



**THE DATASHEET OF  
IXTP24N65X2M**



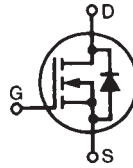
# X2-Class Power MOSFET

## IXTP24N65X2M

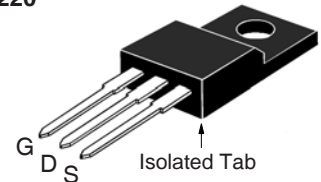
$V_{DSS} = 650V$   
 $I_{D25} = 24A$   
 $R_{DS(on)} \leq 145m\Omega$

(Electrically Isolated Tab)

N-Channel Enhancement Mode



OVERMOLDED  
TO-220



G = Gate      D = Drain  
S = Source

| Symbol     | Test Conditions  | Maximum Ratings |            |
|------------|--|-----------------|------------|
| $V_{DSS}$  | $T_J = 25^\circ C$ to $150^\circ C$                                | 650             | V          |
| $V_{DGR}$  | $T_J = 25^\circ C$ to $150^\circ C$ , $R_{GS} = 1M\Omega$          | 650             | V          |
| $V_{GSS}$  | Continuous   | $\pm 30$        | V          |
| $V_{GSM}$  | Transient  | $\pm 40$        | V          |
| $I_{D25}$  | $T_C = 25^\circ C$ , Limited by $T_{JM}$                           | 24              | A          |
| $I_{DM}$   | $T_C = 25^\circ C$ , Pulse Width Limited by $T_{JM}$               | 48              | A          |
| $I_A$      | $T_C = 25^\circ C$   | 12              | A          |
| $E_{AS}$   | $T_C = 25^\circ C$   | 600             | mJ         |
| dv/dt      | $I_S \leq I_{DM}$ , $V_{DD} \leq V_{DSS}$ , $T_J \leq 150^\circ C$ | 15              | V/ns       |
| $P_D$      | $T_C = 25^\circ C$   | 37              | W          |
| $T_J$      |  | -55 ... +150    | $^\circ C$ |
| $T_{JM}$   |  | 150             | $^\circ C$ |
| $T_{stg}$  |  | -55 ... +150    | $^\circ C$ |
| $T_L$      | Maximum Lead Temperature for Soldering                             | 300             | $^\circ C$ |
| $T_{SOLD}$ | 1.6 mm (0.062in.) from Case for 10s                                | 260             | $^\circ C$ |
| $V_{ISOL}$ | 50/60 Hz, 1 Minute   | 2500            | V~         |
| $M_d$      | Mounting Torque  | 1.13 / 10       | Nm/lb.in   |
| Weight     |  | 2.5             | g          |

### Features

- International Standard Package
- Plastic Overmolded Tab
- Low  $R_{DS(ON)}$  and  $Q_G$
- Avalanche Rated
- 2500V~ Electrical Isolation
- Low Package Inductance

### Advantages

- High Power Density
- Easy to Mount
- Space Savings

### Applications

- Switch-Mode and Resonant-Mode Power Supplies
- DC-DC Converters
- PFC Circuits
- AC and DC Motor Drives
- Robotics and Servo Controls

| Symbol       | Test Conditions<br>( $T_J = 25^\circ C$ , Unless Otherwise Specified) | Characteristic Values |      |                          |
|--------------|---|-----------------------|------|--------------------------|
|              |   | Min.                  | Typ. | Max.                     |
| $BV_{DSS}$   | $V_{GS} = 0V$ , $I_D = 250\mu A$                                      | 650                   |      | V                        |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 250\mu A$                                  | 3.0                   |      | 5.0 V                    |
| $I_{GSS}$    | $V_{GS} = \pm 30V$ , $V_{DS} = 0V$                                    |                       |      | $\pm 100$ nA             |
| $I_{DSS}$    | $V_{DS} = V_{DSS}$ , $V_{GS} = 0V$<br>$T_J = 125^\circ C$             |                       |      | 5 $\mu A$<br>100 $\mu A$ |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 12A$ , Note 1                                 |                       |      | 145 m $\Omega$           |

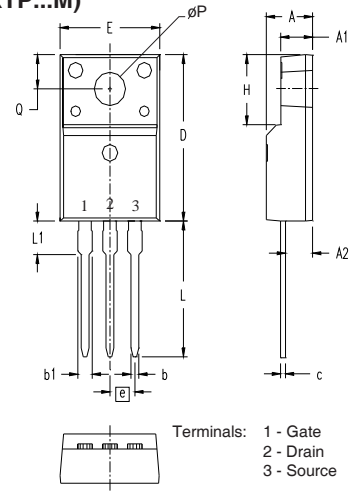
| Symbol                              | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)  | Characteristic Values                                |      |                         |
|-------------------------------------|--|--|------|-------------------------|
|                                     |  | Min.   | Typ. | Max                     |
| $g_{fs}$                            | $V_{DS} = 10\text{V}$ , $I_D = 12\text{A}$ , Note 1  | 13   | 22   | S                       |
| $R_{Gi}$                            | Gate Input Resistance  |  | 1.1  | $\Omega$                |
| $C_{iss}$                           | $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$   |  | 2060 | pF                      |
| $C_{oss}$                           |  |  | 1470 | pF                      |
| $C_{rss}$                           |  |  | 1.2  | pF                      |
| <b>Effective Output Capacitance</b> |  |  |      |                         |
| $C_{o(er)}$                         | Energy related   | $V_{GS} = 0\text{V}$<br>$V_{DS} = 0.8 \cdot V_{DSS}$ | 83   | pF                      |
| $C_{o(tr)}$                         | Time related   |  | 336  | pF                      |
| $t_{d(on)}$                         | <b>Resistive Switching Times</b><br>$V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 12\text{A}$<br>$R_G = 10\Omega$ (External) |  | 20   | ns                      |
| $t_r$                               |  |  | 25   | ns                      |
| $t_{d(off)}$                        |  |  | 50   | ns                      |
| $t_f$                               |  |  | 19   | ns                      |
| $Q_{g(on)}$                         | $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 12\text{A}$  |  | 36   | nC                      |
| $Q_{gs}$                            |  |  | 9    | nC                      |
| $Q_{gd}$                            |  |  | 13   | nC                      |
| $R_{thJC}$                          |  |  |      | 3.37 $^\circ\text{C/W}$ |
| $R_{thCS}$                          |  | 0.50   |      | $^\circ\text{C/W}$      |

### Source-Drain Diode

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)    | Characteristic Values |      |               |
|----------|--|-----------------------|------|---------------|
|          |  | Min.                  | Typ. | Max           |
| $I_S$    | $V_{GS} = 0\text{V}$   |                       |      | 24 A          |
| $I_{SM}$ | Repetitive, pulse Width Limited by $T_{JM}$                                    |                       |      | 96 A          |
| $V_{SD}$ | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1                                    |                       |      | 1.4 V         |
| $t_{rr}$ | $I_F = 12\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ |                       | 390  | ns            |
| $Q_{RM}$ |  |                       | 3.3  | $\mu\text{C}$ |
| $I_{RM}$ |  |                       | 17   | A             |

Note 1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .

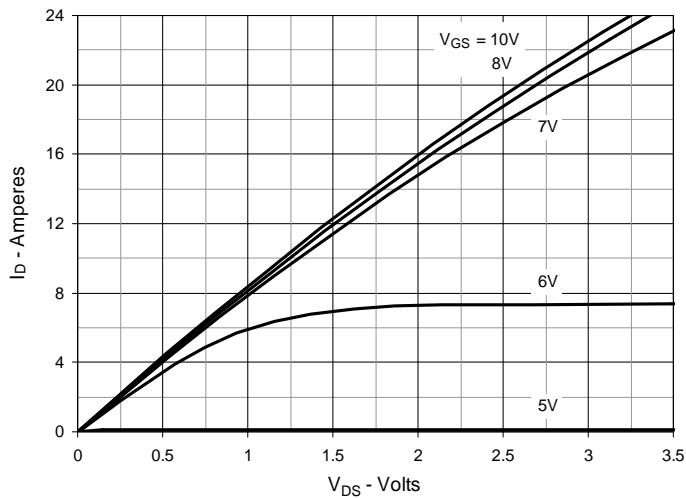
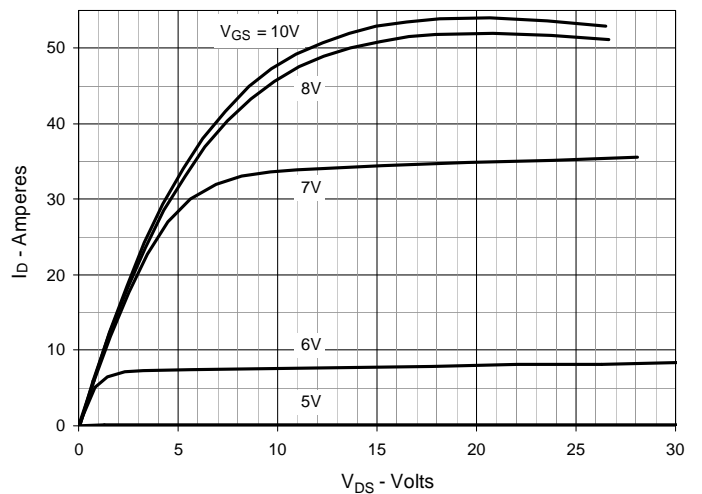
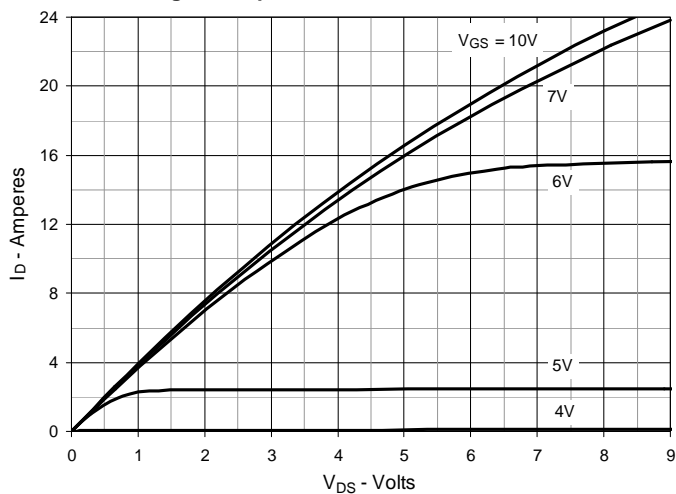
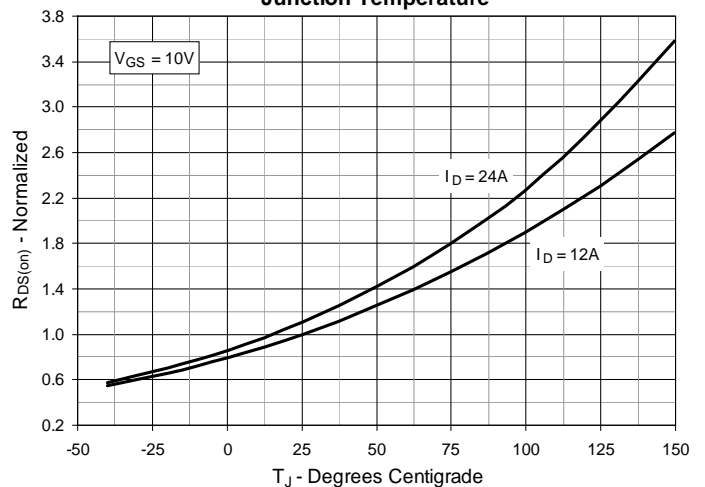
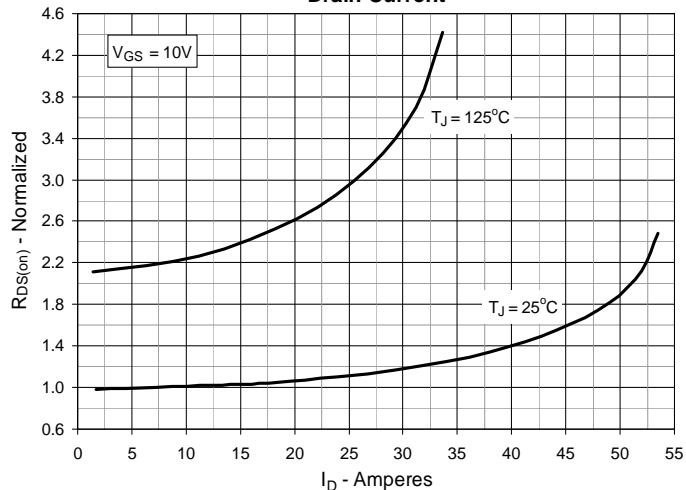
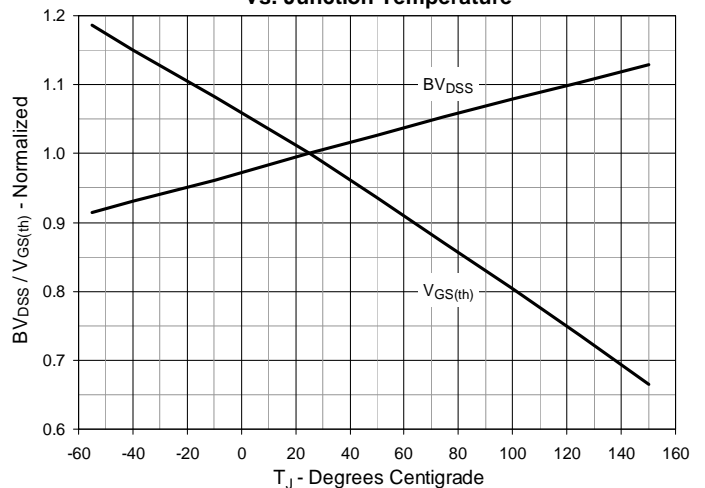
### OVERMOLDED TO-220 (IXTP...M)

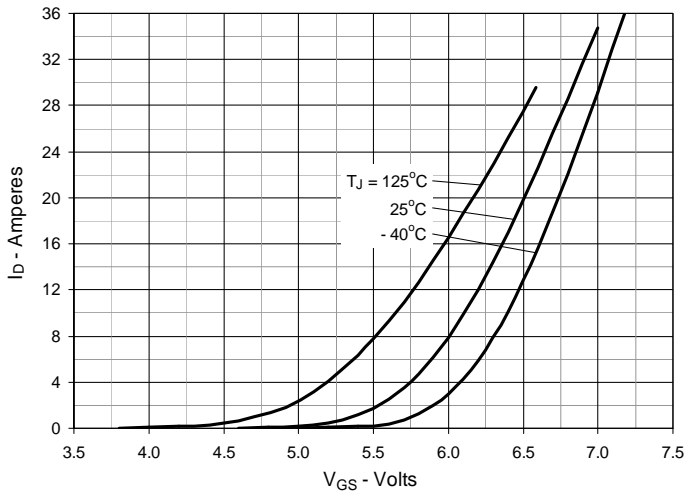
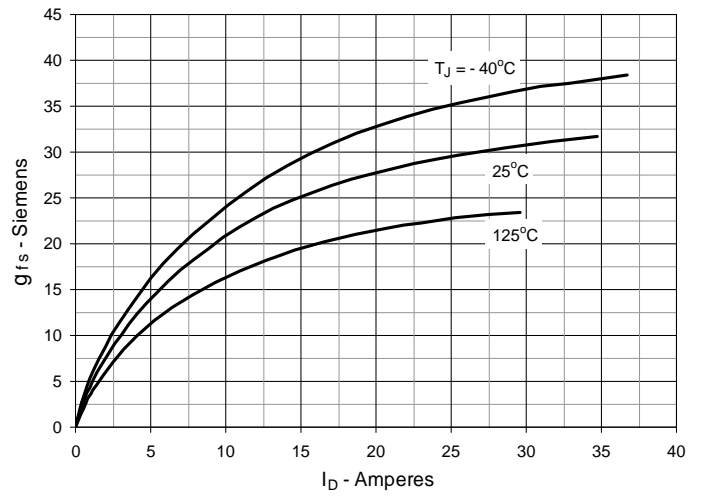
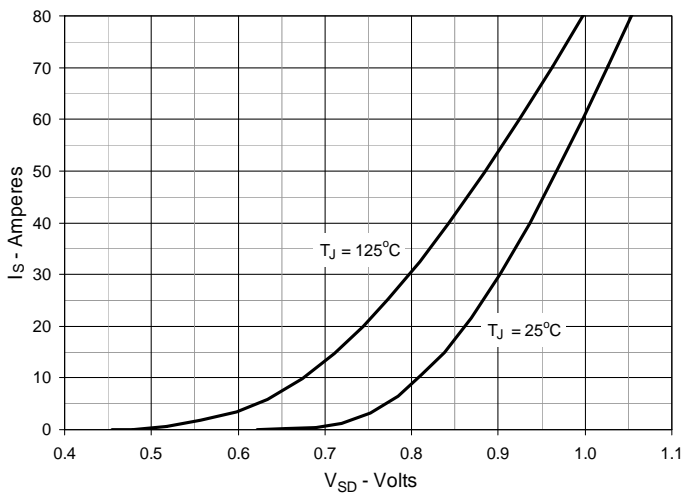
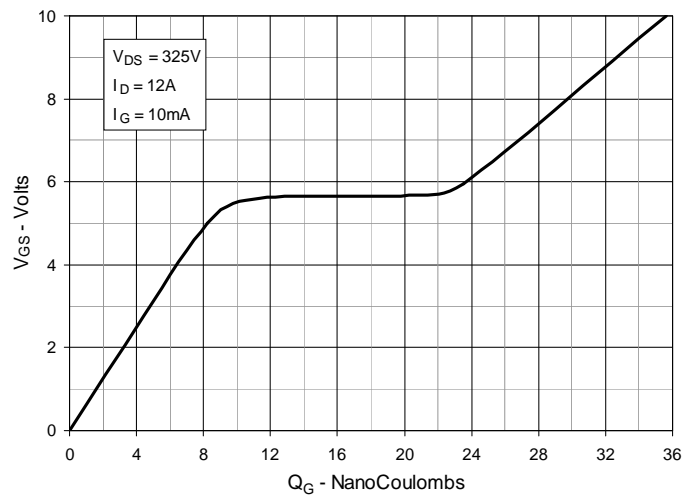
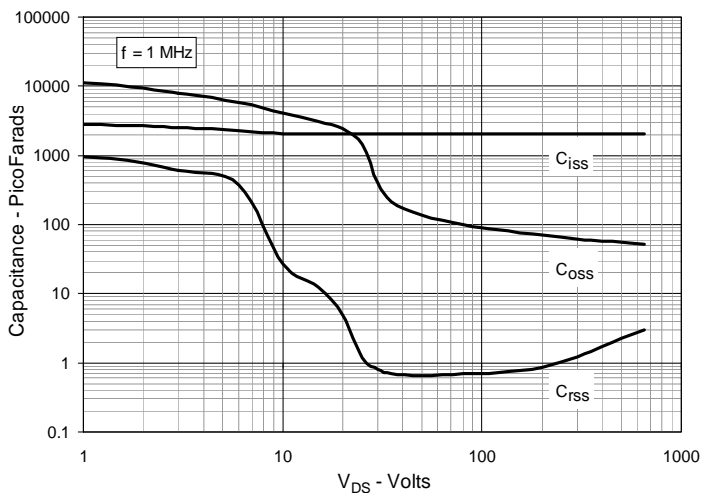
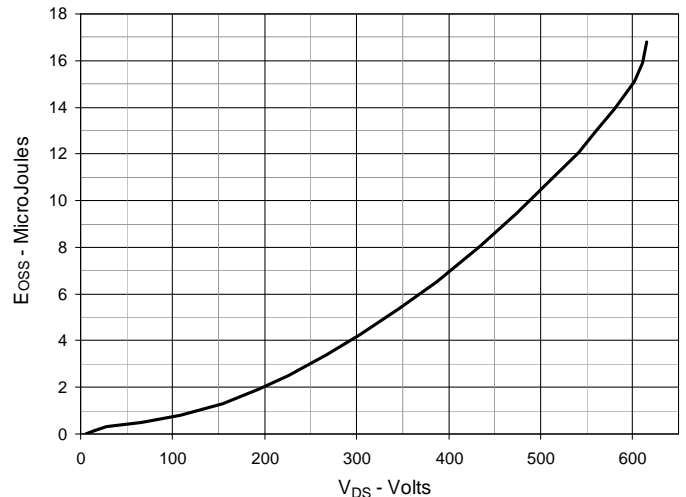


| SYM           | INCHES   |      | MILLIMETERS |       |
|---------------|----------|------|-------------|-------|
|               | MIN      | MAX  | MIN         | MAX   |
| A             | .177     | .193 | 4.50        | 4.90  |
| A1            | .092     | .108 | 2.34        | 2.74  |
| A2            | .101     | .117 | 2.56        | 2.96  |
| b             | .028     | .035 | 0.70        | 0.90  |
| b1            | .050     | .058 | 1.27        | 1.47  |
| c             | .018     | .024 | 0.45        | 0.60  |
| D             | .617     | .633 | 15.67       | 16.07 |
| E             | .392     | .408 | 9.96        | 10.36 |
| e             | .100 BSC |      | 2.54 BSC    |       |
| H             | .255     | .271 | 6.48        | 6.88  |
| L             | .499     | .523 | 12.68       | 13.28 |
| L1            | .119     | .135 | 3.03        | 3.43  |
| $\emptyset P$ | .121     | .129 | 3.08        | 3.28  |
| Q             | .126     | .134 | 3.20        | 3.40  |

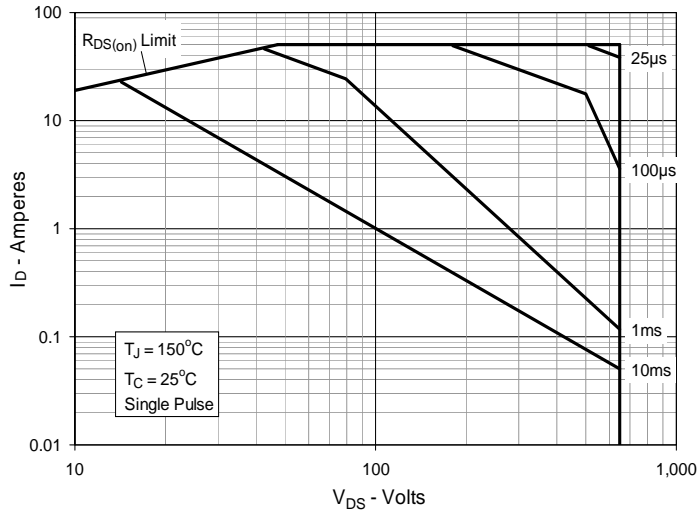
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|  |           |           |           |           |             |             |             |             |             |             |
|--|-----------|-----------|-----------|-----------|-------------|-------------|-------------|-------------|-------------|-------------|
| 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   | 6,404,065B1 | 6,683,344   | 6,727,585   | 7,005,734B2 | 7,157,338B2 |
|  | 4,860,072 | 5,017,508 | 5,063,307 | 5,381,025 | 6,259,123B1 | 6,534,343   | 6,710,405B2 | 6,759,692   | 7,063,975B2 |             |
|  | 4,881,106 | 5,034,796 | 5,187,117 | 5,486,715 | 6,306,728B1 | 6,583,505   | 6,710,463   | 6,771,478B2 | 7,071,537   |             |

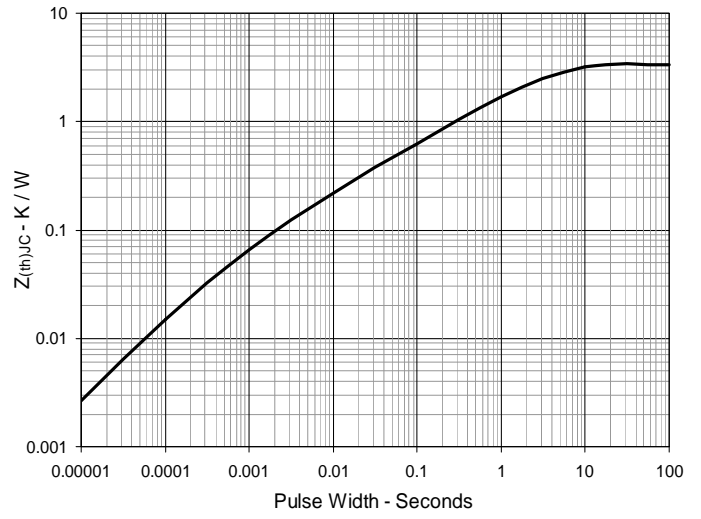
**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$** 

**Fig. 2. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$** 

**Fig. 3. Output Characteristics @  $T_J = 125^\circ\text{C}$** 

**Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 12\text{A}$  Value vs. Junction Temperature**

**Fig. 5.  $R_{DS(on)}$  Normalized to  $I_D = 12\text{A}$  Value vs. Drain Current**

**Fig. 6. Normalized Breakdown & Threshold Voltages vs. Junction Temperature**


**Fig. 7. Input Admittance**

**Fig. 8. Transconductance**

**Fig. 9. Forward Voltage Drop of Intrinsic Diode**

**Fig. 10. Gate Charge**

**Fig. 11. Capacitance**

**Fig. 12. Output Capacitance Stored Energy**


**Fig. 13. Forward-Bias Safe Operating Area**



**Fig. 14. Maximum Transient Thermal Impedance**





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