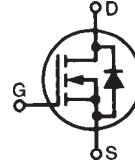


# High Current Power MOSFET Q-Class

## IXTQ 40N50Q

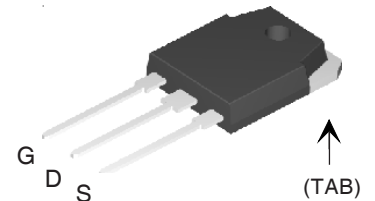
$$\begin{aligned} V_{DSS} &= 500 \text{ V} \\ I_{D25} &= 40 \text{ A} \\ R_{DS(on)} &= 0.16 \Omega \end{aligned}$$

N-Channel Enhancement Mode  
Avalanche Rated, Low  $Q_g$ , High  $dv/dt$   
Data Sheet



| Symbol    | Test Conditions                                                                                                                         | Maximum Ratings |                  |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------|
| $V_{DSS}$ | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$                                                                                         | 500             | V                |
| $V_{DGR}$ | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ ; $R_{GS} = 1 \text{ M}\Omega$                                                          | 500             | V                |
| $V_{GS}$  | Continuous                                                                                                                              | $\pm 30$        | V                |
| $V_{GSM}$ | Transient                                                                                                                               | $\pm 40$        | V                |
| $I_{D25}$ | $T_C = 25^\circ\text{C}$                                                                                                                | 40              | A                |
| $I_{DM}$  | $T_C = 25^\circ\text{C}$ , pulse width limited by $T_{JM}$                                                                              | 160             | A                |
| $I_{AR}$  | $T_C = 25^\circ\text{C}$                                                                                                                | 40              | A                |
| $E_{AR}$  | $T_C = 25^\circ\text{C}$                                                                                                                | 50              | mJ               |
| $E_{AS}$  |                                                                                                                                         | 2.0             | mJ               |
| $dv/dt$   | $I_S \leq I_{DM}$ , $di/dt \leq 100 \text{ A}/\mu\text{s}$ , $V_{DD} \leq V_{DSS}$ ,<br>$T_J \leq 150^\circ\text{C}$ , $R_G = 2 \Omega$ | 5               | V/ns             |
| $P_D$     | $T_C = 25^\circ\text{C}$                                                                                                                | 500             | W                |
| $T_J$     |                                                                                                                                         | -55 to +150     | $^\circ\text{C}$ |
| $T_{JM}$  |                                                                                                                                         | 150             | $^\circ\text{C}$ |
| $T_{stg}$ |                                                                                                                                         | -55 to +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                                                                                                                         | 1.13/10         | Nm/lb.in.        |
| Weight    |                                                                                                                                         | 6               | g                |

TO-3P (IXTQ)



G = Gate D = Drain  
S = Source TAB = Drain

### Features

- IXYS advanced low  $Q_g$  process
- Low gate charge and capacitances
  - easier to drive
  - faster switching
- International standard packages
- Low  $R_{DS(on)}$
- Rated for unclamped Inductive load switching (UIS) rated
- Molding epoxies meet UL 94 V-0 flammability classification

### Advantages

- Easy to mount
- Space savings
- High power density

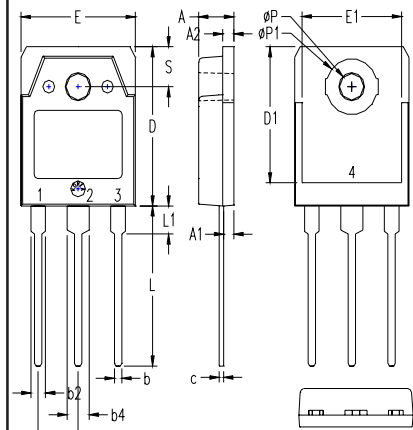
| Symbol       | Test Conditions                                                                                                  | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |                          |
|--------------|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|--------------------------|
|              |                                                                                                                  | min.                                                                              | typ. | max.                     |
| $V_{DSS}$    | $V_{GS} = 0 \text{ V}$ , $I_D = 250 \mu\text{A}$                                                                 | 500                                                                               |      | V                        |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 4 \text{ mA}$                                                                         | 2.5                                                                               |      | 4.5 V                    |
| $I_{GSS}$    | $V_{GS} = \pm 30 \text{ V}_{DC}$ , $V_{DS} = 0$                                                                  |                                                                                   |      | $\pm 100 \text{ nA}$     |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0 \text{ V}$                                                                      |                                                                                   |      | 25 $\mu\text{A}$<br>1 mA |
| $R_{DS(on)}$ | $V_{GS} = 10 \text{ V}$ , $I_D = 0.5 I_{D25}$<br>Pulse test, $t \leq 300 \mu\text{s}$ , duty cycle $d \leq 2 \%$ |                                                                                   |      | 0.16 $\Omega$            |

| Symbol       | Test Conditions                                                                                                | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |      |
|--------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|------|
|              |                                                                                                                | min.                                                                              | typ. | max. |
| $g_{fs}$     | $V_{DS} = 20\text{ V}; I_D = 0.5 \cdot I_{D25}$ , pulse test                                                   | 22                                                                                | 35   | S    |
| $C_{iss}$    | $V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1\text{ MHz}$                                                  |                                                                                   | 4500 | pF   |
| $C_{oss}$    |                                                                                                                |                                                                                   | 700  | pF   |
| $C_{rss}$    |                                                                                                                |                                                                                   | 180  | pF   |
| $t_{d(on)}$  | $V_{GS} = 10\text{ V}, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$<br>$R_G = 2.0\ \Omega$ (External), |                                                                                   | 17   | ns   |
| $t_r$        |                                                                                                                |                                                                                   | 20   | ns   |
| $t_{d(off)}$ |                                                                                                                |                                                                                   | 56   | ns   |
| $t_f$        |                                                                                                                |                                                                                   | 14   | ns   |
| $Q_{g(on)}$  | $V_{GS} = 10\text{ V}, V_{DS} = 0.5 \cdot V_{DSS}, I_D = 0.5 \cdot I_{D25}$                                    |                                                                                   | 130  | nC   |
| $Q_{gs}$     |                                                                                                                |                                                                                   | 26   | nC   |
| $Q_{gd}$     |                                                                                                                |                                                                                   | 58   | nC   |
| $R_{thJC}$   |                                                                                                                |                                                                                   | 0.25 | K/W  |
| $R_{thCK}$   |                                                                                                                |                                                                                   | 0.25 | K/W  |

### Source-Drain Diode

| Symbol   | Test Conditions                                                                                       | Characteristic Values<br>( $T_J = 25^\circ\text{C}$ , unless otherwise specified) |      |        |
|----------|-------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------|--------|
|          |                                                                                                       | min.                                                                              | typ. | max.   |
| $I_S$    | $V_{GS} = 0\text{ V}$                                                                                 |                                                                                   |      | 40 A   |
| $I_{SM}$ | Repetitive; pulse width limited by $T_{JM}$                                                           |                                                                                   |      | 160 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  |
| $t_{rr}$ |                                                                                                       |                                                                                   |      | 600 ns |

### TO-3P (IXTQ) Outline



- 1 - GATE
- 2 - DRAIN (COLLECTOR)
- 3 - SOURCE (EMITTER)
- 4 - DRAIN (COLLECTOR)

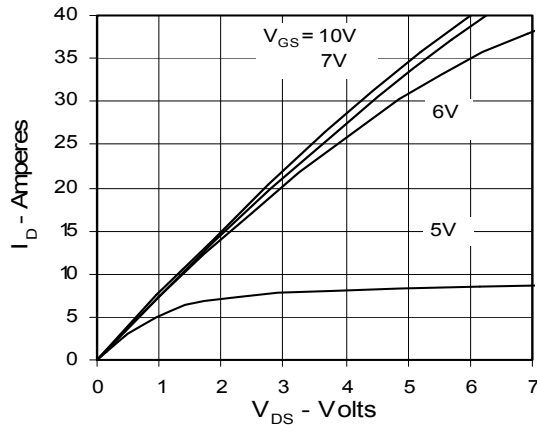
| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .185     | .193 | 4.70        | 4.90  |
| A1  | .051     | .059 | 1.30        | 1.50  |
| A2  | .057     | .065 | 1.45        | 1.65  |
| b   | .035     | .045 | 0.90        | 1.15  |
| b2  | .075     | .087 | 1.90        | 2.20  |
| b4  | .114     | .126 | 2.90        | 3.20  |
| c   | .022     | .031 | 0.55        | 0.80  |
| D   | .780     | .791 | 19.80       | 20.10 |
| D1  | .665     | .677 | 16.90       | 17.20 |
| E   | .610     | .622 | 15.50       | 15.80 |
| E1  | .531     | .539 | 13.50       | 13.70 |
| e   | .215 BSC |      | 5.45 BSC    |       |
| L   | .779     | .795 | 19.80       | 20.20 |
| L1  | .134     | .142 | 3.40        | 3.60  |
| ØP  | .126     | .134 | 3.20        | 3.40  |
| ØP1 | .272     | .280 | 6.90        | 7.10  |
| S   | .193     | .201 | 4.90        | 5.10  |

All metal area are tin plated.

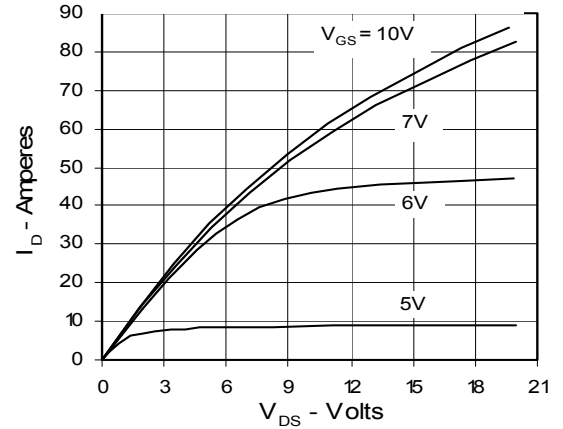
IXYS reserves the right to change limits, test conditions, and dimensions.

|                                                                                  |           |           |           |           |              |              |              |           |
|----------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|--------------|--------------|--------------|-----------|
| IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents: | 4,835,592 | 4,931,844 | 5,049,961 | 5,237,481 | 6,162,665    | 6,404,065 B1 | 6,683,344    | 6,727,585 |
|                                                                                  | 4,850,072 | 5,017,508 | 5,063,307 | 5,381,025 | 6,259,123 B1 | 6,534,343    | 6,710,405 B2 | 6,759,692 |
|                                                                                  | 4,881,106 | 5,034,796 | 5,187,117 | 5,486,715 | 6,306,728 B1 | 6,583,505    | 6,710,463    |           |

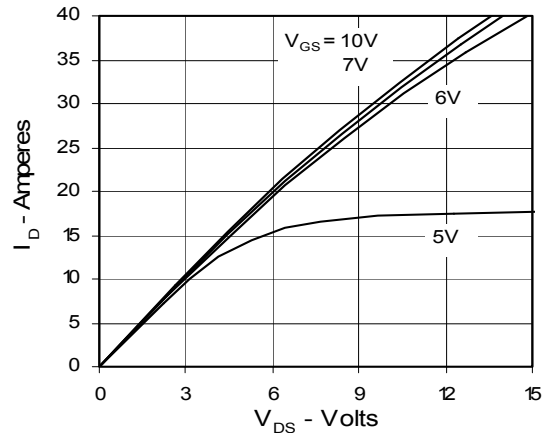
**Fig. 1. Output Characteristics  
@ 25 Deg. C**



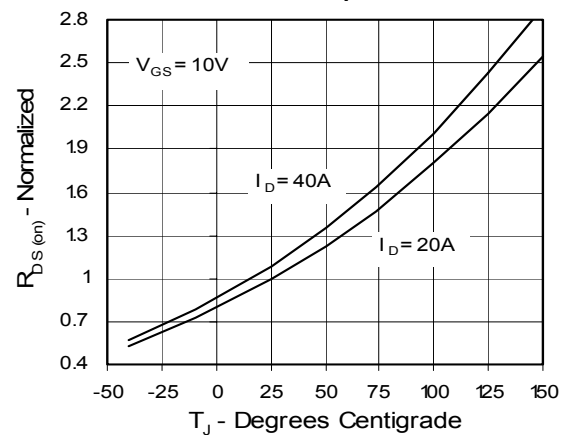
**Fig. 2. Extended Output Characteristics  
@ 25 deg. C**



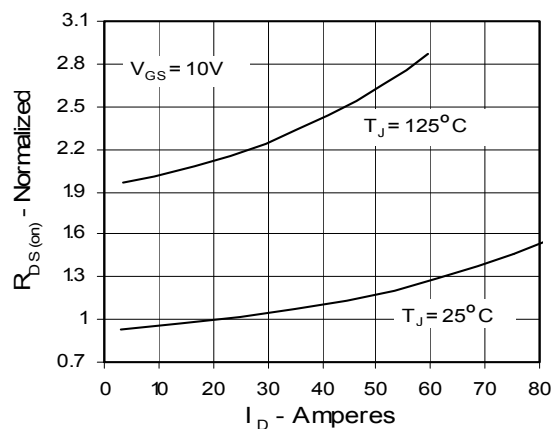
**Fig. 3. Output Characteristics  
@ 125 Deg. C**



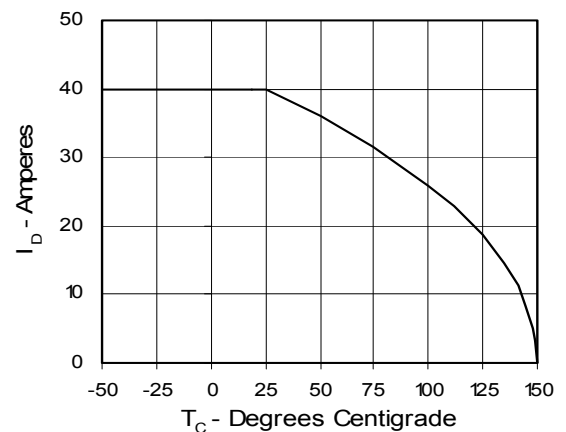
**Fig. 4.  $R_{DS(on)}$  Normalized to  $I_{D25}$  Value vs.  
Junction Temperature**



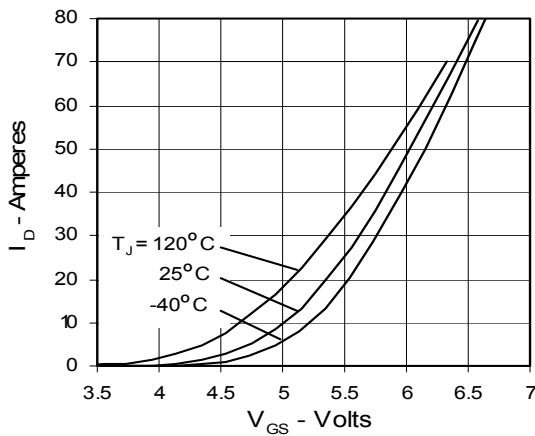
**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_{D25}$   
Value vs.  $I_D$**



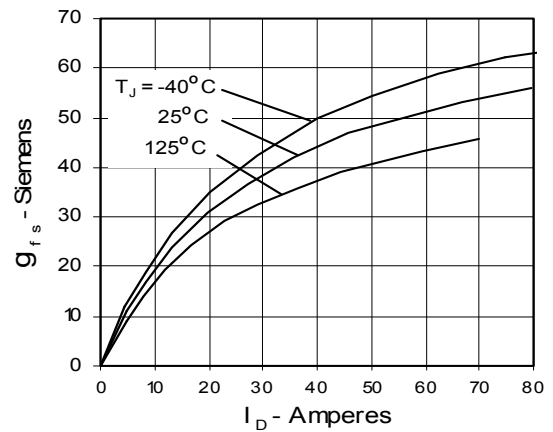
**Fig. 6. Drain Current vs. Case  
Temperature**



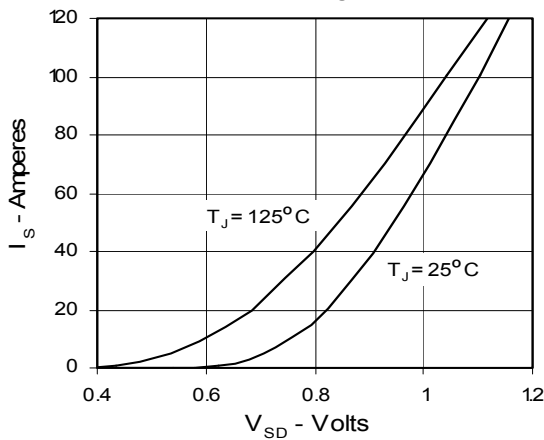
**Fig. 7. Input Admittance**



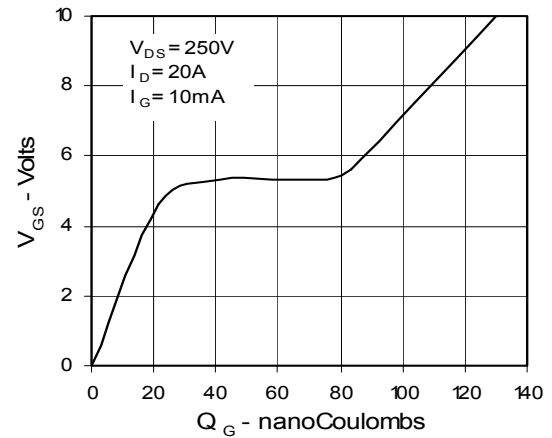
**Fig. 8. Transconductance**



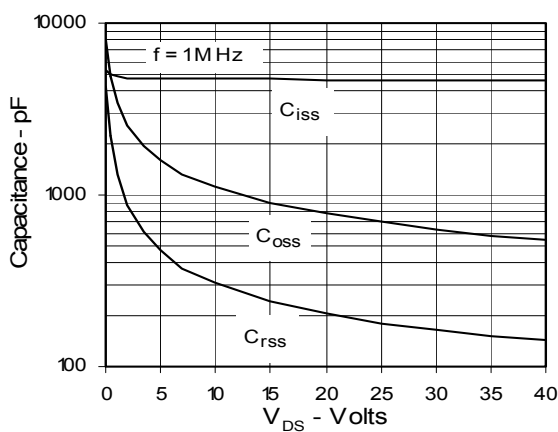
**Fig. 9. Source Current vs. Source-To-Drain Voltage**



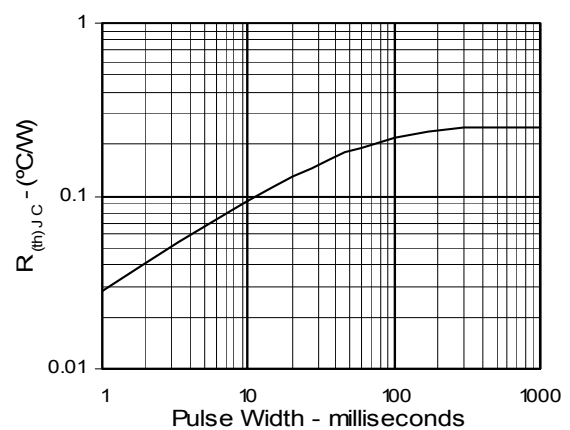
**Fig. 10. Gate Charge**



**Fig. 11. Capacitance**



**Fig. 12. Maximum Transient Thermal Resistance**



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|           |           |           |           |              |              |              |           |
|-----------|-----------|-----------|-----------|--------------|--------------|--------------|-----------|
| 4,835,592 | 4,931,844 | 5,049,961 | 5,237,481 | 6,162,665    | 6,404,065 B1 | 6,683,344    | 6,727,585 |
| 4,850,072 | 5,017,508 | 5,063,307 | 5,381,025 | 6,259,123 B1 | 6,534,343    | 6,710,405 B2 | 6,759,692 |
| 4,881,106 | 5,034,796 | 5,187,117 | 5,486,715 | 6,306,728 B1 | 6,583,505    | 6,710,463    |           |