

NCE N&P-Channel complementary Power MOSFET

Description

The NCE60NP1515K uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. It can be used in a wide variety of applications.

General Features

N channel

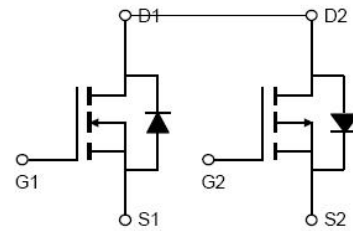
- $V_{DS} = 60V, I_D = 15A$
- $R_{DS(ON)} < 40m\Omega @ V_{GS} = 10V$
- $R_{DS(ON)} < 71m\Omega @ V_{GS} = 4.5V$

p channel

- $V_{DS} = -60V, I_D = -15A$
- $R_{DS(ON)} < 65m\Omega @ V_{GS} = -10V$
- $R_{DS(ON)} < 85m\Omega @ V_{GS} = -4.5V$
- High density cell design for ultra low R_{dson}
- Fully characterized avalanche voltage and current
- Good stability and uniformity with high E_{AS}
- Excellent package for good heat dissipation
- Special process technology for high ESD capability

Application

- H-bridge
- Inverters



Schematic diagram



Marking and pin assignment

100% UIS TESTED!

100% ΔV_{ds} TESTED!

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
60NP1515K	NCE60NP1515K	TO-252-4L	-	-	-

Absolute Maximum Ratings ($T_C = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage	V_{DS}	60	-60	V
Gate-Source Voltage	V_{GS}	± 20	± 20	V
Continuous Drain Current	I_D	15	-15	A
		10.6	-10.6	
Pulsed Drain Current (Note 1)	I_{DM}	60	-60	A
Maximum Power Dissipation	P_D	35		W
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 175		$^\circ C$

Thermal Characteristic

Thermal Resistance, Junction-to-Case (Note 2)	$R_{\theta JC}$	4.3	$^\circ C/W$
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N-Channel Electrical Characteristics (T_C=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	60	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =60V, V _{GS} =0V	-	-	1	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA
On Characteristics <small>(Note 3)</small>						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250μA	1.2	1.9	2.5	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V, I _D =10A	-	34	40	mΩ
		V _{GS} =4.5V, I _D =10A		59	71	
Forward Transconductance	g _{FS}	V _{DS} =5V, I _D =10A	8	-	-	S
Dynamic Characteristics <small>(Note4)</small>						
Input Capacitance	C _{iss}	V _{DS} =30V, V _{GS} =0V, F=1.0MHz	-	551	-	PF
Output Capacitance	C _{Oss}		-	42	-	PF
Reverse Transfer Capacitance	C _{rss}		-	38.5	-	PF
Switching Characteristics <small>(Note 4)</small>						
Turn-on Delay Time	t _{d(on)}	V _{DD} =30V, R _L =3Ω V _{GS} =10V, R _G =3Ω	-	5	-	nS
Turn-on Rise Time	t _r		-	2.6	-	nS
Turn-Off Delay Time	t _{d(off)}		-	16.1	-	nS
Turn-Off Fall Time	t _f		-	2.3	-	nS
Total Gate Charge	Q _g	V _{DS} =30V, I _D =10A, V _{GS} =10V	-	17.1	-	nC
Gate-Source Charge	Q _{gs}		-	3.6	-	nC
Gate-Drain Charge	Q _{gd}		-	4.5	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage <small>(Note 3)</small>	V _{SD}	V _{GS} =0V, I _S =10A	-		1.2	V
Diode Forward Current <small>(Note 2)</small>	I _S		-	-	15	A
Reverse Recovery Time	t _{rr}	T _J = 25°C, I _F =10A	-	29	-	nS
Reverse Recovery Charge	Q _{rr}	di/dt = 100A/μs <small>(Note3)</small>	-	49	-	nC
Forward Turn-On Time	t _{on}	Intrinsic turn-on time is negligible (turn-on is dominated by LS+LD)				

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
5. EAS condition: T_J=25°C, V_{DD}=30V, V_G=10V, L=0.5mH, R_G=25Ω

N-Channel Typical Electrical and Thermal Characteristics (Curves)

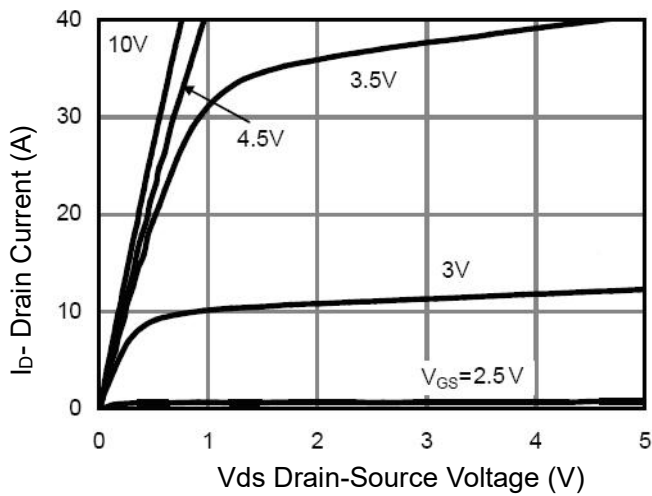


Figure 1 Output Characteristics

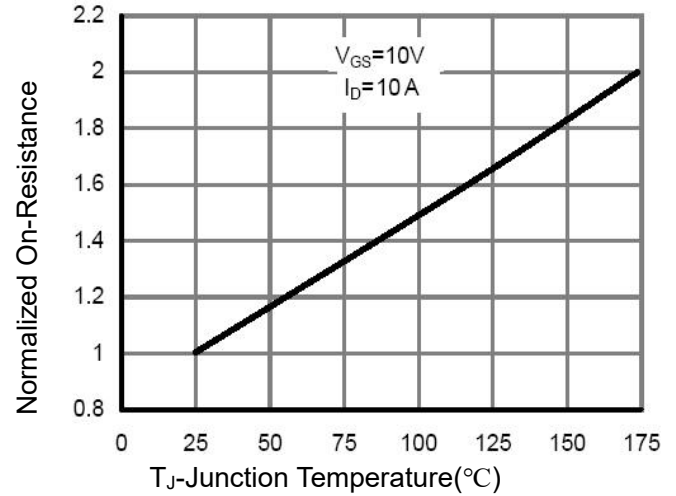


Figure 4 Rdson-Junction Temperature

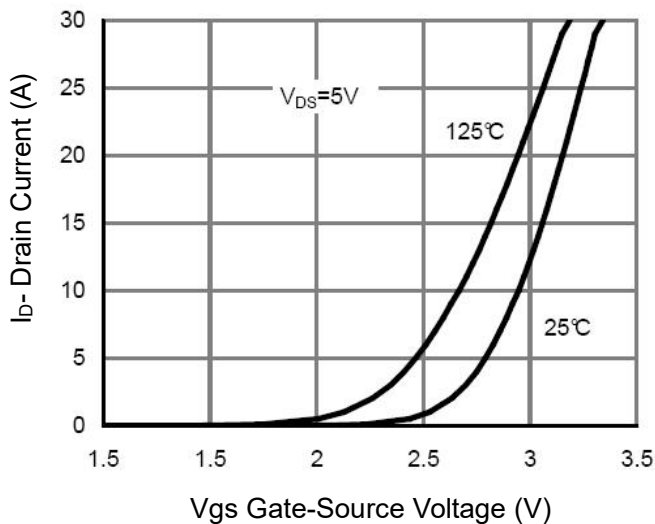


Figure 2 Transfer Characteristics

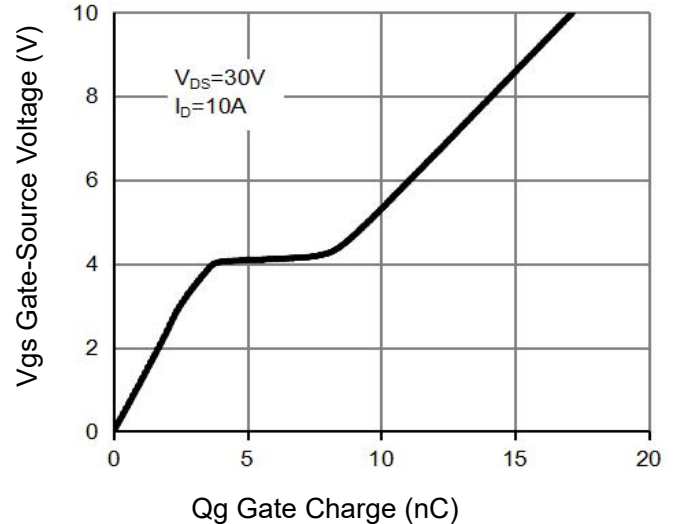


Figure 5 Gate Charge

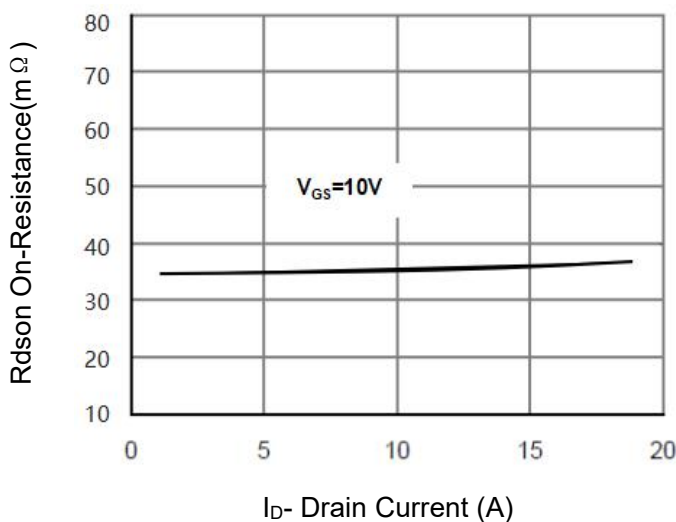


Figure 3 Rdson- Drain Current

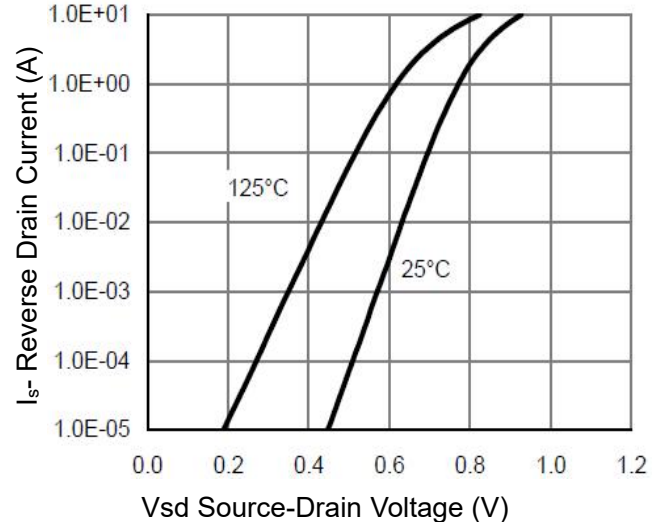


Figure 6 Source- Drain Diode Forward

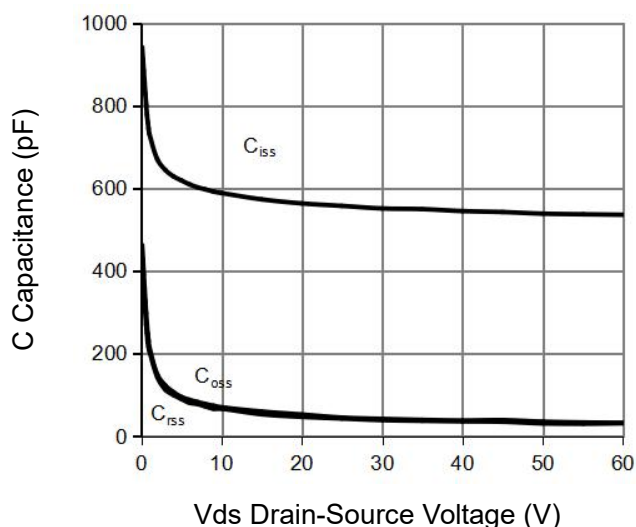


Figure 7 Capacitance vs Vds

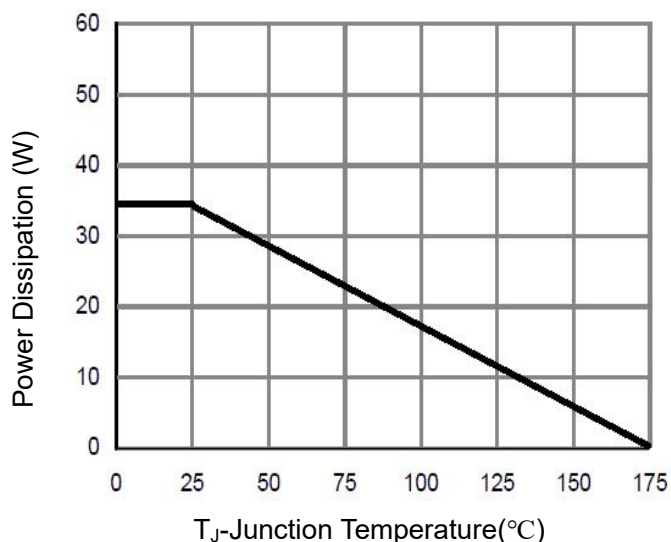


Figure 9 Power De-rating

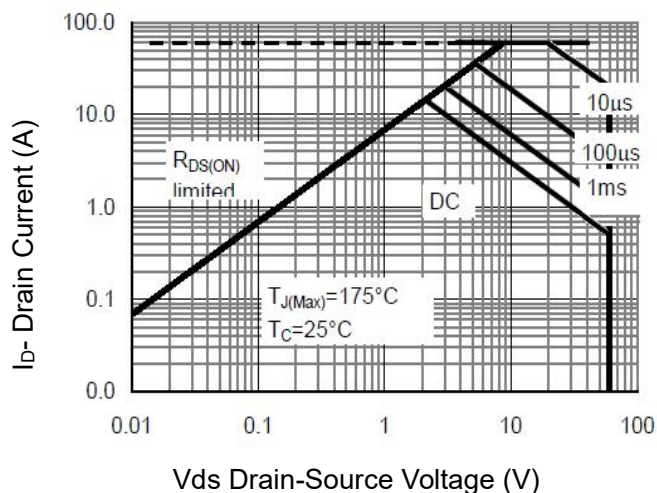


Figure 8 Safe Operation Area

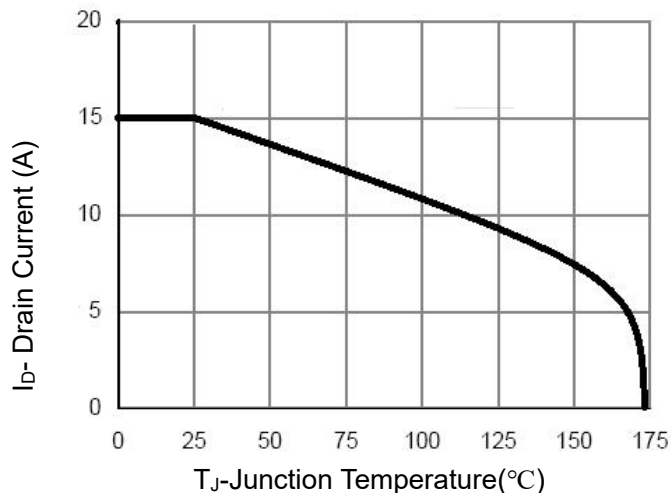


Figure 10 ID Current De-rating

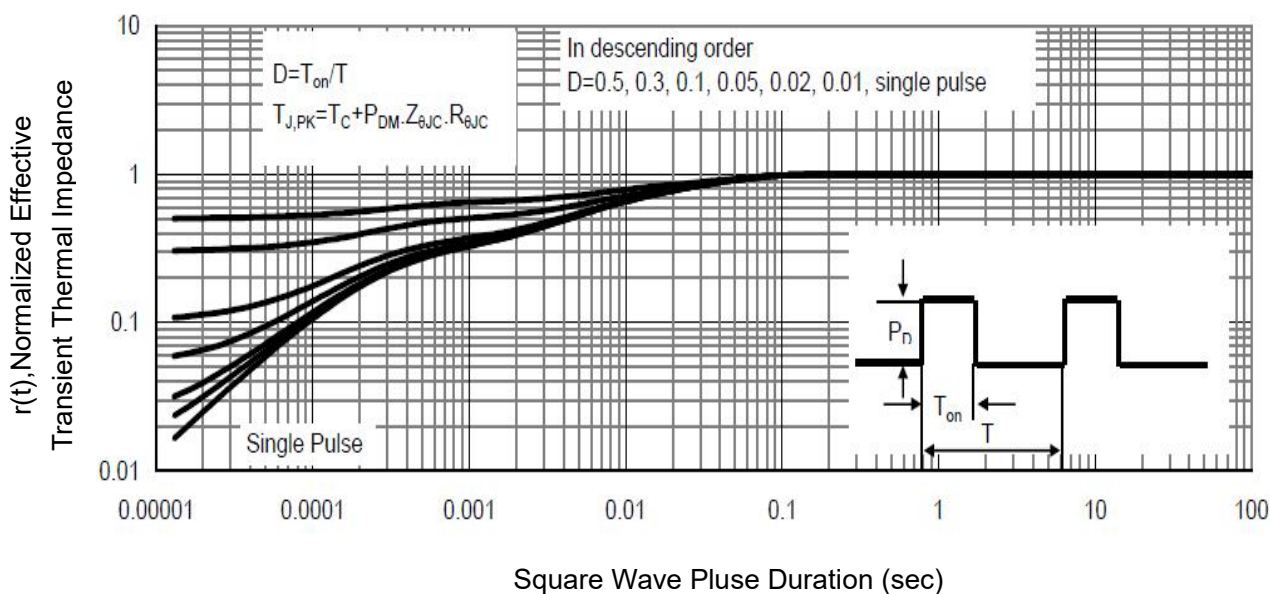


Figure 11 Normalized Maximum Transient Thermal Impedance

P-Channel Electrical Characteristics (T_C=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	-60	-	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =-60V, 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	-1.0	1.5	-2.0	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =-10V, I _D =-10A	-	55	65	mΩ
		V _{GS} =-4.5V, I _D =-10A	-	65	85	mΩ
Forward Transconductance	g _{FS}	V _{DS} =-5V, I _D =-10A	-	15	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =-30V, V _{GS} =0V, F=1.0MHz	-	1108	-	PF
Output Capacitance	C _{oss}		-	73.7	-	PF
Reverse Transfer Capacitance	C _{rss}		-	58.2	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =-30V, R _L =3Ω, V _{GS} =-10V, R _G =3Ω	-	8	-	nS
Turn-on Rise Time	t _r		-	4	-	nS
Turn-Off Delay Time	t _{d(off)}		-	32	-	nS
Turn-Off Fall Time	t _f		-	7	-	nS
Total Gate Charge	Q _g	V _{DS} =-30, I _D =-10A, V _{GS} =-10V	-	23.4	-	nC
Gate-Source Charge	Q _{gs}		-	4.1	-	nC
Gate-Drain Charge	Q _{gd}		-	4.8	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =-10A	-		-1.2	V
Diode Forward Current (Note 2)	I _S		-	-	-15	A
Reverse Recovery Time	t _{rr}	T _J = 25°C, I _F =- 10A	-	25		nS
Reverse Recovery Charge	Q _{rr}	di/dt = -100A/μs(Notes3)	-	31		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

P-Channel Typical Electrical and Thermal Characteristics (Curves)

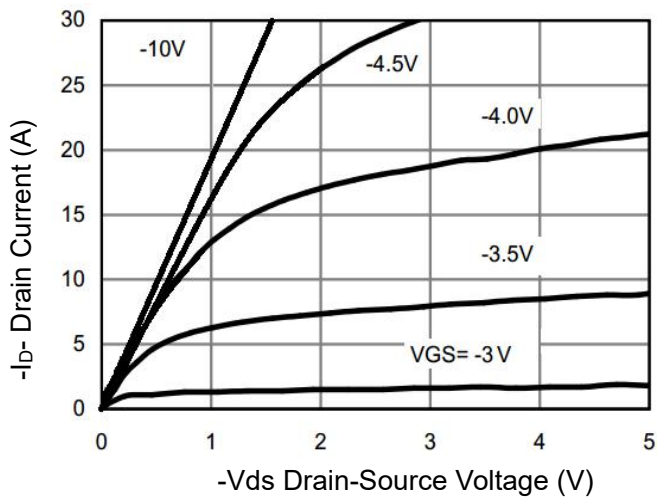


Figure 1 Output Characteristics

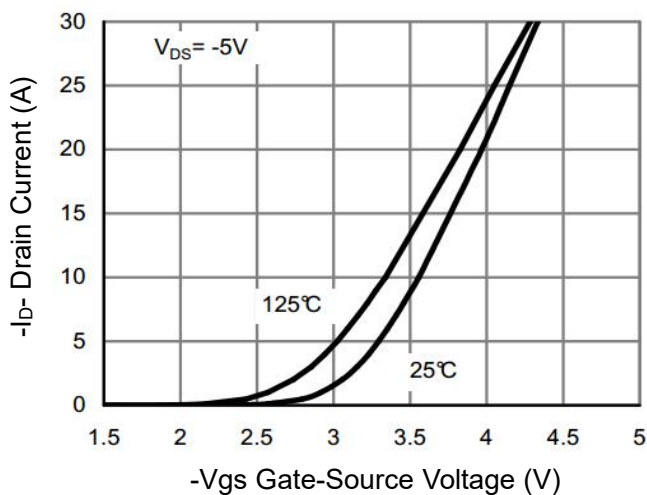


Figure 2 Transfer Characteristics

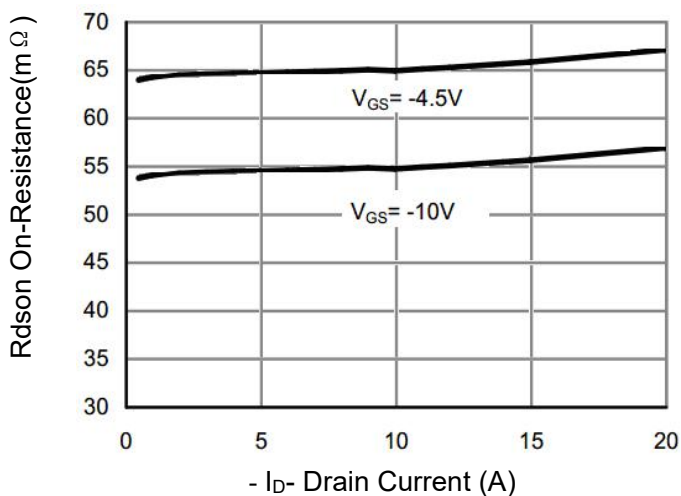


Figure 3 Rdson- Drain Current

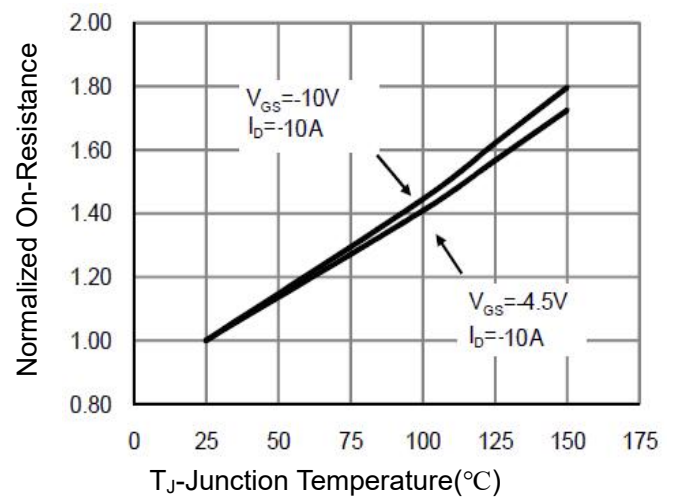


Figure 4 Rdson-Junction Temperature

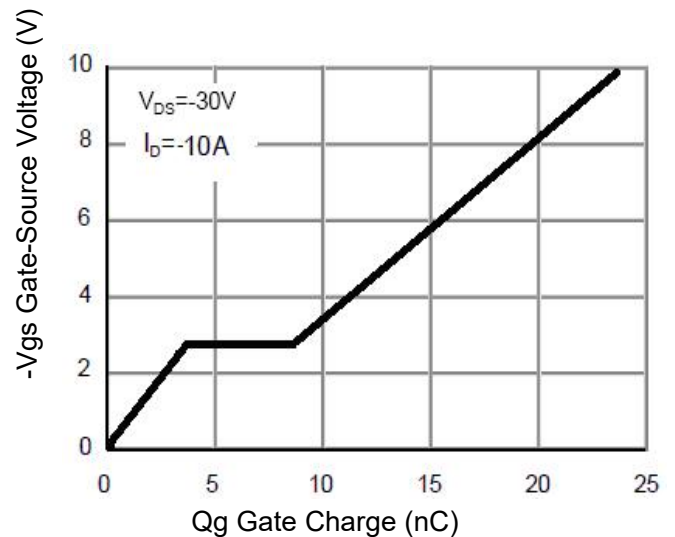


Figure 5 Gate Charge

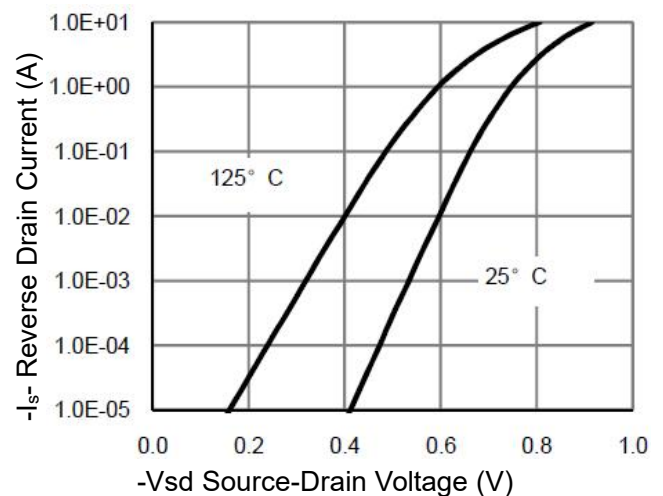


Figure 6 Source- Drain Diode Forward

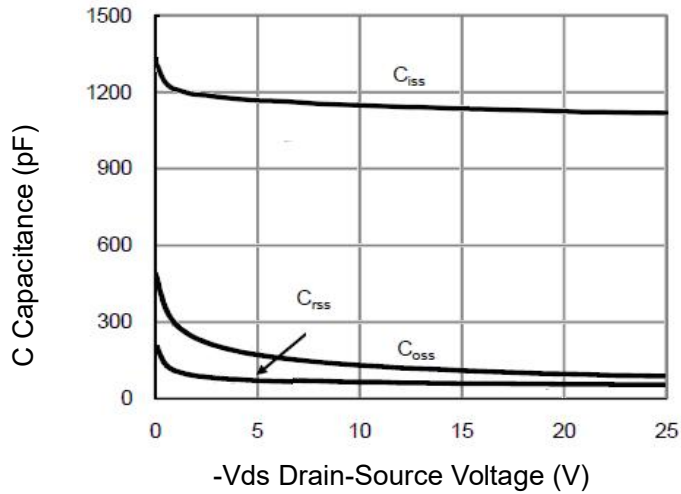


Figure 7 Capacitance vs Vds

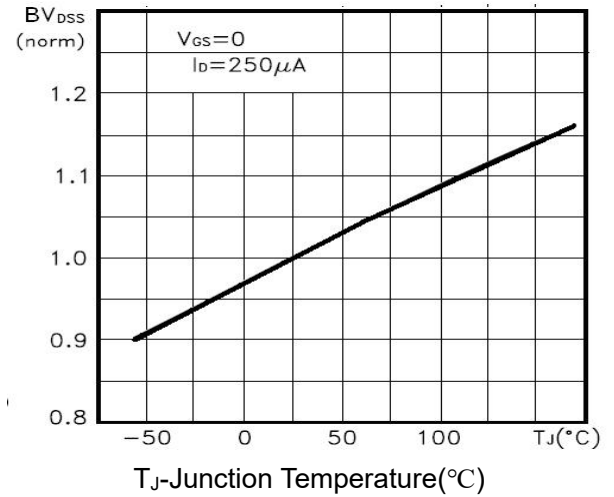


Figure 9 BV_{DSS} vs Junction Temperature

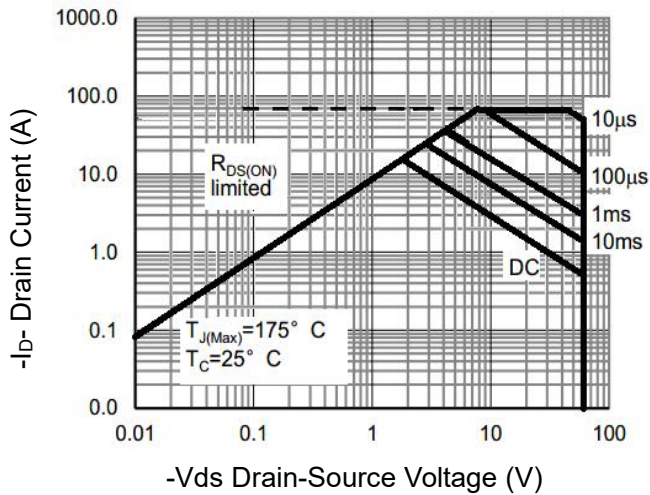


Figure 8 Safe Operation Area

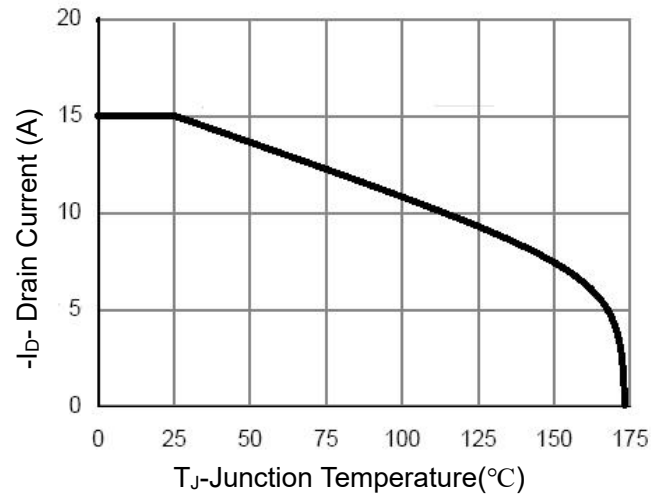


Figure 10 I_D Current De-rating

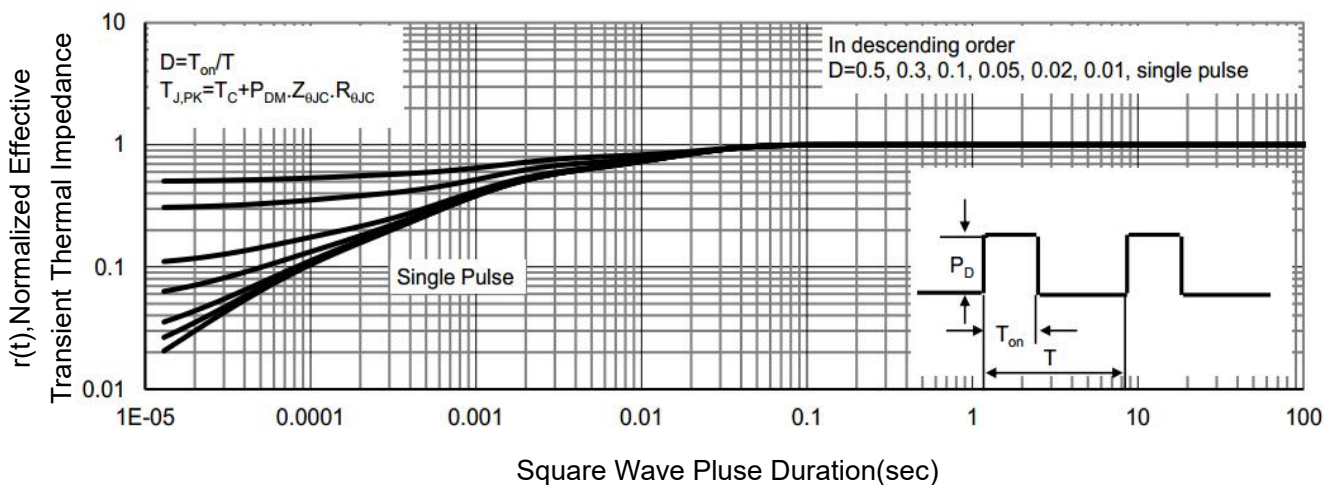
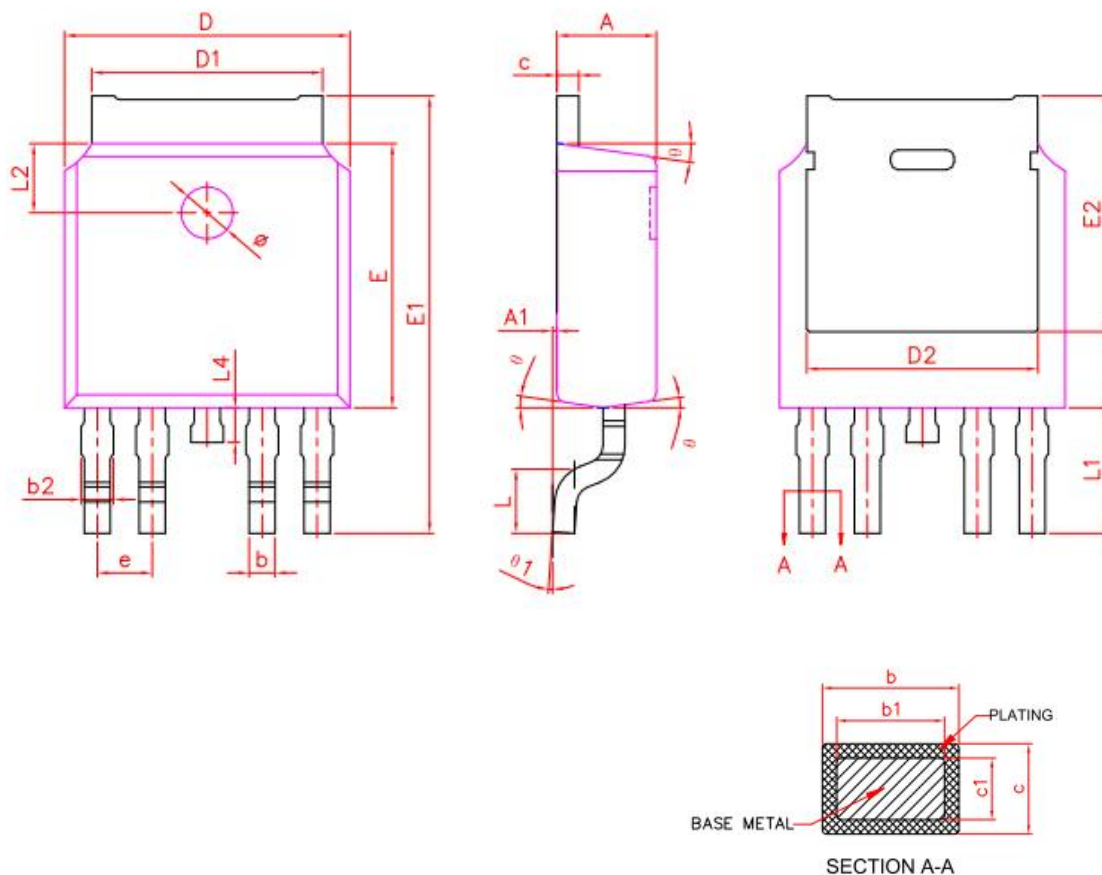


Figure 11 Normalized Maximum Transient Thermal Impedance

TO-252-4L Package Information



T0252-4L			
DIM.	MIN.	NOM.	MAX.
A	2.20	2.30	2.40
A1	0.00	0.08	0.13
b	0.50	0.60	0.70
b1	0.57	0.60	0.63
b2	0.75REF		
c	0.46	0.508	0.58
c1	0.50	0.508	0.52
D	6.50	6.60	6.70
D1	5.10	5.334	5.46
D2	5.346REF		
E	6.00	6.10	6.20
E1	9.80	10.10	10.40
E2	5.446REF		
e	1.17	1.27	1.37
L	1.40	1.50	1.70
L1	2.90REF		
L2	1.60REF		
L4	0.60	0.80	1.00
ϕ	$\phi 1.10$	$\phi 1.20$	$\phi 1.30$
θ	5°	8°	10°
$\theta 1$	0°	—	8°
All dimensions in millimeters			

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