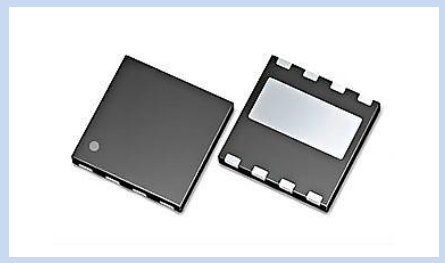
# N-Channel GaN Transistor
# 650V 29A 188W DFN8x8

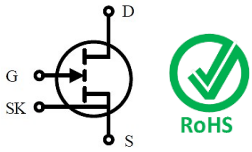
MFTG65N29D88

MERITEK

## FEATURE

- $R_{DS(ON)}$<80mΩ at $V_{GS}$=6V, $I_D$=8A
- Enhancement Mode Transistor-Normally Off Power Switch
- Low Gate Charge, Low Output charge
- Ultra-High Switching Frequency
- No Reverse-Recovery Charge
- Applications: AC-DC & DC-DC Converter, BCM/DCM Totem Pole PFC, Fast Battery Charging





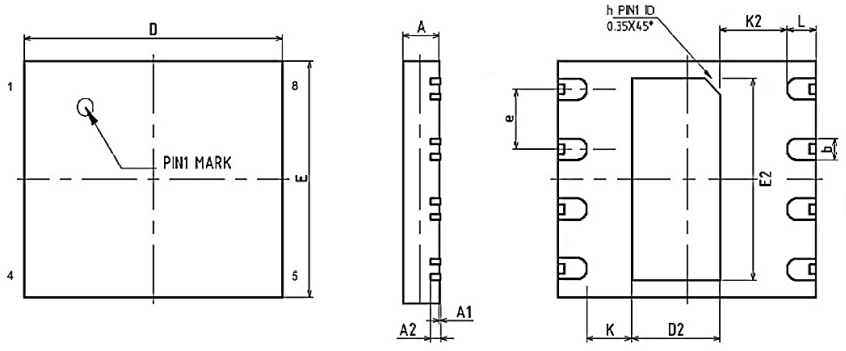

## MAXIMUM RATINGS

| Parameter | | Symbol | Value | Unit |
|---|---|---|---|---|
| Maximum Drain-Source Voltage | $V_{GS}$=0V | $V_{DS, max}$ | 650 | V |
| Transient Drain-Source Voltage | $V_{GS}$=0V | $V_{DS, transient}$ | 800 | V |
| Pulse Drain-Source Voltage | $T_J$=25°C, Total time<10hrs | $V_{DS, pulse}$ | 750 | V |
| | $T_J$=125°C, Total time<1hrs | | | |
| Continuous Gate-Source Voltage | | $V_{GS}$ | -6 to 7 | V |
| Pulse Gate-Source Voltage | t= 50ns, f =100kHz, open drain | $V_{GS, pulse}$ | -20 to 10 | V |
| Drain Current – Continuous | $T_C$=25°C | $I_D$ | 29 | A |
| Drain Current – Pulsed | $V_{GS}$ = 6V, $T_C$=25°C, t= 10μs | $I_{DM}$ | 58 | A |
| | $V_{GS}$ = 6V, $T_C$=125°C, t= 10μs | | 29 | |
| Power Dissipation | $T_C$=25°C | $P_D$ | 188 | W |
| Thermal Resistance, Junction to Ambient | | $R_{\theta JA}$ | 33.6 | °C / W |
| Thermal Resistance, Junction to Case | | $R_{\theta JC}$ | 0.52 | °C / W |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to 150 | °C |
| Soldering Temperature | | $T_{sold}$ | 260 | °C |

## DIMENSIONS

| Item | Min. (mm) | Max. (mm) |
|---|---|---|
| A | 0.80 | 1.00 |
| A1 | 0.00 | 0.05 |
| A2 | 0.203 REF | |
| b | 0.92 | 1.05 |
| D | 8.00 BSC | |
| D2 | 3.10 | 3.30 |
| E | 8.00 BSC | |
| E2 | 6.84 | 7.04 |
| e | 2.00 BSC | |
| L | 0.40 | 0.60 |
| K | 0.90 | 1.10 |
| K2 | 2.70 | 2.90 |

Pin Layout: 8:Gate(G), 1,2,3,4:Drain(D),
7:Kelvin Source(SK), 5,6,9: Source(S)

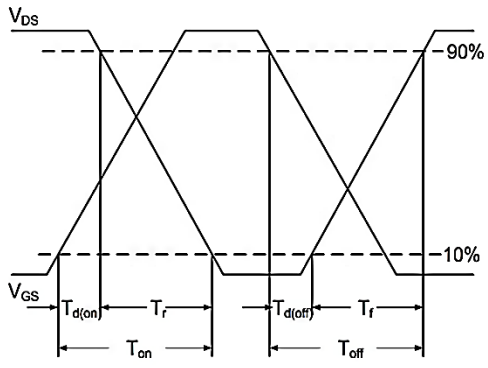


## ELECTRICAL CHARACTERISTICS

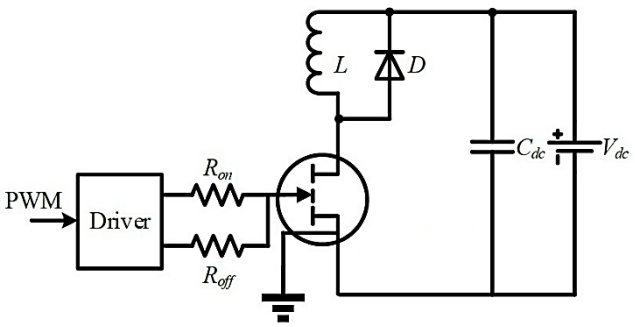
| Static Characteristics | Conditions | Symbol | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Drain-Source Leakage Current | $V_{DS}$=650V, $V_{GS}$=0V ,$T_J$=25°C | $I_{DSS}$ | -- | 5 | 65 | μA |
| | $V_{DS}$=650V, $V_{GS}$=0V ,$T_J$=150°C | | -- | 13 | 390 | |
| Gate-Source Leakage Current | $V_{GS}$=6V, $V_{DS}$=0V | $I_{GSS}$ | -- | 163 | -- | μA |
| **Static Characteristics** | **Conditions** | **Symbol** | **Min** | **Typ.** | **Max** | **Unit** |
| Static Drain-Source On-Resistance | $V_{GS}$=6V, $I_D$=8A, $T_J$=25°C | $R_{DS(ON)}$ | -- | 60 | 80 | mΩ |
| | $V_{GS}$=6V, $I_D$=8A, $T_J$=150°C | | -- | 135 | -- | |
| Gate Threshold Voltage | $V_{GS}$=$V_{DS}$, $I_D$=30.7mA, $T_J$=25°C | $V_{GS(th)}$ | 1.2 | 1.7 | 2.5 | V |
| | $V_{GS}$=$V_{DS}$, $I_D$=30.7mA, $T_J$=150°C | | -- | 1.6 | -- | |
| Gate Resistance | f=5MHz, open drain | $R_G$ | -- | 3 | -- | Ω |
| **Dynamic Characteristics** | **Conditions** | **Symbol** | **Min** | **Typ.** | **Max** | **Unit** |
| Total Gate Charge | $V_{DS}$=400V, $I_D$=8A, $V_{GS}$= 0 to 6V | $Q_g$ | -- | 6.2 | -- | nC |
| Gate-Source Charge | | $Q_{gs}$ | -- | 0.5 | -- | |
| Gate-Drain Charge | | $Q_{gd}$ | -- | 2.2 | -- | |
| Gate Plateau Voltage | $V_{DS}$=400V, $I_D$=8A | $V_{Plat}$ | -- | 2.2 | -- | V |
| Turn-On Delay Time | $V_{DS}$=400V, $I_D$=16A, L=318μH<br>$V_{GS}$= 6V, $R_{ON}$=10Ω, $R_{OFF}$=2Ω | $T_{d(on)}$ | -- | 3 | -- | ns |
| Rise Time | | $T_r$ | -- | 4 | -- | |
| Turn-Off Delay Time | | $T_{d(off)}$ | -- | 5 | -- | |
| Fall Time | | $T_f$ | -- | 4 | -- | |
| Input Capacitance | $V_{DS}$=400V, $V_{GS}$=0V,<br>f=100KHz | $C_{iss}$ | -- | 225 | -- | pF |
| Output Capacitance | | $C_{oss}$ | -- | 70 | -- | |
| Reverse Transfer Capacitance | | $C_{rss}$ | -- | 0.5 | -- | |
| Effective Output Capacitance, Energy Related | $V_{DS}$=0 to 400V, $V_{GS}$=0V | $C_{o(er)}$ | -- | 105 | -- | |
| Effective Output Capacitance, Time Related | | $C_{o(tr)}$ | -- | 150 | -- | |
| Output Charge | | $Q_{OSS}$ | -- | 60 | -- | nC |
| **Reverse Conduction Diode** | **Conditions** | **Symbol** | **Min** | **Typ.** | **Max** | **Unit** |
| Source-Darin Reverse Voltage | $V_{GS}$= 0V, $I_S$=8A | $V_{SD}$ | -- | 2.3 | -- | V |
| Pulsed Current, Reverse | $V_{GS}$= 6V, $t_{PULSE}$= 10μs | $I_{S,Pulse}$ | -- | -- | 58 | A |
| Peak Reverse Recovery Current | -- | $I_{rrm}$ | -- | 0 | -- | A |
| Reverse Recovery Time | -- | $T_{rr}$ | -- | 0 | -- | ns |
| Reverse Recovery Charge | $V_{DS}$=400V, $I_S$=8A | $Q_{rr}$ | -- | 0 | -- | nC |

Note:
1. $V_{DS,\ transient}$ is intended for non-repetitive events, $t_{PULSE}$<200μs
2. $V_{DS,\ pulse}$ is intended for repetitive pulse, $t_{PULSE}$<100ns
3. $C_{o(er)}$ is the fixed capacitance that gives the same stored energy as $C_{oss}$ while $V_{DS}$ is rising from 0 to 400V.
4. $C_{o(tr)}$ is the fixed capacitance that gives the same charging time as $C_{oss}$ while $V_{DS}$ is rising from 0 to 400V.
5. Guaranteed by design, not subject to production testing.
6. Moisture Sensitive Level: MSL3

**Switching Time Waveform**

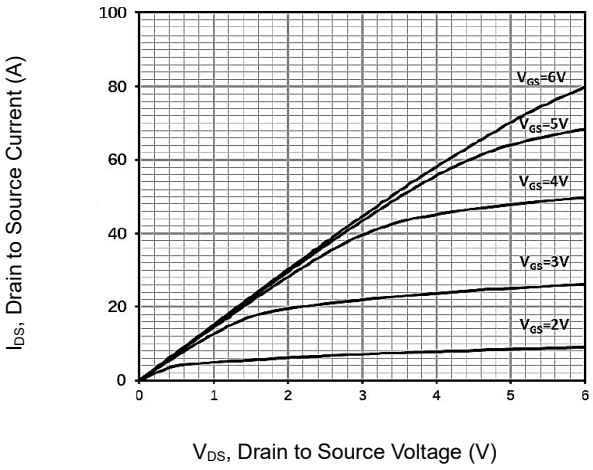



**Switching Test Circuit**

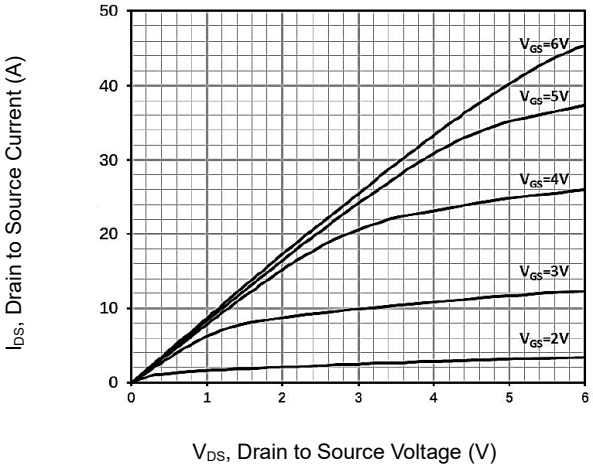


## CHARACTERISTIC CURVES

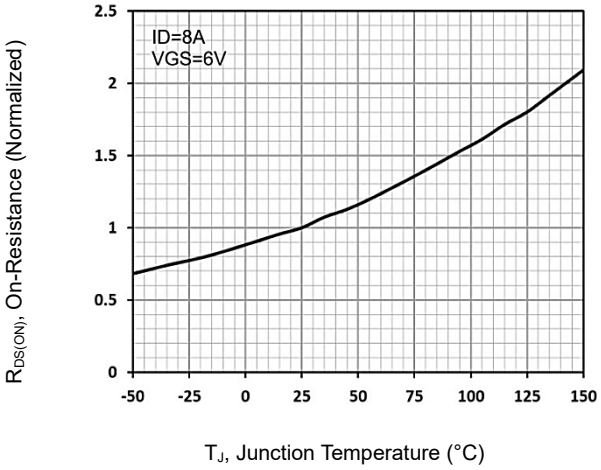
**Output Characteristics at $T_J$=25°C**



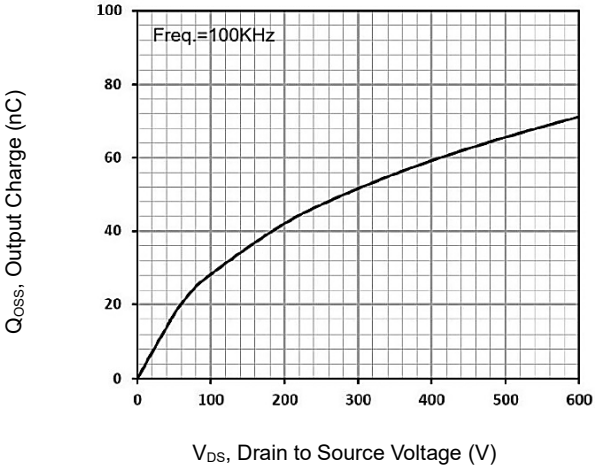

**Output Characteristics at $T_J$=125°C**



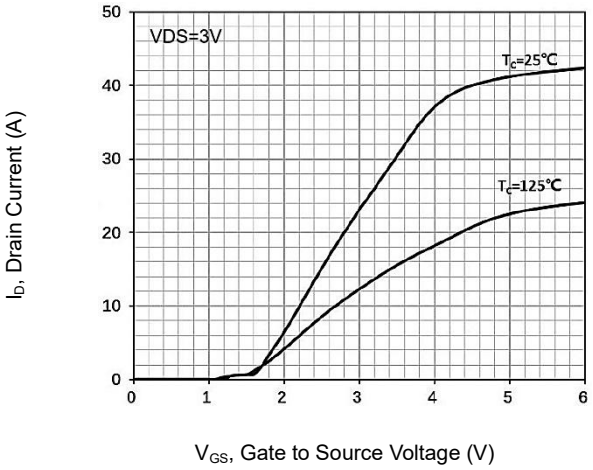

**Normalized On-Resistance vs. Junction temperature**



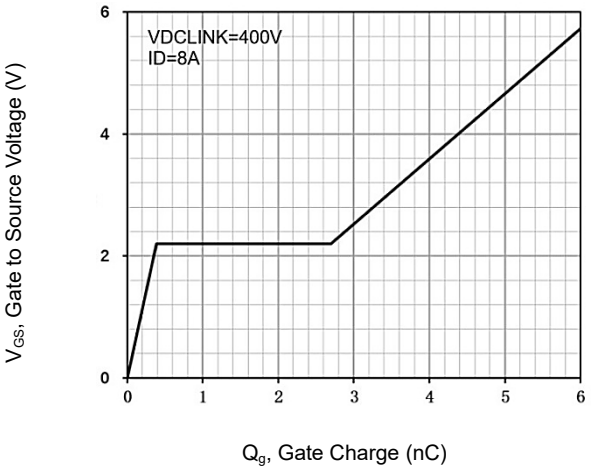

**Output-Charge Characteristics**




**Transfer Characteristic**

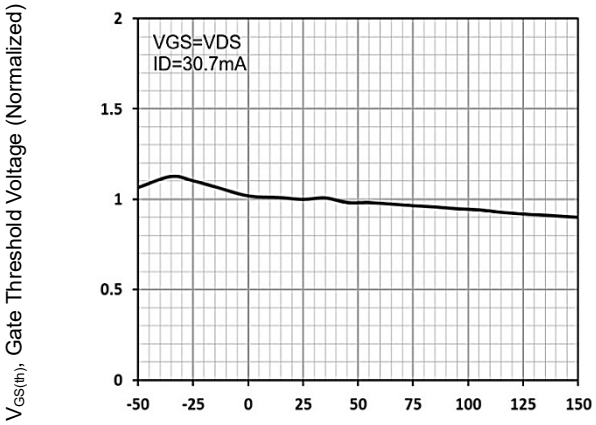



**Gate-Charge Characteristics**



## CHARACTERISTIC CURVES

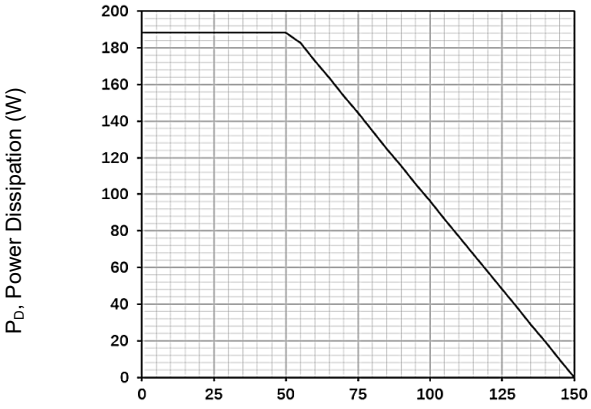
**Normalized Threshold Voltage vs. Junction Temperature**




$V_{GS(th)}$, Gate Threshold Voltage (Normalized)

$T_J$, Junction Temperature (°C)

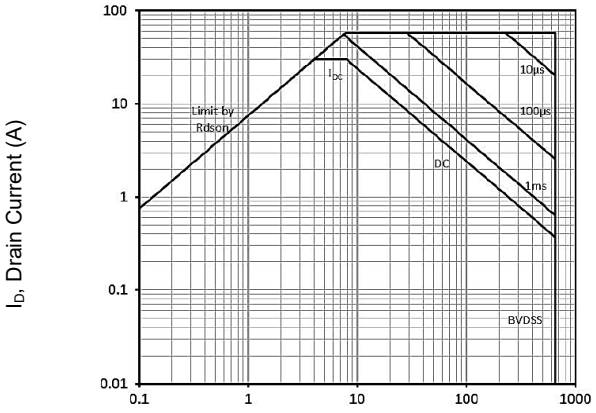
**Power Dissipation Derating**




$P_D$, Power Dissipation (W)

$T_C$, Case Temperature (°C)

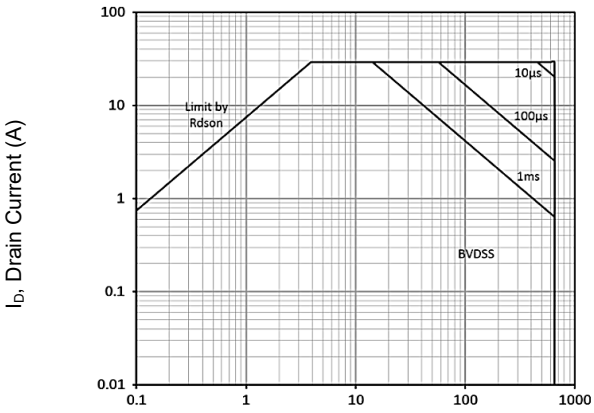
**Safe Operating Area at $T_C$=25°C**




$I_D$, Drain Current (A)

$V_{DS}$, Drain to Source Voltage (V)

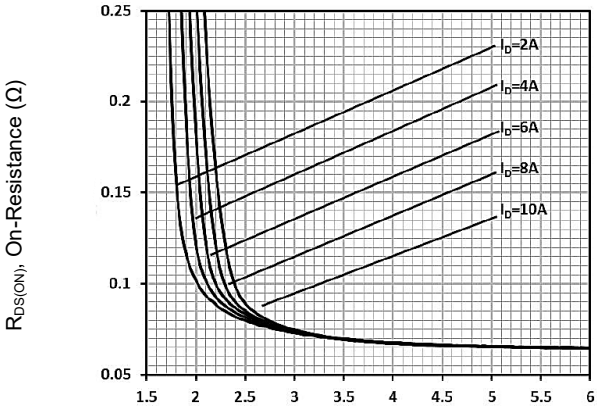
**Safe Operating Area at $T_C$=125°C**




$I_D$, Drain Current (A)

$V_{DS}$, Drain to Source Voltage (V)

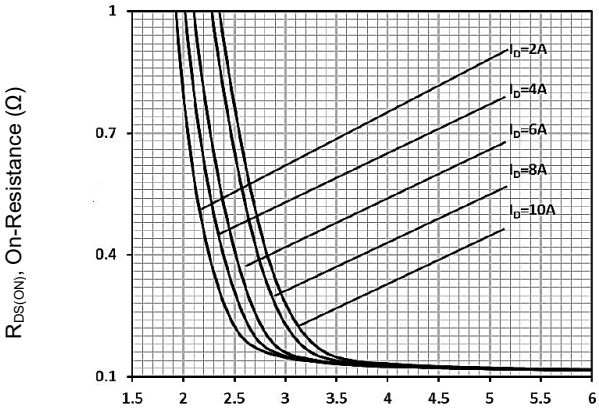
**On-Resistance vs. Gate-Source Voltage at $T_J$=25°C**




$R_{DS(ON)}$, On-Resistance (Ω)

$V_{GS}$, Gate to Source Voltage (V)

**On-Resistance vs. Gate-Source Voltage at $T_J$=125°C**

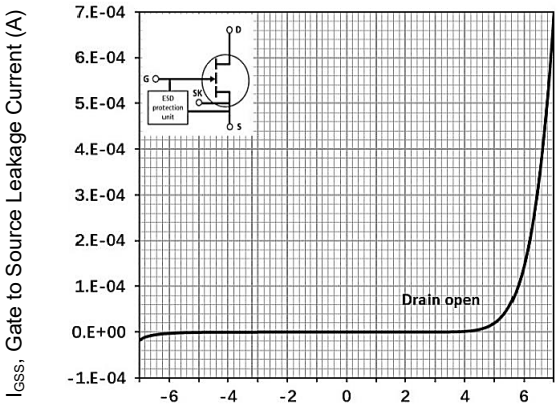



$R_{DS(ON)}$, On-Resistance (Ω)

$V_{GS}$, Gate to Source Voltage (V)

## CHARACTERISTIC CURVES

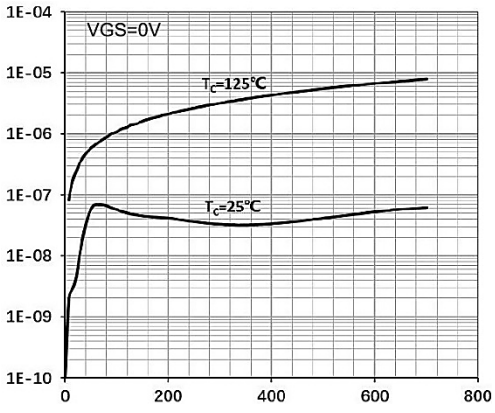
**Gate to Source Leakage Characteristics**




$I_{GSS}$, Gate to Source Leakage Current (A)

$V_{GS}$, Gate to Source Voltage (V)

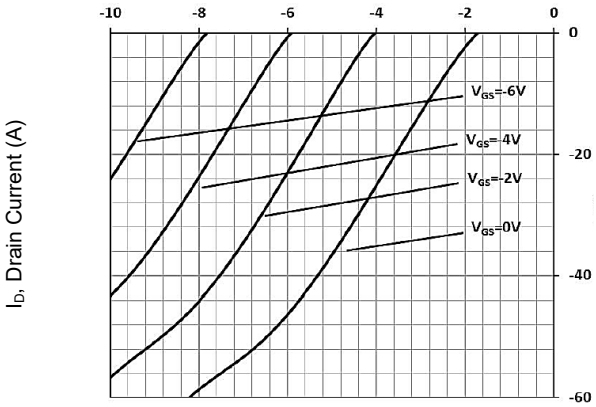
**Drain to Source Leakage Characteristics**




$I_{DSS}$, Drain to Source Leakage Current (A)

$V_{DS}$, Drain to Source Voltage (V)

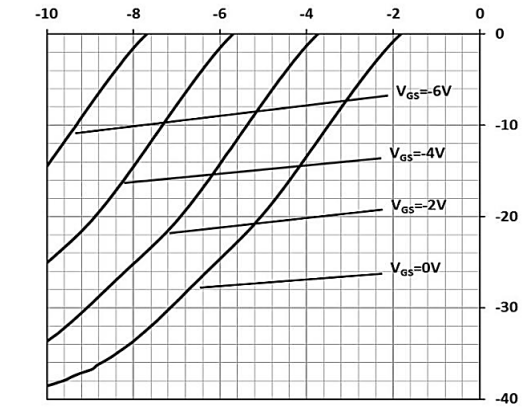
**Reverse Characteristics at $T_J$=25°C**




$I_D$, Drain Current (A)

$V_{DS}$, Drain to Source Voltage (V)

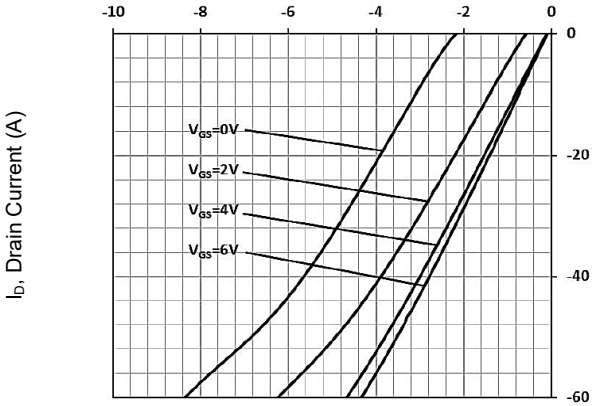
**Reverse Characteristics at $T_J$=125°C**




$I_D$, Drain Current (A)

$V_{DS}$, Drain to Source Voltage (V)

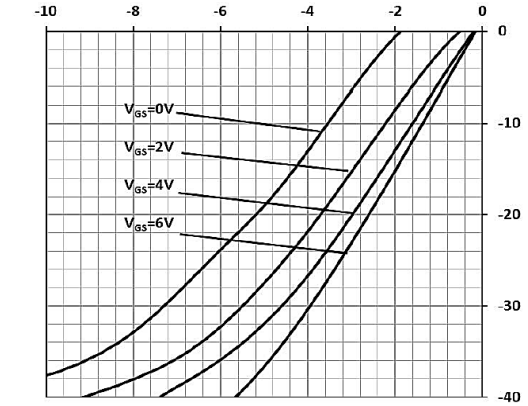
**Reverse Characteristics at $T_J$=25°C**




$I_D$, Drain Current (A)

$V_{DS}$, Drain to Source Voltage (V)

**Reverse Characteristics at $T_J$=125°C**

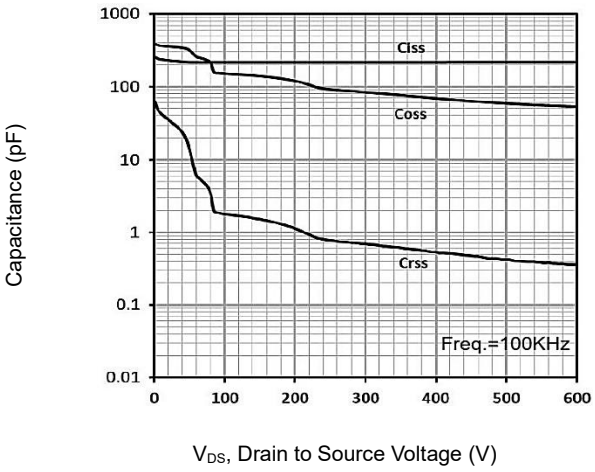



$I_D$, Drain Current (A)

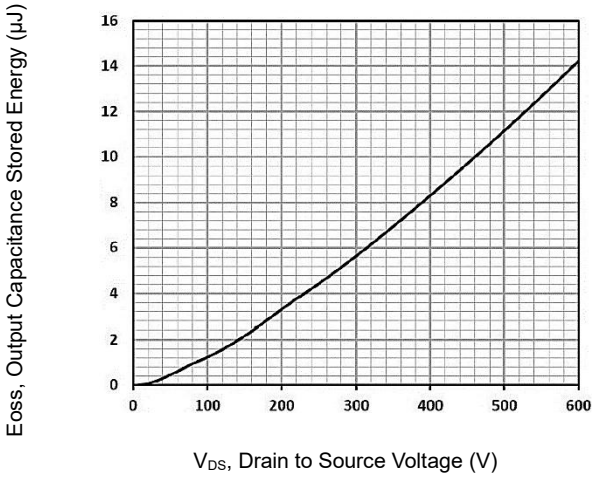
$V_{DS}$, Drain to Source Voltage (V)

## CHARACTERISTIC CURVES

**Capacitance**




**Output Capacitance Stored Energy**




**Maximum Transient Thermal Impedance**