

1. Description

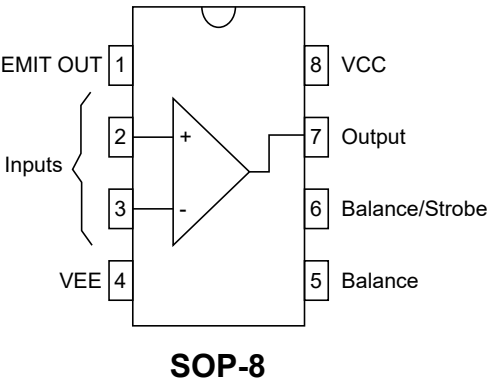
LM311DR and LM211DR can work on a single power supply of 5V to 30V or a dual power supply of $\pm 15V$. Like the commonly used comparator, LM311 can become a real universal comparator. The input of LM311DR and LM211DR can be isolated from the system, and the output can be referenced to ground power supply or VEE. This flexibility can drive DTL, RTL, TTL or MOS level logic. When the output current is 50mA, the output can switch the voltage to 50V, which can be used to drive relays, lamps or solenoids.

2. Features

- Fast Response Time: 165ns
- Strobe Capability
- Maximum Input Bias Current: 300nA
- Maximum Input Offset Current: 70nA
- Can Operate From Single 5-V Supply
- Available in Q-Temp Automotive High-Reliability Automotive Applications
- Configuration Control and Print Support
- Qualification to Automotive Standards
- On Products Compliant to MIL-PRF-38535 All Parameters Are Tested Unless Otherwise Noted. On All Other Products, Production Processing Does Not Necessarily Include Testing of All Parameters



3.Pinning Information



Outlet function

Pin		I/O ⁽¹⁾	Description
Name	SOP-8		
IN+	2	I	Noninverting comparator
IN-	3	I	Inverting input comparator
BALANCE	5	I	Balance
BAL/STRB	6	I	Strobe
COL OUT	7	O	Output collector comparator
EMIT OUT	1	O	Output emitter comparator
V _{CC-}	4	-	Negative supply
V _{CC+}	8	-	Positive supply

(1) I=Input, O=Output



4.Limit parameter ($T_A=+25^{\circ}\text{C}$, untitled otherwise.)

Parameter	Symbol	LM211	LM311	Units
Total supply voltage	$V_{CC}+ V_{EE} $	36	36	V
Output to negative supply voltage	V_O-V_{EE}	50	40	V
Ground to negative power supply	V_{EE}	30	30	V
Input differential voltage	V_{ID}	± 30	± 30	V
Input voltage (Note 2)	V_{in}	± 15	± 15	V
Strobe pin voltage gating		V_{CC} to $V_{CC}-5$	V_{CC} to $V_{CC}-5$	V
Power consumption and thermal characterstics plastic package DIP T_A decreases when it exceeds 25°C	P_D	625		mW
		5		mW/ $^{\circ}\text{C}$
Operating ambient temperature	T_A	-40 to +85	0 to +70	$^{\circ}\text{C}$
Operating junction temperature range	$T_{J(max)}$	150	150	$^{\circ}\text{C}$
Storage temperature	T_{STG}	-65 to +150	-65 to +150	$^{\circ}\text{C}$



5. Electrical characteristics

$V_{CC}=+15\text{ V}$, $V_{EE}=-15\text{ V}$, $T_A=25^\circ\text{C}$, Unless Otherwise Noted (Note 1).

Parameter	Symbol	Conditions		LM211			LM311			Units
				Min	Typ	Max	Min	Typ	Max	
Input offset voltage (Note 3)	V _{IO}	T _A =+25°C			0.7	3		2	7.5	mV
		T _{low} ≤T _A ≤T _{high} *				4			10	mV
Input Offset current (Note 3)	I _{IO}	T _A =+25°C			5	10		7	50	nA
		T _{low} ≤T _A ≤T _{high} *				20			70	nA
Input bias current	I _{IB}	T _A =+25°C			80	100		105	250	nA
		T _{low} ≤T _A ≤T _{high} *				150			300	nA
Large-signal differential-voltage amplification	A _{VD}	5V≤V _O ≤ 35V R _L =1kΩ		40	200		40	200		V/mV
Response time (Note 4)					200			200		ns
Low-level (collector-toemitter) output voltage	V _{OL}	I _{OL} =50mA	V _{ID} =-5mV		0.75	1.5				V
			V _{ID} =-10mV					0.75	1.5	V
		V _{CC+} =4.5V V _{CC-} =0V I _{OL} =8mA	V _{ID} =-6mV		0.23	0.4				V
			V _{ID} =-10mV					0.23	0.4	V
Gated on current (Note 5)	I _S				3			3		mA
High-level (collector) output leakage current	I _{OH}	I _(strobe) =-3mA	V _{OH} =35V		0.2	10				nA
		V _{ID} =5mV				0.5				μA
		V _{ID} =5mV, V _{OH} =35V						0.2	50	nA
Common-mode input-voltage range	V _{ICR}	Lower range			-14.7	-14.5		-14.7	-14.5	V
		Upper range		13	13.8		13	13.8		V
Positive supply current	I _{CC}				2.4	6		2.4	7.5	mA
Negative supply current	I _{EE}				-1.3	-5		-1.3	-5	mA



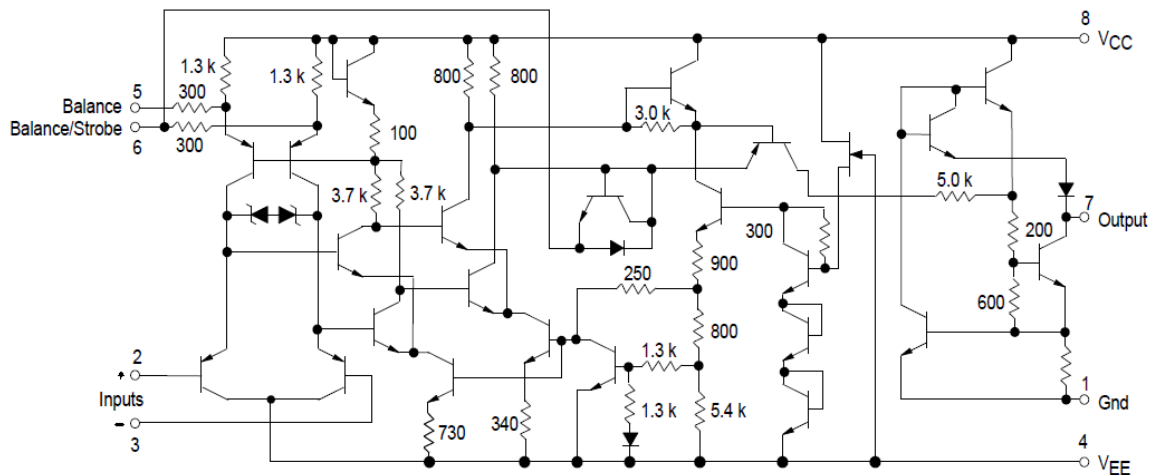
* $T_{low} = -25^{\circ}\text{C}$ corresponds to Im 211, and $t_{low} = 0^{\circ}\text{C}$ corresponds to LM311.

* $T_{high} = 85^{\circ}\text{C}$ corresponds to Im 211, and $T_{high} = 75^{\circ}\text{C}$ corresponds to LM311.

NOTES:

1. The specifications of offset voltage, offset current and bias current correspond to the power supply voltage of 5V to $\pm 15\text{V}$.
2. This rating is for the case of $\pm 15\text{V}$ power supply. The positive input voltage limit is 30V higher than the negative power supply, and the negative input limit is equivalent to the negative power supply voltage, or 30V lower than the power supply, or whichever is smaller.
3. Given offset voltage and offset current, it is required to drive a load with a maximum value of 1mA in any power supply voltage range, and these parameters define the error range, thus taking the worst case of voltage gain and input impedance into account.
4. The specified response time is 100Mv input plus 5MV overdrive signal.
5. Don't directly ground the STROBE pin, it needs to be driven by 3mA~5mA current.

6. Schematic Circuit Diagram





7.1 Typical Characteristics

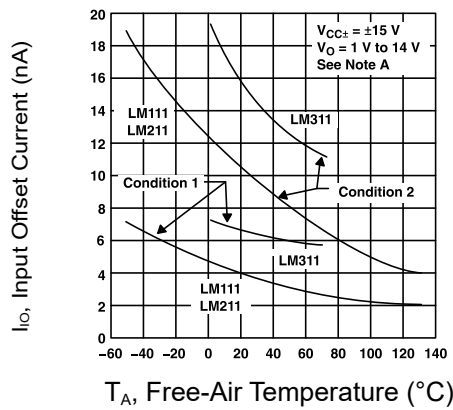


Figure 1: Input Offset Current vs Free-Air Temperature

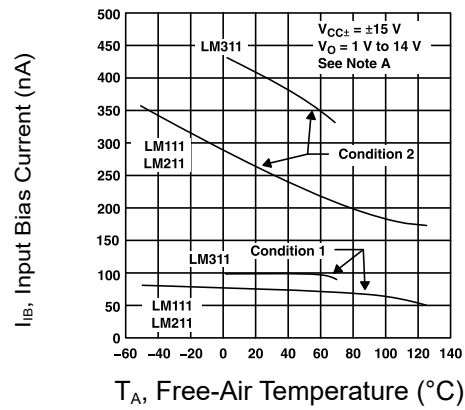


Figure 2: Input Bias Current vs Free-Air Temperature

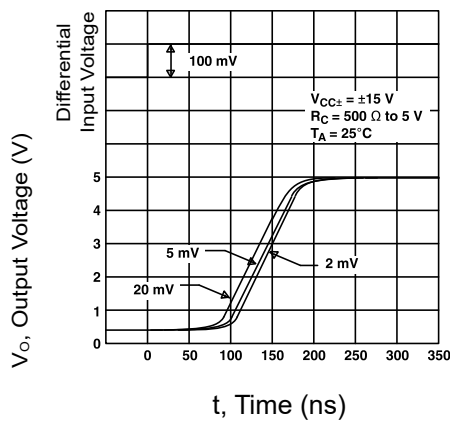


Figure 3: Output Response for Various Input Overdrives

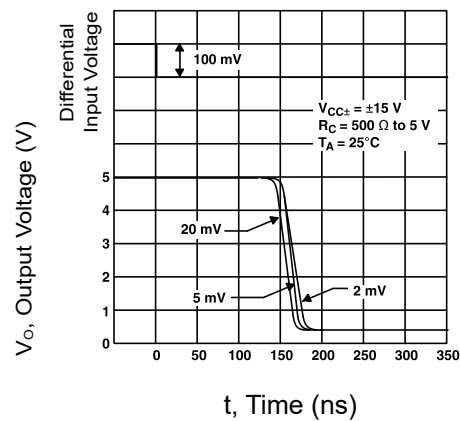


Figure 4: Output Response for Various Input Overdrives

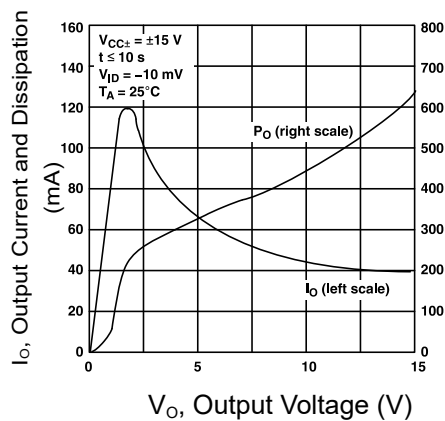


Figure 5: Output Current and Dissipation vs Output Voltage

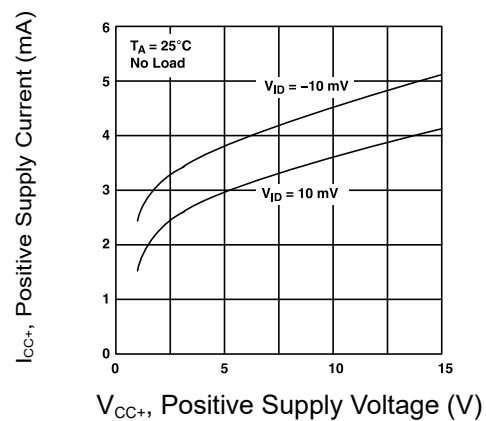
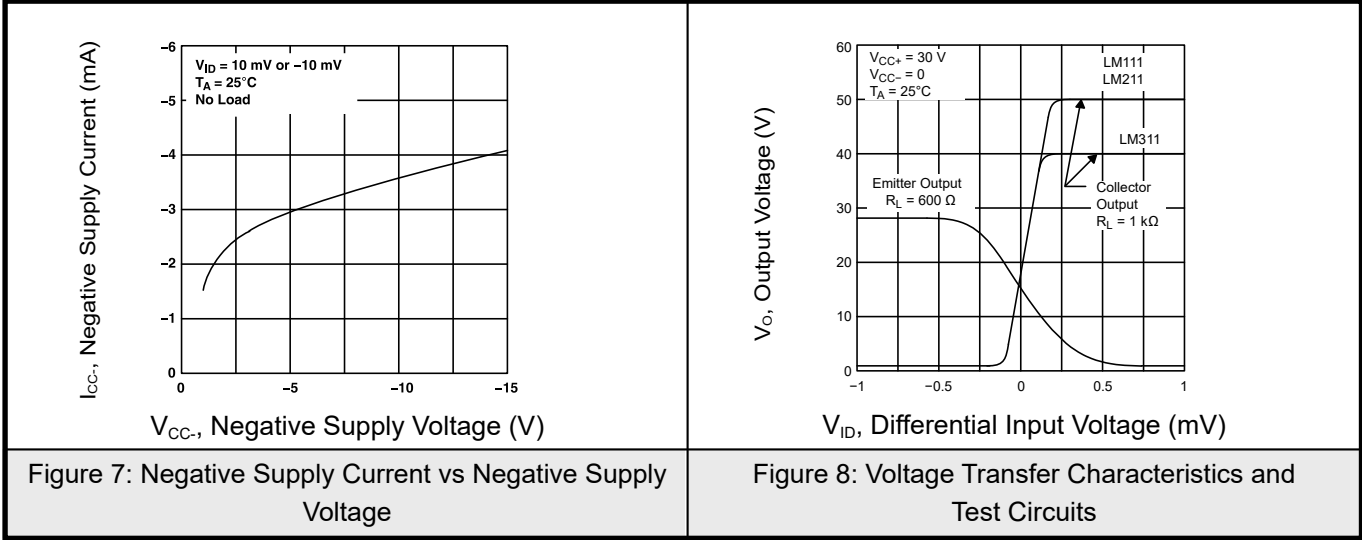


Figure 6: Positive Supply Current vs Positive Supply Voltage



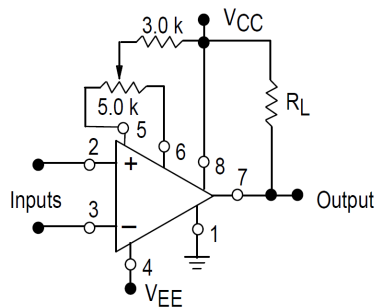
7.2 Typical Characteristics



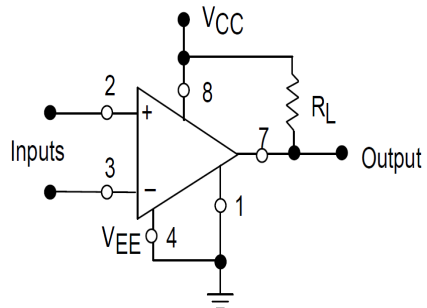


8. Typical Comparator Design Scheme

Separate power

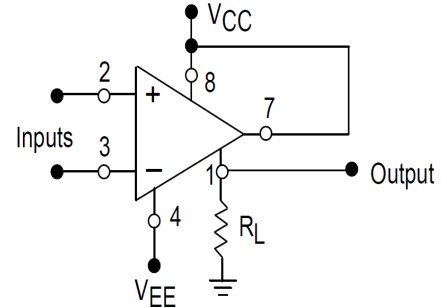


Single

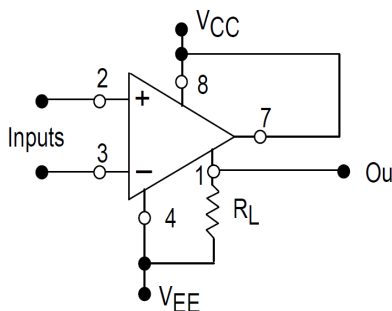


(When GND is the output,
the input polarity is reversed.)

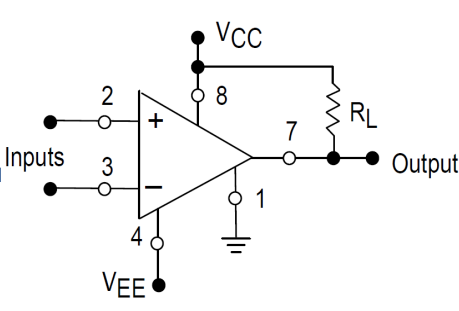
Load with



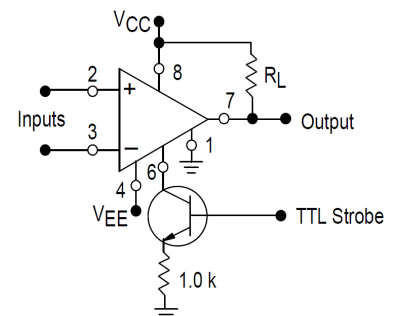
(When GND is the output,
the input polarity is reversed.)

Load referenced to negative
power supply positive power supply

Gating ability

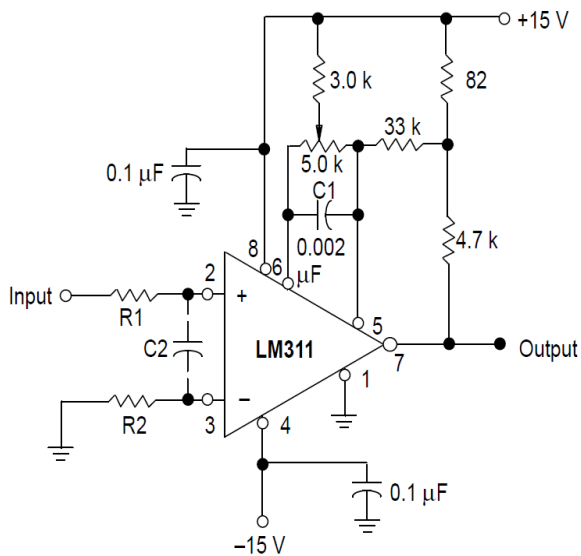


Load with reference to

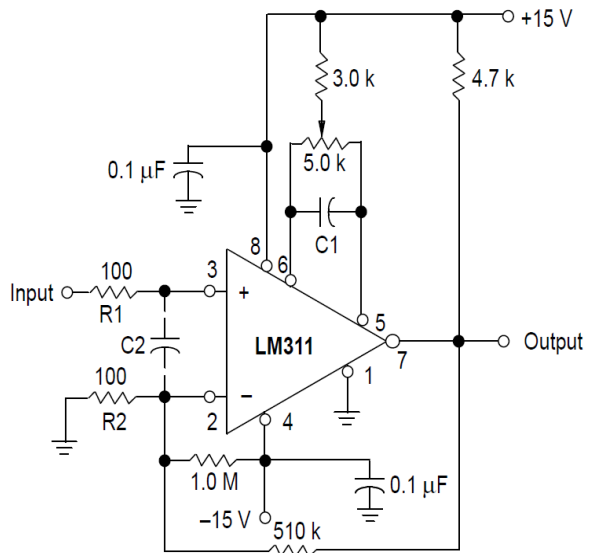




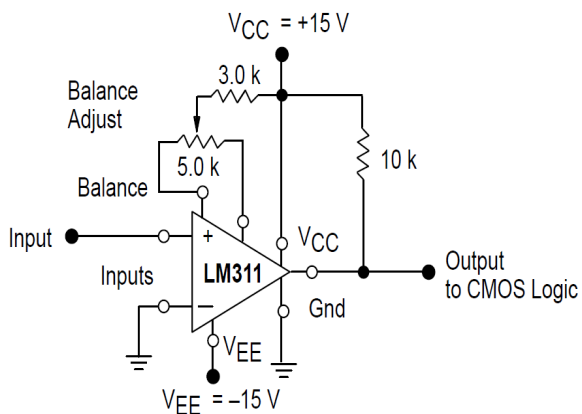
An improved method without input positive feedback and lag/hysteresis



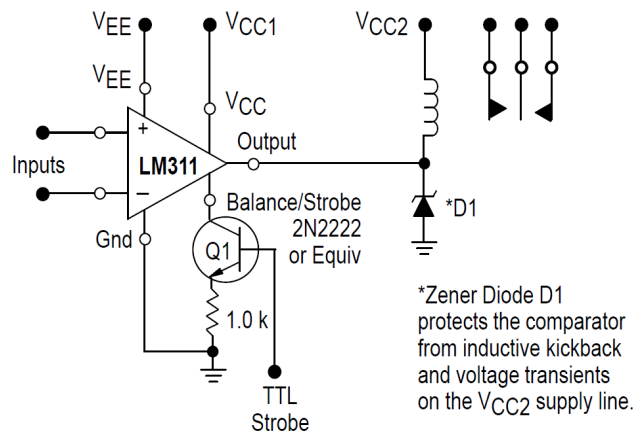
Techniques for adding



Zero-crossing detector driving CMOS logic

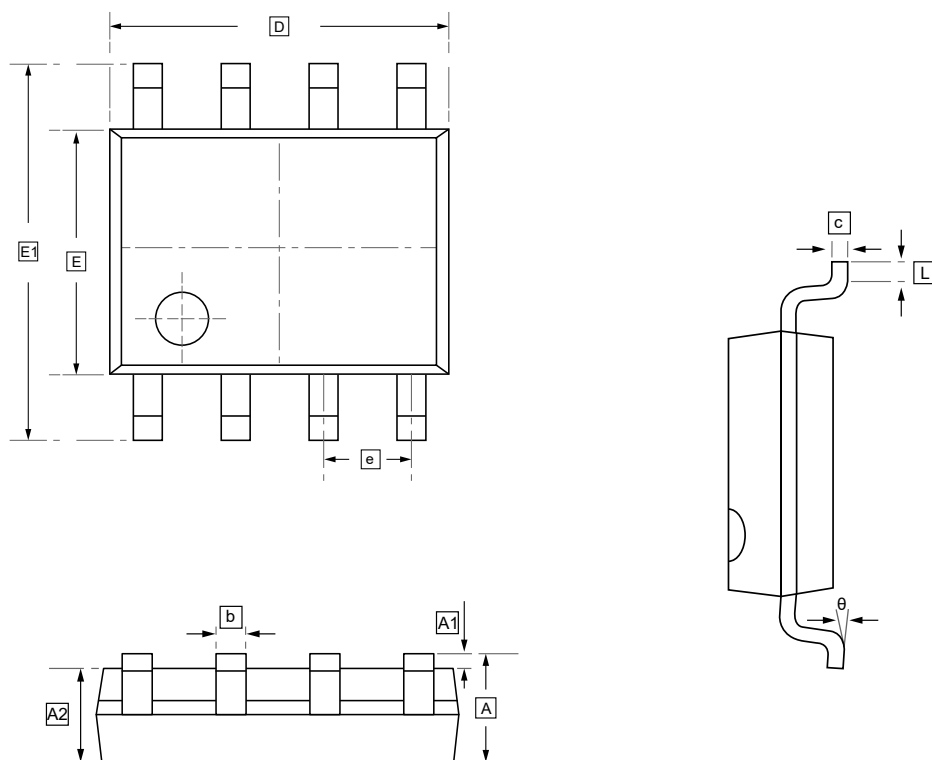


Relay driver with gating capability





9.SOP-8 Package Outline Dimensions

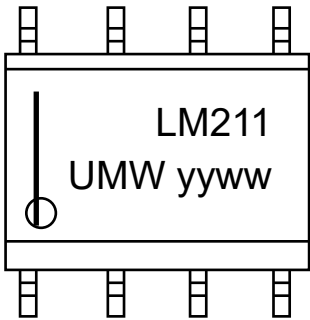


DIMENSIONS (mm are the original dimensions)

Symbol	A	A1	A2	b	c	D	E	E1	e	L	θ
Min	1.350	0.000	1.350	0.330	0.170	4.700	3.800	5.800	1.270	0.400	0°
Max	1.750	0.100	1.550	0.510	0.250	5.100	4.000	6.200	BSC	1.270	8°



10.Ordering information



yy: Year Code
ww: Week Code

Order Code	Marking	Package	Base QTY	Delivery Mode
UMW LM211DR	LM211	SOP-8	2500	Tape and reel
UMW LM311DR	LM311	SOP-8	2500	Tape and reel



11.Disclaimer

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