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# High Power Infrared Emitting Diode, 940 nm, Surface Emitter Technology



## FEATURES

- Package type: surface-mount
- Package form: high power SMD with lens
- Dimensions (L x W x H in mm): 3.4 x 3.4 x 2.45
- Peak wavelength: $\lambda_p$ = 950 nm
- Angle of half intensity: $\varphi$ = ± 40°
- Designed for high drive currents: up to 1.5 A (DC) and up to 5 A (pulsed)
- Low thermal resistance: $R_{thJSP}$ < 7 K/W
- ESD: up to 10 kV (according to ANSI / ESDA / JEDEC® JS-001)
- Floor life: 168 h, MSL 3, according to J-STD-020E
- Lead (Pb)-free reflow soldering
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e4

RoHS COMPLIANT

HALOGEN FREE

GREEN (5-2008)

## LINKS TO ADDITIONAL RESOURCES

Application Notes

3D Models

## APPLICATIONS

- Driver and occupant monitoring
- Eye tracking
- Safety and security, CCTV

## DESCRIPTION

As part of the Astral portfolio, the VSMA1094401 is an infrared, 940 nm emitting diode. It features a double stack emitter chip for highest radiant power while minimizing the red glow effect. The 42 mil chip size allows 1.5 A DC operation and supports pulsed currents up to 5.0 A.

| PRODUCT SUMMARY | | | | | |
|---|---|---|---|---|---|
| COMPONENT | $I_e$ (mW/sr) at $I_F$ = 1.0 A | $\varphi$ (°) | $\lambda_p$ (nm) | $\lambda_{centroid}$ (nm) | $t_r$ (ns) |
| VSMA1094401 | 860 | ± 40 | 950 | 945 | 10 |

**Note**

- Test conditions see table “Basic Characteristics”

| ORDERING INFORMATION | | | |
|---|---|---|---|
| ORDERING CODE | PACKAGING | REMARKS | PACKAGE FORM |
| VSMA1094401 | Tape and reel | MOQ: 600 pcs, 600 pcs/reel | High power with lens |

**Note**

- MOQ: minimum order quantity



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| **ABSOLUTE MAXIMUM RATINGS** ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | |
|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **VALUE** | **UNIT** |
| Reverse voltage | | $V_R$ | 5 | V |
| Minimum forward current | | $I_{F,\ min.}$ | 100 | mA |
| Forward current | | $I_F$ | 1.5 | A |
| Surge forward current | $t_p$ = 100 µs | $I_{FSM}$ | 5 | A |
| Power dissipation | | $P_V$ | 5 | W |
| Junction temperature | | $T_j$ | 145 | °C |
| Ambient temperature range | | $T_{amb}$ | -40 to +125 | °C |
| Storage temperature range | | $T_{stg}$ | -40 to +125 | °C |
| Soldering temperature | According to Fig. 11, J-STD-020E | $T_{sd}$ | 260 | °C |
| Thermal resistance junction to solder point real (1) | JESD 51 | $R_{thJSP,real}$ | < 7 | K/W |
| ESD sensitivity | According to ANSI / ESDA / JEDEC JS-001 | $V_{ESD}$ | 10 | kV |

**Note**

(1) Thermal resistance junction to solder point real has been measured with the part mounted on an ideal heatsink and the optical output power has been deducted from the total electrical power dissipation

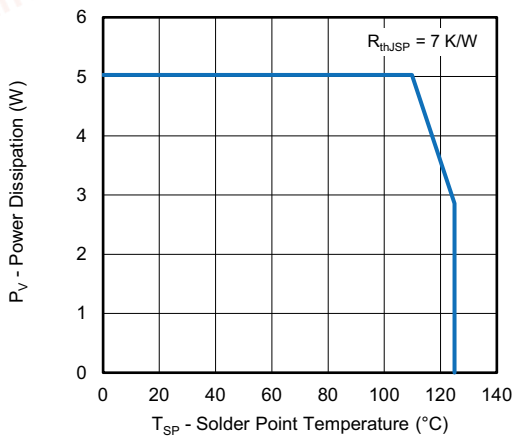



Fig. 1 - Power Dissipation Limit vs. Solder Point Temperature

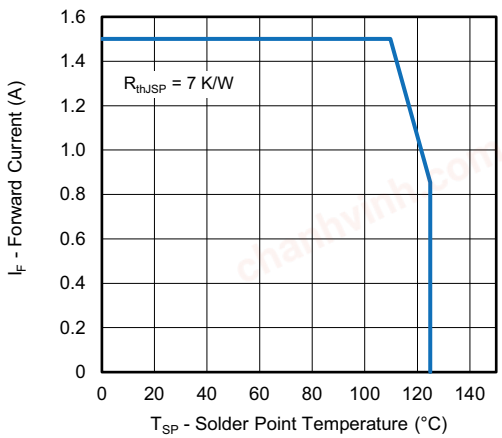



Fig. 2 - Forward Current Limit vs. Solder Point Temperature


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| BASIC CHARACTERISTICS ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | |
|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Forward voltage | $I_F$ = 0.35 A, $t_p$ = 10 ms | $V_F$ | 2.2 | 2.6 | 3.0 | V |
| | $I_F$ = 1 A, $t_p$ = 100 µs | $V_F$ | 2.3 | 2.8 | 3.1 | V |
| | $I_F$ = 1.5 A, $t_p$ = 100 µs | $V_F$ | 2.6 | 2.9 | 3.3 | V |
| | $I_F$ = 5 A, $t_p$ = 100 µs | $V_F$ | 3.1 | 3.7 | 4.2 | V |
| Temperature coefficient of $V_F$ | $I_F$ = 1 A, $t_p$ = 100 µs | | - | -1.23 | - | mV/K |
| Reverse current (1) | | $I_R$ | Not designed for reverse operation | | | µA |
| Radiant intensity | $I_F$ = 0.35 A, $t_p$ = 10 ms | $I_e$ | 250 | 320 | 420 | mW/sr |
| | $I_F$ = 1 A, $t_p$ = 100 µs | $I_e$ | 680 | 860 | 1050 | mW/sr |
| | $I_F$ = 1.5 A, $t_p$ = 100 µs | $I_e$ | 1000 | 1300 | 1600 | mW/sr |
| | $I_F$ = 5 A, $t_p$ = 100 µs | $I_e$ | 3050 | 3850 | 4650 | mW/sr |
| Radiant power | $I_F$ = 1 A, $t_p$ = 100 µs | $\phi_e$ | - | 1250 | - | mW |
| | $I_F$ = 1.5 A, $t_p$ = 100 µs | $\phi_e$ | - | 1850 | - | mW |
| Temperature coefficient of $\phi$ | $I_F$ = 1 A, $t_p$ = 100 µs | $TK_\phi$ | - | -0.20 | - | %/K |
| Angle of half intensity | | $\varphi$ | - | ± 40 | - | ° |
| Peak wavelength | $I_F$ = 1 A, $t_p$ = 100 µs | $\lambda_p$ | 940 | 950 | 965 | nm |
| Centroid wavelength | $I_F$ = 1 A, $t_p$ = 100 µs | $\lambda_{centroid}$ | - | 945 | - | nm |
| Spectral bandwidth | $I_F$ = 1 A, $t_p$ = 100 µs | $\Delta\lambda$ | - | 35 | - | nm |
| Temperature coefficient of $\lambda_p$ | $I_F$ = 100 mA, $t_p$ = 20 ms | $TK_{\lambda p}$ | - | 0.31 | - | nm/K |
| Rise time | $I_F$ = 1 A, $R_L$ = 50 Ω | $t_r$ | - | 10 | - | ns |
| Fall time | $I_F$ = 1 A, $R_L$ = 50 Ω | $t_f$ | - | 13 | - | ns |

**Note**

(1) This infrared LED is designed to be operated within the specified forward current range. Continuous reverse operation must be avoided because it may damage the infrared LED.

| RADIANT INTENSITY BINNING ($T_{amb}$ = 25 °C, unless otherwise specified) | | | | | | | |
|---|---|---|---|---|---|---|---|
| **PARAMETER** | **TEST CONDITION** | **SELECTION CODE** | **SYMBOL** | **MIN.** | **TYP.** | **MAX.** | **UNIT** |
| Radiant intensity | $I_F$ = 1 A, $t_p$ = 100 µs | 0 | $I_e$ | 680 | 860 | 1050 | mW/sr |
| | | 1 | | 680 | n/a | 800 | mW/sr |
| | | 2 | | 800 | | 925 | mW/sr |
| | | 3 | | 925 | | 1050 | mW/sr |

**Note**

- Each reel will contain a single selection code. The label on the bag indicates the selection code. Production shipments can include multiple selection codes in multiple bags.

## BASIC CHARACTERISTICS ($T_{amb}$ = 25 °C, unless otherwise specified)

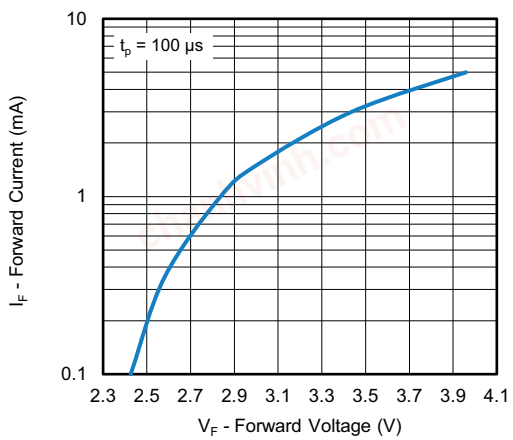



Fig. 3 - Forward Current vs. Forward Voltage

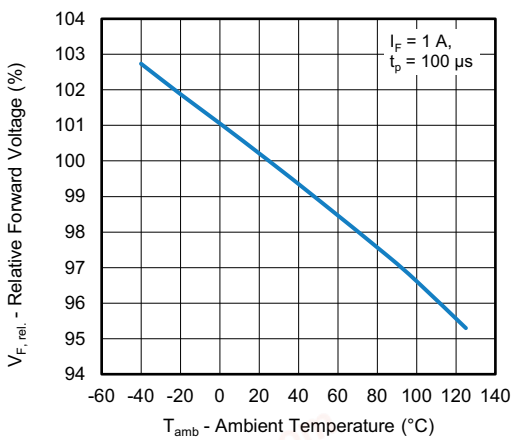



Fig. 4 - Relative Forward Voltage vs. Ambient Temperature



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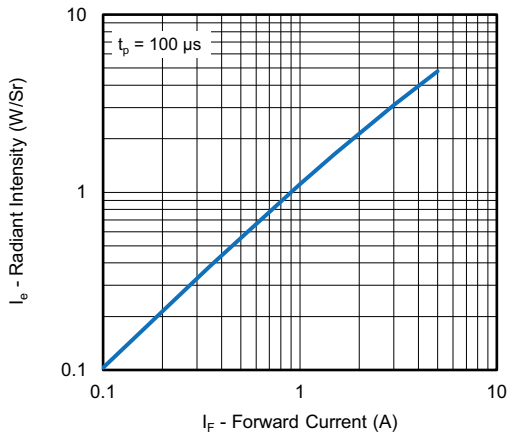



Fig. 5 - Relative Radiant Intensity vs. Forward Current

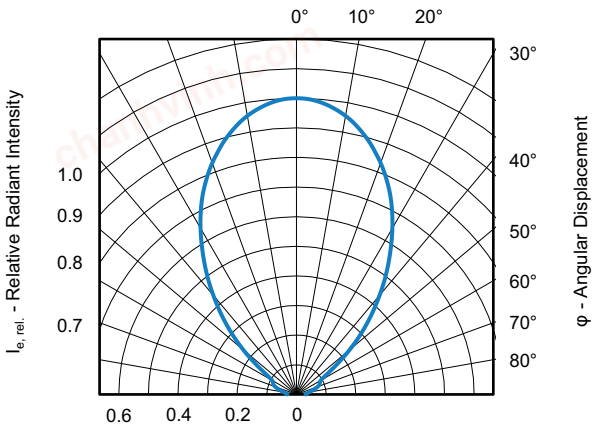



Fig. 8 - Relative Radiant Intensity vs. Angular Displacement

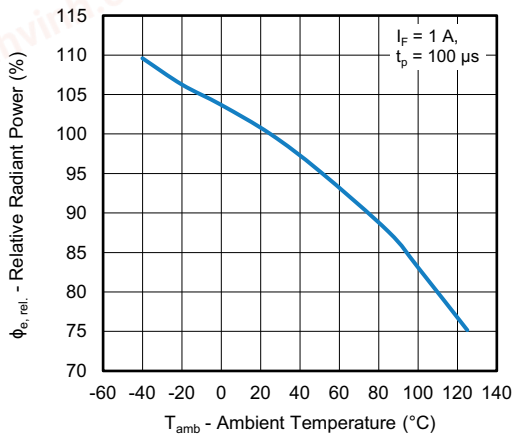



Fig. 6 - Relative Radiant Power vs. Ambient Temperature

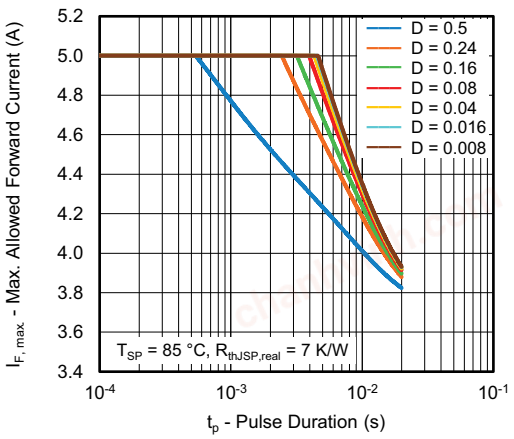



Fig. 9 - Max. Allowed Forward Current vs. Pulse Duration

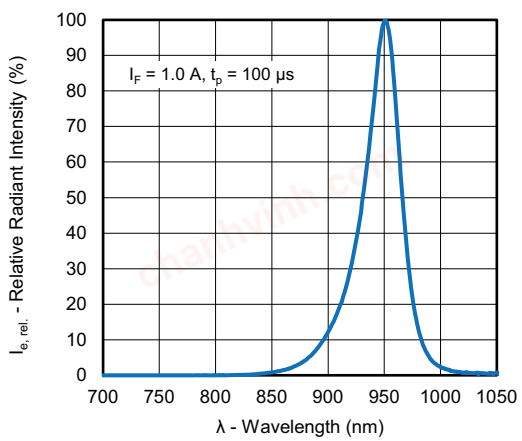


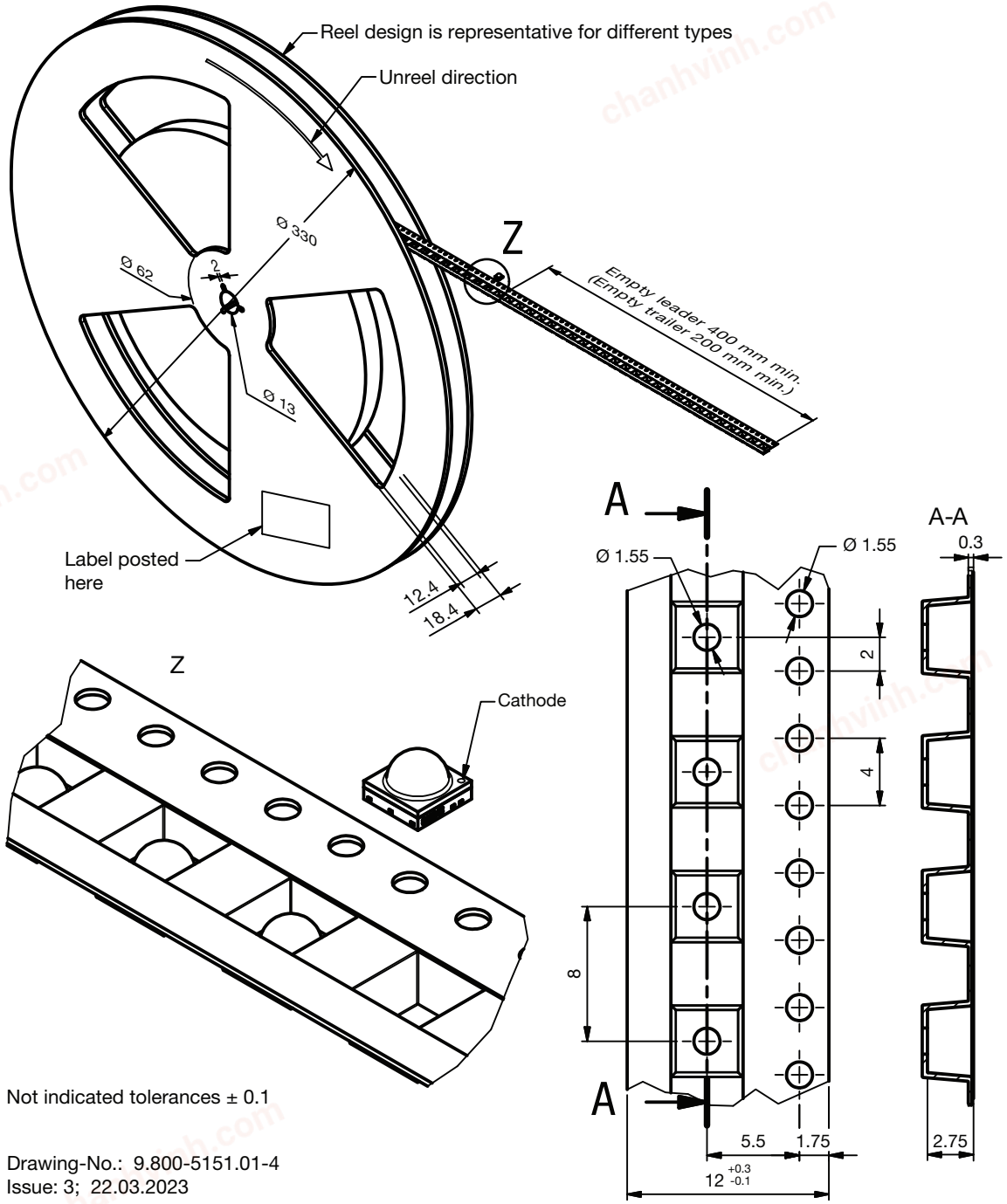

Fig. 7 - Relative Radiant Intensity vs. Wavelength


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**TAPING DIMENSIONS** in millimeters




Not indicated tolerances ± 0.1

Drawing-No.: 9.800-5151.01-4
Issue: 3; 22.03.2023

**Notes**

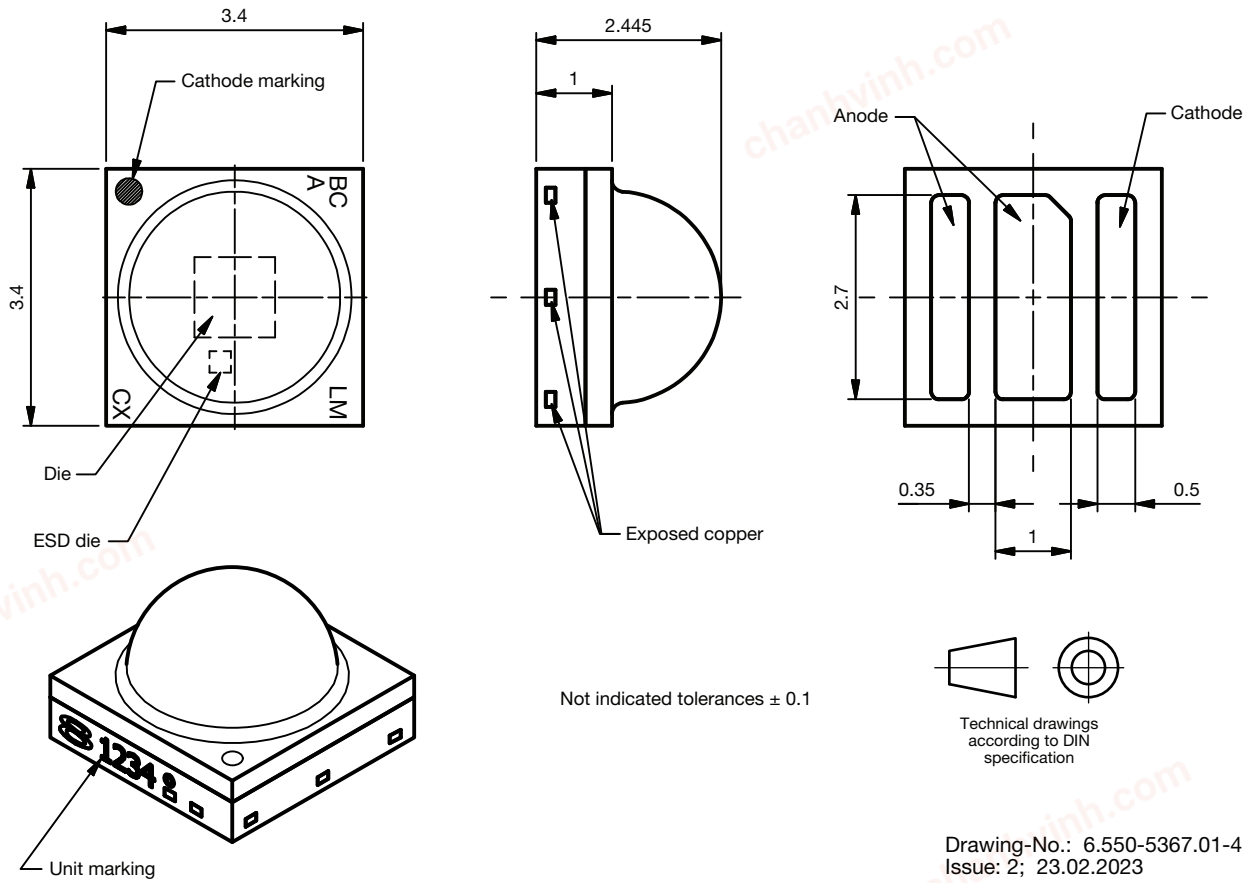
- Empty component pockets sealed with top cover tape
- 7 inch reel - 600 pieces per reel
- The maximum number of consecutive missing lamps is two
- In accordance with ANSI / EIA 481-1-A-1994 specifications


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**PACKAGE DIMENSIONS** in millimeters




Not indicated tolerances ± 0.1

Technical drawings according to DIN specification

Drawing-No.: 6.550-5367.01-4
Issue: 2; 23.02.2023

**Notes**

- Tolerance is ± 0.10 mm (0.004") unless otherwise noted
- Specifications are subject to change without notice



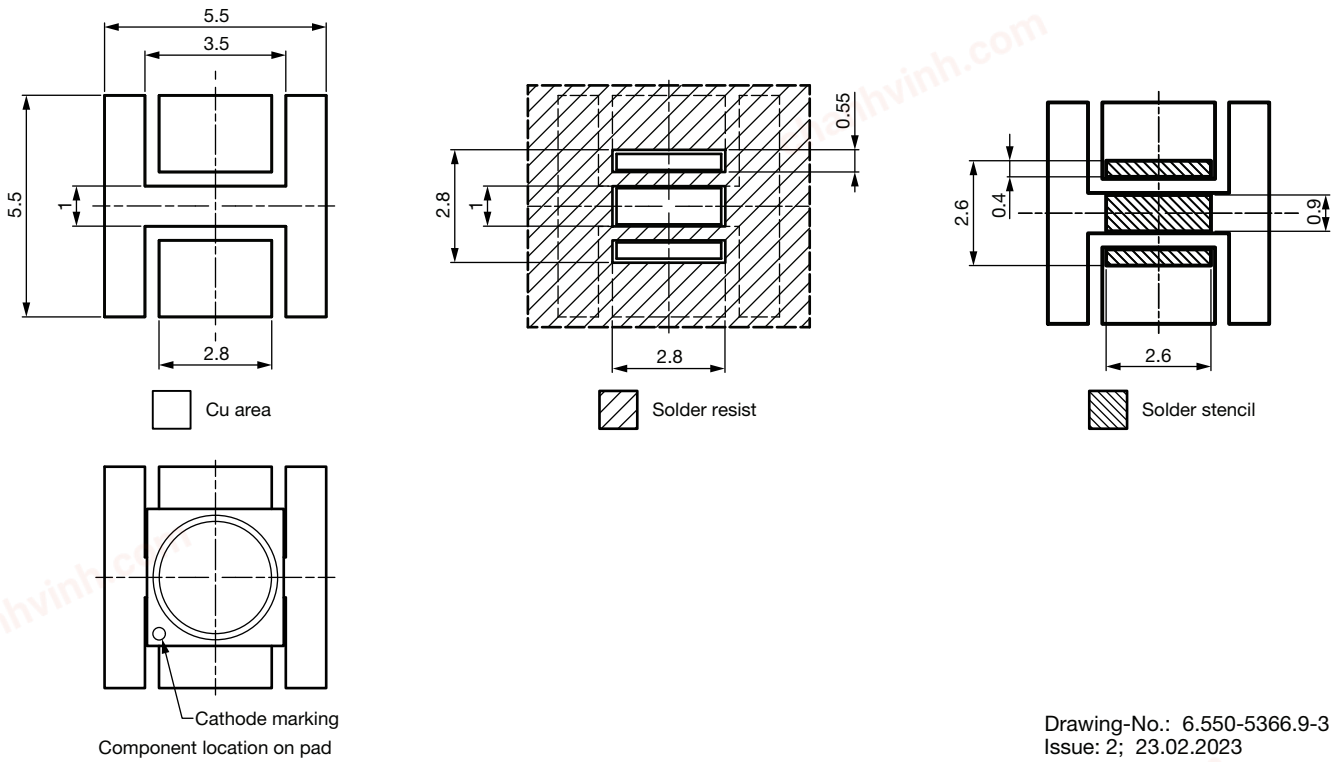
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## RECOMMENDED FOOTPRINT




Drawing-No.: 6.550-5366.9-3
Issue: 2; 23.02.2023

## SOLDER PROFILE

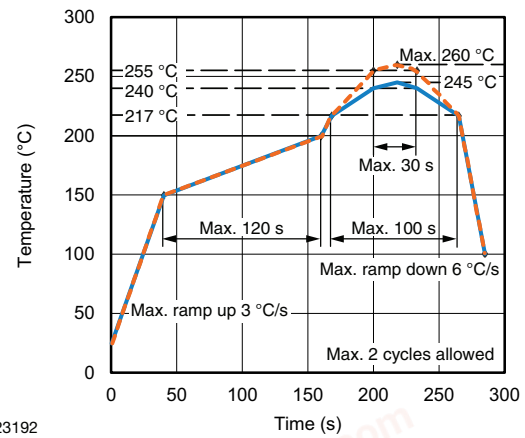



Fig. 10 - Lead (Pb)-free (Sn) Infrared Reflow Solder Profile According to J-STD-020E for Surface-Mount Components

## DRYPACK

Devices are packed in moisture barrier bags (MBB) to prevent the products from moisture absorption during transportation and storage. Each bag contains a desiccant.

## FLOOR LIFE

Floor life (time between soldering and removing from MBB) must not exceed the time indicated on MBB label:

Floor life: 168 h

Conditions: $T_{amb}$ < 30 °C, RH < 60 %

Moisture sensitivity level 3, according to J-STD-020E

## DRYING

In case of moisture absorption devices should be baked before soldering. Conditions see J-STD-033D or label. Devices taped on reel dry using recommended conditions 192 h at 40 °C (+ 5 °C), RH < 5 %.


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