

To our customers,

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## Old Company Name in Catalogs and Other Documents

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April 1<sup>st</sup>, 2010  
Renesas Electronics Corporation

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# HD74HCT138

## 3-to-8-line Decoder/Demultiplexer

REJ03D0659-0200  
 (Previous ADE-205-547)  
 Rev.2.00  
 Mar 30, 2006

### Description

The HD74HCT138 has 3 binary select inputs (A, B, and C). If the device is enabled these inputs determine which one of the eight normally high outputs will go low. Two active low and one active high enables ( $G_1$ ,  $G_{2A}$  and  $G_{2B}$ ) are provided to ease the cascading of decoders.

### Features

- High Speed Operation:  $t_{pd}$  (A, B, C to Y) = 16.5 ns typ ( $C_L = 50$  pF)
- High Output Current: Fanout of 10 LSTTL Loads
- Wide Operating Voltage:  $V_{CC} = 2$  V to 6 V
- Low Input Current: 1  $\mu$ A max
- Low Quiescent Supply Current:  $I_{CC}$  (static) = 4  $\mu$ A max ( $T_a = 25^\circ\text{C}$ )
- Ordering Information

Part Name	Package Type	Package Code (Previous Code)	Package Abbreviation	Taping Abbreviation (Quantity)
HD74HCT138P	DILP-16 pin	PRDP0016AE-B (DP-16FV)	P	—
HD74HCT138FPEL	SOP-16 pin (JEITA)	PRSP0016 DH-B (FP-16DAV)	FP	EL (2,000 pcs/reel)

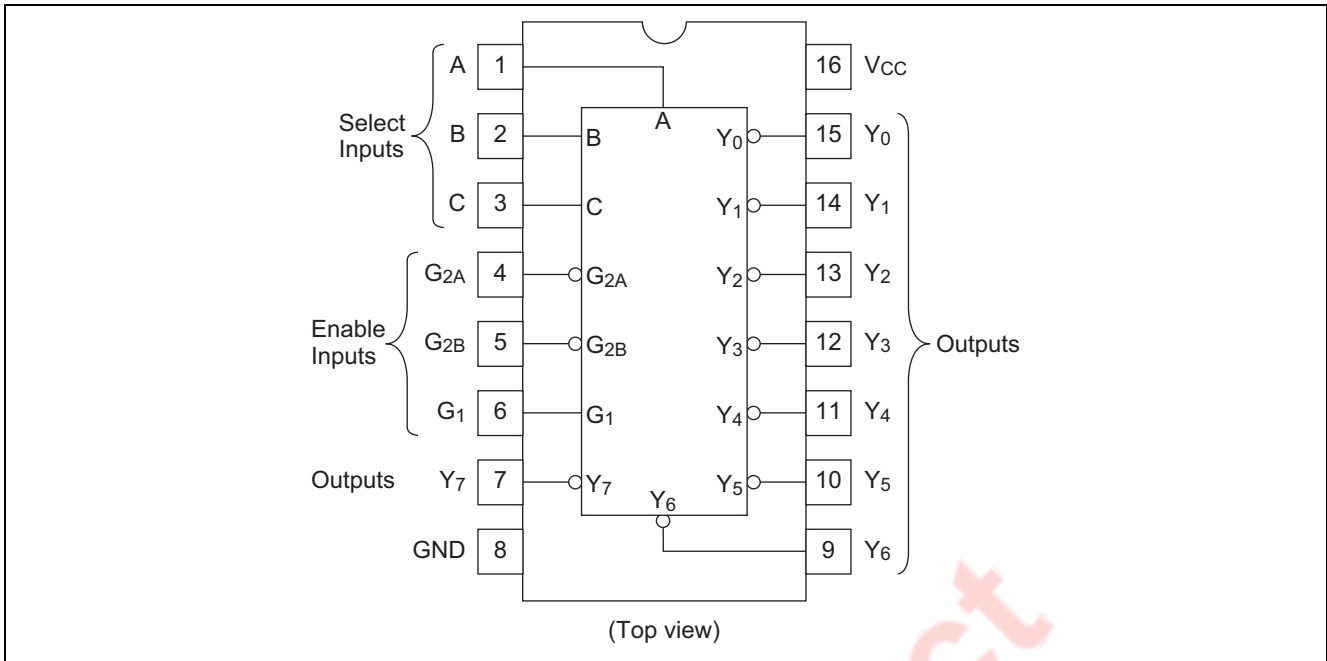
Note: Please consult the sales office for the above package availability.

### Function Table

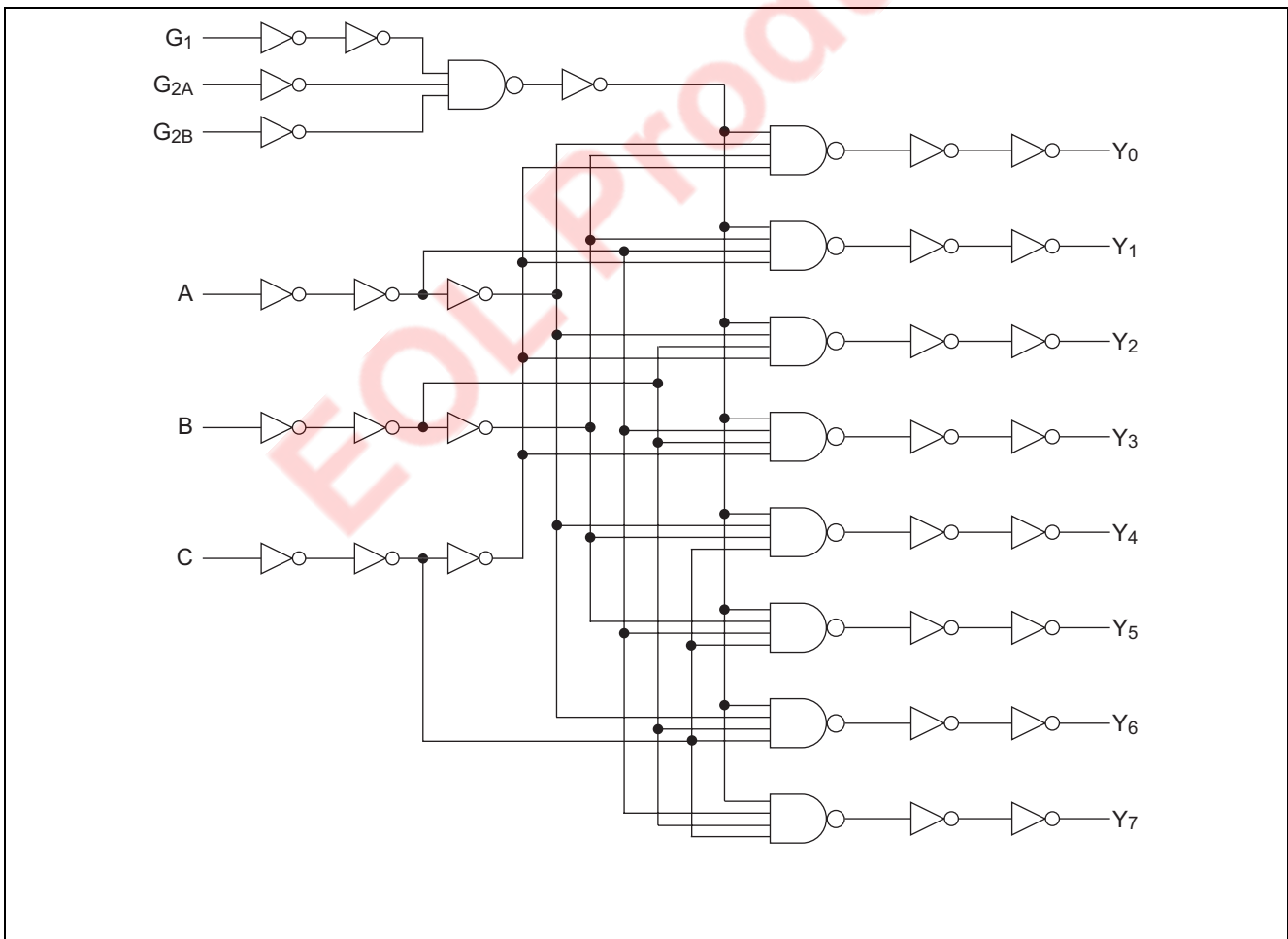
Inputs						Outputs							
Enable			Select										
$G_1$	$G_{2A}$	$G_{2B}$	C	B	A	$Y_0$	$Y_1$	$Y_2$	$Y_3$	$Y_4$	$Y_5$	$Y_6$	$Y_7$
X	X	H	X	X	X	H	H	H	H	H	H	H	H
X	H	X	X	X	X	H	H	H	H	H	H	H	H
L	X	X	X	X	X	H	H	H	H	H	H	H	H
H	L	L	L	L	L	L	H	H	H	H	H	H	H
H	L	L	L	L	H	H	L	H	H	H	H	H	H
H	L	L	L	H	L	H	H	L	H	H	H	H	H
H	L	L	L	H	H	H	H	H	L	H	H	H	H
H	L	L	H	L	L	H	H	H	H	L	H	H	H
H	L	L	H	L	H	H	H	H	H	H	L	H	H
H	L	L	H	H	L	H	H	H	H	H	H	L	H
H	L	L	H	H	H	H	H	H	H	H	H	H	L

H : High level  
 L : Low level  
 X : Irrelevant

Pin Arrangement



Logic Diagram



### Absolute Maximum Ratings

Item	Symbol	Rating	Unit
Supply voltage range	$V_{CC}$	-0.5 to +7.0	V
Input voltage	$V_{IN}$	-0.5 to $V_{CC} + 0.5$	V
Output voltage	$V_{OUT}$	-0.5 to $V_{CC} + 0.5$	V
Output current	$I_{OUT}$	$\pm 25$	mA
DC current drain per $V_{CC}$ , GND	$I_{CC}$ , $I_{GND}$	$\pm 50$	mA
DC input diode current	$I_{IK}$	$\pm 20$	mA
DC output diode current	$I_{OK}$	$\pm 20$	mA
Power dissipation per package	$P_T$	500	mW
Storage temperature	$T_{stg}$	-65 to +150	°C

Note: The absolute maximum ratings are values, which must not individually be exceeded, and furthermore, no two of which may be realized at the same time.

### Recommended Operating Conditions

Item	Symbol	Ratings	Unit	Conditions
Supply voltage	$V_{CC}$	4.5 to 5.5	V	
Input / Output voltage	$V_{IN}$ , $V_{OUT}$	0 to $V_{CC}$	V	
Operating temperature	$T_a$	-40 to 85	°C	
Input rise / fall time <sup>*1</sup>	$t_r$ , $t_f$	0 to 500	ns	$V_{CC} = 4.5 V$

Notes: 1. This item guarantees maximum limit when one input switches.

Waveform: Refer to test circuit of switching characteristics.

### Electrical Characteristics

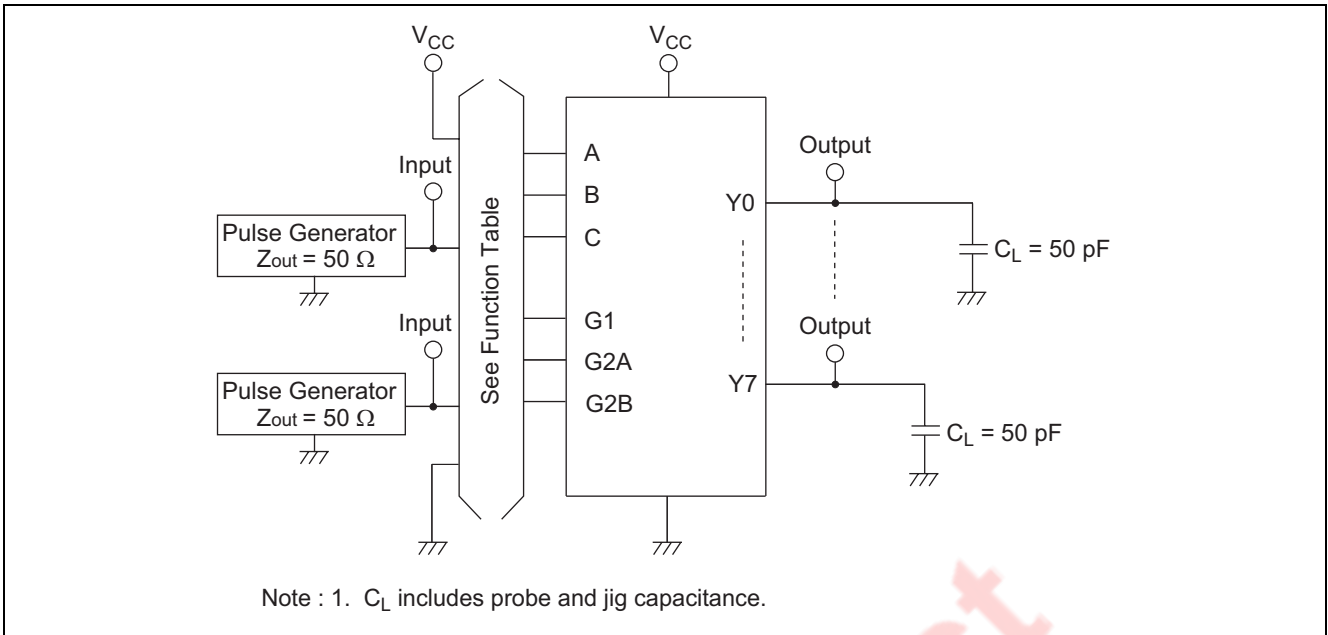
Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ C$			$T_a = -40 \text{ to } +85^\circ C$		Unit	Test Conditions	
			Min	Typ	Max	Min	Max			
Input voltage	$V_{IH}$	4.5 to 5.5	2.0	—	—	2.0	—	V		
	$V_{IL}$	4.5 to 5.5	—	—	0.8	—	0.8	V		
Output voltage	$V_{OH}$	4.5	4.4	—	—	4.4	—	V	$V_{in} = V_{IH} \text{ or } V_{IL}$	$I_{OH} = -20 \mu A$
		4.5	4.18	—	—	4.13	—	V		$I_{OH} = -4 \text{ mA}$
	$V_{OL}$	4.5	—	—	0.1	—	0.1	V	$V_{in} = V_{IH} \text{ or } V_{IL}$	$I_{OL} = 20 \mu A$
		4.5	—	—	0.26	—	0.33	V		$I_{OL} = 4 \text{ mA}$
Input current	$I_{in}$	5.5	—	—	$\pm 0.1$	—	$\pm 1.0$	$\mu A$	$V_{in} = V_{CC} \text{ or } GND$	
Quiescent supply current	$I_{CC}$	5.5	—	—	4.0	—	40	$\mu A$	$V_{in} = V_{CC} \text{ or } GND, I_{out} = 0 \mu A$	

### Switching Characteristics

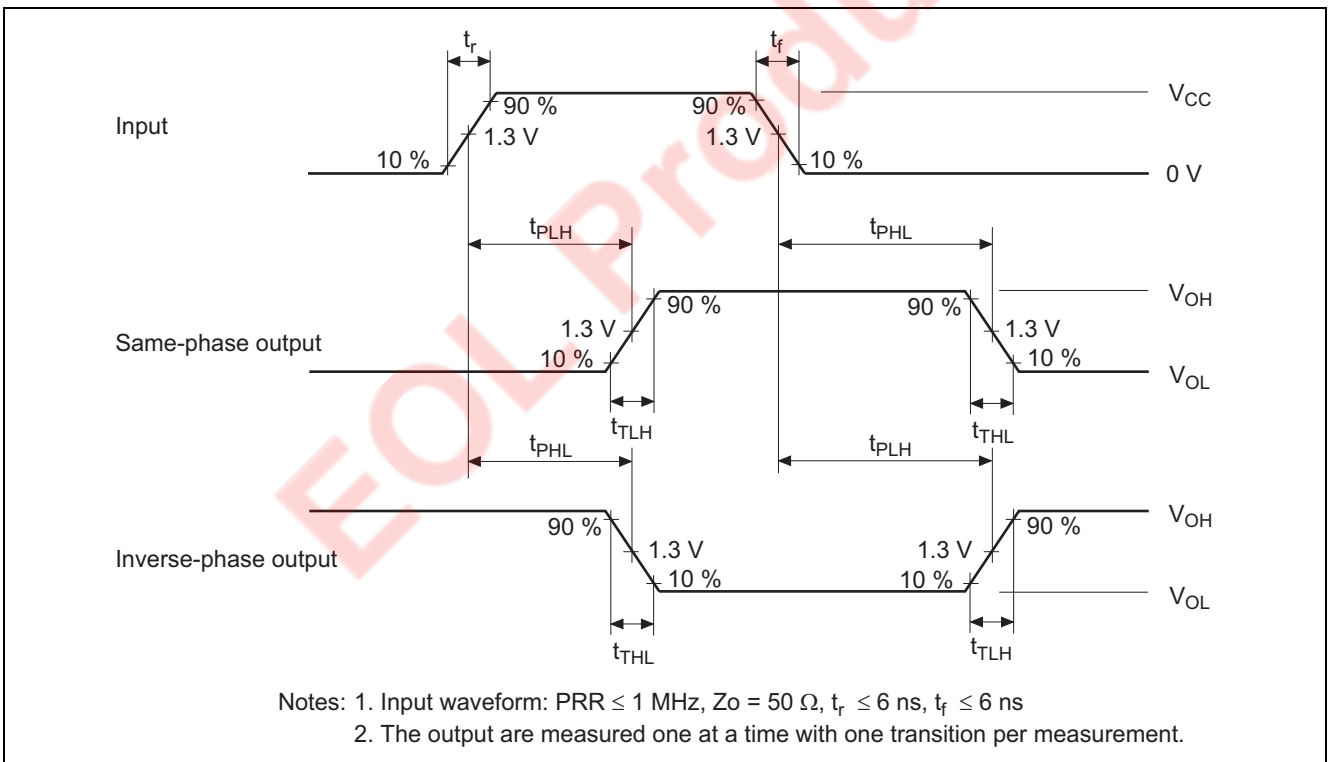
( $C_L = 50 \text{ pF}$ , Input  $t_r = t_f = 6 \text{ ns}$ )

Item	Symbol	$V_{CC}$ (V)	$T_a = 25^\circ C$			$T_a = -40 \text{ to } +85^\circ C$		Unit	Test Conditions	
			Min	Typ	Max	Min	Max			
Propagation delay time	$t_{PHL}$	4.5	—	18	35	—	44	ns	A, B or C to output	
	$t_{PLH}$	4.5	—	19	30	—	38	ns		
	$t_{PHL}$	4.5	—	17	30	—	38	ns	G <sub>1</sub> to output	
	$t_{PLH}$	4.5	—	17	30	—	38	ns		
	$t_{PHL}$	4.5	—	17	35	—	44	ns	G <sub>2A</sub> or G <sub>2B</sub> to output	
	$t_{PLH}$	4.5	—	17	30	—	38	ns		
Output rise/fall time	$t_{TLH}$ $t_{THL}$	4.5	—	5	15	—	19	ns		
Input capacitance	$C_{in}$	—	—	5	10	—	10	pF		

Test Circuit

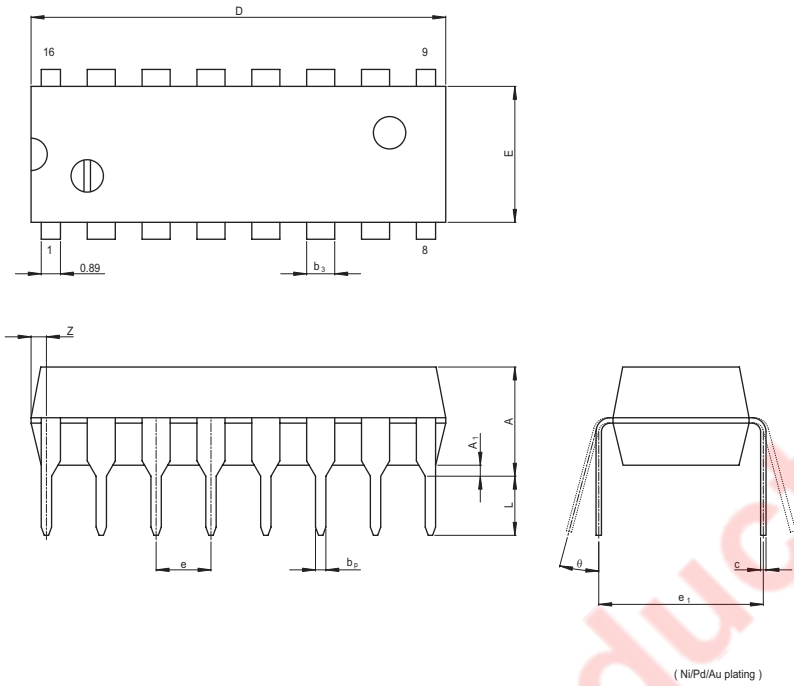


Waveforms



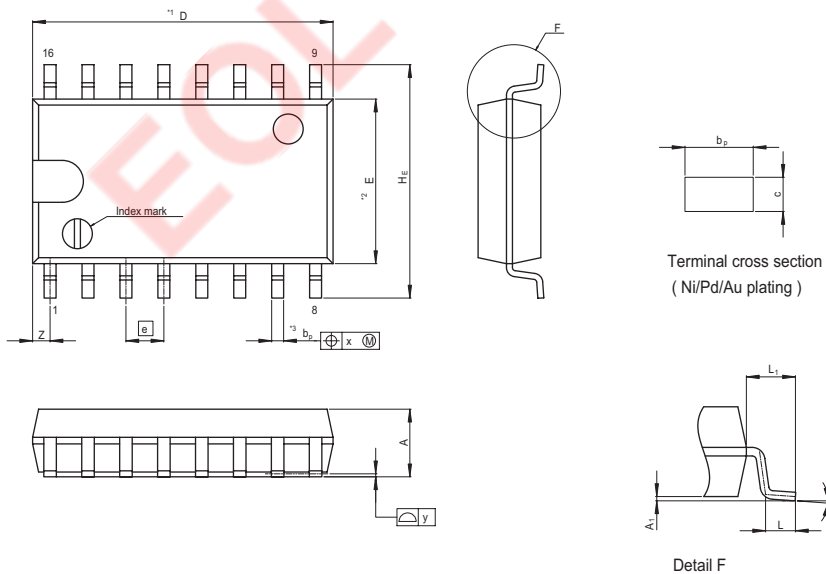
Package Dimensions

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-DIP16-6.3x19.2-2.54	PRDP0016AE-B	DP-16FV	1.05g



Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
e <sub>1</sub>	—	7.62	—
D	—	19.2	20.32
E	—	6.3	7.4
A	—	—	5.06
A <sub>1</sub>	0.51	—	—
b <sub>P</sub>	0.40	0.48	0.56
b <sub>3</sub>	—	1.30	—
c	0.19	0.25	0.31
θ	0°	—	15°
e	2.29	2.54	2.79
Z	—	—	1.12
L	2.54	—	—

JEITA Package Code	RENESAS Code	Previous Code	MASS[Typ.]
P-SOP16-5.5x10.06-1.27	PRSP0016DH-B	FP-16DAV	0.24g



NOTE  
 1. DIMENSIONS\*\*1 (Nom)\*\*AND\*\*2\*  
 DO NOT INCLUDE MOLD FLASH.  
 2. DIMENSION\*\*3\*DOES NOT  
 INCLUDE TRIM OFFSET.

Reference Symbol	Dimension in Millimeters		
	Min	Nom	Max
D	—	10.06	10.5
E	—	5.50	—
A <sub>2</sub>	—	—	—
A <sub>1</sub>	0.00	0.10	0.20
A	—	—	2.20
b <sub>P</sub>	0.34	0.40	0.46
b <sub>1</sub>	—	—	—
c	0.15	0.20	0.25
c <sub>1</sub>	—	—	—
θ	0°	—	8°
H <sub>E</sub>	7.50	7.80	8.00
⊕	—	1.27	—
x	—	—	0.12
y	—	—	0.15
Z	—	—	0.80
L	0.50	0.70	0.90
L <sub>1</sub>	—	1.15	—

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