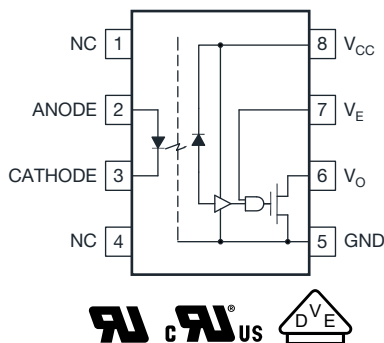
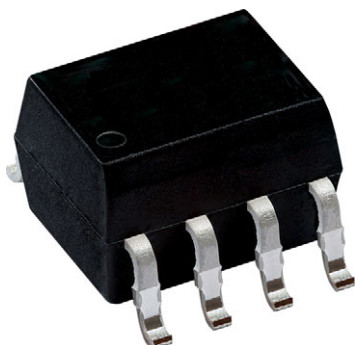


## High Speed Optocoupler, 10 MBd



### DESCRIPTION

The VOIH060A is a single channel 10 MBd optocoupler utilizing a high efficient input LED coupled to a high speed integrated photo-detector logic gate with a strobable output. This detector features an open drain output. The internal shield provides a guaranteed common mode transient immunity of 15 kV/ $\mu$ s.

### FEATURES

- CMTI of 15 kV/ $\mu$ s (min.)
- 3.3 V / 5 V dual supply voltage
- LVTTL/LVCMOS compatibility
- Low power consumption
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT

### APPLICATIONS

- Microprocessor system interface
- Ground loop elimination
- Digital bus systems isolation
- High speed A/D and D/A conversion
- Digital control power supply
- Level shifting

### AGENCY APPROVALS

- [UL1577](#)
- [cUL](#)
- [DIN EN 60747-5-5 \(VDE 0884-5\), available with option 1](#)

### LINKS TO ADDITIONAL RESOURCES



**ORDERING INFORMATION**

<div><div>V</div><div>O</div><div>I</div><div>H</div><div>0</div><div>6</div><div>0</div><div>A</div><div>-</div><div>X</div><div>0</div><div>#</div><div>#</div><div>T</div></div> <div>PART NUMBER</div> <div>PACKAGE OPTION</div> <div>TAPE AND REEL</div>													
AGENCY CERTIFIED / PACKAGE													
UL, cUL													
SOIC-8		VOIH060AT											
UL, cUL, VDE (option 1)													
SOIC-8		VOIH060A-X001T											

**Note**

- Additional options may be possible, please contact sales office

**ABSOLUTE MAXIMUM RATINGS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Input forward current		$I_F$	20	mA
Reverse input voltage		$V_R$	5	V
Enable input voltage		$V_E$	$V_{CC} + 0.5\text{ V}$	V
Enable input current		$I_E$	5	mA
Input power dissipation		$P_{diss}$	40	mW
<b>OUTPUT</b>				
Supply voltage		$V_{CC}$	7	V
Output current		$I_O$	50	mA
Output voltage		$V_O$	7	V
Output power dissipation		$P_{diss}$	85	mW
<b>COUPLER</b>				
Storage temperature		$T_{stg}$	-55 to +125	$^{\circ}\text{C}$
Operating temperature		$T_{amb}$	-40 to +110	$^{\circ}\text{C}$
Solder reflow temperature <sup>(1)</sup>	5 s		260	$^{\circ}\text{C}$

**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.

<sup>(1)</sup> Refer to reflow profile for soldering conditions for surface mounted devices (SMD)

**RECOMMENDED OPERATING CONDITIONS**

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Operating temperature	$T_{amb}$	-40	+110	$^{\circ}\text{C}$
Supply voltage	$V_{CC}$	2.7	3.6	V
	$V_{CC}$	4.5	5.5	V
Input current low level	$I_{FL}$	0	250	$\mu\text{A}$
Input current high level	$I_{FH}$	5	15	mA
Logic low enable voltage	$V_{EL}$	0	0.8	V
Logic high enable voltage	$V_{EH}$	2	$V_{CC}$	V
Output pull up resistor	$R_L$	330	4000	$\Omega$
Fanout ( $R_L = 1\text{ k}\Omega$ )	N	-	5	TTL loads

**TRUTH TABLE** (positive logic)

LED	ENABLE	OUTPUT
On	H	L
Off	H	H
On	L	H
Off	L	H
On	Not connected / open	L
Off	Not connected / open	H

**ELECTRICAL CHARACTERISTICS** ( $T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+110\text{ }^{\circ}\text{C}$ ,  $2.7\text{ V} \leq V_{CC} \leq 3.6\text{ V}$ ,  $I_F = 7.5\text{ mA}$ , unless otherwise specified; typical values are at  $V_{CC} = 3.3\text{ V}$ ,  $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Input forward voltage	$I_F = 10\text{ mA}$	$V_F$	-	1.38	1.70	V
Input forward voltage temperature coefficient	$I_F = 10\text{ mA}$	$\Delta V_F / \Delta T$	-	-1.5	-	mV/K
Input reverse voltage	$I_R = 10\text{ }\mu\text{A}$	$BV_R$	5	-	-	V
Input threshold current	$V_E = 2\text{ V}$ , $V_O = 0.6\text{ V}$ , $V_{CC} = 3.3\text{ V}$ , $I_{OL}(\text{sinking}) = 13\text{ mA}$	$I_{TH}$	-	2	5	mA
Input capacitance	$f = 1\text{ MHz}$ , $V_F = 0\text{ V}$	$C_I$	-	34	-	pF
<b>OUTPUT</b>						
Low level supply current	$I_F = 10\text{ mA}$ , $V_{CC} = 3.3\text{ V}$ , $V_E = 0.5\text{ V}$	$I_{CCL}$	-	3.1	5	mA
High level supply current	$I_F = 0\text{ mA}$ , $V_{CC} = 3.3\text{ V}$ , $V_E = 0.5\text{ V}$	$I_{CCH}$	-	3.3	5	mA
Low level enable current	$V_{CC} = 3.3\text{ V}$ , $V_E = 0.5\text{ V}$	$I_{EL}$	-	-0.41	-1.6	mA
High level enable current	$V_{CC} = 3.3\text{ V}$ , $V_E = 2\text{ V}$	$I_{EH}$	-	-0.19	-1.6	mA
Low level enable voltage		$V_{EL}$	-	-	0.8	V
High level enable voltage		$V_{EH}$	2	-	-	V
Low level output voltage	$V_{CC} = 3.3\text{ V}$ , $V_E = 2\text{ V}$ , $I_F = 5\text{ mA}$ , $I_{OL}(\text{sinking}) = 13\text{ mA}$	$V_{OL}$	-	0.2	0.6	V
High level output current	$V_{CC} = 3.3\text{ V}$ , $V_E = 2\text{ V}$ , $V_O = 3.3\text{ V}$ , $I_F = 250\text{ }\mu\text{A}$	$I_{OH}$	-	1	10	$\mu\text{A}$
<b>COUPLER</b>						
Input to output capacitance	$f = 1\text{ MHz}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$	$C_{IO}$	-	1	-	pF

**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.

**ELECTRICAL CHARACTERISTICS** ( $T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+110\text{ }^{\circ}\text{C}$ ,  $4.5\text{ V} \leq V_{CC} \leq 5.5\text{ V}$ ,  $I_F = 7.5\text{ mA}$ , unless otherwise specified; typical values are at  $V_{CC} = 5.0\text{ V}$ ,  $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Input forward voltage	$I_F = 10\text{ mA}$	$V_F$	-	1.38	1.70	V
Input forward voltage temperature coefficient	$I_F = 10\text{ mA}$	$\Delta V_F / \Delta T$	-	-1.5	-	mV/K
Input reverse voltage	$I_R = 10\text{ }\mu\text{A}$	$BV_R$	5	-	-	V
Input threshold current	$V_E = 2\text{ V}$ , $V_O = 0.6\text{ V}$ , $V_{CC} = 5.5\text{ V}$ , $I_{OL}(\text{sinking}) = 13\text{ mA}$	$I_{TH}$	-	2	5	mA
Input capacitance	$f = 1\text{ MHz}$ , $V_F = 0\text{ V}$	$C_I$	-	34	-	pF

**ELECTRICAL CHARACTERISTICS** ( $T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+110\text{ }^{\circ}\text{C}$ ,  $4.5\text{ V} \leq V_{CC} \leq 5.5\text{ V}$ ,  $I_F = 7.5\text{ mA}$ , unless otherwise specified; typical values are at  $V_{CC} = 5.0\text{ V}$ ,  $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>OUTPUT</b>						
Low level supply current	$I_F = 10\text{ mA}$ , $V_{CC} = 5.5\text{ V}$ , $V_E = 0.5\text{ V}$	$I_{CCL}$	-	3.5	5	mA
High level supply current	$I_F = 0\text{ mA}$ , $V_{CC} = 5.5\text{ V}$ , $V_E = 0.5\text{ V}$	$I_{CCH}$	-	3.7	5	mA
Low level enable current	$V_{CC} = 5.5\text{ V}$ , $V_E = 0.5\text{ V}$	$I_{EL}$	-	-0.9	-1.6	mA
High level enable current	$V_{CC} = 5.5\text{ V}$ , $V_E = 2\text{ V}$	$I_{EH}$	-	-0.6	-1.6	mA
Low level enable voltage		$V_{EL}$	-	-	0.8	V
High level enable voltage		$V_{EH}$	2	-	-	V
Low level output voltage	$V_{CC} = 5.5\text{ V}$ , $V_E = 2\text{ V}$ , $I_F = 5\text{ mA}$ , $I_{OL}(\text{sinking}) = 13\text{ mA}$	$V_{OL}$	-	0.20	0.60	V
High level output current	$V_{CC} = 5.5\text{ V}$ , $V_E = 2\text{ V}$ , $V_O = 5.5\text{ V}$ , $I_F = 250\text{ }\mu\text{A}$	$I_{OH}$	-	1	10	$\mu\text{A}$
<b>COUPLER</b>						
Input to output capacitance	$f = 1\text{ MHz}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$	$C_{IO}$	-	1	-	pF

**Note**

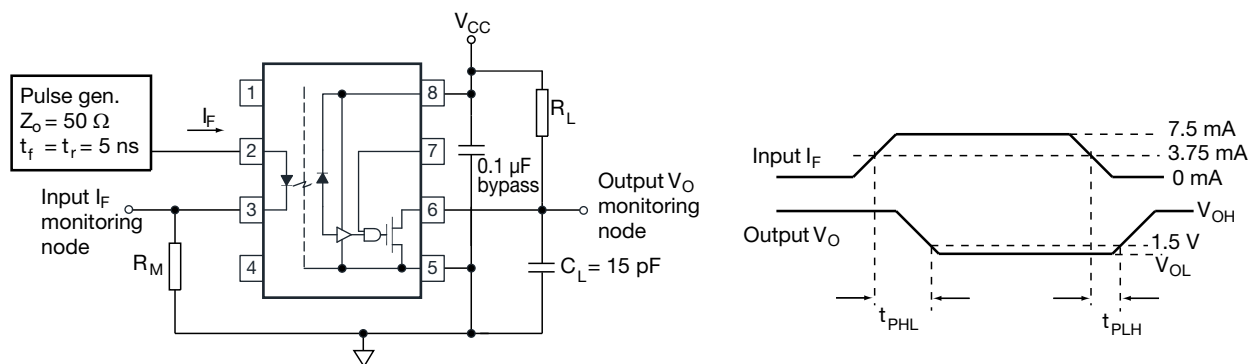
- Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.

**SWITCHING CHARACTERISTICS** ( $T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+110\text{ }^{\circ}\text{C}$ ,  $2.7\text{ V} \leq V_{CC} \leq 3.6\text{ V}$ ,  $I_F = 7.5\text{ mA}$ , unless otherwise specified; typical values are at  $V_{CC} = 3.3\text{ V}$ ,  $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Propagation delay time to high output level	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$t_{PLH}$	25	50	90	ns
Propagation delay time to low output level	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$t_{PHL}$	25	44	75	ns
Pulse width distortion	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$ t_{PLH} - t_{PHL} $	-	6	-	ns
Propagation delay skew	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$t_{PSK}$	-	-	40	ns
Output rise time (10 % to 90 %)	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$t_r$	-	11	-	ns
Output fall time (90 % to 10 %)	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$t_f$	-	2.3	-	ns
Propagation delay time of enable from $V_{EH}$ to $V_{EL}$	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$ , $V_{EL} = 0\text{ V}$ , $V_{EH} = 3\text{ V}$	$t_{ELH}$	-	15	-	ns
Propagation delay time of enable from $V_{EL}$ to $V_{EH}$	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$ , $V_{EL} = 0\text{ V}$ , $V_{EH} = 3\text{ V}$	$t_{EHL}$	-	15	-	ns

**SWITCHING CHARACTERISTICS** ( $T_{amb} = -40\text{ }^{\circ}\text{C}$  to  $+110\text{ }^{\circ}\text{C}$ ,  $4.5\text{ V} \leq V_{CC} \leq 5.5\text{ V}$ ,  $I_F = 7.5\text{ mA}$ , unless otherwise specified; typical values are at  $V_{CC} = 5.0\text{ V}$ ,  $T_{amb} = 25\text{ }^{\circ}\text{C}$ )

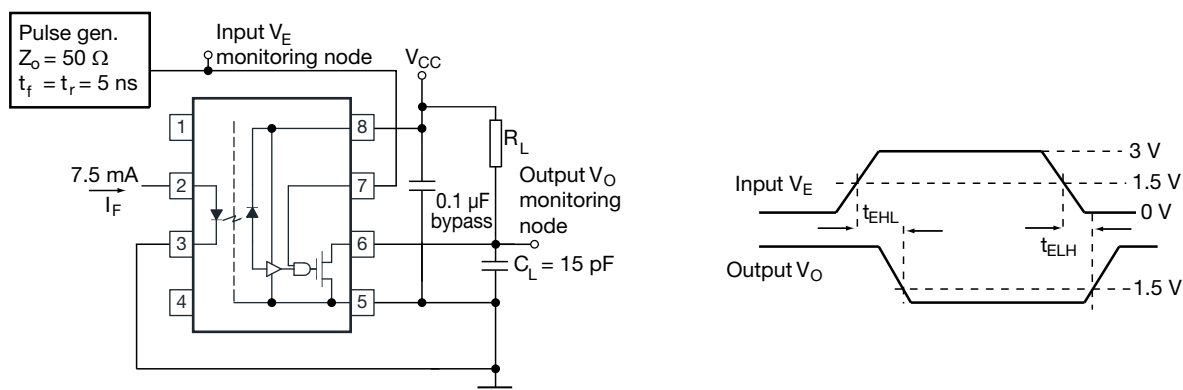
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Propagation delay time to high output level	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$	$t_{PLH}$	25	50	90	ns
	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$t_{PLH}$	-	-	100	ns
Propagation delay time to low output level	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$	$t_{PHL}$	25	40	75	ns
	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$t_{PHL}$	-	-	100	ns
Pulse width distortion	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$ t_{PLH} - t_{PHL} $	-	10	-	ns
Propagation delay skew	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$t_{PSK}$	-	-	40	ns
Output rise time (10 % to 90 %)	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$t_r$	-	11	-	ns
Output fall time (90 % to 10 %)	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$	$t_f$	-	2.3	-	ns
Propagation delay time of enable from $V_{EH}$ to $V_{EL}$	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$ , $V_{EL} = 0\text{ V}$ , $V_{EH} = 3\text{ V}$	$t_{ELH}$	-	15	-	ns
Propagation delay time of enable from $V_{EL}$ to $V_{EH}$	$R_L = 350\text{ }\Omega$ , $C_L = 15\text{ pF}$ , $V_{EL} = 0\text{ V}$ , $V_{EH} = 3\text{ V}$	$t_{EHL}$	-	15	-	ns



The probe and jig capacitances are included in  $C_1$

Fig. 1 - Test Circuit for  $t_{PLH}$ ,  $t_{PHL}$ ,  $t_r$ , and  $t_f$

18964-7



The probe and jig capacitances are included in  $C_L$

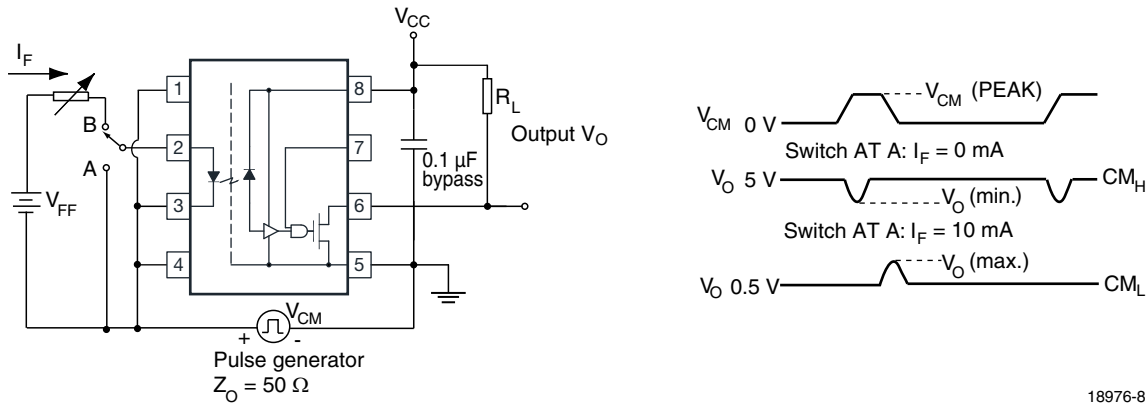
Fig. 2 - Test Circuit for  $t_{EHL}$ , and  $t_{ELH}$

18975-5

COMMON MODE TRANSIENT IMMUNITY (T <sub>amb</sub> = 25 °C, unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Logic high common mode transient immunity	V <sub>CC</sub> = 3.3 V,  V <sub>CM</sub>   = 1000 V, I <sub>F</sub> = 0 mA, V <sub>O</sub> > 2.0 V, R <sub>L</sub> = 350 Ω	CM <sub>H</sub>	15 000	-	-	V/μs
	V <sub>CC</sub> = 5 V,  V <sub>CM</sub>   = 1000 V, I <sub>F</sub> = 0 mA, V <sub>O</sub> > 2.0 V, R <sub>L</sub> = 350 Ω	CM <sub>H</sub>	15 000	-	-	V/μs
Logic low common mode transient immunity	V <sub>CC</sub> = 5 V,  V <sub>CM</sub>   = 1000 V, I <sub>F</sub> = 10 mA, V <sub>O</sub> < 0.8 V, R <sub>L</sub> = 350 Ω	CM <sub>L</sub>	15 000	-	-	V/μs
	V <sub>CC</sub> = 5 V,  V <sub>CM</sub>   = 1000 V, I <sub>F</sub> = 10 mA, V <sub>O</sub> < 0.8 V, R <sub>L</sub> = 350 Ω	CM <sub>L</sub>	15 000	-	-	V/μs

## Notes

- No external pull up is required for a high logic state on the enable input. If the enable pin is not used, connect it to  $V_{CC}$ .



18976-8

## 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	Insulation group IIIa	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	$V_{IORM}$	567	$V_{peak}$
Isolation resistance	$T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^{12}$	$\Omega$
Maximum output power dissipation		$P_{SO}$	85	mW
Maximum input current		$I_{SI}$	50	mA
Maximum ambient temperature (derated)		$T_S$	175	$^{\circ}\text{C}$
Creepage distance			$\geq 5$	mm
Clearance distance			$\geq 5$	mm
Insulation thickness		DTI	$\geq 0.4$	mm

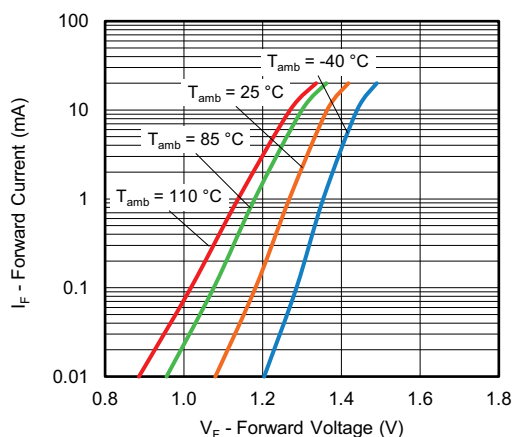
**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)


Fig. 4 - Diode Forward Current vs. Forward Voltage

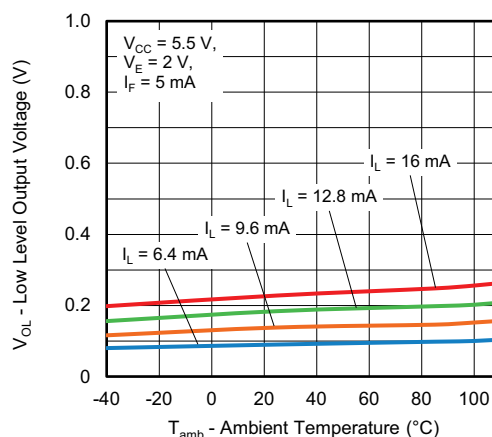


Fig. 7 - Low Level Output Voltage vs. Ambient Temperature

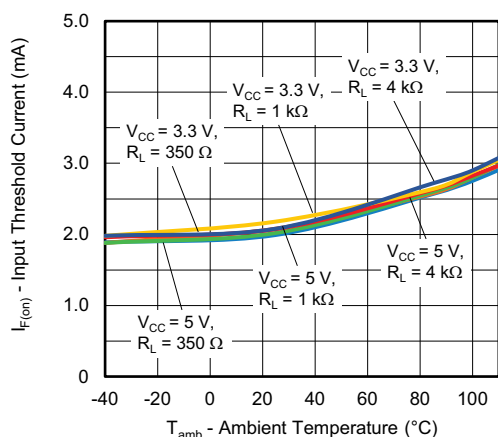


Fig. 5 - Input Threshold Current vs. Ambient Temperature

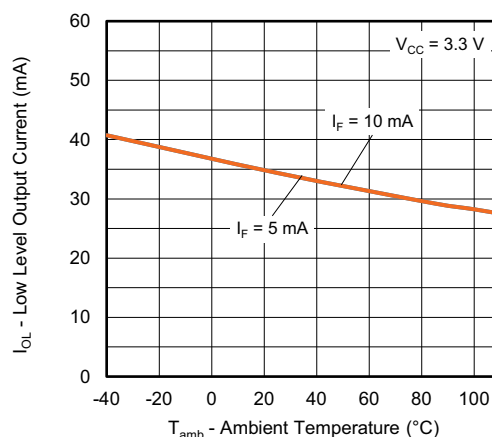


Fig. 8 - Low Level Output Current vs. Ambient Temperature

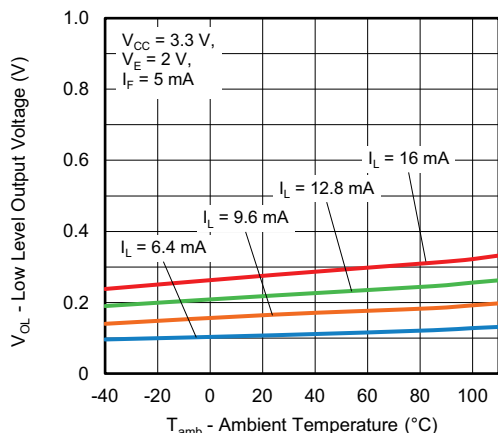


Fig. 6 - Low Level Output Voltage vs. Ambient Temperature

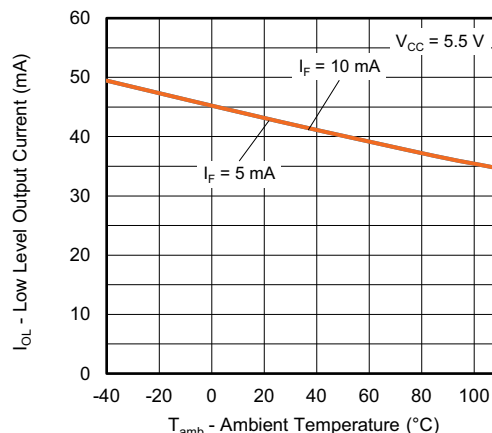


Fig. 9 - Low Level Output Current vs. Ambient Temperature

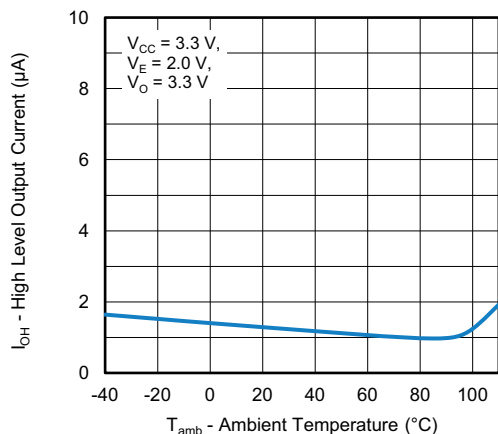


Fig. 10 - High Level Output Current vs. Ambient Temperature

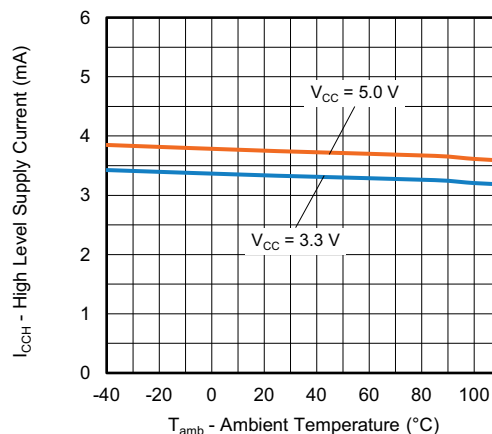


Fig. 13 - High Level Supply Current vs. Ambient Temperature

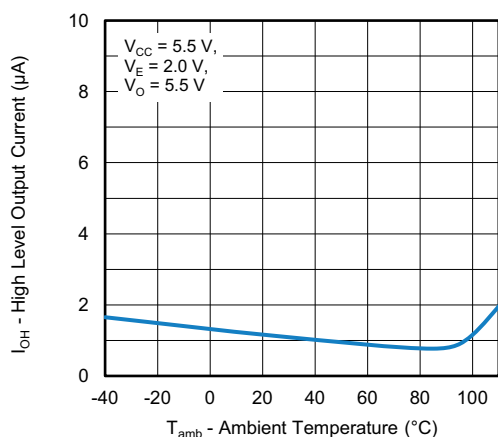


Fig. 11 - High Level Output Current vs. Ambient Temperature

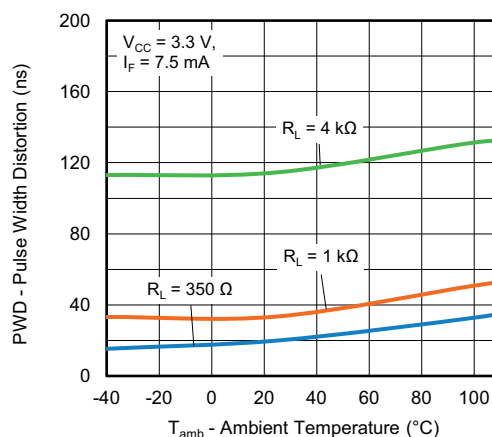


Fig. 14 - Pulse Width Distortion vs. Ambient Temperature

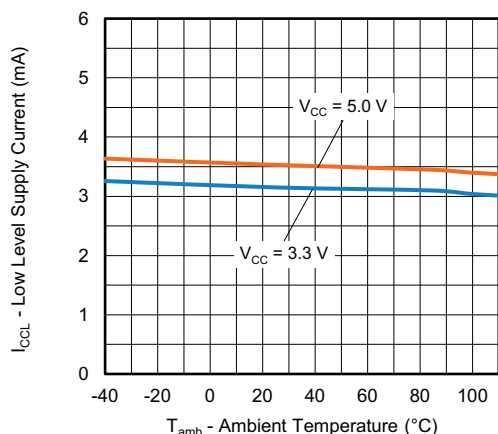


Fig. 12 - Low Level Supply Current vs. Ambient Temperature

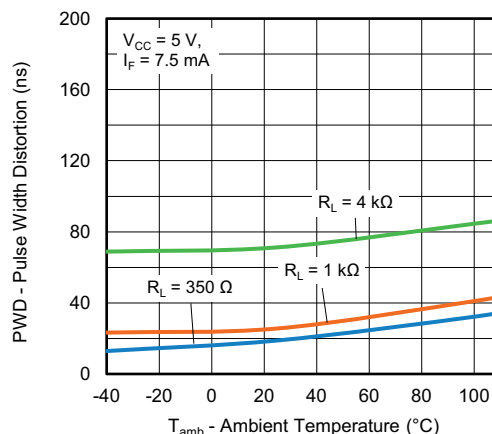


Fig. 15 - Pulse Width Distortion vs. Ambient Temperature



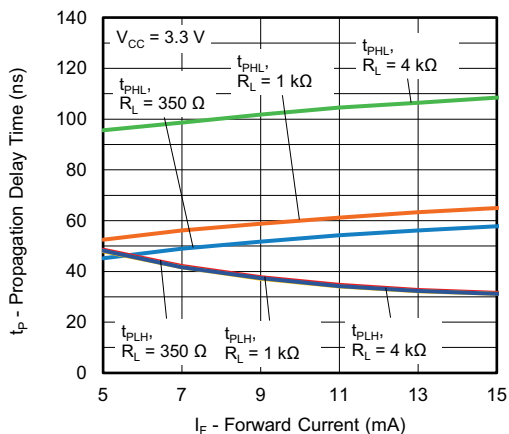


Fig. 16 - Propagation Delay Time vs. Ambient Temperature

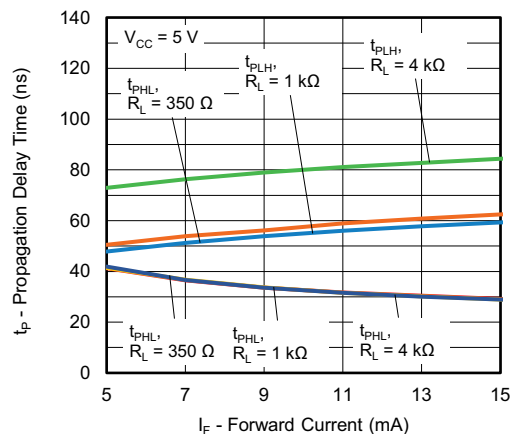


Fig. 19 - Propagation Delay Time vs. Forward Current

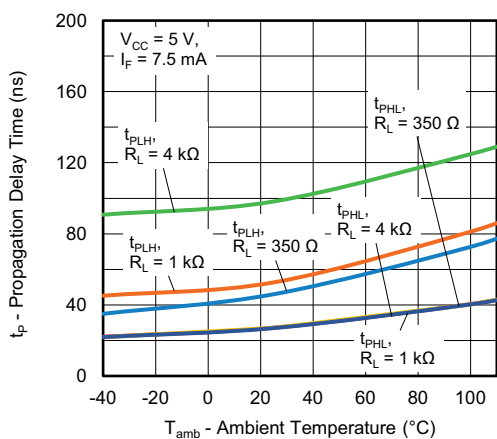


Fig. 17 - Propagation Delay Time vs. Ambient Temperature

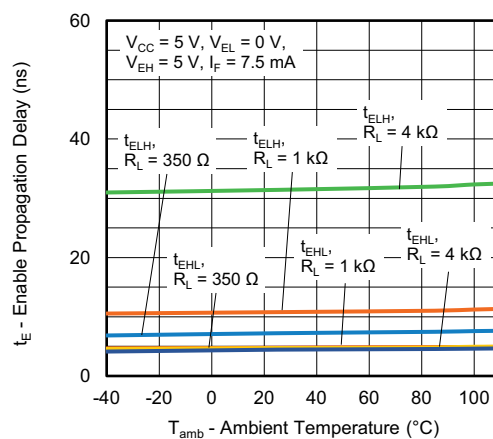


Fig. 20 - Enable Propagation Delay vs. Ambient Temperature

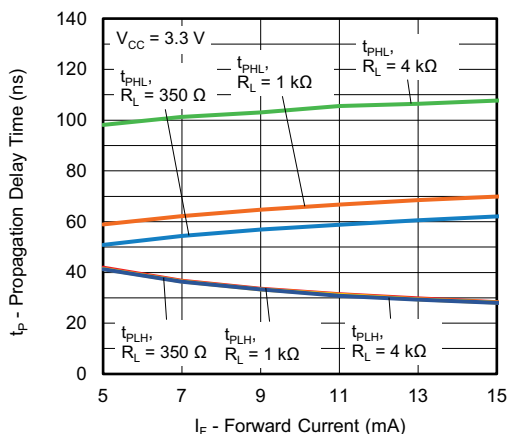


Fig. 18 - Propagation Delay Time vs. Forward Current

**PACKAGE DIMENSIONS** (in millimeters)

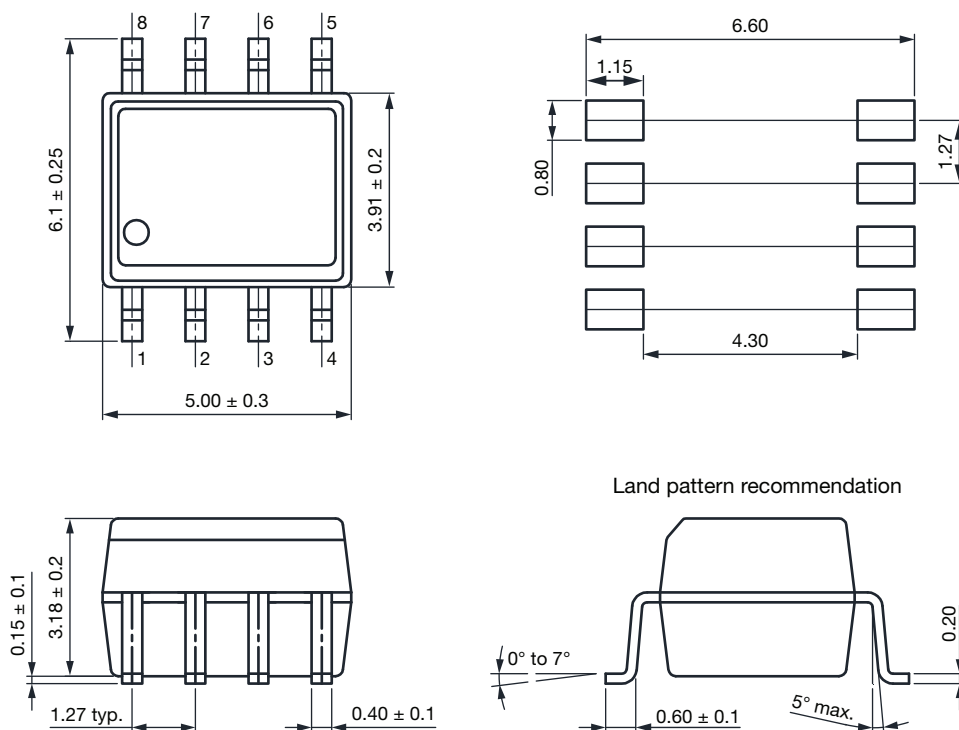
**SOIC-8**


Fig. 21

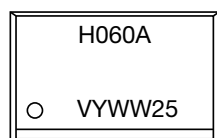
**PACKAGE MARKING**


Fig. 22 - Example of VOIH060AT

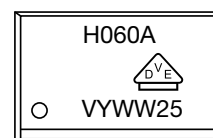


Fig. 23 - Example of VOIH060A-X001T

**Notes**

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

**PACKAGING INFORMATION** (in millimeters)

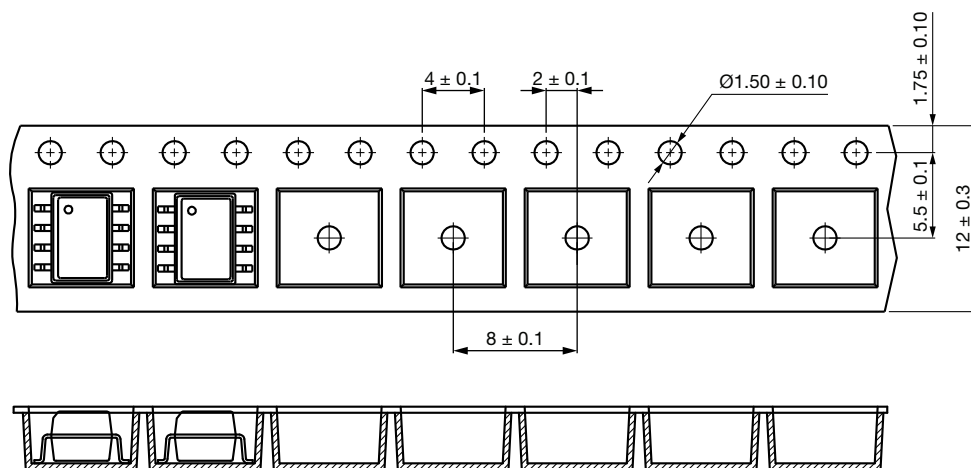
**SOIC-8 Tape**


Fig. 24 - Tape and Reel Packaging (2000 pieces on reel)

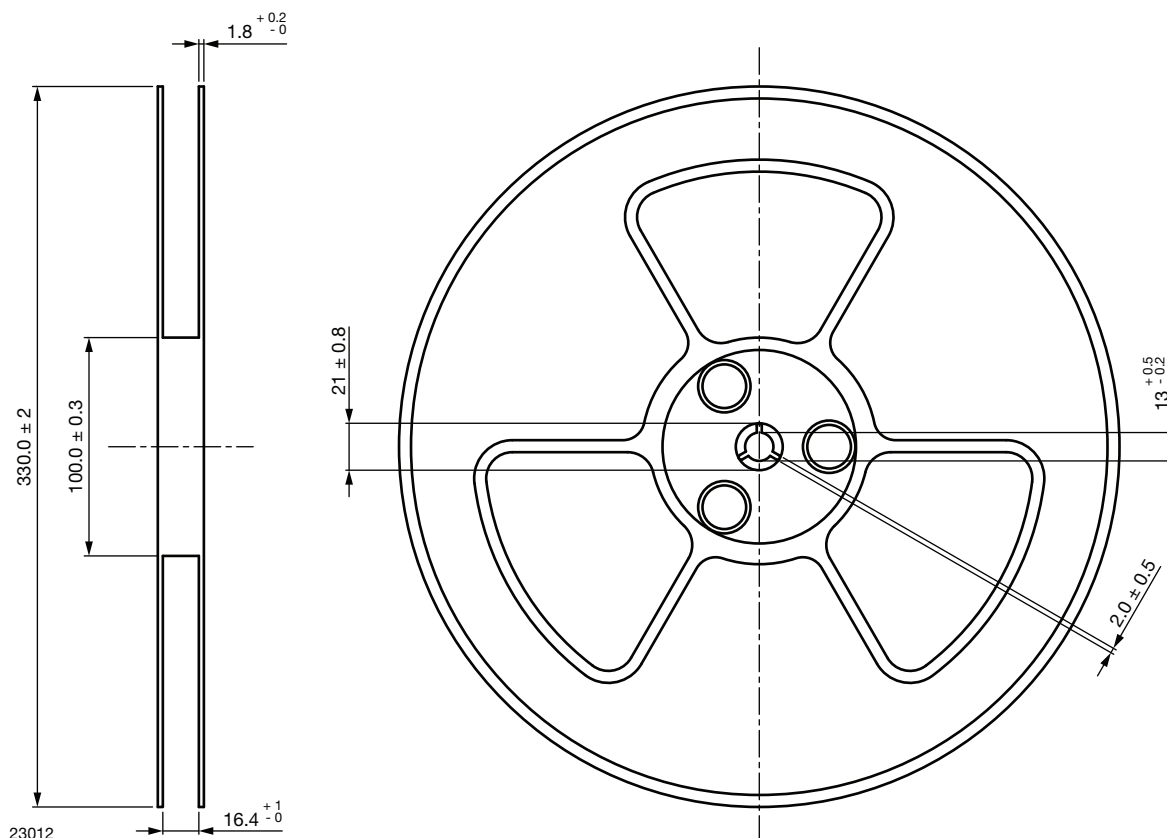
**Reel**


Fig. 25 - 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 ( $T_{S \text{ min.}}$ )	150 °C
- Temperature maximum ( $T_{S \text{ max.}}$ )	200 °C
- Time (min. to max.) ( $t_S$ )	90 s $\pm$ 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

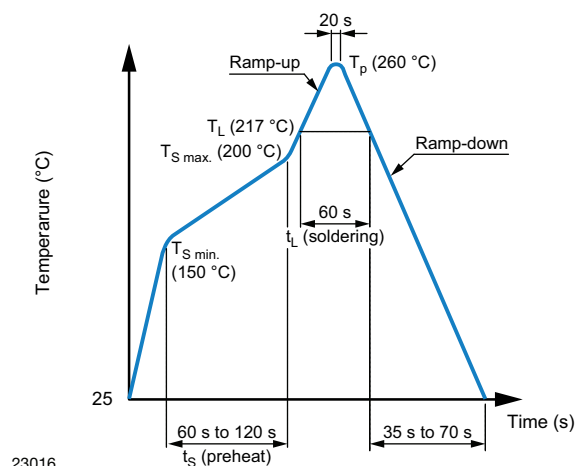


Fig. 26

### 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

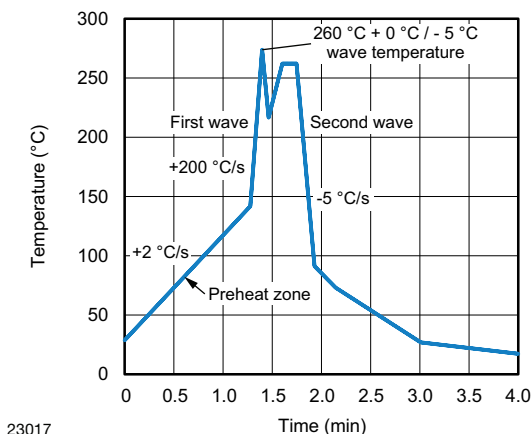


Fig. 27

### 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:  $T_{\text{amb}} < 30 \text{ °C}$ , RH < 85 %

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



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