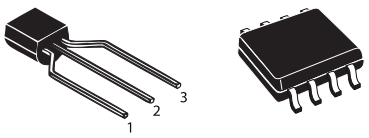
LEXX

Very low-dropout voltage regulator with inhibit function

Datasheet - production data



TO-92
Tape and reel
Ammopack

SO-8

Features

- Very low-dropout voltage (0.2 V typ.)
- Very low quiescent current (typ. 50 µA in OFF mode, 0.5 mA in ON mode, no load)
- Output current up to 100 mA
- Output voltages: 3 V, 3.3 V, 4.5 V, 5 V, 8 V
- Internal current and thermal limit
- Small 2.2 µF capacitor for stability
- Available in ±1% (A) or ±2% (C) selection at 25 °C
- Supply voltage rejection: 80 dB (typ.)
- Temperature range: -40 to 125 °C

Description

The LEXX is a very low-dropout voltage regulator available in SO-8, TO-92 packages and over a wide range of output voltages.

The very low-dropout voltage (0.2 V) and low quiescent current make it particularly suitable for low-noise, low-power applications and in battery-powered systems.

This device is pin-to-pin compatible with the L78L series. Furthermore, in the 8-pin configuration (SO-8), it uses a shutdown logic control (pin 5, TTL compatible). This means that when the device is used as a local regulator, a part of the board can be put in standby, decreasing the total power consumption. In the three-terminal configuration (TO-92), the device is always in on-state. It requires a 2.2 µF capacitor for stability, reducing the component size and cost.

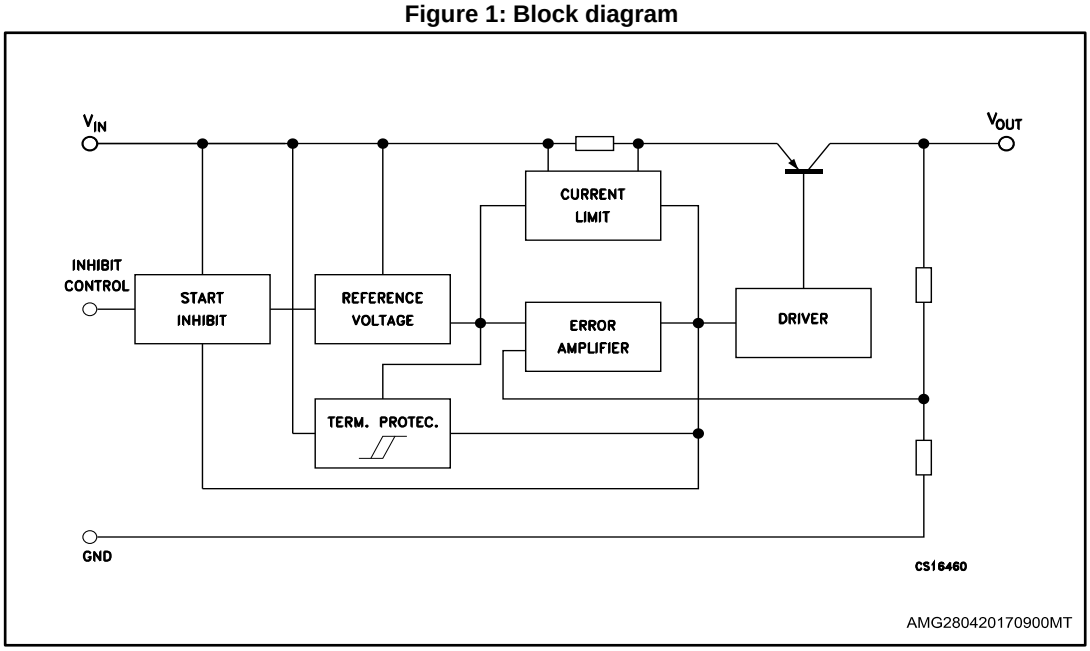
Table 1: Device summary

Order code			Output voltage (V)
SO-8	TO-92 (Ammopack)	TO-92 (tape and reel)	
LE30CD-TR			3
LE33CD-TR	LE33CZ-AP	LE33CZ-TR	3.3
LE45CD-TR			4.5
LE50ABD-TR	LE33ABZ-AP		5
LE50CD-TR			5
LE80CD-TR			8

Contents

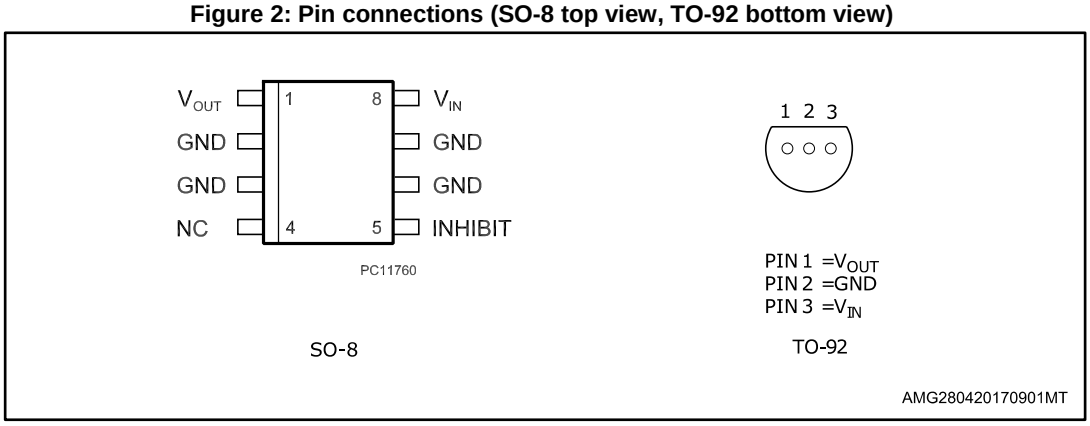
1 Diagram

Figure 1: Block diagram



2 Pin configuration

Figure 2: Pin connections (SO-8 top view, TO-92 bottom view)



3 Maximum ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_I	DC input voltage	20	V
I_O	Output current	Internally limited (1)	
P_{TOT}	Power dissipation	Internally limited	
T_{STG}	Storage temperature range	-65 to 150	°C
T_{OP}	Operating junction temperature range	-40 to 125	°C

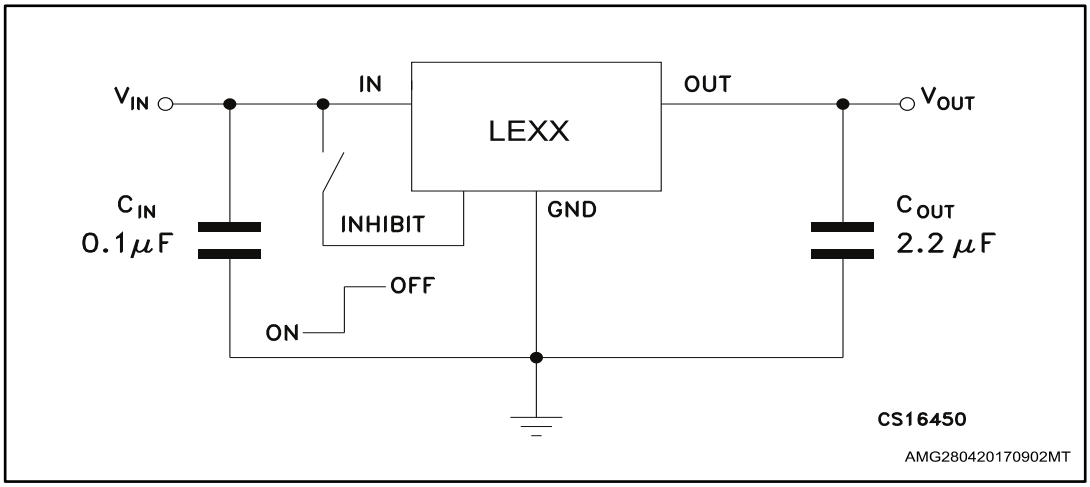
Notes:

(1)Our SO-8 package, used for voltage regulators, is modified internally to have pins 2, 3, 6 and 7 electrically fused to the die attach pad. This frame decreases the total thermal resistance of the package and increases its ability to dissipate power when an appropriate area of copper on the printed circuit board is available for heatsinking. The external dimensions are the same as SO-8 standard.

Table 3: Thermal data

Symbol	Parameter	SO-8	TO-92	Unit
R_{thJC}	Thermal resistance junction-case	20		°C/W
R_{thJA}	Thermal resistance junction-ambient	55	200	°C/W

Figure 3: Test circuit



If the INHIBIT pin is left floating, the regulator is in ON mode. However, when the inhibit function is not used, it should be grounded to avoid any noise.

4 Electrical characteristics

Refer to test circuits, T_J = 25 °C, C_I = 0.1 µF, C_O = 2.2 µF unless otherwise specified.

Table 4: LE30AB electrical characteristics

Symbol	Parameter	Test condition		Min.	Typ.	Max.	Unit
V_O	Output voltage	I_O = 10 mA V_I = 5 V		2.970	3	3.030	V
		I_O = 10 mA V_I = 5 V T_J = -25 to 85 °C		2.940		3.060	
V_I	Operating input voltage	I_O = 100 mA				18	V
I_O	Output current limit			150			mA
ΔV_O	Line regulation	V_I = 3.7 to 18 V I_O = 0.5 mA			3	15	mV
ΔV_O	Load regulation	V_I = 4 V I_O = 0.5 to 100 mA			3	15	mV
I_d	Quiescent current	V_I = 4 to 18 V I_O = 0 mA	ON mode		0.5	1	mA
		V_I = 4 to 18 V I_O = 100 mA			1.5	3	
		V_I = 6 V	OFF mode		50	100	µA
SVR	Supply voltage rejection	I_O = 5 mA V_I = 5 ± 1 V	f = 120 Hz		81		dB
			f = 1 kHz		76		
			f = 10 kHz		60		
eN	Output noise voltage	B = 10 Hz to 100 kHz			50		µV
V_d	Dropout voltage	I_O = 100 mA			0.2	0.4	V
		I_O = 100 mA T_J = -40 to 125 °C				0.5	
V_{IL}	Control input logic low	T_J = -40 to 125 °C				0.8	V
V_{IH}	Control input logic high	T_J = -40 to 125 °C		2			V
I_I	Control input current	V_I = 6 V V_C = 6 V			10		µA
C_O	Output bypass capacitance	ESR = 0.1 to 10 Ω I_O = 0 to 100 mA		2	10		µF

Refer to test circuits, T_J = 25 °C, C_I = 0.1 µF, C_O = 2.2 µF unless otherwise specified.

Table 5: LE30C electrical characteristics

Symbol	Parameter	Test condition		Min.	Typ.	Max.	Unit
V_O	Output voltage	I_O = 10 mA V_I = 5 V		2.940	3	3.060	V
		I_O = 10 mA V_I = 5 V T_J = -25 to 85 °C		2.880		3.120	
V_I	Operating input voltage	I_O = 100 mA				18	V
I_O	Output current limit			150			mA
ΔV_O	Line regulation	V_I = 3.7 to 18 V I_O = 0.5 mA			3	20	mV
ΔV_O	Load regulation	V_I = 4 V I_O = 0.5 to 100 mA			3	25	mV
I_d	Quiescent current	V_I = 4 to 18 V I_O = 0 mA	ON mode		0.5	1	mA
		V_I = 4 to 18 V I_O = 100 mA			1.5	3	
		V_I = 6 V	OFF mode		50	100	µA
SVR	Supply voltage rejection	I_O = 5 mA V_I = 5 ± 1 V	f = 120 Hz		81		dB
			f = 1 kHz		76		
			f = 10 kHz		60		
eN	Output noise voltage	B = 10 Hz to 100 kHz			50		µV
V_d	Dropout voltage	I_O = 100 mA			0.2	0.4	V
		I_O = 100 mA T_J = -40 to 125 °C				0.5	
V_{IL}	Control input logic low	T_J = -40 to 125 °C				0.8	V
V_{IH}	Control input logic high	T_J = -40 to 125 °C		2			V
I_I	Control input current	V_I = 6 V V_C = 6 V			10		µA
C_O	Output bypass capacitance	ESR = 0.1 to 10 Ω I_O = 0 to 100 mA		2	10		µF

Refer to test circuits, T_J = 25 °C, C_I = 0.1 µF, C_O = 2.2 µF unless otherwise specified.

Table 6: LE33C electrical characteristics

Symbol	Parameter	Test condition		Min.	Typ.	Max.	Unit
V_O	Output voltage	I_O = 10 mA V_I = 5.3 V		3.234	3.3	3.366	V
		I_O = 10 mA V_I = 5.3 V T_J = -25 to 85 °C		3.168		3.432	
V_I	Operating input voltage	I_O = 100 mA				18	V
I_O	Output current limit			150			mA
ΔV_O	Line regulation	V_I = 4 to 18 V I_O = 0.5 mA			3	20	mV
ΔV_O	Load regulation	V_I = 4.3 V I_O = 0.5 to 100 mA			3	25	mV
I_d	Quiescent current	V_I = 4.3 to 18 V I_O = 0 mA	ON mode		0.5	1	mA
		V_I = 4.3 to 18 V I_O = 100 mA			1.5	3	
		V_I = 6 V	OFF mode		50	100	µA
SVR	Supply voltage rejection	I_O = 5 mA V_I = 5.3 ± 1 V	f = 120 Hz		80		dB
			f = 1 kHz		75		
			f = 10 kHz		60		
eN	Output noise voltage	B = 10 Hz to 100 kHz			50		µV
V_d	Dropout voltage	I_O = 100 mA			0.2	0.4	V
		I_O = 100 mA T_J = -40 to 125 °C				0.5	
V_{IL}	Control input logic low	T_J = -40 to 125 °C				0.8	V
V_{IH}	Control input logic high	T_J = -40 to 125 °C		2			V
I_I	Control input current	V_I = 6 V V_C = 6 V			10		µA
C_O	Output bypass capacitance	ESR = 0.1 to 10 Ω I_O = 0 to 100 mA		2	10		µF

Refer to test circuits, T_J = 25 °C, C_I = 0.1 µF, C_O = 2.2 µF unless otherwise specified.

Table 7: LE45C electrical characteristics

Symbol	Parameter	Test condition		Min.	Typ.	Max.	Unit
V_O	Output voltage	I_O = 10 mA V_I = 6.5 V		4.41	4.5	4.59	V
		I_O = 10 mA V_I = 6.5 V T_J = -25 to 85 °C		4.32		4.68	
V_I	Operating input voltage	I_O = 100 mA				18	V
I_O	Output current limit			150			mA
ΔV_O	Line regulation	V_I = 5.2 to 18 V I_O = 0.5 mA			4	30	mV
ΔV_O	Load regulation	V_I = 5.5 V I_O = 0.5 to 100 mA			3	25	mV
I_d	Quiescent current	V_I = 5.5 to 18 V I_O = 0 mA	ON mode		0.5	1	mA
		V_I = 5.5 to 18 V I_O = 100 mA			1.5	3	
		V_I = 6 V	OFF mode		50	100	µA
SVR	Supply voltage rejection	I_O = 5 mA V_I = 6.5 ± 1 V	f = 120 Hz		77		dB
			f = 1 kHz		72		
			f = 10 kHz		60		
eN	Output noise voltage	B = 10 Hz to 100 kHz			50		µV
V_d	Dropout voltage	I_O = 100 mA			0.2	0.4	V
		I_O = 100 mA T_J = -40 to 125 °C				0.5	
V_{IL}	Control input logic low	T_J = -40 to 125 °C				0.8	V
V_{IH}	Control input logic high	T_J = -40 to 125 °C		2			V
I_I	Control input current	V_I = 6 V V_C = 6 V			10		µA
C_O	Output bypass capacitance	ESR = 0.1 to 10 Ω I_O = 0 to 100 mA		2	10		µF

Refer to test circuits, T_J = 25 °C, C_I = 0.1 µF, C_O = 2.2 µF unless otherwise specified.

Table 8: LE50AB electrical characteristics

Symbol	Parameter	Test condition		Min.	Typ.	Max.	Unit
V_O	Output voltage	I_O = 10 mA V_I = 7 V		4.95	5	5.05	V
		I_O = 10 mA V_I = 7 V T_J = -25 to 85 °C		4.9		5.1	
V_I	Operating input voltage	I_O = 100 mA				18	V
I_O	Output current limit			150	350	425	mA
ΔV_O	Line regulation	V_I = 5.7 to 18 V I_O = 0.5 mA			4	20	mV
ΔV_O	Load regulation	V_I = 6 V I_O = 0.5 to 100 mA			3	15	mV
I_d	Quiescent current	V_I = 6 to 18 V I_O = 0 mA	ON mode		0.5	1	mA
		V_I = 6 to 18 V I_O = 100 mA			1.5	3	
		V_I = 6 V	OFF mode		50	100	µA
SVR	Supply voltage rejection	I_O = 5 mA V_I = 7 ± 1 V	f = 120 Hz		76		dB
			f = 1 kHz		71		
			f = 10 kHz		60		
eN	Output noise voltage	B = 10 Hz to 100 kHz			50		µV
V_d	Dropout voltage	I_O = 100 mA			0.2	0.4	V
		I_O = 100 mA T_J = -40 to 125 °C				0.5	
V_{IL}	Control input logic low	T_J = -40 to 125 °C				0.8	V
V_{IH}	Control input logic high	T_J = -40 to 125 °C		2			V
I_I	Control input current	V_I = 6 V V_C = 6 V			10		µA
C_O	Output bypass capacitance	ESR = 0.1 to 10 Ω I_O = 0 to 100 mA		2	10		µF

Refer to test circuits, T_J = 25 °C, C_I = 0.1 µF, C_O = 2.2 µF unless otherwise specified.

Table 9: LE50C electrical characteristics

Symbol	Parameter	Test condition		Min.	Typ.	Max.	Unit
V_O	Output voltage	I_O = 10 mA V_I = 7 V		4.9	5	5.1	V
		I_O = 10 mA V_I = 7 V T_J = -25 to 85 °C		4.8		5.2	
V_I	Operating input voltage	I_O = 100 mA				18	V
I_O	Output current limit			150	350	425	mA
ΔV_O	Line regulation	V_I = 5.7 to 18 V I_O = 0.5 mA			4	30	mV
ΔV_O	Load regulation	V_I = 6 V I_O = 0.5 to 100 mA			3	25	mV
I_d	Quiescent current	V_I = 6 to 18 V I_O = 0 mA	ON mode		0.5	1	mA
		V_I = 6 to 18 V I_O = 100 mA			1.5	3	
		V_I = 6 V	OFF mode		50	100	µA
SVR	Supply voltage rejection	I_O = 5 mA V_I = 7 ± 1 V	f = 120 Hz		76		dB
			f = 1 kHz		71		
			f = 10 kHz		60		
eN	Output noise voltage	B = 10 Hz to 100 kHz			50		µV
V_d	Dropout voltage	I_O = 100 mA			0.2	0.4	V
		I_O = 100 mA T_J = -40 to 125 °C				0.5	
V_{IL}	Control input logic low	T_J = -40 to 125 °C				0.8	V
V_{IH}	Control input logic high	T_J = -40 to 125 °C		2			V
I_I	Control input current	V_I = 6 V V_C = 6 V			10		µA
C_O	Output bypass capacitance	ESR = 0.1 to 10 Ω I_O = 0 to 100 mA		2	10		µF

Refer to test circuits, T_J = 25 °C, C_I = 0.1 µF, C_O = 2.2 µF unless otherwise specified.

Table 10: LE80C electrical characteristics

Symbol	Parameter	Test condition		Min.	Typ.	Max.	Unit
V_O	Output voltage	I_O = 10 mA V_I = 10 V		7.84	8	8.16	V
		I_O = 10 mA V_I = 10 V T_J = -25 to 85 °C		7.68		8.32	
V_I	Operating input voltage	I_O = 100 mA				18	V
I_O	Output current limit			150			mA
ΔV_O	Line regulation	V_I = 8.7 to 18 V I_O = 0.5 mA			5	35	mV
ΔV_O	Load regulation	V_I = 9 V I_O = 0.5 to 100 mA			3	25	mV
I_d	Quiescent current	V_I = 9 to 18 V I_O = 0 mA	ON mode		0.7	1.6	mA
		V_I = 9 to 18 V I_O = 100 mA			1.7	3.6	
		V_I = 9 V	OFF mode		70	140	µA
SVR	Supply voltage rejection	I_O = 5 mA V_I = 10 ± 1 V	f = 120 Hz		72		dB
			f = 1 kHz		66		
			f = 10 kHz		57		
eN	Output noise voltage	B = 10 Hz to 100 kHz			50		µV
V_d	Dropout voltage	I_O = 100 mA			0.2	0.4	V
		I_O = 100 mA T_J = -40 to 125 °C				0.5	
V_{IL}	Control input logic low	T_J = -40 to 125 °C				0.8	V
V_{IH}	Control input logic high	T_J = -40 to 125 °C		2			V
I_I	Control input current	V_I = 9 V V_C = 6 V			10		µA
C_O	Output bypass capacitance	ESR = 0.1 to 10 Ω I_O = 0 to 100 mA		2	10		µF

5 Typical performance characteristics

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

Figure 4: Dropout voltage vs output current

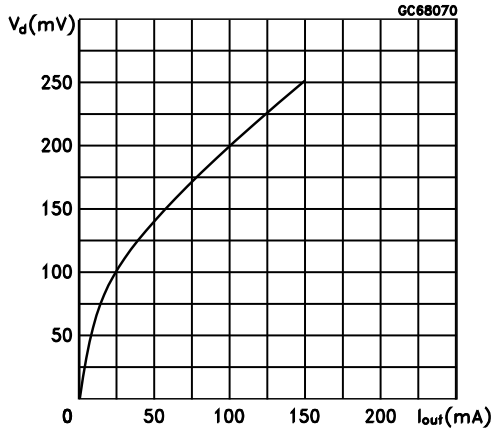


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Figure 5: Dropout voltage vs temperature

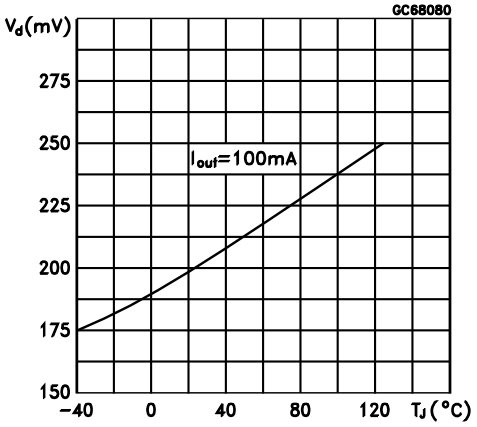

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Figure 6: Shutdown current vs temperature

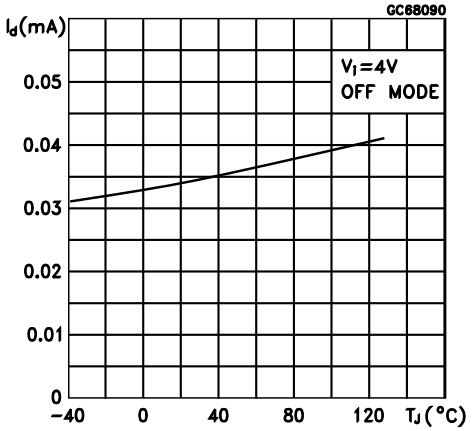

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Figure 7: Supply current vs input voltage

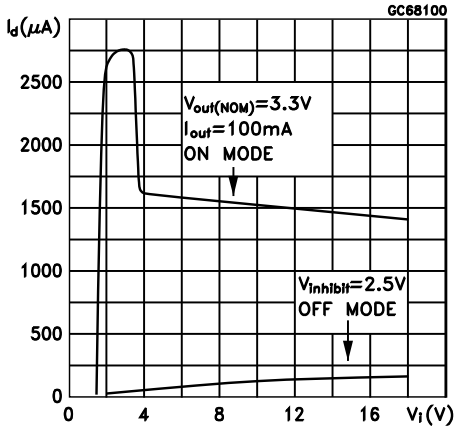

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Figure 8: Short-circuit current vs dropout voltage

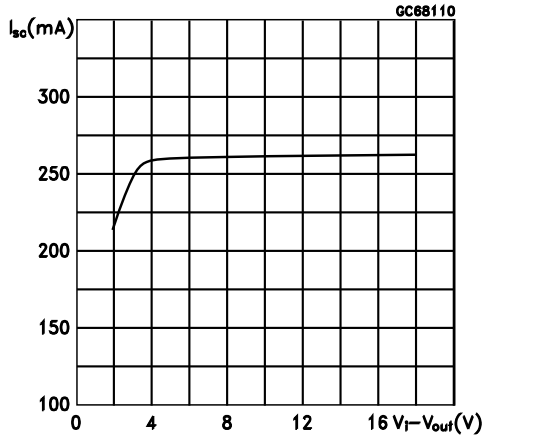


Figure 9: SVR vs frequency

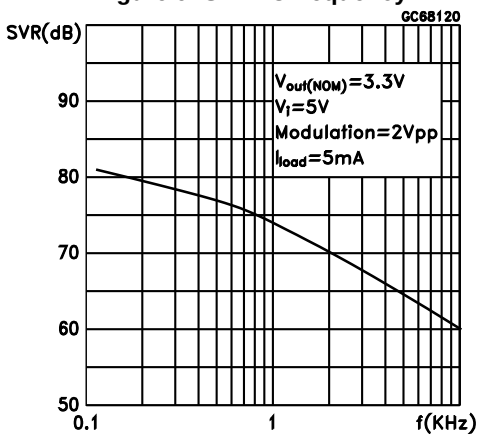


Figure 10: Logic-controlled precision 3.3/5.0 V selectable output

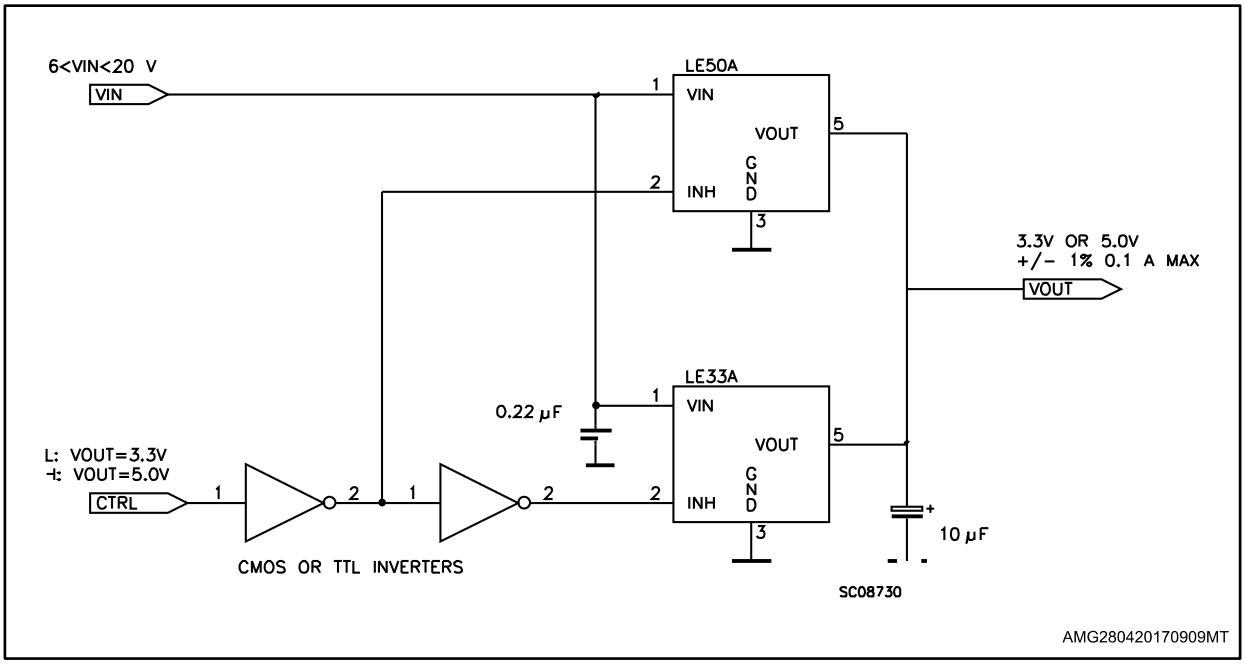


Figure 11: Sequential multi-output supply

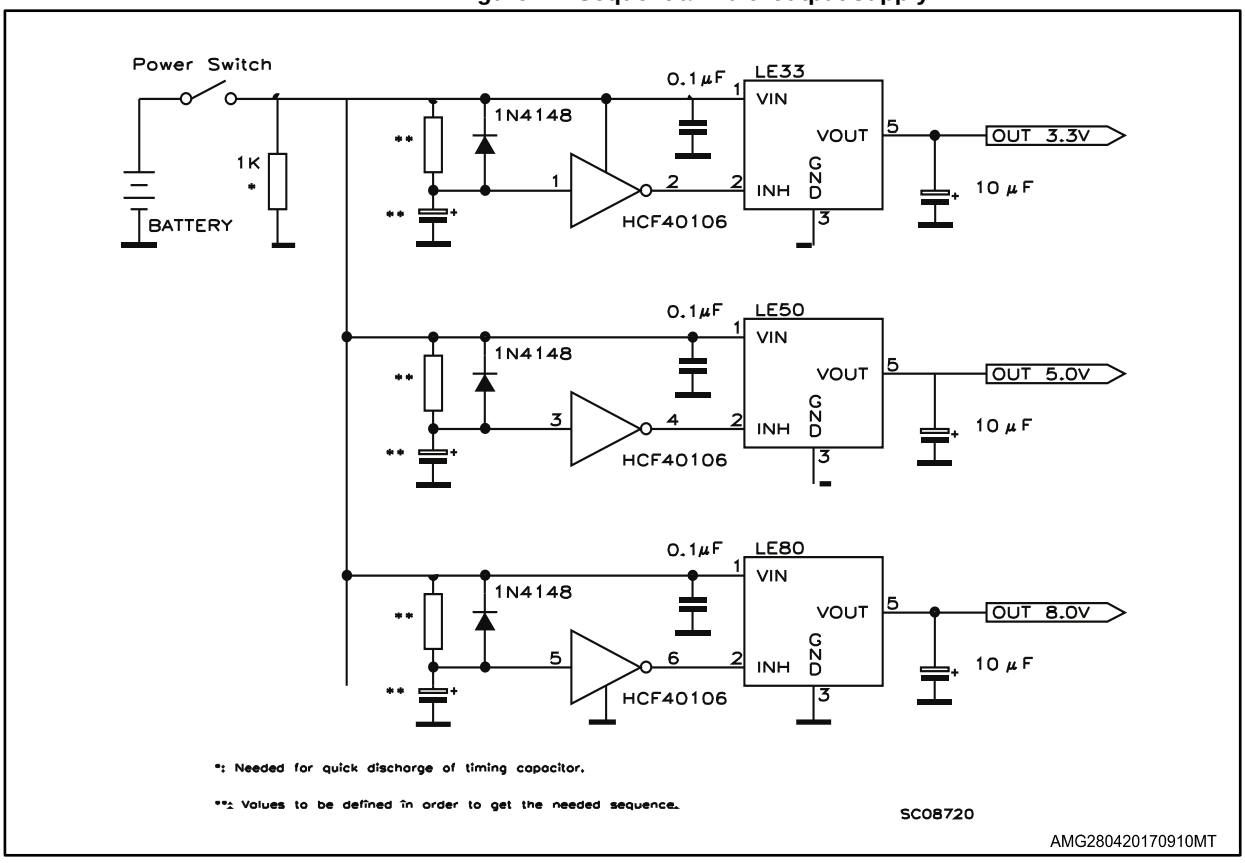
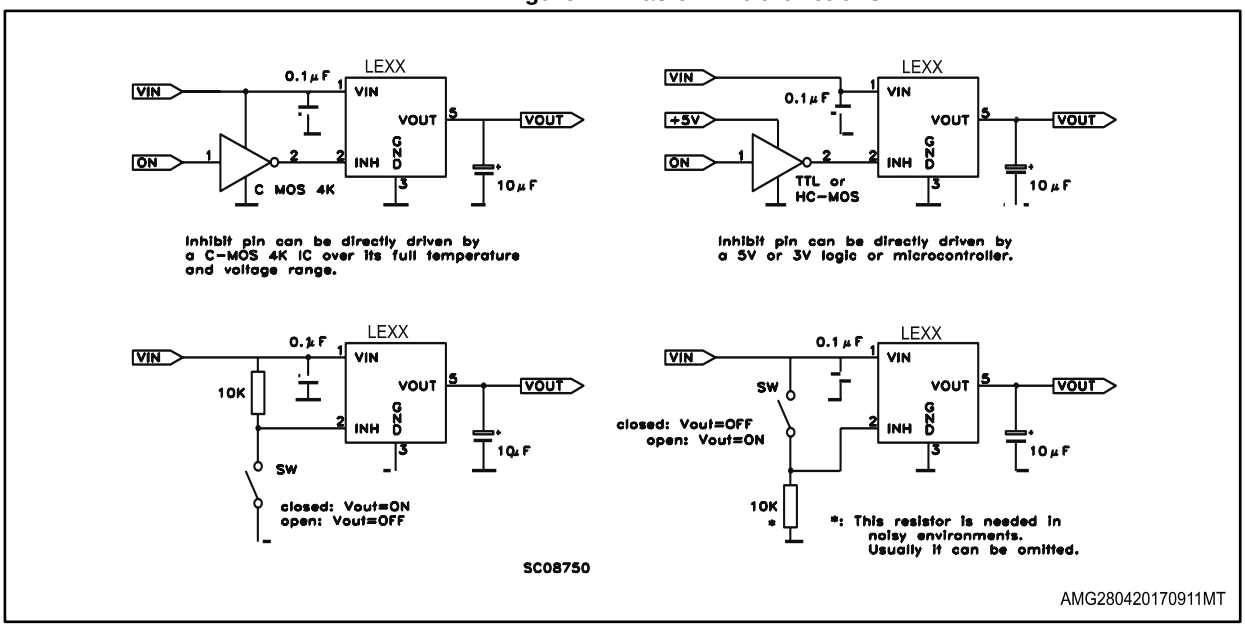


Figure 12: Basic inhibit functions



6 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***. ECOPACK® is an ST trademark.

6.1 SO-8 package information

Figure 13: SO-8 package outline

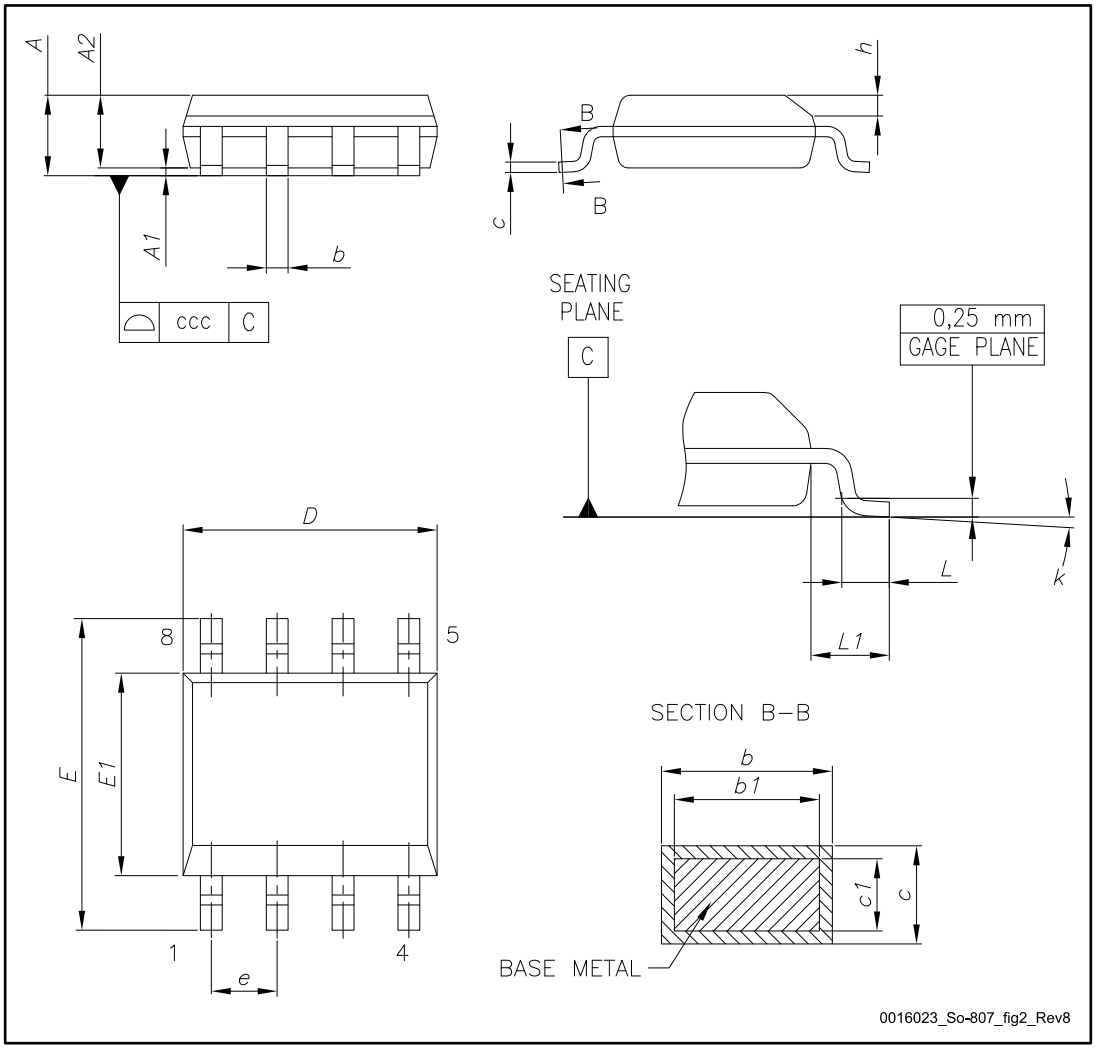
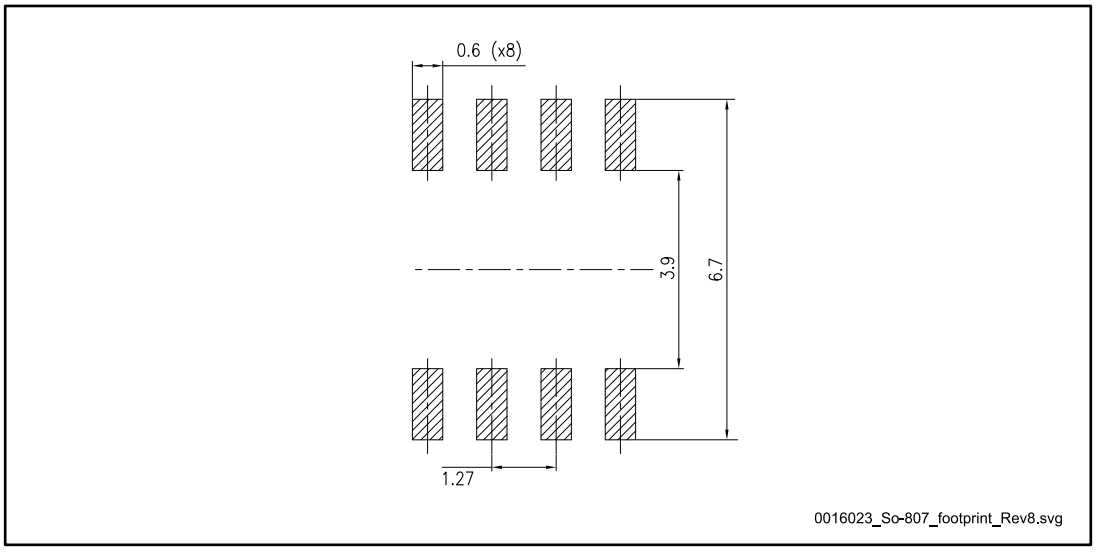


Table 11: SO-8 mechanical data

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	
k	0°		8°
ccc			0.10

Figure 14: SO-8 recommended footprint (dimensions are in mm)



6.2 SO-8 packing information

Figure 15: SO-8 tape and reel dimensions

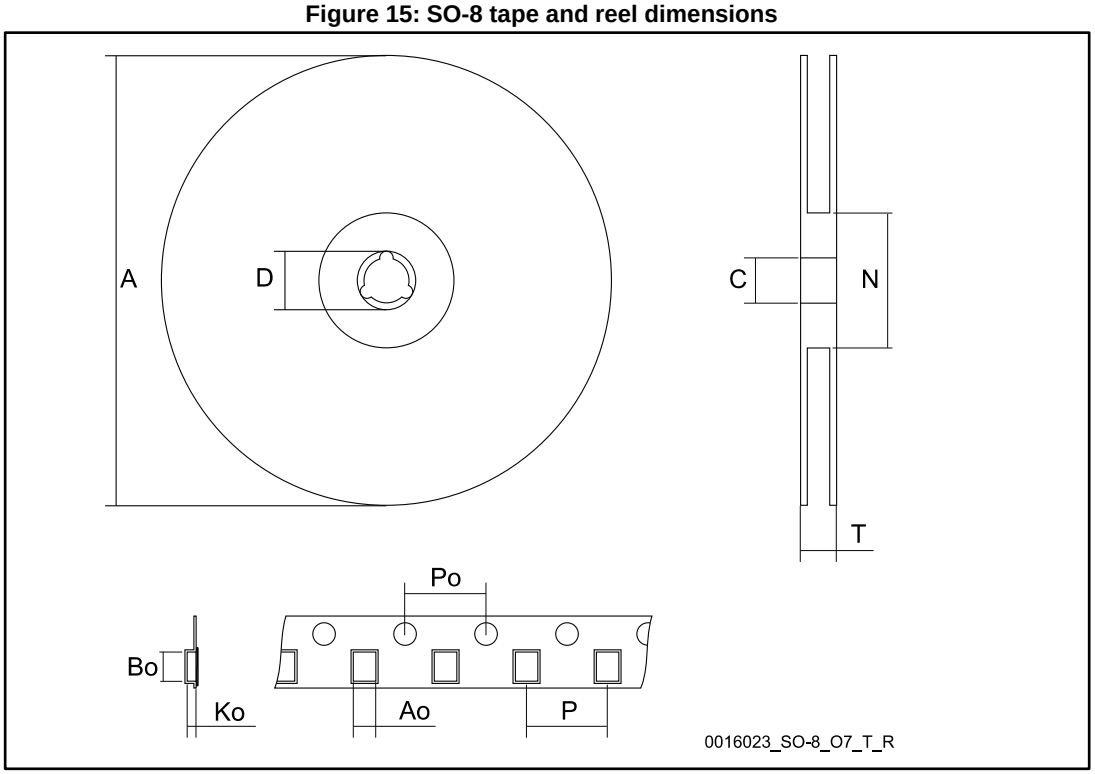


Table 12: SO-8 tape and reel mechanical data

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

6.3 TO-92 packing information

Figure 16: TO-92 tape and reel outline

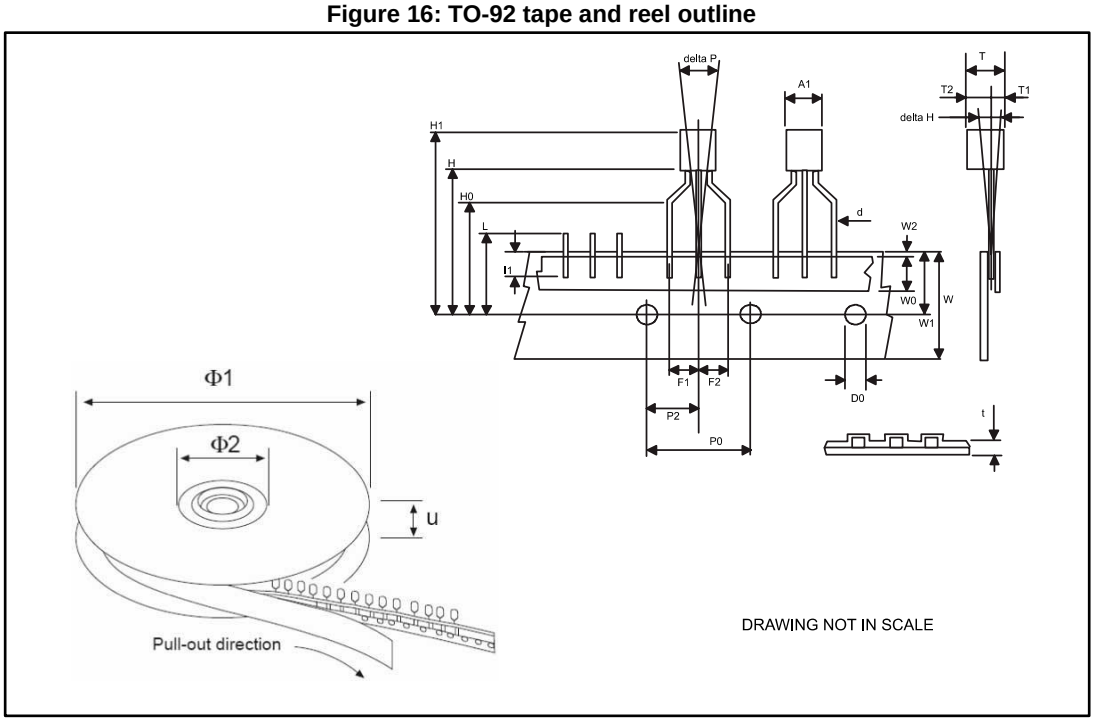


Table 13: TO-92 tape and reel mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A1			4.80
T			3.80
T1			1.60
T2			2.30
d	0.45	0.47	0.48
P0	12.50	12.70	12.90
P2	5.65	6.35	7.05
F1, F2	2.40	2.50	2.94
F3	4.98	5.08	5.48
delta H	-2.00		2.00
W	17.50	18.00	19.00
W0	5.5	6.00	6.5
W1	8.50	9.00	9.25
W2			0.50
H		18.50	21
H3	0.5	1	2
H0	15.50	16.00	18.8
H1		25.0	27.0
D0	3.80	4.00	4.20
t			0.90
L			11.00
I1	3.00		
delta P	-1.00		1.00
Ø1	352	355	358
Ø2	28	30	32
u	44	47	50

6.4 TO-92 Ammopak packing information

Figure 17: TO-92 Ammopak tape and reel outline

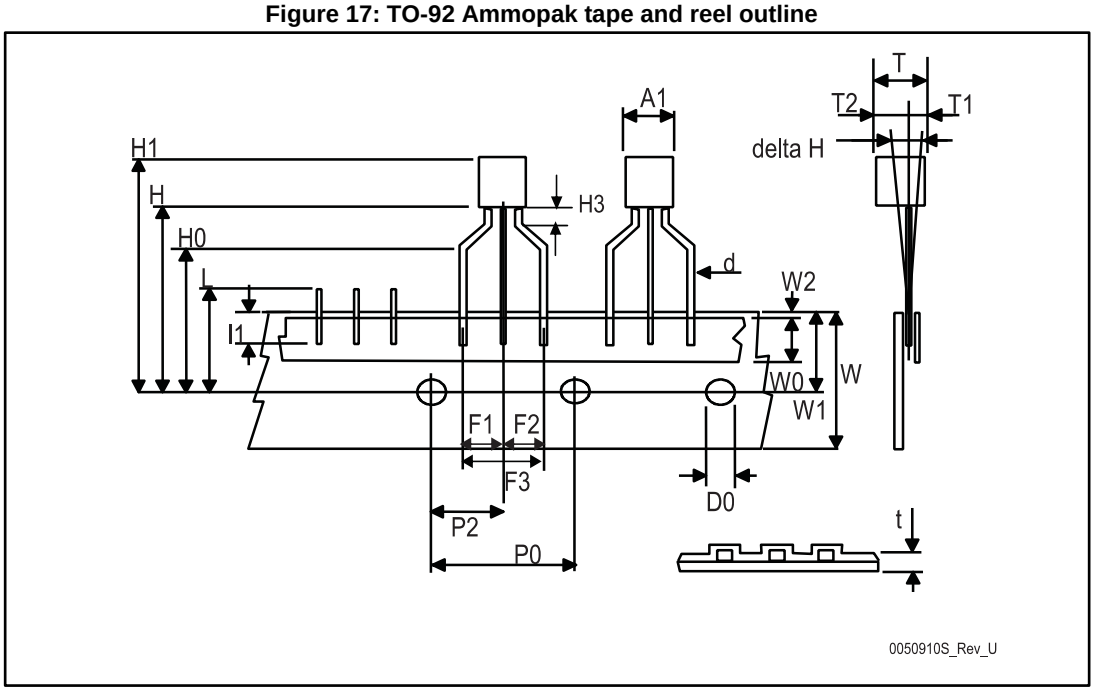


Table 14: TO-92 Ammopak tape and reel mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A1			4.80
T			3.80
T1			1.60
T2			2.30
d	0.45	0.47	0.48
P0	12.50	12.70	12.90
P2	5.65	6.35	7.05
F1, F2	2.40	2.50	2.94
F3	4.98	5.08	5.48
delta H	-2.00		2.00
W	17.50	18.00	19.00
W0	5.5	6.00	6.5
W1	8.50	9.00	9.25
W2			0.50
H		18.50	21
H3	0.5	1	2
H0	15.50	16.00	18.8
H1		25.0	27.0
D0	3.80	4.00	4.20
t			0.90
L			11.00
I1	3.00		
delta P	-1.00		1.00

7 Revision history

Table 15: Document revision history

Date	Revision	Changes
09-Jul-2004	6	I_O typ. and max. are changed in tab. 24 and 25 - pag. 14.
16-Mar-2005	7	Add Tape & Reel for TO-92 - Note on Table 3.
12-Feb-2007	8	Change value T_{OP} on Table 2.
26-Jul-2007	9	Add Table 1 in cover page.
29-Nov-2007	10	Modified: Table 25.
12-Feb-2008	11	Modified: Table 25.
10-Jul-2008	12	Modified: Table 1 and Table 25.
22-May-2012	13	Updated: Table 1 on page 1. Changed: TA in TJ test conditions from table 4 to table 10.
14-Mar-2014	14	Changed the part numbers LExxAB and LExxC to LEXX. Updated the title. Added the ammopack package to the figure in cover page. Updated the Table 1: Device summary. Updated the Description. Updated Figure 3. Changed the title of Figure 6. Updated mechanical data.
03-May-2017	15	Updated *Table 1: "Device summary"* and *Section 6: "Package information"*. Minor text changes.

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