# PerFET™ Power Transistor

## FEATURES

- Ultra-low On-resistance
- Wettable Flank leads for Enhanced AOI
- 100% UIS and Rg tested
- 175°C Operating Junction Temperature
- RoHS Compliant
- Halogen-Free according to IEC 61249-2-21

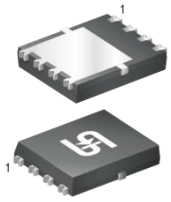
| PRODUCT SUMMARY | | | |
|---|---|---|---|
| **PARAMETER** | | **VALUE** | **UNIT** |
| $V_{DS}$ | | 40 | V |
| $R_{DS(on)}$ (max) | $V_{GS}$ = 10V | 3.2 | mΩ |
| | $V_{GS}$ = 4.5V | 4.5 | |
| $Q_g$ | $V_{GS}$ = 4.5V | 23.7 | nC |

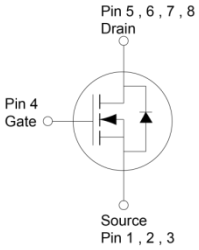
## APPLICATIONS

- DC-DC Converters
- Solenoid and Motor Drivers
- Load Switch

Pb-Free RoHS COMPLIANT HALOGEN FREE

**PDFN56U**






**Note:** MSL 1 (Moisture Sensitivity Level) per J-STD-020

| **ABSOLUTE MAXIMUM RATINGS** ($T_A$ = 25°C unless otherwise noted) | | | | |
|---|---|---|---|---|
| **PARAMETER** | | **SYMBOL** | **LIMIT** | **UNIT** |
| Drain-Source Voltage | | $V_{DS}$ | 40 | V |
| Gate-Source Voltage | | $V_{GS}$ | ±16 | V |
| Continuous Drain Current, Silicon limited | $T_C$ = 25°C | $I_D$ | 143 | A |
| Continuous Drain Current (Note 1) | $T_C$ = 25°C | $I_D$ | 81 | A |
| | $T_C$ = 100°C | | 81 | |
| | $T_A$ = 25°C | | 23 | |
| Pulsed Drain Current | | $I_{DM}$ | 324 | A |
| Single Pulse Avalanche Current (Note 2) | | $I_{AS}$ | 31.8 | A |
| Single Pulse Avalanche Energy (Note 2) | | $E_{AS}$ | 152 | mJ |
| Total Power Dissipation | $T_C$ = 25°C | $P_D$ | 115 | W |
| | $T_C$ = 125°C | | 38 | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +175 | °C |

| **THERMAL RESISTANCE** | | | |
|---|---|---|---|
| **PARAMETER** | **SYMBOL** | **MAXIMUM** | **UNIT** |
| Thermal Resistance – Junction to Case | $R_{\Theta JC}$ | 1.3 | °C/W |
| Thermal Resistance – Junction to Ambient | $R_{\Theta JA}$ | 50 | °C/W |

**Note**: $R_{\Theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistances. The case-thermal reference is defined at the solder mounting surface of the drain pins. $R_{\Theta JC}$ is guaranteed by design while $R_{\Theta CA}$ is determined by the user's board design.

| **ELECTRICAL CHARACTERISTICS** ($T_A$ = 25°C unless otherwise noted) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **CONDITIONS** | **SYMBOL** | **MIN** | **TYP** | **MAX** | **UNIT** |
| **Static** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{GS}$ = 0V, $I_D$ = 1mA | $BV_{DSS}$ | 40 | -- | -- | V |
| Gate Threshold Voltage | $V_{GS}$ = $V_{DS}$, $I_D$ = 250μA | $V_{GS(TH)}$ | 1.4 | 1.8 | 2.2 | V |
| Gate-Source Leakage Current | $V_{GS}$ = ±16V, $V_{DS}$ = 0V | $I_{GSS}$ | -- | -- | ±100 | nA |
| Drain-Source Leakage Current | $V_{GS}$ = 0V, $V_{DS}$ = 40V | $I_{DSS}$ | -- | -- | 1 | μA |
| | $V_{GS}$ = 0V, $V_{DS}$ = 40V<br>$T_J$ = 125°C | | -- | -- | 100 | |
| Drain-Source On-State Resistance (Note 3) | $V_{GS}$ = 10V, $I_D$ = 40A | $R_{DS(on)}$ | -- | 2.5 | 3.2 | mΩ |
| | $V_{GS}$ = 4.5V, $I_D$ = 40A | | -- | 3.2 | 4.5 | |
| Forward Transconductance (Note 3) | $V_{DS}$ = 10V, $I_D$ = 10A | $g_{fs}$ | -- | 93 | -- | S |
| **Dynamic** | | | | | | |
| Total Gate Charge | $V_{GS}$ = 4.5V, $V_{DS}$ = 20V, $I_D$ = 23A | $Q_g$ | -- | 23.7 | -- | nC |
| Total Gate Charge | $V_{GS}$ = 10V, $V_{DS}$ = 20V, $I_D$ = 23A | $Q_g$ | -- | 50 | -- | |
| Gate-Source Charge | | $Q_{gs}$ | -- | 9.8 | -- | |
| Gate-Drain Charge | | $Q_{gd}$ | -- | 6.9 | -- | |
| Input Capacitance | $V_{GS}$ = 0V, $V_{DS}$ = 25V, f = 1.0MHz | $C_{iss}$ | -- | 3007 | -- | pF |
| Output Capacitance | | $C_{oss}$ | -- | 562 | -- | |
| Reverse Transfer Capacitance | | $C_{rss}$ | -- | 34 | -- | |
| Gate Resistance | f = 1.0MHz | $R_g$ | -- | 0.7 | -- | Ω |
| **Switching** (Note 4) | | | | | | |
| Turn-On Delay Time | $V_{GS}$ = 10V, $V_{DS}$ = 20V, $I_D$ = 23A, $R_G$ = 3.3Ω | $t_{d(on)}$ | -- | 11.3 | -- | nS |
| Rise Time | | $t_r$ | -- | 72.5 | -- | |
| Turn-Off Delay Time | | $t_{d(off)}$ | -- | 37 | -- | |
| Fall Time | | $t_f$ | -- | 33.7 | -- | |
| **Source-Drain Diode** | | | | | | |
| Diode Forward Voltage (Note 3) | $V_{GS}$ = 0V, $I_S$ = 40A | $V_{SD}$ | -- | -- | 1.1 | V |
| Reverse Recovery Time | $I_S$ = 23A, di/dt = 100A/μs | $t_{rr}$ | -- | 42 | -- | nS |
| Reverse Recovery Charge | | $Q_{rr}$ | -- | 41 | -- | nC |

**Notes:**

1. Package current limit.
2. L = 0.3mH, $V_{GS}$ = 10V, $R_G$ = 25Ω, Starting $T_J$ = 25°C.
3. Pulse test: Pulse Width ≤ 300μs, duty cycle ≤ 2%.
4. Switching time is essentially independent of operating temperature.

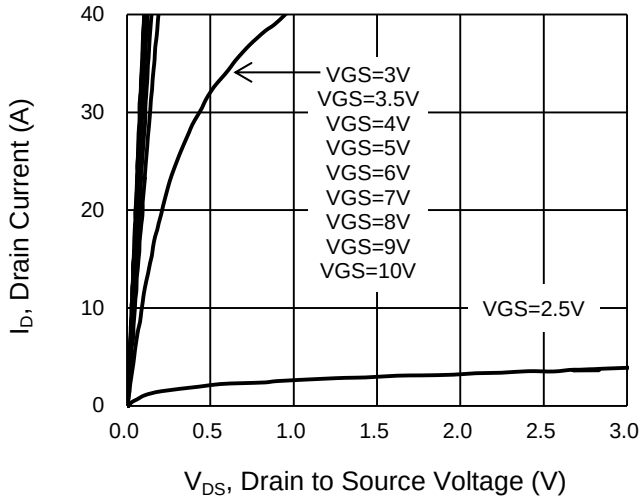
## ORDERING INFORMATION

| ORDERING CODE | PACKAGE | PACKING |
|---|---|---|
| TSM032NH04LCR RLG | PDFN56U | 2,500pcs / 13” Reel |

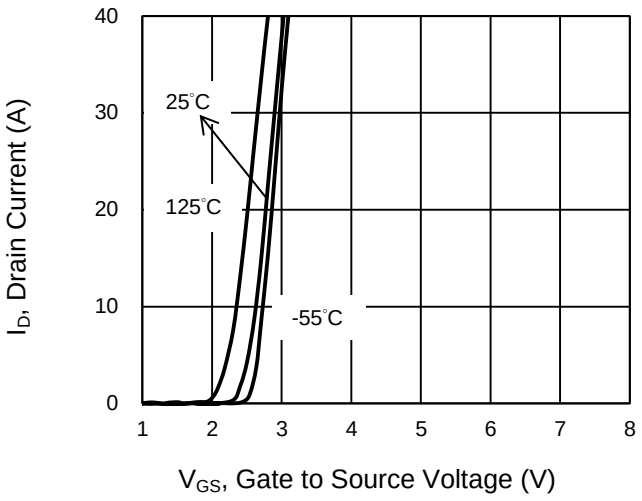
## CHARACTERISTICS CURVES

($T_A$ = 25°C unless otherwise noted)

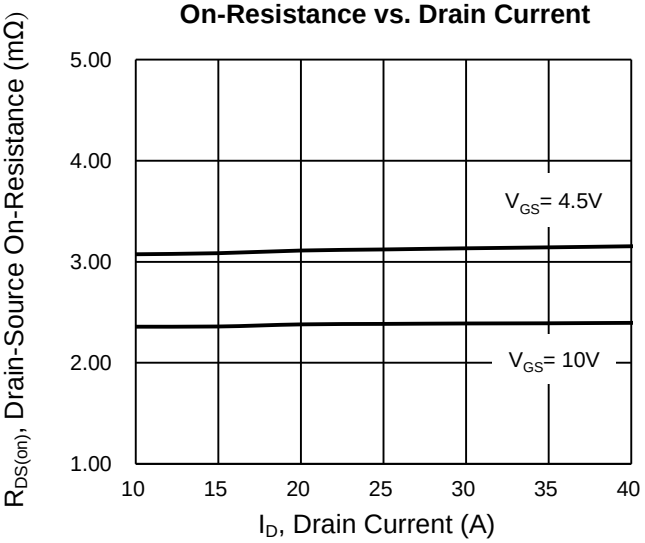
**Output Characteristics**



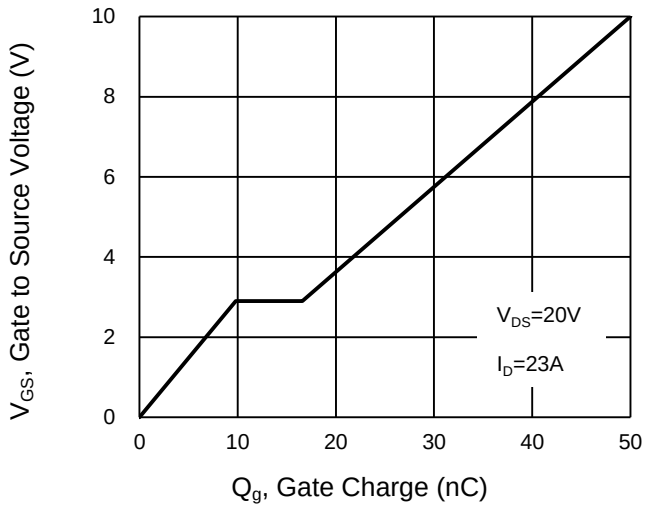

**Transfer Characteristics**



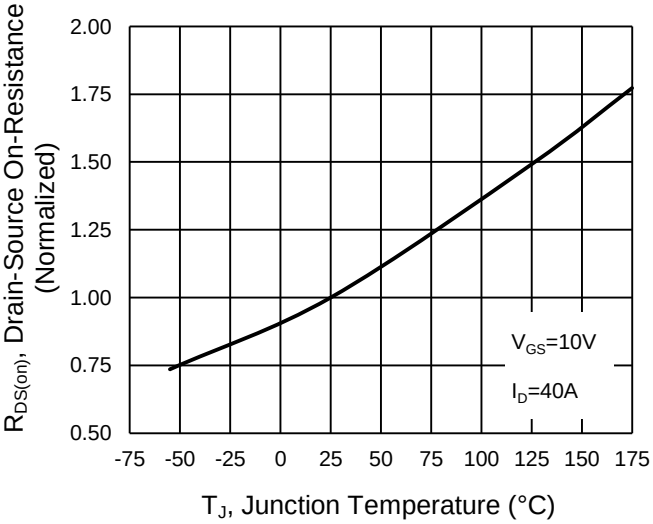

**On-Resistance vs. Drain Current**



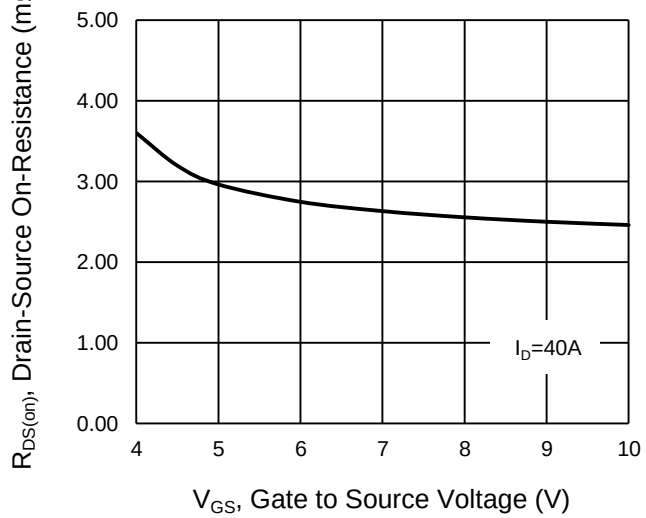

**Gate-Source Voltage vs. Gate Charge**




**On-Resistance vs. Junction Temperature**



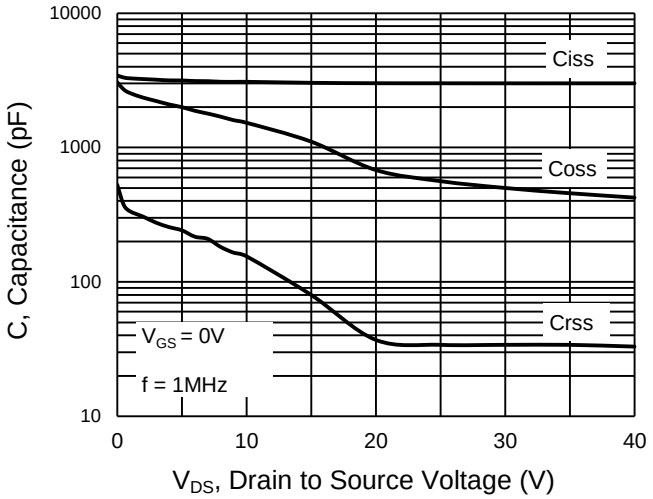

**On-Resistance vs. Gate-Source Voltage**



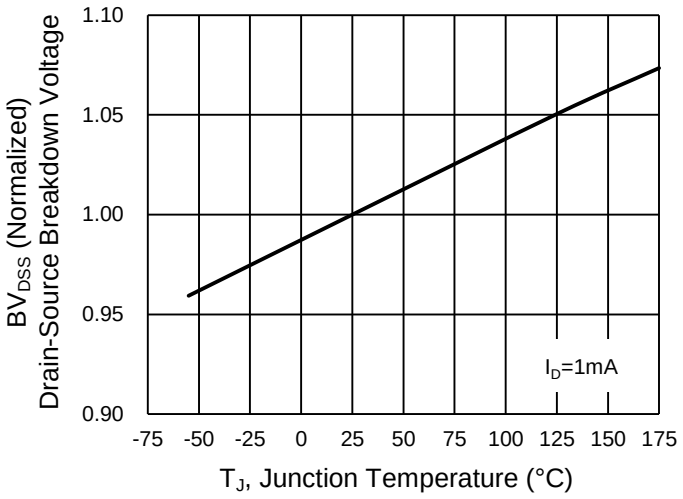
## CHARACTERISTICS CURVES

($T_A$ = 25°C unless otherwise noted)

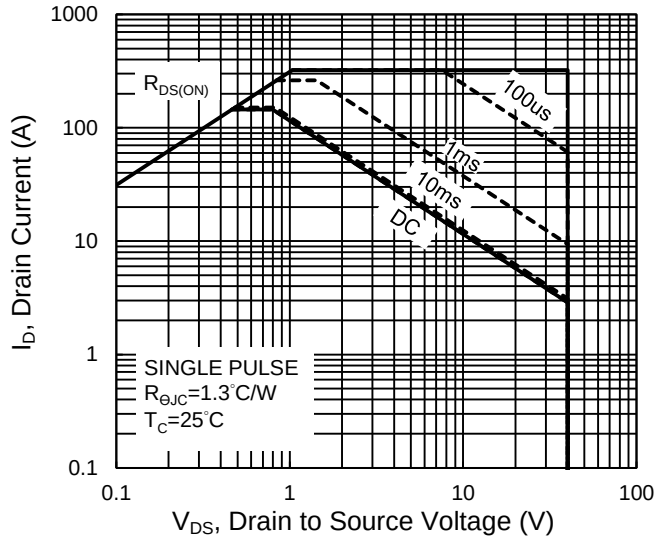
**Capacitance vs. Drain-Source Voltage**



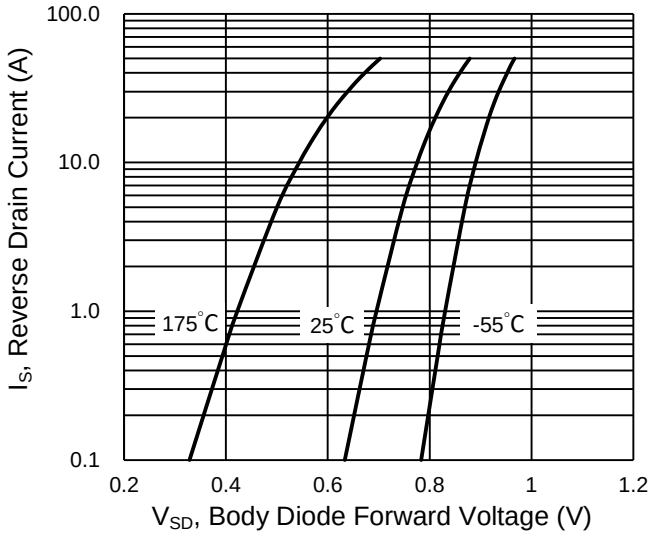

**$BV_{DSS}$ vs. Junction Temperature**



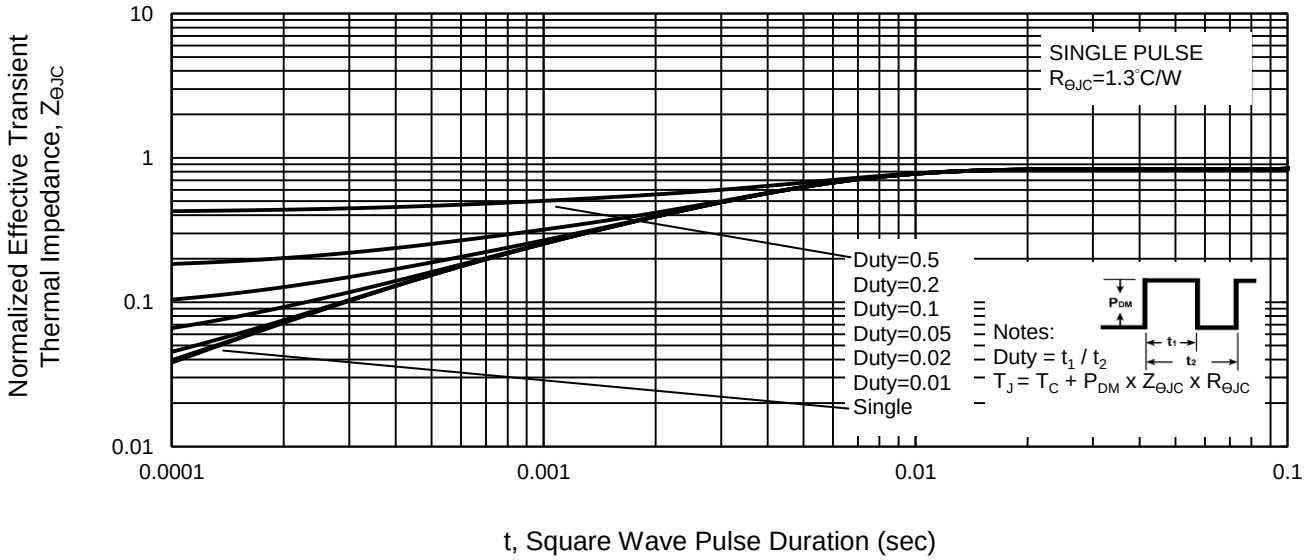

**Maximum Safe Operating Area, Junction-to-Case**




**Source-Drain Diode Forward Current vs. Voltage**



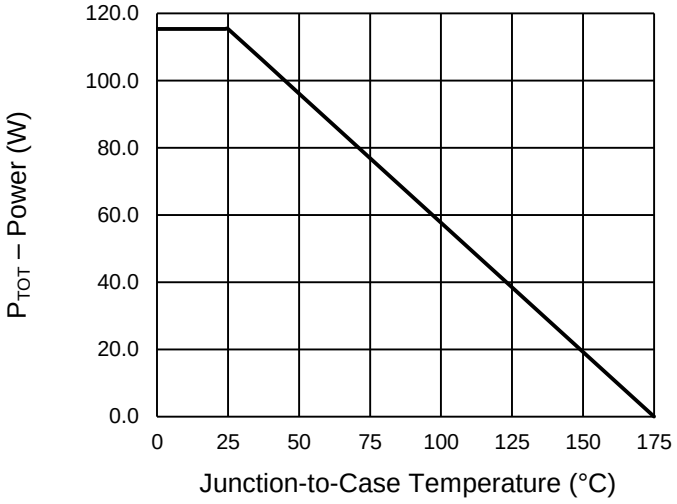

**Normalized Thermal Transient Impedance, Junction-to-Case**



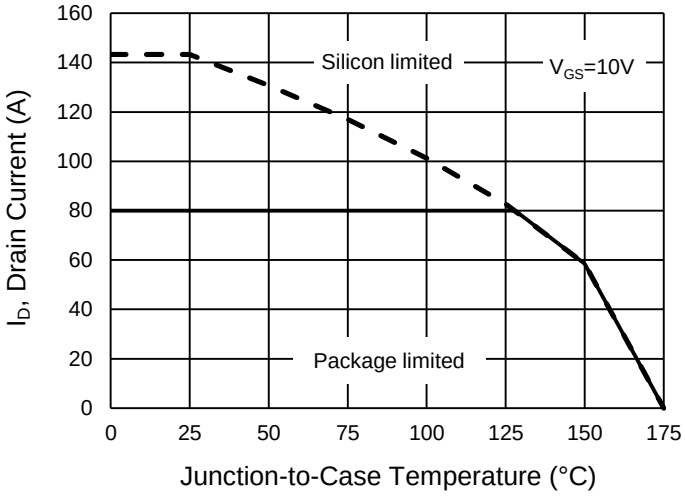
## CHARACTERISTICS CURVES

($T_A$ = 25°C unless otherwise noted)

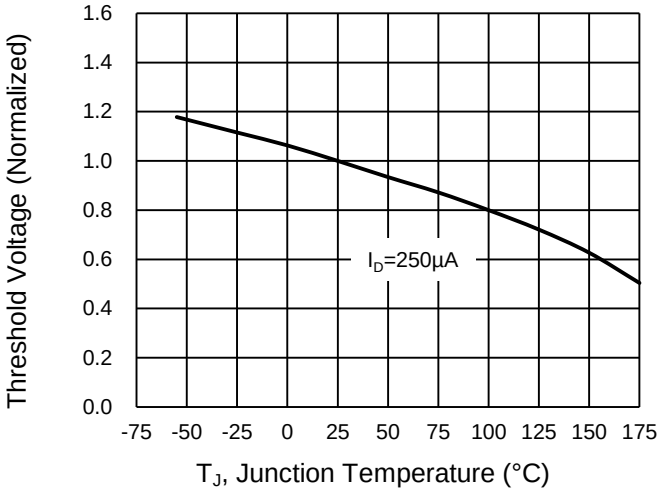
**Power Dissipation**




**Drain Current**

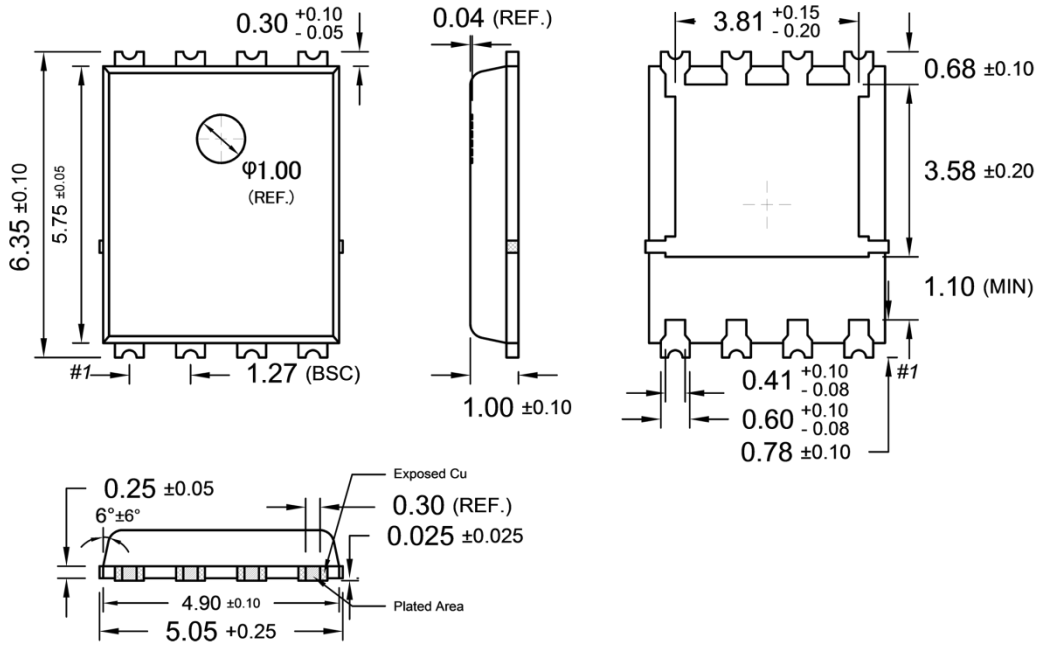



**Normalized gate threshold voltage vs Temperature**

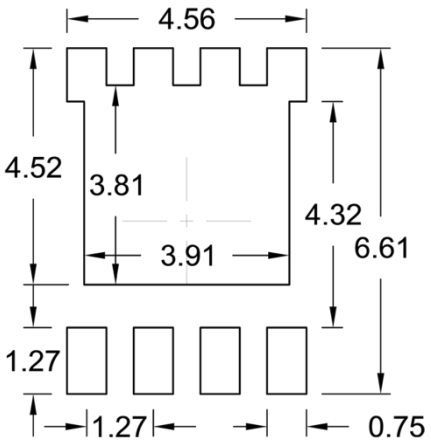


## PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

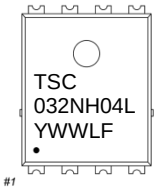
**PDFN56U**




## SUGGESTED PAD LAYOUT (Unit: Millimeters)




## MARKING DIAGRAM




**Y** = Year Code
**WW** = Week Code (01~52)
**L** = Lot Code (1~9,A~Z)
**F** = Factory Code

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