N-Channel 40 V (D-S) MOSFET

PRODUCT SUMMARY			
V_{DS} (V)	$R_{DS(on)}$ (Ω) MAX.	I_D (A) [d]	Q_g (TYP.)
40	0.0033 at V_{GS} = 10 V	90	87
	0.0041 at V_{GS} = 4.5 V	90	

FEATURES

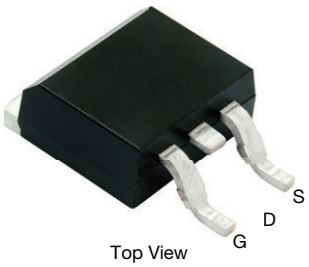
- TrenchFET® Power MOSFET
- 100 % R_g and UIS tested
- Material categorization: For definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

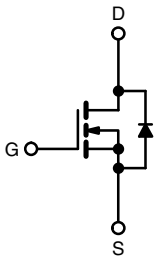
APPLICATIONS

- Power supply
  - Secondary synchronous rectification
- DC/DC converter
- Power tools

TO-263



Top View



N-Channel MOSFET

Ordering Information:
SUM90N04-3m3P-E3 (Lead (Pb)-free)

ABSOLUTE MAXIMUM RATINGS (T_C = 25 °C, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V_{DS}	40	V
Gate-Source Voltage		V_{GS}	± 20	
Continuous Drain Current (T_J = 150 °C)	T_C = 25 °C	I_D	90 [d]	A
	T_C = 70 °C		90 [d]	
Pulsed Drain Current (t = 300 µs)		I_{DM}	160	
Avalanche Current		I_{AS}	60	
Single Avalanche Energy [a]	L = 0.1 mH	E_{AS}	180	mJ
Maximum Power Dissipation [a]	T_C = 25 °C	P_D	125 [b]	W
	T_A = 25 °C [c]		3.1	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55 to 150	°C

THERMAL RESISTANCE RATINGS			
PARAMETER	SYMBOL	LIMIT	UNIT
Junction-to-Ambient (PCB Mount) [c]	R_{thJA}	40	°C/W
Junction-to-Case (Drain)	R_{thJC}	1	

Notes

a. Duty cycle ≤ 1 %.
b. See SOA curve for voltage derating.
c. When mounted on 1" square PCB (FR-4 material).
d. Package limited.

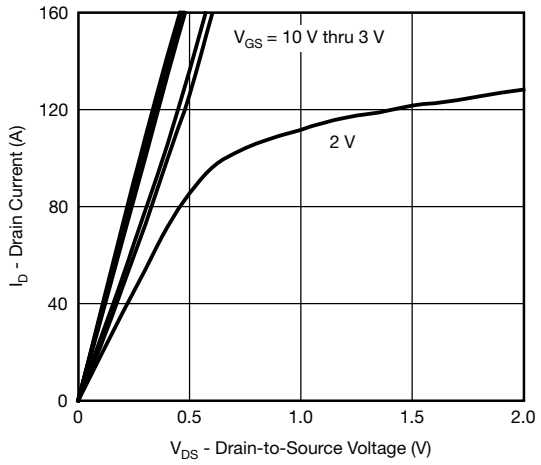
SPECIFICATIONS (T_J = 25 °C, unless otherwise noted)						
PARAMETER	**SYMBOL**	**TEST CONDITIONS**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Static						
Drain-Source Breakdown Voltage	V_{DS}	V_{GS} = 0 V, I_D = 250 µA	40	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 µA	1	-	2.5	
Gate-Body Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 20 V	-	-	± 250	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 40 V, V_{GS} = 0 V	-	-	1	µA
		V_{DS} = 40 V, V_{GS} = 0 V, T_J = 125 °C	-	-	50	
		V_{DS} = 40 V, V_{GS} = 0 V, T_J = 150 °C	-	-	250	
On-State Drain Current [a]	$I_{D(on)}$	V_{DS} ≥ 10 V, V_{GS} = 10 V	50	-	-	A
Drain-Source On-State Resistance [a]	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 22 A	-	0.0027	0.0033	Ω
		V_{GS} = 4.5 V, I_D = 20 A	-	0.0034	0.0041	
Forward Transconductance [a]	g_{fs}	V_{DS} = 15 V, I_D = 20 A	-	169	-	S
Dynamic [b]						
Input Capacitance	C_{iss}	V_{GS} = 0 V, V_{DS} = 20 V, f = 1 MHz	-	5286	-	pF
Output Capacitance	C_{oss}		-	705	-	
Reverse Transfer Capacitance	C_{rss}		-	283	-	
Total Gate Charge [c]	Q_g	V_{DS} = 20 V, V_{GS} = 10 V, I_D = 20 A	-	87	131	nC
Gate-Source Charge [c]	Q_{gs}		-	15.3	-	
Gate-Drain Charge [c]	Q_{gd}		-	12.2	-	
Gate Resistance	R_g	f = 1 MHz	0.5	2.7	5.4	Ω
Turn-On Delay Time [c]	$t_{d(on)}$	V_{DD} = 20 V, R_L = 2 Ω I_D ≅ 10 A, V_{GEN} = 10 V, R_g = 1 Ω	-	11	20	ns
Rise Time [c]	t_r		-	7	14	
Turn-Off Delay Time [c]	$t_{d(off)}$		-	45	68	
Fall Time [c]	t_f		-	7	14	
Drain-Source Body Diode Ratings and Characteristics (T_C = 25 °C) [b]						
Continuous Current	I_S		-	-	90	A
Pulsed Current	I_{SM}		-	-	160	
Forward Voltage [a]	V_{SD}	I_F = 10 A, V_{GS} = 0 V	-	0.72	1.2	V
Reverse Recovery Time	t_{rr}	I_F = 10 A, dI/dt = 100 A/µs	-	42	63	ns
Peak Reverse Recovery Current	$I_{RM(REC)}$		-	2.5	3.8	A
Reverse Recovery Charge	Q_{rr}		-	52	78	nC

Notes

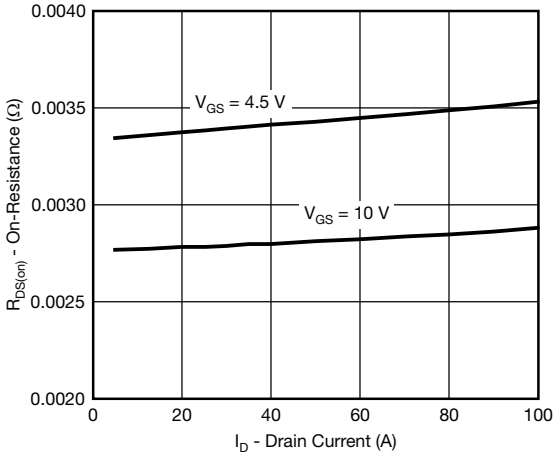
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.
c. Independent of operating temperature.

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.

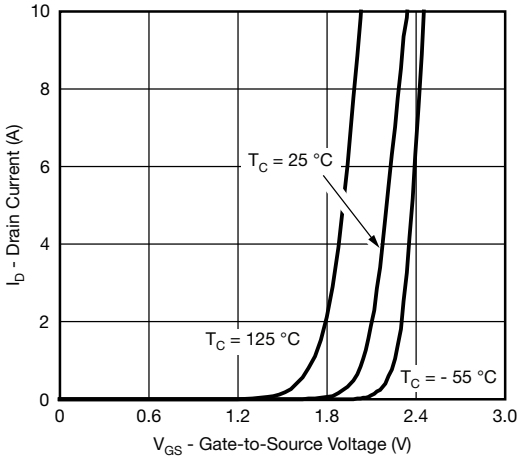
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



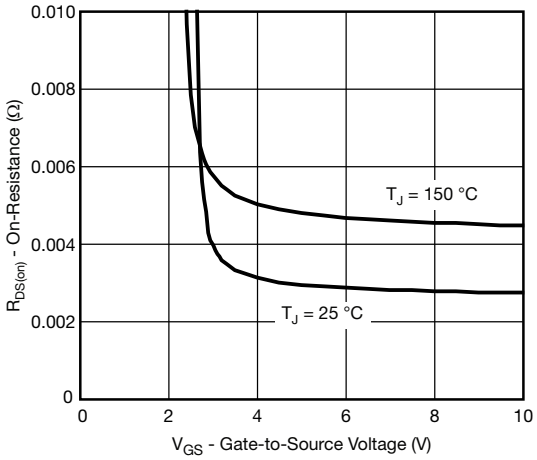
Output Characteristics



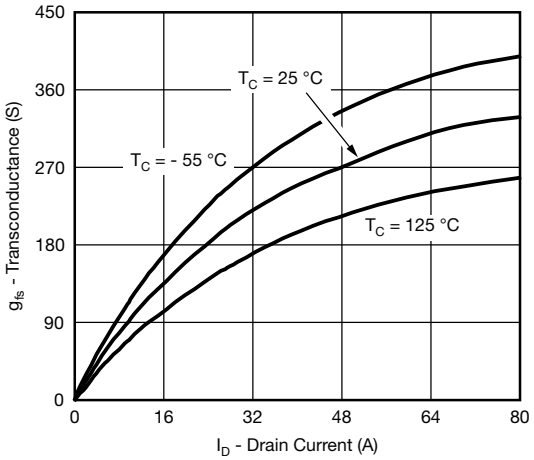
On-Resistance vs. Drain Current



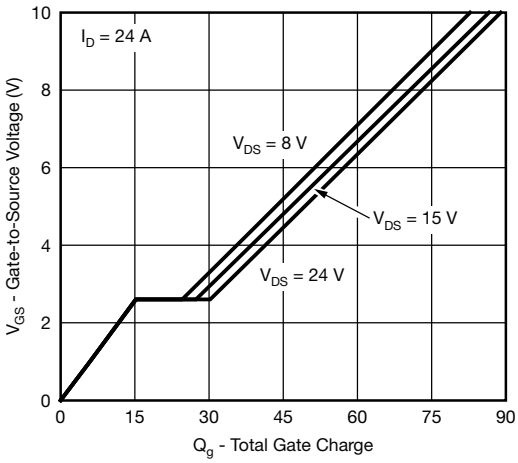
Transfer Characteristics



On-Resistance vs. Gate-to-Source Voltage

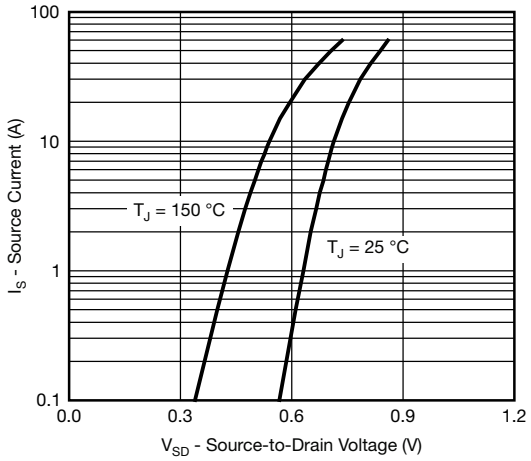


Transconductance

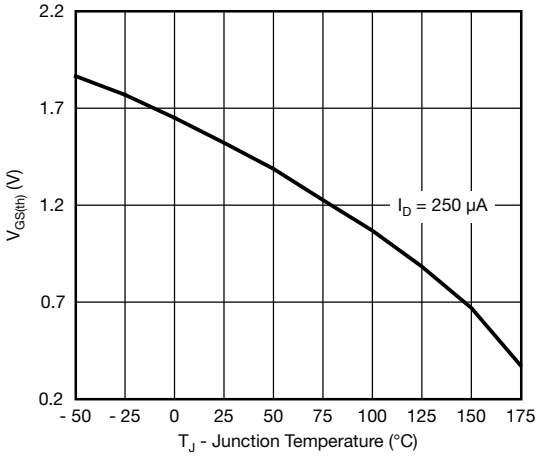


Gate Charge

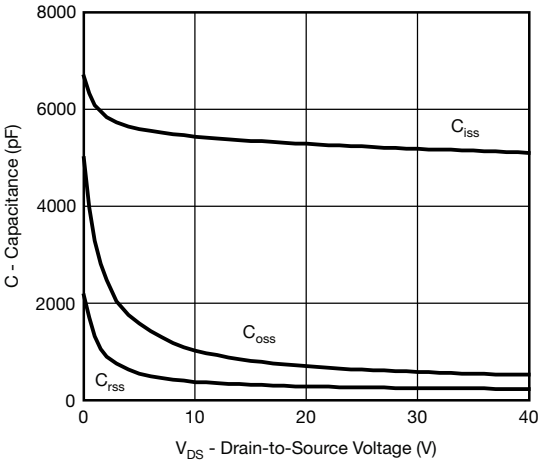
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



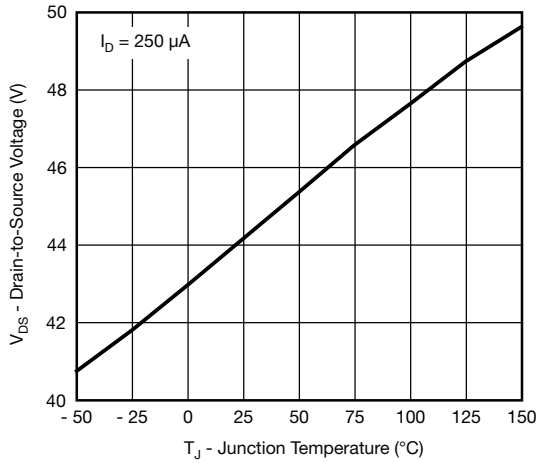
Source-Drain Diode Forward Voltage



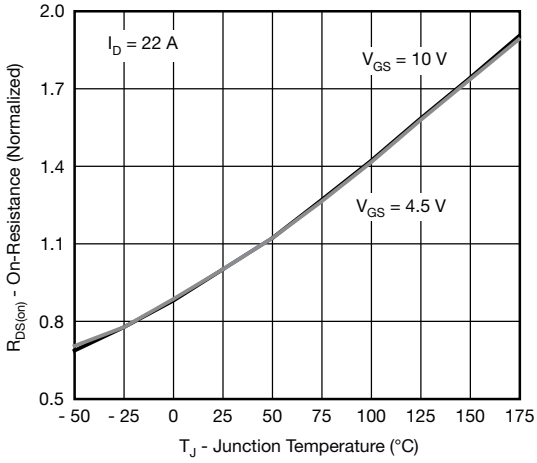
Threshold Voltage



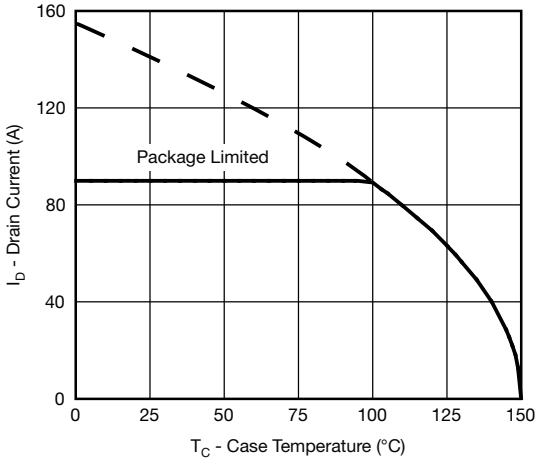
Capacitance



Drain Source Breakdown vs. Junction Temperature

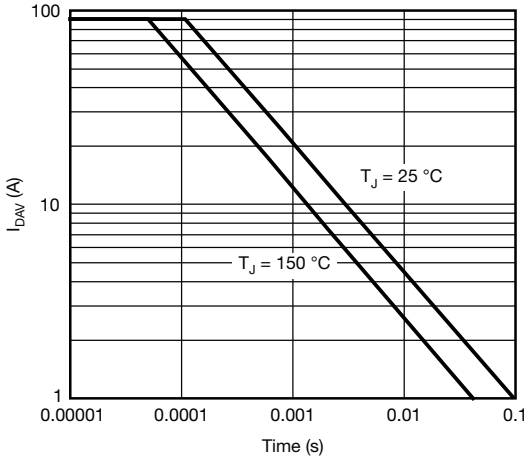


On-Resistance vs. Junction Temperature

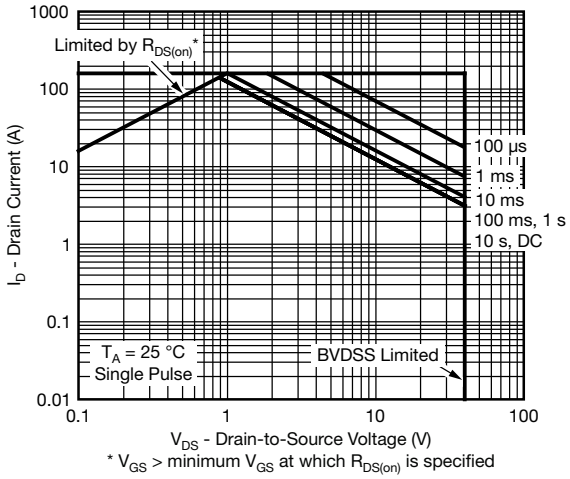


Current Derating

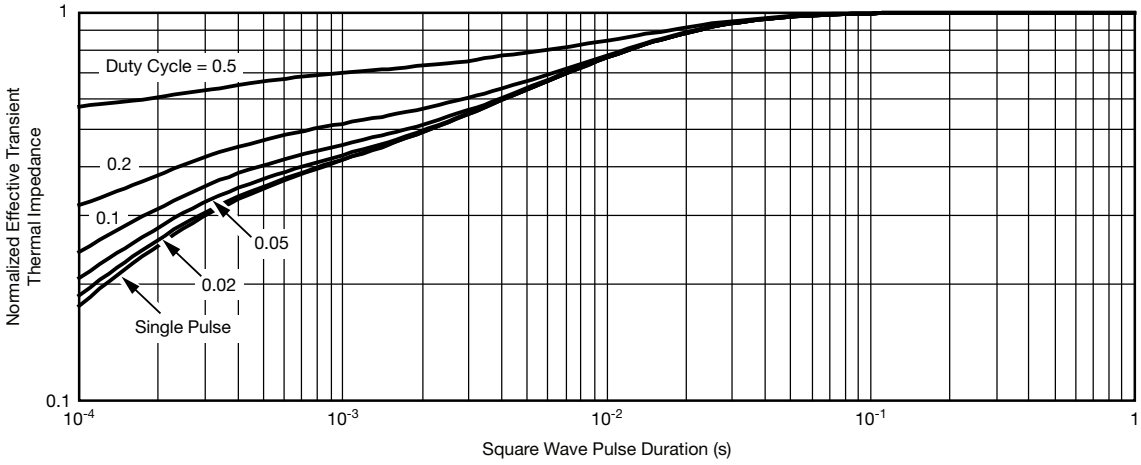
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Single Pulse Avalanche Current Capability vs. Time



Safe Operating Area



Normalized Thermal Transient Impedance, Junction-to-Case

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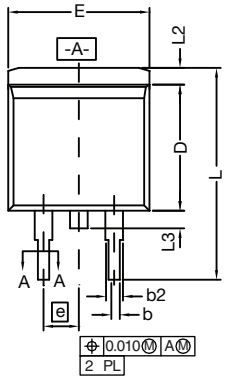
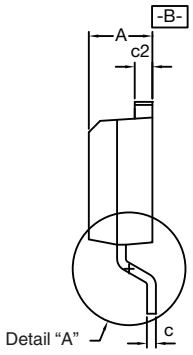
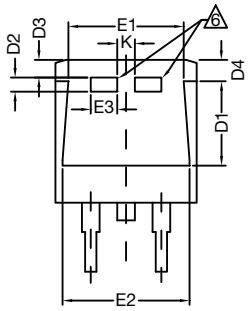
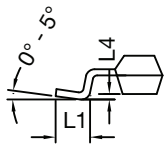
TO-263 (D²PAK): 3-LEAD

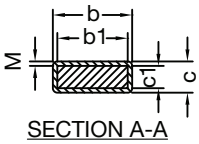








DETAIL A (ROTATED 90°)



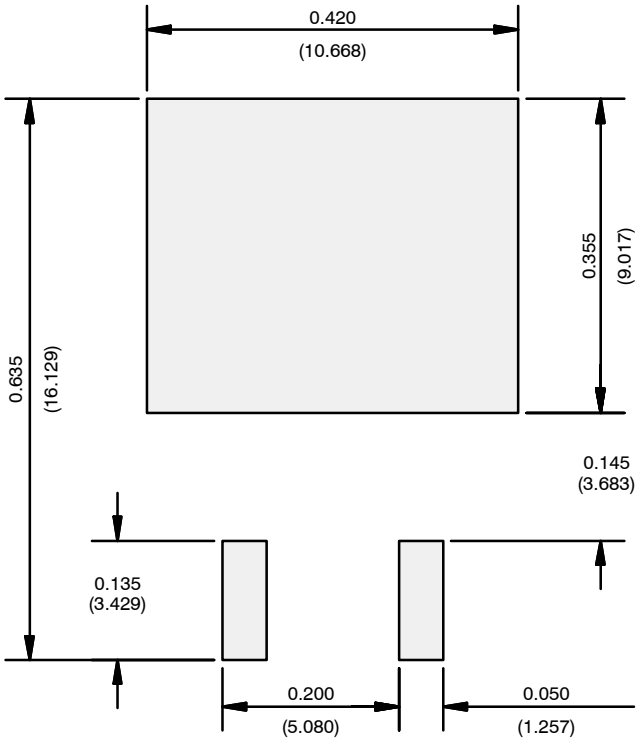
SECTION A-A

DIM.		INCHES		MILLIMETERS	
		MIN.	MAX.	MIN.	MAX.
A		0.160	0.190	4.064	4.826
b		0.020	0.039	0.508	0.990
b1		0.020	0.035	0.508	0.889
b2		0.045	0.055	1.143	1.397
c*	Thin lead	0.013	0.018	0.330	0.457
	Thick lead	0.023	0.028	0.584	0.711
c1	Thin lead	0.013	0.017	0.330	0.431
	Thick lead	0.023	0.027	0.584	0.685
c2		0.045	0.055	1.143	1.397
D		0.340	0.380	8.636	9.652
D1		0.220	0.240	5.588	6.096
D2		0.038	0.042	0.965	1.067
D3		0.045	0.055	1.143	1.397
D4		0.044	0.052	1.118	1.321
E		0.380	0.410	9.652	10.414
E1		0.245	-	6.223	-
E2		0.355	0.375	9.017	9.525
E3		0.072	0.078	1.829	1.981
e		0.100 BSC		2.54 BSC	
K		0.045	0.055	1.143	1.397
L		0.575	0.625	14.605	15.875
L1		0.090	0.110	2.286	2.794
L2		0.040	0.055	1.016	1.397
L3		0.050	0.070	1.270	1.778
L4		0.010 BSC		0.254 BSC	
M		-	0.002	-	0.050
ECN: T13-0707-Rev. K, 30-Sep-13 DWG: 5843					

Notes

1. Plane B includes maximum features of heat sink tab and plastic.
2. No more than 25 % of L1 can fall above seating plane by max. 8 mils.
3. Pin-to-pin coplanarity max. 4 mils.
4. *: Thin lead is for SUB, SYB.
   Thick lead is for SUM, SYM, SQM.
5. Use inches as the primary measurement.
6. This feature is for thick lead.

RECOMMENDED MINIMUM PADS FOR D²PAK: 3-Lead



Recommended Minimum Pads
Dimensions in Inches/(mm)

Return to Index

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