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# MSM6568A

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## 160-DOT COMMON DRIVER

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### GENERAL DESCRIPTION

The MSM6568A is a dot matrix LCD common driver which is fabricated in CMOS technology. The MSM6568A consists of two 80-bit bidirectional shift registers, two 80-bit level shifters, and two 80-bit 4-level drivers.

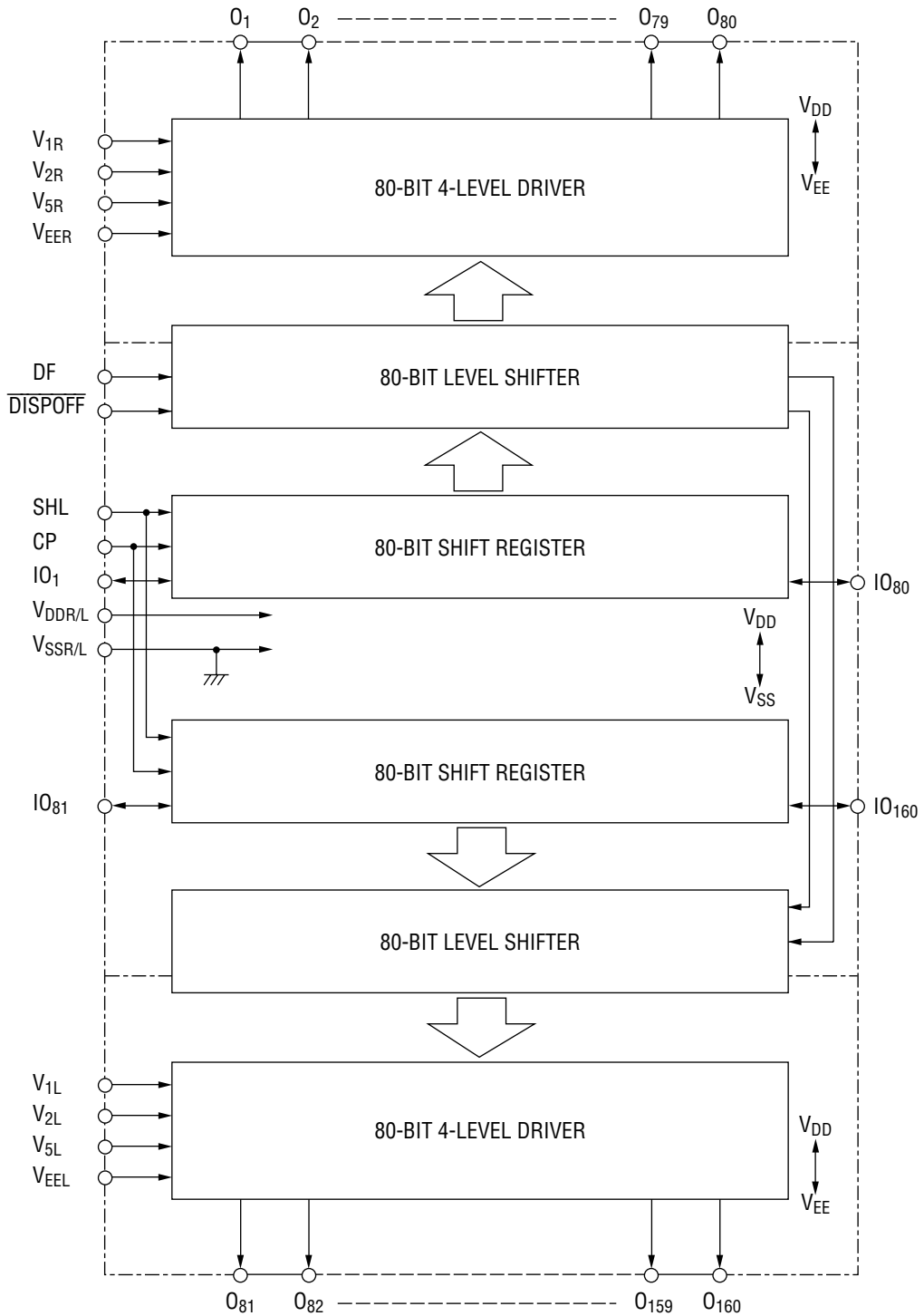
The MSM6568A is equipped with 160 output pins. By connecting two or more MSM6568A devices in cascade, the number of LCD outputs can be increased.

The MSM6568A can drive a variety of LCD panels because the bias voltage, which determines the LCD driving voltage, can be optionally supplied from an external source.

### FEATURES

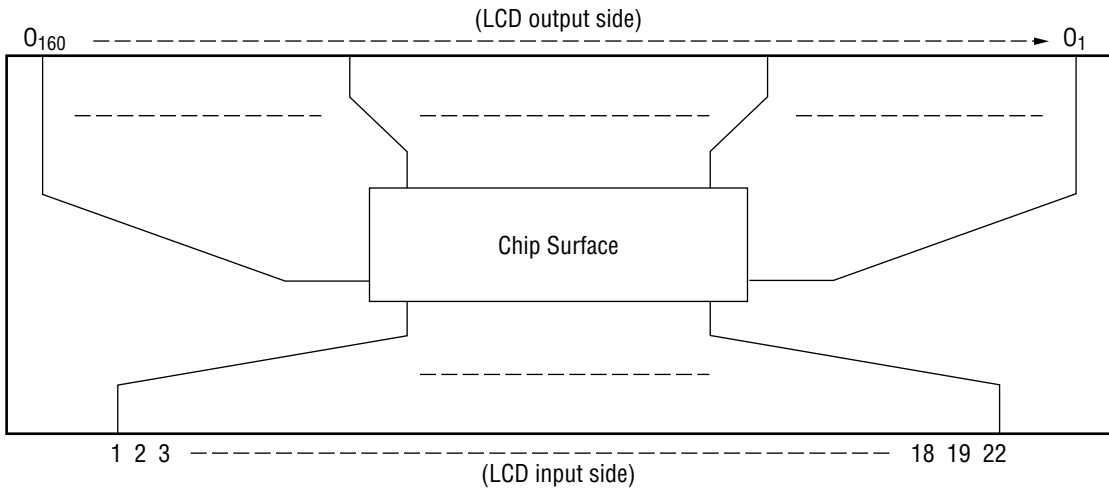
- Logic supply voltage : 2.7 to 5.5V
- LCD driving voltage : 14 to 28V
- Applicable LCD duty : 1/64 to 1/256
- External bias power supply available
- Package :
  - TCP mounting with 70mm wide film (Product name : MSM6568AV-Z)
  - Tin-plated

**BLOCK DIAGRAM**



(V<sub>DDR/L</sub> stands for V<sub>DDR</sub> and V<sub>DDL</sub>, and V<sub>SSR/L</sub> for V<sub>SSR</sub> and V<sub>SSL</sub>.)

**PIN CONFIGURATION (TOP VIEW)**



Pin	Symbol	Pin	Symbol
1	V <sub>1L</sub>	12	IO <sub>160</sub>
2	V <sub>2L</sub>	13	IO <sub>81</sub>
3	V <sub>5L</sub>	14	IO <sub>80</sub>
4	V <sub>EEL</sub>	15	IO <sub>1</sub>
5	NC	16	V <sub>SSR</sub>
6	V <sub>DDL</sub>	17	V <sub>DDR</sub>
7	SHL	18	NC
8	V <sub>SSL</sub>	19	V <sub>EER</sub>
9	$\overline{\text{DISPOFF}}$	20	V <sub>5R</sub>
10	CP	21	V <sub>2R</sub>
11	DF	22	V <sub>1R</sub>

NC : No connection

**ABSOLUTE MAXIMUM RATINGS**

Parameter	Symbol	Condition	Rating	Unit
Power Supply Voltage	$V_{DD}$	$T_a=25^\circ\text{C}$	-0.3 to +6.5	V
Bias Voltage	$V_{LCD}$	$T_a=25^\circ\text{C}, V_{DD} - V_{EE}$	0 to 30	V
Input Voltage	$V_i$	$T_a=25^\circ\text{C}$	-0.3 to $V_{DD}+0.3$	V
Storage Temperature	$T_{STG}$	—	-30 to +85	$^\circ\text{C}$

- \*  $V_1 > V_2 > V_5 > V_{EE}$   
 $V_{EE} < V_5 \leq V_{EE} + 10\text{V}$   
 $V_{DD} \geq V_1 > V_2 \geq V_{DD} - 10\text{V}$   
 $V_{DD} = V_{DDR} = V_{DDL}, V_1 = V_{1R} = V_{1L}, V_2 = V_{2R} = V_{2L},$   
 $V_5 = V_{5R} = V_{5L}, V_{EE} = V_{EER} = V_{EEL}$

**RECOMMENDED OPERATING CONDITIONS**

Parameter	Symbol	Condition	Range	Unit	
Power Supply Voltage	$V_{DD}$	—	2.7 to 5.5	V	
Bias Voltage	$V_{LCD}$	$V_{DD} - V_{EE}$	No load	14 to 28	V
			LCD being driven	18 to 28	V
Operating Temperature	$T_{op}$	—	-20 to +75	$^\circ\text{C}$	

- \*  $V_1 > V_2 > V_5 > V_{EE}$   
 $V_{EE} < V_5 \leq V_{EE} + 7\text{V}$   
 $V_{DD} \geq V_1 > V_2 \geq V_{DD} - 7\text{V}$   
 $V_{DD} = V_{DDR} = V_{DDL}, V_1 = V_{1R} = V_{1L}, V_2 = V_{2R} = V_{2L},$   
 $V_5 = V_{5R} = V_{5L}, V_{EE} = V_{EER} = V_{EEL}$

**ELECTRICAL CHARACTERISTICS**

**DC Characteristics**

(V<sub>DD</sub>=2.7 to 5.5V, T<sub>a</sub>=-20 to +75°C)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
"H" Input Voltage	V <sub>IH</sub> *1	—	0.8V <sub>DD</sub>	—	—	V
"L" Input Voltage	V <sub>IL</sub> *1	—	—	—	0.2V <sub>DD</sub>	V
"H" Input Current	I <sub>IH</sub> *1	V <sub>I</sub> =V <sub>DD</sub> , V <sub>DD</sub> =5.5V	—	—	1	μA
"L" Input Current	I <sub>IL</sub> *1	V <sub>I</sub> =0V, V <sub>DD</sub> =5.5V	—	—	-1	μA
"H" Output Voltage	V <sub>OH</sub> *2	I <sub>O</sub> =-0.2mA, V <sub>DD</sub> =2.7V	V <sub>DD</sub> -0.4	—	—	V
"L" Output Voltage	V <sub>OL</sub> *2	I <sub>O</sub> =0.2mA, V <sub>DD</sub> =2.7V	—	—	0.4	V
ON Resistance	R <sub>ON</sub> *4	V <sub>DD</sub> -V <sub>EE</sub> =25V *3  V <sub>N</sub> -V <sub>O</sub>  =0.25V	—	—	2.0	kΩ
Supply Current	I <sub>SS</sub>	CP=22kHz, V <sub>DD</sub> =3.0V	—	—	50	μA
	I <sub>EE</sub>	V <sub>DD</sub> -V <sub>EE</sub> =25V, no load*5	—	—	300	
Input Capacitance	C <sub>I</sub>	f=1MHz	—	5	—	pF

\*1 Applied to CP, IO<sub>1</sub>, IO<sub>80</sub>, IO<sub>81</sub>, IO<sub>160</sub>, SHL, DF, DISPOFF

\*2 Applied to IO<sub>1</sub>, IO<sub>80</sub>, IO<sub>81</sub>, IO<sub>160</sub>

\*3 V<sub>N</sub>=V<sub>DD</sub> to V<sub>EE</sub>, V<sub>2</sub>=1/16 (V<sub>DD</sub> - V<sub>EE</sub>), V<sub>5</sub>=15/16 (V<sub>DD</sub> - V<sub>EE</sub>)  
 V<sub>DD</sub>=V<sub>1</sub>, V<sub>DD</sub>=4.5V, V<sub>1</sub>=V<sub>1L</sub>=V<sub>1R</sub>, V<sub>2</sub>=V<sub>2L</sub>=V<sub>2R</sub>, V<sub>5</sub>=V<sub>5L</sub>=V<sub>5R</sub>, V<sub>EE</sub>=V<sub>EEL</sub>=V<sub>EER</sub>,  
 V<sub>DD</sub>=V<sub>DDL</sub>=V<sub>DDR</sub>

\*4 Applied to O<sub>1</sub> to O<sub>160</sub>

\*5 Input a "H" level signal through the IO pins every 240 clock pulses when a supply current is measured.

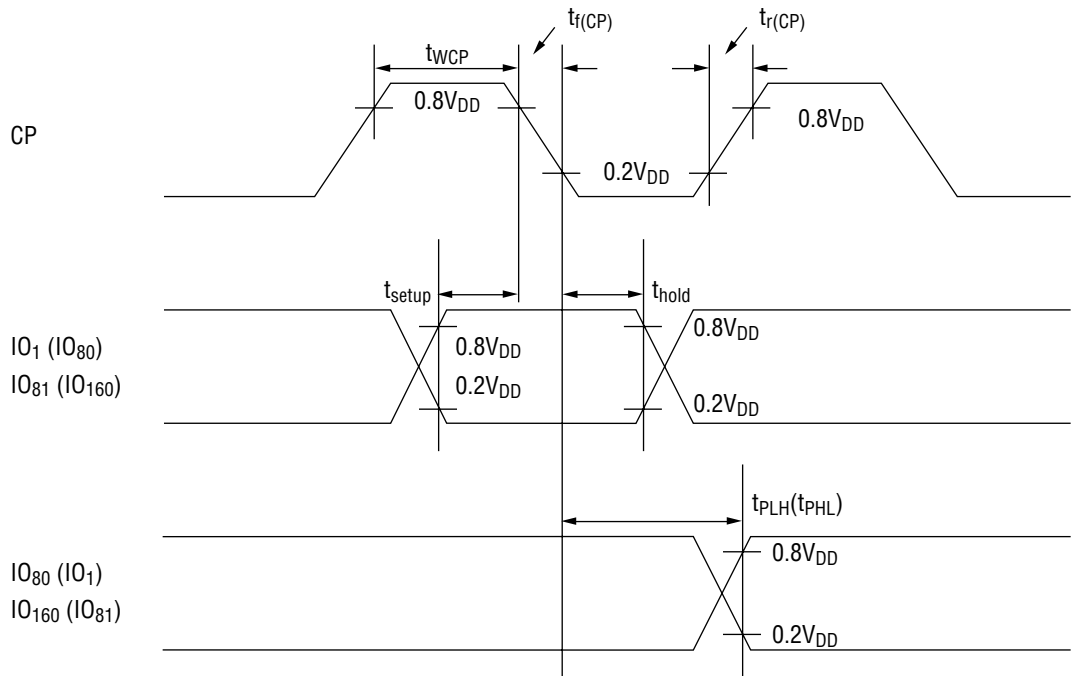
The DF frequency is 45Hz.

**Switching Characteristics**

(V<sub>DD</sub>=2.7 to 5.5V, T<sub>a</sub>=-20 to +75°C, C<sub>L</sub>=15pF)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
"H", "L" Propagation Delay Time	t <sub>PHL</sub> t <sub>PLH</sub>	—	—	—	3	μs
Maximum Clock Frequency	f <sub>CP</sub>	—	1	—	—	MHz
Clock Pulse Width	t <sub>WCP</sub>	—	63	—	—	ns
Data Setup Time IO <sub>n</sub> →CP	t <sub>setup</sub> *1	—	100	—	—	ns
Data Hold Time CP→IO <sub>n</sub>	t <sub>hold</sub> *1	—	100	—	—	ns
Rise Time / Fall Time of CP	t <sub>r</sub> (CP) t <sub>f</sub> (CP)	—	—	—	20	ns

\*1 IO<sub>n</sub>=IO<sub>1</sub>-IO<sub>160</sub>



## FUNCTIONAL DESCRIPTION

### Pin Functional Description

- IO<sub>1</sub>, IO<sub>80</sub>, IO<sub>81</sub>, IO<sub>160</sub>  
Data input/output pins for the two 80-bit bidirectional shift registers.
- SHL  
Input pin to select the shift direction of the two 80-bit bidirectional registers.  
Table 1 shows the relations between the SHL pin and the IO<sub>1</sub>, IO<sub>80</sub>, IO<sub>81</sub>, IO<sub>160</sub> pins.
- CP  
Clock pulse input pin for the two 80-bit bidirectional shift registers.  
Scan data shifts at the falling edge of a clock pulse.
- DF  
Signal input pin to synchronize with AC current for LCD driving waveforms.  
Normally an inverted frame signal is input to this pin.
- V<sub>DDL</sub>, V<sub>DDR</sub>, V<sub>SSL</sub>, V<sub>SSR</sub>  
Power supply pins.  
Normal operating conditions are V<sub>DDR</sub>=V<sub>DDL</sub>=2.7 to 5.5V, V<sub>SSR</sub>=V<sub>SSL</sub>=0V.
- DISPOFF  
Input pin to control the O<sub>1</sub> to O<sub>160</sub> outputs. During input of "L" level, V<sub>1</sub> levels are output from O<sub>1</sub> to O<sub>160</sub>.
- V<sub>1L</sub>, V<sub>1R</sub>, V<sub>2L</sub>, V<sub>2R</sub>, V<sub>5L</sub>, V<sub>5R</sub>, V<sub>EEL</sub>, V<sub>EER</sub>  
Bias voltage input pins for LCD driving. Voltages must be input to all these pins.
- O<sub>1</sub> to O<sub>160</sub>  
4-level driver output pins corresponding to each bit of the shift registers.  
The V<sub>1</sub>, V<sub>2</sub>, V<sub>5</sub>, or V<sub>EE</sub> level is selected and output based on the combination of shift register data and a DF signal.  
Table 2 shows the relations between the scan data and the LCD driving outputs.

**Table 1**

SHL	Shift direction	IO <sub>1</sub> , IO <sub>81</sub> / IO <sub>80</sub> , IO <sub>160</sub>	I/O	Input
L	O <sub>1</sub> →O <sub>80</sub>	IO <sub>1</sub> , IO <sub>81</sub>	Input	IO <sub>1</sub> and IO <sub>81</sub> are data input pins for the shift register. Data is input to these pins in synchronization with clocks and is output from IO <sub>80</sub> and IO <sub>160</sub> with delay by the number (80) of shift register bits in synchronization with clocks.
	O <sub>81</sub> →O <sub>160</sub>	IO <sub>80</sub> , IO <sub>160</sub>	Output	
H	O <sub>80</sub> →O <sub>1</sub>	IO <sub>80</sub> , IO <sub>160</sub>	Input	IO <sub>80</sub> and IO <sub>160</sub> are data input pins for the shift register. Data is input to these pins in synchronization with clocks and is output from IO <sub>1</sub> and IO <sub>81</sub> with delay by the number (80) of shift register bits in synchronization with clocks.
	O <sub>160</sub> →O <sub>81</sub>	IO <sub>1</sub> , IO <sub>81</sub>	Output	

**Table 2**

Scan data	LCD driving output
H	Select levels (V <sub>1</sub> , V <sub>EE</sub> )
L	Non-select levels (V <sub>2</sub> , V <sub>5</sub> )

**Truth Table**

<b>DF</b>	<b>Shift register data</b>	<b><math>\overline{\text{DISPOFF}}</math></b>	<b>Driver output level (O<sub>1</sub>-O<sub>160</sub>)</b>
L	L	H	V <sub>2</sub>
L	H	H	V <sub>EE</sub>
H	L	H	V <sub>5</sub>
H	H	H	V <sub>1</sub>
X	X	L	V <sub>1</sub>

X : Don't Care