

N-Channel Power MOSFET

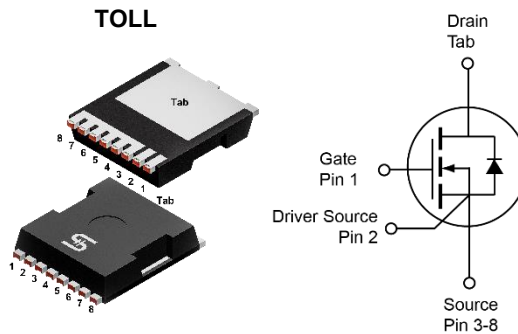
FEATURES

- Latest super-junction technology
- Low gate charge capacitance
- High gate noise immunity
- TOLL package offers good thermal performance
- The driver source pin (Kelvin-source) helps reduce switching losses
- RoHS compliant
- Halogen-free

APPLICATIONS

- Switching power supply
- HV motor driver

KEY PERFORMANCE PARAMETERS		
PARAMETER	VALUE	UNIT
$V_{DS} @ T_{j,max}$	650	V
$R_{DS(on)} (max)$	110	mΩ
$Q_{g,typ}$	55	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}	600	V
Gate-Source Voltage	static	V_{GS}	± 20	V
	AC($f > 1\text{Hz}$)		± 30	
Continuous Drain Current	$T_C = 25^\circ\text{C}$	I_D	30	A
Pulsed Drain Current (Note 1)		I_{DM}	90	A
Total Power Dissipation @ $T_C = 25^\circ\text{C}$		P_D	231	W
Single Pulse Avalanche Energy (Note 2)		E_{AS}	161	mJ
Single Pulse Avalanche Current (Note 2)		I_{AS}	2.4	A
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		$R_{\theta JC}$	0.54	$^\circ\text{C/W}$
Junction to Ambient Thermal Resistance (Note 3)		$R_{\theta JA}$	45	$^\circ\text{C/W}$

Notes:

1. Pulse Width $\leq 100\mu\text{s}$.
2. $L = 50\text{mH}$, $R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$.
3. Device on a PCB FR4 with 1 in² (single layer, 2 oz thickness) copper area for drain connection.

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

PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNIT
Static (Note 4)						
Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 1mA$	BV_{DSS}	600	--	--	V
Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 2.5mA$	$V_{GS(TH)}$	4	4.8	6	V
Gate Body Leakage	$V_{GS} = \pm 30V, V_{DS} = 0V$	I_{GSS}	--	--	± 100	nA
Zero Gate Voltage Drain Current	$V_{DS} = 600V, V_{GS} = 0V$	I_{DSS}	--	--	100	μA
Drain-Source On-State Resistance	$V_{GS} = 12V, I_D = 10A$	$R_{DS(on)}$	--	84	105	m Ω
	$V_{GS} = 10V, I_D = 10A$		--	88	110	
Dynamic (Note 5)						
Total Gate Charge	$V_{DS} = 480V, I_D = 30A,$ $V_{GS} = 10V$	Q_g	--	55	--	nC
Gate-Source Charge		Q_{gs}	--	20	--	
Gate-Drain Charge		Q_{gd}	--	30	--	
Input Capacitance	$V_{DS} = 300V, V_{GS} = 0V,$ $f = 100kHz$	C_{iss}	--	2340	--	pF
Output Capacitance		C_{oss}	--	69	--	
Effective output capacitance energy related	$V_{GS} = 0V$	$C_{o(er)}$	--	144	--	
Effective output capacitance time related	$V_{DS} = 0V$ to 480V	$C_{o(tr)}$	--	605	--	
Gate Resistance	$f = 1.0MHz$	R_g	--	1.3	--	Ω
Switching (Note 6)						
Turn-On Delay Time	$V_{DD} = 300V, R_G = 3.3\Omega,$ $I_D = 30A, V_{GS} = 10V$	$t_{d(on)}$	--	40	--	ns
Turn-On Rise Time		t_r	--	64	--	
Turn-Off Delay Time		$t_{d(off)}$	--	58	--	
Turn-Off Fall Time		t_f	--	39	--	
Source-Drain Diode						
Forward Voltage (Note 4)	$I_S = 10A, V_{GS} = 0V$	V_{SD}	--	--	1.5	V
Reverse Recovery Time	$I_S = 15A$	t_{rr}	--	360	--	ns
Reverse Recovery Charge	$dI_F/dt = 100A/\mu s$	Q_{rr}	--	6.4	--	μC

Notes:

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

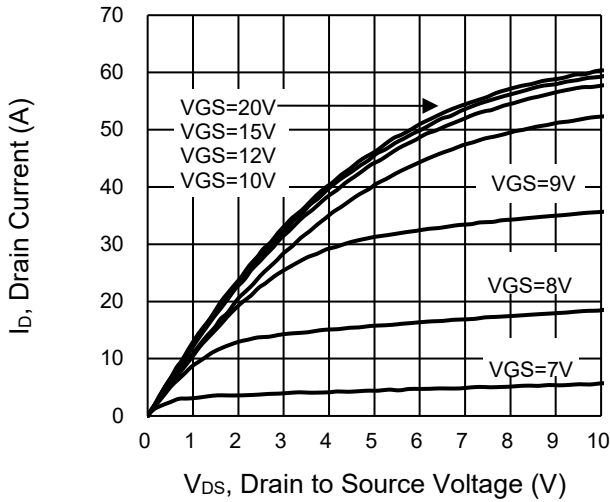
ORDERING INFORMATION

ORDERING CODE	PACKAGE	PACKING
TSM60NE110TL RAG	TOLL	2,000pcs / 13" Reel

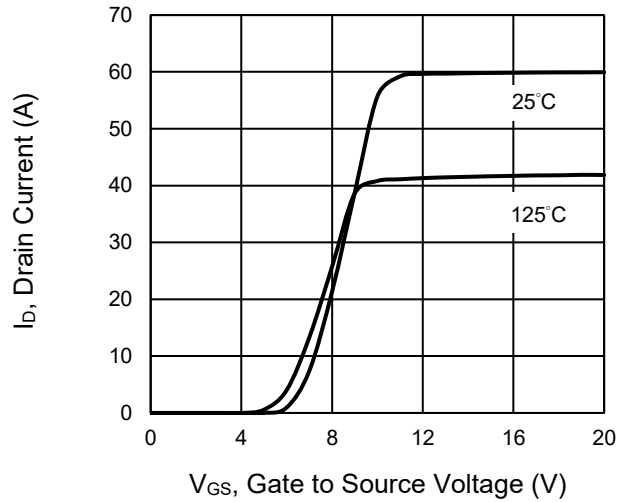
CHARACTERISTICS CURVES

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

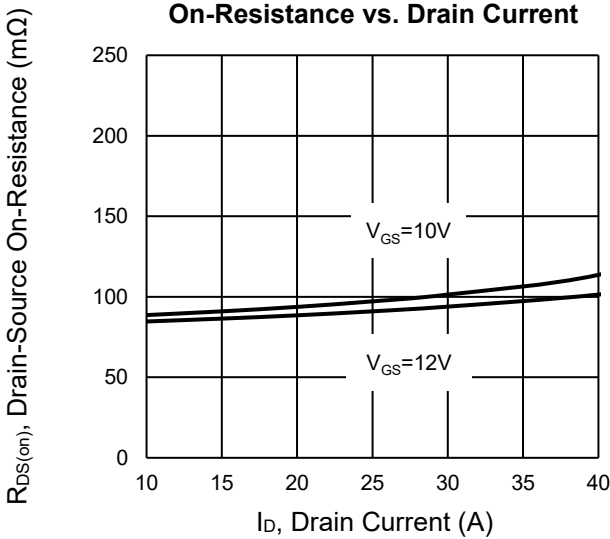
Output Characteristics



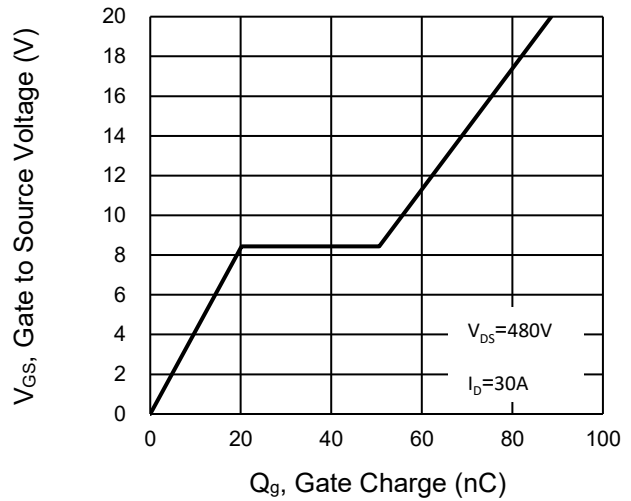
Transfer Characteristics



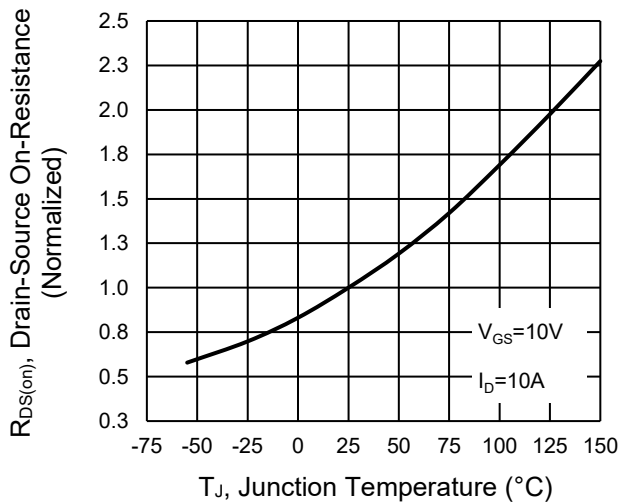
On-Resistance vs. Drain Current



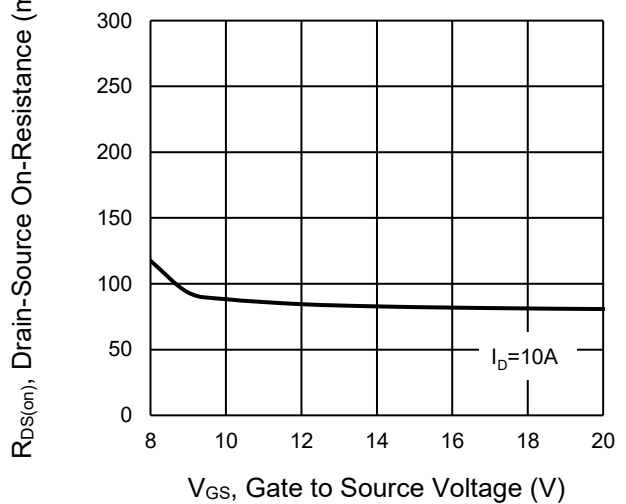
Gate-Source Voltage vs. Gate Charge



On-Resistance vs. Junction Temperature



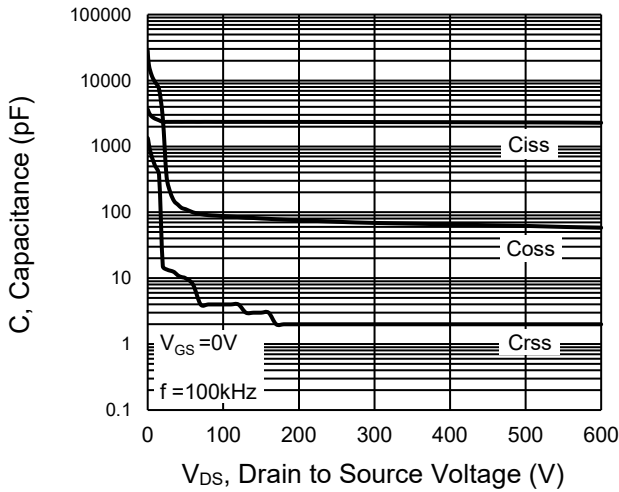
On-Resistance vs. Gate-Source Voltage



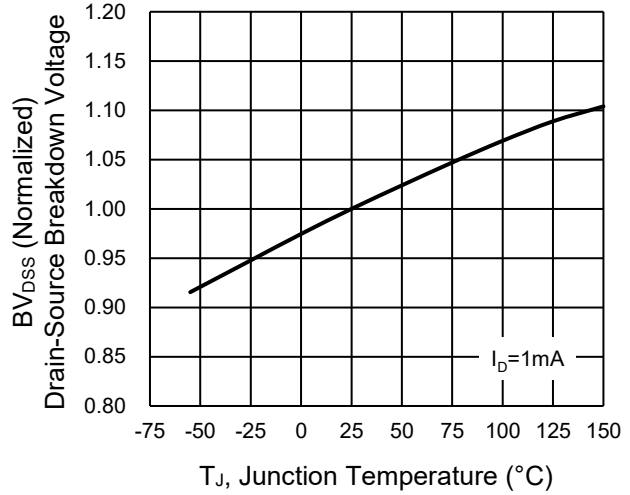
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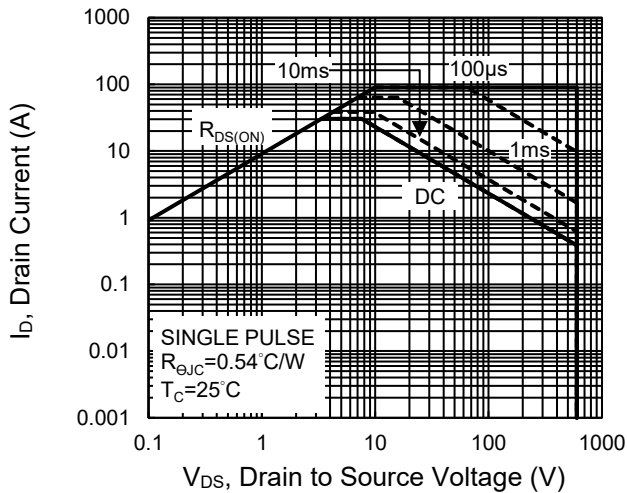
Capacitance vs. Drain-Source Voltage



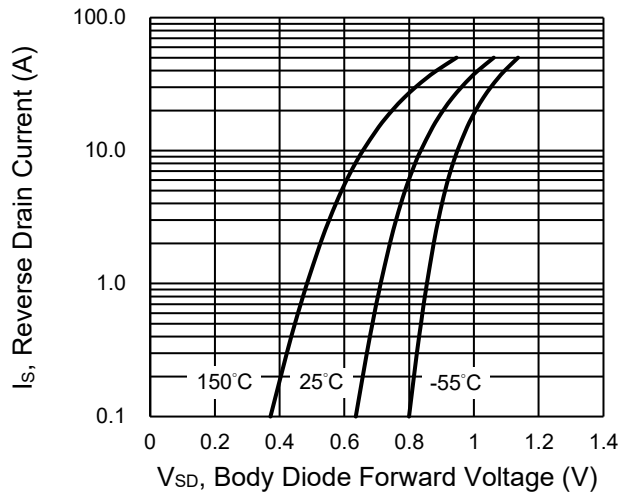
BV_{DSS} vs. Junction Temperature



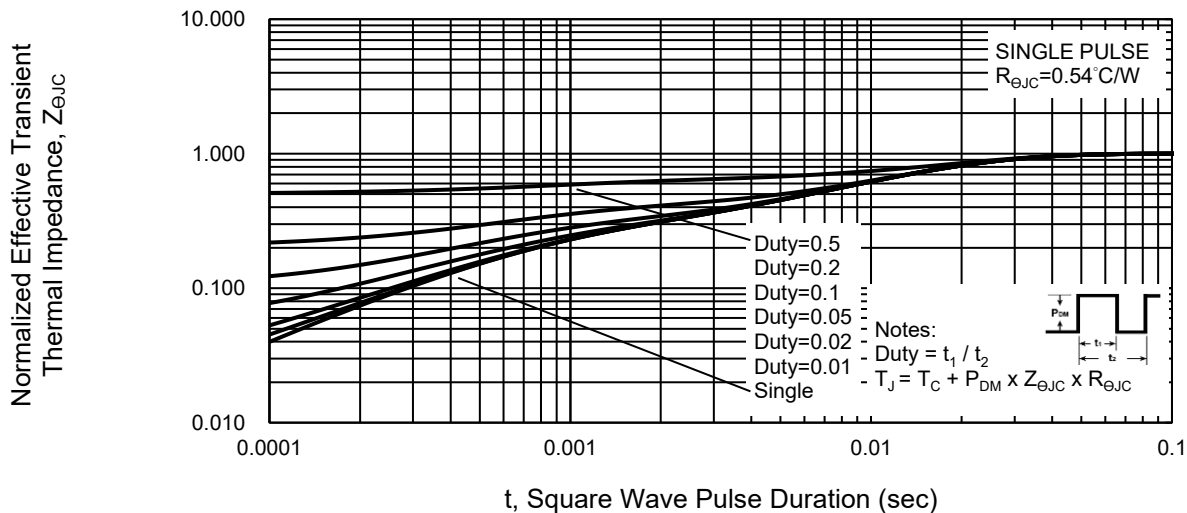
Maximum Safe Operating Area, Junction-to-Case



Source-Drain Diode Forward Current vs. Voltage



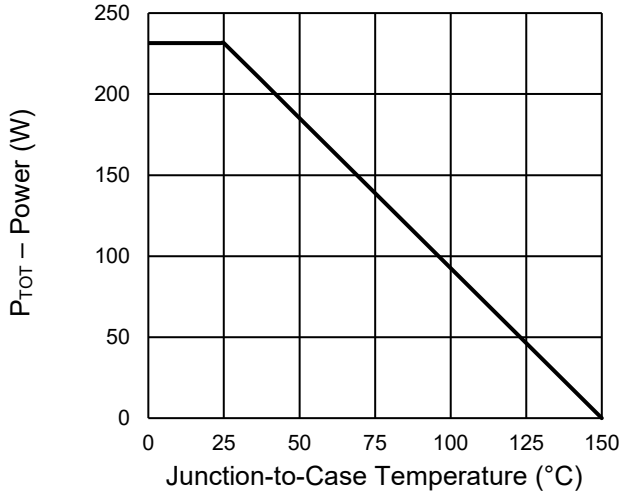
Normalized Thermal Transient Impedance, Junction-to-Case



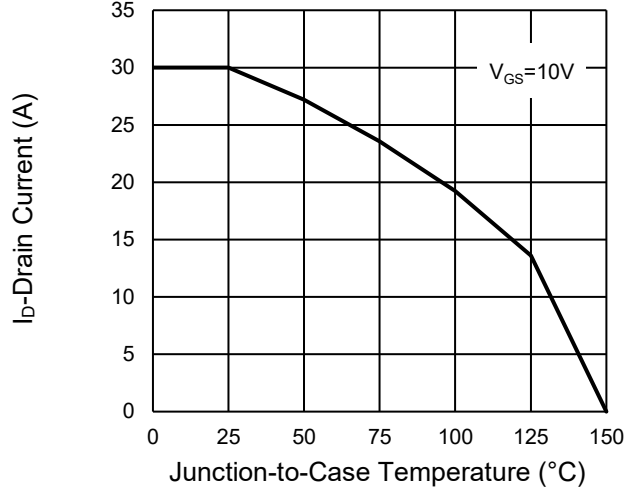
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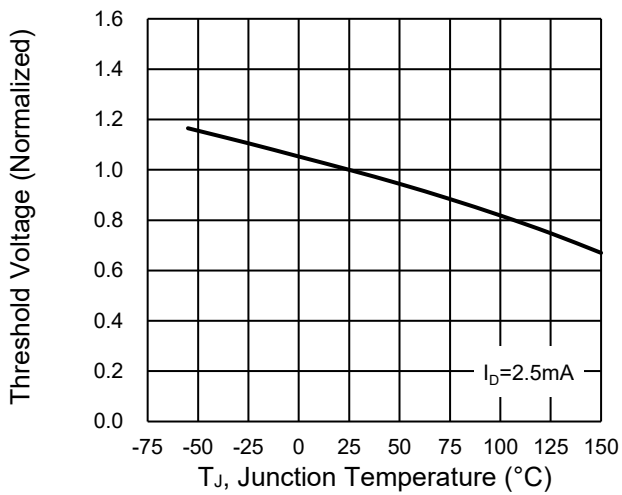
Power Dissipation



Drain Current



Normalized gate threshold voltage vs Temperature



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