

Quad voltage comparator

LM139A/LM139

FEATURES

- Wide single supply voltage range 2.0V_{DC} to 36V_{DC} or dual supplies ±1.0V_{DC} to ±18V_{DC}
- Very low supply current drain (0.8mA) independent of supply voltage (1.0mW/comparator at 5.0V_{DC})
- Low input biasing current 25nA
- Low input offset current and offset voltage
- Input common-mode voltage range includes ground
- Differential input voltage range equal to the power supply voltage
- Low output 250mV at 4mA saturation voltage
- Output voltage compatible with TTL, DTL, ECL, MOS and CMOS logic systems

APPLICATIONS

- A/D converters
- Wide range VCO
- MOS clock generator
- High voltage logic gate
- Multivibrators

DESCRIPTION

The LM139 series consists of four independent precision voltage comparators with an offset voltage specification as low as 2.0mV max for each comparator which were designed specifically to operate from a single

power supply over a wide range of voltages. Operation from split power supplies is also possible and the low power supply current drain is independent of the magnitude of the power supply voltage. These comparators also have a unique characteristic in that the input common mode voltage range includes ground, even though operated from a single power supply voltage.

The LM139 series was designed to directly interface with TTL and CMOS. When operated from both plus and minus power supplies, the LM139 series will directly interface with MOS logic where their low power drain is a distinct advantage over standard comparators.

ORDERING INFORMATION

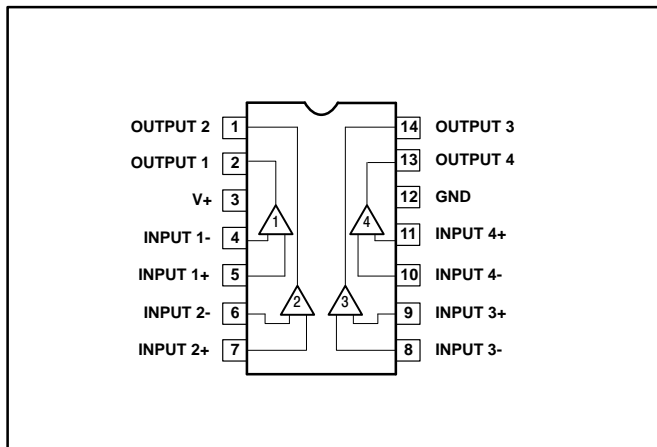
DESCRIPTION	ORDER CODE	PACKAGE DESIGNATOR*
14-Pin Ceramic DIP	LM139/BCA	GDIP1-T14
14-Pin Ceramic DIP	LM139A/BCA	GDIP1-T14

* MIL-STD 1835 or Appendix A of 1995 Military Data Handbook

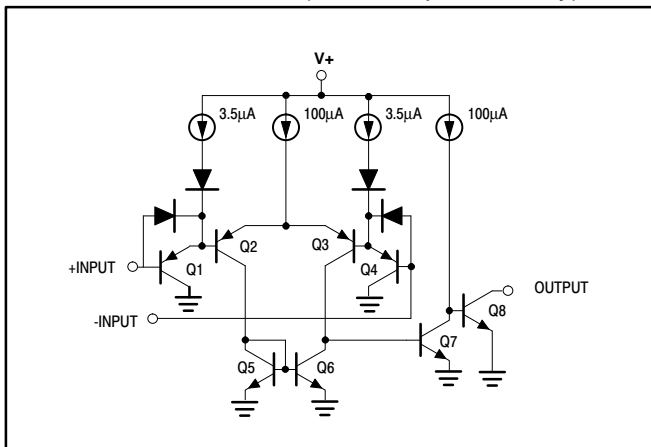
ABSOLUTE MAXIMUM RATINGS¹⁰

SYMBOL	PARAMETER	RATING	UNIT
V _{CC}	Supply voltage	36 or ±18	V
V _{DIFF}	Differential input voltage	36	V
V _{IN}	Input voltage	-0.3 to +36	V
P _D	Power dissipation ¹	900	mW
I _{SC}	Output short circuit to ground ³	Continuous	
I _{IN}	Input current (V _{IN} < -0.3V _{DC}) ⁴	50	mA
T _{STG}	Storage temperature range	-65 to +150	°C

PIN CONFIGURATION



EQUIVALENT CIRCUIT (One Comparator Only)



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DC ELECTRICAL CHARACTERISTICS

V+ = +5V, unless otherwise specified.

SYMBOL	PARAMETER	TEST CONDITIONS	T _{amb} = +25°C			T _{amb} = -55°C, +125°C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
V _{IO}	Input offset voltage ⁶	LM139A (only)		1.0	2.0			4.0	mV
V _{IO}	Input offset voltage ⁶	LM139 (only)		2.0	5.0			9	mV
V _{ICR}	Common mode voltage range ⁷		0		V+ -1.5	0		V+ -2.0	V
V _{IDR}	Differential input voltage ⁵	Keep all V _{IN} ≥ 0V (or V- if need)			V+			V+	V
I _{IB}	Input bias current ⁶	I _{IN(+)} or I _{IN(-)} with output in linear range		25	100			300	nA
I _{IO}	Input offset current	I _{IN(+)} - I _{IN(-)}		3.0	25			100	nA
I _{OL}	Output sink current	V _{IN(-)} ≥ 1V, V _{IN(+)} = 0V, V _O ≤ 1.5V	6.0	16		4.0			mA
I _{OH}	Output leakage current	V _{IN(+)} ≥ 1V, V _{IN(-)} = 0V, V _O = 5V		0.1					nA
		V ≤ 30V			1.0		1.0	μA	
I _{CC}	Supply current	V+ = 30V, R _L = ∞		0.8	2.0			3.0	mA
A _V	Voltage gain	R _L = 15kΩ, V+ = 15V	50	200		25			V/mV
V _{OL}	Saturation voltage	V _{IN(-)} ≥ 1V _{DC} , V _{IN(+)} = 0, I _{SINK} ≤ 4mA		250	400			700	mV
t _{LSR}	Large signal response time	V _{IN} = TTL logic swing, V _{REF} = 1.4V, V _{RL} = 5V, R _L = 5.1kΩ		300					ns
t _R	Response time ⁹	V _{RL} = 5V, R _L = 5.1kΩ		1.3					μs
PSRR	Power supply rejection ratio	V+ = 5V to 30V – LM139	65			65			dB
PSRR	Power supply rejection ratio	V+ = 5V to 30V – LM139A	70			70			dB
CMRR	Common mode rejection ratio	R _L ≥ 15kΩ, V+ = 30V, V _{CM} = 0V to 28.5V, LM139 25°C	65						dB
		LM139 temp, V _{CM} = 0V to 28V				65			dB
CMRR	Common mode rejection ratio	R _L ≥ 15kΩ, V+ = 30V, V _{CM} = 0V to 28.5V, LM139A 25°C	70						dB
		LM139A temp, V _{CM} = 28.0V				70			dB

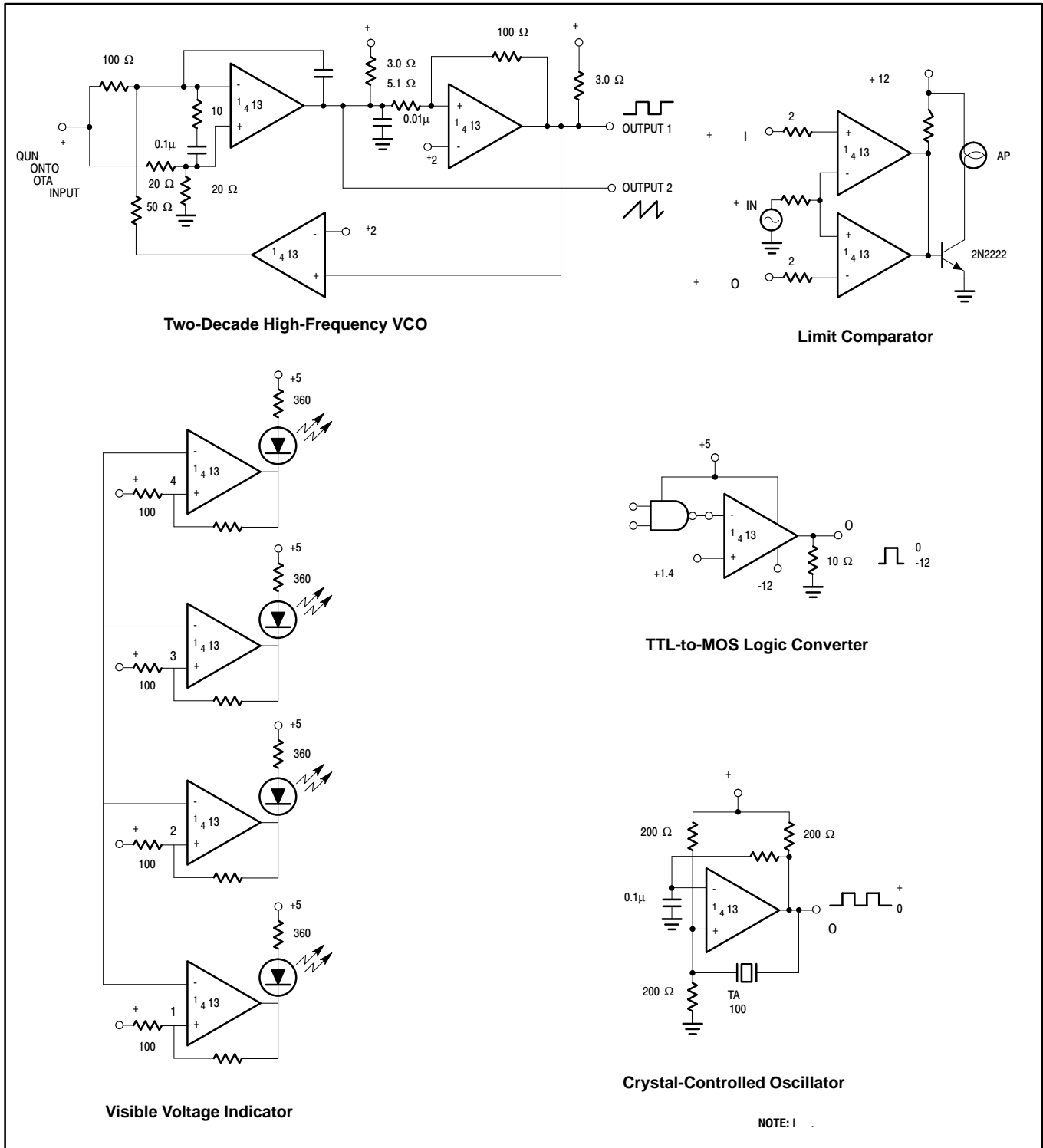
NOTES:

- Operation beyond the limits of this table may impair the useful life of the device.
- The LM139/139A must be derated on a 150°C max. junction temperature. The low power dissipation and the "On-Off" characteristics of the outputs keep the chip dissipation very small (P_D ≤ 100mW), provided the output transistors are allowed to saturate.
- Short circuits from the output to V+ can cause excessive heating and eventual destruction. The max. output current is approximately 20mA independent of the magnitude of V+.
- This input current will only exist when the voltage at any of the input leads is driven negative. It is due to the collector-base junction of the input PNP transistors becoming forward biased and thereby acting as input diode clamps. In addition to this diode action, there is lateral NPN parasitic transistor action on the IC chip. This transistor action can cause the output voltages of the comparators to go to the V+ voltage level (or to ground for a large overdrive) for the time duration that an input is driven negative. This is not destructive and normal output states will re-establish when the input voltage, which was negative, again returns to a value greater than -0.3V_{DC}.
- Positive excursions of input voltage may exceed the power supply level by 17V. As long as the other voltage remains within the common-mode range, the comparator will provide a proper output state. The low input voltage state must not be less than -0.3V_{DC} (or 0.3V_{DC} below the magnitude of the negative power supply, if used).
- At output switch point, V_O ≈ 1.4V_{DC}, R_S = 100Ω with V+ from 5V_{DC} to 30V_{DC}, over the full input common-mode range (0V_{DC} to V+ -1.5V_{DC}).
- The input common-mode voltage or either input signal voltage should not be allowed to go negative by more than 0.3V. the upper end of the common-mode voltage range is V+ -1.5V, but either or both inputs can go to 30V_{DC} without damage.
- The direction of the input current is out of the IC due to the PNP input stage. This current is essentially constant, independent of the state of the output so no loading change exists on the reference or input lines.
- The response time specified is for a 100mV input step with a 5mV overdrive. For larger overdrive signals, 300ns can be obtained. See Typical Performance Characteristics section.
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TYPICAL APPLICATIONS



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TYPICAL PERFORMANCE CHARACTERISTICS

