

## NCE P-Channel Enhancement Mode Power MOSFET

### Description

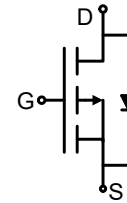
The NCE1216 uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages. This device is suitable for use as a load switching application and a wide variety of other applications.

### General Features

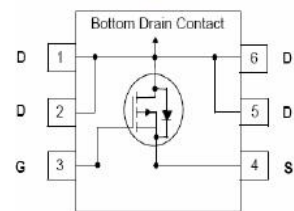
- $V_{DS} = -12V, I_D = -16A$   
 $R_{DS(ON)} < 22m\Omega @ V_{GS} = -2.5V$   
 $R_{DS(ON)} < 18m\Omega @ V_{GS} = -4.5V$
- Advanced trench MOSFET process technology
- Ultra low on-resistance with low gate charge

### Application

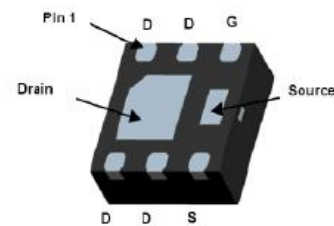
- PWM applications
- Load switch
- Battery charge in cellular handset



Schematic diagram



Pin assignment



DFN2X2-6L bottom view

### Package marking and ordering information

| Device Marking | Device  | Device Package | Reel Size | Tape Width | Quantity |
|----------------|---------|----------------|-----------|------------|----------|
| 1216           | NCE1216 | DFN2X2-6L      | -         | -          | -        |

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

| Parameter                                        | Symbol                   | Limit      | Unit       |
|--------------------------------------------------|--------------------------|------------|------------|
| Drain-Source Voltage                             | $V_{DS}$                 | -12        | V          |
| Gate-Source Voltage                              | $V_{GS}$                 | $\pm 12$   | V          |
| Drain Current-Continuous                         | $I_D$                    | -16        | A          |
| Drain Current -Pulsed (Note 1)                   | $I_{DM}$                 | -65        | A          |
| Maximum Power Dissipation ( $T_C = 25^\circ C$ ) | $P_D (T_C = 25^\circ C)$ | 18         | W          |
| Maximum Power Dissipation ( $T_A = 25^\circ C$ ) | $P_D (T_A = 25^\circ C)$ | 2.5        | W          |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$           | -55 To 150 | $^\circ C$ |

### Thermal Characteristic

|                                                  |                 |     |              |
|--------------------------------------------------|-----------------|-----|--------------|
| Thermal Resistance, Junction-to-Case (Note 2)    | $R_{\theta JC}$ | 6.9 | $^\circ C/W$ |
| Thermal Resistance, Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 50  | $^\circ C/W$ |

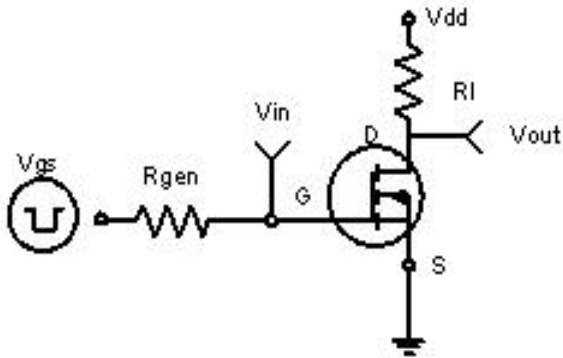
## Electrical characteristics (T<sub>A</sub>=25°C unless otherwise noted)

| 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                                                  | -12  | -    | -    | V    |
| Zero Gate Voltage Drain Current    | I <sub>DSS</sub>      | V <sub>DS</sub> =-12V, V <sub>GS</sub> =0V                                                  | -    | -    | -1   | μA   |
| Gate-Body Leakage Current          | I <sub>GSS</sub>      | V <sub>GS</sub> =±12V, 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                                   | -0.4 | -0.7 | -1   | V    |
| Drain-Source On-State Resistance   | R <sub>DS(ON)</sub>   | V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-6.7A                                               | -    | 11.5 | 18   | mΩ   |
|                                    |                       | V <sub>GS</sub> =-2.5V, I <sub>D</sub> =-6.2A                                               | -    | 14   | 22   | mΩ   |
| Forward Transconductance           | g <sub>FS</sub>       | V <sub>DS</sub> =-5V, I <sub>D</sub> =-6.7A                                                 | 20   | -    | -    | S    |
| Dynamic Characteristics (Note4)    |                       |                                                                                             |      |      |      |      |
| Input Capacitance                  | C <sub>iss</sub>      | V <sub>DS</sub> =-10V, V <sub>GS</sub> =0V,<br>F=1.0MHz                                     | -    | 2700 | -    | PF   |
| Output Capacitance                 | C <sub>oss</sub>      |                                                                                             | -    | 680  | -    | PF   |
| Reverse Transfer Capacitance       | C <sub>rss</sub>      |                                                                                             | -    | 590  | -    | PF   |
| Switching Characteristics (Note 4) |                       |                                                                                             |      |      |      |      |
| Turn-on Delay Time                 | t <sub>d(on)</sub>    | V <sub>DD</sub> =-10V, I <sub>D</sub> =-1A<br>V <sub>GS</sub> =-4.5V, R <sub>GEN</sub> =10Ω | -    | 11   | -    | nS   |
| Turn-on Rise Time                  | t <sub>r</sub>        |                                                                                             | -    | 35   | -    | nS   |
| Turn-Off Delay Time                | t <sub>d(off)</sub>   |                                                                                             | -    | 30   | -    | nS   |
| Turn-Off Fall Time                 | t <sub>f</sub>        |                                                                                             | -    | 10   | -    | nS   |
| Total Gate Charge                  | Q <sub>g</sub>        | V <sub>DS</sub> =-6V, I <sub>D</sub> =-10A,<br>V <sub>GS</sub> =-4.5V                       | -    | 35   | 48   | nC   |
| Gate-Source Charge                 | Q <sub>gs</sub>       |                                                                                             | -    | 5    | -    | nC   |
| Gate-Drain Charge                  | Q <sub>gd</sub>       |                                                                                             | -    | 10   | -    | nC   |
| Drain-Source Diode Characteristics |                       |                                                                                             |      |      |      |      |
| Diode Forward Voltage (Note 3)     | V <sub>SD</sub>       | V <sub>GS</sub> =0V, I <sub>S</sub> =-8A                                                    | -    | -    | -1.2 | V    |
| Diode Forward Current (Note 2)     | I <sub>S</sub>        |                                                                                             | -    | -    | -16  | A    |

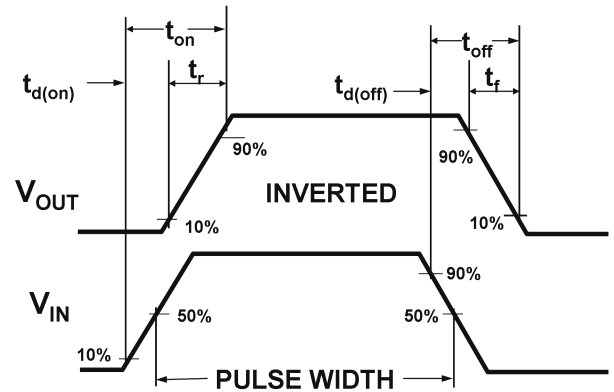
### Notes:

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

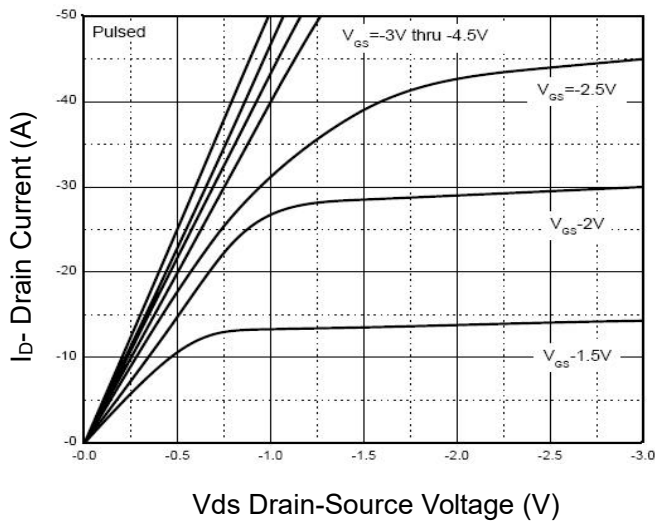
## Typical Electrical and Thermal Characteristics



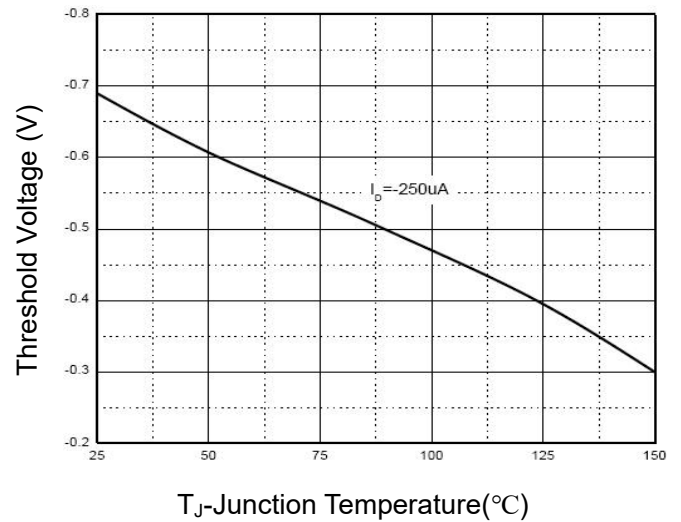
**Figure 1: Switching Test Circuit**



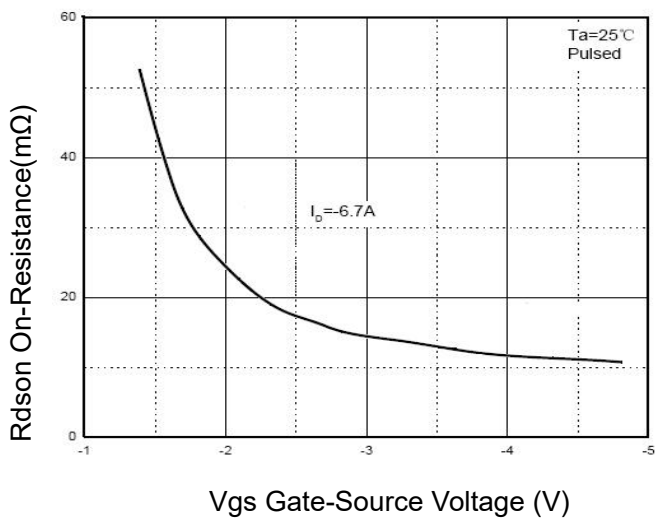
**Figure 2: Switching Waveforms**



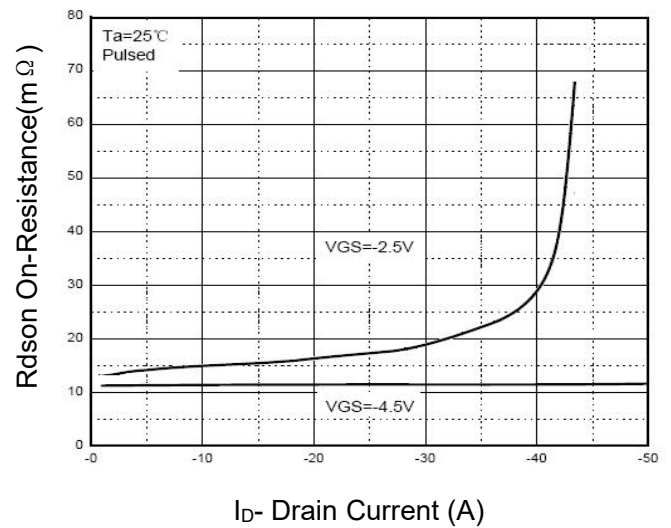
**Figure 3: Output Characteristics**



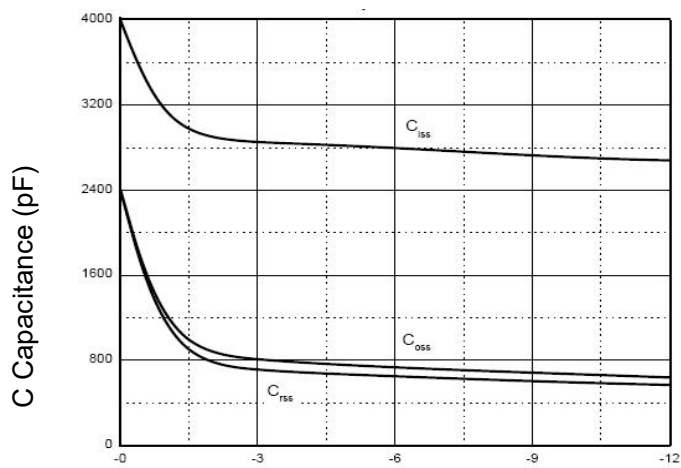
**Figure 4: Drain Current**



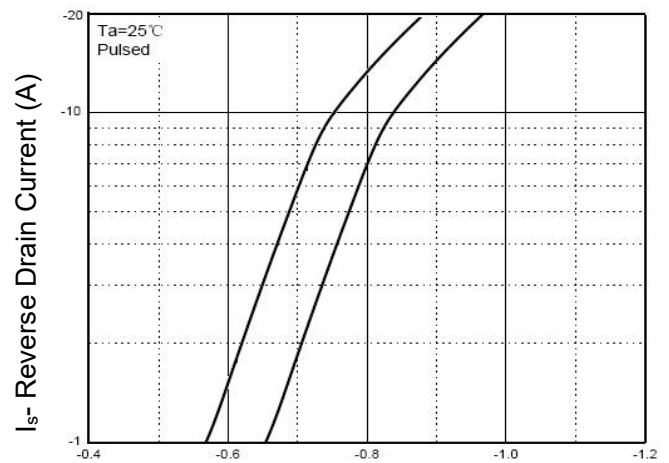
**Figure 5: Rdson vs Vgs**



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

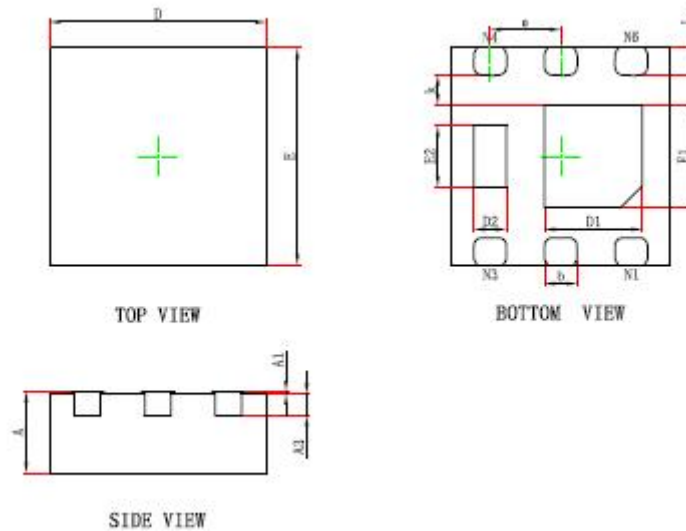


Vds Drain-Source Voltage (V)  
**Figure 7 Capacitance vs Vds**



Vsd Source-Drain Voltage (V)  
**Figure 8 Source- Drain Diode Forward**

## DFN2X2-6L Package Information



| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min.                      | Max.  | Min.                 | Max.  |
| A      | 0.700                     | 0.800 | 0.028                | 0.031 |
| 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 |

## Notes

1. All dimensions are in millimeters.
2. Tolerance  $\pm 0.10\text{mm}$  (4 mil) unless otherwise specified
3. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils.
4. Dimension L is measured in gauge plane.
5. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

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