

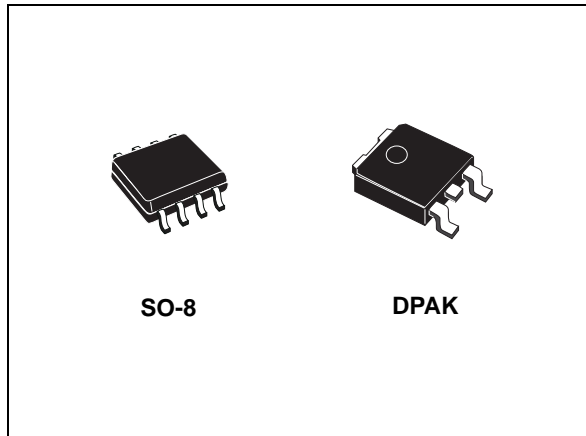


**THE DATASHEET OF  
KF33BD-TR**



## Very low drop voltage regulators with inhibit

Datasheet - production data



### Description

The KF series are very low drop regulators available in SO-8 and DPAK packages and in a wide range of output voltages.

The very low dropout voltage (0.4 V) and the very low quiescent current make them particularly suitable for low noise, low power applications and especially in battery powered systems.

A shutdown logic control function is available (pin 5, TTL compatible). This means that when the device is used as a local regulator, it is possible to put a part of the board in standby, decreasing the total power consumption. It requires only a 2.2  $\mu$ F capacitor for stability allowing space and cost saving.

### Features

- Very low dropout voltage (0.4 V)
- Very low quiescent current (typ. 50  $\mu$ A in OFF mode, 500  $\mu$ A in ON mode)
- Output current up to 500 mA
- Logic-controlled electronic shutdown
- Output voltages of 2.5; 3.3; 5; 8 V
- Internal current and thermal limit
- Only 2.2  $\mu$ F for stability
- Available in  $\pm 2$  % accuracy at 25 °C
- Supply voltage rejection: 70 db (typ.)
- Temperature range: - 40 to 125 °C

**Table 1. Device summary**

Order codes		Output voltages
SO-8 (tape and reel)	DPAK (tape and reel)	
KF25BD-TR	KF25BDT-TR	2.5 V
KF33BD-TR	KF33BDT-TR	3.3 V
KF50BD-TR	KF50BDT-TR	5 V
	KF80BDT-TR	8 V

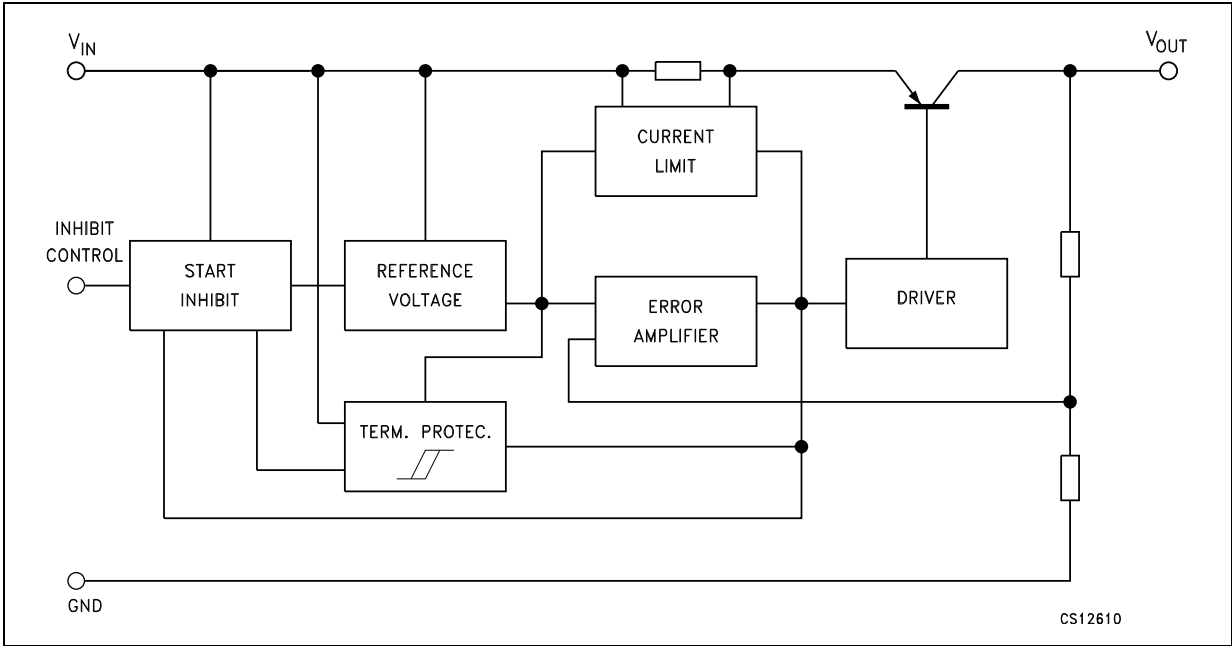
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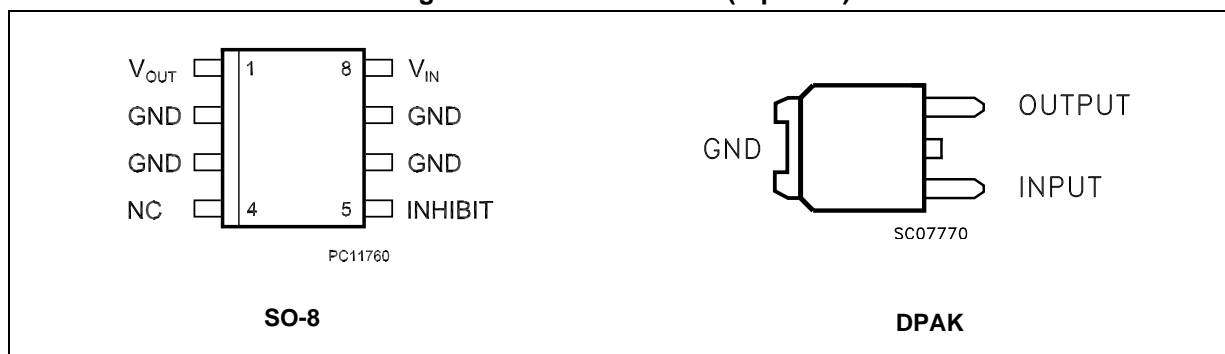
# 1 Diagram

Figure 1. Schematic diagram



## 2 Pin configuration

Figure 2. Pin connections (top view)



### 3 Maximum ratings

Table 2. Absolute maximum ratings

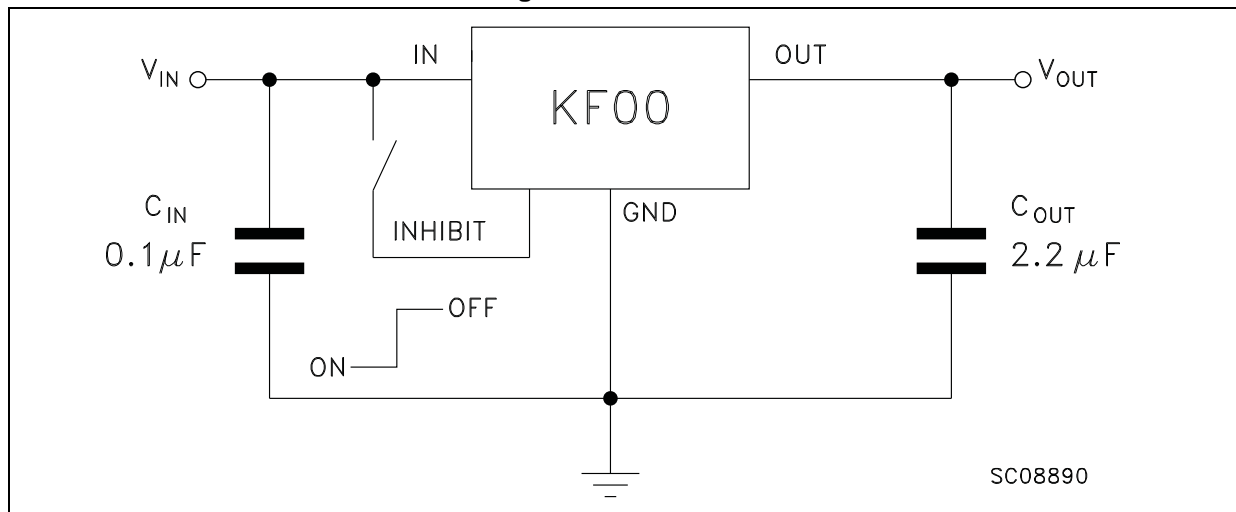
Symbol	Parameter	Value	Unit
$V_I$	DC input voltage	- 0.5 to 20	V
$I_O$	Output current	Internally Limited	
$P_{TOT}$	Power dissipation	Internally Limited	
$T_{STG}$	Storage temperature range	- 40 to 150	°C
$T_{OP}$	Operating junction temperature range	- 40 to 125	°C

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

Table 3. Thermal data

Symbol	Parameter	DPAK	SO-8	Unit
$R_{thJC}$	Thermal resistance junction-case	8	20	°C/W
$R_{thJA}$	Thermal resistance junction-ambient	100	55	°C/W

Figure 3. Test circuit



## 4 Electrical characteristics

Refer to the test circuits,  $T_J = 25\text{ }^\circ\text{C}$ ,  $C_I = 0.1\text{ }\mu\text{F}$ ,  $C_O = 2.2\text{ }\mu\text{F}$  unless otherwise specified.

**Table 4. Electrical characteristics ( $V_O = 2.5\text{ V}$ )**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage	$I_O = 50\text{ mA}$ , $V_I = 4.5\text{ V}$	2.45	2.5	2.55	V
		$I_O = 50\text{ mA}$ , $V_I = 4.5\text{ V}$ , $T_a = -25\text{ to }85\text{ }^\circ\text{C}$	2.4		2.6	
$V_I$	Operating input voltage	$I_O = 500\text{ mA}$			20	V
$I_O$	Output current limit			1		A
$\Delta V_O$	Line regulation	$V_I = 3.5\text{ to }20\text{ V}$ , $I_O = 5\text{ mA}$		2	12	mV
$\Delta V_O$	Load regulation	$V_I = 3.8\text{ V}$ , $I_O = 5\text{ to }500\text{ mA}$		2	50	mV
$I_d$	Quiescent current	$V_I = 3.5\text{ to }20\text{ V}$ , $I_O = 0\text{ mA}$	ON MODE	0.5	1	mA
		$V_I = 3.8\text{ to }20\text{ V}$ , $I_O = 500\text{ mA}$			12	
		$V_I = 6\text{ V}$	OFF MODE	50	100	$\mu\text{A}$
SVR	Supply voltage rejection	$I_O = 5\text{ mA}$ , $V_I = 4.5 \pm 1\text{ V}$	$f = 120\text{ Hz}$	82		dB
			$f = 1\text{ kHz}$	77		
			$f = 10\text{ kHz}$	60		
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ KHz}$		50		$\mu\text{V}$
$V_d$	Dropout voltage	$I_O = 200\text{ mA}$		0.2	0.35	V
		$I_O = 500\text{ mA}$		0.4	0.7	
$V_{IL}$	Control input logic low	$T_a = -40\text{ to }125\text{ }^\circ\text{C}$			0.8	V
$V_{IH}$	Control input logic high	$T_a = -40\text{ to }125\text{ }^\circ\text{C}$	2			V
$I_I$	Control input current	$V_I = 6\text{ V}$ , $V_C = 6\text{ V}$		10		$\mu\text{A}$
$C_O$	Output bypass capacitance	$\text{ESR} = 0.1\text{ to }10\text{ }\Omega$ , $I_O = 0\text{ to }500\text{ mA}$	2	10		$\mu\text{F}$

Refer to the test circuits,  $T_J = 25\text{ }^\circ\text{C}$ ,  $C_I = 0.1\text{ }\mu\text{F}$ ,  $C_O = 2.2\text{ }\mu\text{F}$  unless otherwise specified.

**Table 5. Electrical characteristics ( $V_O = 3.3\text{ V}$ )**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
$V_O$	Output voltage	$I_O = 50\text{ mA}$ , $V_I = 5.3\text{ V}$	3.234	3.3	3.366	V	
		$I_O = 50\text{ mA}$ , $V_I = 5.3\text{ V}$ , $T_a = -25\text{ to }85\text{ }^\circ\text{C}$	3.168		3.432		
$V_I$	Operating input voltage	$I_O = 500\text{ mA}$			20	V	
$I_O$	Output current limit			1		A	
$\Delta V_O$	Line regulation	$V_I = 4.3\text{ to }20\text{ V}$ , $I_O = 5\text{ mA}$		2	12	mV	
$\Delta V_O$	Load regulation	$V_I = 4.6\text{ V}$ , $I_O = 5\text{ to }500\text{ mA}$		2	50	mV	
$I_d$	Quiescent current	$V_I = 4.3\text{ to }20\text{ V}$ , $I_O = 0\text{ mA}$	ON MODE		0.5	1	mA
		$V_I = 4.6\text{ to }20\text{ V}$ , $I_O = 500\text{ mA}$				12	
		$V_I = 6\text{ V}$	OFF MODE		50	100	$\mu\text{A}$
SVR	Supply voltage rejection	$I_O = 5\text{ mA}$ , $V_I = 5.3 \pm 1\text{ V}$	$f = 120\text{ Hz}$		80	dB	
			$f = 1\text{ kHz}$		75		
			$f = 10\text{ kHz}$		60		
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ KHz}$		50		$\mu\text{V}$	
$V_d$	Dropout voltage	$I_O = 200\text{ mA}$		0.2	0.35	V	
		$I_O = 500\text{ mA}$		0.4	0.7		
$V_{IL}$	Control input logic low	$T_a = -40\text{ to }125\text{ }^\circ\text{C}$			0.8	V	
$V_{IH}$	Control input logic high	$T_a = -40\text{ to }125\text{ }^\circ\text{C}$	2			V	
$I_I$	Control input current	$V_I = 6\text{ V}$ , $V_C = 6\text{ V}$		10		$\mu\text{A}$	
$C_O$	Output bypass capacitance	$\text{ESR} = 0.1\text{ to }10\text{ }\Omega$ , $I_O = 0\text{ to }500\text{ mA}$	2	10		$\mu\text{F}$	

Refer to the test circuits,  $T_J = 25\text{ }^\circ\text{C}$ ,  $C_I = 0.1\text{ }\mu\text{F}$ ,  $C_O = 2.2\text{ }\mu\text{F}$  unless otherwise specified.

**Table 6. Electrical characteristics ( $V_O = 5\text{ V}$ )**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage	$I_O = 50\text{ mA}$ , $V_I = 7\text{ V}$	4.9	5	5.1	V
		$I_O = 50\text{ mA}$ , $V_I = 7\text{ V}$ , $T_a = -25\text{ to }85\text{ }^\circ\text{C}$	4.8		5.2	
$V_I$	Operating input voltage	$I_O = 500\text{ mA}$			20	V
$I_O$	Output current limit			1		A
$\Delta V_O$	Line regulation	$V_I = 6\text{ to }20\text{ V}$ , $I_O = 5\text{ mA}$		3	18	mV
$\Delta V_O$	Load regulation	$V_I = 6.3\text{ V}$ , $I_O = 5\text{ to }500\text{ mA}$		2	50	mV
$I_d$	Quiescent current	$V_I = 6\text{ to }20\text{ V}$ , $I_O = 0\text{ mA}$	ON MODE	0.5	1	mA
		$V_I = 6.3\text{ to }20\text{ V}$ , $I_O = 500\text{ mA}$			12	
		$V_I = 6\text{ V}$	OFF MODE	50	100	$\mu\text{A}$
SVR	Supply voltage rejection	$I_O = 5\text{ mA}$ , $V_I = 7 \pm 1\text{ V}$	$f = 120\text{ Hz}$	76		dB
			$f = 1\text{ kHz}$	71		
			$f = 10\text{ kHz}$	60		
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ KHz}$		50		$\mu\text{V}$
$V_d$	Dropout voltage	$I_O = 200\text{ mA}$		0.2	0.35	V
		$I_O = 500\text{ mA}$		0.4	0.7	
$V_{IL}$	Control input logic low	$T_a = -40\text{ to }125\text{ }^\circ\text{C}$			0.8	V
$V_{IH}$	Control input logic high	$T_a = -40\text{ to }125\text{ }^\circ\text{C}$	2			V
$I_I$	Control input current	$V_I = 6\text{ V}$ , $V_C = 6\text{ V}$		10		$\mu\text{A}$
$C_O$	Output bypass capacitance	$\text{ESR} = 0.1\text{ to }10\text{ }\Omega$ , $I_O = 0\text{ to }500\text{ mA}$	2	10		$\mu\text{F}$

Refer to the test circuits,  $T_J = 25\text{ }^\circ\text{C}$ ,  $C_I = 0.1\text{ }\mu\text{F}$ ,  $C_O = 2.2\text{ }\mu\text{F}$  unless otherwise specified.

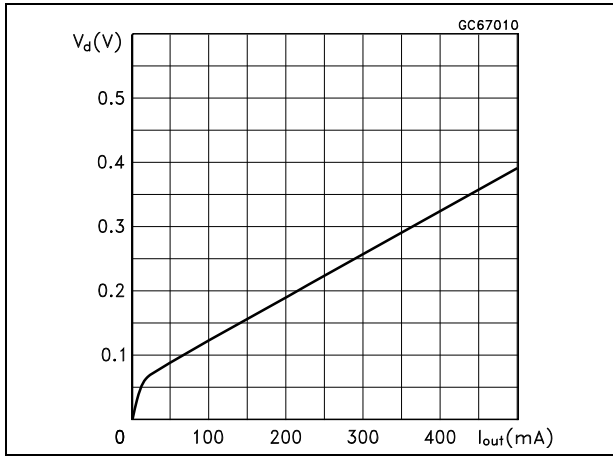
**Table 7. Electrical characteristics ( $V_O = 8\text{ V}$ )**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage	$I_O = 50\text{ mA}$ , $V_I = 10\text{ V}$	7.84	8	8.16	V
		$I_O = 50\text{ mA}$ , $V_I = 10\text{ V}$ , $T_a = -25\text{ to }85\text{ }^\circ\text{C}$	7.68		8.32	
$V_I$	Operating input voltage	$I_O = 500\text{ mA}$			20	V
$I_O$	Output current limit			1		A
$\Delta V_O$	Line regulation	$V_I = 9\text{ to }20\text{ V}$ , $I_O = 5\text{ mA}$		4	24	mV
$\Delta V_O$	Load regulation	$V_I = 9.3\text{ V}$ , $I_O = 5\text{ to }500\text{ mA}$		2	50	mV
$I_d$	Quiescent current	$V_I = 9\text{ to }20\text{ V}$ , $I_O = 0\text{ mA}$	ON MODE	0.7	1.5	mA
		$V_I = 9.3\text{ to }20\text{ V}$ , $I_O = 500\text{ mA}$			12	
		$V_I = 9\text{ V}$	OFF MODE	70	140	$\mu\text{A}$
SVR	Supply voltage rejection	$I_O = 5\text{ mA}$ , $V_I = 10 \pm 1\text{ V}$	$f = 120\text{ Hz}$	72		dB
			$f = 1\text{ kHz}$	67		
			$f = 10\text{ kHz}$	60		
eN	Output noise voltage	$B = 10\text{ Hz to }100\text{ KHz}$		50		$\mu\text{V}$
$V_d$	Dropout voltage	$I_O = 200\text{ mA}$		0.2	0.35	V
		$I_O = 500\text{ mA}$		0.4	0.7	
$V_{IL}$	Control input logic low	$T_a = -40\text{ to }125\text{ }^\circ\text{C}$			0.8	V
$V_{IH}$	Control input logic high	$T_a = -40\text{ to }125\text{ }^\circ\text{C}$	2			V
$I_I$	Control input current	$V_I = 6\text{ V}$ , $V_C = 6\text{ V}$		10		$\mu\text{A}$
$C_O$	Output bypass capacitance	$\text{ESR} = 0.1\text{ to }10\text{ }\Omega$ , $I_O = 0\text{ to }500\text{ mA}$	2	10		$\mu\text{F}$

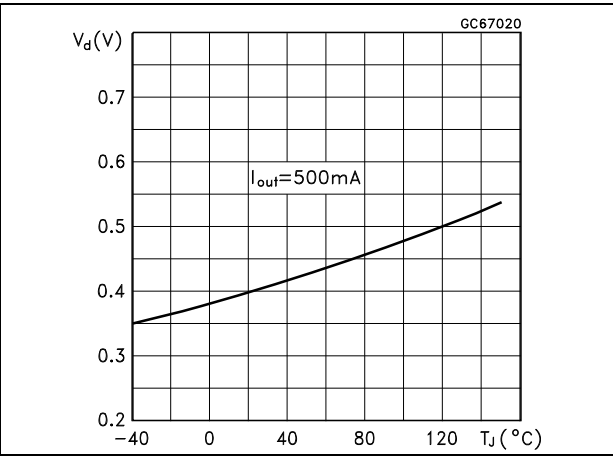
# 5 Typical performance characteristics

Unless otherwise specified  $V_{O(NOM)} = 3.3\text{ V}$ .

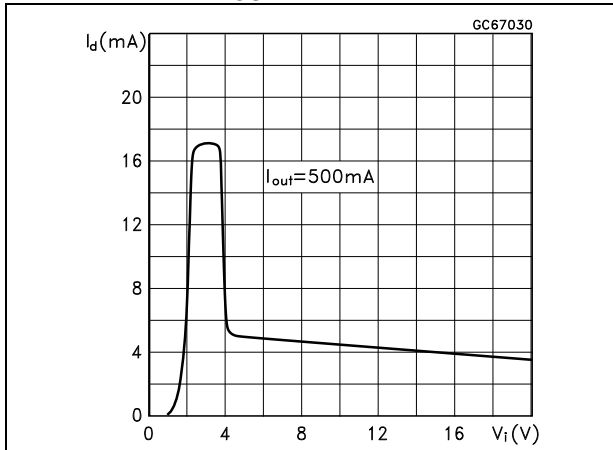
**Figure 4. Dropout voltage vs. output current**



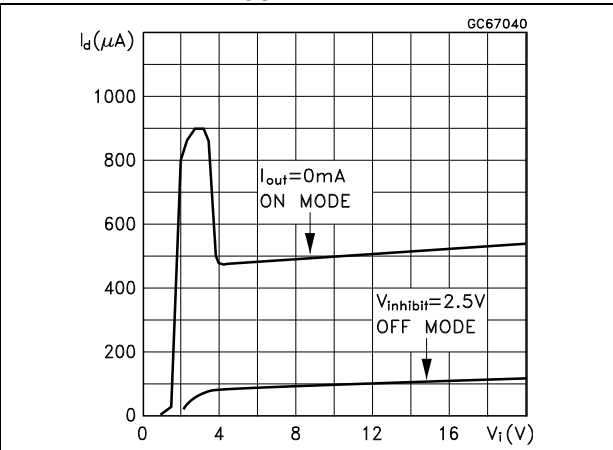
**Figure 5. Dropout voltage vs. temperature**



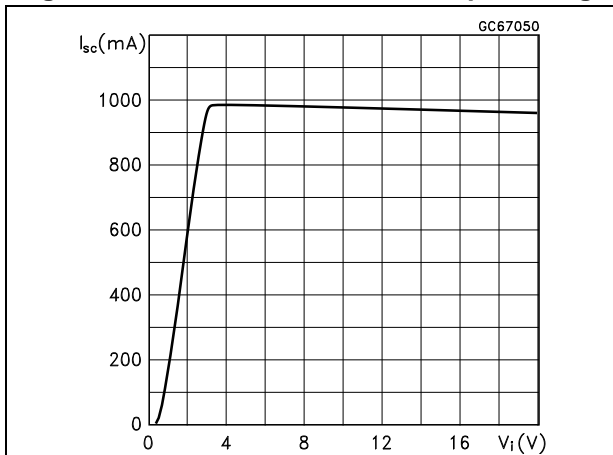
**Figure 6. Supply current vs. input voltage ( $I_{OUT} = 500\text{ mA}$ )**



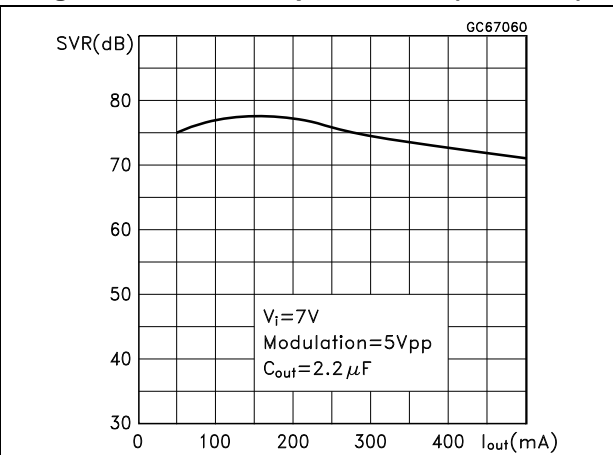
**Figure 7. Supply current vs. input voltage ( $I_{OUT} = 0\text{ mA}$ )**



**Figure 8. Short circuit current vs. input voltage**



**Figure 9. SVR vs. output current ( $f = 120\text{ Hz}$ )**



## 6 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.

Figure 10. DPAK (TO-252) type A drawing

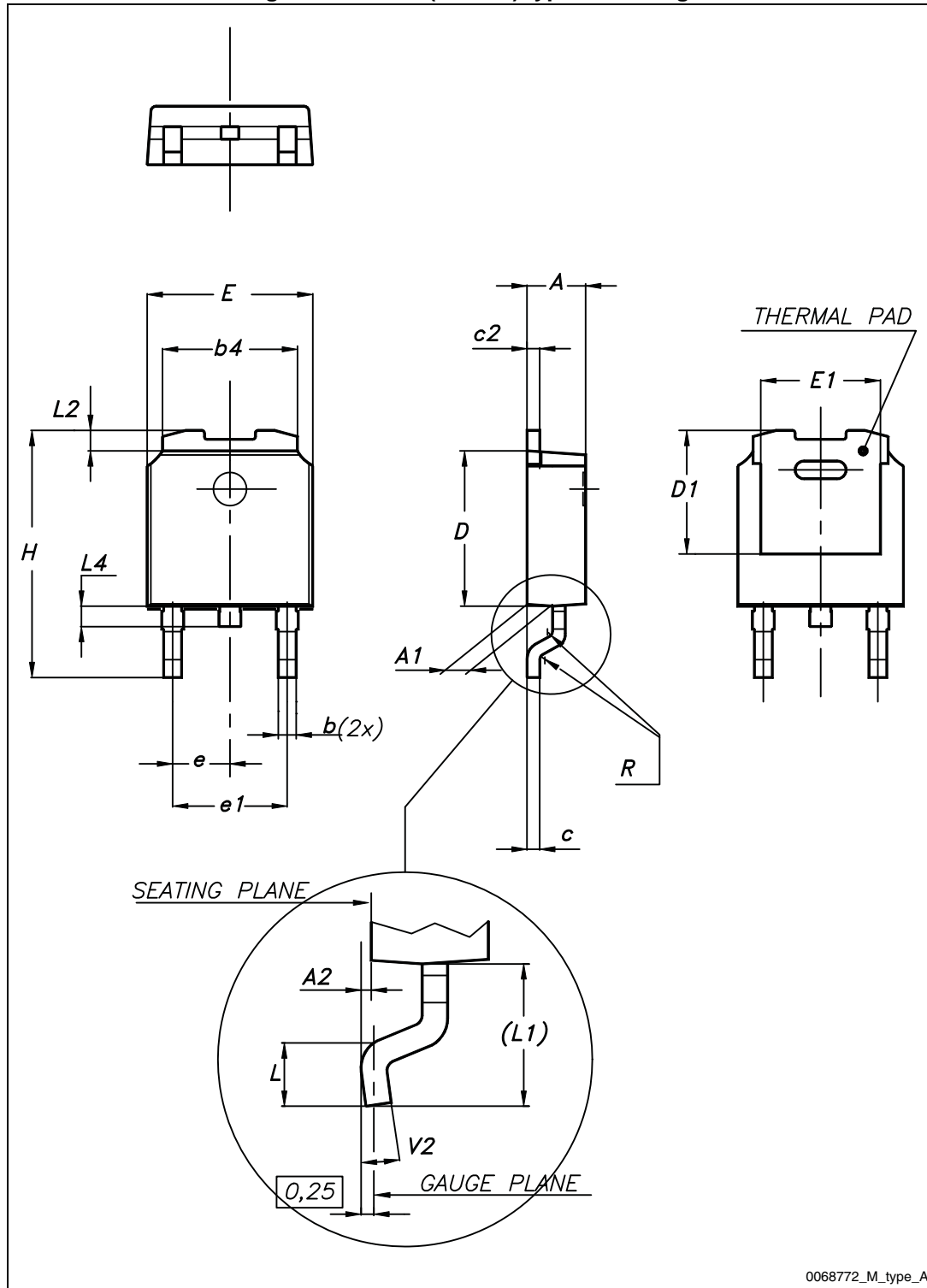
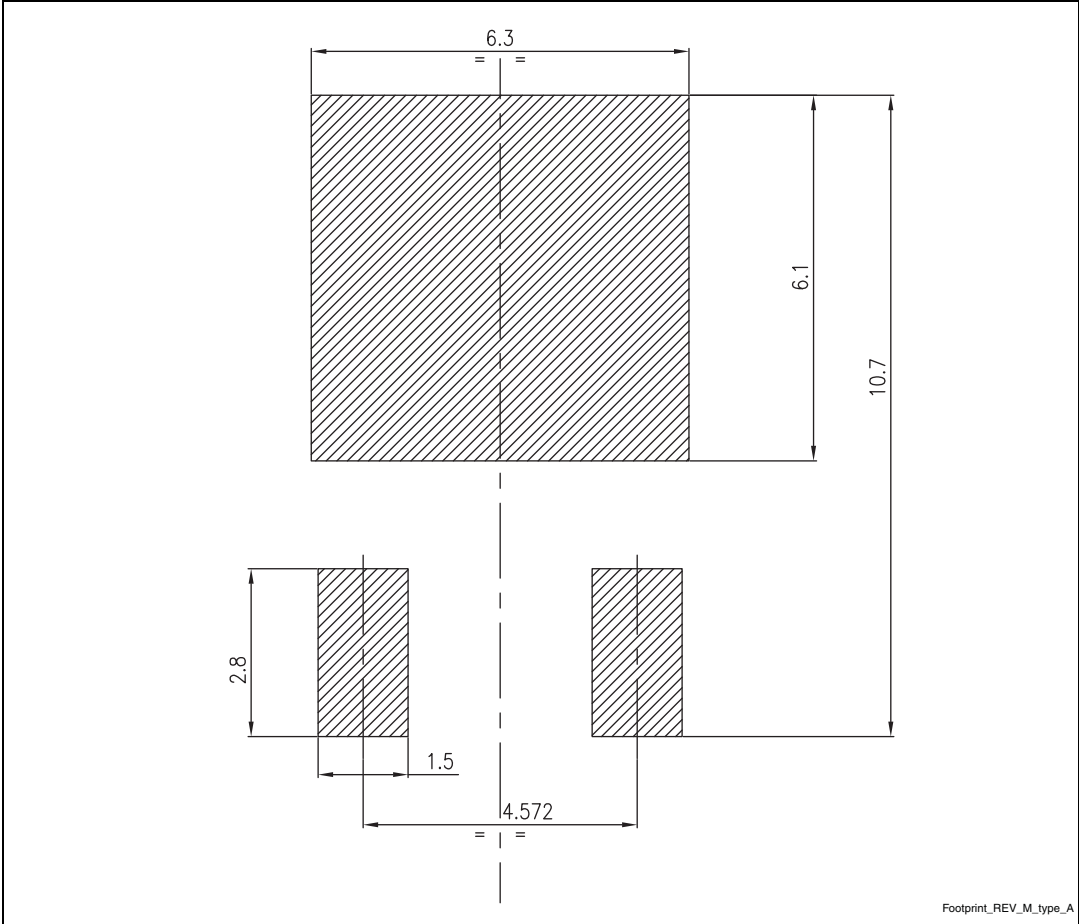


Table 8. DPAK (TO-252) type A mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1.00		1.50
(L1)		2.80	
L2		0.80	
L4	0.60		1.00
R		0.20	
V2	0°		8°

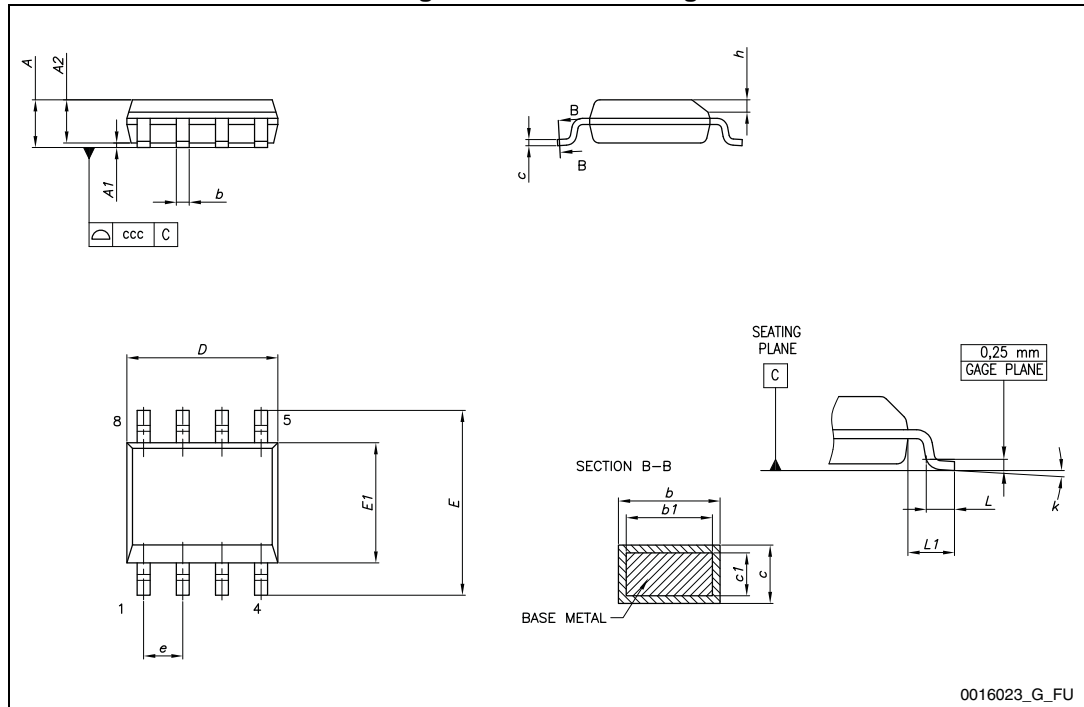
Figure 11. DPAK (TO-252) type A footprint (a)



a. All dimensions are in millimeters



Figure 12. SO-8 drawing



0016023\_G\_FU

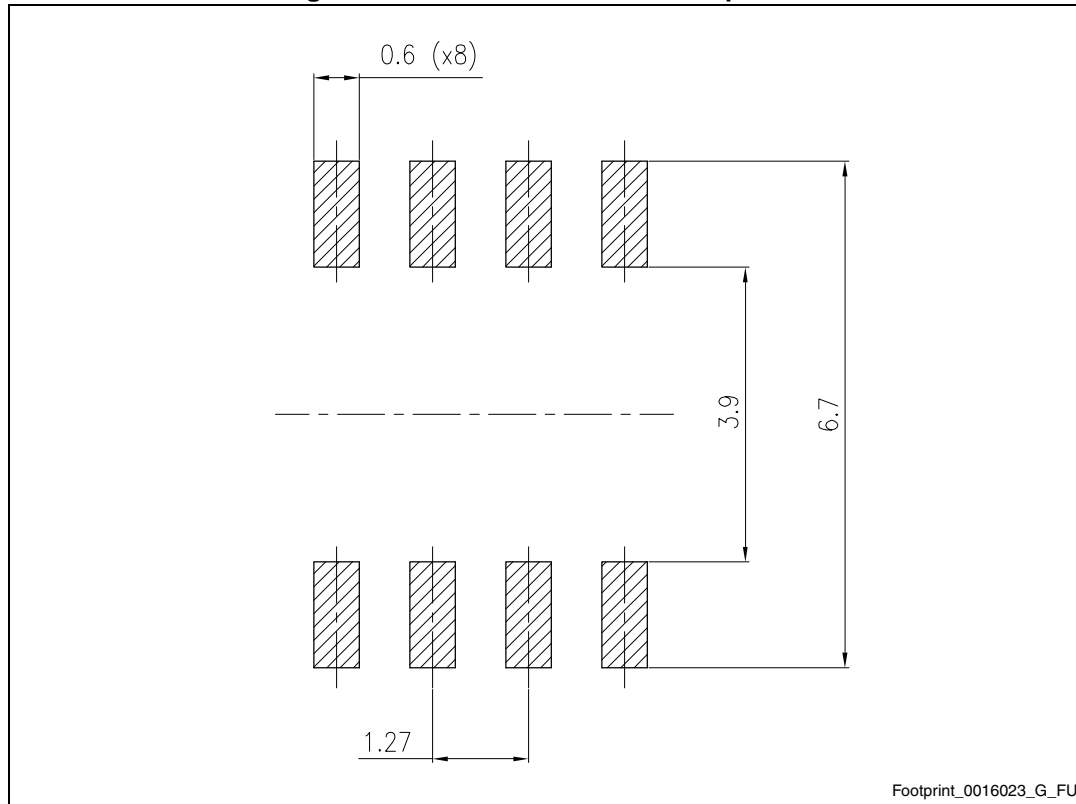
Table 9. SO-8 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			1.75
A1	0.10		0.25
A2	1.25		
b	0.31		0.51
b1	0.28		0.48
c	0.10		0.25
c1	0.10		0.23
D	4.80	4.90	5.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e		1.27	
h	0.25		0.50
L	0.40		1.27
L1		1.04	
L2		0.25	

Table 9. SO-8 mechanical data (continued)

Dim.	mm		
	Min.	Typ.	Max.
k	0°		8°
ccc			0.10

Figure 13. SO-8 recommended footprint<sup>(b)</sup>



Footprint\_0016023\_G\_FU

b. All dimensions are in millimeters.

# 7 Packaging mechanical data

Figure 14. Tape for DPAK (TO-252)

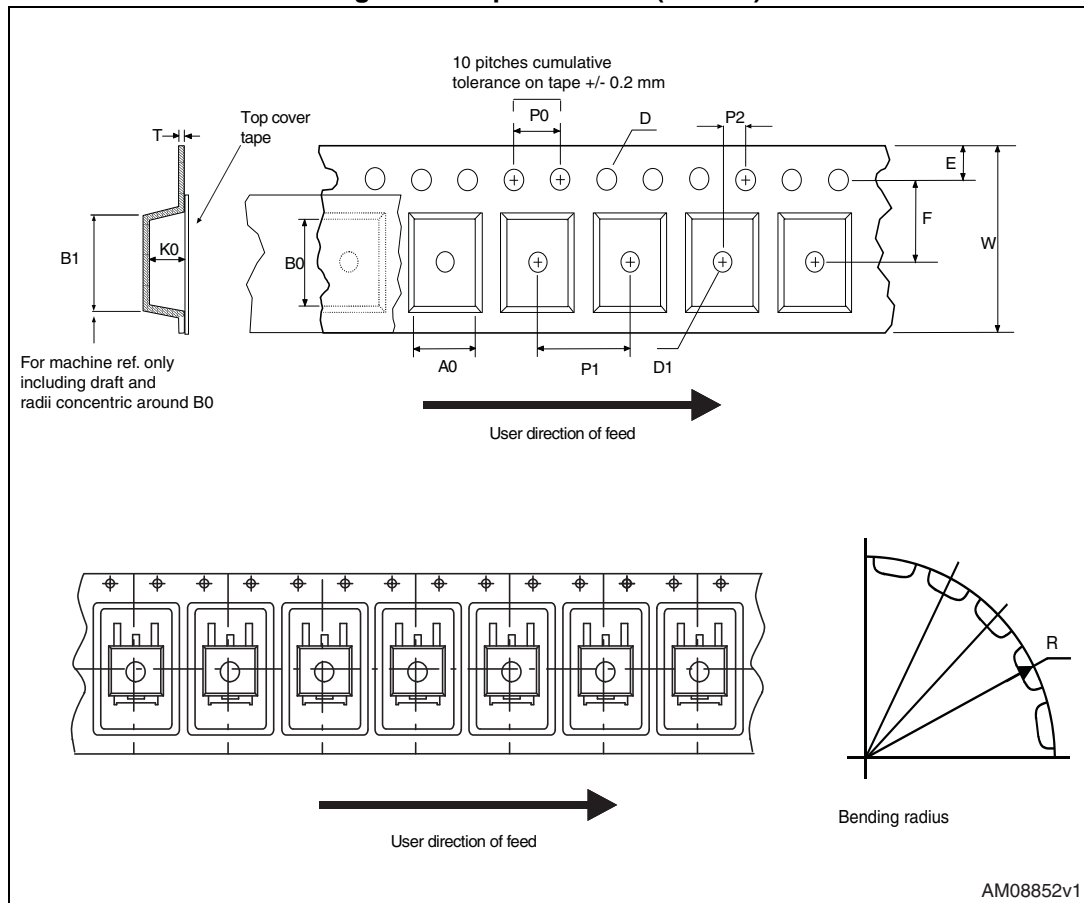


Figure 15. Reel for DPAK (TO-252)

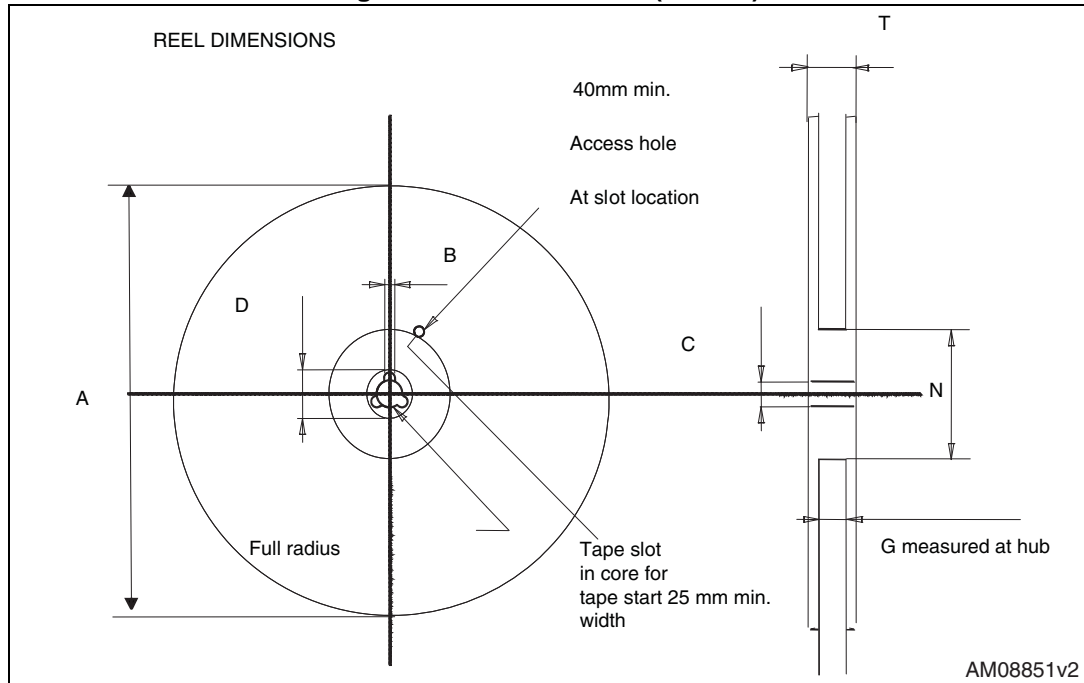


Table 10. DPAK (TO-252) tape and reel mechanical data

Tape			Reel		
Dim.	mm		Dim.	mm	
	Min.	Max.		Min.	Max.
A0	6.8	7	A		330
B0	10.4	10.6	B	1.5	
B1		12.1	C	12.8	13.2
D	1.5	1.6	D	20.2	
D1	1.5		G	16.4	18.4
E	1.65	1.85	N	50	
F	7.4	7.6	T		22.4
K0	2.55	2.75			
P0	3.9	4.1		Base qty.	2500
P1	7.9	8.1		Bulk qty.	2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

Figure 16. SO-8 tape and reel dimensions

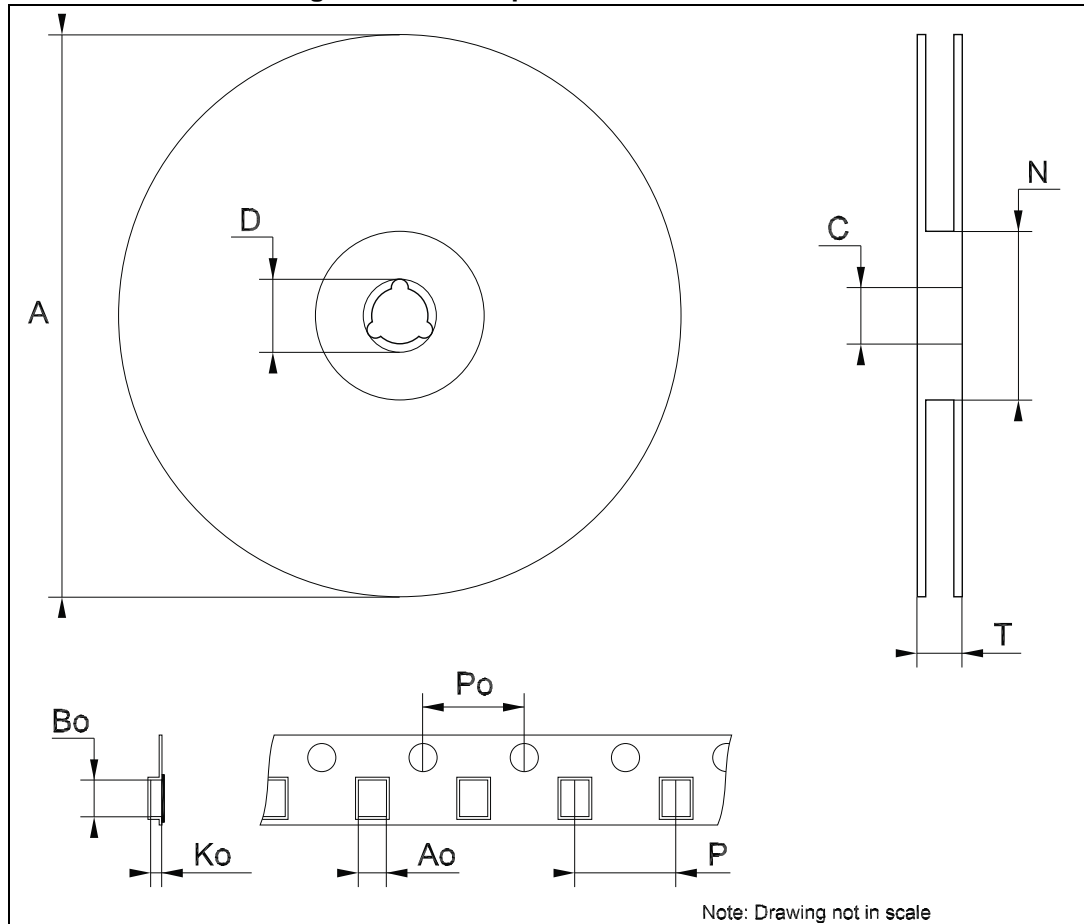


Table 11. SO-8 tape and reel mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A			330
C	12.8		13.2
D	20.2		
N	60		
T			22.4
Ao	8.1		8.5
Bo	5.5		5.9
Ko	2.1		2.3
Po	3.9		4.1
P	7.9		8.1

## 8 Revision history

**Table 12. Document revision history**

<b>Date</b>	<b>Revision</b>	<b>Changes</b>
06-Jun-2007	9	Order codes updated.
14-Dec-2007	10	Modified: Table 1.
21-Feb-2008	11	Modified: Table 1.
23-Oct-2012	12	Change title description in cover page. Updated: Table 1 on page 1. Added: $R_{thJA}$ value for DPAK and SO-8 Table 3 on page 5. Modified: titles Figure 6 and Figure 7 on page 10.
19-Mar-2014	13	The part numbers KF25B, KF33B, KF50B, KF80B changed to KF. Updated Section 6: Package mechanical data and Section 7: Packaging mechanical data. Minor text changes.
16-Feb-2018	14	Minor text changes.

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