

NCE Automotive N-Channel Super Trench Power MOSFET

Description

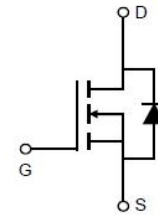
The NCEAP40T11AK uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of $R_{DS(ON)}$ and Q_g . This device is ideal for high-frequency switching and synchronous rectification.

General Features

- $V_{DS} = 40V, I_D = 135A$ (Silicon Limited)
 $R_{DS(ON)} = 3.2m\Omega$ (typical) @ $V_{GS} = 10V$
- Excellent gate charge x $R_{DS(on)}$ product(FOM)
- Very low on-resistance $R_{DS(on)}$
- 175 °C operating temperature
- Pb-free lead plating
- 100% UIS tested
- 100% ΔV_{ds} tested
- **AEC-Q101 qualified**

Application

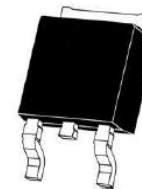
- Automotive application
- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification



Schematic Diagram



Marking and pin assignment



TO-252-2L top view

Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|----------------|--------------|----------------|-----------|------------|----------|
| AP40T11AK | NCEAP40T11AK | TO-252-2L | - | - | - |

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 (Silicon Limited) ^(Note1) | I_D | 135 | A |
| Drain Current-Continuous (Silicon Limited) ^(Note1) | $I_D(100^\circ C)$ | 97 | A |
| Drain Current-Continuous (Package Limited) | I_D | 110 | A |
| Pulsed Drain Current | I_{DM} | 440 | A |
| Maximum Power Dissipation | P_D | 150 | W |
| Derating factor | | 1 | W/°C |
| Single pulse avalanche energy ^(Note 2) | E_{AS} | 480 | mJ |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 To 175 | °C |

Thermal Characteristic

| | | | |
|--------------------------------------|-----------------|-----|------|
| Thermal Resistance, Junction-to-Case | $R_{\theta JC}$ | 1.0 | °C/W |
|--------------------------------------|-----------------|-----|------|

Electrical Characteristics (T_c=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 | 40 | - | - | V |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} =40V, V _{GS} =0V | - | - | 1 | μA |
| Gate-Body Leakage Current | I _{GSS} | V _{GS} =±20V, V _{DS} =0V | - | - | ±100 | nA |
| On Characteristics | | | | | | |
| Gate Threshold Voltage | V _{GS(th)} | V _{DS} =V _{GS} , I _D =250μA | 2.0 | 3.0 | 4.0 | V |
| Drain-Source On-State Resistance | R _{DS(ON)} | V _{GS} =10V, I _D =20A | - | 3.2 | 4.2 | mΩ |
| Forward Transconductance | g _{FS} | V _{DS} =5V, I _D =20A | - | 60 | - | S |
| Dynamic Characteristics | | | | | | |
| Input Capacitance | C _{iss} | V _{DS} =20V, V _{GS} =0V, F=1.0MHz | - | 2750 | - | pF |
| Output Capacitance | C _{oss} | | - | 850 | - | pF |
| Reverse Transfer Capacitance | C _{rss} | | - | 54 | - | pF |
| Switching Characteristics (Note 1) | | | | | | |
| Turn-on Delay Time | t _{d(on)} | V _{DD} =20V, I _D =20A V _{GS} =10V, R _G =1.6Ω | - | 9 | - | nS |
| Turn-on Rise Time | t _r | | - | 3.5 | - | nS |
| Turn-Off Delay Time | t _{d(off)} | | - | 31 | - | nS |
| Turn-Off Fall Time | t _f | | - | 4 | - | nS |
| Total Gate Charge | Q _g | V _{DS} =20V, I _D =20A, V _{GS} =10V | - | 38.5 | - | nC |
| Gate-Source Charge | Q _{gs} | | - | 13.5 | - | nC |
| Gate-Drain Charge | Q _{gd} | | - | 7.0 | - | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Diode Forward Voltage | V _{SD} | V _{GS} =0V, I _S =55A | - | - | 1.2 | V |
| Diode Forward Current | I _S | | - | - | 135 | A |
| Reverse Recovery Time | t _{rr} | T _J = 25°C, I _F = I _S | - | 22 | - | nS |
| Reverse Recovery Charge | Q _{rr} | di/dt = 100A/μs | - | 62 | - | nC |

Notes:

1. Defined by design. Not Subject to production test
2. EAS condition : T_J=25°C, V_{DD}=20V, V_G=10V, L=0.5mH, R_G=25Ω
3. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T_J(MAX)=175° C. The SOA curve provides a single pulse rating.

Typical Electrical and Thermal Characteristics

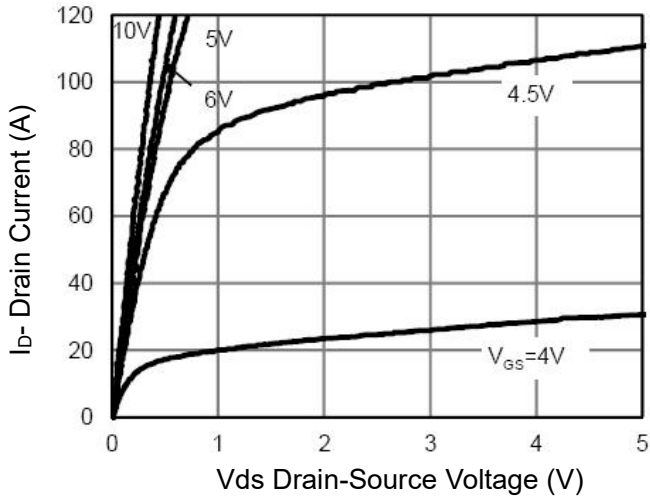


Figure 1 Output Characteristics

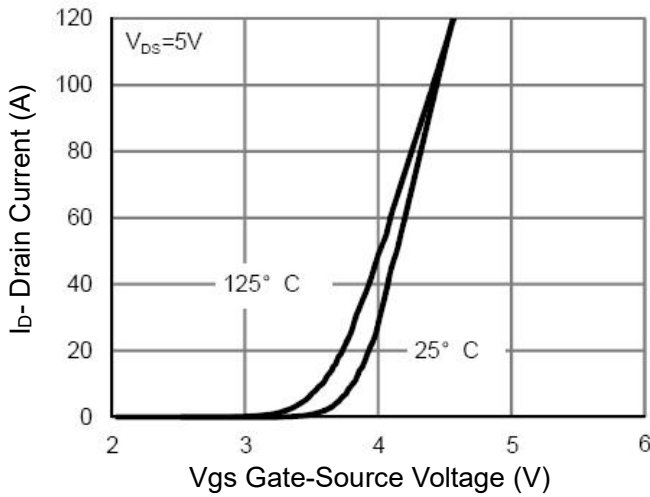


Figure 2 Transfer Characteristics

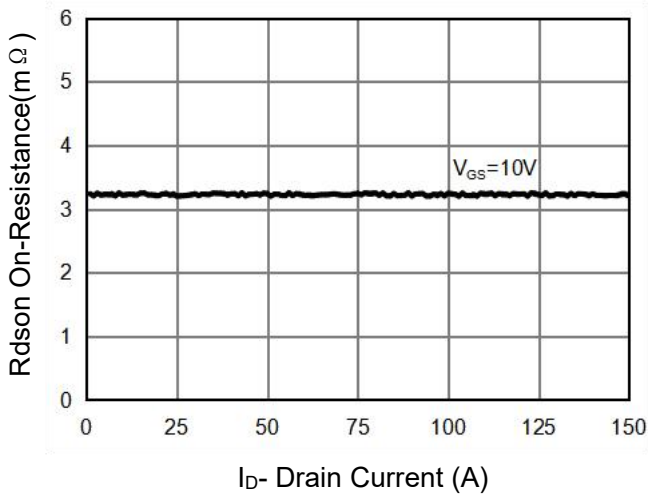


Figure 3 Rdson- Drain Current

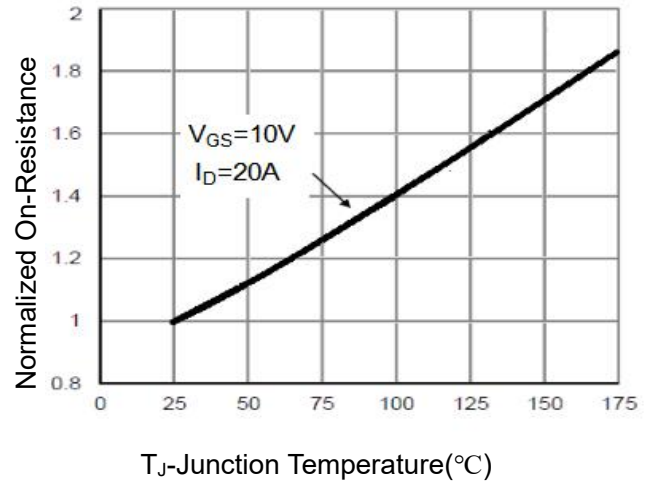


Figure 4 Rdson-Junction Temperature

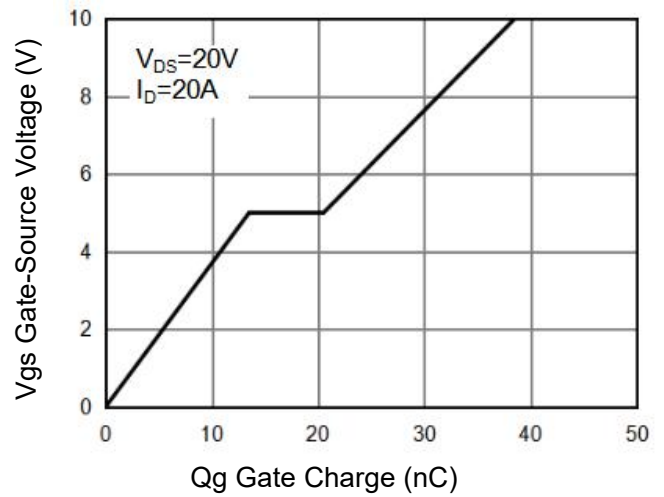


Figure 5 Gate Charge

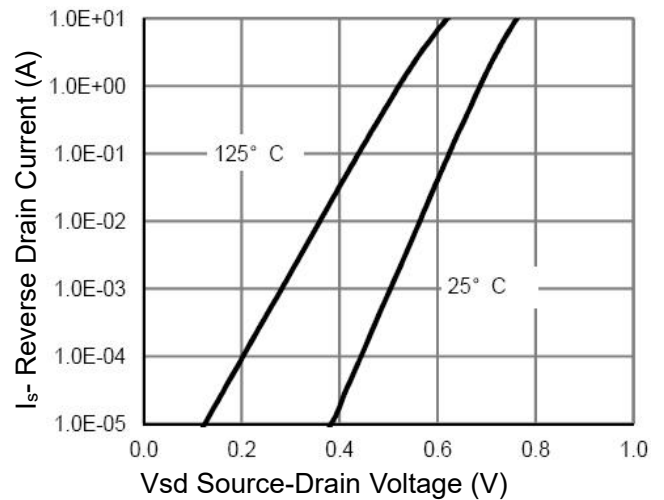


Figure 6 Source- Drain Diode Forward

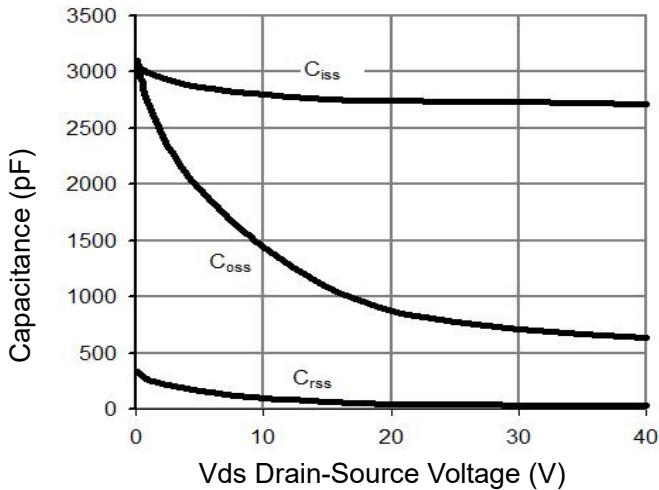


Figure 7 Capacitance vs Vds

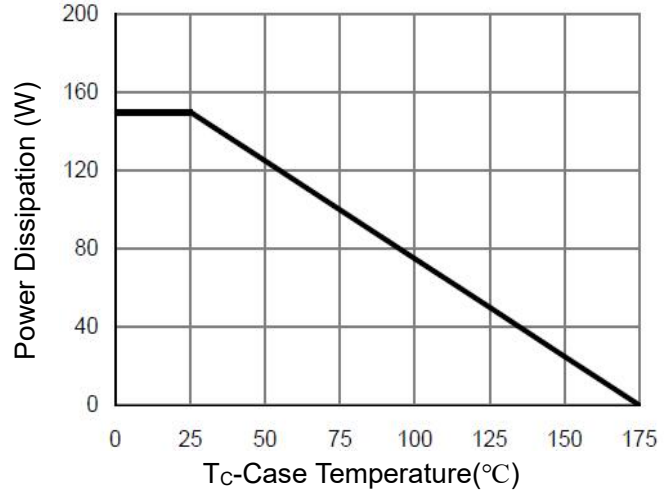


Figure 9 Power De-rating

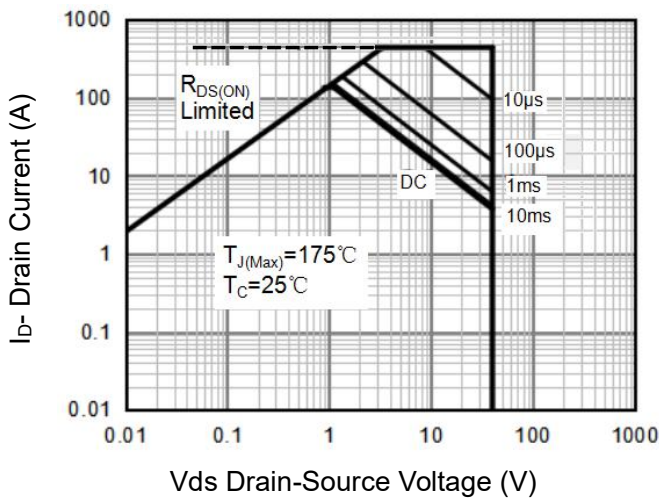


Figure 8 Safe Operation Area (Note 3)

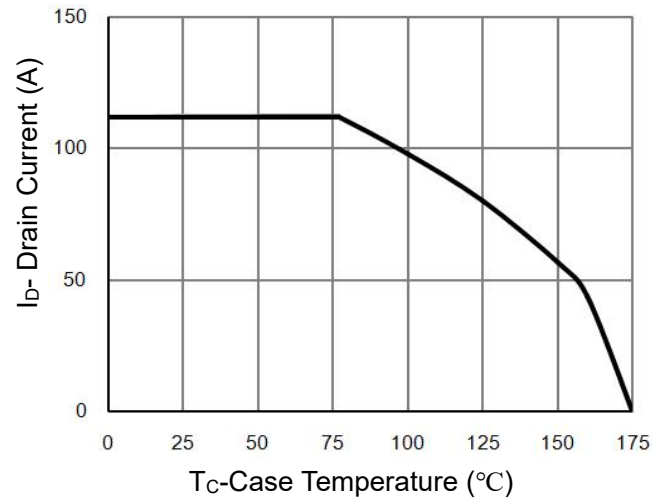


Figure 10 Current De-rating

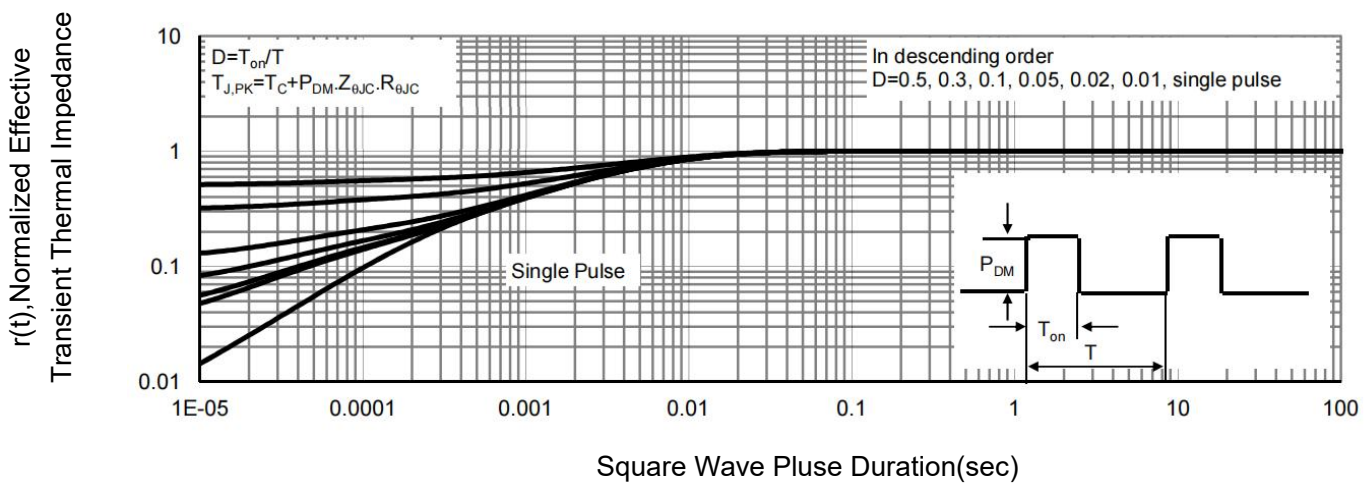
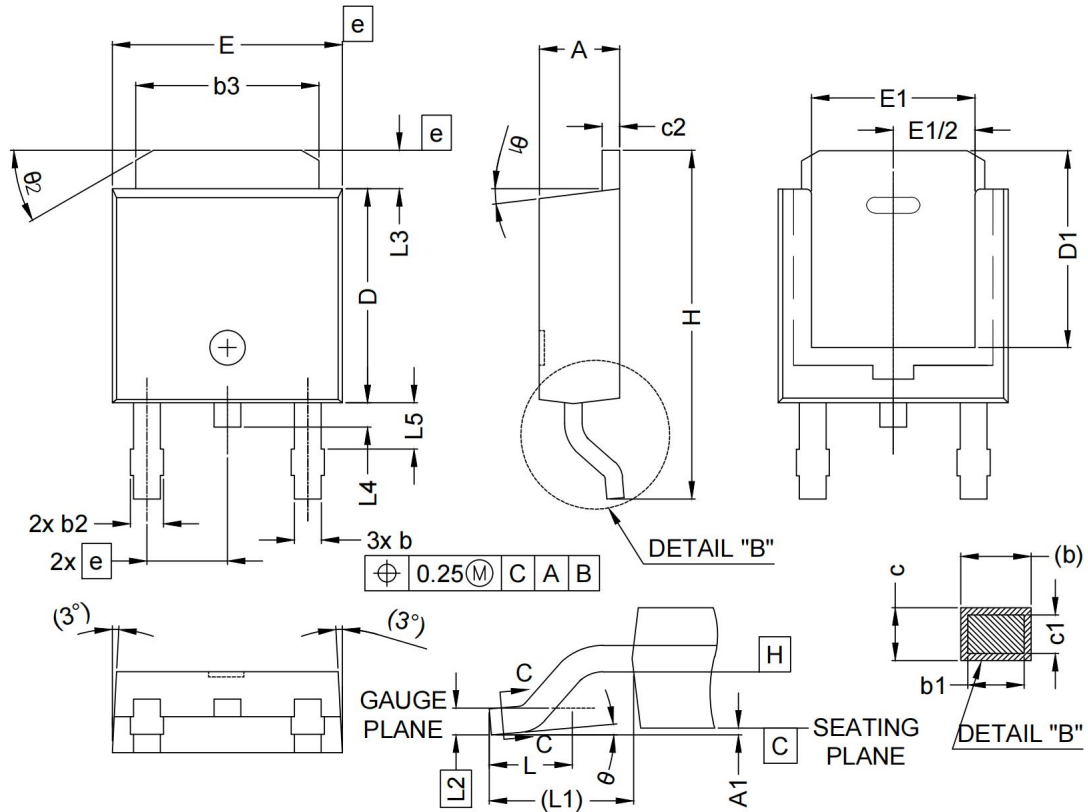


Figure 11 Normalized Maximum Transient Thermal Impedance

TO-252-2L Package Information



| SYMBOL | MIN. | MAX. | SYMBOL | MIN. | MAX. | SYMBOL | MIN. | MAX. |
|--------|------|------|----------|----------|-------|------------|------|------|
| A | 2.18 | 2.39 | E | 6.35 | 6.73 | θ_1 | 0° | 15° |
| A1 | - | 0.13 | E1 | 4.32 | - | θ_2 | 25° | 35° |
| b | 0.65 | 0.89 | e | 2.29 BSC | | | | |
| b1 | 0.64 | 0.79 | H | 9.94 | 10.34 | | | |
| b2 | 0.76 | 1.13 | L | 1.50 | 1.78 | | | |
| b3 | 4.95 | 5.46 | L1 | 2.74 REF | | | | |
| c | 0.46 | 0.61 | L2 | 0.51 BSC | | | | |
| c1 | 0.41 | 0.56 | L3 | 0.89 | 1.27 | | | |
| c2 | 0.46 | 0.60 | L4 | - | 1.02 | | | |
| D | 5.97 | 6.22 | L5 | 1.14 | 1.49 | | | |
| D1 | 5.21 | - | θ | 0° | 10° | | | |

NOTE ; 1.0 DIMENSIONING & TOLERANCEING CONFIRM TO ASME Y14.5M-1994.
 2.0 ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
 3.0 HEAT SINK SIDE FLASH IS MAX. 0.8mm.
 4.0 RADIUS ON TERMINAL IS OPTIONAL.

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