Ordering number : EN*5953

CMOS IC

LC4131C

LCD Dot Matrix Common Driver for STN Displays

Preliminary

Overview

The LC4131C is a common driver for large-scale dot matrix LCD panels. It includes a 120-bit bidirectional shift register and 4-level LCD driver circuits. The number of bits can be further increased by using the provided input and output pins to connect multiple LC4131Cs in cascade. The LC4131C and LC4104C form a large-screen LCD panel driver chip set.

Features

- Fabricated in a CMOS (P-sub) high-voltage process.
- LCD drive voltage: 36 V
- Logic system power-supply voltage: 2.7 to 5.5 V
- fcp max: 2.5 MHz
- Slim chip (output pads are concentrated on one of the longer sides)
- Bidirectional shift register
- The shift register can be split into two 60-bit registers. (Two screens drivable)
- DISPOFF function that locks the drive voltages output to the LCD at fixed levels.
- Display duty: 1/160 to 1/480
- Appropriate for COG (chip on glass) mounting. (A gold bump structure is adopted in the pad areas.)

Specifications

The electrical characteristics values shown below are for devices encapsulated in the Sanyo standard PGA-208 package.

Absolute Maximum Ratings at V_{SS} = 0 V

Parameter	Symbol	Applicable pins	Ratings			Unit
			min	typ	max	
Supply voltage	V_{DD} max	V_{DD}	–0.3		7.0	V
	V_{EE} max	V_{EE}	–0.3		40.0	V
Input voltage	V_{SSH} max	V_{SSH}	–0.3		0.3	V
	V_{IN}	*1	–0.3		V_{DD} + 0.3	V
	V0, V1	V0, V1 *2	V_{EE} – 7.0		V_{EE} + 0.3	V
	V4	V4 *2	–0.3		V_{SS} + 7.0	V
	V5	V5 *2	–0.3		+0.3	V
Operating temperature	Topr		–20		+75	°C
Storage temperature	Tstg		–55		+125	°C

Note: 1. LOAD, RS/LS, DISP, DF, DIO1, DIO120, DMIN and MODE
2. The voltages V0, V1, V4, and V5 must obey the relationships $V_{EE} \geq V0 \geq V1 \geq V_{EE} - 7$ V, and $7 \text{ V} \geq V4 \geq V5 \geq V_{SSH}$.

Allowable Operating Ranges at V_{SS} = 0 V, Ta = –20 to +75°C

Parameter	Symbol	Applicable pins	Ratings			Unit
			min	typ	max	
Supply voltage	V_{DD}	V_{DD}	2.7		5.5	V
	V_{EE}	V_{EE}	14		36	V
	V_{SSH}	V_{SSH}		0		V
Input high-level voltage	V_{IH}	*1	$0.8 \times V_{DD}$		V_{DD}	V
Input low-level voltage	V_{IL}	*1	0		$0.2 \times V_{DD}$	V
Input voltage	V0, V1	V0, V1 *2	V_{EE} – 7.0		V_{EE}	V
	V4	V4 *2	0		V_{SSH} + 7.0	V
	V5	V5 *2		0		V

Note: 1. LOAD, RS/LS, DISP, DF, DIO1, DIO120, DMIN and MODE
2. The voltages V0, V1, V4, and V5 must obey the relationships $V_{EE} \geq V0 \geq V1 \geq V_{EE} - 7$ V, and $7 \text{ V} \geq V4 \geq V5 \geq V_{SSH}$.
When turning on the power supplies, first turn on the logic system power supply and then turn on the high-voltage system power supply; alternatively, turn both on at the same time.
When turning off the power supplies, first turn off the high-voltage system power supply and then turn off the logic system power supply; alternatively, turn both off at the same time.

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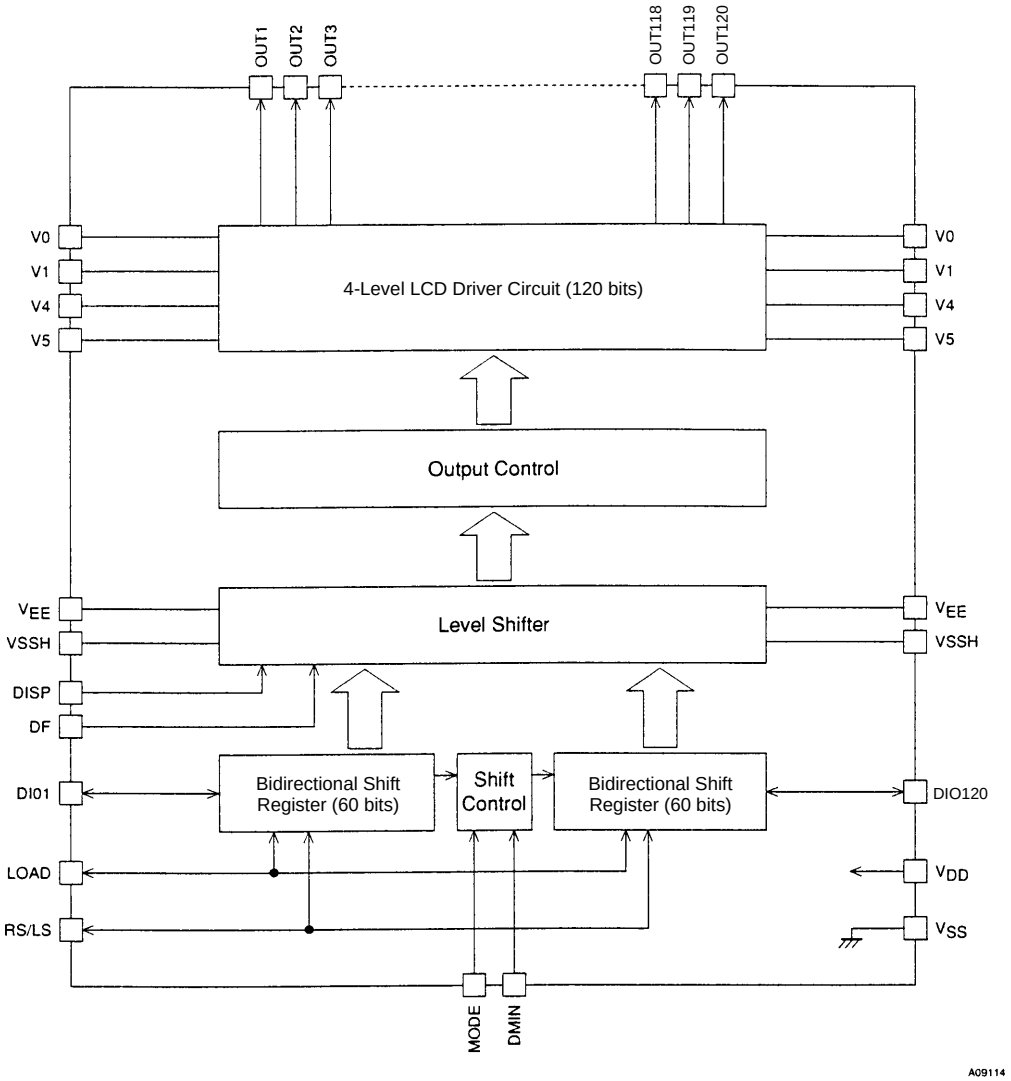
Electrical Characteristics at Ta = –20 to +75°C, V_{DD} = 2.7 to 5.5 V, V_{SS} = 0 V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Input high-level current	I_{IH}	$V_{IN} = V_{DD}$*1			1	µA
Input low-level current	I_{IL}	$V_{IN} = V_{SS}$*1	–1			
Output high-level voltage	V_{OH}	I_{OH} = –0.4 mA, DIO1, DIO120	$0.8 \times V_{DD}$		V_{DD}	V
Output low-level voltage	V_{OL}	I_{OL} = 0.4 mA, DIO1, DIO120	V_{SS}		$0.2 \times V_{DD}$	
Output on resistance	RON0	V_{OUT} = V0 – 0.5 V *2, OUT1 to 120			1000	Ω
	RON1	V_{OUT} = V1 – 0.5 V *2, OUT1 to 120			1000	
	RON4	V_{OUT} = V4 + 0.5 V *2, OUT1 to 120			1000	
	RON5	V_{OUT} = V5 + 0.5 V *2, OUT1 to 120			1000	
Current drain 1	I_{DD}	V_{DD}*3			200	µA
Current drain 2	I_{DDH}	V_{DD}*4			500	

Note: 1. LOAD, RS/LS, DISP, DF, DIO1, DIO120, DMIN and MODE
2. V_{OUT} is the voltage applied to on-state outputs. V0 = V_{EE}, V1 = 19/20 (V_{EE} – V_{SSH}), V4 = 1/20 (V_{EE} – V_{SSH}), V5 = V_{SSH}, V_{SSH} = V_{SS}
3. V_{DD} = 2.7 to 5.5 V, f_{CP} = 50 kHz
4. f_{DF} = 100 Hz, with no output load, V_{EE} = 36 V, for a single data shift

* This IC must be handled carefully enough because the ESD Is not so firm.

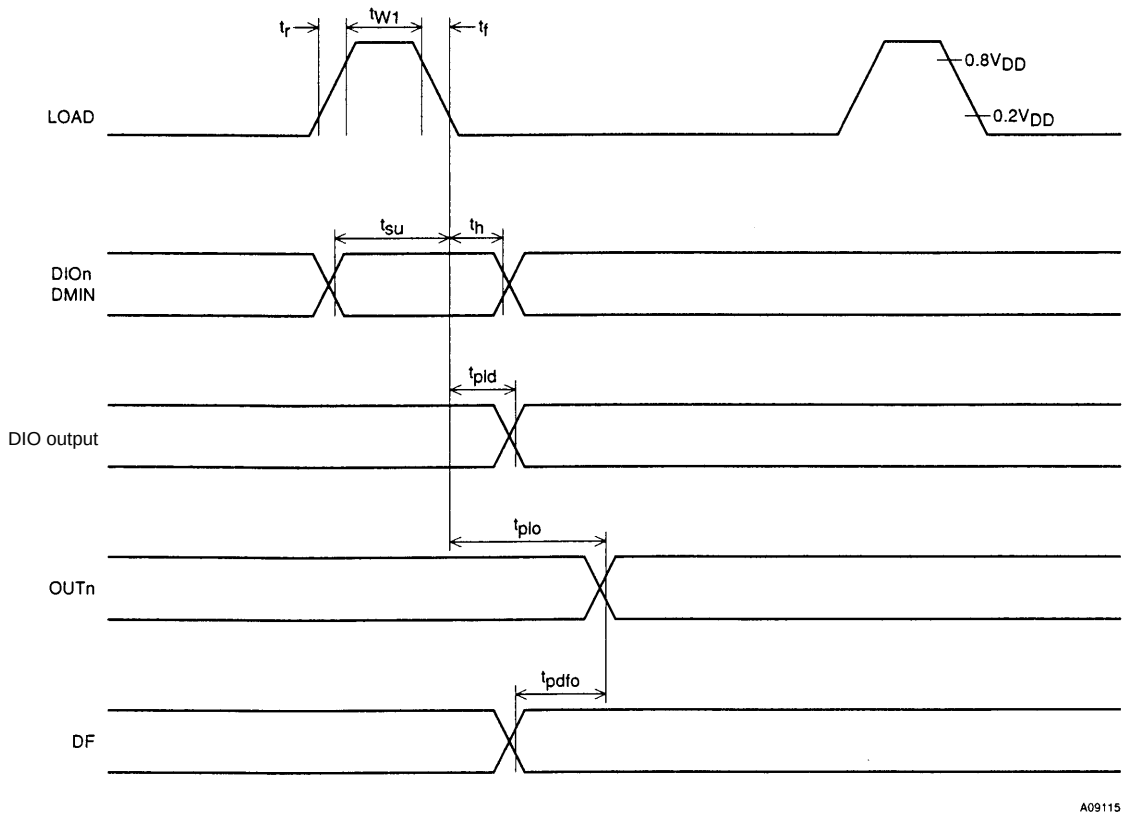
Block Diagram



Switching Characteristics at V_{DD} = 2.7 to 5.5 V, Ta = –20 to +75°C, V_{SS} = 0 V

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Clock frequency	fload	LOAD			2.5	MHz
High-level clock pulse width	twl	LOAD	100			ns
Input setup time	tsu	LOAD, DIOn, DMIN	100			
Input hold time	th	LOAD, DIOn, DMIN	30			
LOAD rise time	tr	LOAD			30	
LOAD fall time	tf	LOAD			30	
DIO output delay time	tpld	LOAD, DIOn: 30 pF capacitance load			200	
LOAD-on delay time	tplo	LOAD, OUTn: 100 pF capacitance load			1.0	µs
DF-on delay time	tpdfo	DF, OUTn: 100 pF capacitance load			1.0	

Switching Characteristics



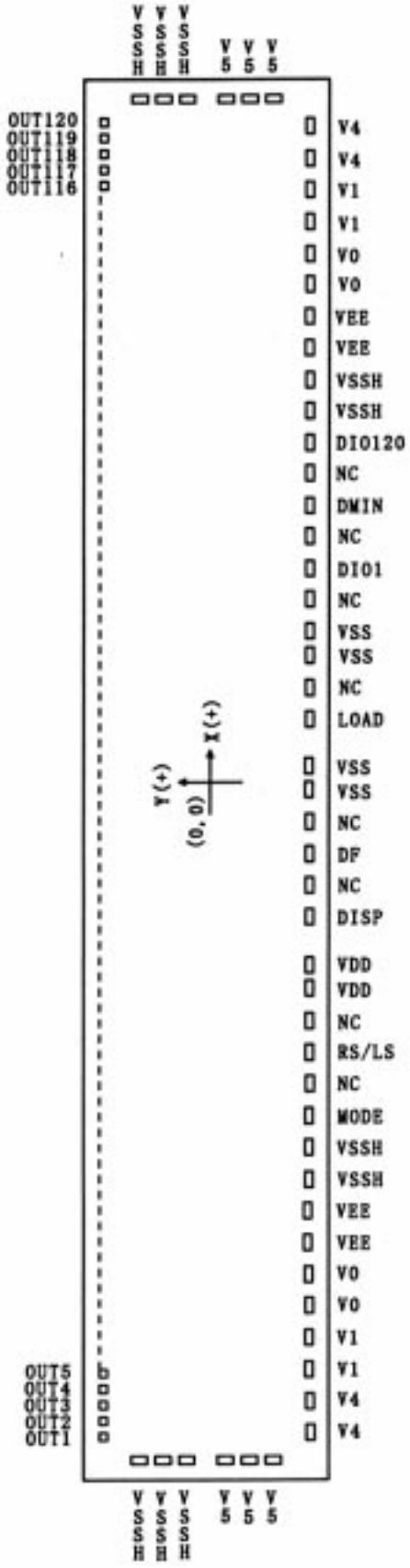
Pin Functions

<table>
<tr><th>Symbol</th><th>I/O</th><th>Function</th></tr>
<tr><td>OUT1 to
OUT120</td><td>O</td><td>LCD drive outputs

<table>
<tr><th>DF</th><th>Data</th><th>DISP</th><th>OUTn</th></tr>
<tr><td>L</td><td>H</td><td>H</td><td>V0</td></tr>
<tr><td>H</td><td>L</td><td>H</td><td>V1</td></tr>
<tr><td>L</td><td>L</td><td>H</td><td>V4</td></tr>
<tr><td>H</td><td>H</td><td>H</td><td>V5</td></tr>
<tr><td>*</td><td>*</td><td>L</td><td>V5</td></tr>
</table>
*: don’t care</td></tr>
<tr><td>V0
V1
V4
V5</td><td>I
I
I
I</td><td>V0 level drive voltage input
V1 level drive voltage input
V4 level drive voltage input
V5 level drive voltage input</td></tr>
<tr><td>V_{EE}</td><td>–</td><td>High-voltage block power supply</td></tr>
<tr><td>V_{SSH}</td><td>–</td><td>High-voltage block ground</td></tr>
<tr><td>DISP</td><td>I</td><td>All outputs will be held at a fixed V5 level when this pin is low.</td></tr>
<tr><td>DF</td><td>I</td><td>Alternation input</td></tr>
<tr><td>LOAD</td><td>I</td><td>Data shift pulse input (falling edge)</td></tr>
<tr><td>MODE
RS/LS
DIO1
DMIN
DIO120</td><td>I
I
I/O
I
I/O</td><td>Data shift direction specification input

<table>
<tr><th>MODE</th><th>RS/LS</th><th>Shift direction</th><th>DIO1</th><th>DIO160</th><th>DMIN</th></tr>
<tr><td>L</td><td>L</td><td>OUT120 → OUT1</td><td>OUT</td><td>IN</td><td>*</td></tr>
<tr><td>L</td><td>H</td><td>OUT1 → OUT120</td><td>IN</td><td>OUT</td><td>*</td></tr>
<tr><td>H</td><td>L</td><td>OUT120 → OUT61
OUT60 → OUT1</td><td>OUT</td><td>IN</td><td>IN</td></tr>
<tr><td>H</td><td>H</td><td>OUT1 → OUT60
OUT61 → OUT120</td><td>IN</td><td>OUT</td><td>IN</td></tr>
</table>
*: don’t care (Must be fixed at low or high.)</td></tr>
<tr><td>V_{DD}</td><td>—</td><td>Logic system power supply</td></tr>
<tr><td>V_{SS}</td><td>—</td><td>Logic system ground</td></tr>
</table>

Pad Assignment



Chip size : 12.11 x 2.00 mm

LC4131C Pad Coordinates

Pin	X coordinate	Y coordinate	Pad type	Pin	X coordinate	Y coordinate	Pad type
OUT1	–5652.9	718.5	B	OUT51	–902.9	718.5	B
OUT2	–5557.9	718.5	B	OUT52	–807.9	718.5	B
OUT3	–5462.9	718.5	B	OUT53	–712.9	718.5	B
OUT4	–5367.9	718.5	B	OUT54	–617.9	718.5	B
OUT5	–5272.9	718.5	B	OUT55	–522.9	718.5	B
OUT6	–5177.9	718.5	B	OUT56	–427.9	718.5	B
OUT7	–5082.9	718.5	B	OUT57	–332.9	718.5	B
OUT8	–4987.9	718.5	B	OUT58	–237.9	718.5	B
OUT9	–4892.9	718.5	B	OUT59	–142.9	718.5	B
OUT10	–4797.9	718.5	B	OUT60	–47.9	718.5	B
OUT11	–4702.9	718.5	B	OUT61	47.1	718.5	B
OUT12	–4607.9	718.5	B	OUT62	142.1	718.5	B
OUT13	–4512.9	718.5	B	OUT63	237.1	718.5	B
OUT14	–4417.9	718.5	B	OUT64	332.1	718.5	B
OUT15	–4322.9	718.5	B	OUT65	427.1	718.5	B
OUT16	–4227.9	718.5	B	OUT66	522.1	718.5	B
OUT17	–4132.9	718.5	B	OUT67	617.1	718.5	B
OUT18	–4037.9	718.5	B	OUT68	712.1	718.5	B
OUT19	–3942.9	718.5	B	OUT69	807.1	718.5	B
OUT20	–3847.9	718.5	B	OUT70	902.1	718.5	B
OUT21	–3752.9	718.5	B	OUT71	997.1	718.5	B
OUT22	–3657.9	718.5	B	OUT72	1092.1	718.5	B
OUT23	–3562.9	718.5	B	OUT73	1187.1	718.5	B
OUT24	–3467.9	718.5	B	OUT74	1282.1	718.5	B
OUT25	–3372.9	718.5	B	OUT75	1377.1	718.5	B
OUT26	–3277.9	718.5	B	OUT76	1472.1	718.5	B
OUT27	–3182.9	718.5	B	OUT77	1567.1	718.5	B
OUT28	–3087.9	718.5	B	OUT78	1622.1	718.5	B
OUT29	–2992.9	718.5	B	OUT79	1757.1	718.5	B
OUT30	–2897.9	718.5	B	OUT80	1852.1	718.5	B
OUT31	–2802.9	718.5	B	OUT81	1947.1	718.5	B
OUT32	–2707.9	718.5	B	OUT82	2042.1	718.5	B
OUT33	–2612.9	718.5	B	OUT83	2137.1	718.5	B
OUT34	–2517.9	718.5	B	OUT84	2232.1	718.5	B
OUT35	–2422.9	718.5	B	OUT85	2327.1	718.5	B
OUT36	–2327.9	718.5	B	OUT86	2422.1	718.5	B
OUT37	–2232.9	718.5	B	OUT87	2517.1	718.5	B
OUT38	–2137.9	718.5	B	OUT88	2612.1	718.5	B
OUT39	–2042.9	718.5	B	OUT89	2707.1	718.5	B
OUT40	–1947.9	718.5	B	OUT90	2802.1	718.5	B
OUT41	–1852.9	718.5	B	OUT91	2897.1	718.5	B
OUT42	–1757.9	718.5	B	OUT92	2992.1	718.5	B
OUT43	–1662.9	718.5	B	OUT93	3087.1	718.5	B
OUT44	–1567.9	718.5	B	OUT94	3182.1	718.5	B
OUT45	–1472.9	718.5	B	OUT95	3277.1	718.5	B
OUT46	–1377.9	718.5	B	OUT96	3372.1	718.5	B
OUT47	–1282.9	718.5	B	OUT97	3467.1	718.5	B
OUT48	–1187.9	718.5	B	OUT98	3562.1	718.5	B
OUT49	–1092.9	718.5	B	OUT99	3657.1	718.5	B
OUT50	–997.9	718.5	B	OUT100	3752.1	718.5	B

Pad type	Size
A	120 µm × 60 µm
B	75 µm × 60 µm
C	100 µm × 60 µm

Continued on next page.

Continued from preceding page.

Pin	X coordinate	Y coordinate	Pad type	Pin	X coordinate	Y coordinate	Pad type
OUT101	3847.1	718.5	B	V_{SS}	88.6	–804.0	A
OUT102	3942.1	718.5	B	LOAD	475.2	–804.0	A
OUT103	4037.1	718.5	B	Dammy	757.0	–804.0	A
OUT104	4132.1	718.5	B	Dammy	1502.6	–804.0	A
OUT105	4227.1	718.5	B	DIO1	1785.4	–804.0	A
OUT106	4322.1	718.5	B	Dammy	2065.4	–804.0	A
OUT107	4417.1	718.5	B	DMIN	2348.2	–804.0	A
OUT108	4512.1	718.5	B	Dammy	2631.0	–804.0	A
OUT109	4607.1	718.5	B	DIO120	2913.8	–804.0	A
OUT110	4702.1	718.5	B	V_{SSH}	3196.6	–803.8	A
OUT111	4797.1	718.5	B	V_{SSH}	3476.6	–803.8	A
OUT112	4892.1	718.5	B	V_{EE}	3756.6	–823.8	A
OUT113	4987.1	718.5	B	V_{EE}	4036.6	–823.8	A
OUT114	5082.1	718.5	B	V0	4316.6	–813.8	A
OUT115	5177.1	718.5	B	V0	4596.6	–813.8	A
OUT116	5272.1	718.5	B	V1	4876.6	–791.0	A
OUT117	5367.1	718.5	B	V1	5156.6	–791.0	A
OUT118	5462.1	718.5	B	V4	5436.6	–790.1	A
OUT119	5557.1	718.5	B	V4	5716.6	–790.1	A
OUT120	5652.1	718.5	B	V_{SS}	1039.8	–783.6	A
V4	–5713.8	–790.8	A	V_{SS}	1219.8	–783.6	A
V4	–5433.8	–790.8	A	V1	–5153.8	–786.9	A
V_{EE}	–4033.8	–813.8	A	V1	–4873.8	–786.9	A
V_{EE}	–3753.8	–813.8	A	V0	–4593.8	–786.9	A
V_{SSH}	–3473.8	–811.2	A	V0	–4313.8	–786.9	A
V_{SSH}	–3193.8	–811.2	A	V5	5895.0	–462.5	C
MODE	–2911.0	–804.0	A	V5	–5891.7	–459.5	C
Dammy	–2631.0	–804.0	A	V5	5895.0	–322.5	C
RSLS	–2347.2	–804.0	A	V5	–5891.7	–319.5	C
Dammy	–2065.4	–804.0	A	V5	5895.0	–182.5	C
V_{DD}	–1782.6	–804.0	A	V5	–5891.7	–179.5	C
V_{DD}	–1605.4	–804.0	A	V_{SSH}	–5885.7	87.5	C
DISP	–1219.8	–804.0	A	V_{SSH}	5885.6	87.5	C
Dammy	–939.8	–804.0	A	V_{SSH}	–5885.7	227.5	C
DF	–654.2	–804.0	A	V_{SSH}	5885.6	227.5	C
Dammy	–374.2	–804.0	A	V_{SSH}	–5885.7	367.5	C
V_{SS}	–91.4	–804.0	A	V_{SSH}	5885.6	367.5	C

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