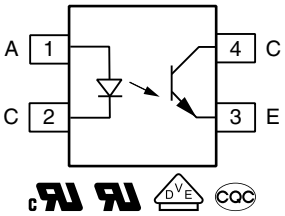
Automotive Phototransistor Optocoupler, 4 Pin LSOP, Long Creepage Mini-Flat Package



FEATURES

- AEC-Q102 qualified
- Low profile package
- Wide temperature range: -40 °C to +125 °C
- High collector emitter voltage, V_{CEO} = 80 V
- Isolation voltage V_{ISO} = 5000 V_{RMS}
- Low coupling capacitance
- High common mode transient immunity
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

AUTOMOTIVE GRADE

Pb-free

e4

RoHS COMPLIANT

HALOGEN FREE GREEN (5-2008)

DESCRIPTION

The VOLA617A series has an infrared emitting diode, which is optically coupled to a silicon planar phototransistor detector, and is incorporated in a 4-pin LSOP mini-flat package with long creepage.

It features a high current transfer ratio at low input current, low coupling capacitance, and high isolation voltage.

The coupling device is designed for signal transmission between two electrically separated circuits, specifically for use in automotive, as well as high reliable industrial applications.

APPLICATIONS

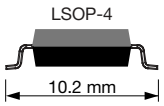
- Galvanic and noise isolation
- Battery management systems
- Grid connected on-board chargers
- DC/DC converter
- Isolated wake-up signal
- System control

AGENCY APPROVALS

- UL 1577 (pending)
- cUL 1577 (pending)
- DIN EN 60747-5-5 (VDE 0884-5) (pending)
- CQC (pending)

ORDERING INFORMATION

V	O	L	A	6	1	7	A	-	#	X	0	0	1	T
PART NUMBER									CTR BIN	PACKAGE OPTION				TAPE AND REEL



AGENCY CERTIFIED / PACKAGE	CTR (%)			
	5 mA			
UL, cUL, CQC, VDE	50 to 600	63 to 125	100 to 200	130 to 260
LSOP-4	VOLA617A-X001T	VOLA617A-2X001T	VOLA617A-3X001T	VOLA617A-8X001T

ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
Reverse voltage		V_R	6	V
Power dissipation		P_{diss}	80	mW
Forward current		I_F	50	mA
Forward surge current	t_p < 10 µs	I_{FSM}	1.5	A
Junction temperature		T_j	145	°C
OUTPUT				
Collector emitter voltage		V_{CEO}	80	V
Emitter collector voltage		V_{ECO}	7	V
Collector current		I_C	50	mA
	t_p/T = 0.5, t_p < 10 ms	I_C	100	mA
Power dissipation		P_{diss}	150	mW
Junction temperature		T_j	140	°C
COUPLER				
Total power dissipation		P_{tot}	200	mW
Storage temperature range		T_{stg}	-40 to +150	°C
Operating temperature range		T_{amb}	-40 to +125	°C
Soldering temperature [1]	≤ 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.

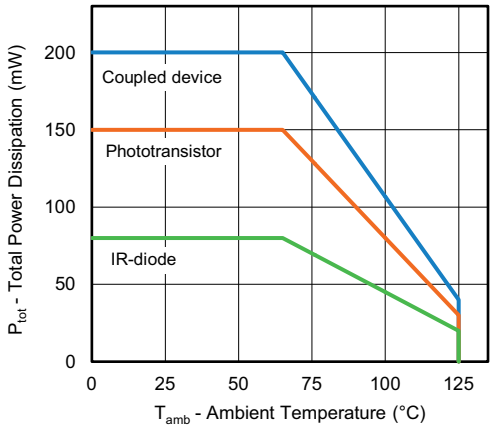


Fig. 1 - Total Power Dissipation vs. Ambient Temperature

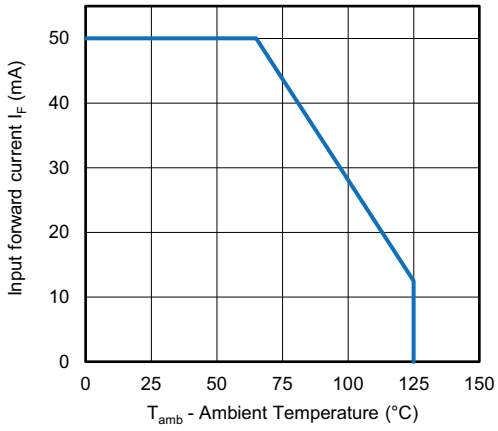


Fig. 2 - Total Power Dissipation vs. Ambient Temperature

RECOMMENDED OPERATING CONDITIONS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**SYMBOL**	**MIN.**	**MAX.**	**UNIT**
Forward current	I_F	0.5	20	mA

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
Forward voltage	I_F = 5 mA	V_F	1.2	1.34	1.5	V
Capacitance	V_R = 0 V, f = 1 MHz	C_{CI}	-	30	-	pF
Reverse current	V_R = 6 V	I_R	-	-	10	µA
Thermal resistance (IR diode)		R_{thJA}	-	1000	-	K/W
OUTPUT						
Collector emitter leakage current	V_{CE} = 10 V, I_F = 0 A	I_{CEO}	-	10	100	nA
	V_{CE} = 10 V, I_F = 0 A, T_{amb} = 100 °C	I_{CEO}	-	3	50	µA
Collector emitter breakdown voltage	I_C = 100 µA	BV_{CEO}	80	-	-	V
Collector emitter capacitance	V_{CE} = 5 V, f = 1 MHz	C_{CE}	-	4	-	pF
Thermal resistance (phototransistor)		R_{thJA}	-	500	-	K/W
COUPLER						
Collector emitter saturation voltage	I_F = 5 mA, I_C = 1 mA	V_{CEsat}	-	0.25	0.4	V
Cut-off frequency	I_F = 10 mA, V_{CC} = 5 V, R_L = 100 Ω	f_{CTR}	-	160	-	kHz
Coupling capacitance	f = 1 MHz	C_{IO}	-	0.5	-	pF
Thermal resistance (coupled device)		R_{thJA}	-	375	-	K/W

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.

CURRENT TRANSFER RATIO (T_{amb} = 25 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
I_C/I_F	I_F = 5 mA, V_{CE} = 5 V	VOLA617A	CTR	50	-	600	%
		VOLA617A-2	CTR	63	-	125	%
		VOLA617A-3	CTR	100	-	200	%
		VOLA617A-8	CTR	130	-	260	%

SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
NON-SATURATED						
Rise time	I_C = 2 mA, V_{CC} = 5 V, R_L = 100 Ω	t_r	-	3.6	-	µs
Fall time		t_f	-	5.7	-	µs
Turn-on time		t_{on}	-	5.3	-	µs
Turn-off time		t_{off}	-	6.9	-	µs
SATURATED						
Rise time	I_F = 5 mA, V_{CC} = 5 V, R_L = 1.9 kΩ	t_r	-	3.7	-	µs
Fall time		t_f	-	9.8	-	µs
Turn-on time		t_{on}	-	4.5	-	µs
Turn-off time		t_{off}	-	14.6	-	µs

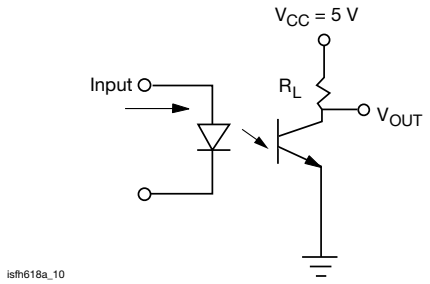


Fig. 3 - Test Circuit

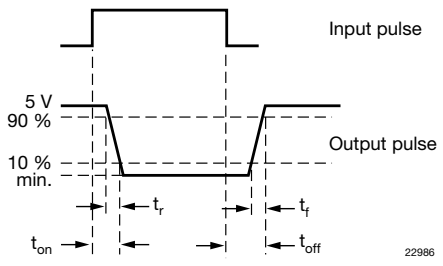


Fig. 4 - Test Circuit and Waveforms

SAFETY AND INSULATION RATINGS				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
Climatic classification	According to IEC 68 part 1		40 / 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	V_{IOTM}	8000	V_{peak}
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	V_{IORM}	1414	V_{peak}
Maximum working isolation voltage	According to DIN EN 60747-5-5	V_{IOWM}	1000	V_{RMS}
Isolation resistance	T_{amb} = 125 °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}	400	mW
Input safety current		I_{SI}	180	mA
Input safety temperature		T_S	175	°C
Creepage distance			≥ 8	mm
Clearance distance			≥ 8	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}	2651	V_{peak}
Input to output test voltage, method A	V_{IORM} x 1.6 = V_{PR}, sample test with t_M = 10 s, partial discharge < 5 pC	V_{PR}	2262	V_{peak}

Note

- As per IEC 60747-5-5, 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.

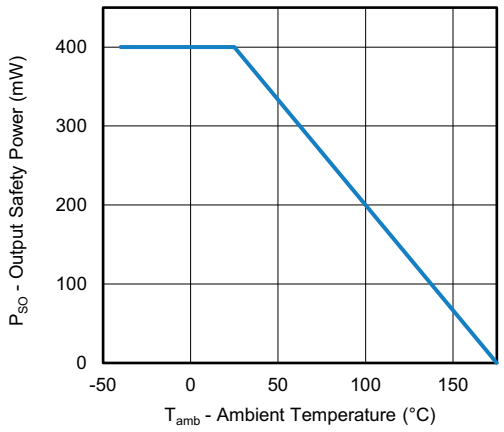


Fig. 5 - Derating Diagram

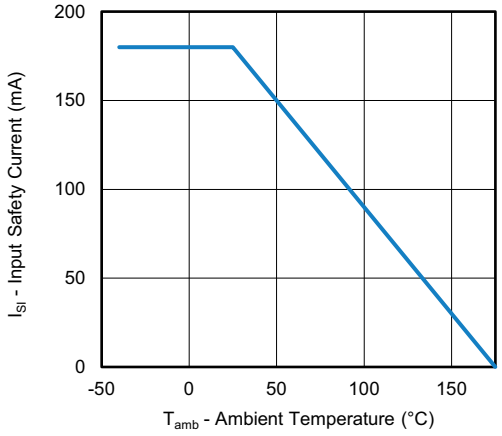


Fig. 6 - Safety Input Current vs. Temperature

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

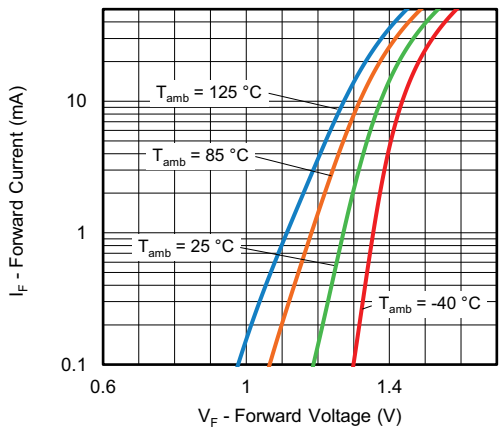


Fig. 7 - Forward Current vs. Forward Voltage

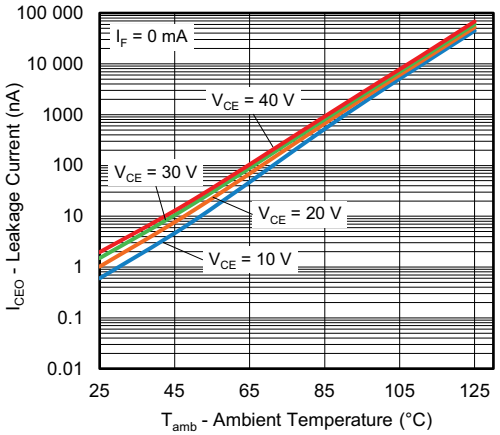


Fig. 10 - Leakage Current vs. Ambient Temperature

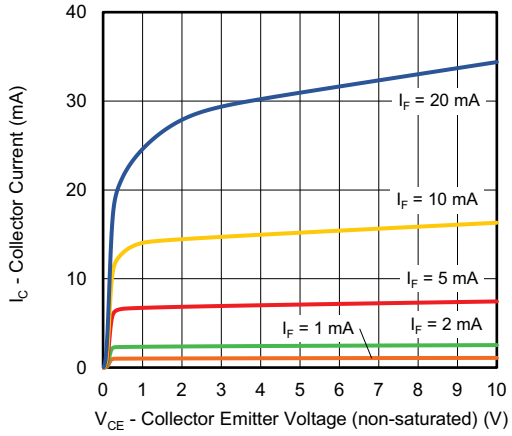


Fig. 8 - Collector Current vs. Collector Emitter Voltage (non-saturated)

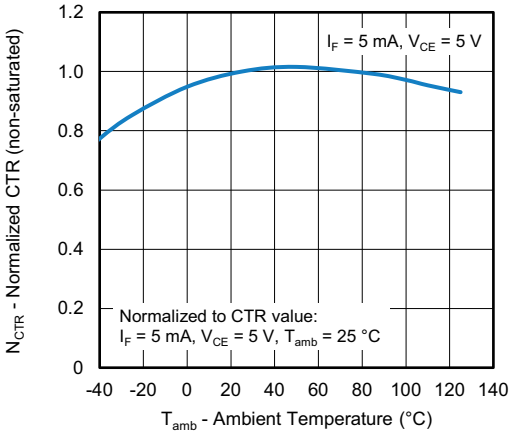


Fig. 11 - Normalized CTR (non-saturated) vs. Ambient Temperature

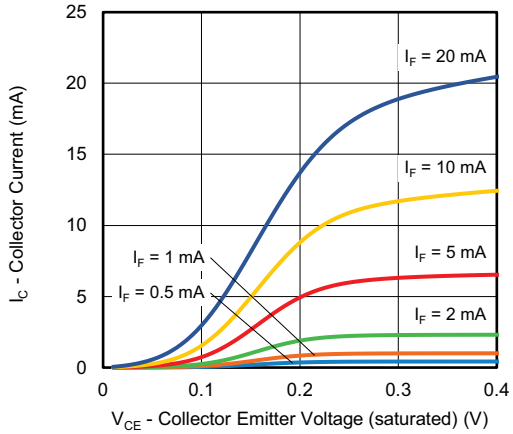


Fig. 9 - Collector Current vs. Collector Emitter Voltage (saturated)

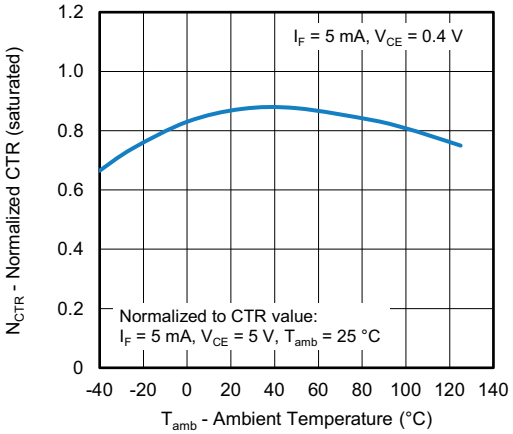


Fig. 12 - Normalized CTR (saturated) vs. Ambient Temperature

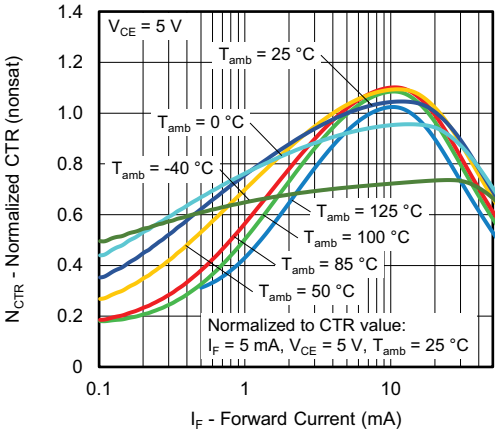


Fig. 13 - Normalized CTR (non-saturated) vs. Forward Current

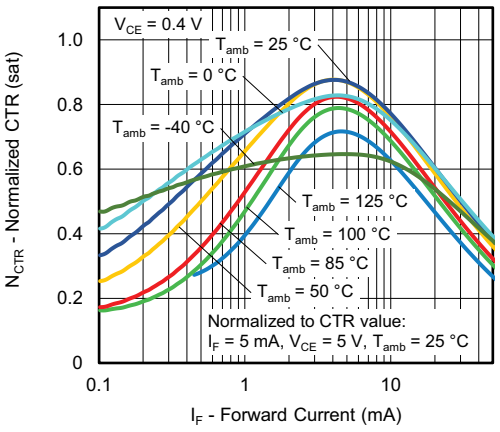


Fig. 14 - Normalized CTR (saturated) vs. Forward Current

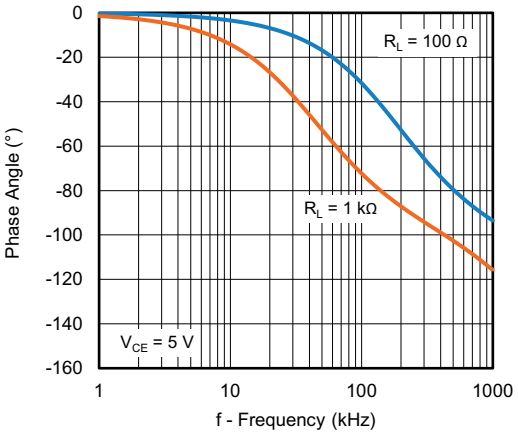


Fig. 15 - Phase Angle vs. Frequency

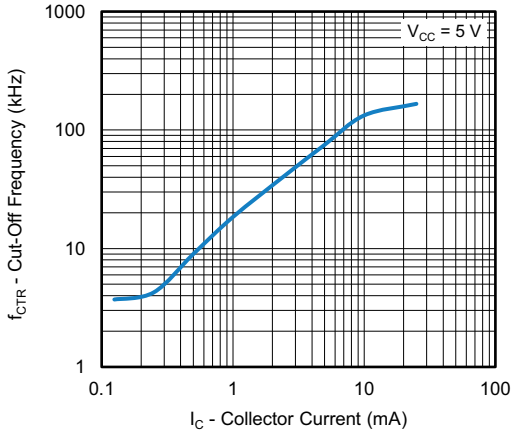


Fig. 16 - Cut-Off Frequency vs. Collector Current

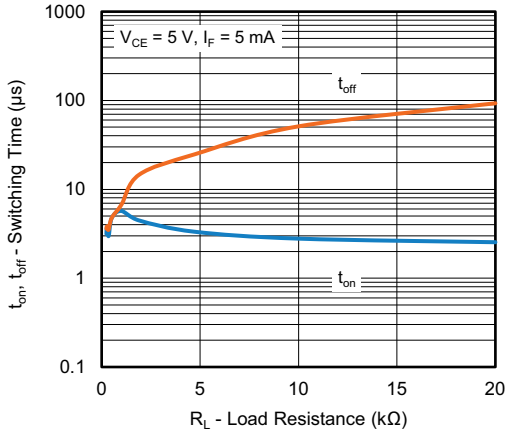


Fig. 17 - Switching Time vs. Load Resistance

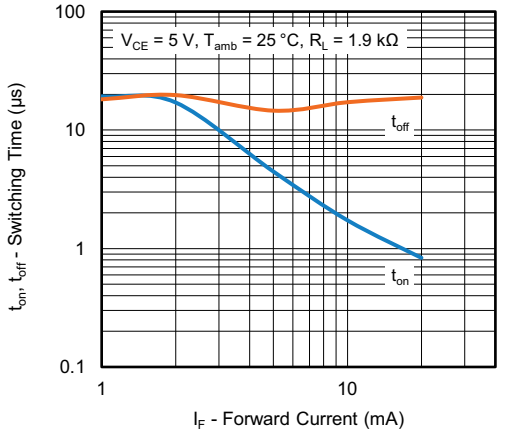
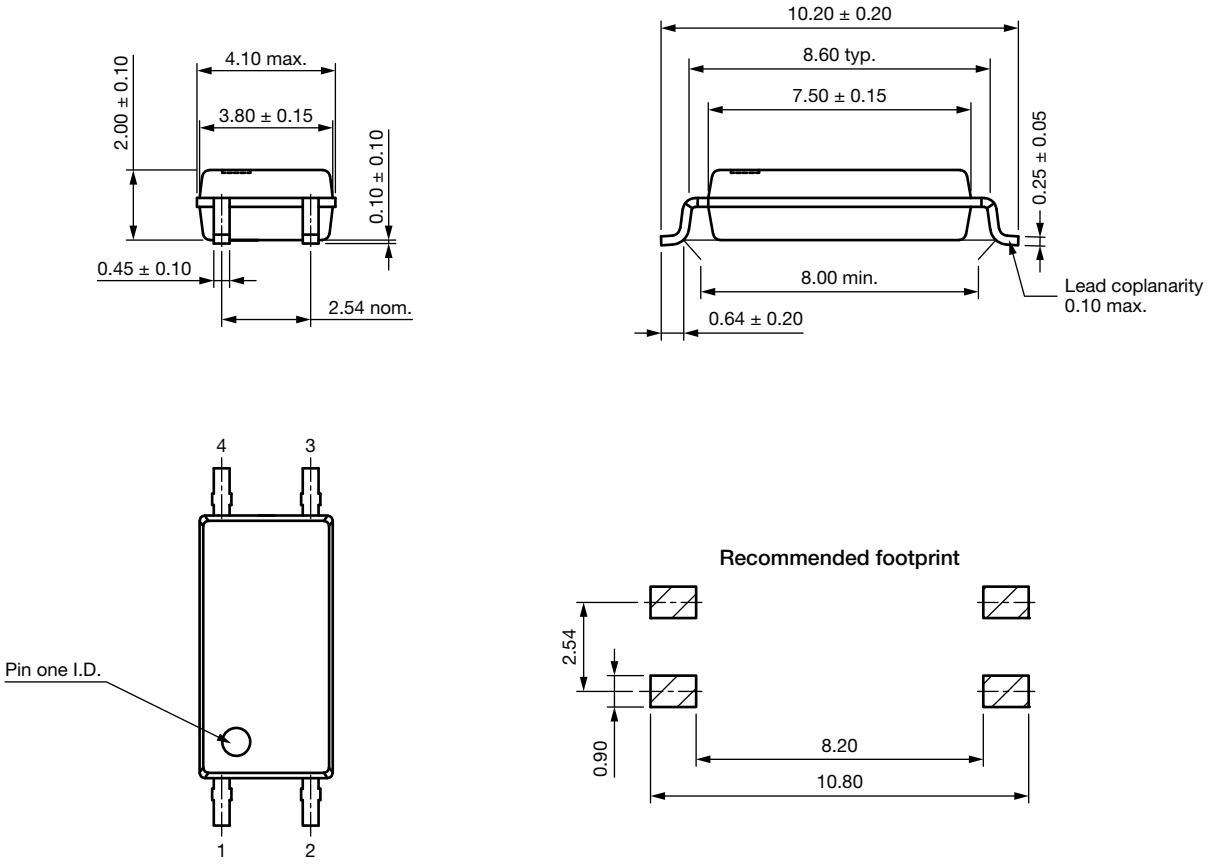
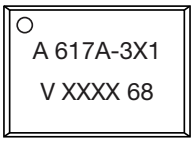


Fig. 18 - Switching Time vs. Forward Current

PACKAGE DIMENSIONS (in millimeters)



PACKAGE MARKING (example of VOLA617A-3X001T)



Notes

- XXXX lot marking code
- Tape and reel suffix (T) is not part of the package marking

TAPE AND REEL DIMENSIONS (in millimeters)

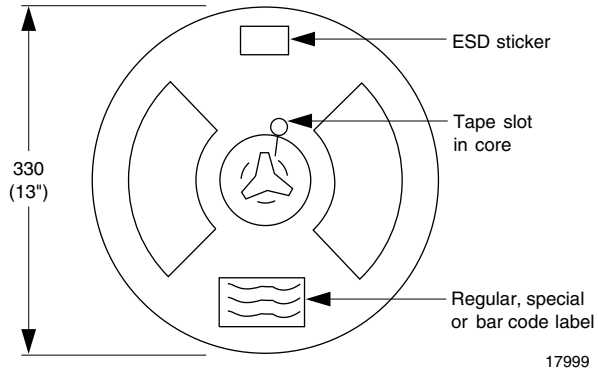


Fig. 19 - Reel Dimensions (3000 units per reel)

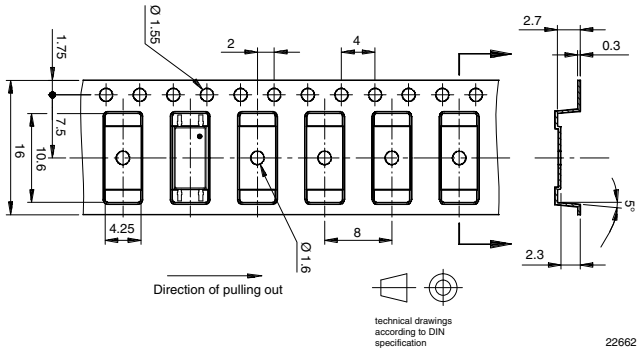


Fig. 20 - Tape Dimensions

SOLDER PROFILE

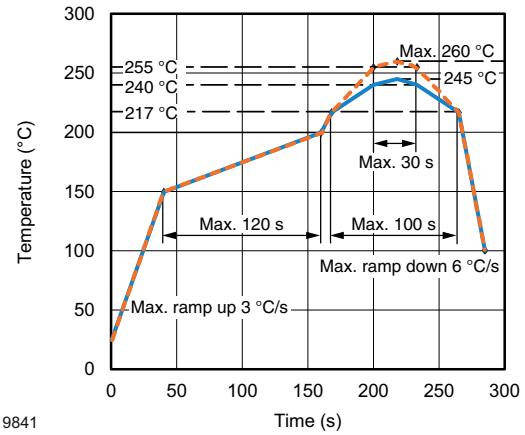


Fig. 21 - Lead (Pb)-free Reflow Solder Profile
According to J-STD-020

HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

Conditions: T_{amb} < 30 °C, RH < 60 %

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

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