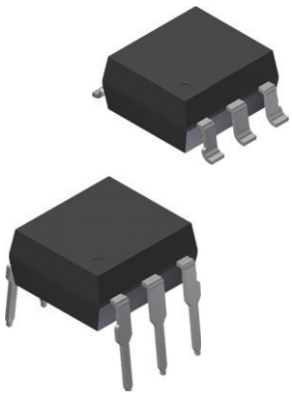
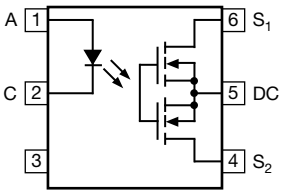
1 Form A Solid-State Relay (Normally Open)





FEATURES

- Isolation test voltage 5300 V_{RMS}
- Typical R_{ON} 12 Ω
- Load voltage 250 V
- Load current 200 mA / 370 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

Pb-free
RoHS COMPLIANT
HALOGEN FREE
GREEN (5-2008)

DESCRIPTION

The VOR1121 is a 250 V single 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.

APPLICATIONS

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

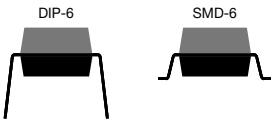
AGENCY APPROVALS

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

ORDERING INFORMATION

V O R 1 1 2 1 B 6 #

PART NUMBER — PACKAGE CONFIGURATION



PACKAGE	UL, VDE
SMD-6, tape and reel	VOR1121B6T
SMD-6, tube	VOR1121B6
DIP-6, tube	VOR1121A6

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ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
IRED continuous forward current		I_F	50	mA
IRED reverse voltage		V_R	5	V
Input power dissipation		P_{diss}	80	mW
OUTPUT				
DC or peak AC load voltage		V_L	250	V
Continuous load current (AC/DC configuration)		I_L	200	mA
Continuous load current (DC only configuration)		I_L	370	mA
SSR output power dissipation (continuous)		P_{diss}	550	mW
SSR				
Ambient temperature range		T_{amb}	-40 to +100	°C
Storage temperature range		T_{stg}	-40 to +150	°C
Soldering temperature	t = 10 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 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
IRED forward current, switch turn-on	I_L = 100 mA, t = 10 ms	I_{Fon}	-	0.4	2	mA
IRED forward current, switch turn-off	V_L = ± 200 V	I_{Foff}	0.05	0.35	-	mA
IRED forward voltage	I_F = 10 mA	V_F	-	1.36	1.5	V
IRED reverse current	V_R = 5 V	I_R	-	-	10	µA
OUTPUT						
On-resistance (AC/DC configuration)	I_F = 5 mA, I_L = 50 mA	R_{ON}	-	12	15	Ω
On-resistance (DC only configuration)	I_F = 5 mA, I_L = 100 mA	R_{ON}	-	3.2	3.6	Ω
Off-resistance	I_F = 0 mA, V_L = ± 100 V	R_{OFF}	1	5000	-	GΩ
Off-state leakage current	I_F = 0 mA, V_L = ± 100 V	I_O	-	< 1	100	nA
	I_F = 0 mA, V_L = ± 200 V	I_O	-	< 1	500	nA
Output capacitance (AC/DC configuration)	I_F = 0 mA, V_L = 1 V, 1 MHz	C_O	-	39	-	pF
	I_F = 0 mA, V_L = 50 V, 1 MHz	C_O	-	6	-	pF
Current limit (AC/DC configuration)	I_F = 5 mA, t = 5 ms, V_L = ± 6 V	I_{limit}	300	440	550	mA
Current limit (DC only configuration)	I_F = 5 mA, t = 5 ms, V_L = ± 6 V	I_{limit}	600	870	1100	mA
TRANSFER						
Capacitance (input to output)	V_{IO} = 1 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.

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PIN CONFIGURATION

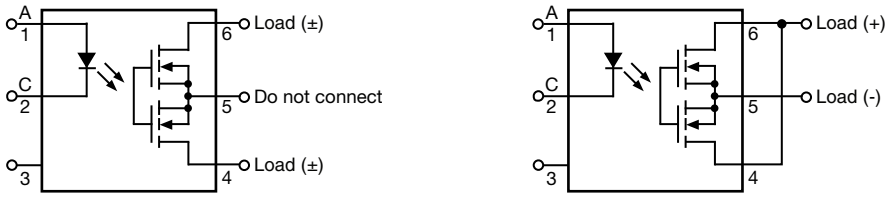

Fig. 1 - Pin Configuration

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

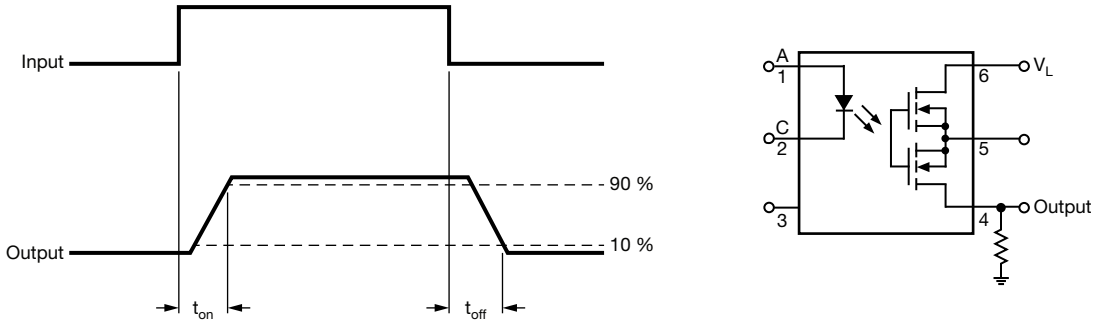

Fig. 2 - Timing Schematic

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 V, T_{amb} = 25 °C	R_{IO}	$\geq 10^{12}$	Ω
	V_{IO} = 500 V, T_{amb} = 100 °C	R_{IO}	$\geq 10^{11}$	Ω
Output safety power		P_{SO}	720	mW
Input safety current		I_{SI}	240	mA
Safety temperature		T_S	175	°C
Creepage distance	DIP-6		≥ 7	mm
Clearance distance			≥ 7	mm
Creepage distance	SMD-6		≥ 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}	1669	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}	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.

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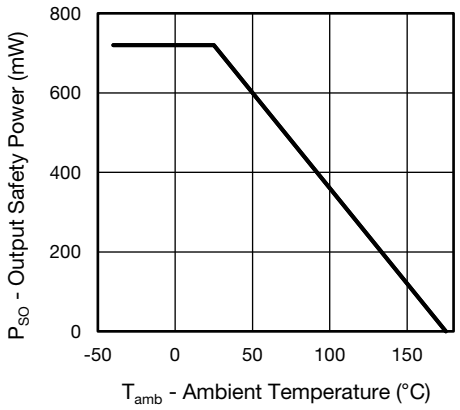

Fig. 3 - Output Safety Power vs. Ambient Temperature

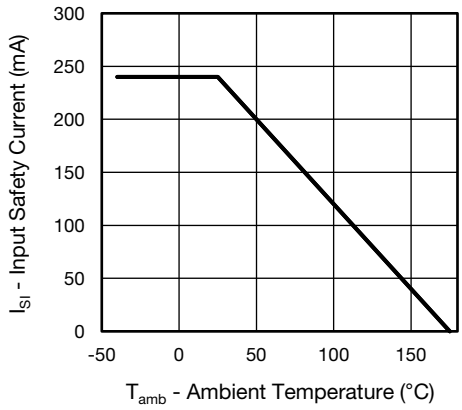

Fig. 4 - Input Safety Current vs. Ambient Temperature

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

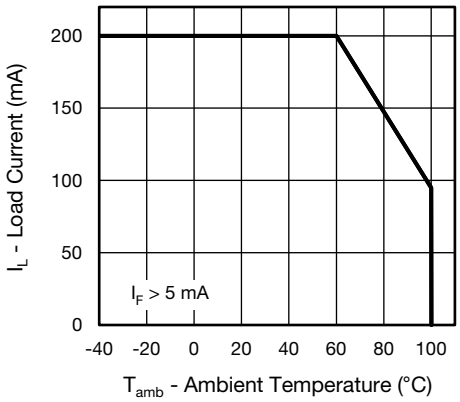

Fig. 5 - Load Current vs. Ambient Temperature

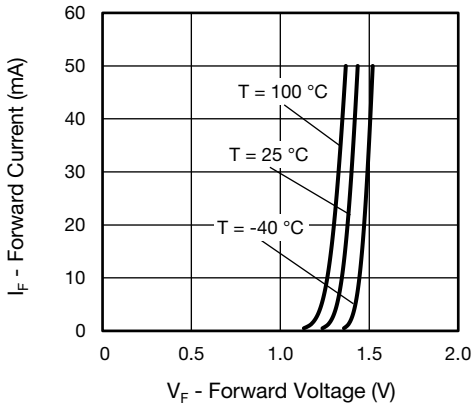

Fig. 7 - Forward Current vs. Forward Voltage

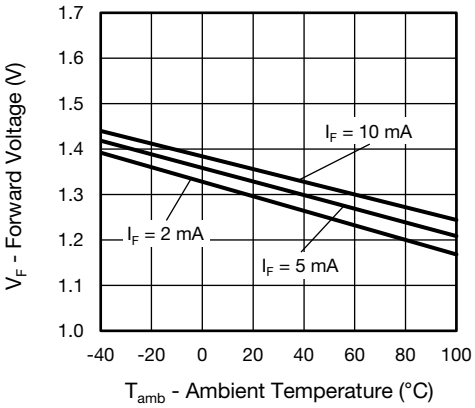

Fig. 6 - Forward Voltage vs. Ambient Temperature

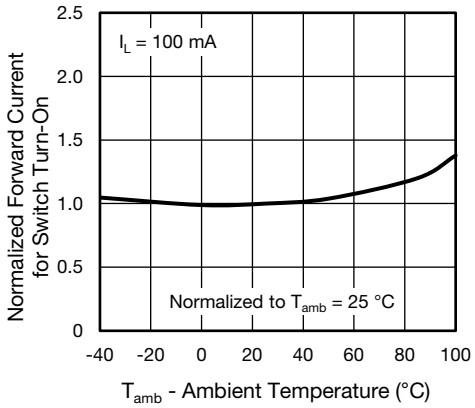

Fig. 8 - Normalized Forward Current for Switch Turn-On vs. Ambient Temperature

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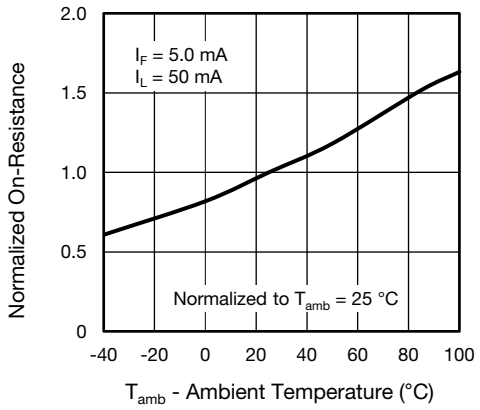

Fig. 9 - Normalized On-Resistance vs. Ambient Temperature

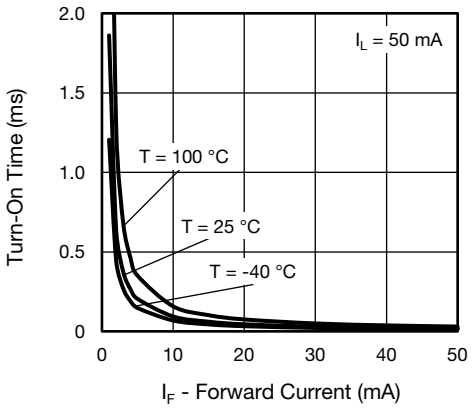

Fig. 12 - Turn-On Time vs. Forward Current

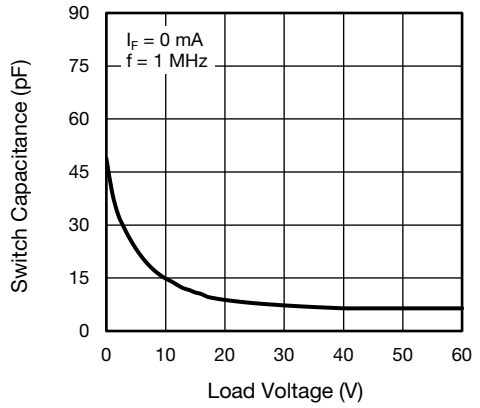

Fig. 10 - Switch Capacitance vs. Load Voltage

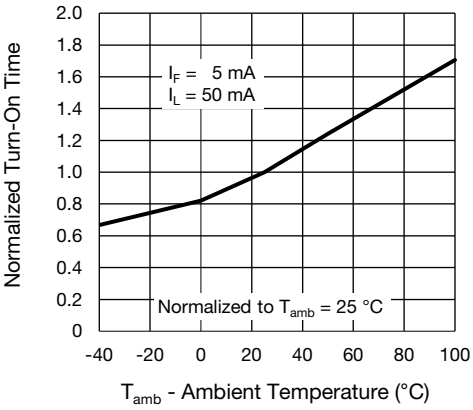

Fig. 13 - Normalized Turn-On Time vs. Ambient Temperature

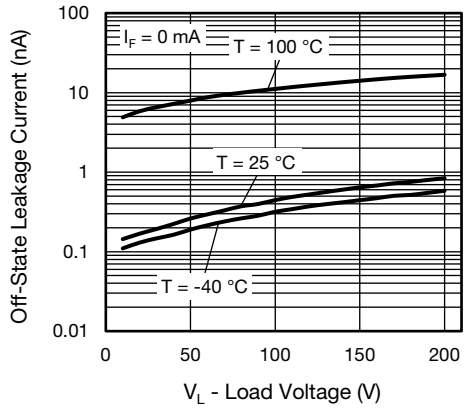

Fig. 11 - Off-State Leakage Current vs. Load Voltage

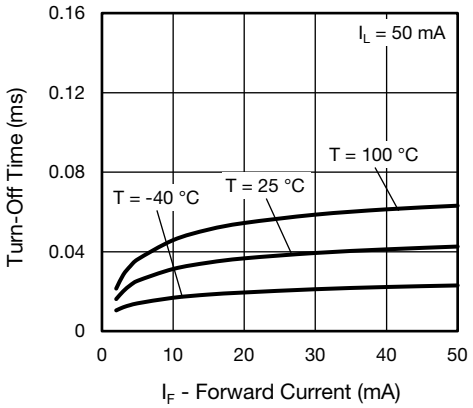

Fig. 14 - Turn-Off Time vs. Forward Current

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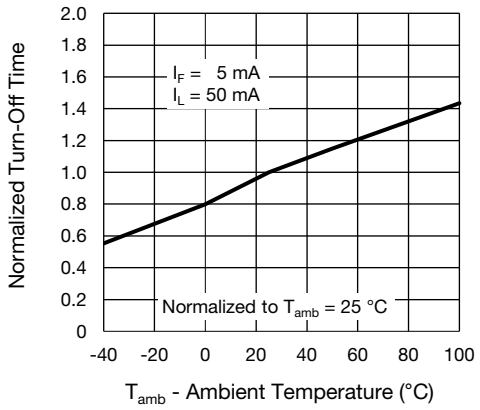

Fig. 15 - Normalized Turn-Off Time vs. Ambient Temperature

PACKAGE DIMENSIONS (in millimeters)

SMD-6

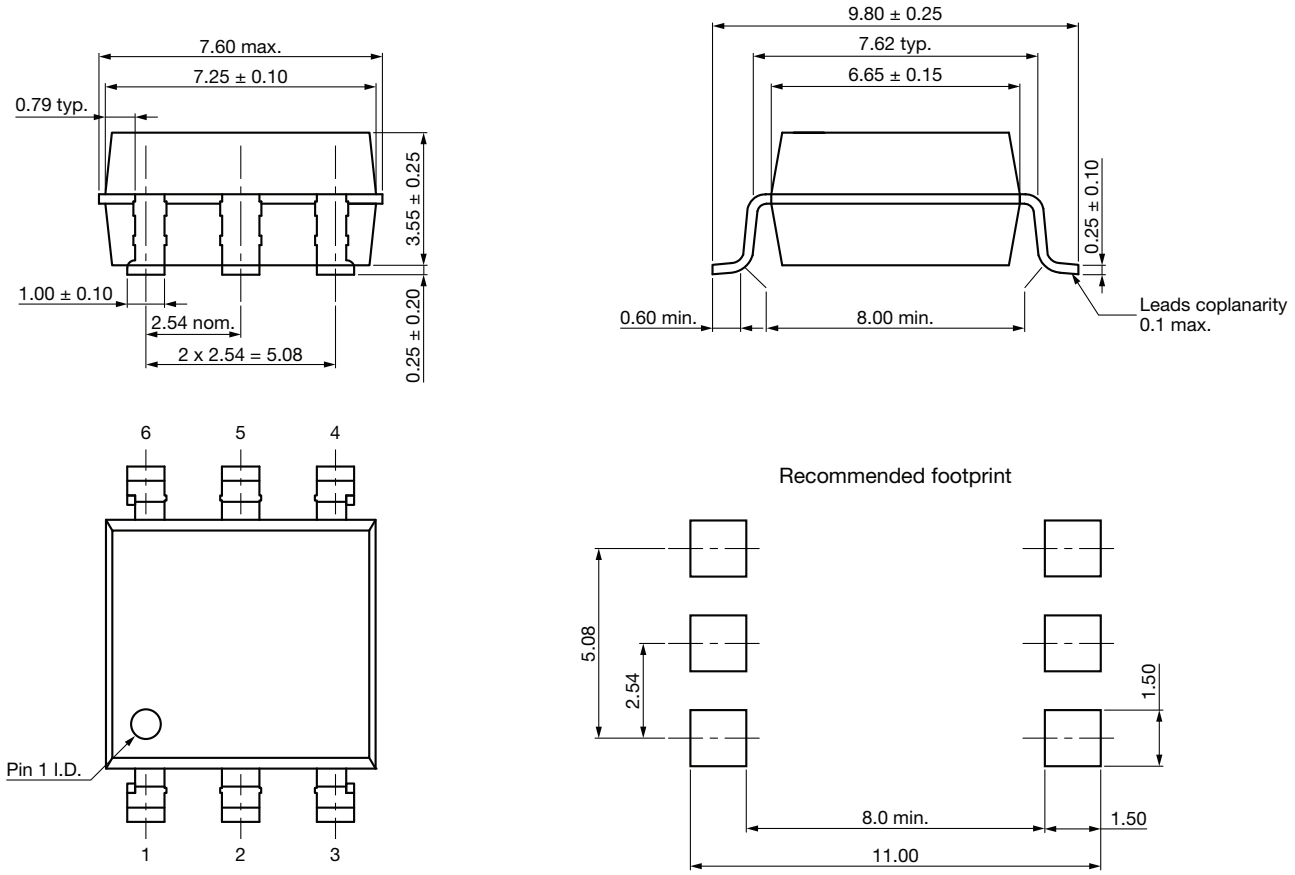

Fig. 16 - Package Drawings

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DIP-6

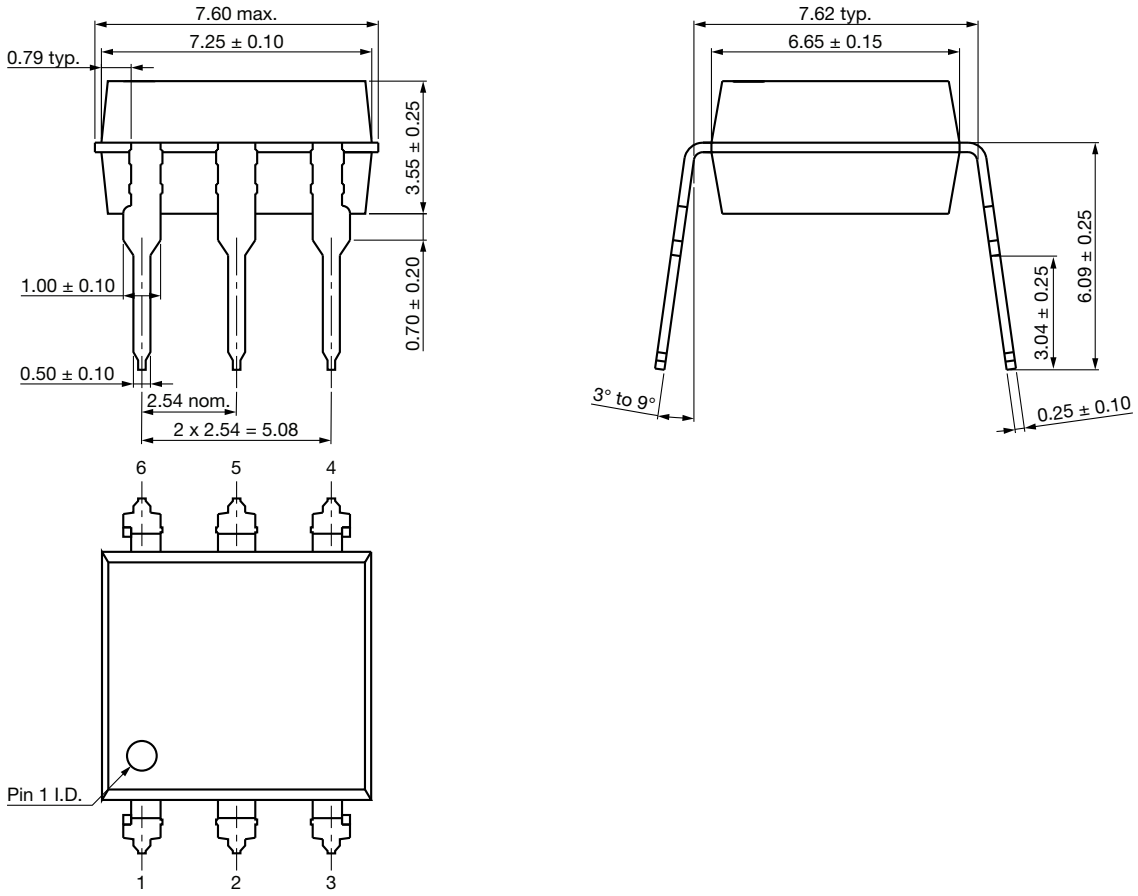

Fig. 17 - Package Drawings

PACKAGE MARKING

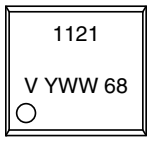

Fig. 18 - VOR1121

Note

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

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PACKING INFORMATION (in millimeters)

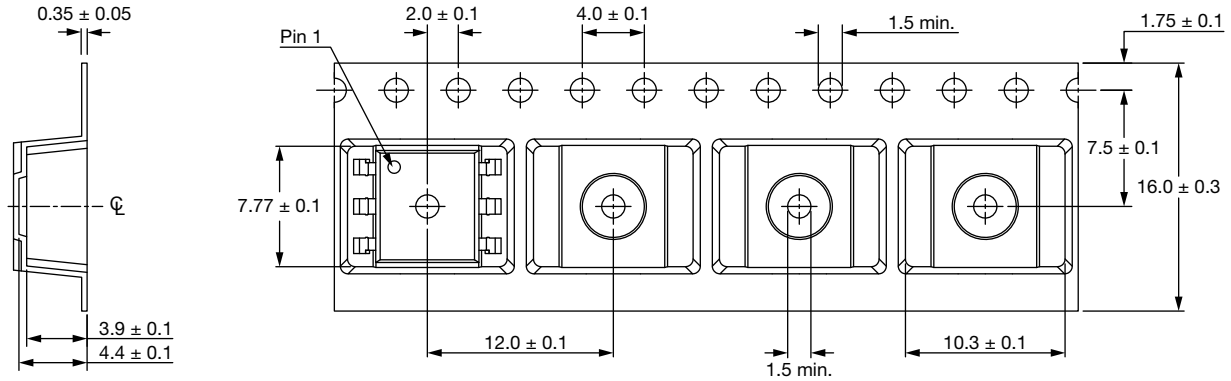

Fig. 19 - Tape and Reel Packing

TAPE AND REEL PACKING	
TYPE	UNITS/REEL
SMD-6	1000

TUBE PACKING			
TYPE	UNITS/TUBE	TUBES/BOX	UNITS/BOX
SMD-6	50	40	2000
DIP-6	50	40	2000

SOLDER PROFILES

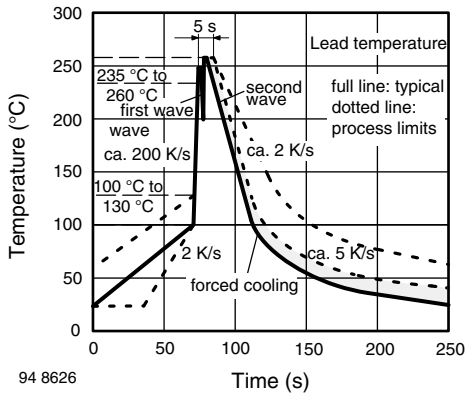

Fig. 20 - Wave Soldering Double Wave Profile According to J-STD-020 for DIP Devices

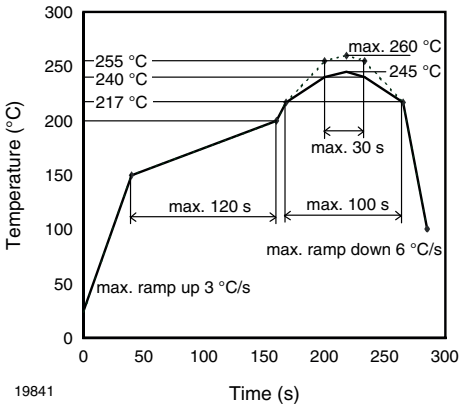

Fig. 21 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

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

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

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