

## NCE P-Channel Super Trench Power MOSFET

### Description

The NCEP40P60G uses **Super Trench** technology that is uniquely optimized to provide the most efficient high frequency switching performance. Both conduction and switching power losses are minimized due to an extremely low combination of  $R_{DS(on)}$  and  $Q_g$ . This device is ideal for high-frequency switching and synchronous rectification

### Application

- DC/DC Converter
- Ideal for high-frequency switching and synchronous rectification

### General Features

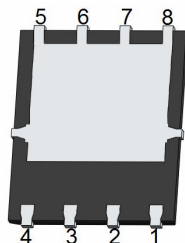
- $V_{DS} = -40V, I_D = -60A$
- $R_{DS(on)} = 8.8m\Omega$  (typical) @  $V_{GS} = -10V$
- $R_{DS(on)} = 12.5m\Omega$  (typical) @  $V_{GS} = -4.5V$
- Excellent gate charge x  $R_{DS(on)}$  product(FOM)
- Very low on-resistance  $R_{DS(on)}$
- 150 °C operating temperature
- Pb-free lead plating

**100% UIS TESTED!**  
**100% ΔVds TESTED!**

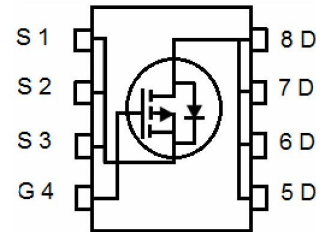
### DFN 5X6



Top View



Bottom View



Schematic Diagram

### Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
P40P60G	NCEP40P60G	DFN5X6-8L	-	-	-

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	-40	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Drain Current-Continuous	$I_D(T_c=25^\circ C)$	-60	A
Drain Current-Continuous( $T_c=100^\circ C$ )	$I_D(T_c=100^\circ C)$	-42	A
Pulsed Drain Current	$I_{DM}$	-240	A
Maximum Power Dissipation( $T_c=25^\circ C$ )	$P_D(T_c=25^\circ C)$	80	W
Derating factor		0.64	W/°C
Single pulse avalanche energy <sup>(Note 1)</sup>	$E_{AS}$	352	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	°C

### Thermal Characteristic

Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	1.56	°C/W
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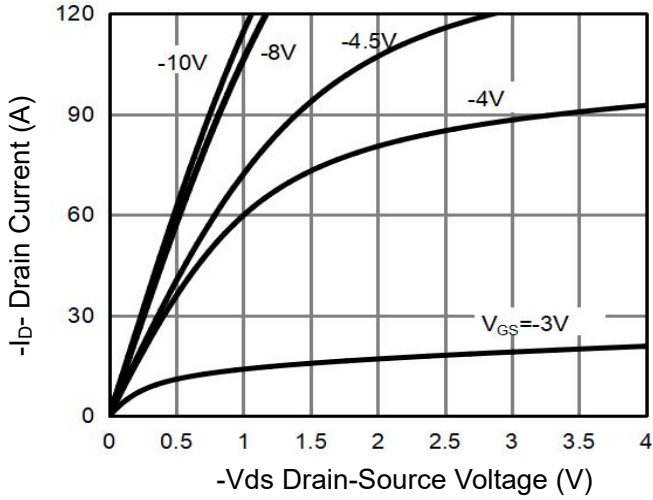
## Electrical Characteristics (T<sub>c</sub>=25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =-250μA	-40		-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =-40V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±20V, V <sub>DS</sub> =0V	-	-	±100	nA
<b>On Characteristics</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =-250μA	-1.1	-1.7	-2.2	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =-10V, I <sub>D</sub> =-20A	-	8.8	11.0	mΩ
		V <sub>GS</sub> =-4.5V, I <sub>D</sub> =-20A	-	12.5	17.0	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =-5V, I <sub>D</sub> =-20A	-	30	-	S
<b>Dynamic Characteristics</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =-20V, V <sub>GS</sub> =0V, F=1.0MHz	-	2450	-	PF
Output Capacitance	C <sub>oss</sub>		-	660	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	18	-	PF
<b>Switching Characteristics</b> (Note 2)						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =-20V, I <sub>D</sub> =-20A V <sub>GS</sub> =-10V, R <sub>G</sub> =1.6Ω	-	9	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	4	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	30	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	5	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =-20V, I <sub>D</sub> =-20A, V <sub>GS</sub> =-10V	-	39	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	7.8		nC
Gate-Drain Charge	Q <sub>gd</sub>		-	5.3		nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =-20A	-		-1.2	V
Diode Forward Current	I <sub>S</sub>		-	-	-60	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> = 25°C, I <sub>F</sub> = -20A	-	22		nS
Reverse Recovery Charge	Q <sub>rr</sub>	di/dt = 100A/μs	-	58		nC

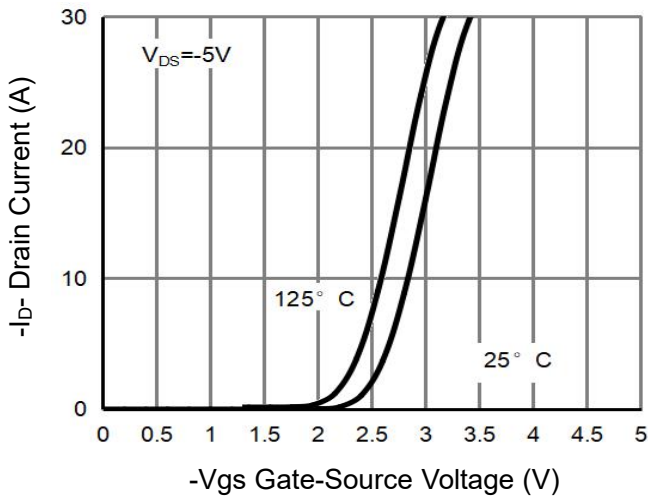
### Notes:

1. EAS condition : T<sub>J</sub>=25°C, V<sub>DD</sub>=-20V, V<sub>G</sub>=-10V, L=0.5mH, R<sub>G</sub>=25Ω
2. Guaranteed by design, not subject to production
3. These curves are based on the junction-to-case thermal impedance which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of T<sub>J</sub>(MAX)=150°C. The SOA curve provides a single pulse rating.

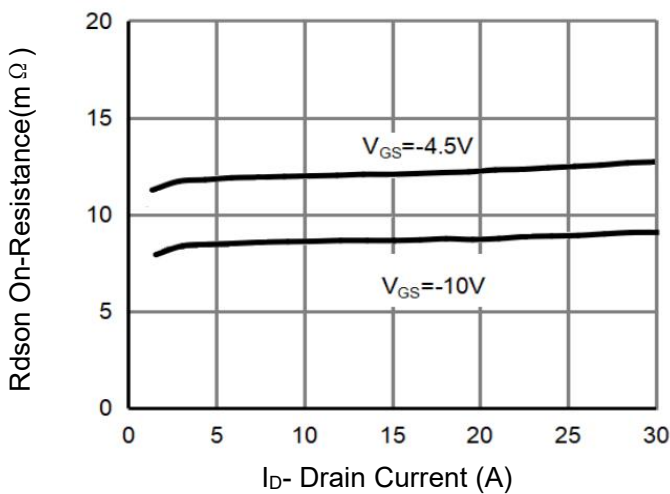
## Typical Electrical and Thermal Characteristics



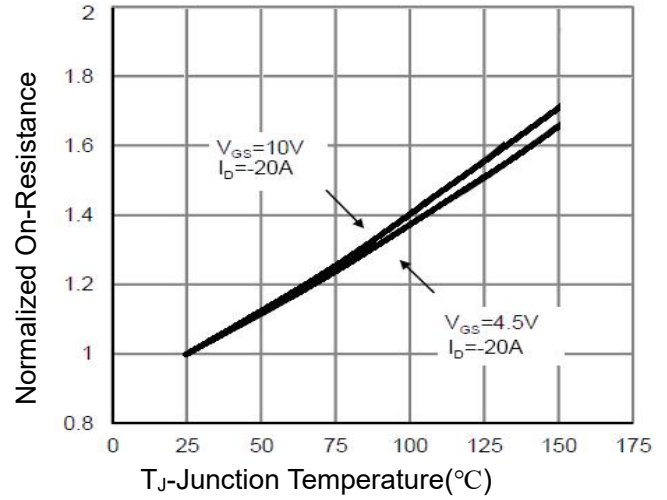
**Figure 1 Output Characteristics**



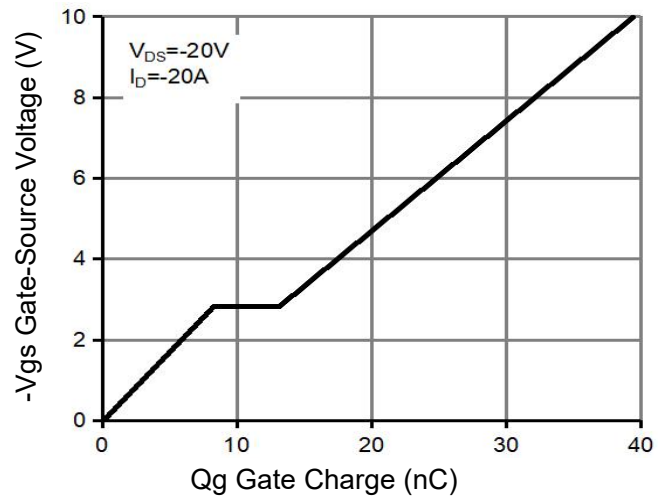
**Figure 2 Transfer Characteristics**



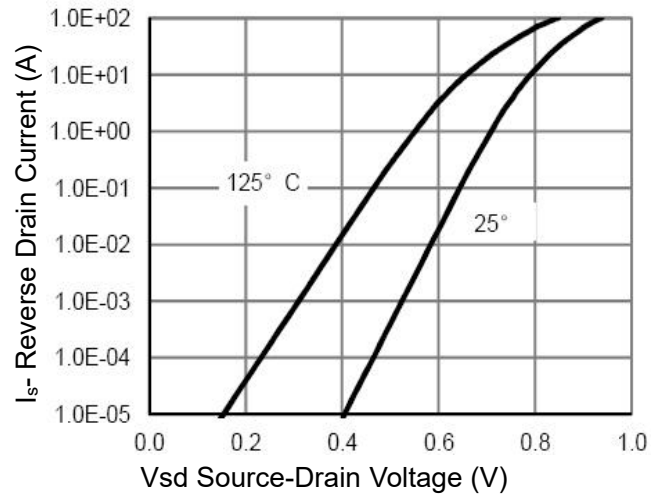
**Figure 3 Rdson- Drain Current**



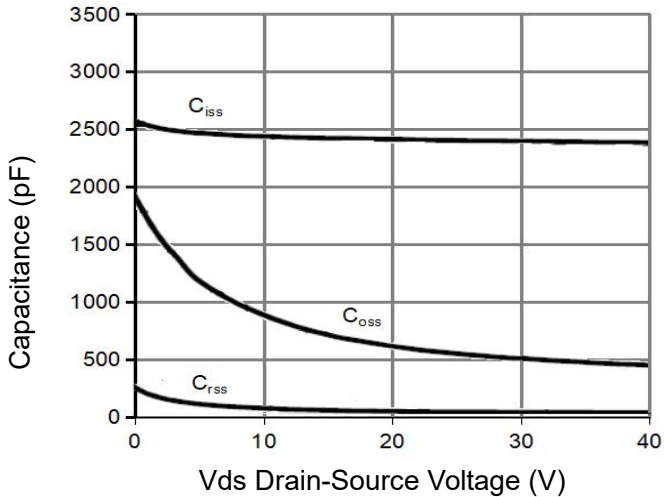
**Figure 4 Rdson-Junction Temperature**



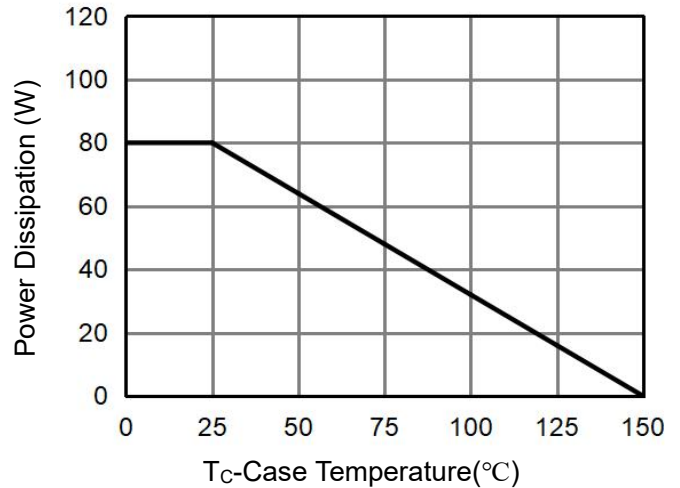
**Figure 5 Gate Charge**



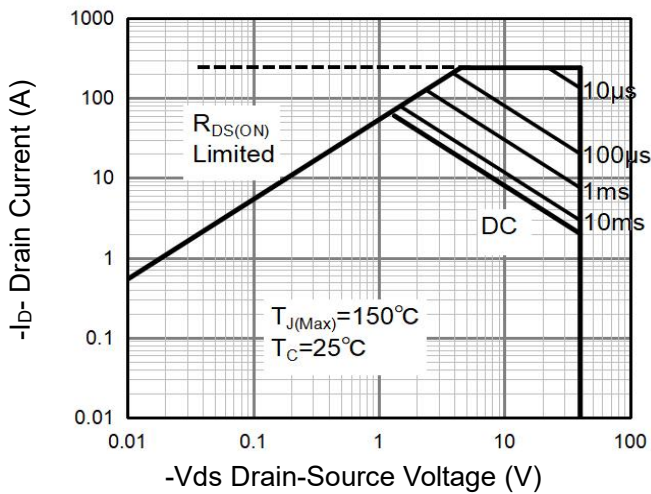
**Figure 6 Source- Drain Diode Forward**



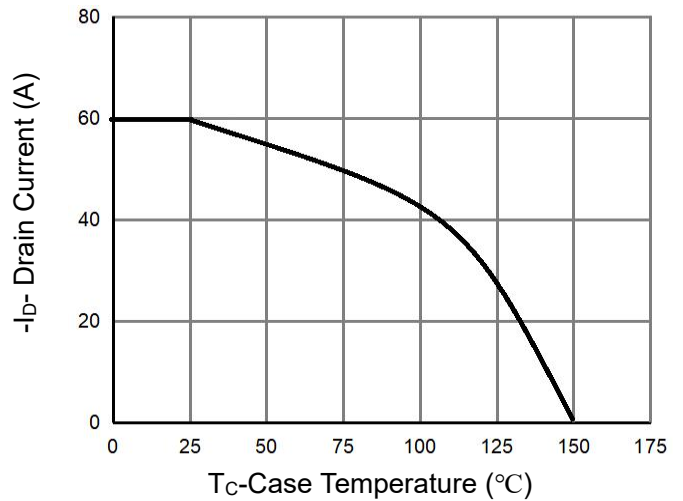
**Figure 7 Capacitance vs Vds**



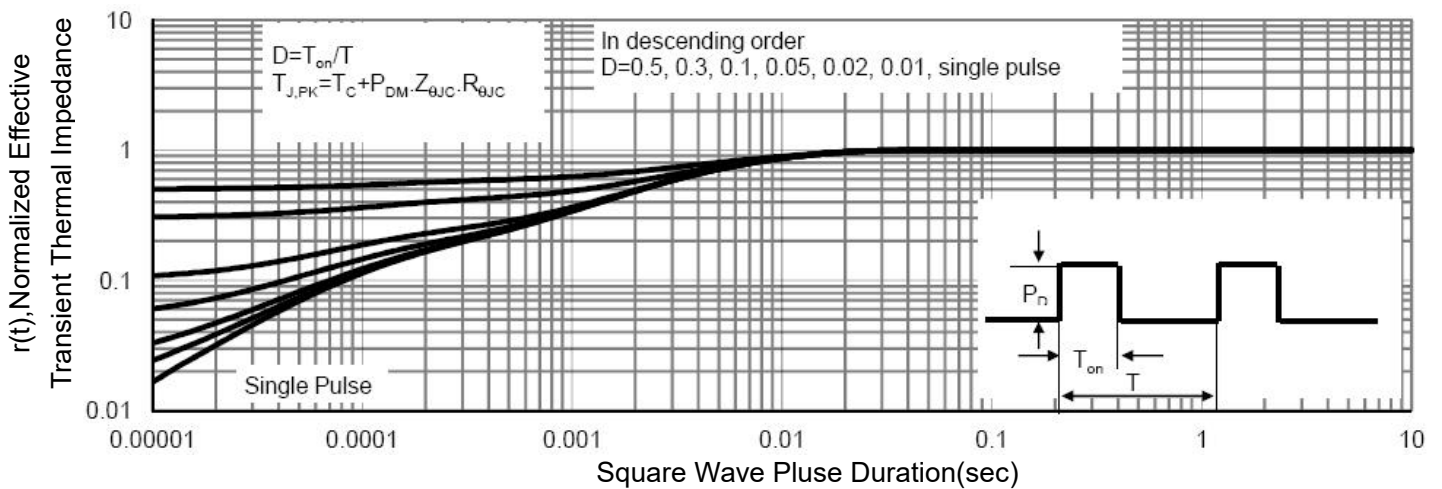
**Figure 9 Power De-rating**



**Figure 8 Safe Operation Area** (Note3)

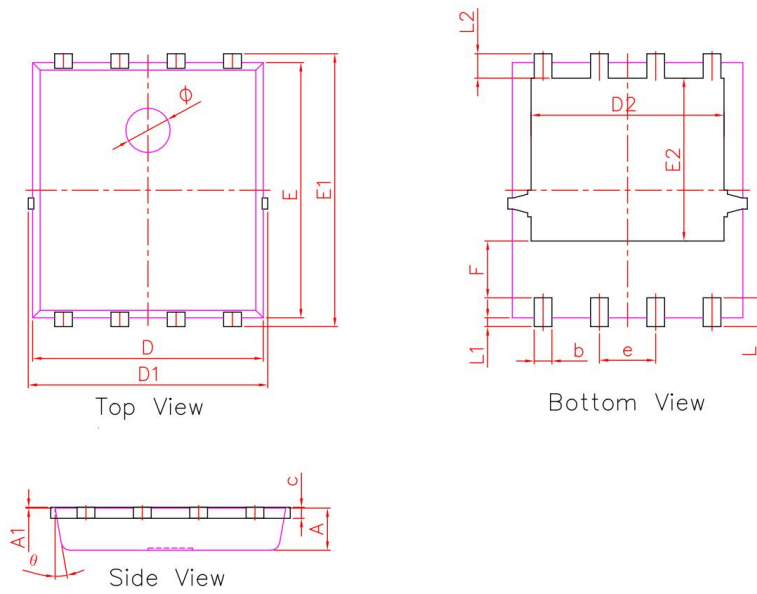


**Figure 10 Current De-rating**



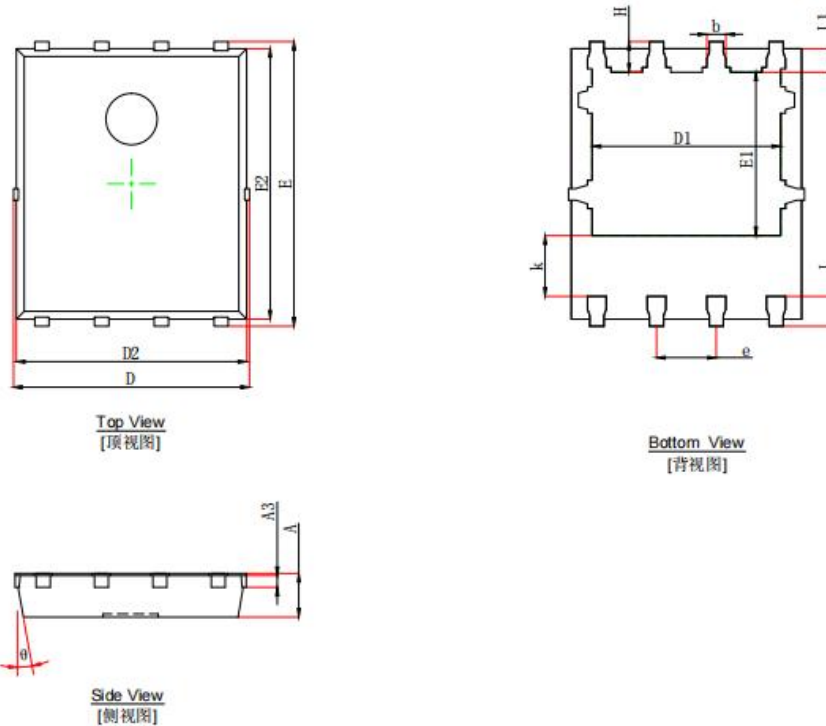
**Figure 11 Normalized Maximum Transient Thermal Impedance**

## DFN5X6-8L (E) Package Information



PDFN5X6-8L			
DIM.	MIN.	NOM.	MAX.
A	0.90	0.95	1.00
A1	0.00	0.02	0.05
b	0.35	0.40	0.50
c	0.20	0.25	0.30
D	5.10	5.20	5.30
D1	5.10	5.40	5.50
D2	4.25	4.35	4.45
e	1.27 BSC		
E	5.70	5.75	5.80
E1	6.00	6.15	6.30
E2	3.57	3.67	3.77
F	1.18	1.28	1.38
L	0.55	0.65	0.75
L1	0.15	0.20	0.25
L2	0.45	0.55	0.65
$\phi$	0.90	1.00	1.10
$\theta$	8°	10°	12°
All dimensions in millimeters			

DFN5X6-8L (C) Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.900	1.000	0.035	0.039
A3	0.254REF.		0.010REF.	
D	4.944	5.096	0.195	0.201
E	5.974	6.126	0.235	0.241
D1	3.910	4.110	0.154	0.162
E1	3.375	3.575	0.133	0.141
D2	4.824	4.976	0.190	0.196
E2	5.674	5.826	0.223	0.229
k	1.190	1.390	0.047	0.055
b	0.350	0.450	0.014	0.018
e	1.270TYP.		0.050TYP.	
L	0.559	0.711	0.022	0.028
L1	0.424	0.576	0.017	0.023
H	0.574	0.726	0.023	0.029
$\theta$	10°	12°	10°	12°

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