



Group-Semi N/P-Channel Complementary MOSFET

Jul 2021

## GENERAL DESCRIPTION

The GSD4018DT uses advanced trench technology MOSFETs to provide excellent  $R_{DS(ON)}$  and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications. Standard Product GSD4018DT is Pb-free. GSD4018DT is electrically identical.

## GENERAL FEATURES

### N-channel

- $V_{DS}=40V, I_D=10A$   
 $R_{DS(ON)} < 23m\Omega @ V_{GS}=10V$   
 $R_{DS(ON)} < 30m\Omega @ V_{GS}=4.5V$

### P-channel

- $V_{DS}=-40V, I_D=-10A$   
 $R_{DS(ON)} < 45m\Omega @ V_{GS}=-10V$   
 $R_{DS(ON)} < 50m\Omega @ V_{GS}=-4.5V$

- High density cell design for ultra low  $R_{dson}$
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high EAS
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

## Application

- H-bridge
- Inverters

## PIN CONFIGURATION

| Package   | Pin Configuration (Top View) |
|-----------|------------------------------|
| TO-252-4L |                              |



## Absolute Maximum Ratings $T_A=25^\circ C$ unless otherwise noted

| Symbol         | Parameter                                                                                 | Max N-channel | Max P-channel | Unit       |
|----------------|-------------------------------------------------------------------------------------------|---------------|---------------|------------|
| $V_{DS}$       | Drain-Source Voltage                                                                      | 40            | -40           | V          |
| $I_D$          | Drain Current<br>-Continuous ( $T_A = 25^\circ C$ )<br>-Continuous ( $T_A = 70^\circ C$ ) | 12<br>8       | -12<br>-8     | A          |
| $I_{DM}$       | Drain Current - Pulsed<br>(Note 1)                                                        | 24            | -24           | A          |
| $V_{GS}$       | Gate-Source voltage                                                                       | $\pm 20$      | $\pm 20$      | V          |
| $I_{AS}$       | Single Pulse Avalanche Current<br>(Note 1)                                                | 14            | 24            | A          |
| $E_{AS}$       | Single Pulse Avalanche Energy $L=0.1mH$<br>(Note 1)                                       | 18            | 36            | mJ         |
| $P_D$          | Power Dissipation - $T_A = 25^\circ C$<br>- $T_A = 70^\circ C$                            | 2             | 2             | W          |
| $T_J, T_{STG}$ | Operating and Storage Temperature Range                                                   | -55 to +150   | -55 to +150   | $^\circ C$ |



## Thermal Characteristics

| Symbol           | Parameter                                 | GSD4018DT | Unit |
|------------------|-------------------------------------------|-----------|------|
| R <sub>θJA</sub> | Maximum Junction-to-Ambient, t<10s        | 48        | °C/W |
|                  | Maximum Junction-to-Ambient, Steady-State | 74        | °C/W |
| R <sub>θJL</sub> | Maximum Junction-to-Lead, Steady-State    | 32        | °C/W |

## N-Channel Electrical Characteristics

| Symbol                                                 | Parameter                                             | Conditions                                          | Min | Typ      | Max      | Unit     |
|--------------------------------------------------------|-------------------------------------------------------|-----------------------------------------------------|-----|----------|----------|----------|
| Off Characteristics                                    |                                                       |                                                     |     |          |          |          |
| BVDSS                                                  | Drain-Source Breakdown Voltage                        | VGS = 0V, ID = 250μA, TJ = 25℃                      | 40  | -        | -        | V        |
| IDSS                                                   | Zero Gate Voltage Drain Current                       | VDS = 40V, VGS = 0V<br>-TJ = 55℃                    | -   | -        | 1<br>5   | μA<br>μA |
| IGSSF                                                  | Gate-Body Leakage Current, Forward                    | VGS = 20V, VDS = 0V                                 | -   | -        | 100      | nA       |
| IGSSR                                                  | Gate-Body Leakage Current, Reverse                    | VGS = -20V, VDS = 0V                                | -   | -        | -100     | nA       |
| On Characteristics                                     |                                                       |                                                     |     |          |          |          |
| VGS(th)                                                | Gate Threshold Voltage                                | VDS = VGS, ID = 250μA                               | 1.0 | 1.8      | 3.0      | V        |
| RDS(on)                                                | Static Drain-Source On-Resistance                     | VGS = 10V, ID = 6A<br>VGS = 4.5V, ID = 5A           | -   | 17<br>25 | 23<br>28 | mΩ       |
| gFS                                                    | Forward Transconductance                              | VDS = 5V, ID = 6A                                   | -   | 20       | -        | S        |
| Rg                                                     | Gate resistance                                       | VGS=0V, VDS=0V, f=1MHz                              | -   | 3.2      | -        | Ω        |
| Dynamic Characteristics                                |                                                       |                                                     |     |          |          |          |
| Ciss                                                   | Input Capacitance                                     | VDS = 20V, VGS = 0V, f=1MHz                         | -   | 516      | -        | pF       |
| Coss                                                   | Output Capacitance                                    |                                                     | -   | 82       | -        | pF       |
| Crss                                                   | Reverse Transfer Capacitance                          |                                                     | -   | 43       | -        | pF       |
| Switching Characteristics                              |                                                       |                                                     |     |          |          |          |
| td(on)                                                 | Turn-On Delay Time                                    | VDS = 20V, RG = 3Ω, ID = 6A , VGS = 10V (Note 5, 6) | -   | 6.4      | -        | ns       |
| tr                                                     | Turn-On Rise Time                                     |                                                     | -   | 3.6      | -        | ns       |
| td(off)                                                | Turn-Off Delay Time                                   |                                                     | -   | 16.2     | -        | ns       |
| tf                                                     | Turn-Off Fall Time                                    |                                                     | -   | 6.6      | -        | ns       |
| Qg(10V)                                                | Total Gate Charge                                     | VDS = 20V, ID = 6A, VGS = 0~10V (Note 5, 6)         | -   | 8.3      | -        | nC       |
| Qg(4.5V)                                               | Total Gate Charge                                     |                                                     | -   | 6.2      | -        | nC       |
| Qgs                                                    | Gate-Source Charge                                    |                                                     | -   | 2.3      | -        | nC       |
| Qgd                                                    | Gate-Drain Charge                                     |                                                     | -   | 1.6      | -        | nC       |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                       |                                                     |     |          |          |          |
| IS                                                     | Maximum Continuous Drain-Source Diode Forward Current | -                                                   | -   | -        | 25       | A        |
| ISM                                                    | Maximum Pulsed Drain-Source Diode Forward Current     | -                                                   | -   | -        | 50       | A        |
| VSD                                                    | Drain-Source Diode Forward Voltage                    | VGS = 0V, IS = 1A                                   | -   | 0.7      | 1.0      | V        |
| trr                                                    | Reverse Recovery Time                                 | VGS = 0V, IS =12A dIF/dt =100A/μs (Note 5)          | -   | 8.5      | -        | ns       |
| Qrr                                                    | Reverse Recovery Charge                               |                                                     | -   | 2.2      | -        | nC       |



N-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

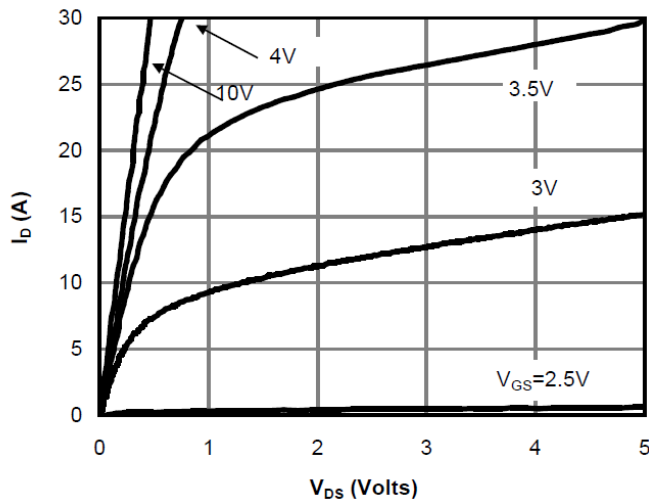


Fig 1: On-Region Characteristics (Note E)

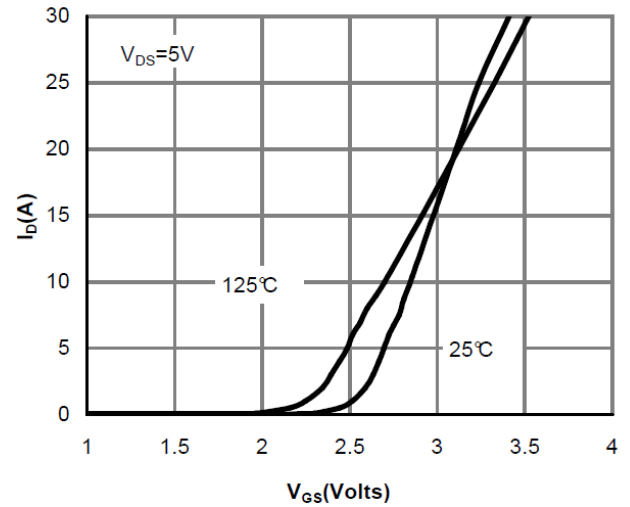


Figure 2: Transfer Characteristics (Note E)

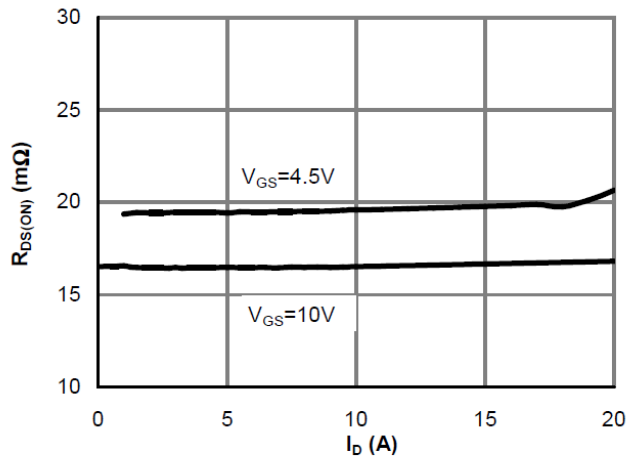


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

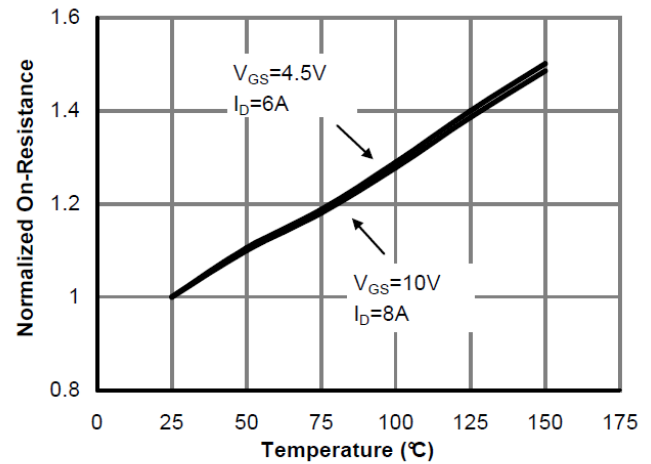


Figure 4: On-Resistance vs. Junction Temperature (Note E)

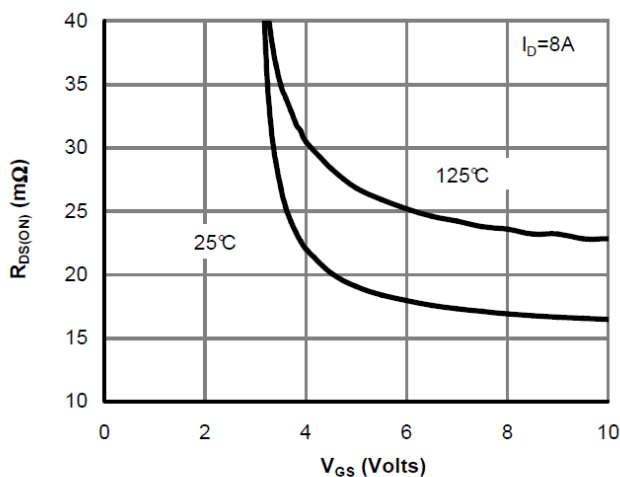


Figure 5: On-Resistance vs. Gate-Source Voltage (Note F)

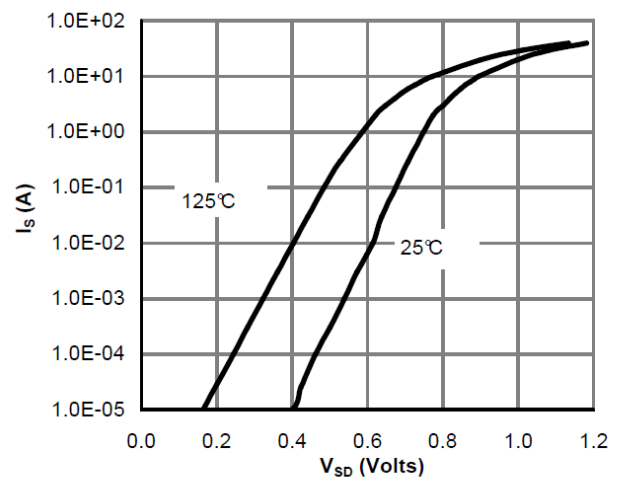
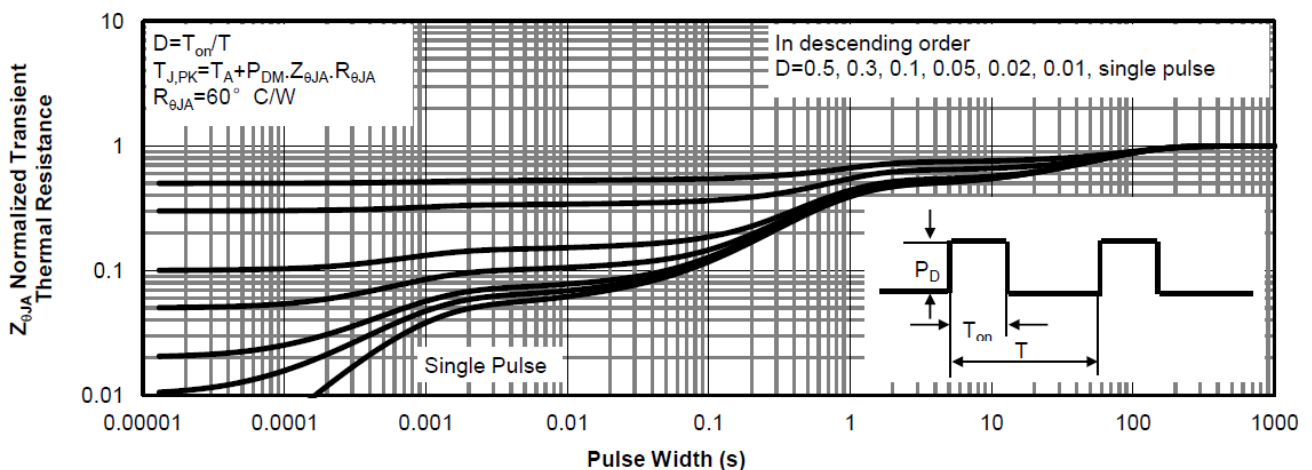
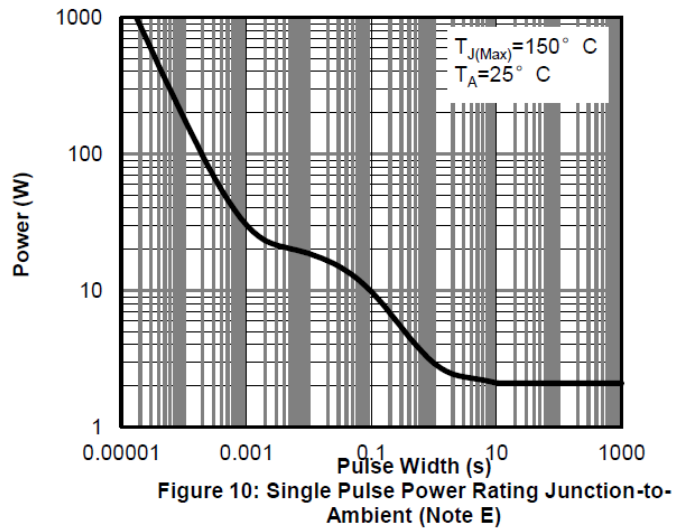
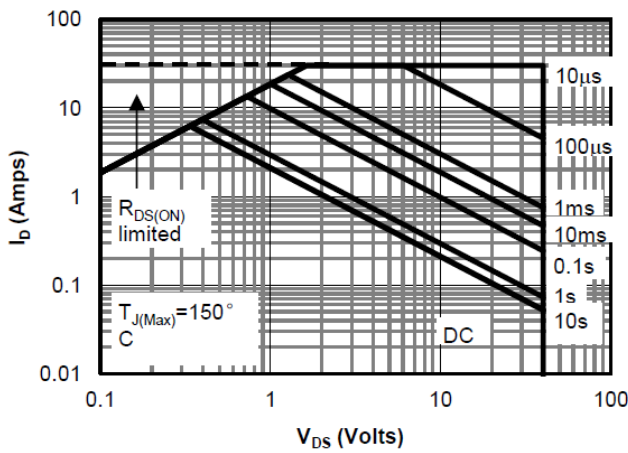
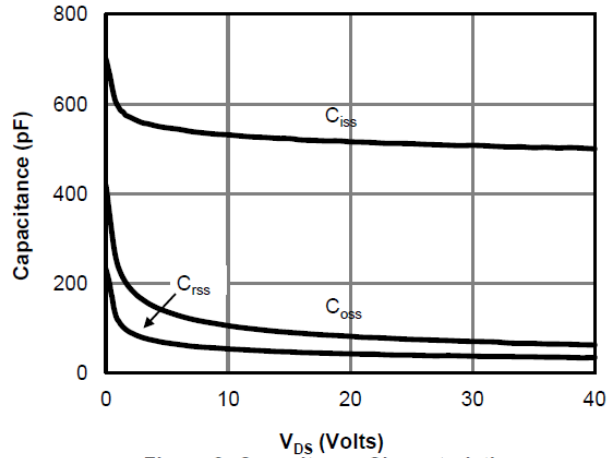
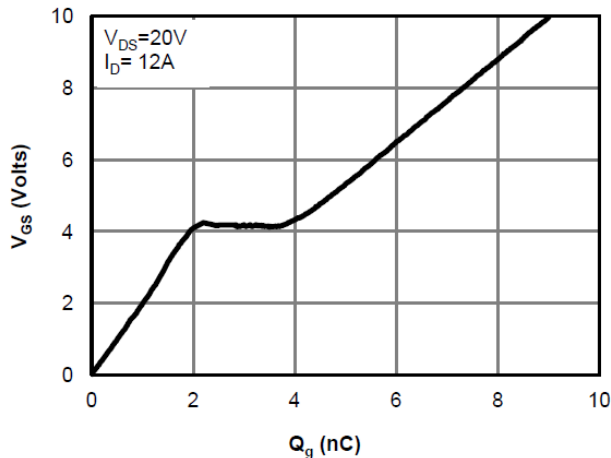


Figure 6: Body-Diode Characteristics (Note E)



N-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS





## P-Channel Electrical Characteristics

| Symbol                                                 | Parameter                                             | Conditions                                             | Min  | Typ      | Max      | Unit     |
|--------------------------------------------------------|-------------------------------------------------------|--------------------------------------------------------|------|----------|----------|----------|
| Off Characteristics                                    |                                                       |                                                        |      |          |          |          |
| BVDSS                                                  | Drain-Source Breakdown Voltage                        | VGS = 0V, ID = -250μA, TJ = 25℃                        | -40  | -        | -        | V        |
| IDSS                                                   | Zero Gate Voltage Drain Current                       | VDS = -40V, VGS = 0V<br>-TJ = 55℃                      | -    | -        | -1<br>-5 | μA<br>μA |
| IGSSF                                                  | Gate-Body Leakage Current, Forward                    | VGS = 12V, VDS = 0V                                    | -    | -        | 100      | nA       |
| IGSSR                                                  | Gate-Body Leakage Current, Reverse                    | VGS = -12V, VDS = 0V                                   | -    | -        | -100     | nA       |
| On Characteristics                                     |                                                       |                                                        |      |          |          |          |
| VGS(th)                                                | Gate Threshold Voltage                                | VDS = VGS, ID = 250μA                                  | -1.0 | -1.8     | -3.0     | V        |
| RDS(on)                                                | Static Drain-Source On-Resistance                     | VGS = -10V, ID = -6A<br>VGS = -4.5V, ID = -5A          | -    | 40<br>45 | 45<br>50 | mΩ       |
| gFS                                                    | Forward Transconductance                              | VDS = -5V, ID = -6A                                    | -    | 20       | -        | S        |
| Rg                                                     | Gate resistance                                       | VGS=0V, VDS=0V, f=1MHz                                 | -    | 3.2      | -        | Ω        |
| Dynamic Characteristics                                |                                                       |                                                        |      |          |          |          |
| Ciss                                                   | Input Capacitance                                     | VDS = -20V, VGS = 0V, f=1MHz                           | -    | 1400     | -        | pF       |
| Coss                                                   | Output Capacitance                                    |                                                        | -    | 200      | -        | pF       |
| Crss                                                   | Reverse Transfer Capacitance                          |                                                        | -    | 125      | -        | pF       |
| Switching Characteristics                              |                                                       |                                                        |      |          |          |          |
| td(on)                                                 | Turn-On Delay Time                                    | VDS = -20V, RG = 3Ω, ID = -6A , VGS = -10V (Note 5, 6) | -    | 10       | -        | ns       |
| tr                                                     | Turn-On Rise Time                                     |                                                        | -    | 31       | -        | ns       |
| td(off)                                                | Turn-Off Delay Time                                   |                                                        | -    | 24       | -        | ns       |
| tf                                                     | Turn-Off Fall Time                                    |                                                        | -    | 28       | -        | ns       |
| Qg(10V)                                                | Total Gate Charge                                     | VDS = -20V, ID = -6A, VGS =- 0~10V (Note 5, 6)         | -    | 18       | -        | nC       |
| Qg(4.5V)                                               | Total Gate Charge                                     |                                                        | -    | 14       | -        | nC       |
| Qgs                                                    | Gate-Source Charge                                    |                                                        | -    | 3.2      | -        | nC       |
| Qgd                                                    | Gate-Drain Charge                                     |                                                        | -    | 4.4      | -        | nC       |
| Drain-Source Diode Characteristics and Maximum Ratings |                                                       |                                                        |      |          |          |          |
| IS                                                     | Maximum Continuous Drain-Source Diode Forward Current |                                                        | -    | -        | -        | A        |
| ISM                                                    | Maximum Pulsed Drain-Source Diode Forward Current     |                                                        | -    | -        | -25      | A        |
| VSD                                                    | Drain-Source Diode Forward Voltage                    | VGS = 0V, IS = -1A                                     | -    | -0.7     | -1.2     | V        |
| trr                                                    | Reverse Recovery Time                                 | VGS = 0V, IS =-12A dIF/dt =-100A/μs (Note 5)           | -    | 24       | -        | ns       |
| Qrr                                                    | Reverse Recovery Charge                               |                                                        | -    | 30       | -        | nC       |



P-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

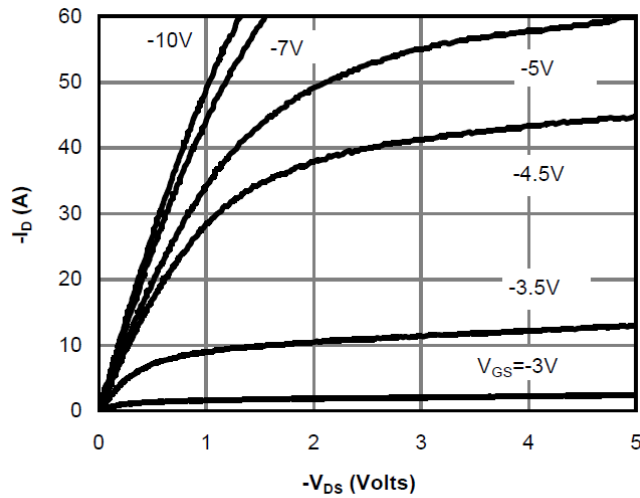


Fig 1: On-Region Characteristics (Note E)

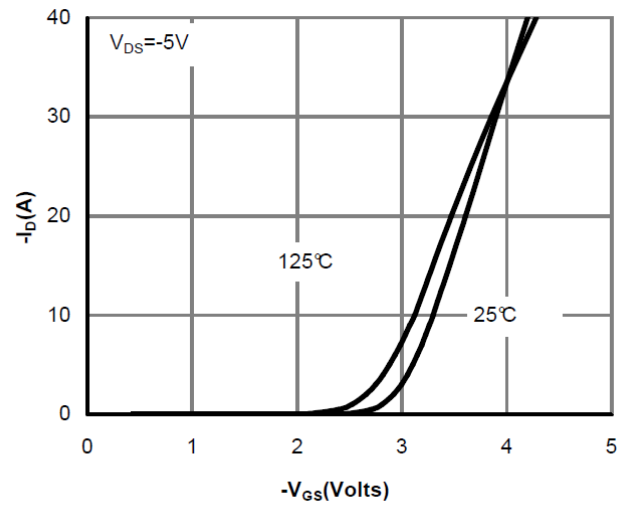


Figure 2: Transfer Characteristics (Note E)

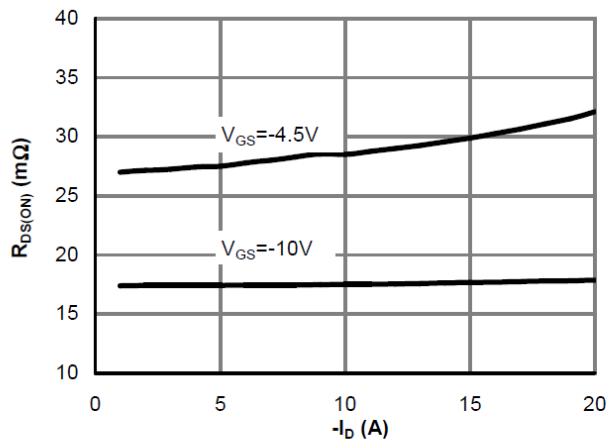


Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)

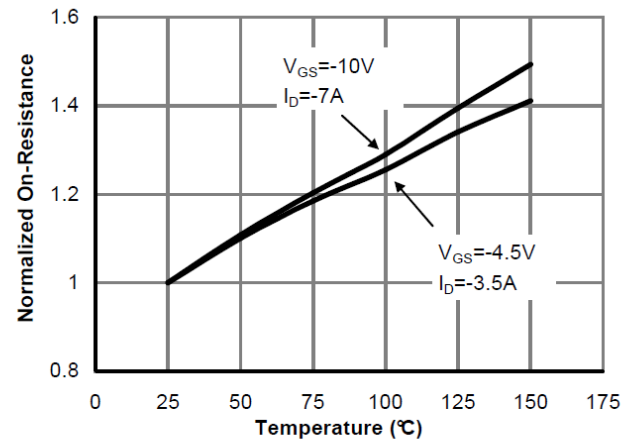


Figure 4: On-Resistance vs. Junction Temperature (Note E)

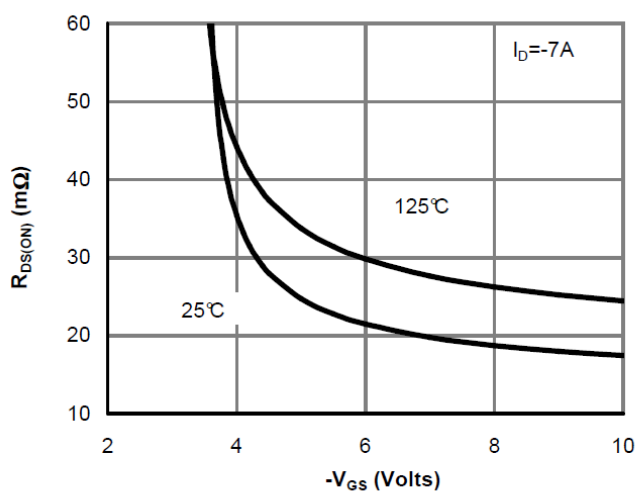


Figure 5: On-Resistance vs. Gate-Source Voltage (Note E)

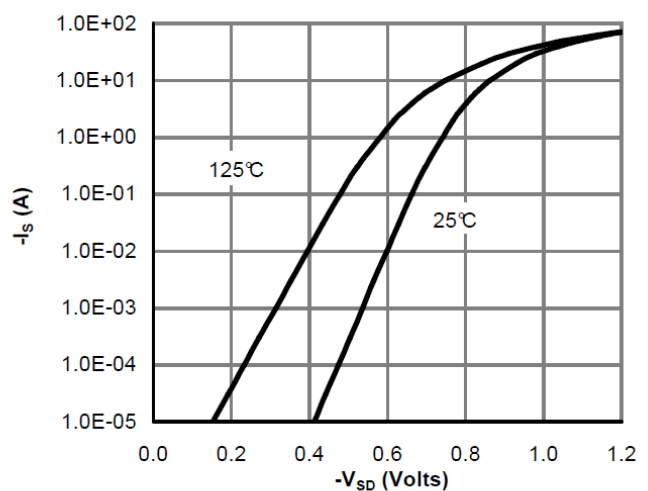
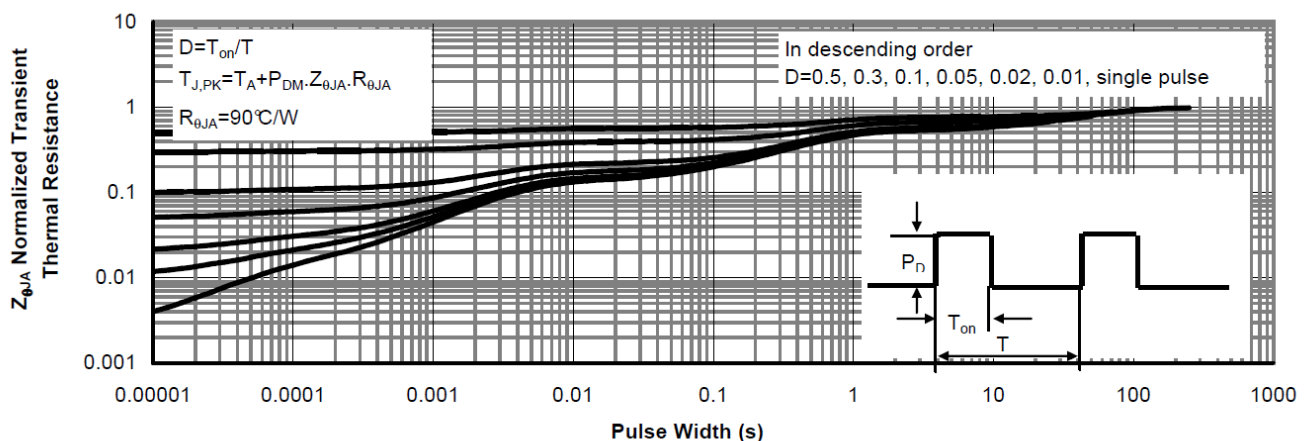
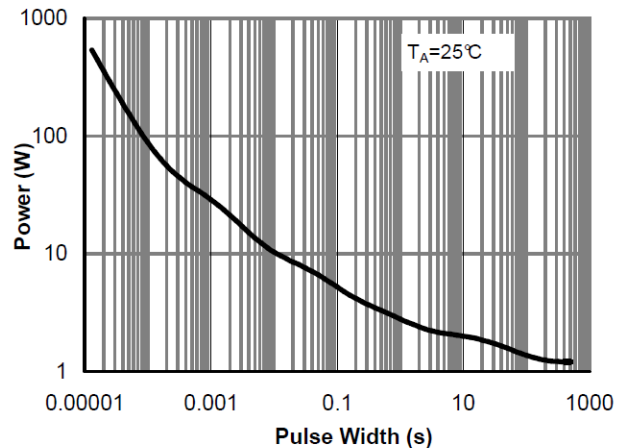
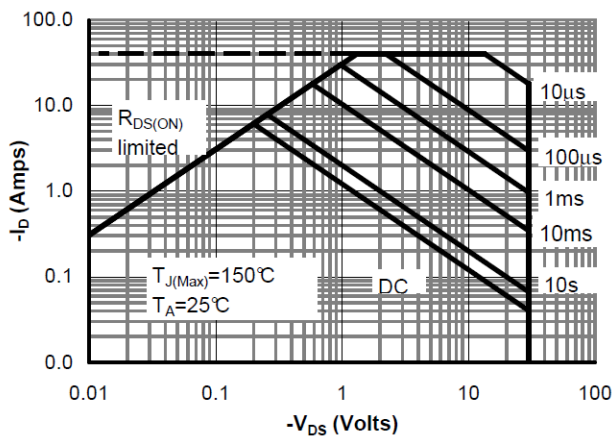
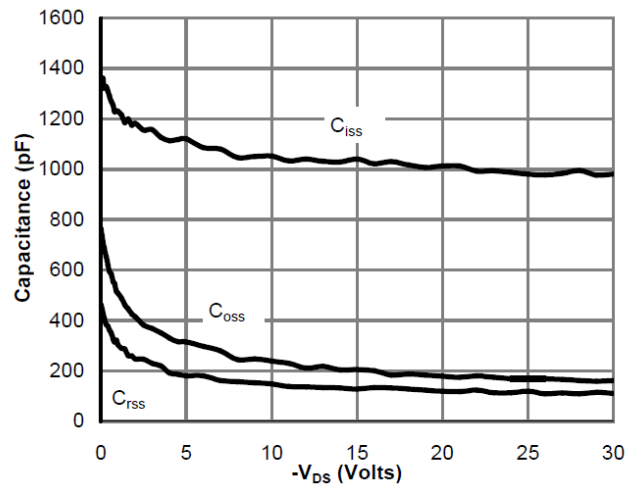
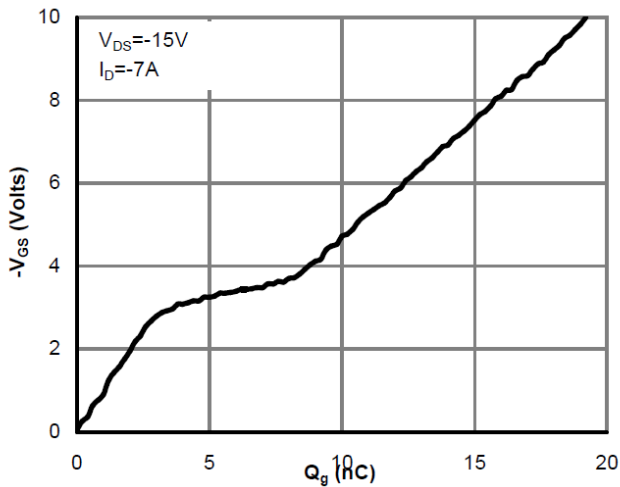


Figure 6: Body-Diode Characteristics (Note E)

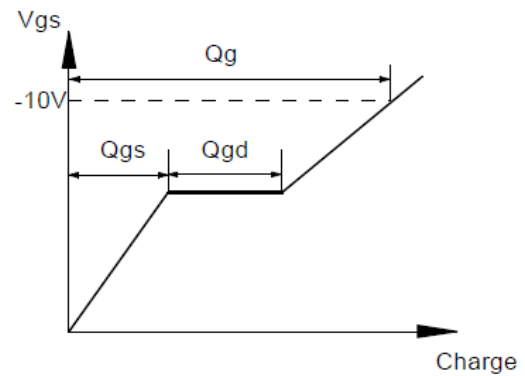
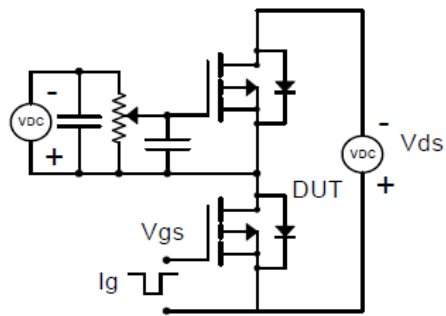


## P-CHANNEL: TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

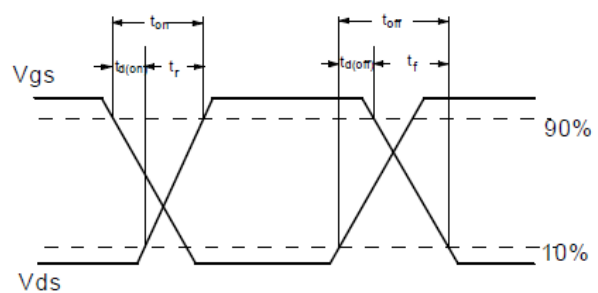
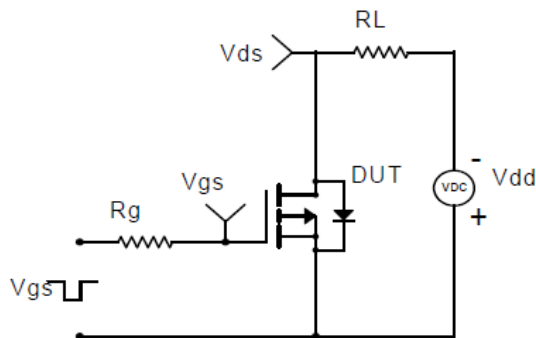




Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

