

Optocoupler, Phototriac Output, Zero Crossing, High dV/dt, Low Input Current



(1) Zero crossing circuit



23041

DESIGN SUPPORT TOOLS

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DESCRIPTION

The VOT8024AD consists of a GaAs IRLED optically coupled to a photosensitive zero crossing TRIAC packaged in a board space saving DIP-4 package.

The VOT8024AD isolates low-voltage logic from 120 V_{AC}, 240 V_{AC}, and 380 V_{AC} lines to control resistive, inductive, or capacitive loads including motors, solenoids, high current thyristors or TRIAC and relays.

FEATURES

- Space saving package
- High static dV/dt 1000 V/μs
- High input sensitivity I_{FT} = 5 mA
- 100 mA on-state current
- Zero voltage crossing detector
- 800 V peak off-state blocking voltage
- Isolation rated voltage 5300 V_{RMS}
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



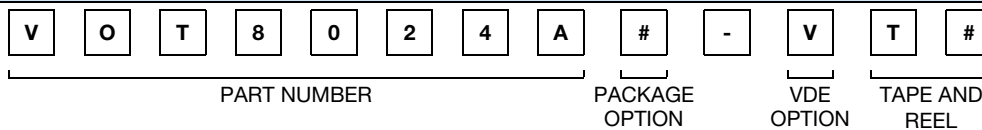
APPLICATIONS

- Power TRIAC driver in solid-state relays
- 3-phase AC equipment
- Motor control
- Industrial control
- White goods / household equipment

AGENCY APPROVALS

- [UL 1577](#)
- [cUL](#)
- [DIN EN 60747-5-5 \(VDE 0884-5\), available with option "V"](#)
- [CQC](#)

ORDERING INFORMATION



AGENCY CERTIFIED/PACKAGE	TRIGGER CURRENT, I _{FT} (mA)
UL, cUL	5
DIP-4	VOT8024AD
DIP-4, 400 mil	VOT8024AG
SMD-4	VOT8024AB-T ⁽¹⁾
SMD-4, 90° orientation	VOT8024AB-T1
SMD-4, 180° orientation	VOT8024AB-T2
SMD-4, 270° orientation	VOT8024AB-T3
VDE, UL, cUL	5
DIP-4	VOT8024AD-V
DIP-4, 400 mil	VOT8024AG-V
SMD-4	VOT8024AB-VT ⁽¹⁾
SMD-4, 90° orientation	VOT8024AB-VT1
SMD-4, 180° orientation	VOT8024AB-VT2
SMD-4, 270° orientation	VOT8024AB-VT3

Note

(1) Also available in tubes; do not add T to end



ABSOLUTE MAXIMUM RATINGS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
INPUT				
Reverse voltage		V_R	6	V
Forward current		I_F	50	mA
Power dissipation		P_{diss}	120	mW
Junction temperature		T_j	125	$^{\circ}\text{C}$
OUTPUT				
Peak off-state voltage		V_{DRM}	800	V
Power dissipation		P_{diss}	150	mW
On-state current		$I_{T(RMS)}$	100	mA
Peak repetitive surge current	PW = 1 ms, 120 pps	I_{TSM}	1	A
Junction temperature		T_j	125	$^{\circ}\text{C}$
COUPLER				
Storage temperature range		T_{stg}	-55 to +150	$^{\circ}\text{C}$
Ambient temperature range		T_{amb}	-55 to +110	$^{\circ}\text{C}$
Total power dissipation		P_{diss}	250	mW
Soldering temperature	For 10 s	T_{sld}	260	$^{\circ}\text{C}$

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. This phototriac should not be used to drive a load directly. It is intended to be a trigger device only



Fig. 1 - Maximum Forward Current vs. Ambient Temperature



Fig. 2 - Maximum On-State Current vs. Ambient Temperature



ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
INPUT						
Forward voltage	$I_F = 20\text{ mA}$	V_F	-	1.2	1.4	V
Reverse current	$V_R = 3\text{ V}$	I_R	-	-	10	μA
OUTPUT						
Off-state current	$V_{DRM} = 800\text{ V}$	I_{DRM}	-	-	1	μA
On-state voltage	$I_T = 100\text{ mA peak}$	V_{TM}	-	-	3	V
Holding current		I_H	-	400	-	μA
Zero cross inhibit voltage	$I_F = \text{rated } I_{FT}$	V_{INH}	-	5	20	V
Critical rate of rise of off-state voltage		$dV/dt^{(1)}$	1000	-	-	$\text{V}/\mu\text{s}$
Leakage in inhibit state	$I_F = \text{rated } I_{FT}, \text{ rated } V_{DRM}, \text{ off-state}$	I_{DRM2}	-	-	500	μA
COUPLER						
Trigger current	$V_{TM} = 3\text{ V}$	I_{FT}	-	-	5	mA

Notes

- Minimum and maximum values were tested 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
- ⁽¹⁾ Static dV/dt

SAFETY AND INSULATION RATINGS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Climatic classification	According to IEC 68 part 1		55 / 110 / 21	
Comparative tracking index	Insulation group IIIa	CTI	175	
Maximum rated withstanding isolation voltage	According to UL1577, $t = 1\text{ min}$	V_{ISO}	5300	V_{RMS}
Maximum transient isolation voltage	According to DIN EN 60747-5-5	V_{IOTM}	8000	V_{peak}
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5, DIP-4, SMD-4	V_{IORM}	890	V_{peak}
	According to DIN EN 60747-5-5, DIP-4, 400 mil	V_{IORM}	1140	V_{peak}
Isolation resistance	$V_{IO} = 500\text{ V}, T_{amb} = 25\text{ }^{\circ}\text{C}$	R_{IO}	$\geq 10^{12}$	Ω
	$V_{IO} = 500\text{ V}, T_{amb} = 100\text{ }^{\circ}\text{C}$	R_{IO}	$\geq 10^{11}$	Ω
Output safety power		P_{SO}	600	mW
Input safety current		I_{SI}	400	mA
Input safety temperature		T_S	175	$^{\circ}\text{C}$
Creepage distance	DIP-4, SMD-4		≥ 7	mm
Clearance distance			≥ 7	mm
Creepage distance	DIP-4, 400 mil		≥ 8	mm
Clearance distance			≥ 8	mm
Insulation thickness		DTI	≥ 0.4	mm

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



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

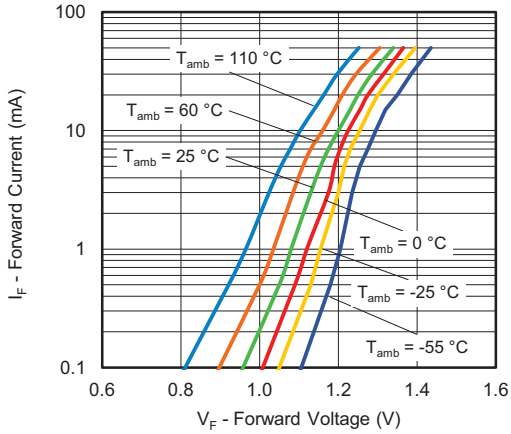


Fig. 3 - Forward Current vs. Forward Voltage



Fig. 6 - On State Current vs. On State Voltage

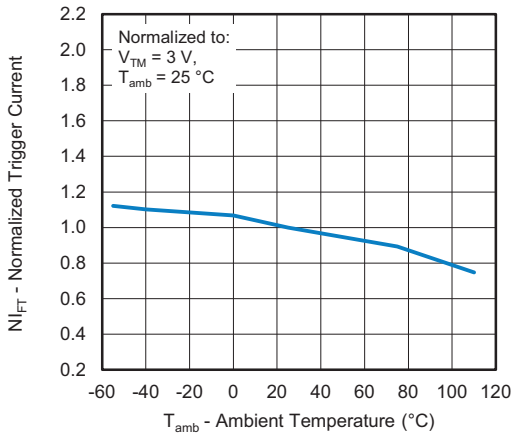


Fig. 4 - Normalized Trigger Current vs. Ambient Temperature

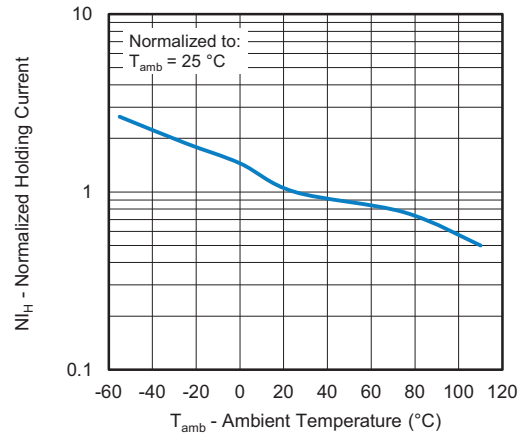


Fig. 7 - Normalized Holding Current vs. Ambient Temperature

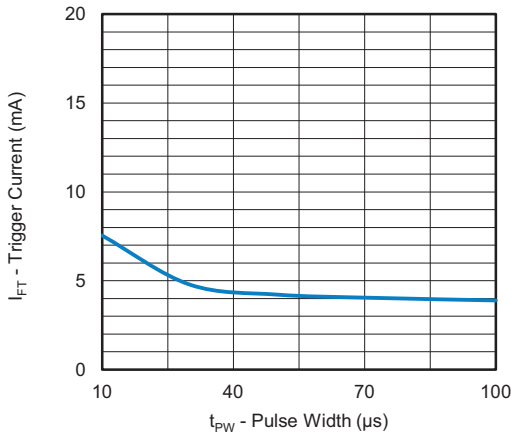


Fig. 5 - Trigger Current vs. Pulse Width

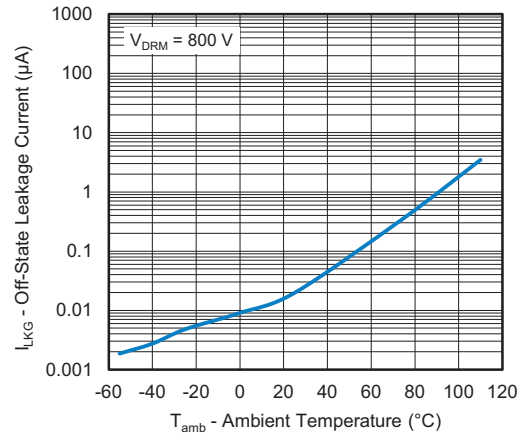


Fig. 8 - Off-State Leakage Current vs. Ambient Temperature

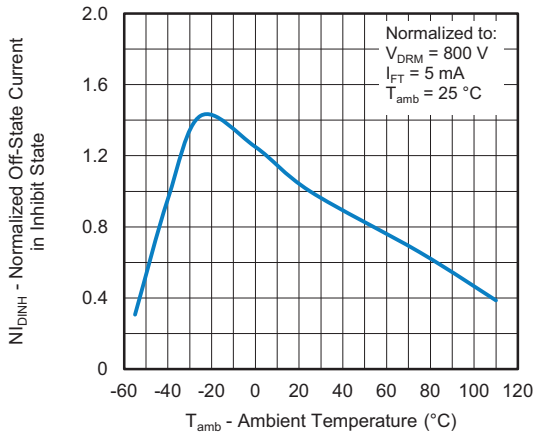


Fig. 9 - Normalized Off-State Current in Inhibit State vs. Ambient Temperature

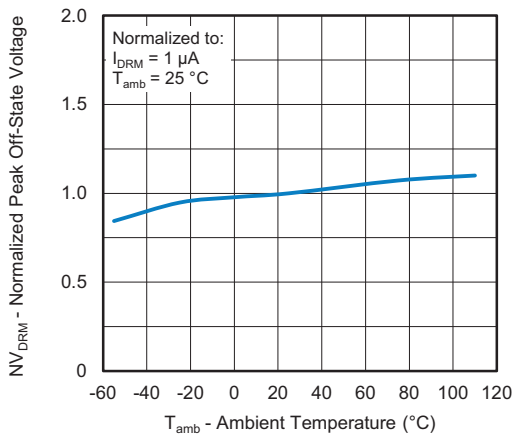


Fig. 10 - Normalized Peak Off-State Voltage vs. Ambient Temperature

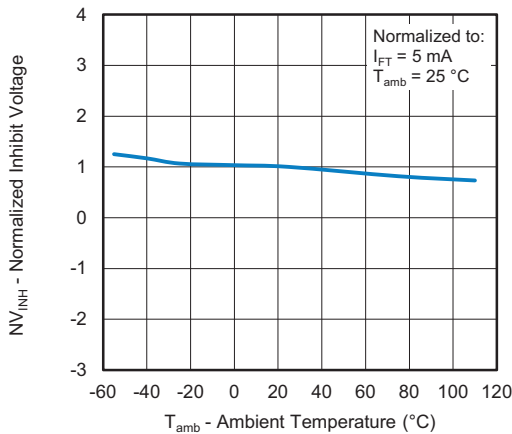


Fig. 11 - Normalized Inhibit Voltage vs. Ambient Temperature



PACKAGE DIMENSIONS (in millimeters)

DIP-4



Fig. 1

DIP-4, 400 mil

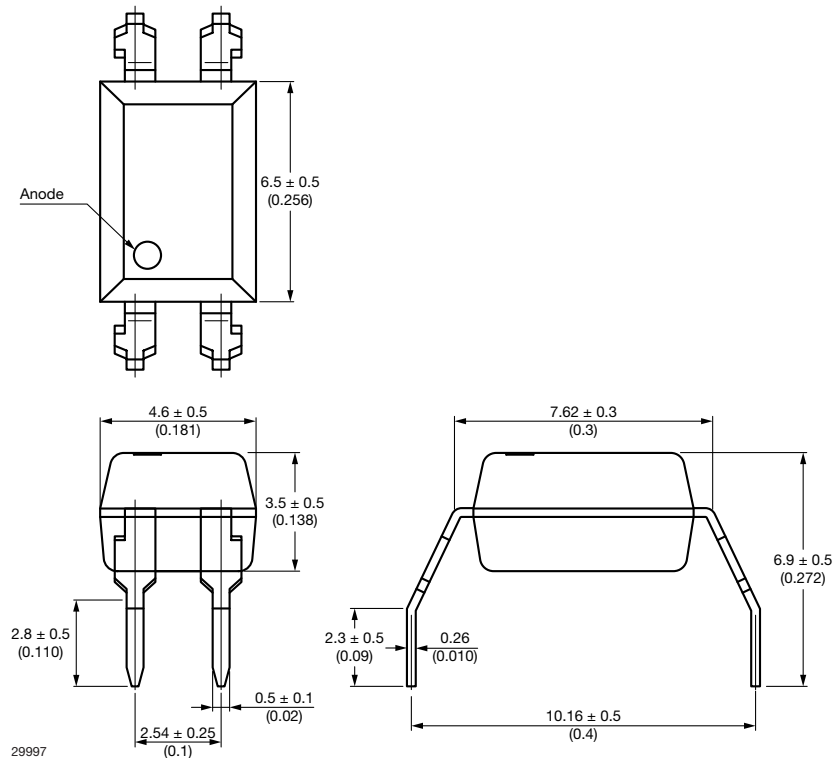


Fig. 2



SMD-4



Fig. 3

PACKAGE MARKING



Fig. 12 - Example of VOT8024AD-VT

Notes

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



PACKAGING INFORMATION (in millimeters)

DEVICES PER TUBE			
TYPE	UNITS/TUBE	TUBES/BOX	UNITS/BOX
DIP-4	100	40	4000
DIP-4, 400 mil	100	40	4000

DIP-4 Tube



23009

Fig. 13 - LTK-O-092

SMD-4 Tape



23013

Fig. 14 - Tape and Reel Packaging (1000 pieces on reel)

SMD-4 Tape, 90° Orientation



Fig. 15 - Tape and Reel Packaging (2000 pieces on reel)

SMD-4 Tape, 180° Orientation

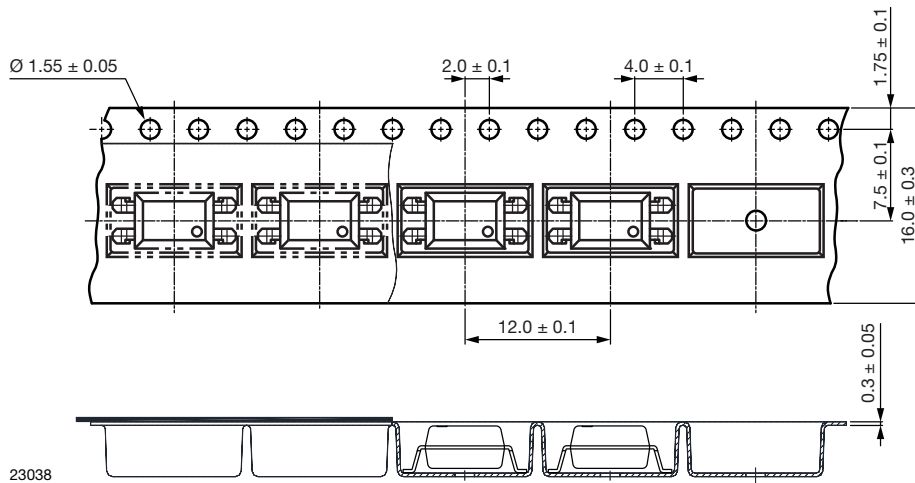


Fig. 16 - Tape and Reel Packaging (1000 pieces on reel)

SMD-4 Tape, 270° Orientation

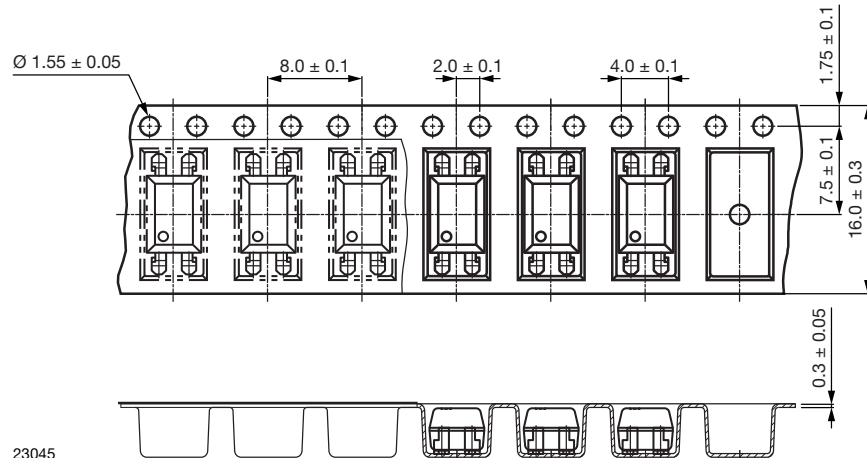


Fig. 17 - Tape and Reel Packaging (2000 pieces on reel)



Reel



Fig. 18 - 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 ± 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

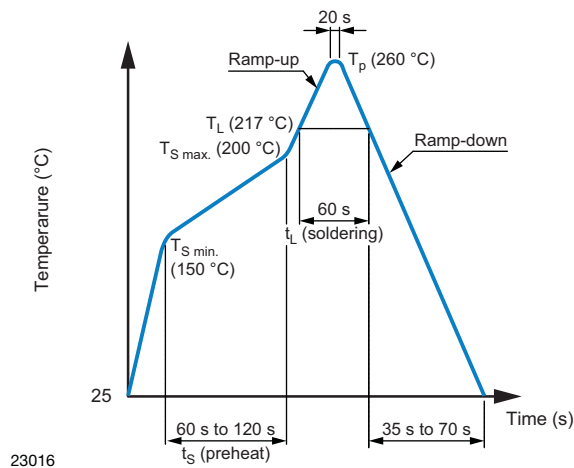


Fig. 4

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

23017

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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