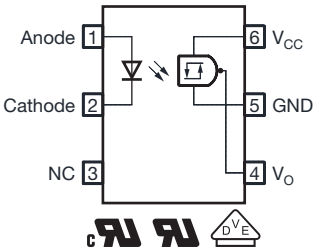
High Speed Optocoupler, 1 MBd, Schmitt Trigger



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DESIGN SUPPORT TOOLS

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DESCRIPTION

The VOH1016A is a single channel 1 MBd optocoupler utilizing a high efficient input LED coupled with an integrated optical photodiode IC detector. The detector has an open collector transistor output with Schmitt-Trigger functionality. The low turn-on threshold and low supply current together with a guaranteed common mode transient immunity of 10 kV/µs makes the VOH1016A to a perfect solution for galvanic noise isolation or to break up ground loops in digital applications. The wide power supply range up to 15 V enables isolated level shifting in applications using different voltage domains.

FEATURES

- High data rate 2 MHz (NRZ)
- Latch up and oscillation free
- Low turn-on threshold current 2 mA
- Logic compatible output
- Guaranteed on / off threshold hysteresis
- Wide supply voltage range 3 V to 15 V
- Minimum common mode transient immunity (CMTI) 10 kV/µs
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

APPLICATIONS

- Microprocessor system interface
- Ground loop elimination
- Galvanic noise isolation
- Serial bus systems
- Digital control power supply
- Signal level translation
- PLC, ATE input / output isolation
- Computer peripheral interface

AGENCY APPROVALS

- UL 1577
- cUL 1577
- DIN EN 60747-5-5 (VDE 0884-5) available with option “V”

ORDERING INFORMATION

V	O	H	1	0	1	6	A	#	-	V	T	#

PART NUMBER | PACKAGE OPTION | VDE OPTION | TAPE AND REEL

AGENCY CERTIFIED / PACKAGE	CMTI (kV/µs)
UL, cUL	**10**
DIP-6	VOH1016AD
DIP-6, 400 mil	VOH1016AG
SMD-6	VOH1016AB-T
SMD-6, 180° oriented	VOH1016AB-T2
VDE, UL, cUL	**10**
DIP-6	VOH1016AD-V
DIP-6, 400 mil	VOH1016AG-V
SMD-6	VOH1016AB-VT
SMD-6, 180° oriented	VOH1016AB-VT2

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TRUTH TABLE (positive logic)	
LED	**OUTPUT**
On	L
Off	H

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**CONDITIONS**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
Forward current		I_F	50	mA
Reverse voltage		V_R	6	V
Power dissipation		P_{diss}	120	mW
OUTPUT				
Supply voltage		V_{CC}	16	V
Output voltage		V_O	V_{CC}	V
Output current		I_O	50	mA
Power dissipation		P_{diss}	130	mW
COUPLER				
Power dissipation		P_{diss}	250	mW
Storage temperature		T_{stg}	-55 to +150	°C
Operating temperature		T_{amb}	-40 to +100	°C
Solder temperature	For 10 s	T_{sld}	260	°C

Note

- 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

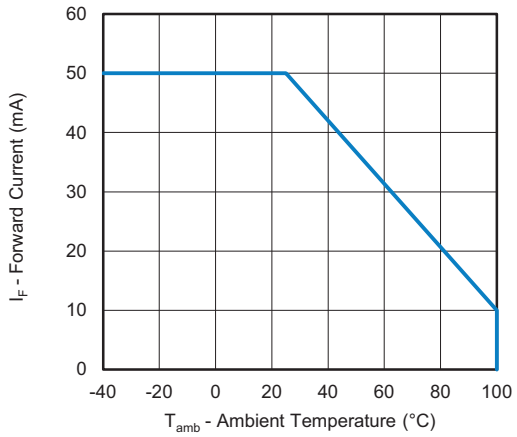

Fig. 1 - Forward Current vs. Ambient Temperature

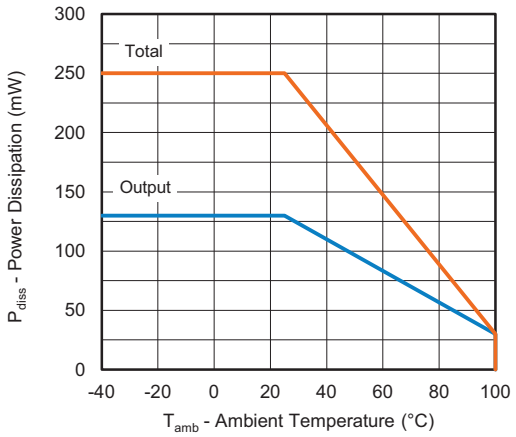

Fig. 2 - Power Dissipation vs. Ambient Temperature

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ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
Forward voltage	I_F = 4 mA	V_F	-	1.1	1.4	V
	I_F = 0.3 mA		0.7	1.0	-	
Reverse current	V_R = 3 V	I_R	-	-	10	µA
Input capacitance	f = 1 MHz, V_F = 0 V	C_{IN}	-	30	250	pF
OUTPUT						
Supply voltage		V_{CC}	3	-	15	V
High level supply current	I_F = 0 mA, V_{CC} = 5 V	I_{CCH}	-	0.55	1.0	mA
Low level supply current	I_F = 4 mA, V_{CC} = 5 V	I_{CCL}	-	0.55	1.0	mA
High level output current	V_{CC} = V_O = 15 V, I_F = 0 mA	I_{OH}	-	-	100	µA
Low level output voltage	V_{CC} = 5 V, I_F = 4 mA, I_{OL} = 16 mA	V_{OL}	-	0.2	0.4	V
Turn-On threshold current	V_{CC} = 5 V, R_L = 280 Ω	$I_{F(on)}$	-	0.65	2.0	mA
Turn-Off threshold current	V_{CC} = 5 V, R_L = 280 Ω	$I_{F(off)}$	0.4	0.6	-	mA
Hysteresis ratio	V_{CC} = 5 V, R_L = 280 Ω	$I_{F(off)}/I_{F(on)}$	0.5	0.9	0.95	

Note

- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. 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**
Propagation delay time to high output level	R_L = 280 Ω, V_{CC} = 5 V, I_F = 4 mA	t_{PLH}	-	0.25	2	µs
Propagation delay time to low output level		t_{PHL}	-	0.05	1.2	µs
Rise time		t_r	-	0.05	0.5	µs
Fall time		t_f	-	0.04	0.5	µs
Data rate			-	2	-	MHz

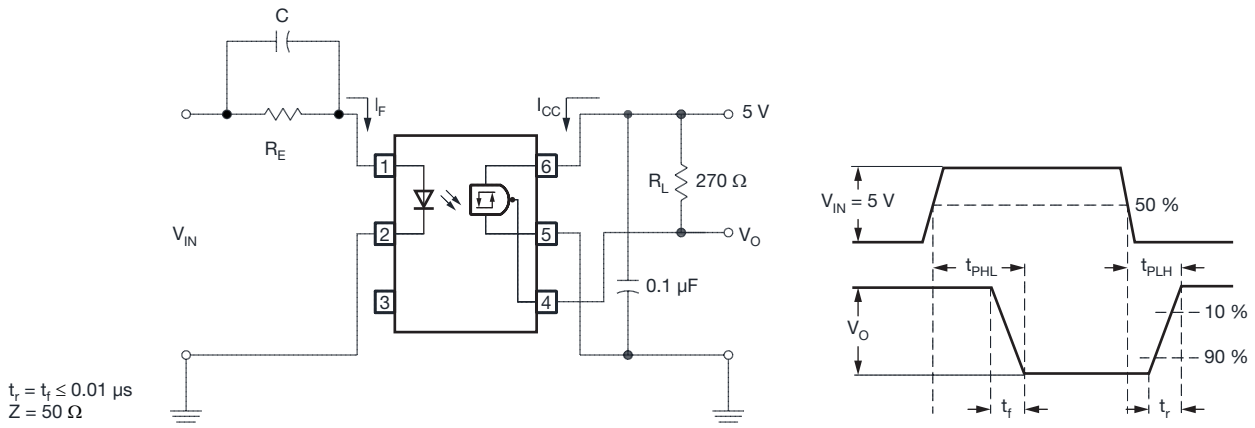

Fig. 3 - Test Circuit for t_{on}, t_{off}, t_r, and t_f

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COMMON MODE TRANSIENT IMMUNITY (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Common mode transient immunity	R_L = 270 Ω, V_{CC} = 5 V, V_{CM} = 1000 V, I_F = 0 mA	$\|CM_H\|$	10	-	-	kV/µs
	R_L = 270 Ω, V_{CC} = 5 V, V_{CM} = 1000 V, I_F = $I_{F(on)}$ (max.)	$\|CM_L\|$	10	-	-	kV/µs

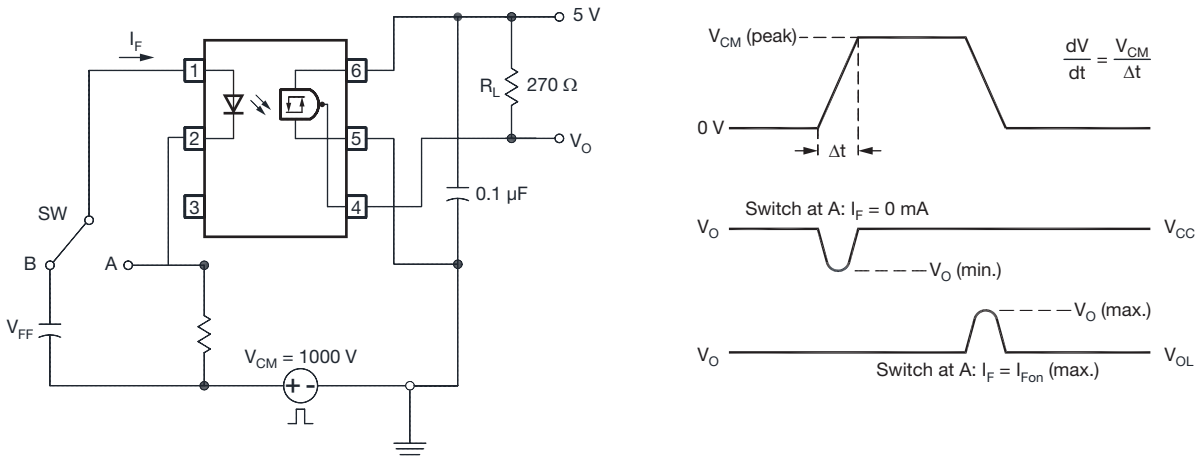

Fig. 4 - Test Circuit for Common Mode Transient Immunity

SAFETY AND INSULATION RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Comparative tracking index	Insulation group IIIa	CTI	175	
Maximum rated withstanding isolation voltage	According to UL1577, t = 1 min	V_{ISO}	5000	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}	630	V_{peak}
Isolation resistance	T_{amb} = 25 °C, V_{IO} = 500 V	R_{IO}	10^{12}	Ω
	T_{amb} = 100 °C, V_{IO} = 500 V	R_{IO}	10^{11}	Ω
Output safety power		P_{SO}	150	mW
Input safety current		I_{SI}	20	mA
Input safety temperature		T_S	175	°C
Creepage distance			> 7	mm
Clearance distance			> 7	mm
Insulation thickness		DTI	> 0.4	mm

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

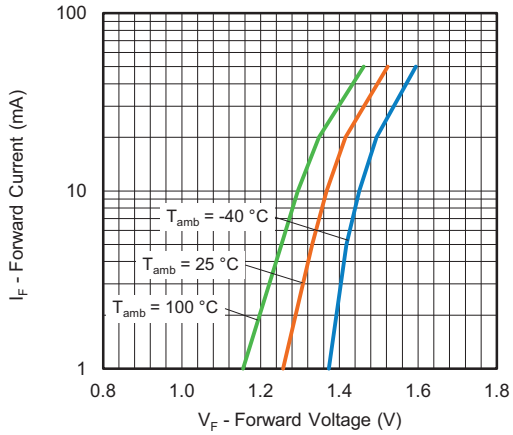

Fig. 5 - Forward Current vs. Forward Voltage

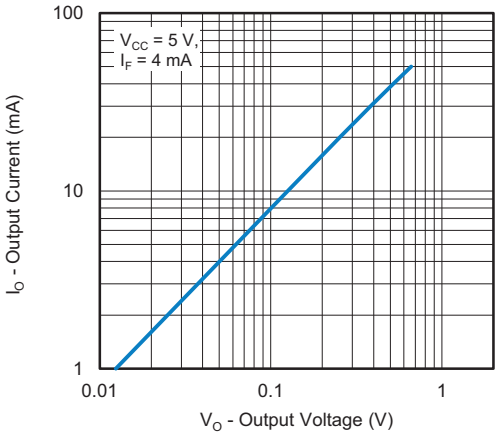

Fig. 8 - Output Current vs. Output Voltage

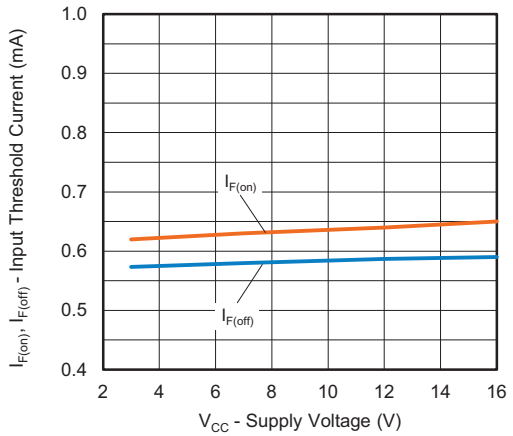

Fig. 6 - Input Threshold Current vs. Supply Voltage

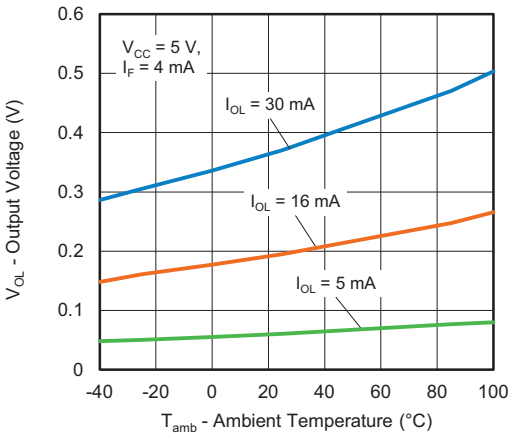

Fig. 9 - Output Voltage vs. Ambient Temperature

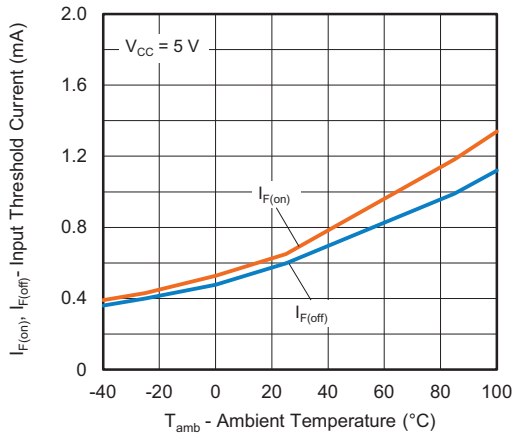

Fig. 7 - Input Threshold Current vs. Ambient Temperature

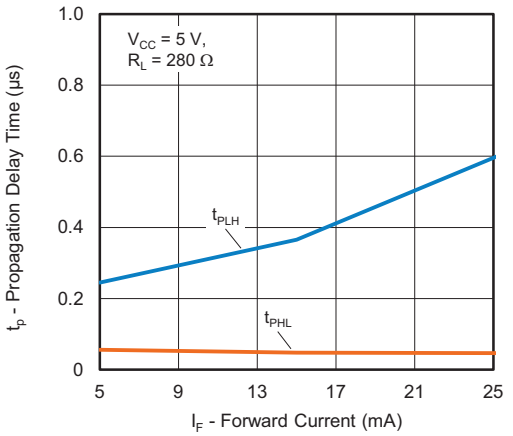

Fig. 10 - Propagation Delay Time vs. Forward Current

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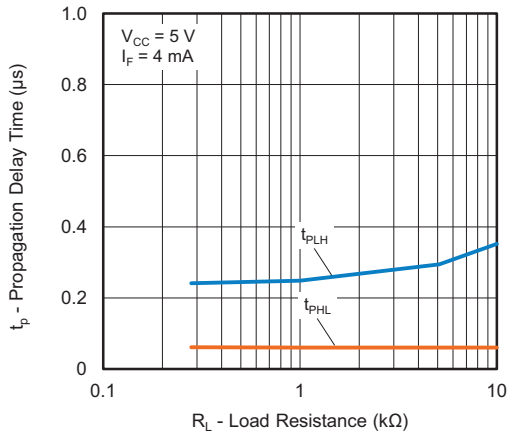

Fig. 11 - Propagation Delay Time vs. Load Resistance

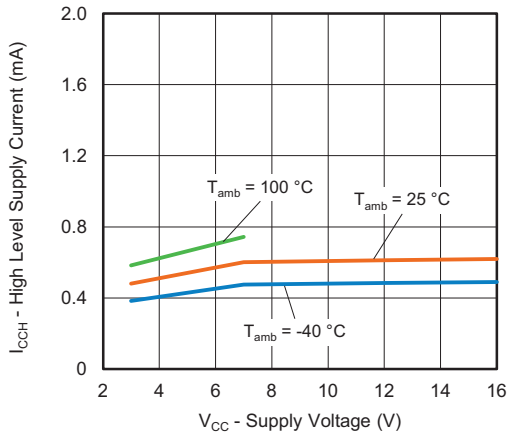

Fig. 12 - High Level Supply Current vs. Supply Voltage

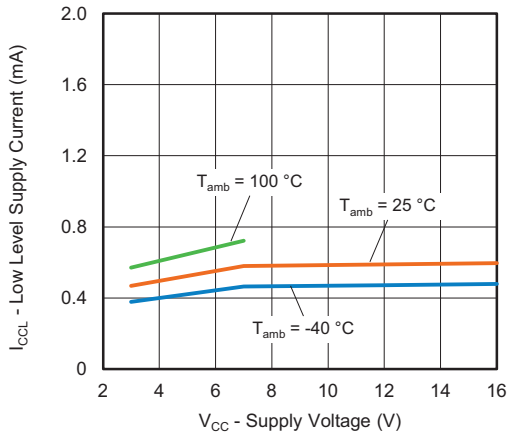

Fig. 13 - Low Level Supply Current vs. Supply Voltage

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PACKAGE DIMENSIONS (in millimeters)

DIP-6

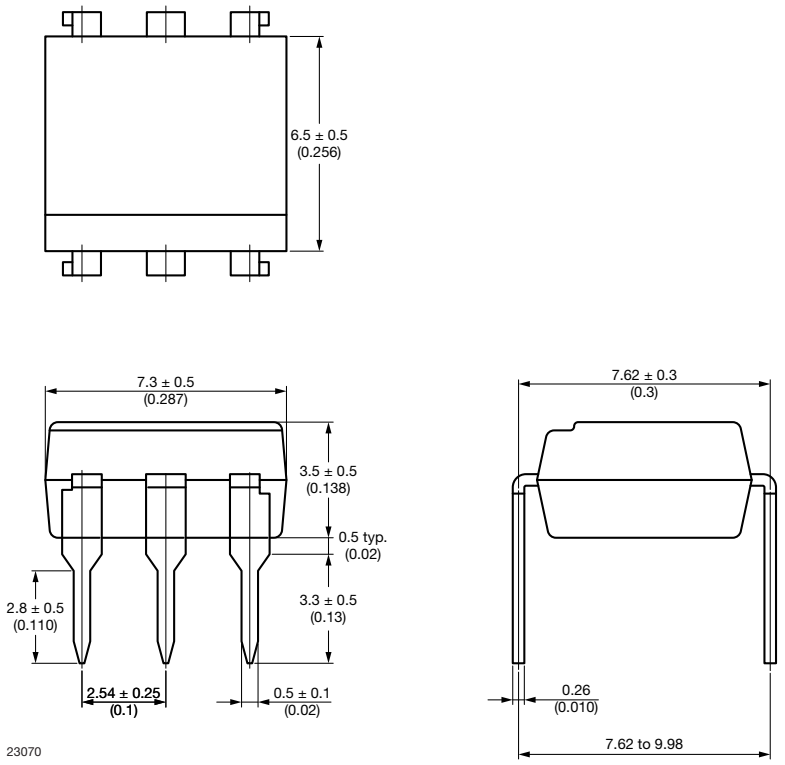

Fig. 1

DIP-6, 400 mil

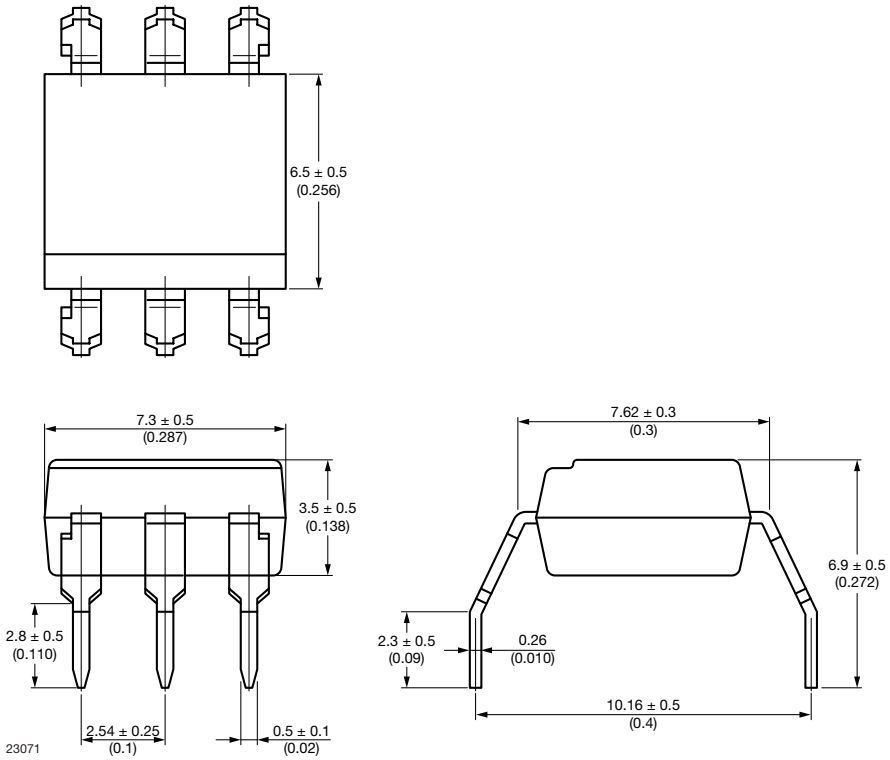

Fig. 2

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SMD-6

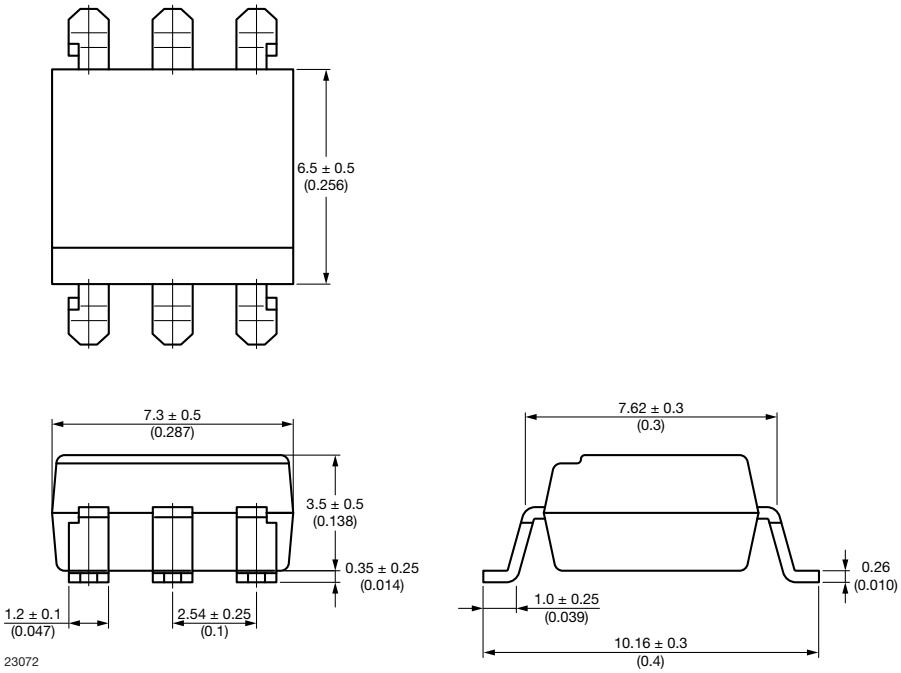

Fig. 3

PACKAGE MARKING

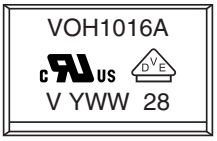

Fig. 14 - Example of VOH1016AB-VT

Notes

- "YWW" is the date code marking (Y = year code, WW = week code)
- VDE logo is only marked on option "V" parts
- Tape and reel suffix (T) is not part of the package marking

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PACKING INFORMATION (in millimeters)

DEVICES PER TUBES			
TYPE	**UNITS/TUBE**	**TUBES/BOX**	**UNITS/BOX**
DIP-6	50	40	2000
DIP-6, 400 mil	50	40	2000

Tape SMD-6

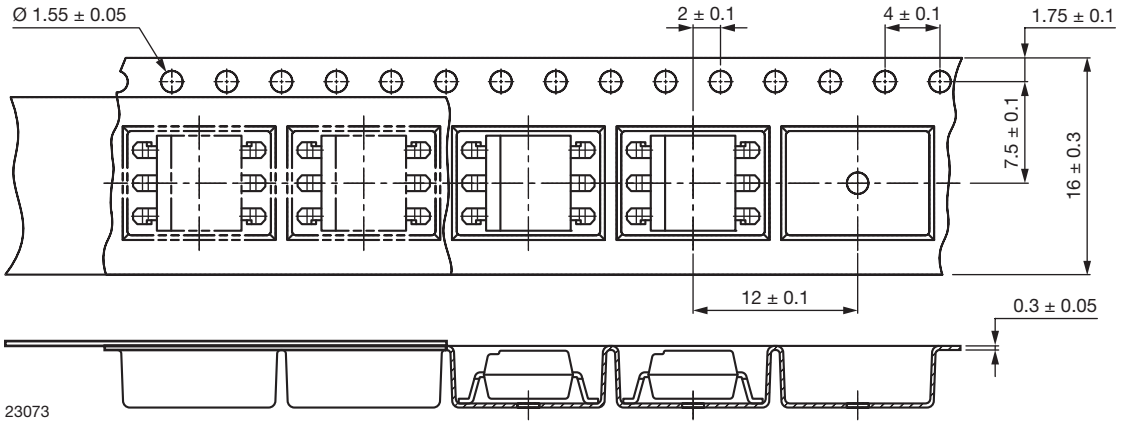

Fig. 15 - Tape and Reel Packaging (1000 pieces on reel)

Tape SMD-6, 180° orientation

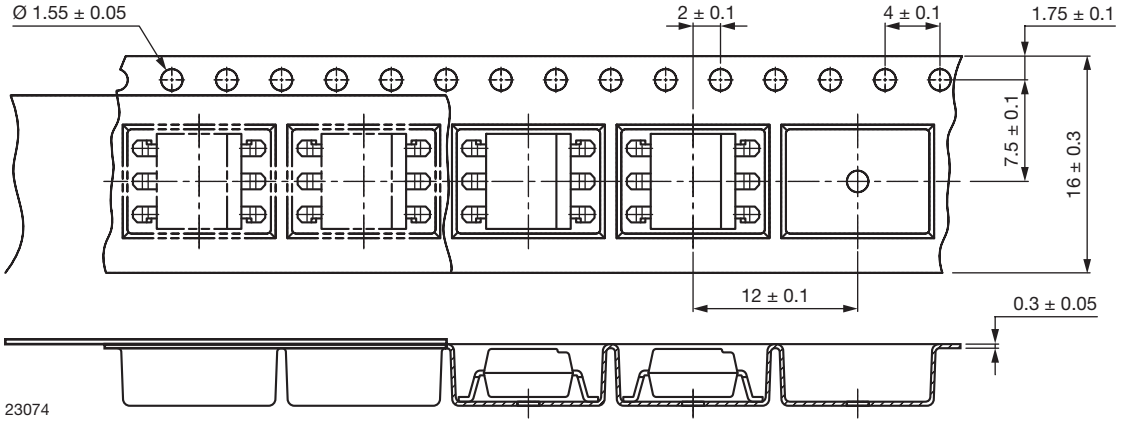

Fig. 16 - Tape and Reel Packaging (1000 pieces on reel)

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Reel

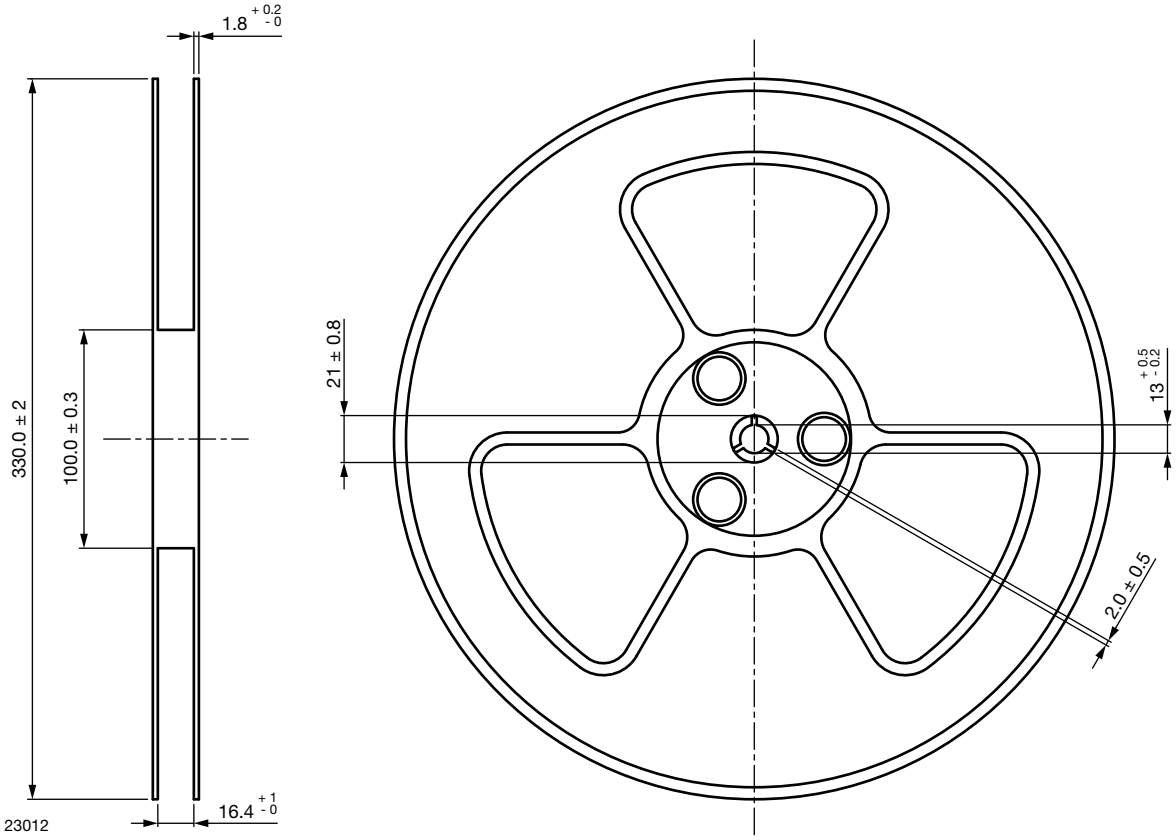

Fig. 17 - Tape and Reel Shipping Medium

SOLDER PROFILES

IR Reflow Soldering (JEDEC® J-STD-020C compliant)

One time soldering reflow is recommended within the condition of temperature and time profile shown below. Do not solder more than three times.

PROFILE ITEM	CONDITIONS
Preheat	
- Temperature minimum ($T_{S\ min.}$)	150 °C
- Temperature maximum ($T_{S\ max.}$)	200 °C
- Time (min. to max.) (t_S)	90 s ± 30 s
Soldering zone	
- Temperature (T_L)	217 °C
- Time (t_L)	60 s
Peak temperature (T_p)	260 °C
Ramp-up rate	3 °C/s max.
Ramp-down rate	3 °C/s to 6 °C/s

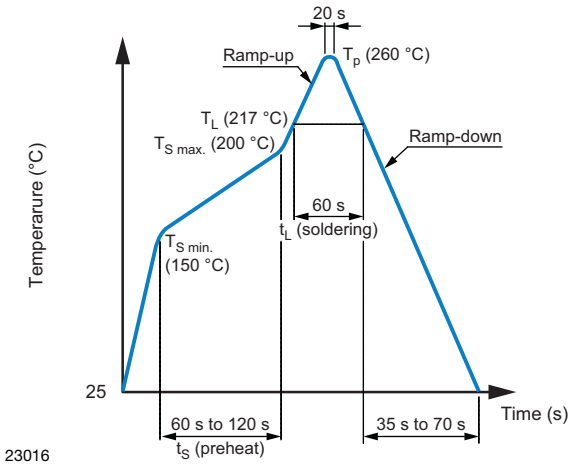

Fig. 4

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Wave Soldering (JEDEC JESD22-A111 compliant)

One time soldering is recommended within the condition of temperature.

Temperature: 260 °C + 0 °C / - 5 °C

Time: 10 s

Preheat temperature: 25 °C to 140 °C

Preheat time: 30 s to 80 s

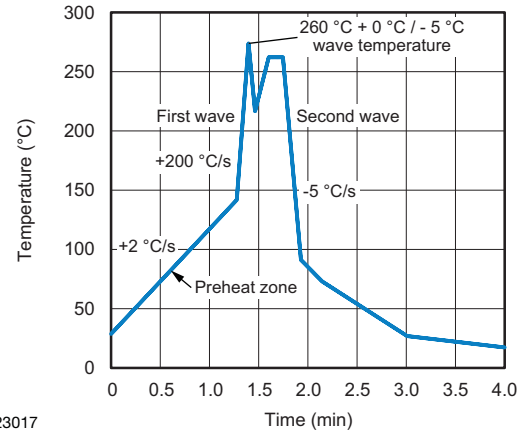

Fig. 5

Hand Soldering by Soldering Iron

Allow single lead soldering in every single process. One time soldering is recommended.

Temperature: 380 °C + 0 °C / - 5 °C

Time: 3 s max.

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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