# NCE N&P-Channel complementary Power MOSFET

## Description

The NCE40NP2815G uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications.

## General Features

### N channel

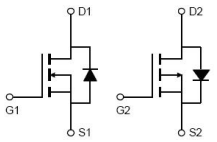
- $V_{DS}$ =40V,$I_D$ =28A
  $R_{DS(ON)}$ <18mΩ @ $V_{GS}$=10V
  $R_{DS(ON)}$ <28mΩ @ $V_{GS}$=4.5V

### p channel

- $V_{DS}$ =-40V,$I_D$ =-15A
  $R_{DS(ON)}$ <35mΩ @ $V_{GS}$=-10V
  $R_{DS(ON)}$ <45mΩ @ $V_{GS}$=-4.5V
- High density cell design for ultra low Rdson
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high $E_{AS}$
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

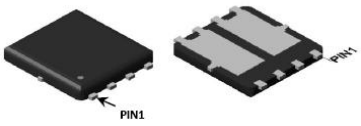
## Application

- H-bridge
- Inverters




**Schematic diagram**


**Marking and pin assignment**




**Top View** **Bottom View**

## Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|---|---|---|---|---|---|
| 40NP2815G | NCE40NP2815G | DFN5X6-8L | - | - | - |

## Absolute Maximum Ratings ($T_C$=25℃unless otherwise noted)

| Parameter | | Symbol | N-Channel | P-Channel | Unit |
|---|---|---|---|---|---|
| Drain-Source Voltage | | $V_{DS}$ | 40 | -40 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±20 | ±20 | V |
| Continuous Drain Current | $T_C$=25℃ | $I_D$ | 28 | -15 | A |
| | $T_C$=100℃ | | 19.8 | -10.6 | |
| Pulsed Drain Current (Note 1) | | $I_{DM}$ | 120 | -60 | A |
| Maximum Power Dissipation | $T_C$=25℃ | $P_D$ | 35 | | W |
| Operating Junction and Storage Temperature Range | | $T_J$,$T_{STG}$ | -55 To 150 | | ℃ |

## Thermal Characteristic

| | | | |
|---|---|---|---|
| Thermal Resistance,Junction-to-Case(Note 2) | $R_{\theta JC}$ | 3.6 | ℃/W |

## N-Channel Electrical Characteristics ($T_C$=25℃unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=250μA | 40 | - | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=40V,$V_{GS}$=0V | - | - | 1 | μA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V,$V_{DS}$=0V | - | - | ±100 | nA |
| **On Characteristics** (Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=250μA | 1.0 | 1.4 | 2.0 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=10V, $I_D$=15A | - | 15 | 18 | mΩ |
| | | $V_{GS}$=4.5V, $I_D$=10A | - | 22 | 28 | mΩ |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=5V,$I_D$=15A | - | 25 | - | S |
| **Dynamic Characteristics** (Note4) | | | | | | |
| Input Capacitance | $C_{lss}$ | $V_{DS}$=20V,$V_{GS}$=0V, F=1.0MHz | - | 1163 | - | pF |
| Output Capacitance | $C_{oss}$ | | - | 104 | - | pF |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 100 | - | pF |
| **Switching Characteristics** (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=20V ,$R_L$=2.5Ω $V_{GS}$=10V,$R_G$=3Ω | - | 5.5 | - | nS |
| Turn-on Rise Time | $t_r$ | | - | 14 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 24 | - | nS |
| Turn-Off Fall Time | $t_f$ | | - | 12 | - | nS |
| Total Gate Charge | $Q_g$ | $V_{DS}$=20V,$I_D$=15A, $V_{GS}$=10V | - | 28 | | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | 3.9 | | nC |
| Gate-Drain Charge | $Q_{gd}$ | | - | 5.9 | | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| Diode Forward Voltage (Note 3) | $V_{SD}$ | $V_{GS}$=0V,$I_S$=15A | - | - | 1.2 | V |
| Diode Forward Current (Note 2) | $I_S$ | | - | - | 28 | A |

## Notes:

**1.** Repetitive Rating: Pulse width limited by maximum junction temperature.
**2.** Surface Mounted on FR4 Board, t ≤ 10 sec.
**3.** Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
**4.** Guaranteed by design, not subject to production
**5.** EAS condition:Tj=25℃,VDD=20V,VG=10V,L=0.5mH,Rg=25Ω

## N- Channel Typical Electrical and Thermal Characteristics (Curves)

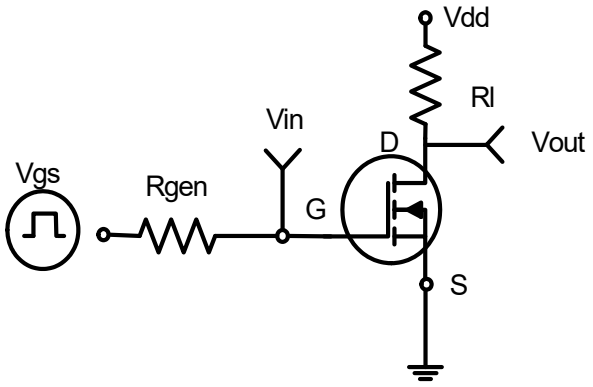



**Figure 1:Switching Test Circuit**

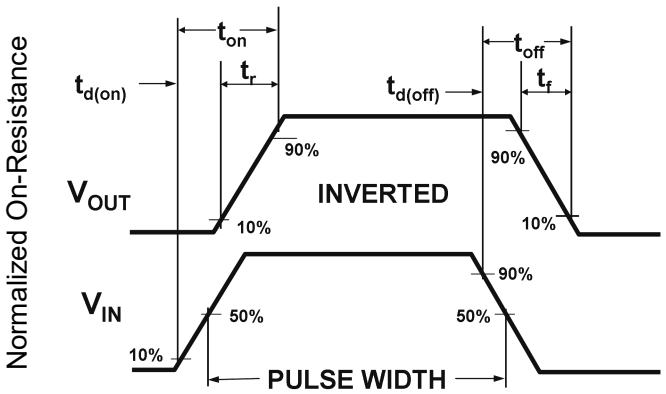



**Figure 2:Switching Waveforms**

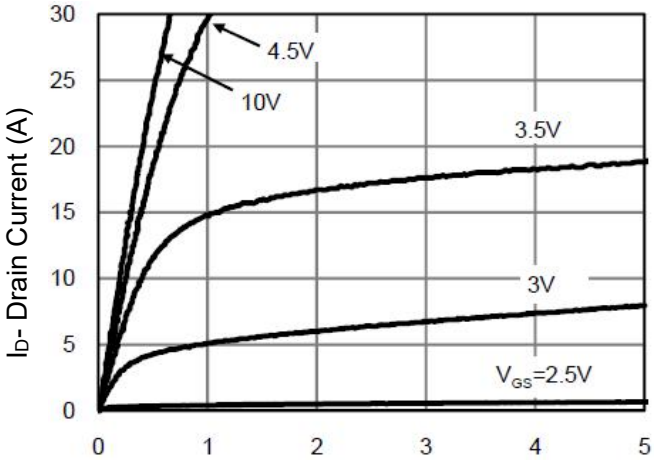



**Figure 3 Output Characteristics**

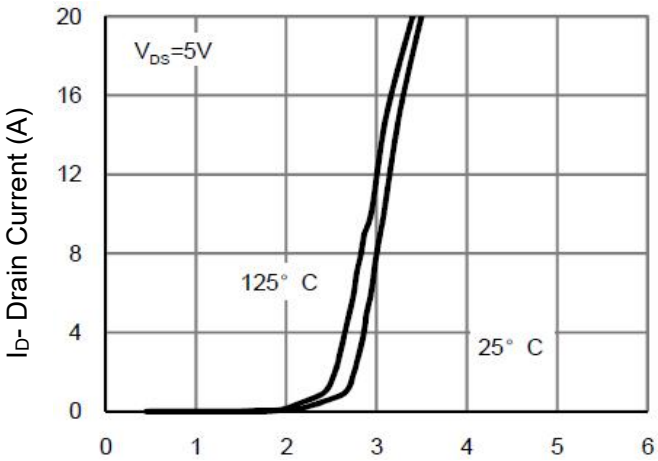



**Figure 4 Transfer Characteristics**

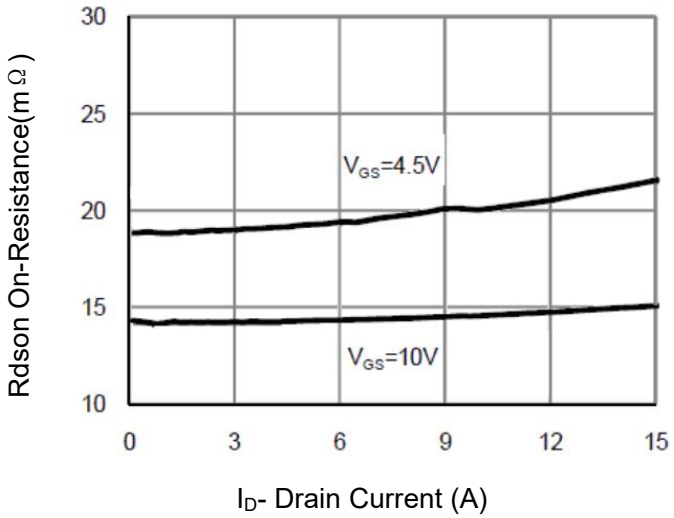



**Figure 5 Drain-Source On-Resistance**

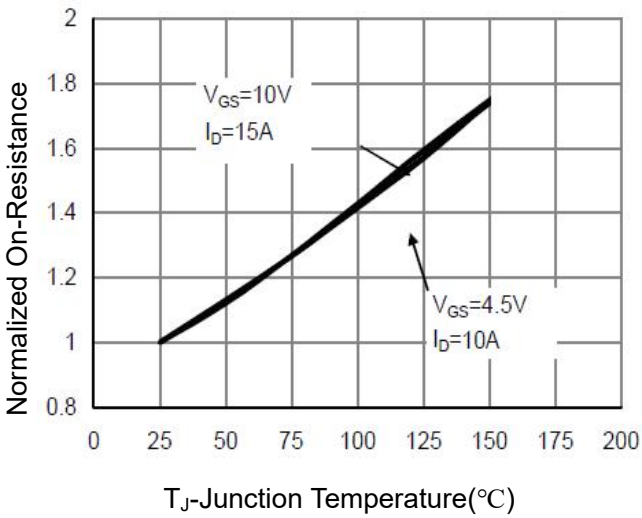



**Figure 6 Drain-Source On-Resistance**

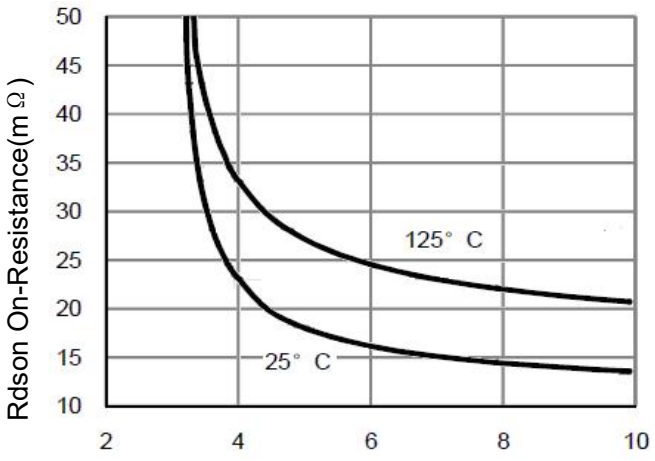



**Figure7 Rdson vs Vgs**

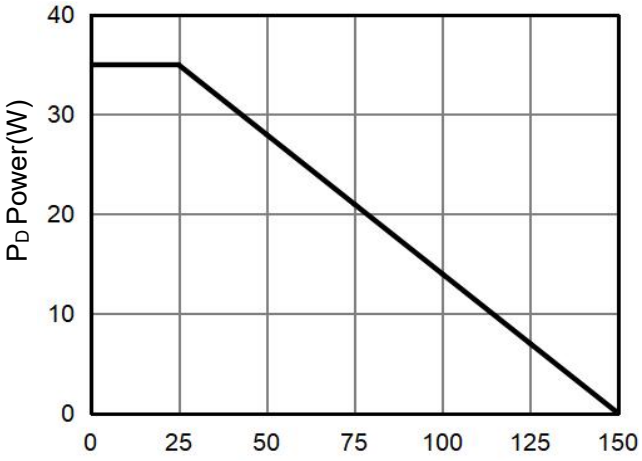



**Figure 8 Power Dissipation**

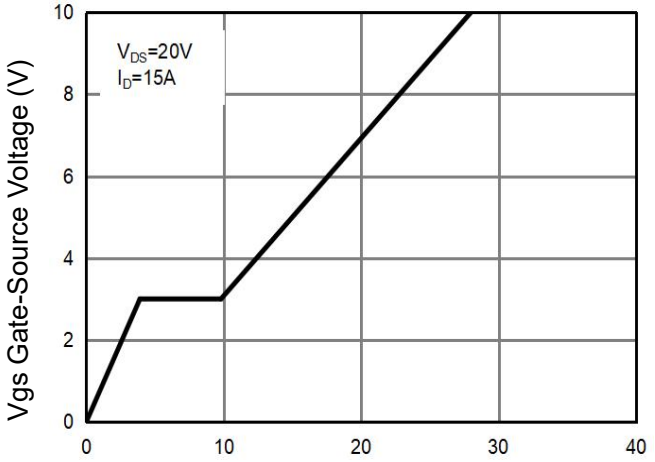



**Figure 9 Gate Charge**

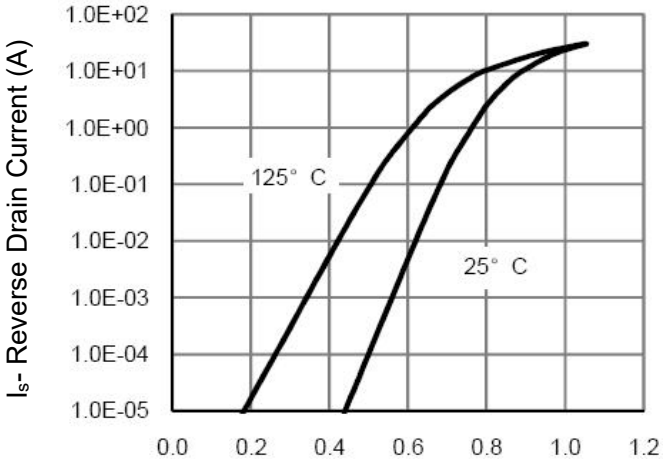



**Figure 10 Source- Drain Diode Forward**

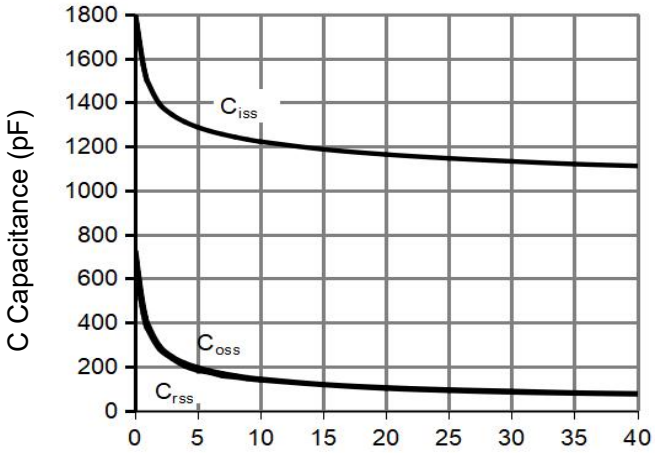



**Figure 11 Capacitance vs Vds**

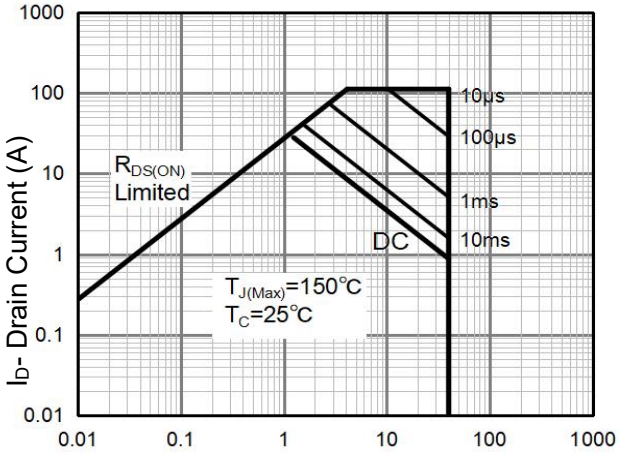



**Figure 12 Safe Operation Area**

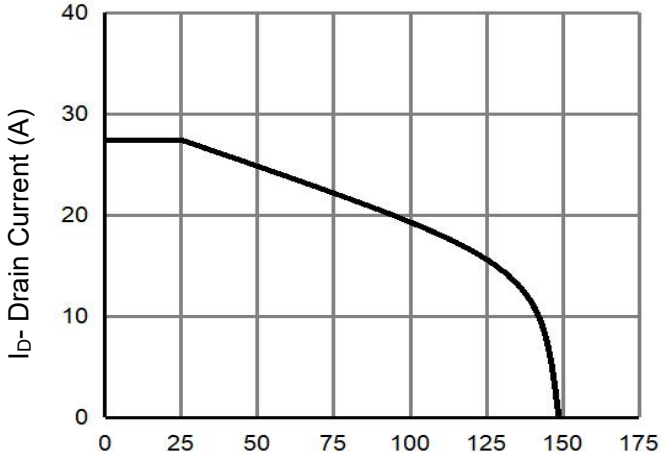



**Figure 10 Current De-rating**

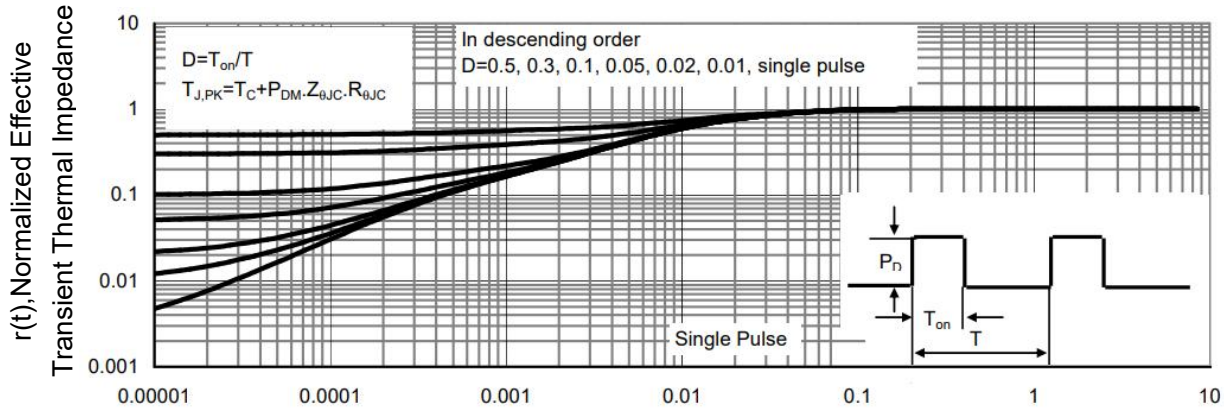



**Figure 13 Normalized Maximum Transient Thermal Impedance**

## P-Channel Electrical Characteristics ($T_C$=25℃unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=-250μA | -40 | - | - | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=-40V,$V_{GS}$=0V | - | - | -1 | μA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±20V,$V_{DS}$=0V | - | - | ±100 | nA |
| **On Characteristics** (Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$,$I_D$=-250μA | -1.0 | -1.5 | -2.0 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=-10V, $I_D$=-7A | - | 29 | 35 | mΩ |
| | | $V_{GS}$=-4.5V, $I_D$=-4A | - | 34 | 45 | mΩ |
| Forward Transconductance | $g_{FS}$ | $V_{DS}$=-5V,$I_D$=-7A | - | 20 | - | S |
| **Dynamic Characteristics** (Note4) | | | | | | |
| Input Capacitance | $C_{lss}$ | $V_{DS}$=-20V,$V_{GS}$=0V, F=1.0MHz | - | 1060 | - | pF |
| Output Capacitance | $C_{oss}$ | | - | 121 | - | pF |
| Reverse Transfer Capacitance | $C_{rss}$ | | - | 111 | - | pF |
| **Switching Characteristics** (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=-20V, $R_L$=2.3Ω $V_{GS}$=-10V,$R_{GEN}$=6Ω | - | 5.5 | - | nS |
| Turn-on Rise Time | $t_r$ | | - | 14 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 24 | - | nS |
| Turn-Off Fall Time | $t_f$ | | - | 12 | - | nS |
| Total Gate Charge | $Q_g$ | $V_{DS}$=-20V,$I_D$=-7A $V_{GS}$=-10V | - | 26 | - | nC |
| Gate-Source Charge | $Q_{gs}$ | | - | 3.7 | - | nC |
| Gate-Drain Charge | $Q_{gd}$ | | - | 6.0 | - | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| Diode Forward Voltage (Note 3) | $V_{SD}$ | $V_{GS}$=0V,$I_S$=-10A | - | - | -1.2 | V |

## P- Channel Typical Electrical and Thermal Characteristics (Curves)

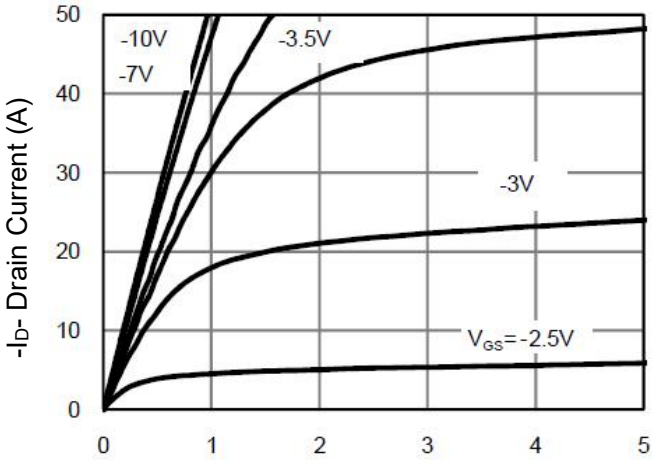



**Figure 1 Output Characteristics**

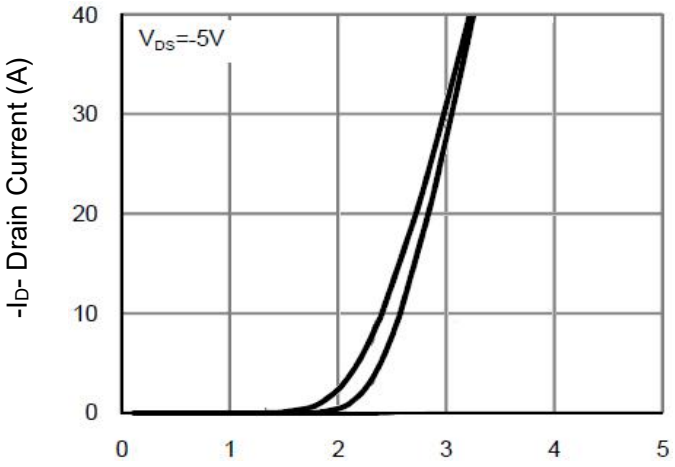



**Figure 2 Transfer Characteristics**

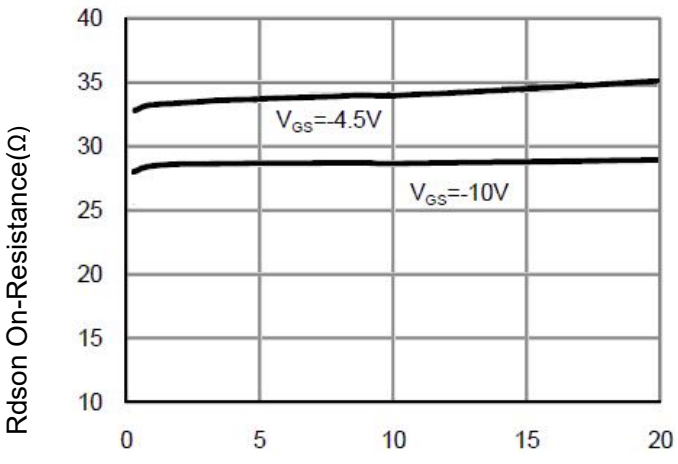



**Figure 3 Rdson- Drain Current**

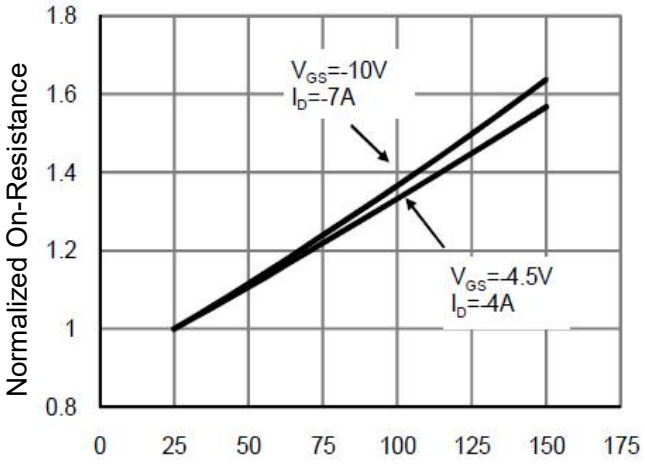



**Figure 4 Rdson-Junction Temperature**

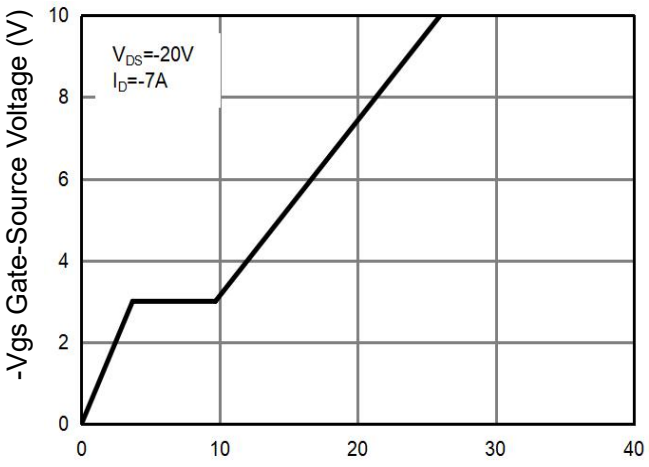



**Figure 5 Gate Charge**

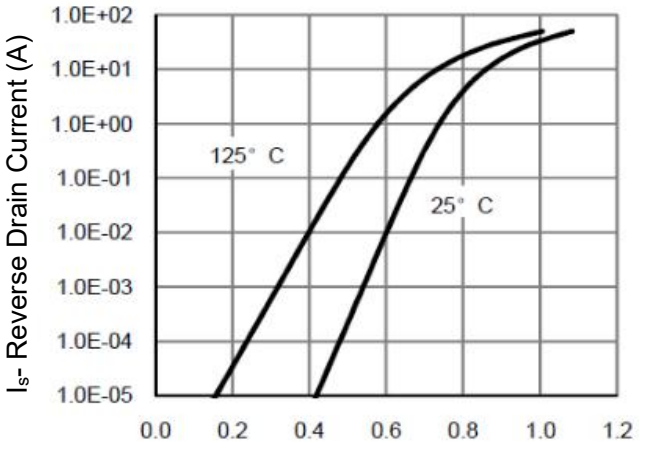



**Figure 6 Source- Drain Diode Forward**

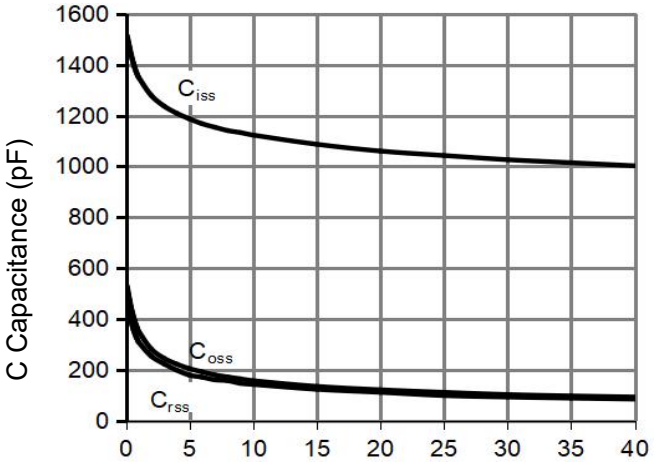



**Figure 7 Capacitance vs Vds**

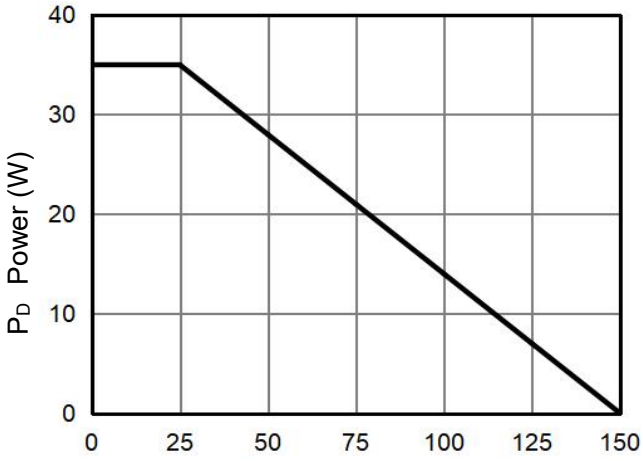



**Figure 9 Power Dissipation**

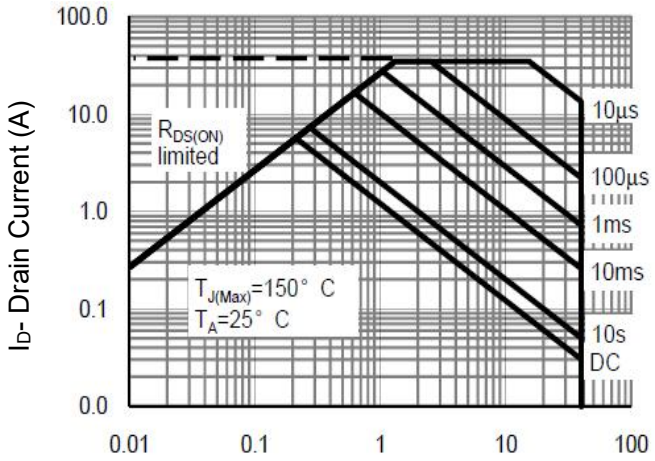



**Figure 8 Safe Operation Area**

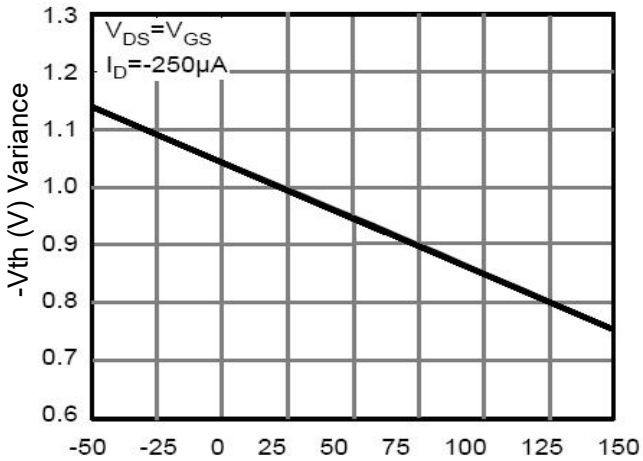



**Figure 10 $V_{GS(th)}$ vs Junction Temperature**

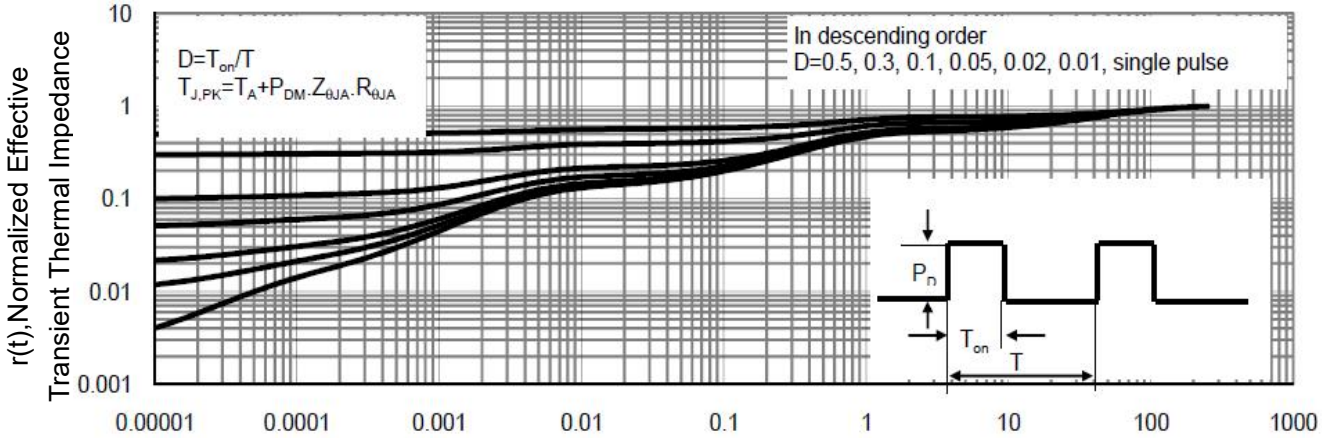



**Figure 11 Normalized Maximum Transient Thermal Impedance**

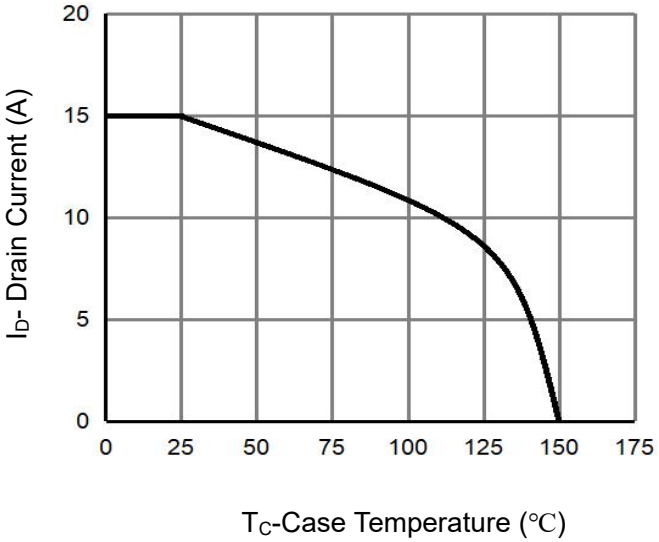
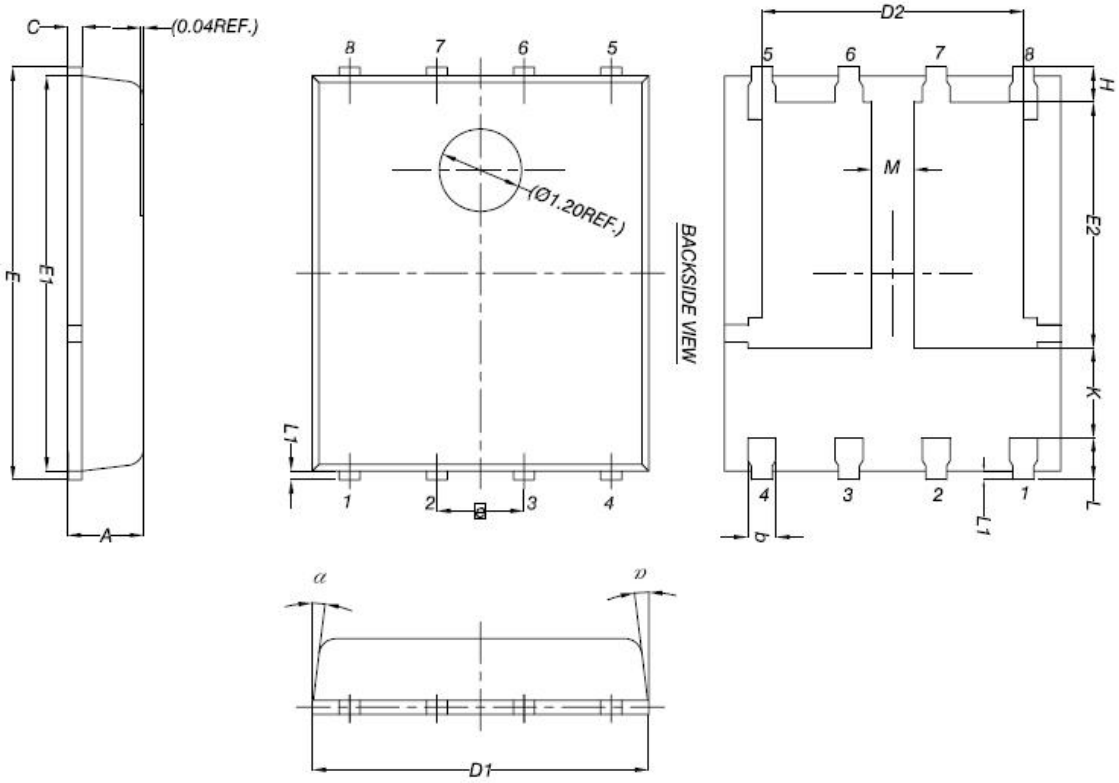



**Figure 12 Current De-rating**

## PDFN5X6-8L Package Information




| DIM. | MILLIMETERS | | |
|---|---|---|---|
| | MIN. | NOM. | MAX. |
| A | 0.90 | 1.00 | 1.10 |
| b | 0.33 | 0.41 | 0.51 |
| C | 0.20 | 0.25 | 0.30 |
| D1 | 4.80 | 4.90 | 5.00 |
| D2 | 3.61 | 3.81 | 3.96 |
| E | 5.90 | 6.00 | 6.10 |
| E1 | 5.70 | 5.75 | 5.80 |
| E2 | 3.38 | 3.58 | 3.78 |
| e | 1.27 BSC | | |
| H | 0.41 | 0.51 | 0.61 |
| K | 1.10 | - | - |
| L | 0.51 | 0.61 | 0.71 |
| L1 | 0.06 | 0.13 | 0.20 |
| M | 0.50 | - | - |
| α | 0° | - | 12° |

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