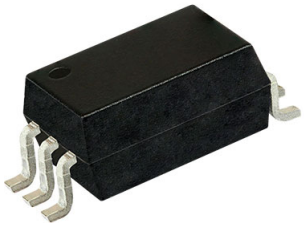
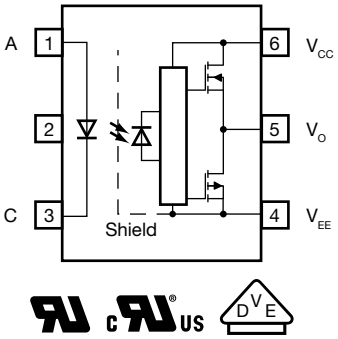
4 A Output Current IGBT and MOSFET Driver





DESCRIPTION

The VOFD343A consists of a AlGaAs LED optically coupled to an integrated circuit with a power output stage. This optocoupler is ideally suited for driving power IGBTs and MOSFETs used in motor control inverter applications. The high operating voltage range of the output stage provides the drive voltages required by gate controlled devices. The VOFD343A is ideally suited for directly driving IGBTs with ratings up to 1200 V / 100 A. For IGBTs with higher ratings, the VOFD343A can be used to drive a discrete power stage which drives the IGBT gate.

FEATURES

- 3.0 A minimum peak current
- 4.0 A peak maximum output current
- Rail-to-rail output stage
- Maximum propagation delay 200 ns
- Maximum propagation delay difference 100 ns
- 35 kV/µs common mode rejection ratio
- Wide operating range of 15 V to 30 V
- Extended temperature range of -40 °C to +125 °C
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

APPLICATIONS

- Isolated IGBT / MOSFET gate driver
- AC and brushless DC motor drives
- Induction stove top
- Industrial inverters
- Uninterruptible power supplies (UPS)

AGENCY APPROVALS

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

LINKS TO ADDITIONAL RESOURCES

Design Tools | Related Documents | Ultra Librarian EDA / CAD | SPICE Models | Evaluation Boards

ORDERING INFORMATION

V	O	F	D	3	4	3	A	-	X	0	#	#	T
PART NUMBER									PACKAGE OPTION				TAPE AND REEL

AGENCY CERTIFIED / PACKAGE	CMR (kV/µs)
UL, cUL	**35**
Stretched SO-6 (option 9)	VOFD343A-X009T
Stretched SO-6 (option 8)	VOFD343A-X008T
UL, cUL, VDE (option 1)	**35**
Stretched SO-6 (option 9)	VOFD343A-X019T
Stretched SO-6 (option 8)	VOFD343A-X018T

TRUTH TABLE

LED	HIGH SIDE	LOW SIDE	V_0
Off	Off	On	Low
On	On	Off	High

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
INPUT				
Forward current		I_F	25	mA
Peak transient input current	≤ 1 µs pulse width, 300 pps	$I_{F(TRAN)}$	1	A
Reverse input voltage		V_R	5	V
Input current (rise / fall time)		$t_{r(in)}$ / $t_{f(in)}$	500	ns
Input power dissipation		P_{diss}	45	mW
OUTPUT				
High peak output current (1)		$I_{OH(PEAK)}$	4.0	A
Low peak output current (1)		$I_{OL(PEAK)}$	4.0	A
Supply voltage		(V_{CC} - V_{EE})	0 to +35	V
Output voltage		$V_{O(PEAK)}$	V_{CC}	V
Output power dissipation		P_{diss}	700	mW
Junction temperature		T_j	125	°C
OPTOCOUPLER				
Storage temperature range		T_S	-55 to +150	°C
Ambient operating temperature range		T_{amb}	-40 to +125	°C
Total power dissipation		P_{tot}	745	mW
Soldering temperature		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) Exponential waveform, pulse width ≤ 0.3 µs, f ≤ 15 kHz

RECOMMENDED OPERATING CONDITION				
PARAMETER	**SYMBOL**	**MIN.**	**MAX.**	**UNIT**
Operating temperature	T_{amb}	-40	+125	°C
Power supply voltage	V_{CC} - V_{EE}	15	30	V
Forward current (V_O in “high” state) (1)	$I_{F(ON)}$	8	16	mA
Forward voltage (V_O in “low” state)	$V_{F(OFF)}$	-3.0	0.8	V
Operating frequency	f	0	75	kHz

Note

(1) The rise and fall times of the input on-current should be less than 0.5 µs

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
Forward voltage	I_F = 10 mA	V_F	1.2	1.37	1.8	V
Temperature coefficient of forward voltage	I_F = 10 mA	$\Delta V_F/\Delta T$	-	-2.0	-	mV/°C
Reverse breakdown voltage	I_R = 10 µA	BV_R	5	-	-	V
Threshold forward current (V_O from “low” to “high”)	V_{CC} = 30 V, V_O < 5 V	I_{FLH}	-	2.5	5	mA
Threshold forward voltage (V_O from “high” to “low”)	V_{CC} = 30 V, V_O > 5 V	V_{FLH}	0.8	-	-	V
Input capacitance	f = 1 MHz, V_F = 0 V	C_{IN}	-	33	-	pF
OUTPUT						
High level supply current	I_F = 10 mA, V_{CC} = 30 V, V_O = open	I_{CCH}	-	1.7	3.0	mA
Low level supply current	I_F = 0 mA, V_{CC} = 30 V, V_O = open	I_{CCL}	-	2.0	3.0	mA
High level output current	V_O = (V_{CC} - 1.5 V)	I_{OH} (1)	-	-	-1.0	A
	V_O = (V_{CC} - 4 V)	I_{OH} (2)	-	-	-3.0	A
Low level output current	V_O = (V_{EE} + 1.5 V)	I_{OL} (1)	1.0	-	-	A
	V_O = (V_{EE} + 4 V)	I_{OL} (2)	3.0	-	-	A
High level output voltage	I_F = 10 mA, I_O = -100 mA	V_{OH}	V_{CC} - 0.3 V	V_{CC} - 0.1 V	-	V
Low level output voltage	I_F = 0 mA, I_O = 100 mA	V_{OL}	-	V_{EE} + 0.1 V	V_{EE} + 0.25 V	V
UVLO threshold	V_O > 5 V, I_F = 10 mA	V_{UVLO+}	11.0	12.7	13.5	V
	V_O < 5 V, I_F = 10 mA	V_{UVLO-}	9.5	11.2	12.0	V
UVLO hysteresis		$UVLO_{HYS}$	-	1.5	-	V
COUPLER						
Input to output capacitance	f = 1 MHz	C_{IO}	-	0.92	-	pF

Notes

- All typical values at T_{amb} = 25°C and V_{CC} - V_{EE} = 30 V, unless otherwise specified; all minimum and maximum specifications are at recommended operating condition

(1) Maximum pulse width = 50 µs

(2) Maximum pulse width = 10 µs

TEST CIRCUITS

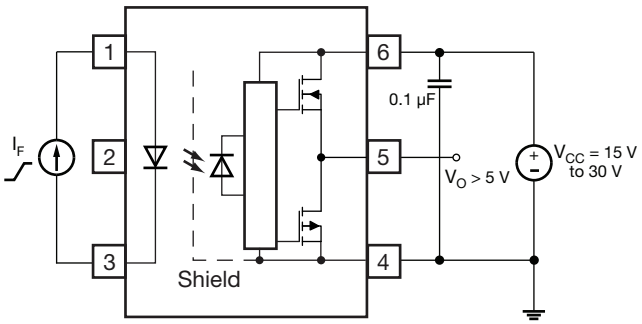


Fig. 1 - I_{FLH} Test Circuit

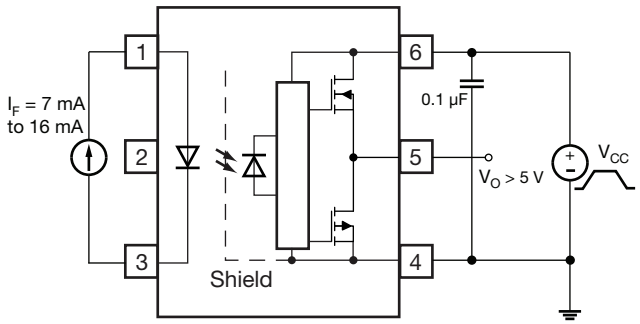


Fig. 2 - UVLO Test Circuit

SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, V_{CC} - V_{EE} = 30 V unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Propagation delay time to V_O = "low"	R_g = 10 Ω, C_g = 15 nF, f = 20 kHz, duty cycle = 50 %, I_F = 7 mA to 16 mA, V_{CC} = 15 V to 30 V, V_{EE} = ground	t_{PHL}	50	-	200	ns
Propagation delay time to V_O = "high"		t_{PLH}	50	-	200	ns
Pulse width distortion		PWD	-	10	70	ns
Propagation delay difference (1)		PDD	-100	-	100	ns
Output rise time (10 % to 90 %)		t_r	-	35	-	ns
Output fall time (90 % to 10 %)		t_f	-	35	-	ns

Note

(1) The difference between t_{PHL} and t_{PLH} between any two parts, series parts, or channels under same test conditions

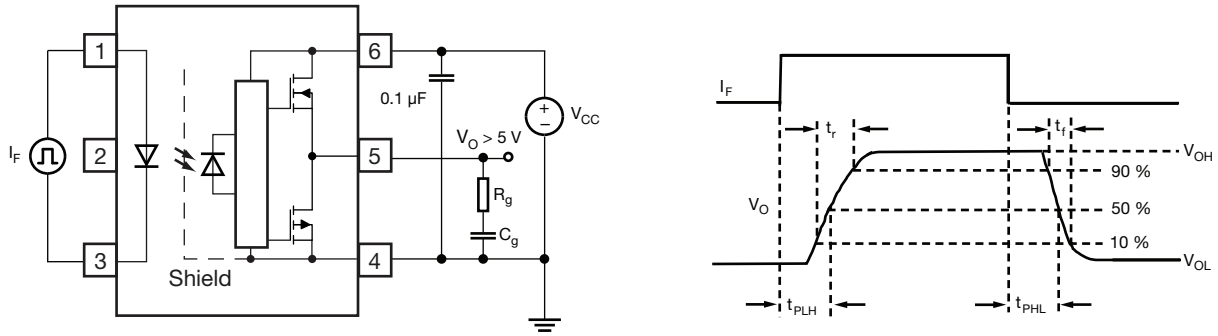


Fig. 3 - t_{PLH}, t_{PHL}, t_r and t_f Test Circuit and Waveforms

COMMON MODE TRANSIENT IMMUNITY (T_{amb} = 25 °C, V_{CC} - V_{EE} = 30 V unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Common mode transient immunity at high level output (V_O = "high") (1)	I_F = 10 mA to 16 mA, V_{CM} = 1500 V, V_{CC} = 30 V	$\|CM_H\|$	35	50	-	kV/µs
Common mode transient immunity at low level output (V_O = "low") (2)	V_F = 0 V, V_{CM} = 1500 V, V_{CC} = 30 V	$\|CM_L\|$	35	50	-	kV/µs

Notes

(1) CM_H is the maximum rate of rise of the common mode voltage that can be sustained with the output voltage in the logic high state (V_O > 15 V)

(2) CM_L is the maximum rate of fall of the common mode voltage that can be sustained with the output voltage in the logic low state (V_O < 1 V)

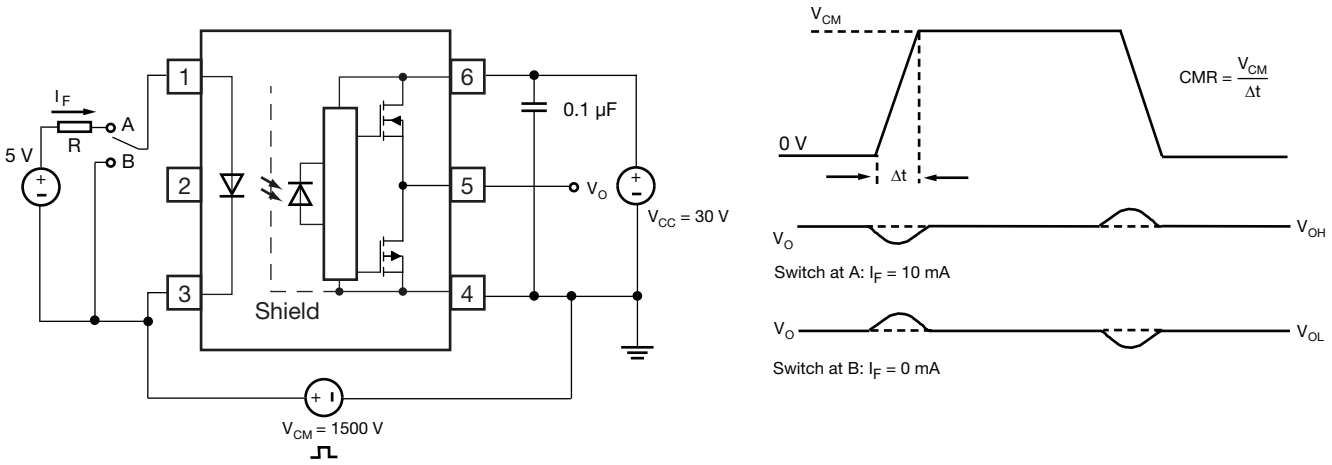


Fig. 4 - CMR Test Circuit and Waveforms

SAFETY AND INSULATION RATINGS				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Climatic classification	According to IEC 68 part 1		55 / 125 / 21	
Pollution degree	According to DIN VDE 0109		2	
Comparative tracking index	Insulation group IIIa	CTI	275	
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, stretched SO-6 (option 9)	V_{IOTM}	6000	V_{peak}
	According to DIN EN 60747-5-5, stretched SO-6 (option 8)		8000	V_{peak}
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5, stretched SO-6 (option 9)	V_{IORM}	891	V_{peak}
	According to DIN EN 60747-5-5, stretched SO-6 (option 8)		1140	V_{peak}
Isolation resistance	T_{amb} = 25 °C, V_{IO} = 500 V	R_{IO}	≥ 10^{12}	Ω
Output safety power		P_{SO}	600	mW
Input safety current		I_{SI}	150	mA
Input safety temperature		T_S	175	°C
Creepage distance	Stretched SO-6 (option 9)		≥ 7	mm
	Stretched SO-6 (option 8)		≥ 8	mm
Clearance distance	Stretched SO-6 (option 9)		≥ 8	mm
	Stretched SO-6 (option 8)		≥ 8	mm
Insulation thickness		DTI	≥ 0.4	mm

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

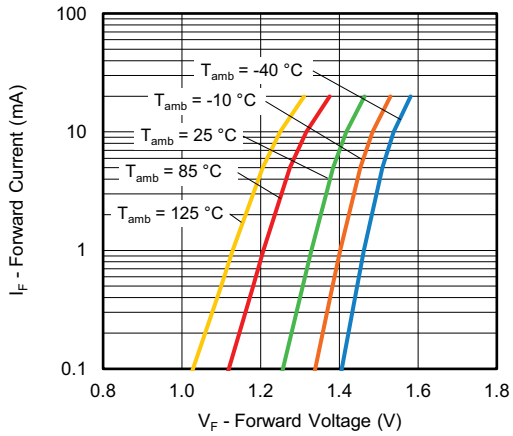


Fig. 5 - Forward Current vs. Forward Voltage

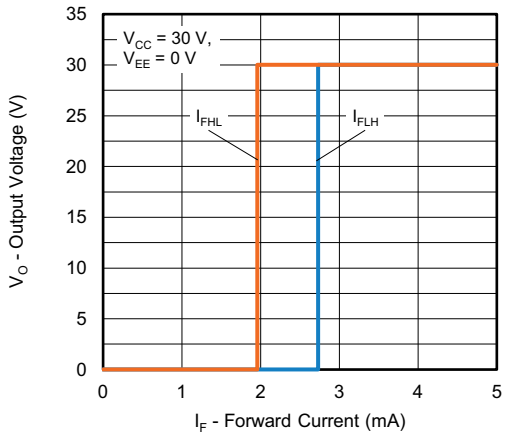


Fig. 6 - Output Voltage vs. Forward Current

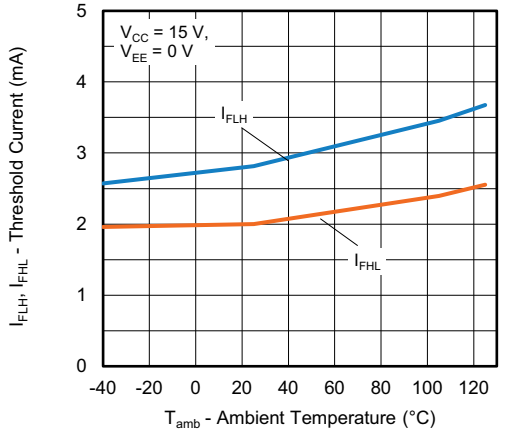


Fig. 7 - Threshold Current vs. Ambient Temperature

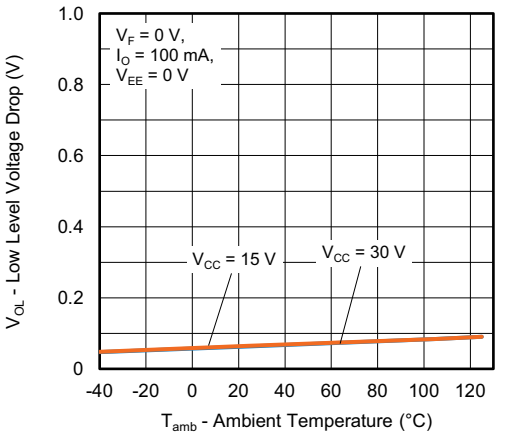


Fig. 8 - Low Level Voltage Drop vs. Ambient Temperature

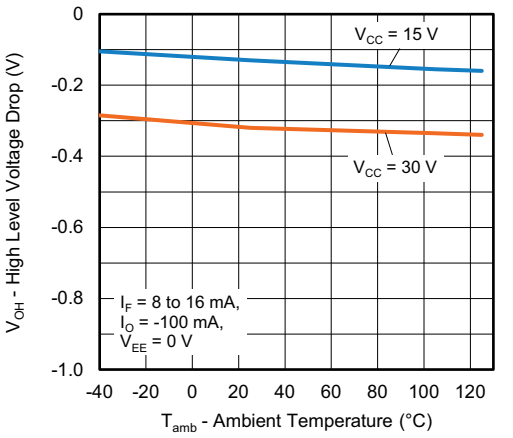


Fig. 9 - High Level Voltage Drop vs. Ambient Temperature

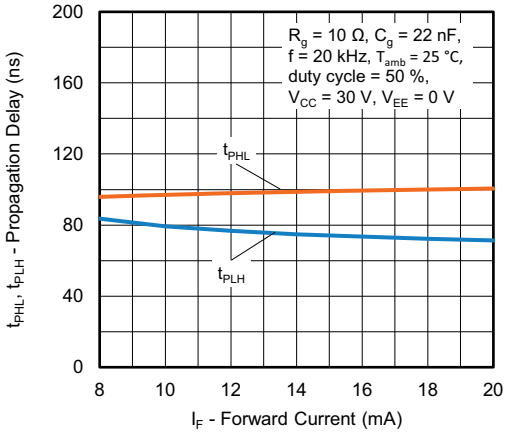


Fig. 10 - Propagation Delay vs. Forward Current

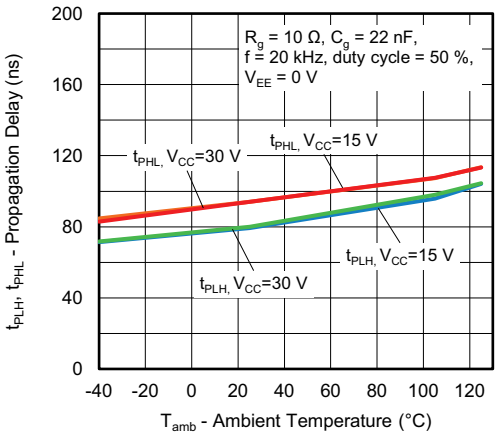


Fig. 11 - Propagation Delay vs. Ambient Temperature

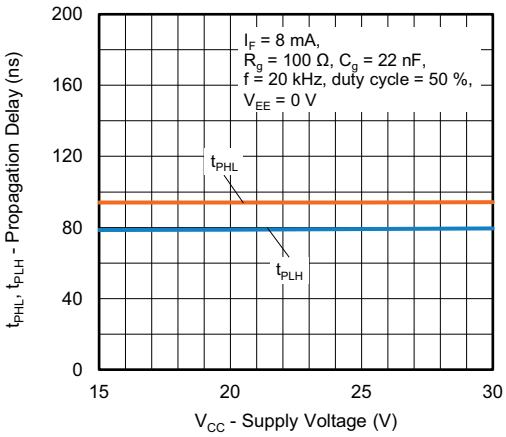


Fig. 12 - Propagation Delay vs. Supply Voltage

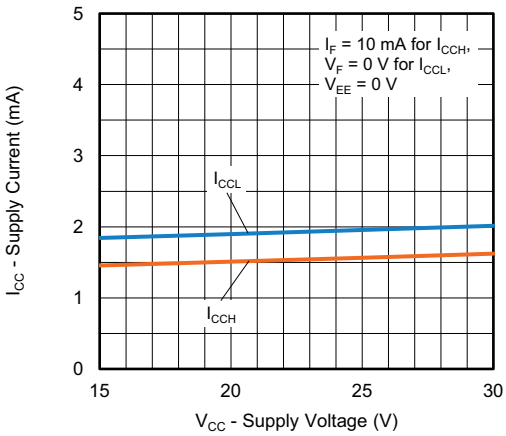


Fig. 13 - Supply Current vs. Supply Voltage

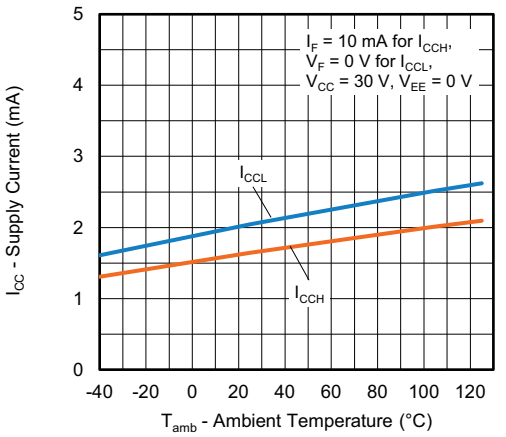


Fig. 14 - Supply Current vs. Ambient Temperature

PACKAGE DIMENSIONS (in millimeters)

Stretched SO-6 (option 9)

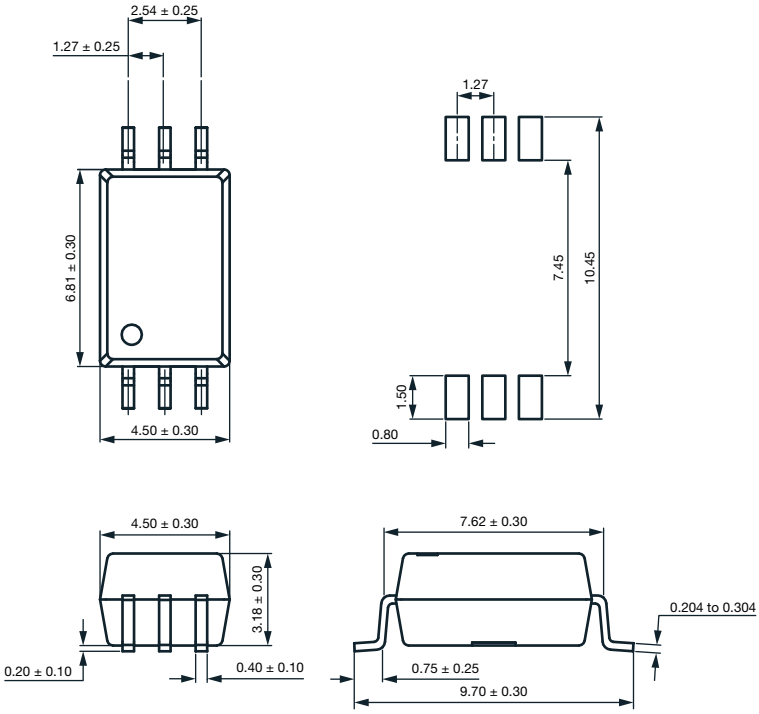


Fig. 15

Stretched SO-6 (option 8)

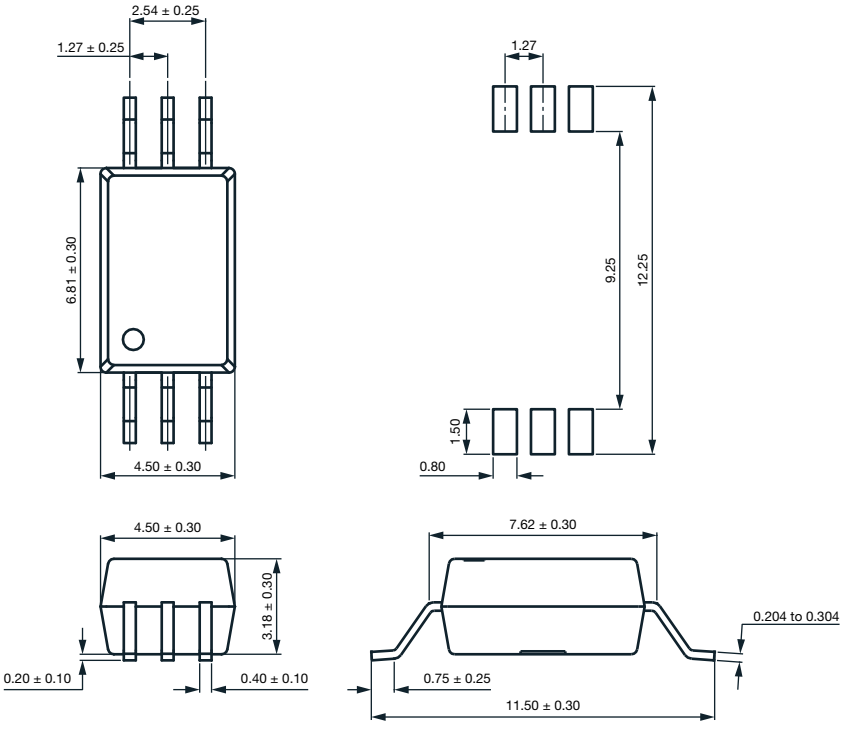


Fig. 16

PACKAGE MARKING

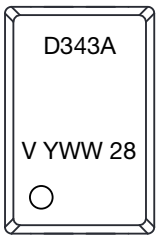


Fig. 17 - Example of VOFD343A-X009T

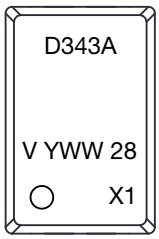


Fig. 18 - Example of VOFD343A-X018T

Notes

- "YWW" is the date code marking (Y = year code, WW = week code)
- "X1" extension is only marked on VDE option parts
- Tape and reel suffix (T) is not part of the package marking

PACKAGING INFORMATION (in millimeters)

Stretched SO-6 (option 9)

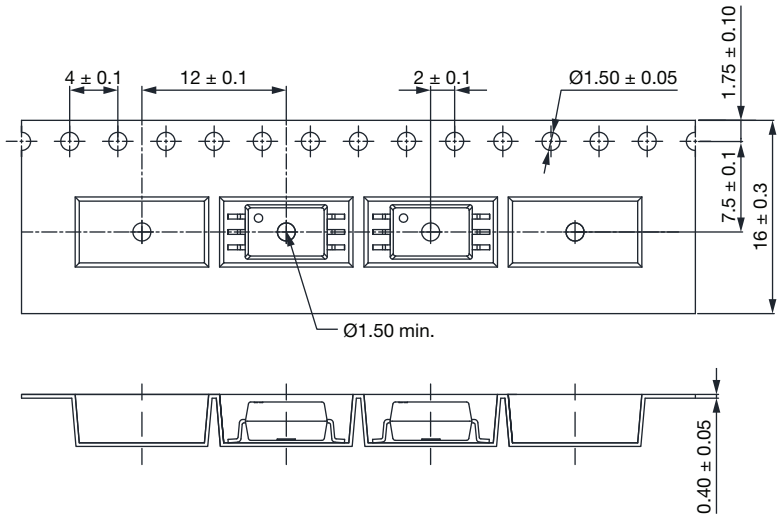


Fig. 19 - Tape and Reel Packaging (1000 pieces on reel)

Stretched SO-6 (option 8)

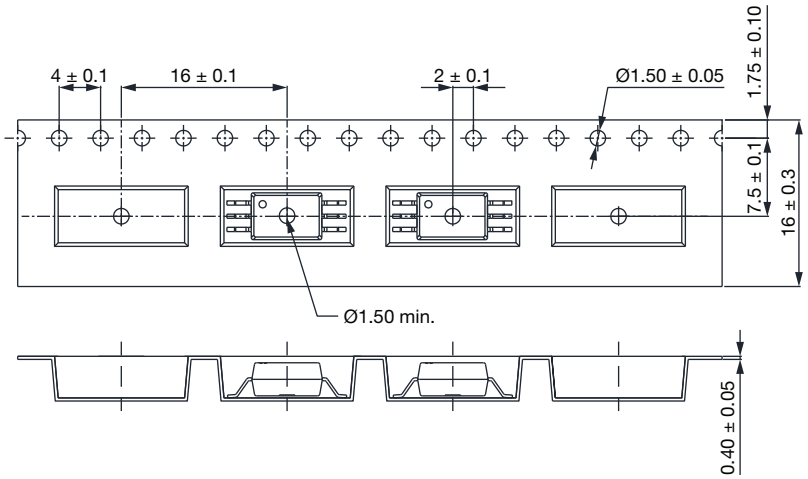


Fig. 20 - Tape and Reel Packaging (1000 pieces on reel)

Reel

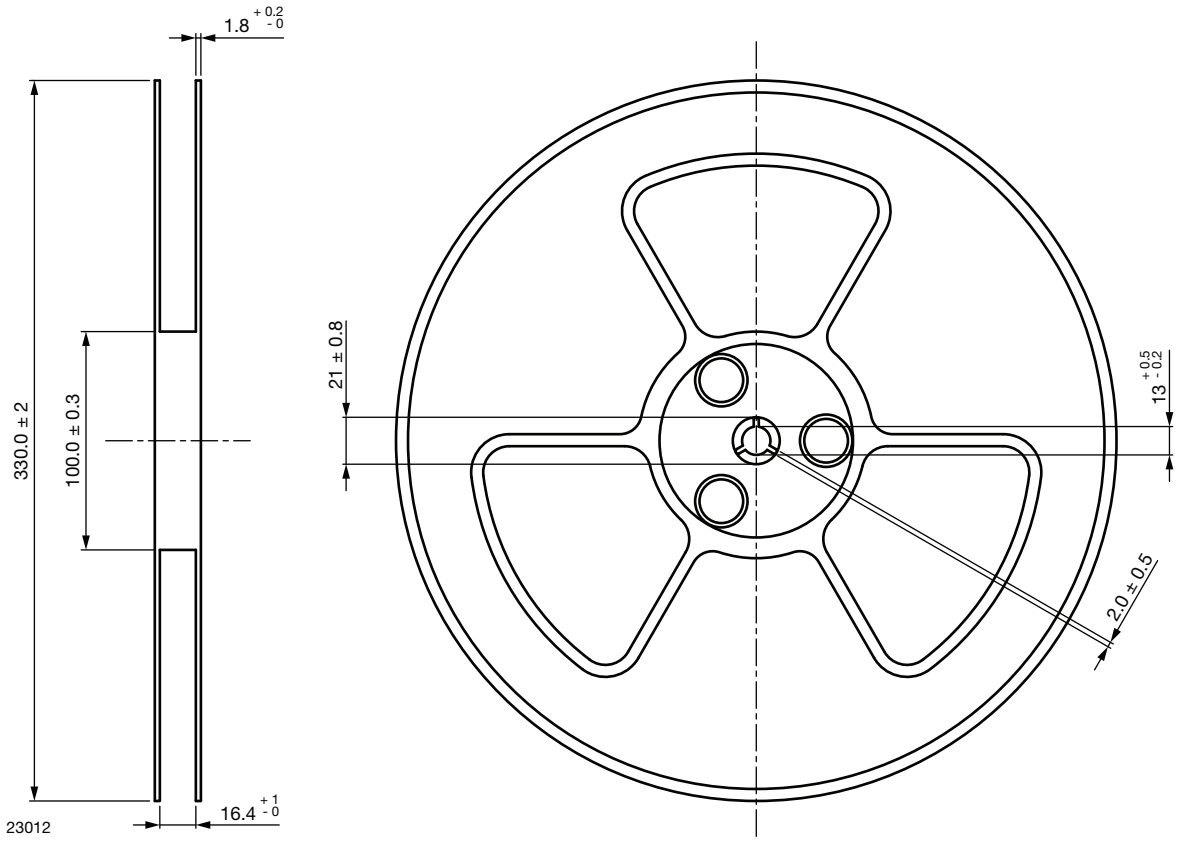


Fig. 21 - Tape and Reel Shipping Medium

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

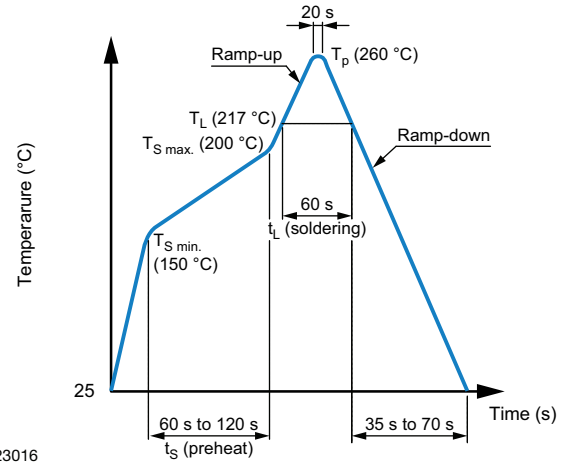


Fig. 1

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

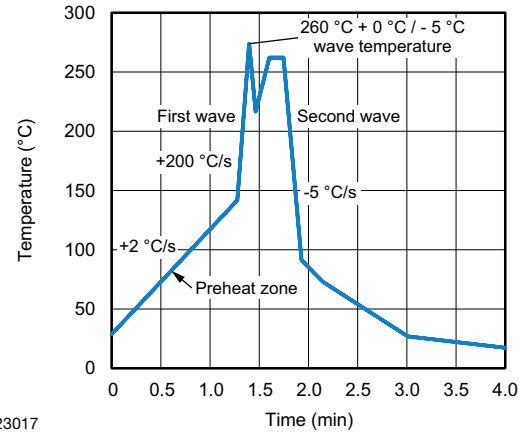


Fig. 2

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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