N- and P-Channel 20V (D-S) Power MOSFET

FEATURES

- Low $R_{DS(ON)}$ to minimize conductive losses
- Low gate charge for fast power switching
- RoHS Compliant
- Halogen-free according to IEC 61249-2-21

APPLICATIONS

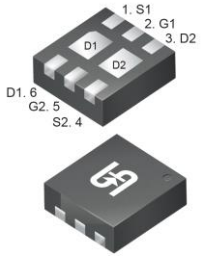
- Load Switch
- Power Management
- Portable Devices

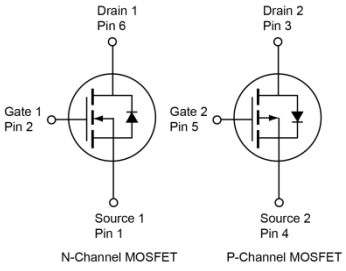
KEY PERFORMANCE PARAMETERS				
PARAMETER		**TYPE**	**VALUE**	**UNIT**
V_{DS}		N-ch	20	V
		P-ch	-20	
$R_{DS(on)}$ (max)	V_{GS} = 4.5V	N-ch	40	mΩ
	V_{GS} = 2.5V		47	
	V_{GS} = 1.8V		54	
	V_{GS} = -4.5V	P-ch	70	
	V_{GS} = -2.5V		100	
	V_{GS} = -1.8V		110	
Q_g		N-ch	7.5	nC
		P-ch	9.4	

Pb-Free

RoHS COMPLIANT HALOGEN FREE

TDFN 2x2





Note: MSL 3 (Moisture Sensitivity Level) per J-STD-020

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)					
PARAMETER		**SYMBOL**	**N-ch**	**P-ch**	**UNIT**
Drain-Source Voltage		V_{DS}	20	-20	V
Gate-Source Voltage		V_{GS}	±10	±10	V
Continuous Drain Current (Note 1)	T_C = 25°C	I_D	10	-8	A
	T_A = 25°C		5.5	-4.4	
Pulsed Drain Current		I_{DM}	40	-32	A
Total Power Dissipation	T_C = 25°C	P_D	5	5	W
	T_C = 125°C		1	1	
Total Power Dissipation	T_A = 25°C	P_D	1.89	1.89	W
	T_A = 125°C		0.38	0.38	
Operating Junction and Storage Temperature Range		T_J, T_{STG}	- 55 to +150		°C

THERMAL PERFORMANCE			
PARAMETER	**SYMBOL**	**LIMIT**	**UNIT**
Thermal Resistance – Junction to Case	$R_{\Theta JC}$	25	°C/W
Thermal Resistance – Junction to Ambient	$R_{\Theta JA}$	66	

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**	**TYPE**	**MIN**	**TYP**	**MAX**	**UNIT**
Static							
Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250μA	BV_{DSS}	N-ch	20	--	--	V
	V_{GS} = 0V, I_D = -250μA		P-ch	-20	--	--	
Gate Threshold Voltage	V_{GS} = V_{DS}, I_D = 250μA	$V_{GS(TH)}$	N-ch	0.4	0.6	0.8	V
	V_{GS} = V_{DS}, I_D = -250μA		P-ch	-0.4	-0.6	-0.8	
Gate-Source Leakage Current	V_{GS} = ±10V, V_{DS} = 0V	I_{GSS}	N-ch	--	--	±100	nA
	V_{GS} = ±10V, V_{DS} = 0V		P-ch	--	--	±100	
Drain-Source Leakage Current	V_{GS} = 0V, V_{DS} = 20V	I_{DSS}	N-ch	--	--	1	μA
	V_{GS} = 0V, V_{DS} = 20V T_J = 125°C			--	--	100	
	V_{GS} = 0V, V_{DS} = -20V		P-ch	--	--	-1	
	V_{GS} = 0V, V_{DS} = -20V T_J = 125°C			--	--	-100	
Drain-Source On-State Resistance (Note 2)	V_{GS} = 4.5V, I_D = 5.5A	$R_{DS(on)}$	N-ch	--	27	40	mΩ
	V_{GS} = 2.5V, I_D = 5A			--	34	47	
	V_{GS} = 1.8V, I_D = 3.9A			--	48	54	
	V_{GS} = -4.5V, I_D = -4.4A		P-ch	--	47	70	
	V_{GS} = -2.5V, I_D = -4A			--	66	100	
	V_{GS} = -1.8V, I_D = -3.9A			--	102	110	
Forward Transconductance (Note 2)	V_{DS} = 5V, I_D = 5.5A	g_{fs}	N-ch	--	19	--	S
	V_{DS} = -5V, I_D = -4.4A		P-ch	--	11	--	
Dynamic (Note 3)							
Total Gate Charge	N-ch V_{GS} = 4.5V, V_{DS} = 10V, I_D = 5.5A P-ch V_{GS} = -4.5V, V_{DS} = -10V, I_D = -4.4A	Q_g	N-ch	--	7.5	--	nC
			P-ch	--	9.4	--	
Gate-Source Charge		Q_{gs}	N-ch	--	0.65	--	
			P-ch	--	1.63	--	
Gate-Drain Charge		Q_{gd}	N-ch	--	2	--	
			P-ch	--	2	--	
Input Capacitance	N-ch V_{GS} = 0V, V_{DS} = 10V f = 1.0MHz P-ch V_{GS} = 0V, V_{DS} = -10V f = 1.0MHz	C_{iss}	N-ch	--	534	--	pF
			P-ch	--	909	--	
Output Capacitance		C_{oss}	N-ch	--	82	--	
			P-ch	--	105	--	
Reverse Transfer Capacitance		C_{rss}	N-ch	--	64	--	
			P-ch	--	90	--	
Gate Resistance	f = 1.0MHz	R_g	N-ch	--	0.69	--	Ω
			P-ch	--	14.9	--	

ELECTRICAL SPECIFICATIONS (T_A = 25°C unless otherwise noted)							
PARAMETER	**CONDITIONS**	**SYMBOL**	**TYPE**	**MIN**	**TYP**	**MAX**	**UNIT**
Switching (Note 3)							
Turn-On Delay Time	N-ch V_{GS} = 4.5V, R_G = 2Ω V_{DS} = 10V, I_D = 5.5A P-ch V_{GS} = -4.5V, R_G = 2Ω V_{DS} = -10V, I_D = -4.4A	$t_{d(on)}$	N-ch	--	8.7	--	ns
			P-ch	--	11.5	--	
Turn-On Rise Time		t_r	N-ch	--	72	--	
			P-ch	--	65.2	--	
Turn-Off Delay Time		$t_{d(off)}$	N-ch	--	24.5	--	
			P-ch	--	39.8	--	
Turn-Off Fall Time		t_f	N-ch	--	88.8	--	
			P-ch	--	85.6	--	
Source-Drain Diode							
Forward Voltage (Note 2)	V_{GS} = 0V, I_S = 5.5A	V_{SD}	N-ch	--	0.9	--	V
	V_{GS} = 0V, I_S = -4.4A		P-ch	--	-0.87	--	
Reverse recovery Time	N-ch I_S= 5.5A, dI/dt=100A/μs P-ch I_S= -4.4A, dI/dt=100A/μs	t_{rr}	N-ch	--	11.7	--	nc
			P-ch	--	12.9	--	
Reverse Recovery Charge		Q_{rr}	N-ch	--	4.73	--	nc
			P-ch	--	5.13	--	

Notes:

1. Silicon limited current only.
2. Pulse test: Pulse Width ≤ 300μs, duty cycle ≤ 2%.
3. Switching time is essentially independent of operating temperature.

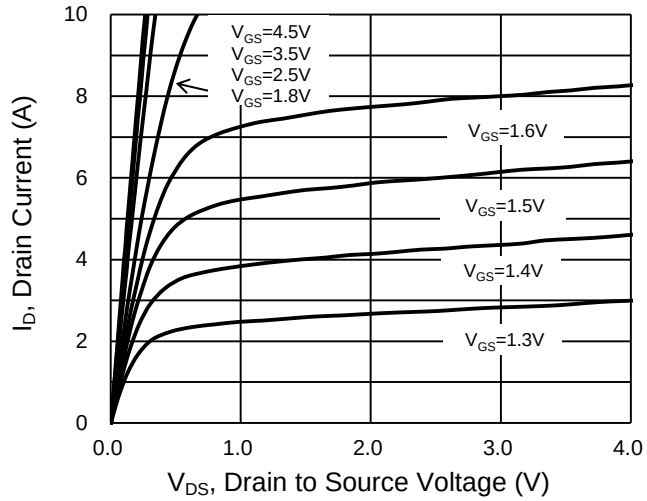
ORDERING INFORMATION

ORDERING CODE	PACKAGE	PACKING
TSM2538CQ RFG	TDFN 2x2	3,000pcs / 7” Reel

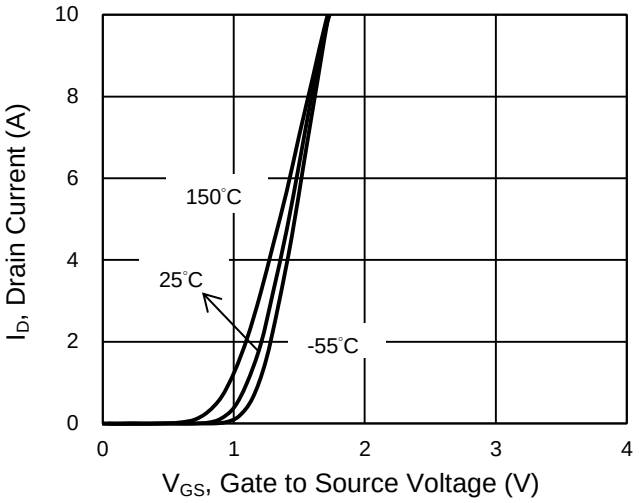
CHARACTERISTICS CURVES (N-Channel)

(T_A = 25°C unless otherwise noted)

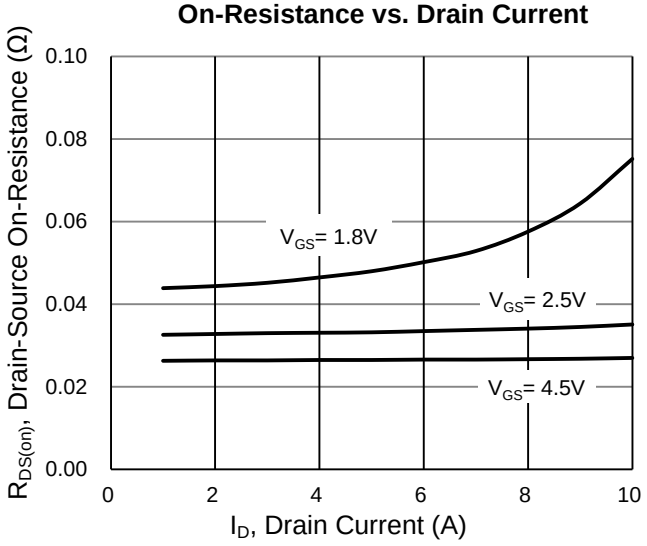
Output Characteristics



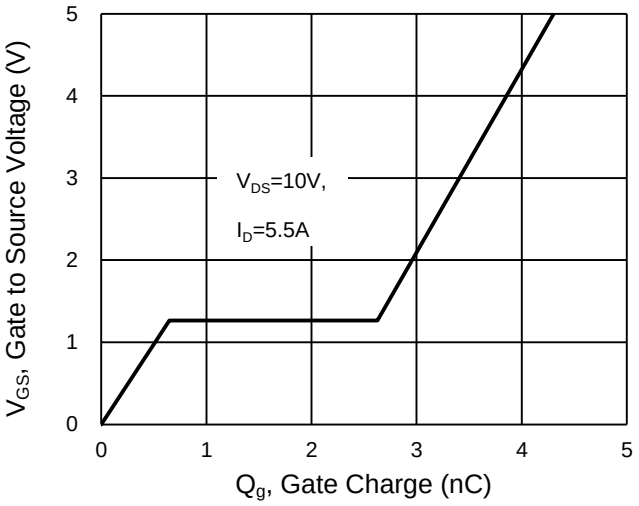
Transfer Characteristics



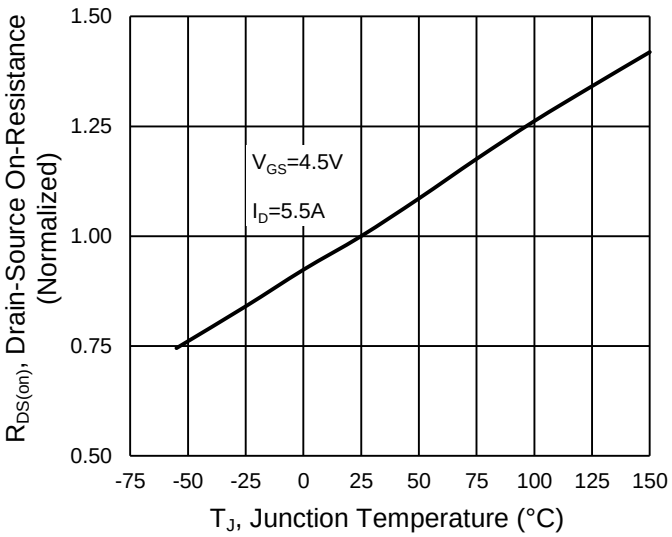
On-Resistance vs. Drain Current



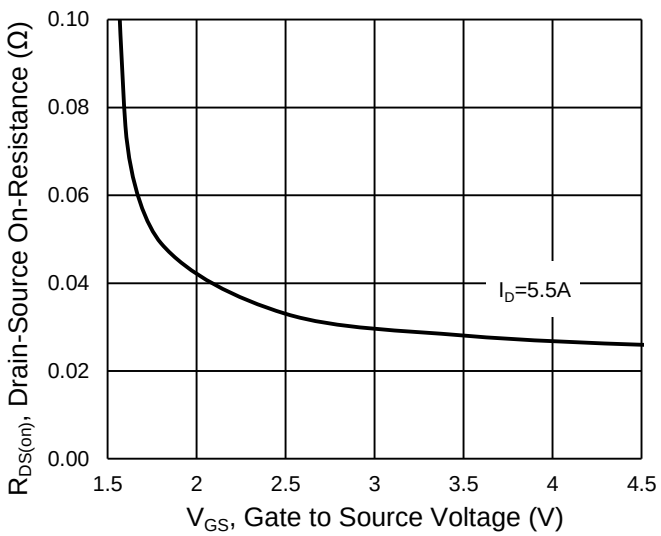
Gate-Source Voltage vs. Gate Charge



On-Resistance vs. Junction Temperature



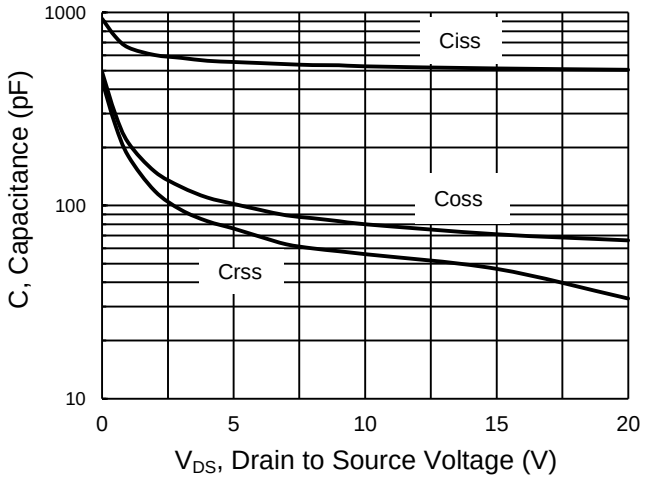
On-Resistance vs. Gate-Source Voltage



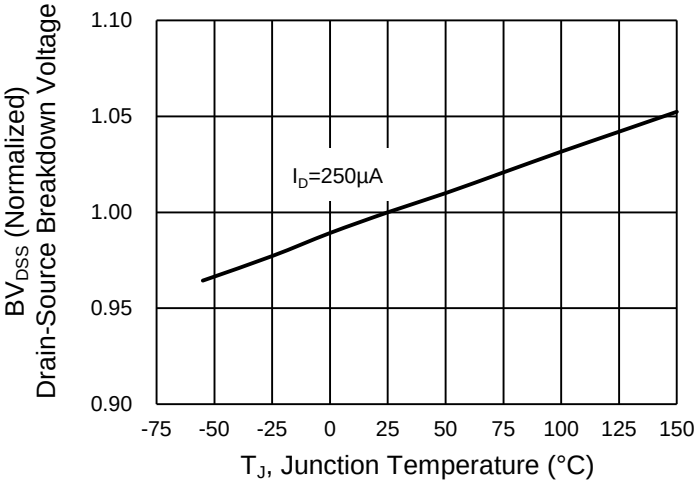
CHARACTERISTICS CURVES (N-Channel)

(T_A = 25°C unless otherwise noted)

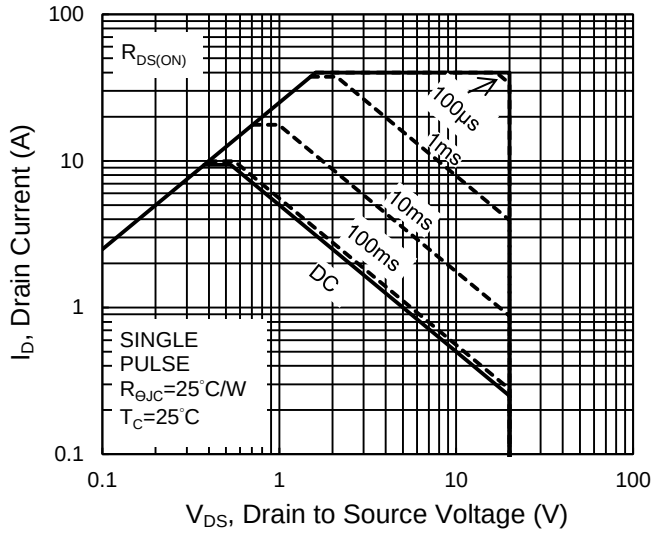
Capacitance vs. Drain-Source Voltage



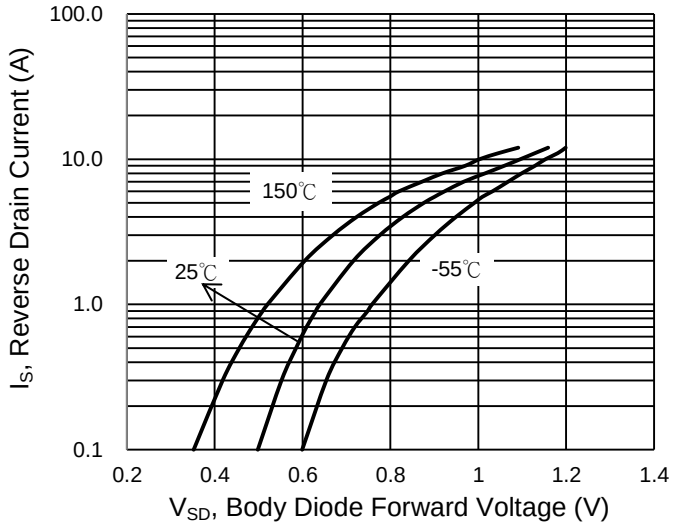
BV_{DSS} vs. Junction Temperature



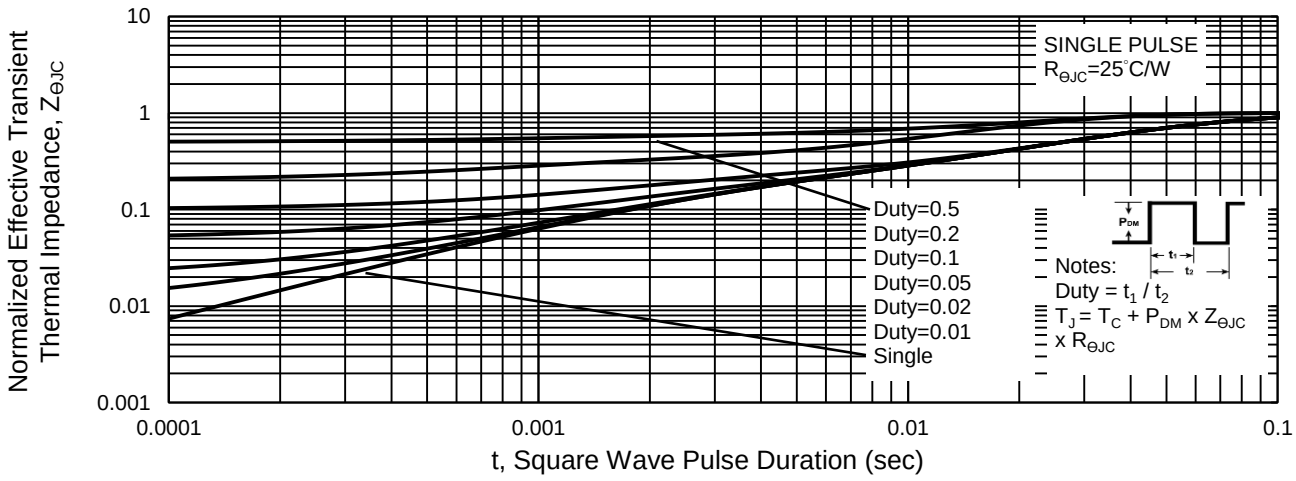
Maximum Safe Operating Area, Junction-to-Case



Source-Drain Diode Forward Current vs. Voltage



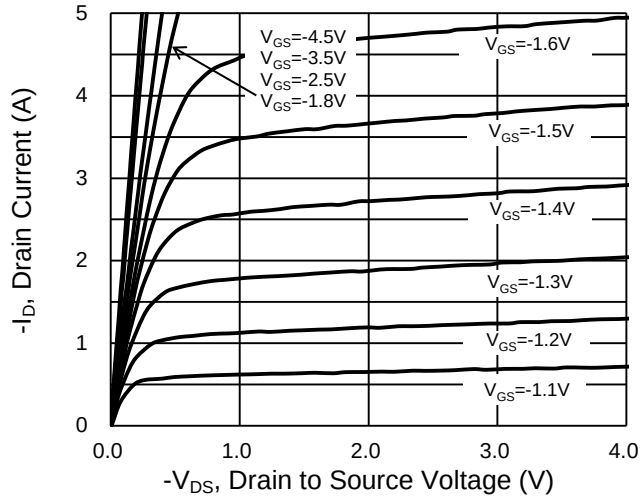
Normalized Thermal Transient Impedance, Junction-to-Case



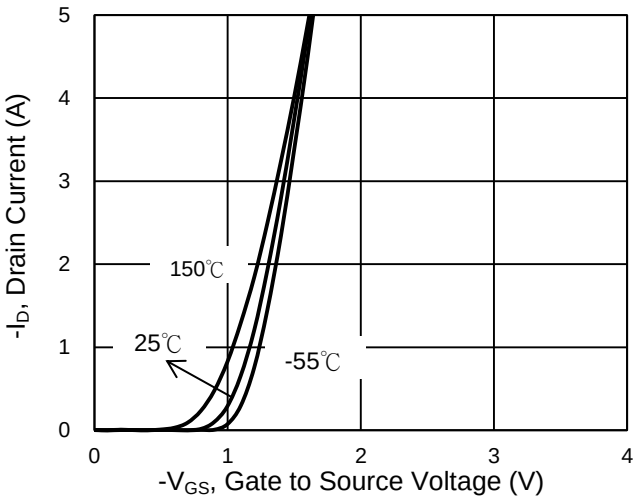
CHARACTERISTICS CURVES (P-Channel)

(T_A = 25°C unless otherwise noted)

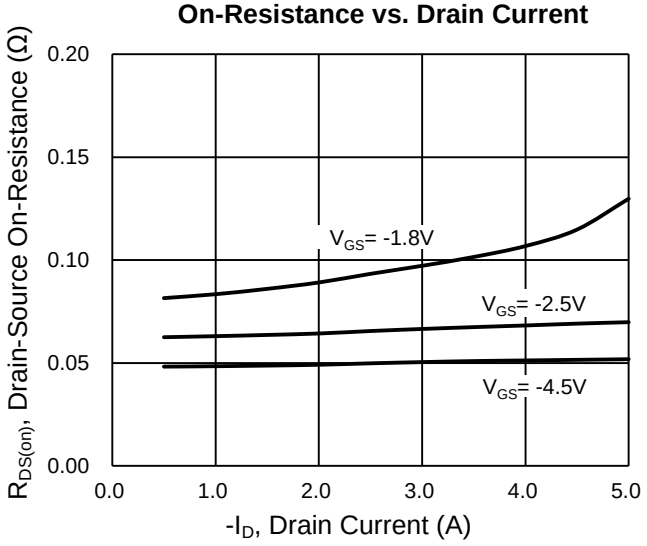
Output Characteristics



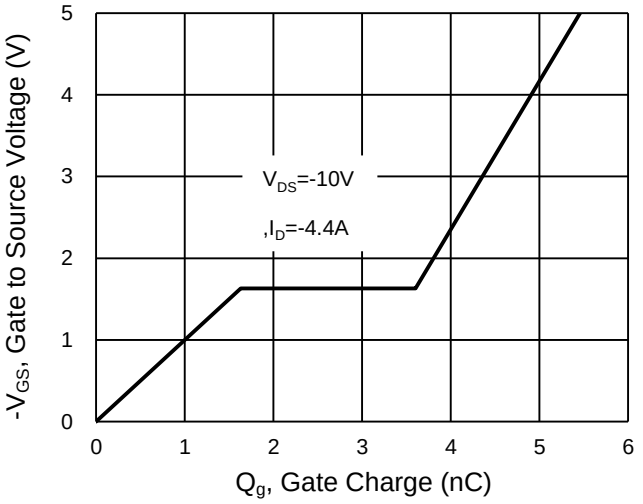
Transfer Characteristics



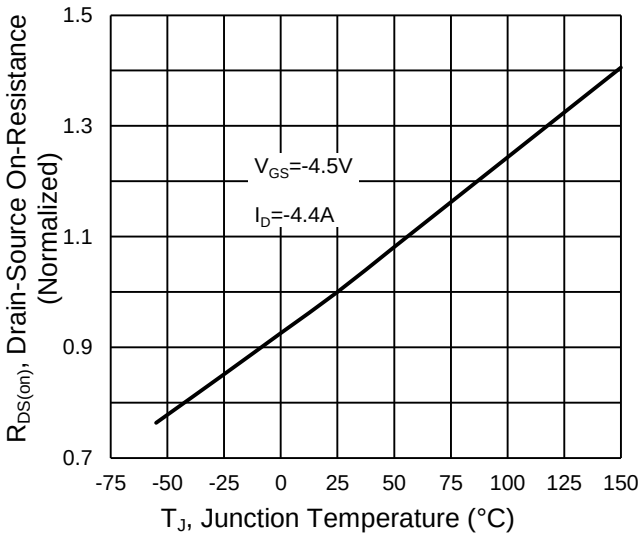
On-Resistance vs. Drain Current



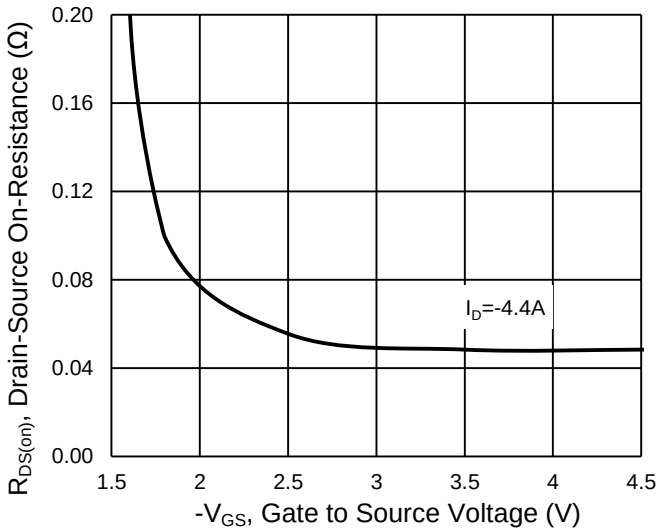
Gate-Source Voltage vs. Gate Charge



On-Resistance vs. Junction Temperature



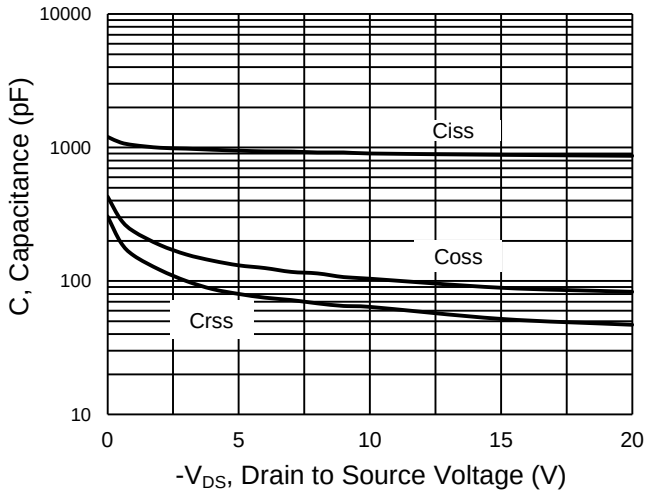
On-Resistance vs. Gate-Source Voltage



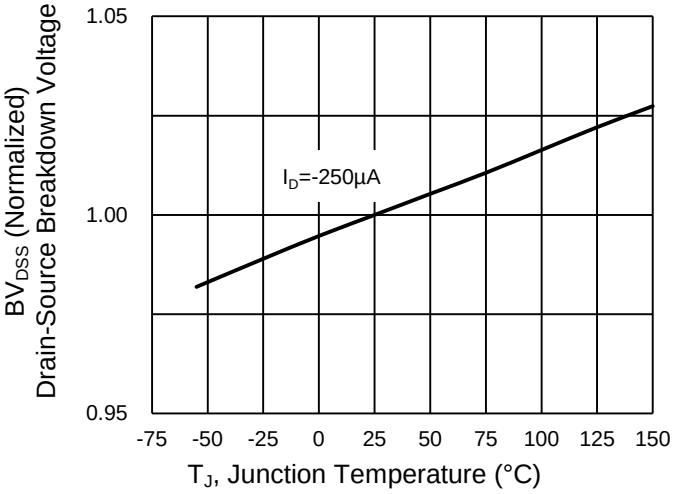
CHARACTERISTICS CURVES (P-Channel)

(T_A = 25°C unless otherwise noted)

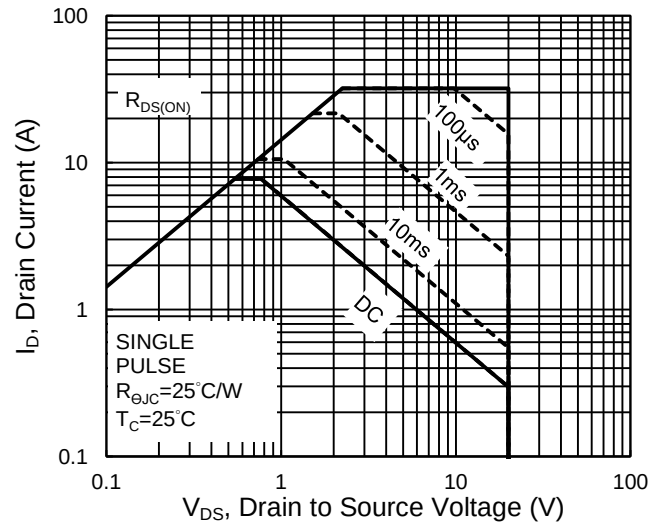
Capacitance vs. Drain-Source Voltage



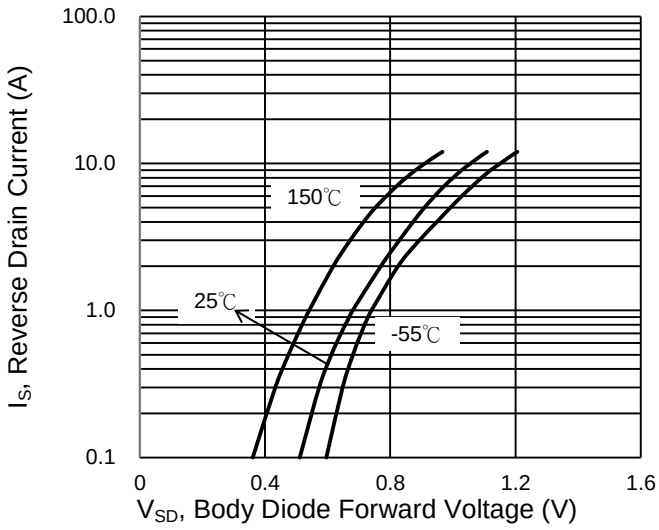
BV_{DSS} vs. Junction Temperature



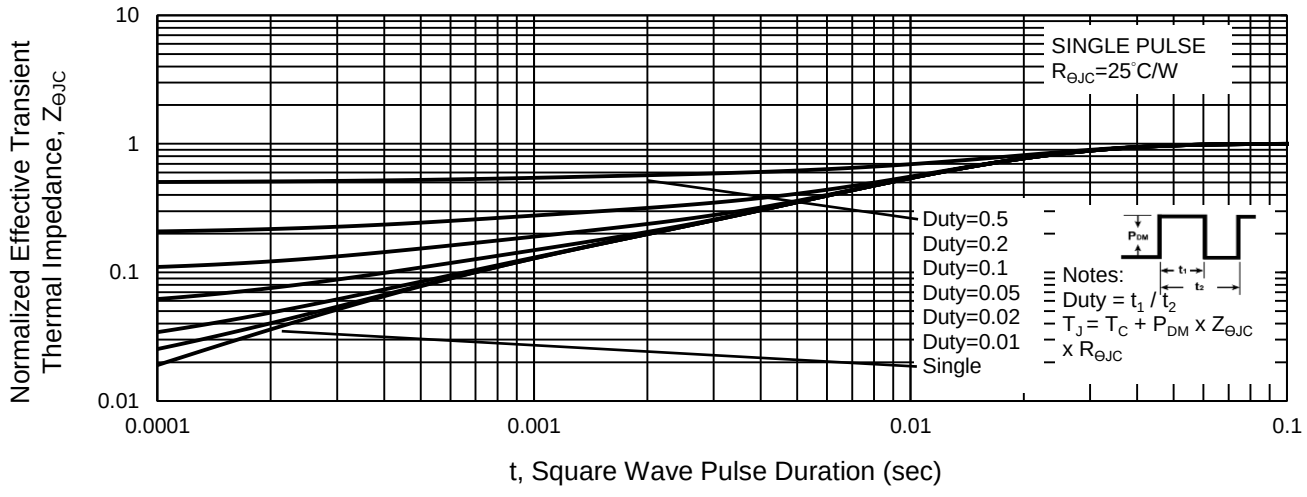
Maximum Safe Operating Area, Junction-to-Case



Source-Drain Diode Forward Current vs. Voltage

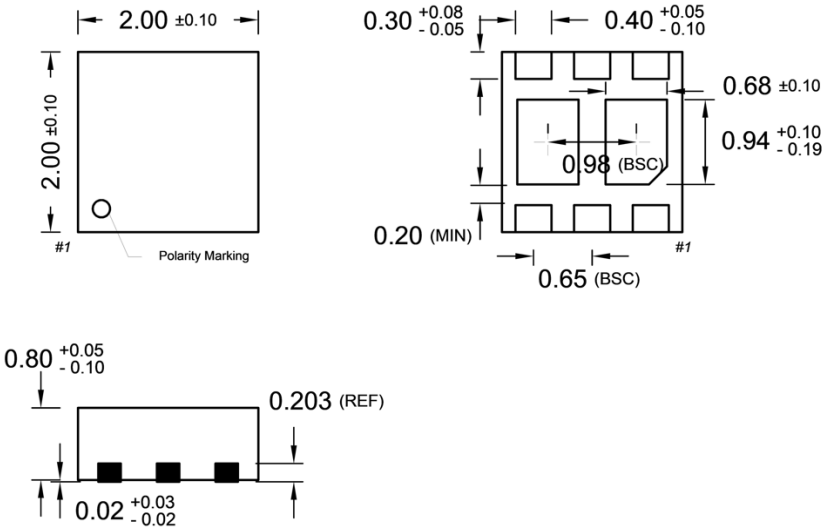


Normalized Thermal Transient Impedance, Junction-to-Case

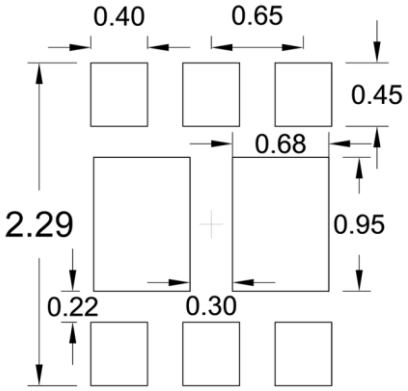


PACKAGE OUTLINE DIMENSIONS (Unit: Millimeters)

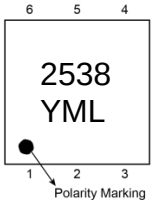
TDFN 2x2



SUGGESTED PAD LAYOUT (Unit: Millimeters)



MARKING DIAGRAM



Y = Year Code

M = Month Code for Halogen Free

O	=Jan	**P**	=Feb	**Q**	=Mar	**R**	=Apr
S	=May	**T**	=Jun	**U**	=Jul	**V**	=Aug
W	=Sep	**X**	=Oct	**Y**	=Nov	**Z**	=Dec

L = Lot Code (1~9, A~Z)

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