

## 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

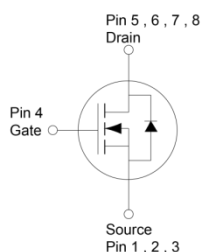
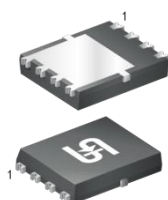
### APPLICATIONS

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

PRODUCT SUMMARY			
PARAMETER	VALUE	UNIT	
$V_{DS}$	40	V	
$R_{DS(on)}$ (max)	$V_{GS} = 10V$	4.3	mΩ
	$V_{GS} = 4.5V$	6	
$Q_g$	$V_{GS} = 4.5V$	20	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		$V_{GS}$	$\pm 16$	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		$I_{DM}$	216	A
Single Pulse Avalanche Current (Note 2)		$I_{AS}$	25.6	A
Single Pulse Avalanche Energy (Note 2)		$E_{AS}$	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	$^\circ\text{C/W}$
Thermal Resistance – Junction to Ambient	$R_{\theta JA}$	50	$^\circ\text{C/W}$

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.

<b>ELECTRICAL CHARACTERISTICS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise noted)						
<b>PARAMETER</b>	<b>CONDITIONS</b>	<b>SYMBOL</b>	<b>MIN</b>	<b>TYP</b>	<b>MAX</b>	<b>UNIT</b>
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 1mA$	$BV_{DSS}$	40	--	--	V
Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu A$	$V_{GS(TH)}$	1.4	1.8	2.2	V
Gate-Source Leakage Current	$V_{GS} = \pm 16V, V_{DS} = 0V$	$I_{GSS}$	--	--	$\pm 100$	nA
Drain-Source Leakage Current	$V_{GS} = 0V, V_{DS} = 40V$	$I_{DSS}$	--	--	1	$\mu A$
Drain-Source On-State Resistance (Note 3)	$V_{GS} = 10V, I_D = 27A$	$R_{DS(on)}$	--	2.9	4.3	m $\Omega$
	$V_{GS} = 4.5V, I_D = 27A$		--	3.7	6	
Forward Transconductance (Note 3)	$V_{DS} = 10V, I_D = 10A$	$g_{fs}$	--	83	--	s
<b>Dynamic</b>						
Total Gate Charge	$V_{GS} = 4.5V, V_{DS} = 25V,$ $I_D = 20A$	$Q_g$	--	20	--	nC
Total Gate Charge	$V_{GS} = 10V, V_{DS} = 25V,$ $I_D = 20A$	$Q_g$	--	42	--	
Gate-Source Charge		$Q_{gs}$	--	8	--	
Gate-Drain Charge		$Q_{gd}$	--	6	--	
Input Capacitance	$V_{GS} = 0V, V_{DS} = 25V,$ $f = 1.0MHz$	$C_{iss}$	--	2480	--	pF
Output Capacitance		$C_{oss}$	--	476	--	
Reverse Transfer Capacitance		$C_{rss}$	--	37	--	
Gate Resistance	$f = 1.0MHz$	$R_g$	--	0.7	--	$\Omega$
<b>Switching</b> (Note 4)						
Turn-On Delay Time	$V_{GS} = 10V, V_{DS} = 25V,$ $I_D = 20A, R_G = 0.7\Omega$	$t_{d(on)}$	--	10	--	ns
Rise Time		$t_r$	--	59	--	
Turn-Off Delay Time		$t_{d(off)}$	--	27	--	
Fall Time		$t_f$	--	13	--	
<b>Source-Drain Diode</b>						
Diode Forward Voltage (Note 3)	$V_{GS} = 0V, I_S = 27A$	$V_{SD}$	--	--	1.1	V
Reverse Recovery Time	$I_S = 20A,$ $di/dt = 100A/\mu s$	$t_{rr}$	--	37	--	ns
Reverse Recovery Charge		$Q_{rr}$	--	31	--	nC

**Notes:**

- Package current limit.
- $L = 0.3mH, V_{GS} = 10V, R_G = 25\Omega,$  Starting  $T_J = 25^\circ\text{C}$ .
- Pulse test: Pulse Width  $\leq 300\mu s,$  duty cycle  $\leq 2\%$ .
- Switching time is essentially independent of operating temperature.

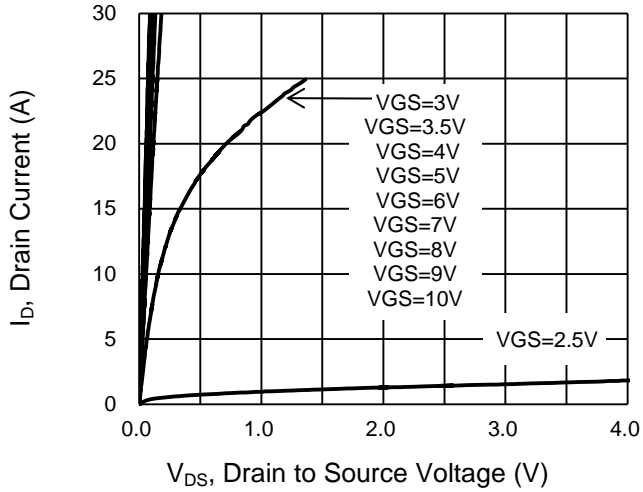
**ORDERING INFORMATION**

<b>ORDERING CODE</b>	<b>PACKAGE</b>	<b>PACKING</b>
TSM043NH04LCR RLG	PDFN56U	2,500pcs / 13" Reel

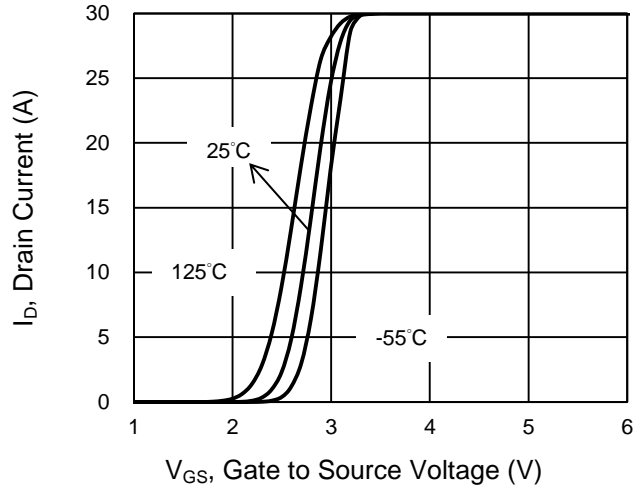
**CHARACTERISTICS CURVES**

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

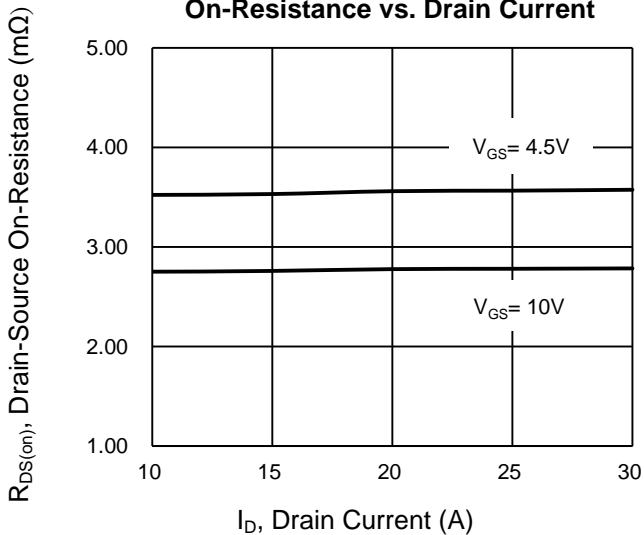
**Output Characteristics**



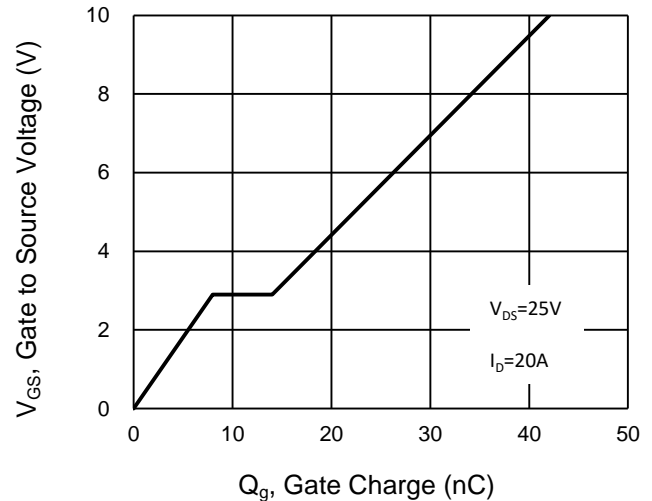
**Transfer Characteristics**



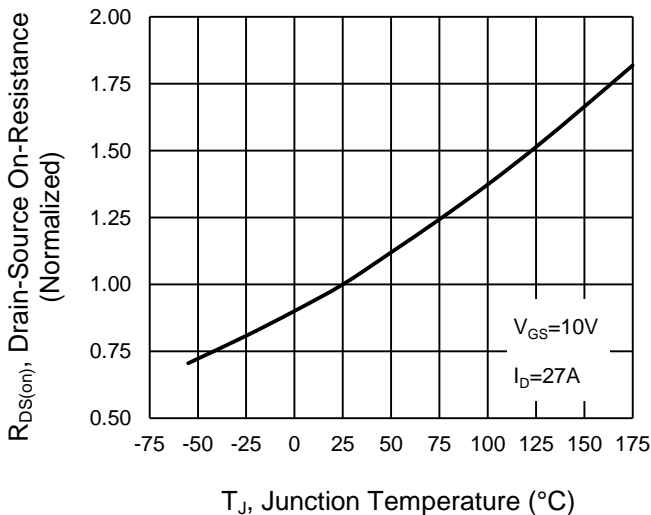
**On-Resistance vs. Drain Current**



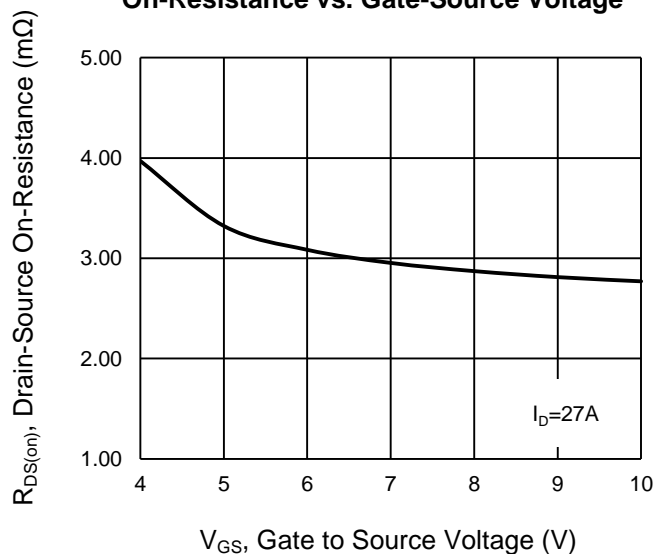
**Gate-Source Voltage vs. Gate Charge**



**On-Resistance vs. Junction Temperature**



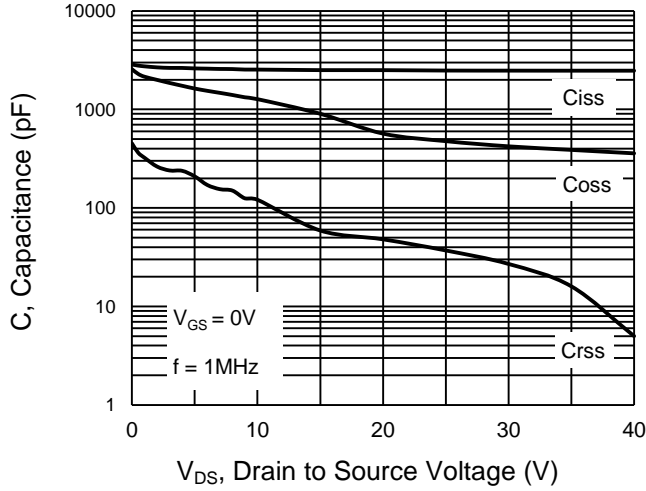
**On-Resistance vs. Gate-Source Voltage**



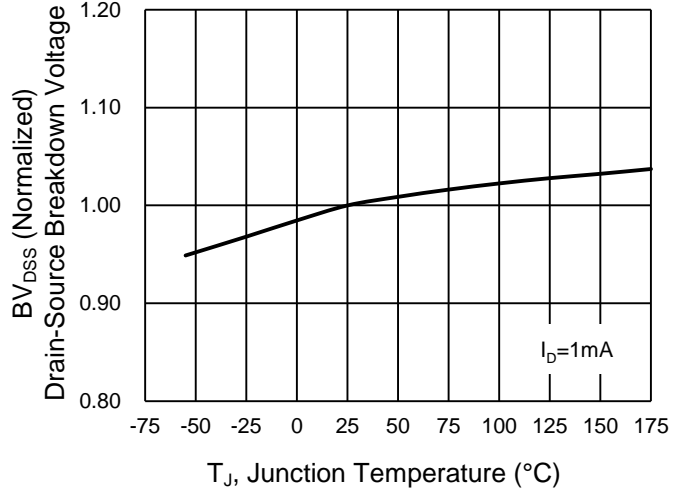
**CHARACTERISTICS CURVES**

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

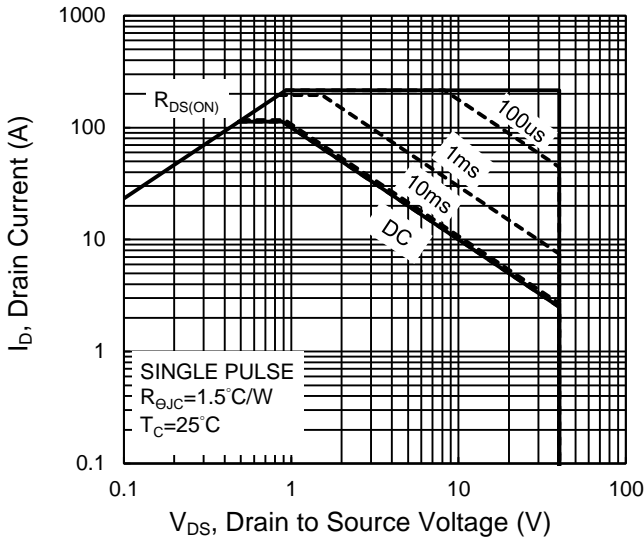
**Capacitance vs. Drain-Source Voltage**



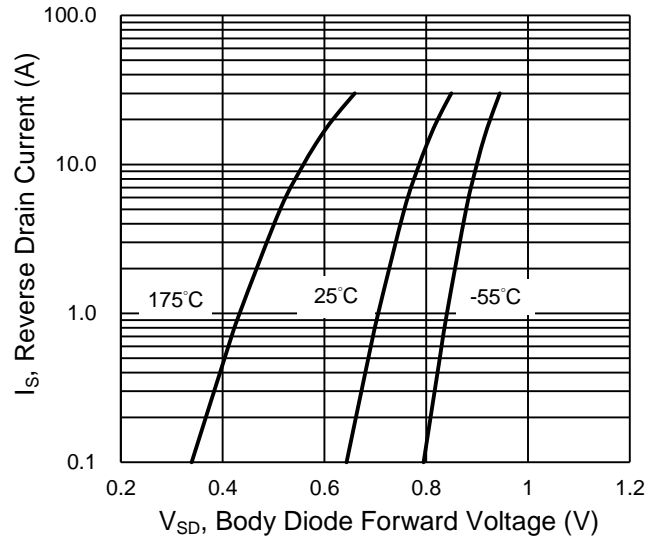
**$BV_{DSS}$  vs. Junction Temperature**



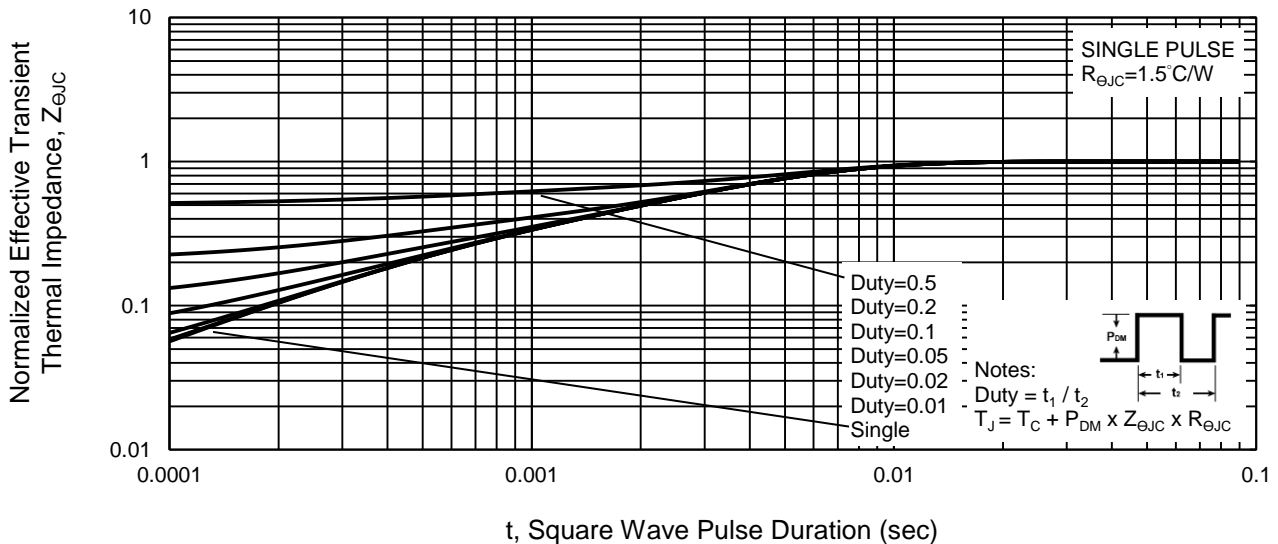
**Maximum Safe Operating Area, Junction-to-Case**



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

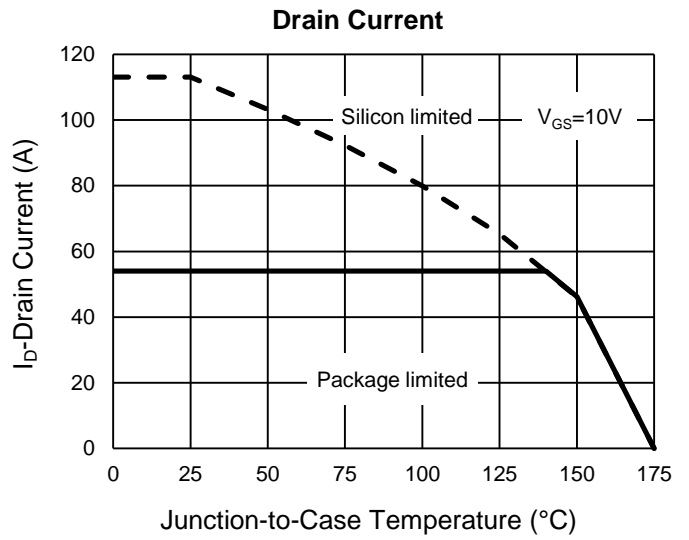
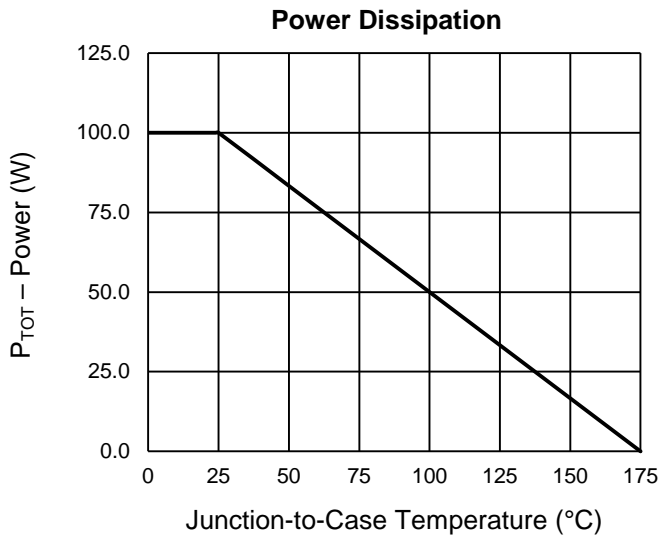


**Normalized Thermal Transient Impedance, Junction-to-Case**

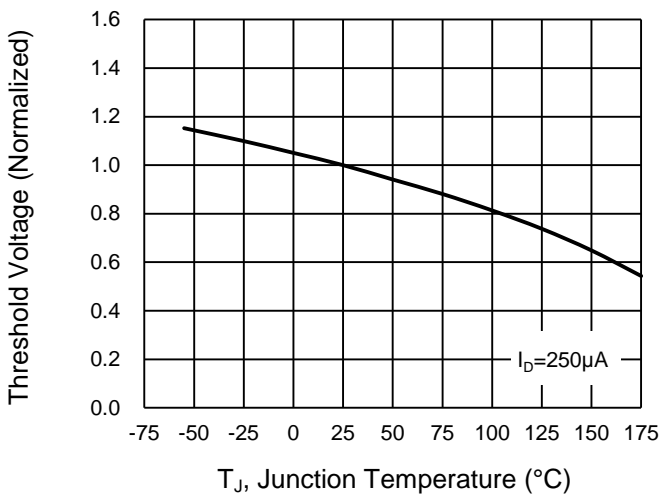


**CHARACTERISTICS CURVES**

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

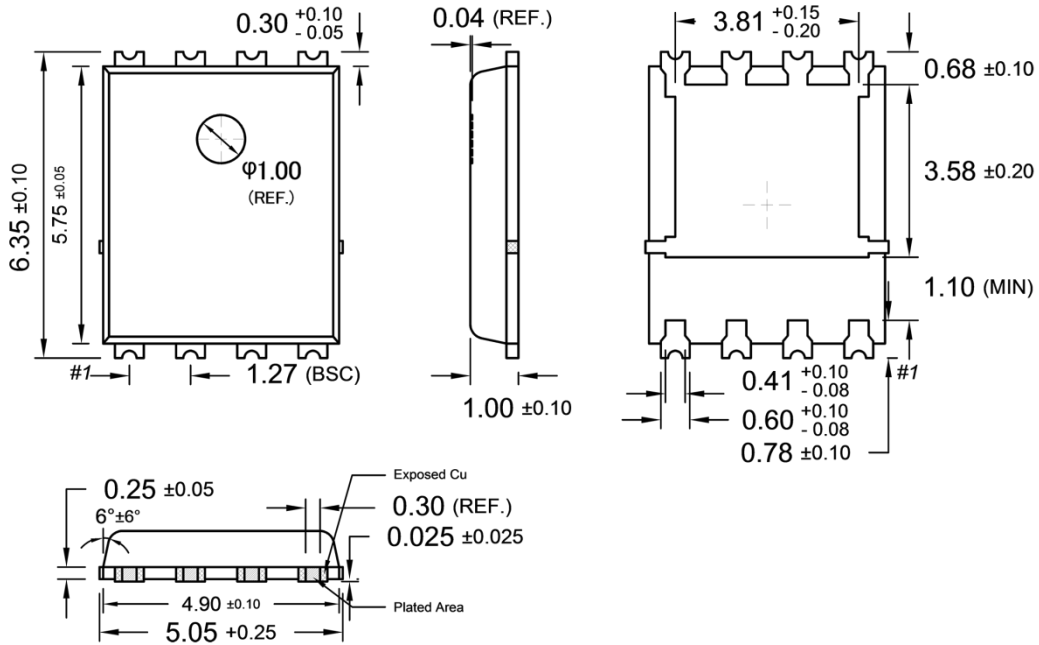


**Normalized gate threshold voltage vs Temperature**

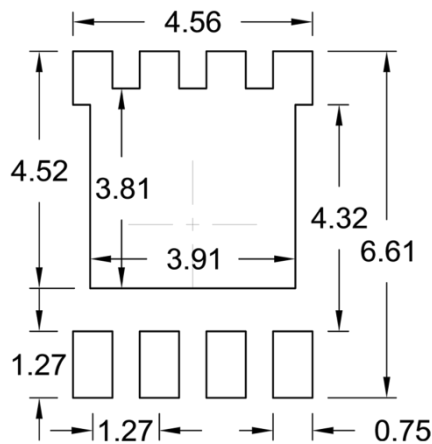


**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

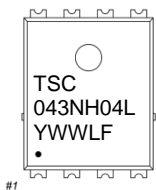
**PDFN56U**



**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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