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

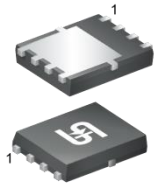
KEY PERFORMANCE PARAMETERS			
PARAMETER		**VALUE**	**UNIT**
V_{DS}		40	V
$R_{DS(on)}$ (max)	V_{GS} = 10V	2.0	mΩ
	V_{GS} = 4.5V	2.6	
Q_g		76	nC

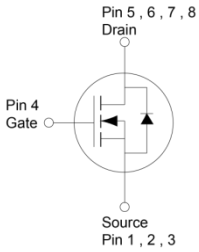
APPLICATIONS

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

Pb-Free RoHS COMPLIANT HALOGEN FREE

PDFN56





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}	±20	V
Continuous Drain Current (Note 1)	T_C = 25°C	I_D	170	A
	T_A = 25°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°C	P_D	104	W
	T_C = 125°C		21	
Total Power Dissipation	T_A = 25°C	P_D	2.6	W
	T_A = 125°C		0.5	
Operating Junction and Storage Temperature Range		T_J, T_{STG}	- 55 to +150	°C

THERMAL PERFORMANCE			
PARAMETER	**SYMBOL**	**LIMIT**	**UNIT**
Junction to Case Thermal Resistance	$R_{\Theta JC}$	1.2	°C/W
Junction to Ambient Thermal Resistance	$R_{\Theta JA}$	48	°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°C unless otherwise noted)						
PARAMETER	**CONDITIONS**	**SYMBOL**	**MIN**	**TYP**	**MAX**	**UNIT**
Static						
Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250uA	BV_{DSS}	40	--	--	V
Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250μA	$V_{GS(TH)}$	1	1.5	2.5	V
Gate-Source Leakage Current	V_{GS} = ±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°C		--	--	100	
Drain-Source On-State Resistance (Note 3)	V_{GS} = 10V, I_D = 27A	$R_{DS(on)}$	--	1.5	2.0	mΩ
	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 = 2Ω,	$t_{d(on)}$	--	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/μs	t_{rr}	--	43	--	ns
Reverse Recovery Charge		Q_{rr}	--	35	--	nC

Notes:

1. Silicon limited current only.
2. L = 0.3mH, V_{GS} = 10V, V_{DD} = 25V, R_G = 25Ω, I_{AS} = 43A, Starting T_J = 25°C
3. Pulse test: Pulse Width ≤ 300μs, duty cycle ≤ 2%.
4. Switching time is essentially independent of operating temperature.

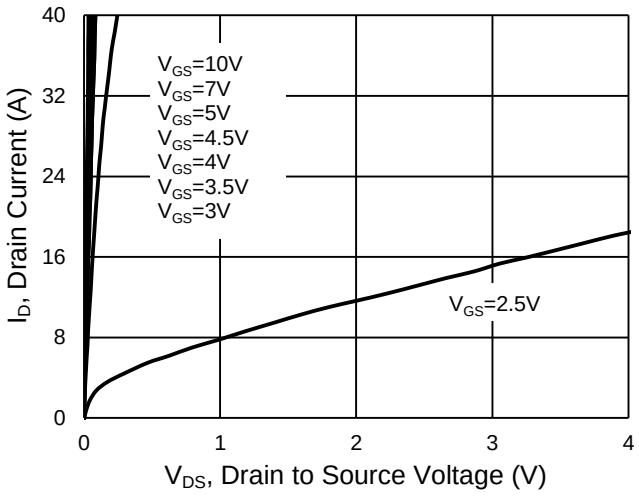
ORDERING INFORMATION

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

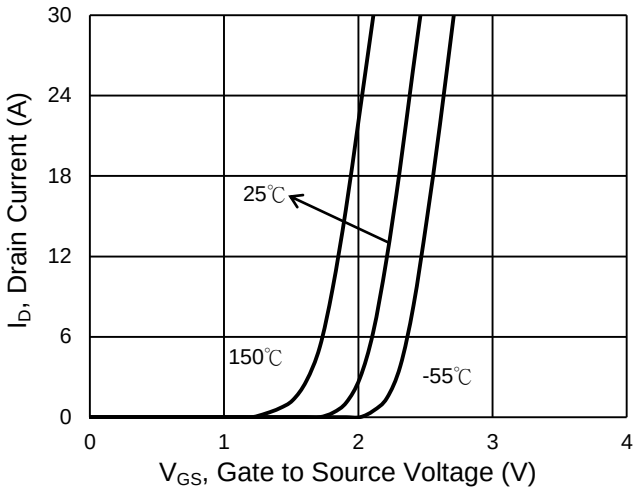
CHARACTERISTICS CURVES

(T_A = 25°C unless otherwise noted)

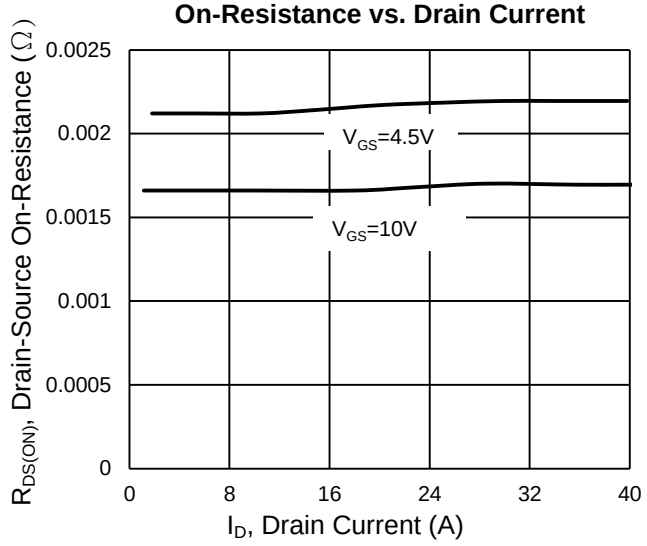
Output Characteristics



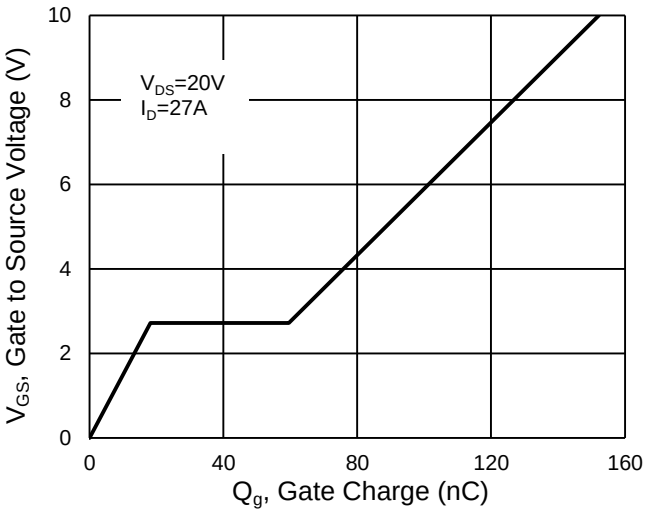
Transfer Characteristics



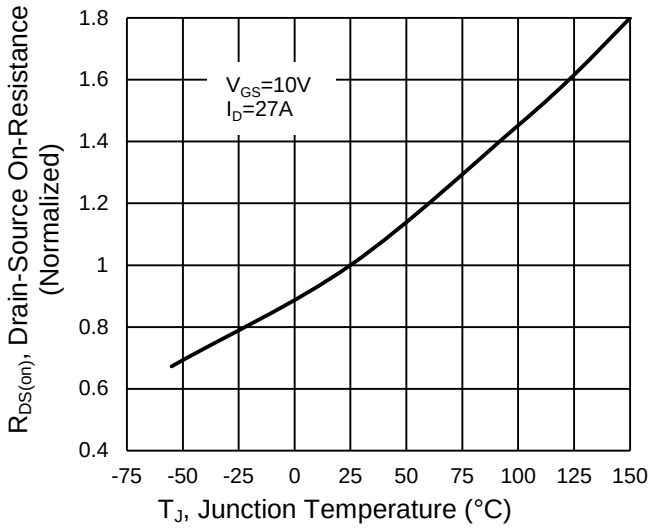
On-Resistance vs. Drain Current



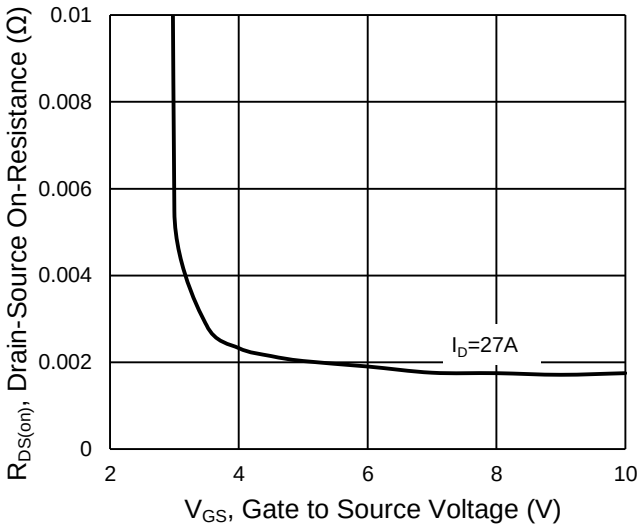
Gate-Source Voltage vs. Gate Charge



On-Resistance vs. Junction Temperature



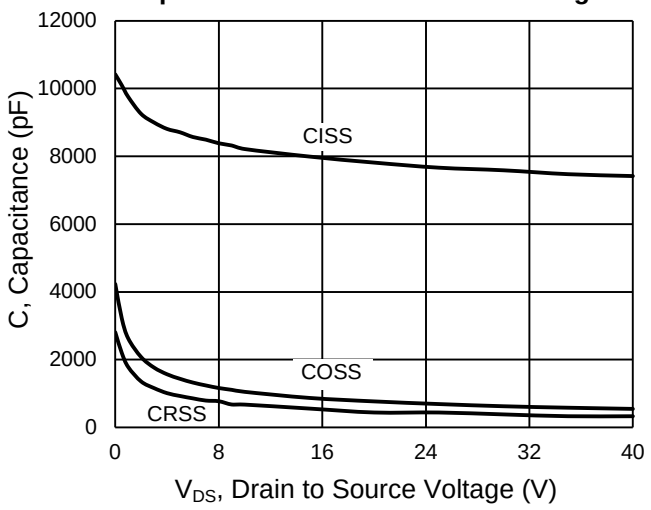
On-Resistance vs. Gate-Source Voltage



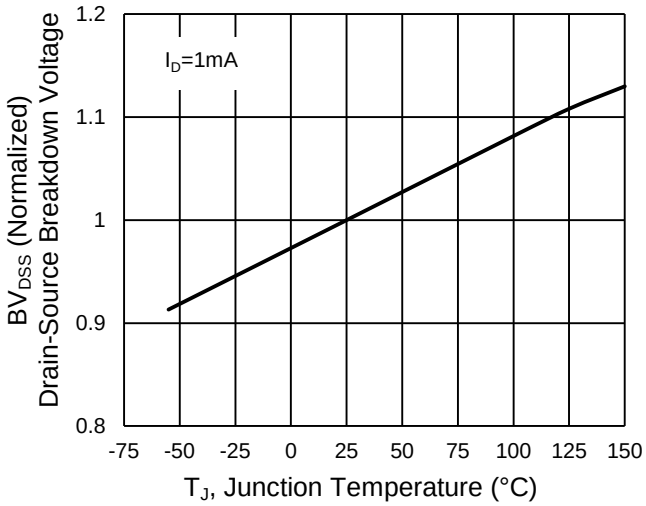
CHARACTERISTICS CURVES

(T_A = 25°C unless otherwise noted)

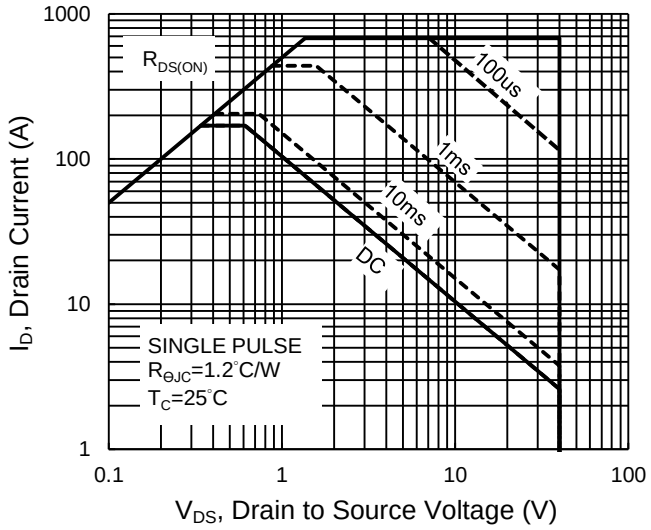
Capacitance vs. Drain-Source Voltage



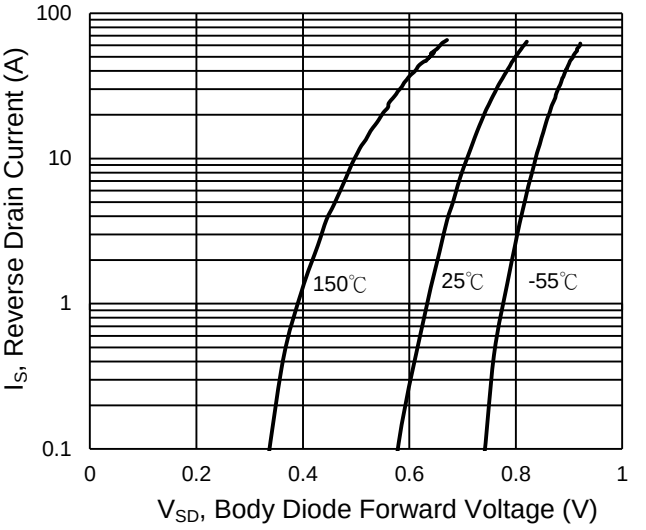
BV_{DSS} vs. Junction Temperature



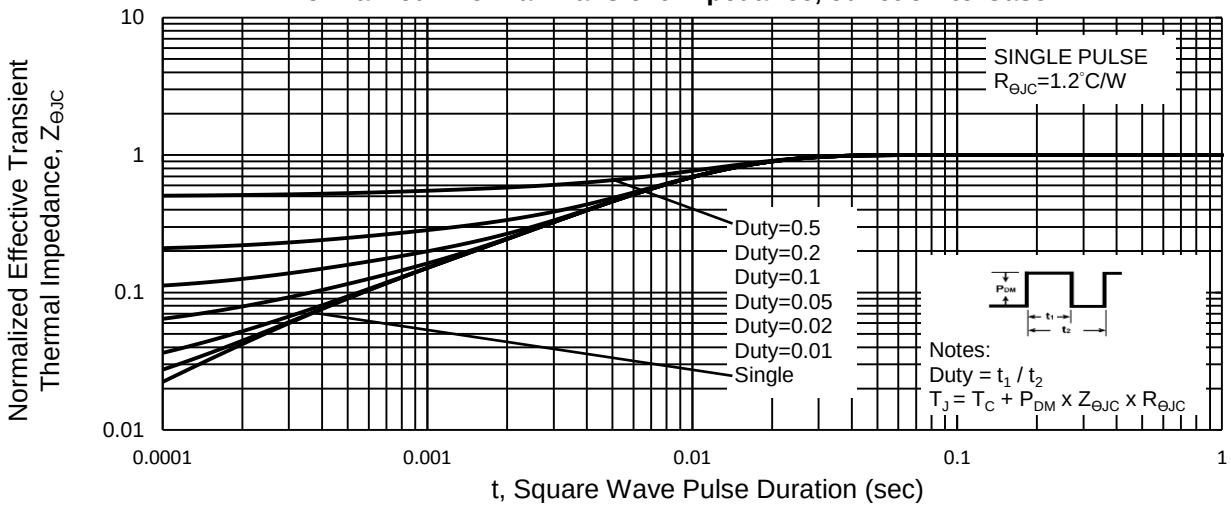
Maximum Safe Operating Area, Junction-to-Case



Source-Drain Diode Forward Current vs. Voltage

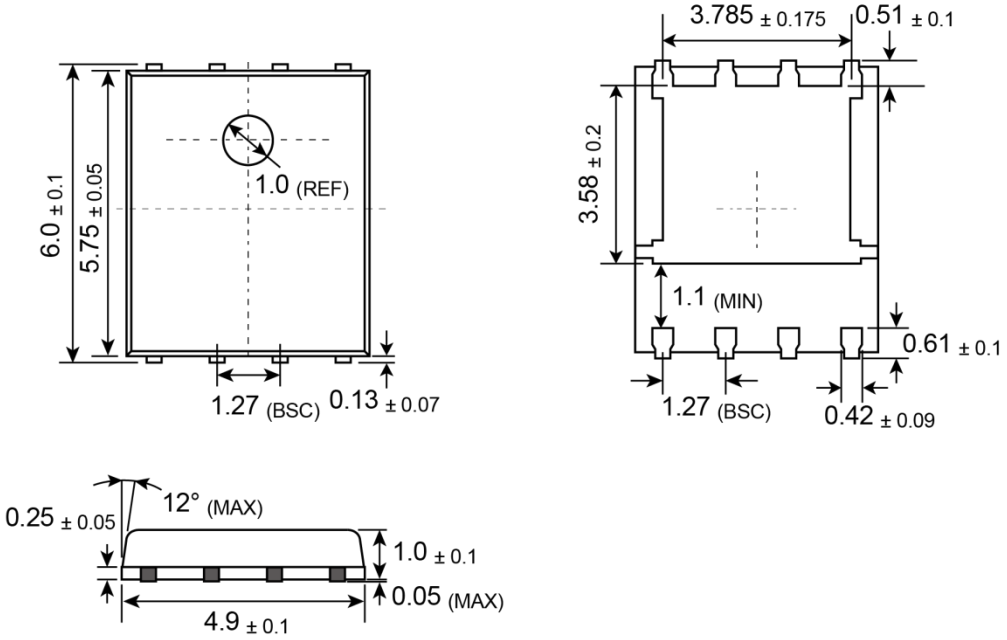


Normalized Thermal Transient Impedance, Junction-to-Case

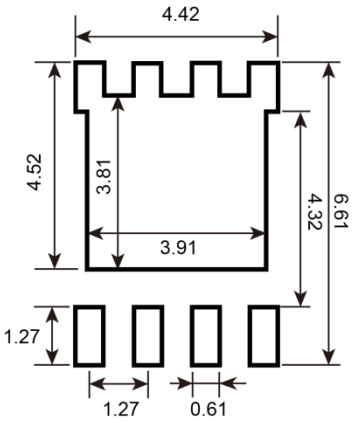


PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

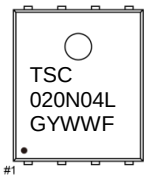
PDFN56



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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