

## Complementary MOSFET

### 2NP13

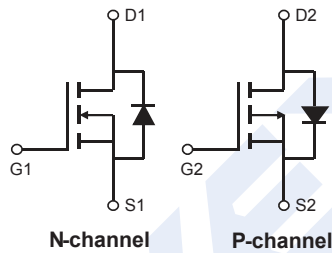
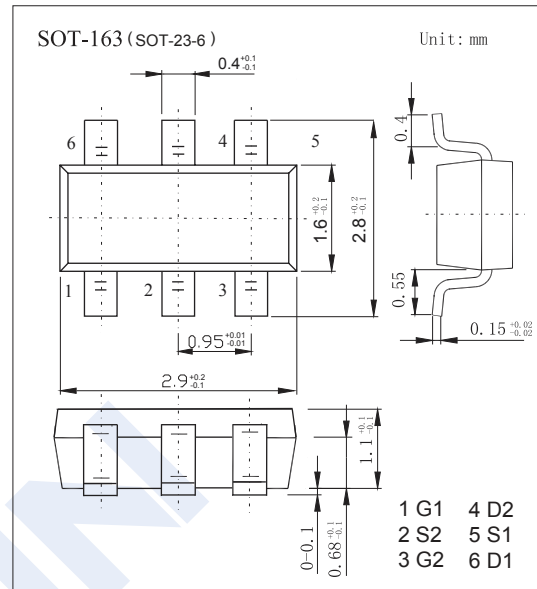
■ Features

N-Channel :

- $V_{DS} (V) = 30V$
- $I_D = 4.3 A (V_{GS} = 10V)$
- $R_{DS(ON)} < 50m\Omega (V_{GS} = 10V)$
- $R_{DS(ON)} < 70m\Omega (V_{GS} = 4.5V)$

P-Channel :

- $V_{DS} (V) = -30V$
- $I_D = -4.1 A (V_{GS} = 10V)$
- $R_{DS(ON)} < 52 m\Omega (V_{GS} = -10V)$
- $R_{DS(ON)} < 87 m\Omega (V_{GS} = -4.5V)$



■ Absolute Maximum Ratings  $T_a = 25^\circ C$

Parameter		Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage		$V_{DS}$	30	-30	V
Gate-Source Voltage		$V_{GS}$	$\pm 20$		
Continuous Drain Current	$T_A=25^\circ C$	$I_D$	4.3	-4.1	A
	$T_A=70^\circ C$		3.7	-3.5	
Pulsed Drain Current		$I_{DM}$	20	-15	
Power Dissipation	$T_A=25^\circ C$	$P_D$	1.15		W
	$T_A=70^\circ C$		0.73		
Thermal Resistance.Junction- to-Ambient	$t \le 10s$	$R_{thJA}$	110		$^\circ C/W$
	Steady-State		150		
Thermal Resistance.Junction- to-Lead		$R_{thJL}$	80		
Junction Temperature		$T_J$	150		$^\circ C$
Storage Temperature Range		$T_{stg}$	-55 to 150		

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■ N-Channel Mosfet Electrical Characteristics  $T_a = 25^\circ\text{C}$ 

Parameter	Symbol	Testconditions	Min	Typ	Max	Unit
Drain-source breakdown voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	30			V
Gate threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1		3	
Gate-body leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
Zero gate voltage drain current	$I_{DSS}$	$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}$			0.5	uA
		$V_{DS} = 30\text{ V}, V_{GS} = 0\text{ V}, T_J = 55^\circ\text{C}$			10	
On-state drain current	$I_{D(on)}$	$V_{DS} \geq 4.5\text{ V}, V_{GS} = 10\text{ V}$	6			A
		$V_{DS} \geq 4.5\text{ V}, V_{GS} = 4.5\text{ V}$	4			
Drain-source on-state resistance	$r_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 3.5\text{ A}$			50	m $\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 2.8\text{ A}$			70	
Forward transconductance	$g_{fs}$	$V_{DS} = 4.5\text{ V}, I_D = 3.5\text{ A}$		6.9		S
Diode forward voltage	$V_{SD}$	$I_S = 1.25\text{ A}, V_{GS} = 0\text{ V}$		0.8	1.2	V
gate charge *	$Q_g$	$V_{DS} = 15\text{ V}, V_{GS} = 5\text{ V}, I_D = 3.5\text{ A}$		4.2	7	nC
Total gate charge *	$Q_{gt}$	$V_{DS} = 15\text{ V}, V_{GS} = 10\text{ V}, I_D = 3.5\text{ A}$		8.5	20	nC
Gate-source charge *	$Q_{gs}$			1.9		
Gate-drain charge *	$Q_{gd}$			1.35		
Gate Resistance	$R_g$		0.5		2.4	$\Omega$
Input capacitance *	$C_{iss}$	$V_{DS} = 15\text{ V}, V_{GS} = 0, f = 1\text{ MHz}$		555		pF
Output capacitance *	$C_{oss}$			120		
Reverse transfer capacitance *	$C_{rss}$			60		
Turn-on time	$t_{d(on)}$		$V_{DD} = 15\text{ V}, R_L = 15\text{ }\Omega,$ $I_D = 1\text{ A}, V_{GEN} = -10\text{ V}, R_G = 6\text{ }\Omega$		9	
	$t_r$			7.5	18	
Turn-off time	$t_{d(off)}$			17	35	
	$t_f$			5.2	12	

\* Pulse test:  $PW \leq 300\text{ }\mu\text{s}$  duty cycle  $\leq 2\%$ .

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## ■ P-Channel Mosfet Electrical Characteristics Ta = 25°C

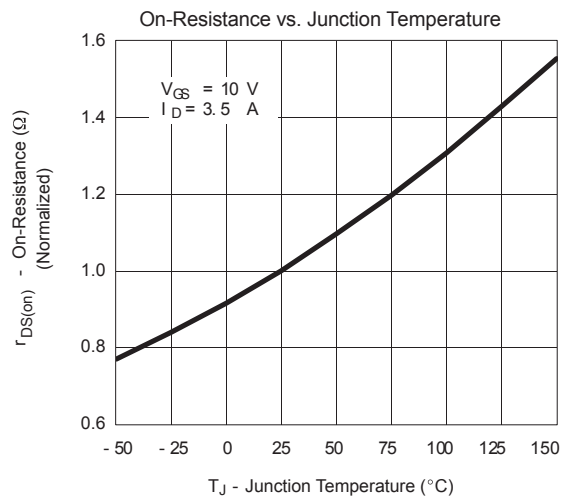
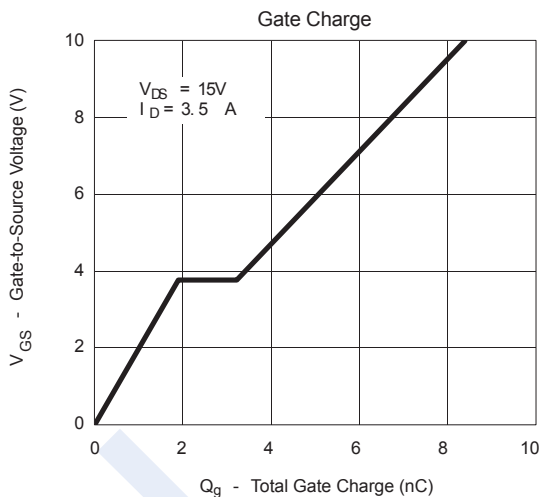
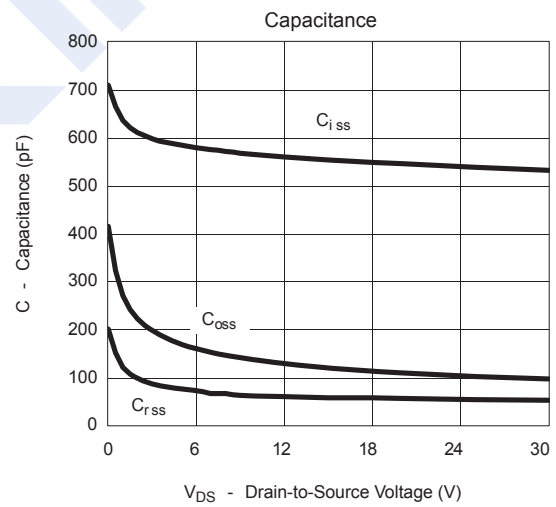
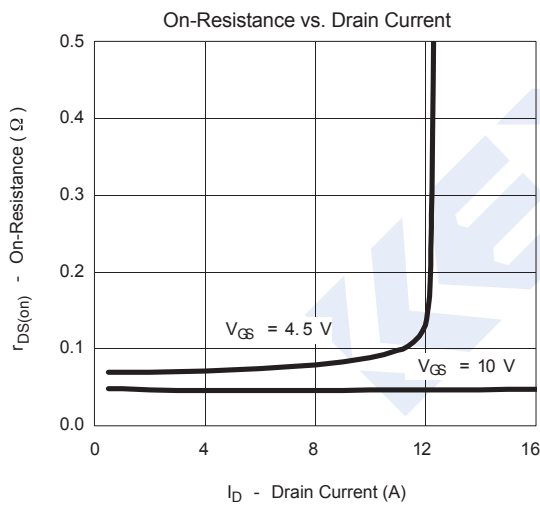
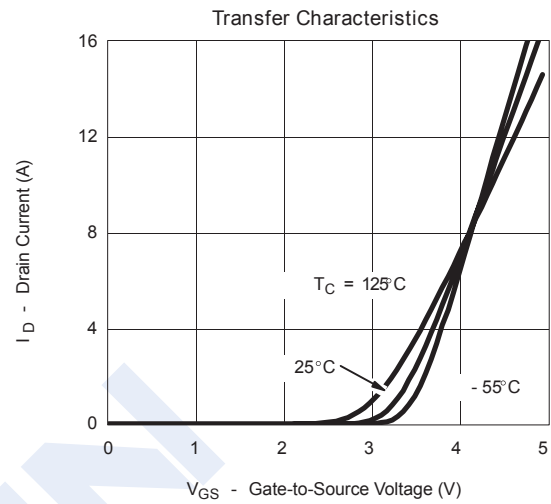
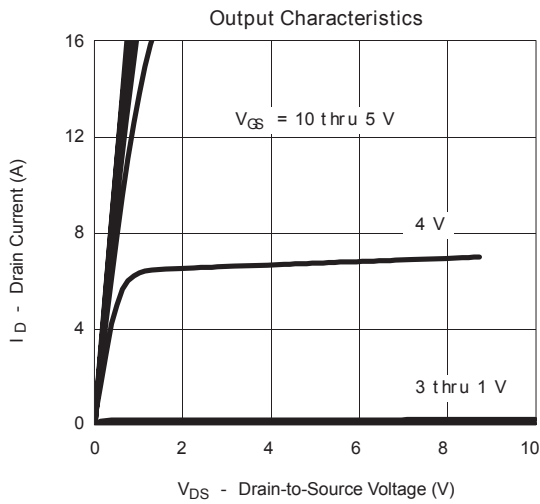
Parameter	Symbol	Test Conditions	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	V <sub>DSS</sub>	I <sub>D</sub> =-250 μ A, V <sub>GS</sub> =0V	-30			V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-24V, V <sub>GS</sub> =0V			-1	μ A
		V <sub>DS</sub> =-24V, V <sub>GS</sub> =0V, T <sub>J</sub> =55°C			-5	
Gate-Body leakage current	I <sub>GSS</sub>	V <sub>DS</sub> =0V, V <sub>GS</sub> =±20V			±100	nA
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> =-250 μ A	-1		-3	V
Static Drain-Source On-Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-4.1A			52	mΩ
		V <sub>GS</sub> =-10V, I <sub>D</sub> =-4.A T <sub>J</sub> =125°C			73	
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-3A			87	
On state drain current	I <sub>D(ON)</sub>	V <sub>GS</sub> =-4.5V, V <sub>DS</sub> =-5V	-10			A
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-5V, I <sub>D</sub> =-4A	5.5	8.2		S
Input Capacitance	C <sub>iss</sub>	V <sub>GS</sub> =0V, V <sub>DS</sub> =-15V, f=1MHz		700		pF
Output Capacitance	C <sub>oss</sub>			120		
Reverse Transfer Capacitance	C <sub>rss</sub>			75		
Gate resistance	R <sub>g</sub>		V <sub>GS</sub> =0V, V <sub>DS</sub> =0V, f=1MHz		10	
Total Gate Charge	Q <sub>g</sub>	V <sub>GS</sub> =-4.5V, V <sub>DS</sub> =-15V, I <sub>D</sub> =-4A		14.3		nC
Gate Source Charge	Q <sub>gs</sub>			7		
Gate Drain Charge	Q <sub>gd</sub>			3.1		
Turn-On DelayTime	t <sub>d(on)</sub>	V <sub>GS</sub> =-10V, V <sub>DS</sub> =-15V, R <sub>L</sub> =3.6Ω, R <sub>GEN</sub> =3Ω		8.6		ns
Turn-On Rise Time	t <sub>r</sub>			5		
Turn-Off DelayTime	t <sub>d(off)</sub>			28.2		
Turn-Off Fall Time	t <sub>f</sub>			13.5		
Body Diode Reverse Recovery Time	t <sub>rr</sub>			27		
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	I <sub>F</sub> =-4A, di/dt=100A/μ s		15		nC
Maximum Body-Diode Continuous Current	I <sub>S</sub>				-2.2	A
Diode Forward Voltage	V <sub>SD</sub>	I <sub>S</sub> =-1A, V <sub>GS</sub> =0V		-0.77	-1	V

## ■ Marking

Marking	NP13 †
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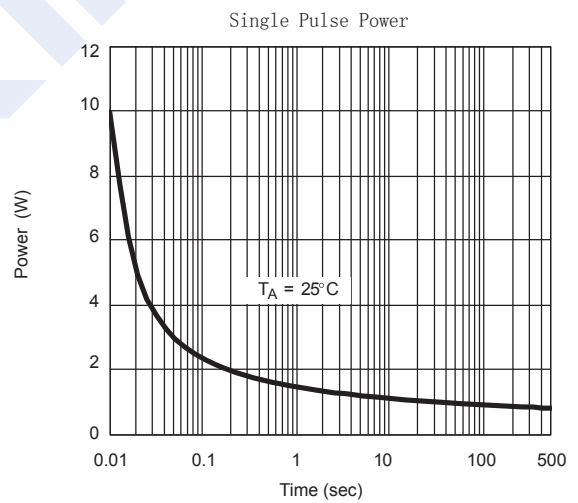
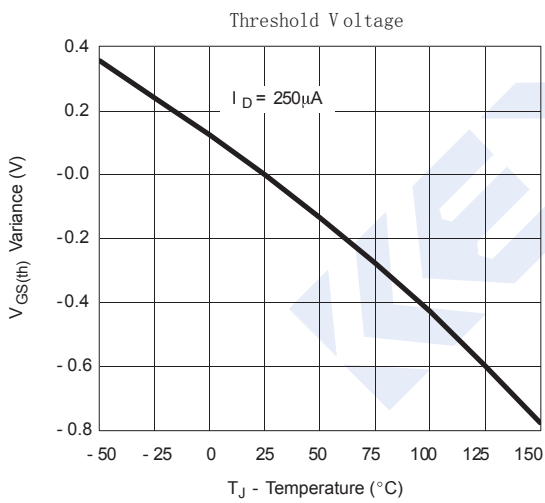
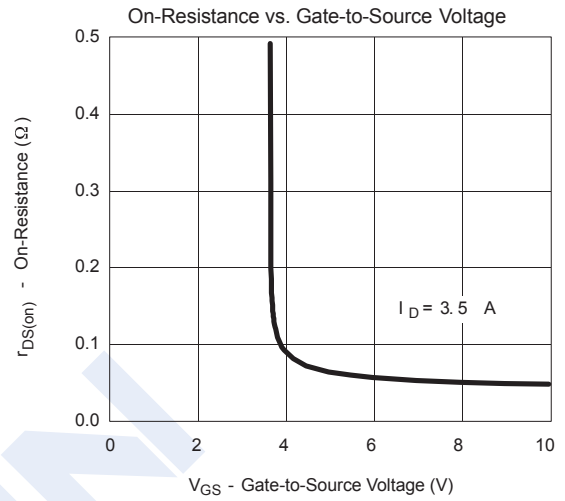
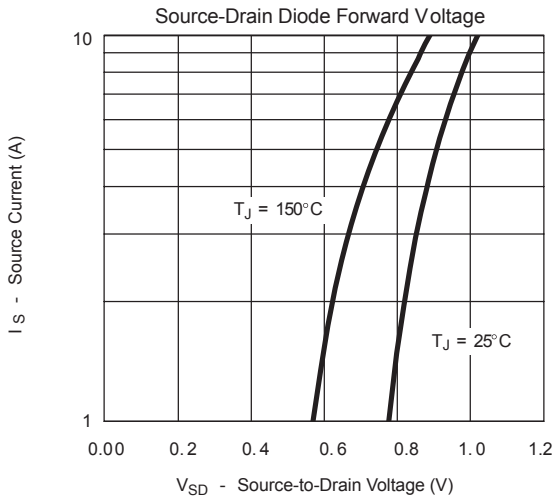
■ N-Channel Mosfet Typical Characteristics



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■ N-Channel Mosfet Typical Characteristics



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### ■ P-Channel Mosfet Typical Characteristics

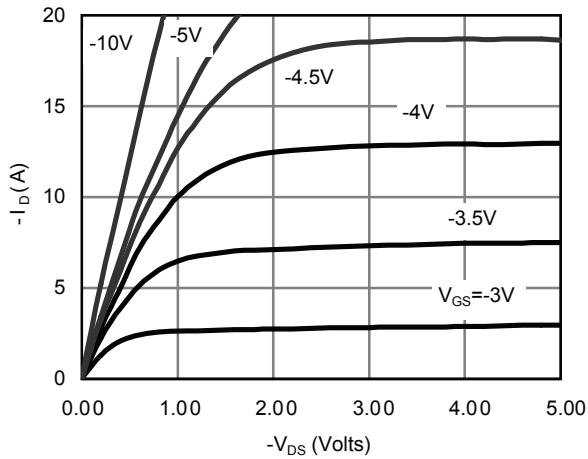


Figure 1: On-Region Characteristics

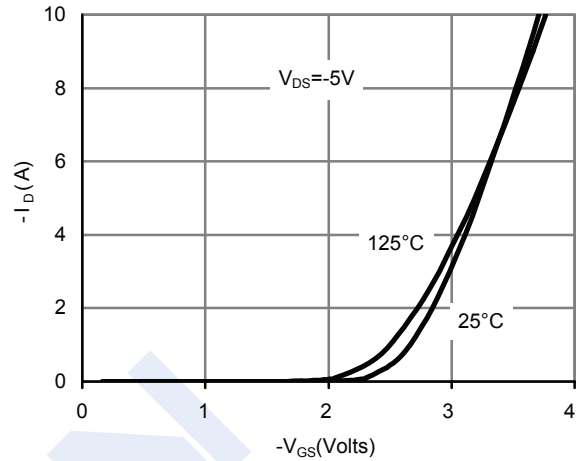


Figure 2: Transfer Characteristics

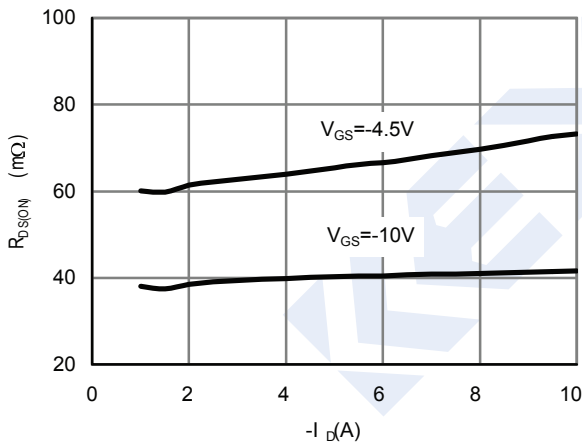


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

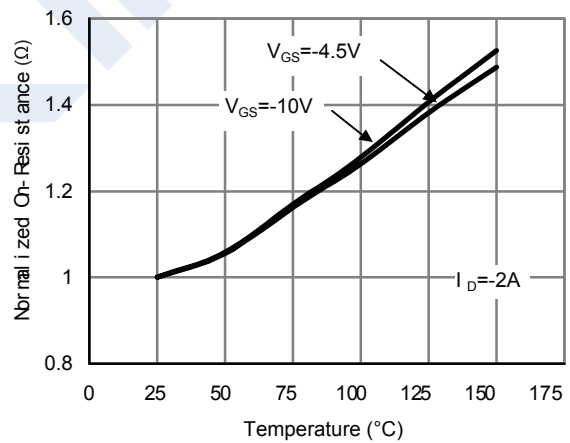


Figure 4: On-Resistance vs. Junction Temperature

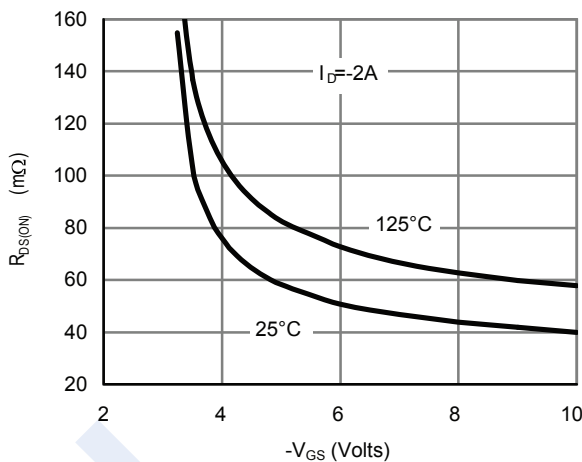


Figure 5: On-Resistance vs. Gate-Source Voltage

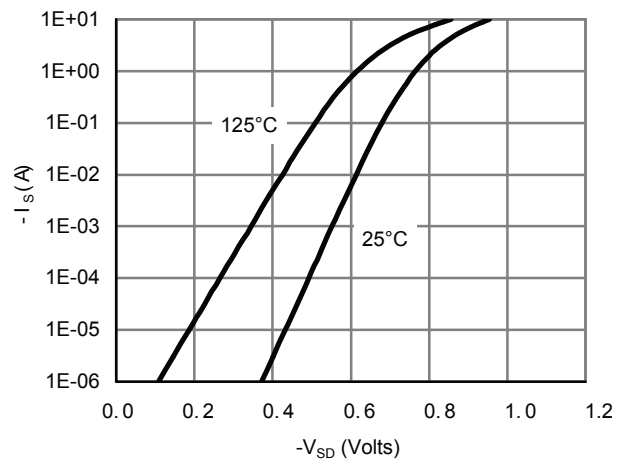


Figure 6: Body-Diode Characteristics

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■ P-Channel Mosfet Typical Characteristics

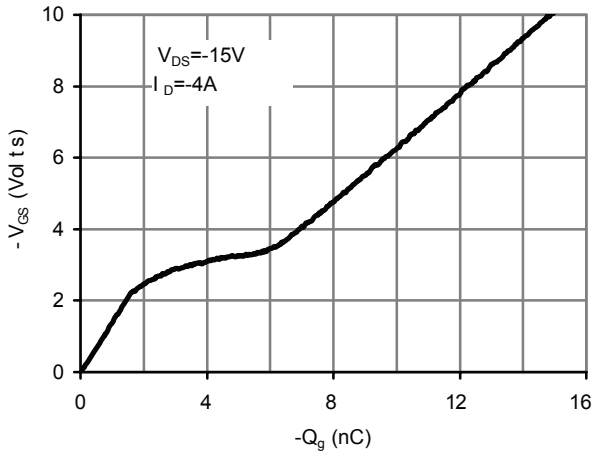


Figure 7: Gate-Charge Characteristics

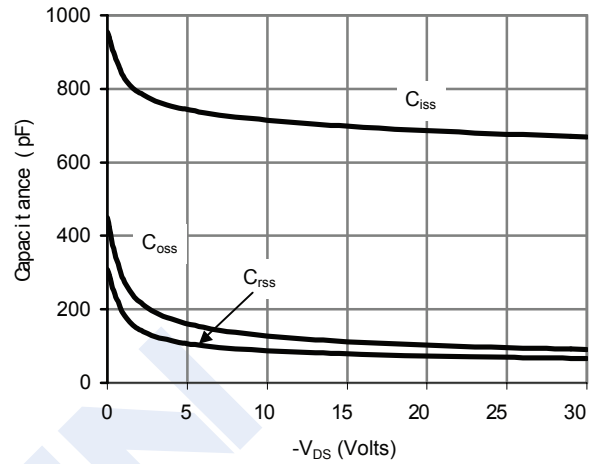


Figure 8: Capacitance Characteristics

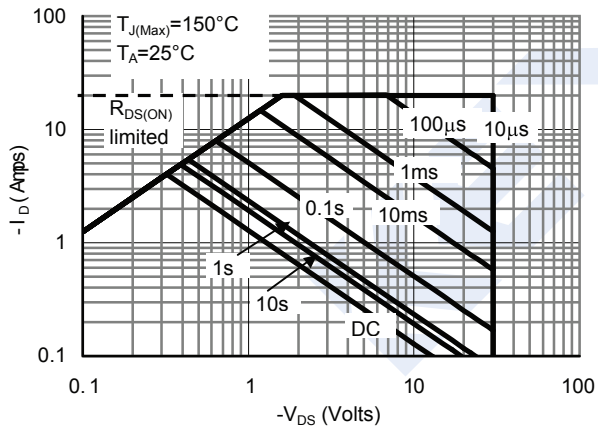


Figure 9: Maximum Forward Biased Safe Operating Area

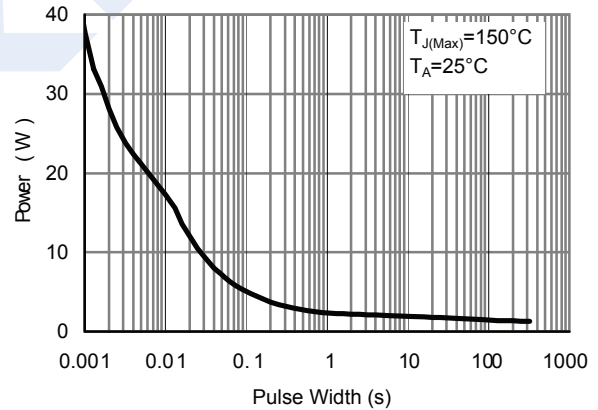


Figure 10: Single Pulse Power Rating Junction-to-Ambient