

N-Channel Power MOSFET

60V, 35A, 22mΩ

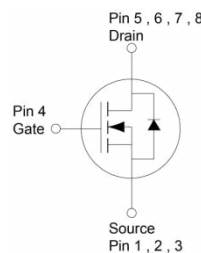
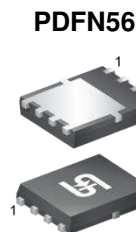
FEATURES

- Low $R_{DS(on)}$ to minimize conductive losses
- Logic level
- Low gate charge for fast power switching
- 100% UIS and R_g tested.
- 175°C Operating Junction Temperature
- Compliant to RoHS directive 2011/65/EU and in accordance to WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21

APPLICATIONS

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

KEY PERFORMANCE PARAMETERS		
PARAMETER	VALUE	UNIT
V_{DS}	60	V
$R_{DS(on)}$ (max)	$V_{GS} = 10V$	22
	$V_{GS} = 4.5V$	28
Q_g	12	nC



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}	60	V
Gate-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current (Note 1)	I_D	$T_C = 25^\circ\text{C}$	35
		$T_A = 25^\circ\text{C}$	8
Pulsed Drain Current	I_{DM}	140	A
Single Pulse Avalanche Current (Note 2)	I_{AS}	13	A
Single Pulse Avalanche Energy (Note 2)	E_{AS}	25	mJ
Total Power Dissipation	P_D	$T_C = 25^\circ\text{C}$	68
		$T_C = 125^\circ\text{C}$	23
Total Power Dissipation	P_D	$T_A = 25^\circ\text{C}$	3.1
		$T_A = 125^\circ\text{C}$	1
Operating Junction and Storage Temperature Range	T_J, T_{STG}	- 55 to +175	$^\circ\text{C}$

THERMAL PERFORMANCE			
PARAMETER	SYMBOL	LIMIT	UNIT
Junction to Case Thermal Resistance	$R_{\theta JC}$	2.2	$^\circ\text{C}/\text{W}$
Junction to Ambient Thermal Resistance	$R_{\theta JA}$	48	$^\circ\text{C}/\text{W}$

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. The $R_{\theta JA}$ limit presented here is based on mounting on a 1 in² pad of 2 oz copper.

ELECTRICAL SPECIFICATIONS ($T_A = 25^\circ\text{C}$ unless otherwise noted)						
PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
Static						
Drain-Source Breakdown Voltage	$V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$	BV_{DSS}	60	--	--	V
Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 250\mu\text{A}$	$V_{GS(TH)}$	1	1.7	2.5	V
Gate-Source Leakage Current	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$	I_{GSS}	--	--	± 100	nA
Drain-Source Leakage Current	$V_{GS} = 0\text{V}, V_{DS} = 60\text{V}$	I_{DSS}	--	--	1	μA
	$V_{GS} = 0\text{V}, V_{DS} = 60\text{V}$ $T_J = 125^\circ\text{C}$		--	--	100	
Drain-Source On-State Resistance (Note 3)	$V_{GS} = 10\text{V}, I_D = 8\text{A}$	$R_{DS(on)}$	--	18	22	m Ω
	$V_{GS} = 4.5\text{V}, I_D = 7\text{A}$		--	21	28	
Forward Transconductance (Note 3)	$V_{DS} = 10\text{V}, I_D = 8\text{A}$	g_{fs}	--	36	--	S
Dynamic (Note 4)						
Total Gate Charge	$V_{GS} = 10\text{V}, V_{DS} = 30\text{V},$ $I_D = 8\text{A}$	Q_g	--	23	--	nC
Total Gate Charge	$V_{GS} = 4.5\text{V}, V_{DS} = 30\text{V},$ $I_D = 7\text{A}$	Q_g	--	12	--	
Gate-Source Charge		Q_{gs}	--	4	--	
Gate-Drain Charge		Q_{gd}	--	5	--	
Input Capacitance	$V_{GS} = 0\text{V}, V_{DS} = 30\text{V}$ $f = 1.0\text{MHz}$	C_{iss}	--	1314	--	pF
Output Capacitance		C_{oss}	--	91	--	
Reverse Transfer Capacitance		C_{rss}	--	26	--	
Gate Resistance	$f = 1.0\text{MHz}$	R_g	0.6	2	4	Ω
Switching (Note 4)						
Turn-On Delay Time	$V_{GS} = 10\text{V}, V_{DS} = 30\text{V},$ $I_D = 8\text{A}, R_G = 2\Omega$	$t_{d(on)}$	--	1	--	ns
Turn-On Rise Time		t_r	--	19	--	
Turn-Off Delay Time		$t_{d(off)}$	--	14	--	
Turn-Off Fall Time		t_f	--	18	--	
Source-Drain Diode						
Forward Voltage (Note 3)	$V_{GS} = 0\text{V}, I_S = 8\text{A}$	V_{SD}	--	--	1.2	V
Reverse Recovery Time	$I_S = 8\text{A},$ $di/dt = 100\text{A}/\mu\text{s}$	t_{rr}	--	12	--	ns
Reverse Recovery Charge		Q_{rr}	--	6	--	nC

Notes:

- Silicon limited current only.
- $L = 0.3\text{mH}, V_{GS} = 10\text{V}, V_{DD} = 30\text{V}, R_G = 25\Omega, I_{AS} = 13\text{A}$, Starting $T_J = 25^\circ\text{C}$
- Pulse test: Pulse Width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$.
- Switching time is essentially independent of operating temperature.

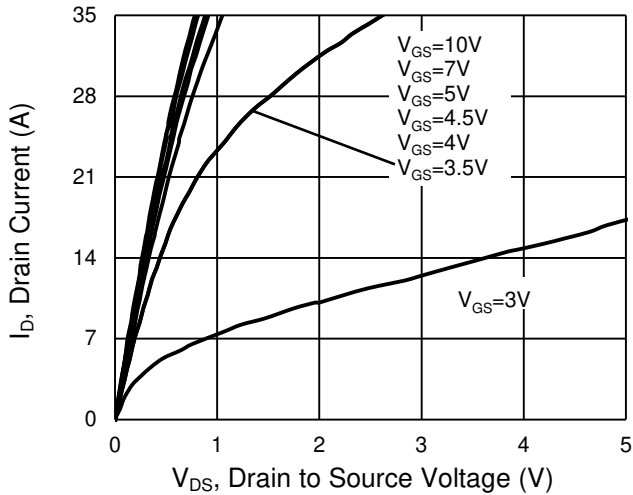
ORDERING INFORMATION

PART NO.	PACKAGE	PACKING
TSM220NB06LCR RLG	PDFN56	2,500pcs / 13" Reel

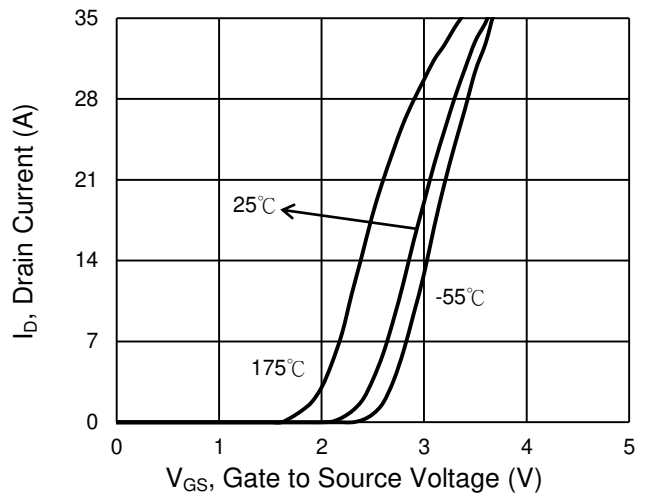
CHARACTERISTICS CURVES

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

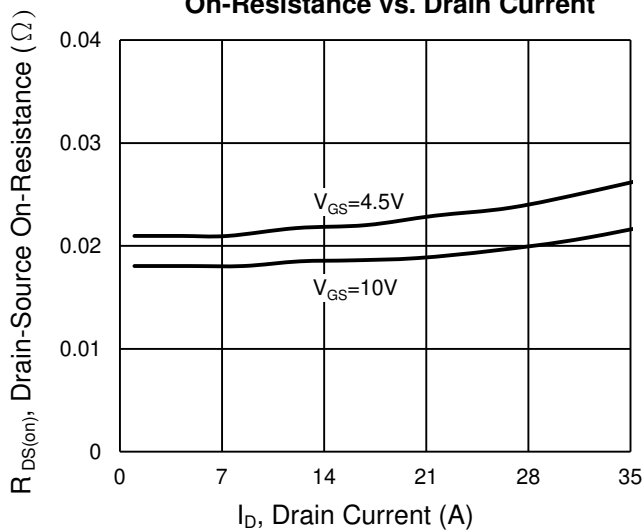
Output Characteristics



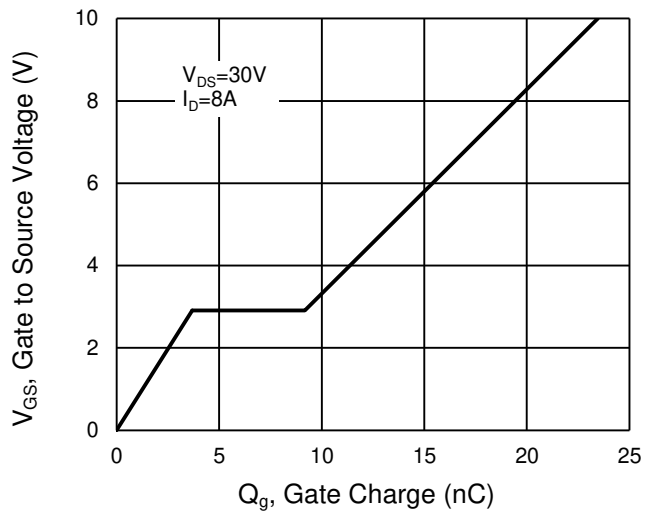
Transfer Characteristics



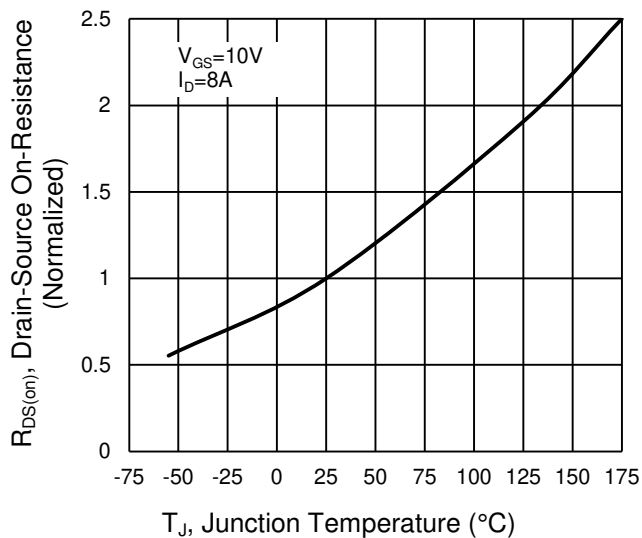
On-Resistance vs. Drain Current



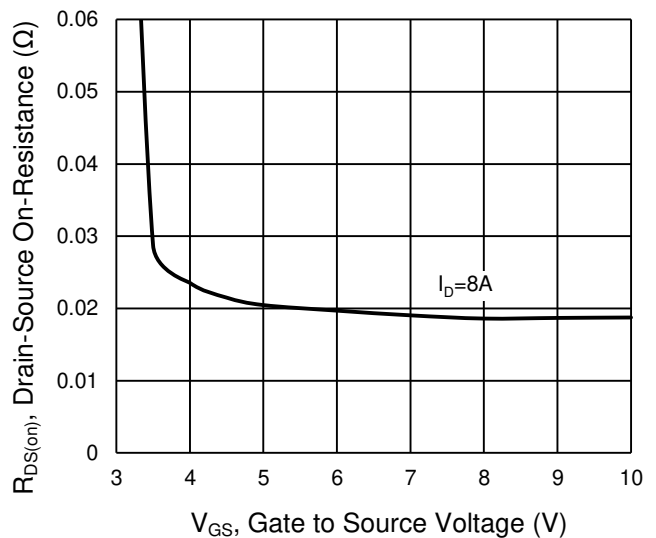
Gate-Source Voltage vs. Gate Charge



On-Resistance vs. Junction Temperature



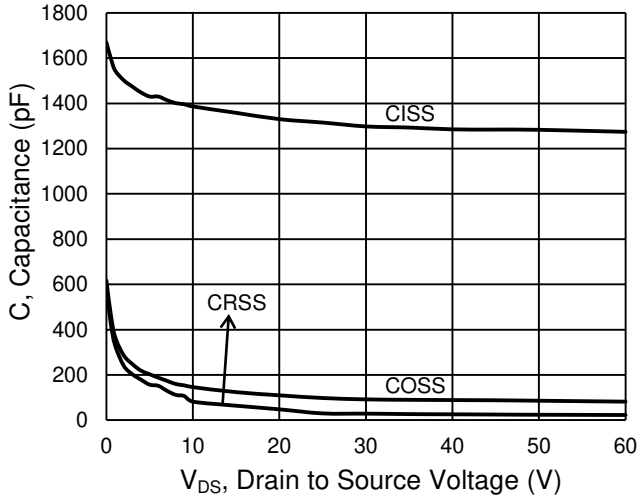
On-Resistance vs. Gate-Source Voltage



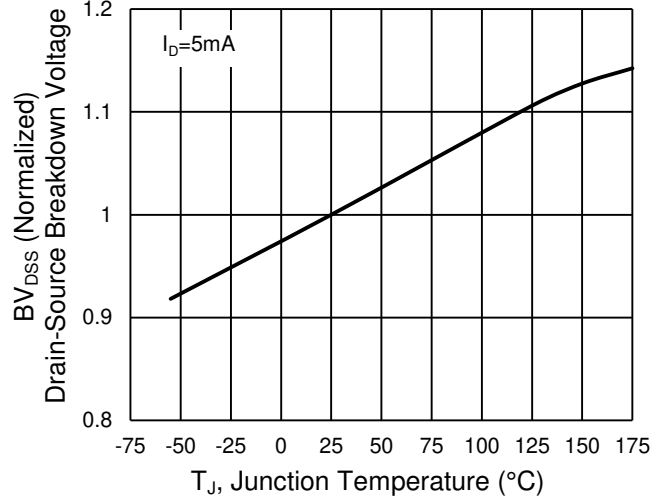
CHARACTERISTICS CURVES

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

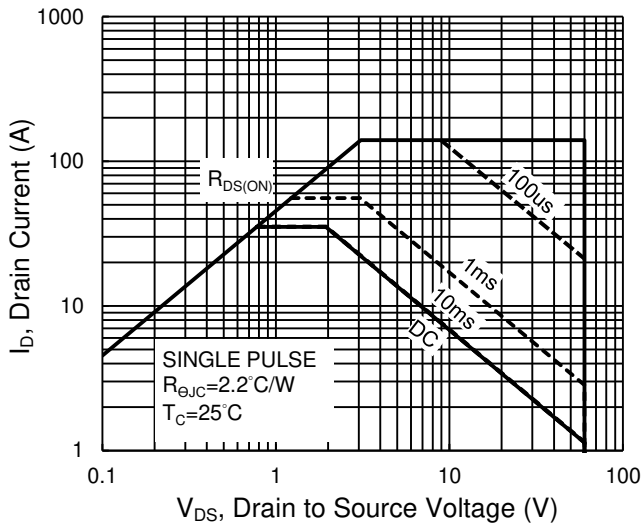
Capacitance vs. Drain-Source Voltage



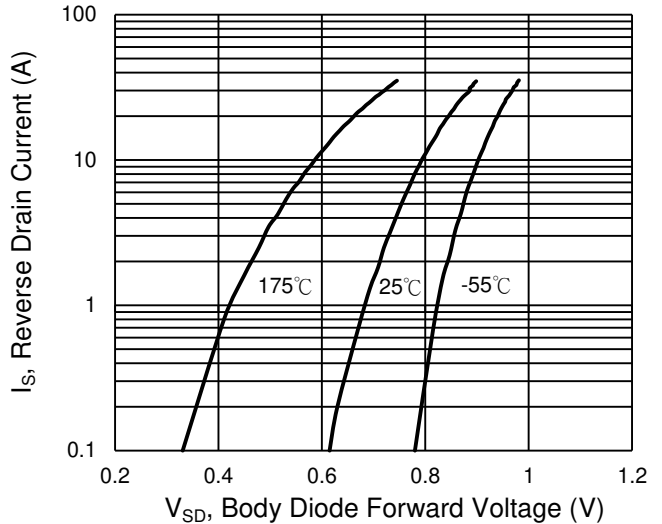
BV_{DSS} vs. Junction Temperature



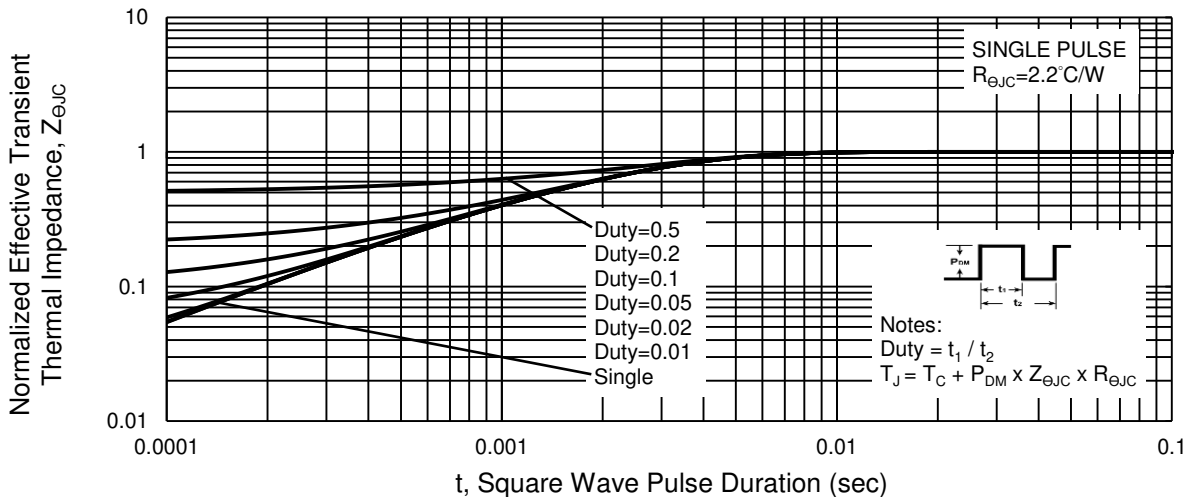
Maximum Safe Operating Area, Junction-to-Case



Source-Drain Diode Forward Current vs. Voltage

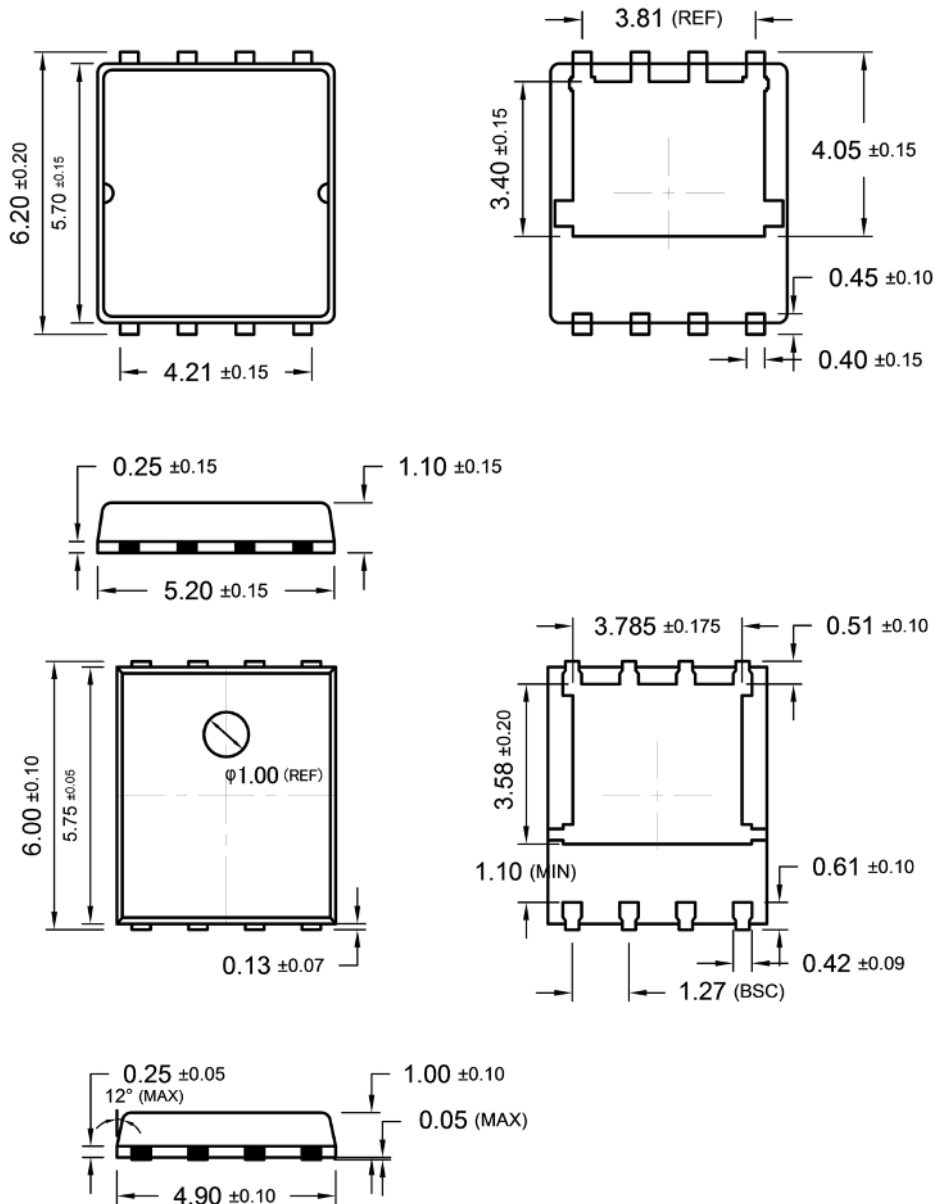


Normalized Thermal Transient Impedance, Junction-to-Case

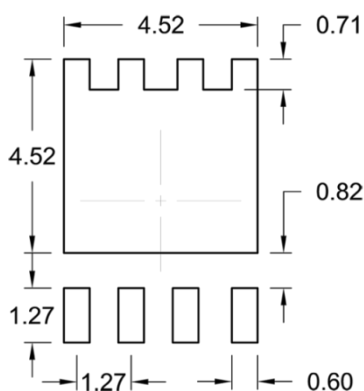


PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

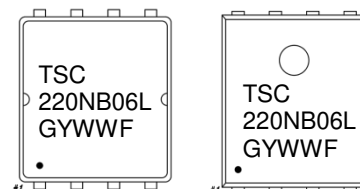
PDFN56



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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