

PHP9NQ20T-VB Datasheet N-Channel 200 V (D-S) MOSFET

PRODUCT SUMMARY

| V_{DS} (V) | $R_{DS(on)}$ (Ω) | I_D (A) |
|--------------|---------------------------|-----------|
| 200 | 0.270 at $V_{GS} = 10$ V | 10 |

FEATURES

- DT-Trench Power MOSFET
- 175 °C Junction Temperature
- PWM Optimized
- 100 % R_g Tested
- Compliant to RoHS Directive 2002/95/EC



RoHS
COMPLIANT

APPLICATIONS

- Primary Side Switch

TO-220AB



G D S
Top View



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ($T_A = 25$ °C, unless otherwise noted)

| Parameter | Symbol | Limit | Unit |
|---|----------------|------------------|------|
| Drain-Source Voltage | V_{DS} | 200 | V |
| Gate-Source Voltage | V_{GS} | ± 20 | |
| Continuous Drain Current ($T_J = 175$ °C) ^b | I_D | 10 | A |
| | | 6 | |
| Pulsed Drain Current | I_{DM} | 38 | |
| Continuous Source Current (Diode Conduction) | I_S | 12 | |
| Avalanche Current | I_{AS} | 10 | |
| Single Pulse Avalanche Energy | E_{AS} | 18 | mJ |
| Maximum Power Dissipation | P_D | 121 ^b | W |
| | | 2 ^a | |
| Operating Junction and Storage Temperature Range | T_J, T_{stg} | - 55 to 175 | °C |

THERMAL RESISTANCE RATINGS

| Parameter | Symbol | Typical | Maximum | Unit |
|----------------------------------|------------|---------|---------|------|
| Junction-to-Ambient ^a | R_{thJA} | 15 | 18 | °C/W |
| | | 40 | 50 | |
| Junction-to-Case (Drain) | R_{thJC} | 0.85 | 1.1 | |

Notes:

a. Surface mounted on 1" x 1" FR4 board.

b. See SOA curve for voltage derating.

| SPECIFICATIONS (T _J = 25 °C, unless otherwise noted) | | | | | | |
|---|---------------------|---|------|-------------------|-------|------|
| Parameter | Symbol | Test Conditions | Min. | Typ. ^a | Max. | Unit |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | V _{DS} | V _{GS} = 0 V, I _D = 250 μA | 200 | | | V |
| Gate Threshold Voltage | V _{GS(th)} | V _{DS} = V _{GS} , I _D = 250 μA | 2 | | 4 | |
| Gate-Body Leakage | I _{GSS} | V _{DS} = 0 V, V _{GS} = ± 20 V | | | ± 100 | nA |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} = 200 V, V _{GS} = 0 V | | | 1 | μA |
| | | V _{DS} = 200 V, V _{GS} = 0 V, T _J = 125 °C | | | 50 | |
| | | V _{DS} = 200 V, V _{GS} = 0 V, T _J = 175 °C | | | 250 | |
| On-State Drain Current ^b | I _{D(on)} | V _{DS} = 5 V, V _{GS} = 10 V | 40 | | | A |
| Drain-Source On-State Resistance ^b | R _{DS(on)} | V _{GS} = 10 V, I _D = 5 A | | 0.270 | | Ω |
| | | V _{GS} = 10 V, I _D = 5 A, T _J = 125 °C | | 0.320 | | |
| | | V _{GS} = 10 V, I _D = 5 A, T _J = 175 °C | | 0.410 | | |
| | | V _{GS} = 4.5 V, I _D = 5 A | | 0.310 | | |
| Forward Transconductance ^b | g _{fs} | V _{DS} = 15 V, I _D = 19 A | | 35 | | S |
| Dynamic ^a | | | | | | |
| Input Capacitance | C _{iss} | V _{GS} = 0 V, V _{DS} = 25 V, F = 1 MHz | | 800 | | pF |
| Output Capacitance | C _{oss} | | | 110 | | |
| Reverse Transfer Capacitance | C _{rss} | | | 80 | | |
| Total Gate Charge ^c | Q _g | V _{DS} = 100 V, V _{GS} = 10 V, I _D = 19 A | | 30 | | nC |
| Gate-Source Charge ^c | Q _{gs} | | | 8 | | |
| Gate-Drain Charge ^c | Q _{gd} | | | 12 | | |
| Gate Resistance | R _g | | 0.5 | | 2.9 | Ω |
| Turn-On Delay Time ^c | t _{d(on)} | V _{DD} = 100 V, R _L = 5.2 Ω I _D ≅ 19 A, V _{GEN} = 10 V, R _g = 2.5 Ω | | 15 | 25 | ns |
| Rise Time ^c | t _r | | | 50 | 75 | |
| Turn-Off Delay Time ^c | t _{d(off)} | | | 30 | 45 | |
| Fall Time ^c | t _f | | | 60 | 90 | |
| Source-Drain Diode Ratings and Characteristics (T _C = 25 °C) | | | | | | |
| Pulsed Current | I _{SM} | | | | 40 | A |
| Diode Forward Voltage ^b | V _{SD} | I _F = 19 A, V _{GS} = 0 V | | 0.9 | 1.5 | V |
| Source-Drain Reverse Recovery Time | t _{rr} | I _F = 19 A, dI/dt = 100 A/μs | | 180 | 250 | ns |

Notes:

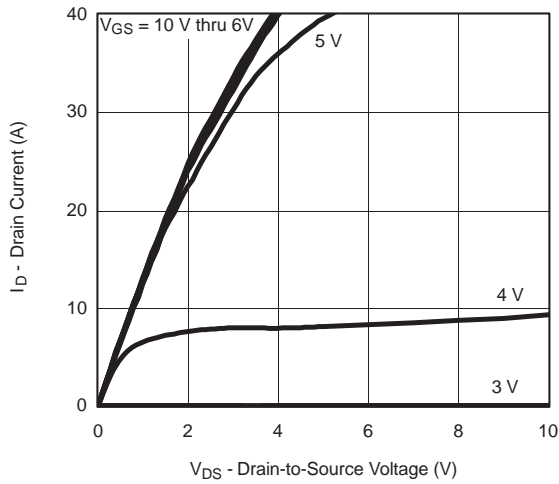
a. Guaranteed by design, not subject to production testing.

b. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %.

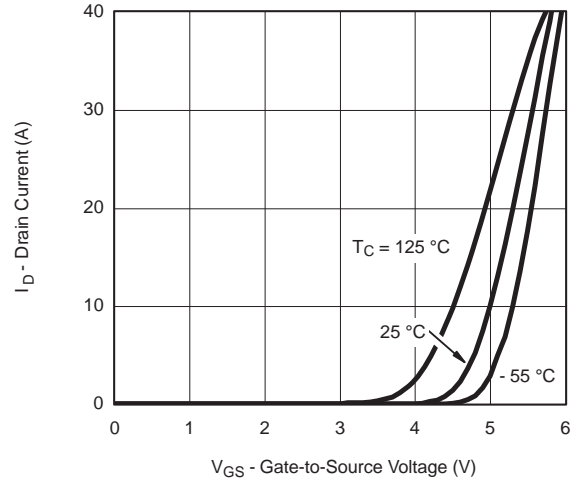
c. Independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

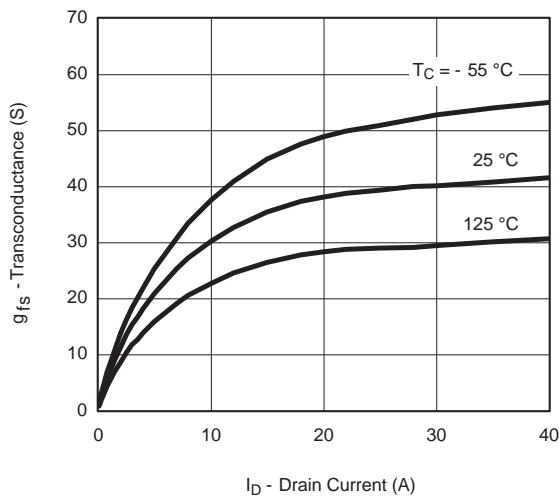
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



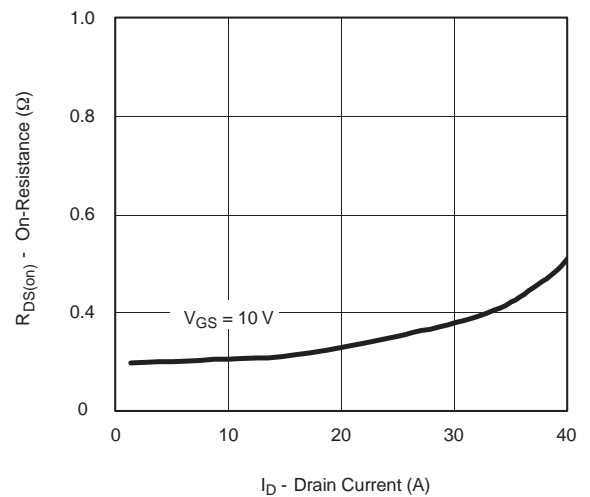
Output Characteristics



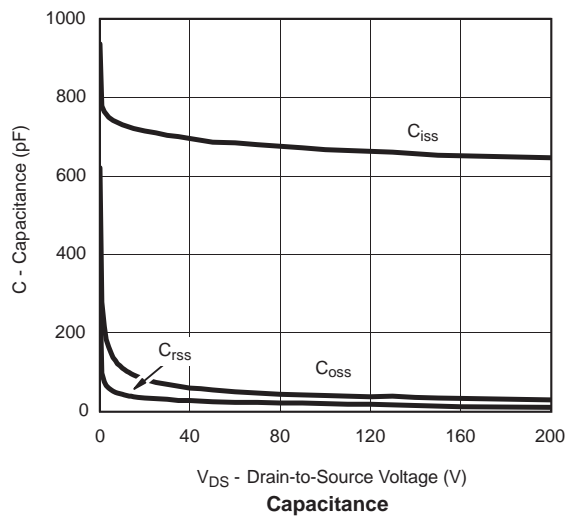
Transfer Characteristics



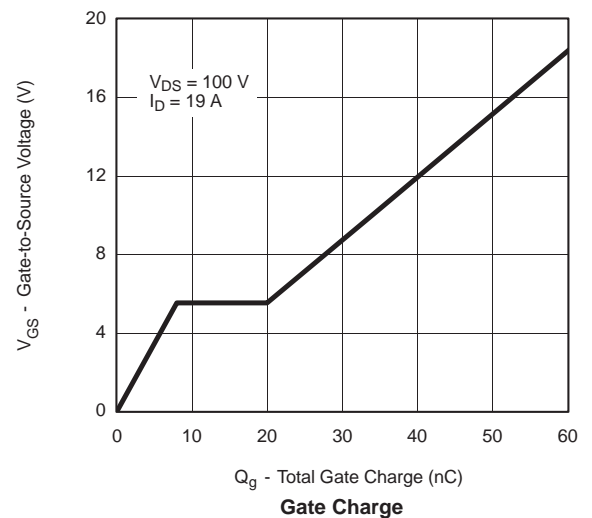
Transconductance



On-Resistance vs. Drain Current



Capacitance



Gate Charge

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



On-Resistance vs. Junction Temperature



Source-Drain Diode Forward Voltage

THERMAL RATINGS



Maximum Avalanche Drain Current vs. Case Temperature



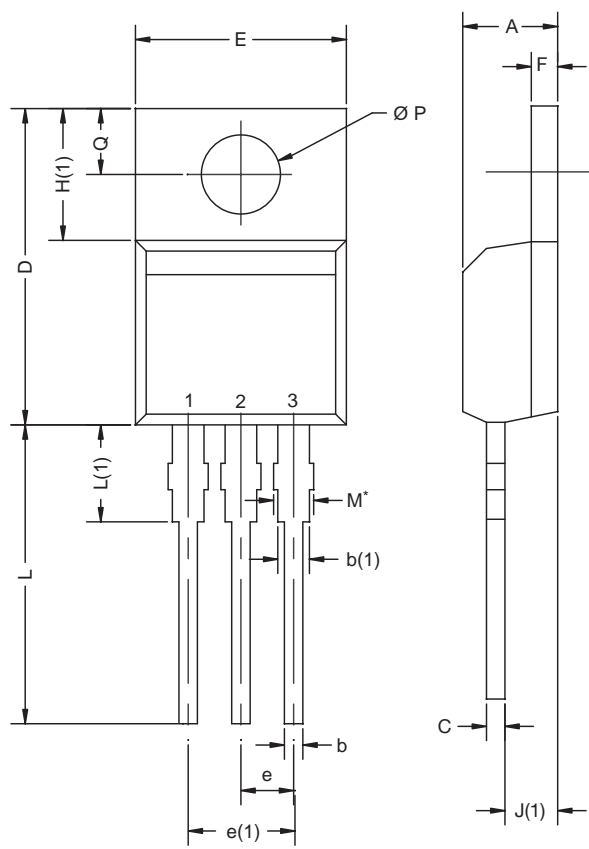
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

TO-220AB



| DIM. | MILLIMETERS | | INCHES | |
|--|-------------|-------|--------|-------|
| | MIN. | MAX. | MIN. | MAX. |
| A | 4.25 | 4.65 | 0.167 | 0.183 |
| b | 0.69 | 1.01 | 0.027 | 0.040 |
| b(1) | 1.20 | 1.73 | 0.047 | 0.068 |
| c | 0.36 | 0.61 | 0.014 | 0.024 |
| D | 14.85 | 15.49 | 0.585 | 0.610 |
| E | 10.04 | 10.51 | 0.395 | 0.414 |
| e | 2.41 | 2.67 | 0.095 | 0.105 |
| e(1) | 4.88 | 5.28 | 0.192 | 0.208 |
| F | 1.14 | 1.40 | 0.045 | 0.055 |
| H(1) | 6.09 | 6.48 | 0.240 | 0.255 |
| J(1) | 2.41 | 2.92 | 0.095 | 0.115 |
| L | 13.35 | 14.02 | 0.526 | 0.552 |
| L(1) | 3.32 | 3.82 | 0.131 | 0.150 |
| Ø P | 3.54 | 3.94 | 0.139 | 0.155 |
| Q | 2.60 | 3.00 | 0.102 | 0.118 |
| ECN: X12-0208-Rev. N, 08-Oct-12 DWG: 5471 | | | | |

Notes
* M = 1.32 mm to 1.62 mm (dimension including protrusion)
Heatsink hole for HVM

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