

# PerFET™ Power Transistor

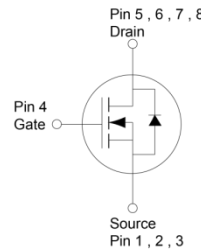
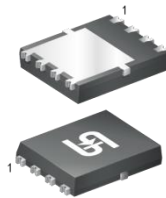
## FEATURES

- 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) | $V_{GS} = 10V$ | 1.9   | mΩ   |
|                    | $V_{GS} = 7V$  | 2.3   |      |
| $Q_g$              | $V_{GS} = 10V$ | 89    | nC   |


**HALOGEN  
FREE**
**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        | $T_C = 25^\circ\text{C}$  | $I_D$          | 214          | A                |
| Continuous Drain Current (Note 1)                | $T_C = 25^\circ\text{C}$  | $I_D$          | 100          | A                |
|                                                  | $T_C = 100^\circ\text{C}$ |                | 100          |                  |
|                                                  | $T_A = 25^\circ\text{C}$  |                | 30           |                  |
| Pulsed Drain Current (Note 2)                    |                           | $I_{DM}$       | 400          | A                |
| Single Pulse Avalanche Current (Note 3)          |                           | $I_{AS}$       | 41.9         | A                |
| Single Pulse Avalanche Energy (Note 3)           |                           | EAS            | 262.9        | mJ               |
| Total Power Dissipation                          | $T_C = 25^\circ\text{C}$  | $P_D$          | 150          | W                |
|                                                  | $T_C = 125^\circ\text{C}$ |                | 50           |                  |
| 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       | $^\circ\text{C/W}$ |
| Thermal Resistance – Junction to Ambient (Note 4) | $R_{\theta JA}$ | 50      | $^\circ\text{C/W}$ |

### NOTE:

1. Package current limit.
2. Pulse Width  $\leq 100\mu\text{s}$ .
3.  $L = 0.3\text{mH}$ ,  $V_{GS} = 10V$ ,  $R_G = 25\Omega$ , 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.

| ELECTRICAL CHARACTERISTICS (T <sub>A</sub> = 25°C unless otherwise noted) |                                                                                              |                     |     |      |      |      |
|---------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------------------|-----|------|------|------|
| PARAMETER                                                                 | CONDITIONS                                                                                   | SYMBOL              | MIN | TYP  | MAX  | UNIT |
| Static                                                                    |                                                                                              |                     |     |      |      |      |
| Drain-Source Breakdown Voltage                                            | V <sub>GS</sub> = 0V, I <sub>D</sub> = 1mA                                                   | BV <sub>DSS</sub>   | 40  | --   | --   | V    |
| Gate Threshold Voltage                                                    | V <sub>GS</sub> = V <sub>DS</sub> , I <sub>D</sub> = 250μA                                   | V <sub>GS(TH)</sub> | 2.4 | 3    | 3.6  | V    |
| Gate-Source Leakage Current                                               | V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V                                                 | I <sub>GSS</sub>    | --  | --   | ±100 | nA   |
| Drain-Source Leakage Current                                              | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 40V                                                  | I <sub>DSS</sub>    | --  | --   | 1    | μA   |
|                                                                           | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 40V                                                  |                     | --  | --   | 100  |      |
|                                                                           | T <sub>J</sub> = 125°C                                                                       |                     |     |      |      |      |
| Drain-Source On-State Resistance<br>(Note 5)                              | V <sub>GS</sub> = 10V, I <sub>D</sub> = 50A                                                  | R <sub>DS(on)</sub> | --  | 1.3  | 1.9  | mΩ   |
|                                                                           | V <sub>GS</sub> = 7V, I <sub>D</sub> = 50A                                                   |                     | --  | 1.6  | 2.3  |      |
| Forward Transconductance (Note 5)                                         | V <sub>DS</sub> = 10V, I <sub>D</sub> = 12.5A                                                | g <sub>fs</sub>     | --  | 88   | --   | S    |
| Dynamic (Note 6)                                                          |                                                                                              |                     |     |      |      |      |
| Total Gate Charge                                                         | V <sub>GS</sub> = 7V, V <sub>DS</sub> = 25V,<br>I <sub>D</sub> = 30A                         | Q <sub>g</sub>      | --  | 64   | 96   | nC   |
| Total Gate Charge                                                         | V <sub>GS</sub> = 10V, V <sub>DS</sub> = 25V,<br>I <sub>D</sub> = 30A                        | Q <sub>g</sub>      | --  | 89   | 134  |      |
| Gate-Source Charge                                                        |                                                                                              | Q <sub>gs</sub>     | --  | 28   | 56   |      |
| Gate-Drain Charge                                                         |                                                                                              | Q <sub>gd</sub>     | --  | 16   | 32   |      |
| Input Capacitance                                                         | V <sub>GS</sub> = 0V, V <sub>DS</sub> = 25V,<br>f = 1.0MHz                                   | C <sub>iss</sub>    | --  | 6029 | 9044 | pF   |
| Output Capacitance                                                        |                                                                                              | C <sub>oss</sub>    | --  | 1218 | 2436 |      |
| Reverse Transfer Capacitance                                              |                                                                                              | C <sub>rss</sub>    | --  | 47   | 94   |      |
| Gate Resistance                                                           | f = 1.0MHz                                                                                   | R <sub>g</sub>      | --  | 1.0  | --   | Ω    |
| Switching (Note 7)                                                        |                                                                                              |                     |     |      |      |      |
| Turn-On Delay Time                                                        | V <sub>GS</sub> = 10V, V <sub>DS</sub> = 25V,<br>I <sub>D</sub> = 30A, R <sub>G</sub> = 3.3Ω | t <sub>d(on)</sub>  | --  | 23   | --   | ns   |
| Rise Time                                                                 |                                                                                              | t <sub>r</sub>      | --  | 76   | --   |      |
| Turn-Off Delay Time                                                       |                                                                                              | t <sub>d(off)</sub> | --  | 52   | --   |      |
| Fall Time                                                                 |                                                                                              | t <sub>f</sub>      | --  | 18   | --   |      |
| Source-Drain Diode                                                        |                                                                                              |                     |     |      |      |      |
| Diode Forward Voltage (Note 5)                                            | V <sub>GS</sub> = 0V, I <sub>S</sub> = 50A                                                   | V <sub>SD</sub>     | --  | --   | 1.1  | V    |
| Reverse Recovery Time                                                     | I <sub>S</sub> = 30A,                                                                        | t <sub>rr</sub>     | --  | 61   | --   | ns   |
| Reverse Recovery Charge                                                   | di/dt = 100A/μs                                                                              | Q <sub>rr</sub>     | --  | 98   | --   | nC   |

**Notes:**

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

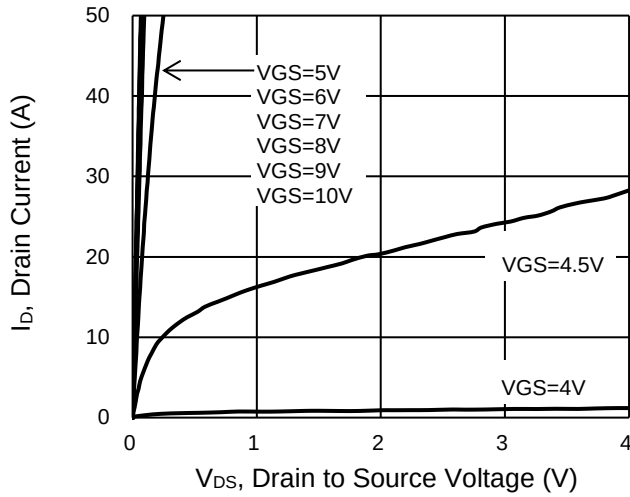
**ORDERING INFORMATION**

| ORDERING CODE    | PACKAGE | PACKING             |
|------------------|---------|---------------------|
| TQM019NH04CR RLG | PDFN56U | 2,500pcs / 13" Reel |

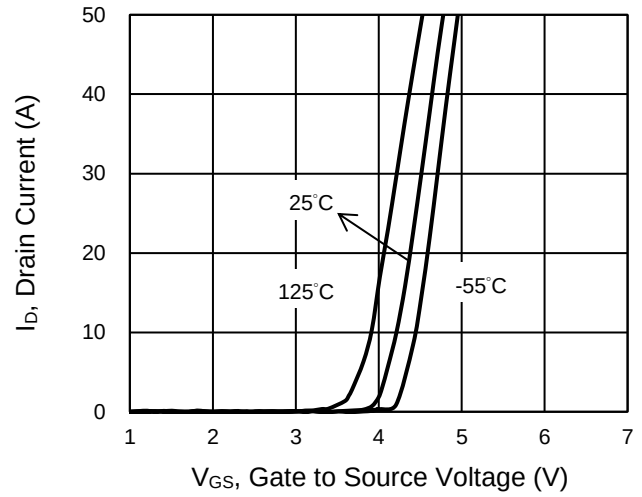
## CHARACTERISTICS CURVES

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

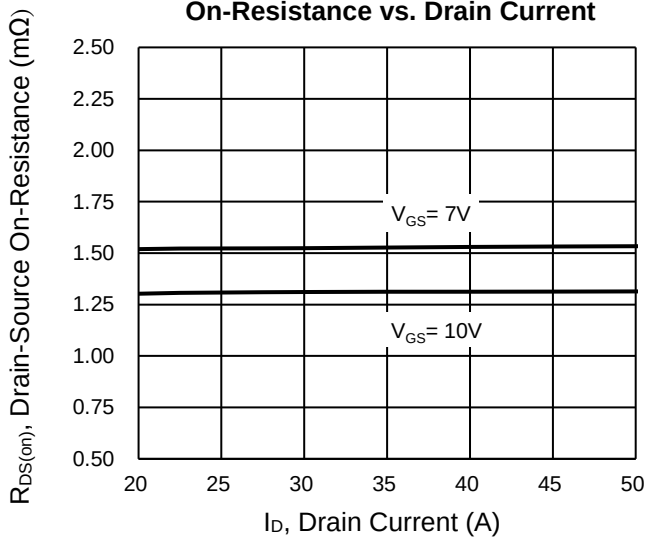
**Output Characteristics**



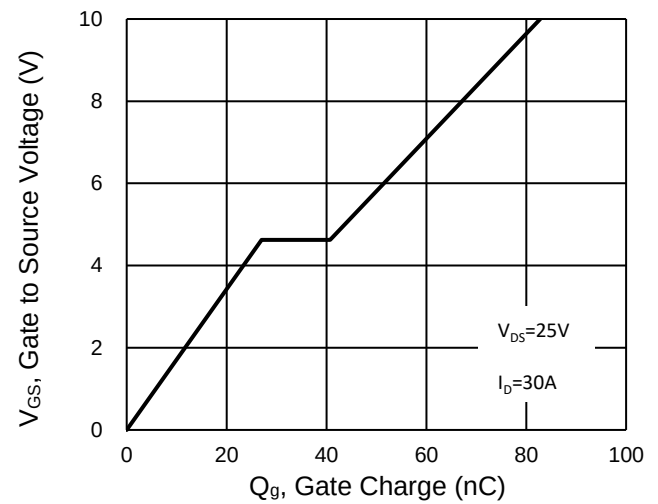
**Transfer Characteristics**



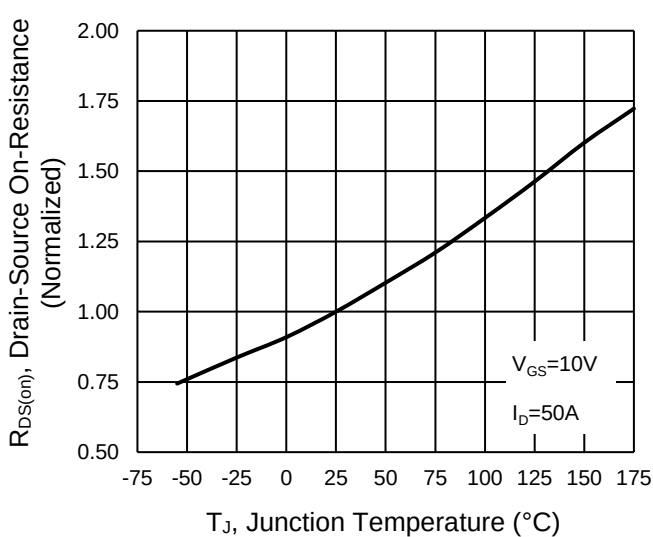
**On-Resistance vs. Drain Current**



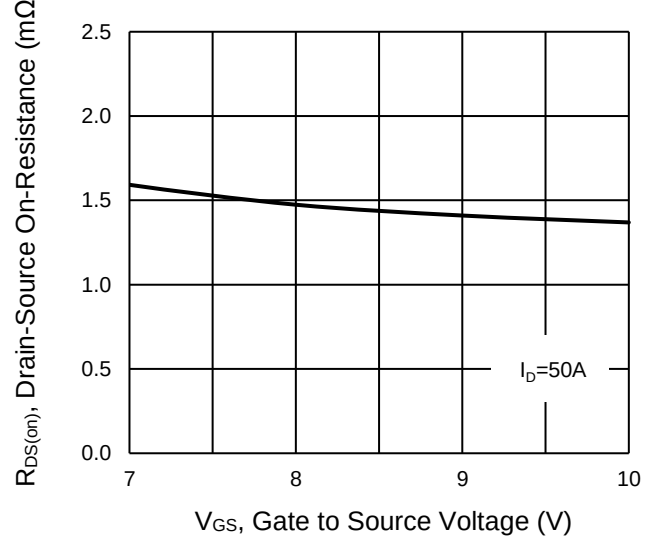
**Gate-Source Voltage vs. Gate Charge**



**On-Resistance vs. Junction Temperature**

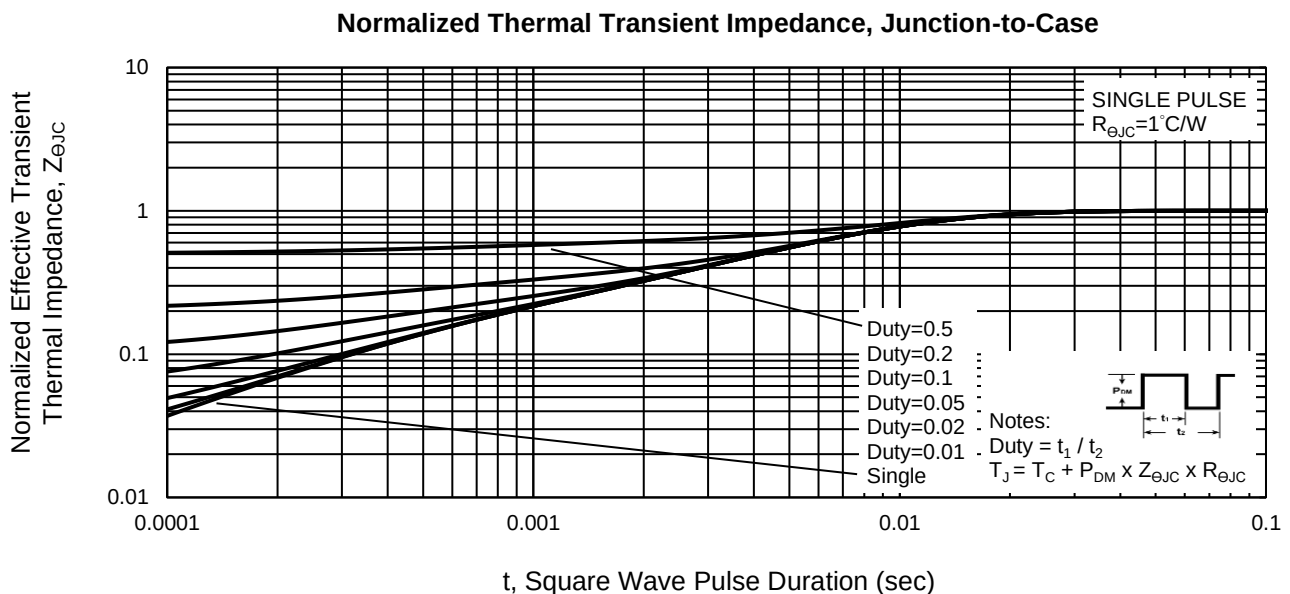
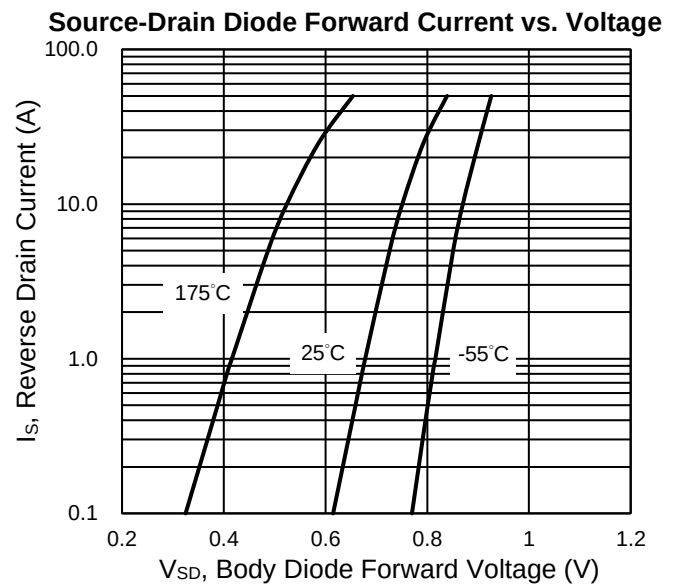
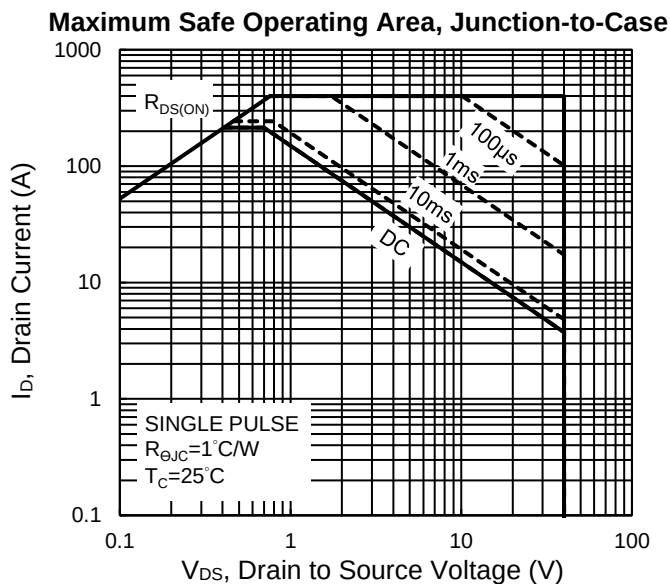
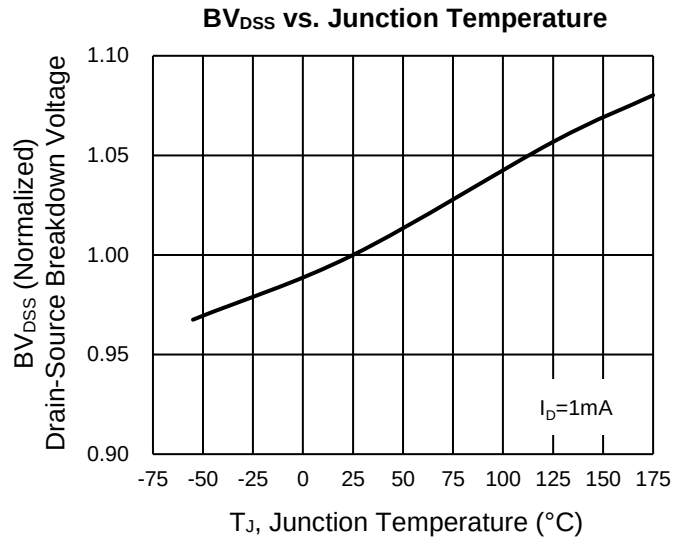
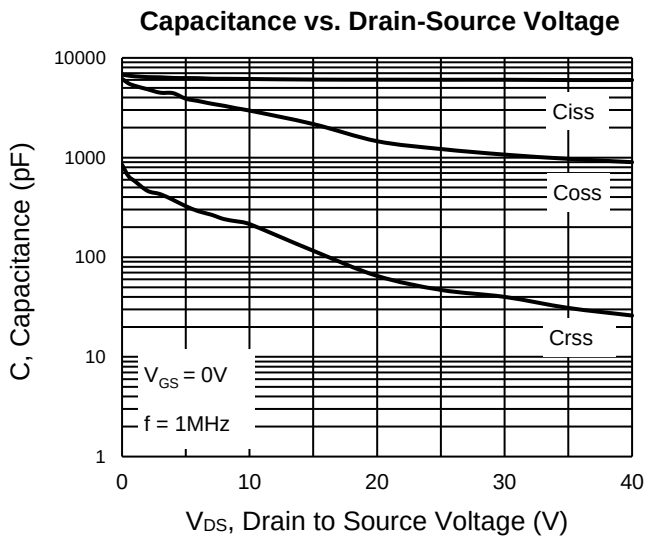


**On-Resistance vs. Gate-Source Voltage**



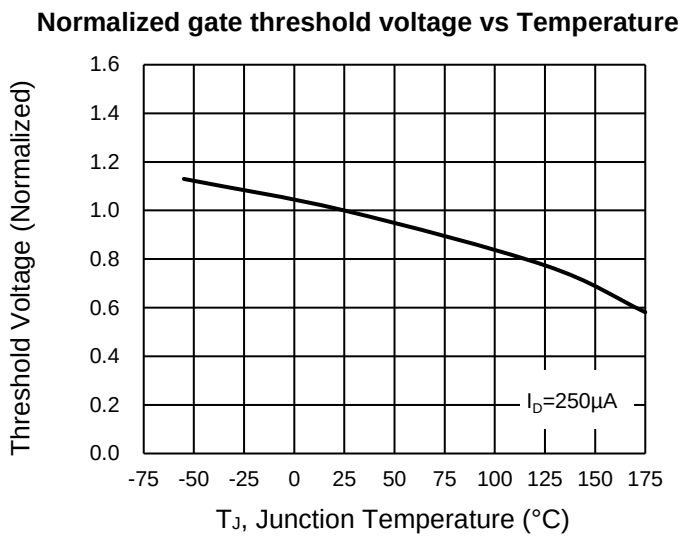
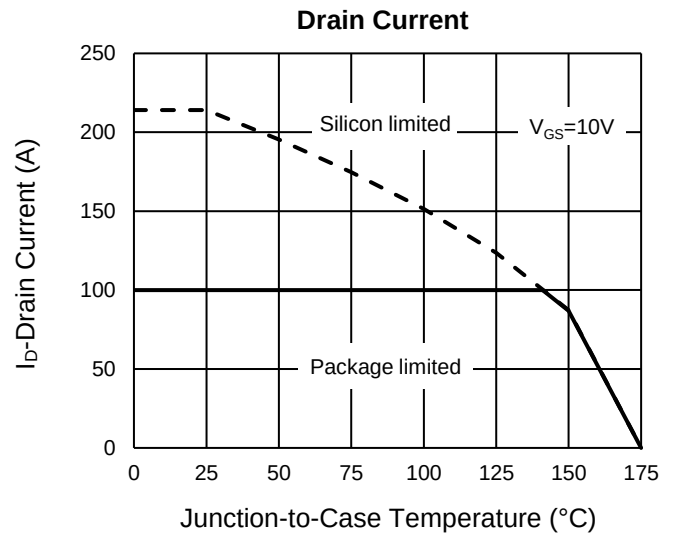
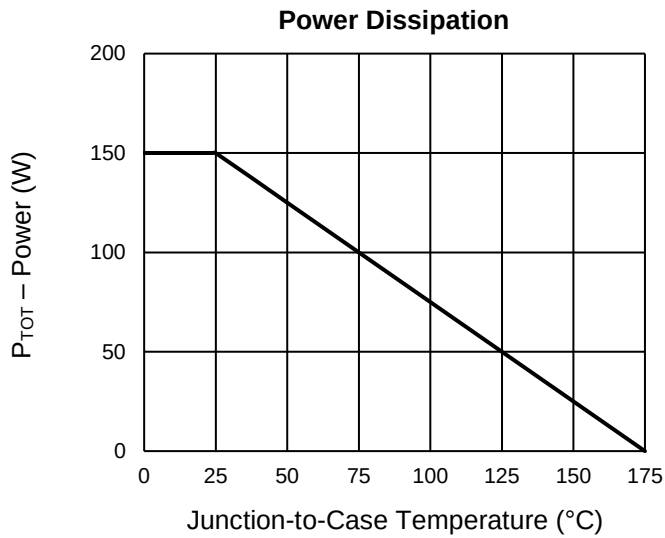
## CHARACTERISTICS CURVES

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



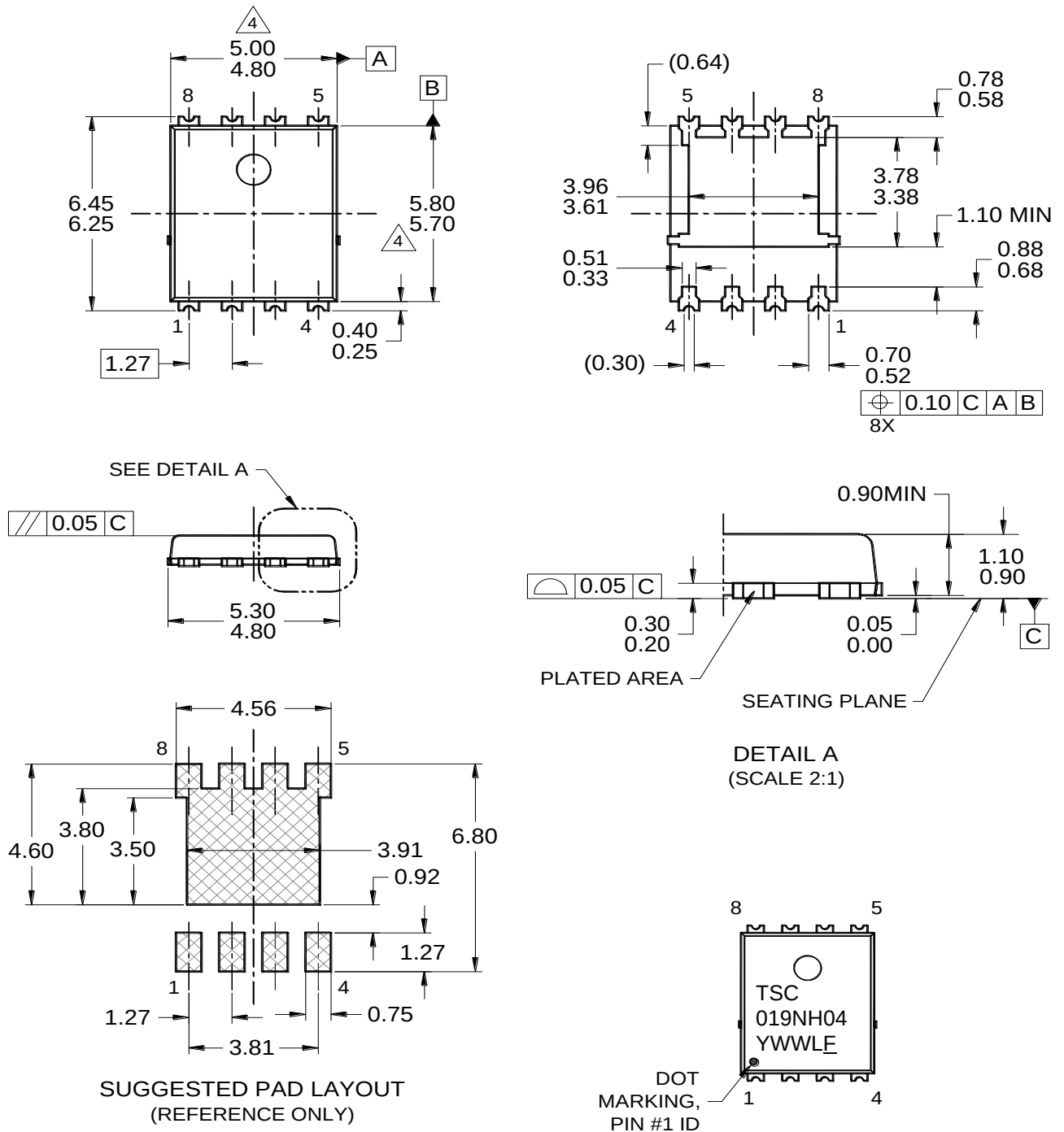
## CHARACTERISTICS CURVES

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



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

PDFN56U



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.

MARKING DIAGRAM

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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