SPA20N65C3XKSA1

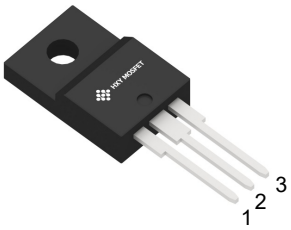
SiC Power MOSFET N-Channel Enhancement Mode

Features

- High Speed Switching with Low Capacitances
- High Blocking Voltage with Low $R_{DS(on)}$
- Easy to drive and parallel
- Effectively lower down Tj and Rth,High anti-EMI ability
- RoHS Compliant

Benefits

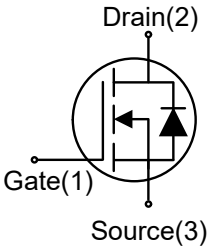
- Increased Power Density
- Faster Operating Freequency
- Reduction of Heat Sink Requirements
- Higher Efficiency
- Reduced EMI



TO-220F

Applications

- Power Factor Correction Modules
- Switch Mode Power Supplies
- Power Inverters
- High Voltage DC/DC Converters



Ordering Part Number	Package	Brand
SPA20N65C3XKSA1	TO-220F	HXY MOSFET

Maximum Ratings (Tc = 25 ˚C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
V_{DSmax}	Drain - Source Voltage	650	V	
V_{GSmax}	Gate - Source Voltage (dynamic)	-5/+26	V	
V_{GSop}	Gate - Source Voltage (static)	0/+15	V	
I_D	Continuous Drain Current	20	A	T_C = 25˚C
		16.5		T_C = 100˚C
$I_{D(pulse)}$	Pulsed Drain Current	30	A	Pulse width t_P limited by T_{jmax}
P_D	Power Dissipation	52	W	T_C = 25˚C
		25		T_C = 100˚C
T_J , T_{stg}	Operating Junction and Storage Temperature	-55 to +175	˚C	

Electrical Characteristics (T_C = 25˚C unless other wise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	650		850	V	V_{GS} = 0 V, I_D = 1 mA	
I_{DSS}	Zero Gate Voltage Drain Current		2	100	μA	V_{GS} = 0 V, V_{DS} = 750 V	
I_{GSS+}	Gate-Source Leakage Current			200	nA	V_{DS} = 0 V, V_{GS} = +22 V	
I_{GSS-}	Gate-Source Leakage Current			200	nA	V_{DS} = 0 V, V_{GS} = -10 V	
$V_{GS(th)}$	Gate Threshold Voltage	2.2	3.5	4.2	V	V_{GS} = V_{DS}, I_{DS} = 1 mA, T_J = 25˚C	Fig. 14
			2.6			V_{GS} = V_{DS}, I_{DS} = 1 mA, T_J = 175˚C	
$R_{DS(on)}$	Static Drain-Source On-Resistance		160	180	mΩ	V_{GS} = 15 V, I_D = 6 A, T_J = 25˚C	Fig. 15
			195			V_{GS} = 15 V, I_D = 6 A, T_J = 175˚C	
C_{iss}	Input Capacitance		208		pF	V_{DS} = 400 V, f = 1 MHz, V_{GS} = 0 V	Fig. 8
C_{oss}	Output Capacitance		18				
C_{rss}	Reverse Transfer Capacitance		1.8				
Q_g	Total Gate Charge		10.6		nC	V_{DD} = 400 V, V_{GS} = -5/18 V, I_D = 5 A	Fig. 7
Q_{gs}	Gate-Source Charge		5.1				
Q_{gd}	Gate-Drain Charge		2.2				
$R_{G(int)}$	Gate Input Resistance		1.2		Ω	f = 1 MHz, I_D = 0 A	
E_{on}	Turn-On Switching Energy		25		μJ	V_{DD} = 400 V, I_D = 5 A, R_G = 10 Ω, V_{GS} = -5/18 V	Fig. 12
E_{off}	Turn-Off Switching Energy		10				
$t_{d(on)}$	Turn-On Delay Time		5		ns	V_{DD} = 400 V, I_D = 5 A, R_G = 10 Ω, V_{GS} = -5/18 V	
t_r	Rise Time		17				
$t_{d(off)}$	Turn-Off Delay Time		8				
t_f	Fall Time		10				

Reverse SiC Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	4.0		V	V_{GS} = -4V, I_{SD} = 5A, T_J = 25°C	Fig. 16
		3.6			V_{GS} = -4 V, I_{SD} = 5 A, T_J = 175°C	Fig. 17
*I_{SD}	Continuous Diode Forward Current		18	A	T_C = 25˚C	
			10		T_C = 175˚C	
t_{rr}	Reverse Recovery Time	50		ns	I_{SD} = 5 A, di/dt = 1000 A/µs, V_{DD} = 400 V, V_{GS} = -5 V	
Q_{rr}	Reverse Recovery Charge	38		nC		
I_{RRM}	Peak Reverse Recovery Current	2.4		A		

* **Depends on bonding wire**

Thermal Characteristics

Symbol	Parameter	Typ.	Unit	Test Conditions	Note
R_{thJC}	Thermal Resistance from Junction to Case	2.88	˚C/W		Fig. 2
R_{thJA}	Thermal Resistance From Junction to Ambient	40			

Typical Performance

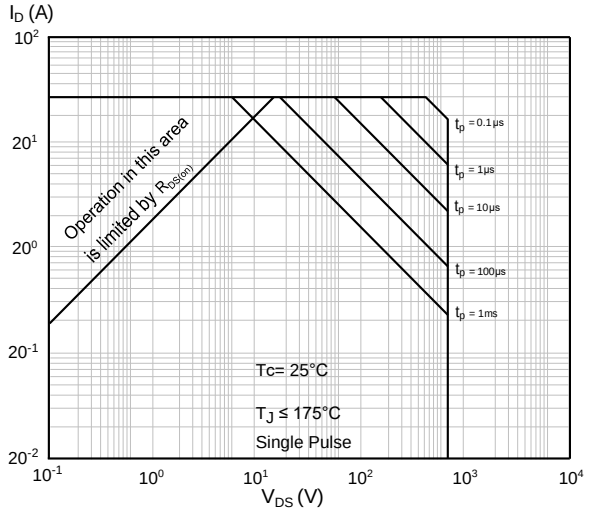


Figure 1. Safe Operating Area

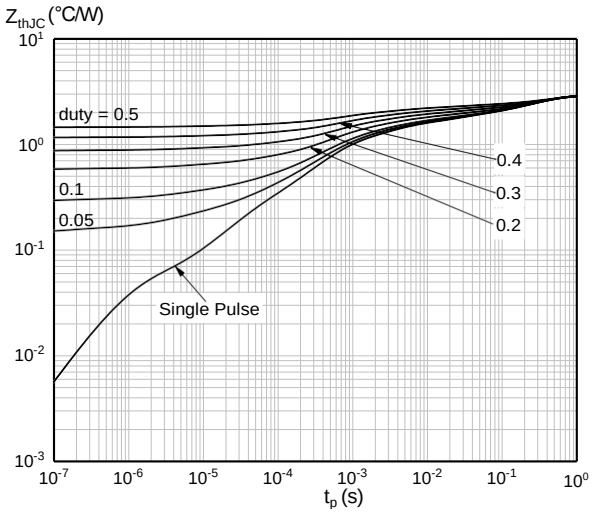


Figure 2. Maximum Transient Thermal Impedance

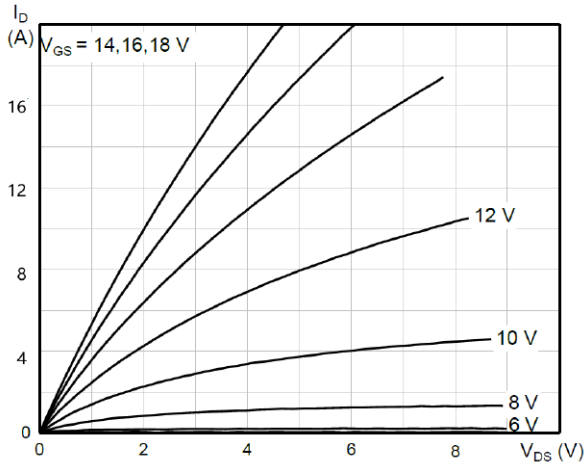


Figure 3. Typical Output Characteristics, T_J = 25°C

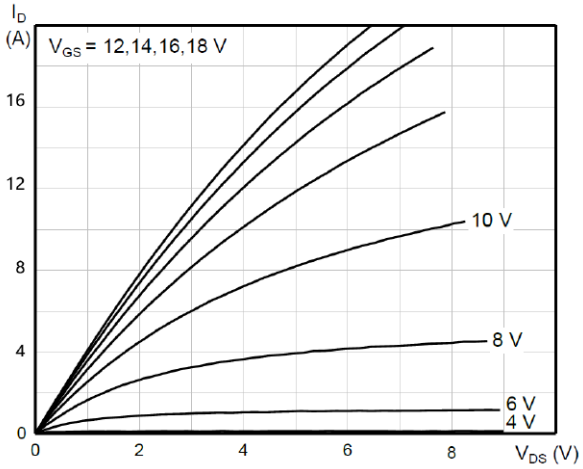


Figure 4. Typical Output Characteristics, T_J =175°C

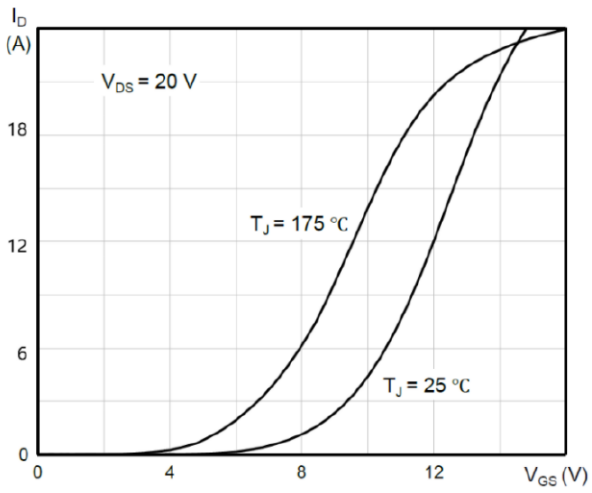


Figure 5. Typical Transfer Characteristics

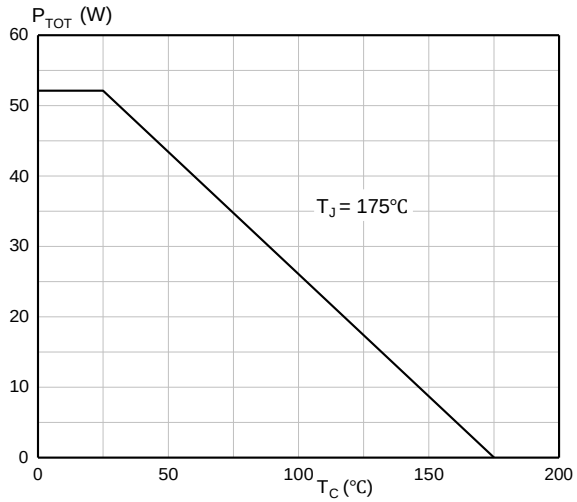


Figure 6. Total Power Dissipation

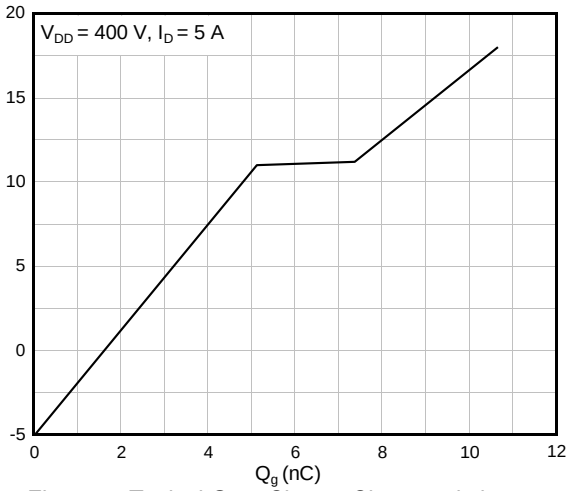


Figure 7. Typical Gate Charge Characteristics

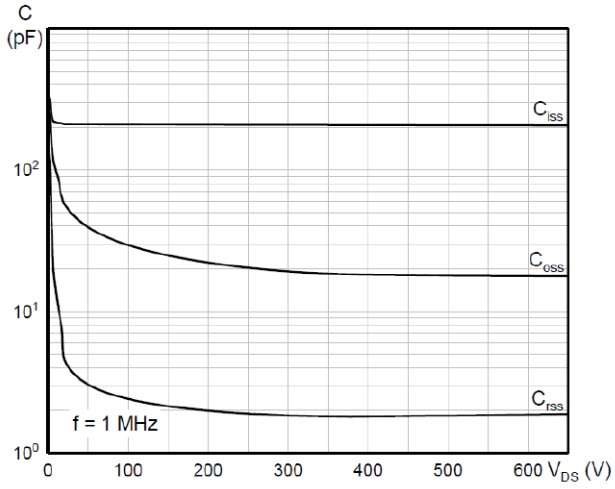


Figure 8. Typical Capacitance Characteristics

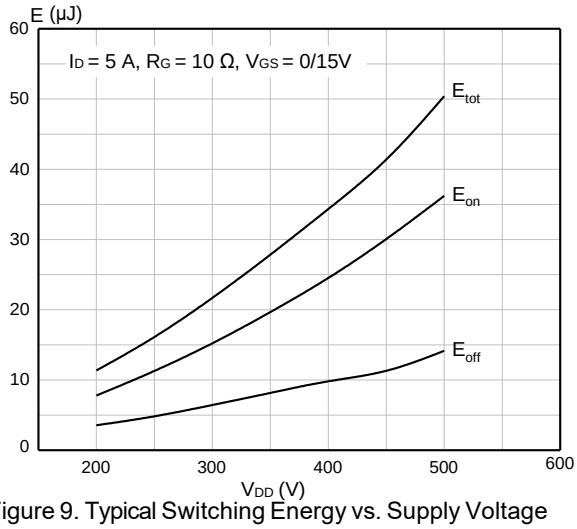


Figure 9. Typical Switching Energy vs. Supply Voltage

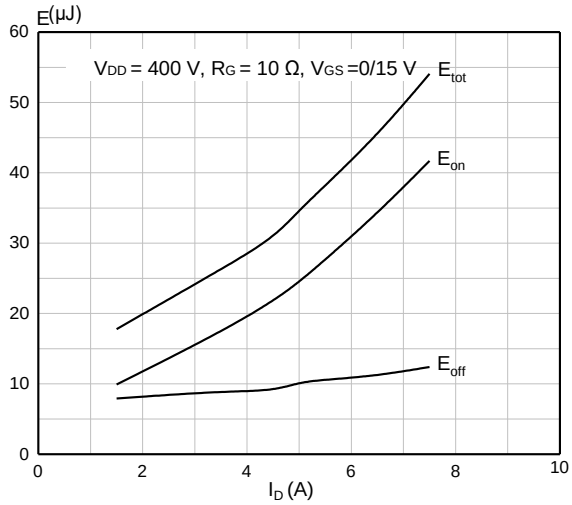


Figure 10. Typical Switching Energy vs. Drain Current

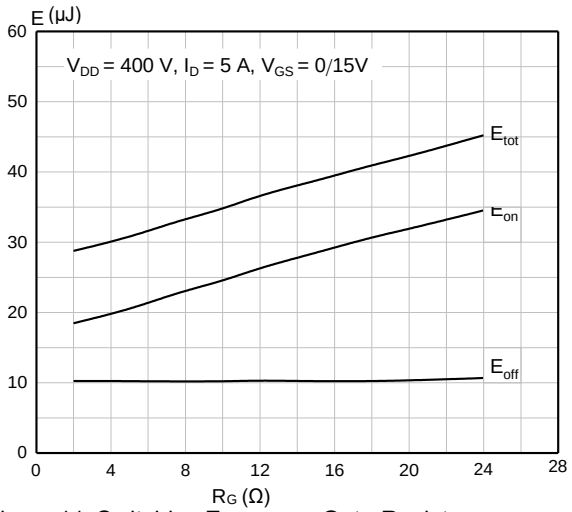


Figure 11. Switching Energy vs. Gate Resistance

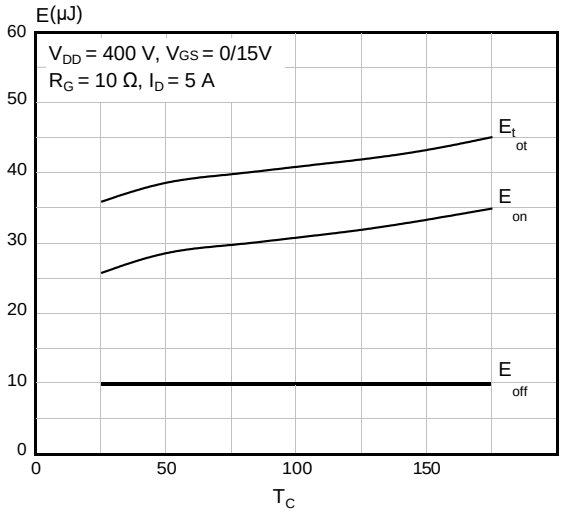


Figure 12. Typical Switching Energy vs. Temperature

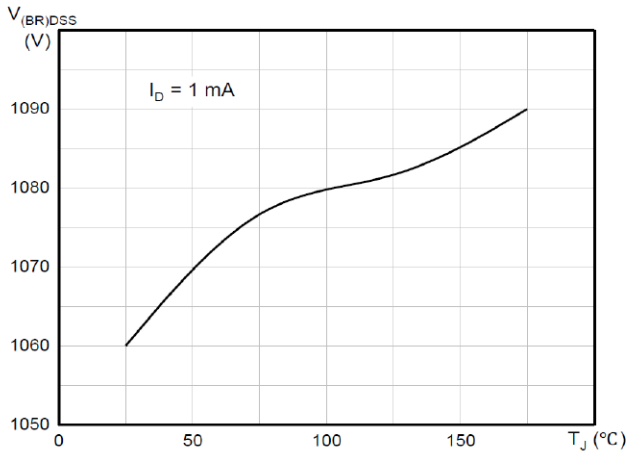


Figure 13. Breakdown Voltage vs. Temperature

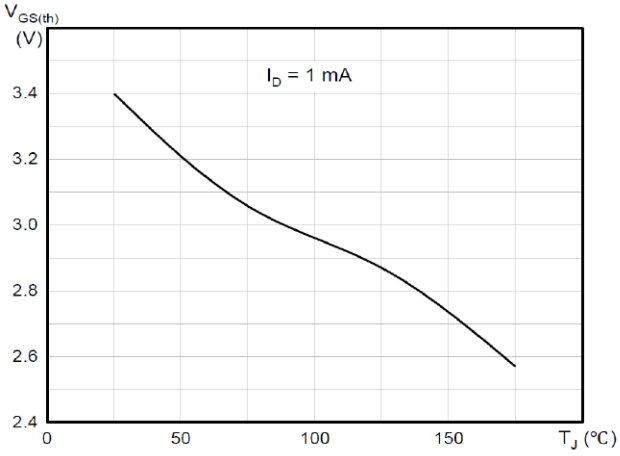


Figure 14. Gate Threshold vs. Temperature

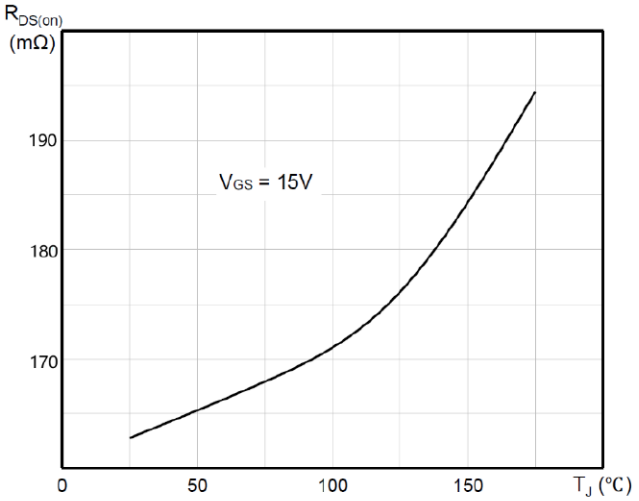


Figure 15. On-Resistance vs. Temperature

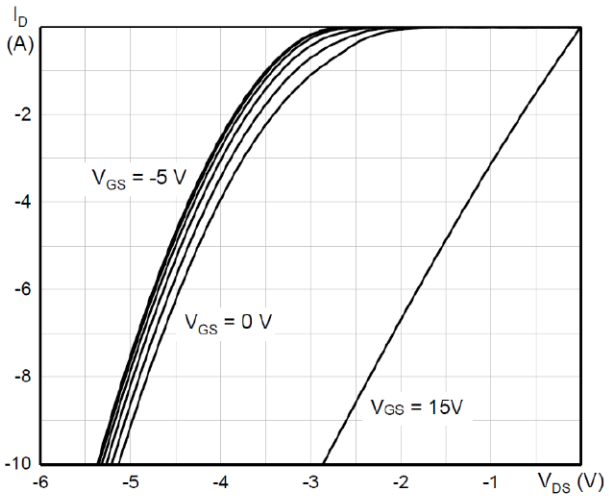
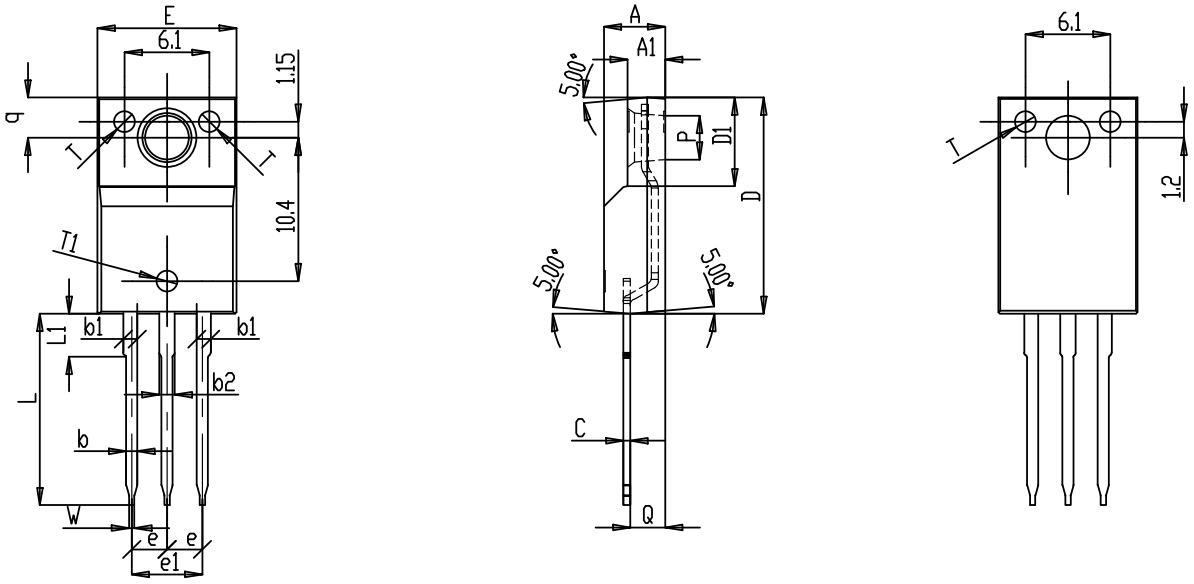


Figure 16.Body Diode Characteristics,T_J=25°C

Package Dimensions

Package TO-220F



SYMBOL	MILLIMETERS			NOTES	SYMBOL	MILLIMETERS			NOTES
	Normal	MIN.	MAX.			Normal	MIN.	MAX.	
A	4.4	4.2	4.6		e1	5.08	5	5.12	
A1	2.7	2.5	2.9		L	13.90	13.5	14.4	
b	0.8	0.7	0.9		L1	3.12	2.8	3.3	
b1	1.07	0.9	1.3		P	3.14	3.00	3.20	
b2	1.17	1	1.4		Q	2.44	2.3	2.6	
C	0.5	0.4	0.6		q	2.87	2.6	3	
D	15.63	15.4	15.8		W	0.37	0.3	0.5	
D1	6.22	6	6.4		T	1.52	1.3	1.7	
E	10.06	9.7	10.3		T1	1.20	1.1	1.3	
e	2.54	2.5	2.58						

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