

N and P-Channel Enhancement Mode Power MOSFET

Description

The NCE4606 uses advanced trench technology to provide excellent $R_{DS(ON)}$ and low gate charge. The complementary MOSFETs may be used to form a level shifted high side switch, and for a host of other applications.

General Features

● N-Channel

$$V_{DS} = 30V, I_D = 6.5A$$

$$R_{DS(ON)} < 24m\Omega @ V_{GS}=10V$$

$$R_{DS(ON)} < 37m\Omega @ V_{GS}=4.5V$$

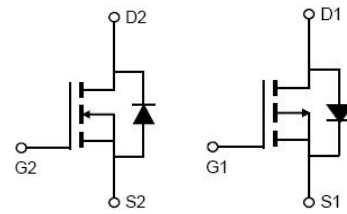
● P-Channel

$$V_{DS} = -30V, I_D = -7A$$

$$R_{DS(ON)} < 32m\Omega @ V_{GS}=-10V$$

$$R_{DS(ON)} < 70m\Omega @ V_{GS}=-4.5V$$

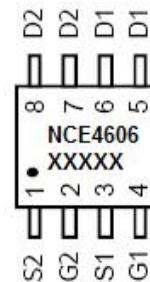
- High power and current handing capability
- Lead free product is acquired
- Surface mount package
- MSL3 up to 260°C peak reflow



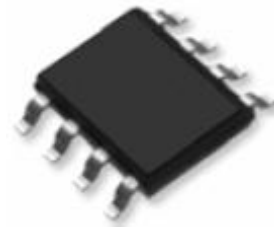
N-channel

P-channel

Schematic diagram



Marking and pin assignment



SOP-8 top view

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
NCE4606	NCE4606	SOP-8	Ø330mm	12mm	4000 units

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

Parameter	Symbol	N-Channel	P-Channel	Unit	
Drain-Source Voltage	V_{DS}	30	-30	V	
Gate-Source Voltage	V_{GS}	± 20	± 20	V	
Continuous Drain Current	I_D	$T_A=25^\circ\text{C}$	6.5	-7	A
		$T_A=70^\circ\text{C}$	5.4	-5.8	
Pulsed Drain Current ^(Note 1)	I_{DM}	30	-30	A	
Maximum Power Dissipation	P_D	2.0	2.0	W	
Single pulse avalanche energy ^(Note 6)	E_{AS}	39	72	mJ	
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	-55 To 150	$^\circ\text{C}$	

Thermal Characteristic

Thermal Resistance, Junction-to-Ambient ^(Note2)	$R_{\theta JA}$	N-Ch	62.5	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient ^(Note2)	$R_{\theta JA}$	P-Ch	62.5	$^\circ\text{C/W}$

N-CH Electrical Characteristics (T_A=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	
Off Characteristics							
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _D =250μA	30	33	-	V	
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =30V, V _{GS} =0V	-	-	1	μA	
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA	
On Characteristics (Note 3)							
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250μA	1	1.6	2.5	V	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} =10V, I _D =6A	T _J =25°C	-	19	24	mΩ
			T _J =125°C	-	30	39	
			T _J =150°C	-	34	44	
		V _{GS} =4.5V, I _D =6A	T _J =25°C	-	26	37	mΩ
			T _J =125°C	-	41	58	
			T _J =150°C	-	45.5	64	
Gate resistance	R _G	V _{DS} =0V, V _{GS} =0V, F=1.0MHz	-	1.1	-	Ω	
Forward Transconductance	g _{FS}	V _{DS} =5V, I _D =6A	15	-	-	S	
Dynamic Characteristics (Note4)							
Input Capacitance	C _{iss}	V _{DS} =15V, V _{GS} =0V, F=1.0MHz	-	530.3	-	PF	
Output Capacitance	C _{oss}		-	67.1	-	PF	
Reverse Transfer Capacitance	C _{rss}		-	61.2	-	PF	
Switching Characteristics (Note 4)							
Turn-on Delay Time	t _{d(on)}	V _{DD} =15V, I _D =6A V _{GS} =10V, R _{GEN} =3Ω	-	4.5	-	nS	
Turn-on Rise Time	t _r		-	2.5	-	nS	
Turn-Off Delay Time	t _{d(off)}		-	14.5	-	nS	
Turn-Off Fall Time	t _f		-	3.5	-	nS	
Total Gate Charge	Q _g	V _{DS} =15V, I _D =6A, V _{GS} =10V	-	14.2	-	nC	
Gate-Source Charge	Q _{gs}		-	1.8	-	nC	
Gate-Drain Charge	Q _{gd}		-	3.3	-	nC	
Drain-Source Diode Characteristics							
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =6A	-	0.8	1.2	V	
Diode Forward Current (Note 2)	I _S		-	-	6.5	A	
Reverse Recovery Time	t _{rr}	T _J = 25°C, I _F = I _S	-	10	-	nS	
Reverse Recovery Charge	Q _{rr}	di/dt = 100A/μs (Note3)	-	5	-	nC	

P-CH Electrical Characteristics (T_A=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit	
Off Characteristics							
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _D =-250μA	-30	-33	-	V	
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =-30V, V _{GS} =0V	-	-	-1	μA	
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA	
On Characteristics (Note 3)							
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =-250μA	-1.3	-1.65	-2.5	V	
Drain-Source On-State Resistance	R _{DS(on)}	V _{GS} =-10V, I _D =-6.5A	T _J =25°C	-	28	32	mΩ
			T _J =125°C	-	41	48	
			T _J =150°C	-	45	52	
		V _{GS} =-4.5V, I _D =-6.5A	T _J =25°C	-	49	70	mΩ
			T _J =125°C	-	63	89	
			T _J =150°C	-	67.5	96	
Gate resistance	R _G	V _{DS} =0V, V _{GS} =0V, F=1.0MHz	-	4.2	-	Ω	
Forward Transconductance	g _{FS}	V _{DS} =-5V, I _D =-6.5A	10	-	-	S	
Dynamic Characteristics (Note4)							
Input Capacitance	C _{iss}	V _{DS} =-15V, V _{GS} =0V, F=1.0MHz	-	729.4	-	PF	
Output Capacitance	C _{oss}		-	112.6	-	PF	
Reverse Transfer Capacitance	C _{riss}		-	107.5	-	PF	
Switching Characteristics (Note 4)							
Turn-on Delay Time	t _{d(on)}	V _{DD} =-15V, I _D =-6.5A V _{GS} =-10V, R _{GEN} =6Ω	-	7.5	-	nS	
Turn-on Rise Time	t _r		-	5.5	-	nS	
Turn-Off Delay Time	t _{d(off)}		-	19	-	nS	
Turn-Off Fall Time	t _f		-	7	-	nS	
Total Gate Charge	Q _g	V _{DS} =-15V, I _D =-6.5A V _{GS} =-10V	-	16.6	-	nC	
Gate-Source Charge	Q _{gs}		-	1.8	-	nC	
Gate-Drain Charge	Q _{gd}		-	4.2	-	nC	
Drain-Source Diode Characteristics							
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =-6.5A	-	-	-1.2	V	
Diode Forward Current (Note 2)	I _S		-	-	-7	A	
Reverse Recovery Time	t _{rr}	T _J = 25°C, I _F = I _S di/dt = 100A/μs (Note3)	-	15	-	nS	
Reverse Recovery Charge	Q _{rr}		-	10	-	nC	

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production

N- Channel Typical Electrical and Thermal Characteristics (Curves)

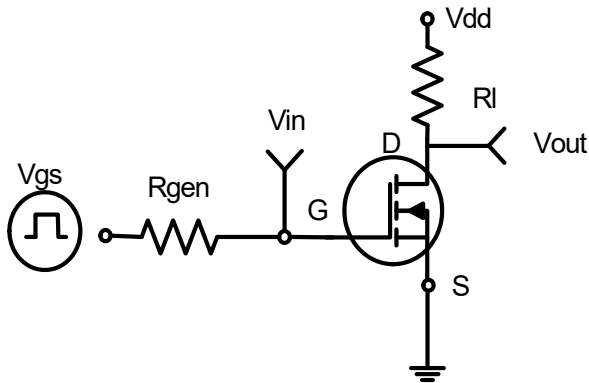


Figure 1: Switching Test Circuit

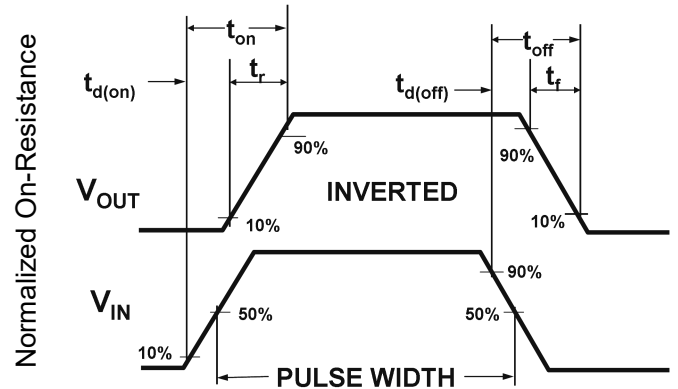


Figure 2: Switching Waveforms

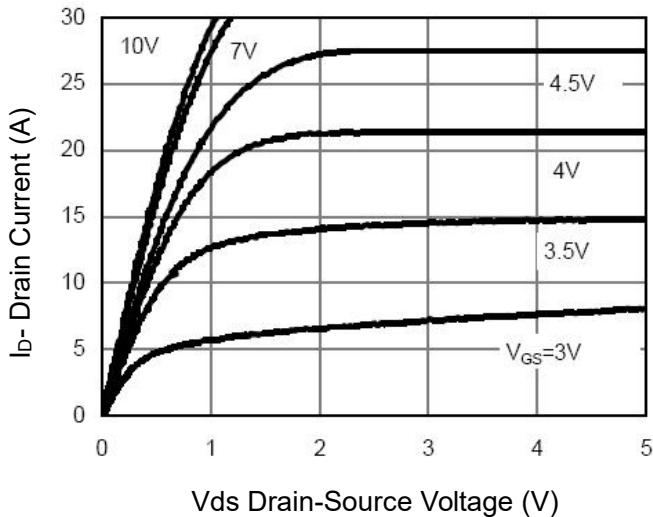


Figure 3 Output Characteristics

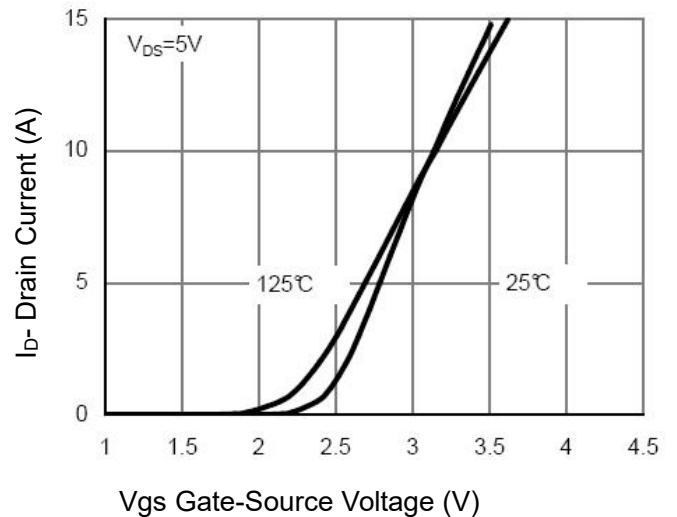


Figure 4 Transfer Characteristics

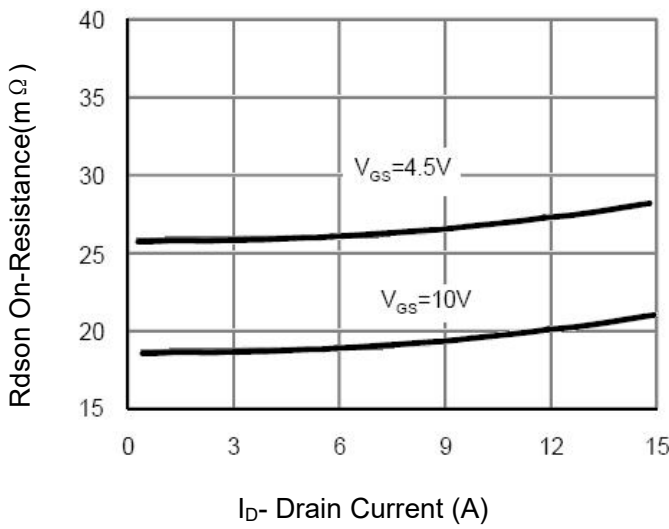


Figure 5 Drain-Source On-Resistance

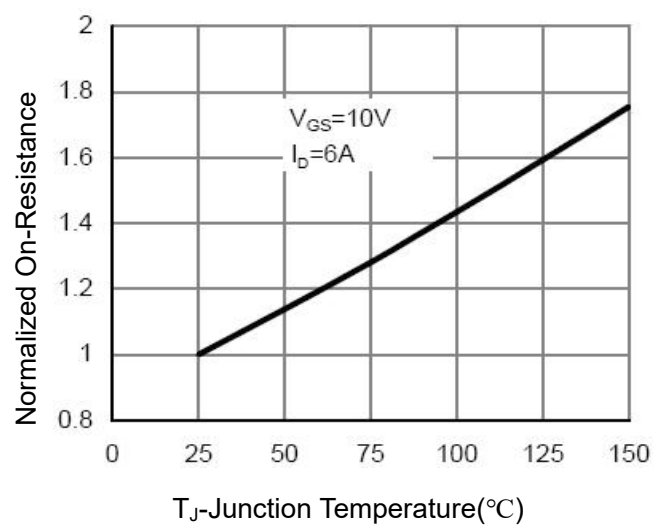
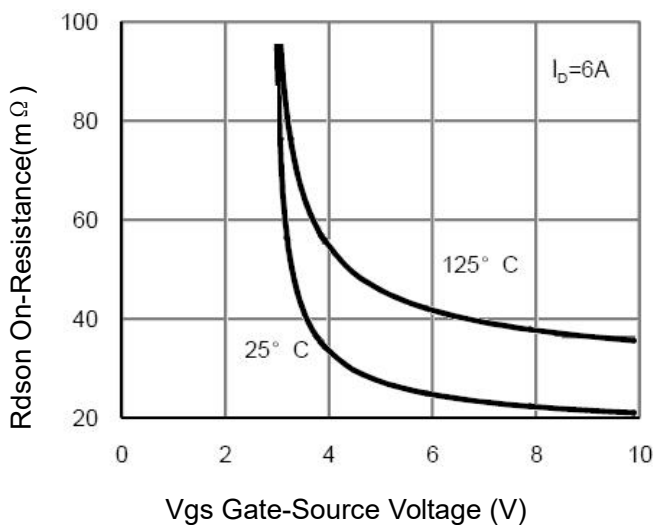
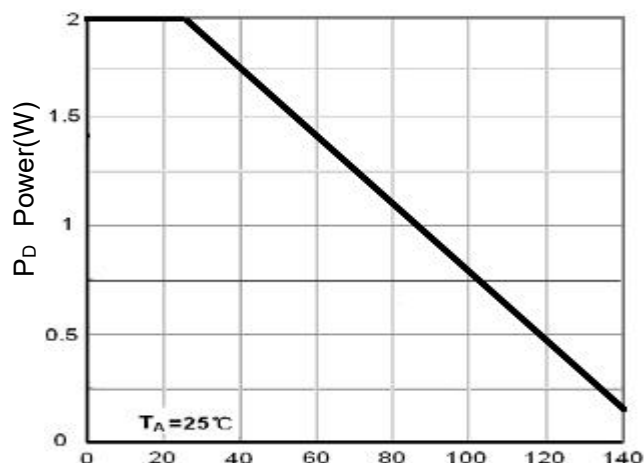


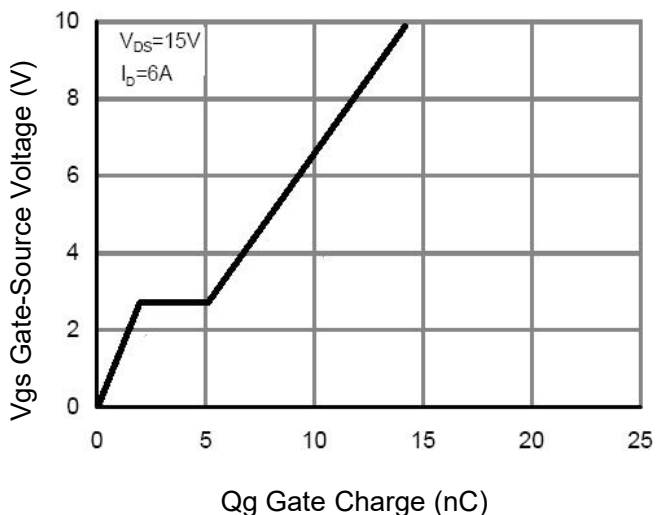
Figure 6 Drain-Source On-Resistance



Vgs Gate-Source Voltage (V)
Figure 7 Rdson vs Vgs



T_J-Junction Temperature(°C)
Figure 8 Power Dissipation



Qg Gate Charge (nC)
Figure 9 Gate Charge

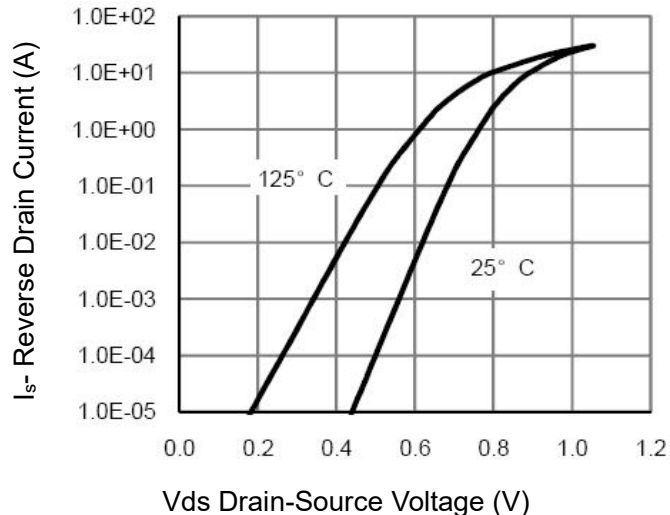
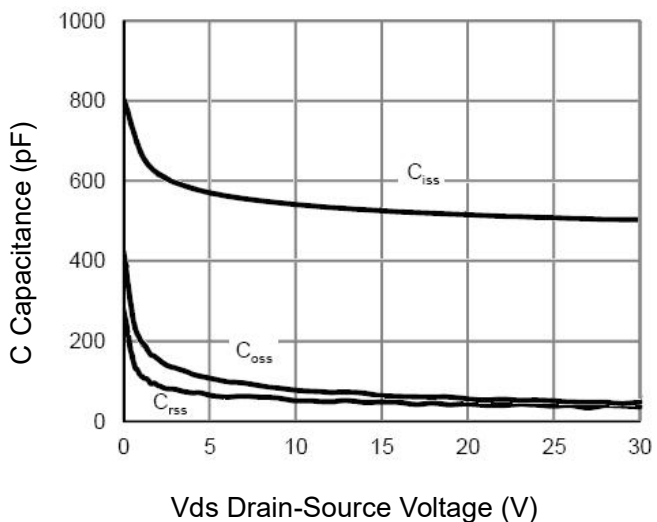


Figure 10 Source- Drain Diode Forward



Vds Drain-Source Voltage (V)
Figure 11 Capacitance vs Vds

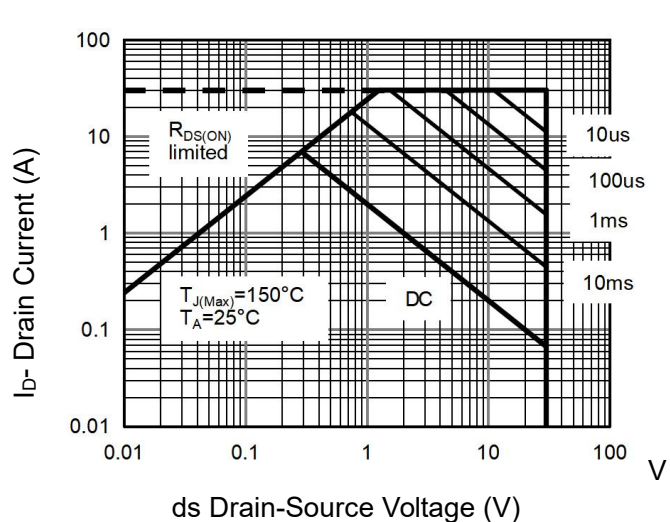


Figure 12 Safe Operation Area

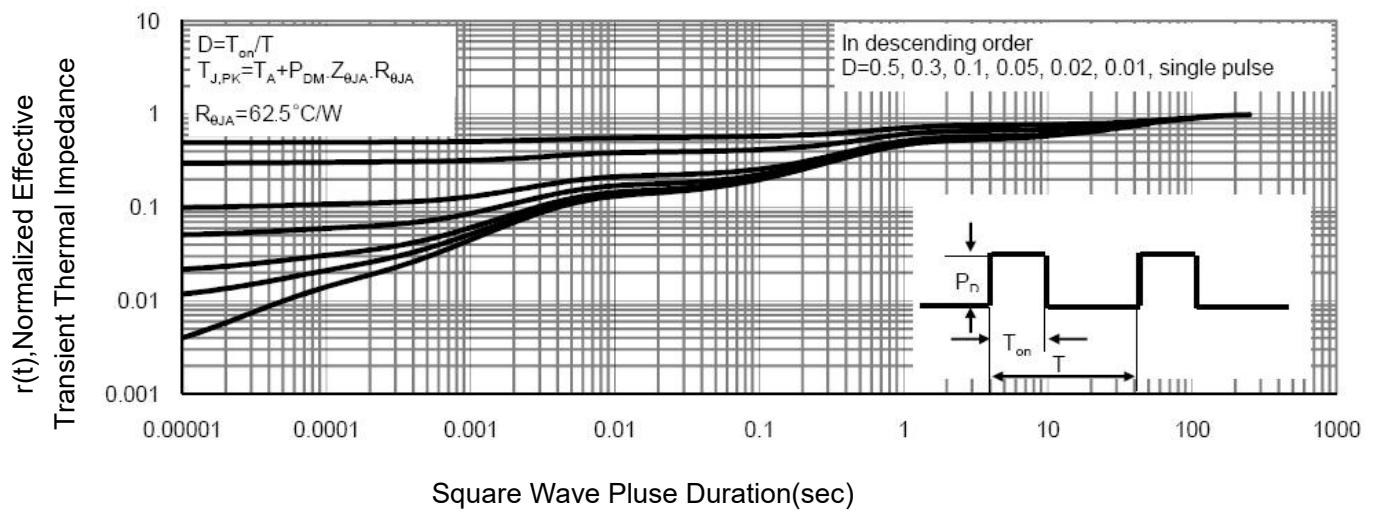


Figure 13 Normalized Maximum Transient Thermal Impedance

P- Channel Typical Electrical and Thermal Characteristics (Curves)

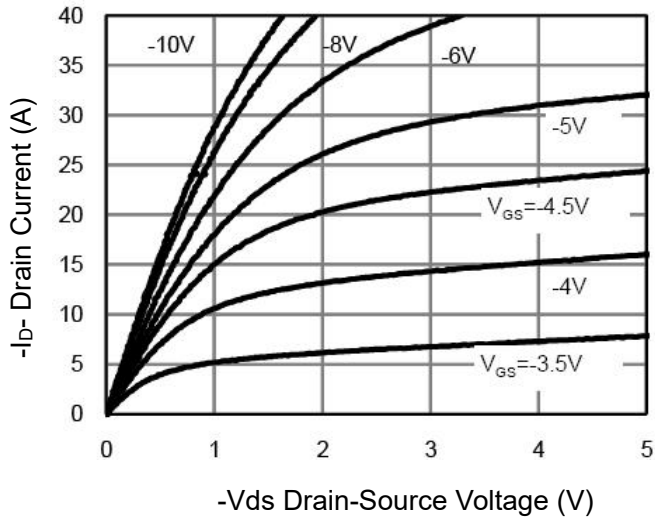


Figure 1 Output Characteristics

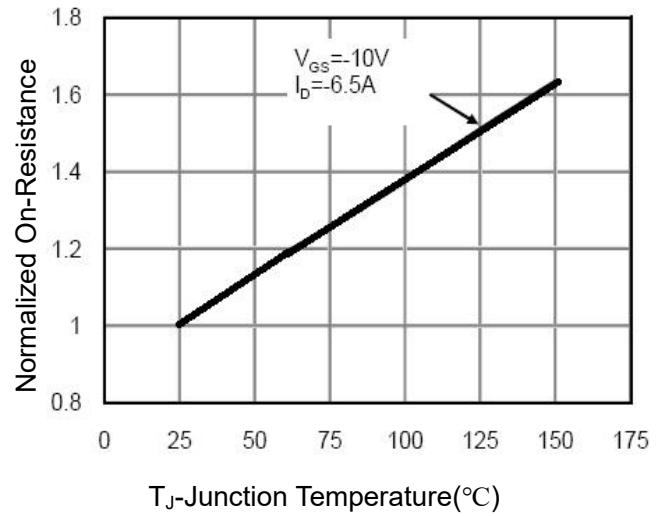


Figure 4 Rdson-Junction Temperature

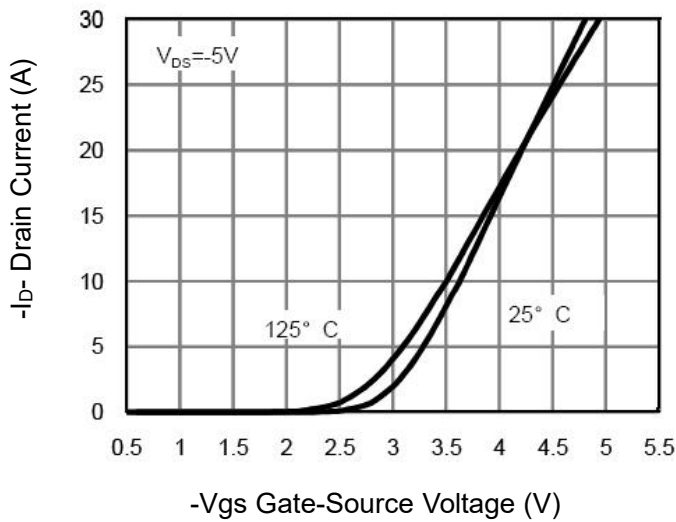


Figure 2 Transfer Characteristics

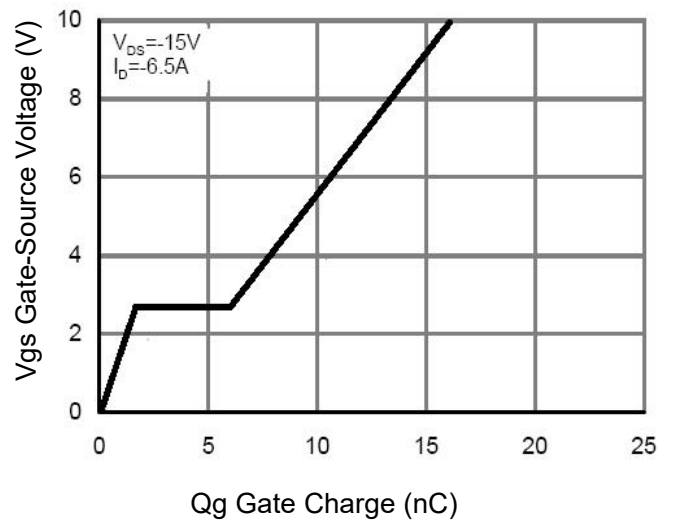


Figure 5 Gate Charge

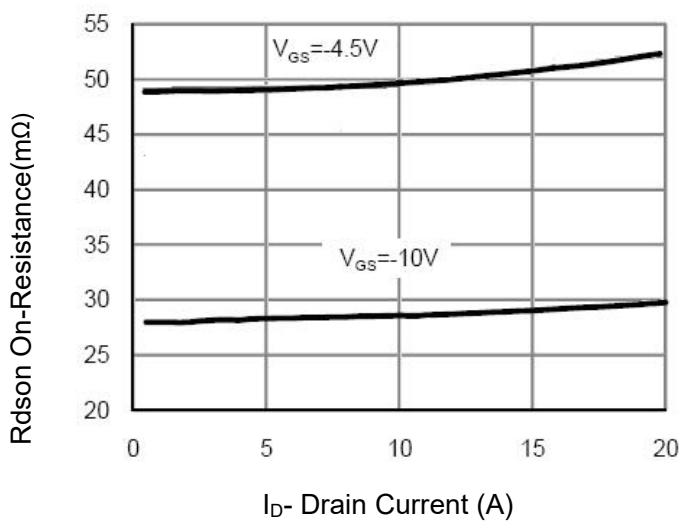


Figure 3 Rdson- Drain Current

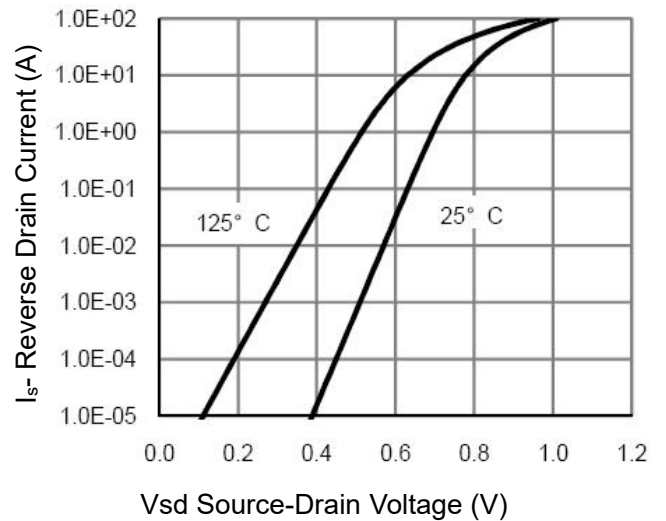


Figure 6 Source- Drain Diode Forward

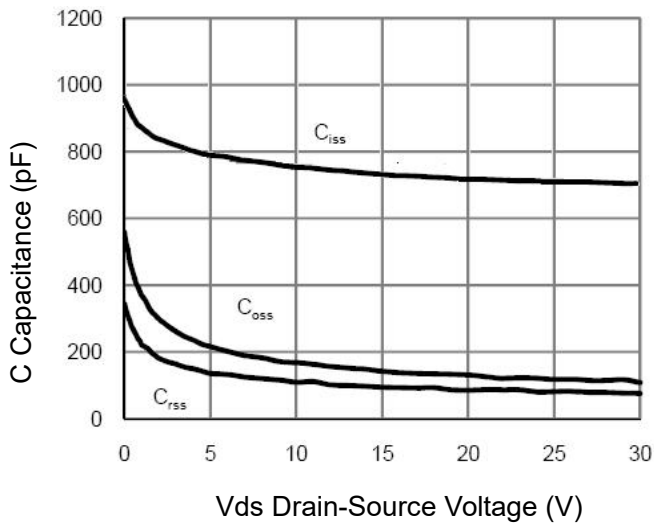


Figure 7 Capacitance vs Vds

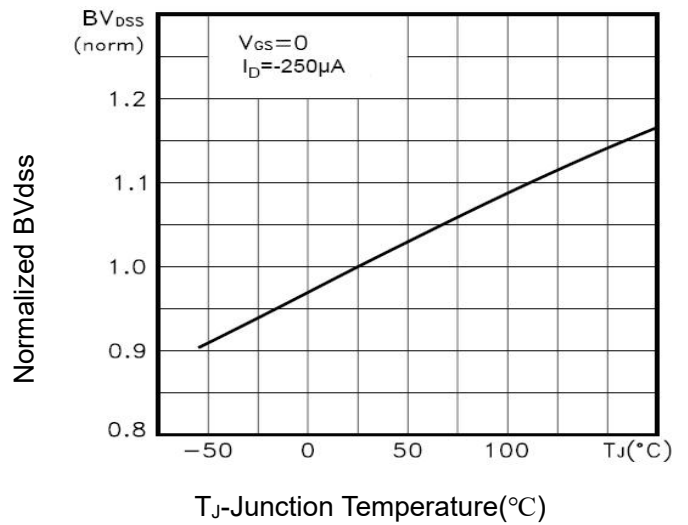


Figure 9 BV_{DSS} vs Junction Temperature

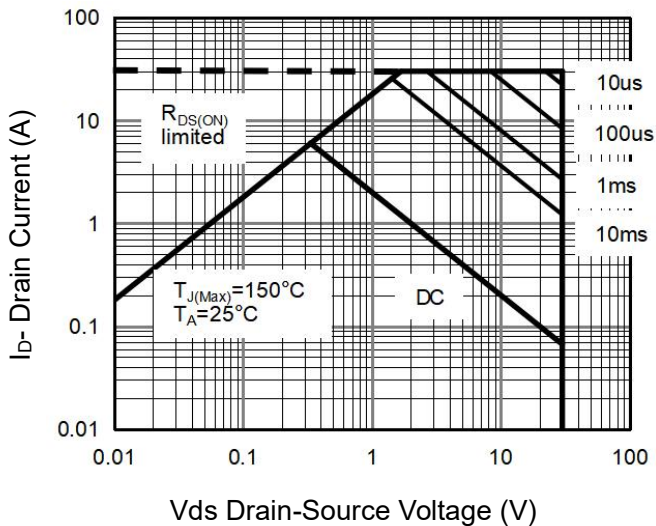


Figure 8 Safe Operation Area

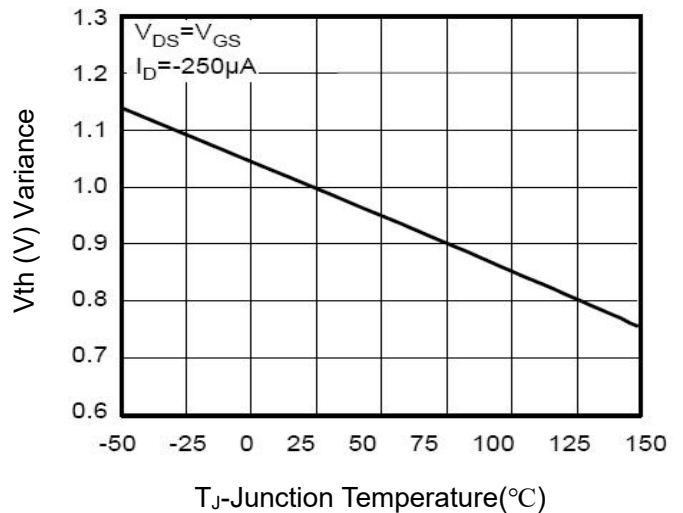


Figure 10 $V_{GS(th)}$ vs Junction Temperature

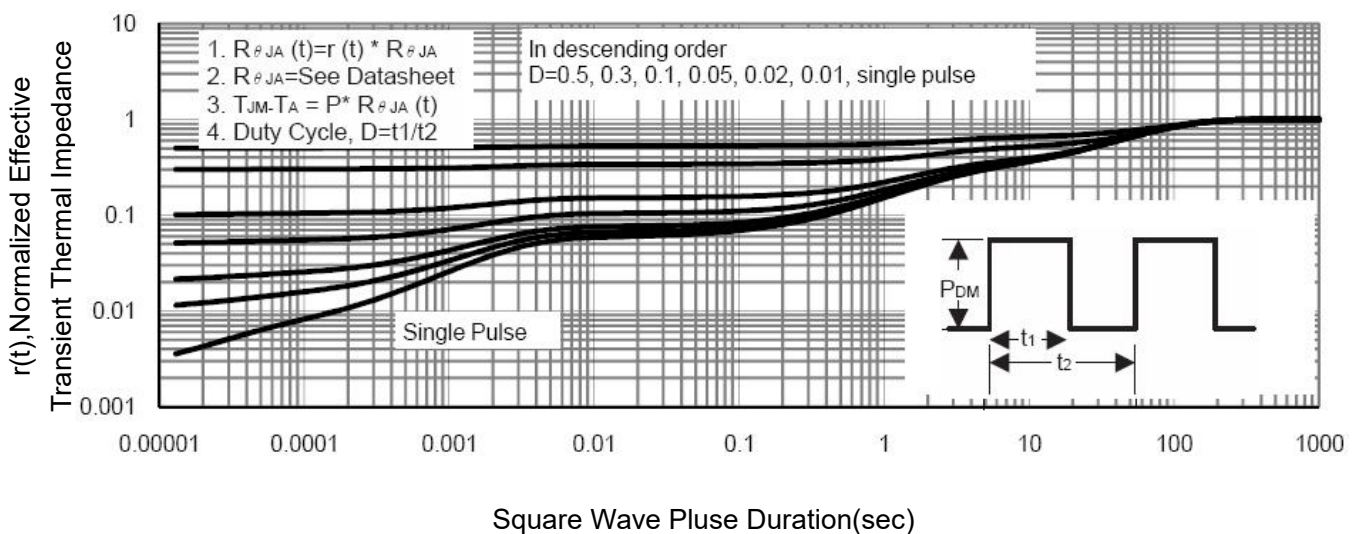
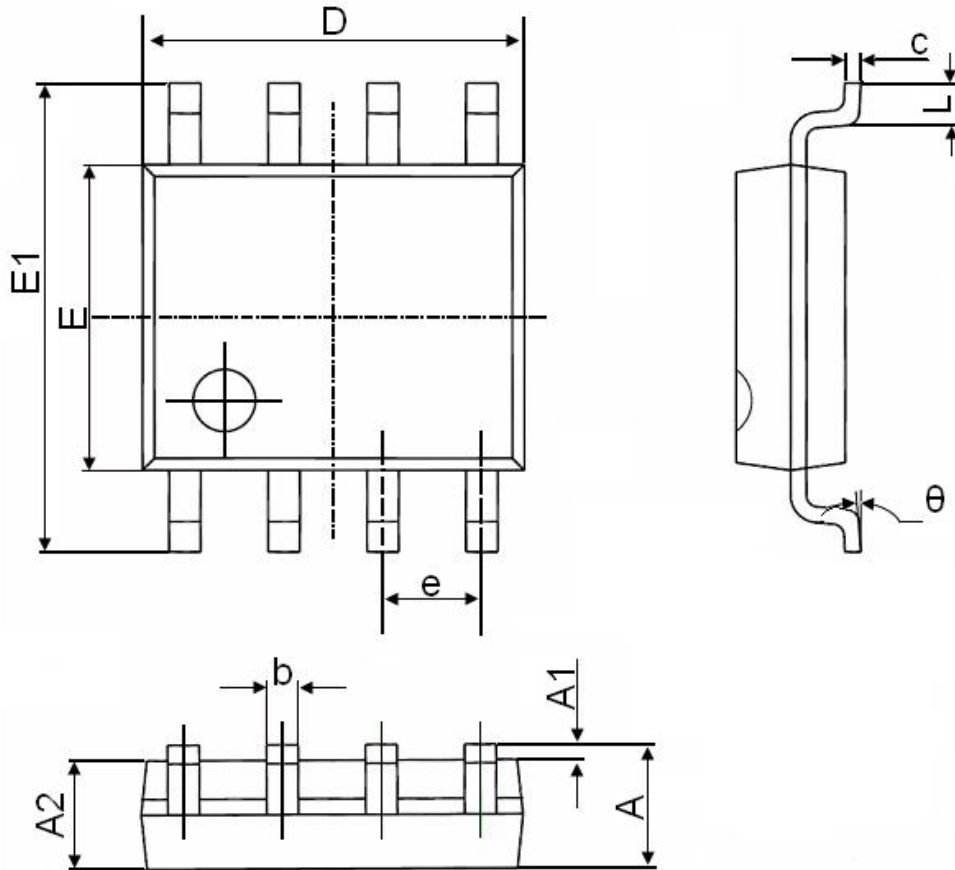


Figure 11 Normalized Maximum Transient Thermal Impedance

SOP-8 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

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