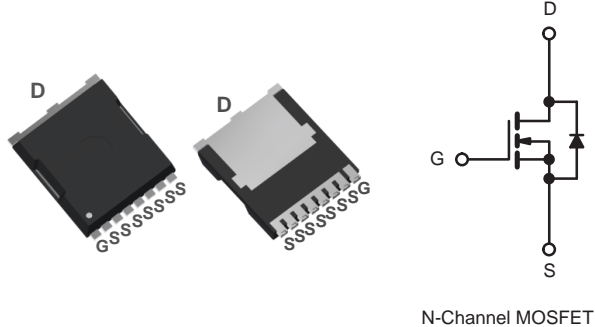


N-Channel 60 V (D-S) MOSFET

PRODUCT SUMMARY

| V _{DS} (V) | R _{DS(on)} (mΩ) TYP. | I _D (A) | Q _g (TYP.) |
|---------------------|-------------------------------|--------------------|-----------------------|
| 60 | 1.3 at V _{GS} = 10 V | 300 | 103 nC |

TOLL Pin Configuration



FEATURES

- DT-Trench Power MOSFET
- 100 % R_g and UIS tested

APPLICATIONS

- Power supplies:
 - Uninterruptible power supplies
 - AC/DC switch-mode power supplies
 - Lighting
- Synchronous rectification
- DC/DC converter
- Motor drive switch
- DC/AC inverter
- Battery management



RoHS
COMPLIANT
HALOGEN
FREE

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

| PARAMETER | SYMBOL | LIMIT | UNIT | |
|--|-----------------------------------|-------------------------|------------------|---|
| Drain-Source Voltage | V _{DS} | 60 | V | |
| Gate-Source Voltage | V _{GS} | ± 20 | | |
| Continuous Drain Current (T _J = 150 °C) | I _D | T _C = 25 °C | 300 | A |
| | | T _C = 100 °C | 191 | |
| Pulsed Drain Current (t = 100 μs) | I _{DM} | 1200 | | |
| Avalanche Current ^{a,d} | I _{AS} | 65 | | |
| Single Avalanche Energy ^{a,d} | E _{AS} | 239 | mJ | |
| Maximum Power Dissipation ^a | P _D | T _C = 25 °C | 363 ^b | W |
| | | T _C = 100 °C | 178 ^b | |
| Operating Junction and Storage Temperature Range | T _J , T _{stg} | -55 to +150 | °C | |

THERMAL RESISTANCE RATINGS

| PARAMETER | SYMBOL | LIMIT | UNIT |
|--|-------------------|-------|------|
| Junction-to-Ambient (PCB Mount) ^c | R _{thJA} | 22 | °C/W |
| Junction-to-Case (Drain) | R _{thJC} | 0.5 | |

Notes

- Duty cycle ≤ 1 %.
- See SOA curve for voltage derating.
- When mounted on 1" square PCB (FR4 material).
- This single-pulse measurement was taken under the following condition [L = 0.1mH, V_{GS} = 10V, V_{DS} = 48V] while its value is limited by T_{J_Max} = 150°C.

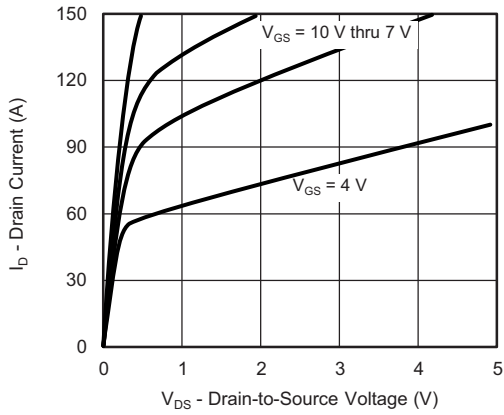
| SPECIFICATIONS (T _J = 25 °C, unless otherwise noted) | | | | | | |
|---|---------------------|---|------|-------|-------|------|
| PARAMETER | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
| Static | | | | | | |
| Drain-Source Breakdown Voltage | V _{DS} | V _{GS} = 0 V, I _D = 250 μA | 60 | - | - | V |
| Gate Threshold Voltage | V _{GS(th)} | V _{DS} = V _{GS} , I _D = 250 μA | 1 | - | 3 | |
| Gate-Body Leakage | I _{GSS} | V _{DS} = 0 V, V _{GS} = ± 20 V | - | - | ± 100 | nA |
| Zero Gate Voltage Drain Current | I _{DSS} | V _{DS} = 60 V, V _{GS} = 0 V | - | - | 1 | μA |
| | | V _{DS} = 48 V, V _{GS} = 0 V, T _J = 85 °C | - | - | 30 | |
| On-State Drain Current ^a | I _{D(on)} | V _{DS} ≥ 10 V, V _{GS} = 10 V | 300 | - | - | A |
| Drain-Source On-State Resistance ^a | R _{DS(on)} | V _{GS} = 10 V, I _D = 30 A | - | 1.3 | 1.6 | mΩ |
| Forward Transconductance ^a | g _{fs} | V _{DS} = 5 V, I _D = 30 A | - | 95 | - | S |
| Dynamic ^b | | | | | | |
| Input Capacitance | C _{iss} | V _{GS} = 0 V, V _{DS} = 30 V, f = 1 MHz | - | 13060 | - | pF |
| Output Capacitance | C _{oss} | | - | 4118 | - | |
| Reverse Transfer Capacitance | C _{rss} | | - | 102 | - | |
| Total Gate Charge ^c | Q _g | V _{DS} = 30 V, V _{GS} = 10 V, I _D = 30 A | - | 103 | - | nC |
| Gate-Source Charge ^c | Q _{gs} | | - | 23 | - | |
| Gate-Drain Charge ^c | Q _{gd} | | - | 11 | - | |
| Gate Resistance | R _g | f = 1 MHz | - | 3.0 | - | Ω |
| Turn-On Delay Time ^c | t _{d(on)} | V _{DD} = 30 V, I _D = 30 A, R _g = 6Ω V _{GEN} = 10 V | - | 22 | - | ns |
| Rise Time ^c | t _r | | - | 67 | - | |
| Turn-Off Delay Time ^c | t _{d(off)} | | - | 95 | - | |
| Fall Time ^c | t _f | | - | 70 | - | |
| Drain-Source Body Diode Ratings and Characteristics ^b (T_C = 25 °C) | | | | | | |
| Continuous Source-Drain Diode Current | I _S | T _C = 25 °C | - | - | 300 | A |
| Pulsed Current (t = 100 μs) | I _{SM} | | - | - | 1200 | A |
| Forward Voltage ^a | V _{SD} | I _F = 1 A, V _{GS} = 0 V | - | - | 1 | V |
| Reverse Recovery Time | t _{rr} | I _F = 20 A, di/dt = 100 A/μs | - | 102 | - | ns |
| Reverse Recovery Charge | Q _{rr} | | - | 70 | - | nC |

Notes

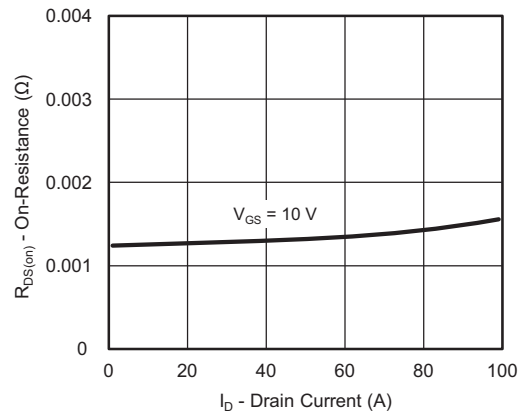
- a. Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %.
- b. Guaranteed by design, not subject to production testing.
- c. Independent of operating temperature.

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.

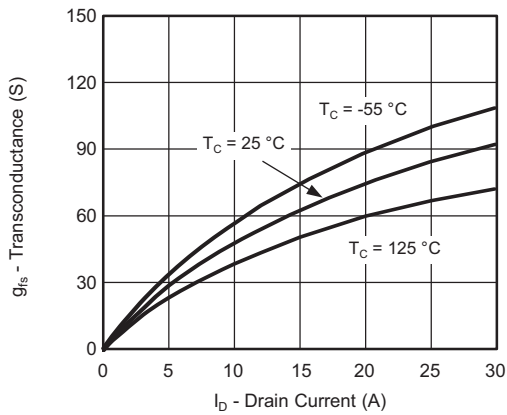
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



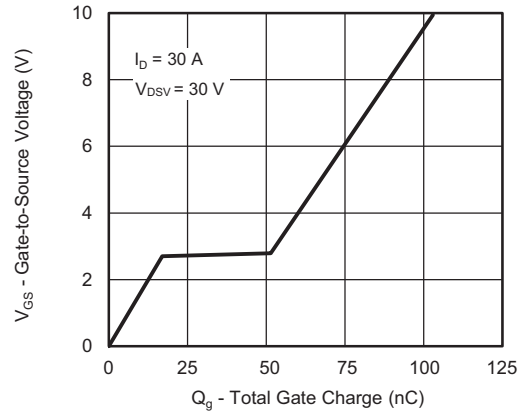
Output Characteristics



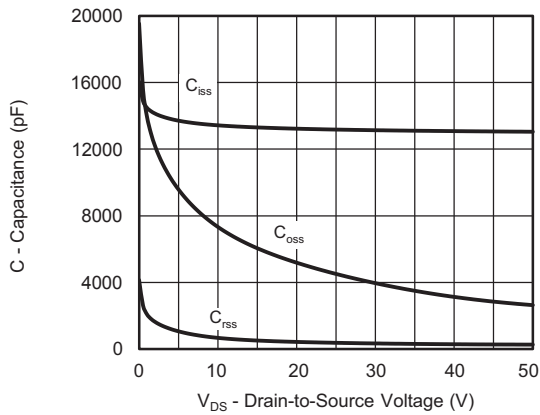
On-Resistance vs. Drain Current



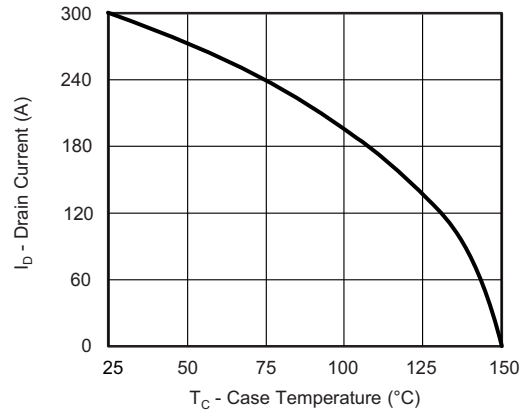
Transconductance



Gate Charge

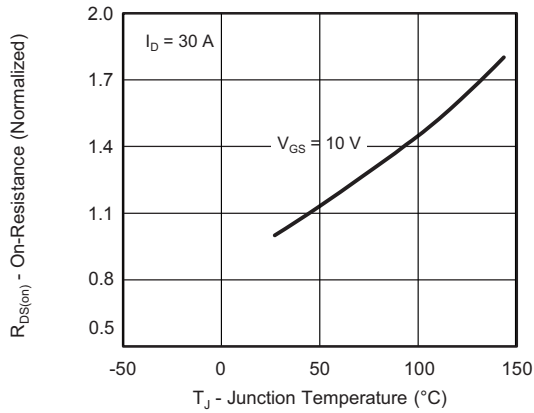


Capacitance

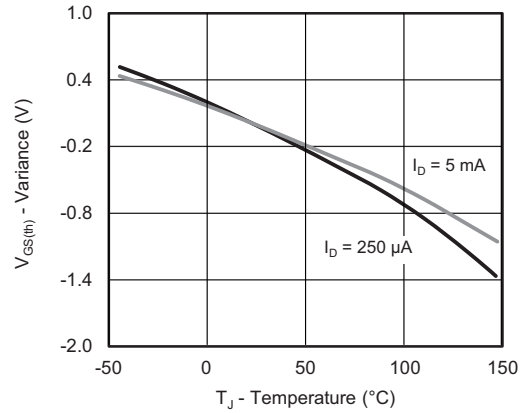


Current De-Rating

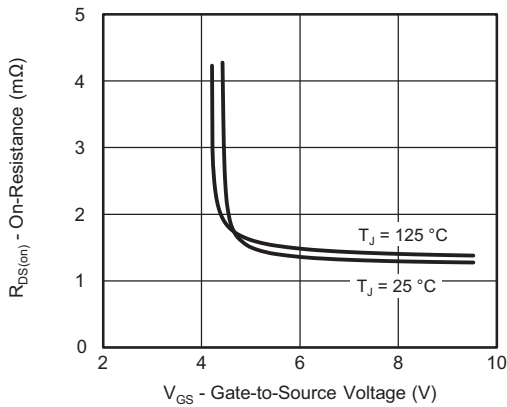
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



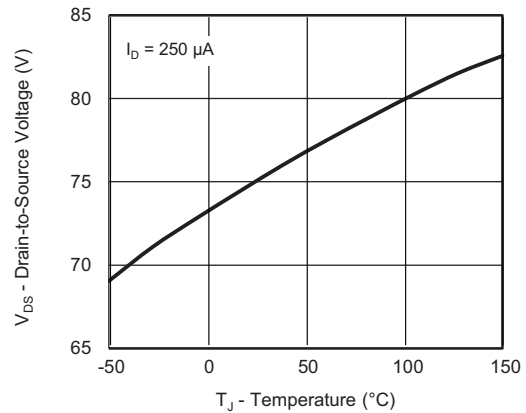
On-Resistance vs. Junction Temperature



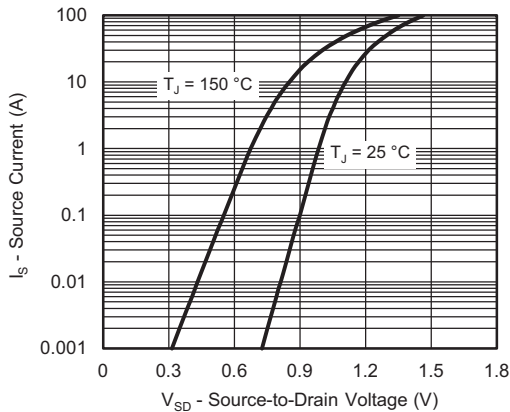
Threshold Voltage



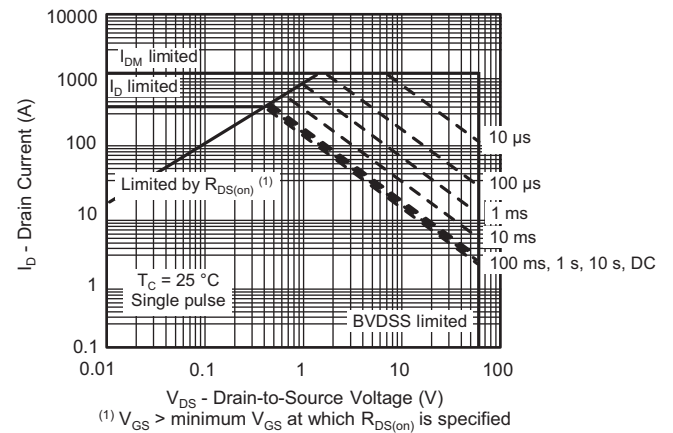
On-Resistance vs. Gate-to-Source Voltage



Drain Source Breakdown vs. Junction Temperature

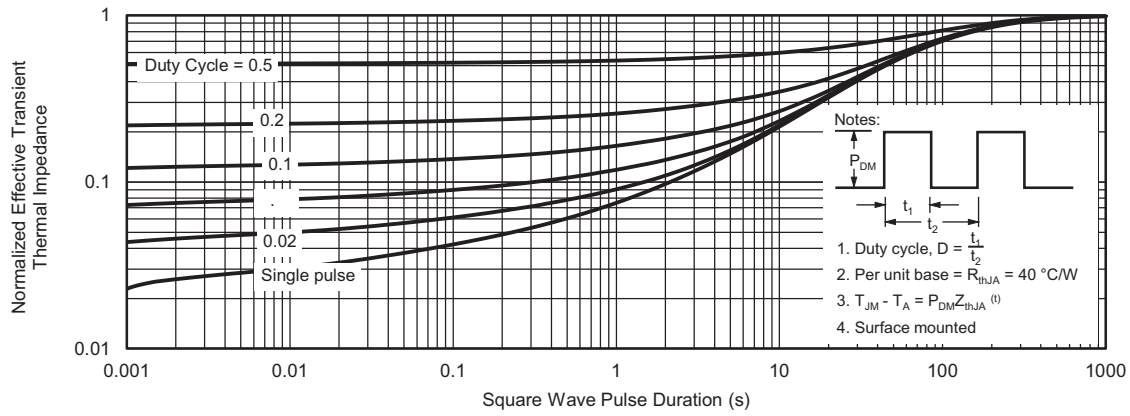


Source Drain Diode Forward Voltage



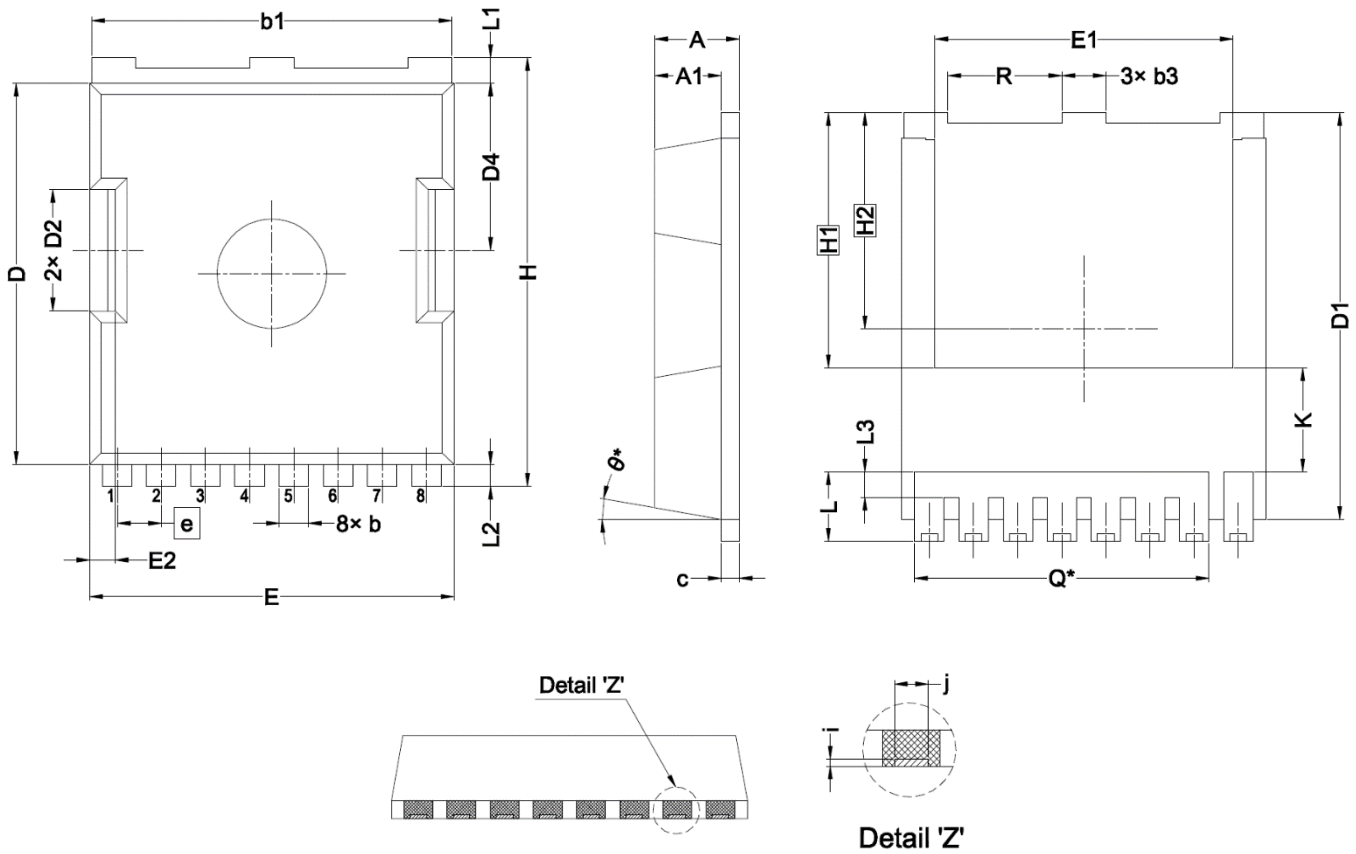
Safe Operating Area

THERMAL RATINGS ($T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted)



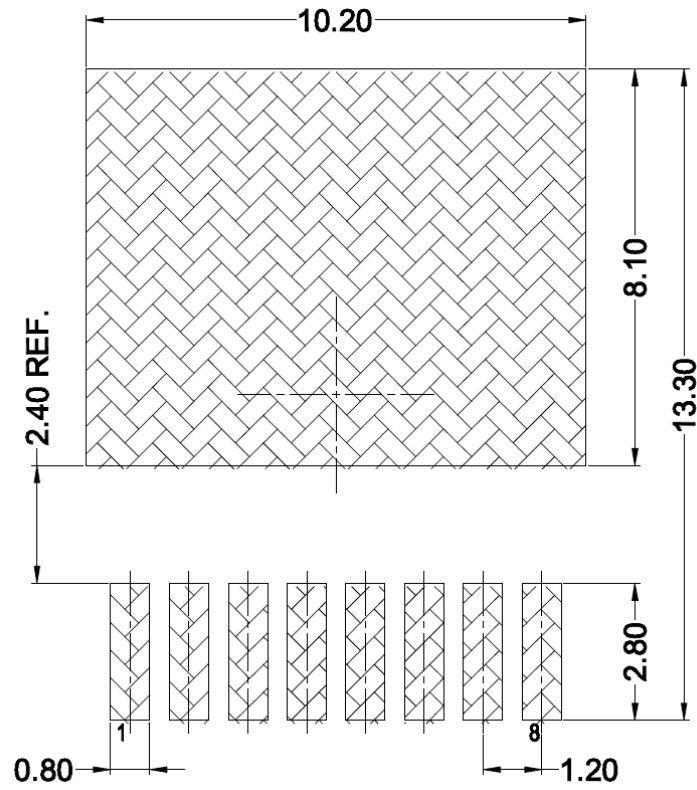
Normalized Thermal Transient Impedance, Junction-to-Ambient

TOLL PACKAGE INFORMATION



| SYMBOL | mm | | | SYMBOL | mm | | |
|--------|----------|-------|-------|--------|----------|-------|-------|
| | MIN | NOM | MAX | | MIN | NOM | MAX |
| A | 2.20 | 2.30 | 2.40 | H | 11.58 | 11.68 | 11.78 |
| A1 | 1.70 | 1.80 | 1.90 | H1 | 6.95 BSC | | |
| b | 0.70 | 0.80 | 0.90 | H2 | 5.89 BSC | | |
| b1 | 9.70 | 9.80 | 9.90 | i | 0.10 REF | | |
| b3 | 1.10 | 1.20 | 1.30 | j | 0.46 REF | | |
| c | 0.40 | 0.50 | 0.60 | K | 2.80 REF | | |
| D | 10.28 | 10.38 | 10.48 | L | 1.40 | 1.90 | 2.10 |
| D1 | 10.98 | 11.08 | 11.18 | L1 | 0.60 | 0.70 | 0.80 |
| D2 | 3.20 | 3.30 | 3.40 | L2 | 0.50 | 0.60 | 0.70 |
| D4 | 4.45 | 4.55 | 4.65 | L3 | 0.30 | 0.70 | 0.80 |
| E | 9.80 | 9.90 | 10.00 | N | 8 | | |
| E1 | 8.00 | 8.10 | 8.20 | Q | 8.00 REF | | |
| E2 | 0.60 | 0.70 | 0.80 | R | 3.00 | 3.10 | 3.20 |
| e | 1.20 BSC | | | theta | 10° REF | | |

TOLL RECOMMENDED LAND PATTERN



unit : mm

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