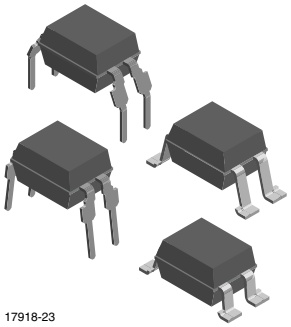
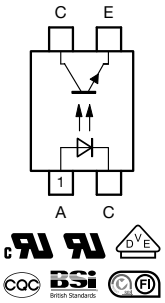
Optocoupler, Phototransistor Output, High Temperature





FEATURES

- Temperature range -55 °C to +110 °C
- Rated impulse voltage (transient overvoltage), V_{IOTM} = 6 kV_{peak}
- Isolation test voltage (partial discharge test voltage), V_{pd} = 1.6 kV
- Rated isolation voltage (RMS includes DC), V_{IOWM} = 600 V_{RMS}
- Rated recurring peak voltage (repetitive) V_{IORM} = 850 V_{peak}
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

DESCRIPTION

The VO615A consists of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4 pin plastic dual inline package.

AGENCY APPROVALS

The safety application model number covering all products in this datasheet is VO615A. This model number should be used when consulting safety agency documents.

- BSI
- DIN EN 60747-5-5 (VDE 0884-5), available with option 1
- FIMKO
- UL 1577
- cUL 1577
- CQC

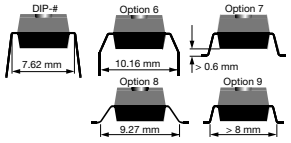
APPLICATIONS

Circuits for safe protective separation against electrical shock according to safety class II (reinforced isolation):

- Application class I to IV at mains voltage ≤ 300 V
- Application class I to IV at mains voltage ≤ 600 V according to table 1 of IEC 60664-1, suitable for:
  - Switch-mode power supplies
  - Line receiver
  - Computer peripheral interface
  - Microprocessor system interface

ORDERING INFORMATION

V	O	6	1	5	A	-	#	X	0	#	#	T
PART NUMBER							CTR BIN	PACKAGE OPTION				TAPE AND REEL



AGENCY CERTIFIED/ PACKAGE	CTR (%)									
	5 mA	10 mA				5 mA				
UL, cUL, BSI, FIMKO, CQC	**50 to 600**	**40 to 80**	**63 to 125**	**100 to 200**	**160 to 320**	**50 to 150**	**100 to 300**	**80 to 160**	**130 to 260**	**200 to 400**
DIP-4	VO615A	VO615A-1	VO615A-2	VO615A-3	VO615A-4	VO615A-5	VO615A-6	VO615A-7	VO615A-8	VO615A-9
DIP-4, 400 mil, option 6	VO615A-X006	VO615A-1X006	VO615A-2X006	VO615A-3X006	VO615A-4X006	VO615A-5X006	VO615A-6X006	VO615A-7X006	VO615A-8X006	VO615A-9X006
SMD-4, option 7	VO615A-X007T	VO615A-1X007T	VO615A-2X007T	VO615A-3X007T	VO615A-4X007T	VO615A-5X007T	VO615A-6X007T	VO615A-7X007T	VO615A-8X007T	VO615A-9X007T
SMD-4, option 8	-	-	-	VO615A-3X008T	-	-	-	-	-	-
SMD-4, option 9	VO615A-X009T	VO615A-1X009T	VO615A-2X009T	VO615A-3X009T	VO615A-4X009T	VO615A-5X009T	VO615A-6X009T	VO615A-7X009T	-	VO615A-9X009T
UL, cUL, BSI, FIMKO, CQC, VDE (option 1)	**50 to 600**	**40 to 80**	**63 to 125**	**100 to 200**	**160 to 320**	**50 to 150**	**100 to 300**	**80 to 160**	**130 to 260**	**200 to 400**
DIP-4	VO615A-X001	VO615A-1X001	VO615A-2X001	VO615A-3X001	VO615A-4X001	-	VO615A-6X001	VO615A-7X001	VO615A-8X001	-
DIP-4, 400 mil, option 6	-	-	VO615A-2X016	VO615A-3X016	VO615A-4X016	VO615A-5X016	-	-	VO615A-8X016	VO615A-9X016
SMD-4, option 7	VO615A-X017T	VO615A-1X017T	-	VO615A-3X017T	VO615A-4X017T	-	VO615A-6X017T	VO615A-7X017T	VO615A-8X017T	VO615A-9X017T
SMD-4, option 8	-	-	-	VO615A-3X018T	VO615A-4X018T	-	-	-	VO615A-8X018T	-
SMD-4, option 9	-	VO615A-1X019T	VO615A-2X019T	VO615A-3X019T	VO615A-4X019T	-	-	-	-	-

Note

- Additional options may be possible, please contact sales office

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ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
Reverse voltage		V_R	6	V
Forward current		I_F	60	mA
Forward surge current	$t_p \leq 10$ µs	I_{FSM}	1.5	A
LED power dissipation	at 25 °C	P_{diss}	100	mW
OUTPUT				
Collector emitter voltage		V_{CEO}	70	V
Emitter collector voltage		V_{ECO}	7	V
Collector current		I_C	50	mA
Collector peak current	$t_p/T = 0.5$, $t_p \leq 10$ ms	I_{CM}	100	mA
Output power dissipation	at 25 °C	P_{diss}	150	mW
COUPLER				
Operating ambient temperature range		T_{amb}	-55 to +110	°C
Storage temperature range		T_{stg}	-55 to +125	°C
Soldering temperature [1]	2 mm from case, ≤ 10 s	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) Refer to reflow profile for soldering conditions for surface mounted devices (SMD), and wave profile for soldering conditions for through hole devices (DIP), please go to “Assembly Instructions” (www.vishay.com/doc?80054)

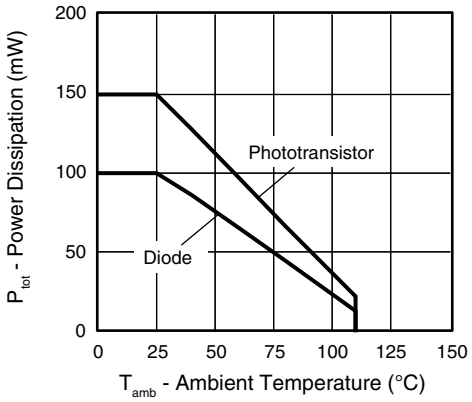

Fig. 1 - Permissible Power Dissipation vs. Ambient Temperature

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
Forward voltage	I_F = 50 mA	V_F	-	1.43	1.6	V
Reverse current	V_R = 6 V	I_R	-	-	100	µA
Junction capacitance	V_R = 0, f = 1 MHz	C_j	-	50	-	pF
OUTPUT						
Collector emitter voltage	I_C = 1 mA	V_{CEO}	70	-	-	V
Emitter collector voltage	I_E = 100 µA	V_{ECO}	7	-	-	V
Collector emitter leakage current	V_{CE} = 20 V, I_F = 0	I_{CEO}	-	10	100	nA
COUPLER						
Collector emitter saturation voltage	I_F = 10 mA, I_C = 1 mA	V_{CEsat}	-	-	0.3	V
Cut-off frequency	V_{CE} = 5 V, I_F = 10 mA, R_L = 100 Ω	f_c	-	110	-	kHz
Coupling capacitance	f = 1 MHz	C_k	-	0.6	-	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

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CURRENT TRANSFER RATIO (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
I_C/I_F	V_{CE} = 5 V, I_F = 1 mA	VO615A-1	CTR	13	30	-	%
		VO615A-2	CTR	22	45	-	%
		VO615A-3	CTR	34	70	-	%
		VO615A-4	CTR	56	90	-	%
	V_{CE} = 5 V, I_F = 5 mA	VO615A	CTR	50	-	600	%
		VO615A-5	CTR	50	-	150	%
		VO615A-6	CTR	100	-	300	%
		VO615A-7	CTR	80	-	160	%
		VO615A-8	CTR	130	-	260	%
		VO615A-9	CTR	200	-	400	%
	V_{CE} = 5 V, I_F = 10 mA	VO615A-1	CTR	40	-	80	%
		VO615A-2	CTR	63	-	125	%
		VO615A-3	CTR	100	-	200	%
		VO615A-4	CTR	160	-	320	%

SAFETY AND INSULATION RATED PARAMETERS				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Climatic classification	According to IEC 68 part 1		55 / 110 / 21	
Pollution degree	According to DIN VDE 0109		2	
Comparative tracking index	Insulation group IIIa	CTI	250	
Maximum rated withstanding isolation voltage	According to UL1577, t = 1 min	V_{ISO}	5000	V_{AC}
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}	850	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
	T_{amb} = T_S, V_{IO} = 500 V	R_{IO}	≥ 10^{9}	Ω
Output safety power		P_{SO}	265	mW
Input safety current		I_{SI}	130	mA
Input safety temperature		T_S	150	°C
Creepage distance	DIP-4; SMD-4, option 7; SMD-4, option 9		≥ 7.6	mm
Clearance distance			≥ 7.6	mm
Creepage distance	DIP-4, 400 mil, option 6; SMD-4, option 8		≥ 8.0	mm
Clearance distance			≥ 8.0	mm
Insulation thickness		DTI	≥ 0.4	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}	1600	V_{peak}
Input to output test voltage, method A	V_{IORM} x 1.6 = V_{PR}, 100 % sample test with t_M = 10 s, partial discharge < 5 pC	V_{PR}	1360	V_{peak}

Note

- According to DIN EN 60747-5-5 (VDE 0884), § 7.4.3.8.2 (see Fig. 2). This optocoupler is suitable for safe electrical isolation only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits

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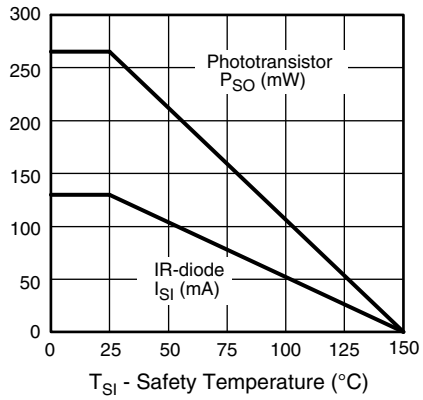

Fig. 2 - Derating Diagram

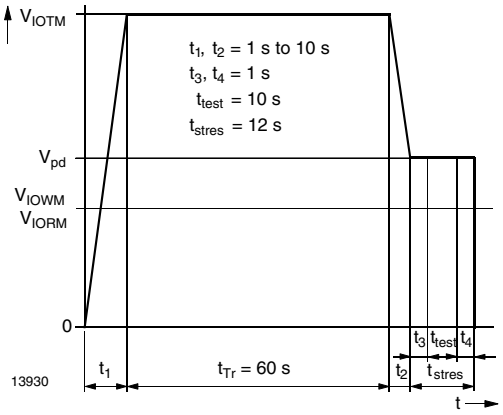

Fig. 3 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-2 (VDE 0884); IEC 60747-5-5

SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Delay time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω	t_d	-	3	-	µs
Rise time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω	t_r	-	3	-	µs
Fall time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω	t_f	-	4.7	-	µs
Storage time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω	t_s	-	0.3	-	µs
Turn-on time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω	t_{on}	-	6	-	µs
Turn-off time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω	t_{off}	-	5	-	µs
Turn-on time	V_S = 5 V, I_F = 10 mA, R_L = 1 kΩ	t_{on}	-	3	-	µs
Turn-off time	V_S = 5 V, I_F = 10 mA, R_L = 1 kΩ	t_{off}	-	10	-	µs

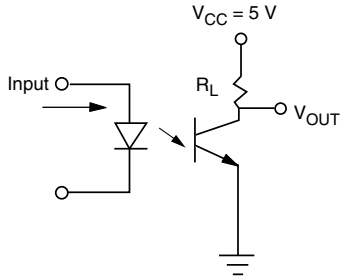

Fig. 4 - Test Circuit

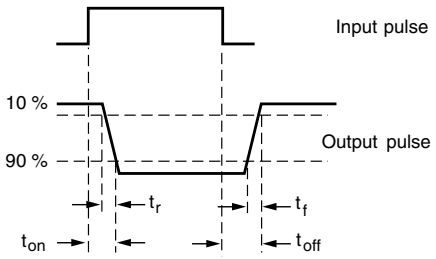

Fig. 5 - Test Circuit and Waveforms

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

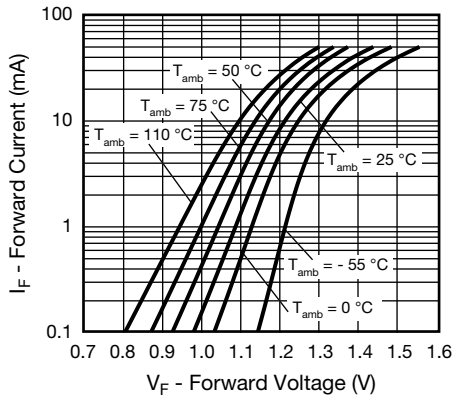

Fig. 6 - Forward Current vs. Forward Voltage

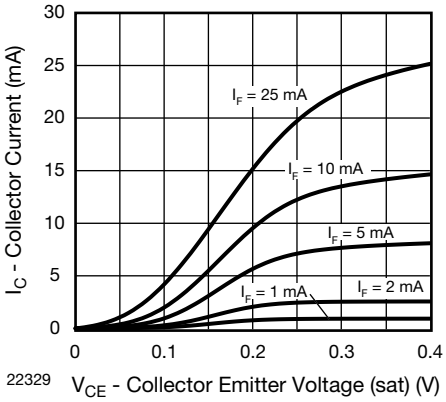

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Fig. 9 - Collector Current vs. Collector Emitter Voltage (saturated)

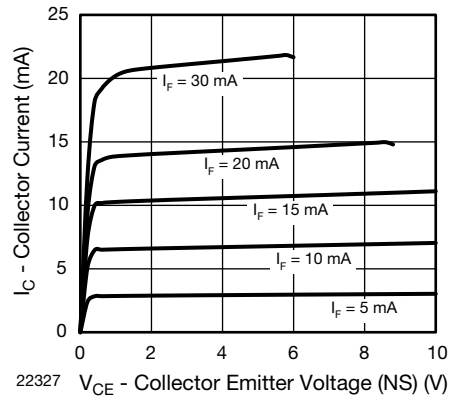

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Fig. 7 - Collector Current vs. Collector Emitter Voltage (non-saturated)

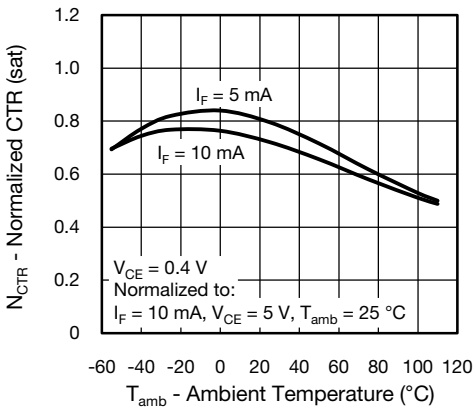

Fig. 10 - Normalized CTR (saturated) vs. Ambient Temperature

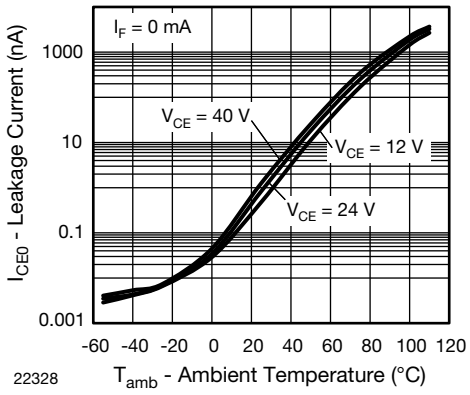

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Fig. 8 - Leakage Current vs. Ambient Temperature

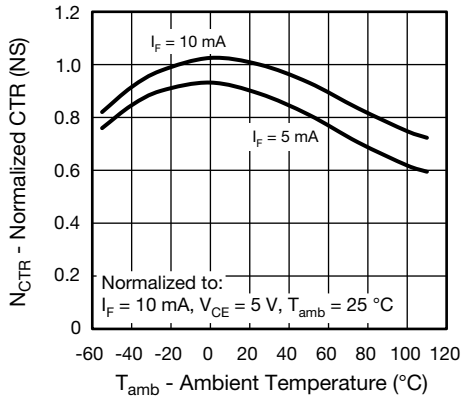

Fig. 11 - Normalized CTR (non-saturated) vs. Ambient Temperature

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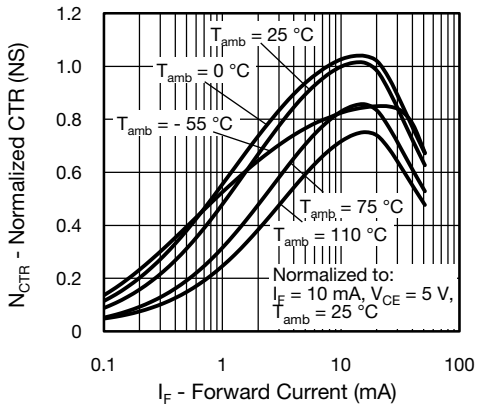

Fig. 12 - Normalized CTR (non-saturated) vs. Forward Current

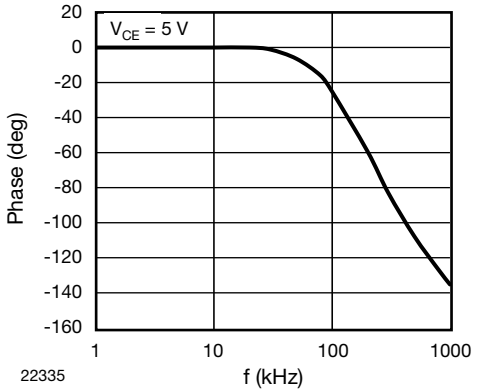

Fig. 15 - Phase Angle vs. Frequency

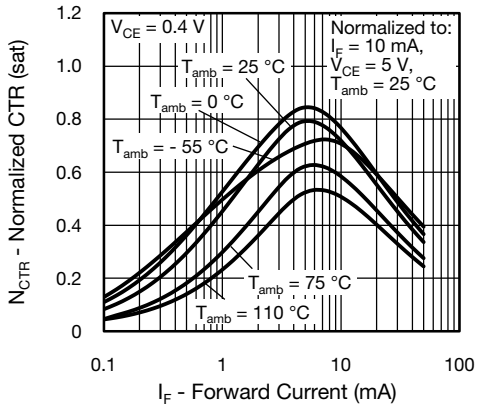

Fig. 13 - Normalized CTR (saturated) vs. Forward Current

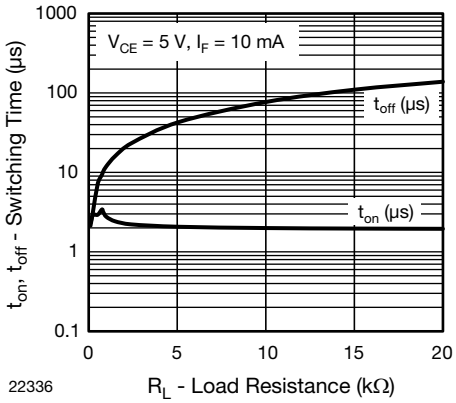

Fig. 16 - Switching Time vs. Load Resistance

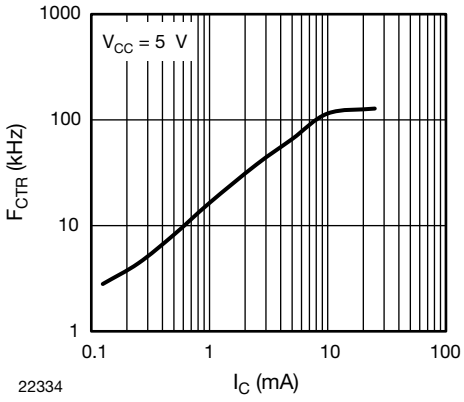

Fig. 14 - F_{CTR} vs. I_C (saturated) (mA)

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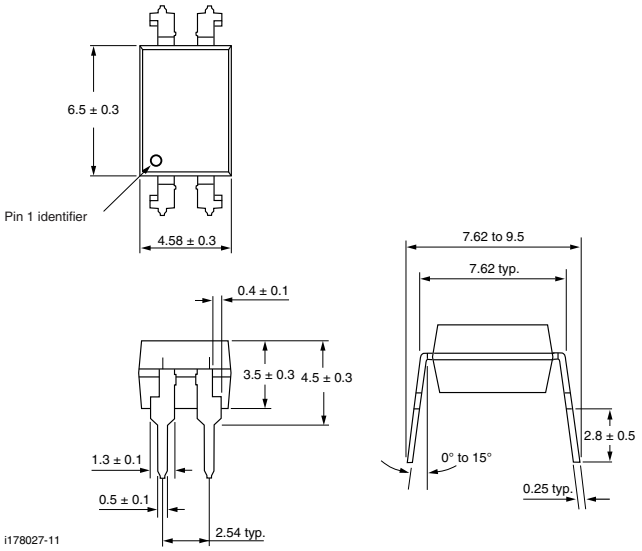
PACKAGE DIMENSIONS (in millimeters)



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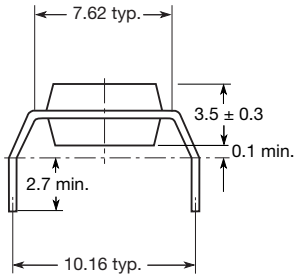
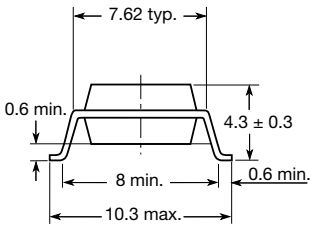
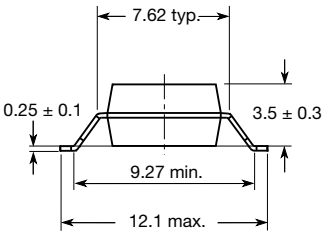


Option 7



Option 8



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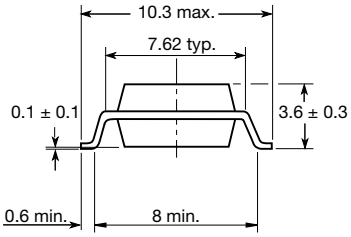

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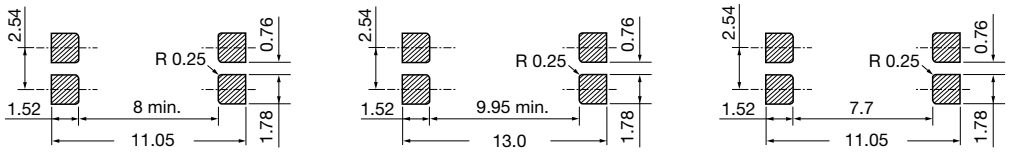
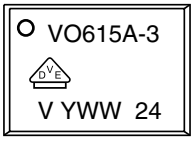


PACKAGE MARKING (example of VO615A-3X017T)



Notes

- Only options 1, 7, and 8 are reflected in the package marking
- The VDE logo is only marked on option1 parts
- Tape and reel suffix (T) is not part of the package marking

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PACKING INFORMATION (in millimeters)

TUBE PACKING			
TYPE	**UNITS/TUBE**	**TUBES/BOX**	**UNITS/BOX**
DIP-4, standard and option 6	100	40	4000

TAPE AND REEL PACKING	
TYPE	**UNITS/TUBE**
SMD-4, option 7 and option 9	1000
SMD-4, option 8	2000

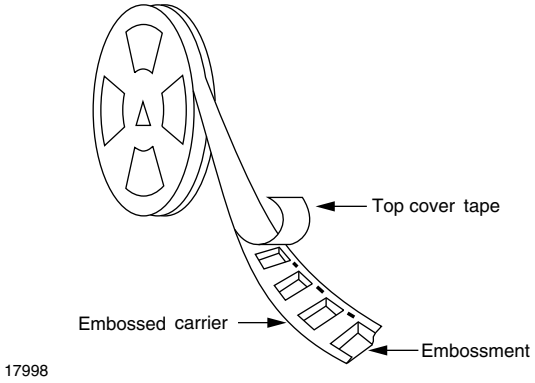

Fig. 17 - Tape and Reel Shipping Medium

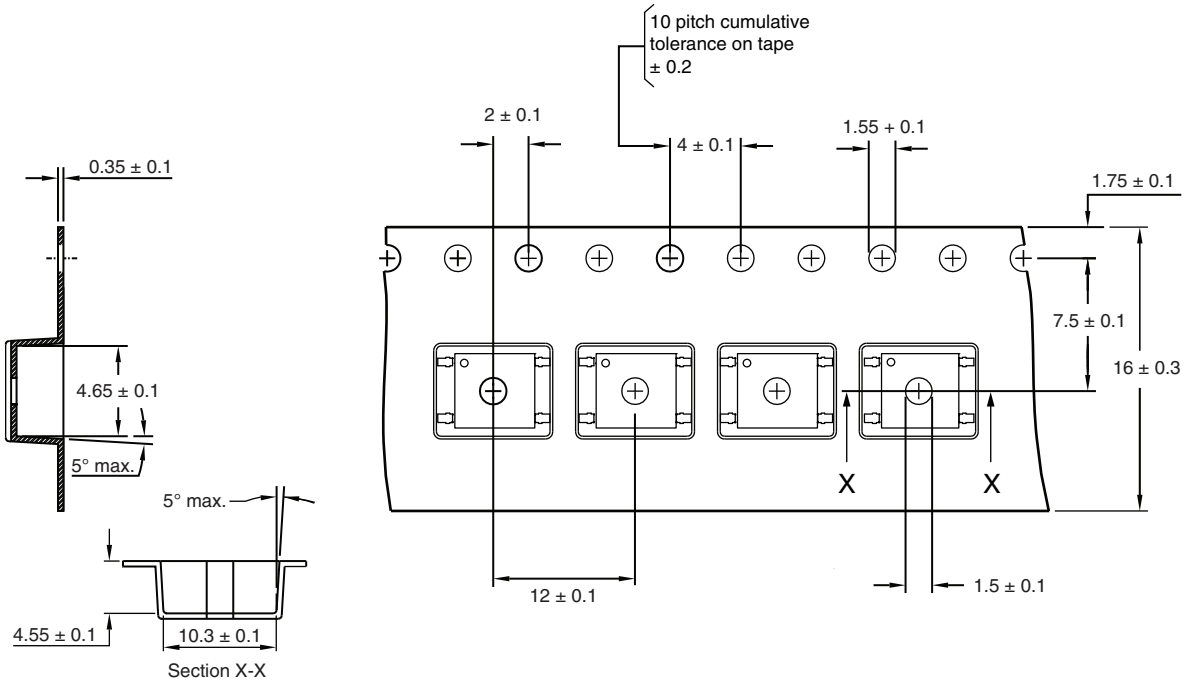

Fig. 18 - Tape and Reel Packing for Option 7 and Option 9
(1000 units per reel)

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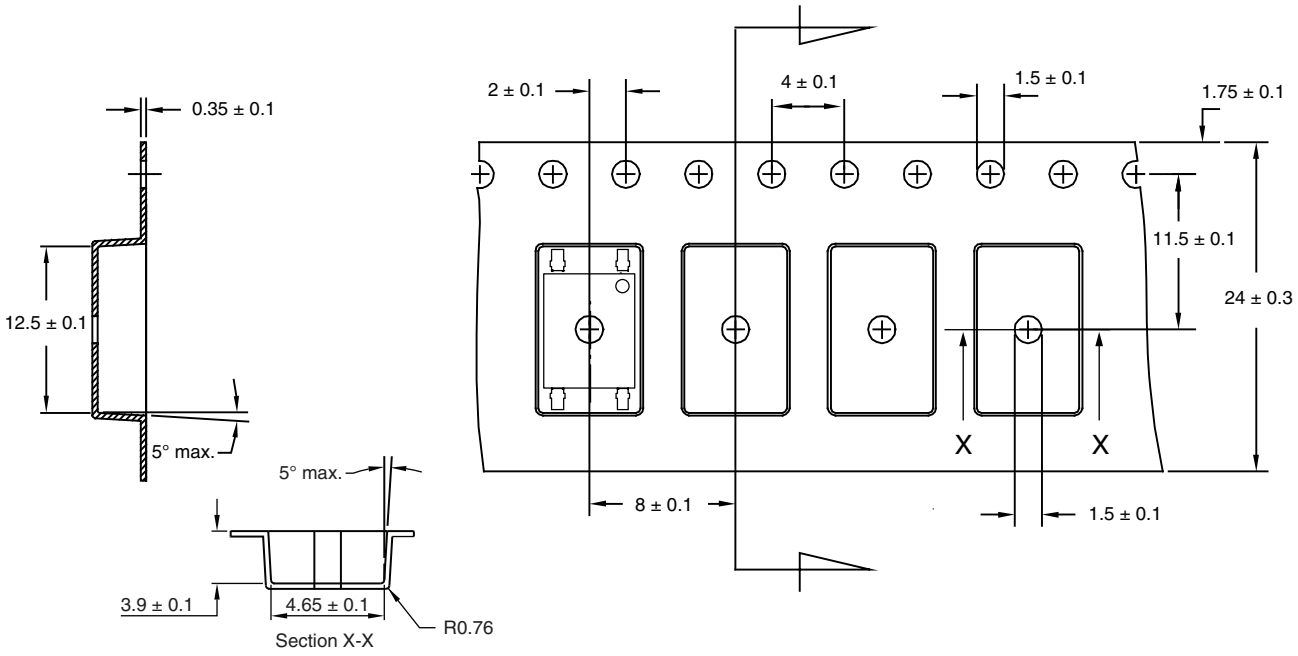

Fig. 19 - Tape and Reel Packing for Option 8
(2000 units per reel)

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