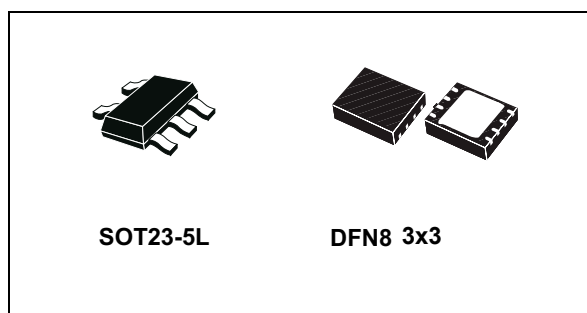


## High input voltage 85 mA LDO linear regulator

Datasheet - production data



### Features

- 4.3 V to 24 V input voltage
- Low-dropout voltage (500 mV typ. at 85 mA)
- Very low quiescent current (5  $\mu$ A typ. at full load)
- 85 mA guaranteed output current
- Output voltages 3.3 V, 4.2 V and 5.0 V (other versions available on request)
- Compatible with ceramic output capacitors from 0.47  $\mu$ F to 10  $\mu$ F
- Internal current limit
- Packages: SOT23-5L and DFN8 3x3
- Temperature range: from -40 °C to 125 °C

### Applications

- Mobile phones
- Industrial
- battery-powered systems

### Description

The LDK715 is a high voltage, ultra low quiescent current and low drop linear regulator capable of providing an output current in excess of 85 mA. The device operates over an input voltage range from 4.3 V to 24 V, and it is stable with output ceramic capacitors. Fault condition protection includes short-circuit current limitation. The ultra low quiescent current of 5  $\mu$ A at full load makes it highly suitable for low power applications and battery-powered systems. The wide input voltage range makes the LDK715 an ideal solution for low power industrial applications. The LDK715 is available in SOT23-5, or DFN8 3x3 - 8 leads.

Table 1. Device summary

| Order codes |                            | Output voltage |
|-------------|----------------------------|----------------|
| SOT23-5L    | DFN8 3x3                   |                |
| LDK715M33R  | LDK715PU33R                | 3.3 V          |
| LDK715M42R  | LDK715PU42R                | 4.2 V          |
| LDK715M50R  | LDK715PU50R <sup>(1)</sup> | 5.0 V          |

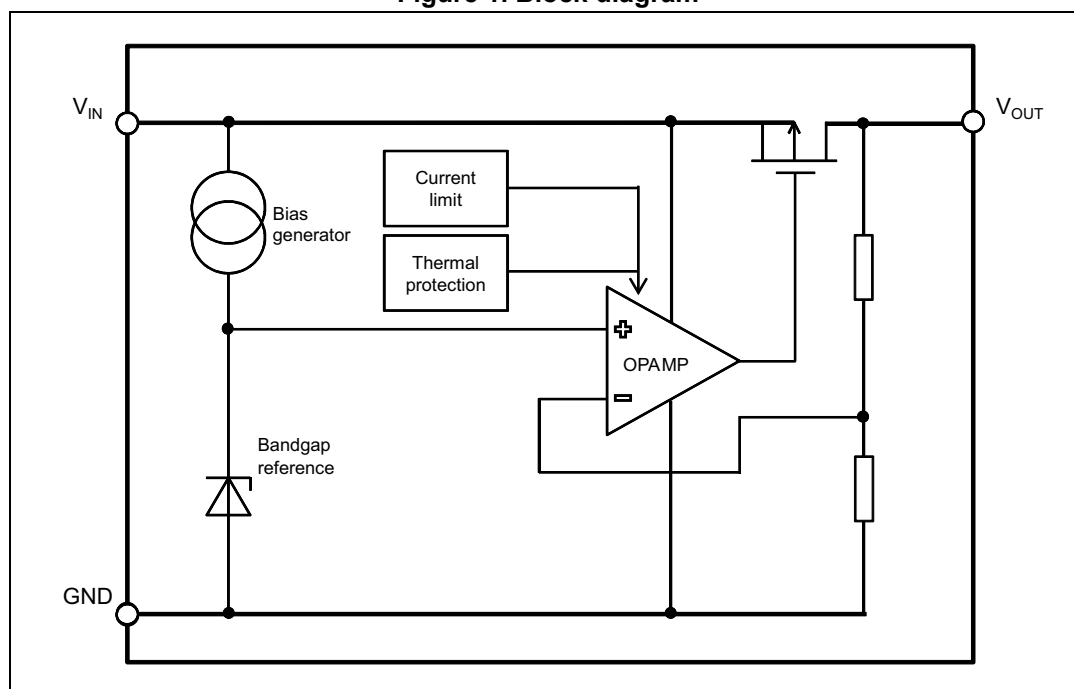
1. Available on request.

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# 1 Diagram

Figure 1. Block diagram



## 2 Pin configuration

Figure 2. Pin connection (top view)

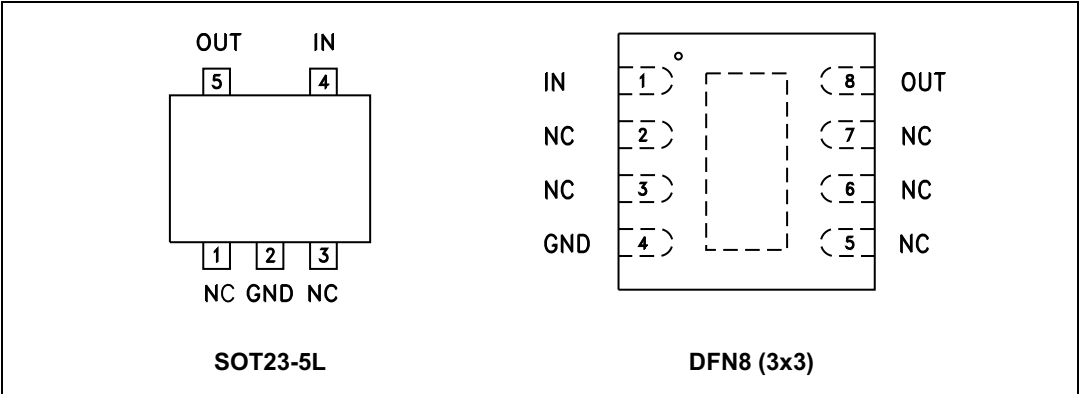


Table 2. Pin description for DFN8 3x3

| Symbol | Pin number                  | Name and function        |
|--------|-----------------------------|--------------------------|
| IN     | 1                           | Input voltage            |
| NC     | 2, 3, 5, 6, 7, and exp. pad | Not internally connected |
| GND    | 4                           | Common ground            |
| OUT    | 8                           | Output voltage           |

Table 3. Pin description for SOT23-5L

| Symbol | Pin number | Name and function        |
|--------|------------|--------------------------|
| IN     | 4          | Input voltage            |
| NC     | 1,3        | Not internally connected |
| GND    | 2          | Common ground            |
| OUT    | 5          | Output voltage           |

### 3 Maximum ratings

**Table 4. Absolute maximum ratings**

| Symbol           | Parameter                                   | Value                                  | Unit |
|------------------|---------------------------------------------|----------------------------------------|------|
| $V_{IN}$         | DC input voltage                            | From -0.3 to 26                        | V    |
| $V_{OUT}$        | DC output voltage                           | From -0.3 to $V_{IN} + 0.3$            | V    |
| $I_{OUT}$        | Continuous output current                   | According to package power dissipation | A    |
| $P_D^{(1), (2)}$ | Maximum power dissipation, DFN package      | 2                                      | W    |
|                  | Maximum power dissipation, SOT23-5L package | 0.45                                   |      |
| $T_{STG}$        | Storage temperature range                   | -65 to 150                             | °C   |
| $T_{OP}$         | Operating junction temperature range        | -40 to 125                             | °C   |

1.  $P_D$  is based on an operating temperature of 25 °C or less. It must be derated according to the operating temperature.
2. The LDK715 has an internal constant current limit feature. Take care not to exceed the power dissipation ratings of the package also during current limit and short-circuit events.

**Note:** *Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied.*

**Table 5. Thermal data**

| Symbol     | Parameter                           | SOT23-5L | DFN8 | Unit |
|------------|-------------------------------------|----------|------|------|
| $R_{thJA}$ | Thermal resistance junction ambient | 195      | 52   | °C/W |

## 4 Electrical characteristics

$T_J = 25\text{ }^{\circ}\text{C}$ ,  $V_{IN} = V_{OUT(NOM)} + 1\text{ V}$ ,  $C_{IN} = 0.1\text{ }\mu\text{F}$ ,  $C_{OUT} = 1\text{ }\mu\text{F}$ ,  $I_{OUT} = 1\text{ mA}$ , unless otherwise specified<sup>(a)</sup>.

**Table 6. Electrical characteristics**

| Symbol           | Parameter                           | Test conditions                                                                                                                                                                                                               | Min.                   | Typ.  | Max.  | Unit                |
|------------------|-------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------|-------|---------------------|
| $V_{IN}$         | Operating input voltage             | $I_{OUT} = 85\text{ mA}$ , $T_J = -40\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$                                                                                                                               | 4.3                    | -     | 24    | V                   |
| $I_{OUT}$        | Output current                      | $V_{IN} = V_{OUT(NOM)} + 1$ to $24\text{ V}$ , $T_J = -40\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$                                                                                                           | 0                      | -     | 85    | mA                  |
| $V_{OUT}$        | $V_{OUT}$ accuracy <sup>(1)</sup>   | $T_J = 25\text{ }^{\circ}\text{C}$                                                                                                                                                                                            | -1                     | -     | +1    | %                   |
|                  |                                     | $V_{IN} = V_{OUT(NOM)} + 1$ to $24\text{ V}$ , $T_J = -40\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$                                                                                                           | -2                     | -     | +2    |                     |
| $\Delta V_{OUT}$ | Line regulation                     | $V_{IN} = V_{OUT(NOM)} + 1$ to $24\text{ V}$ to $24\text{ V}$ ,<br>$I_{OUT} = 1\text{ mA}$ , $T_J = -40\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$                                                             | -                      | 0.001 | 0.004 | %/V                 |
| $\Delta V_{OUT}$ | Load regulation                     | $I_{OUT} = 100\text{ }\mu\text{A}$ to $85\text{ mA}$ ,<br>$T_J = -40\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$                                                                                                | -                      | 0.002 | 0.003 | %/mA                |
| $V_{DROP}$       | Drop output voltage <sup>(2)</sup>  | $I_{OUT} = 85\text{ mA}$ , $T_J = -40\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$                                                                                                                               | -                      | 500   | 1000  | mV                  |
| $e_N$            | Output noise voltage <sup>(3)</sup> | 200 Hz to 100 kHz, $I_{OUT} = 50\text{ mA}$ ,<br>$C_{OUT} = 10\text{ }\mu\text{F}$ , $T_J = -40\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$                                                                     | -                      | -     | 210   | $\mu\text{V}_{RMS}$ |
| SVR              | Supply voltage rejection            | $V_{IN} = V_{OUT(NOM)} + 1\text{ V} \pm V_{RIPPLE}$ ,<br>$V_{RIPPLE} = 0.2\text{ V}$ ,<br>$I_{OUT} = 1\text{ mA}$ , $C_{OUT} = 10\text{ }\mu\text{F}$<br>$T_J = -40\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$ | $f = 1\text{ kHz}$     | -     | 38    | dB                  |
|                  |                                     |                                                                                                                                                                                                                               | $f = 100\text{ kHz}$   | -     | 57    |                     |
| $I_Q$            | Quiescent current                   | $I_{OUT} = 0\text{ mA}$ to $85\text{ mA}$ ,<br>$T_J = -40\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$                                                                                                           |                        | -     | 5     | $\mu\text{A}$       |
|                  |                                     |                                                                                                                                                                                                                               | $V_{IN} = 24\text{ V}$ | -     | -     |                     |
| $I_{SC}$         | Short-circuit current               | $V_{OUT} = 0$ , $T_J = -40\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$<br>$V_{IN} = V_{OUT(NOM)} + 1$ to $24\text{ V}$                                                                                          | 120                    | -     | -     | mA                  |
| $T_{ON}$         | Turn on time <sup>(4)</sup>         | $V_{IN} = V_{OUT(NOM)} + 1$ to $24\text{ V}$ , $C_{OUT} = 10\text{ }\mu\text{F}$ ,<br>$I_{OUT} = 60\text{ mA}$ , $T_J = -40\text{ }^{\circ}\text{C}$ to $125\text{ }^{\circ}\text{C}$                                         | -                      | 0.7   | -     | ms                  |
| $C_{OUT}$        | Output capacitor                    | Capacitance $f = 100\text{ kHz}$                                                                                                                                                                                              | 0.47                   | -     | -     | $\mu\text{F}$       |

1. For  $V_{OUT(NOM)} < 3.3\text{ V}$ ,  $V_{IN} = 4.3\text{ V}$ .

2. Dropout voltage is the input-to-output voltage difference at which the output voltage is 100 mV below its nominal value.

3. Guaranteed by design.

4. Turn-on time is time measured between the input just exceeding 90% of its final value and the output voltage just reaching 95% of its nominal value.

a. For  $V_{OUT(NOM)} < 3.3\text{ V}$ ,  $V_{IN} = 4.3\text{ V}$ .

## 4.1 External capacitor requirements

A 0.1  $\mu\text{F}$  or a larger input bypass capacitor, connected between IN and GND and located close to the device, is recommended. In this manner, the transient response and noise rejection of the power supply, as a whole, improve. A higher value of the input capacitor may be necessary if large, fast-rise-time load transients are present in the application and if the device is several inches far from the power source.

The LDK715 requires an output capacitor connected between OUT and GND to stabilize the internal control loop. Please refer to [Figure 7](#) for the allowable output capacitance and ESR combinations.

## 4.2 Power dissipation and junction temperature

For a reliable operation, junction temperature should not exceed 125 °C. This limits the power dissipation the regulator can handle in any application. To guarantee that the junction temperature is within acceptable limits, calculate the maximum allowable dissipation,  $P_{D(\text{max})}$ , and the dissipation,  $P_D$ , which must be less than or equal to  $P_{D(\text{max})}$ .

The maximum power dissipation limit is given by the following equation:

### Equation 1

$$P_{D(\text{max})} = (T_{J\text{MAX}} - T_A) / R_{\text{thJA}}$$

where:

$T_{J\text{MAX}}$  is the maximum allowable junction temperature

$R_{\text{thJA}}$  is the thermal resistance junction to ambient for the package

$T_A$  is the ambient temperature

The regulator dissipation is calculated by the following equation:

### Equation 2

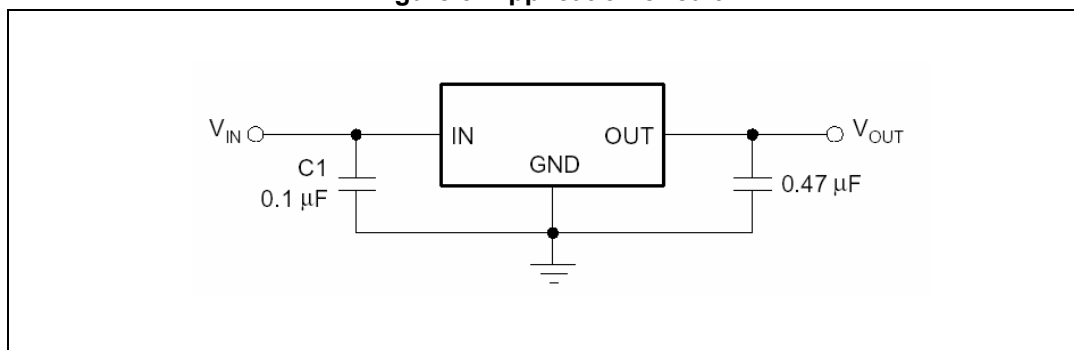
$$P_D = (V_{\text{IN}} - V_{\text{out}}) \times I_{\text{out}}$$

Power dissipation coming from quiescent current is negligible.

The ST715 features the internal current limit. During normal operation, it limits the output current to approximately 350 mA. When the current limit engages, the output voltage scales back linearly until the overcurrent condition ends. Do not exceed the power dissipation ratings of the package.

## 5 Typical application

Figure 3. Application circuit





## 6 Typical performance characteristics

Figure 4. Output voltage vs. temperature

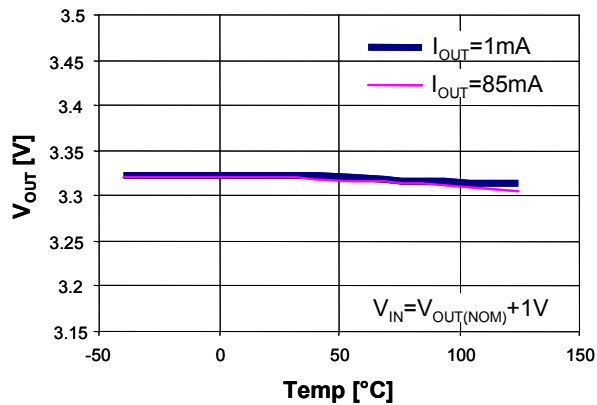


Figure 5. Output voltage vs. input voltage

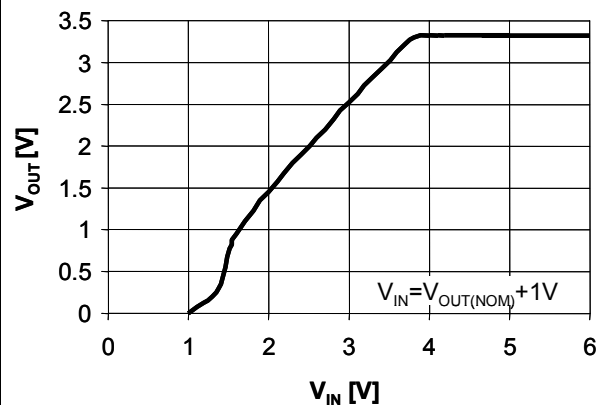


Figure 6. Dropout voltage vs. output current

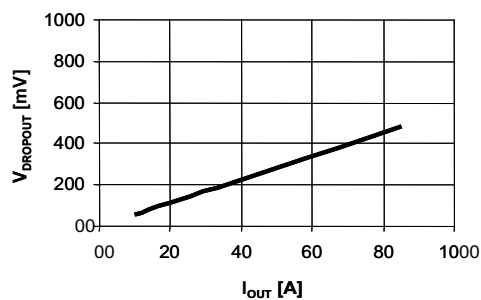
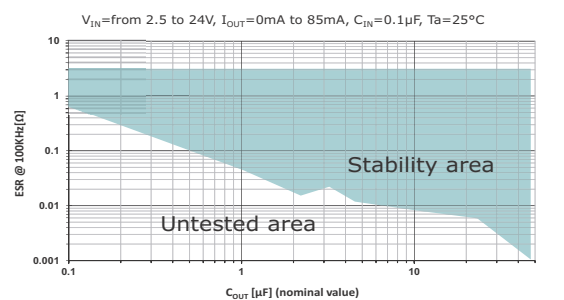
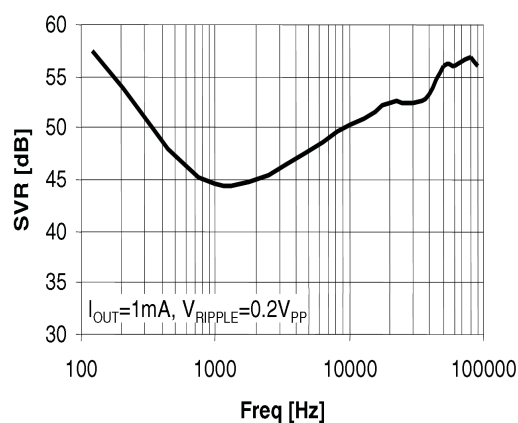


Figure 7. C\_OUT stability region



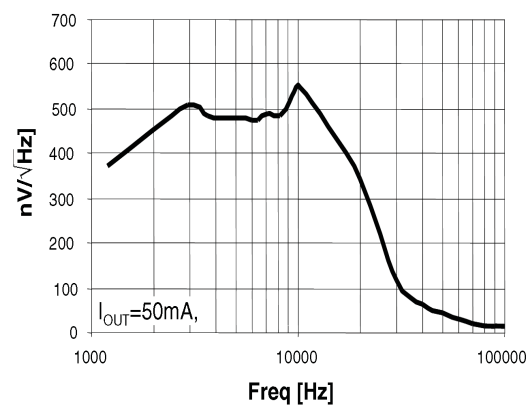
GIPG220520131251RV

Figure 8. Supply voltage rejection vs. frequency



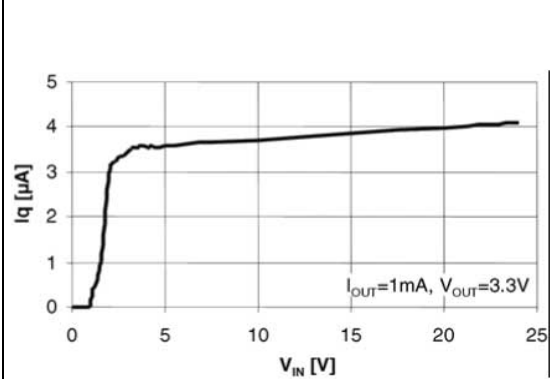
GIPG240420141208RV

Figure 9. Output noise voltage vs. frequency



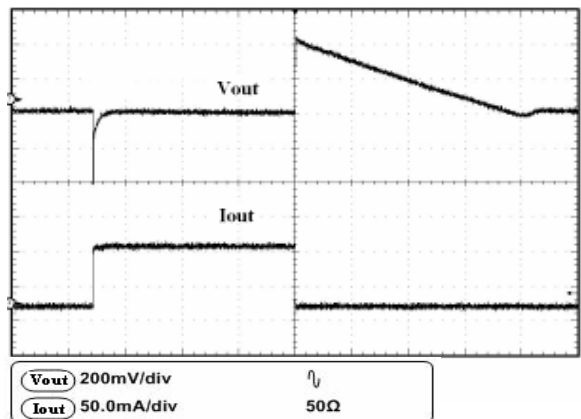
GIPG240420141406RV

Figure 10. Quiescent current vs. input voltage



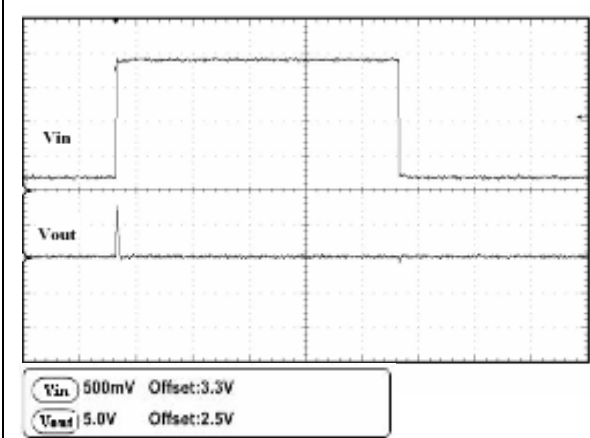
GIPG230420141425RV

Figure 11. Load transient



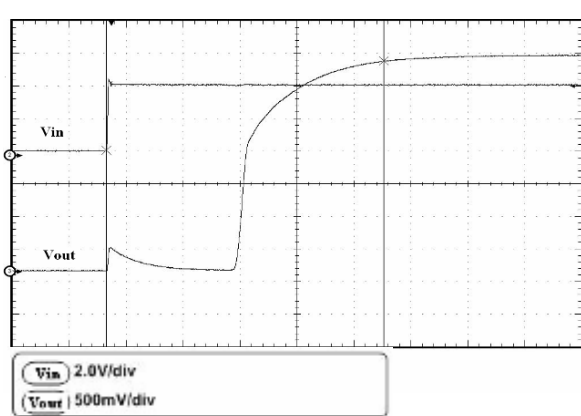
$C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ ,  $V_{EN} = V_{IN} = 24\text{ V}$ ,  $I_{OUT}$  = from 1 mA to 85 mA,  $t_R = t_F = 5\text{ }\mu\text{s}$

Figure 12. Line transient



$C_{OUT} = 1\text{ }\mu\text{F}$ ;  $V_{IN} = V_{EN}$  = from 4.3 to 22 V;  $I_{OUT} = 1\text{ mA}$ ;  $t_R = t_F = 5\text{ }\mu\text{s}$

Figure 13. Enable transient



$C_{IN} = C_{OUT} = 1\text{ }\mu\text{F}$ ,  $V_{EN} = V_{IN} = 0$  to 4.3 V,  $I_{OUT} = 1\text{ mA}$

## 7 Package information

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

### 7.1 SOT23-5L package information

Figure 14. SOT23-5L package outline

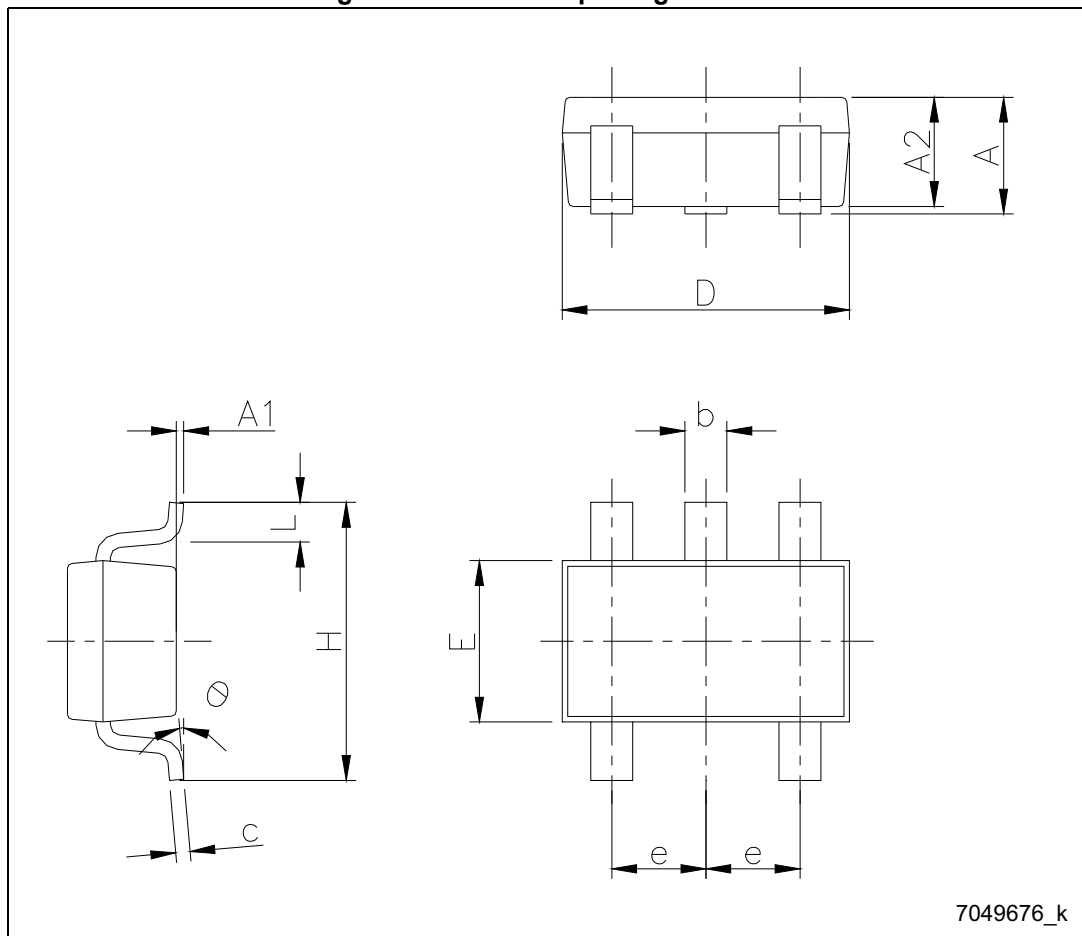
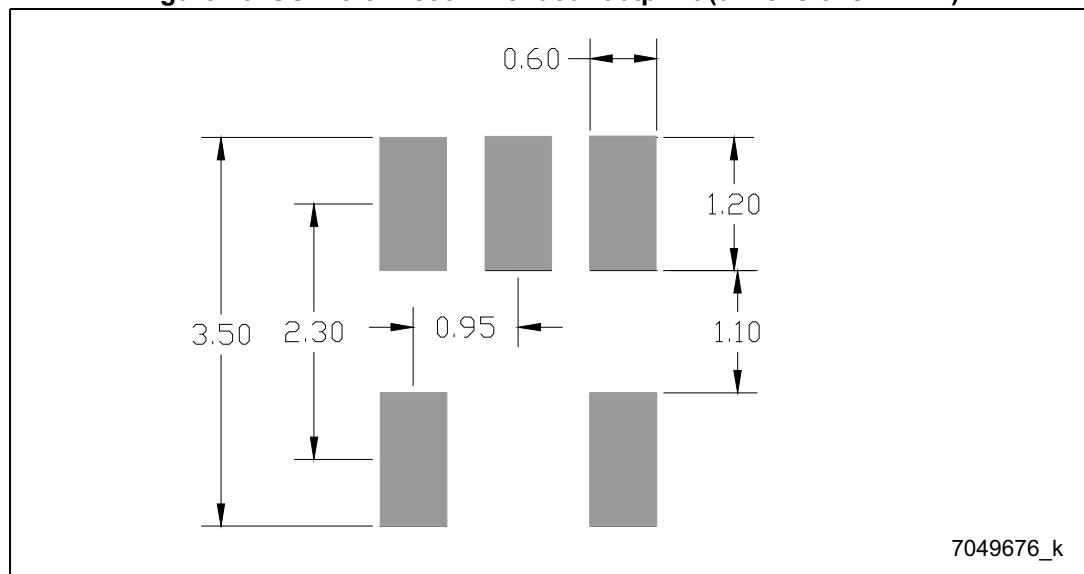


Table 7. SOT23-5L package mechanical data

| Symbol | Dimensions (mm) |      |      |
|--------|-----------------|------|------|
|        | Min.            | Typ. | Max. |
| A      | 0.90            | -    | 1.45 |
| A1     | 0.00            | -    | 0.15 |
| A2     | 0.90            | -    | 1.30 |
| b      | 0.30            | -    | 0.50 |
| c      | 0.009           | -    | 0.20 |
| D      | 2.80            | 2.95 | 3.05 |
| E      | 1.50            | 1.60 | 1.75 |
| e      | -               | 0.95 | -    |
| H      | 2.60            | 2.80 | 3.00 |
| L      | 0.30            | -    | 0.60 |
| q      | 0.00            | -    | 8.00 |

Figure 15. SOT23-5L recommended footprint (dimensions in mm)



## 7.2 DFN8 3x3 package information

Figure 16. DFN8 3x3 package outline

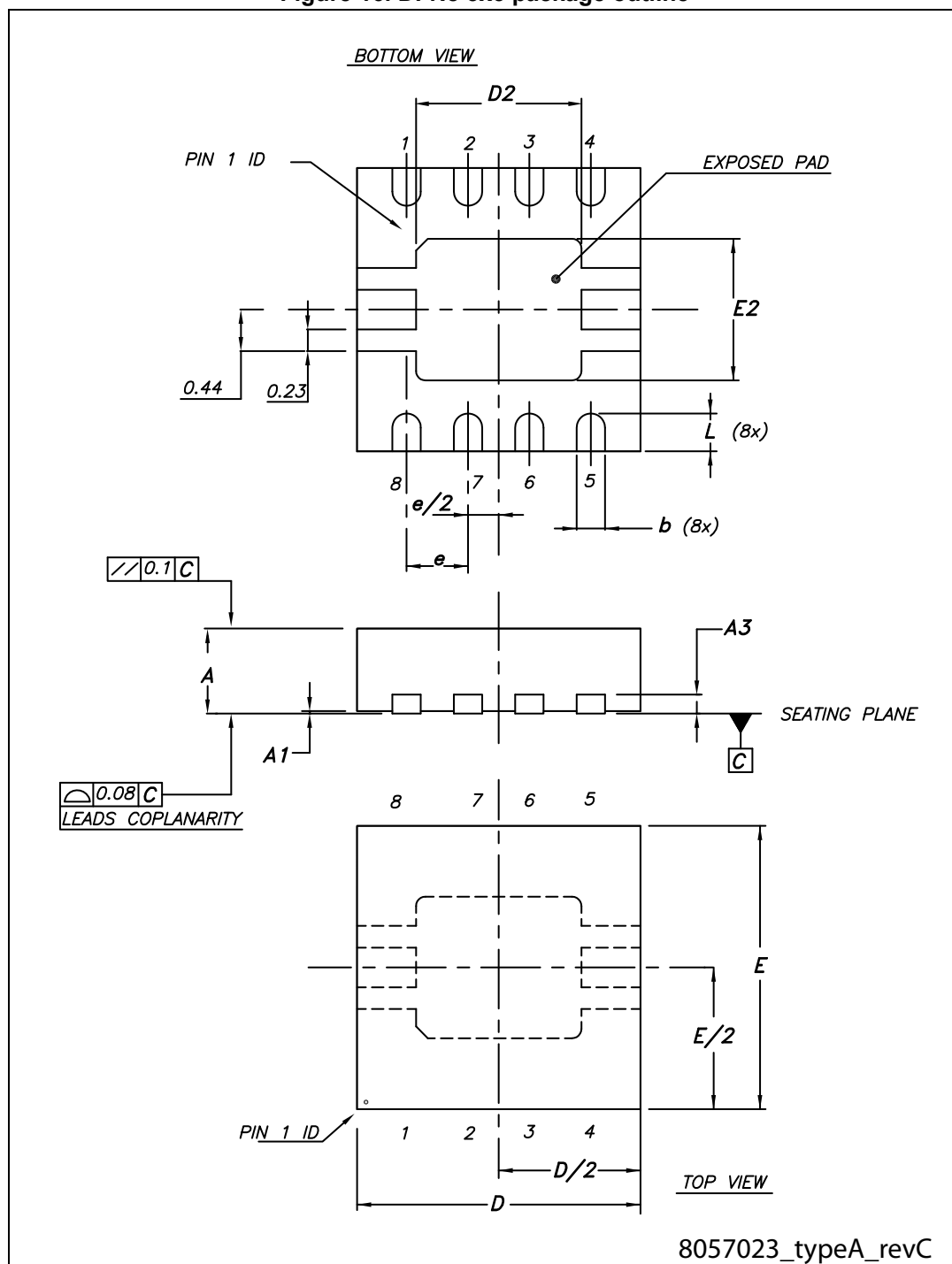
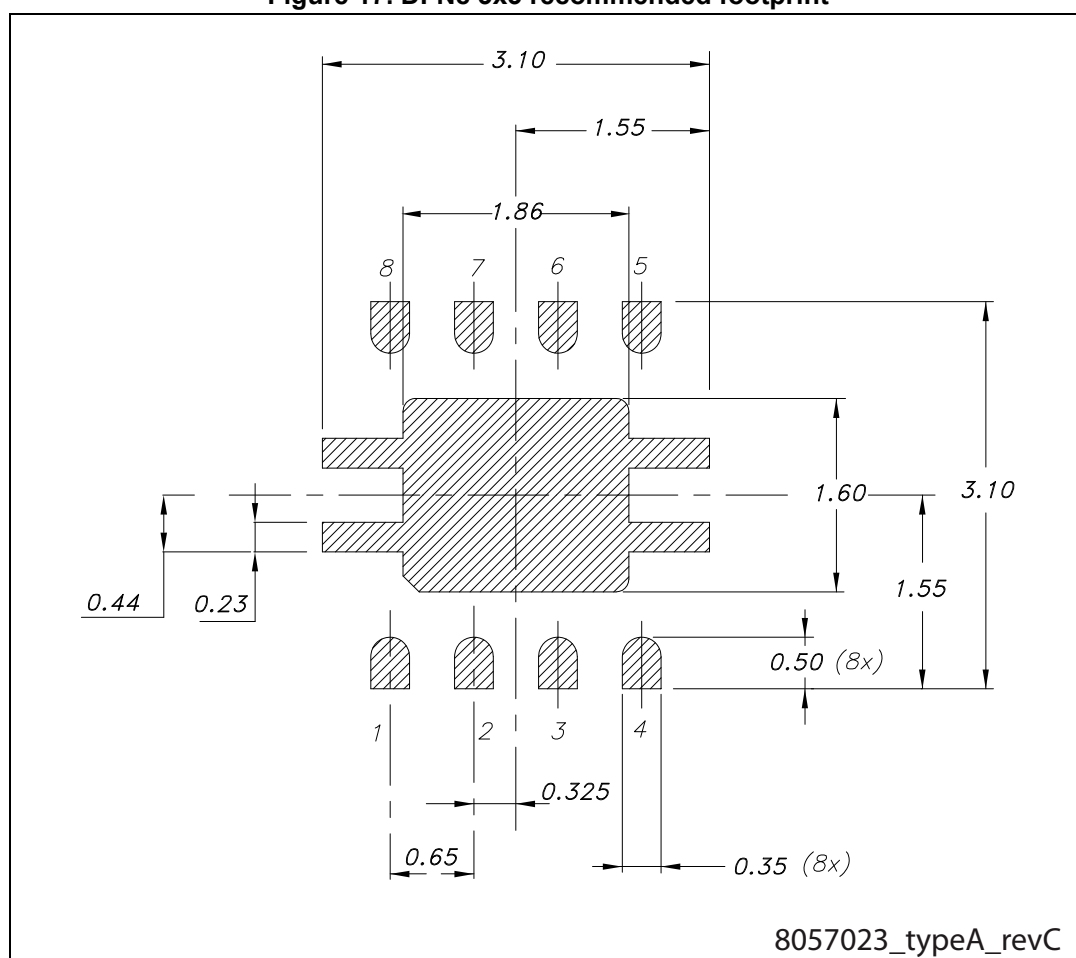


Table 8. DFN8 3x3 package mechanical data

| Symbol | Dimensions (mm) |       |       |
|--------|-----------------|-------|-------|
|        | Min             | Typ   | Max.  |
| A      | 0.80            | 0.90  | 1.00  |
| A1     | 0.00            | 0.02  | 0.05  |
| A3     | -               | 0.20  | -     |
| b      | 0.25            | 0.30  | 0.35  |
| D      | 2.85            | 3.00  | 3.15  |
| D2     | 1.603           | 1.753 | 1.853 |
| E      | 2.85            | 3.00  | 3.15  |
| E2     | 1.345           | 1.495 | 1.595 |
| e      | 0.00            | 0.65  | -     |
| L      | 0.30            | 0.40  | 0.50  |

Figure 17. DFN8 3x3 recommended footprint



## 8 Packaging information

### 8.1 Tape and reel SOT23-5L

Figure 18. SOT23-5L tape and reel drawing

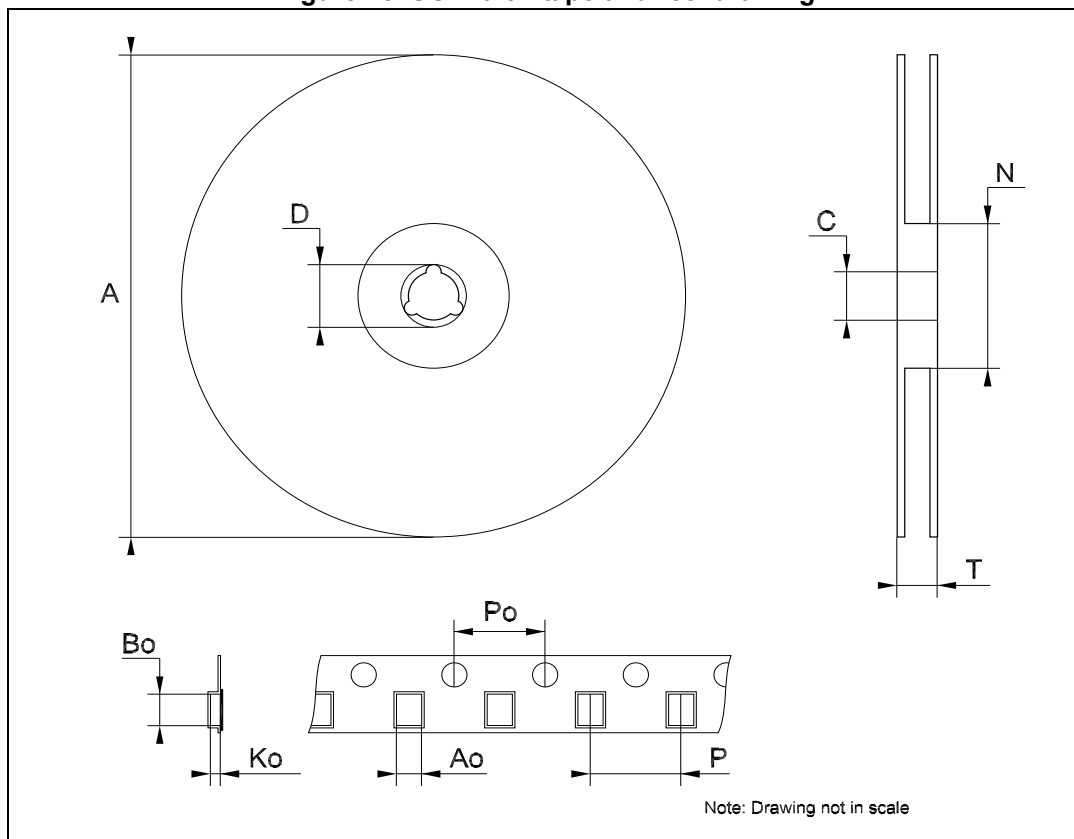
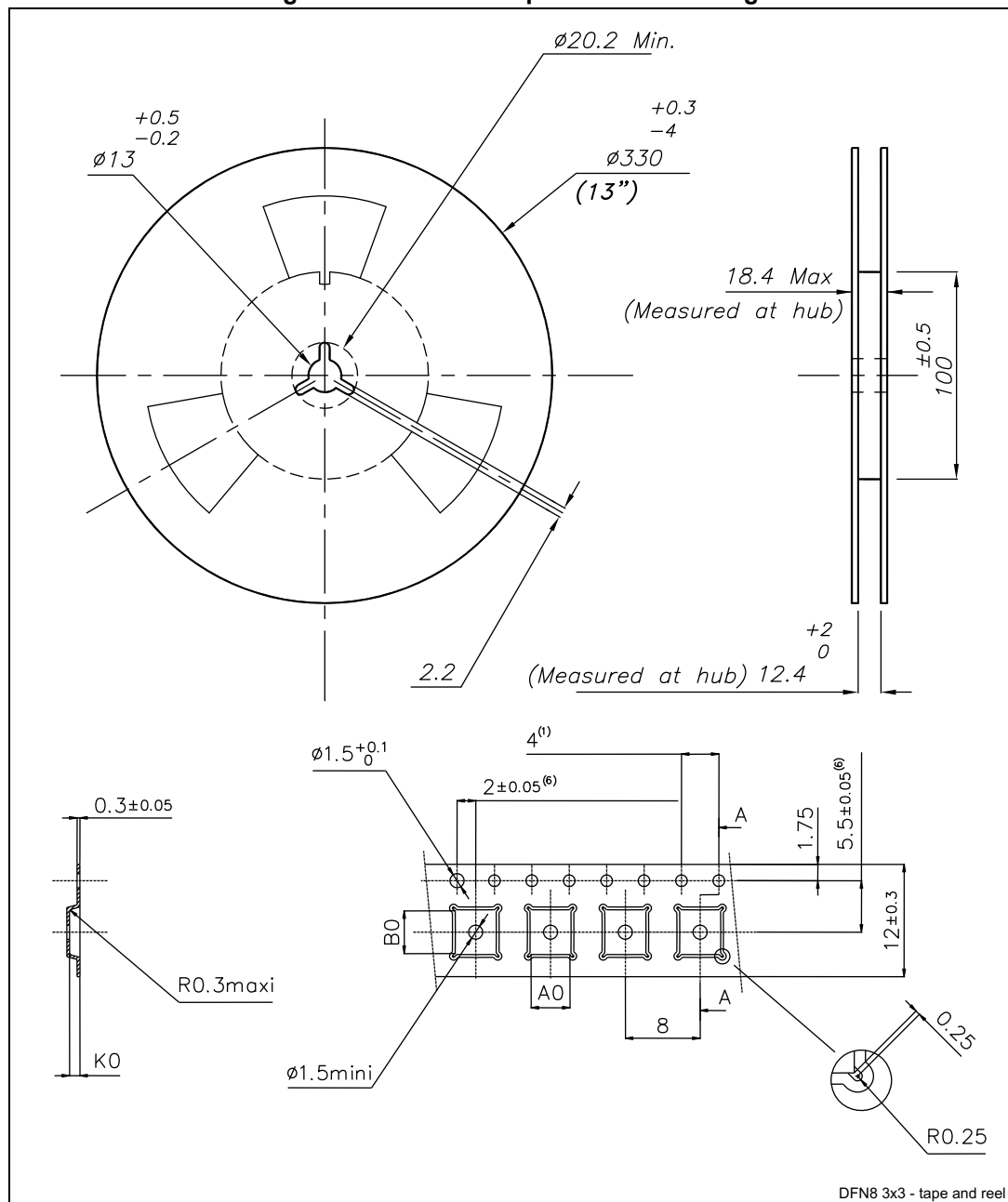


Table 9. SOT23-5L tape and reel mechanical data

| Symbol | Dimensions (mm) |       |        |
|--------|-----------------|-------|--------|
|        | Min.            | Typ.  | Max.   |
| A      |                 | -     | 180.00 |
| C      | 12.80           | 13.00 | 13.20  |
| D      | 20.20           | -     | -      |
| N      | 60.00           | -     | -      |
| T      | -               | -     | 14.40  |
| Ao     | 3.13            | 3.23  | 3.33   |
| Bo     | 3.07            | 3.17  | 3.27   |
| Ko     | 1.27            | 1.37  | 1.47   |
| Po     | 3.90            | 4.00  | 4.10   |
| P      | 3.90            | 4.00  | 4.10   |

## 8.2 Tape and reel DFN8 3x3

Figure 19. DFN8 3x3 tape and reel drawing



1. 10 sprocket hole pitch cumulative tolerance  $\pm 0.2$ .
2. Camber not to exceed 1 mm in 100 mm.
3. Material: PS + C.
4. A0 and B0 measured as indicated.
5. K0 measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
6. Pocked position relative to sprocket hole measured as true position of pocket, not pocket hole.



Table 10. DFN8 3x3 tape and reel mechanical data

| Symbol | Dimensions (mm) |      |        |
|--------|-----------------|------|--------|
|        | Min.            | Typ. | Max.   |
| A      | -               | -    | 180.00 |
| C      | 12.80           | -    | 13.20  |
| D      | 20.20           | -    | -      |
| N      | 60.00           | -    | -      |
| T      | -               | -    | 14.40  |
| Ao     | -               | 3.30 | -      |
| Bo     | -               | 3.30 | -      |
| Ko     | -               | 1.10 | -      |
| Po     | -               | 4.00 | -      |
| P      | -               | 8.00 | -      |

## 9 Revision history

**Table 11. Document revision history**

| Date        | Revision | Changes                                                                                                                                                                                                                               |
|-------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 09-Jul-2014 | 1        | Initial release.                                                                                                                                                                                                                      |
| 28-Nov-2017 | 2        | Updated <a href="#">Table 1 on page 1</a> (removed references to note <a href="#">1</a> . from LDK715M33R, LDK715PU33R, and LDK715PU42R).<br>Added <a href="#">Figure 19 on page 16</a> .<br>Minor modifications throughout document. |

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- Поставка образцов и прототипов;
- Техническая поддержка проекта;
- Защита от снятия компонента с производства.



#### Как с нами связаться

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