Quad Differential Comparator – LM139

Low power, low offset voltage quad comparator in bare die form

Rev 1.0
04/05/18

Description

LM139 consists of x4 independent precision voltage comparators, each with low offset voltages of 2mV typical. The device operates on single or split power supply over a wide voltage range. Common mode input voltage range includes ground even in single supply operation. Supply current drain is independent of supply voltage, useful for low power applications. This device directly interfaces CMOS, TTL & MOS with split supply. Typical uses include level detection, low–level sensing, A/D conversion, VCOs, MOS clock generators, high voltage logic gates & multivibrators.

Features:

- Single-Supply range: 2-36V
- Split–Supply range: ±1.0V to ±18V
- Low Input Offset Voltage 2mV typical
- Common mode input voltage includes ground
- Very low supply current independent of supply voltage (1 mW/comparator at +5V)
- Very Low Input Offset Current
- TTL, DTL, ECL, MOS, CMOS compatible outputs

Ordering Information

The following part suffixes apply:

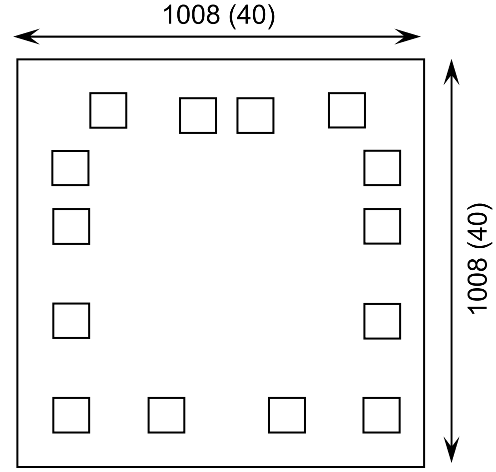
- No suffix - MIL-STD-883 /2010B Visual Inspection
- "**H**" - MIL-STD-883 /2010B Visual Inspection
  + MIL-PRF-38534 Class H LAT
- "**K**" - MIL-STD-883 /2010A Visual Inspection (Space)
  + MIL-PRF-38534 Class K LAT

LAT = Lot Acceptance Test.

For further information on LAT process flows see below.

www.siliconsupplies.com\quality\bare-die-lot-qualification

Die Dimensions in µm (mils)



For a higher electrical grade version of this product see LM139A

Supply Formats:

- Default – Die in Waffle Pack (400 per tray capacity)
- Sawn Wafer on Tape – On request
- Unsawn Wafer – On request
- Die Thickness <> 280µm(11 Mils) – On request
- Assembled into Ceramic Package – On request

Mechanical Specification

Die Size (Unsawn)	1008 x 1008 40 x 40	µm mils
Minimum Bond Pad Size	94 x 94 3.7 x 3.7	µm mils
Die Thickness	280 (±10) 11.02 (±0.39)	µm mils
Top Metal Composition	Al 1%Si 1.1µm	
Back Metal Composition	N/A – Bare Si	

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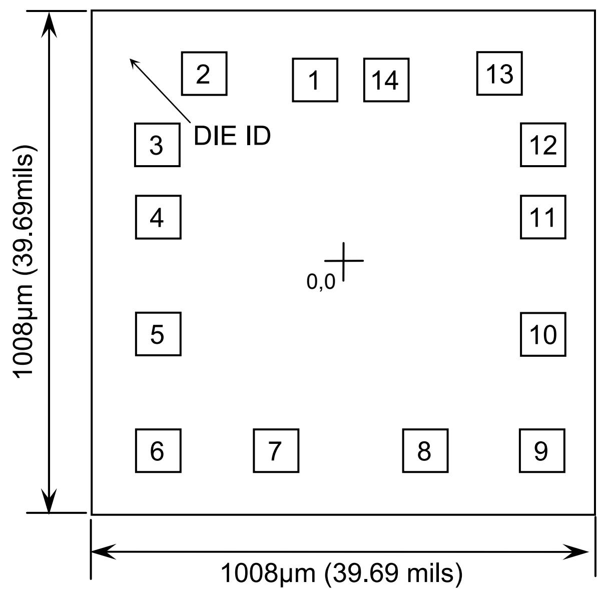
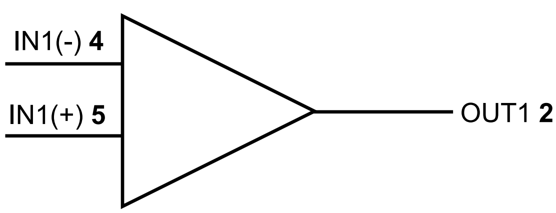
Pad Layout and Functions



PAD	FUNCTION	COORDINATES (µm)	
		X	Y
1	OUTPUT 2	-57	391
2	OUTPUT 1	-299	405
3	V_{CC}	-398.5	251
4	-INPUT 1	-396.5	97
5	+INPUT 1	-396.5	-155
6	-INPUT 2	-395	-405
7	+INPUT 2	-143	-405
8	-INPUT 3	179.5	-405
9	+INPUT 3	431.5	-405
10	-INPUT 4	433	-155
11	+INPUT 4	433	97
12	GND	435	251
13	OUTPUT 4	339.5	405
14	OUTPUT 3	97	391
CHIP BACK POTENTIAL IS GND OR FLOAT			

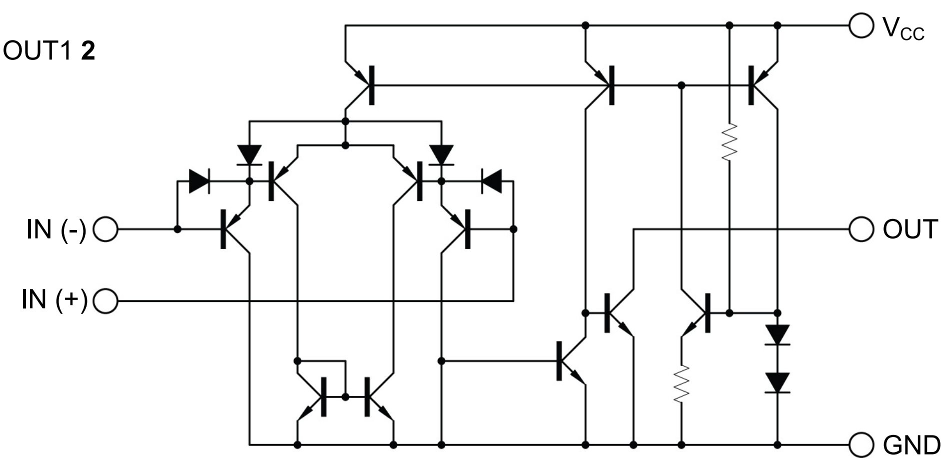
Logic Diagram (Single channel)



PAD **3** = V_{CC}

PAD **12** = GND

Schematic (Single channel)



Absolute Maximum Ratings[1]

PARAMETER	SYMBOL	VALUE	UNIT
Supply Voltage – Single Supply	V_{CC}	36	V
Supply Voltage – Split Supply		±18	V
Input Differential Voltage Range	V_{IDR}	36	V
Input Common Mode Voltage Range	V_{ICR}	-0.3 to V_{CC}	V
Output Short Circuit to Ground	-	Continuous	-
Input Current (per pad)[2]	I_{IN}	50	mA
Junction Temperature	T_J	150	°C
Power Dissipation in Still Air[3]	P_D	756	mW

1. Operation above the absolute maximum rating may cause device failure. Operation at the absolute maximum ratings, for extended periods, may reduce device reliability.
2. V_{IN} < -0.3V. This input current exists when voltage is driven negative at any of the input leads
3. Assembled in 14 lead PDIP

Recommended Operating Conditions

PARAMETER	SYMBOL	MIN	MAX	UNITS
DC Supply Voltage	V_{CC}	2	30	V
Operating Temperature	T_A	-55	+125	°C

DC Electrical Characteristics (V_{CC} =5V, T_A = 25°C unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS		LIMITS MIN	LIMITS TYP	LIMITS MAX	UNITS
Input Offset Voltage	V_{IO}	V_O = 1.4V, R_S = 0Ω; V_{CC} = 5-30V, V_{ICR} =0V-(V_{CC}-1.5V)	25°C	-	2	5	mV
			125°C	-	-	9	
Input Bias Current	I_B	V_O =1.4V, R_S = 0Ω; V_{CC} = 5-30V, V_{ICR} =0V-(V_{CC}-1.5V)	25°C	-	25	100	nA
			125°C	-	-	300	
Input Offset Current	I_{IO}	V_O =1.4V, R_S = 0Ω; V_{CC} = 5-30V, V_{ICR} =0V-(V_{CC}-1.5V)	25°C	-	3	25	nA
			125°C	-	-	100	
Input Common Mode Voltage Range	V_{ICR}	V_{CC} = 5-30V	25°C	0	-	V_{CC} -1.5	V
			125°C	0	-	V_{CC} - 2.0	
Supply Current	I_{CC}	R_L=∞, V_{CC} = 5V		-	1.1	2	mA
		R_L=∞, V_{CC} = 36V		-	-	2.5	
Voltage Gain	A_{VOL}	V_{CC} = 15V, $R_L \geq$ 15kΩ, T_A = 25°C, V_O = 1V to 11V		50	200	-	V/mV
Large Signal Response Time	t_1	V_{IN} =TTL Logic Swing, V_{REF} =1.4V, V_{RL} = 5V R_L = 5.1KΩ		-	300	-	ns
Response Time	t_2	R_L= 5.1KΩ, V_{RL}= 5V		-	1.3	-	µS

DC Electrical Characteristics (V_{CC} =5V, T_A = 25°C unless otherwise specified)

PARAMETER	SYMBOL	CONDITIONS		LIMITS MIN	LIMITS TYP	LIMITS MAX	UNITS
Output Sink Current	I_{SINK}	$V_I(-)$ = 1V, $V_I(+)$ = 0V, $V_O \le$ 1.5V		6	18	-	mA
Saturation Voltage	V_{SAT}	$V_I(-)$ =1V, $V_I(+)$ = 0V $I_{SINK} \le$ 4mA	25°C	-	140	400	mV
			125°C	-	-	700	
Output Leakage Current	I_{OL}	$V_I(+)$ = 1V, $V_I(-)$ = 0V	V_O = 5V, T_A = 25°C	-	0.1	-	nA
			V_O = 30V, T_A = 125°C	-	-	1000	
Differential Input Voltage Range	V_{IDR}	All $V_{IN} \ge$ GND or V- Supply (if used)		-	-	V_{CC}	V

Typical Characteristics

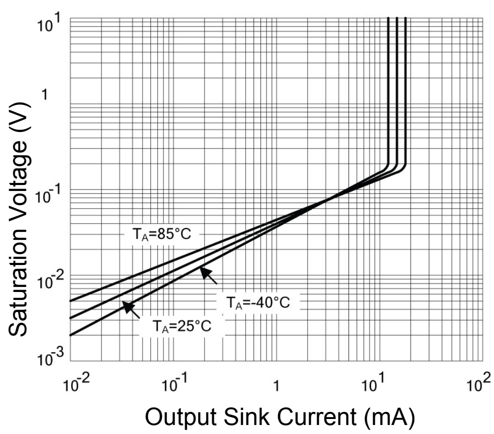


FIGURE 1. Output Saturation Voltage vs Output Sink Current

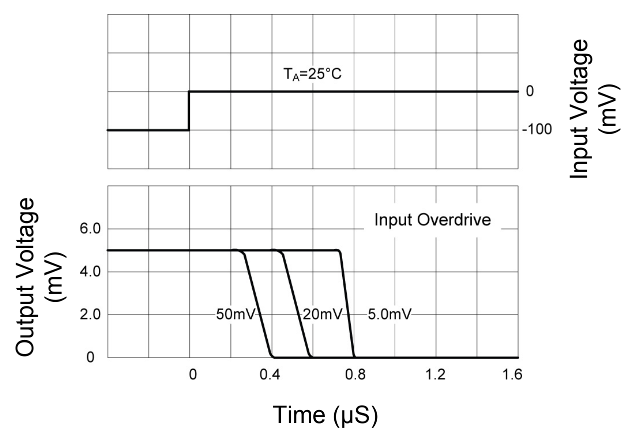


FIGURE 2. Input Overdrive Response time – Negative transition

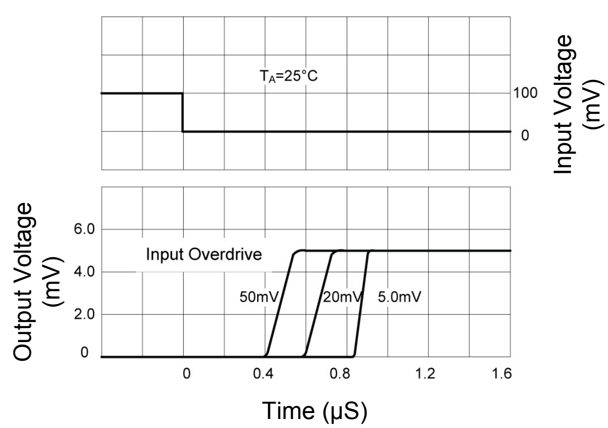


FIGURE 3. Input Overdrive Response time – Positive transition

Typical Applications

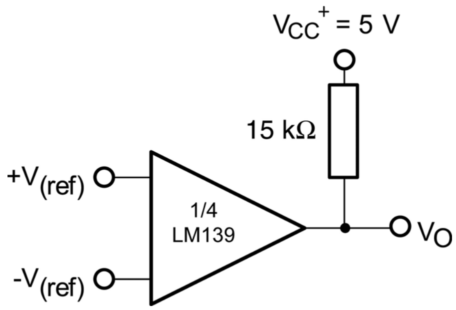


FIGURE 4. Basic Comparator

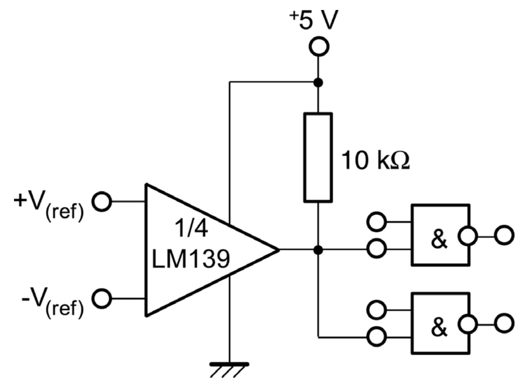


FIGURE 5. Driving TTL

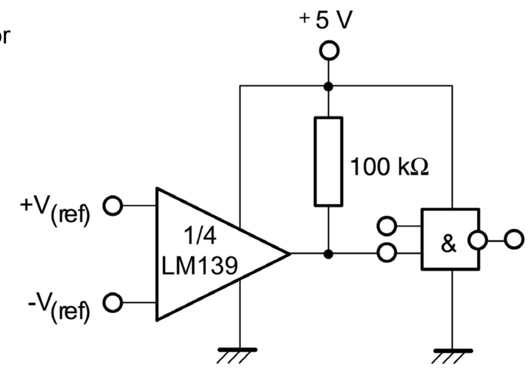


FIGURE 6. Driving CMOS

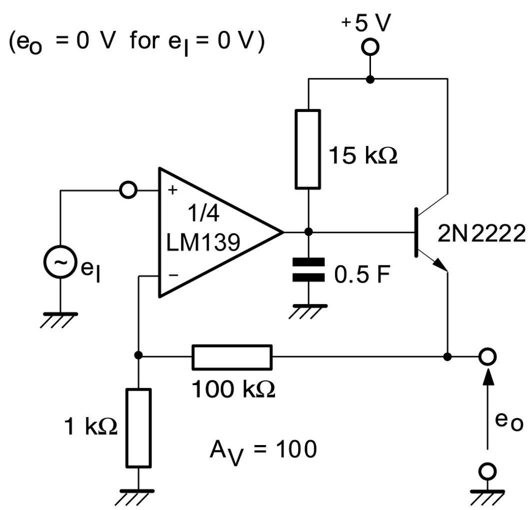


FIGURE 7. Low frequency Operational Amplifier V1

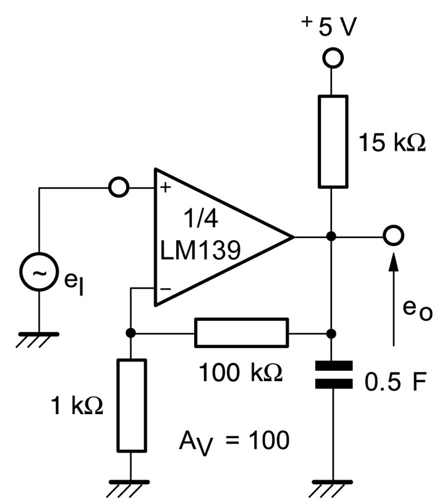


FIGURE 8. Low frequency Operational Amplifier V2

Typical Applications continued

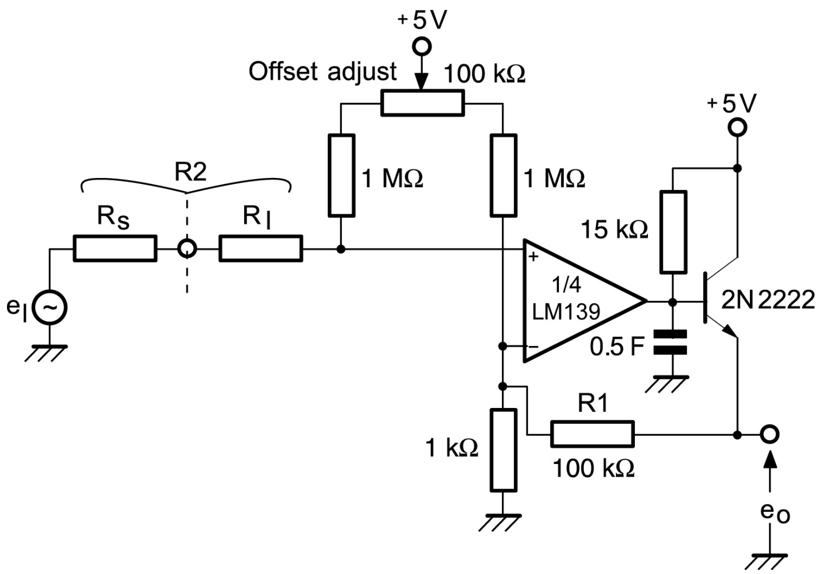


FIGURE 9. Low frequency Op-Amp with Offset adjust

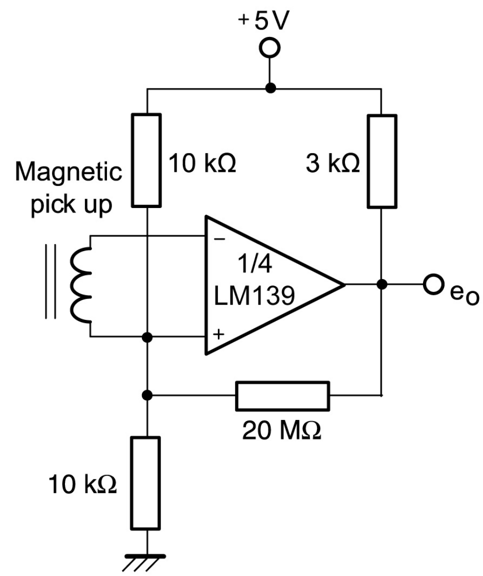


FIGURE 10. Transducer Amplifier

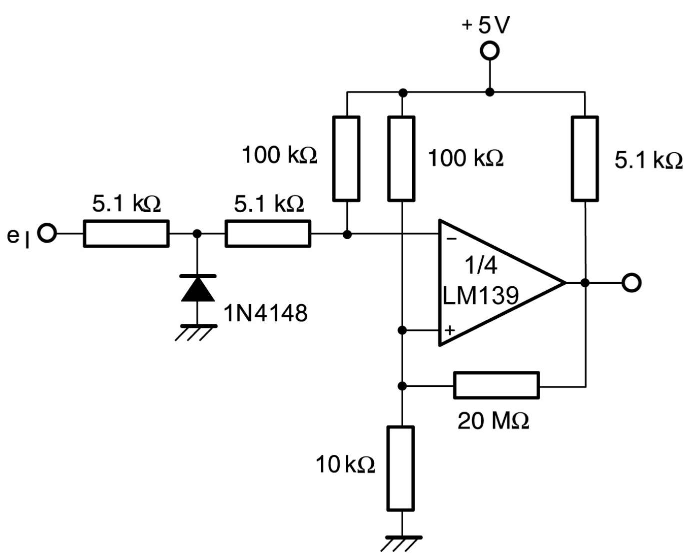


FIGURE 11. Zero crossing detector (single power supply)

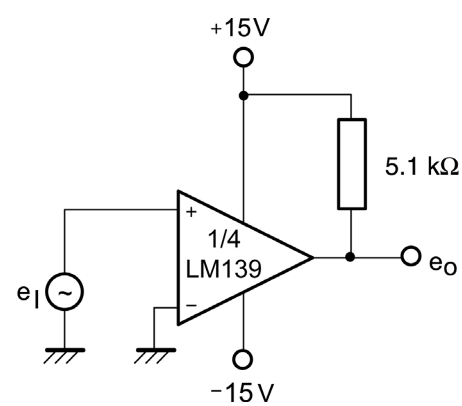


FIGURE 12. Zero crossing detector (split power supply)

Typical Applications continued

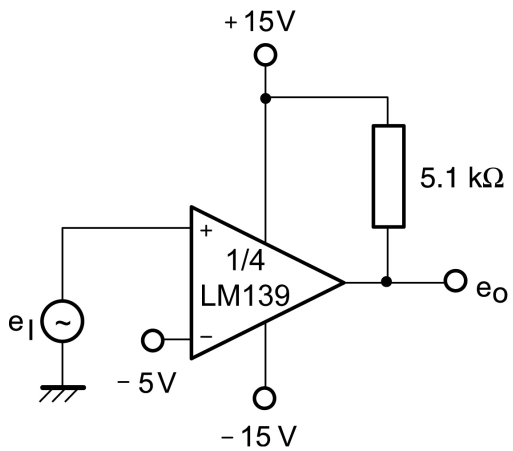


FIGURE 13. Comparator with a negative reference

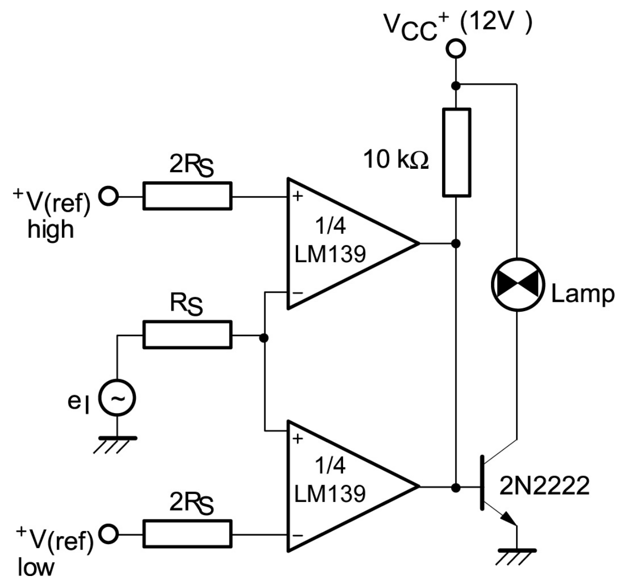


FIGURE 14. Limit Comparator

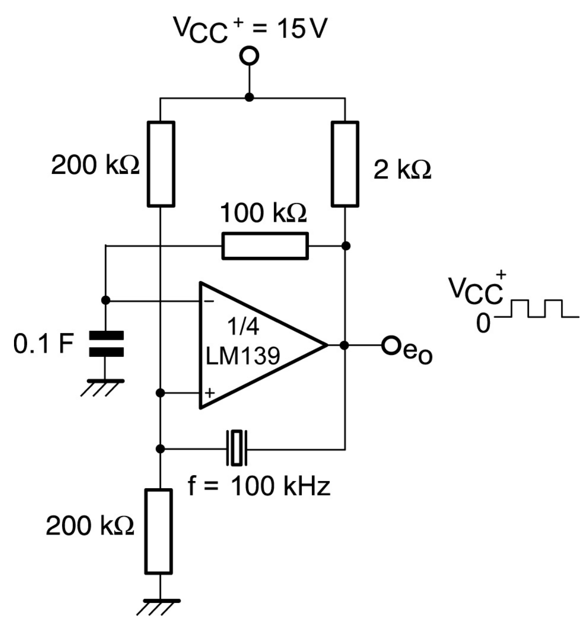


FIGURE 15. Crystal controlled Comparator

Typical Applications continued

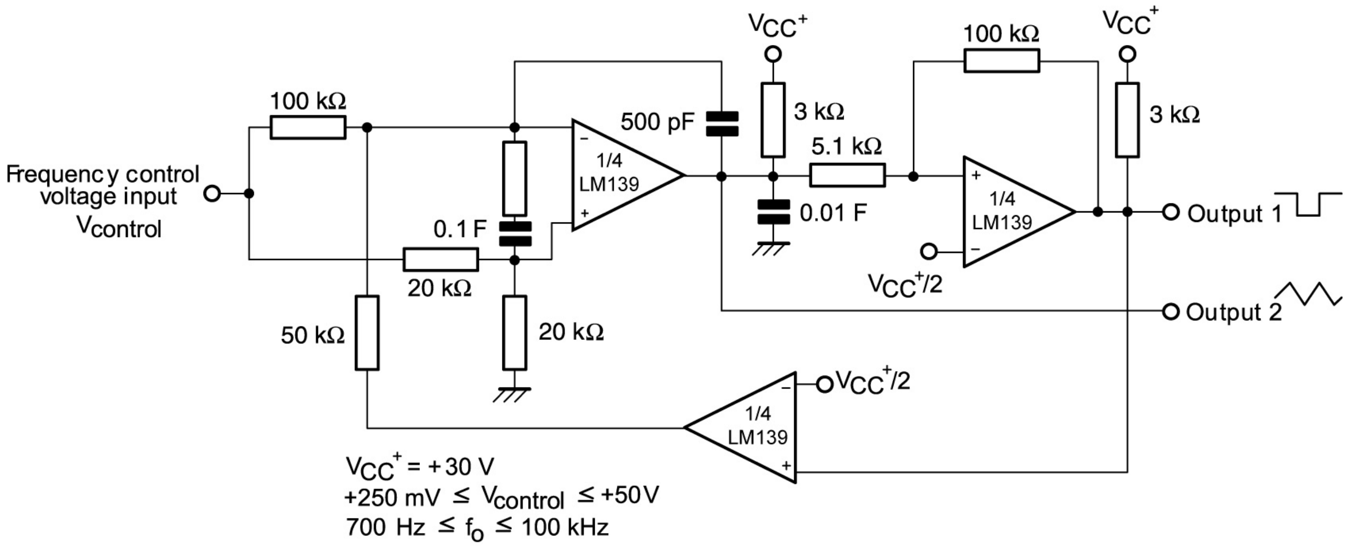


FIGURE 16. Two-decade High-Frequency VCO