

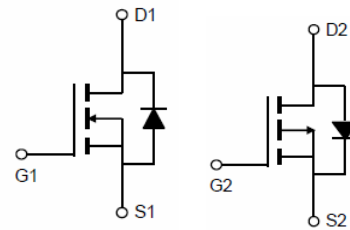
NCE N and P-Channel Enhancement Mode Power MOSFET

Description

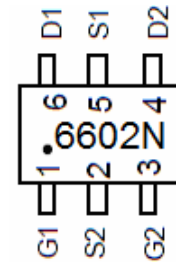
The NCE6602N uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge. This device is suitable for use as a Battery protection or in other Switching application.

General Features

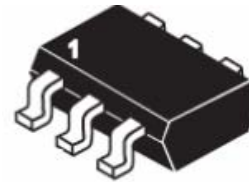
- **N-Channel**
- $V_{DS} = 30V, I_D = 3.5A$
 $R_{DS(ON)} < 58m\Omega @ V_{GS}=10V$
 $R_{DS(ON)} < 95m\Omega @ V_{GS}=4.5V$
- **P-Channel**
- $V_{DS} = -30V, I_D = -2.7A$
 $R_{DS(ON)} < 100m\Omega @ V_{GS}=-10V$
 $R_{DS(ON)} < 150m\Omega @ V_{GS}=-4.5V$
- Low On-Resistance
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage



N-channel P-channel
Schematic diagram



Pin Assignment



SOT23-6L top view

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
6602N	NCE6602N	SOT23-6L	Ø180mm	8mm	3000 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	$T_A=25^\circ\text{C}$	I_D	3.5	-2.7	A
	$T_A=70^\circ\text{C}$		3	-2.1	
Pulsed Drain Current ^(Note 1)		I_{DM}	20	-15	A
Maximum Power Dissipation		P_D	1.2		W
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	104	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Ambient ^(Note2)	$R_{\theta JA}$	P-Ch	104	$^\circ\text{C/W}$

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	1.2	1.5	2.2	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =3.5A	-	36	58	mΩ
		V _{GS} =4.5V, I _D =2A	-	60	95	mΩ
Forward Transconductance	g _{FS}	V _{DS} =5V, I _D =3.1A	-	4	-	S
Dynamic Characteristics (Note 4)						
Input Capacitance	C _{iss}	V _{DS} =15V, V _{GS} =0V, F=1.0MHz	-	251	-	PF
Output Capacitance	C _{oss}		-	38	-	PF
Reverse Transfer Capacitance	C _{rss}		-	32	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =15V, R _L =3Ω V _{GS} =10V, R _{GEN} =6Ω	-	4.5	-	nS
Turn-on Rise Time	t _r		-	1.5	-	nS
Turn-Off Delay Time	t _{d(off)}		-	18.5	-	nS
Turn-Off Fall Time	t _f		-	15.5	-	nS
Total Gate Charge	Q _g	V _{DS} =15V, I _D =3.5A, V _{GS} =10V	-	10.0	-	nC
Gate-Source Charge	Q _{gs}		-	1.9	-	nC
Gate-Drain Charge	Q _{gd}		-	1.8	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =3.5A	-	0.8	1.2	V
Diode Forward Current (Note 2)	I _S		-	-	3.5	A

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

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	-1.6	-2.5	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =-10V, I _D =-2.7A	-	69	100	mΩ
		V _{GS} =-4.5V, I _D =-2A	-	110	150	mΩ
Forward Transconductance	g _{FS}	V _{DS} =-10V, I _D =-2.7A		2	-	S
Dynamic Characteristics (Note 4)						
Input Capacitance	C _{ISS}	V _{DS} =-15V, V _{GS} =0V, F=1.0MHz	-	278	-	PF
Output Capacitance	C _{OSS}		-	43	-	PF
Reverse Transfer Capacitance	C _{RSS}		-	35	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =-15V, R _L =15Ω V _{GS} =-10V, R _{GEN} =6Ω	-	8	-	nS
Turn-on Rise Time	t _r		-	5	-	nS
Turn-Off Delay Time	t _{d(off)}		-	12	-	nS
Turn-Off Fall Time	t _f		-	4	-	nS
Total Gate Charge	Q _g	V _{DS} =-15V, I _D =-2.7A, V _{GS} =-10V	-	5.8	-	nC
Gate-Source Charge	Q _{gs}		-	1	-	nC
Gate-Drain Charge	Q _{gd}		-	1.1	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =-2.7A	-	-	-1.2	V

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

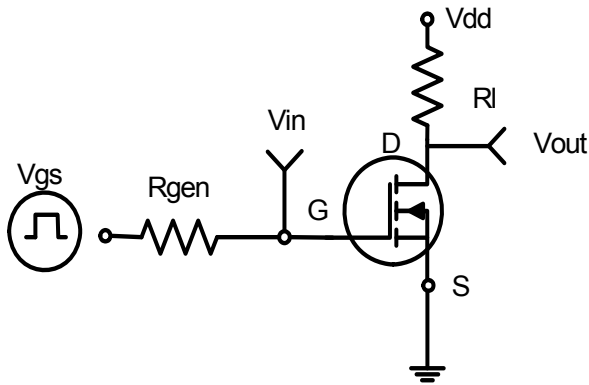


Figure 1: Switching Test Circuit

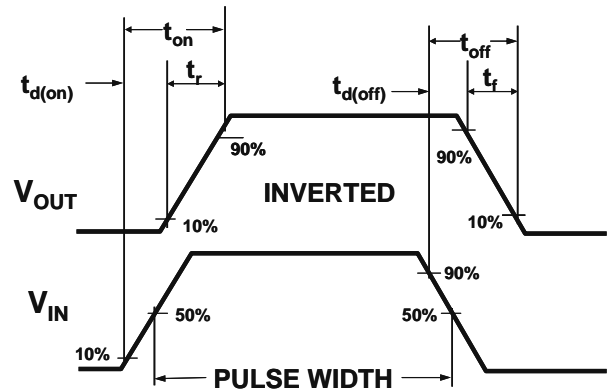


Figure 2: Switching Waveforms

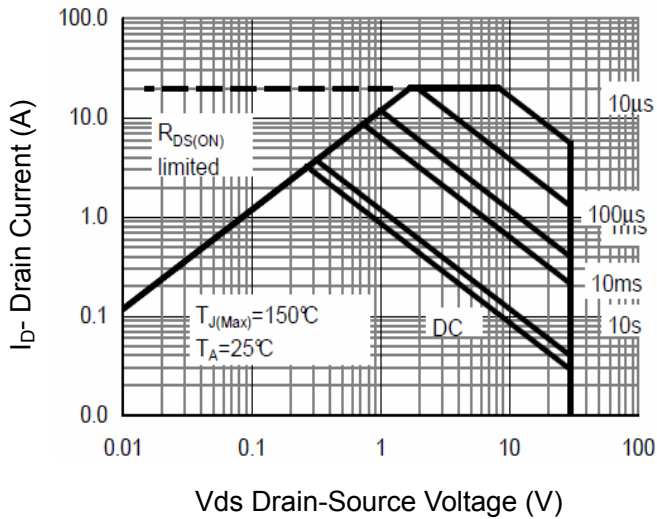


Figure 3 Safe Operation Area

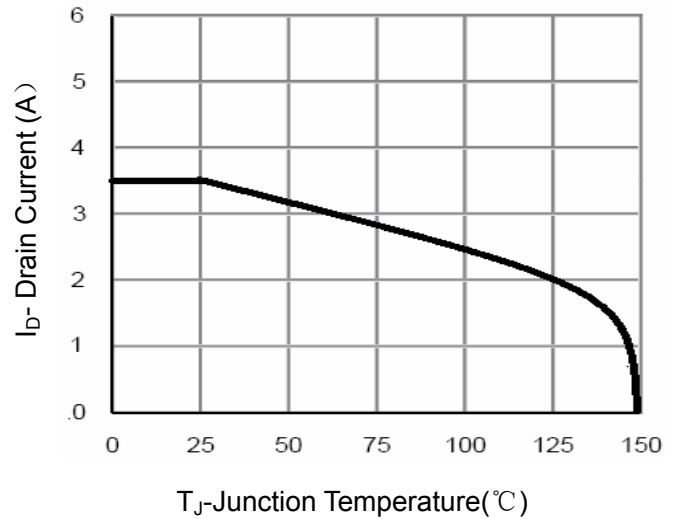


Figure 4 Drain Current

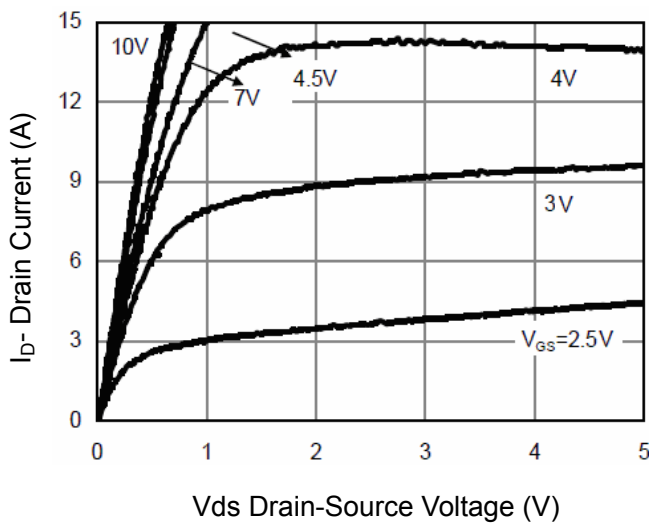


Figure 5 Output Characteristics

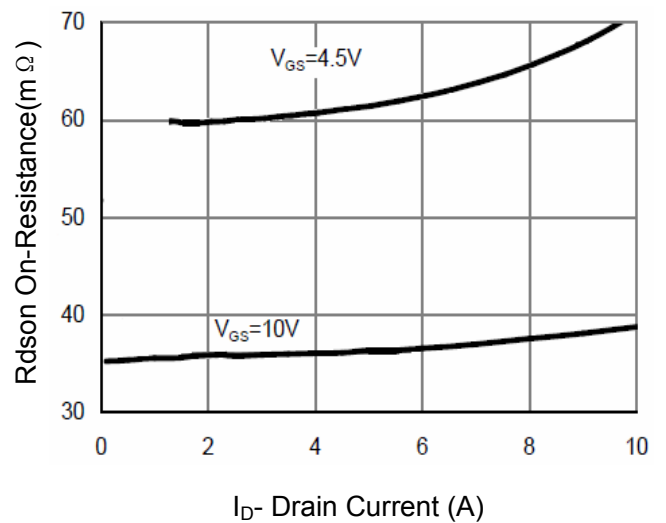


Figure 6 Drain-Source On-Resistance

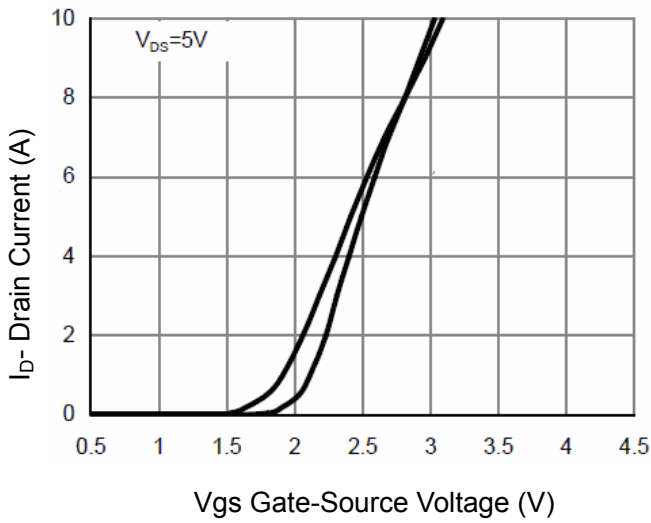


Figure 7 Transfer Characteristics

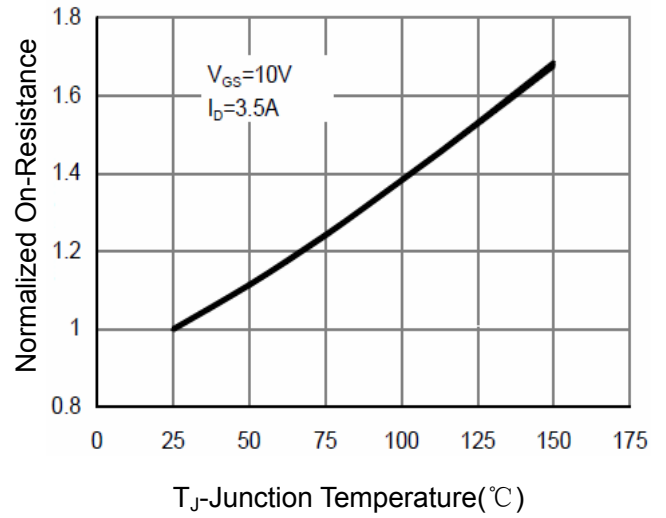


Figure 8 Drain-Source On-Resistance

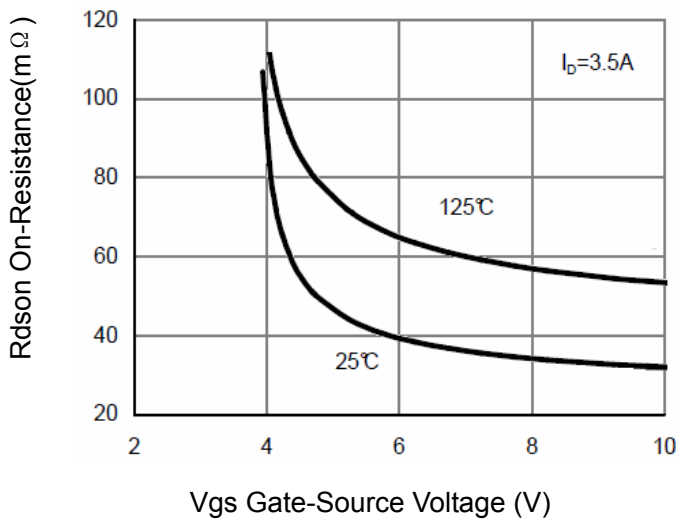


Figure 9 Rdson vs Vgs

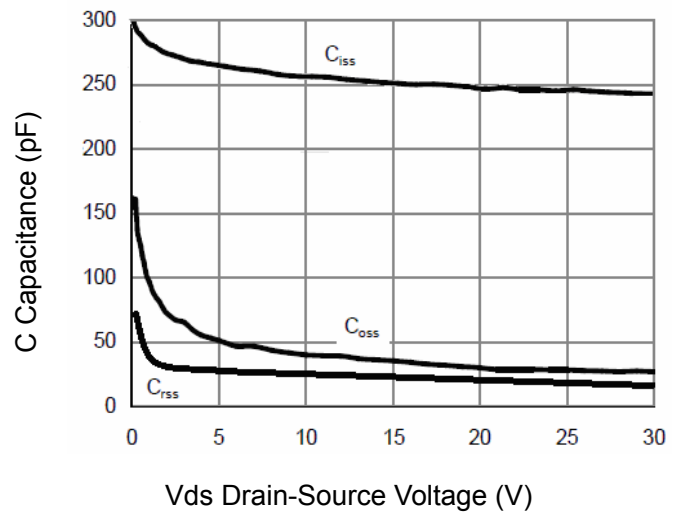


Figure 10 Capacitance vs Vds

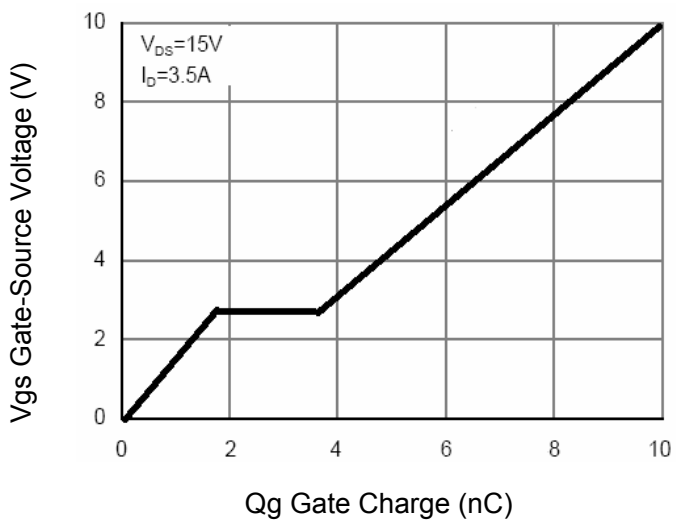


Figure 11 Gate Charge

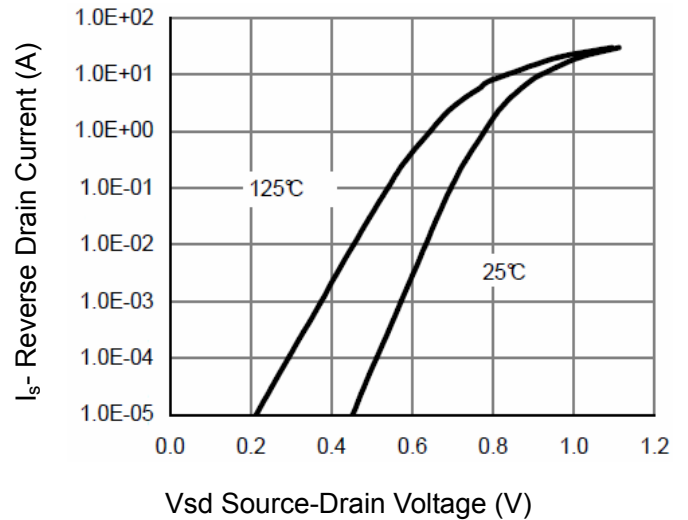


Figure 12 Source- Drain Diode Forward

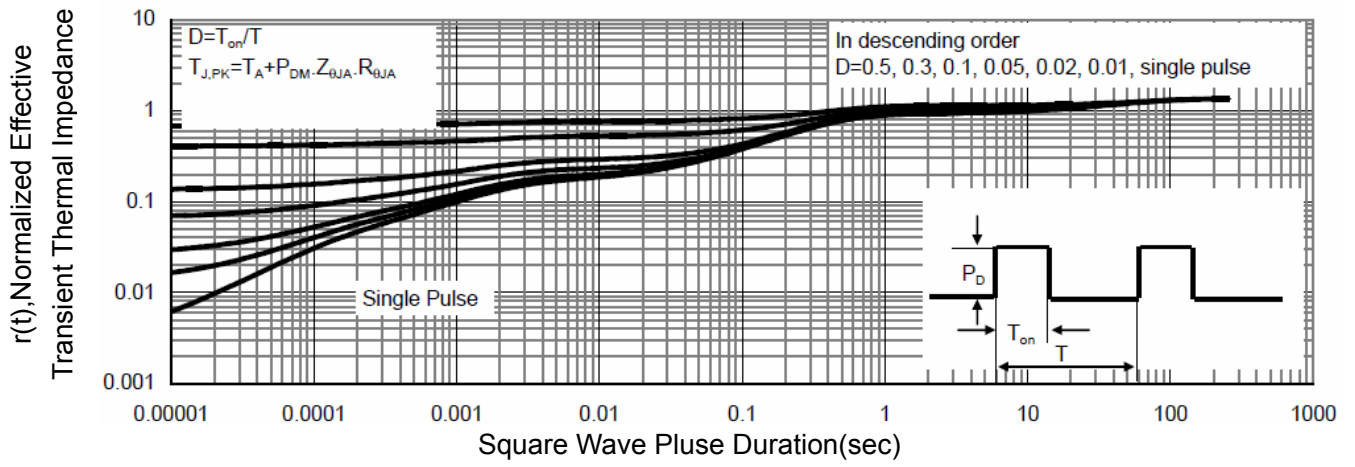


Figure 13 Normalized Maximum Transient Thermal Impedance

P- Channel Typical Electrical and Thermal Characteristics

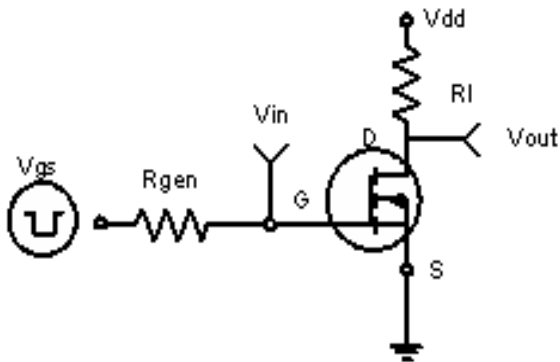


Figure 1: Switching Test Circuit

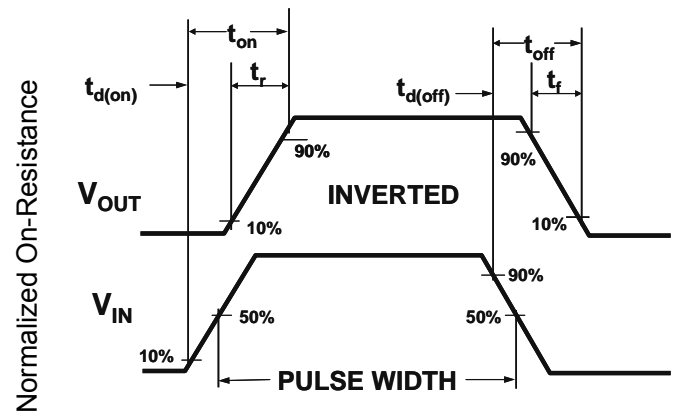


Figure 2: Switching Waveforms

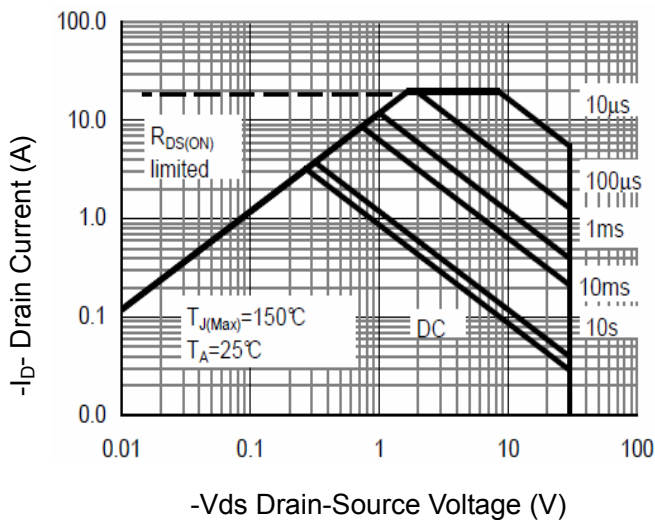


Figure 3 Safe Operation Area

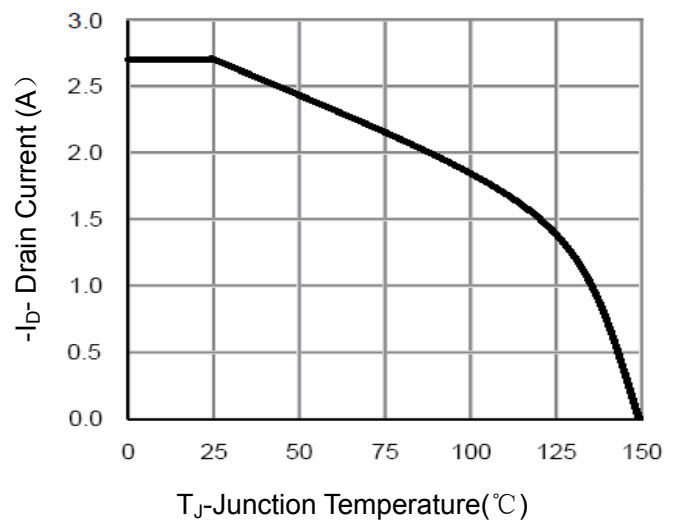


Figure 4 Drain Current

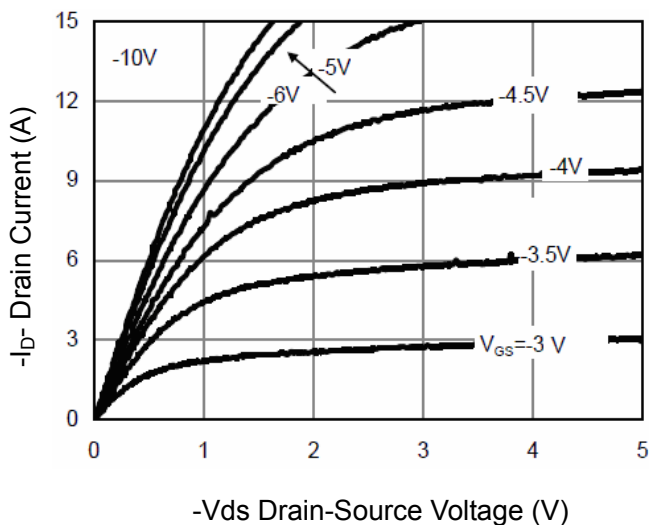


Figure 5 Output Characteristics

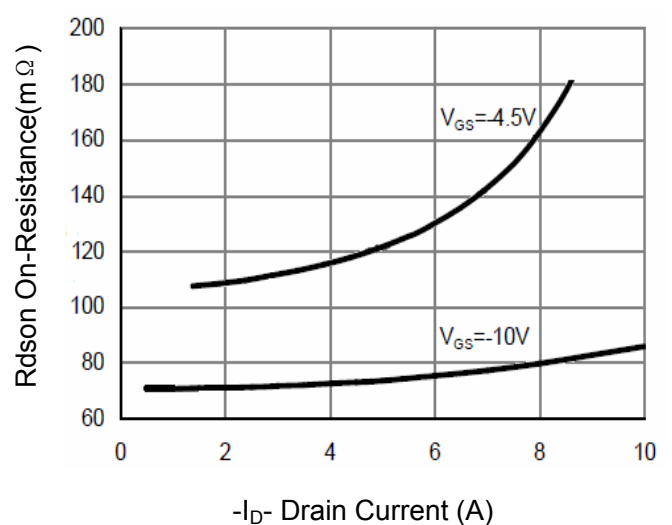


Figure 6 Drain-Source On-Resistance

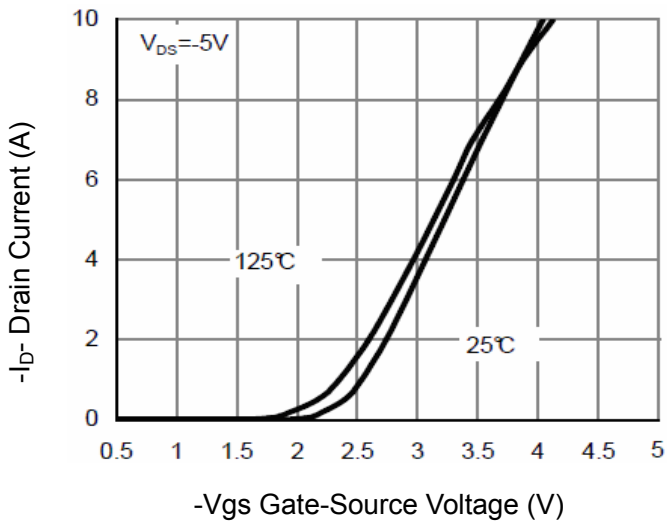


Figure 7 Transfer Characteristics

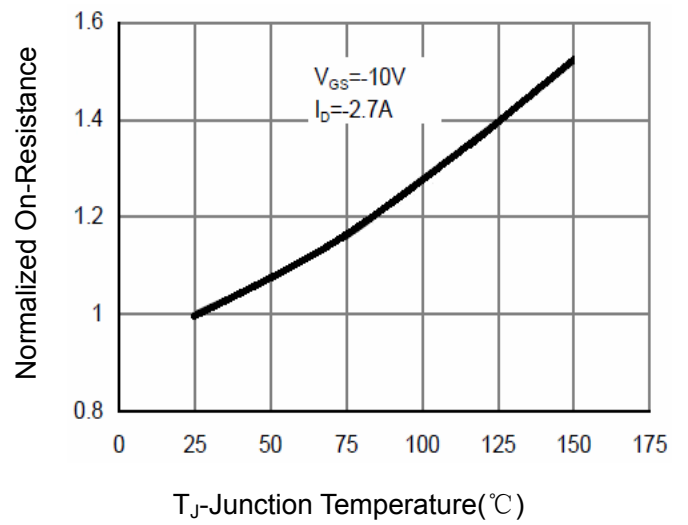


Figure 8 Drain-Source On-Resistance

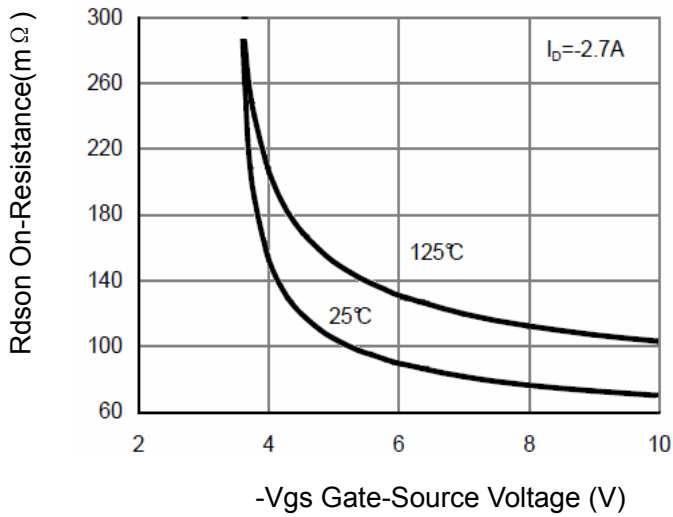


Figure 9 Rdson vs Vgs

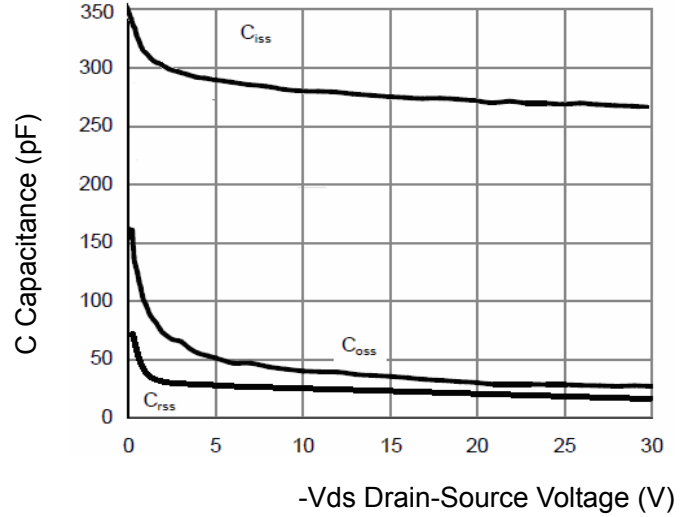


Figure 10 Capacitance vs Vds

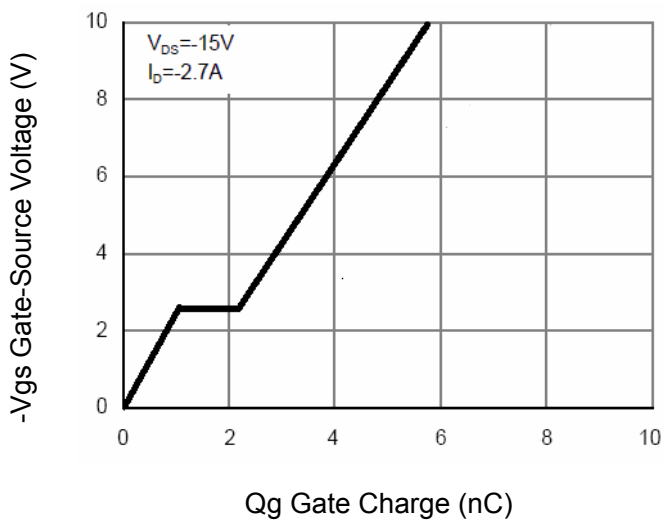


Figure 11 Gate Charge

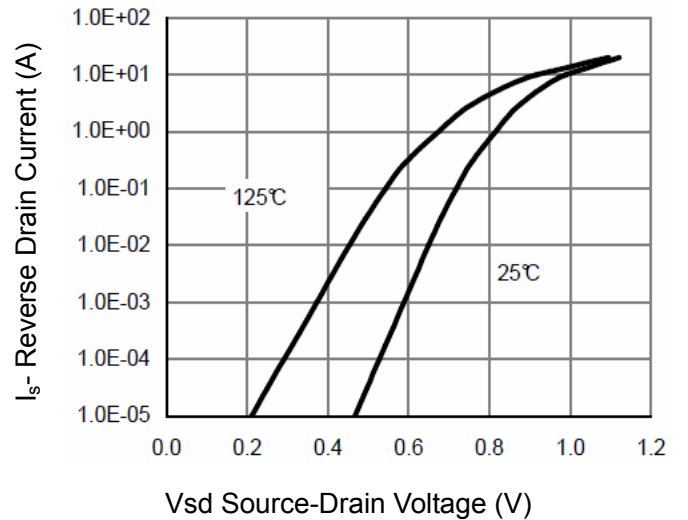


Figure 12 Source- Drain Diode Forward

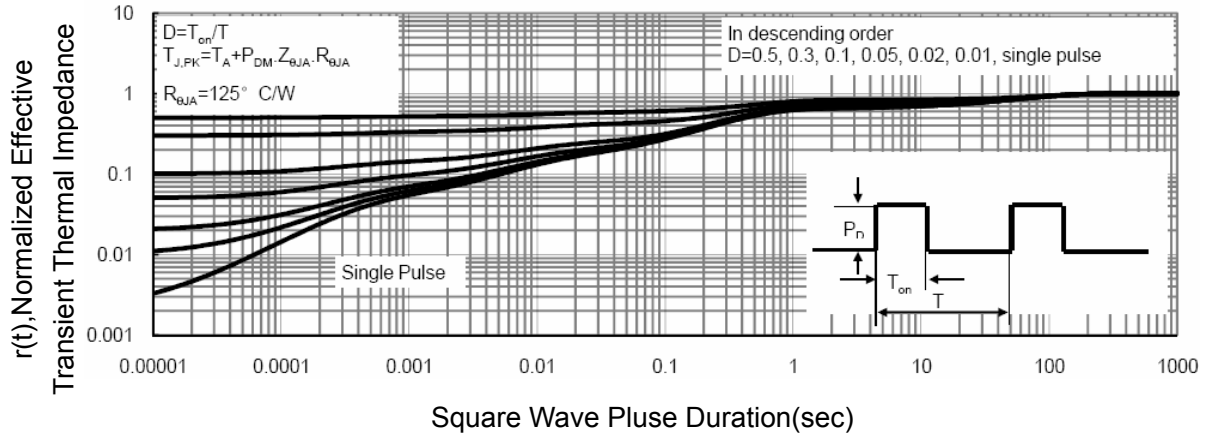
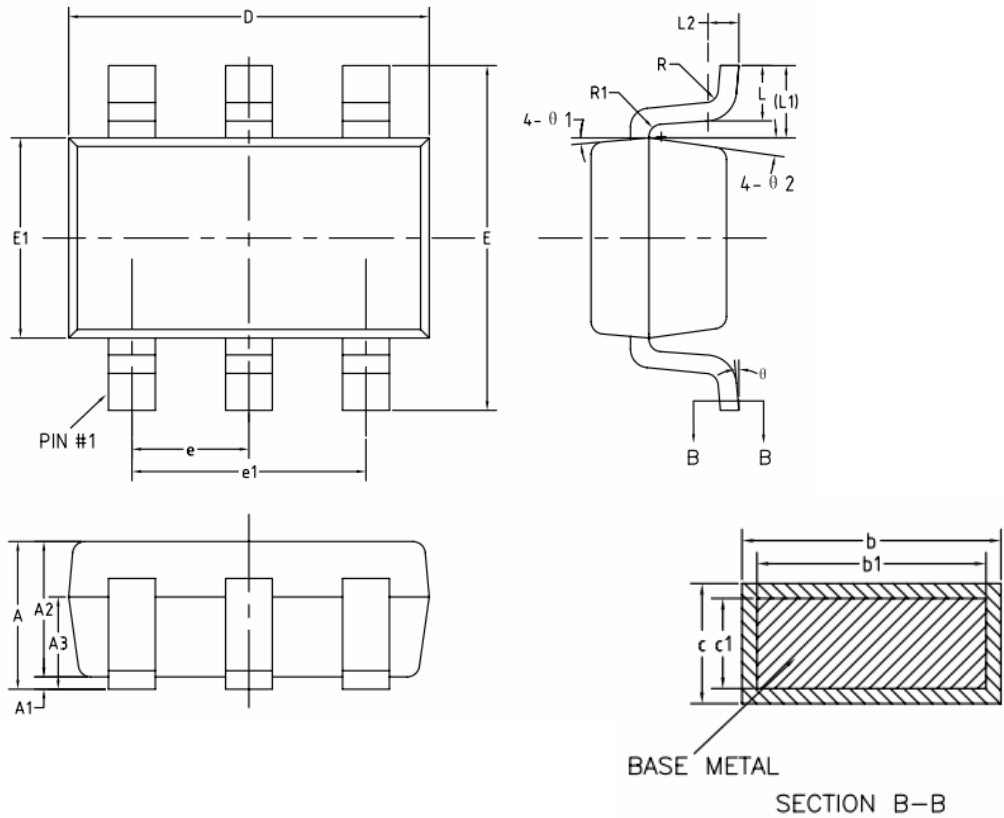


Figure 13 Normalized Maximum Transient Thermal Impedance

SOT23-6L Package Information



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	—	—	1.45
A1	0	—	0.15
A2	0.90	1.10	1.30
A3	0.60	0.65	0.70
b	0.39	—	0.49
b1	0.38	0.40	0.45
c	0.12	—	0.19
c1	0.11	0.13	0.15
D	2.85	2.95	3.05
E	2.60	2.80	3.00
E1	1.55	1.65	1.75
e	0.85	0.95	1.05
e1	1.80	1.90	2.00
L	0.35	0.45	0.60
L1	0.59REF		
L2	0.25BSC		
R	0.05	—	—
R1	0.05	—	0.20
θ	0°	—	8°
$\theta 1$	8°	10°	12°
$\theta 2$	8°	10°	12°

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