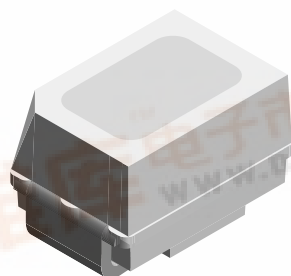


Low Current Mini SMD LED



19226

FEATURES

- SMD LEDs with exceptional brightness
- Luminous intensity categorized
- Compatible with automatic placement equipment
- Available in 8 mm tape
- Low profile package
- Non-diffused lens: excellent for coupling to light pipes and backlighting
- Low power consumption
- IR reflow soldering according to J-STD-020
- Luminous intensity ratio in one packing unit $I_{Vmax}/I_{Vmin} \leq 2.0$, optional ≤ 1.6
- Preconditioning: acc. to JEDEC level 2a
- ESD-withstand voltage: up to 2 kV according to JESD22-A114-B
- Compliant to RoHS directive 2002/95/EC and in accordance to WEEE 2002/96/EC
- AEC-Q101 qualified
- Find out more about Vishay's Automotive Grade Product requirements at: www.vishay.com/applications

AUTOMOTIVE
GRADE



RoHS
COMPLIANT
GREEN
(5-2008)**

DESCRIPTION

The new low current MiniLED Series have been designed in a small white SMT package. The feature of the device is the very small package 2.3 mm x 1.3 mm x 1.4 mm and the low forward current. The MiniLED is an obvious solution for small-scale, high-power products that are expected to work reliability in an arduous environment. This is often the case in automotive and industrial application.

PRODUCT GROUP AND PACKAGE DATA

- Product group: LED
- Package: SMD MiniLED
- Product series: low current
- Angle of half intensity: $\pm 60^\circ$

APPLICATIONS

- Automotive: backlighting in dashboards and switches
- Telecommunication: indicator and backlighting in telephone and fax
- Indicator and backlight for audio and video equipment
- Indicator and backlight in office equipment
- Flat backlight for LCDs, switches and symbols

** Please see document "Vishay Material Category Policy": www.vishay.com/doc?99902

PARTS TABLE

PART	COLOR, LUMINOUS INTENSITY	TECHNOLOGY
VLMS2000-GS08	Super red, $I_V > 2.24$ mcd	AlInGaP on GaAs
VLMS20H2K1-GS08	Super red, $I_V = (3.55 \text{ to } 9)$ mcd	AlInGaP on GaAs
VLMS20J2L1-GS08	Super red, $I_V = (5.6 \text{ to } 14)$ mcd	AlInGaP on GaAs
VLMS20H2L1-GS08	Super red, $I_V = (3.55 \text{ to } 14)$ mcd	AlInGaP on GaAs
VLMO2000-GS08	Soft orange, $I_V > 4.5$ mcd	AlInGaP on GaAs
VLMO20K2L2-35-GS08	Soft orange, $I_V = (9 \text{ to } 18)$ mcd	AlInGaP on GaAs
VLMO20K2M1-GS08	Soft orange, $I_V = (9 \text{ to } 22.4)$ mcd	AlInGaP on GaAs
VLMO20J2M1-GS08	Soft orange, $I_V = (5.6 \text{ to } 22.4)$ mcd	AlInGaP on GaAs
VLMY2000-GS08	Yellow, $I_V > 3.55$ mcd	AlInGaP on GaAs
VLMY20K1L2-GS08	Yellow, $I_V = (7.1 \text{ to } 18)$ mcd	AlInGaP on GaAs
VLMY20J1L2-GS08	Yellow, $I_V = (4.5 \text{ to } 18)$ mcd	AlInGaP on GaAs
VLMK2000-GS08	Amber, $I_V > 7.1$ mcd	AlInGaP on GaAs
VLMK20J2L1-GS08	Amber, $I_V = (5.6 \text{ to } 14)$ mcd	AlInGaP on GaAs
VLMK20K1L2-GS08	Amber, $I_V = (7.1 \text{ to } 18)$ mcd	AlInGaP on GaAs
VLMK20J2L2-GS08	Amber, $I_V = (5.6 \text{ to } 18)$ mcd	AlInGaP on GaAs
VLMP20D2G1-GS08	Pure green, $I_V = (0.56 \text{ to } 2.24)$ mcd	AlInGaP on GaAs
VLMP20E2G1-GS08	Pure green, $I_V = (0.9 \text{ to } 2.24)$ mcd	AlInGaP on GaAs

ABSOLUTE MAXIMUM RATINGS ($T_{amb} = 25^\circ\text{C}$, unless otherwise specified)
VLMS20.., VLMO20.., VLMY20., VLMK20..

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Reverse voltage ¹⁾		V_R	5	V
DC Forward current	$T_{amb} \leq 100^\circ\text{C}$	I_F	15	mA
Surge forward current	$t_p \leq 10 \mu\text{s}$	I_{FSM}	0.1	A
Power dissipation		P_V	40	mW
Junction temperature		T_j	125	$^\circ\text{C}$
Operating temperature range		T_{amb}	- 40 to + 100	$^\circ\text{C}$
Storage temperature range		T_{stg}	- 40 to + 100	$^\circ\text{C}$
Thermal resistance junction/ambient	Mounted on PC board, (pad size > 5 mm ²)	R_{thJA}	580	K/W

Note:

¹⁾ Driving the LED in reverse direction is suitable for a short term application
OPTICAL AND ELECTRICAL CHARACTERISTICS ($T_{amb} = 25^\circ\text{C}$, unless otherwise specified)
VLMS20..., SUPER RED

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Luminous intensity ¹⁾	$I_F = 2$ mA	VLMS2000	I_V	2.24	4.5		mcd
		VLMS20H2K1	I_V	3.55		9	mcd
		VLMS20J2L1	I_V	5.6		14	mcd
		VLMS20H2L1	I_V	3.55		14	mcd
Dominant wavelength	$I_F = 2$ mA		λ_d		630		nm
Peak wavelength	$I_F = 2$ mA		λ_p		643		nm
Angle of half intensity	$I_F = 2$ mA		ϕ		± 60		deg
Forward voltage	$I_F = 2$ mA		V_F		1.8	2.2	V
Reverse voltage	$I_R = 10 \mu\text{A}$		V_R	5			V
Junction capacitance	$V_R = 0$, $f = 1$ MHz		C_j		15		pF

Note:

¹⁾ In one packing unit $I_{Vmax}/I_{Vmin} \leq 2.0$

OPTICAL AND ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)
VLMO20..., SOFT ORANGE

PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
Luminous intensity ¹⁾	$I_F = 2\text{ mA}$	VLMO2000	I_V	4.5	9		mcd
		VLMO20K2L2-35	I_V	9		18	mcd
		VLMO20K2M1	I_V	9		22.4	mcd
		VLMO20J2M1	I_V	5.6		22.4	mcd
Dominant wavelength	$I_F = 2\text{ mA}$		λ_d	598	605	611	nm
Peak wavelength	$I_F = 2\text{ mA}$		λ_p		610		nm
Angle of half intensity	$I_F = 2\text{ mA}$		ϕ		± 60		deg
Forward voltage	$I_F = 2\text{ mA}$		V_F		1.8	2.2	V
Reverse voltage	$I_R = 10\text{ }\mu\text{A}$		V_R	5			V
Junction capacitance	$V_R = 0, f = 1\text{ MHz}$		C_j		15		pF

Note:

¹⁾ In one packing unit $I_{Vmax}/I_{Vmin} \leq 2.0$
OPTICAL AND ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)
VLMY20..., YELLOW

PARAMETER	TEST CONDITION	SYMBOL	SYMBOL	MIN.	TYP.	MAX.	UNIT
Luminous intensity ¹⁾	$I_F = 2\text{ mA}$	VLMY2000	I_V	3.55	7.1		mcd
		VLMY20K1L2	I_V	7.1		18	mcd
		VLMY20J1L2	I_V	4.5		18	mcd
Dominant wavelength	$I_F = 2\text{ mA}$		λ_d	581	588	594	nm
Peak wavelength	$I_F = 2\text{ mA}$		λ_p		590		nm
Angle of half intensity	$I_F = 2\text{ mA}$		ϕ		± 60		deg
Forward voltage	$I_F = 2\text{ mA}$		V_F		1.8	2.2	V
Reverse voltage	$I_R = 10\text{ }\mu\text{A}$		V_R	5			V
Junction capacitance	$V_R = 0, f = 1\text{ MHz}$		C_j		15		pF

Note:

¹⁾ In one packing unit $I_{Vmax}/I_{Vmin} \leq 2.0$
OPTICAL AND ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)
VLMK20..., AMBER

PARAMETER	TEST CONDITION		SYMBOL	MIN.	TYP.	MAX.	UNIT
Luminous intensity ¹⁾	$I_F = 2\text{ mA}$	VLMK2000	I_V	7.1	16		mcd
		VLMK20J2L1	I_V	5.6		14	mcd
		VLMK20K1L2	I_V	7.1		18	mcd
		VLMK20J2L2	I_V	5.6		18	mcd
Dominant wavelength	$I_F = 2\text{ mA}$		λ_d	612	622	624	nm
Peak wavelength	$I_F = 2\text{ mA}$		λ_p		615		nm
Angle of half intensity	$I_F = 2\text{ mA}$		ϕ		± 60		deg
Forward voltage	$I_F = 2\text{ mA}$		V_F		1.8	2.2	V
Reverse voltage	$I_R = 10\text{ }\mu\text{A}$		V_R	5			V
Junction capacitance	$V_R = 0, f = 1\text{ MHz}$		C_j		15		pF

Note:

¹⁾ In one packing unit $I_{Vmax}/I_{Vmin} \leq 2.0$

OPTICAL AND ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified)
VLMP20..., PURE GREEN

PARAMETER	TEST CONDITION		SYMBOL	MIN.	TYP.	MAX.	UNIT
Luminous intensity ¹⁾	$I_F = 2\text{ mA}$	VLMP20D2G1	I_V	0.56		2.24	mcd
		VLMP20E2G1	I_V	0.9		2.24	mcd
Dominant wavelength	$I_F = 2\text{ mA}$		λ_d	555		565	nm
Peak wavelength	$I_F = 2\text{ mA}$		λ_p		565		nm
Angle of half intensity	$I_F = 2\text{ mA}$		ϕ		± 60		deg
Forward voltage	$I_F = 2\text{ mA}$		V_F		1.8	2.2	V
Reverse voltage	$I_R = 10\text{ }\mu\text{A}$		V_R	5			V
Junction capacitance	$V_R = 0, f = 1\text{ MHz}$		C_j		15		pF

Note:

¹⁾ In one packing unit $I_{Vmax}/I_{Vmin} \leq 2.0$ **COLOR CLASSIFICATION**

GROUP	DOMINANT WAVELENGTH (nm)							
	SOFT ORANGE		YELLOW		AMBER		PURE GREEN	
	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.
0							555	559
1	598	601	581	584			558	561
2	600	603	583	586			560	563
3	602	605	585	588			562	565
4	604	607	587	590				
5	606	609	589	592				
6	608	611	591	594				
7					610	613		
8					612	616		
9					615	620		
10					619	624		

Note:

Wavelengths are tested at a current pulse duration of 25 ms.

LUMINOUS INTENSITY CLASSIFICATION

GROUP	LUMINOUS INTENSITY (mcd)		
	STANDARD	OPTIONAL	MIN. MAX.
D	2		0.56 0.71
E	1		0.71 0.9
	2		0.9 1.12
F	1		1.12 1.4
	2		1.4 1.8
G	1		1.8 2.24
	2		2.24 2.8
H	1		2.8 3.55
	2		3.55 4.5
J	1		4.5 5.6
	2		5.6 7.1
K	1		7.1 9
	2		9 11.2
L	1		11.2 14
	2		14 18
M	1		18 22.4
	2		22.4 35.5
N	1		35.5 45
	2		45 56

Note:

Luminous intensity is tested at a current pulse duration of 25 ms and an accuracy of $\pm 11\%$. The above type numbers represent the order groups which include only a few brightness groups. Only one group will be shipped on each reel (there will be no mixing of two groups on each reel). In order to ensure availability, single brightness groups will not be orderable. In a similar manner for colors where wavelength groups are measured and binned, single wavelength groups will be shipped on any one reel. In order to ensure availability, single wavelength groups will not be orderable.

CROSSING TABLE

VISHAY	OSRAM
VLMS20H2K1	LSM67K-H2K1
VLMS20J2L1	LSM67K-J2L1
VLMS20H2L1	LSM67K-H2L1
VLMO20J2L1	LOM67K-J2L1
VLMO20K2M1	LOM67K-K2M1
VLMO20J2M1	LOM67K-J2M1
VLMY20J1K2	LYM67K-J1K2
VLMY20K1L2	LYM67K-K1L2
VLMY20J1L2	LYM67K-J1L2
VLMP20D2G1	LPM67K-D2G1
VLMP20E2G1	LPM67K-E2G1

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

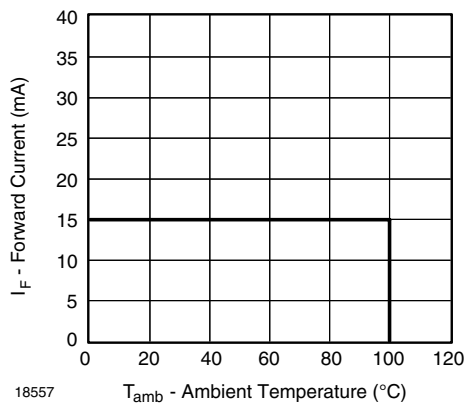


Figure 1. Forward Current vs. Ambient Temperature

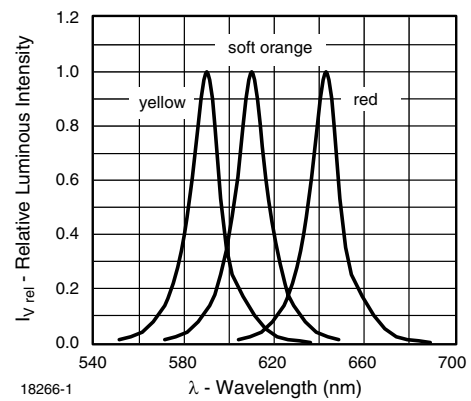


Figure 4. Relative Intensity vs. Wavelength

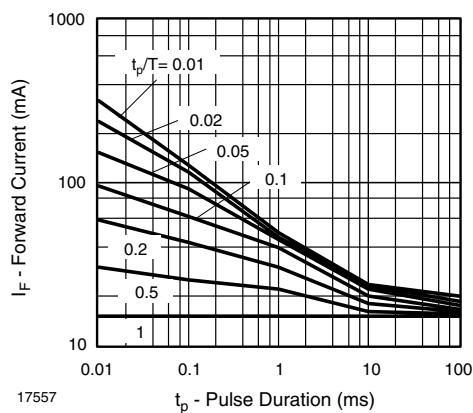


Figure 2. Forward Current vs. Pulse Length

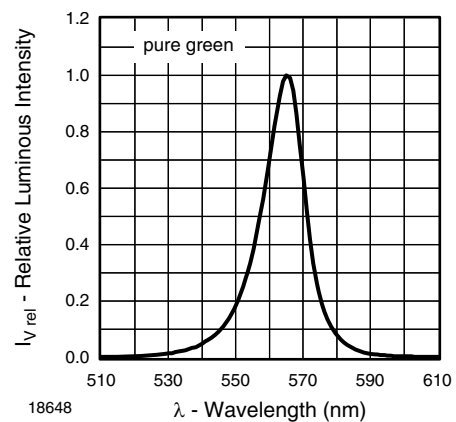


Figure 5. Relative Luminous Intensity vs. Wavelength

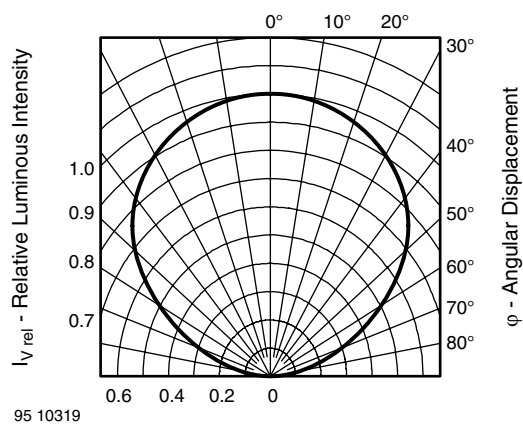


Figure 3. Rel. Luminous Intensity vs. Angular Displacement

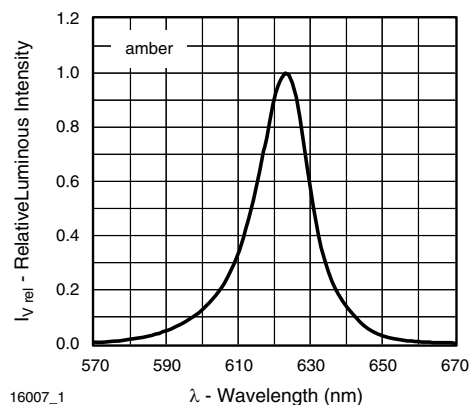


Figure 6. Relative Luminous Intensity vs. Wavelength

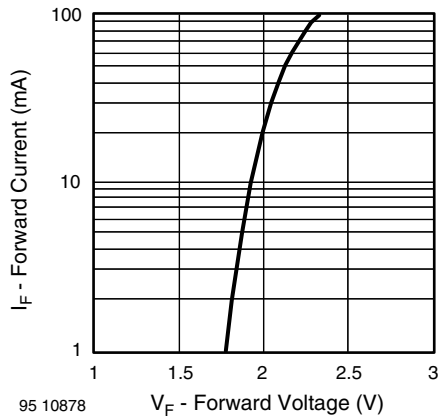


Figure 7. Forward Current vs. Forward Voltage

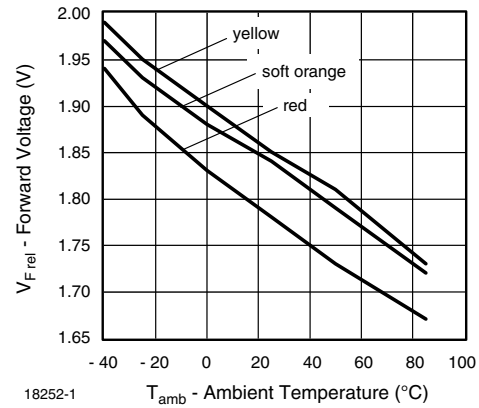


Figure 10. Forward Voltage vs. Ambient Temperature

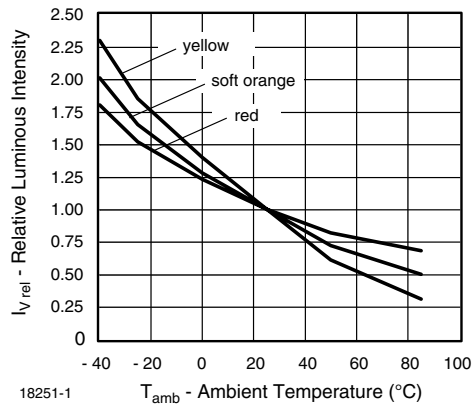


Figure 8. Rel. Luminous Intensity vs. Ambient Temperature

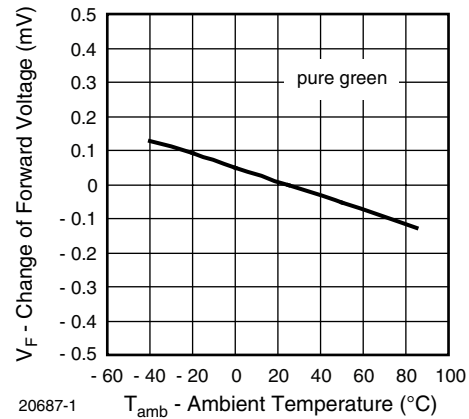


Figure 11. Change of Forward Voltage vs. Ambient Temperature

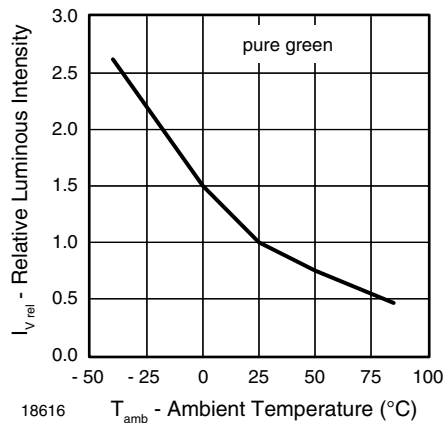
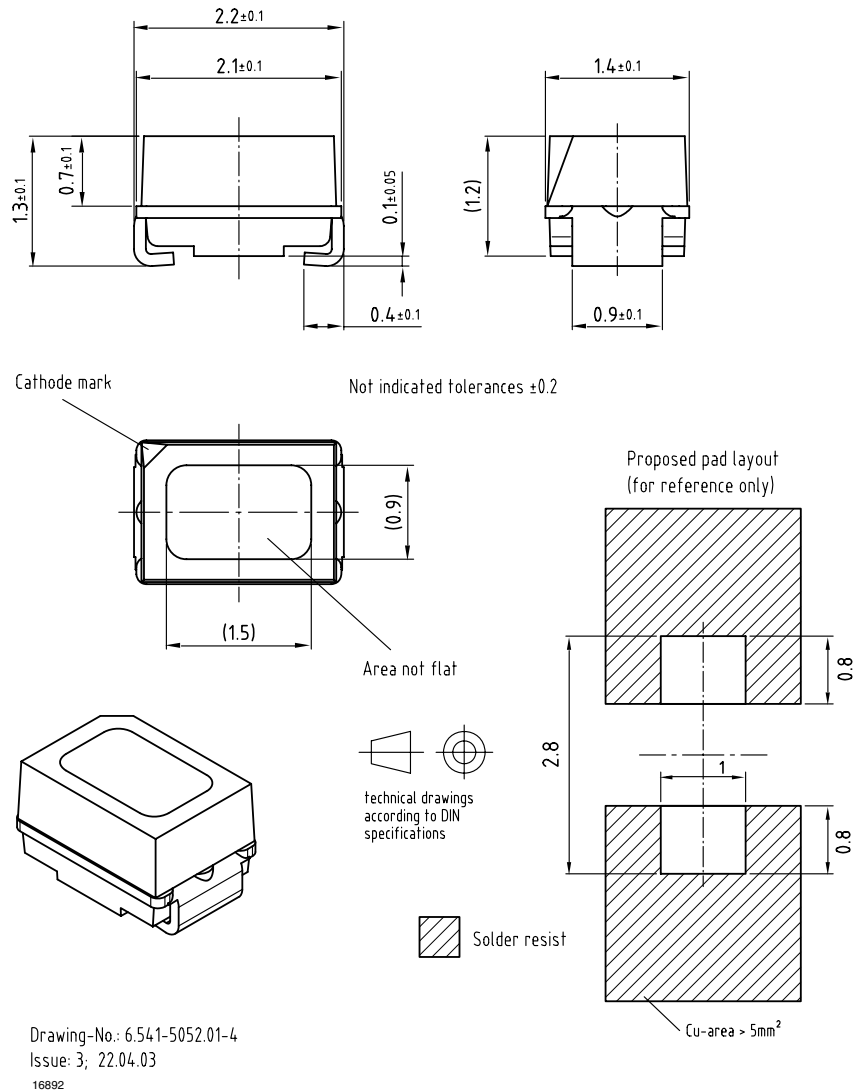


Figure 9. Rel. Luminous Intensity vs. Ambient Temperature

PACKAGE DIMENSIONS in millimeters



**COVER TAPE PEEL STRENGTH**

According to DIN EN 60286-3

0.1 N to 1.3 N

300 ± 10 mm/min

165° to 180° peel angle

LABEL**Standard bar code labels for finished goods**

The standard bar code labels are product labels and used for identification of goods. The finished goods are packed in final packing area. The standard packing units are labeled with standard bar code labels before transported as finished goods to warehouses. The labels are on each packing unit and contain Vishay Semiconductor GmbH specific data.

VISHAY SEMICONDUCTOR GMBH STANDARD BAR CODE PRODUCT LABEL (finished goods)

PLAIN WRITING	ABBREVIATION	LENGTH
Item-description	-	18
Item-number	INO	8
Selection-code	SEL	3
LOT-/serial-number	BATCH	10
Data-code	COD	3 (YWW)
Plant-code	PTC	2
Quantity	QTY	8
Accepted by:	ACC	-
Packed by:	PCK	-
Mixed code indicator	MIXED CODE	-
Origin	xxxxxxx ⁺	Company Logo
LONG BAR CODE TOP	TYPE	LENGTH
Item-number	N	8
Plant-code	N	2
Sequence-number	X	3
Quantity	N	8
Total length	-	21
SHORT BAR CODE BOTTOM	TYPE	LENGTH
Selection-code	X	3
Data-code	N	3
Batch-number	X	10
Filter	-	1
Total length	-	17

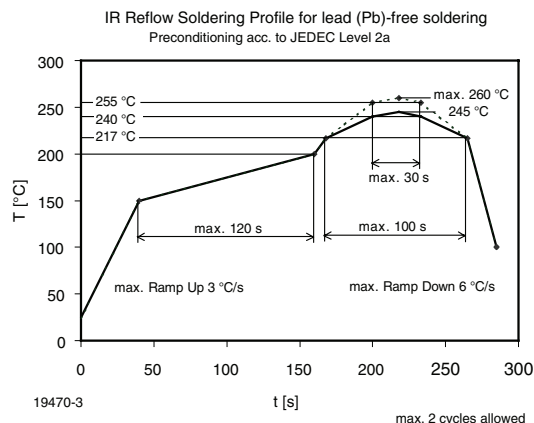
SOLDERING PROFILE

Figure 12. Vishay Lead (Pb)-free Reflow Soldering Profile
(acc. to J-STD-020)

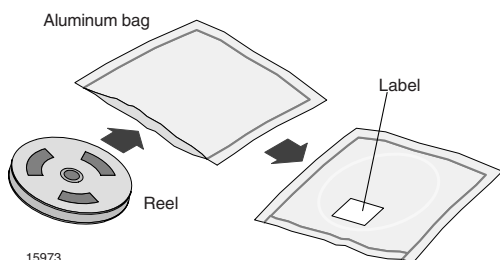
BAR CODE PRODUCT LABEL EXAMPLE:



- A) Type of component
- B) Manufacturing plant
- C) SEL - selection code (bin):
e.g.: J2 = code for luminous intensity group
4 = code for color group
- D) Date code year/week
- E) Day code (e.g. 4: Thursday)
- F) Batch no.
- G) Total quantity
- H) Company code

DRY PACKING

The reel is packed in an anti-humidity bag to protect the devices from absorbing moisture during transportation and storage.



FINAL PACKING

The sealed reel is packed into a cardboard box. A secondary cardboard box is used for shipping purposes.

RECOMMENDED METHOD OF STORAGE

Dry box storage is recommended as soon as the aluminum bag has been opened to prevent moisture absorption. The following conditions should be observed, if dry boxes are not available:

- Storage temperature 10 °C to 30 °C
- Storage humidity ≤ 60 % RH max.

After more than 672 h under these conditions moisture content will be too high for reflow soldering.

In case of moisture absorption, the devices will recover to the former condition by drying under the following condition:

192 h at 40 °C + 5 °C/- 0 °C and < 5 % RH (dry air/nitrogen) or

96 h at 60 °C + 5 °C and < 5 % RH for all device containers or

24 h at 100 °C + 5 °C not suitable for reel or tubes.

An EIA JEDEC standard JESD22-A112 level 2a label is included on all dry bags.

	CAUTION This bag contains MOISTURE-SENSITIVE DEVICES	LEVEL 2a						
1. Shelf life in sealed bag 12 months at <40°C and < 90% relative humidity (RH)								
2. After this bag is opened devices that will be subjected to infrared reflow, vapor-phase reflow, or equivalent processing (peak package body temp. 260°C) must be: a) Mounted within 672 hours at factory condition of ≤ 30°C/60%RH or b) Stored at ≤ 10% RH.								
3. Devices require baking before mounting if: a) Humidity Indicator Card is >10% when read at 23°C ± 5°C or b) 2a or 2b is not met.								
4. If baking is required, devices may be baked for: <table border="0" style="width: 100%;"> <tr> <td style="text-align: center;">192 hours at 40°C + 5°C/-0°C and <5%RH (dry air/nitrogen)</td> <td style="text-align: center;">or</td> </tr> <tr> <td style="text-align: center;">96 hours at 60±5°C and <5%RH</td> <td style="text-align: center;">For all device containers or</td> </tr> <tr> <td style="text-align: center;">24 hours at 100±5°C</td> <td style="text-align: center;">Not suitable for reels or tubes</td> </tr> </table>			192 hours at 40°C + 5°C/-0°C and <5%RH (dry air/nitrogen)	or	96 hours at 60±5°C and <5%RH	For all device containers or	24 hours at 100±5°C	Not suitable for reels or tubes
192 hours at 40°C + 5°C/-0°C and <5%RH (dry air/nitrogen)	or							
96 hours at 60±5°C and <5%RH	For all device containers or							
24 hours at 100±5°C	Not suitable for reels or tubes							
Bag Seal Date: _____ (If blank, see bar code label)								
Note: LEVEL defined by EIA JEDEC Standard JESD22-A113								

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Example of JESD22-A112 level 2a label

ESD PRECAUTION

Proper storage and handling procedures should be followed to prevent ESD damage to the devices especially when they are removed from the antistatic shielding bag. Electro-static sensitive devices warning labels are on the packaging.

VISHAY SEMICONDUCTORS STANDARD BAR CODE LABELS

The Vishay Semiconductors standard bar code labels are printed at final packing areas. The labels are on each packing unit and contain Vishay Semiconductors specific data.



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All product specifications and data are subject to change without notice.

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