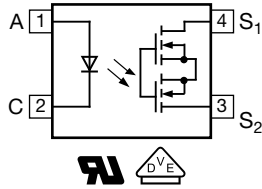
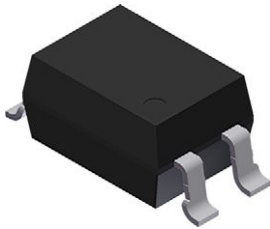


# 1 Form A Solid-State Relay



## FEATURES

- Isolation test voltage 5300 V<sub>RMS</sub>
- Typical R<sub>ON</sub> 22 Ω
- Load voltage 400 V
- Load current 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)



## DESCRIPTION

The VOR1142 is a 400 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<sub>ON</sub> 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 (VDE 0884-5)

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;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">4</div> <div style="border: 1px solid black; padding: 2px 5px;">2</div> <div style="border: 1px solid black; padding: 2px 5px;">B</div> <div style="border: 1px solid black; padding: 2px 5px;">4</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> </div> <p style="text-align: center; margin-top: 5px;"> <span style="display: inline-block; width: 40%; border-bottom: 1px solid black; margin-bottom: 2px;"></span> <span style="display: inline-block; width: 20%; border-bottom: 1px solid black; margin-bottom: 2px;"></span> </p> <p style="text-align: center; margin-top: 5px;"> <span style="display: inline-block; width: 40%; border-bottom: 1px solid black; margin-bottom: 2px;"></span> <span style="display: inline-block; width: 20%; border-bottom: 1px solid black; margin-bottom: 2px;"></span> </p>	<p>SMD-4</p>
<b>PACKAGE</b>	<b>UL, VDE</b>
SMD-4, tape and reel	VOR1142B4T
SMD-4, tube	VOR1142B4



ABSOLUTE MAXIMUM RATINGS (T <sub>amb</sub> = 25 °C, unless otherwise specified)				
PARAMETER	CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
IRED continuous forward current		I <sub>F</sub>	50	mA
IRED reverse voltage		V <sub>R</sub>	5	V
Input power dissipation		P <sub>diss</sub>	80	mW
<b>OUTPUT</b>				
DC or peak AC load voltage		V <sub>L</sub>	400	V
Continuous DC load current at 25 °C, bidirectional		I <sub>L</sub>	140	mA
SSR output power dissipation		P <sub>diss</sub>	550	mW
<b>SSR</b>				
Ambient temperature range		T <sub>amb</sub>	-40 to +100	°C
Storage temperature range		T <sub>stg</sub>	-40 to +150	°C
Soldering temperature	t = 10 s max.	T <sub>sld</sub>	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 <sub>amb</sub> = 25 °C, unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
IRED forward current, switch turn-on	I <sub>L</sub> = 100 mA, t = 10 ms	I <sub>Fon</sub>	-	0.25	2	mA
IRED forward current, switch turn-off	V <sub>L</sub> = ± 350 V, I <sub>L</sub> < 1 μA	I <sub>Foff</sub>	0.05	0.15	-	mA
IRED forward voltage	I <sub>F</sub> = 10 mA	V <sub>F</sub>	-	1.36	1.5	V
IRED reverse current	V <sub>R</sub> = 5 V	I <sub>R</sub>	-	-	10	μA
<b>OUTPUT</b>						
On-resistance, AC/DC: pin 3 (±) to 4 (±)	I <sub>F</sub> = 5 mA, I <sub>L</sub> = 50 mA	R <sub>ON</sub>	-	22	27	Ω
Off-resistance	I <sub>F</sub> = 0 mA, V <sub>L</sub> = ± 100 V	R <sub>OFF</sub>	1	5000	-	GΩ
Off-state leakage current	I <sub>F</sub> = 0 mA, V <sub>L</sub> = ± 100 V	I <sub>O</sub>	-	< 1	100	nA
	I <sub>F</sub> = 0 mA, V <sub>L</sub> = ± 400 V	I <sub>O</sub>	-	6	500	nA
Output capacitance pin 3 to 4	I <sub>F</sub> = 0 mA, V <sub>L</sub> = 1 V, 1 MHz	C <sub>O</sub>	-	39	-	pF
	I <sub>F</sub> = 0 mA, V <sub>L</sub> = 50 V, 1 MHz	C <sub>O</sub>	-	6	-	pF
Current limit AC/DC	I <sub>F</sub> = 5 mA, t = 5 ms, V <sub>L</sub> = ± 6 V	I <sub>limit</sub>	170	300	450	mA
<b>TRANSFER</b>						
Capacitance (input to output)	V <sub>IO</sub> = 1 V	C <sub>IO</sub>	-	1	-	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 <sub>amb</sub> = 25 °C, unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Turn-on time	I <sub>F</sub> = 5 mA, I <sub>L</sub> = 50 mA	t <sub>on</sub>	-	0.13	0.5	ms
Turn-off time	I <sub>F</sub> = 5 mA, I <sub>L</sub> = 50 mA	t <sub>off</sub>	-	0.05	0.2	ms

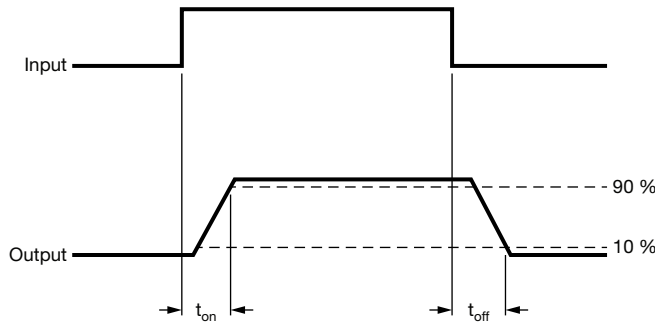
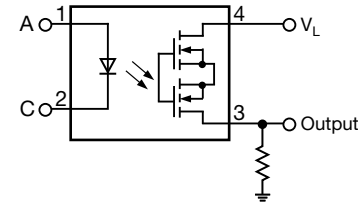


Fig. 1 - Timing Schematic



SAFETY AND INSULATION RATINGS				
PARAMETER	TEST 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	$V_{peak}$
Isolation 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		$P_{SO}$	720	mW
Input safety current		$I_{SI}$	240	mA
Safety temperature		$T_S$	175	$^\circ\text{C}$
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 $< 5 \text{ pC}$	$V_{PR}$	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.

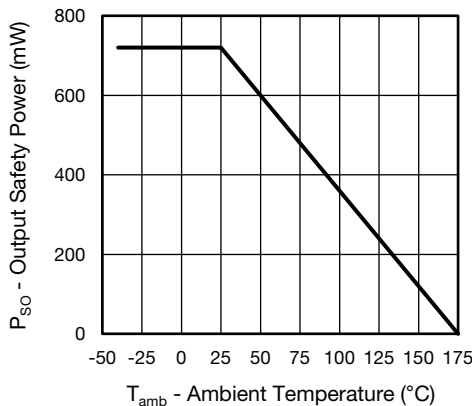


Fig. 2 - Safety Power Dissipation vs. Ambient Temperature

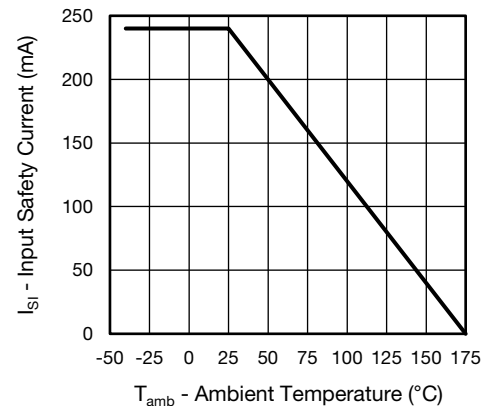


Fig. 3 - Safety Input Current vs. Ambient Temperature

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

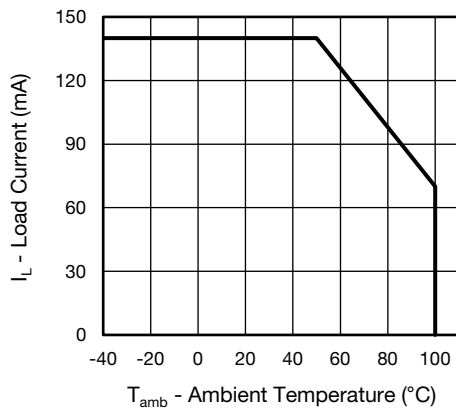


Fig. 4 - Maximum Load Current vs. Ambient Temperature

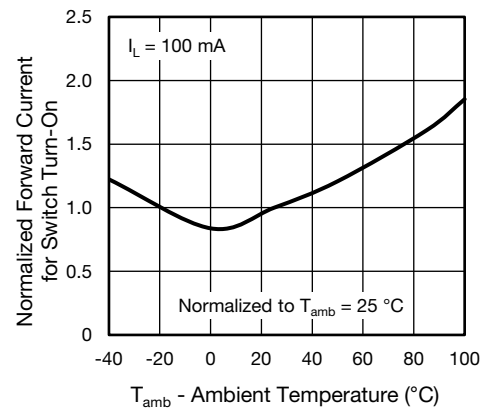


Fig. 7 - Normalized Forward Current for Switch Turn-On vs. Ambient Temperature

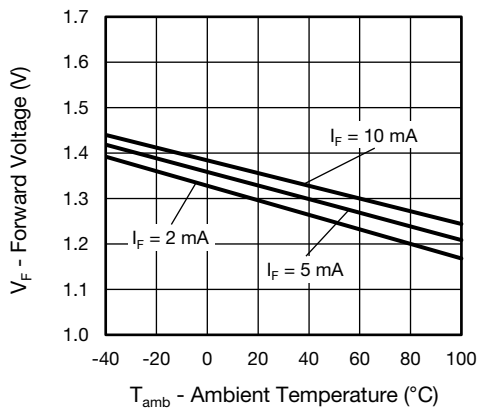


Fig. 5 - Forward Voltage vs. Ambient Temperature

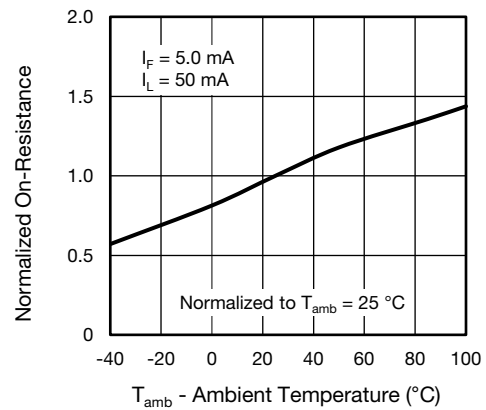


Fig. 8 - Normalized On-Resistance vs. Ambient Temperature

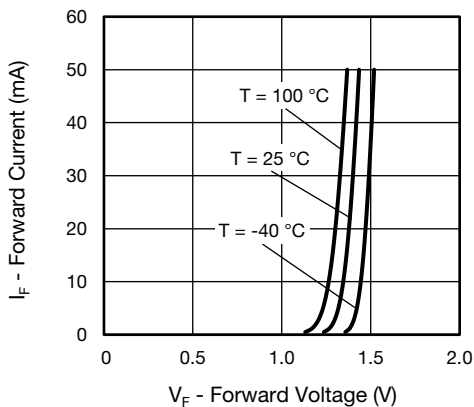


Fig. 6 - Forward Current vs. Forward Voltage

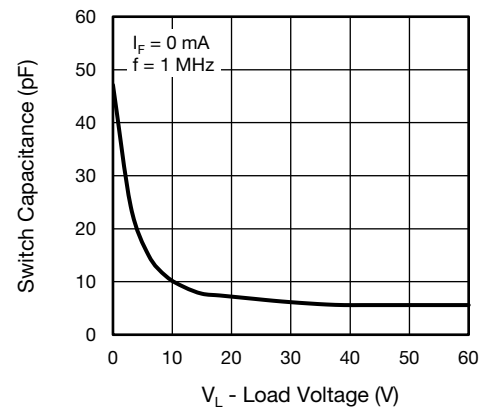


Fig. 9 - Output Capacitance vs. Load Voltage

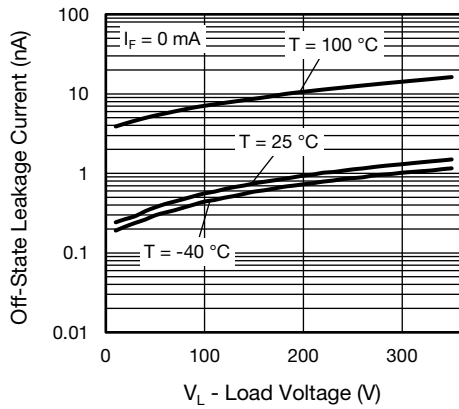


Fig. 10 - Off-State Leakage Current vs. Load Voltage

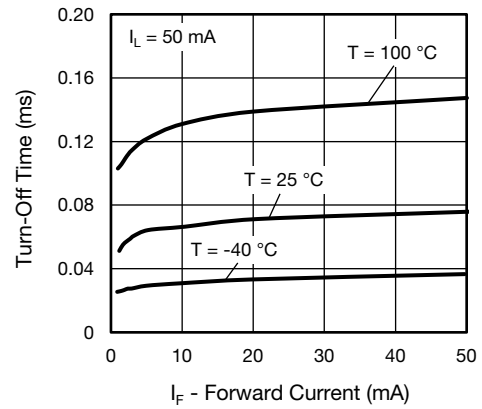


Fig. 13 - Turn-Off Time vs. Forward Current

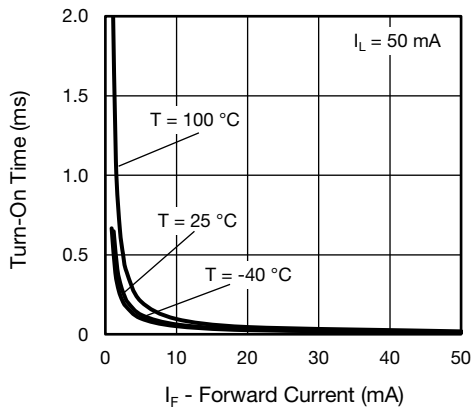


Fig. 11 - Turn-On Time vs. Forward Current

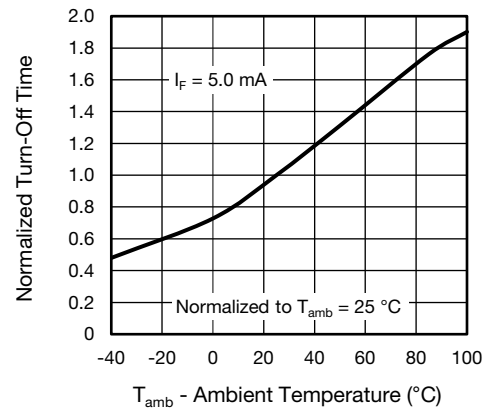


Fig. 14 - Normalized Turn-Off Time vs. Ambient Temperature

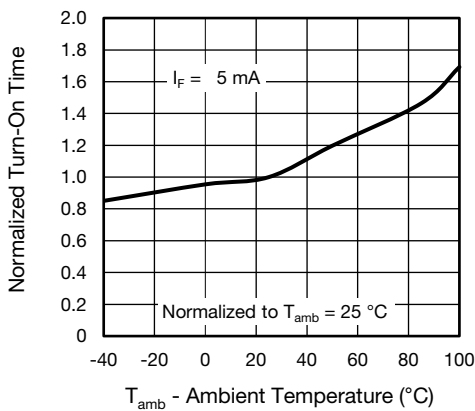
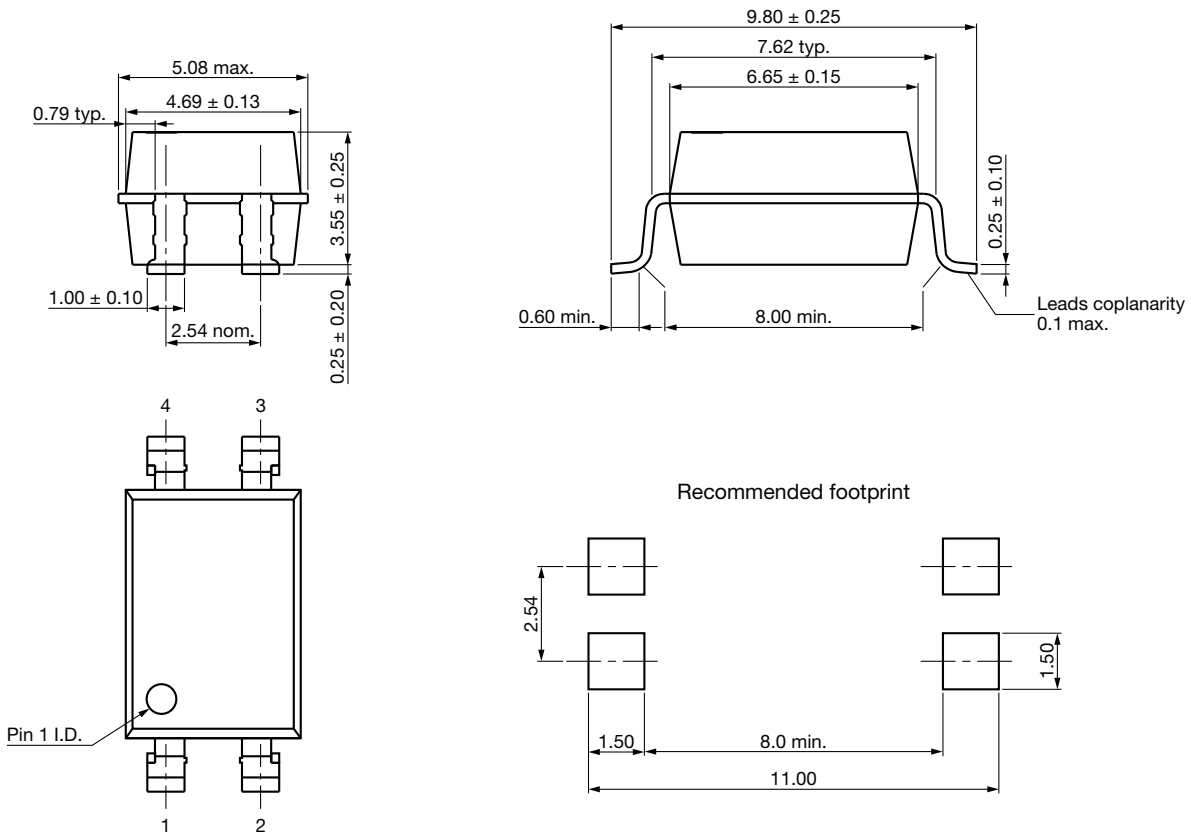


Fig. 12 - Normalized Turn-On Time vs. Ambient Temperature



**PACKAGE DIMENSIONS** in millimeters

**SMD-4**



**PACKAGE MARKING** (example)

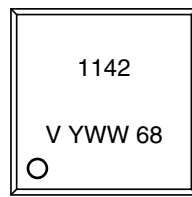


Fig. 15 - VOR1142B4

**Note**

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

**PACKING INFORMATION** (in millimeters)

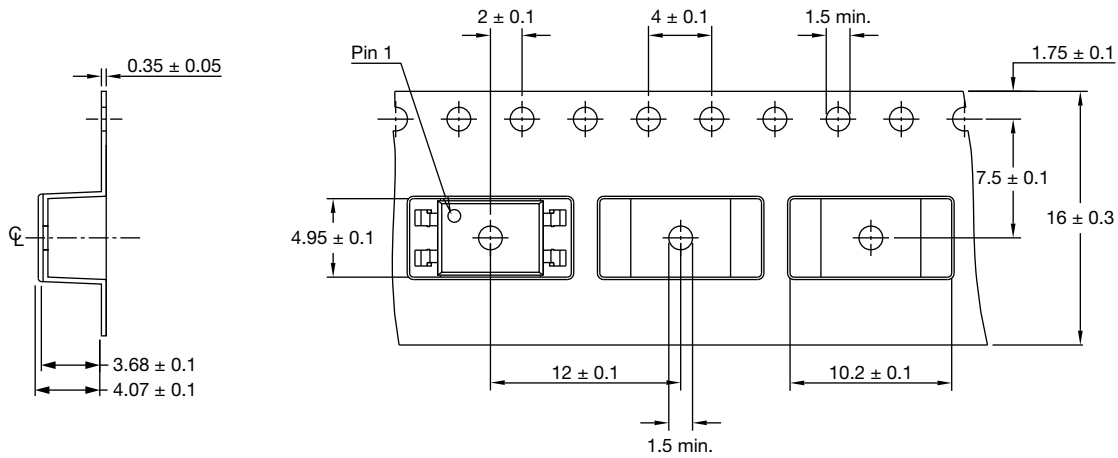


Fig. 16 - Tape and Reel Packing

TAPE AND REEL PACKING	
TYPE	UNITS/REEL
SMD-4	1000

TUBE PACKING			
TYPE	UNITS/TUBE	TUBES/BOX	UNITS/BOX
SMD-4	100	20	2000

**SOLDER PROFILES**

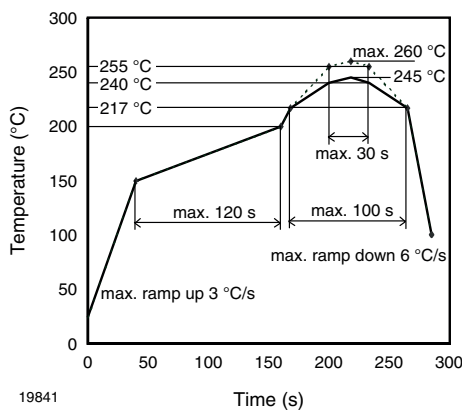


Fig. 17 - Lead (Pb)-free Reflow Solder Profile According to J-STD-020 for SMD Devices

**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



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