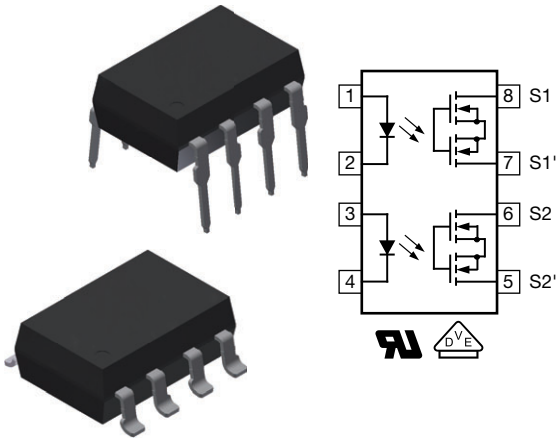


## Dual 1 Form A Solid-State Relay (Normally Open)



### DESCRIPTION

The VOR2121 is a 250 V dual channel normally open optically isolated solid-state relay (SPST - 1 form A). Based on hybrid architecture which allows fast switching times with a wide operating ambient temperature range. A high efficient GaAlAs IRED enables low forward current on the input side. On the output side high performance MOSFET switches provide a low  $R_{ON}$  and can switch both DC and AC signals.

### FEATURES

- Isolation test voltage 5300 V<sub>RMS</sub>
- Typical  $R_{ON}$  12  $\Omega$
- Load voltage 250 V
- Load current 200 mA / 140 mA
- Clean bounce free switching
- Current limit protection
- Low power consumption
- Wide temperature range
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### APPLICATIONS

- General telecom switching
- Metering
- Security equipment
- Instrumentation
- Industrial controls
- Battery management systems
- Automatic test equipment

### AGENCY APPROVALS

- UL1577, file no. E52744
- DIN EN 60747-5-5 (VDE0884-5)

ORDERING INFORMATION	
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px;">V</div> <div style="border: 1px solid black; padding: 2px 5px;">O</div> <div style="border: 1px solid black; padding: 2px 5px;">R</div> <div style="border: 1px solid black; padding: 2px 5px;">2</div> <div style="border: 1px solid black; padding: 2px 5px;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">2</div> <div style="border: 1px solid black; padding: 2px 5px;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> <div style="border: 1px solid black; padding: 2px 5px;">8</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> <div style="text-align: center;"> <p>DIP-8</p> </div> <div style="text-align: center;"> <p>SMD-8</p> </div> </div>	<p>PART NUMBER</p> <p>PACKAGE CONFIGURATION</p>
PACKAGE	UL, VDE
SMD-8, tape and reel	VOR2121B8T
SMD-8, tube	VOR2121B8
DIP-8, tube	VOR2121A8



ABSOLUTE MAXIMUM RATINGS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
IRED continuous forward current		$I_F$	50	mA
IRED reverse voltage		$V_R$	5	V
Input power dissipation		$P_{diss}$	80	mW
<b>OUTPUT</b>				
DC or peak AC load voltage		$V_L$	250	V
Continuous DC load current at 25 °C, one channel		$I_L$	200	mA
Continuous DC load current at 25 °C, two channels		$I_L$	140	mA
SSR output power dissipation		$P_{diss}$	550	mW
<b>SSR</b>				
Ambient temperature range		$T_{amb}$	-40 to +100	°C
Storage temperature range		$T_{stg}$	-40 to +150	°C
Soldering temperature	$t = 10\text{ s max.}$	$T_{sld}$	260	°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.

ELECTRICAL CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
IRED forward current, switch turn-on	$I_L = 100\text{ mA}$ , $t = 10\text{ ms}$	$I_{Fon}$	-	0.4	2	mA
IRED forward current, switch turn-off	$V_L = \pm 200\text{ V}$	$I_{Foff}$	0.05	0.35	-	mA
IRED forward voltage	$I_F = 10\text{ mA}$	$V_F$	-	1.36	1.5	V
IRED reverse current	$V_R = 5\text{ V}$	$I_R$	-	-	10	$\mu\text{A}$
<b>OUTPUT</b>						
On-resistance	$I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$	$R_{ON}$	-	12	15	$\Omega$
Off-resistance	$I_F = 0\text{ mA}$ , $V_L = \pm 100\text{ V}$	$R_{OFF}$	1.0	5000	-	G $\Omega$
Off-state leakage current	$I_F = 0\text{ mA}$ , $V_L = \pm 100\text{ V}$	$I_O$	-	< 1	100	nA
	$I_F = 0\text{ mA}$ , $V_L = \pm 200\text{ V}$	$I_O$	-	< 1	500	nA
Output capacitance pin 3 to 4	$I_F = 0\text{ mA}$ , $V_L = 1\text{ V}$ , 1 MHz	$C_O$	-	39	-	pF
	$I_F = 0\text{ mA}$ , $V_L = 50\text{ V}$ , 1 MHz	$C_O$	-	6	-	pF
Current limit AC/DC	$I_F = 5\text{ mA}$ , $t = 5\text{ ms}$ , $V_L = \pm 6\text{ V}$	$I_{limit}$	300	440	550	mA
<b>TRANSFER</b>						
Capacitance (input to output)	$V_{IO} = 1\text{ V}$	$C_{IO}$	-	0.4	-	pF

**Note**

- Minimum and maximum values are testing 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.

SWITCHING CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Turn-on time	$I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$	$t_{on}$	-	0.20	0.5	ms
Turn-off time	$I_F = 5\text{ mA}$ , $I_L = 50\text{ mA}$	$t_{off}$	-	0.03	0.2	ms

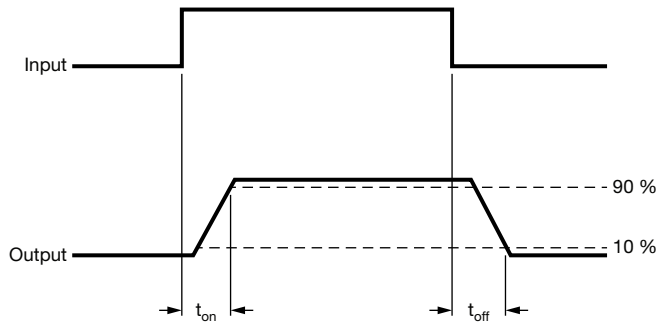
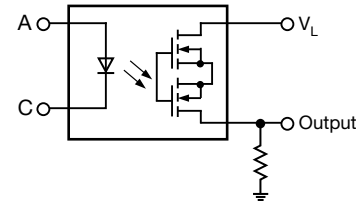


Fig. 1 - Timing Schematic



SAFETY AND INSULATION RATINGS				
PARAMETER	CONDITION	SYMBOL	VALUE	UNIT
Climatic classification	According to IEC 68 part 1		40 / 100 / 21	
Pollution degree	According to DIN VDE 0109		2	
Comparative tracking index	Insulation group IIIa	CTI	175	
Maximum rated withstanding isolation voltage	According to UL1577, t = 1 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	$V_{IORM}$	890	$V_{peak}$
Insulation resistance	$V_{IO} = 500\text{ V}, T_{amb} = 25\text{ }^{\circ}\text{C}$	$R_{IO}$	$\geq 10^{12}$	$\Omega$
	$V_{IO} = 500\text{ V}, T_{amb} = 100\text{ }^{\circ}\text{C}$	$R_{IO}$	$\geq 10^{11}$	$\Omega$
Output safety power	One channel	$P_{SO}$	640	mW
	Two channels		480	
Input safety current	One channel	$I_{SI}$	240	mA
	Two channels		200	
Safety temperature		$T_S$	175	$^{\circ}\text{C}$
Creepage distance	DIP-8		$\geq 7$	mm
Clearance distance			$\geq 7$	mm
Creepage distance	SMD-8		$\geq 8$	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 $< 5\text{ pC}$	$V_{PR}$	1669	$V_{peak}$
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 $< 5\text{ pC}$	$V_{PR}$	1424	$V_{peak}$

**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.

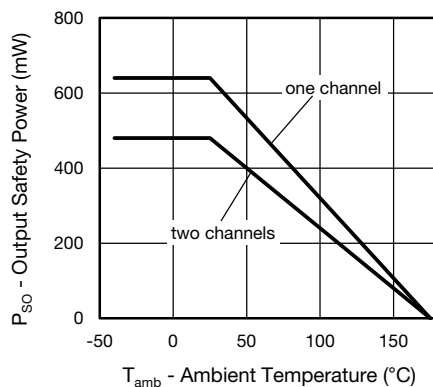


Fig. 2 - Output Safety Power vs. Ambient Temperature

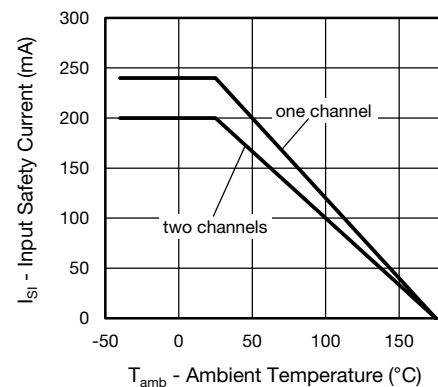


Fig. 3 - Input Safety Current vs. Ambient Temperature

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

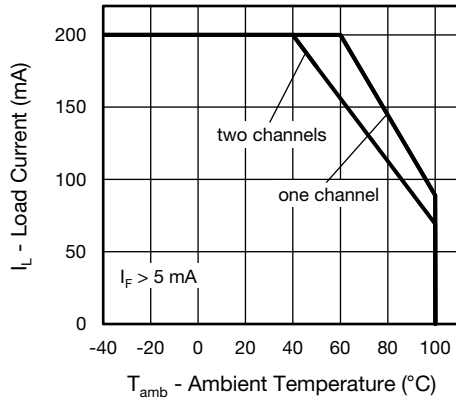


Fig. 4 - Load Current vs. Ambient Temperature

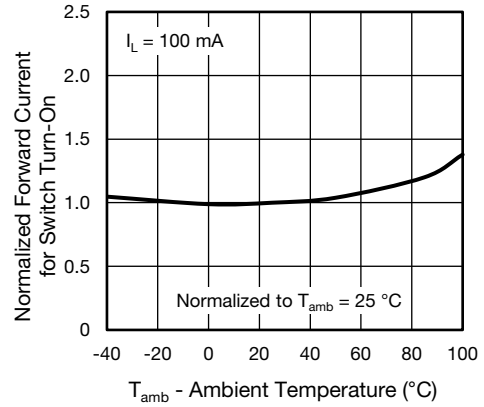


Fig. 7 - Normalized Forward Current vs. Ambient Temperature

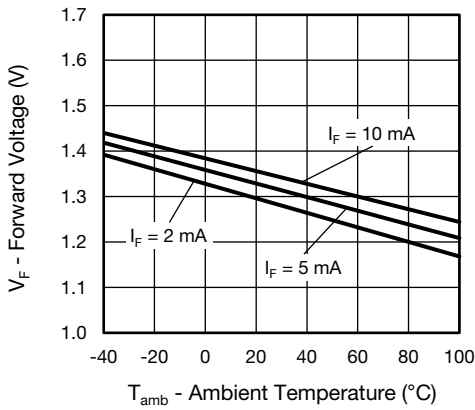


Fig. 5 - Forward Voltage vs. Ambient Temperature

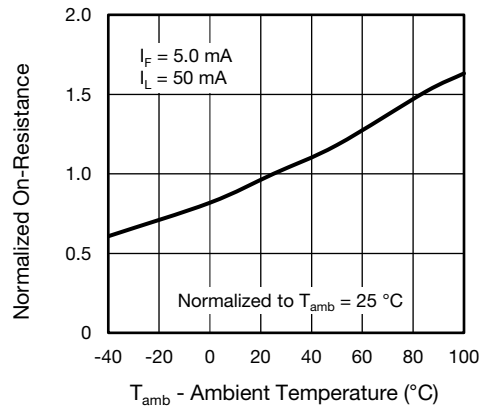


Fig. 8 - Normalized On-Resistance vs. Ambient Temperature

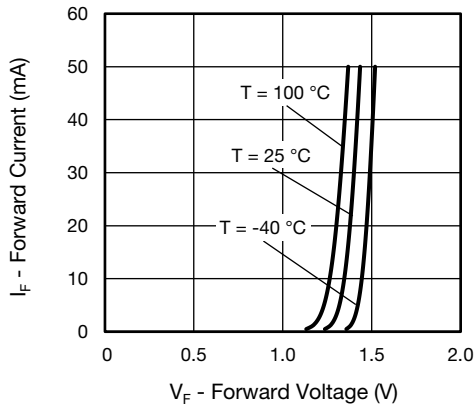


Fig. 6 - Forward Current vs. Forward Voltage

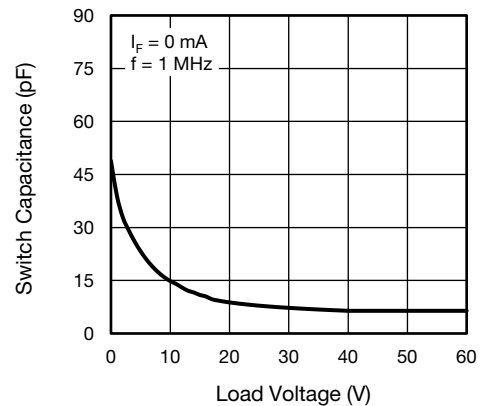


Fig. 9 - Switch Capacitance vs. Load Voltage

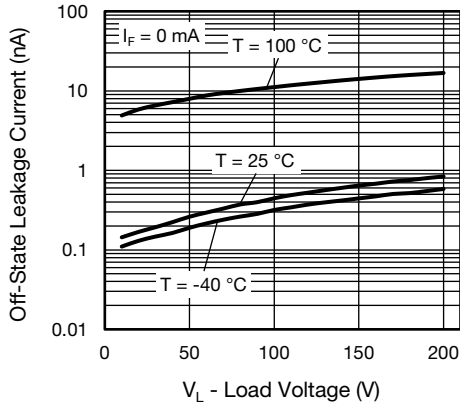


Fig. 10 - Leakage Current vs. Load Voltage

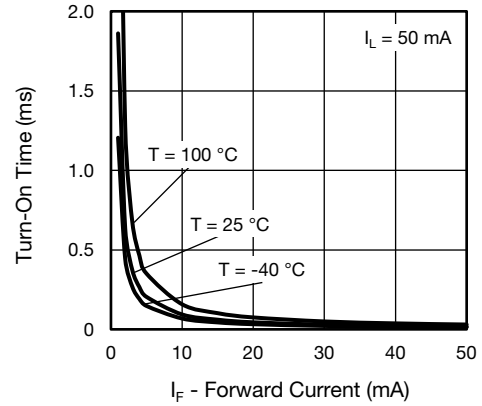


Fig. 13 - Turn-On Time vs. Forward Current

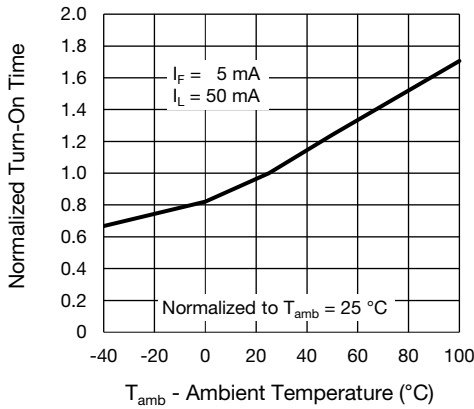


Fig. 11 - Normalized Turn-On Time vs. Ambient Temperature

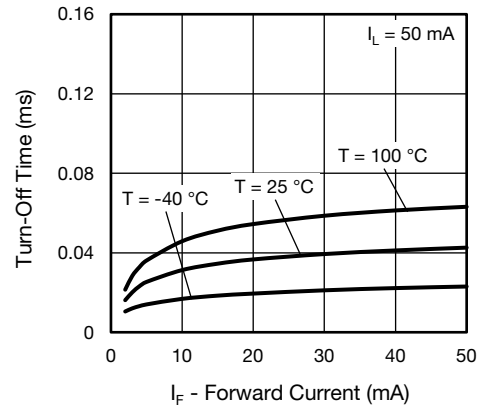


Fig. 14 - Turn-Off Time vs. Forward Current

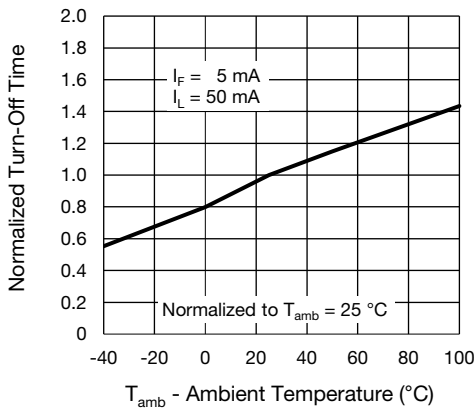
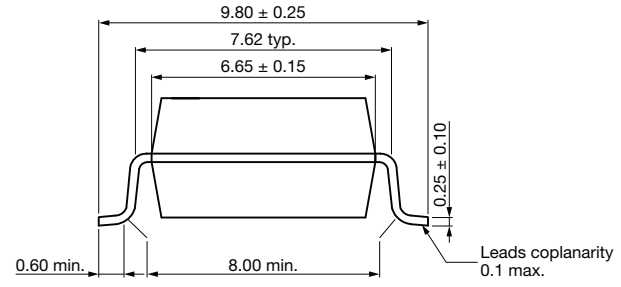
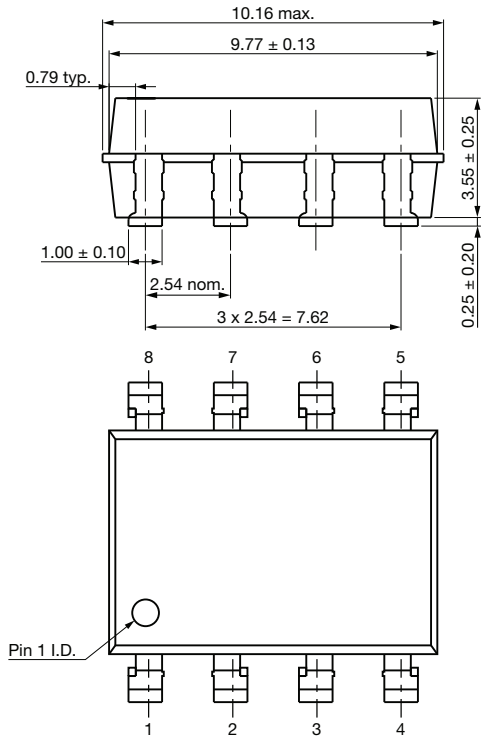


Fig. 12 - Normalized Turn-Off Time vs. Ambient Temperature

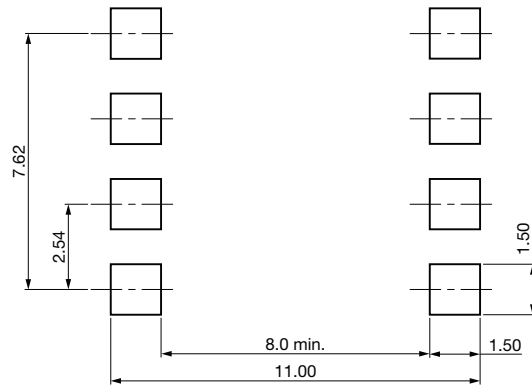


## PACKAGE DIMENSIONS in millimeters

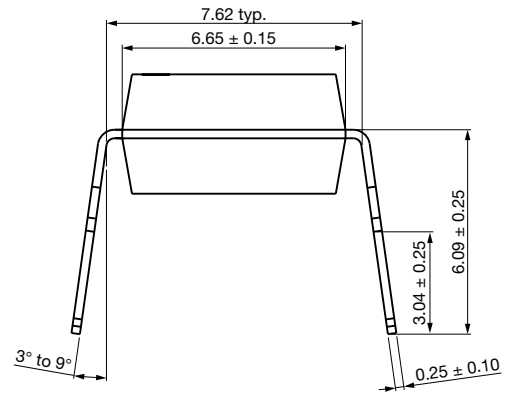
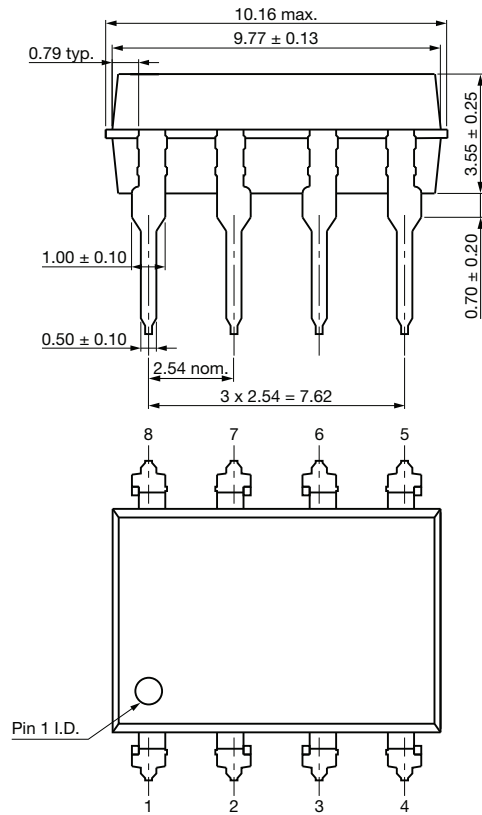
### SMD-8



### Recommended footprint



### DIP-8



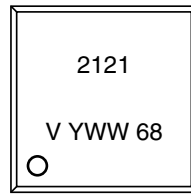
**PACKAGE MARKING** (example)


Fig. 15 - VOR2121

**Note**

- Package configurations (T, A, B) are not part of the package marking.

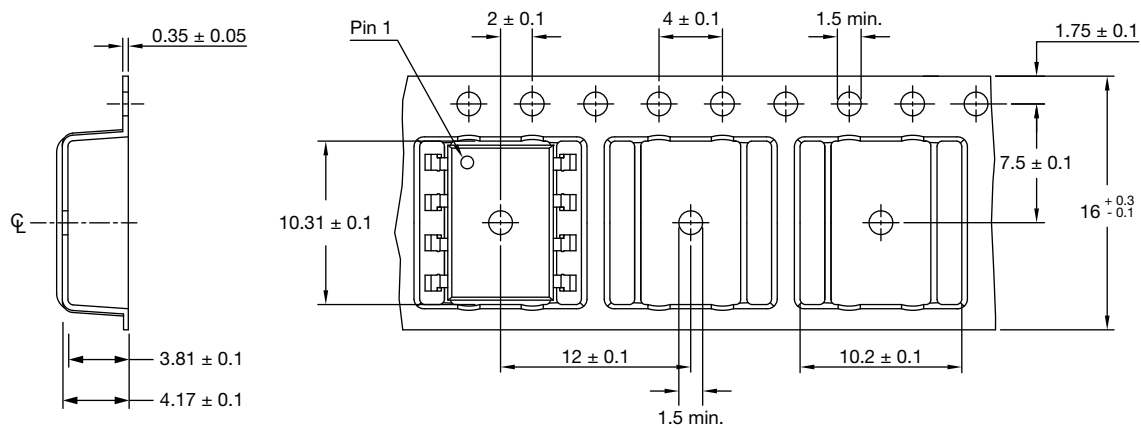
**PACKING INFORMATION** (in millimeters)


Fig. 16 - Tape and Reel Packing

TAPE AND REEL PACKING	
TYPE	UNITS/REEL
SMD-8	1000

TUBE PACKING			
TYPE	UNITS/TUBE	TUBES/BOX	UNITS/BOX
SMD-8	50	40	2000
DIP-8	50	40	2000

**SOLDER PROFILES**

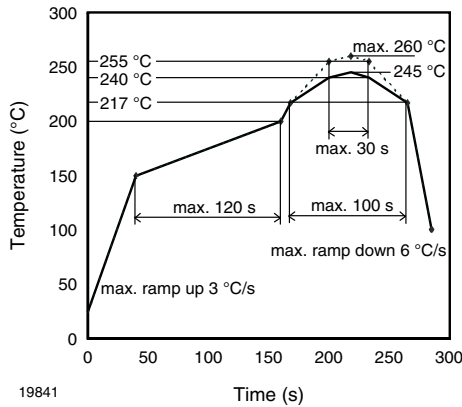


Fig. 17 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

**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

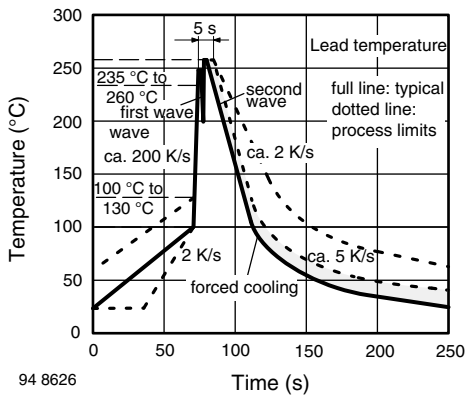


Fig. 18 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP Devices





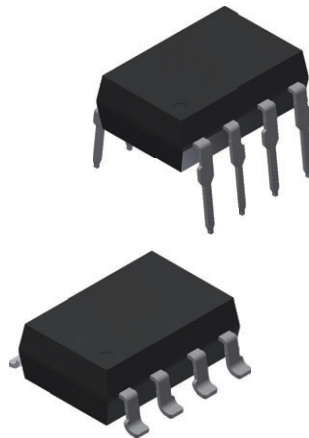
## Footprint and Schematic Information for VOR2121

The footprint and schematic symbols for the following parts can be accessed using the associated links. They are available in Eagle, Altium, KiCad, OrCAD / Allegro, Pulsonix, and PADS.

Note that the 3D models for these parts can be found on the Vishay product page.

PART NUMBER	FOOTPRINT / SCHEMATIC
VOR2121A8	<a href="http://www.snapeda.com/parts/VOR2121A8/Vishay/view-part">www.snapeda.com/parts/VOR2121A8/Vishay/view-part</a>
VOR2121B8	<a href="http://www.snapeda.com/parts/VOR2121B8/Vishay/view-part">www.snapeda.com/parts/VOR2121B8/Vishay/view-part</a>
VOR2121B8T	<a href="http://www.snapeda.com/parts/VOR2121B8T/Vishay/view-part">www.snapeda.com/parts/VOR2121B8T/Vishay/view-part</a>

For technical issues and product support, please contact [optocoupleranswers@vishay.com](mailto:optocoupleranswers@vishay.com).





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