FAIRCHILD

SEMICONDUCTOR®

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FDZ7064AS
# 30V N-Channel PowerTrench® SyncFET™ BGA MOSFET

Features

- 13.5 A, 30 V. $R_{DS(ON)}$ = 5.6 mΩ @ V_{GS} = 10 V
  $R_{DS(ON)}$ = 7.1 mΩ @ V_{GS} = 4.5 V
- Occupies only 14 mm^2 of PCB area. Only 42% of the area of SO-8
- Ultra-thin package: less than 0.76 mm height when mounted to PCB
- 3.5 x 4 mm^2 Footprint
- High power and current handling capability.

Applications

- DC/DC converters

General Description

This MOSFET is designed to replace a single MOSFET and parallel Schottky diode in synchronous DC:DC power supplies. Combining Fairchild's 30V PowerTrench SyncFET process with state of the art BGA packaging, the FDZ7064AS minimizes both PCB space and $R_{DS(ON)}$. This BGA SyncFET embodies a breakthrough in both packaging and power MOSFET integration which enables the device to combine excellent thermal transfer characteristics, high current handling capability, ultra-low profile packaging, low gate charge, ultra-low reverse recovery charge and low $R_{DS(ON)}$.

Bottom

Top
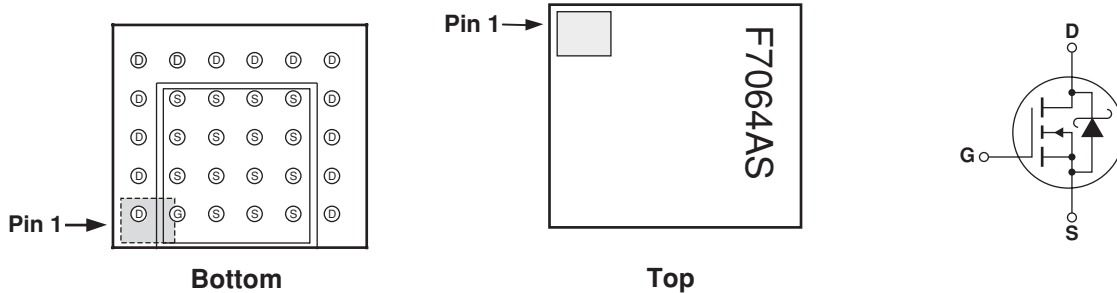
Absolute Maximum Ratings T_A=25°C unless otherwise noted

Symbol	Parameter		Ratings	Units
V_{DSS}	Drain-Source Voltage		30	V
V_{GSS}	Gate-Source Voltage		±20	V
I_D	Drain Current	– Continuous (Note 1a)	13.5	A
		– Pulsed	60	
P_D	Power Dissipation (Steady State) (Note 1a)		2.2	W
T_J, T_{stg}	Operating and Storage Junction Temperature Range		−55 to +150	°C

Thermal Characteristics

|			
$R_{θJA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	56	°C/W
$R_{θJB}$	Thermal Resistance, Junction-to-Ball (Note 1)	4.5	
$R_{θJC}$	Thermal Resistance, Junction-to-Case (Note 1)	0.6	

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
7064AS	FDZ7064AS	13"	12mm	3000

Electrical Characteristics $T_A = 25°C$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
BV_{DSS}	Drain–Source Breakdown Voltage	$V_{GS} = 0$ V, $I_D = 1mA$	30			V
$\dfrac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 10mA$, Referenced to 25°C		25		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24$ V, $V_{GS} = 0$ V			500	uA
I_{GSS}	Gate–Body Leakage	$V_{GS} = ±20$ V, $V_{DS} = 0$ V			±100	nA
On Characteristics (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 1mA$	1	1.4	3	V
$\dfrac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 10mA$, Referenced to 25°C		−0.3		mV/°C
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = 10$ V, $I_D = 13.5$ A $V_{GS} = 4.5$ V, $I_D = 12$ A $V_{GS}=10$ V, $I_D=13.5A$, $T_J =125°C$		4.6 5.7 5.9	5.6 7.1 7.4	mΩ
$I_{D(on)}$	On–State Drain Current	$V_{GS} = 10$ V, $V_{DS} = 5$ V	60			A
g_{FS}	Forward Transconductance	$V_{DS} = 5$ V, $I_D = 13.5$ A		61		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 15$ V, $V_{GS} = 0$ V, $f = 1.0$ MHz		1960		pF
C_{oss}	Output Capacitance			570		pF
C_{rss}	Reverse Transfer Capacitance			210		pF
R_G	Gate Resistance	$V_{GS} = 15$ mV, $I_D = 6$ A		1.4		W
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn–On Delay Time	$V_{DS} = 15$ V, $I_D = 1$ A, $V_{GS} = 10$ V, $R_{GEN} = 6$ Ω		9	18	nS
t_r	Turn–On Rise Time			12	22	nS
$t_{d(off)}$	Turn–Off Delay Time			39	62	nS
t_f	Turn–Off Fall Time			18	33	nS
$Q_{g(TOT)}$	Total Gate Charge, Vgs = 10V	$V_{DS} = 15$ V, $I_D = 13.5A$		36	51	nC
Q_g	Total Gate Charge, Vgs = 5V			20	28	nC
Q_{gs}	Gate–Source Charge			5		nC
Q_{gd}	Gate–Drain Charge			6		nC
Drain–Source Diode Characteristics						
V_{SD}	Drain–Source Diode Forward Voltage	$V_{GS} = 0$ V, $I_S = 3.2$ A (Note 1)		0.4	0.7	V
t_{rr}	Diode Reverse Recovery Time	$I_F = 13.5$ A, $d_{iF}/d_t = 300$ A/µs See Diode Characteristic, page 5		23		nS
Q_{rr}	Diode Reverse Recovery Charge			21		nC

Notes:

1. $R_{θJA}$ is determined with the device mounted on a 1 in^2 2 oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material. The thermal resistance from the junction to the circuit board side of the solder ball, $R_{θJB}$, is defined for reference. For $R_{θJC}$, the thermal reference point for the case is defined as the top surface of the copper chip carrier. $R_{θJC}$ and $R_{θJB}$ are guaranteed by design while $R_{θJA}$ is determined by the user's board design.
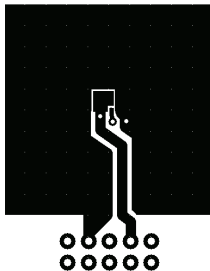
a) 56°C/W when mounted on a 1in^2 pad of 2 oz copper
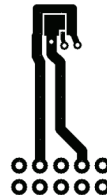
b) 119°C/W when mounted on a minimum pad of 2 oz copper

Scale 1 : 1 on letter size paper

2. Pulse Test: Pulse Width < 300µs, Duty Cycle < 2.0%
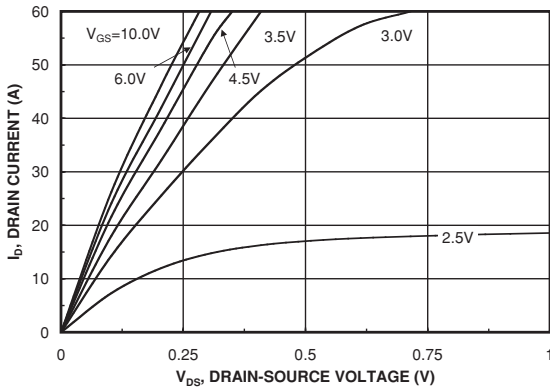
Typical Characteristics

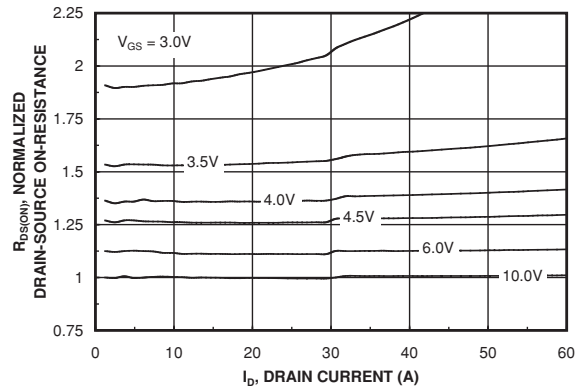Figure 1. On-Region Characteristics.

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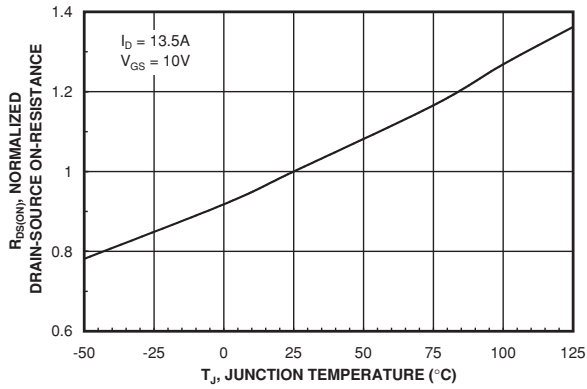Drain Current and Gate Voltage.

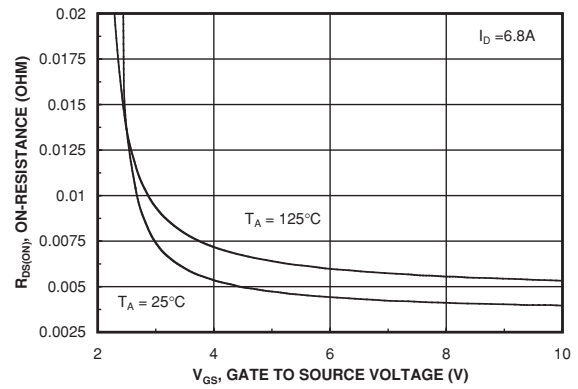Figure 3. On-Resistance Variation with
Temperature.

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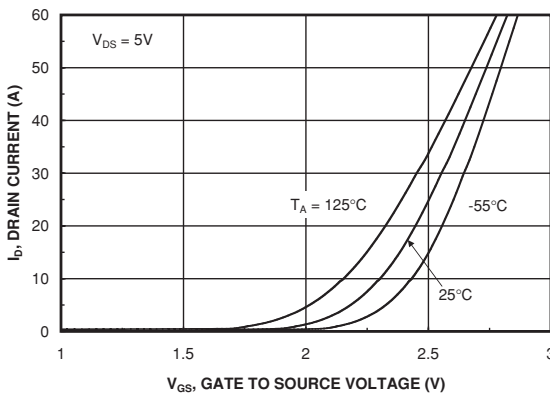Gate-to-Source Voltage.
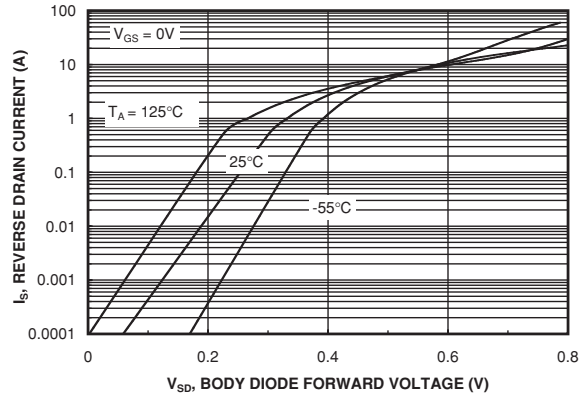

Figure 5. Transfer Characteristics.

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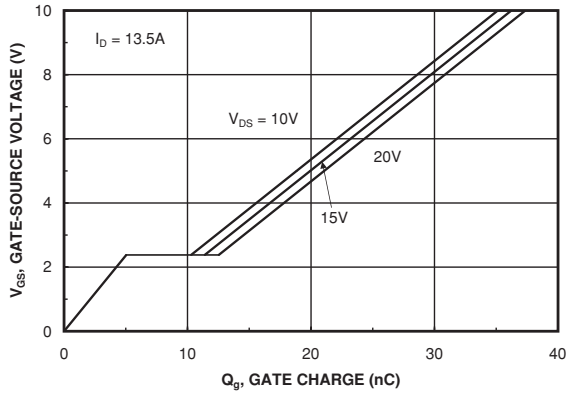
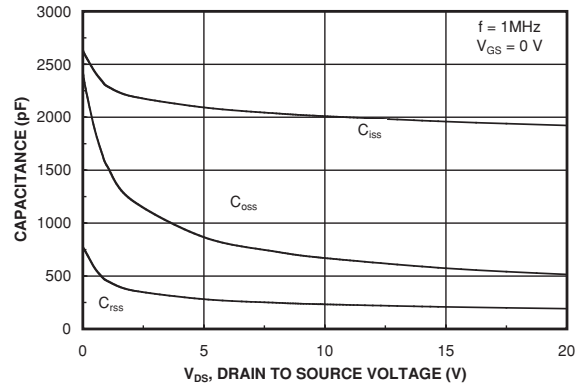## Typical Characteristics

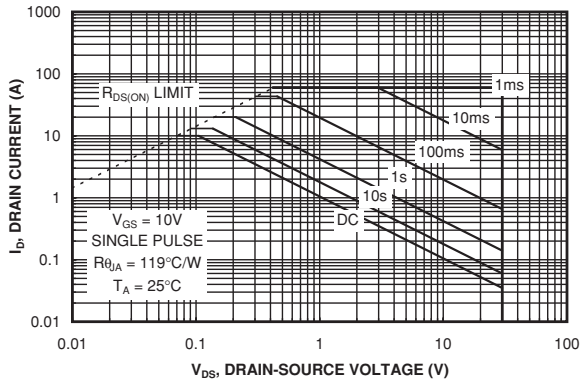Figure 7. Gate Charge Characteristics.

Figure 8. Capacitance Characteristics.

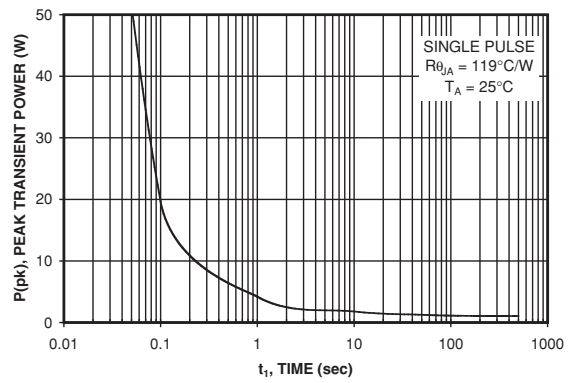

Figure 9. Maximum Safe Operating Area.

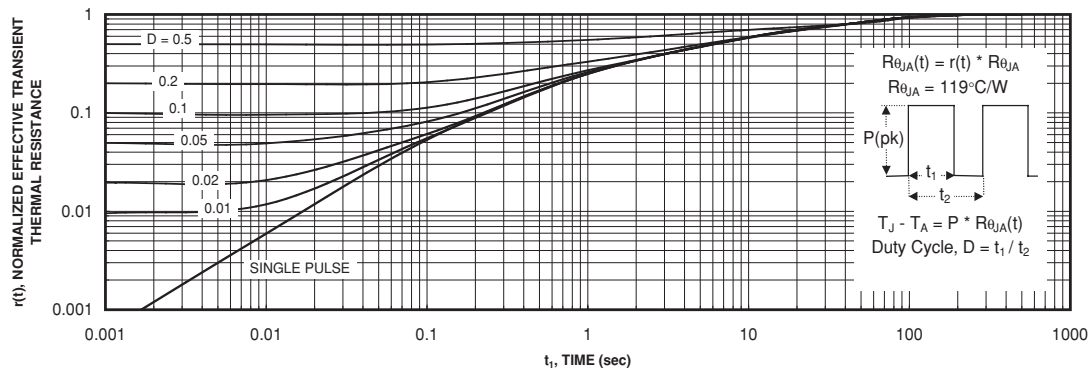Figure 10. Single Pulse Maximum Power Dissipation.

Figure 11. Transient Thermal Response Curve.

**Thermal characterization performed using the conditions described in Note 1b.
Transient thermal response will change depending on the circuit board design.**
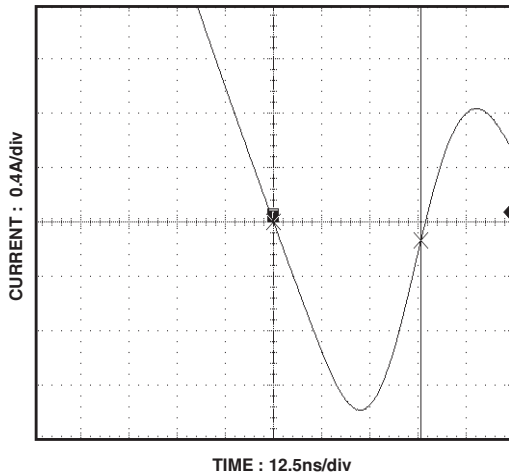
Typical Characteristics

SyncFET Diode Characteristics

Fairchild's SyncFET process embeds a Schottky diode in parallel with PowerTrench MOSFET. This diode exhibits similar characteristics to a discrete external Schottky diode in parallel with a MOSFET. Figure 12 FDZ7064AS.


TIME : 12.5ns/div
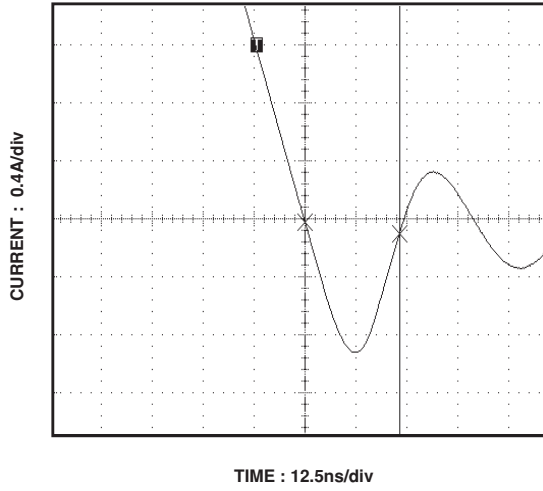
Figure 12. FDZ7064AS SyncFET body diode reverse recovery characteristic.

For comparison purposes, Figure 13 shows the reverse recovery characteristics of the body diode of an equivalent size MOSFET produced without SyncFET .
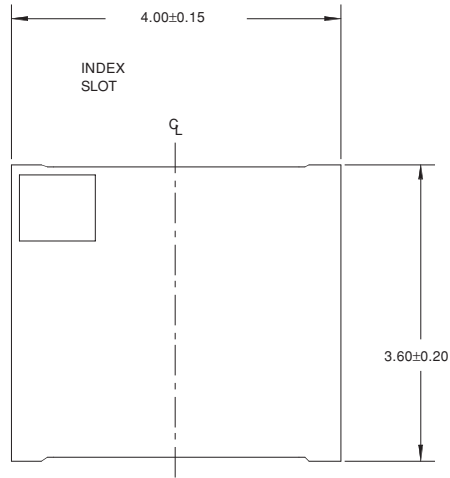

TIME : 12.5ns/div

Figure 13. Non-SyncFET (FDZ7064N) body diode reverse recovery characteristic.

Schottky barrier diodes exhibit significant leakage at high temperature and high reverse voltage. This will increase the power in the device.
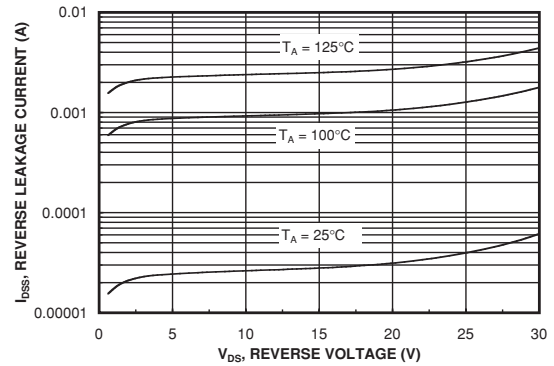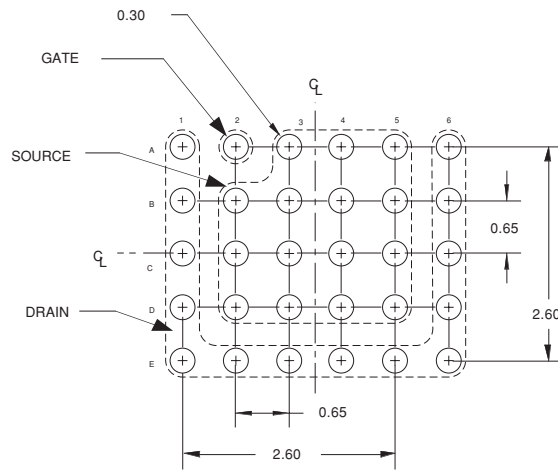

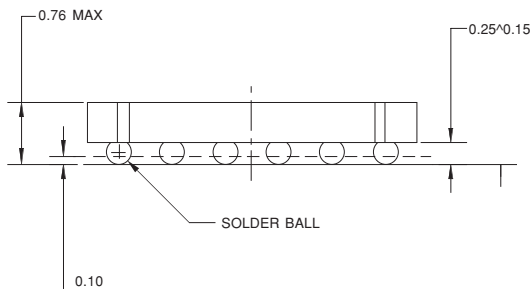**Figure 14. SyncFET diode reverse leakage versus drain-source voltage and temperature.**
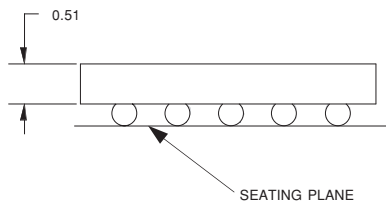
Dimensional Outline and Pad Layout

4.00±0.15

INDEX
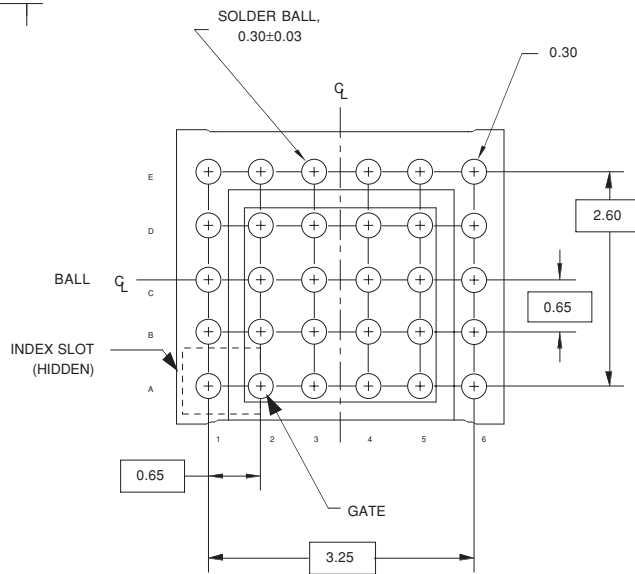SLOT

C̶L̶

3.60±0.20

TOP VIEW

0.76 MAX

0.25^0.15

SOLDER BALL

0.10

FRONT VIEW

0.51

SEATING PLANE

SIDE VIEW

NOTES: UNLESS OTHERWISE SPECIFIED

A) ALL DIMENSIONS ARE IN MILLIMETERS.
B) NO JEDEC REGISTRATION REFERENCE AS
   OF JULY 1999.

0.30
GATE
SOURCE
DRAIN

C̶L̶

0.65
2.60
0.65
2.60

LAND PATTERN
RECOMMENDATION

SOLDER BALL,
0.30±0.03

0.30

C̶L̶

E
D
C BALL C̶L̶
B
A

INDEX SLOT
(HIDDEN)

1 2 3 4 5 6

0.65

GATE

2.60
0.65

0.65

3.25

BOTTOM VIEW

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