

### Features

| Parameter                 | Value |
|---------------------------|-------|
| $BV_{CEO}$                | 60 V  |
| $I_C$ (max)               | 0.6 A |
| $H_{FE}$ at 10 V - 150 mA | > 100 |

- Linear gain characteristics
- Hermetic packages
- ESCC and JANS qualified
- European preferred part list EPPL

### Description

The 2N2907AHR is a silicon planar PNP transistor specifically designed and housed in hermetic packages for aerospace and Hi-Rel applications. It is available in the JAN qualification system (MIL-PRF19500 compliance) and in the ESCC qualification system (ESCC 5000 compliance). In case of discrepancies between this datasheet and the relevant agency specification, the latter takes precedence.

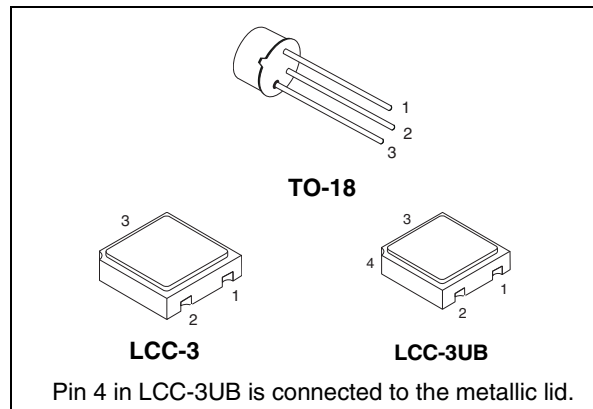


Figure 1. Internal schematic diagram

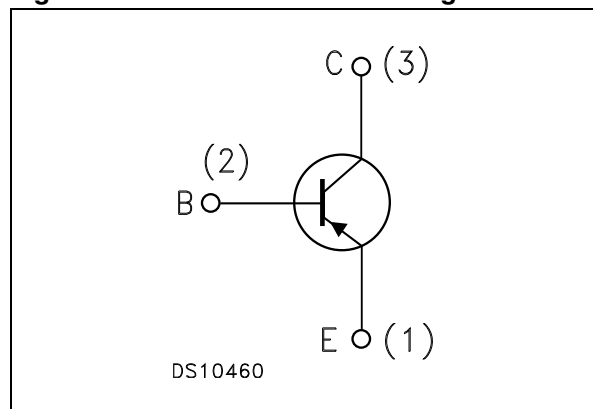


Table 1. Device summary<sup>(1)</sup>

| Order codes | Qualification | Agency spec.      | Package | Radiation level | EPPL |
|-------------|---------------|-------------------|---------|-----------------|------|
| JANS2N2907A | JANS          | MIL-PRF-19500/291 | LCC-3UB | -               | -    |
| 2N2907AUB   | ESCC          | 5201/001          | LCC-3UB |                 | Yes  |
| SOC2907A    |               |                   | LCC-3   |                 | Yes  |
| 2N2907AHR   |               |                   | TO-18   |                 | -    |

1. Contact ST sales office for information about the specific conditions for products in die form and other JAN quality levels.

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

| Symbol  | Parameter  | Value        | Unit   |
|---|--|--------------|--------|
| $V_{CBO}$   | Collector-base voltage ( $I_E = 0$ )             | -60          | V      |
| $V_{CEO}$   | Collector-emitter voltage ( $I_B = 0$ )          | -60          | V      |
| $V_{EBO}$   | Emitter-base voltage ( $I_C = 0$ )               | -5           | V      |
| $I_C$   | Collector current                                |              |        |
|   | for TO-18<br>for LCC-3 and LCC-3UB               | -0.6<br>-0.5 | A<br>A |
| $P_{TOT}$   | Total dissipation at $T_{amb} \leq 25\text{ °C}$ |              | W      |
|   | ESCC: TO-18                                      | 0.4          |        |
|   | LCC-3 and LCC-3UB                                | 0.4          |        |
|   | LCC-3 and LCC-3UB <sup>(1)</sup>                 | 0.73         |        |
|   | JANS: LCC-3UB                                    | 0.5          |        |
| Total dissipation at $T_{case} \leq 25\text{ °C}$ |  |              |        |
| ESCC: TO-18                                       | 1.8  |              |        |
| Total dissipation at $T_{sp(1S)} = 25\text{ °C}$  |  | 1            |        |
| JANS: LCC-3UB                                     |  |              |        |
| $T_{stg}$   | Storage temperature                              | -65 to 200   | °C     |
| $T_J$   | Max. operating junction temperature              | 200          | °C     |

1. When mounted on a 15 x 15 x 0.6 mm ceramic substrate.

**Table 3. Thermal data**

| Symbol          | Parameter   | LCC-3<br>LCC-3UB          | TO-18 | Unit |
|-----------------|---|---------------------------|-------|------|
| $R_{thJC}$      | Thermal resistance junction-case (max) for JANS                       | -                         | -     | °C/W |
|                 | Thermal resistance junction-case (max) for ESCC                       | -                         | 97    |      |
| $R_{thJSP(1S)}$ | Thermal resistance junction-solder pad (infinite sink) (max) for JANS | 90                        | -     |      |
|                 | Thermal resistance junction-solder pad (infinite sink) (max) for ESCC | -                         | -     |      |
| $R_{thJA}$      | Thermal resistance junction-ambient (max) for JANS                    | 325                       | -     |      |
|                 | Thermal resistance junction-ambient (max) for ESCC                    | 437<br>240 <sup>(1)</sup> | 437   |      |

1. When mounted on a 15 x 15 x 0.6 mm ceramic substrate.

## 2 Electrical characteristics<sup>(a)</sup>

JANS and ESCC version of the products are assembled and tested in compliance with the agency specification it is qualified in. The electrical characteristics of each version are provided in dedicated tables.

T<sub>case</sub> = 25 °C unless otherwise specified.

### 2.1 JANS electrical characteristics

Table 4. JANS electrical characteristics

| Symbol                              | Parameter  | Test conditions   | Min.                                | Typ. | Max.           | Unit           |
|-------------------------------------|--|---|-------------------------------------|------|----------------|----------------|
| I <sub>CBO</sub>                    | Collector cut-off current (I <sub>E</sub> = 0)           | V <sub>CB</sub> = 60 V<br>V <sub>CB</sub> = 50 V<br>V <sub>CB</sub> = 50 V      T <sub>amb</sub> = 150 °C   |                                     | -    | 10<br>10<br>10 | μA<br>nA<br>μA |
| I <sub>CES</sub>                    | Collector cut-off current (I <sub>E</sub> = 0)           | V <sub>CE</sub> = 50 V  |                                     | -    | 50             | nA             |
| I <sub>EBO</sub>                    | Emitter cut-off current (I <sub>C</sub> = 0)             | V <sub>EB</sub> = 5 V<br>V <sub>EB</sub> = 4 V  |                                     | -    | 10<br>50       | μA<br>nA       |
| V <sub>(BR)CEO</sub> <sup>(1)</sup> | Collector-emitter breakdown voltage (I <sub>B</sub> = 0) | I <sub>C</sub> = 10 mA  | 60                                  | -    |                | V              |
| V <sub>CE(sat)</sub> <sup>(1)</sup> | Collector-emitter saturation voltage                     | I <sub>C</sub> = 150 mA      I <sub>B</sub> = 15 mA<br>I <sub>C</sub> = 500 mA      I <sub>B</sub> = 50 mA  |                                     | -    | 0.4<br>1.6     | V<br>V         |
| V <sub>BE(sat)</sub> <sup>(1)</sup> | Base-emitter saturation voltage                          | I <sub>C</sub> = 150 mA      I <sub>B</sub> = 15 mA<br>I <sub>C</sub> = 500 mA      I <sub>B</sub> = 50 mA  | 0.6                                 |      | 1.3<br>2.6     | V              |
| h <sub>FE</sub> <sup>(1)</sup>      | DC current gain  | I <sub>C</sub> = 0.1 mA      V <sub>CE</sub> = 10 V<br>I <sub>C</sub> = 1 mA      V <sub>CE</sub> = 10 V<br>I <sub>C</sub> = 10 mA      V <sub>CE</sub> = 10 V<br>I <sub>C</sub> = 150 mA      V <sub>CE</sub> = 10 V<br>I <sub>C</sub> = 500 mA      V <sub>CE</sub> = 10 V<br>I <sub>C</sub> = 10 mA      V <sub>CE</sub> = 10 V<br>T <sub>amb</sub> = -55 °C | 75<br>100<br>100<br>100<br>50<br>50 | -    | 450<br>300     |                |
| h <sub>fe</sub>                     | Small signal current gain                                | V <sub>CE</sub> = 20 V      I <sub>C</sub> = 20 mA<br>f = 100 MHz<br>V <sub>CE</sub> = 10 V      I <sub>C</sub> = 1 mA<br>f = 1 kHz   | 2<br>100                            | -    |                |                |
| C <sub>obo</sub>                    | Output capacitance (I <sub>E</sub> = 0)                  | V <sub>CB</sub> = 10 V<br>100 kHz ≤ f ≤ 1 MHz   |                                     | -    | 8              | pF             |

a. For PNP type, voltage and current values are negative.

Table 4. JANS electrical characteristics (continued)

| Symbol    | Parameter                           | Test conditions   | Min. | Typ. | Max. | Unit |
|-----------|-------------------------------------|---|------|------|------|------|
| $C_{ibo}$ | Output capacitance<br>( $I_E = 0$ ) | $V_{EB} = 2\text{ V}$<br>$100\text{ kHz} \leq f \leq 1\text{ MHz}$                |      | -    | 30   | pF   |
| $t_{on}$  | Turn-on time                        | $V_{CC} = 30\text{ V}$ $I_C = 150\text{ mA}$<br>$I_{B1} = 15\text{ mA}$           |      | -    | 45   | ns   |
| $t_{off}$ | Turn-off time                       | $V_{CC} = 30\text{ V}$ $I_C = 150\text{ mA}$<br>$I_{B1} = -I_{B2} = 15\text{ mA}$ |      | -    | 300  | ns   |

1. Pulsed duration = 300  $\mu\text{s}$ , duty cycle  $\leq 2\%$

## 2.2 ESCC electrical characteristics

Table 5. ESCC electrical characteristics

| Symbol              | Parameter  | Test conditions   | Min.                   | Typ. | Max.     | Unit                |
|---------------------|--|---|------------------------|------|----------|---------------------|
| $I_{CBO}$           | Collector cut-off current<br>( $I_E = 0$ )           | $V_{CB} = 50\text{ V}$<br>$V_{CB} = 50\text{ V}$ $T_{amb} = 150\text{ }^\circ\text{C}$  |                        | -    | 10<br>10 | nA<br>$\mu\text{A}$ |
| $V_{(BR)CBO}$       | Collector-base breakdown voltage<br>( $I_E = 0$ )    | $I_C = 10\text{ }\mu\text{A}$   | 60                     | -    |          | V                   |
| $V_{(BR)CEO}^{(1)}$ | Collector-emitter breakdown voltage<br>( $I_B = 0$ ) | $I_C = 10\text{ mA}$  | 60                     | -    |          | V                   |
| $V_{(BR)EBO}$       | Emitter-base breakdown voltage<br>( $I_C = 0$ )      | $I_E = 10\text{ }\mu\text{A}$   | 5                      | -    |          | V                   |
| $V_{CE(sat)}^{(1)}$ | Collector-emitter saturation voltage                 | $I_C = 150\text{ mA}$ $I_B = 15\text{ mA}$  |                        | -    | 0.4      | V                   |
| $V_{BE(sat)}^{(1)}$ | Base-emitter saturation voltage                      | $I_C = 150\text{ mA}$ $I_B = 15\text{ mA}$  |                        | 0.87 | 1.3      | V                   |
| $h_{FE}^{(1)}$      | DC current gain                                      | $I_C = 0.1\text{ mA}$ $V_{CE} = 10\text{ V}$<br>$I_C = 10\text{ mA}$ $V_{CE} = 10\text{ V}$<br>$I_C = 150\text{ mA}$ $V_{CE} = 10\text{ V}$<br>$I_C = 500\text{ mA}$ $V_{CE} = 10\text{ V}$ | 75<br>100<br>100<br>50 | -    | 300      |                     |
| $h_{fe}$            | Small signal current gain                            | $V_{CE} = 20\text{ V}$ $I_C = 20\text{ mA}$<br>$f = 100\text{ MHz}$   | 2                      | -    |          |                     |
| $C_{obo}$           | Output capacitance<br>( $I_E = 0$ )                  | $V_{CB} = 10\text{ V}$<br>$100\text{ kHz} \leq f \leq 1\text{ MHz}$   |                        | -    | 8        | pF                  |
| $t_{on}$            | Turn-on time   | $V_{CC} = 30\text{ V}$ $I_C = 150\text{ mA}$<br>$I_{B1} = 15\text{ mA}$   |                        | -    | 45       | ns                  |
| $t_{off}$           | Turn-off time  | $V_{CC} = 30\text{ V}$ $I_C = 150\text{ mA}$<br>$I_{B1} = -I_{B2} = 15\text{ mA}$   |                        | -    | 300      | ns                  |

1. Pulsed duration = 300  $\mu\text{s}$ , duty cycle  $\leq 2\%$

### 2.3 Electrical characteristics (curves)

Figure 2. DC current gain ( $V_{CE}=1\text{ V}$ )

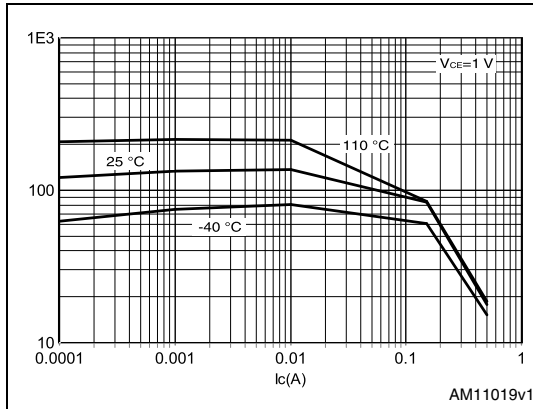


Figure 3. DC current gain ( $V_{CE}=10\text{ V}$ )

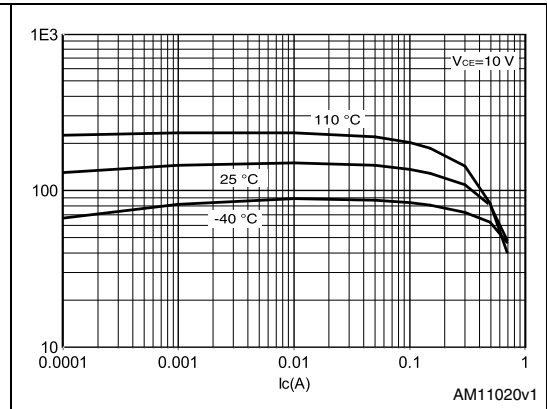


Figure 4. Collector emitter saturation voltage

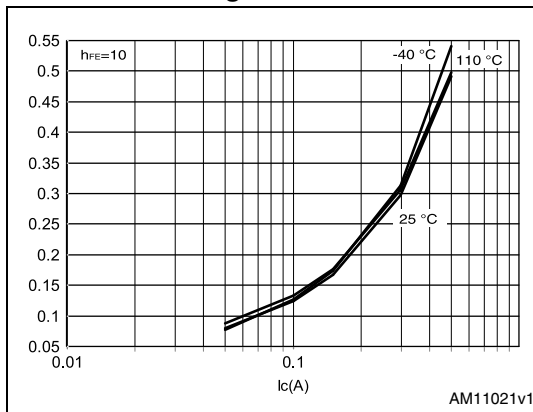
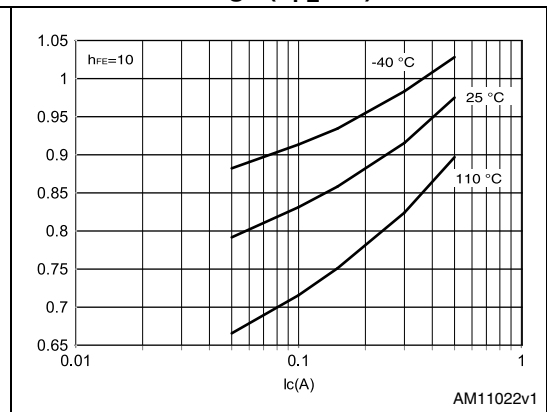


Figure 5. Base emitter saturation voltage ( $h_{FE}=10$ )



## 2.4 Test circuits

Figure 6. JANS saturated turn-on switching time test circuit

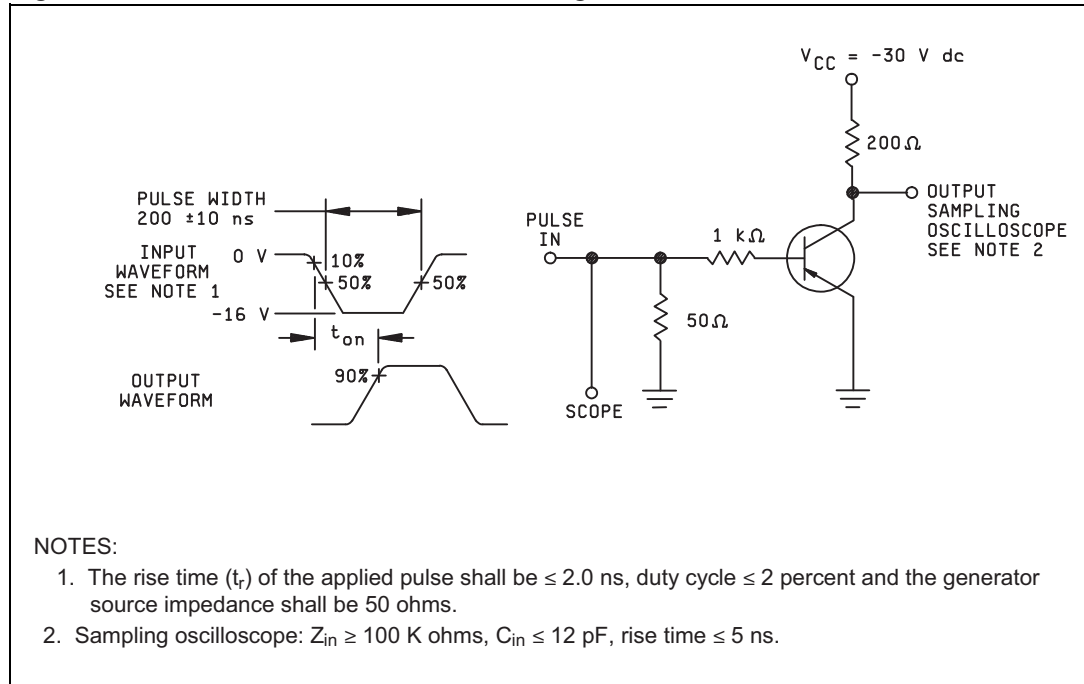


Figure 7. JANS saturated turn-off switching time test circuit

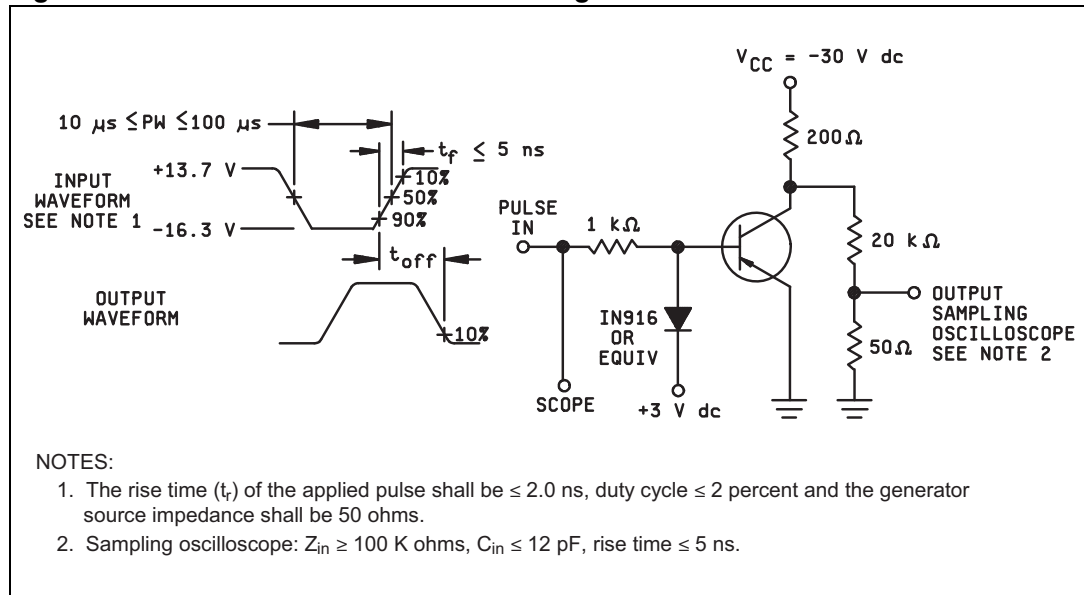
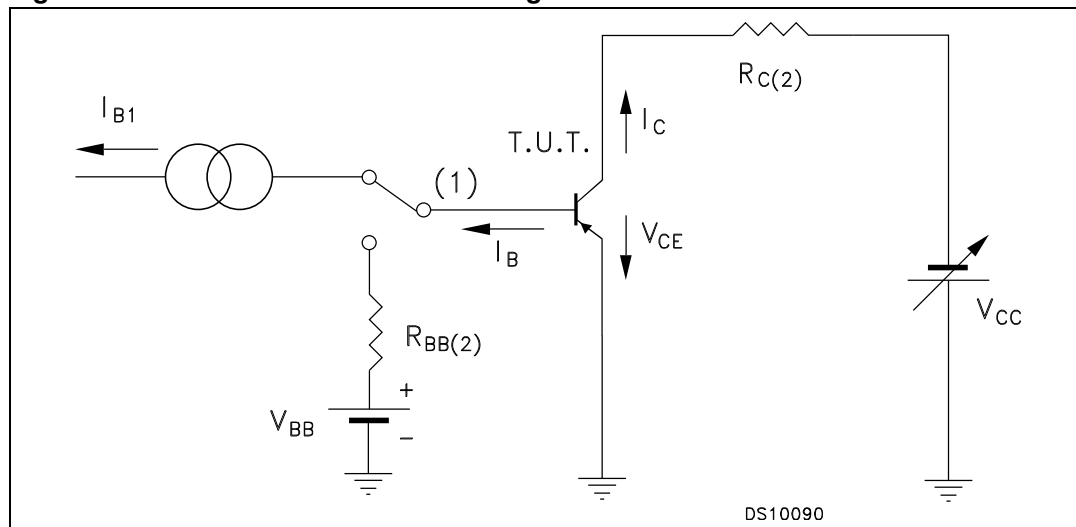


Figure 8. ESCC resistive load switching test circuit



- 1. Fast electronic switch
- 2. Non-inductive resistor



### 3 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

**Table 6. Product mass summary**

| Package | Mass (g) |
|---------|----------|
| LCC-3UB | 0.06     |
| LCC-3   | 0.06     |
| TO-18   | 0.40     |

Table 7. LCC-3UB mechanical data

| Dim. | mm.  |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    | 1.16 |      | 1.42 |
| C    | 0.46 | 0.51 | 0.56 |
| D    | 0.56 | 0.76 | 0.96 |
| E    | 0.92 | 1.02 | 1.12 |
| F    | 1.95 | 2.03 | 2.11 |
| G    | 2.92 | 3.05 | 3.18 |
| I    | 2.41 | 2.54 | 2.67 |
| J    | 0.42 | 0.57 | 0.72 |
| K    | 1.37 | 1.52 | 1.67 |
| L    | 0.41 | 0.51 | 0.61 |
| M    | 2.46 | 2.54 | 2.62 |
| N    | 1.81 | 1.91 | 2.01 |
| r    |      | 0.20 |      |
| r1   |      | 0.30 |      |
| r2   |      | 0.56 |      |

Figure 9. LCC-3UB drawings

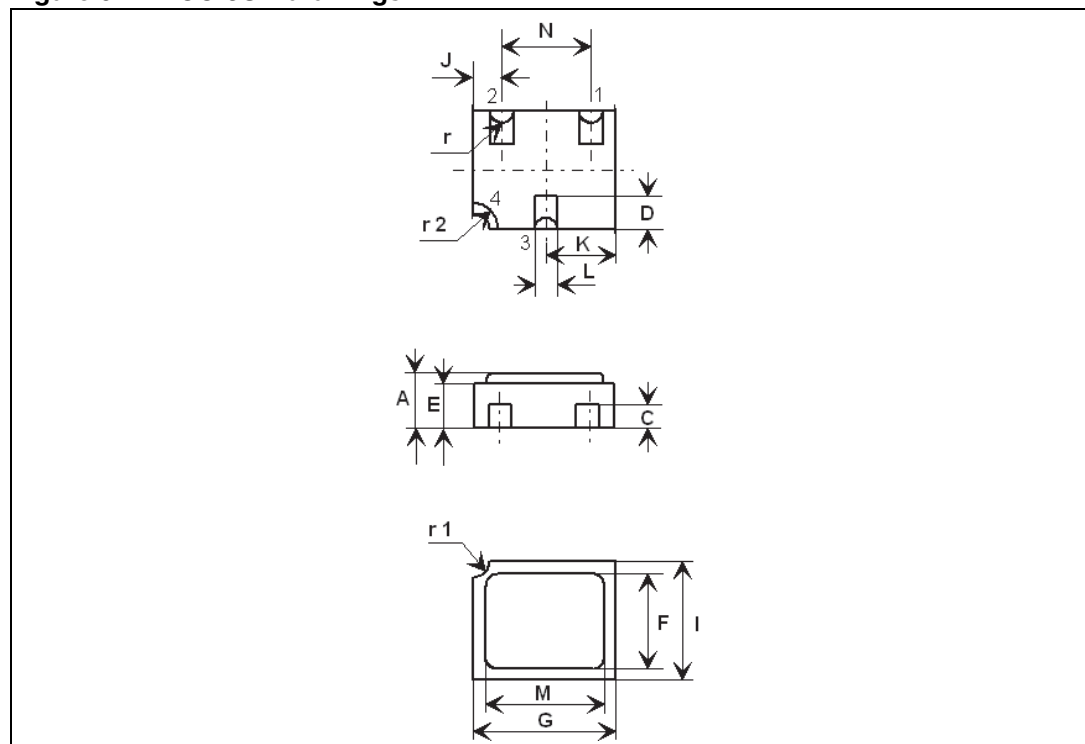


Table 8. LCC-3 mechanical data

| Dim. | mm.  |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    | 1.16 |      | 1.42 |
| C    | 0.45 | 0.50 | 0.56 |
| D    | 0.60 | 0.76 | 0.91 |
| E    | 0.91 | 1.01 | 1.12 |
| F    | 1.95 | 2.03 | 2.11 |
| G    | 2.92 | 3.05 | 3.17 |
| I    | 2.41 | 2.54 | 2.66 |
| J    | 0.42 | 0.57 | 0.72 |
| K    | 1.37 | 1.52 | 1.67 |
| L    | 0.40 | 0.50 | 0.60 |
| M    | 2.46 | 2.54 | 2.62 |
| N    | 1.80 | 1.90 | 2.00 |
| R    |      | 0.30 |      |

Figure 10. LCC-3 drawings

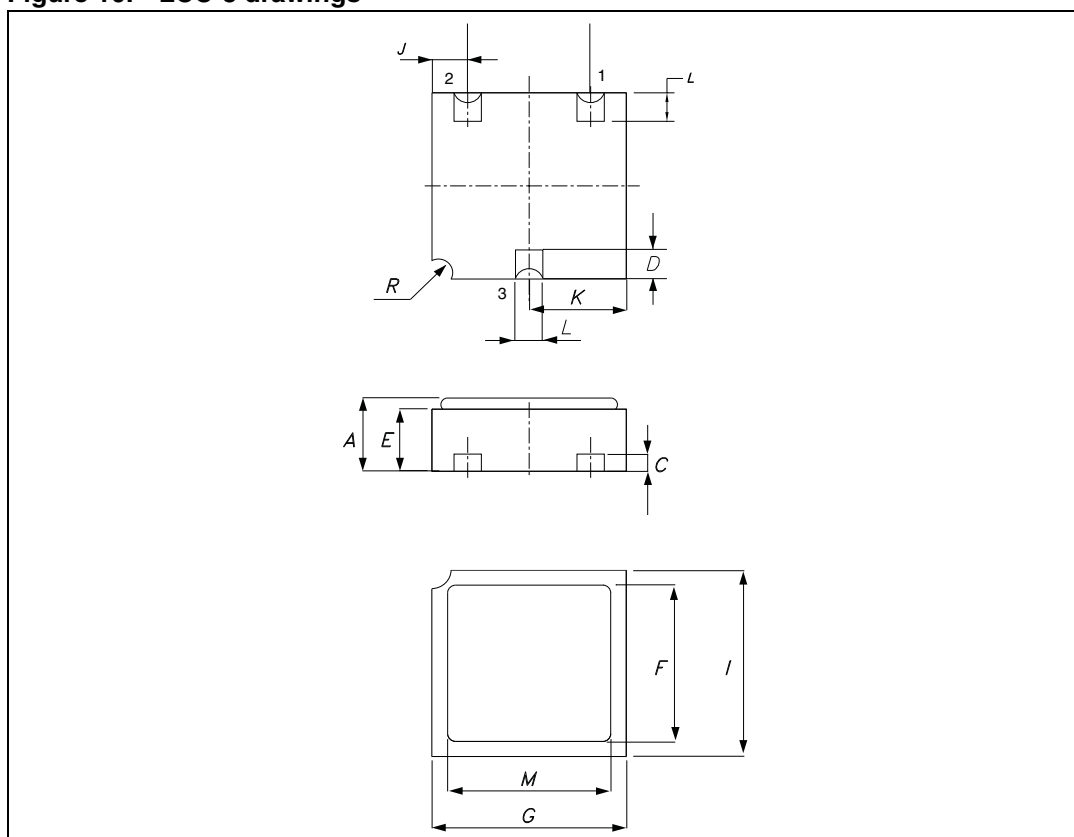
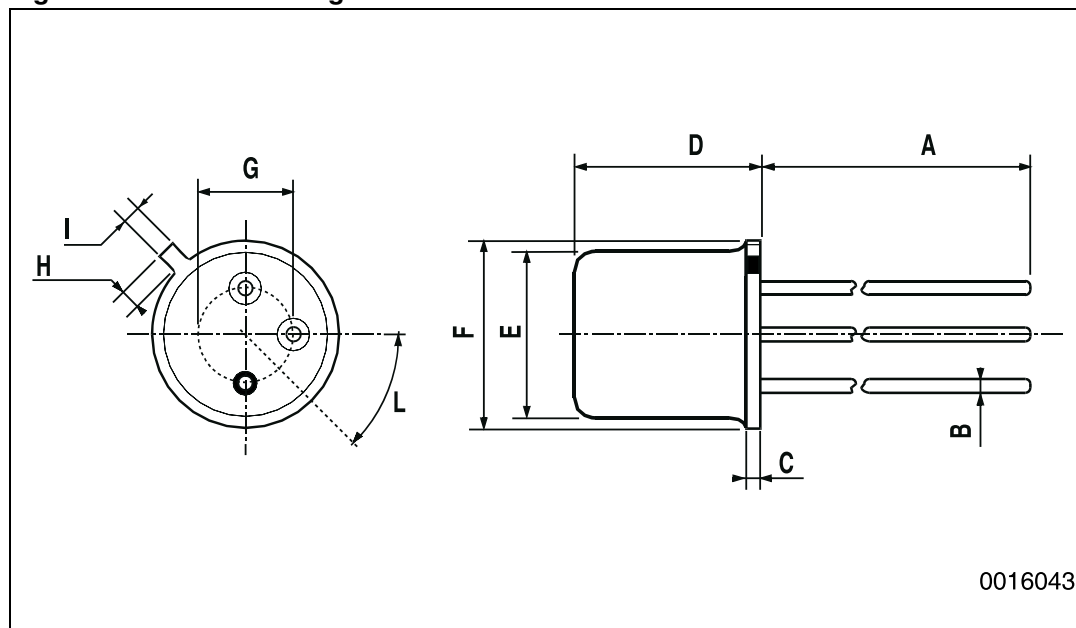


Table 9. TO-18 mechanical data

| Dim. | mm.  |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    |      | 12.7 |      |
| B    |      |      | 0.49 |
| D    |      |      | 5.3  |
| E    |      |      | 4.9  |
| F    |      |      | 5.8  |
| G    | 2.54 |      |      |
| H    |      |      | 1.2  |
| I    |      |      | 1.16 |
| L    | 45°  |      |      |

Figure 11. TO-18 drawings



## 4 Order codes

**Table 10. Order codes**

| Part number    | Agency specification             | EPPL | Quality level             | Radiation level | Package | Lead Finish                          | Marking <sup>(1)</sup>            | Packing     |
|----------------|----------------------------------|------|---------------------------|-----------------|---------|--------------------------------------|-----------------------------------|-------------|
| J2N2907AUB1    | -                                | -    | Engineering model<br>JANS | -               | LCC-3UB | Gold                                 | J2N2907A                          | Waffle pack |
| 2N2907AUB1     |                                  | -    | Engineering model<br>ESCC |                 | LCC-3UB | Gold                                 | U03                               | Waffle pack |
| SOC2907A       |                                  | -    | Engineering model<br>ESCC |                 | LCC-3   | Gold                                 | P03                               | Waffle pack |
| JANS2N2907AUBG | MIL-PRF-19500/291                | -    | JANS flight               |                 | LCC-3UB | Gold                                 | JS2907                            | Waffle pack |
| JANS2N2907AUBT | MIL-PRF-19500/291                | -    |                           |                 | LCC-3UB | Solder Dip                           | JS2907                            | Waffle pack |
| 2N2907AUB06    | 5202/001/06                      | Yes  | ESCC flight               |                 | LCC-3UB | Gold                                 | 520200106                         | Waffle pack |
| 2N2907AUB07    | 5202/001/07                      | Yes  |                           |                 | LCC-3UB | Solder Dip                           | 520200107                         | Waffle pack |
| SOC2907AHRB    | 5202/001/04 or 05 <sup>(2)</sup> | Yes  |                           |                 | LCC-3   | Gold or<br>Solder Dip <sup>(2)</sup> | 520200104<br>or 05 <sup>(2)</sup> | Waffle pack |
| 2N2907AHR      | 5202/001/01 or 02 <sup>(2)</sup> | -    |                           |                 | TO-18   | Gold or<br>Solder Dip <sup>(2)</sup> | 520200101<br>or 02 <sup>(2)</sup> | Strip pack  |

1. Specific marking only. The full marking includes in addition:

For the engineering models : ST logo, date code, country of origin (FR).

For ESCC flight parts : ST logo, date code, country of origin (FR), ESA logo, serial number of the part within the assembly lot.

For JANS flight parts : ST logo, date code, country of origin (FR), manufacturer code (CSTM), serial number of the part within the assembly lot.

2. Depending ESCC part number mentioned on the purchase order.

Contact ST sales office for information about the specific conditions for:

- Products in die form
- Other JANS quality levels
- Tape and reel packing

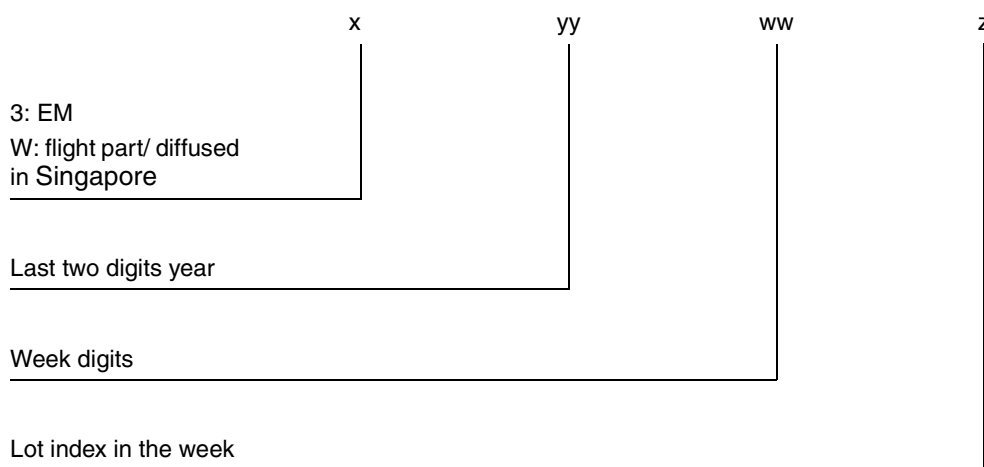
## 5 Shipping details

### 5.1 Data code

Data code is structured as described below:

- EM (ESCC and JANS) xyywwz
- ESCC Flight yywwz
- JANS Flight xyywwz

where:



### 5.2 Documentation

**Table 11. Documentation provided for each type of product**

| Quality level     | Radiation level | Documentation              |
|-------------------|-----------------|----------------------------|
| Engineering model | -               | -                          |
| JANS Flight       | -               | Certificate of conformance |
| ESCC Flight       | -               | Certificate of conformance |

## 6 Revision history

**Table 12. Document revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| 09-Feb-2009 | 1        | Initial release  |
| 30-Nov-2011 | 2        | <ul style="list-style-type: none"><li>– Modified <a href="#">Table 1 on page 1</a></li><li>– Minor text changes in the document title and description on the coverpage</li></ul>   |
| 14-May-2012 | 3        | <p>New package inserted (LCC-3UB).</p> <p>Updated:</p> <ul style="list-style-type: none"><li>– <a href="#">Table 1: Device summary</a>, <a href="#">Table 2: Absolute maximum ratings</a> and <a href="#">Table 3: Thermal data</a>.</li><li>– <a href="#">Section 2: Electrical characteristics</a> and <a href="#">Section 3: Package mechanical data</a>.</li></ul> <p>Added:</p> <ul style="list-style-type: none"><li>– <a href="#">Section 4: Order codes</a> and <a href="#">Section 5: Shipping details</a>.</li></ul> |

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