



# LA5316M

## Variable Divided Voltage Generator for LCD

### Overview

The LA5316M is a variable divided voltage generator IC for multiple drive of LCD matrix.

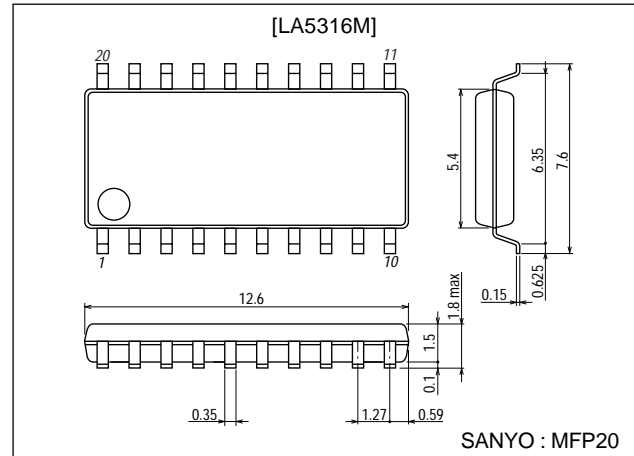
### Features

- Power supply for variable bias LCD drive (1/5 to 1/13 bias available by on-chip resistances).
- 5 operational amplifiers to deliver 5 voltage outputs.
- Low current drain (1.5mA max).
- Miniflat package.
- On-chip variable voltage regulator for  $V_{REF}$ .

### Package Dimensions

unit:mm

3036B-MFP20



### Specifications

**Absolute Maximum Ratings** at  $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	$V_{CC \text{ max}}$	GND- $V_{CC}$	-35 to 0	V
Maximum output current	$I_{OUT \text{ max}}$	V1, V2, V3, V4, V5	15	mA
Allowable power dissipation	$P_d \text{ max}$		370	mW
Operating temperature	$T_{opr}$		-20 to +75	$^\circ\text{C}$
Storage temperature	$T_{stg}$		-30 to +125	$^\circ\text{C}$

**Operating Conditions** at  $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Supply voltage	$V_{CC \text{ op}}$	GND- $V_{CC}$ : (When $V_1 > -1\text{V}$ , $I_{IN}$ is needed.) *	-30 to -10	V
Recommended input voltage	$V_{REF}$	GND- $V_{REF}$ : $V_{REF} \geq V_{CC}$ *	-30 to -6	V
Recommended input current	$I_{IN}$	$V_{IN}$ : $V_1 > -1\text{V}$ , current source of $I_{IN}$ : 1V or greater relative to GND	0.2 to 3	mA
Recommended output current	$I_{OUT1}$	V1	-0.1 to +5	mA
	$I_{OUT2, 3}$	V2, V3	-5 to +5	mA
	$I_{OUT4, 5}$	V4, V5	-10 to +0.1	mA

note \* Set  $V_{CC}$ ,  $V_{REF}$  so that  $|V_2|$ ,  $|V_{CC}-V_5|$  become 1V or greater.

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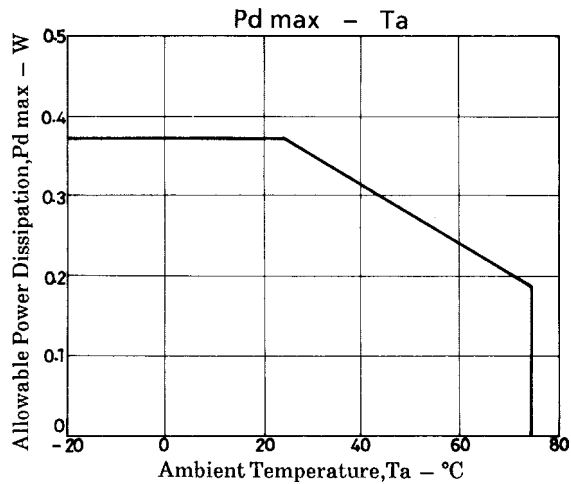
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## Operating Characteristics at $T_a = 25^\circ\text{C}$ , $V_{CC} = -16\text{V}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Current drain	$I_{CC}$	$V_{IN}, GND-V_{CC}, V_{REF} : V_{CC}=V_{REF}=-16\text{V}$ , $V_{IN}=GND, R_X=5R$			1.5	mA
Output voltage ratio 1	Ra1	$V2/V1, V_{ref}=-12\text{V}, V_{CC}=-16\text{V}, 1/9$ bias ( $R_X=5R$ )	1.96	2.00	2.04	
Output voltage ratio 2	Ra2	$(V5-V3)/(V5-V4), V_{ref}=-12\text{V}, V_{CC}=-16\text{V}, 1/9$ bias ( $R_X=5R$ )	1.96	2.00	2.04	
Output voltage ratio 3	Rb1	$V5/V1, V_{ref}=-12\text{V}, V_{CC}=-16\text{V}, 1/9$ bias ( $R_X=5R$ )	8.73	9.00	9.27	
Output voltage ratio 4	Rb2	$V5/V2, V_{ref}=-12\text{V}, V_{CC}=-16\text{V}, 1/9$ bias ( $R_X=5R$ )	4.37	4.50	4.63	
Output voltage ratio 5	Rb3	$V5/(V5-V3), V_{ref}=-12\text{V}, V_{CC}=-16\text{V}, 1/9$ bias ( $R_X=5R$ )	4.37	4.50	4.63	
Output voltage ratio 6	Rb4	$V5/(V5-V4), V_{ref}=-12\text{V}, V_{CC}=-16\text{V}, 1/9$ bias ( $R_X=5R$ )	8.73	9.00	9.27	
Internal resistance ratio 1	4R	$V_{IN3}-R_X1$ , Resistance ratio referenced to R across pins ⑤ and ⑥		4		
Internal resistance ratio 2	5R	$V_{IN3}-R_X2$ , Resistance ratio referenced to R across pins ⑤ and ⑥		5		
Internal resistance ratio 3	6R	$V_{IN3}-R_X3$ , Resistance ratio referenced to R across pins ⑤ and ⑥		6		
Internal resistance ratio 4	7R	$V_{IN3}-R_X4$ , Resistance ratio referenced to R across pins ⑤ and ⑥		7		
Internal resistance ratio 5	8R	$V_{IN3}-R_X5$ , Resistance ratio referenced to R across pins ⑤ and ⑥		8		
Internal resistance ratio 6	9R	$V_{IN3}-R_X6$ , Resistance ratio referenced to R across pins ⑤ and ⑥		9		
Resistance	R	$R_X1-R_X2$ : R value when 0.5V is applied across pins ⑤ and ⑥		20		k $\Omega$
Load regulation 1	$\Delta V1$	$V1 : +100\mu\text{A} < I_{OUT1} < +5\text{mA}$			20	mV
Load regulation 2	$\Delta V2$	$V2 : +100\mu\text{A} < I_{OUT2} < +5\text{mA}$			20	mV
Load regulation 3	$\Delta V3$	$V3 : +100\mu\text{A} < I_{OUT3} < +5\text{mA}$			20	mV
Load regulation 4	$-\Delta V2$	$V2 : -5\text{mA} < I_{OUT2} < -100\mu\text{A}$			20	mV
Load regulation 5	$-\Delta V3$	$V3 : -5\text{mA} < I_{OUT3} < -100\mu\text{A}$			20	mV
Load regulation 6	$-\Delta V4$	$V4 : -10\text{mA} < I_{OUT4} < -100\mu\text{A}$			20	mV
Load regulation 7	$-\Delta V5$	$V5 : -10\text{mA} < I_{OUT5} < -100\mu\text{A}$			20	mV
Regulator voltage	$V_{Reg}$	GND- $V_{Reg}$ : Pins ⑦ and ⑧ shorted	-6.5	-6.2	-5.9	V
$V_{Reg}$ load regulation	$\Delta V_{Reg}$	$V_{Reg} : -5\text{mA} < I_O < +1\text{mA}$			50	mV



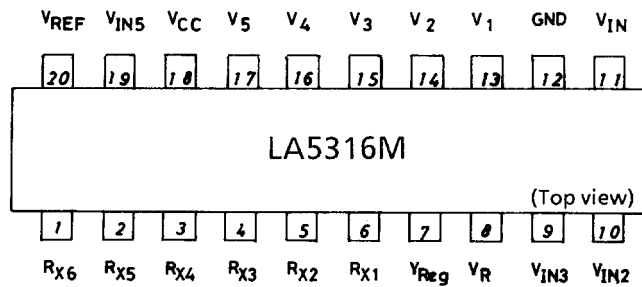
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## Pin Functions

Pin No.	Pin Name	Description	Remarks
1	R <sub>X6</sub>	R <sub>X</sub> pin	Pin 10 shorted R <sub>X</sub> =9R
2	R <sub>X5</sub>	R <sub>X</sub> pin	Pin 10 shorted R <sub>X</sub> =8R
3	R <sub>X4</sub>	R <sub>X</sub> pin	Pin 10 shorted R <sub>X</sub> =7R
4	R <sub>X3</sub>	R <sub>X</sub> pin	Pin 10 shorted R <sub>X</sub> =6R
5	R <sub>X2</sub>	R <sub>X</sub> pin	Pin 10 shorted R <sub>X</sub> =5R
6	R <sub>X1</sub>	R <sub>X</sub> pin	Pin 10 shorted R <sub>X</sub> =4R
7	V <sub>Reg</sub>	V <sub>Reg</sub> output	For supplying V <sub>REF</sub>
8	V <sub>R</sub>	V <sub>Reg</sub> operational amplifier V <sub>IN-</sub>	
9	V <sub>IN3</sub>	V <sub>3</sub> input	
10	V <sub>IN2</sub>	V <sub>2</sub> input	
11	V <sub>IN</sub>	V <sub>1</sub> supply (+ supply)	When V <sub>1</sub> > -1.0V, V <sub>IN</sub> is applied. When V <sub>1</sub> < -1.0V, this pin is shorted to GND.
12	GND	GND	
13	V <sub>1</sub>	V <sub>1</sub> output	
14	V <sub>2</sub>	V <sub>2</sub> output	
15	V <sub>3</sub>	V <sub>3</sub> output	
16	V <sub>4</sub>	V <sub>4</sub> output	
17	V <sub>5</sub>	V <sub>5</sub> output	
18	V <sub>CC</sub>	V <sub>CC</sub> supply (-supply)	
19	V <sub>IN5</sub>	V <sub>5</sub> input	
20	V <sub>REF</sub>	V <sub>REF</sub> supply (-supply)	

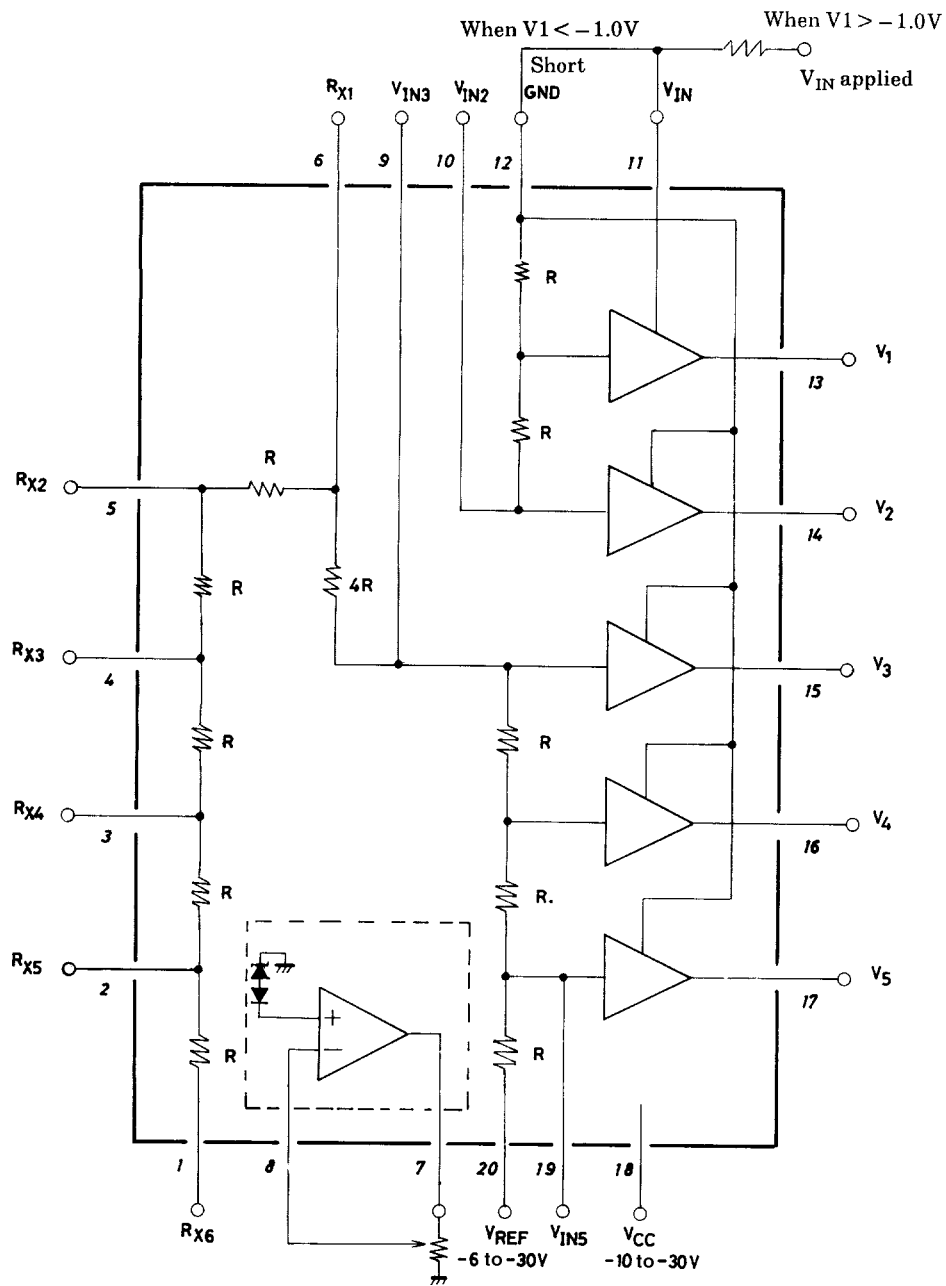
Note ) Do not use the NC pin.

## Pin Assingment



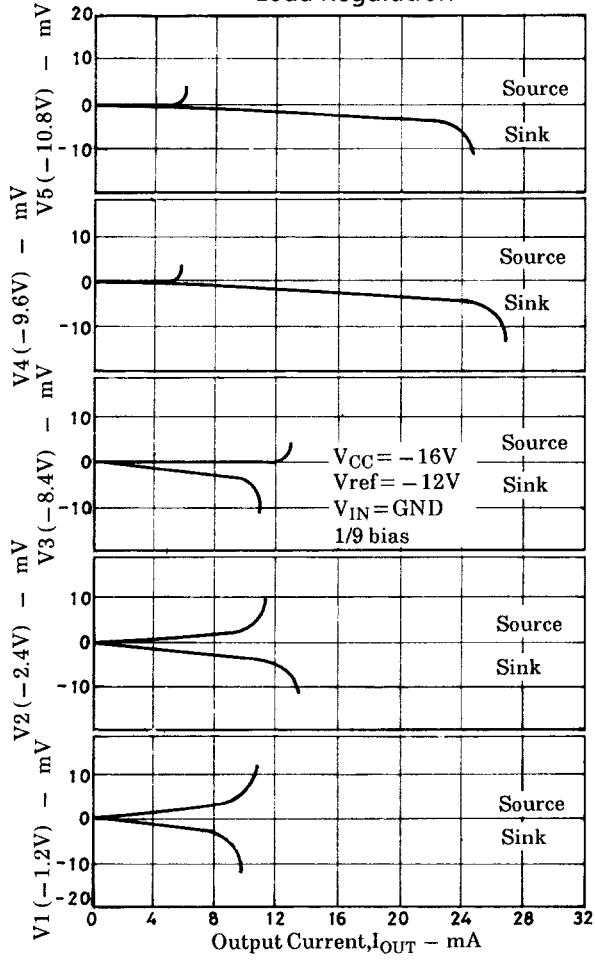
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## Equivalent Circuit Block Diagram

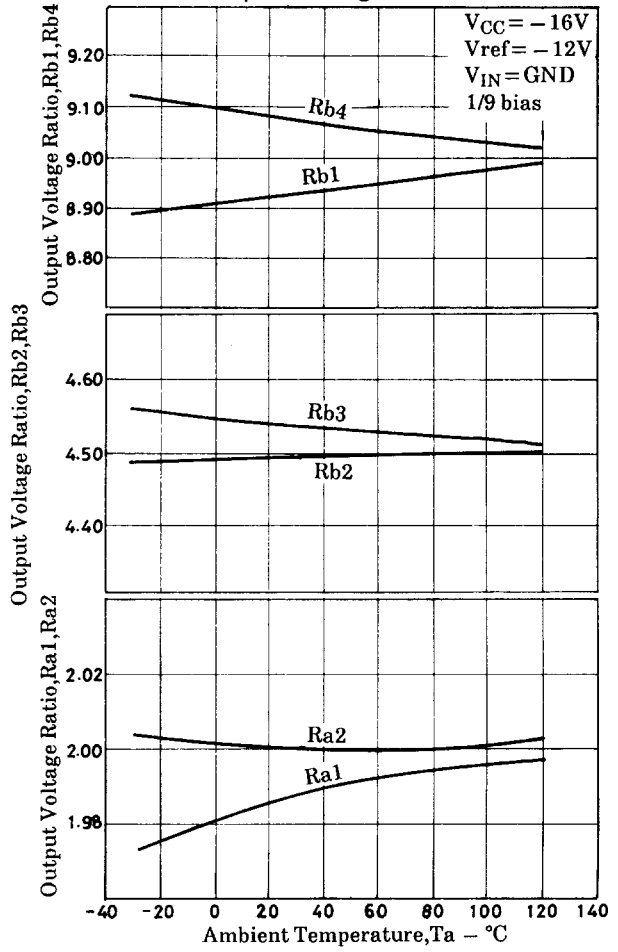


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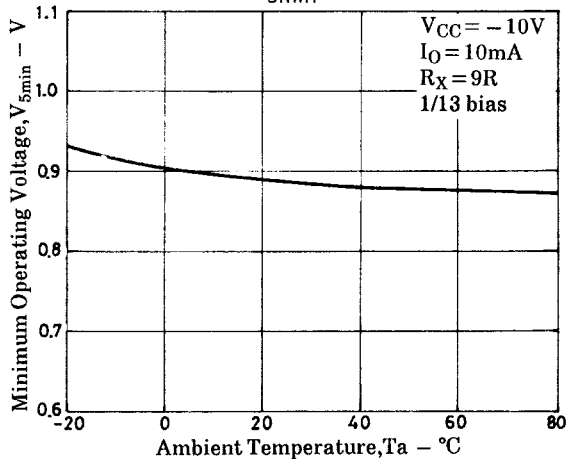
### Load Regulation



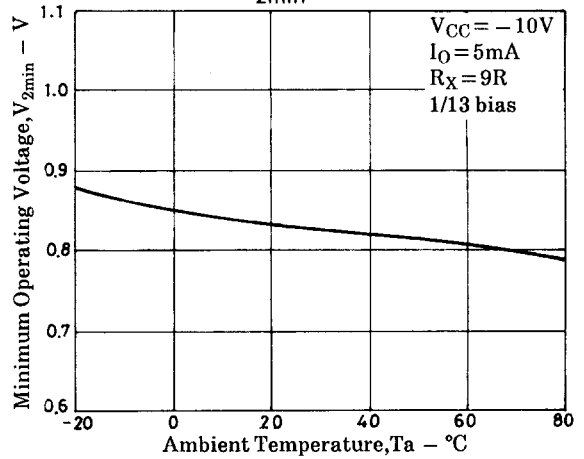
### Output Voltage Ratio - $T_a$



### $V_{5min}$ - $T_a$



### $V_{2min}$ - $T_a$



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