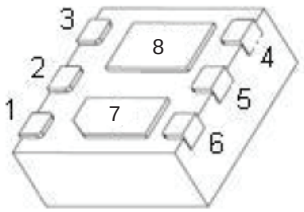
Complementary Trench MOSFET
2NP05

DFN2X2-6



1.S1	5.G2
2.G1	6.D1
3.D2	7.D1
4.S2	8.D2

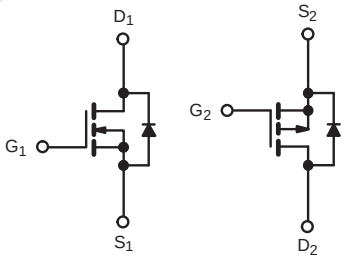
■ Features

N-Channel

- $V_{DS\ (V)}$ = 20V
- I_D = 4.5 A (V_{GS} = 4.5V)
- $R_{DS(ON)}$ < 29mΩ (V_{GS} = 4.5V)
- $R_{DS(ON)}$ < 34mΩ (V_{GS} = 2.5V)
- $R_{DS(ON)}$ < 44mΩ (V_{GS} = 1.8V)
- $R_{DS(ON)}$ < 65mΩ (V_{GS} = 1.5V)

P-Channel

- $V_{DS\ (V)}$ = -20V
- I_D = -4.5 A (V_{GS} = -4.5V)
- $R_{DS(ON)}$ < 61mΩ (V_{GS} = -4.5V)
- $R_{DS(ON)}$ < 81mΩ (V_{GS} = -2.5V)
- $R_{DS(ON)}$ < 115mΩ (V_{GS} = -1.8V)
- $R_{DS(ON)}$ < 170mΩ (V_{GS} = -1.5V)



N-Channel MOSFET P-Channel MOSFET

■ Absolute Maximum Ratings Ta = 25℃

Parameter		Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage		V_{DS}	20	-20	V
Gate-Source Voltage		V_{GS}	±8		
Continuous Drain Current	T_C=25℃	I_D	4.5	-4.5	A
	T_C=70℃		4.5	-4.5	
	T_A=25℃		4.5	-4.3	
	T_A=70℃		4.5	-3.8	
Pulsed Drain Current		I_{DM}	20	-15	
Power Dissipation	T_C=25℃	P_D	6.5		W
	T_C=70℃		5		
	T_A=25℃		1.9		
	T_A=70℃		1.2		
Thermal Resistance.Junction- to-Ambient	t ≤ 5s	R_{thJA}	65		℃/W
Thermal Resistance.Junction- to-Case		R_{thJC}	16		
Junction Temperature		T_J	150		℃
Storage Temperature Range		T_{stg}	-55 to 150		

Complementary Trench MOSFET

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■ Electrical Characteristics Ta = 25℃

Parameter	Symbol	Test Conditions	Type	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	V_{DSS}	I_D=250 uA, V_{GS}=0V	N-CH	20			V
		I_D=-250 uA, V_{GS}=0V	P-CH	-20			
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS}=20V, V_{GS}=0V	N-CH			1	uA
		V_{DS}=-20V, V_{GS}=0V	P-CH			-1	
		V_{DS}=20V, V_{GS}=0V, T_J=55℃	N-CH			10	
		V_{DS}=-20V, V_{GS}=0V, T_J=55℃	P-CH			-10	
Gate-Body Leakage Current	I_{GSS}	V_{DS}=0V, V_{GS}=±8V	N-CH			±100	nA
		V_{DS}=0V, V_{GS}=±8V	P-CH			±100	
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS} , I_D=250 uA	N-CH	0.4		1	V
		V_{DS}=V_{GS}, I_D=-250 uA	P-CH	-0.4		-1	
Static Drain-Source On-Resistance	$R_{DS(ON)}$	V_{GS}=4.5V, I_D=5A	N-CH			29	mΩ
		V_{GS}=2.5V, I_D=4.6A				34	
		V_{GS}=1.8V, I_D=4.1A				44	
		V_{GS}=1.5V, I_D=2A				65	
		V_{GS}=-4.5V, I_D=-3.6A	P-CH			61	
		V_{GS}=-2.5V, I_D=-3.2A				81	
		V_{GS}=-1.8V, I_D=-1A				115	
		V_{GS}=-1.5V, I_D=-1A				170	
On-State Drain Current	$I_{D(on)}$	V_{DS}≥5 V, V_{GS} = 4.5 V	N-CH	15			A
		V_{DS}≤-5 V, V_{GS} = -4.5 V	P-CH	-10			
Forward Transconductance	g_{FS}	V_{DS}=10V, I_D=5A	N-CH		21		S
		V_{DS}=-10V, I_D=-3.6A	P-CH		11		
Input Capacitance	C_{iss}	N-Channel: V_{GS}=0V, V_{DS}=6V, f=1MHz P-Channel: V_{GS}=0V, V_{DS}=-6V, f=1MHz	N-CH		500		pF
			P-CH		590		
Output Capacitance	C_{oss}		N-CH		160		
			P-CH		280		
Reverse Transfer Capacitance	C_{rss}		N-CH		100		
			P-CH		250		
Gate Resistance	R_g	V_{GS}=0V,f=1MHz	N-CH	0.7		7	Ω
			P-CH	2		20	
Total Gate Charge	Q_g	V_{GS}=8V, V_{DS}=6V, I_D=6.5A	N-CH		9.7	15	nC
		V_{GS}=-8V, V_{DS}=-6V, I_D=-4.5A	P-CH		13.1	20	
		N-Channel: V_{GS}=4.5V, V_{DS}=6V, I_D=6.5A P-Channel: V_{GS}=-4.5V, V_{DS}=-6V, I_D=-4.3A	N-CH		5.6	8.5	
			P-CH		8.2	12.5	
Gate Source Charge	Q_{gs}		N-CH		0.72		
			P-CH		1.2		
Gate Drain Charge	Q_{gd}		N-CH		0.74		
			P-CH		2.8		

Complementary Trench MOSFET

2NP05

■ Electrical Characteristics Ta = 25℃

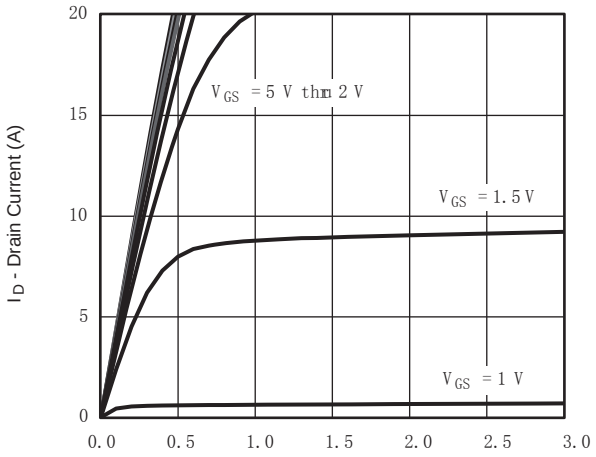
Turn-On DelayTime	$t_{d(on)}$	N-Channel: V_{GS}=4.5V, V_{DS}=6V, I_D=5.2A, R_L=1.2Ω , R_{GEN}=1Ω P-Channel: V_{GS}=-4.5V, V_{DS}=-6V, I_D=-3.8A, R_L=1.6Ω, R_{GEN}=1Ω	N-CH		10	15	ns
			P-CH		30	40	
Turn-On Rise Time	t_r		N-CH		10	15	
			P-CH		25	40	
Turn-Off DelayTime	$t_{d(off)}$		N-CH		22	30	
			P-CH		30	45	
Turn-Off Fall Time	t_f		N-CH		10	15	
			P-CH		20	30	
Turn-On DelayTime	$t_{d(on)}$	N-Channel: V_{GS}=10V, V_{DS}=6V, I_D=5.2A, R_L=1.2Ω , R_{GEN}=1Ω P-Channel: V_{GS}=-10V, V_{DS}=-6V, I_D=-3.8A, R_L=1.6Ω, R_{GEN}=1Ω	N-CH		5	10	
			P-CH		8	15	
Turn-On Rise Time	t_r		N-CH		10	15	
			P-CH		12	20	
Turn-Off DelayTime	$t_{d(off)}$		N-CH		18	30	
			P-CH		25	40	
Turn-Off Fall Time	t_f		N-CH		10	15	
			P-CH		18	30	
Body Diode Reverse Recovery Time	t_{rr}	N-Channel I_F =5.2A, dI//dt = 100A/μs, T_J = 25 °C P-Channel I_F= -3.8A, dI/dt = -100 A/μs, T_J = 25 °C	N-CH		20	40	
			P-CH		30	60	
Body Diode Reverse Recovery Charge	Q_{rr}		N-CH		5	10	nC
			P-CH		12	24	
Reverse Recovery Fall Time	t_a		N-CH		8		nS
			P-CH		16		
Reverse Recovery Rise Time	t_b		N-CH		12		
			P-CH		14		
Maximum Body-Diode Continuous Curren	I_S	T_c = 25 °C	N-CH			4.5	A
			P-CH			-4.5	
Pulsed Body-Diode Current *	I_{SM}		N-CH			20	
			P-CH			-10	
Diode Forward Voltage	V_{SD}	I_S=5.2A,V_{GS}=0V	N-CH			1.2	V
		I_S=-3.4A,V_{GS}=0V	P-CH			-1.2	

Note. Pulse test; pulse width ⩽ 300 μs, duty cycle ⩽ 2 %.

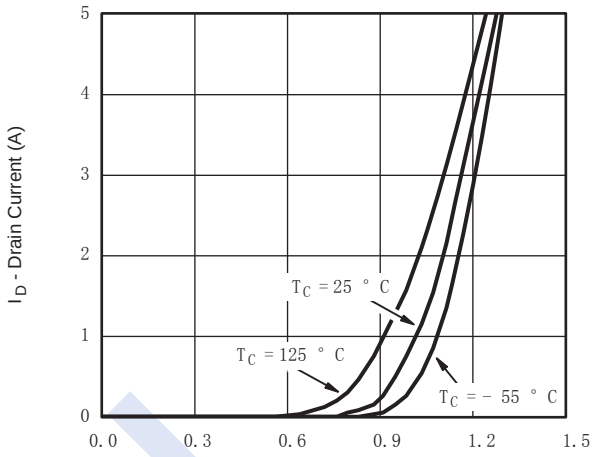
Complementary Trench MOSFET

2NP05

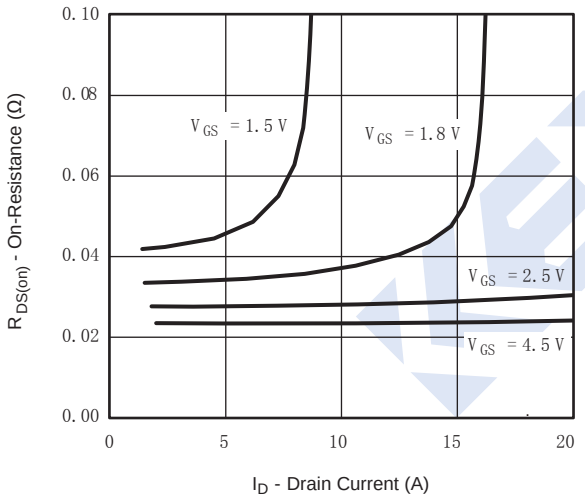
■ N-Channel Typical Characterisitics



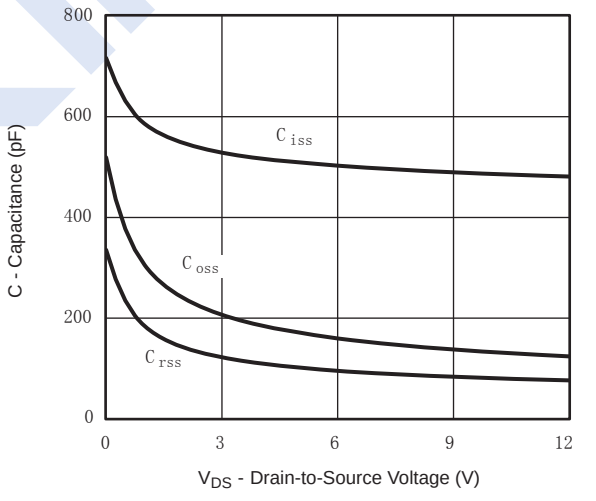
Output Characteristics



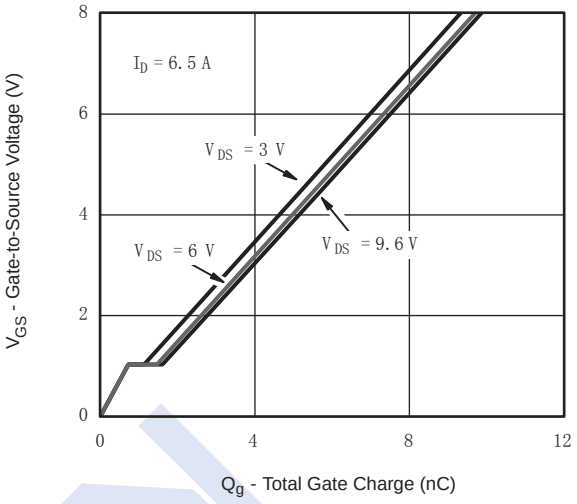
Transfer Characteristics



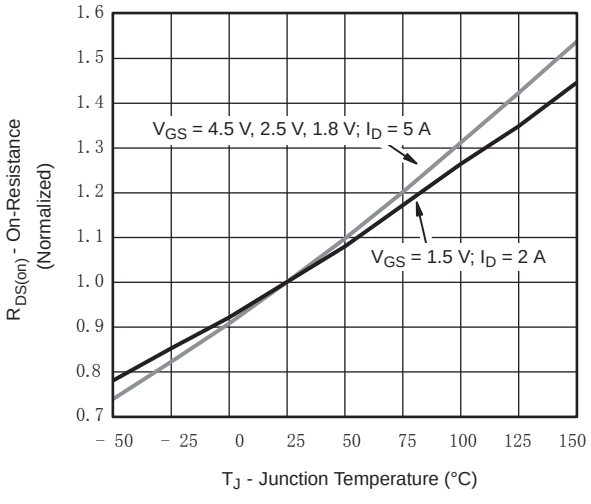
On-Resistance vs. Drain Current and Gate Voltage



Capacitance



Gate Charge



On-Resistance vs. Junction Temperature

Complementary Trench MOSFET

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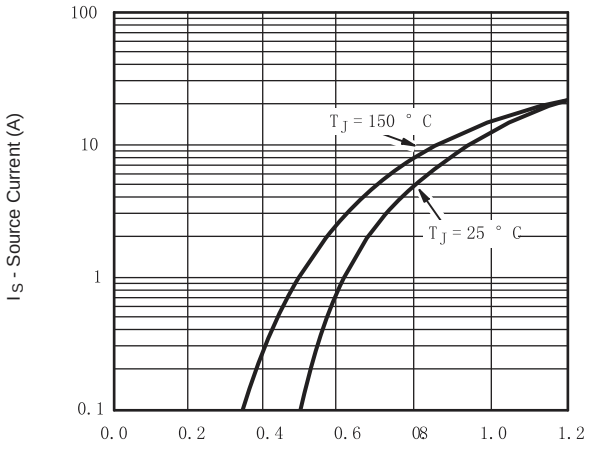
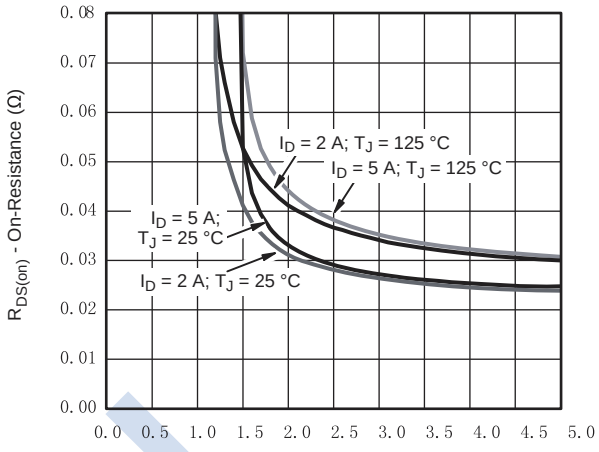
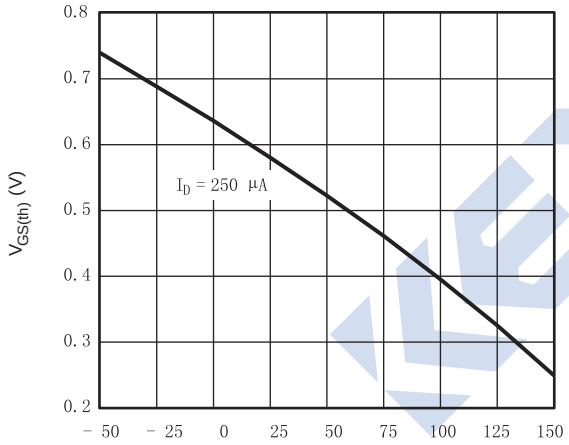
■ N-Channel Typical Characterisitics



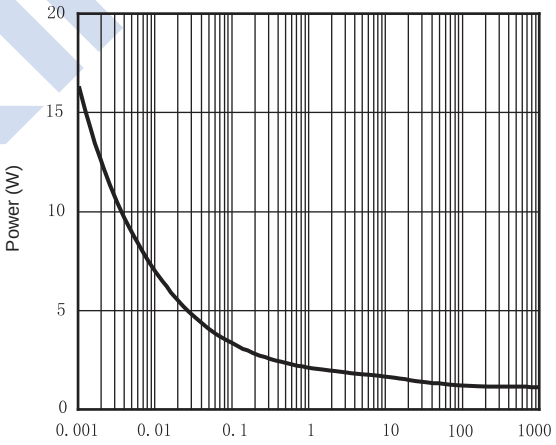
Source-Drain Diode Forward Voltage



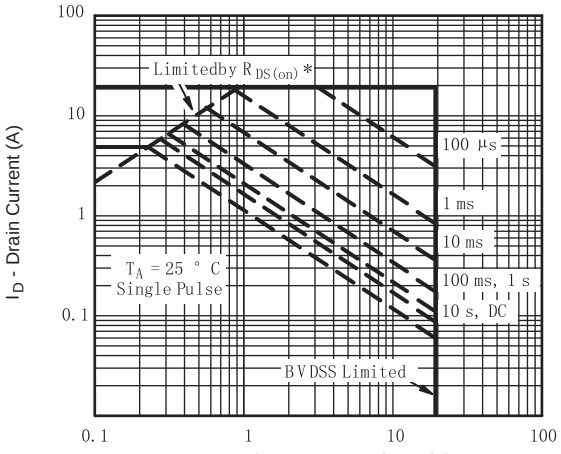
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power (Junction-to-Ambient)



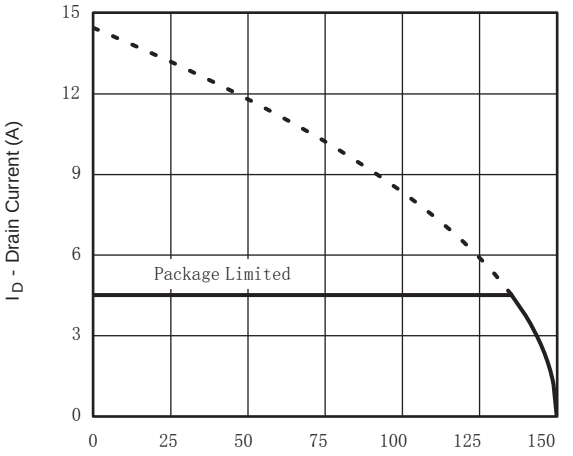
* V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

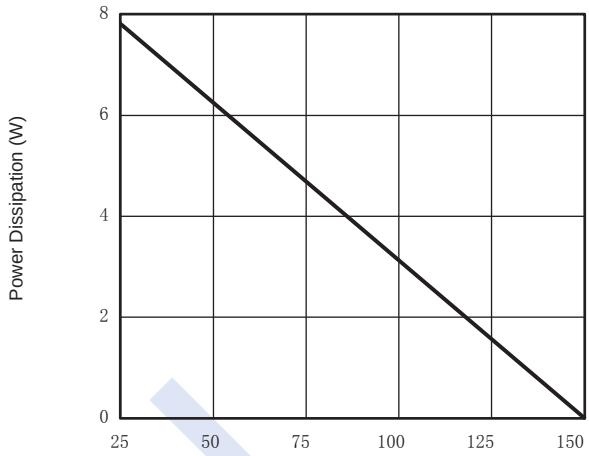
Complementary Trench MOSFET

2NP05

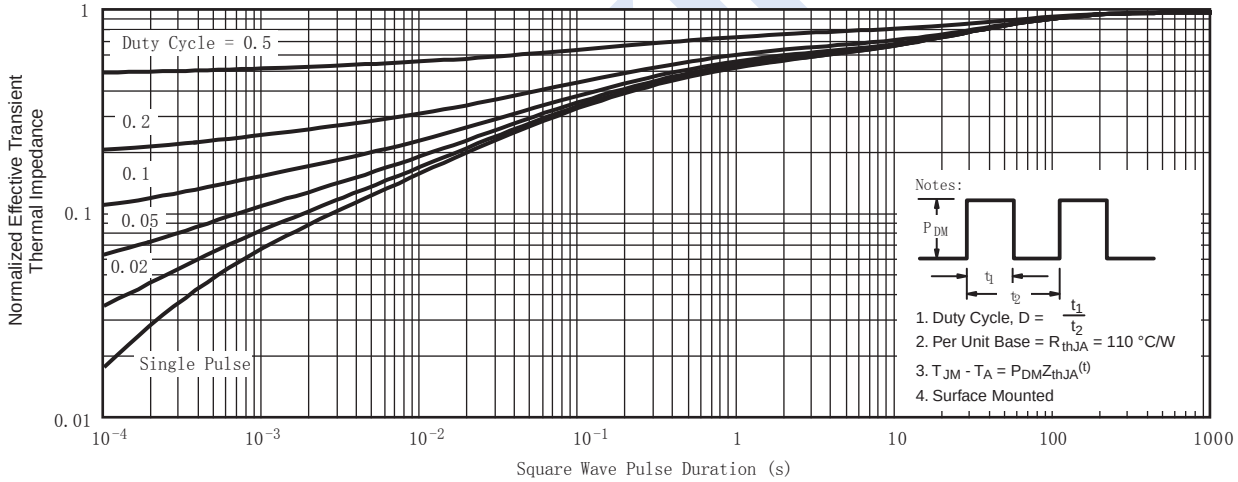
■ N-Channel Typical Characterisitics



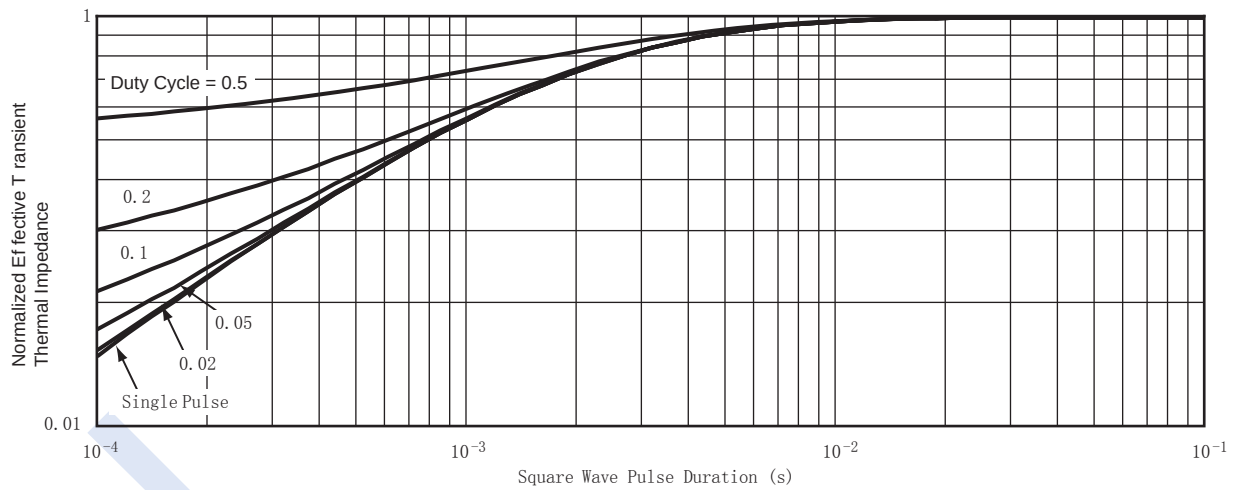
Current Derating*



Power Derating



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

Complementary Trench MOSFET

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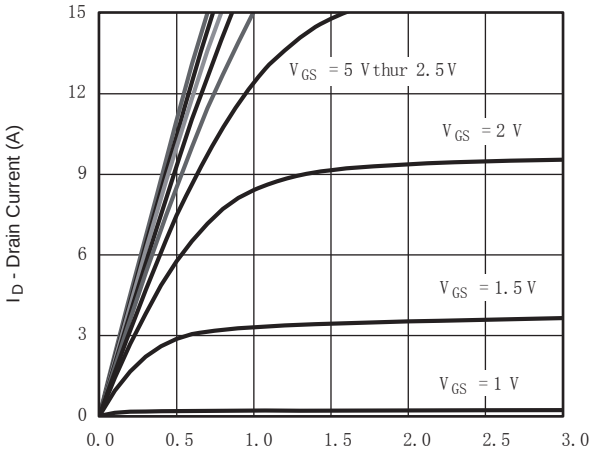
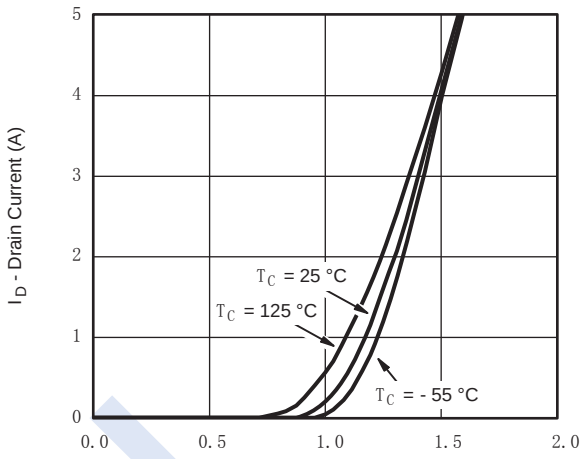
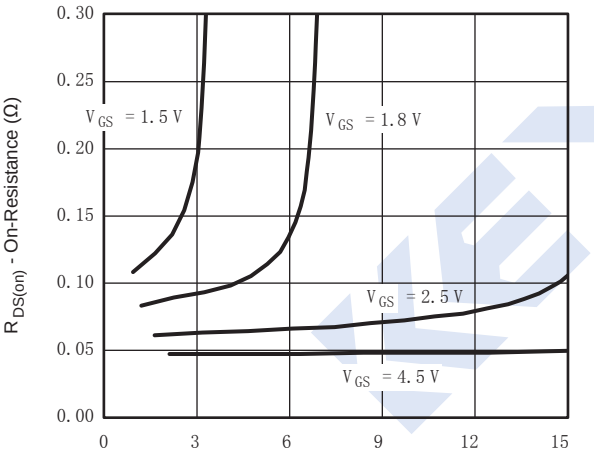
■ P-Channel Typical Characterisitics



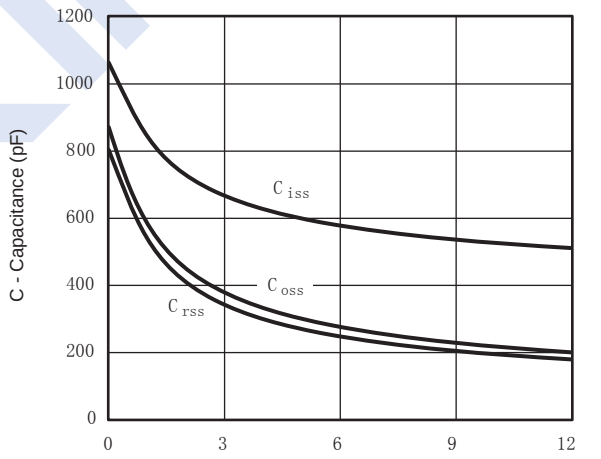
Output Characteristics



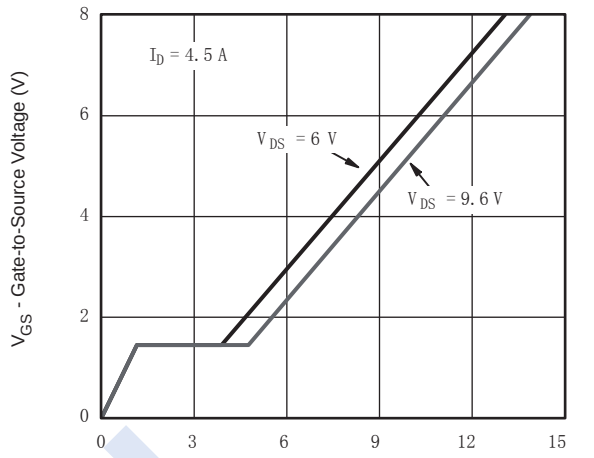
Transfer Characteristics



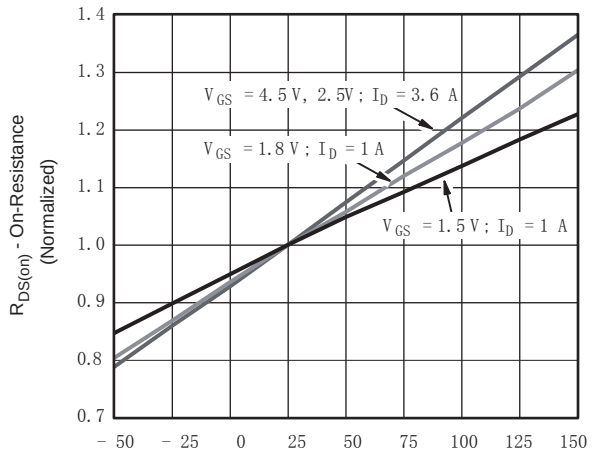
On-Resistance vs. Drain Current and Gate Voltage



Capacitance



Gate Charge



On-Resistance vs. Junction Temperature

Complementary Trench MOSFET

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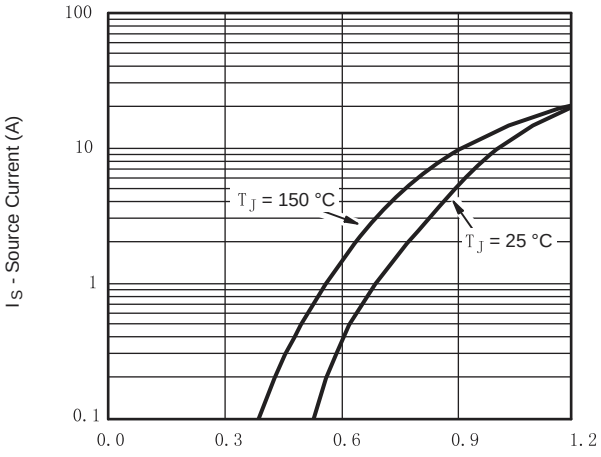
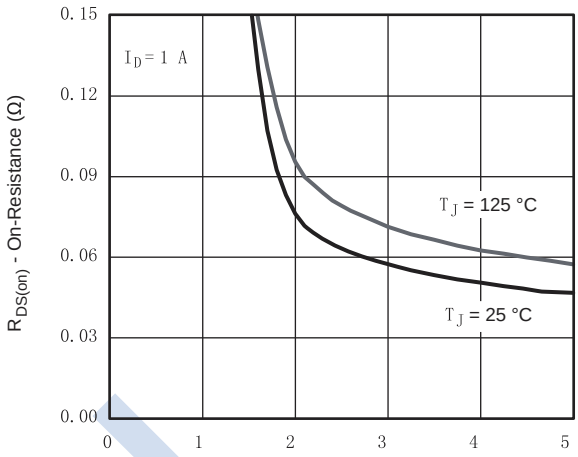
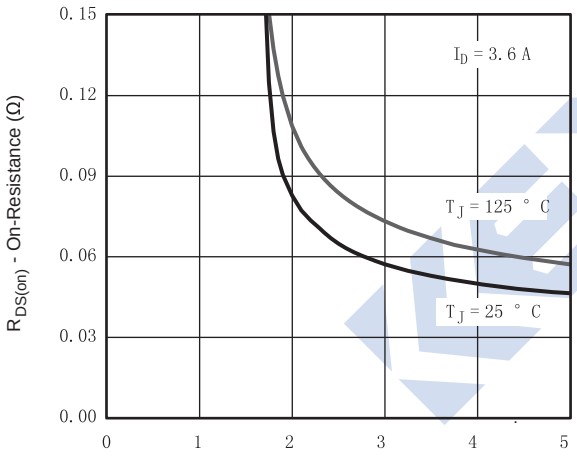
■ P-Channel Typical Characterisitics



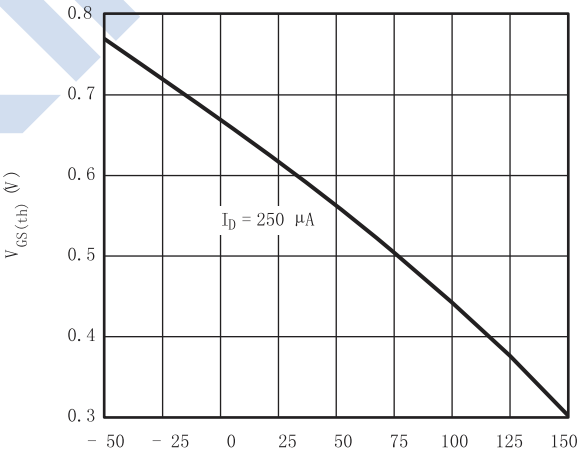
Soure-Drain Diode Forward Voltage



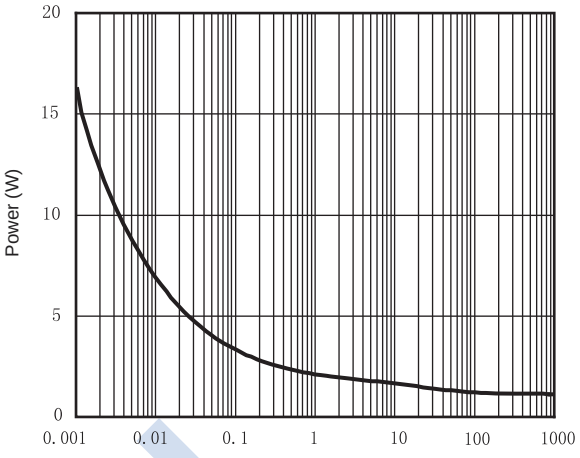
On-Resistance vs. Gate-to-Source Voltage



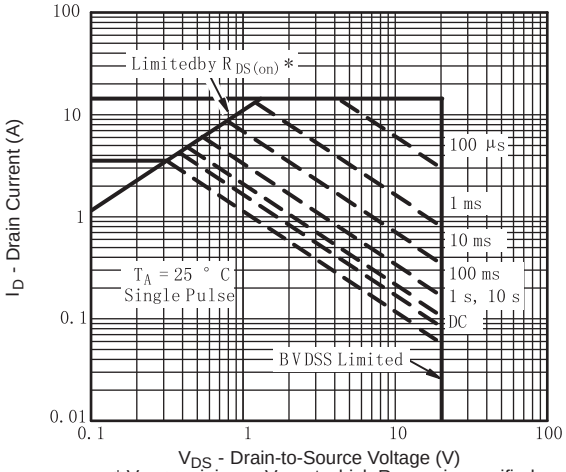
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



Single Pulse Power, Junction-to-Ambient



* V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

Complementary Trench MOSFET

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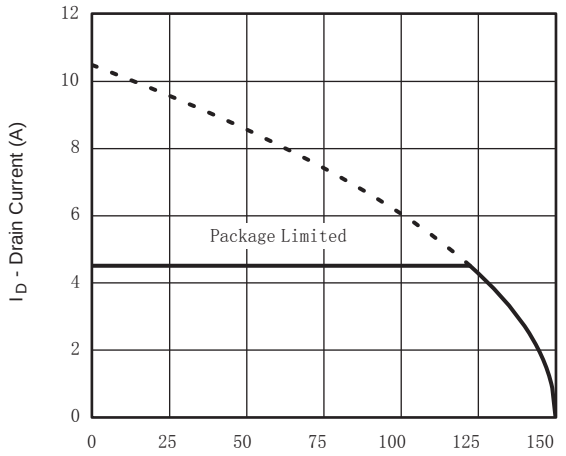
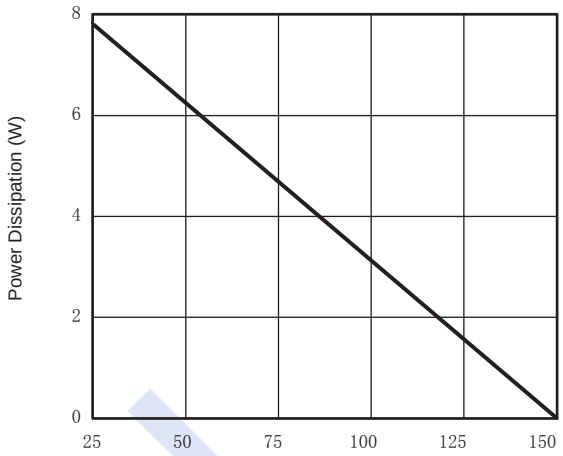
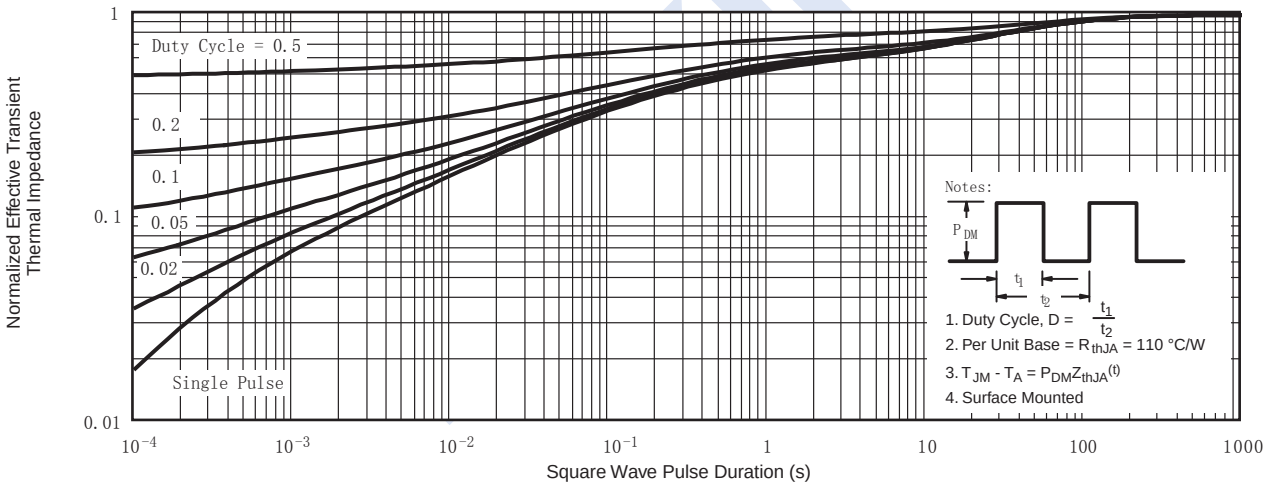
■ P-Channel Typical Characterisitics



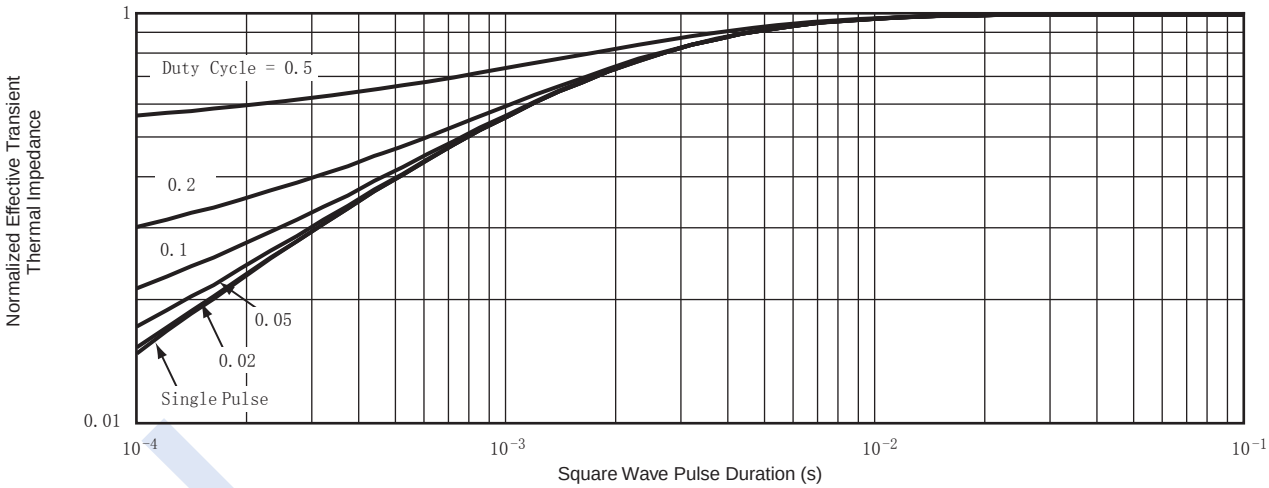
Current Derating*



Power Derating



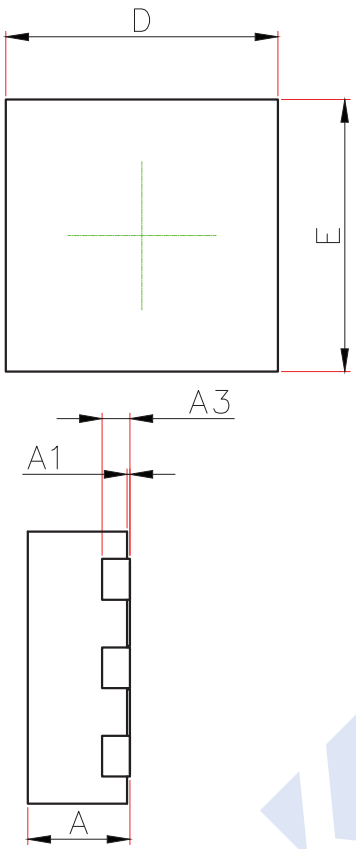
Normalized Thermal Transient Impedance, Junction-to-Ambient

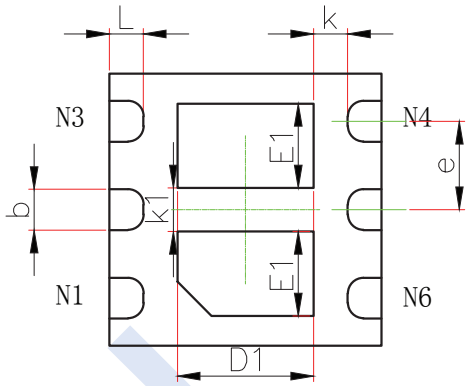


Normalized Thermal Transient Impedance, Junction-to-Case

Complementary Trench MOSFET
2NP05

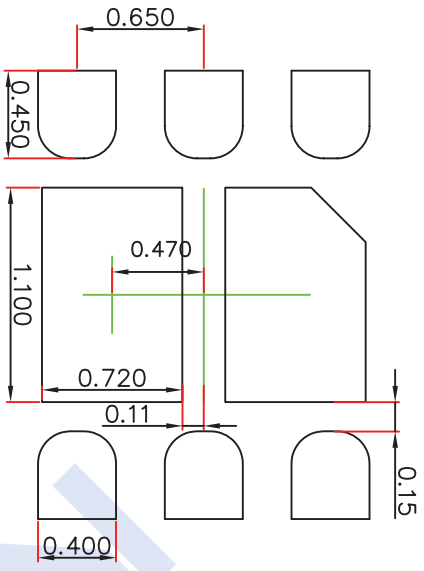
■ DFN2X2-6 Package Outline Dimensions





Symbol	Dimensions In Millimeter		Dimensions In Inches	
	MIN.	MAX.	MIN.	MAX.
A	0.450	0.650	0.019	0.026
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	1.900	2.100	0.075	0.083
E	1.900	2.100	0.075	0.083
D1	0.900	1.100	0.035	0.043
E1	0.520	0.720	0.020	0.028
b	0.250	0.350	0.010	0.014
e	0.625TYP.		0.025TYP.	
k	0.200MIN.		0.008MIN.	
k1	0.320REF.		0.013REF.	
L	0.200	0.300	0.008	0.012

■ Suggested Pad Layout



Note:

1. Controlling dimension: in millimeters,
2. General tolerance:±0.050mm,
3. The pad layout is for reference purposes only.