

N-Channel Power MOSFET

40V, 170A, 2.0mΩ

FEATURES

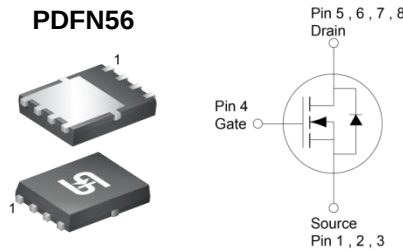
- Low $R_{DS(on)}$ to minimize conductive losses
- Logic level
- Low gate charge for fast power switching
- 100% UIS and R_g tested
- Compliant to RoHS directive 2011/65/EU and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21

KEY PERFORMANCE PARAMETERS

PARAMETER		VALUE	UNIT
V_{DS}		40	V
$R_{DS(on)}$ (max)	$V_{GS} = 10V$	2.0	mΩ
	$V_{GS} = 4.5V$	2.6	
Q_g		76	nC

APPLICATIONS

- BLDC Motor Control
- Battery Power Management
- DC-DC converter
- Secondary Synchronous Rectification



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}	± 20	V
Continuous Drain Current ^(Note 1)	$T_C = 25^\circ\text{C}$	I_D	170	A
	$T_A = 25^\circ\text{C}$		27	
Pulsed Drain Current		I_{DM}	680	A
Single Pulse Avalanche Current ^(Note 2)		I_{AS}	43	A
Single Pulse Avalanche Energy ^(Note 2)		E_{AS}	277	mJ
Total Power Dissipation	$T_C = 25^\circ\text{C}$	P_D	104	W
	$T_C = 125^\circ\text{C}$		21	
Total Power Dissipation	$T_A = 25^\circ\text{C}$	P_D	2.6	W
	$T_A = 125^\circ\text{C}$		0.5	
Operating Junction and Storage Temperature Range		T_J, T_{STG}	- 55 to +150	$^\circ\text{C}$

THERMAL PERFORMANCE

PARAMETER	SYMBOL	LIMIT	UNIT
Junction to Case Thermal Resistance	$R_{\theta JC}$	1.2	$^\circ\text{C/W}$
Junction to Ambient Thermal Resistance	$R_{\theta JA}$	48	$^\circ\text{C/W}$

Thermal Performance 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. $R_{\theta JA}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.

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

PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
Static						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 250\mu A$	BV_{DSS}	40	--	--	V
Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu A$	$V_{GS(TH)}$	1	1.5	2.5	V
Gate-Source Leakage Current	$V_{GS} = \pm 20V, V_{DS} = 0V$	I_{GSS}	--	--	± 100	nA
Drain-Source Leakage Current	$V_{GS} = 0V, V_{DS} = 40V$	I_{DSS}	--	--	1	μA
	$V_{GS} = 0V, V_{DS} = 40V$ $T_J = 125^{\circ}C$		--	--	100	
Drain-Source On-State Resistance (Note 3)	$V_{GS} = 10V, I_D = 27A$	$R_{DS(on)}$	--	1.5	2.0	m Ω
	$V_{GS} = 4.5V, I_D = 27A$		--	1.8	2.6	
Forward Transconductance (Note 3)	$V_{DS} = 5V, I_D = 27A$	g_{fs}	--	43	--	S
Dynamic (Note 4)						
Total Gate Charge	$V_{GS} = 10V, V_{DS} = 20V,$ $I_D = 27A$	Q_g	--	150	--	nC
Total Gate Charge	$V_{GS} = 4.5V, V_{DS} = 20V,$ $I_D = 27A$	Q_g	--	76	--	
Gate-Source Charge		Q_{gs}	--	21	--	
Gate-Drain Charge		Q_{gd}	--	32	--	
Input Capacitance	$V_{GS} = 0V, V_{DS} = 20V$ $f = 1.0MHz$	C_{iss}	--	7942	--	pF
Output Capacitance		C_{oss}	--	768	--	
Reverse Transfer Capacitance		C_{rss}	--	498	--	
Gate Resistance	$f = 1.0MHz$	R_g	0.4	1.2	2.4	Ω
Switching (Note 4)						
Turn-On Delay Time	$V_{GS} = 10V, V_{DS} = 20V,$ $I_D = 27A, R_G = 2\Omega,$	$t_{d(on)}$	--	7.6	--	ns
Turn-On Rise Time		t_r	--	8.8	--	
Turn-Off Delay Time		$t_{d(off)}$	--	67	--	
Turn-Off Fall Time		t_f	--	31	--	
Source-Drain Diode						
Forward Voltage (Note 3)	$V_{GS} = 0V, I_S = 27A$	V_{SD}	--	--	1.2	V
Reverse Recovery Time	$I_S = 27A,$ $di/dt = 100A/\mu s$	t_{rr}	--	43	--	ns
Reverse Recovery Charge		Q_{rr}	--	35	--	nC

Notes:

- Silicon limited current only.
- $L = 0.3\text{mH}$, $V_{GS} = 10V$, $V_{DD} = 25V$, $R_G = 25\Omega$, $I_{AS} = 43A$, 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.

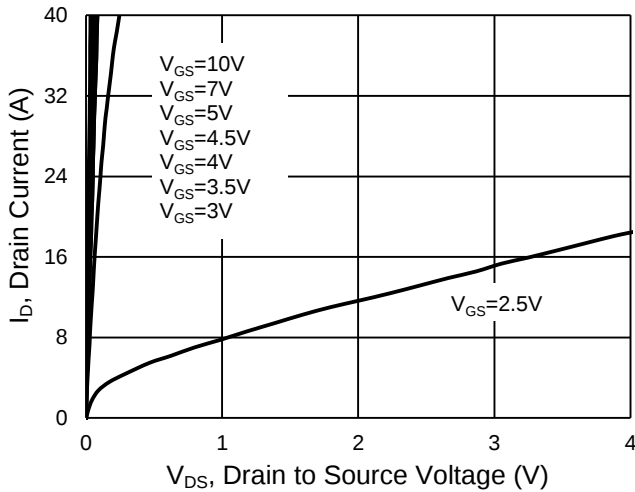
ORDERING INFORMATION

PART NO.	PACKAGE	PACKING
TSM020N04LCR RLG	PDFN56	2,500pcs / 13"Reel

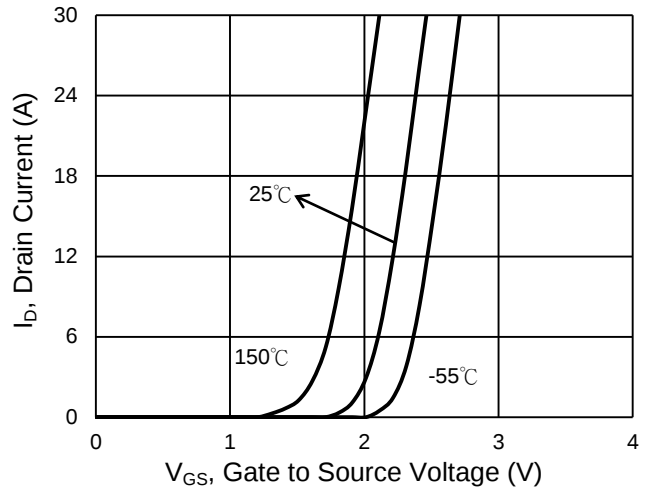
CHARACTERISTICS CURVES

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

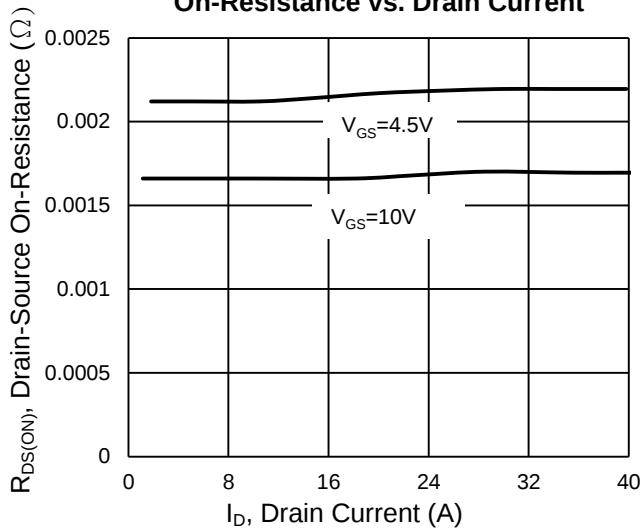
Output Characteristics



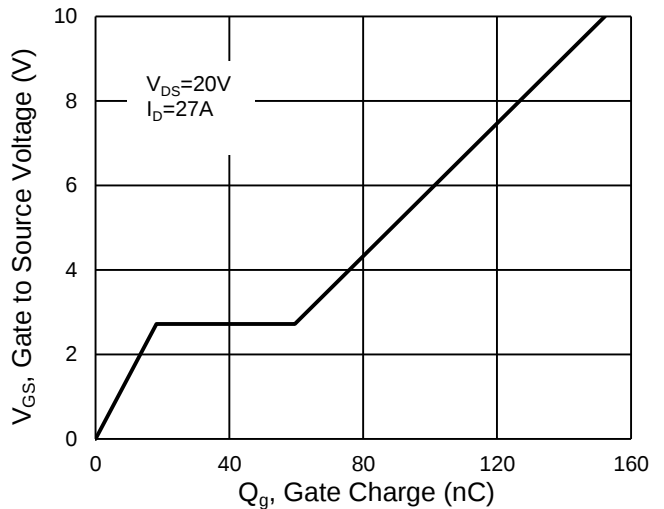
Transfer Characteristics



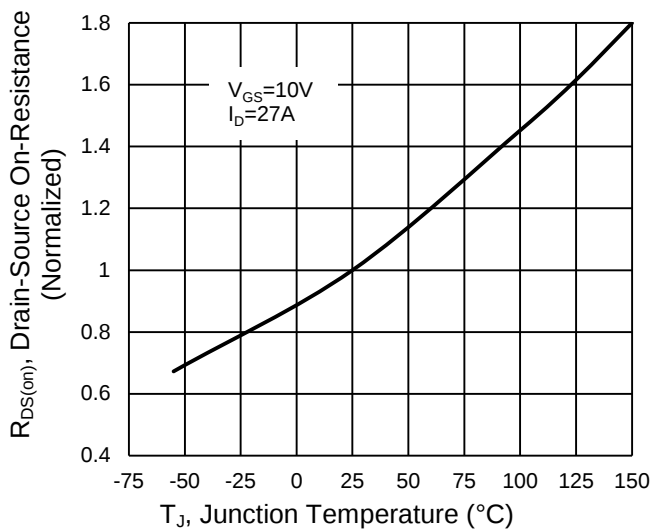
On-Resistance vs. Drain Current



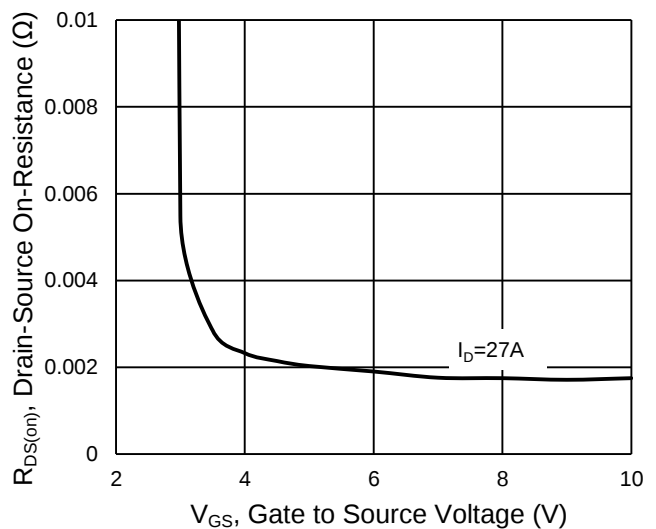
Gate-Source Voltage vs. Gate Charge



On-Resistance vs. Junction Temperature



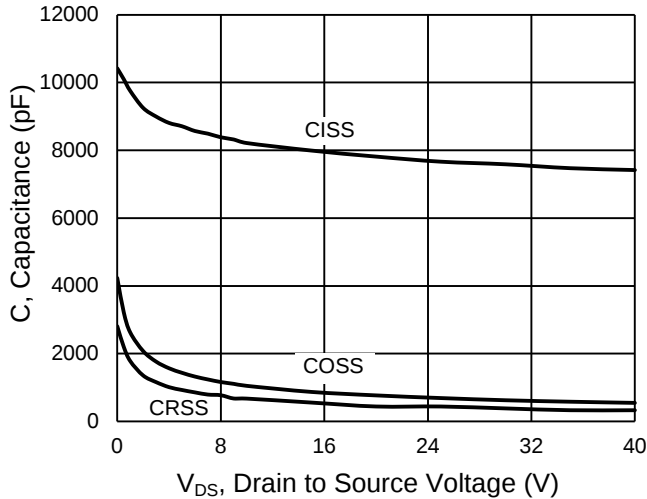
On-Resistance vs. Gate-Source Voltage



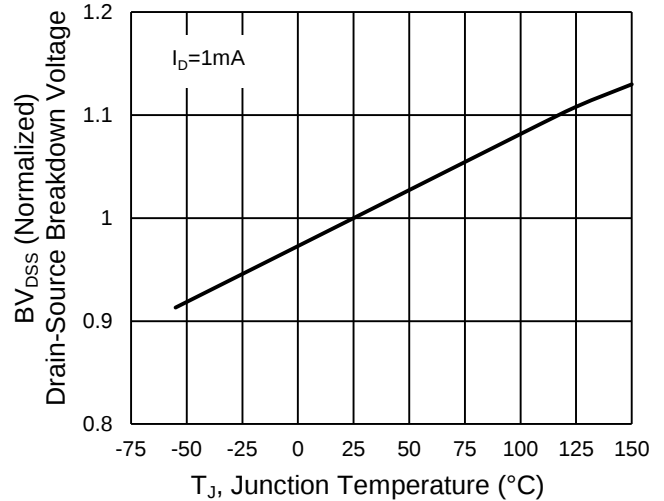
CHARACTERISTICS CURVES

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

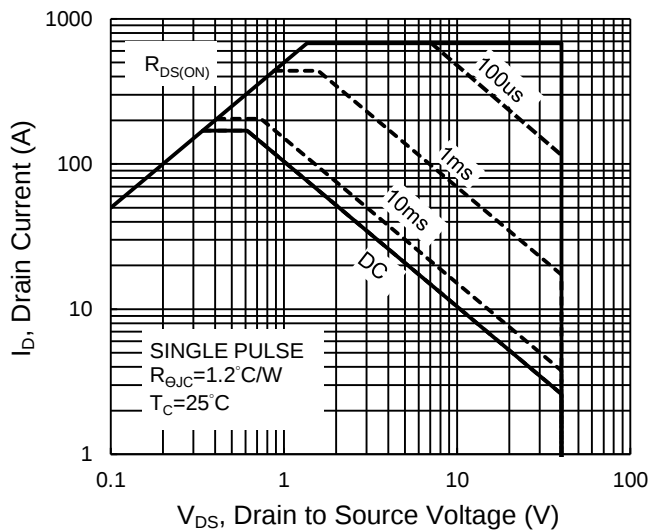
Capacitance vs. Drain-Source Voltage



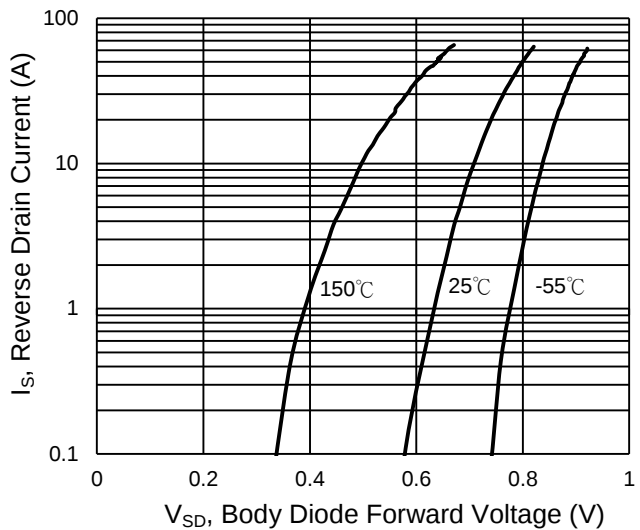
BV_{DSS} vs. Junction Temperature



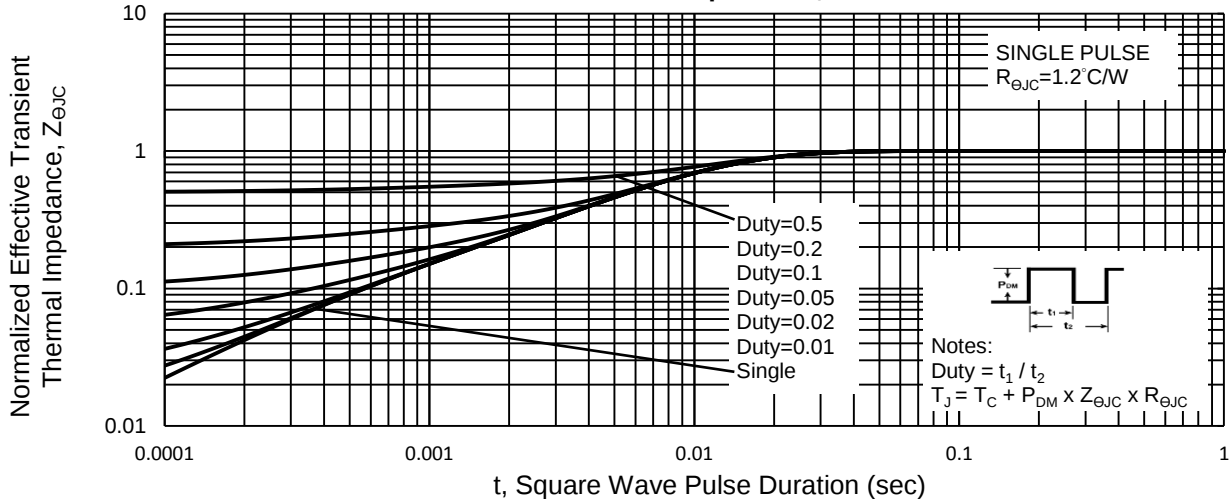
Maximum Safe Operating Area, Junction-to-Case



Source-Drain Diode Forward Current vs. Voltage

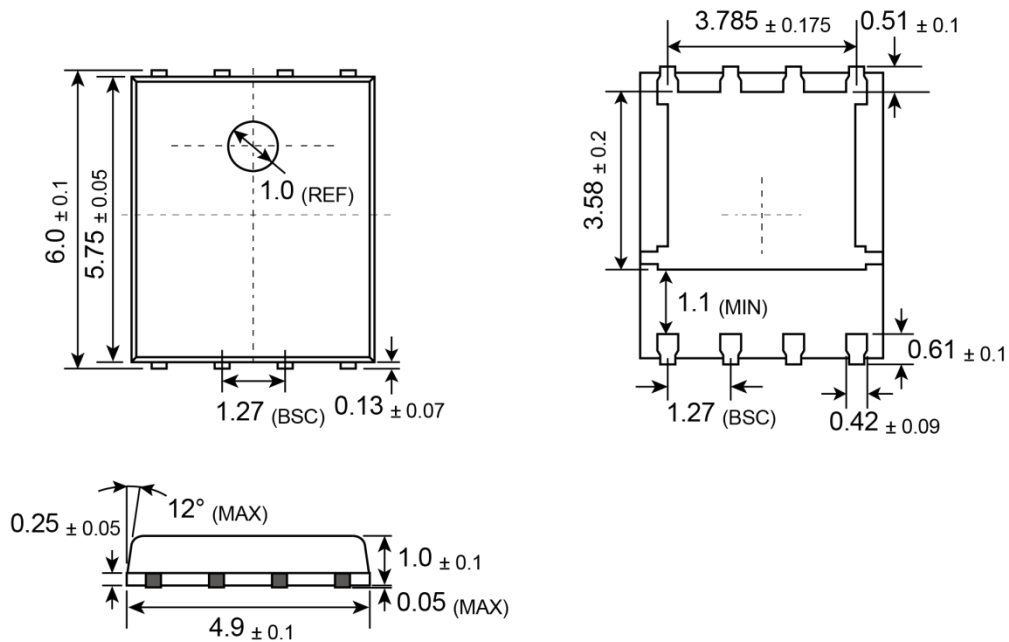


Normalized Thermal Transient Impedance, Junction-to-Case

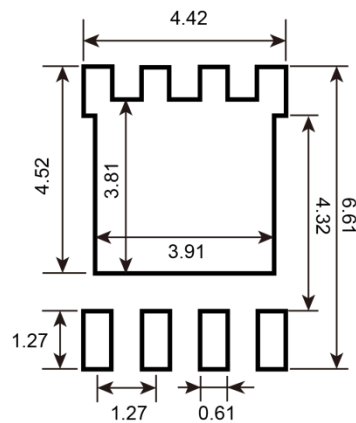


PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

PDFN56



SUGGESTED PAD LAYOUT (Unit: Millimeters)



MARKING DIAGRAM



- G** = Halogen Free
- Y** = Year Code
- WW** = Week Code (01~52)
- F** = Factory Code

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Телефон: +7 812 627 14 35

Электронная почта: sales@st-electron.ru

Адрес: 198099, Санкт-Петербург,
Промышленная ул, дом № 19, литера Н,
помещение 100-Н Офис 331