

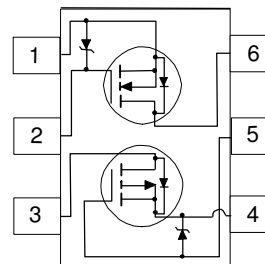
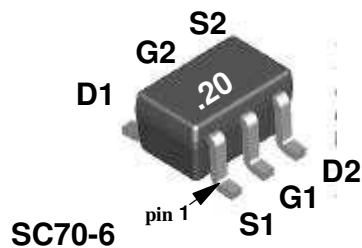
## FDG6320C Dual N & P Channel Digital FET

### General Description

These dual N & P-Channel logic level enhancement mode field effect transistors are produced using Fairchild's proprietary, high cell density, DMOS technology. This very high density process is especially tailored to minimize on-state resistance. This device has been designed especially for low voltage applications as a replacement for bipolar digital transistors and small signal MOSFETS. Since bias resistors are not required, this dual digital FET can replace several different digital transistors, with different bias resistor values.

### Features

- N-Ch 0.22 A, 25 V,  $R_{DS(ON)} = 4.0 \Omega @ V_{GS} = 4.5 \text{ V}$ ,  
 $R_{DS(ON)} = 5.0 \Omega @ V_{GS} = 2.7 \text{ V}$ .
- P-Ch -0.14 A, -25V,  $R_{DS(ON)} = 10 \Omega @ V_{GS} = -4.5 \text{ V}$ ,  
 $R_{DS(ON)} = 13 \Omega @ V_{GS} = -2.7 \text{ V}$ .
- Very small package outline SC70-6.
- Very low level gate drive requirements allowing direct operation in 3 V circuits ( $V_{GS(th)} < 1.5 \text{ V}$ ).
- Gate-Source Zener for ESD ruggedness (>6kV Human Body Model).



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

Symbol	Parameter	N-Channel	P-Channel	Units
$V_{DSS}$	Drain-Source Voltage	25	-25	V
$V_{GSS}$	Gate-Source Voltage	8	-8	V
$I_D$	Drain Current - Continuous	0.22	-0.14	A
	- Pulsed	0.65	-0.4	
$P_D$	Maximum Power Dissipation (Note 1)	0.3		W
$T_J, T_{STG}$	Operating and Storage Temperature Ranger	-55 to 150		$^\circ\text{C}$
ESD	Electrostatic Discharge Rating MIL-STD-883D Human Body Model (100pf / 1500 Ohm)	6		kV

### THERMAL CHARACTERISTICS

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1)	415	$^\circ\text{C/W}$
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**Electrical Characteristics** ( $T_A = 25\text{ }^{\circ}\text{C}$  unless otherwise noted)

Symbol	Parameter	Conditions	Type	Min	Typ	Max	Units
OFF CHARACTERISTICS							
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	N-Ch	25			V
		V <sub>GS</sub> = 0 V, I <sub>D</sub> = -250 μA	P-Ch	-25			
ΔBV <sub>DSS</sub> /ΔT <sub>J</sub>	Breakdown Voltage Temp. Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25 °C	N-Ch		25		mV/°C
		I <sub>D</sub> = -250 μA, Referenced to 25 °C	P-Ch		-19		
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = 20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C	N-Ch			1	μA
					10		
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> = -20 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C	P-Ch			-1	μA
					-10		
I <sub>GSS</sub>	Gate - Body Leakage Current	V <sub>GS</sub> = 8 V, V <sub>DS</sub> = 0 V	N-Ch			100	nA
		V <sub>GS</sub> = -8 V, V <sub>DS</sub> = 0 V	P-Ch			-100	nA
ON CHARACTERISTICS (Note 2)							
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	N-Ch	0.65	0.85	1.5	V
		V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250 μA	P-Ch	-0.65	-0.82	-1.5	
ΔV <sub>GS(th)</sub> /ΔT <sub>J</sub>	Gate Threshold Voltage Temp. Coefficient	I <sub>D</sub> = 250 μA, Referenced to 25 °C	N-Ch		-2.1		mV/°C
		I <sub>D</sub> = -250 μA, Referenced to 25 °C	P-Ch		2.1		
R <sub>DS(on)</sub>	Static Drain-Source On-Resistance	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 0.22 A, T <sub>J</sub> = 125 °C	N-Ch		2.6	4	Ω
					5.3	7	
		V <sub>GS</sub> = 2.7 V, I <sub>D</sub> = 0.19 A			3.7	5	
		V <sub>GS</sub> = -4.5 V, I <sub>D</sub> = -0.14 A, T <sub>J</sub> = 125 °C	P-Ch		7.3	10	
					11	17	
		V <sub>GS</sub> = -2.7 V, I <sub>D</sub> = -0.05 A			10.4	13	
I <sub>D(on)</sub>	On-State Drain Current	V <sub>GS</sub> = 4.5 V, V <sub>DS</sub> = 5 V	N-Ch	0.22			A
		V <sub>GS</sub> = -4.5 V, V <sub>DS</sub> = -5 V	P-Ch	-0.14			
g <sub>FS</sub>	Forward Transconductance	V <sub>DS</sub> = 5 V, I <sub>D</sub> = 0.22 A	N-Ch		0.2		S
		V <sub>DS</sub> = -5 V, I <sub>D</sub> = -0.14 A	P-Ch		0.12		
DYNAMIC CHARACTERISTICS							
C <sub>iss</sub>	Input Capacitance	N-Channel V <sub>DS</sub> = 10 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz P-Channel	N-Ch		9.5		pF
C <sub>oss</sub>	Output Capacitance		P-Ch		12		
			N-Ch		6		
			P-Ch		7		
C <sub>rss</sub>	Reverse Transfer Capacitance	V <sub>DS</sub> = -10 V, V <sub>GS</sub> = 0 V, f = 1.0 MHz	N-Ch		1.3		
			P-Ch		1.5		

## Electrical Characteristics (continued)

### SWITCHING CHARACTERISTICS (Note 2)

Symbol	Parameter	Conditions	Type	Min	Typ	Max	Units
$t_{D(on)}$	Turn - On Delay Time	N-Channel $V_{DD} = 5\text{ V}$ , $I_D = 0.5\text{ A}$ ,	N-Ch		5	12	nS
			P-Ch		5	12	
$t_r$	Turn - On Rise Time	$V_{GS} = 4.5\text{ V}$ , $R_{GEN} = 50\ \Omega$	N-Ch		4.5	10	nS
			P-Ch		8	16	
$t_{D(off)}$	Turn - Off Delay Time	P-Channel $V_{DD} = -5\text{ V}$ , $I_D = -0.5\text{ A}$ ,	N-Ch		4	8	nS
			P-Ch		9	18	
$t_f$	Turn - Off Fall Time	$V_{GS} = -4.5\text{ V}$ , $R_{GEN} = 50\ \Omega$	N-Ch		3.2	7	nS
			P-Ch		5	12	
$Q_g$	Total Gate Charge	N-Channel $V_{DS} = 5\text{ V}$ , $I_D = 0.22\text{ A}$ ,	N-Ch		0.29	0.4	nC
			P-Ch		0.22	0.31	
$Q_{gs}$	Gate-Source Charge	$V_{GS} = 4.5\text{ V}$ P-Channel	N-Ch		0.12		nC
			P-Ch		0.12		
$Q_{gd}$	Gate-Drain Charge	$V_{DS} = -5\text{ V}$ , $I_D = -0.14\text{ A}$ , $V_{GS} = -4.5\text{ V}$	N-Ch		0.03		nC
			P-Ch		0.05		

### DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

$I_S$	Maximum Continuous Drain-Source Diode Forward Current	N-Ch			0.25	A
		P-Ch			-0.25	
$V_{SD}$	Drain-Source Diode Forward Voltage	$V_{GS} = 0\text{ V}$ , $I_S = 0.5\text{ A}$ (Note 2)	N-Ch		0.8	V
		$V_{GS} = 0\text{ V}$ , $I_S = -0.5\text{ A}$ (Note 2)	P-Ch		-0.8	

Notes:

- $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.  $R_{\theta JA} = 415^\circ\text{C/W}$  on minimum mounting pad on FR-4 board in still air.
- Pulse Test: Pulse Width  $\leq 300\mu\text{s}$ , Duty Cycle  $\leq 2.0\%$ .

## Typical Electrical Characteristics: N-Channel

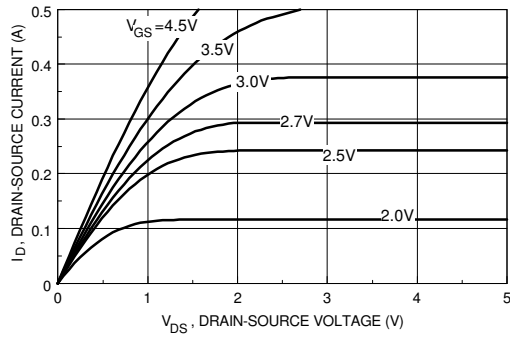


Figure 1. On-Region Characteristics.

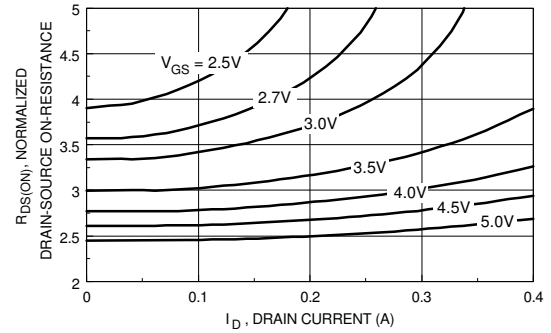


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

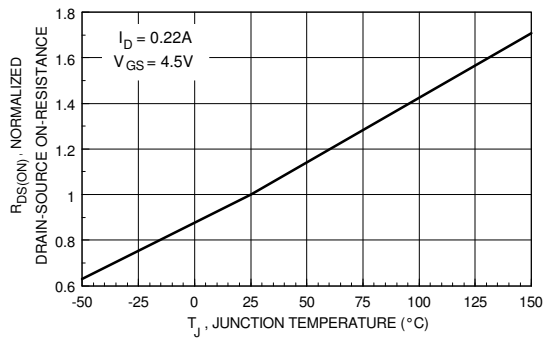


Figure 3. On-Resistance Variation with Temperature.

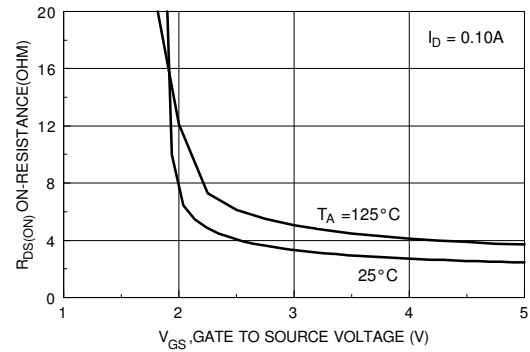


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

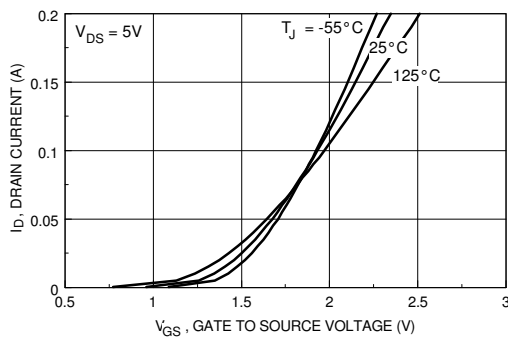


Figure 5. Transfer Characteristics.

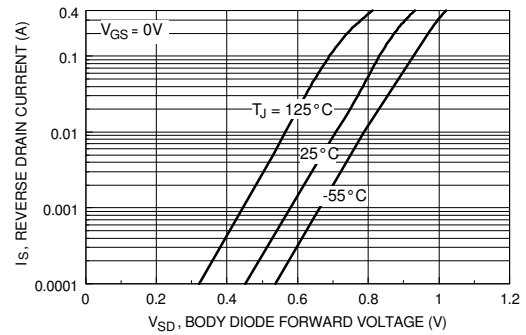


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Electrical Characteristics: N-Channel (continued)

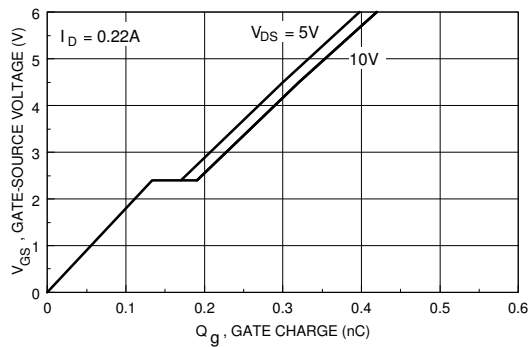


Figure 7. Gate Charge Characteristics.

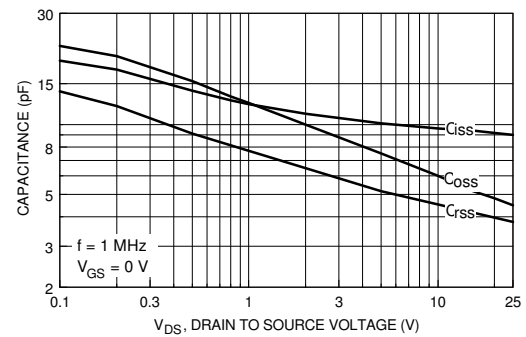


Figure 8. Capacitance Characteristics.

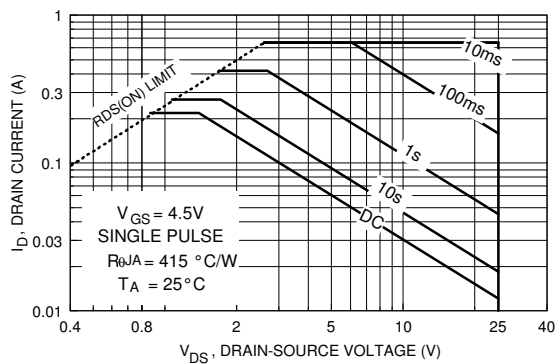


Figure 9. Maximum Safe Operating Area.

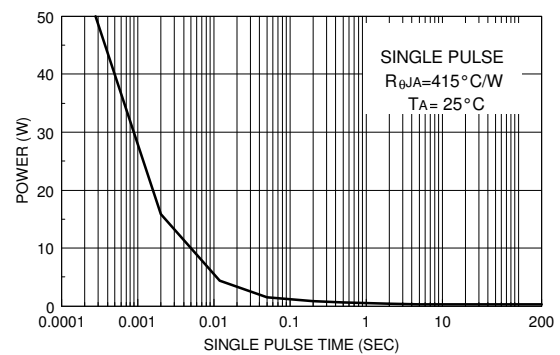


Figure 10. Single Pulse Maximum Power Dissipation.

## Typical Electrical Characteristics: P-Channel

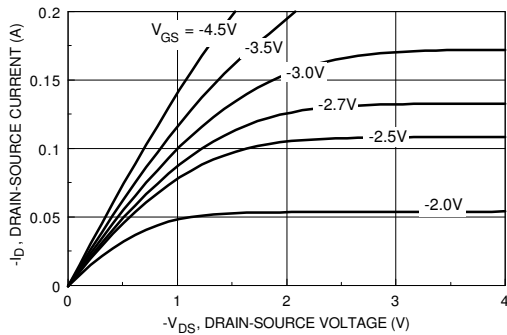


Figure 11. On-Region Characteristics.

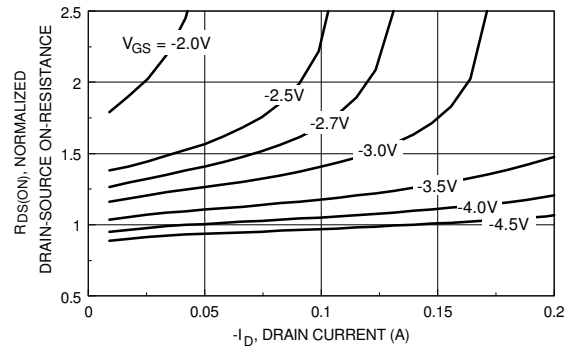


Figure 12. On-Resistance Variation with Drain Current and Gate Voltage.

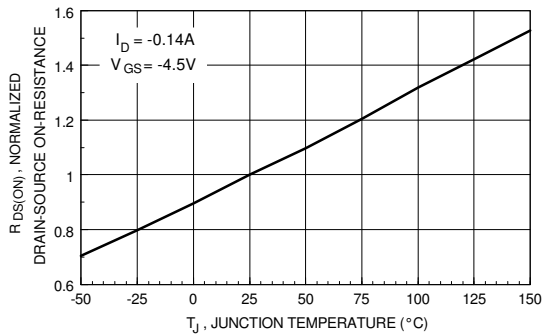


Figure 13. On-Resistance Variation with Temperature.

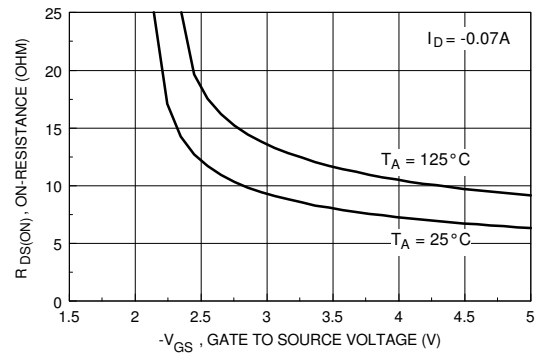


Figure 14. On-Resistance Variation with Gate-to-Source Voltage.

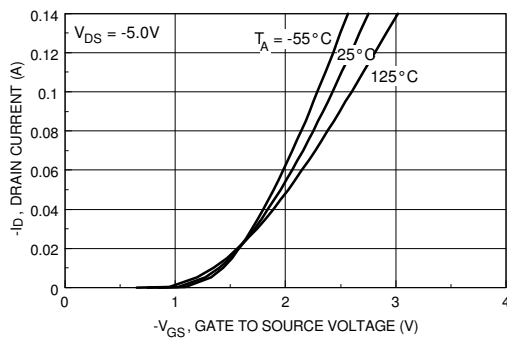


Figure 15. Transfer Characteristics.

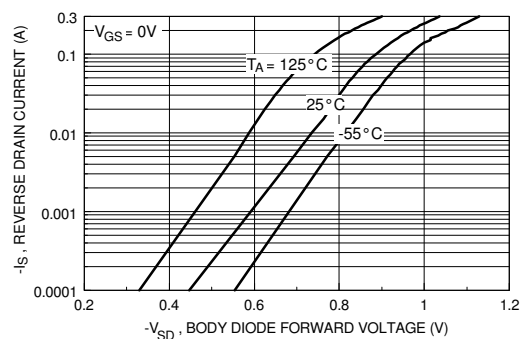


Figure 16. Body Diode Forward Voltage Variation with Source Current and Temperature.

## Typical Electrical Characteristics: P-Channel (continued)

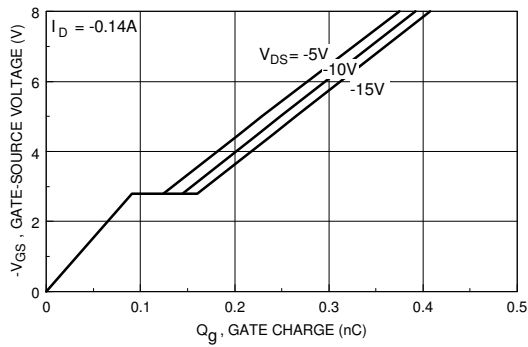


Figure 17. Gate Charge Characteristics.

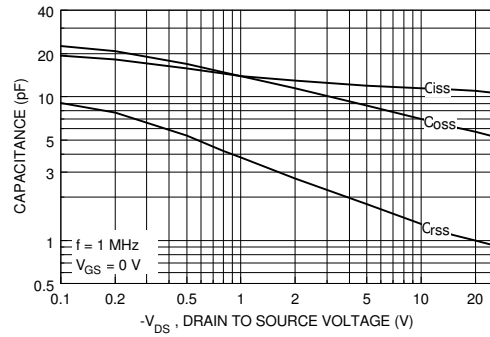


Figure 18. Capacitance Characteristics.

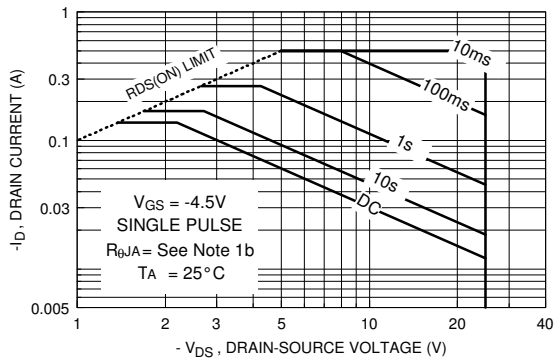


Figure 19. Maximum Safe Operating Area.

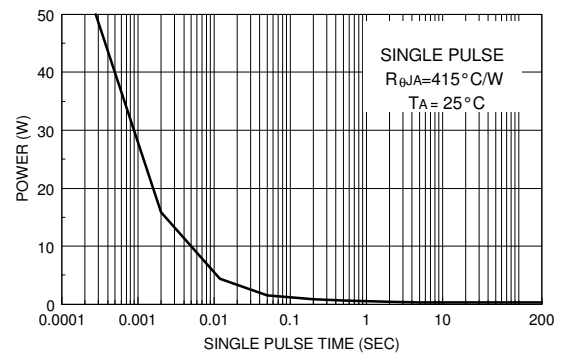
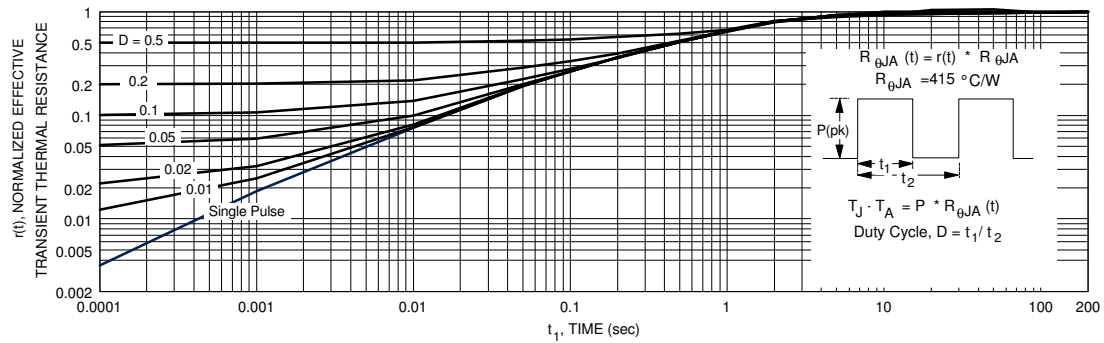


Figure 20. Single Pulse Maximum Power Dissipation.

## Typical Thermal Characteristics: N & P-Channel (continued)



**Figure 21. Transient Thermal Response Curve.**

Thermal characterization performed using the conditions described in note 1.  
Transient thermal response will change depending on the circuit board design.

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