

## NCE N-Channel Super Trench Power MOSFET

### Description

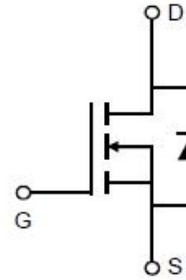
The NCEP40T11G uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

### General Features

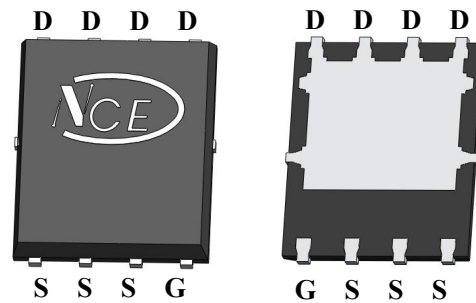
- $V_{DS} = 40V, I_D = 110A$
- $R_{DS(ON)} = 2.2m\Omega$  (typical) @  $V_{GS} = 10V$
- $R_{DS(ON)} = 3.3m\Omega$  (typical) @  $V_{GS} = 4.5V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 150 °C operating temperature
- Pb-free lead plating
- 100% UIS tested

### Application

- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification



Schematic Diagram



Top View

Bottom View

**100% UIS TESTED!**

**100% ΔVds TESTED!**

### Package Marking and Ordering Information

| Device Marking | Device     | Device Package | Reel Size | Tape width | Quantity |
|----------------|------------|----------------|-----------|------------|----------|
| NCEP40T11G     | NCEP40T11G | DFN5X6-8L      | -         | -          | -        |

### Absolute Maximum Ratings (T<sub>c</sub>=25°C unless otherwise noted)

| Parameter  | Symbol             | Limit      | Unit |
|--|--------------------|------------|------|
| Drain-Source Voltage                             | $V_{DS}$           | 40         | V    |
| Gate-Source Voltage                              | $V_{GS}$           | ±20        | V    |
| Drain Current-Continuous (Silicon Limited)       | $I_D$              | 110        | A    |
| Drain Current-Continuous(T <sub>c</sub> =100°C)  | $I_D(100^\circ C)$ | 77.8       | A    |
| Pulsed Drain Current (Package Limited)           | $I_{DM}$           | 340        | A    |
| Maximum Power Dissipation                        | $P_D$              | 100        | W    |
| Derating factor                                  |                    | 0.8        | W/°C |
| Single pulse avalanche energy (Note 5)           | $E_{AS}$           | 500        | mJ   |
| Operating Junction and Storage Temperature Range | $T_J, T_{STG}$     | -55 To 150 | °C   |

## Thermal Characteristic

|  |                 |      |               |
|--|-----------------|------|---------------|
| Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup> | $R_{\theta JC}$ | 1.25 | $^{\circ}C/W$ |
|--|-----------------|------|---------------|

## Electrical Characteristics ( $T_C=25^{\circ}C$ unless otherwise noted)

| Parameter  | Symbol       | Condition  | Min | Typ  | Max       | Unit       |
|--|--------------|--|-----|------|-----------|------------|
| <b>Off Characteristics</b>                           |              |  |     |      |           |            |
| Drain-Source Breakdown Voltage                       | $BV_{DSS}$   | $V_{GS}=0V, I_D=250\mu A$  | 40  |      | -         | V          |
| Zero Gate Voltage Drain Current                      | $I_{DSS}$    | $V_{DS}=40V, V_{GS}=0V$  | -   | -    | 1         | $\mu A$    |
| Gate-Body Leakage Current                            | $I_{GSS}$    | $V_{GS}=\pm 20V, V_{DS}=0V$  | -   | -    | $\pm 100$ | nA         |
| <b>On Characteristics</b> <sup>(Note 3)</sup>        |              |  |     |      |           |            |
| Gate Threshold Voltage                               | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$  | 1.2 | 1.7  | 2.2       | V          |
| Drain-Source On-State Resistance                     | $R_{DS(on)}$ | $V_{GS}=10V, I_D=55A$  | -   | 2.2  | 2.8       | m $\Omega$ |
|  |              | $V_{GS}=4.5V, I_D=55A$   | -   | 3.3  | 4.0       | m $\Omega$ |
| Forward Transconductance                             | $g_{FS}$     | $V_{DS}=5V, I_D=55A$   | -   | 60   | -         | S          |
| <b>Dynamic Characteristics</b> <sup>(Note 4)</sup>   |              |  |     |      |           |            |
| Input Capacitance                                    | $C_{iss}$    | $V_{DS}=20V, V_{GS}=0V,$<br>$F=1.0MHz$                                     | -   | 3510 | 4200      | PF         |
| Output Capacitance                                   | $C_{oss}$    |  | -   | 860  | 1000      | PF         |
| Reverse Transfer Capacitance                         | $C_{rss}$    |  | -   | 60   | 78        | PF         |
| <b>Switching Characteristics</b> <sup>(Note 4)</sup> |              |  |     |      |           |            |
| Turn-on Delay Time                                   | $t_{d(on)}$  | $V_{DD}=20V, I_D=55A$<br>$V_{GS}=10V, R_G=1.6\Omega$                       | -   | 10.5 | -         | nS         |
| Turn-on Rise Time                                    | $t_r$        |  | -   | 4    | -         | nS         |
| Turn-Off Delay Time                                  | $t_{d(off)}$ |  | -   | 35   | -         | nS         |
| Turn-Off Fall Time                                   | $t_f$        |  | -   | 5    | -         | nS         |
| Total Gate Charge                                    | $Q_g$        | $V_{DS}=20V, I_D=55A,$<br>$V_{GS}=10V$                                     | -   | 60   | 72        | nC         |
| Gate-Source Charge                                   | $Q_{gs}$     |  | -   | 9.9  |           | nC         |
| Gate-Drain Charge                                    | $Q_{gd}$     |  | -   | 9.5  |           | nC         |
| <b>Drain-Source Diode Characteristics</b>            |              |  |     |      |           |            |
| Diode Forward Voltage <sup>(Note 3)</sup>            | $V_{SD}$     | $V_{GS}=0V, I_S=55A$   | -   |      | 1.2       | V          |
| Diode Forward Current <sup>(Note 2)</sup>            | $I_S$        |  | -   | -    | 110       | A          |
| Reverse Recovery Time                                | $t_{rr}$     | $T_J = 25^{\circ}C, I_F = I_S$<br>$di/dt = 100A/\mu s$ <sup>(Note 3)</sup> | -   |      | 24        | nS         |
| Reverse Recovery Charge                              | $Q_{rr}$     |  | -   |      | 68        | nC         |

### 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
5. EAS condition :  $T_J=25^{\circ}C, V_{DD}=20V, V_G=10V, L=0.5mH, R_G=25\Omega$

Typical Electrical and Thermal Characteristics

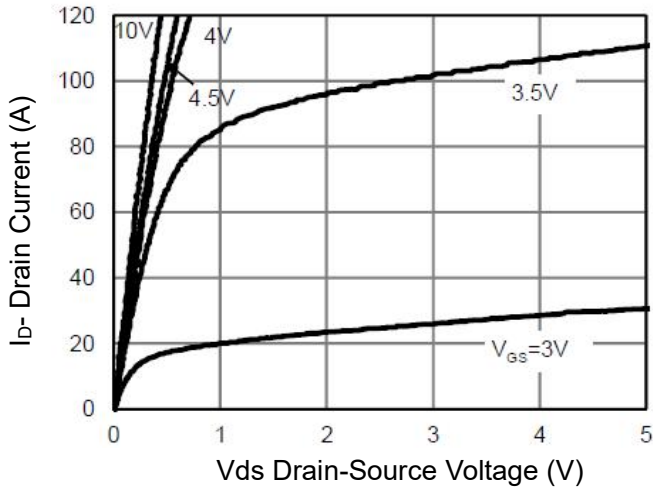


Figure 1 Output Characteristics

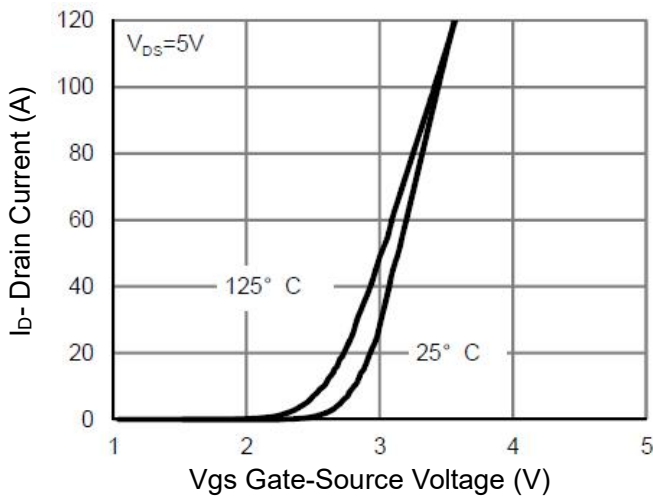


Figure 2 Transfer Characteristics

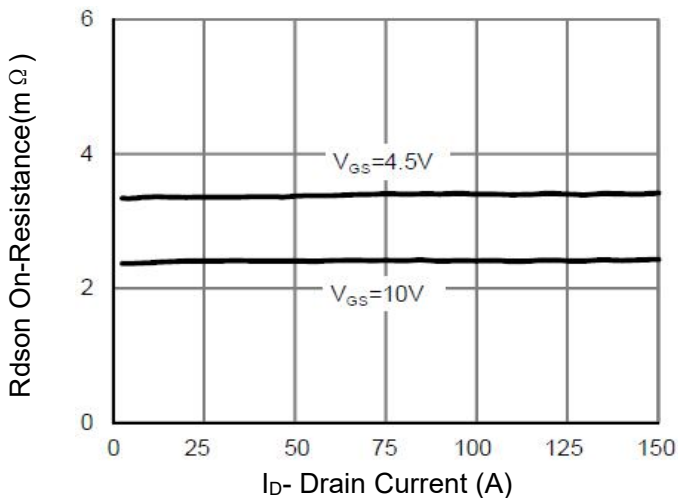


Figure 3 Rdson- Drain Current

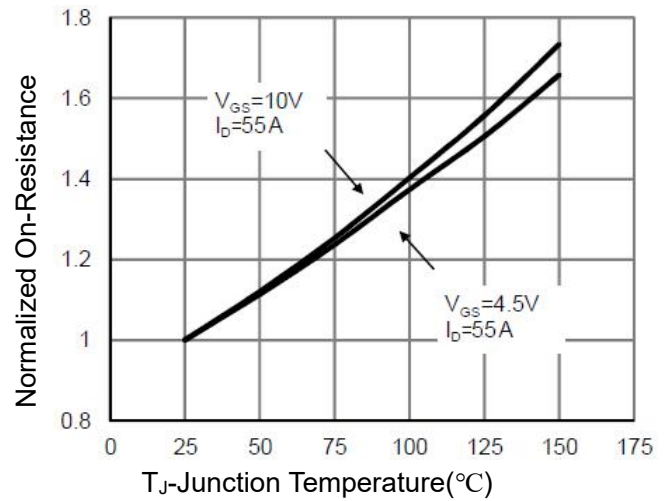


Figure 4 Rdson-Junction Temperature

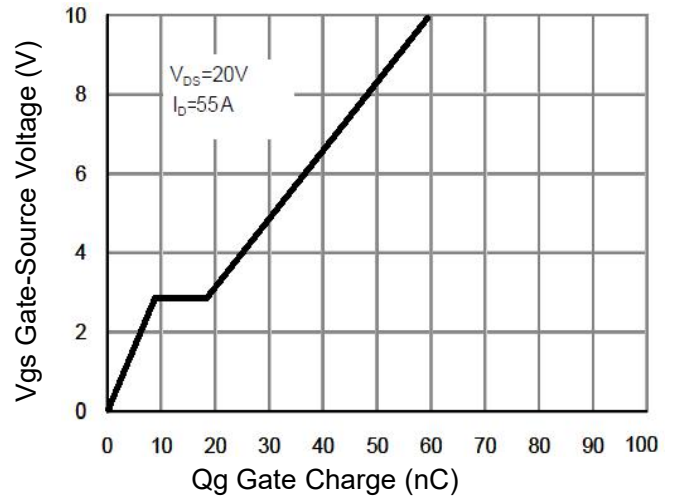


Figure 5 Gate Charge

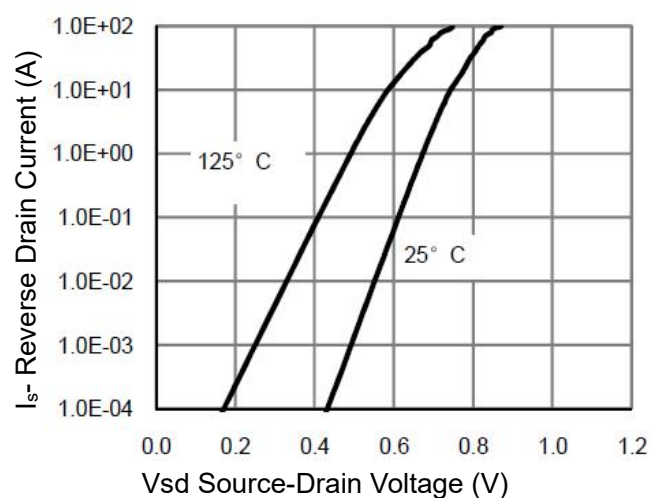


Figure 6 Source- Drain Diode Forward

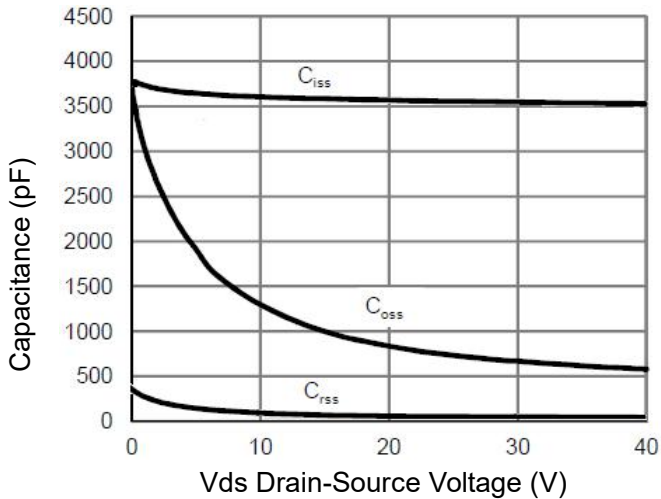


Figure 7 Capacitance vs Vds

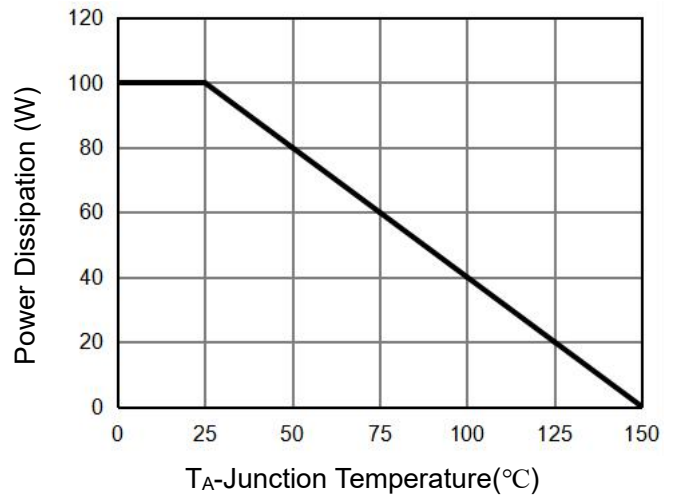


Figure 9 Power De-rating

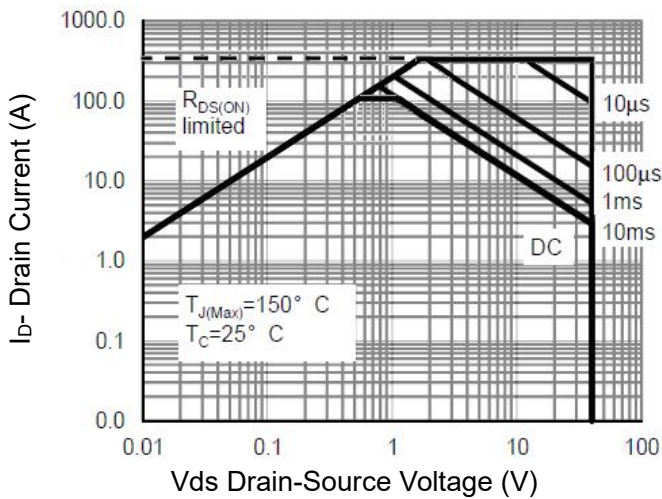


Figure 8 Safe Operation Area

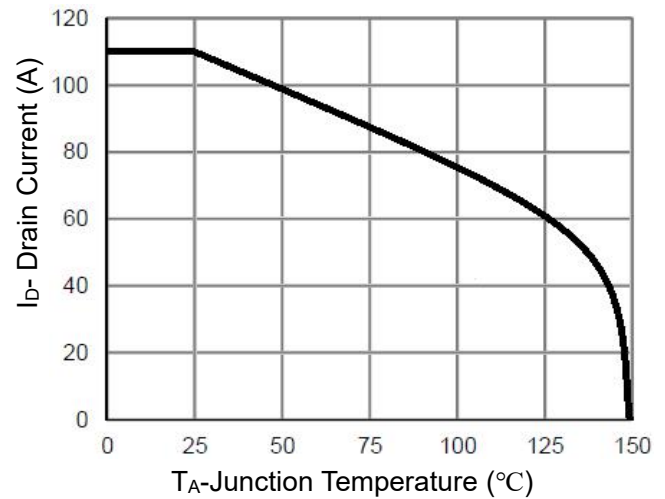


Figure 10 Current De-rating

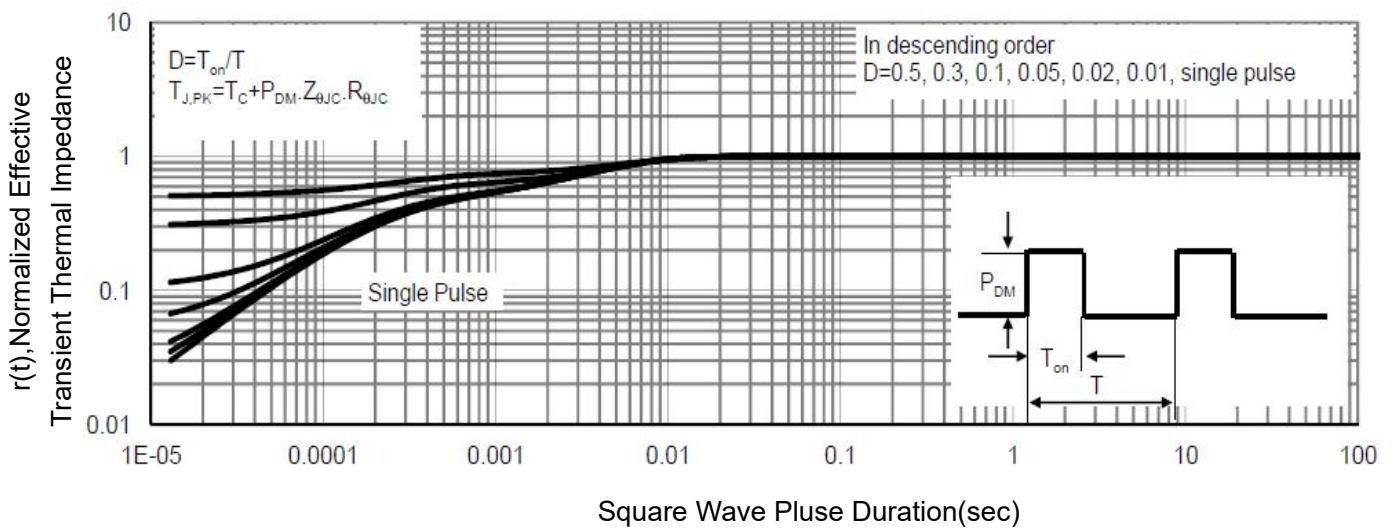
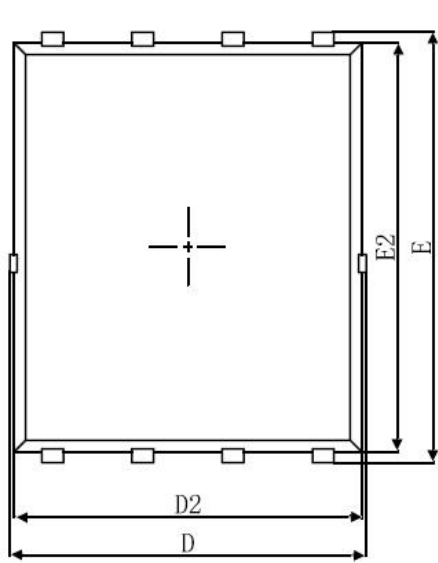
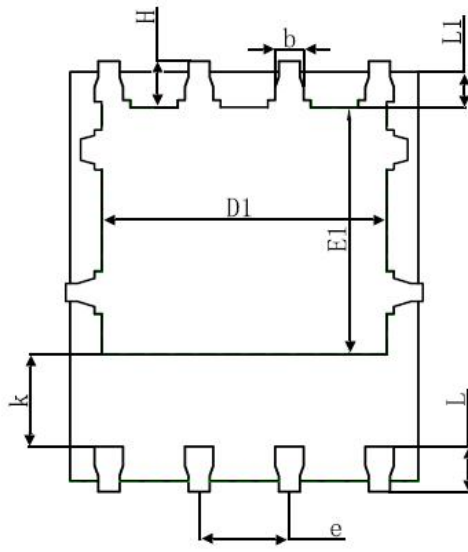


Figure 11 Normalized Maximum Transient Thermal Impedance

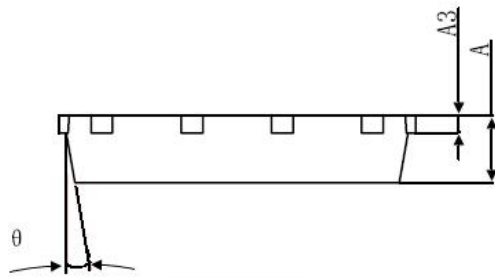
DFN5X6-8L Package Information



Top View  
[顶视图]



Bottom View  
[背视图]



Side View  
[侧视图]

| Symbol | Dimensions In Millimeters |       | Dimensions In Inches |       |
|--------|---------------------------|-------|----------------------|-------|
|        | Min.                      | Max.  | Min.                 | Max.  |
| A      | 0.900                     | 1.000 | 0.035                | 0.039 |
| A3     | 0.254REF.                 |       | 0.010REF.            |       |
| D      | 4.944                     | 5.096 | 0.195                | 0.201 |
| E      | 5.974                     | 6.126 | 0.235                | 0.241 |
| D1     | 3.910                     | 4.110 | 0.154                | 0.162 |
| E1     | 3.375                     | 3.575 | 0.133                | 0.141 |
| D2     | 4.824                     | 4.976 | 0.190                | 0.196 |
| E2     | 5.674                     | 5.826 | 0.223                | 0.229 |
| k      | 1.190                     | 1.390 | 0.047                | 0.055 |
| b      | 0.350                     | 0.450 | 0.014                | 0.018 |
| e      | 1.270TYP.                 |       | 0.050TYP.            |       |
| L      | 0.559                     | 0.711 | 0.022                | 0.028 |
| L1     | 0.424                     | 0.576 | 0.017                | 0.023 |
| H      | 0.574                     | 0.726 | 0.023                | 0.029 |
| θ      | 8°                        | 12°   | 8°                   | 12°   |

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