# BLF944P

**Power LDMOS transistor**

**Rev. 1 — 7 September 2023**

AMPLEON

**Product data sheet**

## 1. Product profile

### 1.1 General description

A 135 W LDMOS transistor for non cellular communication and industrial applications. The excellent ruggedness of this device makes it ideal for mobile NCC and ISM applications in the frequency range from HF to 1300 MHz.

**Table 1. Application information**

| Test signal | f | $V_{DS}$ | $P_L$ | $G_p$ | $\eta_D$ |
|---|---|---|---|---|---|
| | (MHz) | (V) | (W) | (dB) | (%) |
| pulsed RF | 860 | 32 | 135 | 20.3 | 67 |

### 1.2 Features and benefits

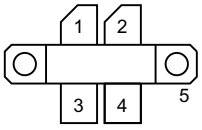
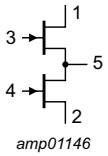
- Designed for broadband operation
- High efficiency
- Integrated dual sided ESD protection
- Excellent ruggedness
- High power gain
- Excellent reliability
- Easy power control
- Excellent stability
- For RoHS compliance see the product details on the Ampleon website

### 1.3 Applications

- Non cellular communication applications
- Industrial, scientific and medical applications

## 2. Pinning information

**Table 2. Pinning**

| Pin | Description | Simplified outline | Graphic symbol |
|---|---|---|---|
| 1 | drain1 |  |  |
| 2 | drain2 | | |
| 3 | gate1 | | |
| 4 | gate2 | | |
| 5 | source [1] | | |





[1] Connected to flange.

## 3. Ordering information

**Table 3. Ordering information**

| Package name | Orderable part number | 12NC | Packing description | Min. orderable quantity (pieces) |
|---|---|---|---|---|
| SOT1228A | BLF944PU | 9349 606 51112 | Tray; 20-fold; non-dry pack | 60 |

## 4. Limiting values

**Table 4. Limiting values**

*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{DS}$ | drain-source voltage | | - | 106 | V |
| $V_{GS}$ | gate-source voltage | | –6 | +11 | V |
| $T_{stg}$ | storage temperature | | –65 | +150 | °C |
| $T_j$ | junction temperature | [1] | - | 225 | °C |

[1] Continuous use at maximum temperature will affect the reliability, for details refer to the online MTF calculator.

## 5. Thermal characteristics

**Table 5. Thermal characteristics**

| Symbol | Parameter | Conditions | Typ | Unit |
|---|---|---|---|---|
| $R_{th(j-c)}$ | thermal resistance from junction to case | $T_{case}$ = 80 °C; $V_{DS}$ = 32 V; $P_L$ = 135 W | 0.45 | K/W |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# 6. Characteristics

**Table 6. DC characteristics**

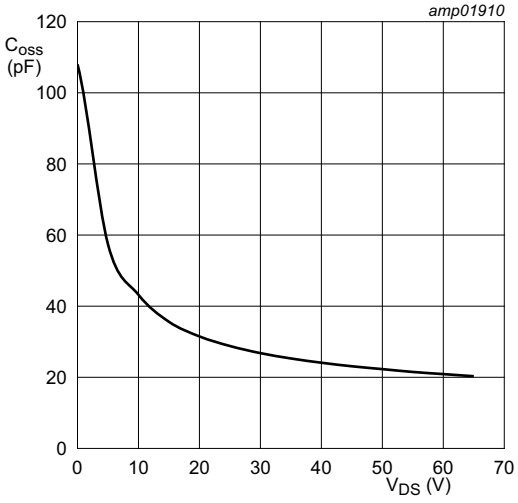
*$T_j$ = 25 °C; per section unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $V_{(BR)DSS}$ | drain-source breakdown voltage | $V_{GS}$ = 0 V; $I_D$ = 0.67 mA | 106 | - | - | V |
| $V_{GS(th)}$ | gate-source threshold voltage | $V_{DS}$ = 10 V; $I_D$ = 67mA | 1.5 | 2.0 | 2.5 | V |
| $V_{GSq}$ | gate-source quiescent voltage | $V_{DS}$ = 32 V; $I_D$ = 120 mA | 1.5 | 2.0 | 2.5 | V |
| $I_{DSS}$ | drain leakage current | $V_{GS}$ = 0 V; $V_{DS}$ = 32 V | - | - | 1.4 | µA |
| $I_{DSX}$ | drain cut-off current | $V_{GS}$ = $V_{GS(th)}$ + 3.75 V; $V_{DS}$ = 10 V | - | 11.8 | - | A |
| $I_{GSS}$ | gate leakage current | $V_{GS}$ = 11 V; $V_{DS}$ = 0 V | - | - | 140 | nA |
| $R_{DS(on)}$ | drain-source on-state resistance | $V_{GS}$ = $V_{GS(th)}$ + 3.75 V; $I_D$ = 2.35 A | - | 0.30 | - | Ω |

**Table 7. AC characteristics**

*$T_j$ = 25 °C; unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $C_{rs}$ | feedback capacitance | $V_{GS}$ = 0 V; $V_{DS}$ = 32 V; f = 1 MHz | - | 0.42 | - | pF |
| $C_{iss}$ | input capacitance | $V_{GS}$ = 0 V; $V_{DS}$ = 32 V; f = 1 MHz | - | 74 | - | pF |
| $C_{oss}$ | output capacitance | $V_{GS}$ = 0 V; $V_{DS}$ = 32 V; f = 1 MHz | - | 26 | - | pF |




$V_{GS}$ = 0 V; f = 1 MHz.

**Fig 1. Output capacitance as a function of drain-source voltage; typical values per section**


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**Table 8. RF characteristics**

*Test signal: pulsed RF; $t_p$ = 100 μs; $\delta$ = 20 %; f = 860 MHz; RF performance at $V_{DS}$ = 32 V; $I_{Dq}$ = 240 mA; $T_{case}$ = 25 °C; unless otherwise specified in a class-AB production circuit.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| $G_p$ | power gain | $P_L$ = 135 W | 19.3 | 20.3 | - | dB |
| $RL_{in}$ | input return loss | $P_L$ = 135 W | - | –9 | –6 | dB |
| $\eta_D$ | drain efficiency | $P_L$ = 135 W | 63 | 67 | - | % |

# 7. Test information

## 7.1 Ruggedness in class-AB operation

The BLF944P is capable of withstanding a load mismatch corresponding to VSWR = 40 : 1 through all phases under the following conditions: $V_{DS}$ = 32 V; $I_{Dq}$ = 240 mA; $P_L$ = 135 W; f = 860 MHz; pulsed CW ($t_p$ = 100 μs; δ = 20 %).

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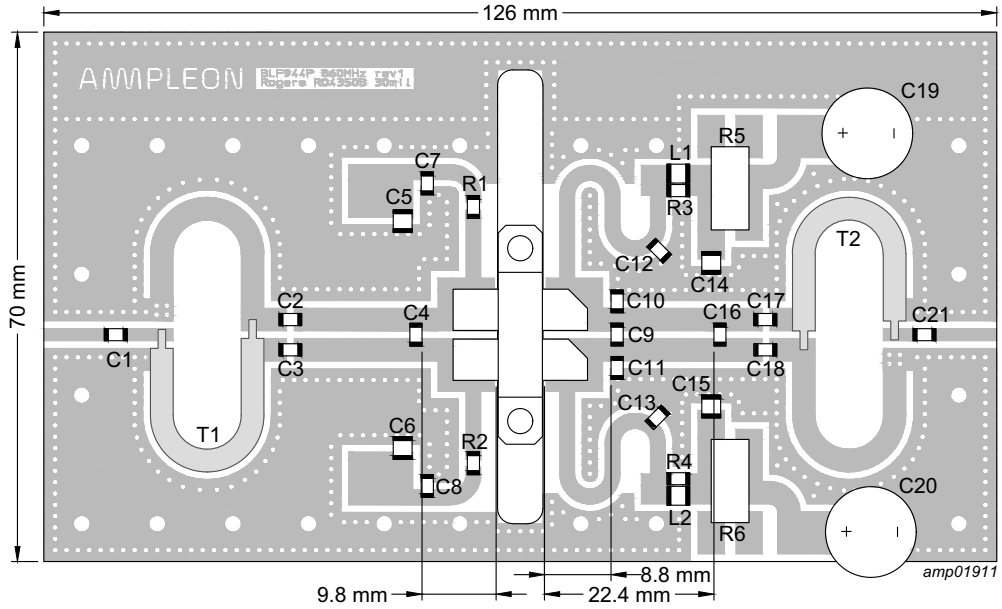
## 7.2 Test circuit




Printed-Circuit Board (PCB): Rogers RO4350B; thickness = 0.762 mm.

See Table 9 for a list of components.

**Fig 2. Component layout for class-AB production test circuit**

**Table 9. List of components**

*For test circuit see Figure 2.*

| Component | Description | Value | Remarks |
|---|---|---|---|
| C1 | multilayer ceramic chip capacitor | 20 pF [1][2] | |
| C2, C3 | multilayer ceramic chip capacitor | 6.8 pF [1][2] | |
| C4 | multilayer ceramic chip capacitor | 16 pF [1][2] | |
| C5, C6 | multilayer ceramic chip capacitor | 4.7 μF, 50 V | |
| C7, C8, C12, C13 | multilayer ceramic chip capacitor | 100 pF [1][2] | |
| C9 | multilayer ceramic chip capacitor | 13 pF [1][2] | |
| C10, C11 | multilayer ceramic chip capacitor | 3.6 pF [1][2] | |
| C14, C15 | multilayer ceramic chip capacitor | 4.7 μF, 100 V | |
| C16 | multilayer ceramic chip capacitor | 4.3 pF [1][2] | |
| C17, C18 | multilayer ceramic chip capacitor | 9.1 pF [1][2] | |
| C19, C20 | electrolytic capacitor | 470 μF, 63 V | |
| C21 | multilayer ceramic chip capacitor | 56 pF [1][2] | |
| L1, L2 | air core inductor | 13 nH | Coilcraft: 1508-13N |
| R1, R2 | chip resistor | 560 Ω | SMD 1206 |
| R3, R4 | chip resistor | 6.8 Ω | SMD 1206 |
| R5, R6 | chip resistor | 0.01 Ω | FC4L110R010FER |
| T1, T2 | semi rigid coax | 50 Ω, 38 mm | |

[1] American Technical Ceramics type 800B or capacitor of same quality.

[2] Vertical mounted.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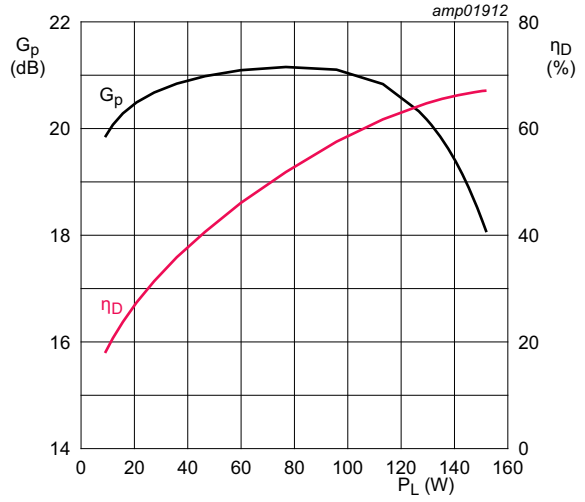
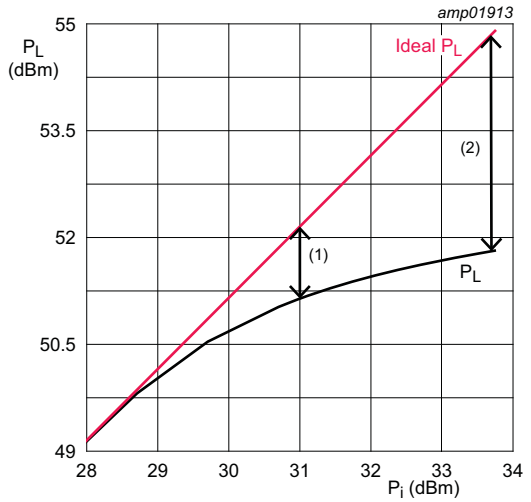
## 7.3 Graphical data

### 7.3.1 Pulsed CW performance measured in production RF test circuit




$V_{DS}$ = 32 V; $I_{Dq}$ = 240 mA; f = 860 MHz; $t_p$ = 100 μs; δ = 20 %.

**Fig 3. Power gain and drain efficiency as function of output power; typical values**




$V_{DS}$ = 32 V; $I_{Dq}$ = 240 mA; f = 860 MHz; $t_p$ = 100 μs; δ = 20 %.

(1) $P_{L(1dB)}$ = 51.1 dBm (130 W)

(2) $P_{L(3dB)}$ = 51.8 dBm (151 W)

**Fig 4. Output power as a function of input power; typical values**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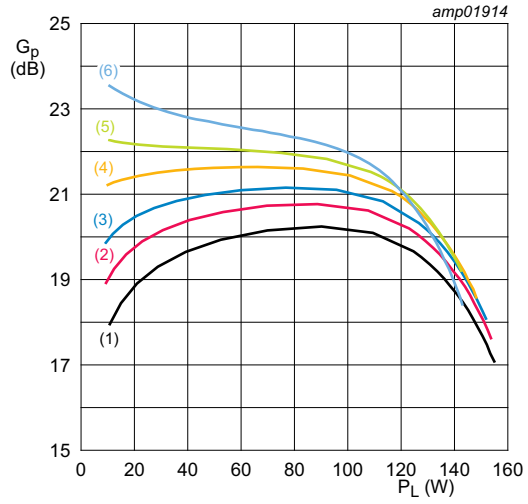
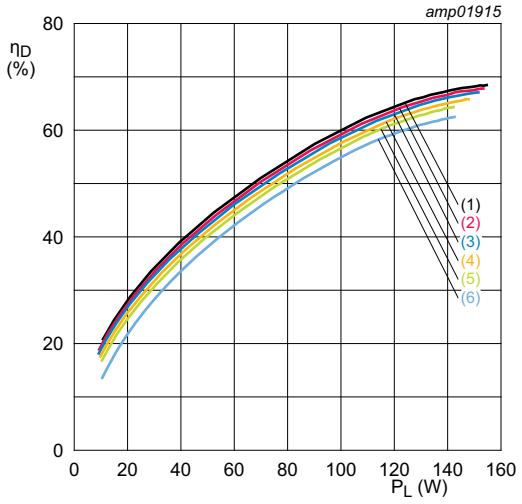



$V_{DS}$ = 32 V; f = 860 MHz; $t_p$ = 100 µs; δ = 20 %.

(1) $I_{Dq}$ = 20 mA
(2) $I_{Dq}$ = 100 mA
(3) $I_{Dq}$ = 240 mA
(4) $I_{Dq}$ = 600 mA
(5) $I_{Dq}$ = 1000 mA
(6) $I_{Dq}$ = 2000 mA

**Fig 5. Power gain as a function of output power; typical values**




$V_{DS}$ = 32 V; f = 860 MHz; $t_p$ = 100 µs; δ = 20 %.

(1) $I_{Dq}$ = 20 mA
(2) $I_{Dq}$ = 100 mA
(3) $I_{Dq}$ = 240 mA
(4) $I_{Dq}$ = 600 mA
(5) $I_{Dq}$ = 1000 mA
(6) $I_{Dq}$ = 2000 mA

**Fig 6. Drain efficiency as a function of output power; typical values**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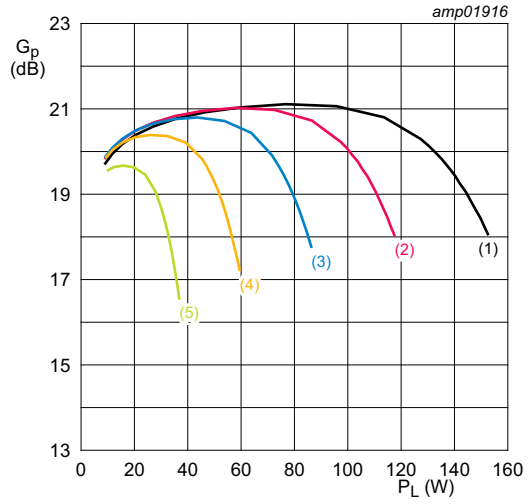
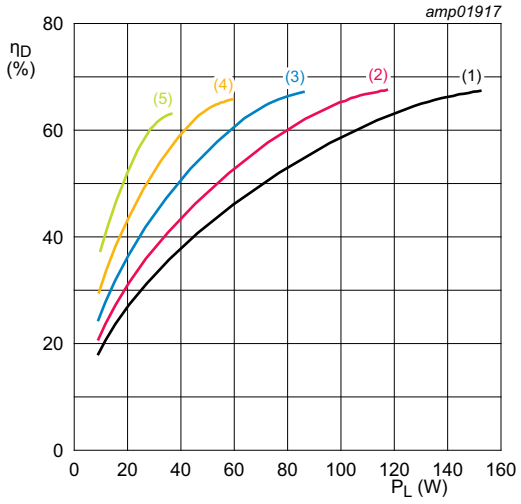



$I_{Dq}$ = 240 mA; f = 860 MHz; $t_p$ = 100 µs; δ = 20 %.

(1) $V_{DS}$ = 32 V
(2) $V_{DS}$ = 28 V
(3) $V_{DS}$ = 24 V
(4) $V_{DS}$ = 20 V
(5) $V_{DS}$ = 16 V

**Fig 7. Power gain as a function of output power; typical values**

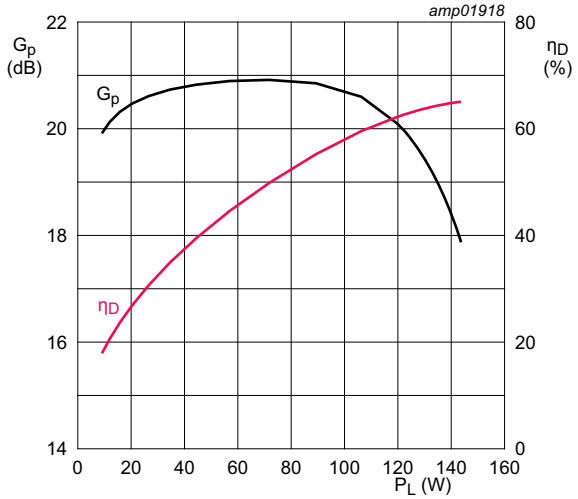



$I_{Dq}$ = 240 mA; f = 860 MHz; $t_p$ = 100 µs; δ = 20 %.

(1) $V_{DS}$ = 32 V
(2) $V_{DS}$ = 28 V
(3) $V_{DS}$ = 24 V
(4) $V_{DS}$ = 20 V
(5) $V_{DS}$ = 16 V

**Fig 8. Drain efficiency as a function of output power; typical values**

### 7.3.2 CW performance measured in production RF test circuit




$V_{DS}$ = 32 V; $I_{Dq}$ = 240 mA; f = 860 MHz.

**Fig 9. Power gain and drain efficiency as function of output power; typical values**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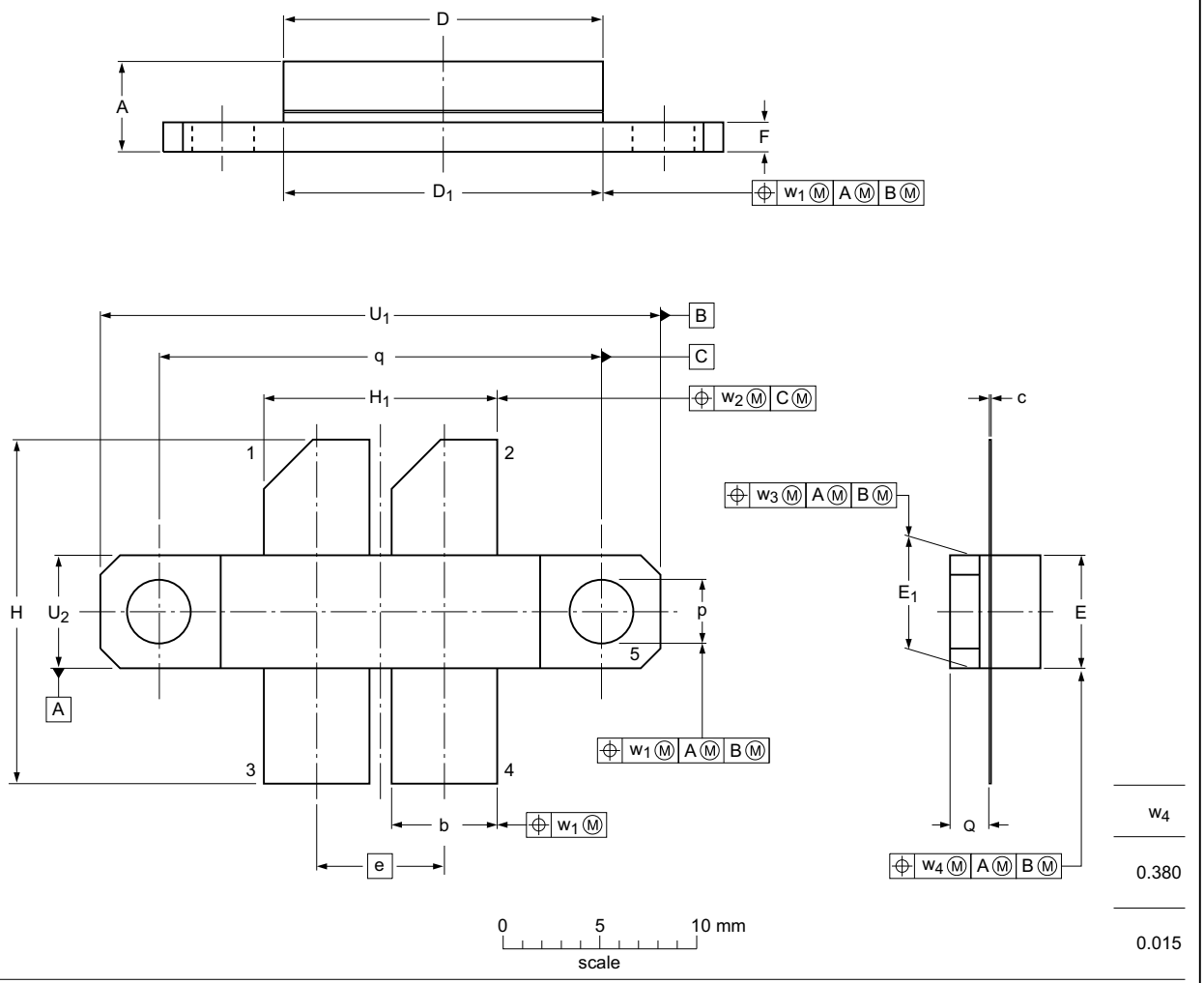
# 8. Package outline

**Flanged LDMOST ceramic package; 2 mounting holes; 4 leads** **SOT1228A**




| | w4 |
|---|---|
| | 0.380 |
| | 0.015 |

Dimensions

| Unit(1) | | A | b | c | D | $D_1$ | e | E | $E_1$ | F | H | $H_1$ | p | Q(2) | q | $U_1$ | $U_2$ | $w_1$ | $w_2$ | $w_3$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | max | 5.2 | 5.59 | 0.15 | 16.66 | 16.69 | | 5.92 | 5.97 | 1.65 | 18.29 | 12.19 | 3.43 | 2.21 | | 29.08 | 5.97 | | | |
| | nom | | | | | | 6.60 | | | | | | | | 22.86 | | | 0.25 | 0.51 | 0.125 |
| | min | 4.5 | 5.33 | 0.08 | 16.36 | 16.33 | | 5.77 | 5.72 | 1.40 | 17.27 | 11.94 | 3.18 | 1.96 | | 28.83 | 5.72 | | | |
| inches | max | 0.205 | 0.220 | 0.006 | 0.656 | 0.657 | | 0.233 | 0.235 | 0.065 | 0.720 | 0.480 | 0.135 | 0.087 | | 1.145 | 0.235 | | | |
| | nom | | | | | | 0.26 | | | | | | | | 0.900 | | | 0.01 | 0.02 | 0.005 |
| | min | 0.177 | 0.210 | 0.003 | 0.644 | 0.643 | | 0.227 | 0.225 | 0.055 | 0.680 | 0.470 | 0.125 | 0.077 | | 1.135 | 0.225 | | | |

Note
1. Millimeter dimensions are derived from the original inch dimensions.
2. Dimension is measured 0.030 inch (0.76 mm) from body.

*sot1228a_po*

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT1228A | | | | | | ~~12-06-11~~ 13-05-16 |

**Fig 10. Package outline SOT1228A**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# 9. Handling information

| CAUTION | |
|---|---|
|  | This device is sensitive to ElectroStatic Discharge (ESD). Observe precautions for handling electrostatic sensitive devices.<br>Such precautions are described in the *ANSI/ESD S20.20*, *IEC/ST 61340-5*, *JESD625-A* or equivalent standards. |

**Table 10. ESD sensitivity**

| ESD model | Class |
|---|---|
| Charged Device Model (CDM); According to ANSI/ESDA/JEDEC standard JS-002 | C3 [1] |
| Human Body Model (HBM); According to ANSI/ESDA/JEDEC standard JS-001 | 2 [2] |

[1] CDM classification C3 is granted to any part that passes after exposure to an ESD pulse of 1000 V.

[2] HBM classification 2 is granted to any part that passes after exposure to an ESD pulse of 2000 V.

# 10. Abbreviations

**Table 11. Abbreviations**

| Acronym | Description |
|---|---|
| CW | Continuous Wave |
| GaN | Gallium Nitride |
| ISM | Industrial, Scientific and Medical |
| LDMOS | Laterally Diffused Metal-Oxide Semiconductor |
| LDMOST | Laterally Diffused Metal-Oxide Semiconductor Transistor |
| MTF | Median Time to Failure |
| NCC | Non-Cellular Communication |
| RoHS | Restriction of Hazardous Substances |
| SMD | Surface Mounted Device |
| VSWR | Voltage Standing Wave Ratio |

# 11. Revision history

**Table 12. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| BLF944P v.1 | 20230907 | Product data sheet | - | - |


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| Document status[1][2] | Product status[3] | Definition |
|---|---|---|
| Objective [short] data sheet | Development | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet | Qualification | This document contains data from the preliminary specification. |
| Product [short] data sheet | Production | This document contains the product specification. |

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

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**Date of release: 7 September 2023**
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