

N and P-Channel Enhancement Mode Power MOSFET

Description

The NCE4606 uses advanced trench technology 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.

General Features

- **N-Channel**

$$V_{DS} = 30V, I_D = 6.5A$$

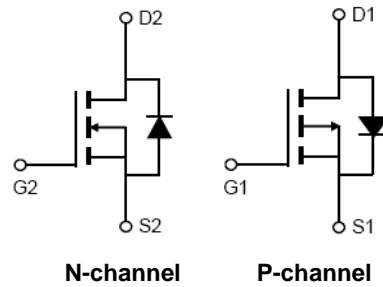
$$R_{DS(ON)} < 30m\Omega @ V_{GS}=10V$$

- **P-Channel**

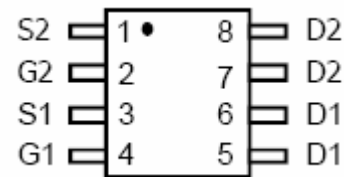
$$V_{DS} = -30V, I_D = -7A$$

$$R_{DS(ON)} < 33m\Omega @ V_{GS}=-10V$$

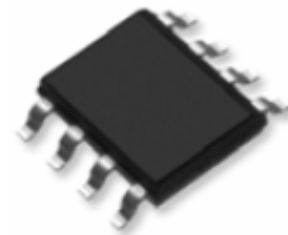
- High power and current handling capability
- Lead free product is acquired
- Surface mount package



Schematic diagram



Marking and pin assignment



SOP-8 top view

Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|----------------|---------|----------------|-----------|------------|------------|
| 4606 | NCE4606 | SOP-8 | Ø330mm | 12mm | 2500 units |

Absolute Maximum Ratings ($T_A=25^\circ\text{C}$ unless otherwise noted)

| Parameter | Symbol | N-Channel | P-Channel | Unit | |
|--|----------------|------------------------|------------|------------------|---|
| Drain-Source Voltage | V_{DS} | 30 | -30 | V | |
| Gate-Source Voltage | V_{GS} | ± 20 | ± 20 | V | |
| Continuous Drain Current | I_D | $T_A=25^\circ\text{C}$ | 6.5 | -7 | A |
| | | $T_A=70^\circ\text{C}$ | 5.4 | -5.8 | |
| Pulsed Drain Current ^(Note 1) | I_{DM} | 30 | -30 | A | |
| Maximum Power Dissipation | P_D | 2.0 | 2.0 | W | |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 To 150 | -55 To 150 | $^\circ\text{C}$ | |

Thermal Characteristic

| | | | | |
|---|-----------------|------|------|--------------------|
| Thermal Resistance, Junction-to-Ambient ^(Note 2) | $R_{\theta JA}$ | N-Ch | 62.5 | $^\circ\text{C/W}$ |
| Thermal Resistance, Junction-to-Ambient ^(Note 2) | $R_{\theta JA}$ | P-Ch | 62.5 | $^\circ\text{C/W}$ |

N-CH Electrical Characteristics (T_A=25°C unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---------------------|--|-----|------|------|------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV _{DSS} | V _{GS} =0V, I _D =250μA | 30 | 33 | - | V |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} =30V, 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 | 1.6 | 3 | V |
| Drain-Source On-State Resistance | R _{DS(ON)} | V _{GS} =10V, I _D =6A | - | 20 | 30 | mΩ |
| Forward Transconductance | g _{FS} | V _{DS} =5V, I _D =6A | 15 | - | - | S |
| Dynamic Characteristics (Note4) | | | | | | |
| Input Capacitance | C _{iss} | V _{DS} =15V, V _{GS} =0V, F=1.0MHz | - | 255 | - | PF |
| Output Capacitance | C _{oss} | | - | 45 | - | PF |
| Reverse Transfer Capacitance | C _{rss} | | - | 35 | - | PF |
| Switching Characteristics (Note 4) | | | | | | |
| Turn-on Delay Time | t _{d(on)} | V _{DD} =15V, R _L =2.5Ω V _{GS} =10V, R _{GEN} =3Ω | - | 4.5 | - | nS |
| Turn-on Rise Time | t _r | | - | 2.5 | - | nS |
| Turn-Off Delay Time | t _{d(off)} | | - | 14.5 | - | nS |
| Turn-Off Fall Time | t _f | | - | 3.5 | - | nS |
| Total Gate Charge | Q _g | V _{DS} =15V, I _D =6A, V _{GS} =10V | - | 13 | - | nC |
| Gate-Source Charge | Q _{gs} | | - | 5.5 | - | nC |
| Gate-Drain Charge | Q _{gd} | | - | 3.5 | - | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Diode Forward Voltage (Note 3) | V _{SD} | V _{GS} =0V, I _S =6A | - | 0.8 | 1.2 | V |

P-CH Electrical Characteristics ($T_A=25^{\circ}\text{C}$ unless otherwise noted)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|--------------|--|------|------|-----------|------------|
| Off Characteristics | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | $V_{GS}=0V, I_D=-250\mu A$ | -30 | -33 | - | V |
| Zero Gate Voltage Drain Current | I_{DSS} | $V_{DS}=-30V, V_{GS}=0V$ | - | - | -1 | μA |
| Gate-Body Leakage Current | I_{GSS} | $V_{GS}=\pm 20V, V_{DS}=0V$ | - | - | ± 100 | nA |
| On Characteristics (Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=-250\mu A$ | -1.5 | -1.9 | -2.5 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}=-10V, I_D=-6.5A$ | - | 28 | 33 | m Ω |
| Forward Transconductance | g_{FS} | $V_{DS}=-5V, I_D=-6.5A$ | 10 | - | - | S |
| Dynamic Characteristics (Note4) | | | | | | |
| Input Capacitance | C_{ISS} | $V_{DS}=-15V, V_{GS}=0V,$ $F=1.0MHz$ | - | 520 | - | PF |
| Output Capacitance | C_{OSS} | | - | 100 | - | PF |
| Reverse Transfer Capacitance | C_{RSS} | | - | 65 | - | PF |
| Switching Characteristics (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}=-15V, R_L=2.3\Omega$ $V_{GS}=-10V, R_{GEN}=6\Omega$ | - | 7.5 | - | nS |
| Turn-on Rise Time | t_r | | - | 5.5 | - | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | - | 19 | - | nS |
| Turn-Off Fall Time | t_f | | - | 7 | - | nS |
| Total Gate Charge | Q_g | $V_{DS}=-15V, I_D=-6.5A$ $V_{GS}=-10V$ | - | 9.2 | - | nC |
| Gate-Source Charge | Q_{gs} | | - | 1.6 | - | nC |
| Gate-Drain Charge | Q_{gd} | | - | 2.2 | - | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Diode Forward Voltage (Note 3) | V_{SD} | $V_{GS}=0V, I_S=-6.5A$ | - | - | -1.2 | V |

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, $t \leq 10$ sec.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production

N- Channel Typical Electrical and Thermal Characteristics (Curves)

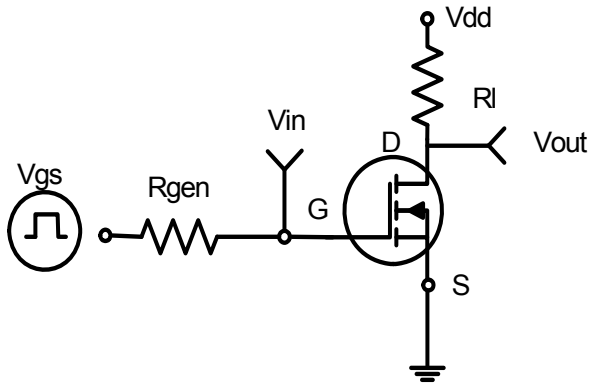


Figure 1: Switching Test Circuit

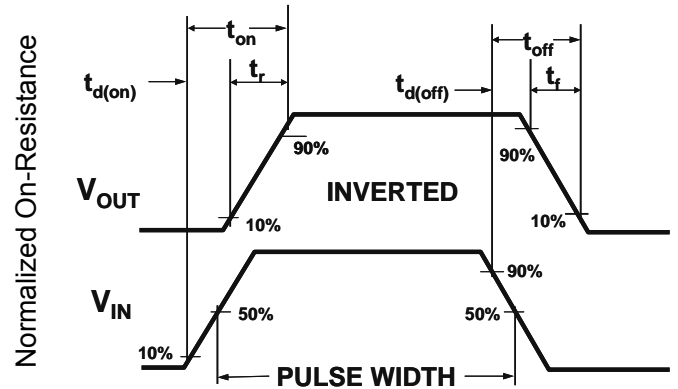


Figure 2: Switching Waveforms

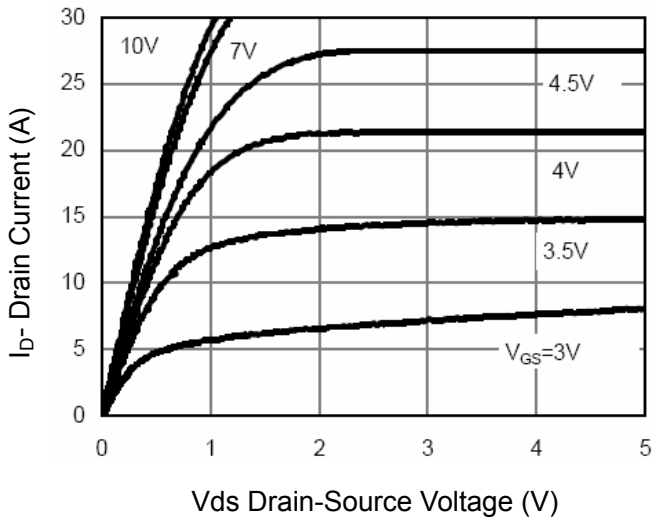


Figure 3 Output Characteristics

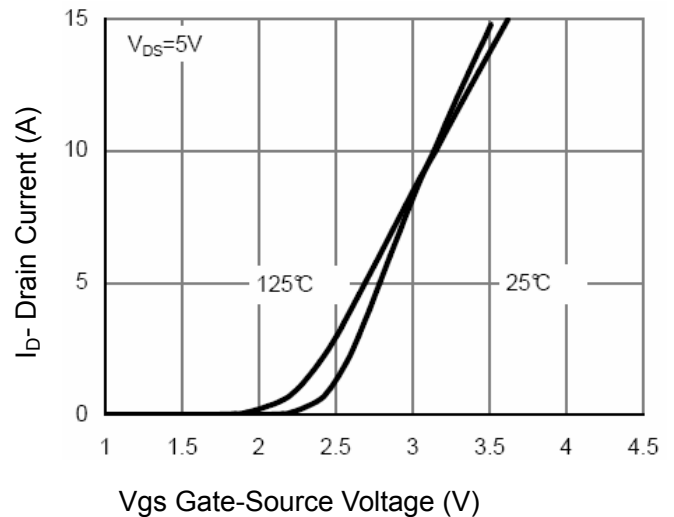


Figure 4 Transfer Characteristics

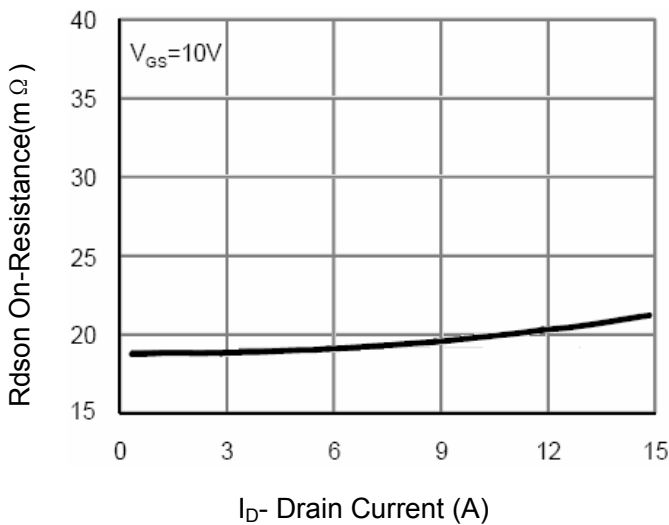


Figure 5 Drain-Source On-Resistance

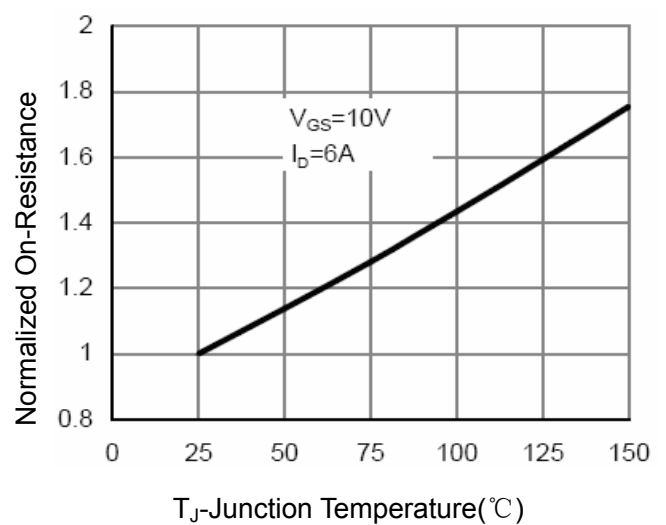
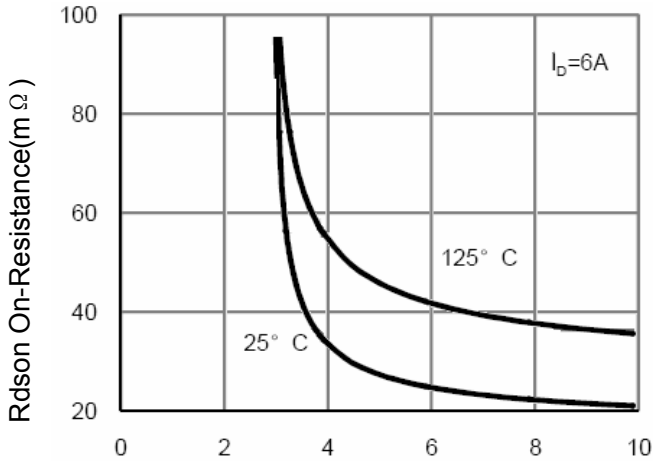
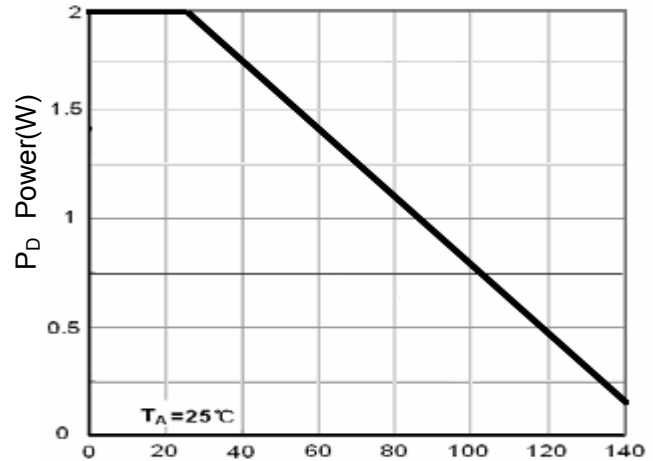


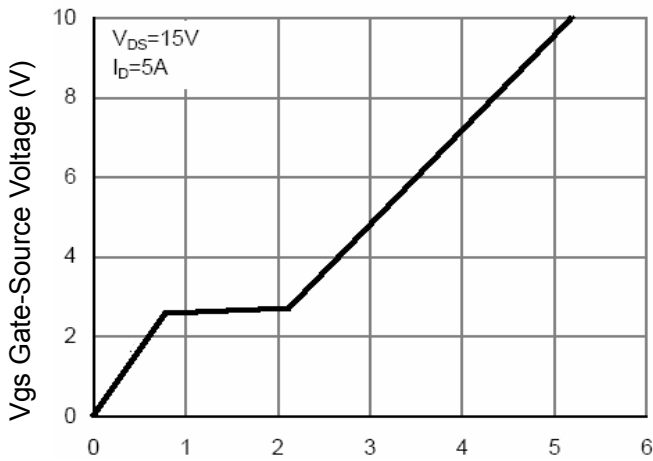
Figure 6 Drain-Source On-Resistance



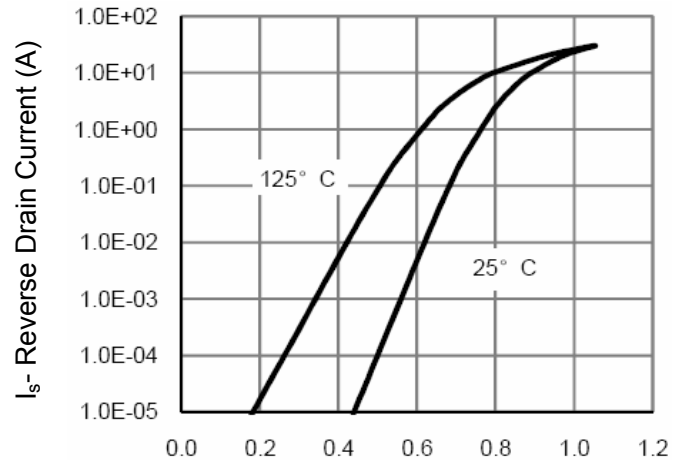
Vgs Gate-Source Voltage (V)
Figure 7 Rdson vs Vgs



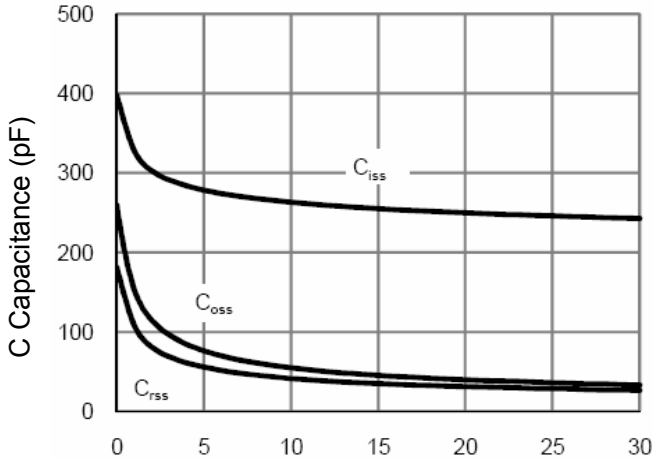
Tj Junction Temperature (°C)
Figure 8 Power Dissipation



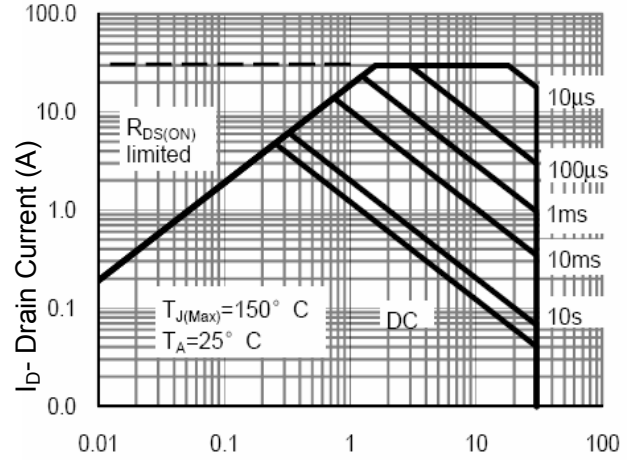
Qg Gate Charge (nC)
Figure 9 Gate Charge



Vds Drain-Source Voltage (V)
Figure 10 Source- Drain Diode Forward



Vds Drain-Source Voltage (V)
Figure 11 Capacitance vs Vds



Vds Drain-Source Voltage (V)
Figure 12 Safe Operation Area

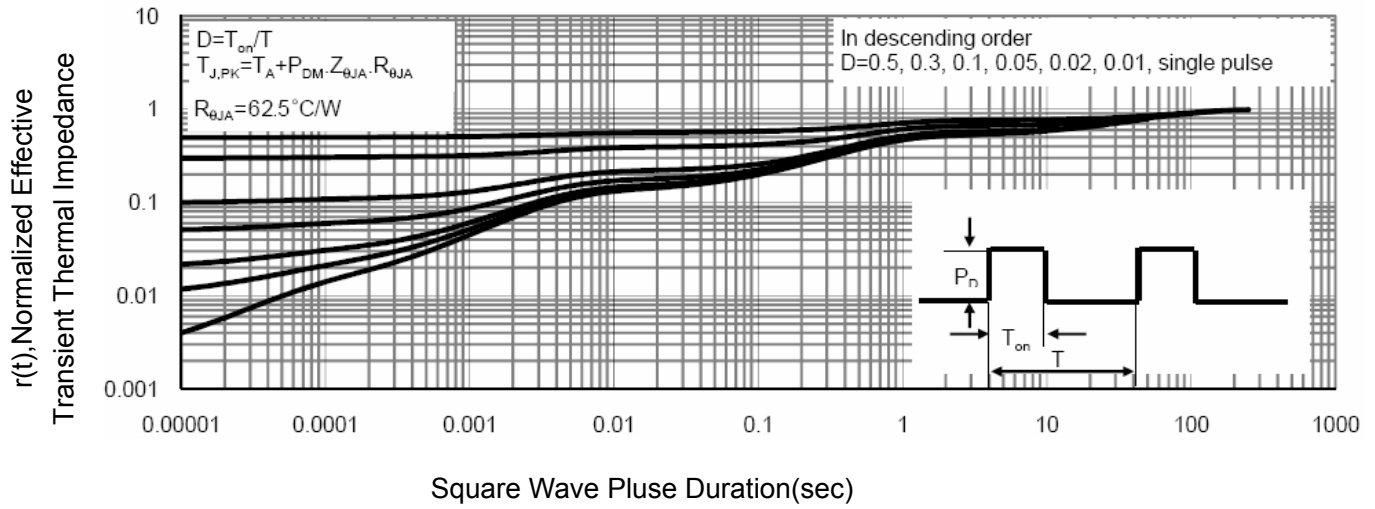


Figure 13 Normalized Maximum Transient Thermal Impedance

P- Channel Typical Electrical and Thermal Characteristics (Curves)

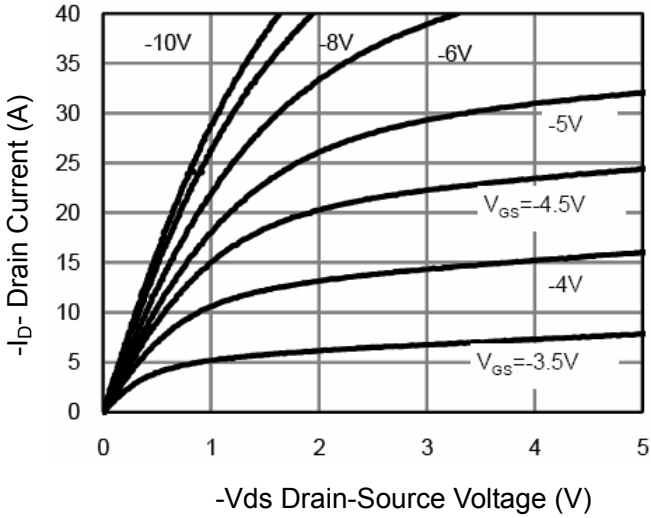


Figure 1 Output Characteristics

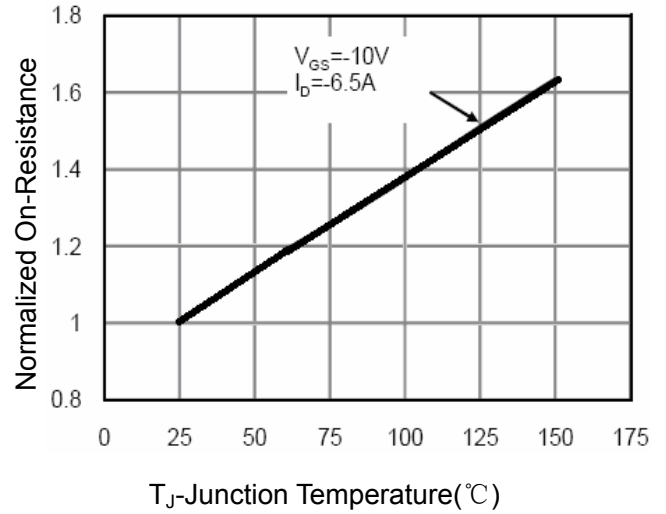


Figure 4 Rdson-Junction Temperature

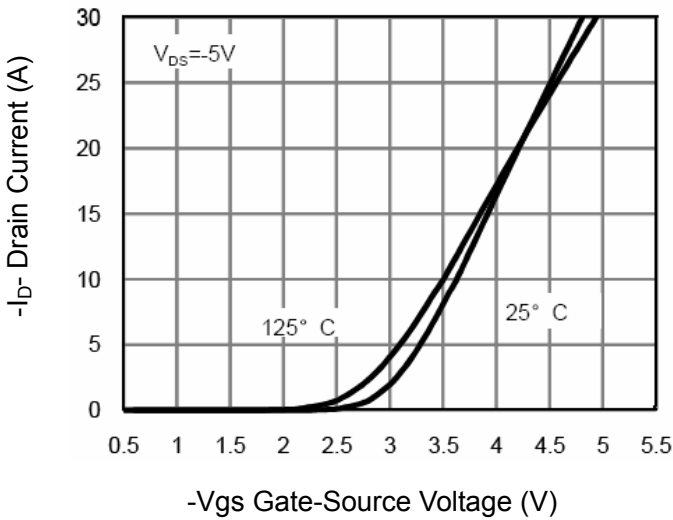


Figure 2 Transfer Characteristics

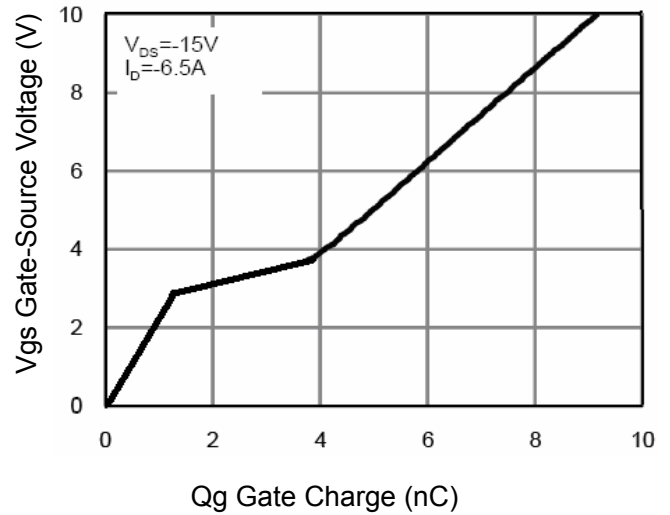


Figure 5 Gate Charge

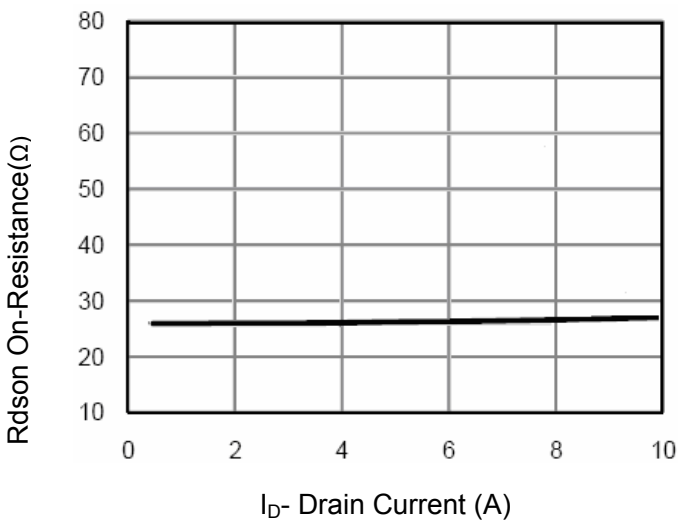


Figure 3 Rdson- Drain Current

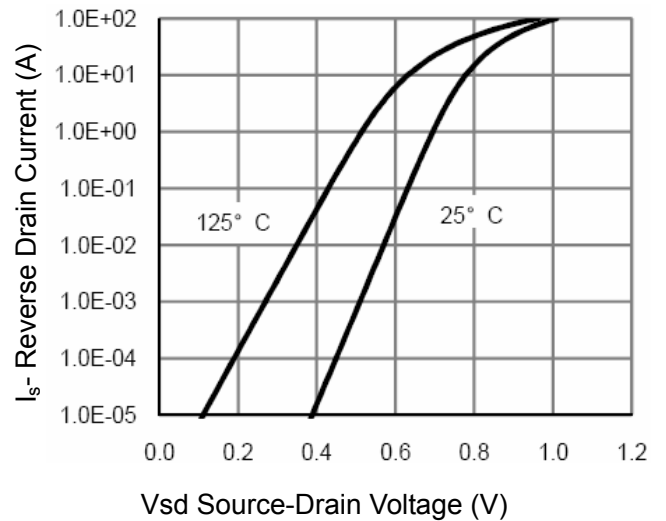


Figure 6 Source- Drain Diode Forward

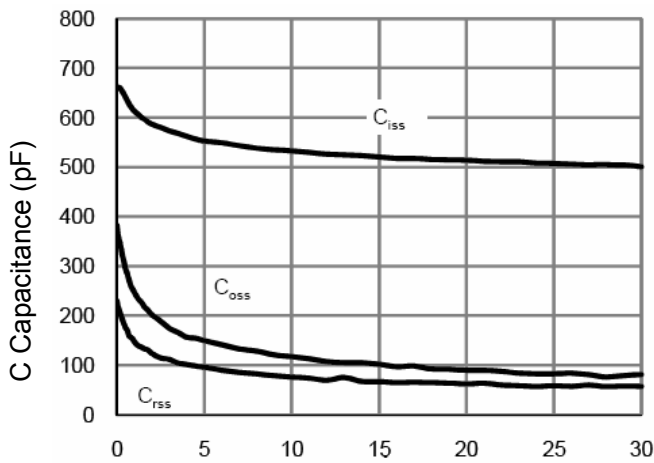


Figure 7 Capacitance vs Vds

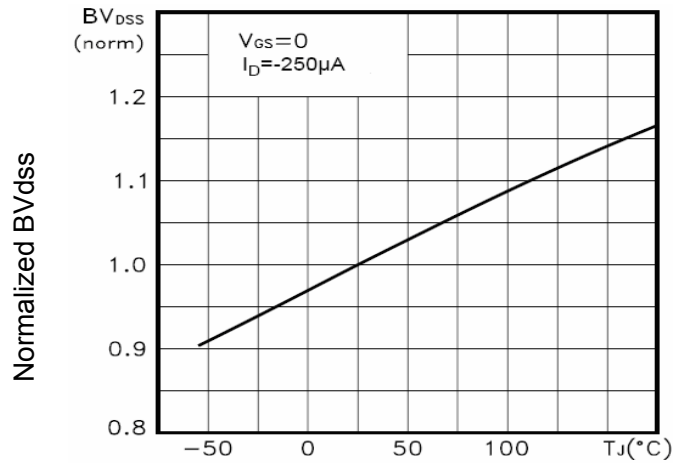


Figure 9 BV_{DSS} vs Junction Temperature

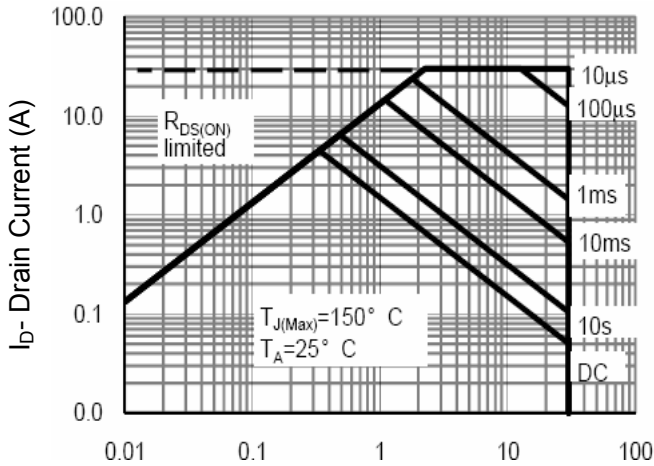


Figure 8 Safe Operation Area

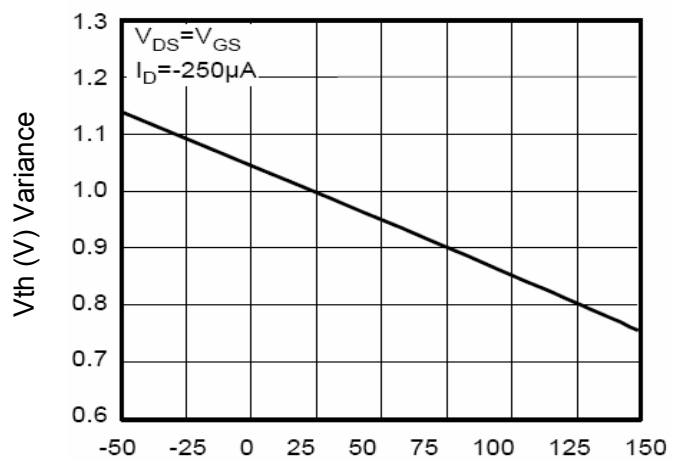


Figure 10 $V_{GS(th)}$ vs Junction Temperature

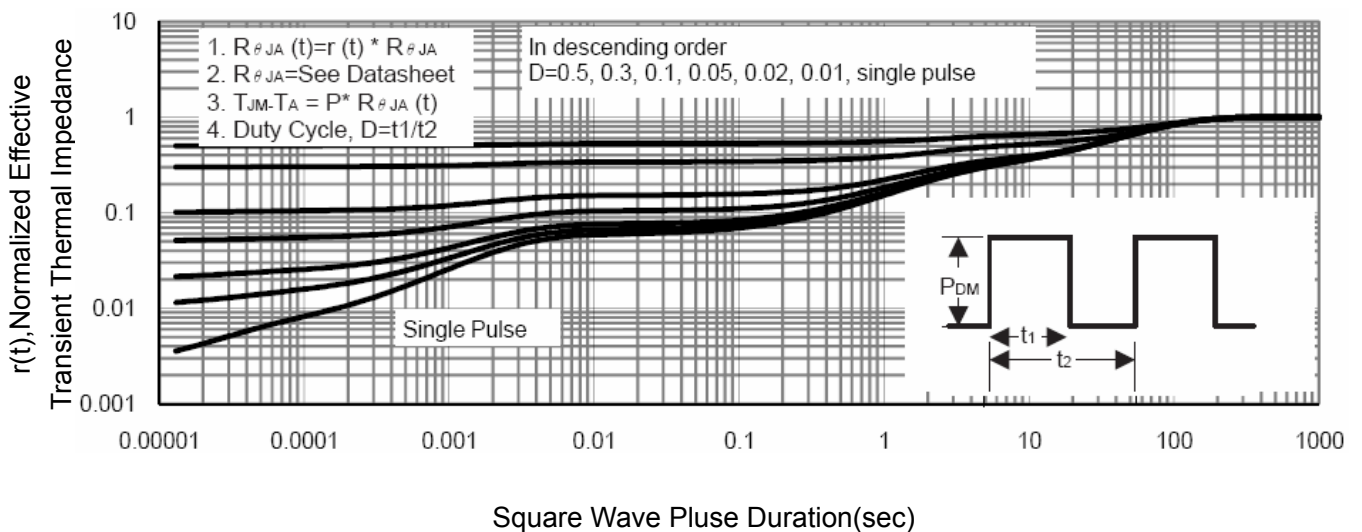
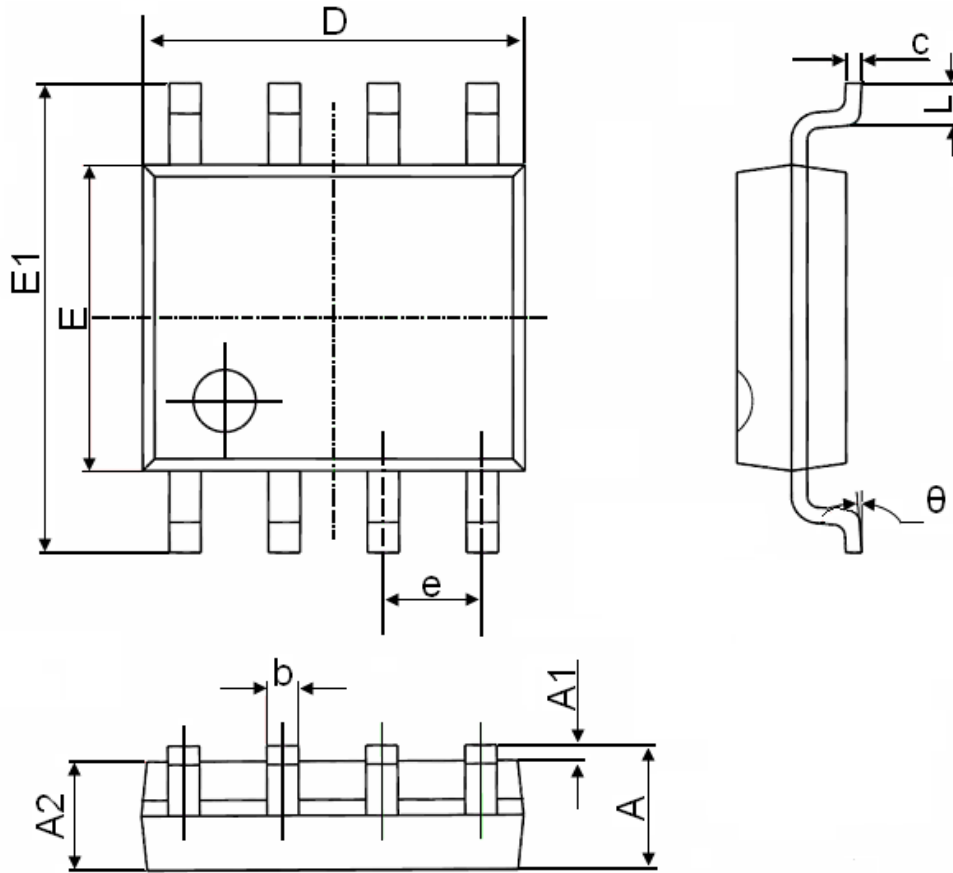


Figure 11 Normalized Maximum Transient Thermal Impedance

SOP-8 Package Information


| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|---------------------------|-------|----------------------|-------|
| | Min. | Max. | Min. | Max. |
| A | 1.350 | 1.750 | 0.053 | 0.069 |
| A1 | 0.100 | 0.250 | 0.004 | 0.010 |
| A2 | 1.350 | 1.550 | 0.053 | 0.061 |
| b | 0.330 | 0.510 | 0.013 | 0.020 |
| c | 0.170 | 0.250 | 0.006 | 0.010 |
| D | 4.700 | 5.100 | 0.185 | 0.200 |
| E | 3.800 | 4.000 | 0.150 | 0.157 |
| E1 | 5.800 | 6.200 | 0.228 | 0.244 |
| e | 1.270(BSC) | | 0.050(BSC) | |
| L | 0.400 | 1.270 | 0.016 | 0.050 |
| theta | 0° | 8° | 0° | 8° |

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