

## NCE N-Channel Super Trench Power MOSFET

### Description

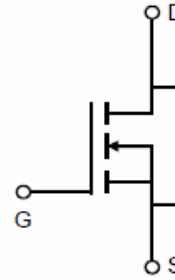
The NCEP40T17G uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(ON)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification.

### General Features

- $V_{DS} = 40V, I_D = 170A$   
 $R_{DS(ON)} = 1.25m\Omega$  (typical) @  $V_{GS} = 10V$   
 $R_{DS(ON)} = 1.55m\Omega$  (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 |
|----------------|------------|----------------|-----------|------------|----------|
| NCEP40T17G     | NCEP40T17G | DFN5X6-8L      | -         | -          | -        |

### Absolute Maximum Ratings ( $T_C = 25^\circ C$ unless otherwise noted)

| Parameter   | Symbol             | Limit      | Unit |
|---|--------------------|------------|------|
| Drain-Source Voltage                                | $V_{DS}$           | 40         | V    |
| Gate-Source Voltage                                 | $V_{GS}$           | ±20        | V    |
| Drain Current-Continuous ( <b>Silicon Limited</b> ) | $I_D$              | 170        | A    |
| Drain Current-Continuous( $T_C = 100^\circ C$ )     | $I_D(100^\circ C)$ | 120        | A    |
| Pulsed Drain Current ( <b>Package Limited</b> )     | $I_{DM}$           | 400        | A    |
| Maximum Power Dissipation                           | $P_D$              | 95         | W    |
| Derating factor                                     |                    | 0.76       | W/°C |
| Single pulse avalanche energy <sup>(Note 5)</sup>   | $E_{AS}$           | 1200       | 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> | $R_{\theta JC}$ | 1.31 | °C/W |
|--|-----------------|------|------|

## Electrical Characteristics ( $T_C=25^\circ\text{C}$ 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 | 1.5  | 2.2       | V          |
| Drain-Source On-State Resistance                     | $R_{DS(on)}$ | $V_{GS}=10V, I_D=85A$   | -   | 1.25 | 1.5       | m $\Omega$ |
|  |              | $V_{GS}=4.5V, I_D=85A$  | -   | 1.55 | 1.95      | m $\Omega$ |
| Forward Transconductance                             | $g_{FS}$     | $V_{DS}=5V, I_D=85A$  | -   | 80   | -         | S          |
| <b>Dynamic Characteristics</b> <sup>(Note 4)</sup>   |              |   |     |      |           |            |
| Input Capacitance                                    | $C_{iss}$    | $V_{DS}=20V, V_{GS}=0V,$<br>$F=1.0\text{MHz}$                                   | -   | 7400 | 8800      | PF         |
| Output Capacitance                                   | $C_{oss}$    |   | -   | 1930 | 2300      | PF         |
| Reverse Transfer Capacitance                         | $C_{rss}$    |   | -   | 110  | 130       | PF         |
| <b>Switching Characteristics</b> <sup>(Note 4)</sup> |              |   |     |      |           |            |
| Turn-on Delay Time                                   | $t_{d(on)}$  | $V_{DD}=20V, I_D=85A$<br>$V_{GS}=10V, R_G=1.6\Omega$                            | -   | 14.1 | -         | nS         |
| Turn-on Rise Time                                    | $t_r$        |   | -   | 7.9  | -         | nS         |
| Turn-Off Delay Time                                  | $t_{d(off)}$ |   | -   | 56.5 | -         | nS         |
| Turn-Off Fall Time                                   | $t_f$        |   | -   | 9.6  | -         | nS         |
| Total Gate Charge                                    | $Q_g$        | $V_{DS}=20V, I_D=85A,$<br>$V_{GS}=10V$  | -   | 125  | 140       | nC         |
| Gate-Source Charge                                   | $Q_{gs}$     |   | -   | 18   |           | nC         |
| Gate-Drain Charge                                    | $Q_{gd}$     |   | -   | 13   |           | nC         |
| <b>Drain-Source Diode Characteristics</b>            |              |   |     |      |           |            |
| Diode Forward Voltage <sup>(Note 3)</sup>            | $V_{SD}$     | $V_{GS}=0V, I_S=85A$  | -   |      | 1.2       | V          |
| Diode Forward Current <sup>(Note 2)</sup>            | $I_S$        |   | -   | -    | 170       | A          |
| Reverse Recovery Time                                | $t_{rr}$     | $T_J = 25^\circ\text{C}, I_F = I_S$<br>$di/dt = 100A/\mu s$ <sup>(Note 3)</sup> | -   |      | 35        | nS         |
| Reverse Recovery Charge                              | $Q_{rr}$     |   | -   |      | 124       | 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 :  $T_J=25^\circ\text{C}, V_{DD}=20V, V_G=10V, L=0.5\text{mH}, R_G=25\Omega$

Typical Electrical and Thermal Characteristics

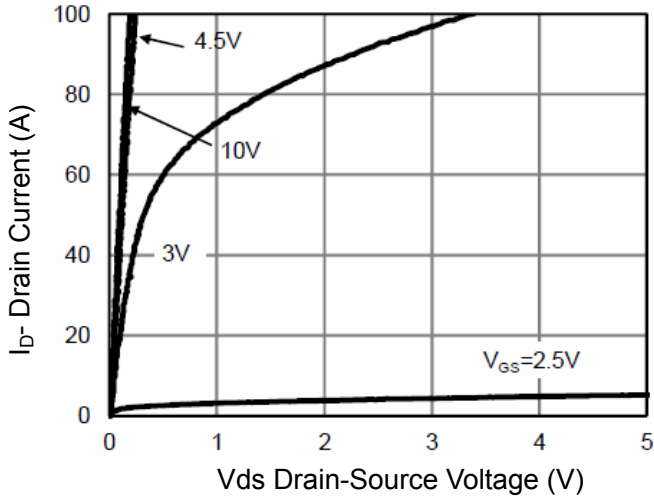


Figure 1 Output Characteristics

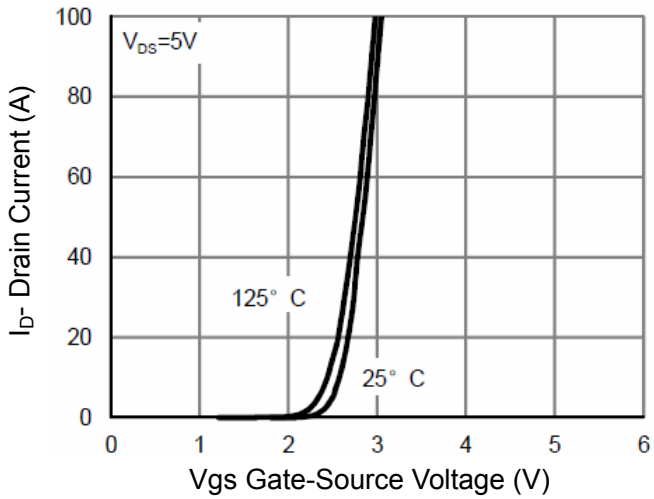


Figure 2 Transfer Characteristics

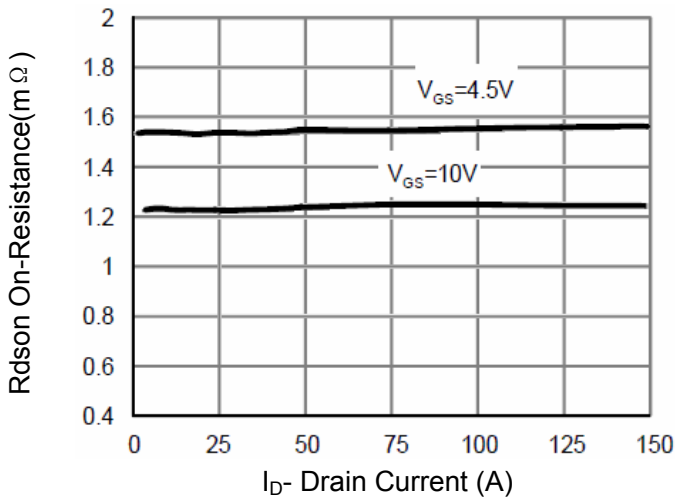


Figure 3 Rdson- Drain Current

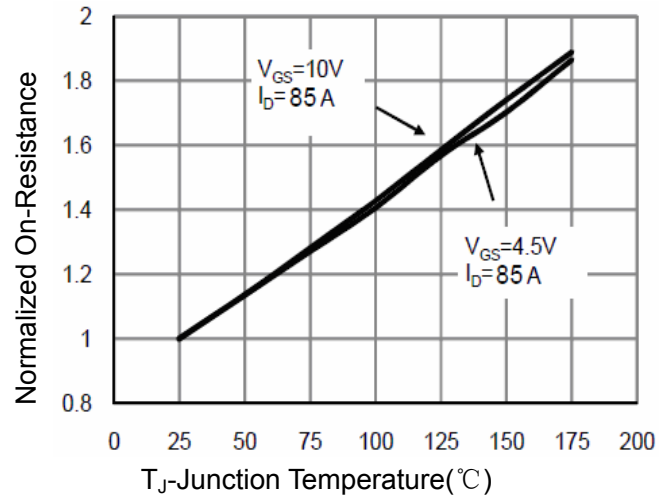


Figure 4 Rdson-Junction Temperature

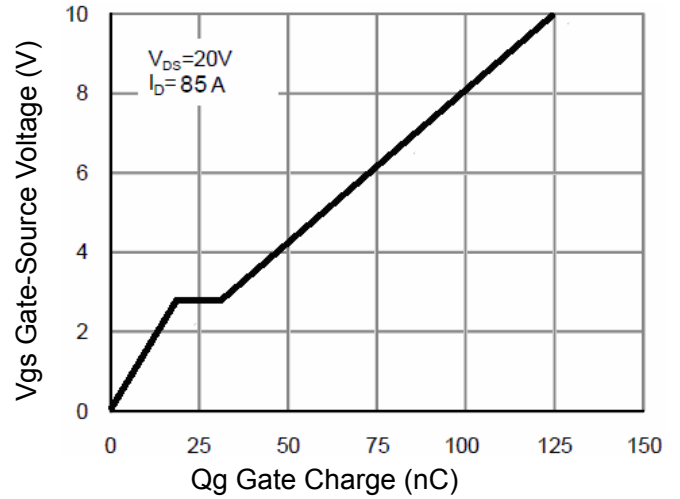


Figure 5 Gate Charge

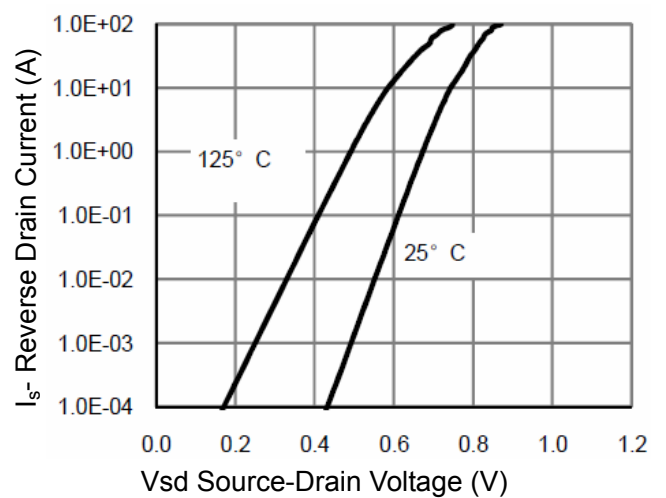


Figure 6 Source- Drain Diode Forward

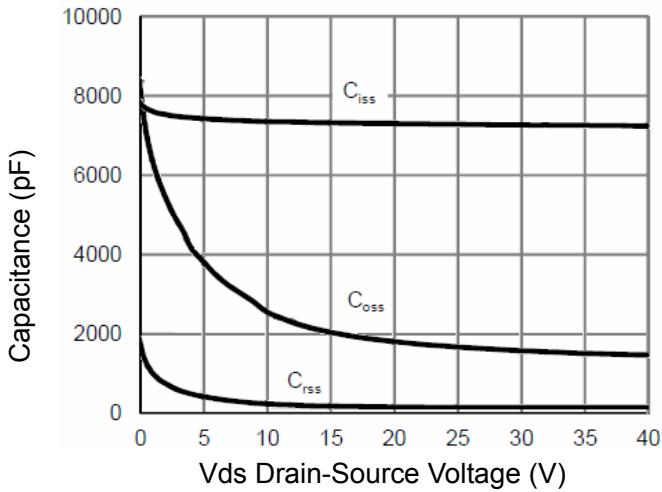


Figure 7 Capacitance vs Vds

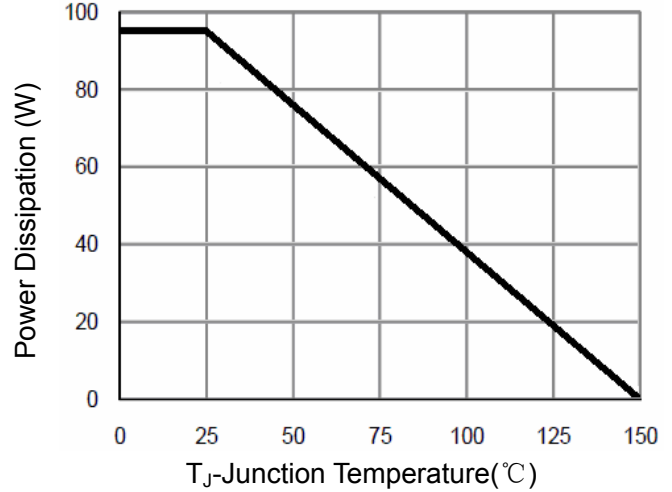


Figure 9 Power De-rating

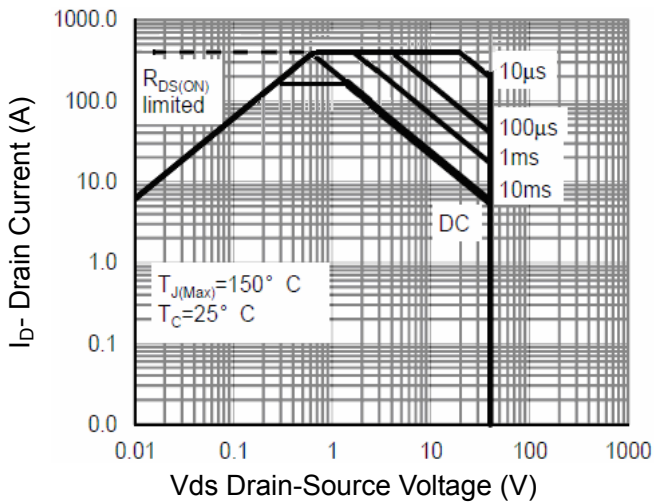


Figure 8 Safe Operation Area

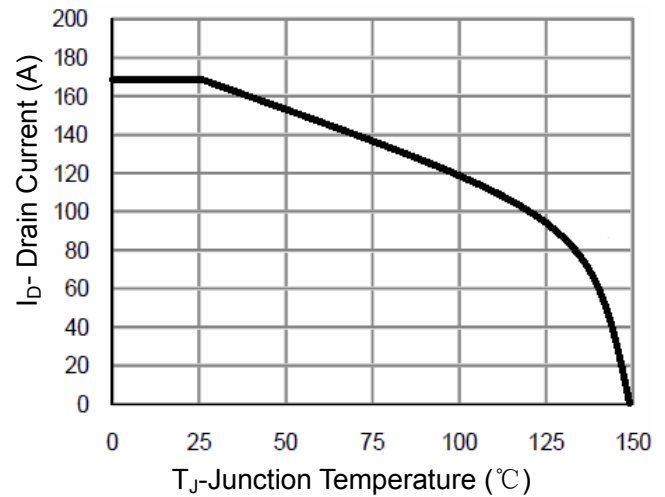


Figure 10 Current De-rating

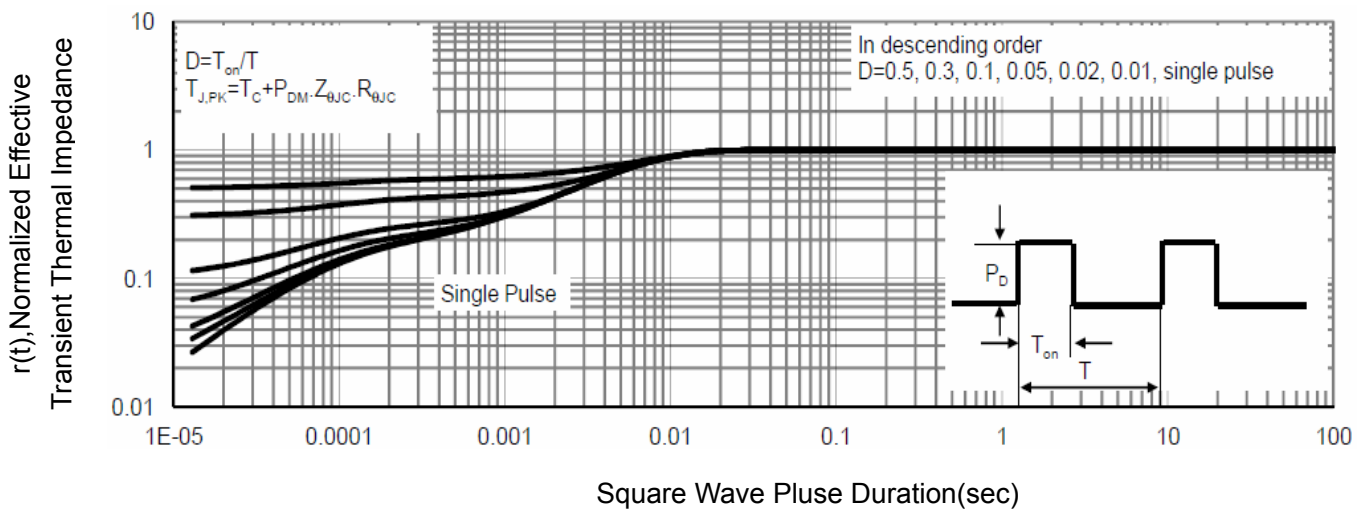
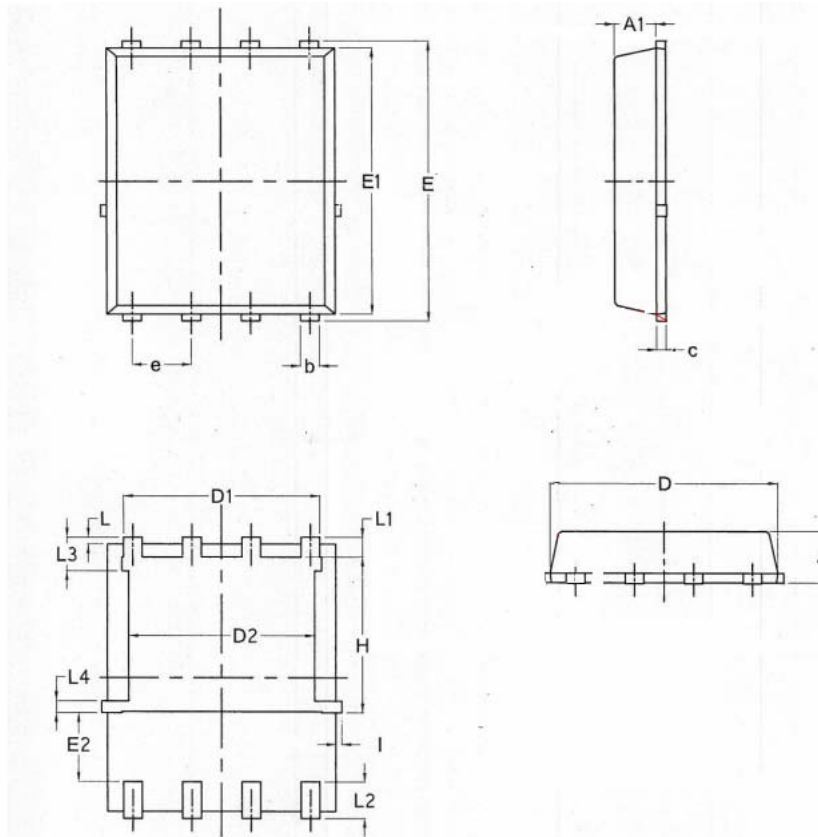


Figure 11 Normalized Maximum Transient Thermal Impedance

**DFN5X6-8L Package Information**


| Symbol | Dimensions In Millimeters |       |       | Dimensions In Inches |        |        |
|--------|---------------------------|-------|-------|----------------------|--------|--------|
|        | Min.                      | Nom.  | Max.  | Min.                 | Nom.   | Max.   |
| A      | 0.90                      | 1.10  | 1.17  | 0.0354               | 0.0433 | 0.0461 |
| A1     | 0.824                     | 0.897 | 0.97  | 0.0324               | 0.0353 | 0.0382 |
| b      | 0.33                      | 0.41  | 0.50  | 0.0130               | 0.0161 | 0.0197 |
| C      | 0.150                     | 0.20  | 0.250 | 0.0059               | 0.0079 | 0.0098 |
| D      | 4.80                      | 4.90  | 5.00  | 0.1890               | 0.1929 | 0.1969 |
| D1     | 3.91                      | 4.22  | 4.36  | 0.1539               | 0.1661 | 0.1717 |
| D2     | 3.85                      | 4.00  | 4.15  | 0.1516               | 0.1575 | 0.1634 |
| E      | 5.90                      | 60.5  | 6.15  | 0.2323               | 0.2382 | 0.2421 |
| E1     | 5.65                      | 5.76  | 5.85  | 0.2224               | 0.2268 | 0.2303 |
| E2     | 1.10                      | /     | /     | 0.0433               | /      | /      |
| e      | 1.27 BSC                  |       |       | 0.050 BSC            |        |        |
| L      | 0.05                      | 0.15  | 0.25  | 0.0020               | 0.0059 | 0.0098 |
| L1     | 0.38                      | 0.425 | 0.50  | 0.0150               | 0.0167 | 0.0197 |
| L2     | 0.51                      | 0.785 | 0.86  | 0.0201               | 0.0309 | 0.0339 |
| L3     | 0.55                      | 0.70  | 0.85  | 0.0217               | 0.0276 | 0.0335 |
| L4     | 0.10                      | 0.25  | 0.40  | 0.0039               | 0.0098 | 0.0157 |
| H      | 3.25                      | 3.35  | 3.58  | 0.1280               | 0.1319 | 0.1409 |
| I      | 0                         | /     | 0.18  | 0                    | /      | 0.0071 |

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