

N- and P-Channel 40-V (D-S) MOSFET

PRODUCT SUMMARY

	V _{DS} (V)	R _{DS(on)} (Ω)	I _D (A) ^a	Q _g (Typ.)
N-Channel	40	0.125 at V _{GS} = 10 V	2.250	2.2
		0.165 at V _{GS} = 4.5 V	1.95	
P-Channel	- 40	0.215 at V _{GS} = - 10 V	- 1.76	2.3
		0.335 at V _{GS} = - 4.5 V	- 1.4	

FEATURES

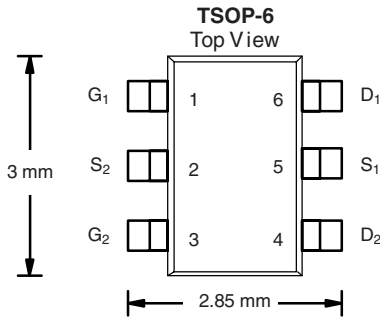
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFETs
- Compliant to RoHS Directive 2002/95/EC



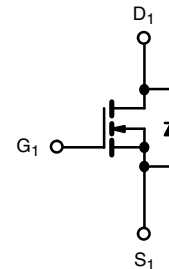
RoHS
COMPLIANT
HALOGEN
FREE
Available

APPLICATIONS

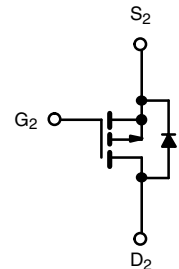
- Stepper Motor
- Motor Drives



Ordering Information: Si3529DV-T1-E3 (Lead (Pb)-free)
Si3529DV-T1-GE3 (Lead (Pb)-free and Halogen-free)



N-Channel MOSFET



P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS T_A = 25 °C, unless otherwise noted

Parameter		Symbol	N-Channel	P-Channel	Unit
Drain-Source Voltage		V _{DS}	40	- 40	V
Gate-Source Voltage		V _{GS}	± 20		
Continuous Drain Current (T _J = 150 °C)	T _C = 25 °C	I _D	2.5	- 1.95	A
	T _C = 70 °C		2.0	- 1.56	
	T _A = 25 °C		2.25 ^{b, c}	- 1.76 ^{b, c}	
	T _A = 70 °C		1.8 ^{b, c}	- 1.4 ^{b, c}	
Pulsed Drain Current (10 μs Pulse Width)		I _{DM}	10	- 6	
Source-Drain Current Diode Current	T _C = 25 °C	I _S	1.26	- 1.26	
	T _A = 25 °C		1.05 ^{b, c}	- 1.05 ^{b, c}	
Pulsed Source-Drain Current		I _{SM}	10	- 6	
Single Pulse Avalanche Current	L = 0.1 mH	I _{AS}	5	5	
Single Pulse Avalanche Energy		E _{AS}	1.25	1.25	mJ
Maximum Power Dissipation	T _C = 25 °C	P _D	1.4	1.4	W
	T _C = 70 °C		0.9	0.9	
	T _A = 25 °C		1.15 ^{b, c}	1.15 ^c	
	T _A = 70 °C		0.7 ^{b, c}	0.78 ^{b, c}	
Operating Junction and Storage Temperature Range		T _J , T _{stg}	- 55 to 150		°C

THERMAL RESISTANCE RATINGS

Parameter	Symbol	N-Channel		P-Channel		Unit
		Typ.	Max.	Typ.	Max.	
Maximum Junction-to-Ambient ^{b, d}	R _{thJA}	93	110	93	110	°C/W
Maximum Junction-to-Foot (Drain)	R _{thJF}	75	90	75	90	

Notes:

a. Based on T_C = 25 °C.

b. Surface Mounted on 1" x 1" FR4 Board.

c. t = 10 s.

d. Maximum under Steady State conditions is 150 °C/W (N-Channel) and 150 °C/W (P-Channel).

SPECIFICATIONS $T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted

Parameter	Symbol	Test Conditions		Min.	Typ. ^a	Max.	Unit
Static							
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA	N-Ch	40			V
		V _{GS} = 0 V, I _D = - 250 μA	P-Ch	- 40			
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = 250 μA	N-Ch		40		mV/°C
		I _D = - 250 μA	P-Ch		- 40		
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J	I _D = 250 μA	N-Ch		- 5.4		
		I _D = - 250 μA	P-Ch		3.7		
Gate Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	N-Ch	1		3	V
		V _{DS} = V _{GS} , I _D = - 250 μA	P-Ch	- 1		- 3	
Gate-Body Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = ± 20 V	N-Ch			100	nA
			P-Ch			- 100	
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 40 V, V _{GS} = 0 V	N-Ch			1	μA
		V _{DS} = - 40 V, V _{GS} = 0 V	P-Ch			- 1	
		V _{DS} = 40 V, V _{GS} = 0 V, T _J = 55 °C	N-Ch			10	
		V _{DS} = - 40 V, V _{GS} = 0 V, T _J = 55 °C	P-Ch			- 10	
On-State Drain Current ^b	I _{D(on)}	V _{DS} = 5 V, V _{GS} = 10 V	N-Ch	10			A
		V _{DS} = - 5 V, V _{GS} = - 10 V	P-Ch	- 6			
Drain-Source On-State Resistance ^b	R _{DS(on)}	V _{GS} = 10 V, I _D = 2.2 A	N-Ch		0.100	0.125	Ω
		V _{GS} = - 10 V, I _D = - 1.7 A	P-Ch		0.172	0.215	
		V _{GS} = 4.5 V, I _D = 1.9 A	N-Ch		0.130	0.165	
		V _{GS} = - 4.5 V, I _D = - 1.4 A	P-Ch		0.268	0.335	
Forward Transconductance ^b	g _{fs}	V _{DS} = 15 V, I _D = 2.2 A	N-Ch		2		S
		V _{DS} = - 15 V, I _D = - 3.6 A	P-Ch		1.3		
Dynamic ^a							
Input Capacitance	C _{iss}	N-Channel V _{DS} = 20 V, V _{GS} = 0 V, f = 1 MHz	N-Ch		205		pF
			P-Ch		175		
Output Capacitance	C _{oss}	P-Channel V _{DS} = - 20 V, V _{GS} = 0 V, f = 1 MHz	N-Ch		33		
			P-Ch		35		
Reverse Transfer Capacitance	C _{rss}		N-Ch		17		
			P-Ch		21		
Total Gate Charge	Q _g	V _{DS} = 20 V, V _{GS} = 10 V, I _D = 2.25 A	N-Ch		4.6	7.0	nC
		V _{DS} = - 20 V, V _{GS} = - 10 V, I _D = - 1.7 A	P-Ch		4.8	7.2	
Gate-Source Charge	Q _{gs}	N-Channel V _{DS} = 20 V, V _{GS} = 4.5 V, I _D = 2.25 A	N-Ch		2.2	3.3	
			P-Ch		2.3	3.5	
		P-Channel V _{DS} = - 20 V, V _{GS} = - 4.5 V, I _D = - 1.8 A	N-Ch		1.0		
			P-Ch		0.8		
Gate-Drain Charge	Q _{gd}		N-Ch		0.9		
			P-Ch		1.1		
Gate Resistance	R _g	f = 1 MHz	N-Ch		2.7	4.1	Ω
			P-Ch		12.0		



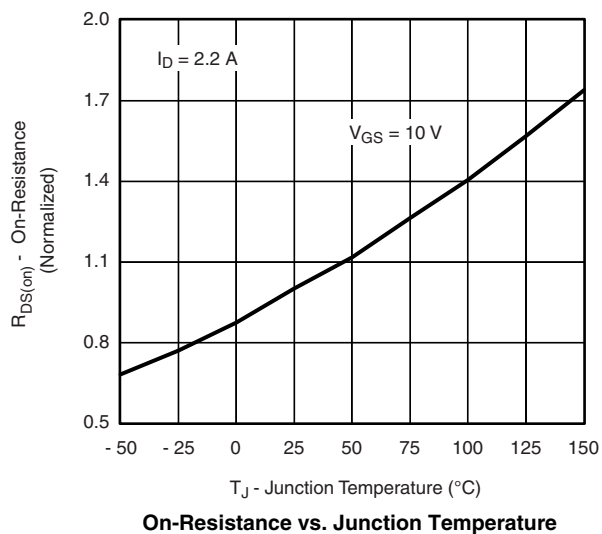
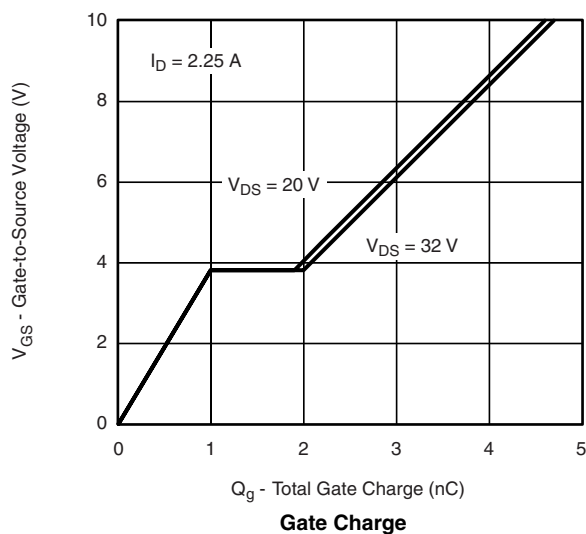
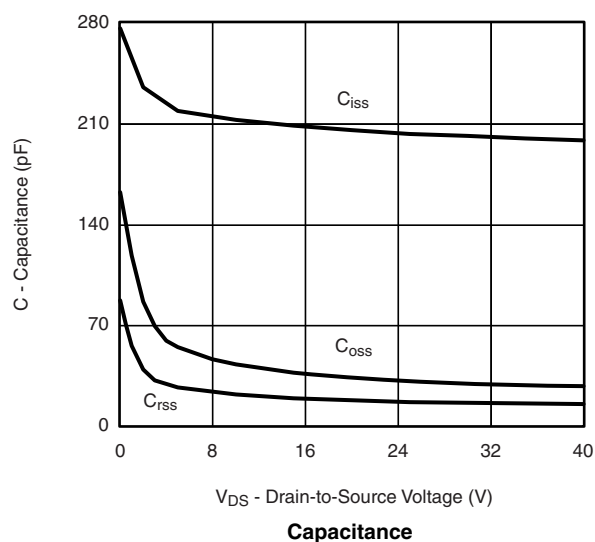
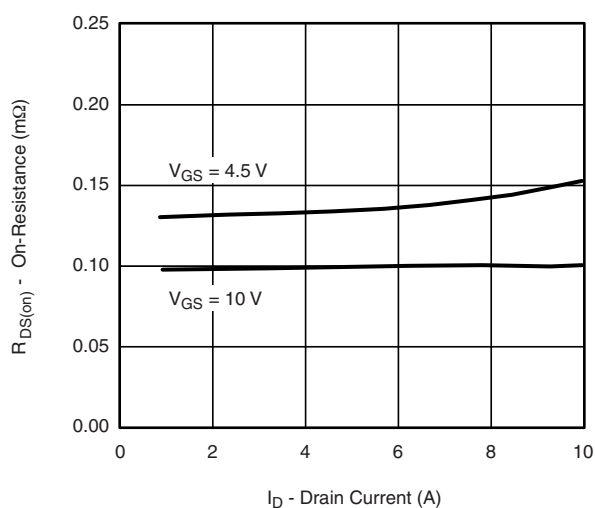
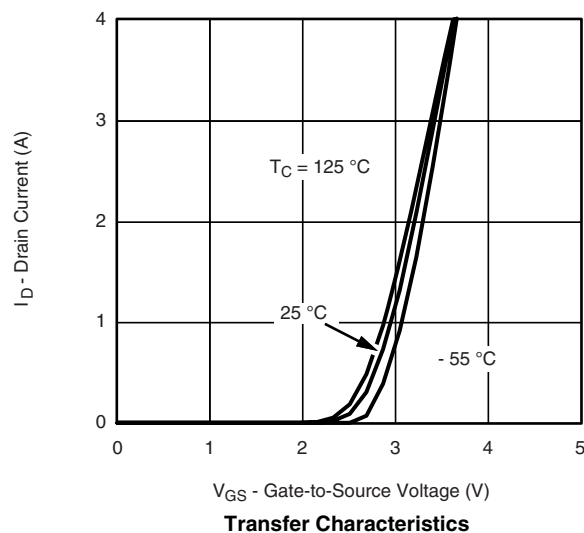
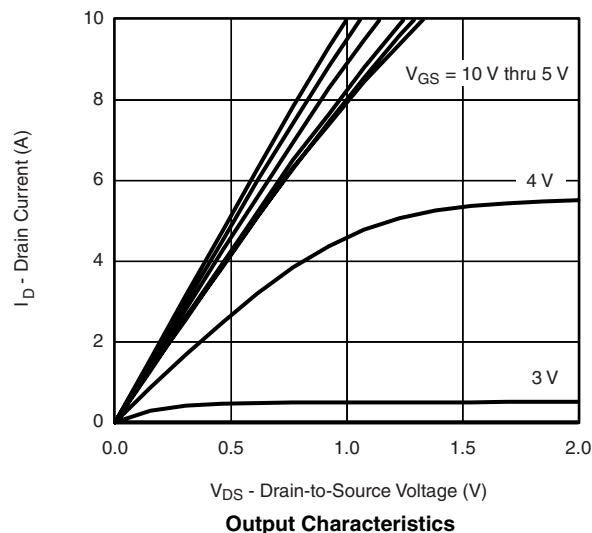
SPECIFICATIONS T _J = 25 °C, unless otherwise noted							
Parameter	Symbol	Test Conditions	Min.	Typ. ^a	Max.	Unit	
Dynamic ^a							
Turn-On Delay Time	t _{d(on)}	N-Channel V _{DD} = 20 V, R _L = 4 Ω I _D ≅ 1 A, V _{GEN} = 10 V, R _g = 1 Ω	N-Ch		2.5	4	ns
			P-Ch		5	7.5	
Rise Time	t _r		N-Ch		12.5	20	
			P-Ch		12.5	20	
Turn-Off Delay Time	t _{d(off)}	P-Channel V _{DD} = - 20 V, R _L = 4 Ω I _D ≅ - 1 A, V _{GEN} = - 10 V, R _g = 1 Ω	N-Ch		8	12	
			P-Ch		10	15	
Fall Time	t _f		N-Ch		6.0	9	
			P-Ch		7.5	12	
Turn-On Delay Time	t _{d(on)}	N-Channel V _{DD} = 20 V, R _L = 4 Ω I _D ≅ 1 A, V _{GEN} = 4.5 V, R _g = 1 Ω	N-Ch		13	20	
			P-Ch		23	35	
Rise Time	t _r		N-Ch		65	100	
			P-Ch		38	60	
Turn-Off Delay Time	t _{d(off)}	P-Channel V _{DD} = - 20 V, R _L = 4 Ω I _D ≅ - 1 A, V _{GEN} = - 4.5 V, R _g = 16 Ω	N-Ch		5	7.5	
			P-Ch		20	30	
Fall Time	t _f		N-Ch		8	12	
			P-Ch		16	25	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C	N-Ch			1.05	A
			P-Ch			- 1.05	
Pulse Diode Forward Current ^a	I _{SM}		N-Ch			10	
			P-Ch			- 6	
Body Diode Voltage	V _{SD}	I _S = 1.0 A	N-Ch		0.8	1.2	V
			P-Ch		- 0.8	- 1.2	
Body Diode Reverse Recovery Time	t _{rr}	N-Channel I _F = 2 A, dI/dt = 100 A/μs, T _J = 25 °C	N-Ch		20	40	ns
			P-Ch		26	40	
Body Diode Reverse Recovery Charge	Q _{rr}		N-Ch		20	30	nC
			P-Ch		22	35	
Reverse Recovery Fall Time	t _a	P-Channel I _F = - 2 A, dI/dt = - 100 A/μs, T _J = 25 °C	N-Ch		17		ns
			P-Ch		12		
Reverse Recovery Rise Time	t _b		N-Ch		3		
			P-Ch		14		

Notes:

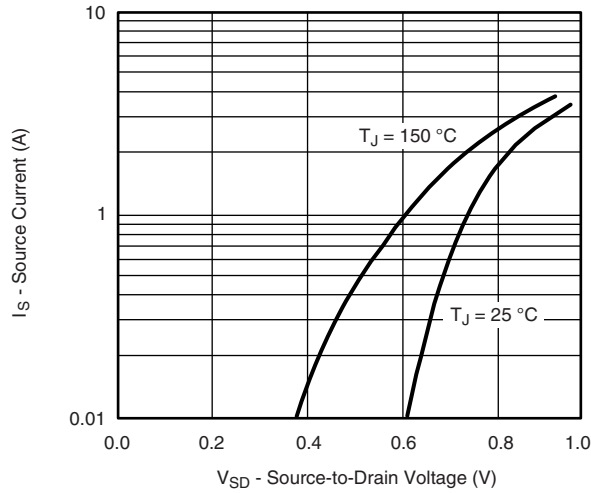
a. Guaranteed by design, not subject to production testing.

b. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.

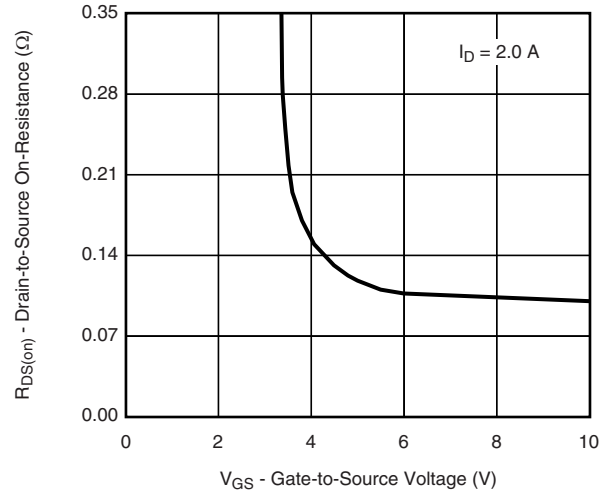
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

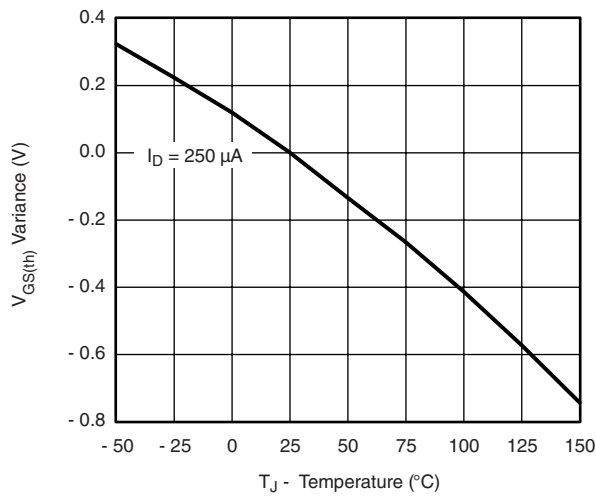
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



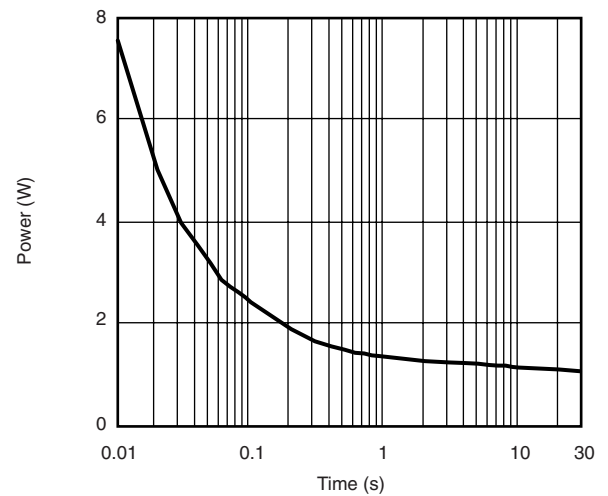
Source-Drain Diode Forward Voltage



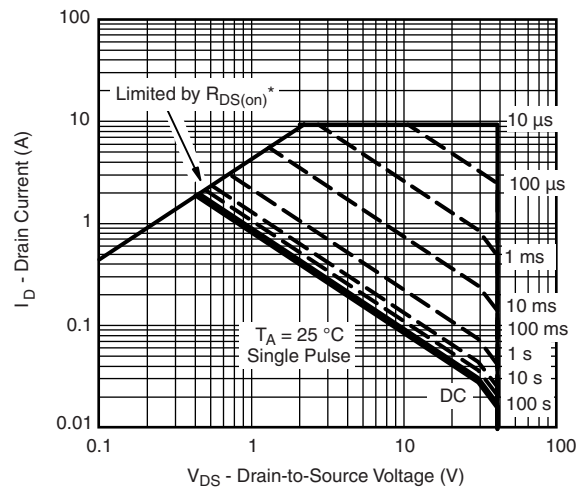
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

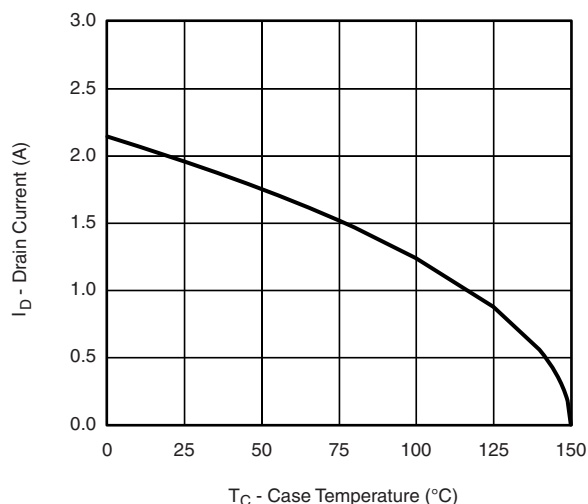
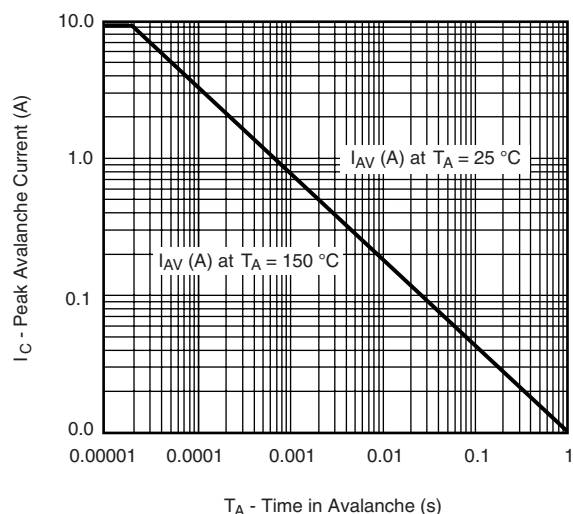
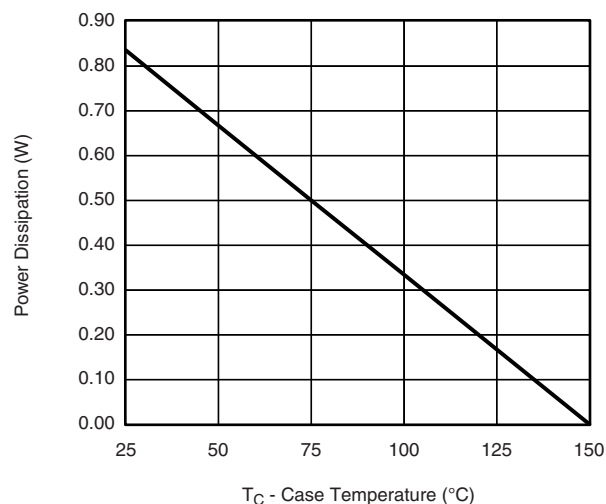


Single Pulse Power, Junction-to-Ambient



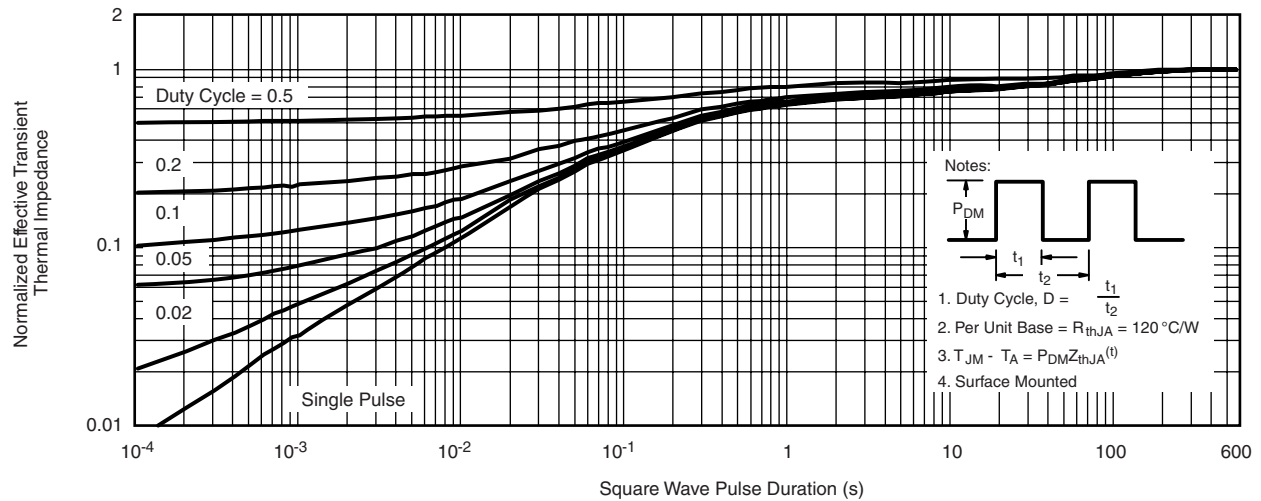
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

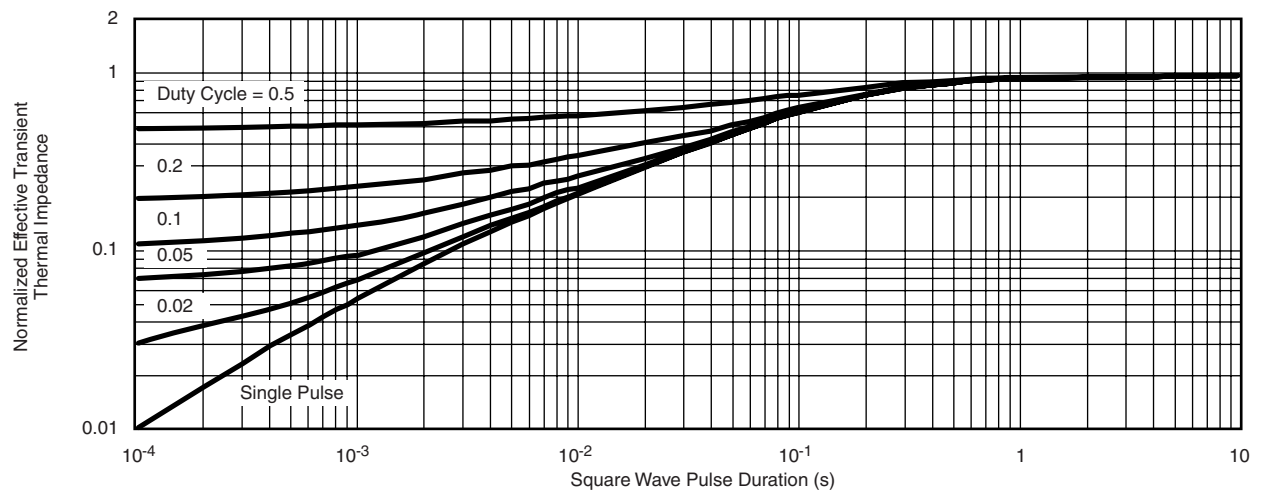
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted**Current Derating*****Single Pulse Avalanche Capability****Power Derating, Junction-to-Ambient**

* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

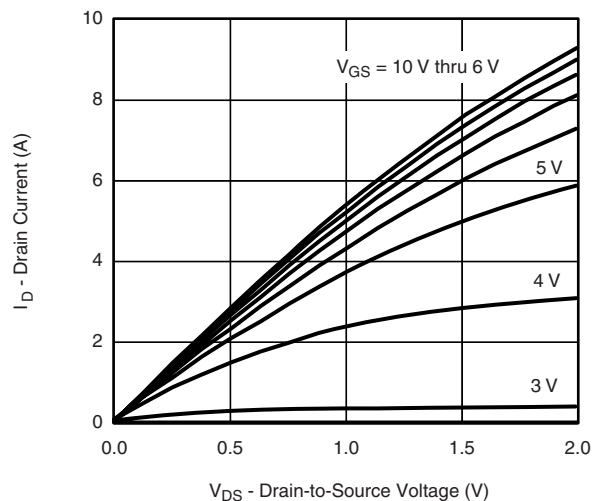
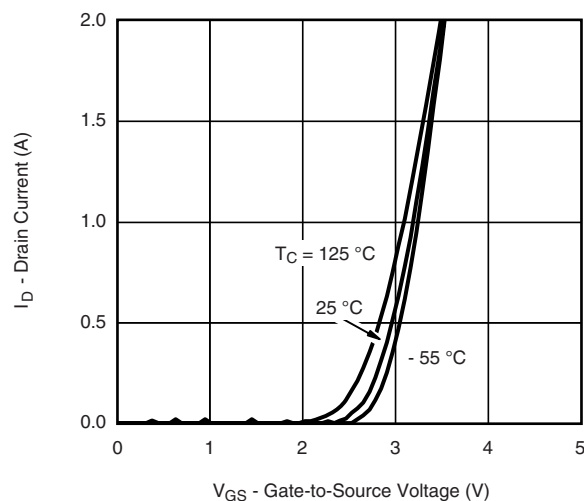
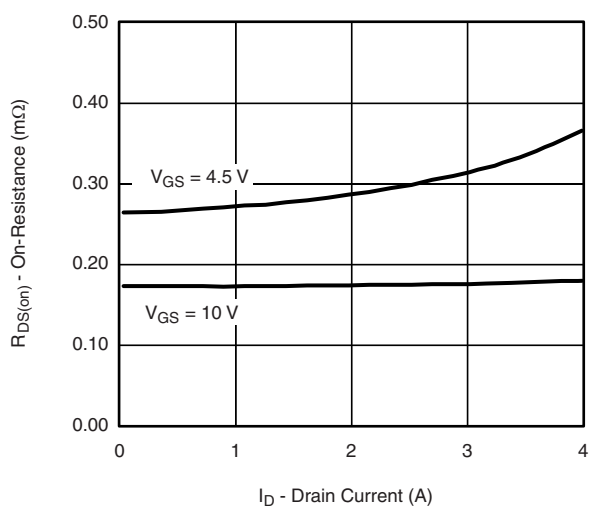
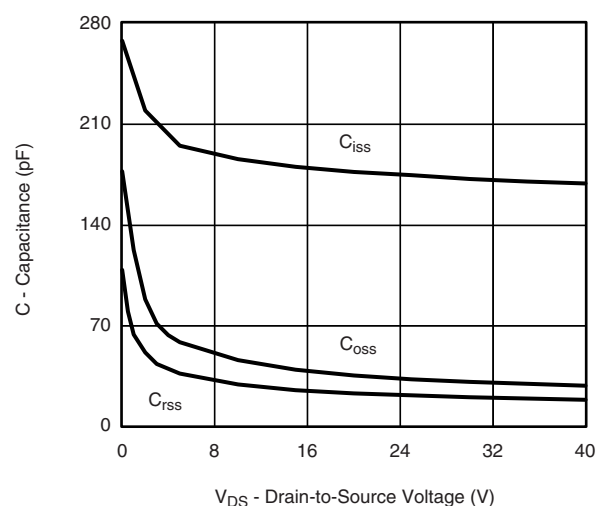
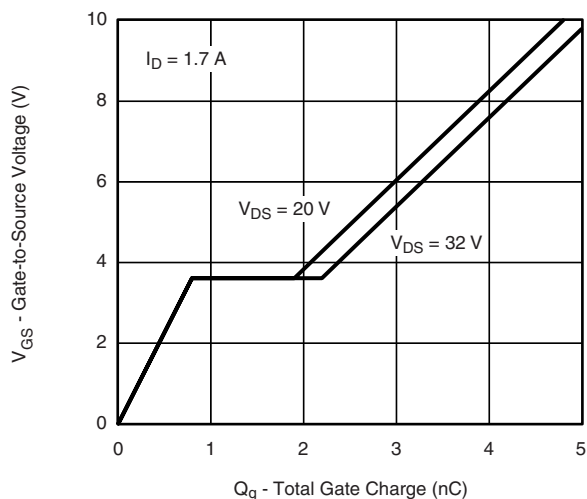
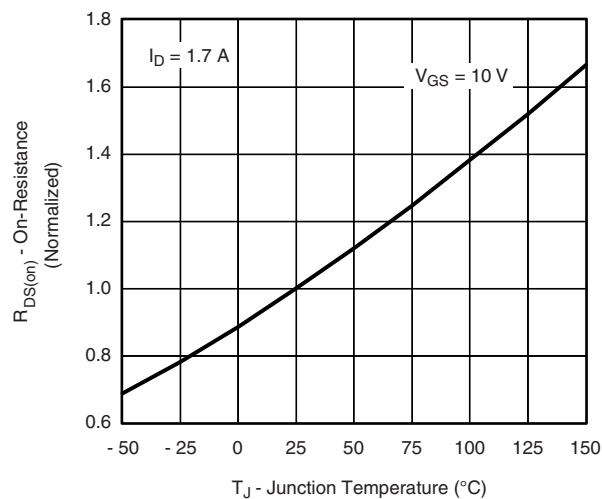
N-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



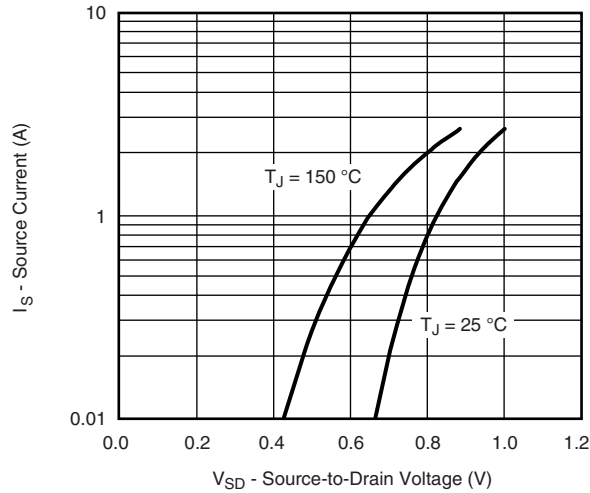
Normalized Thermal Transient Impedance, Junction-to-Ambient



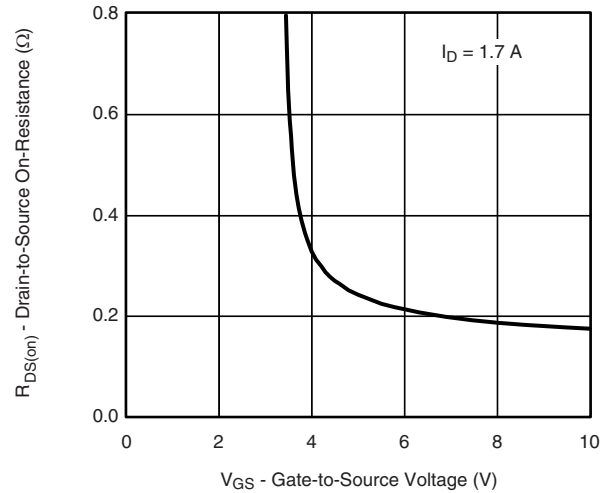
Normalized Thermal Transient Impedance, Junction-to-Foot

P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted**Output Characteristics****Transfer Characteristics****On-Resistance vs. Drain Current and Gate Voltage****Capacitance****Gate Charge****On-Resistance vs. Junction Temperature**

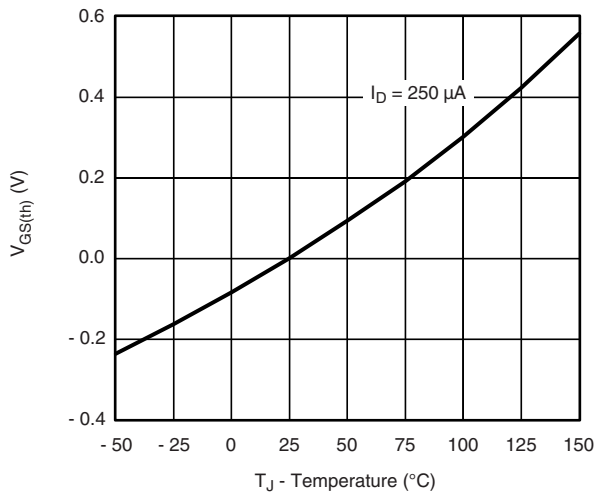
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



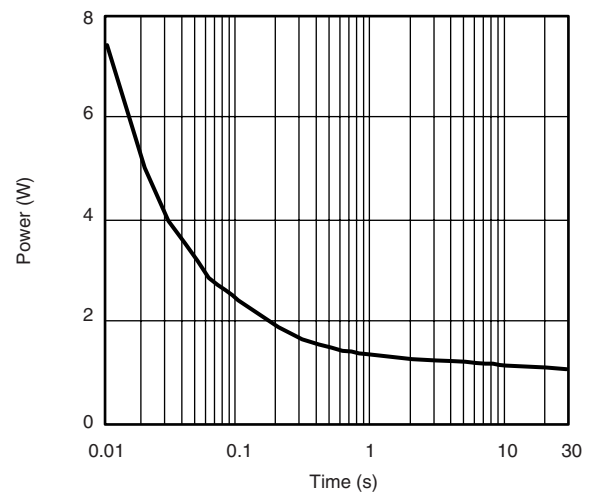
Source-Drain Diode Forward Voltage



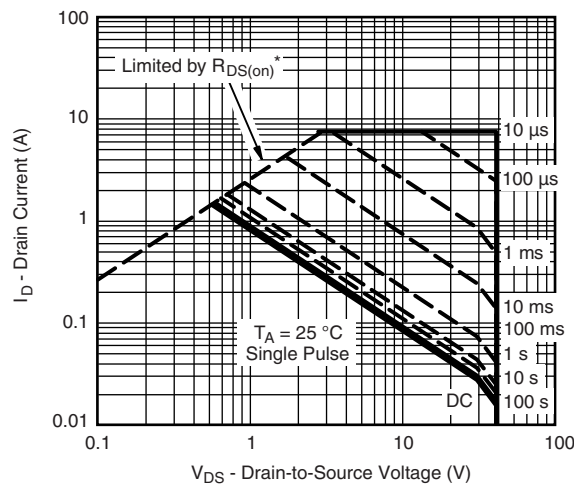
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

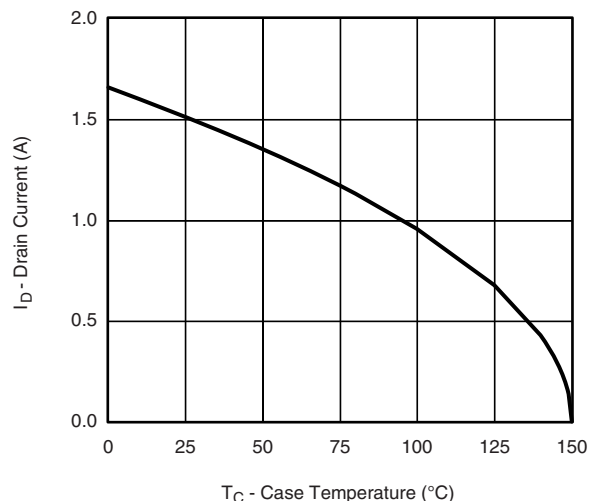
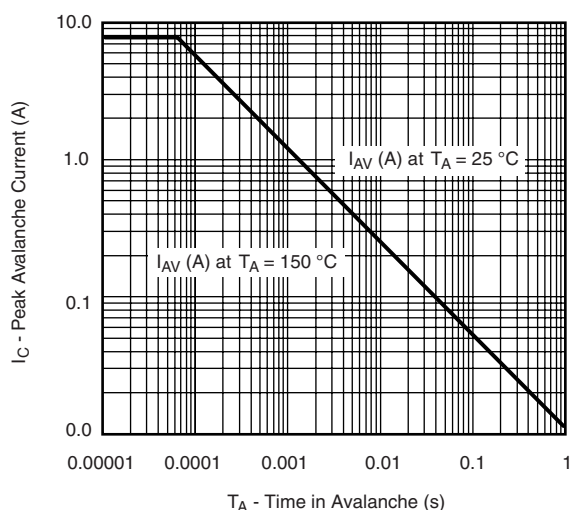
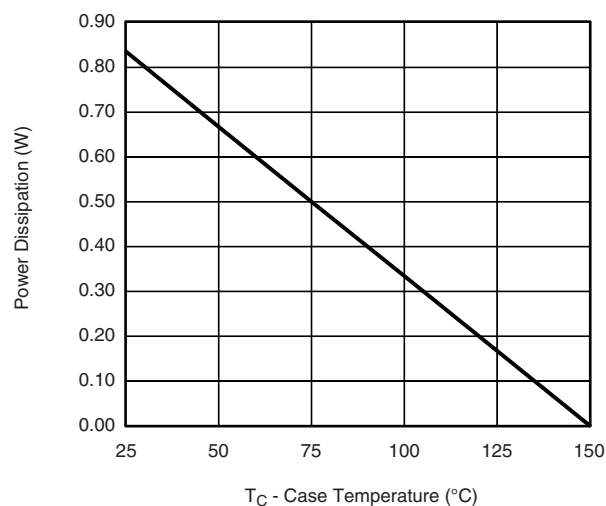


Single Pulse Power, Junction-to-Ambient



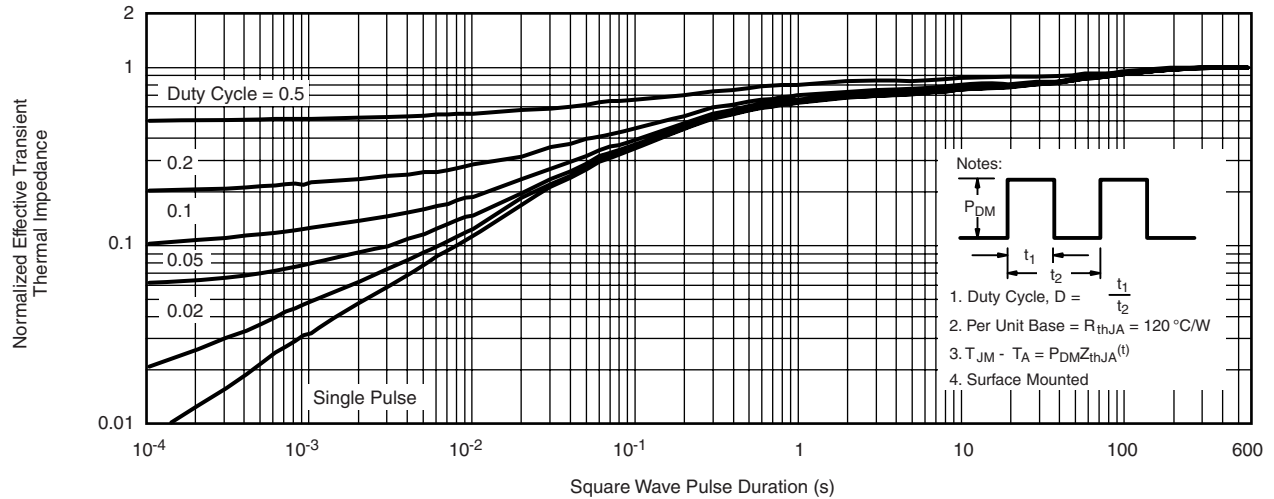
* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Ambient

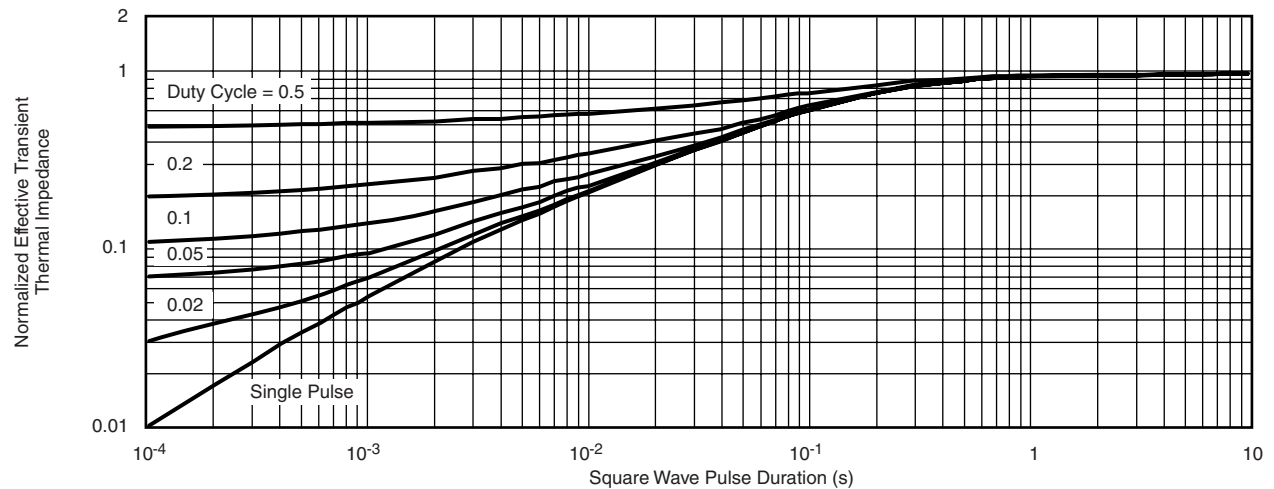
P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

Current Derating*

Single Pulse Avalanche Capability

Power Derating, Junction-to-Ambient

* The power dissipation P_D is based on $T_{J(max)} = 150$ °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

P-CHANNEL TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

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