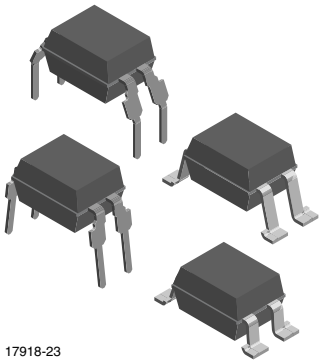
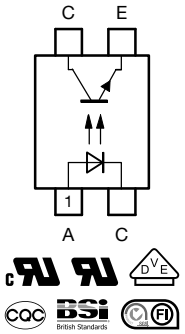
Optocoupler, Phototransistor Output, High Temperature





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

(All parts are certified under base model VO615A)

- BSI: EN 60065:2002, EN 60950-1:2006
- DIN EN 60747-5-5 (VDE 0884), available with option 1
- FIMKO: FI25155
- UL 1577 file no. E52744
- cUL 1577 tested to CSA 22.2 bulletin 5A
- CQC file no. 09001038077; 09001038080

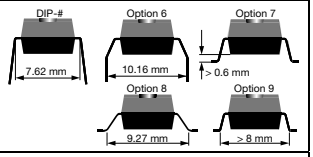
APPLICATIONS

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				
BSI, FIMKO, UL, cUL, CQC (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	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	-	-
VDE, BSI, FIMKO, UL, cUL, 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-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}	70	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}	70	mW
COUPLER				
Isolation test voltage (RMS)	t = 1 s	V_{ISO}	5000	V_{RMS}
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).

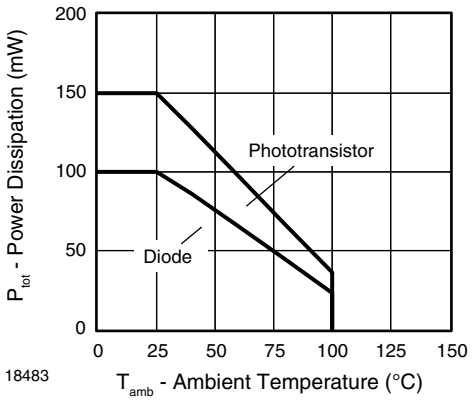


Fig. 1 - Permissible Power Dissipation vs. Ambient Temperature

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 cut-off 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**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Partial discharge test voltage - routine test	100 %, t_{test} = 1 s	V_{pd}	1.6			kV
Partial discharge test voltage - lot test (sample test)	t_{Tr} = 60 s, t_{test} = 10 s, (see figure 2)	V_{pd}	1.36			kV
Insulation resistance	V_{IO} = 500 V	R_{IO}	10^{12}			Ω
	V_{IO} = 500 V, T_{amb} = 100 °C	R_{IO}	10^{11}			Ω
	V_{IO} = 500 V, T_{amb} = 150 °C (construction test only)	R_{IO}	10^{9}			Ω
Rated impulse voltage		V_{IOTM}			6000	V_{peak}
Max. working voltages	Recurring peak voltage	V_{IORM}			850	V_{peak}
Forward current		I_{SI}			130	mA
Power dissipation		P_{SO}			265	mW
Safety temperature		T_{si}			150	°C
Creepage distance					7.6	mm

Note

- According to DIN EN 60747-5-5 (VDE 0884), § 7.4.3.8.2 (see figure 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.

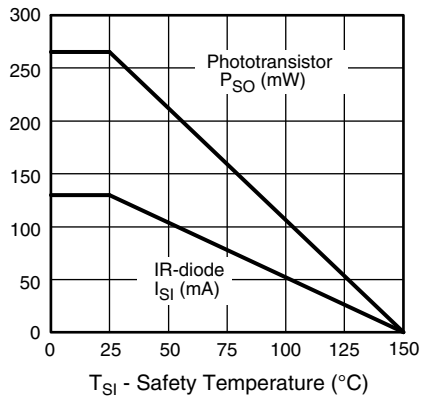


Fig. 2 - Derating Diagram

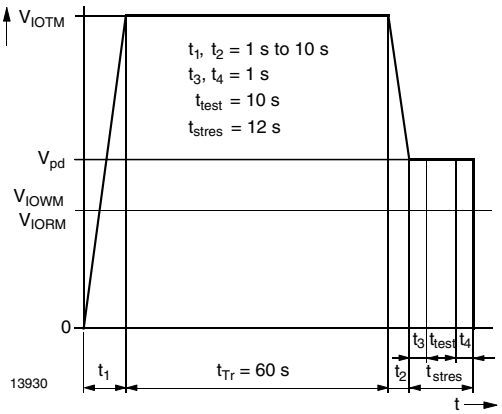


Fig. 3 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-2 (VDE 0884); IEC 60747-5-5

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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

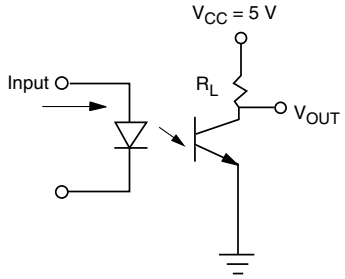


Fig. 4 - Test Circuit

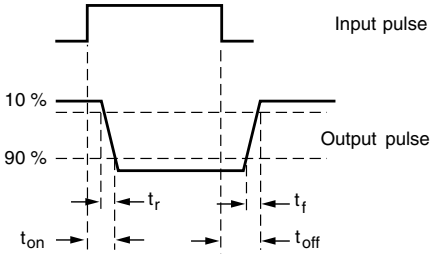


Fig. 5 - Test Circuit and Waveforms

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

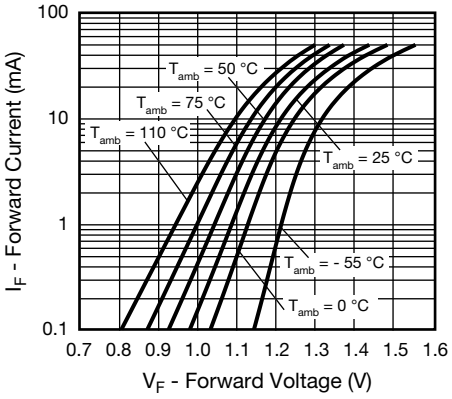


Fig. 6 - Forward Voltage vs. Forward Current

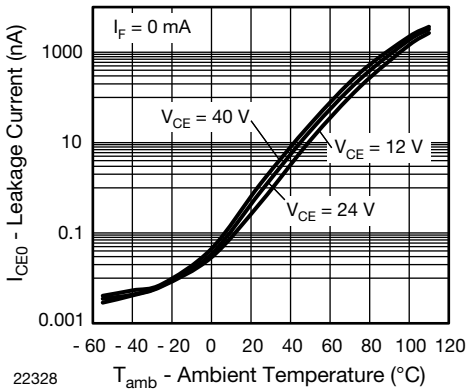


Fig. 8 - Leakage Current vs. Ambient Temperature

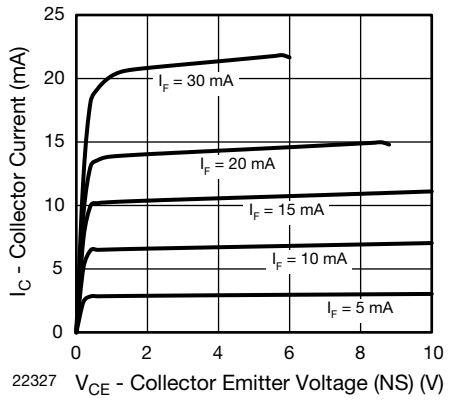


Fig. 7 - Collector Current vs. Collector Emitter Voltage (NS)

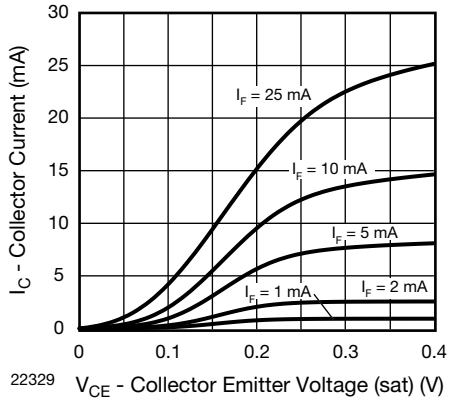


Fig. 9 - Collector Current vs. Collector Emitter Voltage (sat)

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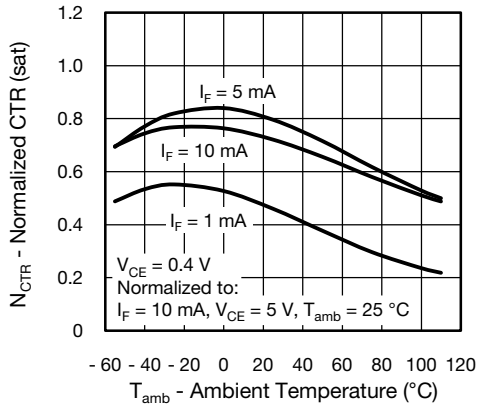


Fig. 10 - Normalized CTR (sat) vs. Ambient Temperature

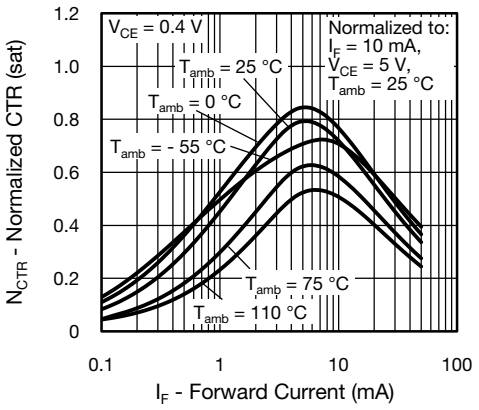


Fig. 13 - Normalized CTR (sat) vs. Forward Current

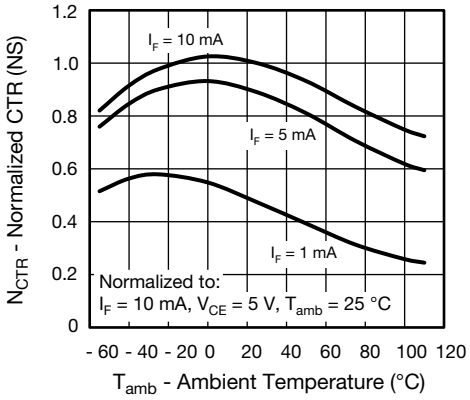


Fig. 11 - Normalized CTR (NS) vs. Ambient Temperature

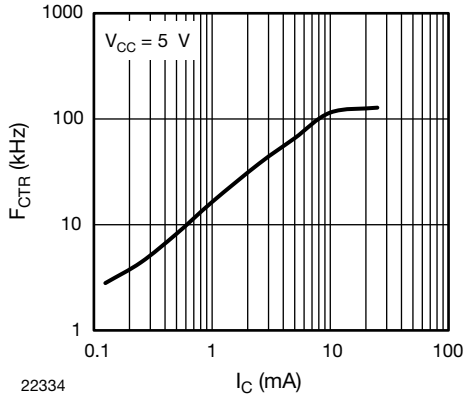


Fig. 14 - F_{CTR} vs. I_C (sat) (mA)

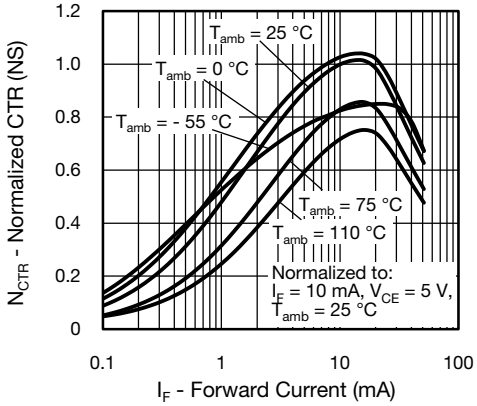


Fig. 12 - Normalized CTR (NS) vs. Forward Current

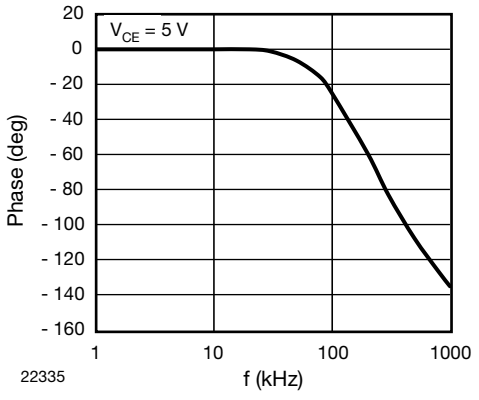


Fig. 15 - F_{CTR} vs. Phase Angle (kHz)

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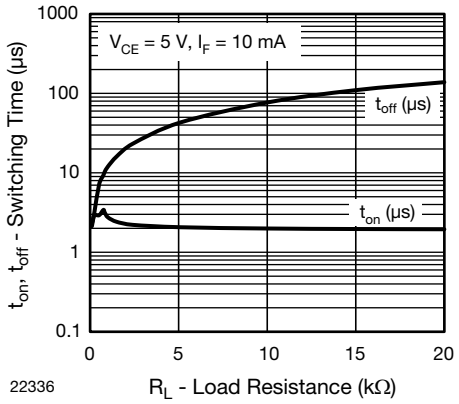
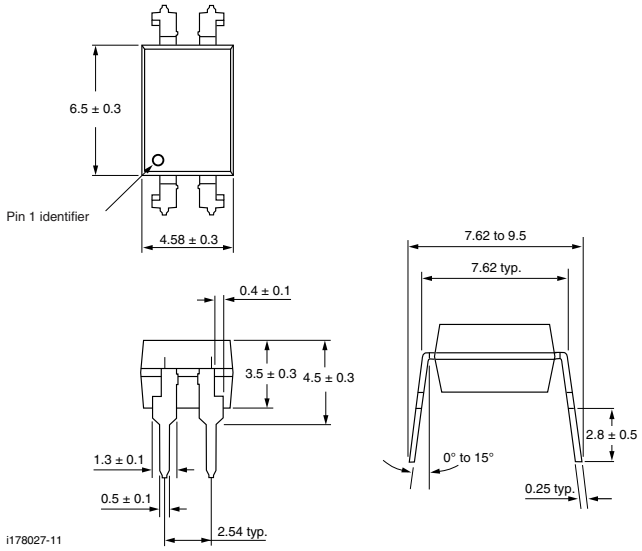
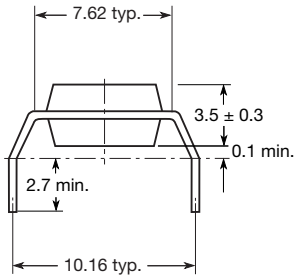


Fig. 16 - Switching Time vs. Load Resistance

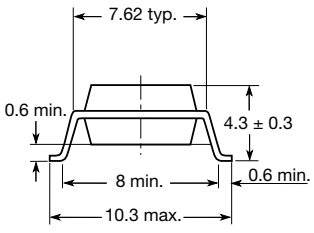
PACKAGE DIMENSIONS in millimeters



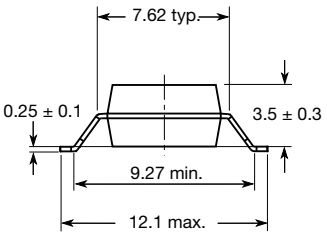
Option 6



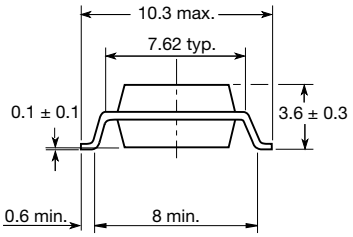
Option 7

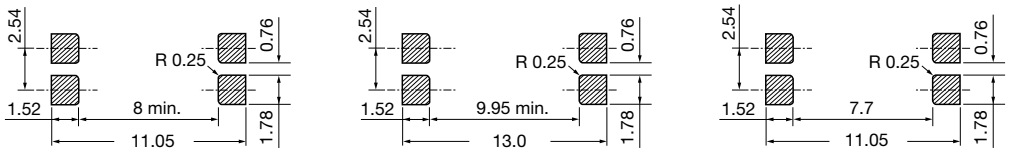


Option 8



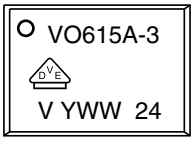
Option 9





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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.

PACKING INFORMATION

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

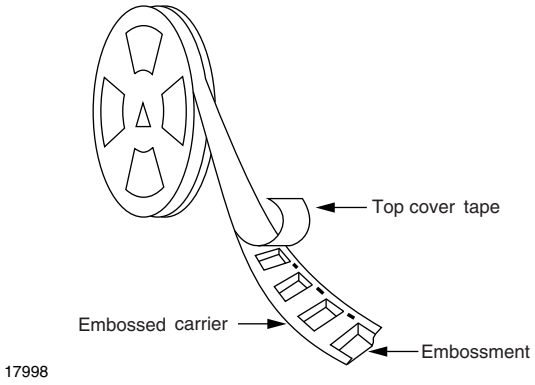


Fig. 17 - Tape and Reel Shipping Medium

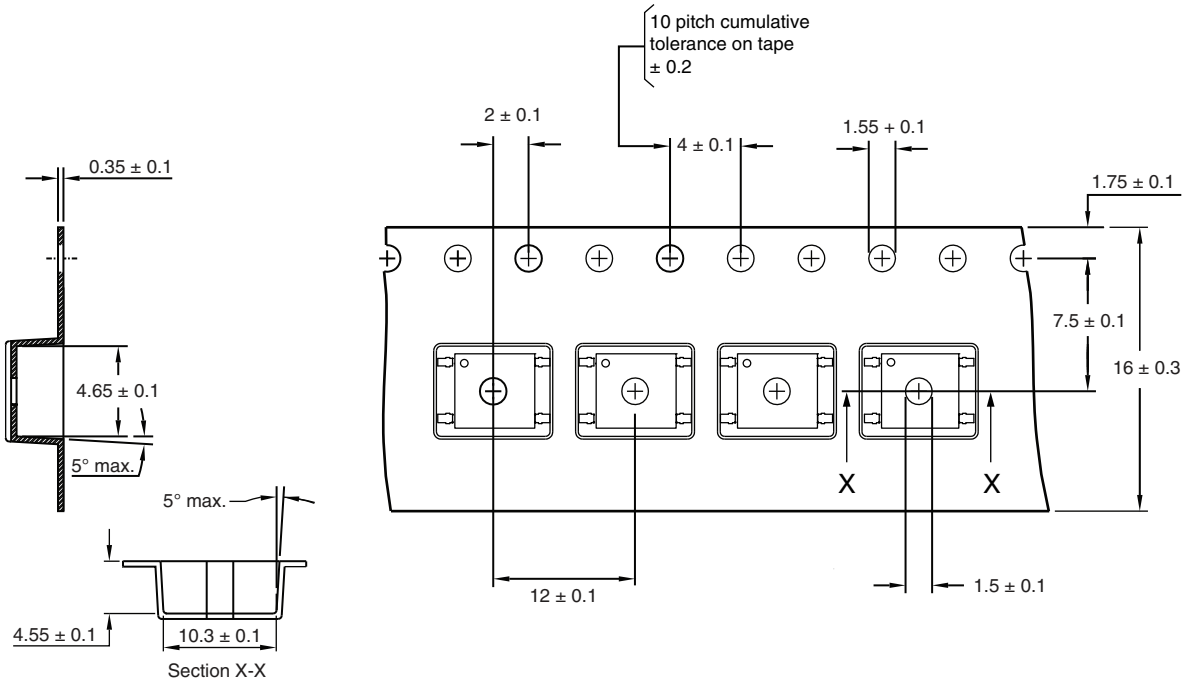


Fig. 18 - Tape and Reel Packing for Option 7 and Option 9
(1000 units per reel)

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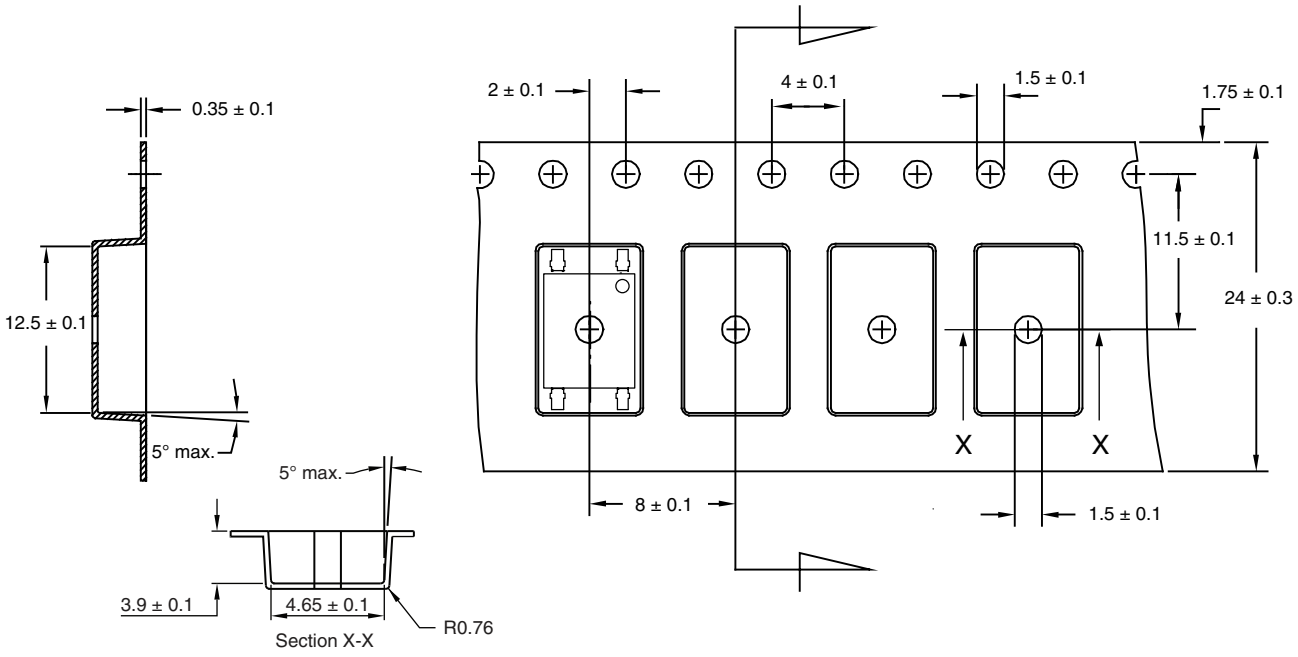


Fig. 19 - Tape and Reel Packing for Option 8
(2000 units per reel)

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