Temperature**

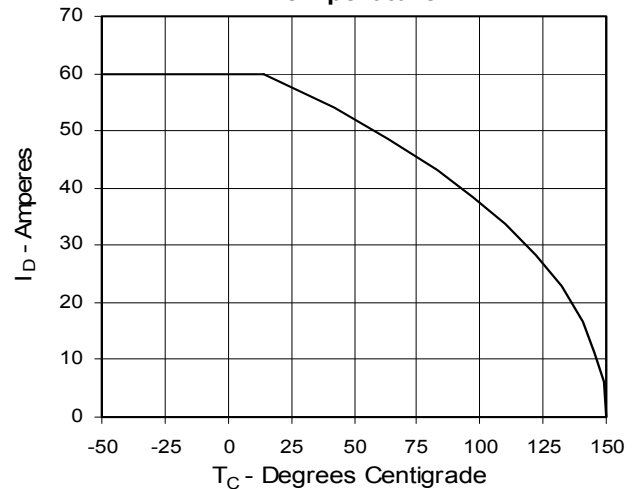


Fig. 7. Input Admittance

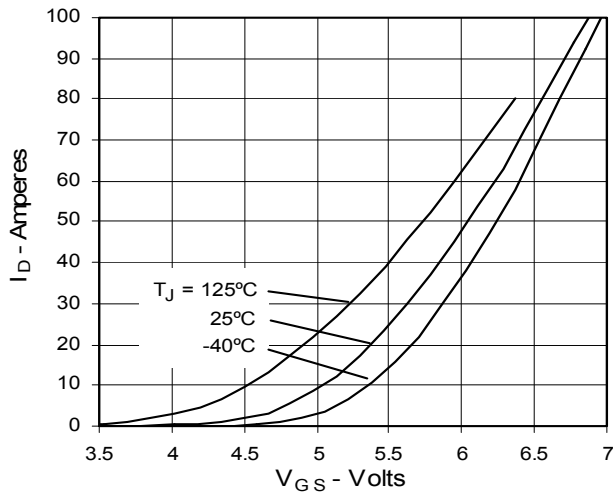


Fig. 8. Transconductance

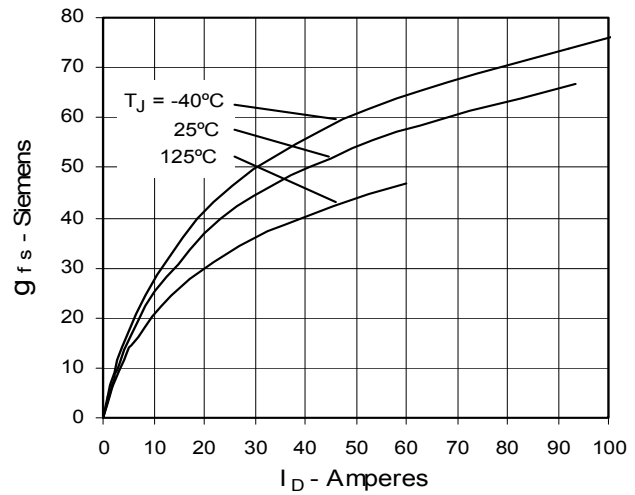


Fig. 9. Source Current vs. Source-To-Drain Voltage

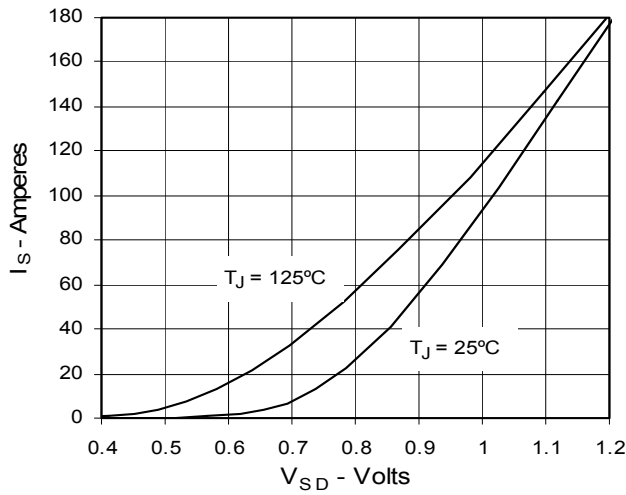


Fig. 10. Gate Charge

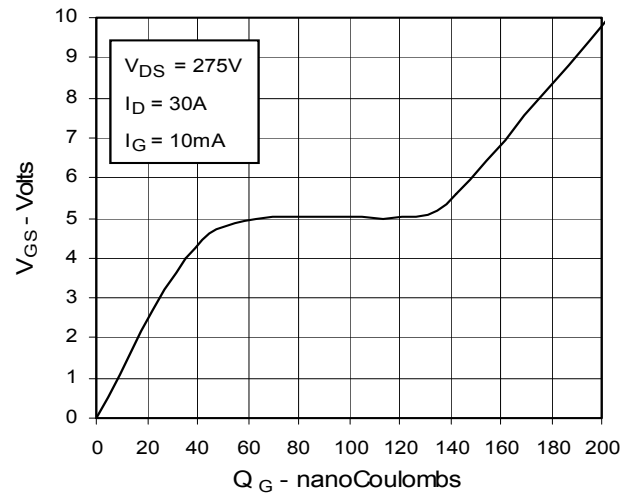


Fig. 11. Capacitance

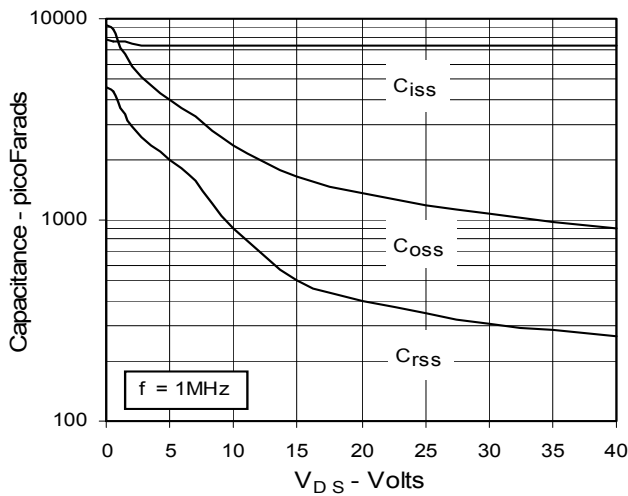
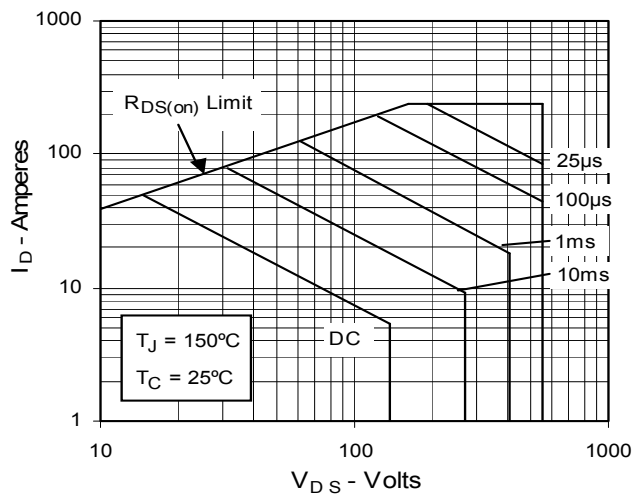


Fig. 12. Forward-Bias Safe Operating Area



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|-----------|-----------|-----------|-----------|-----------|-----------|-------------|-------------|-------------|-----------|
| 4,850,072 | 4,931,844 | 5,034,796 | 5,063,307 | 5,237,481 | 5,381,025 | 6,404,065B1 | 6,162,665   | 6,534,343   | 6,583,505 |
| 4,835,592 | 4,881,106 | 5,017,508 | 5,049,961 | 5,187,117 | 5,486,715 | 6,306,728B1 | 6,259,123B1 | 6,306,728B1 | 6,683,344 |

Fig. 13. Maximum Transient Thermal Resistance

