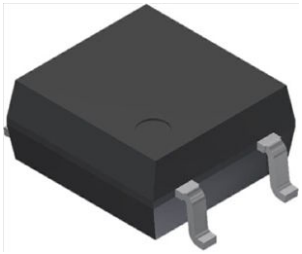
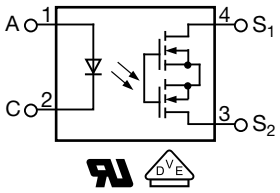
1 Form A Solid-State Relay





FEATURES

- Current limit protection
- Isolation test voltage 3750 V_{RMS}
- Typical R_{ON} 22 Ω
- Load voltage 400 V
- Load current 140 mA
- High surge capability
- Clean bounce free switching
- Low power consumption
- High temperature range
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free
RoHS COMPLIANT
HALOGEN FREE
GREEN (5-2008)

DESCRIPTION

The VOR1142 is an SPST normally open switch (1 form A) that can replace electromechanical relays in many applications. It is constructed using a GaAlAs IRED actuation control and MOSFETs for the switch output.

APPLICATIONS

- General telecom switching
- Metering
- Security equipment
- Instrumentation
- Industrial controls
- Battery management systems
- Automatic measurement equipment

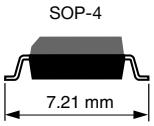
AGENCY APPROVALS

- UL1577, file no. E52744
- DIN EN 60747-5-5 (VDE0884-5)

ORDERING INFORMATION

V	O	R	1	1	4	2	M	4	#

PART NUMBER — PACKAGE CONFIGURATION



PACKAGE	UL, VDE
SOP-4, tape and reel	VOR1142M4T
SOP-4, tube	VOR1142M4

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**CONDITIONS**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
IRED continuous forward current		I_F	50	mA
IRED reverse voltage		V_R	5	V
Input power dissipation		P_{diss}	80	mW
OUTPUT				
DC or peak AC load voltage		V_L	400	V
Continuous DC load current		I_L	140	mA
SSR output power dissipation		P_{diss}	550	mW
SSR				
Ambient temperature range (1)		T_{amb}	-40 to +100	°C
Storage temperature range		T_{stg}	-40 to +150	°C
Soldering temperature	t = 10 s max.	T_{sld}	260	°C

Notes

- Stresses in excess of the absolute maximum ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute maximum ratings for extended periods of the time can adversely affect reliability.

(1) For continuous negative potential from output side to input side only 85 °C is allowed.

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
IRED forward current, switch turn-on	I_L = 100 mA, t = 10 ms	I_{Fon}	-	0.25	2	mA
IRED forward current, switch turn-off	V_L = ± 350 V, I_L < 1 µA	I_{Foff}	0.05	0.15	-	mA
IRED forward voltage	I_F = 10 mA	V_F	-	1.36	1.5	V
IRED reverse current	V_R = 5 V	I_R	-	-	10	µA
OUTPUT						
On-resistance	I_F = 5 mA, I_L = 50 mA	R_{ON}	-	22	27	Ω
Off-resistance	I_F = 0 mA, V_L = ± 100 V	R_{OFF}	0.5	850	-	GΩ
Off-state leakage current	I_F = 0 mA, V_L = ± 100 V	I_{leak}	-	< 1	100	nA
	I_F = 0 mA, V_L = ± 400 V	I_{leak}	-	6	500	nA
Output capacitance	I_F = 0 mA, V_L = 1 V, 1 MHz	C_O	-	39	-	pF
	I_F = 0 mA, V_L = 50 V, 1 MHz	C_O	-	6	-	pF
Current limit AC/DC	I_F = 5 mA, t = 5 ms, V_L = ± 6 V	I_{limit}	170	300	450	mA
COUPLER						
Capacitance (input to output)	V_{IO} = 1 V	C_{IO}	-	0.4	-	pF

Note

- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluations. Typical values are for information only and are not part of the testing requirements.

SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Turn-on time	I_F = 5 mA, I_L = 50 mA	t_{on}	-	0.2	0.5	ms
Turn-off time	I_F = 5 mA, I_L = 50 mA	t_{off}	-	0.05	0.2	ms

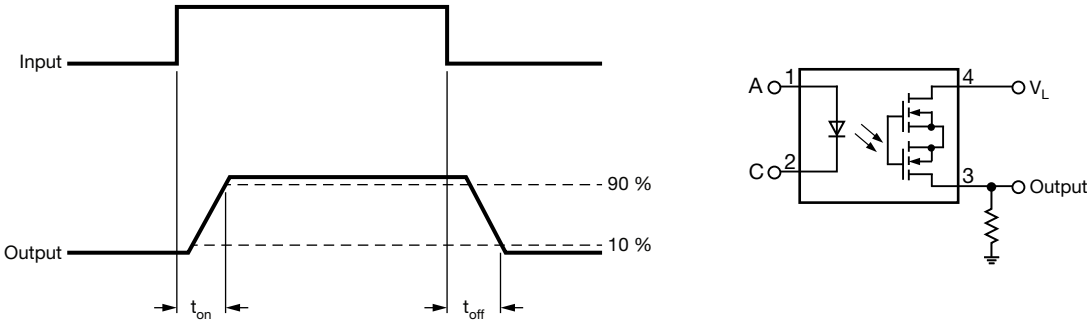


Fig. 1 - Timing Schematic

SAFETY AND INSULATION RATINGS				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Climatic classification	According to IEC 68 part 1		40/100/21	
Pollution degree	According to DIN VDE 0109		2	
Comparative tracking index		CTI	175	
Maximum rated withstanding isolation voltage	According to UL1577, t = 1 min	V_{ISO}	3750	V_{RMS}
Maximum transient isolation voltage	According to DIN EN 60747-5-5	V_{IOTM}	6000	V_{peak}
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	V_{IORM}	707	V_{peak}
Isolation resistance	T_{amb} = 25 °C, V_{IO} = 500 V	R_{IO}	$\geq 10^{12}$	Ω
	T_{amb} = 100 °C, V_{IO} = 500 V	R_{IO}	$\geq 10^{11}$	Ω
Output safety power		P_{SO}	550	mW
Input safety current		I_{SI}	180	mA
Input safety temperature		T_S	175	°C
Clearance distance	SOP-4		≥ 5	mm
Creepage distance	SOP-4		≥ 5	mm
Insulation thickness		DTI	≥ 0.3	mm
Input to output test voltage, method B	V_{IORM} x 1.875 = V_{PR}, 100 % production test with t_M = 1 s, partial discharge < 5 pC	V_{PR}	1326	V_{peak}
Input to output test voltage, method A	V_{IORM} x 1.6 = V_{PR}, sample test with t_M = 10 s, partial discharge < 5 pC	V_{PR}	1131	V_{peak}

Note

- As per IEC 60747-5-5, §7.4.3.8.2, this optocoupler is suitable for “safe electrical insulation” only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

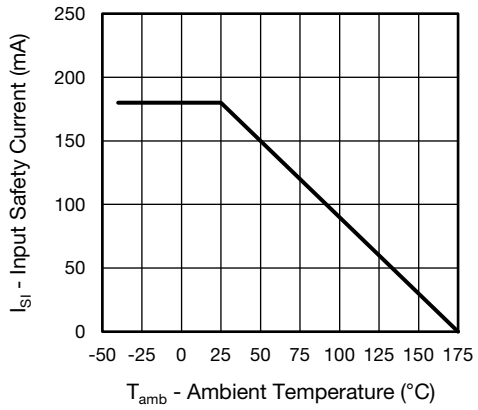


Fig. 2 - Safety Input Current vs. Ambient Temperature

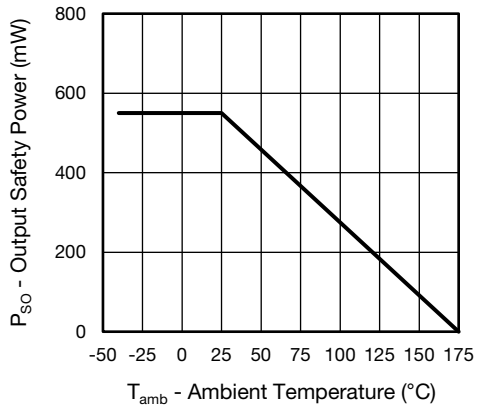


Fig. 3 - Safety Power Dissipation vs. Ambient Temperature

TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

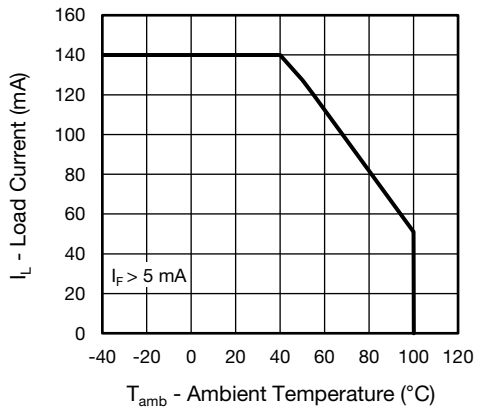


Fig. 4 - Maximum Load Current vs. Ambient Temperature

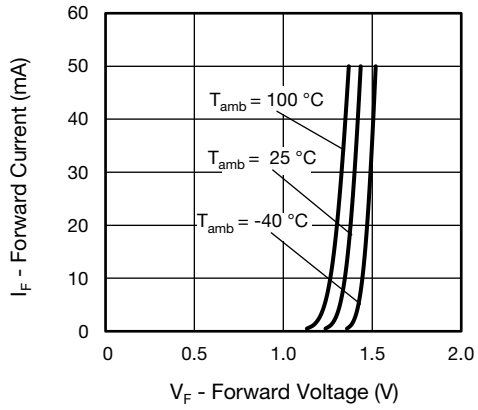


Fig. 6 - Forward Current vs. Forward Voltage

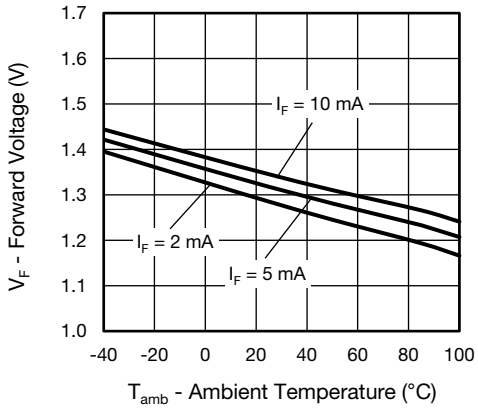


Fig. 5 - Forward Voltage vs. Ambient Temperature

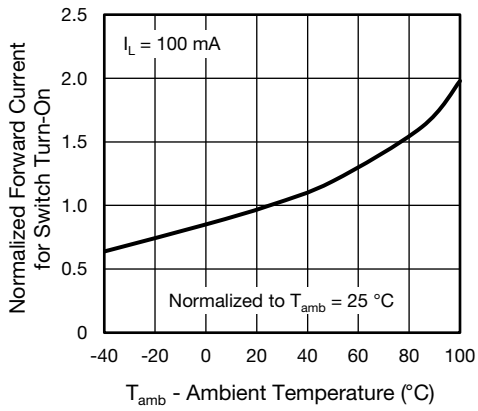


Fig. 7 - Normalized Forward Current for Switch Turn-On vs. Ambient Temperature

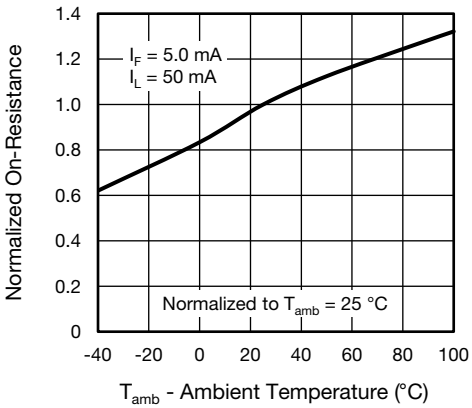


Fig. 8 - Normalized On-Resistance vs. Ambient Temperature

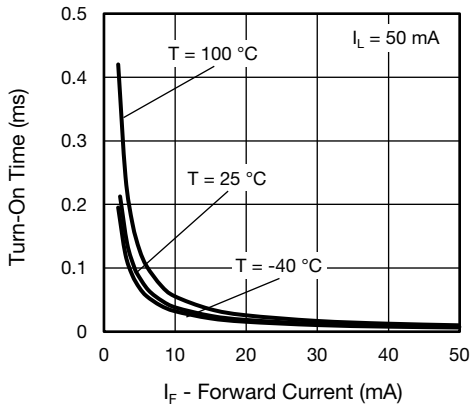


Fig. 11 - Turn-On Time vs. Forward Current

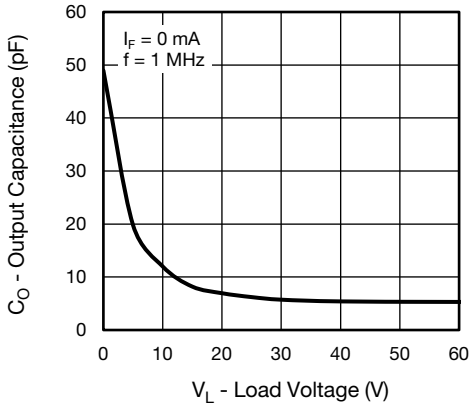


Fig. 9 - Output Capacitance vs. Load Voltage

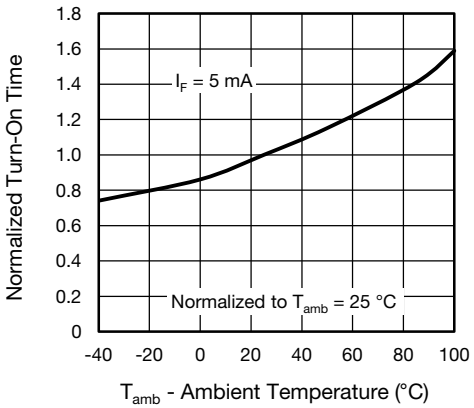


Fig. 12 - Normalized Turn-On Time vs. Ambient Temperature

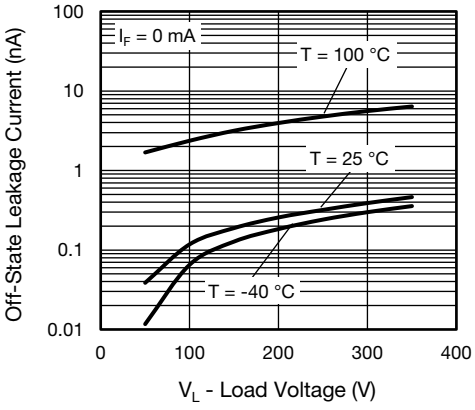


Fig. 10 - Off-State Leakage Current vs. Load Voltage

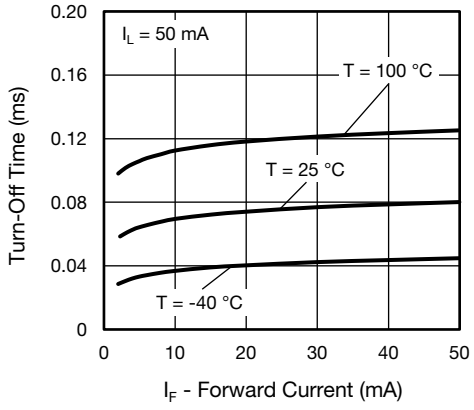


Fig. 13 - Turn-Off Time vs. Forward Current

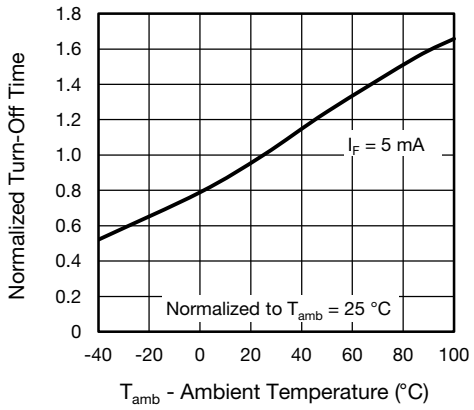
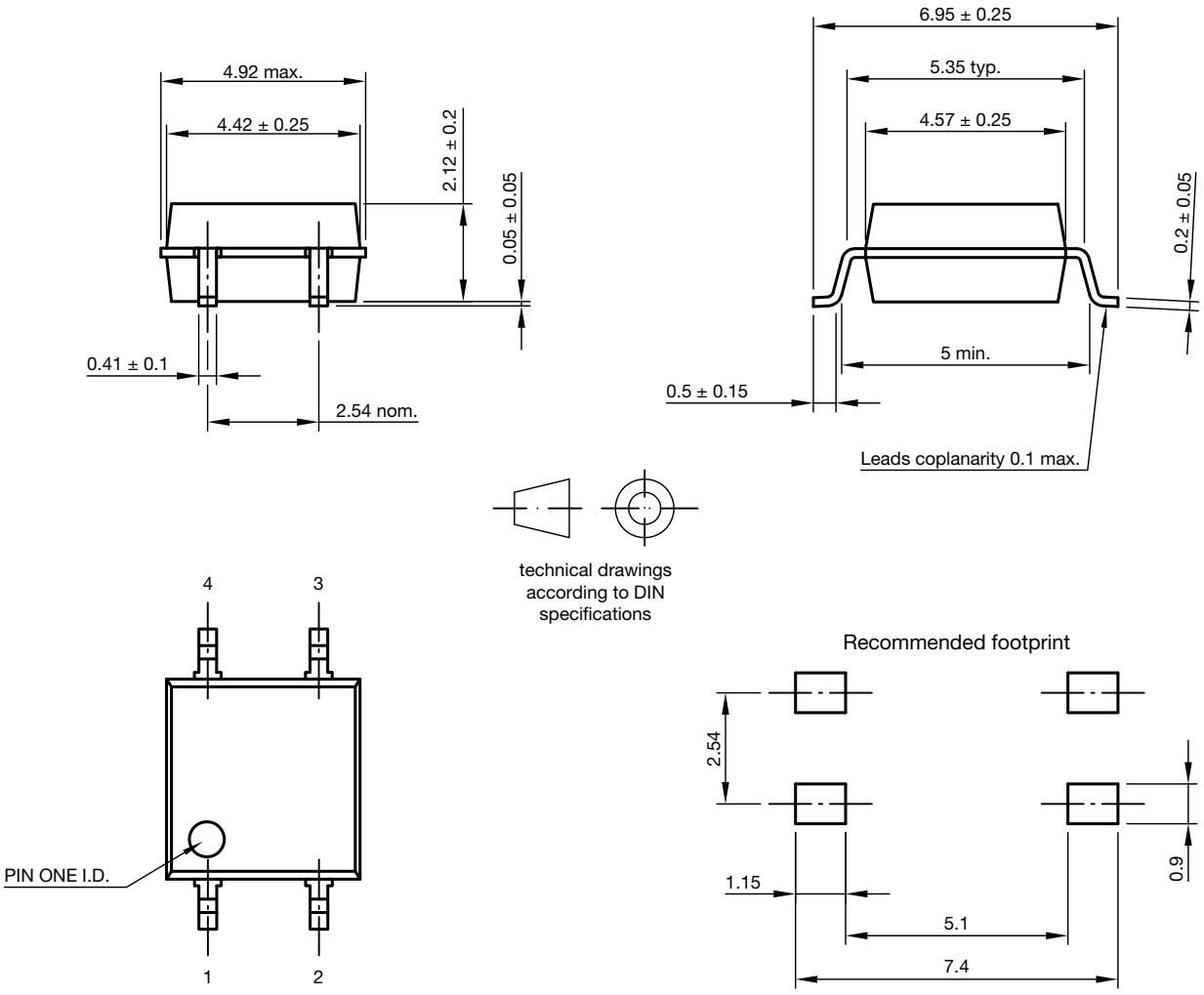


Fig. 14 - Normalized Turn-Off Time vs. Ambient Temperature

PACKAGE DIMENSIONS (in millimeters)



Drawing-No.: 6.544-5415.01-4
Issue: 2; 23.07.12

Fig. 15 - Package Drawing

PACKAGE MARKING

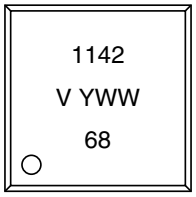
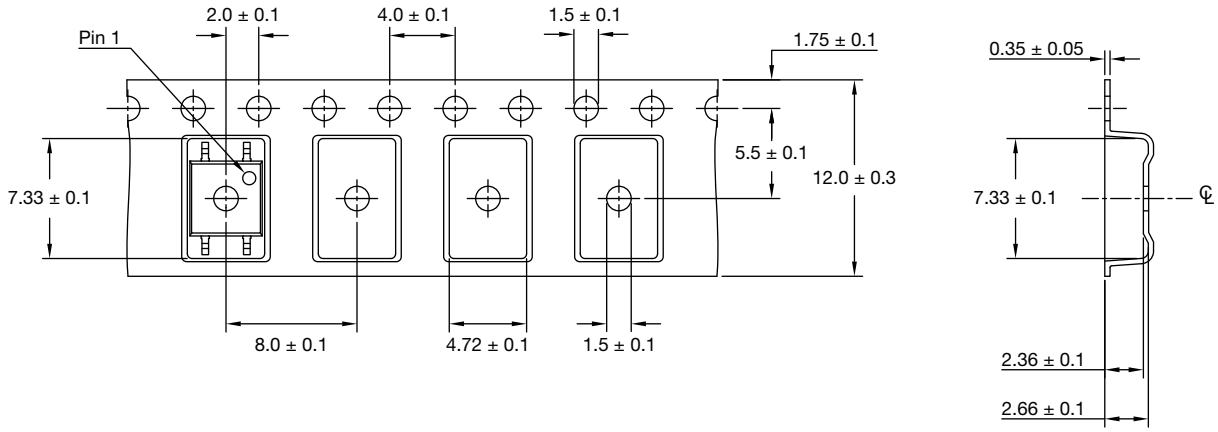


Fig. 16 - VOR1142M4

Note

- Package configuration (T, M) are not part of the package marking.

PACKAGING INFORMATION (in millimeters)



Note:

- Cummulative tolerance of 10 spocket holes is 0.20 mm

Fig. 17 - Tape and Reel Packing (2000 pieces on reel)

DEVICE PER TUBE			
TYPE	**UNITS/TUBE**	**TUBES/BOX**	**UNITS/BOX**
SOP-4	100	40	4000

SOLDER PROFILES

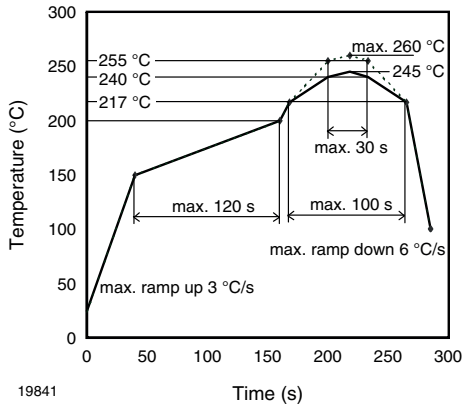


Fig. 18 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

Conditions: T_{amb} < 30 °C, RH < 85 %

Moisture sensitivity level 1, according to J-STD-020

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