

## PerFET™ Power Transistor

### FEATURES

- Excellent FOM
- AEC-Q101 Qualified
- Wettable Flank leads for Enhanced AOI
- 100% UIS and Rg tested
- 175°C Operating Junction Temperature
- RoHS Compliant
- Halogen-Free

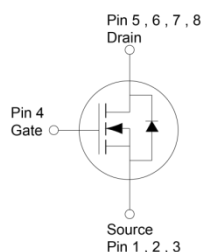
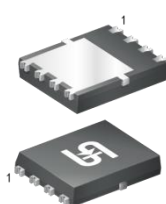
### APPLICATIONS

- Automotive Applications
- Solenoid and Motor Drivers
- DC-DC Converters

| PRODUCT SUMMARY    |                |      |    |
|--------------------|----------------|------|----|
| PARAMETER          | VALUE          | UNIT |    |
| $V_{DS}$           | 40             | V    |    |
| $R_{DS(on)}$ (max) | $V_{GS} = 10V$ | 4.3  | mΩ |
|                    | $V_{GS} = 7V$  | 5.2  |    |
| $Q_g$              | $V_{GS} = 10V$ | 37   | nC |



PDFN56U



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

| ABSOLUTE MAXIMUM RATINGS ( $T_A = 25^\circ\text{C}$ unless otherwise noted) |                           |              |                  |   |
|---|---------------------------|--------------|------------------|---|
| PARAMETER   | SYMBOL                    | LIMIT        | UNIT             |   |
| Drain-Source Voltage  | $V_{DS}$                  | 40           | V                |   |
| Gate-Source Voltage   | $V_{GS}$                  | $\pm 20$     | V                |   |
| Continuous Drain Current, Silicon limited                                   | $T_C = 25^\circ\text{C}$  | $I_D$        | 113              | A |
| Continuous Drain Current (Note 1)   | $T_C = 25^\circ\text{C}$  | $I_D$        | 54               | A |
|   | $T_C = 100^\circ\text{C}$ |              | 54               |   |
|   | $T_A = 25^\circ\text{C}$  |              | 20               |   |
| Pulsed Drain Current (Note 2)   | $I_{DM}$                  | 216          | A                |   |
| Single Pulse Avalanche Current (Note 3)                                     | $I_{AS}$                  | 25.6         | A                |   |
| Single Pulse Avalanche Energy (Note 3)                                      | $E_{AS}$                  | 98.3         | mJ               |   |
| Total Power Dissipation   | $T_C = 25^\circ\text{C}$  | $P_D$        | 100              | W |
|   | $T_C = 125^\circ\text{C}$ |              | 33               |   |
| Operating Junction and Storage Temperature Range                            | $T_J, T_{STG}$            | - 55 to +175 | $^\circ\text{C}$ |   |

| THERMAL RESISTANCE                                |                 |         |                           |
|---|-----------------|---------|---------------------------|
| PARAMETER   | SYMBOL          | MAXIMUM | UNIT                      |
| Thermal Resistance – Junction to Case             | $R_{\theta JC}$ | 1.5     | $^\circ\text{C}/\text{W}$ |
| Thermal Resistance – Junction to Ambient (Note 4) | $R_{\theta JA}$ | 50      | $^\circ\text{C}/\text{W}$ |

### NOTE:

1. Package current limit.
2. Pulse Width  $\leq 100\mu\text{s}$ .
3.  $L = 0.3\text{mH}$ ,  $V_{GS} = 10\text{V}$ ,  $R_G = 25\Omega$ , Starting  $T_J = 25^\circ\text{C}$ .
4. Device on a PCB FR4 with 1 in<sup>2</sup> (single layer, 2 oz thick) copper area for drain connection.

| <b>ELECTRICAL CHARACTERISTICS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise noted) |   |              |     |      |           |            |
|--|---|--------------|-----|------|-----------|------------|
| PARAMETER  | CONDITIONS  | SYMBOL       | MIN | TYP  | MAX       | UNIT       |
| <b>Static</b>  |   |              |     |      |           |            |
| Drain-Source Breakdown Voltage   | $V_{GS} = 0V, I_D = 1mA$                                      | $BV_{DSS}$   | 40  | --   | --        | V          |
| Gate Threshold Voltage   | $V_{GS} = V_{DS}, I_D = 250\mu A$                             | $V_{GS(TH)}$ | 2.4 | 3.1  | 3.6       | V          |
| Gate-Source Leakage Current  | $V_{GS} = \pm 20V, V_{DS} = 0V$                               | $I_{GSS}$    | --  | --   | $\pm 100$ | nA         |
| Drain-Source Leakage Current   | $V_{GS} = 0V, V_{DS} = 40V$                                   | $I_{DSS}$    | --  | --   | 1         | $\mu A$    |
| Drain-Source On-State Resistance<br>(Note 5)   | $V_{GS} = 10V, I_D = 27A$                                     | $R_{DS(on)}$ | --  | 3.1  | 4.3       | m $\Omega$ |
|  | $V_{GS} = 7V, I_D = 27A$                                      |              | --  | 3.6  | 5.2       |            |
| Forward Transconductance (Note 5)  | $V_{DS} = 10V, I_D = 7A$                                      | $g_{fs}$     | --  | 48   | --        | S          |
| <b>Dynamic</b> (Note 6)  |   |              |     |      |           |            |
| Total Gate Charge  | $V_{GS} = 7V, V_{DS} = 25V,$<br>$I_D = 20A$                   | $Q_g$        | --  | 26   | 39        | nC         |
| Total Gate Charge  | $V_{GS} = 10V, V_{DS} = 25V,$<br>$I_D = 20A$                  | $Q_g$        | --  | 37   | 56        |            |
| Gate-Source Charge   |   | $Q_{gs}$     | --  | 11   | 22        |            |
| Gate-Drain Charge  |   | $Q_{gd}$     | --  | 6.9  | 14        |            |
| Input Capacitance  | $V_{GS} = 0V, V_{DS} = 25V,$<br>$f = 1.0MHz$                  | $C_{iss}$    | --  | 2381 | 3572      | pF         |
| Output Capacitance   |   | $C_{oss}$    | --  | 465  | 930       |            |
| Reverse Transfer Capacitance   |   | $C_{rss}$    | --  | 32   | 64        |            |
| Gate Resistance  | $f = 1.0MHz$  | $R_g$        | --  | 0.7  | --        | $\Omega$   |
| <b>Switching</b> (Note 7)  |   |              |     |      |           |            |
| Turn-On Delay Time   | $V_{GS} = 10V, V_{DS} = 25V,$<br>$I_D = 20A, R_G = 0.7\Omega$ | $t_{d(on)}$  | --  | 12   | --        | ns         |
| Rise Time  |   | $t_r$        | --  | 62   | --        |            |
| Turn-Off Delay Time  |   | $t_{d(off)}$ | --  | 22   | --        |            |
| Fall Time  |   | $t_f$        | --  | 10   | --        |            |
| <b>Source-Drain Diode</b>  |   |              |     |      |           |            |
| Diode Forward Voltage (Note 5)   | $V_{GS} = 0V, I_S = 27A$                                      | $V_{SD}$     | --  | --   | 1.1       | V          |
| Reverse Recovery Time  | $I_S = 20A,$<br>$di/dt = 100A/\mu s$                          | $t_{rr}$     | --  | 39   | --        | ns         |
| Reverse Recovery Charge  |   | $Q_{rr}$     | --  | 33   | --        | nC         |

**Notes:**

5. Pulse test: Pulse Width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .
6. Defined by design. Not subject to production test.
7. Switching time is essentially independent of operating temperature.

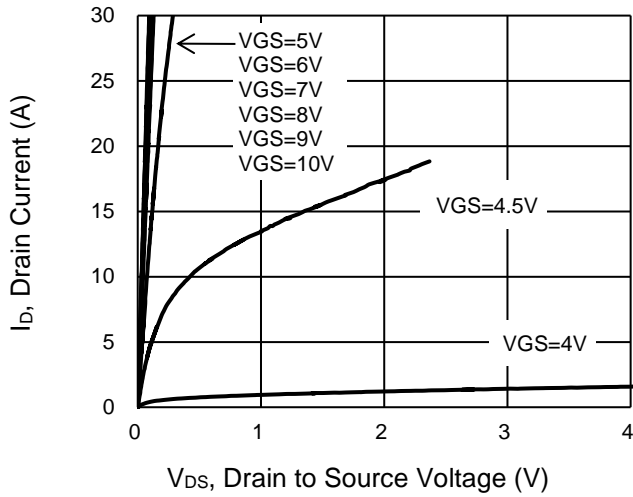
**ORDERING INFORMATION**

| ORDERING CODE    | PACKAGE | PACKING             |
|------------------|---------|---------------------|
| TQM043NH04CR RLG | PDFN56U | 2,500pcs / 13" Reel |

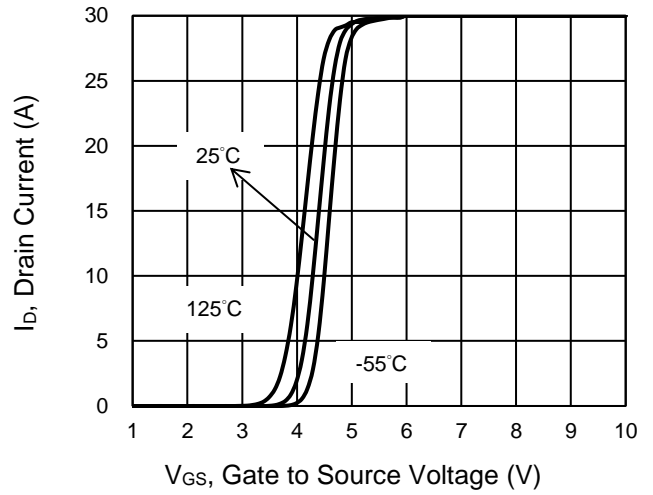
**CHARACTERISTICS CURVES**

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

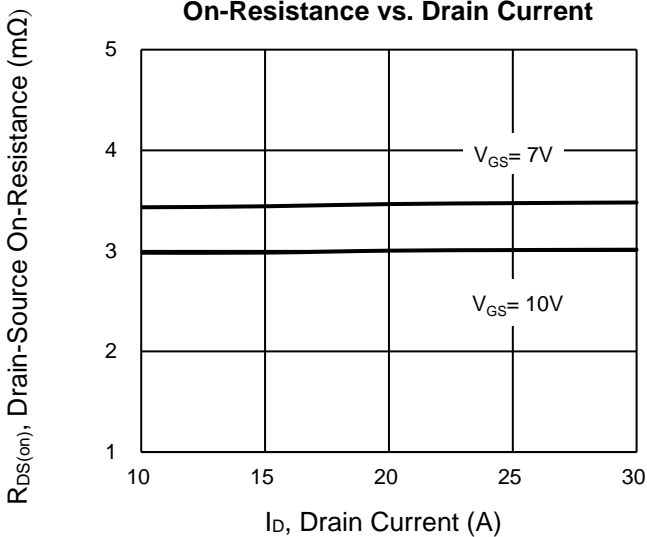
**Output Characteristics**



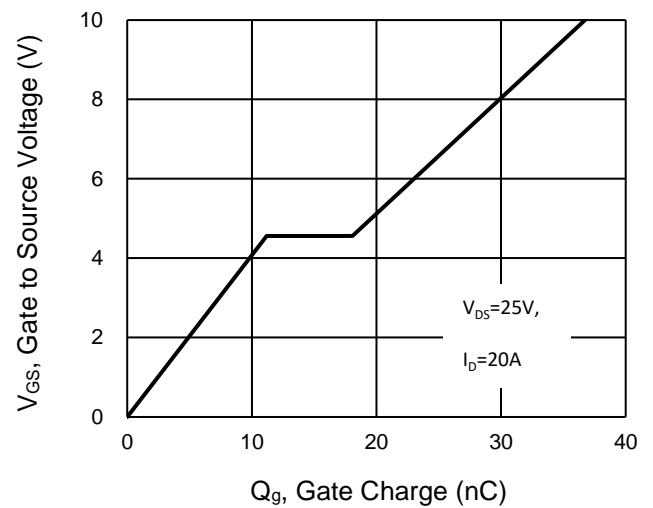
**Transfer Characteristics**



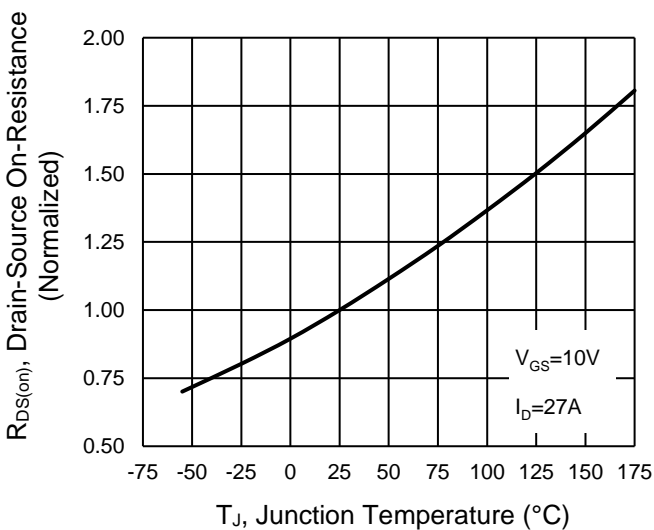
**On-Resistance vs. Drain Current**



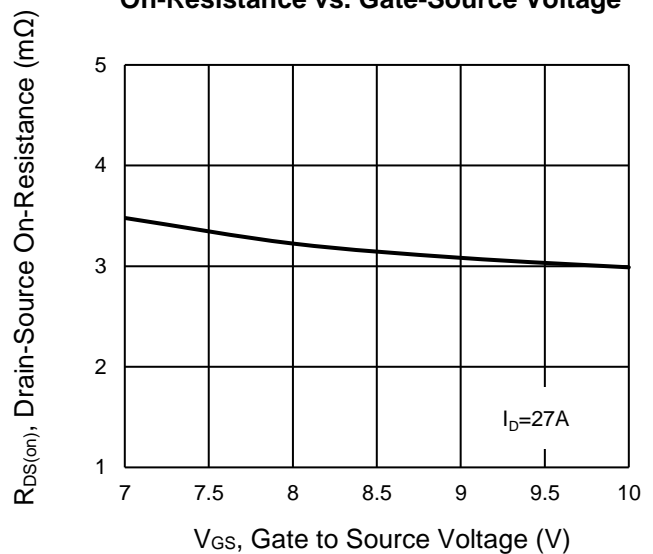
**Gate-Source Voltage vs. Gate Charge**



**On-Resistance vs. Junction Temperature**



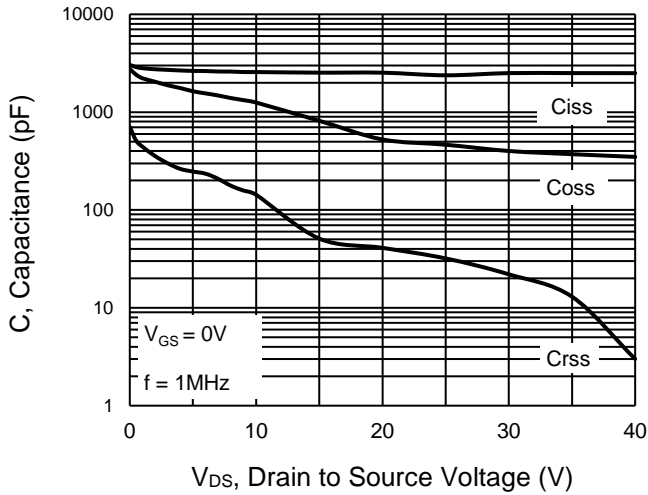
**On-Resistance vs. Gate-Source Voltage**



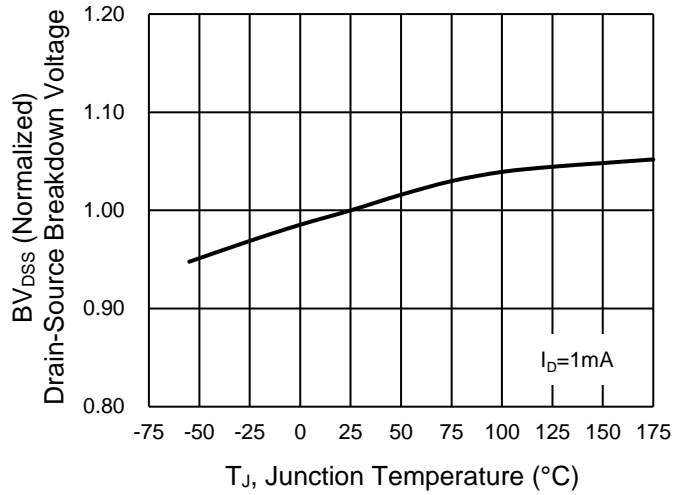
**CHARACTERISTICS CURVES**

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

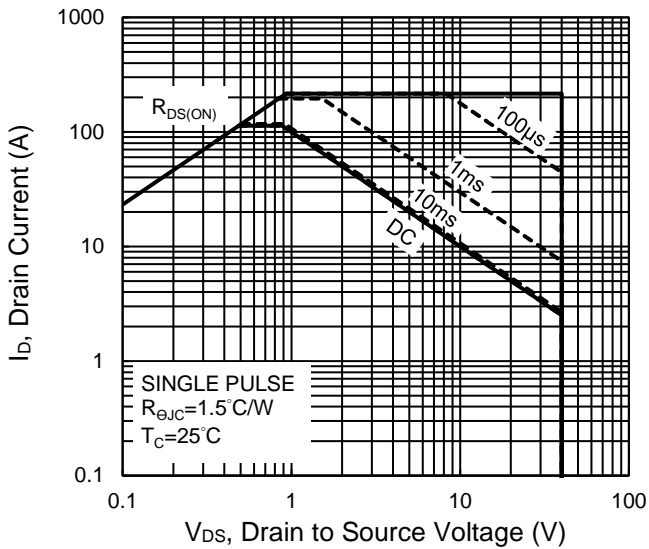
**Capacitance vs. Drain-Source Voltage**



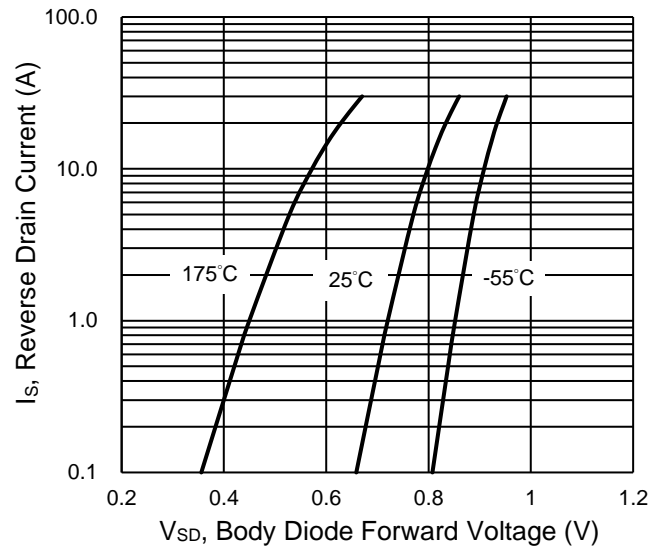
**$BV_{DSS}$  vs. Junction Temperature**



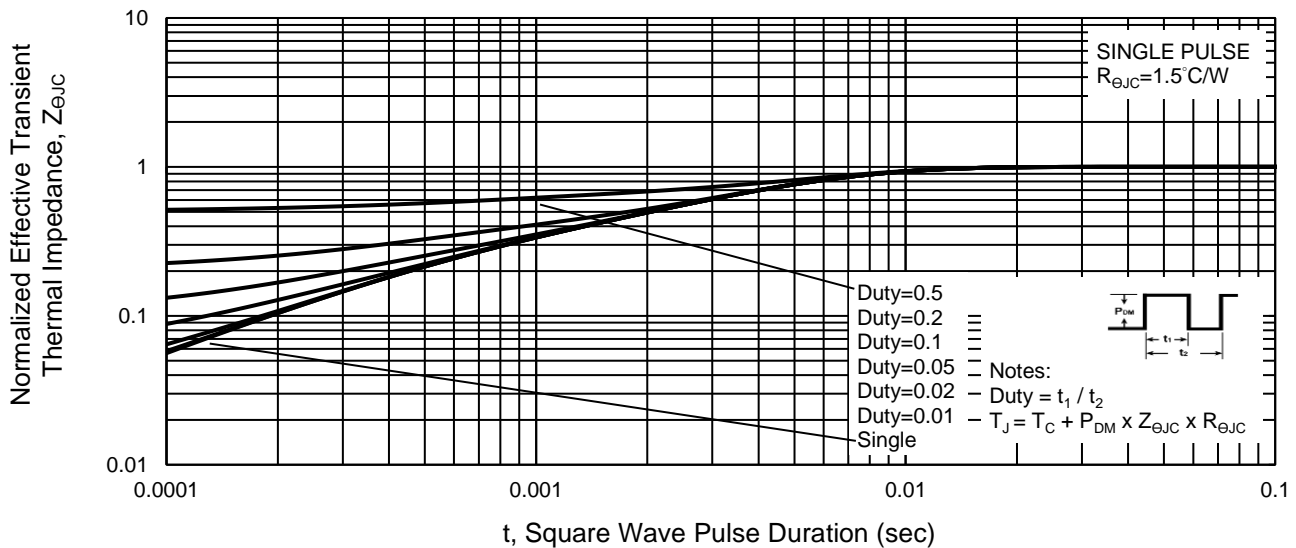
**Maximum Safe Operating Area, Junction-to-Case**



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



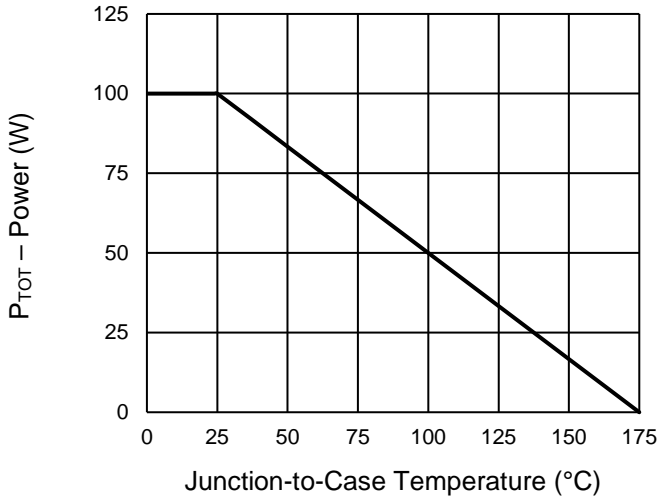
**Normalized Thermal Transient Impedance, Junction-to-Case**



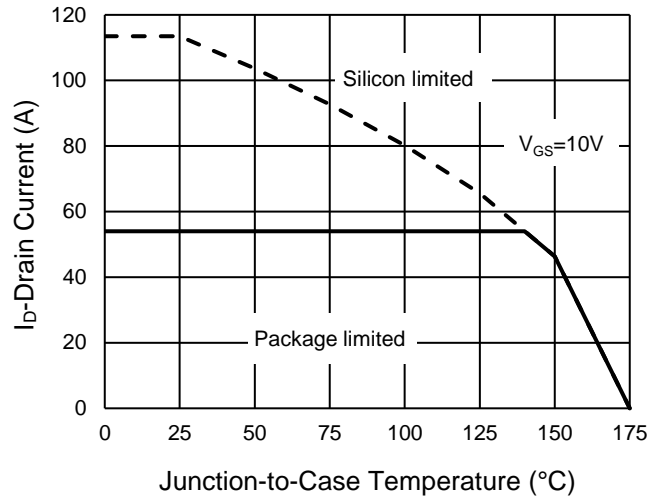
**CHARACTERISTICS CURVES**

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

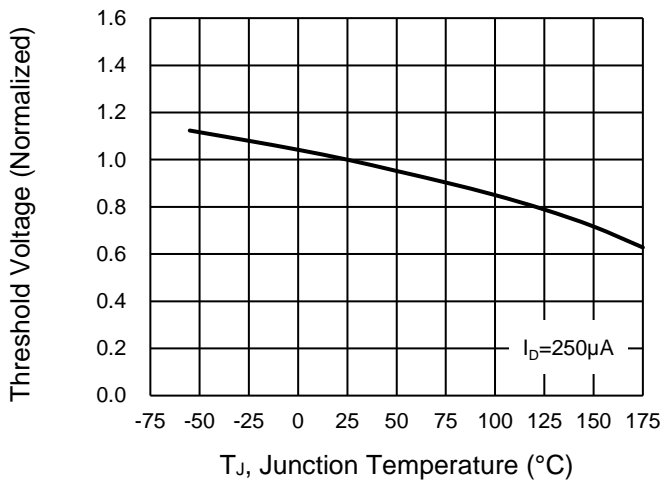
**Power Dissipation**



**Drain Current**

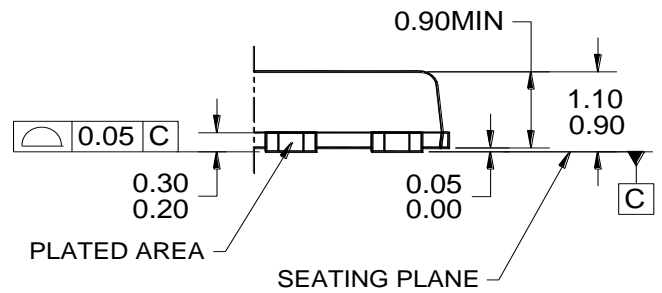
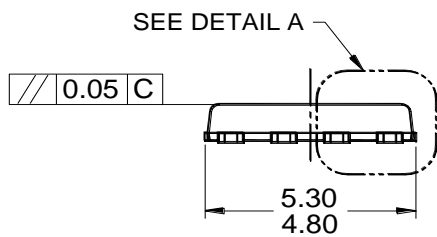
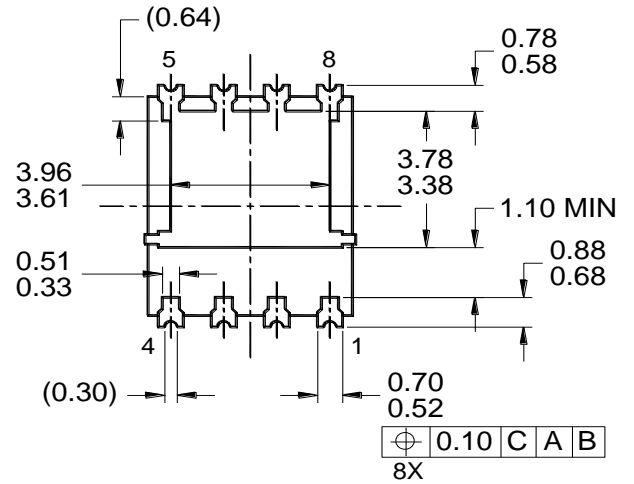
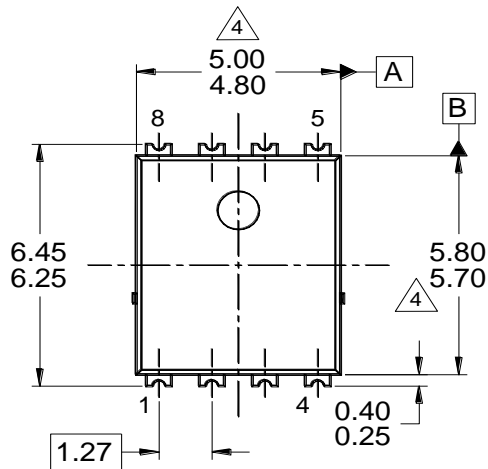


**Normalized gate threshold voltage vs Temperature**

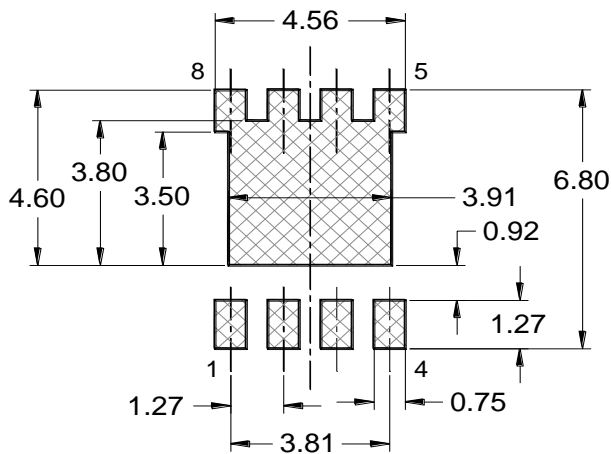


**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

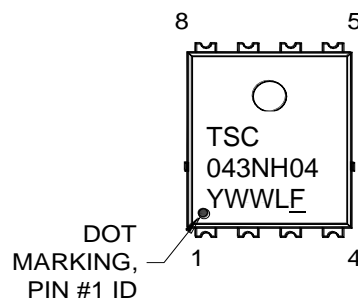
**PDFN56U**



DETAIL A  
(SCALE 2:1)



SUGGESTED PAD LAYOUT  
(REFERENCE ONLY)



MARKING DIAGRAM

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL DIMENSIONS ARE IN MILLIMETERS.
2. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
3. PACKAGE OUTLINE REFERENCE: JEITA ED-7500B, EIAJ SC-111BB.
4. MOLDED PLASTIC BODY DIMENSIONS DO NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.
5. DWG NO. REF: HQ2SD07-PDFN56U-023 REV B.

- Y = YEAR CODE  
 WW = WEEK CODE (01~52)  
 L = LOT CODE (1~9, A~Z)  
 F = FACTORY CODE  
 - = AEC-Q101 QUALIFIED

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