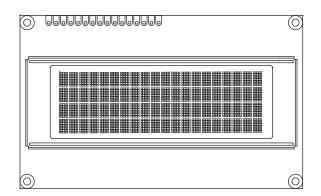


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COMPLIANT

20 x 4 Character OLED



FEATURES

• Type: character

• Display format: 20 x 4 characters

• Built-in controller: OLED-0010

Duty cycle: 1/16
+5 V power supply
Interface: 6800
With polarizer

• Material categorization: for definitions of compliance

please see www.vishay.com/doc?99912

MECHANICAL DATA						
ITEM	STANDARD VALUE	UNIT				
Module dimension	98.0 x 60.0 x 10.0 (max.)					
Viewing area	77.0 x 25.2					
Active area	70.16 x 20.95					
Dot size	0.54 x 0.55	mm				
Dot pitch	0.59 x 0.60	mm				
Mounting hole	93.0 x 55.0					
Character size	2.9 x 4.75					
Character pitch	3.54 x 5.4					

ABSOLUTE MAXIMUM RATINGS								
ITEM	SYMBOL	STANDAF	RD VALUE					
ITEM	SYMBOL	MIN.	MAX.	UNIT				
Supply voltage for logic	V _{DD} to V _{SS}	-0.3	5.3	V				
Operating temperature	T _{OP}	-40	+80	°C				
Storage temperature	T _{STG}	-40	+80	O				

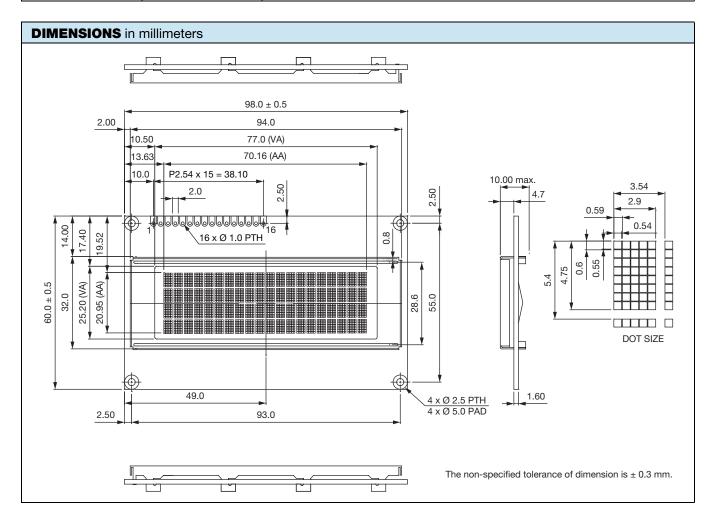
ELECTRICAL CHARACTERISTICS								
ITEM	CVMDOL	CONDITION	ST	ANDARD VAL	.UE	UNIT		
IIEWI	SYMBOL CONDITION		MIN.	TYP.	MAX.	UNII		
Supply voltage for logic	V _{DD} to V _{SS}	-	4.8	5.0	5.3			
Input high voltage	V _{IH}	-	0.8 V _{DD}	-	V_{DD}			
Input low voltage	V_{IL}	-	GND	-	0.2 V _{DD}	V		
Output high voltage	V _{OH}	$I_{OH} = -0.5 \text{ mA}$	0.8 V _{DD}	-	V_{DD}			
Output low voltage	V _{OL}	$I_{OL} = 0.5 \text{ mA}$	GND	-	0.2 V _{DD}			
50 % check board operating current	I _{DD}	$V_{DD} = 5 V$	46	55	73	mA		

Note

 $\bullet \quad \text{When you use 5 V for V_{DD} please do not use 3 V or 3.3 V for logic I/O this will cause module does not work}\\$

OPTIONS				
		EMITTING COLOR		
YELLOW GREEN RED BLUE WHITE				
Yes	-	=	=	=

INTERFACE PI	N FUNCTION	
PIN NO.	SYMBOL	FUNCTION
1	V _{SS}	Ground (0 V)
2	V_{DD}	Supply voltage for logic (5.0 V)
3	NC	No connection
4	RS	H / L, H: data; L: instruction code
5	R/W	H / L, H: read (module \rightarrow MPU); L: write (MPU \rightarrow module)
6	E	$H, H \rightarrow L$, chip enable signal
7	DB0	H / L, data bit 0
8	DB1	H / L, data bit 1
9	DB2	H / L, data bit 2
10	DB3	H / L, data bit 3
11	DB4	H / L, data bit 4
12	DB5	H / L, data bit 5
13	DB6	H / L, data bit 6
14	DB7	H / L, data bit 7
15	NC	No connection
16	NC	No connection





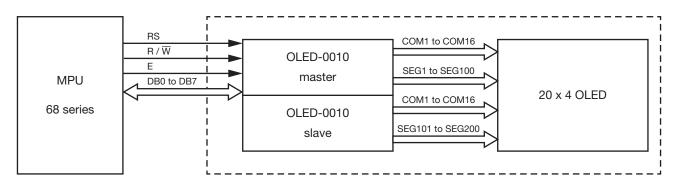
MODULE CLAS	SSIFICATION INFORMA	ATION					
OLED -	020 N 004 A	- L P P 5 N 0 0 000					
	2 3 4 5						
1	Brand	Vishay Intertechnology, Inc.					
2	Horizontal format	20 characters					
3	Display type	H: graphic type N: character type O: COG type Y: tab type					
4	Vertical format	4 lines					
5	Serials code	A					
6	Emitting color	A: amber B: blue C: full color G: green L: yellow R: red W: white Y: yellow green					
7	Polarizer	N: without polarizer P: with polarizer					
8	Display mode	A: active matrix P: passive matrix					
9	Driver voltage	3: 3.0 V to 3.3 V 5: 5.0 V					
10	Touch panel	N: without touch panel T: with touch panel					
11	Products type	0: standard 1: sunlight readable 2: transparent OLED (TOLED) 3: flexible OLED 4: OLED for lighting					
12	Product grades	0: standard (A level) 2: B level 3: C level 4: high class (AA level) 5: customer offerings					
13	Serial number	Application serial number (000 to ZZZ)					



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GENERAL SPECIFICATIONS						
ITEM	DIMENSION	UNIT				
Number of characters	20 characters x 4 lines					
Module dimension	98.0 x 60.0 x 10.0 (max.)	mm				
View area	77.0 x 25.2	mm				
Active area	70.16 x 20.95	mm				
Dot size	0.54 x 0.55	mm				
Dot pitch	0.59 x 0.60	mm				
Character size	2.9 x 4.75	mm				
Character pitch	3.54 x 5.4	mm				
Panel type	OLED, yellow					
Duty	1/16					

FUNCTION BLOCK DIAGRAM



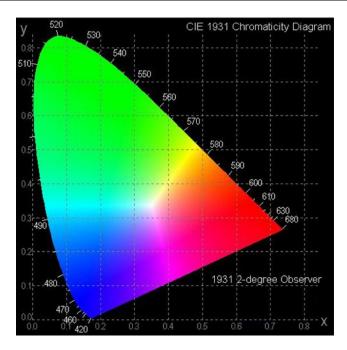
Address format	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0
CA (character address)	1	ADD6	ADD5	ADD4	ADD3	ADD2	ADD1	ADD0
				I				1

Display position	1	2	3	4	 	17	18	19	20
DD RAM address	00	01	02	03	 	00	01	02	03
DD RAM address	40	41	42	43	 	50	51	52	53
DD RAM address	14	15	16	17	 	24	25	26	27
DD RAM address	54	55	56	57	 	64	65	66	67



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OPTICAL CHARACTERISTICS								
ITEM	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT		
View angle	(V)θ		160	-	-	dog		
view arigie	(H)φ		160	-	-	deg		
Contrast ratio	CR	Dark	2000 : 1	-	-	-		
Response time	t _{rise}		=.	10	-	μs		
nesponse time	t _{fall}		=.	10	-	μs		
Display with 50 % check board brightness			70	80	-	cd/m ²		
CIE _x (yellow)	(CIE1931)		0.45	0.47	0.49			
CIE _y (yellow)	(CIE1931)		0.48	0.50	0.52			



OLED LIFETIME			
ITEM	CONDITIONS	MIN.	TYP.
Operating life time	T _A = 25 °C, initial 50 % check board brightness typical value	80 000 h	100 000 h

Notes

- Life time is defined the amount of time when the luminance has decayed to < 50 % of the initial value
- This analysis method uses life data obtained under accelerated conditions to extrapolate an estimated probability density function (PDF) for the product under normal use conditions
- Screen saving mode will extend OLED lifetime



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RELABILITY		
ENVIRONMENTAL TEST		
TEST ITEM	CONTENT OF TEST	TEST CONDITION
High temperature storage	Endurance test applying the high storage temperature for a long time	80 °C, 240 h
Low temperature storage	Endurance test applying the low storage temperature for a long time	-40 °C, 240 h
High temperature operation	Endurance test applying the electric stress (voltage and current) and the thermal stress to the element for a long time	80 °C, 240 h
Low temperature operation	Endurance test applying the electric stress under low temperature for a long time	-40 °C, 240 h
High temperature / humidity storage	Endurance test applying the high temperature and high humidity storage for a long time	60 °C, 90 % RH, 240 h
Temperature cycle	Endurance test applying the low and high temperature cycle -40 °C 25 °C 80 °C 30 min 5 min 30 min	-40 °C / 80 °C, 100 cycles
	1 cycle	
MECHANICAL TEST		
Vibration test	Endurance test applying the vibration during transportation and using	10 Hz to 22 Hz for 1.5 mm peak-to-peak, 22 Hz to 500 Hz for 1.5 <i>g</i> , total 0.5 h
Shock test	Constructional and mechanical endurance test applying the shock during transportation	50 g half sin wave 11 ms, 3 times of each direction
Atmospheric pressure test	Endurance test applying the atmospheric pressure during transportation by air	115 mbar, 40 h
OTHERS		
Static electricity test	Endurance test applying the electric stress to the terminal	$V_S = \pm 600$ V (contact), ± 800 V (air), $R_S = 330$ Ω , $C_S = 150$ pF, 10 times

Note

Supply voltage for OLED system = operating voltage at 25 °C

TEST AND MEASUREMENT CONDITIONS

- 1. All measurements shall not be started until the specimens attain to temperature stability. After the completion of the described reliability test, the samples were left at room temperature for 2 hours prior to conducting the failure test at $23 \,^{\circ}\text{C} \pm 5 \,^{\circ}\text{C}$, $55 \,^{\circ}\text{M} \pm 15 \,^{\circ}\text{RH}$
- 2. All-pixels-on is used as operation test pattern
- 3. The degradation of polarizer are ignored for high temperature storage, high temperature / humidity storage, temperature cycle

EVALUATION CRITERIA

- 4. The function test is OK
- 5. No observable defects
- 6. Luminance: > 50 % of initial value
- 7. Current consumption: within ± 50 % of initial value

APPENDIX: RESIDUE IMAGE

Because the pixels are lighted in different time, the luminance of active pixels may reduce or differ from inactive pixels. Therefore, the residue image will occur. To avoid the residue image, every pixel needs to be lighted up uniformly.



INSI	PECTION SPECII	ECATION					
NO.	ITEM		CRITERIO	N		AQL	
01	Electrical testing	 1.1 Missing vertical, horizontal segment, segment contrast defect 1.2 Missing character, dot or icon 1.3 Display malfunction 1.4 No function or no display 1.5 Current consumption exceeds product specifications 1.6 OLED viewing angle defect 1.7 Mixed product types 		0.65			
		1.8 Contrast defect					
02	Black or white spots on OLED (display only)	 2.1 White and black spots on display ≤ 0.25 mm, no more than three white or black spots present 2.2 Densely spaced: no more than two spots or lines within 3 mm 			2.5		
		3.1 Round type: as following	drawing	SIZE	ACCEPTABLE QTY		
		$\Phi = (x + y)/2$ $\Rightarrow \times = $		Φ ≤ 0.10	Accept no dense		
				0.10 < Φ ≤ 0.20	2	2.5	
		У		$0.20 < \Phi \le 0.25$	1		
	OLED black spots,	_ 		0.25 < Ф	0		
03	white spots, contamination					2.5	
	(non-display)	3.2 Line type	LENGTH	WIDTH	ACCEPTABLE QTY		
		(as following drawing)	-	W ≤ 0.02	Accept no dense		
			L ≤ 3.0	0.02 < W ≤ 0.03	2		
			L ≤ 2.5	0.03 < W ≤ 0.05	A		
			-	0.05 < W	As round type		
	Polarizer bubbles		SIZE ACCEPTABLE QT				
		If bubbles are visible, judge using black spot $\Phi \le 0.20$ Accept no dense $0.20 < 0.50$ 3			3	2.5	
04		specifications, not easy to find, must check in specify direction. $ \frac{0.50 < \Phi \le 1.00}{0.50 < \Phi} = \frac{0}{0} $					
				Total QTY	3		
05	Scratches	Follow no. 3 OLED black spots, white spots, contamination					
	Chipped glass	Symbols: x: chip length k: seal width l: electrode pad length 6.1 General glass chip: 6.1.1 Chip on panel surface and	y: chip width t: glass thickness d crack between pane	els:	z: chip thickness a: OLED side length		
06		z: chip thickness y: chip width x: chip length $z \le 1/2$ t Not over viewing area $z \le 1/8$ a Note • If there are 2 or more chips, x is total length of each chip			2.5		



	PECTION SPEC	IFICATION			1
NO.	ITEM		CRITERION		AQL
06	Chipped glass	6.1.2 Corner crack:	X Z Y		2.5
		z: chip thickness	y: chip width	x: chip length	
		z ≤ 1/2 t	Not over viewing area	x ≤ 1/8 a	
		1/2 t < z ≤ 2 t	Not exceed 1/3 k	x ≤ 1/8 a	
		Note	s, x is total length of each chip		
		Symbols: x: chip length k: seal width l: electrode pad length 6.2 Protrusion over termin	y: chip width t: glass thickness	z: chip thickness a: OLED side length	
			× ×	z	
		y: chip width	x: chip length	z: chip thickness	
		y ≤ 0.5 mm	x ≤ 1/8 a	0 < z ≤ t	
		6.2.2 Non-conductive portion			
06	Glass crack	y 1 _z		, , , , , , , , , , , , , , , , , , ,	2.5
		y: chip width	x: chip length	z: chip thickness	
		y ≤ l	x ≤ 1/8 a	0 < z ≤ t	
		according to electrode terr	sealed by the customer, the alignment		
			ack is not acceptable		2.





INSPECTION SPECIFICATION				
NO.	ITEM	CRITERION	AQL	
		8.1 Illumination source flickers when lit	0.65	
08	Backlight elements	8.2 Spots or scratched that appear when lit must be judged. Using OLED spot, lines and contamination standards	2.5	
		8.3 Backlight does not light or color wrong	0.65	
09	Bezel	9.1 Bezel may not have rust, be deformed or have fingerprints, stains or other contamination	2.5	
09		9.2 Bezel must comply with job specifications	0.65	
		10.1 COB seal may not have pinholes larger than 0.2 mm or contamination	2.5	
		10.2 COB seal surface may not have pinholes through to the IC	2.5	
		10.3 The height of the COB should not exceed the height indicated in the assembly diagram	0.65	
	PCB, COB	10.4 There may not be more than 2 mm of sealant outside the seal area on the PCB. And there should be no more than three places	2.5	
10		10.5 No oxidation or contamination PCB terminals	2.5	
		10.6 Parts on PCB must be the same as on the production characteristic chart. There should be no wrong parts, missing parts or excess parts	0.65	
		10.7 The jumper on the PCB should conform to the product characteristic chart	0.65	
		10.8 If solder gets on bezel tab pads, OLED pad, zebra pad or screw hold pad, make sure it is smoothed down	2.5	
	Soldering	11.1 No un-melted solder paste may be present on the PCB	2.5	
11		11.2 No cold solder joints, missing solder connections, oxidation or icicle	2.5	
''		11.3 No residue or solder balls on PCB	2.5	
		11.4 No short circuits in components on PCB	0.65	
		12.1 No oxidation, contamination, curves or, bends on interface pin (OLB) of TCP	2.5	
		12.2 No cracks on interface pin (OLB) of TCP	0.65	
		12.3 No contamination, solder residue or solder balls on product	2.5	
		12.4 The IC on the TCP may not be damaged, circuits	2.5	
	General appearance	12.5 The uppermost edge of the protective strip on the interface pin must be present or look as if it cause the interface pin to sever	2.5	
12		12.6 The residual rosin or tin oil of soldering (component or chip component) is not burned into brown or black color	2.5	
		12.7 Sealant on top of the ITO circuit has not hardened	2.5	
		12.8 Pin type must match type in specification sheet	0.65	
		12.9 OLED pin loose or missing pins	0.65	
		12.10 Product packaging must the same as specified on packaging specification sheet	0.65	
		12.11 Product dimension and structure must conform to product specification sheet	0.65	



CHECK ITEM	CLASSIFICATION	CRITERIA
No display	Major	
Missing line	Major	
Wissing line		
Pixel short	Major	
Darker short	Major	
Wrong display	Major	
Un-uniform	Major	
B/A x 100 % < 70 % A/C x 100 % < 70 %		A Normal B Dark pixel C Light pixel

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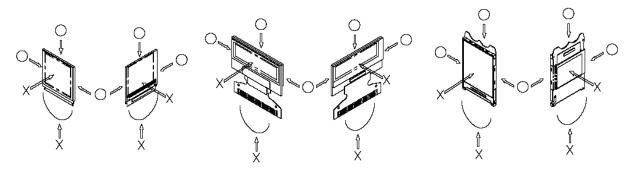
PRECAUTIONS IN USE OF OLED MODULES

MODULES

- 1. Avoid applying excessive shocks to module or making any alterations or modifications to it
- 2. Do not make extra holes on the printed circuit board, modify its shape or change the components of OLED display module
- 3. Do not disassemble the OLED display module
- 4. Do not operate it above the absolute maximum rating
- 5. Do not drop, bend or twist OLED display module
- 6. Soldering: only to the I/O terminals
- 7. Storage: please storage in anti-static electricity container and clean environment
- 8. It is pretty common to use "screen saver" to extend the lifetime and do not use fix information for long time in real application
- 9. Do not use fixed information in OLED panel for long time, that will extend "screen burn" effect time
- 10. Vishay has the right to change the passive components, including R2 and R3 adjust resistors. (Resistors, capacitors, and other passive components will have different appearance and color caused by the different supplier)
- 11. Vishay have the right to change the PCB Rev. (In order to satisfy the supplying stability, management optimization, and the best product performance... etc, under the premise of not affecting the electrical characteristics and external dimensions, Vishay have the right to modify the version)

HANDLING PRECAUTIONS

- 1. Since the display panel is being made of glass, do not apply mechanical impacts such us dropping from a high position
- 2. If the display panel is broken by some accident and the internal organic substance leaks out, be careful not to inhale nor lick the organic substance
- 3. If pressure is applied to the display surface or its neighborhood of the OLED display module, the cell structure may be damaged and be careful not to apply pressure to these sections
- 4. The polarizer covering the surface of the OLED display module is soft and easily scratched. Please be careful when handling the OLED display module
- 5. When the surface of the polarizer of the OLED display module has soil, clean the surface. It takes advantage of by using following adhesion tape
- Scotch mending tape no. 810 or an equivalent
 Never try to breathe upon the soiled surface nor wipe the surface using cloth containing solvent such as ethyl alcohol, since
 the surface of the polarizer will become cloudy. Also, pay attention that the following liquid and solvent may spoil the
 polarizer:
 - Water
 - Ketone
 - Aromatic solvents
- 6. Hold OLED display module very carefully when placing OLED display module into the system housing. Do not apply excessive stress or pressure to OLED display module. And, do not over bend the film with electrode pattern layouts. These stresses will influence the display performance. Also, secure sufficient rigidity for the outer cases



- 7. Do not apply stress to the LSI chips and the surrounding molded sections
- 8. Do not disassemble nor modify the OLED display module
- 9. Do not apply input signals while the logic power is off

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- 10. Pay sufficient attention to the working environments when handing OLED display modules to prevent occurrence of element breakage accidents by static electricity
 - Be sure to make human body grounding when handling OLED display modules
 - · Be sure to ground tools to use or assembly such as soldering irons

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- . To suppress generation of static electricity, avoid carrying out assembly work under dry environments
- Protective film is being applied to the surface of the display panel of the OLED display module. Be careful since static electricity may be generated when exfoliating the protective film
- 11. Protection film is being applied to the surface of the display panel and removes the protection film before assembling it. At this time, if the OLED display module has been stored for a long period of time, residue adhesive material of the protection film may remain on the surface of the display panel after removed of the film. In such case, remove the residue material by the method introduced in the above no. 5
- 12. If electric current is applied when the OLED display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful to avoid the above

STORAGE PRECAUTIONS

- 1. When storing OLED display modules, put them in static electricity preventive bags avoiding exposure to direct sun light nor to lights of fluorescent lamps and, also, avoiding high temperature and high humidity environment or low temperature (less than 0 °C) environments. We recommend you to store these modules in the packaged state when they were shipped from Vishay. At that time, be careful not to let water drops adhere to the packages or bags nor let dewing occur with them
- 2. If electric current is applied when water drops are adhering to the surface of the OLED display module, when the OLED display module is being dewed or when it is placed under high humidity environments, the electrodes may be corroded and be careful about the above

DESIGNING PRECAUTIONS

- 1. The absolute maximum ratings are the ratings which cannot be exceeded for OLED display module, and if these values are exceeded, panel damage may be happen
- 2. To prevent occurrence of malfunctioning by noise, pay attention to satisfy the VIL and VIH specifications and, at the same time, to make the signal line cable as short as possible
- 3. We recommend you to install excess current preventive unit (fuses, etc.) to the power circuit (VDD) (recommend value: 0.5 A)
- 4. Pay sufficient attention to avoid occurrence of mutual noise interference with the neighboring devices
- 5. As for EMI, take necessary measures on the equipment side basically
- 6. When fastening the OLED display module, fasten the external plastic housing section
- 7. If power supply to the OLED display module is forcibly shut down by such errors as taking out the main battery while the OLED display panel is in operation, we cannot guarantee the quality of this OLED display module
 - Connection (contact) to any other potential than the above may lead to rupture of the IC

PRECAUTIONS WHEN DISPOSING OF THE OLED DISPLAY MODULES

1. Request the qualified companies to handle industrial wastes when disposing of the OLED display modules. Or, when burning them, be sure to observe the environmental and hygienic laws and regulations

OTHER PRECAUTIONS

- 1. When an OLED display module is operated for a long of time with fixed pattern may remain as an after image or slight contrast deviation may occur. Nonetheless, if the operation is interrupted and left unused for a while, normal state can be restored. Also, there will be no problem in the reliability of the module
- 2. To protect OLED display modules from performance drops by static electricity rapture, etc., do not touch the following sections whenever possible while handling the OLED display modules
 - · Pins and electrodes
 - Pattern layouts such as the TCP and FPC
- 3. With this OLED display module, the OLED driver is being exposed. Generally speaking, semiconductor elements change their characteristics when light is radiated according to the principle of the solar battery. Consequently, if this OLED driver is exposed to light, malfunctioning may occur
 - Design the product and installation method so that the OLED driver may be shielded from light in actual usage
 - · Design the product and installation method so that the OLED driver may be shielded from light during the inspection processes

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- 4. Although this OLED display module stores the operation state data by the commands and the indication data, when excessive external noise, etc. enters into the module, the internal status may be changed. It therefore is necessary to take appropriate measures to suppress noise generation or to protect from influences of noise on the system design
- 5. We recommend you to construct its software to make periodical refreshment of the operation statuses (re-setting of the commands and re-transference of the display data) to cope with catastrophic noise
- 6. Resistors, capacitors, and other passive components will have different appearance and color caused by the different supplier
- 7. Our company will has the right to upgrade and modify the product function



Legal Disclaimer Notice

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