

## NCE P-Channel Enhancement Mode Power MOSFET

### Description

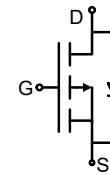
The NCE40P06J uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages. This device is suitable for use as a load switching application and a wide variety of other applications.

### General Features

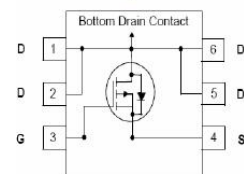
- $V_{DS} = -40V, I_D = -6A$   
 $R_{DS(ON)} < 33m\Omega @ V_{GS} = -2.5V$   
 $R_{DS(ON)} < 45m\Omega @ V_{GS} = -4.5V$
- Advanced trench MOSFET process technology
- Ultra low on-resistance with low gate charge

### Application

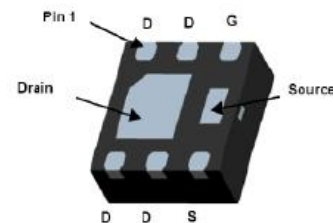
- PWM applications
- Load switch
- Battery charge in cellular handset



Schematic diagram



Pin assignment



DFN2X2-6L bottom view

### Package marking and ordering information

| Device Marking | Device    | Device Package | Reel Size | Tape Width | Quantity |
|----------------|-----------|----------------|-----------|------------|----------|
| NCE40P06J      | NCE40P06J | DFN2X2-6L      | -         | -          | -        |

### Absolute maximum ratings ( $T_A = 25^\circ C$ unless otherwise noted)

| Parameter                                        |                    | Symbol         | Limit      | Unit       |
|--------------------------------------------------|--------------------|----------------|------------|------------|
| Drain-Source Voltage                             |                    | $V_{DS}$       | -40        | V          |
| Gate-Source Voltage                              |                    | $V_{GS}$       | $\pm 20$   | V          |
| Drain Current-Continuous                         | $T_A = 25^\circ C$ | $I_D$          | -6         | A          |
| Drain Current-Continuous                         | $T_C = 25^\circ C$ |                | -15        | A          |
| Drain Current -Pulsed (Note 1)                   |                    | $I_{DM}$       | -38        | A          |
| Maximum Power Dissipation                        | $T_A = 25^\circ C$ | $P_D$          | 2.1        | W          |
|                                                  | $T_C = 25^\circ C$ |                | 12.3       | W          |
| Operating Junction and Storage Temperature Range |                    | $T_J, T_{STG}$ | -55 To 150 | $^\circ C$ |

### Thermal Characteristic

|                                                  |                 |      |              |
|--------------------------------------------------|-----------------|------|--------------|
| Thermal Resistance, Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 59.5 | $^\circ C/W$ |
| Thermal Resistance, Junction-to-Case (Note 2)    | $R_{\theta JC}$ | 10.2 | $^\circ C/W$ |

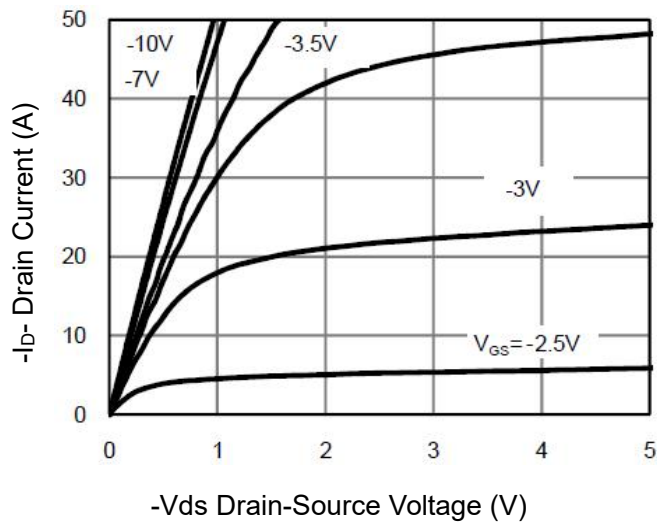
## Electrical characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| Parameter                          | Symbol                | Condition                                                                                  | Min  | Typ  | Max  | Unit |
|------------------------------------|-----------------------|--------------------------------------------------------------------------------------------|------|------|------|------|
| Off Characteristics                |                       |                                                                                            |      |      |      |      |
| Drain-Source Breakdown Voltage     | V <sub>(BR) DSS</sub> | V <sub>GS</sub> =0V I <sub>D</sub> =-250μA                                                 | -40  | -    | -    | V    |
| Zero Gate Voltage Drain Current    | I <sub>DSS</sub>      | V <sub>DS</sub> =-40V, V <sub>GS</sub> =0V                                                 | -    | -    | -1   | μA   |
| Gate-Body Leakage Current          | I <sub>GSS</sub>      | V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V                                                 | -    | -    | ±100 | nA   |
| On Characteristics (Note 3)        |                       |                                                                                            |      |      |      |      |
| Gate Threshold Voltage             | V <sub>GS(th)</sub>   | V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA                                  | -1.1 | -1.7 | -2.1 | V    |
| Drain-Source On-State Resistance   | R <sub>DS(ON)</sub>   | V <sub>GS</sub> =-10V, I <sub>D</sub> =-6A                                                 | -    | 26   | 33   | mΩ   |
|                                    |                       | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-5A                                                | -    | 34   | 45   | mΩ   |
| Gate resistance                    | R <sub>G</sub>        | V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, F=1.0MHz                                         | -    | 8.0  | -    | Ω    |
| Forward Transconductance           | g <sub>FS</sub>       | V <sub>DS</sub> =-5V, I <sub>D</sub> =-6A                                                  | -    | 5    | -    | S    |
| Dynamic Characteristics (Note4)    |                       |                                                                                            |      |      |      |      |
| Input Capacitance                  | C <sub>iss</sub>      | V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                    | -    | 964  | -    | PF   |
| Output Capacitance                 | C <sub>oss</sub>      |                                                                                            | -    | 109  | -    | PF   |
| Reverse Transfer Capacitance       | C <sub>rss</sub>      |                                                                                            | -    | 96   | -    | PF   |
| Switching Characteristics (Note 4) |                       |                                                                                            |      |      |      |      |
| Turn-on Delay Time                 | t <sub>d(on)</sub>    | V <sub>DD</sub> =-20V, I <sub>D</sub> =-6A<br>V <sub>GS</sub> =-10V, R <sub>GEN</sub> =10Ω | -    | 5.5  | -    | nS   |
| Turn-on Rise Time                  | t <sub>r</sub>        |                                                                                            | -    | 14   | -    | nS   |
| Turn-Off Delay Time                | t <sub>d(off)</sub>   |                                                                                            | -    | 24   | -    | nS   |
| Turn-Off Fall Time                 | t <sub>f</sub>        |                                                                                            | -    | 12   | -    | nS   |
| Total Gate Charge                  | Q <sub>g</sub>        | V <sub>DS</sub> =-20V, I <sub>D</sub> =-6A,<br>V <sub>GS</sub> =-10V                       | -    | 22.9 | -    | nC   |
| Gate-Source Charge                 | Q <sub>gs</sub>       |                                                                                            | -    | 3.5  | -    | nC   |
| Gate-Drain Charge                  | Q <sub>gd</sub>       |                                                                                            | -    | 5.3  | -    | nC   |
| Drain-Source Diode Characteristics |                       |                                                                                            |      |      |      |      |
| Diode Forward Voltage (Note 3)     | V <sub>SD</sub>       | V <sub>GS</sub> =0V, I <sub>S</sub> =-6A                                                   | -    | -    | -1.2 | V    |
| Diode Forward Current (Note 2)     | I <sub>S</sub>        |                                                                                            | -    | -    | -6   | A    |

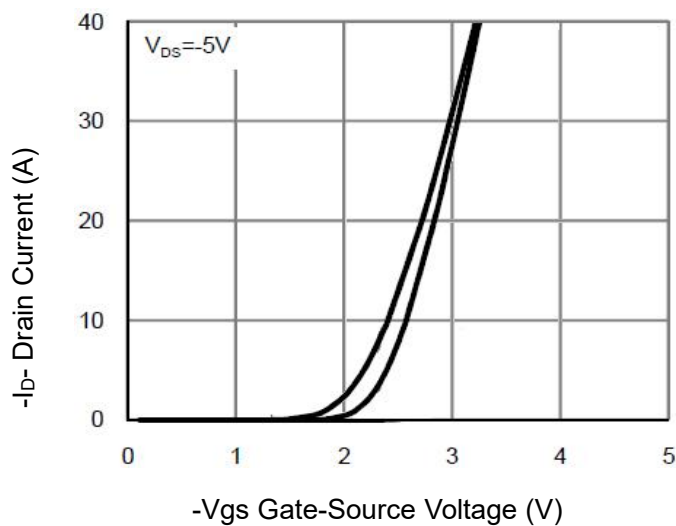
### Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Device mounted on FR-4 substrate PC board, 2oz copper, with thermal vias to bottom layer 1inch square copper plate.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production

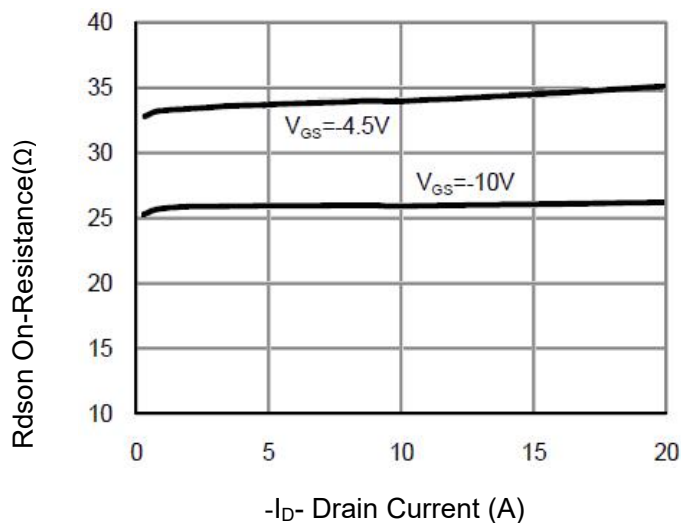
## P- Channel Typical Electrical and Thermal Characteristics (Curves)



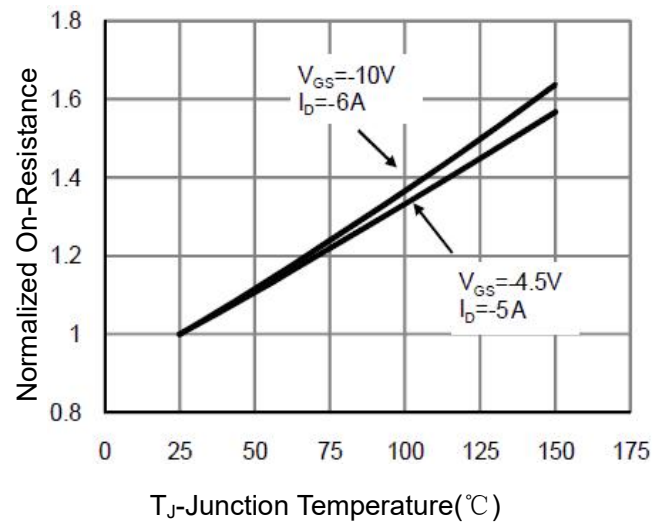
**Figure 1 Output Characteristics**



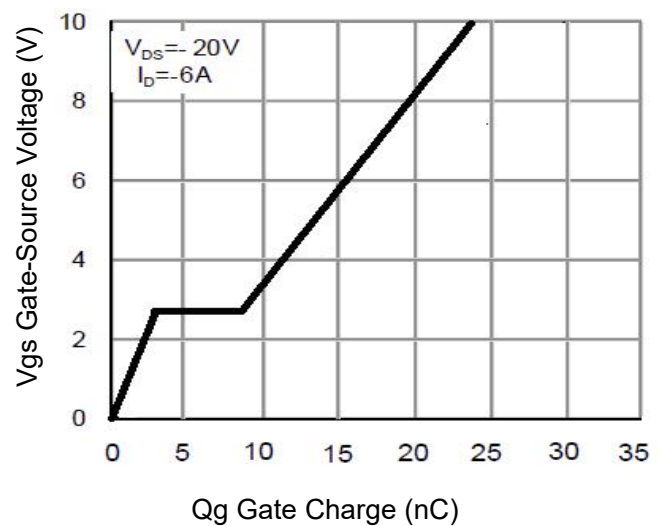
**Figure 2 Transfer Characteristics**



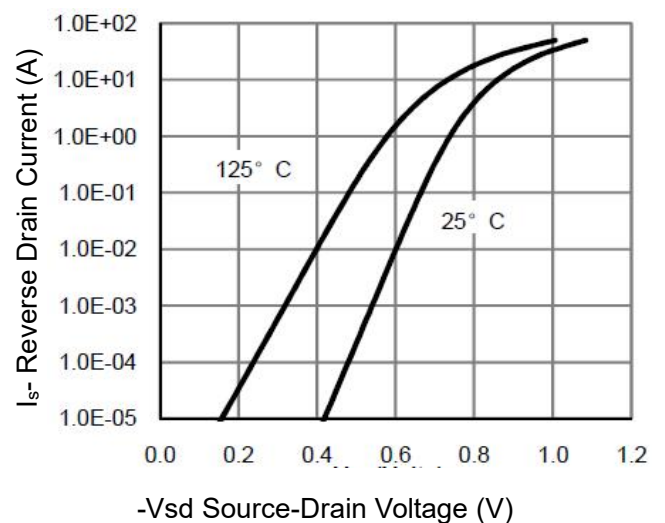
**Figure 3 Rdson- Drain Current**



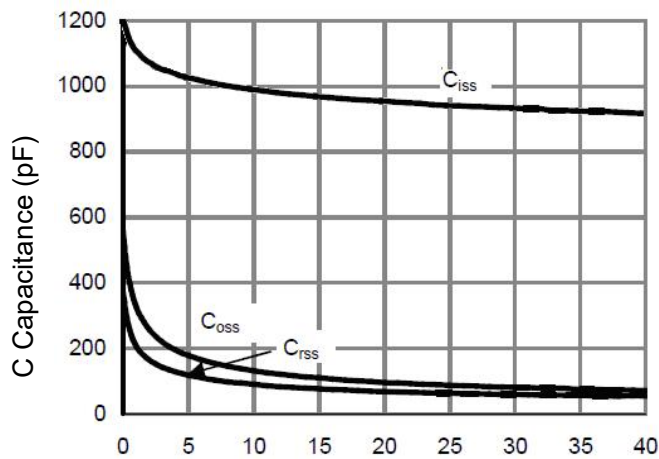
**Figure 4 Rdson-Junction Temperature**



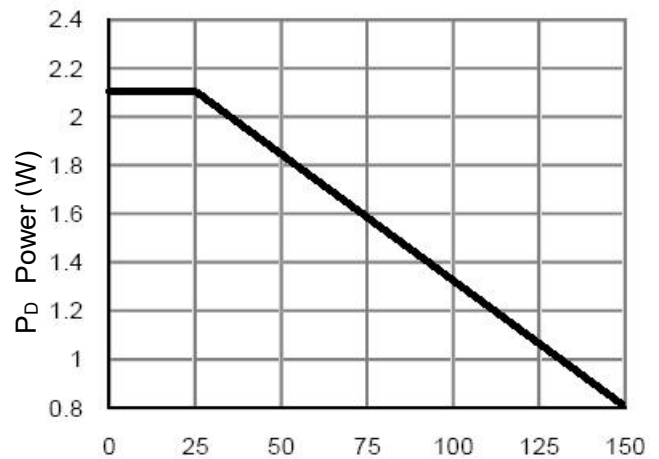
**Figure 5 Gate Charge**



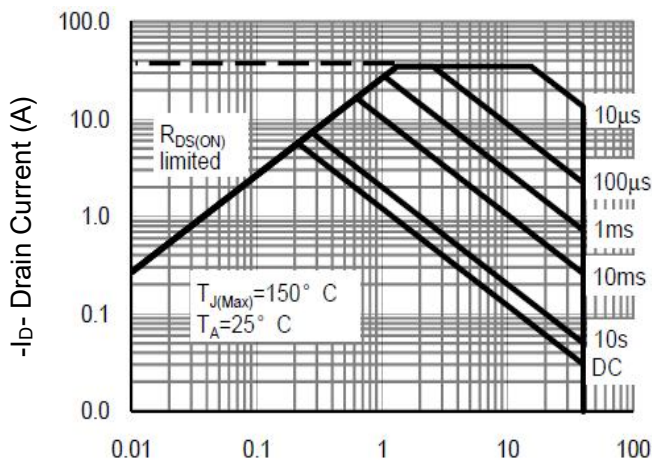
**Figure 6 Source- Drain Diode Forward**



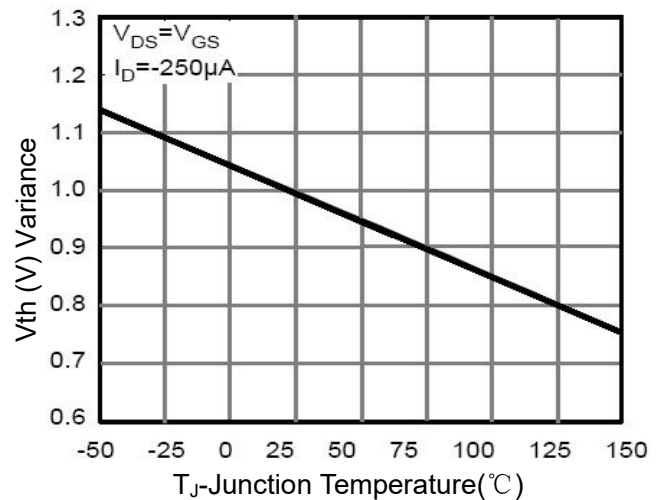
-Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



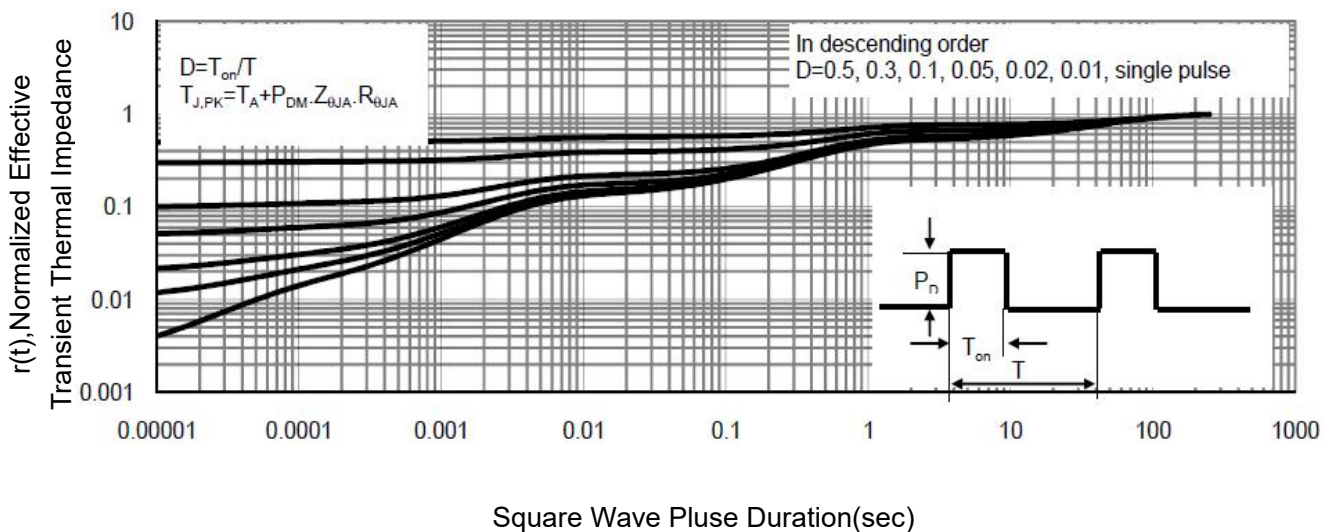
TA-Ambient Temperature(°C)  
**Figure 9 Power Dissipation**



-Vds Drain-Source Voltage (V)  
**Figure 8 Safe Operation Area**

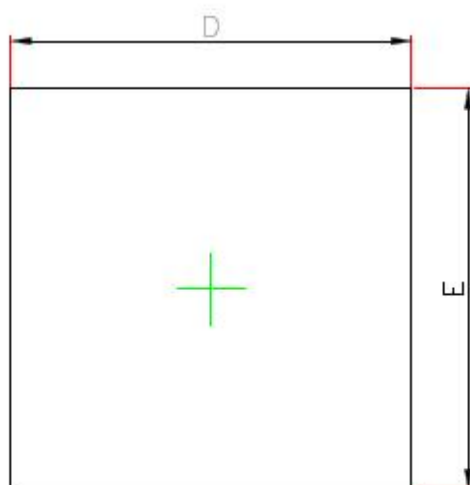


**Figure 10 VGS(th) vs Junction Temperature**

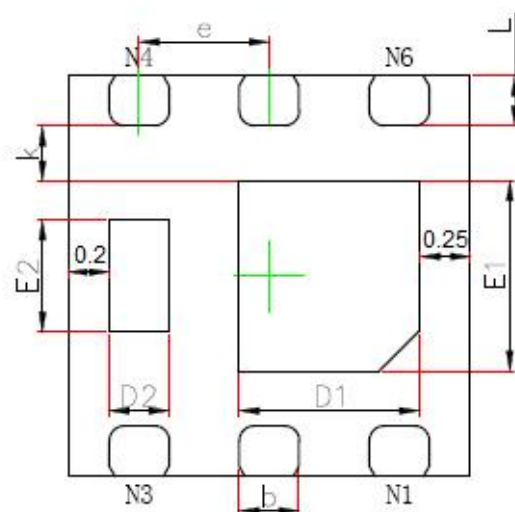


**Figure 11 Normalized Maximum Transient Thermal Impedance**

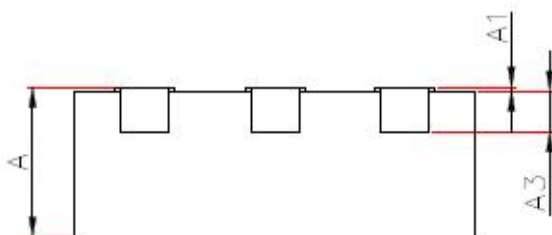
## DFN2X2-6L Package Information



TOP VIEW



BOTTOM VIEW



SIDE VIEW

| Symbol | Dimensions In Millimeters |             | Dimensions In Inches |             |
|--------|---------------------------|-------------|----------------------|-------------|
|        | Min.                      | Max.        | Min.                 | Max.        |
| A      | 0.700/0.800               | 0.800/0.900 | 0.028/0.031          | 0.031/0.035 |
| A1     | 0.000                     | 0.050       | 0.000                | 0.002       |
| A3     | 0.203REF.                 |             | 0.008REF.            |             |
| D      | 1.924                     | 2.076       | 0.076                | 0.082       |
| E      | 1.924                     | 2.076       | 0.076                | 0.082       |
| D1     | 0.800                     | 1.000       | 0.031                | 0.039       |
| E1     | 0.850                     | 1.050       | 0.033                | 0.041       |
| D2     | 0.200                     | 0.400       | 0.008                | 0.016       |
| E2     | 0.460                     | 0.660       | 0.018                | 0.026       |
| k      | 0.200MIN.                 |             | 0.008MIN.            |             |
| b      | 0.250                     | 0.350       | 0.010                | 0.014       |
| e      | 0.650TYP.                 |             | 0.026TYP.            |             |
| L      | 0.174                     | 0.326       | 0.007                | 0.013       |

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