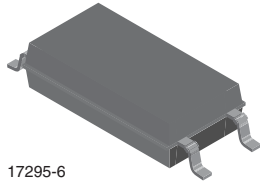
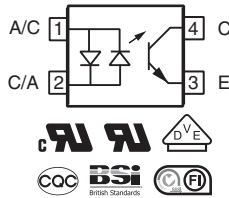




# Optocoupler, Phototransistor Output, AC Input, Low Input Current, 4 Pin LSOP, Long Creepage Mini-Flat Package



17295-6



## FEATURES

- Low profile package
- High collector emitter voltage,  $V_{CEO} = 80\text{ V}$
- Isolation test voltage,  $5000\text{ V}_{RMS}$
- Low coupling capacitance
- High common mode transient immunity
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



## DESCRIPTION

The VOL628A has two GaAs infrared emitting diodes, which are optically coupled to a silicon planar phototransistor detector, and are incorporated in a 4 pin LSOP wide body package.

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

The coupling device is designed for signal transmission between two electrically separated circuits.

## APPLICATIONS

- Telecom
- Industrial controls
- Battery powered equipment
- Office machines
- Programmable controllers

## AGENCY APPROVALS

(All parts are certified under base model VOL628A)

- UL1577, file no. E76222
- cUL CSA 22.2 bulletin 5A, double protection
- DIN EN 60747-5-5 (VDE 0884-5), available with option 1
- BSI: EN 60065:2002, EN 60950-1:2006
- FIMKO EN60950-1
- CQC: GB8898-2011, GB4943.1-2011

ORDERING INFORMATION				
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px;">V</div> <div style="border: 1px solid black; padding: 2px;">O</div> <div style="border: 1px solid black; padding: 2px;">L</div> <div style="border: 1px solid black; padding: 2px;">6</div> <div style="border: 1px solid black; padding: 2px;">2</div> <div style="border: 1px solid black; padding: 2px;">8</div> <div style="border: 1px solid black; padding: 2px;">A</div> <div style="border: 1px solid black; padding: 2px;">-</div> <div style="border: 1px solid black; padding: 2px;">#</div> <div style="border: 1px solid black; padding: 2px;">X</div> <div style="border: 1px solid black; padding: 2px;">0</div> <div style="border: 1px solid black; padding: 2px;">0</div> <div style="border: 1px solid black; padding: 2px;">1</div> <div style="border: 1px solid black; padding: 2px;">T</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <span>PART NUMBER</span> <span>CTR BIN</span> <span>PACKAGE OPTION</span> <span>TAPE AND REEL</span> </div>				
AGENCY CERTIFIED / PACKAGE	CTR (%)			
	1 mA			
<b>UL, cUL, BSI, FIMKO, CQC</b>	<b>50 to 600</b>	<b>63 to 125</b>	<b>100 to 200</b>	<b>160 to 320</b>
4 pin LSOP, mini-flat, long creepage	VOL628AT	VOL628A-2T	VOL628A-3T	VOL628A-4T
<b>UL, cUL, BSI, FIMKO, CQC, VDE (option 1)</b>	<b>50 to 600</b>	<b>63 to 125</b>	<b>100 to 200</b>	<b>160 to 320</b>
4 pin LSOP, mini-flat, long creepage	-	VOL628A-2X001T	VOL628A-3X001T	VOL628A-4X001T

<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		$V_R$	6	V
Power dissipation		$P_{diss}$	100	mW
Forward current		$I_F$	$\pm 60$	mA
Junction temperature		$T_j$	125	$^{\circ}\text{C}$
<b>OUTPUT</b>				
Collector emitter voltage		$V_{CEO}$	80	V
Emitter collector voltage		$V_{ECO}$	7	V
Collector current		$I_C$	50	mA
	$t_p/T = 0.5, t_p < 10\text{ ms}$	$I_C$	100	mA
Power dissipation		$P_{diss}$	150	mW
Junction temperature		$T_j$	125	$^{\circ}\text{C}$
<b>COUPLER</b>				
Total power dissipation		$P_{tot}$	250	mW
Storage temperature range		$T_{stg}$	-55 to +125	$^{\circ}\text{C}$
Ambient temperature range		$T_{amb}$	-55 to +110	$^{\circ}\text{C}$
Soldering temperature <sup>(1)</sup>	$\leq 10\text{ s}$	$T_{sld}$	260	$^{\circ}\text{C}$

**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

<sup>(1)</sup> Refer to reflow profile for soldering conditions for surface mounted devices

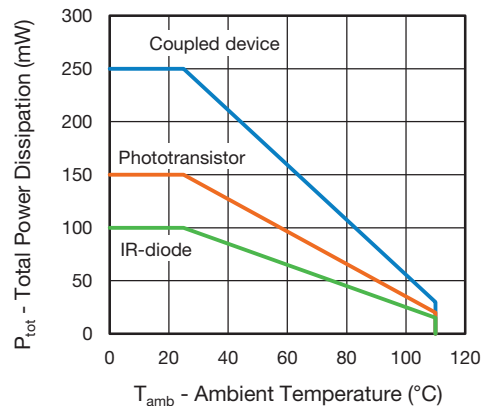


Fig. 1 - Total Power Dissipation vs. Ambient Temperature

<b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>							
Forward voltage	$I_F = \pm 5\text{ mA}$		$V_F$	-	1.16	1.5	V
Reverse current	$V_R = 6\text{ V}$		$I_R$	-	-	100	$\mu\text{A}$
Capacitance	$V_R = 0\text{ V}, f = 1\text{ MHz}$		$C_O$	-	45	-	pF
<b>OUTPUT</b>							
Collector emitter leakage current	$V_{CE} = 10\text{ V}, I_F = 0\text{ A}$		$I_{CEO}$	-	10	200	nA
Collector emitter capacitance	$V_{CE} = 5\text{ V}, f = 1\text{ MHz}$		$C_{CE}$	-	7	-	pF
<b>COUPLER</b>							
Collector emitter saturation voltage	$I_C = 0.2\text{ mA}, I_F = \pm 1\text{ mA}$	VOL628A	$V_{CEsat}$	-	0.25	0.4	V
	$I_C = 0.32\text{ mA}, I_F = \pm 1\text{ mA}$	VOL628A-2T	$V_{CEsat}$	-	0.25	0.4	V
	$I_C = 0.5\text{ mA}, I_F = \pm 1\text{ mA}$	VOL628A-3T	$V_{CEsat}$	-	0.25	0.4	V
	$I_C = 0.8\text{ mA}, I_F = \pm 1\text{ mA}$	VOL628A-4T	$V_{CEsat}$	-	0.25	0.4	V
Coupling capacitance	$f = 1\text{ MHz}$		$C_C$	-	0.25	-	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

<b>CURRENT TRANSFER RATIO</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
$I_C/I_F$	$I_F = \pm 1\text{ mA}$ , $V_{CE} = 5\text{ V}$	VOL628A	CTR	50	-	600	%
		VOL628A-2	CTR	63	-	125	%
		VOL628A-3	CTR	100	-	200	%
		VOL628A-4	CTR	160	-	320	%

<b>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Turn on time	$V_{CC} = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$	$t_{on}$	-	6	-	$\mu\text{s}$
Rise time	$V_{CC} = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$	$t_r$	-	3.5	-	$\mu\text{s}$
Turn off time	$V_{CC} = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$	$t_{off}$	-	5.5	-	$\mu\text{s}$
Fall time	$V_{CC} = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$	$t_f$	-	5	-	$\mu\text{s}$

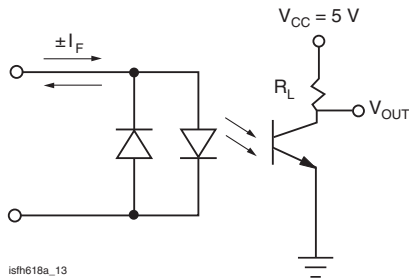


Fig. 2 - Test Circuit

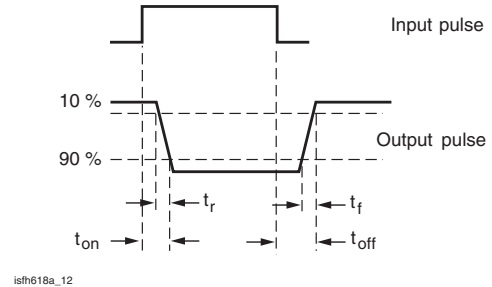


Fig. 3 - Test Circuit and Waveforms

<b>SAFETY AND INSULATION RATINGS</b>				
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	275	
Maximum rated withstanding isolation voltage	According to UL1577, $t = 1\text{ min}$	$V_{ISO}$	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	$V_{IORM}$	1050	$V_{peak}$
Isolation resistance	$T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^{12}$	$\Omega$
	$T_{amb} = 100\text{ }^{\circ}\text{C}$ , $V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^{11}$	$\Omega$
	$T_{amb} = TS$ , $V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^9$	$\Omega$
Output safety power		$P_{SO}$	265	mW
Input safety current		$I_{SI}$	130	mA
Input safety temperature		$T_S$	150	$^{\circ}\text{C}$
Creepage distance			$\geq 8$	mm
Clearance distance			$\geq 8$	mm
Insulation thickness		DTI	$\geq 0.4$	mm
Input to output test voltage, method B	$V_{IORM} \times 1.875 = V_{PR}$ , 100 % production test with $t_M = 1\text{ s}$ , partial discharge $< 5\text{ pC}$	$V_{PR}$	2000	$V_{peak}$
Input to output test voltage, method A	$V_{IORM} \times 1.6 = V_{PR}$ , 100 % sample test with $t_M = 10\text{ s}$ , partial discharge $< 5\text{ pC}$	$V_{PR}$	1680	$V_{peak}$

**Note**

- According to DIN EN 60747-5-5 (VDE 0884), § 7.4.3.8.2, (see Fig. 4). 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

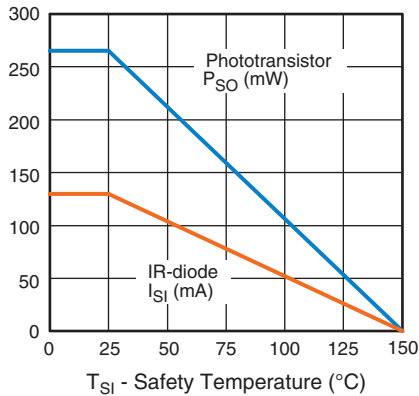


Fig. 4 - Derating Diagram

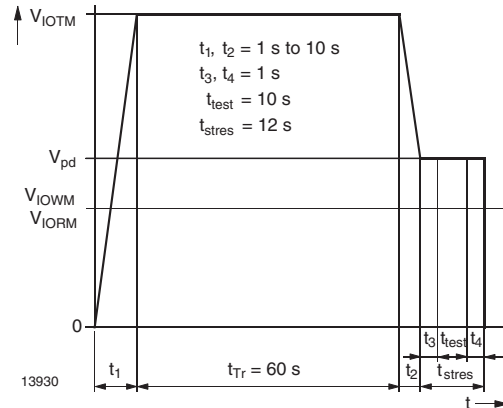


Fig. 5 - Test Pulse Diagram for Sample Test according to DIN EN 60747-5-5

**TYPICAL CHARACTERISTICS** ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)

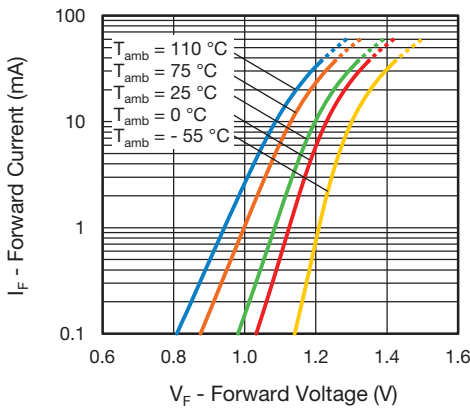


Fig. 6 - Forward Current vs. Forward Voltage

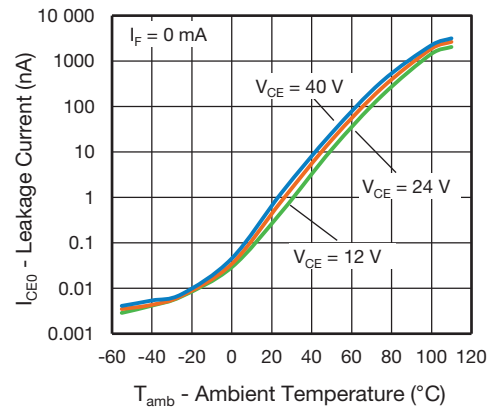


Fig. 8 - Collector Emitter Current vs. Ambient Temperature

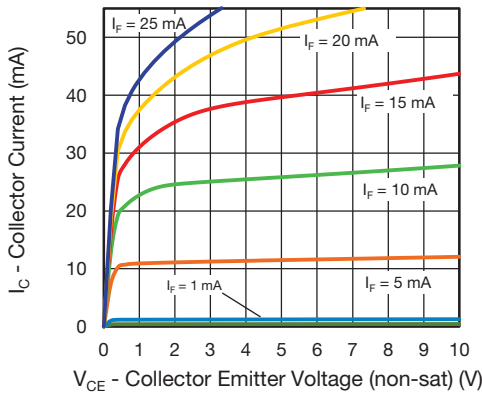


Fig. 7 - Collector Current vs. Collector Emitter Voltage (non-saturated)

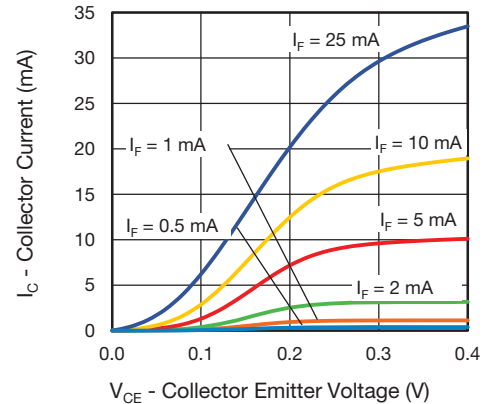


Fig. 9 - Collector Current vs. Collector Emitter Voltage (saturated)

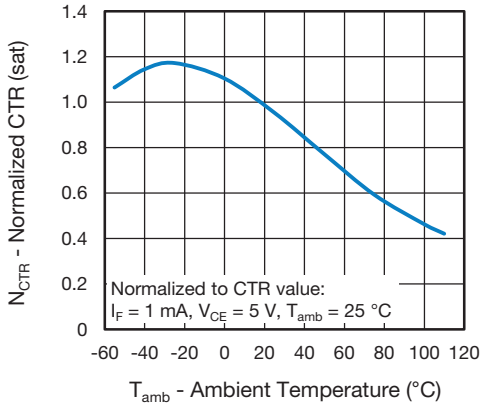


Fig. 10 - Normalized Current Transfer Ratio vs. Ambient Temperature (saturated)

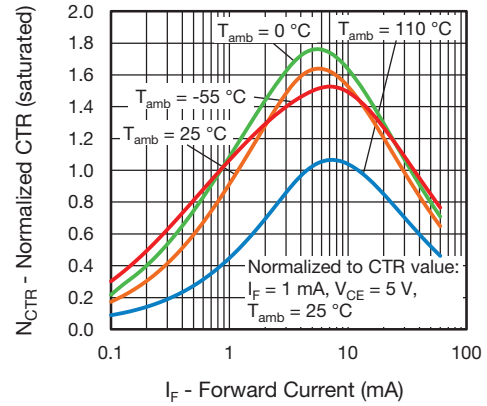


Fig. 13 - Normalized Current Transfer Ratio (saturated) vs. Forward Current

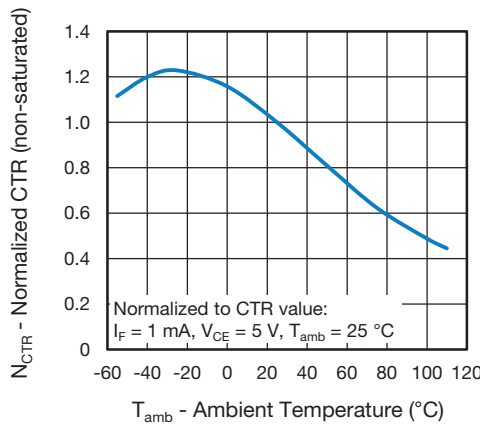


Fig. 11 - Normalized Current Transfer Ratio vs. Ambient Temperature (non-saturated)

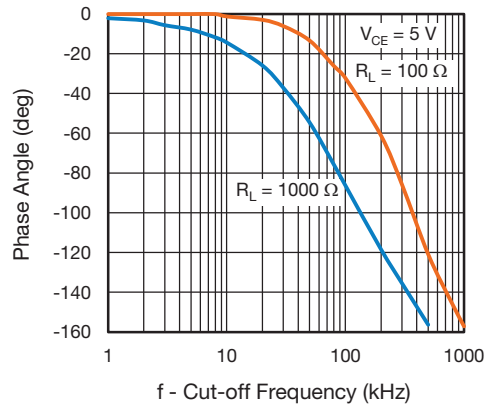


Fig. 14 - Phase Angle vs. Frequency

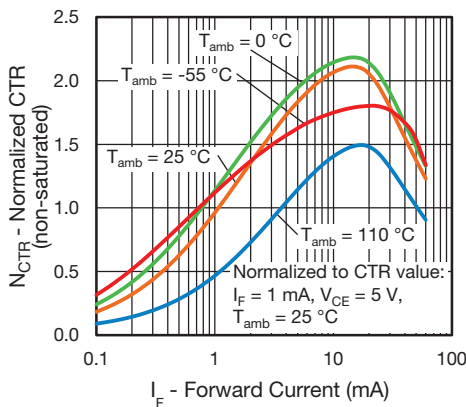


Fig. 12 - Normalized Current Transfer Ratio (non-saturated) vs. Forward Current

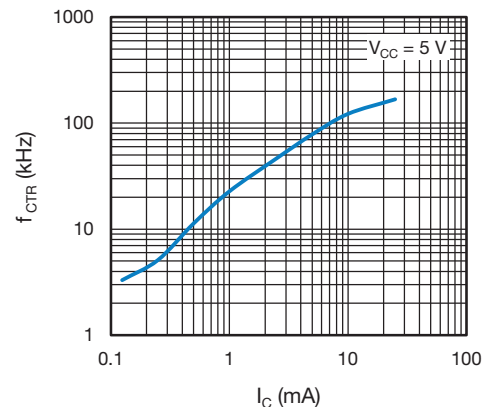


Fig. 15 -  $f_{CTR}$  vs. Collector Current

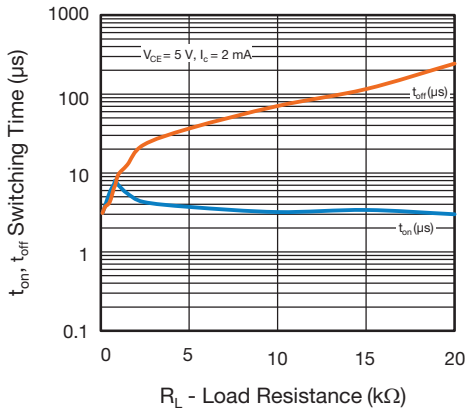


Fig. 16 - Switching Time vs. Load Resistance

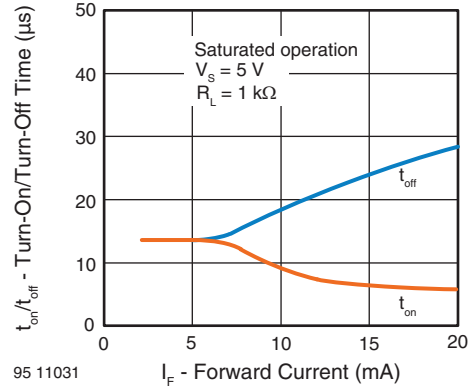


Fig. 18 - Turn-On/Turn-Off Time vs. Forward Current

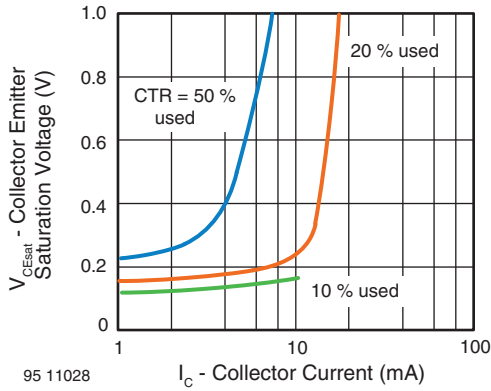


Fig. 17 - Collector Emitter Saturation Voltage vs. Collector Current

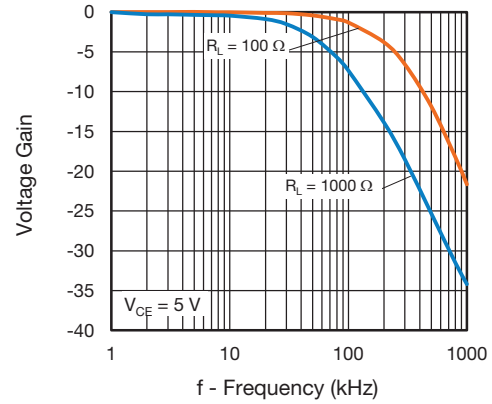
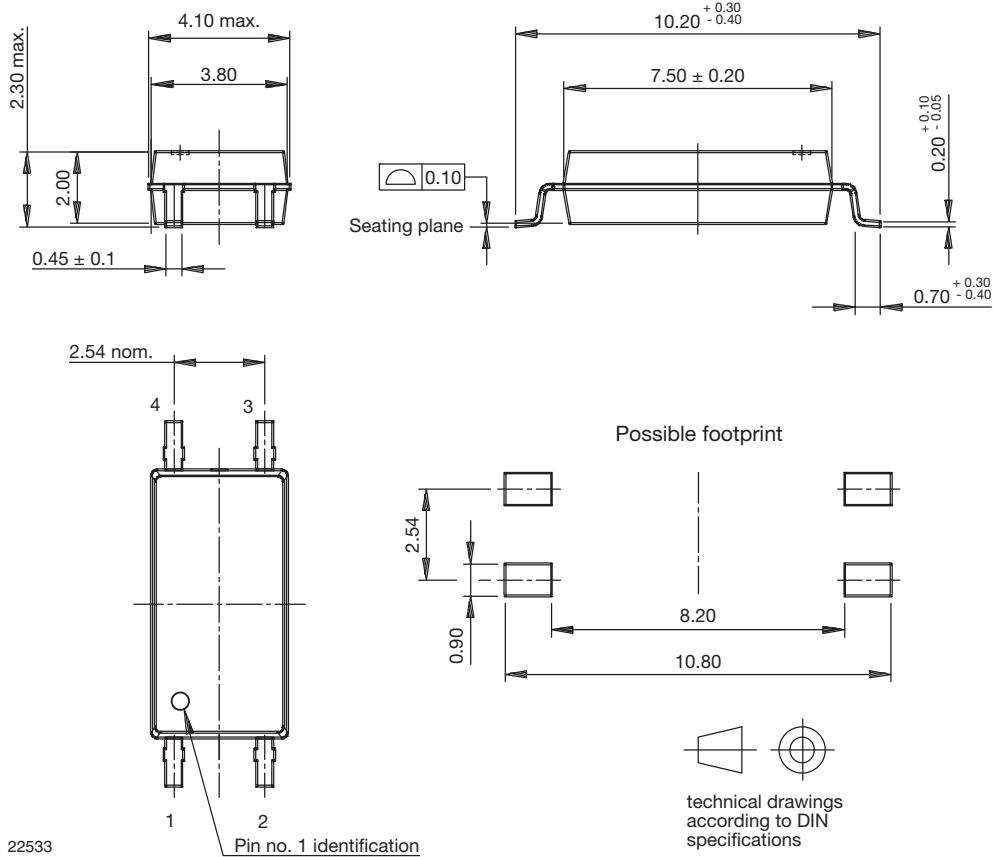
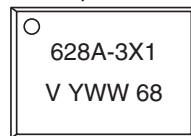


Fig. 19 - Voltage Gain vs. Cut-off Frequency

**PACKAGE DIMENSIONS** (in millimeters)



**PACKAGE MARKING** (example of VOL628A-3X001T)



**Notes**

- Only option 1 is reflected in the package marking with the characters "X1"
- Tape and reel suffix (T) is not part of the package marking

**TAPE AND REEL DIMENSIONS** (in millimeters)

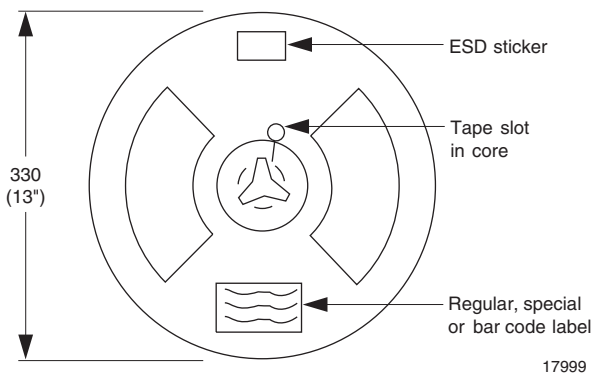


Fig. 20 - Reel Dimensions (3000 units per reel)

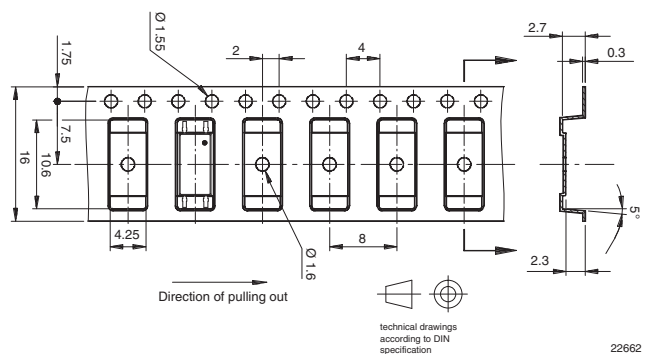
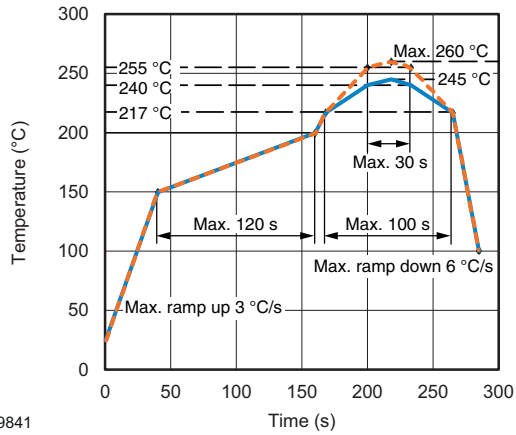


Fig. 21 - Tape Dimensions



**SOLDER PROFILE**



19841

Fig. 22 - Lead (Pb)-free Reflow Solder Profile according to J-STD-020

**HANDLING AND STORAGE CONDITIONS**

ESD level: HBM class 2

Floor life: unlimited

Conditions:  $T_{amb} < 30\text{ °C}$ , RH < 85 %

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





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