

N-Channel Super Trench Power MOSFET

Description

The HMS45N04Q 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.

Application

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

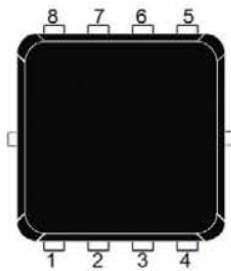
General Features

- $V_{DS} = 40V, I_D = 65A$
 $R_{DS(ON)} = 2.7m\Omega$ (typical) @ $V_{GS} = 10V$
 $R_{DS(ON)} = 3.6m\Omega$ (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

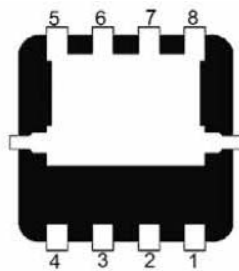
100% UIS TESTED!

100% ΔV_{ds} TESTED!

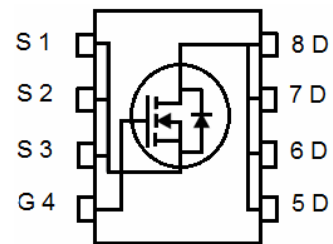
DFN 3.3X3.3



Top View



Bottom View



Schematic Diagram

Package Marking and Ordering Information

| Device Marking | Device | Device Package | Reel Size | Tape width | Quantity |
|----------------|-----------|----------------|-----------|------------|----------|
| HMS45N04Q | HMS45N04Q | DFN3.3X3.3-8L | - | - | - |

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 | I_D | 65 | A |
| Drain Current-Continuous($T_C = 100^\circ C$) | $I_D(100^\circ C)$ | 45.5 | A |
| Pulsed Drain Current | I_{DM} | 195 | A |
| Maximum Power Dissipation | P_D | 55 | W |
| Derating factor | | 0.44 | W/ $^\circ C$ |
| Single pulse avalanche energy ^(Note 5) | E_{AS} | 500 | mJ |
| Operating Junction and Storage Temperature Range | T_J, T_{STG} | -55 To 150 | $^\circ C$ |

Thermal Characteristic

| | | | |
|--|-----------------|-----|----------------------|
| Thermal Resistance, Junction-to-Case ^(Note 2) | $R_{\theta JC}$ | 2.3 | $^{\circ}\text{C/W}$ |
|--|-----------------|-----|----------------------|

Electrical Characteristics ($T_C=25^{\circ}\text{C}$ 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 (Note 3) | | | | | | |
| Gate Threshold Voltage | V _{GS(th)} | V _{DS} =V _{GS} ,I _D =250μA | 1.0 | 1.5 | 2.0 | V |
| Drain-Source On-State Resistance | R _{DS(ON)} | V _{GS} =10V, I _D =20A | - | 2.7 | 3.8 | mΩ |
| | | V _{GS} =4.5V, I _D =20A | - | 3.6 | 5.2 | mΩ |
| Forward Transconductance | g _{FS} | V _{DS} =5V,I _D =20A | | 60 | - | S |
| Dynamic Characteristics (Note4) | | | | | | |
| Input Capacitance | C _{iss} | V _{DS} =20V,V _{GS} =0V, F=1.0MHz | - | 2100 | - | PF |
| Output Capacitance | C _{oss} | | - | 773 | - | PF |
| Reverse Transfer Capacitance | C _{rss} | | - | 15.5 | - | PF |
| Switching Characteristics (Note 4) | | | | | | |
| Turn-on Delay Time | t _{d(on)} | V _{DD} =20V,I _D =20A V _{GS} =10V,R _G =1.6Ω | - | 7.5 | - | nS |
| Turn-on Rise Time | t _r | | - | 4.0 | - | nS |
| Turn-Off Delay Time | t _{d(off)} | | - | 37 | - | nS |
| Turn-Off Fall Time | t _f | | - | 7.5 | - | nS |
| Total Gate Charge | Q _g | V _{DS} =20V,I _D =20A, V _{GS} =10V | - | 34.8 | - | nC |
| Gate-Source Charge | Q _{gs} | | - | 6.2 | | nC |
| Gate-Drain Charge | Q _{gd} | | - | 5.1 | | nC |
| Drain-Source Diode Characteristics | | | | | | |
| Diode Forward Voltage (Note 3) | V _{SD} | V _{GS} =0V,I _S =20A | - | | 1.2 | V |
| Diode Forward Current (Note 2) | I _S | | - | - | 65 | A |
| Reverse Recovery Time | t _{rr} | T _J = 25°C, I _F = I _S | - | 14 | - | nS |
| Reverse Recovery Charge | Q _{rr} | di/dt = 100A/μs (Note3) | - | 21 | - | 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 : $T_J=25^{\circ}\text{C}, V_{DD}=20V, V_G=10V, L=0.5mH, R_g=25\Omega$

Typical Electrical and Thermal Characteristics

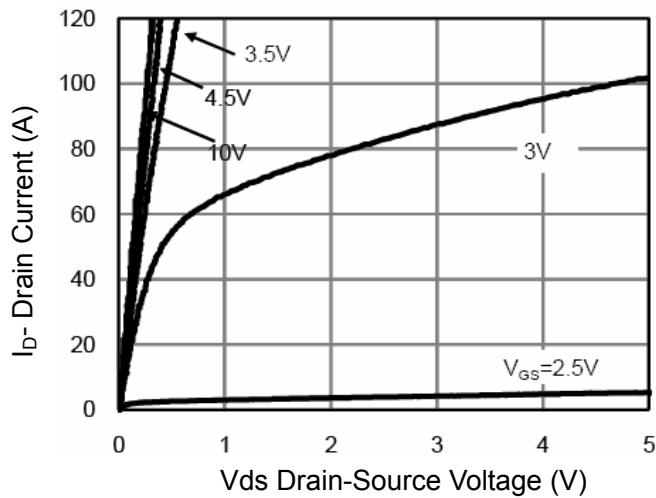


Figure 1 Output Characteristics

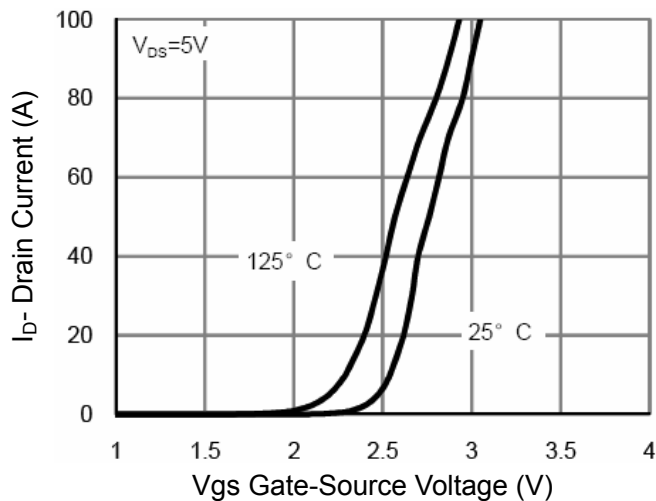


Figure 2 Transfer Characteristics

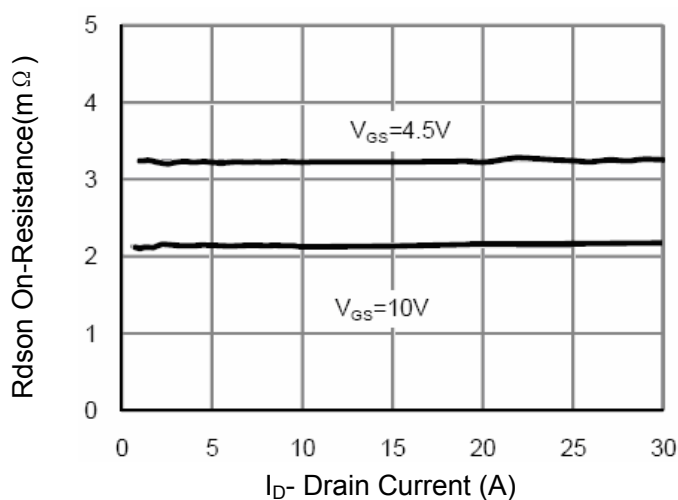


Figure 3 $R_{DS(on)}$ - Drain Current

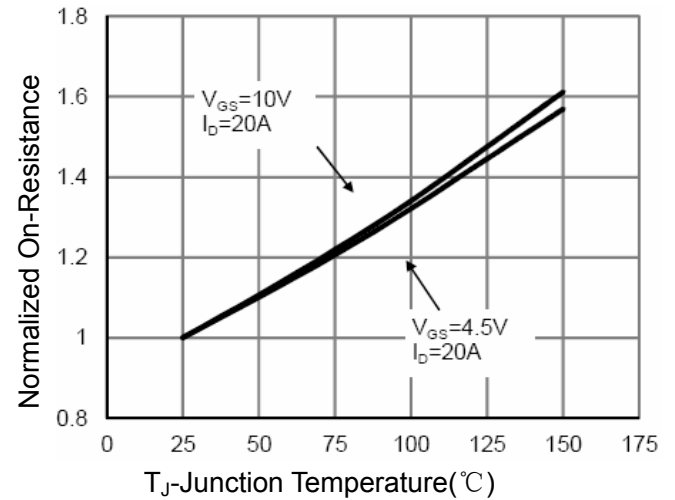


Figure 4 $R_{DS(on)}$ -Junction Temperature

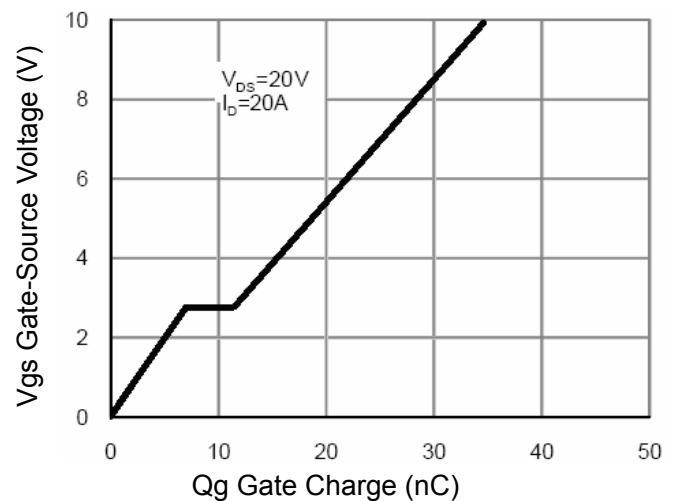


Figure 5 Gate Charge

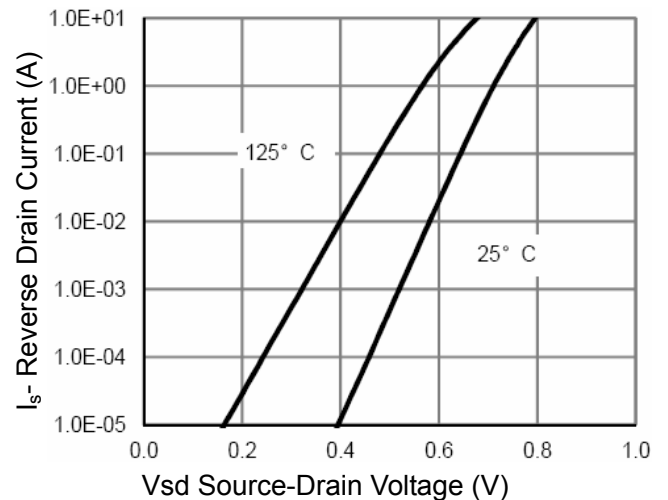


Figure 6 Source- Drain Diode Forward

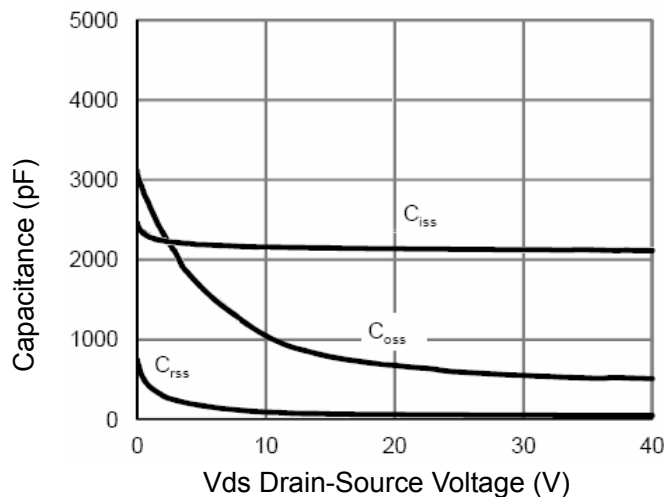


Figure 7 Capacitance vs Vds

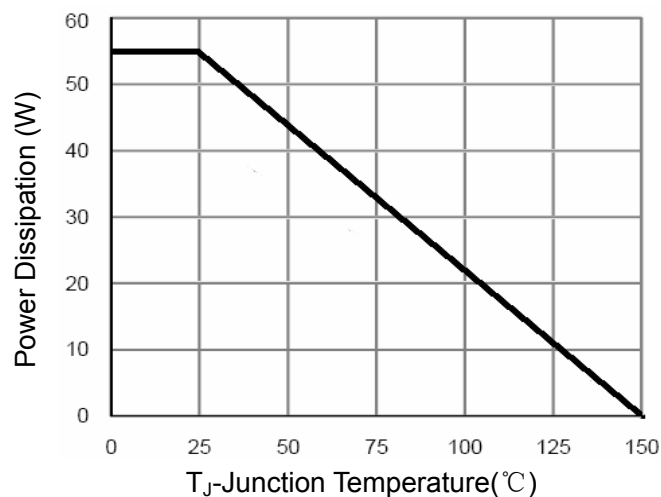


Figure 9 Power De-rating

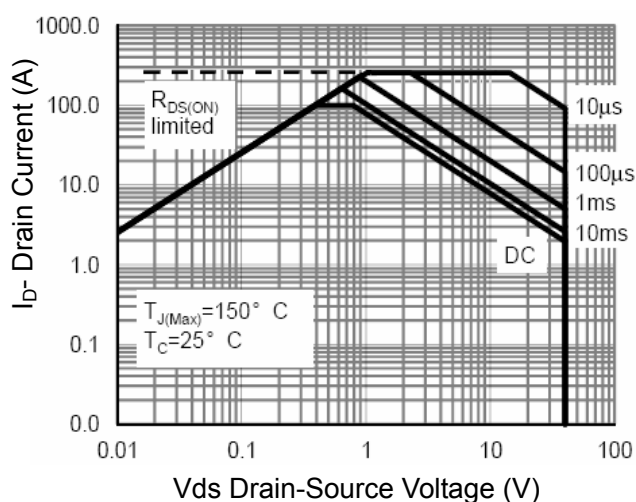


Figure 8 Safe Operation Area

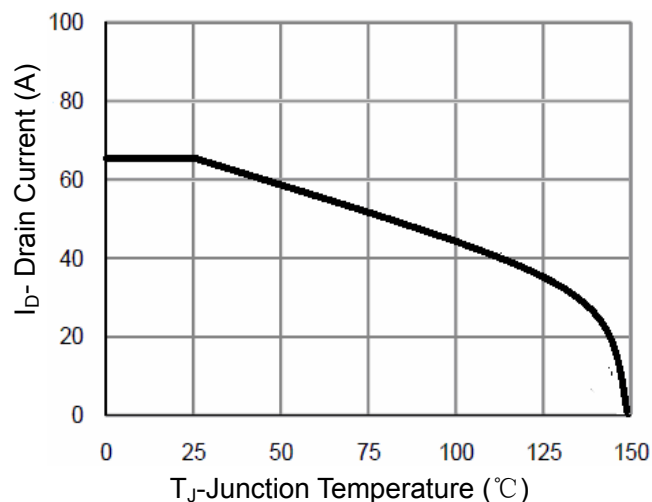


Figure 10 Current De-rating

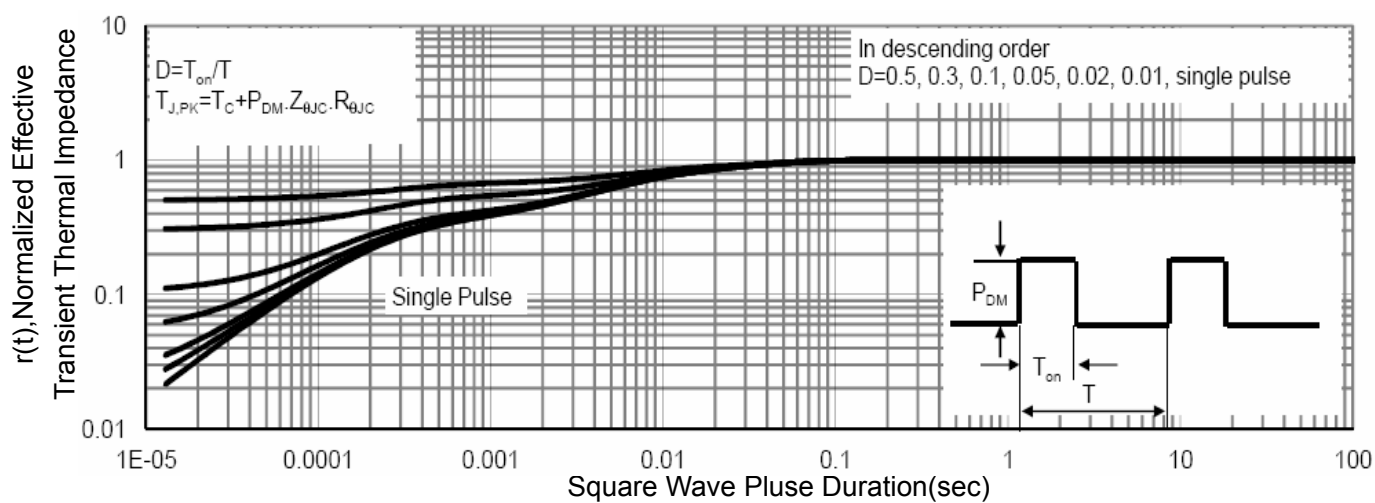
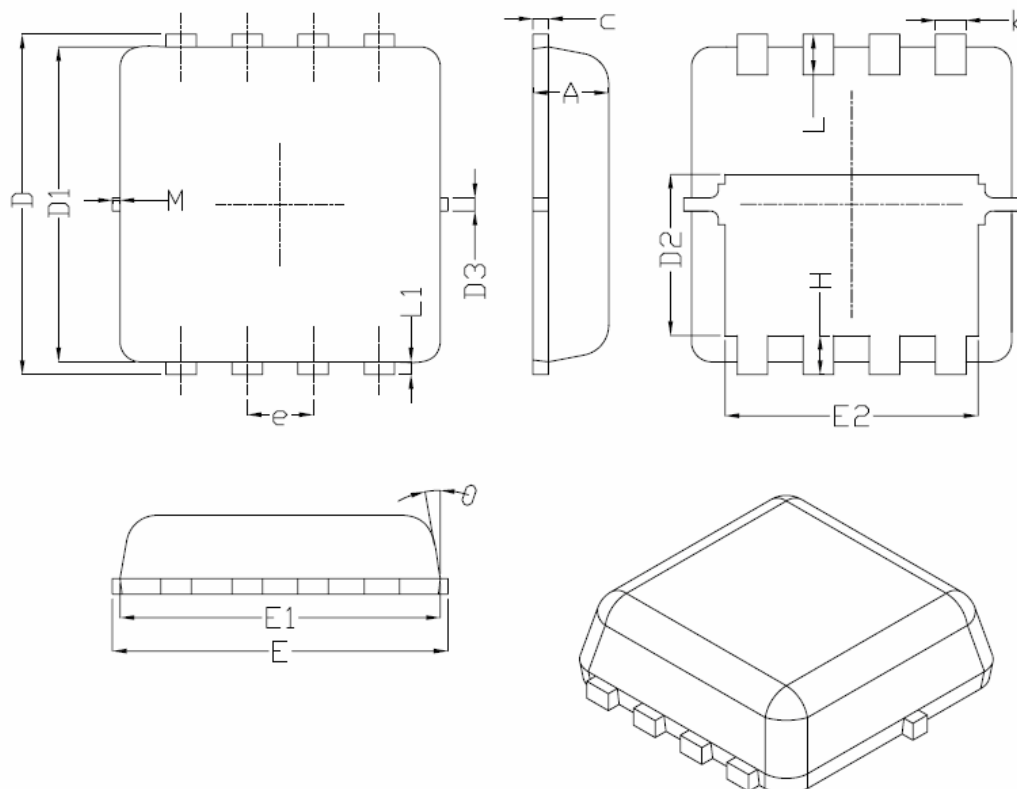


Figure 11 Normalized Maximum Transient Thermal Impedance

DFN3.3X3.3-8L Package Information



| Symbol | Dimensions In Millimeters | | |
|--------|---------------------------|------|------|
| | Min. | Nom. | Max. |
| A | 0.70 | 0.75 | 0.80 |
| b | 0.25 | 0.30 | 0.35 |
| c | 0.10 | 0.15 | 0.25 |
| D | 3.25 | 3.35 | 3.45 |
| D1 | 3.00 | 3.10 | 3.20 |
| D2 | 1.48 | 1.58 | 1.68 |
| D3 | - | 0.13 | - |
| E | 3.20 | 3.30 | 3.40 |
| E1 | 3.00 | 3.15 | 3.20 |
| E2 | 2.39 | 2.49 | 2.59 |
| e | 0.65BSC | | |
| H | 0.30 | 0.39 | 0.50 |
| L | 0.30 | 0.40 | 0.50 |
| L1 | - | 0.13 | - |
| M | * | * | 0.15 |
| θ | | 10° | 12° |