N-Channel Enhancement-Mode Vertical DMOS FET

Features

- Free from secondary breakdown
- Low power drive requirement
- Ease of paralleling
- Low C_{ISS} and fast switching speeds
- Excellent thermal stability
- Integral source-drain diode
- High input impedance and high gain
- Complementary N- and P-channel devices

Applications

- Logic level interfaces - ideal for TTL and CMOS
- Solid state relays
- Battery operated systems
- Photo-voltaic drives
- Analog switches
- General purpose line drivers
- Telecom switches

General Description

This low threshold, enhancement-mode (normally-off) transistor utilizes a vertical DMOS structure and Supertex's well-proven, silicon-gate manufacturing process. This combination produces a device with the power handling capabilities of bipolar transistors and the high input impedance and positive temperature coefficient inherent in MOS devices. Characteristic of all MOS structures, this device is free from thermal runaway and thermally-induced secondary breakdown.

Supertex's vertical DMOS FETs are ideally suited to a wide range of switching and amplifying applications where very low threshold voltage, high breakdown voltage, high input impedance, low input capacitance, and fast switching speeds are desired.

Ordering Information

Device	Package Option		BV_{DSS}/BV_{DGS} (V)	$R_{DS(ON)}$ (max) (Ω)	$V_{GS(th)}$ (max) (V)
	TO-236AB (SOT-23)	TO-92			
TN2106	TN2106K1-G	TN2106N3-G	60	2.5	2.0

-G indicates package is RoHS compliant ('Green')

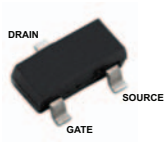
Absolute Maximum Ratings

Parameter	Value
Drain-to-source	BV_{DSS}
Drain-to-gate	BV_{DGS}
Gate-to-source	±20V
Operating and storage temperature	-55°C to +150°C
Soldering temperature*	300°C

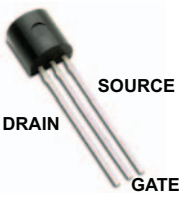
Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Continuous operation of the device at the absolute rating level may affect device reliability. All voltages are referenced to device ground.

** Distance of 1.6mm from case for 10 seconds.*

Pin Configurations



TO-236AB (SOT-23) (K1)



TO-92 (N3)

Product Marking

W = Code for week sealed
_____ = "Green" Packaging

TO-236AB (SOT-23) (K1)

YY = Year Sealed
WW = Week Sealed
_____ = "Green" Packaging

TO-92 (N3)

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Thermal Characteristics

Package	I_D (continuous)† (mA)	I_D (pulsed) (A)	Power Dissipation @T_A = 25°C (W)	θ_{jc} (°C/W)	θ_{ja} (°C/W)	I_{DR}† (mA)	I_{DRM} (A)
TO-236AB (SOT-23)	280	0.8	0.36	200	350	280	0.8
TO-92	300	1.0	0.74	125	170	300	1.0

Notes:

† I_D *(continuous) is limited by max rated* T_j .

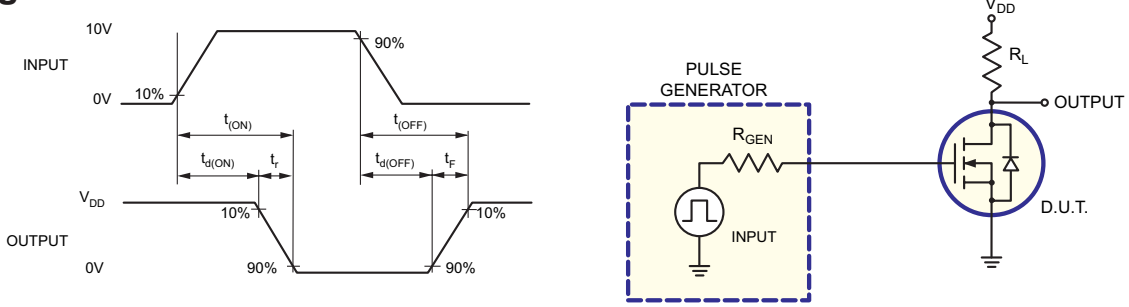
Electrical Characteristics *(T_A = 25°C unless otherwise specified)*

Sym	Parameter	Min	Typ	Max	Units	Conditions
BV_{DSS}	Drain-to-source breakdown voltage	60	-	-	V	V_{GS} = 0V, I_D = 1.0mA
$V_{GS(th)}$	Gate threshold voltage	0.6	-	2.0	V	V_{GS} = V_{DS}, I_D = 1.0mA
$\Delta V_{GS(th)}$	Change in $V_{GS(th)}$ with temperature	-	-3.8	-5.5	mV/°C	V_{GS} = V_{DS}, I_D = 1.0mA
I_{GSS}	Gate body leakage	-	0.1	100	nA	V_{GS} = ± 20V, V_{DS} = 0V
I_{DSS}	Zero gate voltage drain current	-	-	1.0	µA	V_{GS} = 0V, V_{DS} = Max Rating
		-	-	100		V_{DS} = 0.8Max Rating, V_{GS} = 0V, T_A = 125°C
$I_{D(ON)}$	On-state drain current	0.6	-	-	A	V_{GS} = 10V, V_{DS} = 25V
$R_{DS(ON)}$	Static drain-to-source on-state resistance	-	-	5.0	Ω	V_{GS} = 4.5V, I_D = 200mA
		-	-	2.5		V_{GS} = 10V, I_D = 500mA
$\Delta R_{DS(ON)}$	Change in $R_{DS(ON)}$ with temperature	-	0.70	1.0	%/°C	V_{GS} = 10V, I_D = 500mA
G_{FS}	Forward transductance	150	400	-	mmho	V_{DS} = 25V, I_D = 500mA
C_{ISS}	Input capacitance	-	35	50	pF	V_{GS} = 0V, V_{DS} = 25V, f = 1.0MHz
C_{OSS}	Common source output capacitance	-	17	25		
C_{RSS}	Reverse transfer capacitance	-	7.0	8.0		
$t_{d(ON)}$	Turn-on delay time	-	3.0	5.0	ns	V_{DD} = 25V, I_D = 0.5A, R_{GEN} = 25Ω
t_r	Rise time	-	5.0	8.0		
$t_{d(OFF)}$	Turn-off delay time	-	6.0	9.0		
t_f	Fall time	-	5.0	8.0		
V_{SD}	Diode forward voltage drop	-	1.2	1.8	V	V_{GS} = 0V, I_{SD} = 500mA
t_{rr}	Reverse recovery time	-	400	-	ns	V_{GS} = 0V, I_{SD} = 500mA

Notes:

1. *All D.C. parameters 100% tested at 25°C unless otherwise stated. (Pulse test: 300µs pulse, 2% duty cycle.)*
2. *All A.C. parameters sample tested.*

Switching Waveforms and Test Circuit



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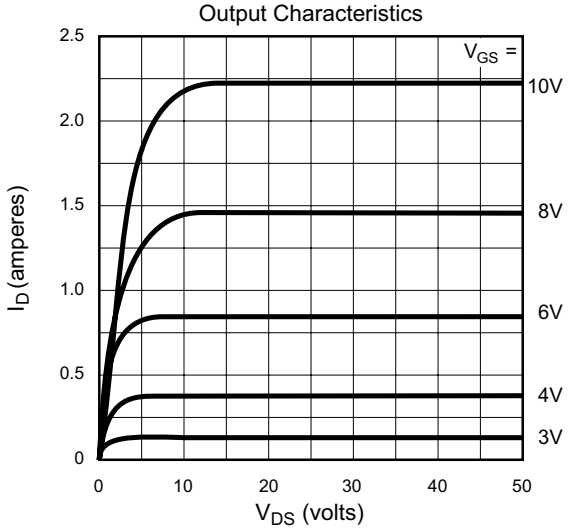
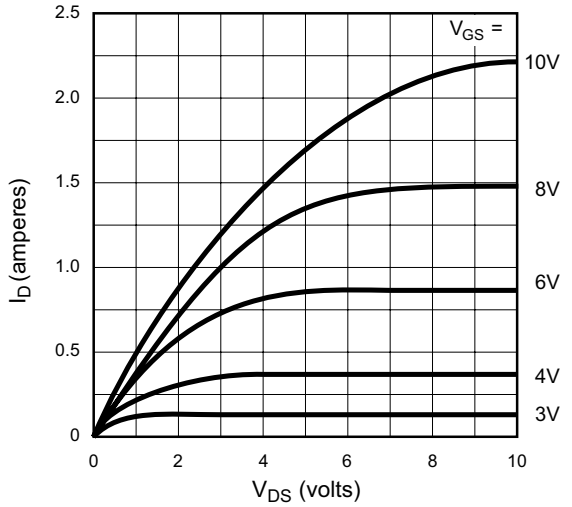
Typical Performance Curves

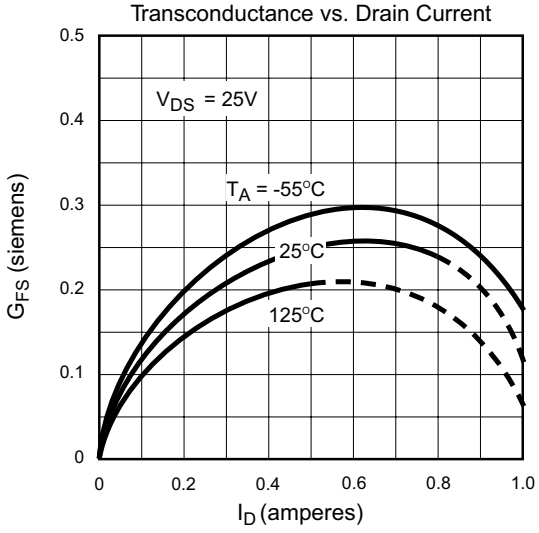
Output Characteristics



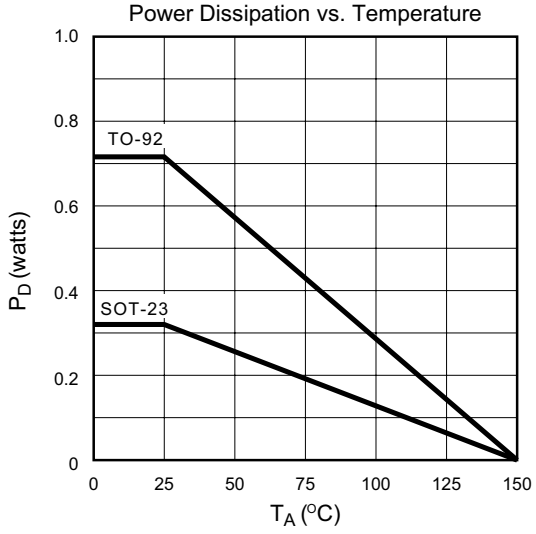
Saturation Characteristics



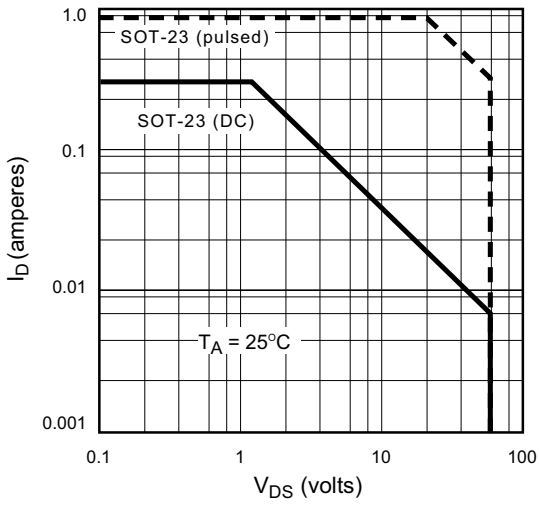
Transconductance vs. Drain Current



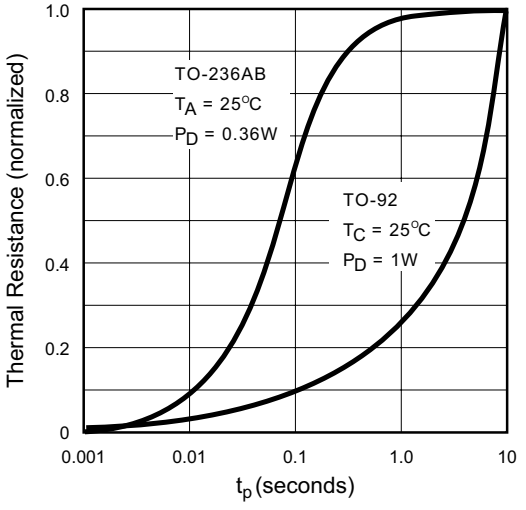
Power Dissipation vs. Temperature



Maximum Rated Safe Operating Area



Thermal Response Characteristics



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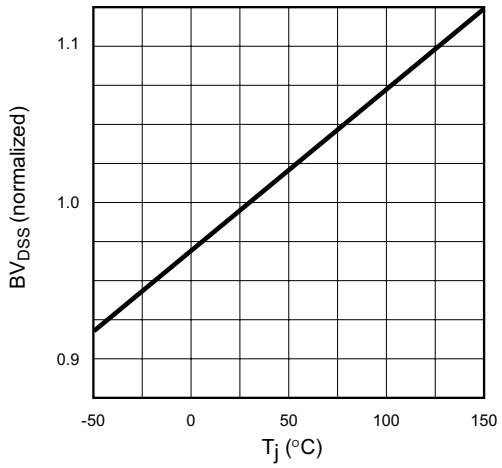
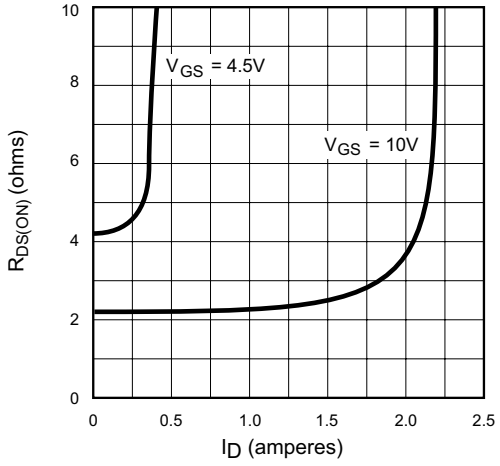
Typical Performance Curves *(cont.)*

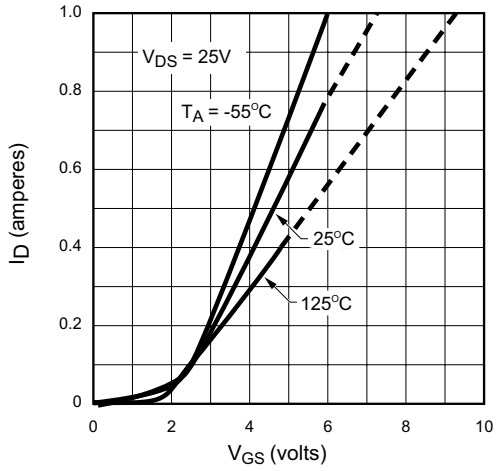
BV_{DSS} Variation with Temperature



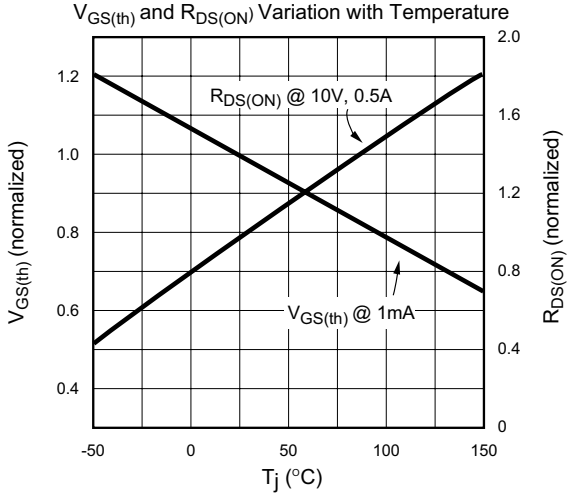
On-Resistance vs. Drain Current



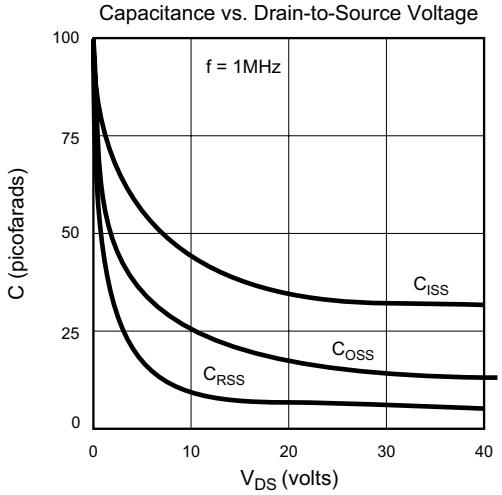
Transfer Characteristics



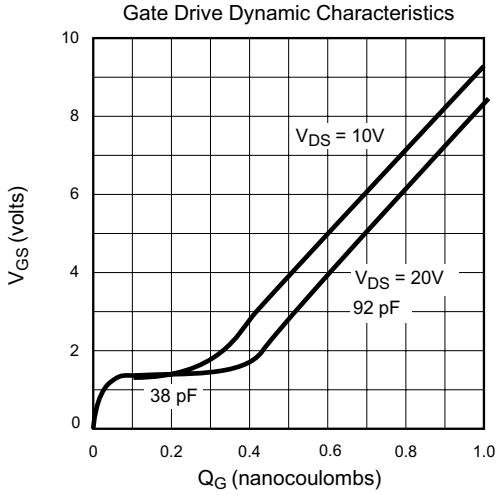
$V_{GS(th)}$ and $R_{DS(ON)}$ Variation with Temperature



Capacitance vs. Drain-to-Source Voltage



Gate Drive Dynamic Characteristics



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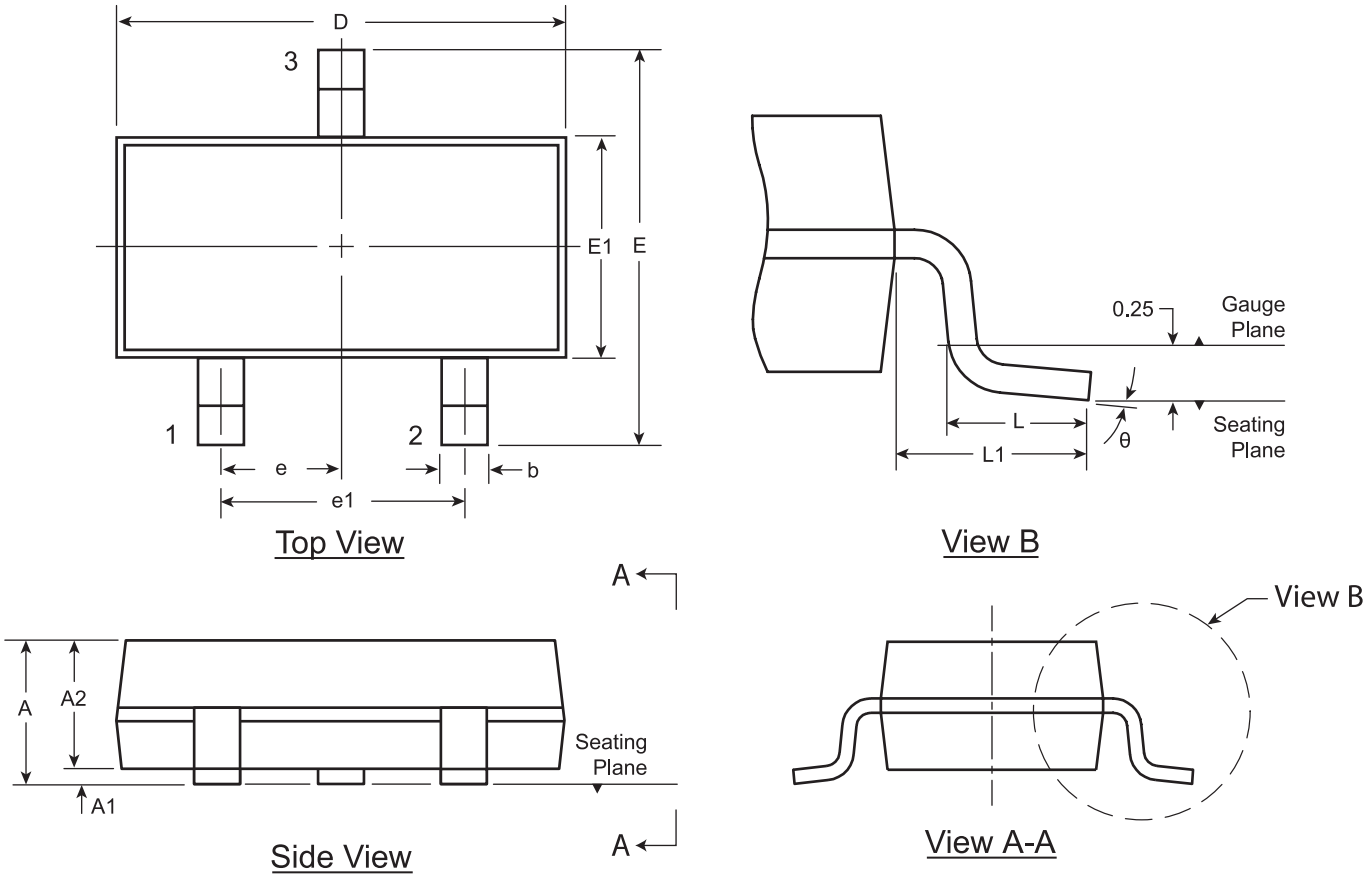
3-Lead TO-236AB (SOT-23) Package Outline (K1)

2.90x1.30mm body, 1.12mm height (max), 1.90mm pitch



Symbol		A	A1	A2	b	D	E	E1	e	e1	L	L1	θ
Dimension (mm)	MIN	0.89	0.01	0.88	0.30	2.80	2.10	1.20	0.95 BSC	1.90 BSC	0.40	0.54 REF	0°
	NOM	-	-	0.95	-	2.90	-	1.30			0.50		-
	MAX	1.12	0.10	1.02	0.50	3.04	2.64	1.40			0.60		8°

JEDEC Registration TO-236, Variation AB, Issue H, Jan. 1999.

Drawings not to scale.

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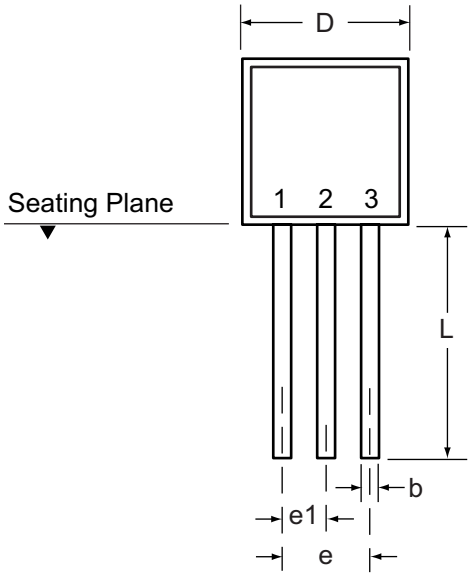
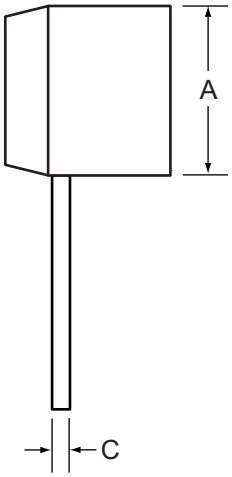
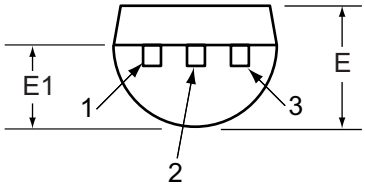
3-Lead TO-92 Package Outline (N3)



Front View



Side View



Bottom View

Symbol		A	b	C	D	E	E1	e	e1	L
Dimension (inches)	MIN	.170	.014	.014	.175	.125	.080	.095	.045	.500
	NOM	-	-	-	-	-	-	-	-	-
	MAX	.210	.022	.022	.205	.165	.105	.105	.055	-

Drawings not to scale.

(The package drawing(s) in this data sheet may not reflect the most current specifications. For the latest package outline information go to http://www.supertex.com/packaging.html.)

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