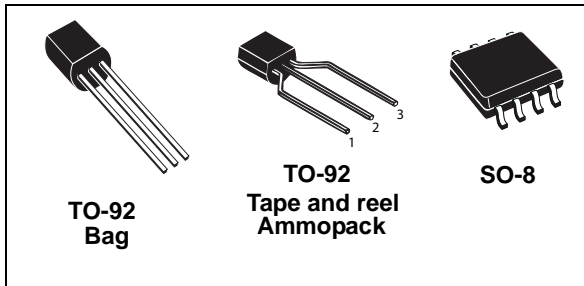


Low current 1.2 to 37 V adjustable voltage regulators

Datasheet - production data



Description

The LM217L/LM317L are monolithic integrated circuits in SO-8 and TO-92 packages intended for use as positive adjustable voltage regulators. They are designed to supply up to 100 mA of load current with an output voltage adjustable over a 1.2 to 37 V range. The nominal output voltage is selected by means of only a resistive divider, making the device exceptionally easy to use and eliminating the stocking of many fixed regulators.

Features

- Output voltage range: 1.2 to 37 V
- Output current in excess of 100 mA
- Output current up to 100 mA
- Line regulation typ. 0.01%
- Load regulation typ. 0.1%
- Thermal overload protection
- Short-circuit protection
- Output transition safe area compensation
- Floating operation for high voltage applications

Table 1. Device summary

Order codes			
SO-8 (tape and reel)	TO-92 (Bag)	TO-92 (Ampack)	TO-92 (tape and reel)
LM217LD13TR			LM217LZ-TR
LM217LD13TR	LM317LZ	LM317LZ-AP	LM317LZ-TR

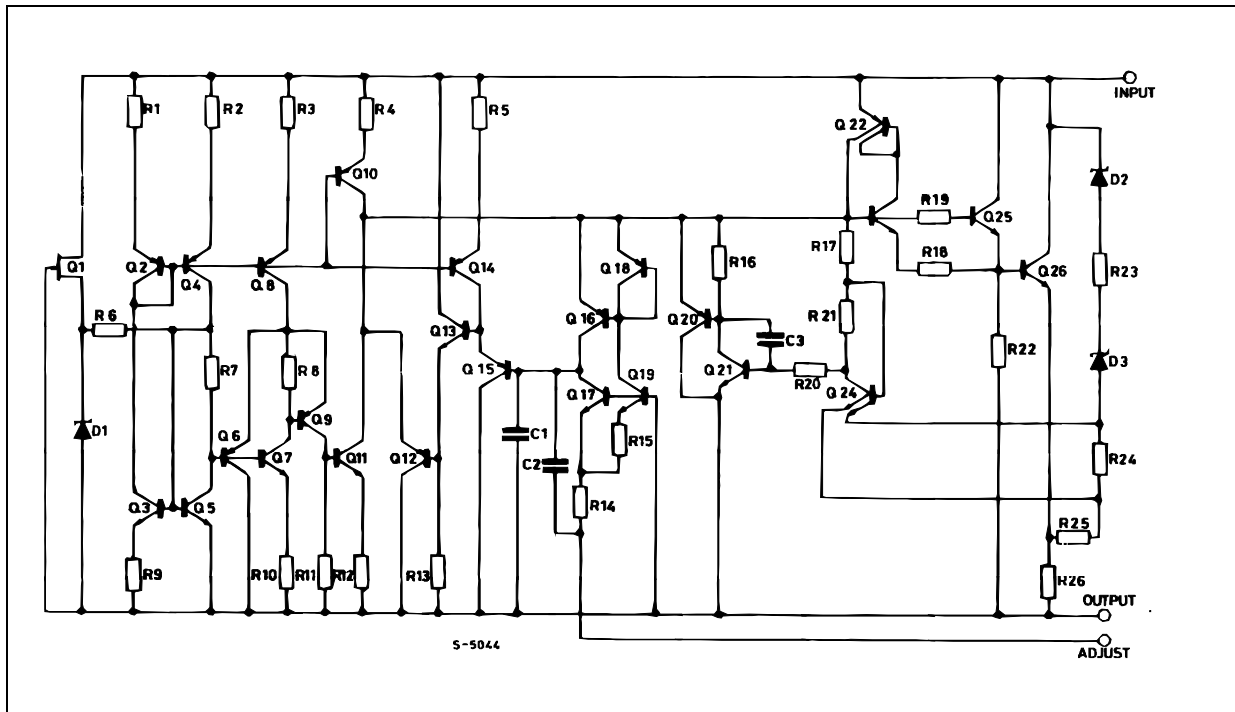
Contents

1	Diagram	3
2	Pin configuration	4
3	Maximum ratings	5
4	Electrical characteristics	6
5	Typical performance	8
6	Application information	9
7	Application circuits	10
8	Package mechanical data	12
9	Packaging information	16
10	Revision history	22



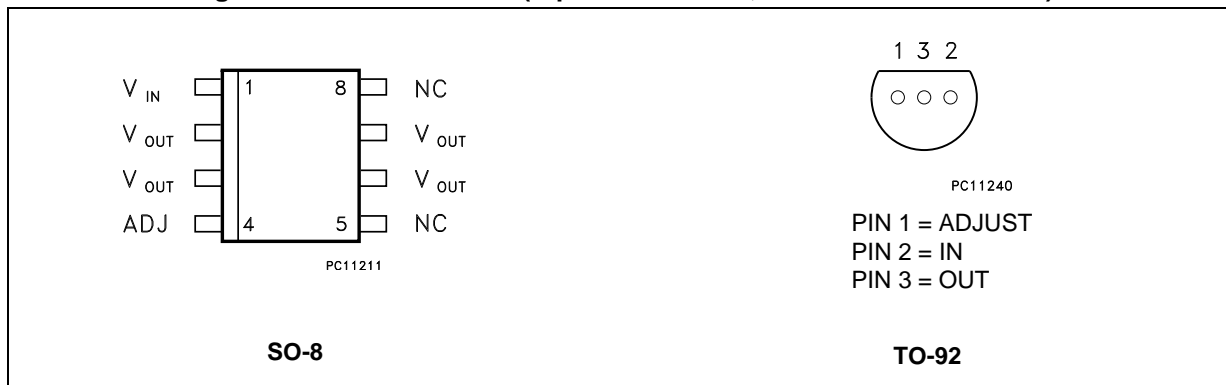
1 Diagram

Figure 1. Schematic diagram



2 Pin configuration

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

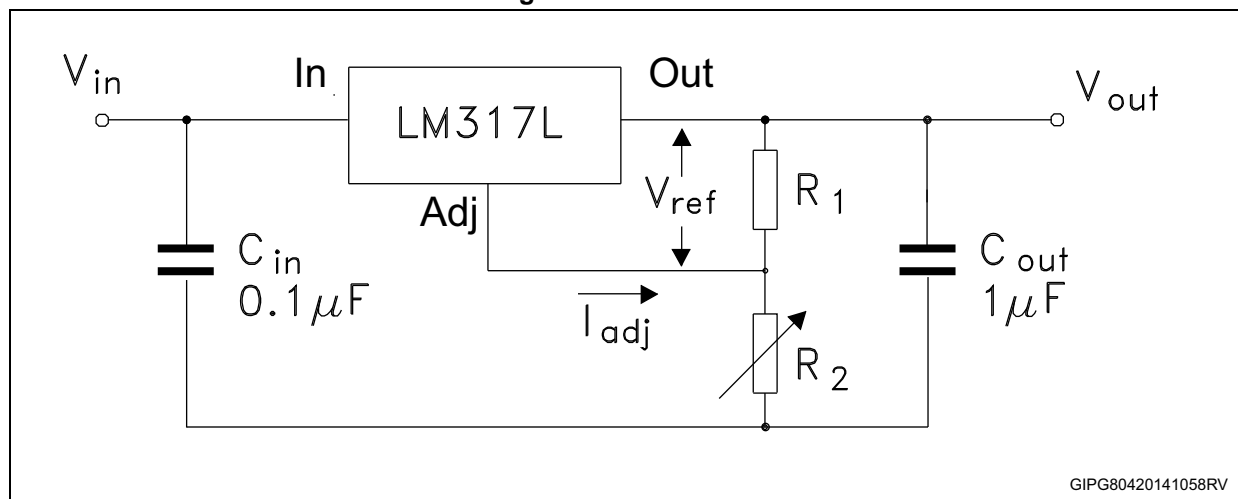


3 Maximum ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_I-V_O	Input-output differential voltage	40	V
P_D	Power dissipation	Internally limited	mW
T_{OP}	Operating junction temperature range	for LM217L	-40 to 125
		for LM317L	0 to 125
T_{STG}	Storage temperature range	-55 to 150	°C

Figure 3. Test circuit



GIPG80420141058RV

4 Electrical characteristics

(Refer to the test circuits, $T_J = -40$ to 125°C , $V_I - V_O = 5\text{ V}$, $I_O = 40\text{ mA}$, unless otherwise specified)

Table 3. Electrical characteristics of LM217L

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
DV_O	Line regulation	$V_I - V_O = 3$ to 40 V , $I_L = 20\text{ mA}$	$T_J = 25^\circ\text{C}$		0.01	0.02	%V
					0.02	0.05	
DV_O	Load regulation	$V_O \leq 5\text{ V}$, $I_O = 5$ to 100 mA	$T_J = 25^\circ\text{C}$		5	15	mV
					20	50	
		$V_O \geq 5\text{ V}$, $I_O = 5$ to 100 mA	$T_J = 25^\circ\text{C}$		0.1	0.3	%
					0.3	1	
I_{ADJ}	Adjustment pin current			50	100	μA	
DI_{ADJ}	Adjustment pin current	$V_I - V_O = 3$ to 40 V , $I_O = 5$ to 100 mA $P_d < 625\text{ mW}$		0.2	5	μA	
V_{REF}	Reference voltage	$V_I - V_O = 3$ to 40 V , $I_O = 10$ to 500 mA $P_d < 625\text{ mW}$	1.2	1.25	1.3	V	
DV_O/V_O	Output voltage temperature stability			0.7		%	
$I_{O(\min)}$	Minimum load current	$V_I - V_O = 40\text{ V}$		3.5	5	mA	
$I_{O(\max)}$	Maximum output current	$V_I - V_O = 3$ to 13 V	100	200		mA	
		$V_I - V_O = 40\text{ V}$		50			
eN	Output noise voltage	$B = 10\text{ Hz}$ to 10 KHz , $T_J = 25^\circ\text{C}$		0.003		%	
SVR	Supply voltage rejection ⁽¹⁾	$T_J = 25^\circ\text{C}$ $f = 120\text{ Hz}$	$C_{ADJ} = 0$		65	dB	
			$C_{ADJ} = 10\ \mu\text{F}$	66	80		

1. C_{ADJ} is connected between adjust pin and ground.

(Refer to the test circuits, $T_J = 0$ to 125°C , $V_I - V_O = 5\text{ V}$, $I_O = 40\text{ mA}$, unless otherwise specified)

Table 4. Electrical characteristics of LM317L

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit	
DV_O	Line regulation	$V_I - V_O = 3$ to 40 V , $I_L < 20\text{ mA}$	$T_J = 25^\circ\text{C}$		0.01	0.04	%V
					0.02	0.07	
DV_O	Load regulation	$V_O \leq 5\text{ V}$, $I_O = 5$ to 100 mA	$T_J = 25^\circ\text{C}$		5	25	mV
					20	70	
		$V_O \geq 5\text{ V}$, $I_O = 5$ to 100 mA	$T_J = 25^\circ\text{C}$		0.1	0.5	%
					0.3	1.5	
I_{ADJ}	Adjustment pin current			50	100	μA	
DI_{ADJ}	Adjustment pin current	$V_I - V_O = 3$ to 40 V , $I_O = 5$ to 100 mA $P_d < 625\text{ mW}$		0.2	5	μA	
V_{REF}	Reference voltage	$V_I - V_O = 3$ to 40 V , $I_O = 5$ to 100 mA $P_d < 625\text{ mW}$	1.2	1.25	1.3	V	
DV_O/V_O	Output voltage temperature stability			0.7		%	
$I_{O(\min)}$	Minimum load current	$V_I - V_O = 40\text{ V}$		3.5	5	mA	
$I_{O(\max)}$	Maximum output current	$V_I - V_O = 3$ to 13 V	100	200		mA	
		$V_I - V_O = 40\text{ V}$		50			
eN	Output noise voltage	$B = 10\text{ Hz}$ to 10 KHz , $T_J = 25^\circ\text{C}$		0.003		%	
SVR	Supply voltage rejection ⁽¹⁾	$T_J = 25^\circ\text{C}$ $f = 120\text{ Hz}$	$C_{ADJ} = 0$		65		dB
			$C_{ADJ} = 10\ \mu\text{F}$	66	80		

1. C_{ADJ} is connected between adjust pin and ground.

5 Typical performance

Figure 4. Current limit

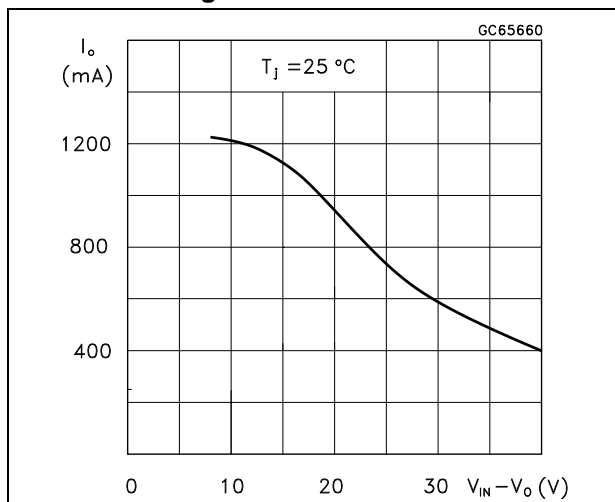
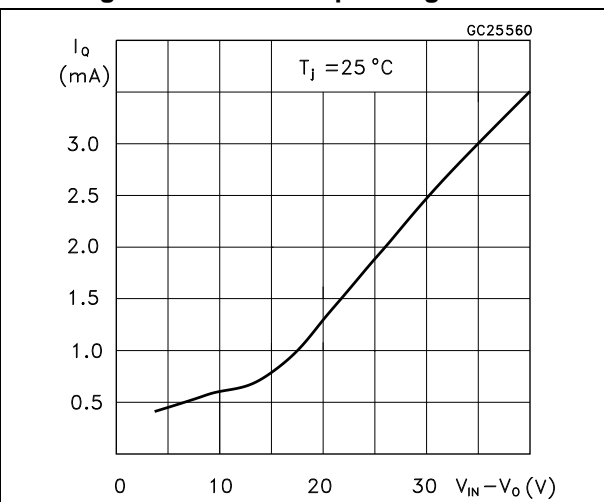


Figure 5. Minimum operating current



6 Application information

The LM317L provides an internal reference voltage of 1.25 V between the output and adjustments terminals. This is used to set a constant current flow across an external resistor divider (see [Figure 6.](#)), giving an output voltage V_O of:

$$V_O = V_{REF} (1 + R_2/R_1) + I_{ADJ} R_2$$

The device was designed to minimize the term I_{ADJ} (100 μ A max) and to maintain it very constant with line and load changes. Usually, the error term $I_{ADJ} \times R_2$ can be neglected. To obtain the previous requirement, all the regulator quiescent current is returned to the output terminal, imposing a minimum load current condition. If the load is insufficient, the output voltage will rise.

Since the LM317L is a floating regulator and "sees" only the input-to-output differential voltage, supplies of very high voltage with respect to ground can be regulated as regulator as the maximum input-to-output differential is not exceeded. Furthermore, programmable regulators are easily obtainable and, by connecting a fixed resistor between the adjustment and output, the device can be used as a precision current regulator. In order to optimize the load regulation, the current set resistor R_1 (see [Figure 6.](#)) should be tied as close as possible to the regulator, while the ground terminal of R_2 should be near the ground of the load to provide remote ground sensing.

7 Application circuits

Figure 6. Basic adjustable regulator

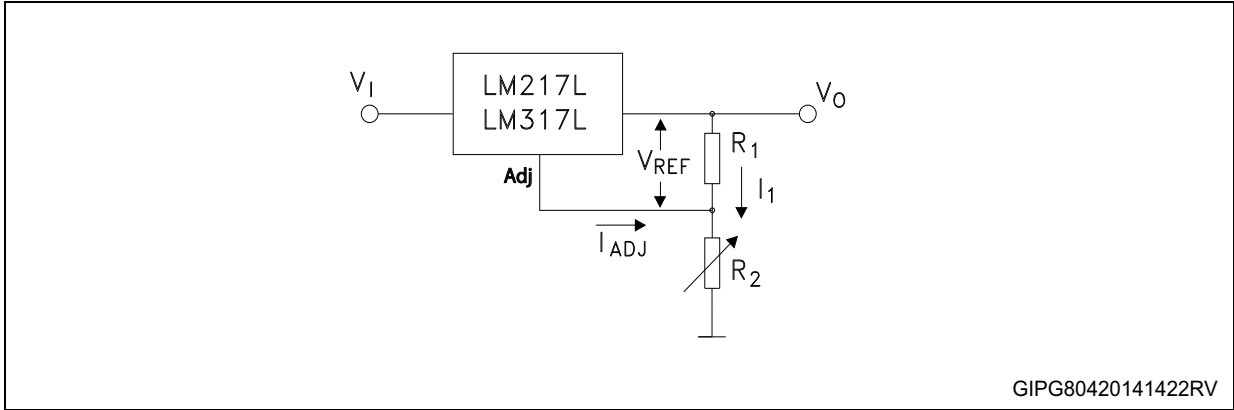


Figure 7. Voltage regulator with protection diodes

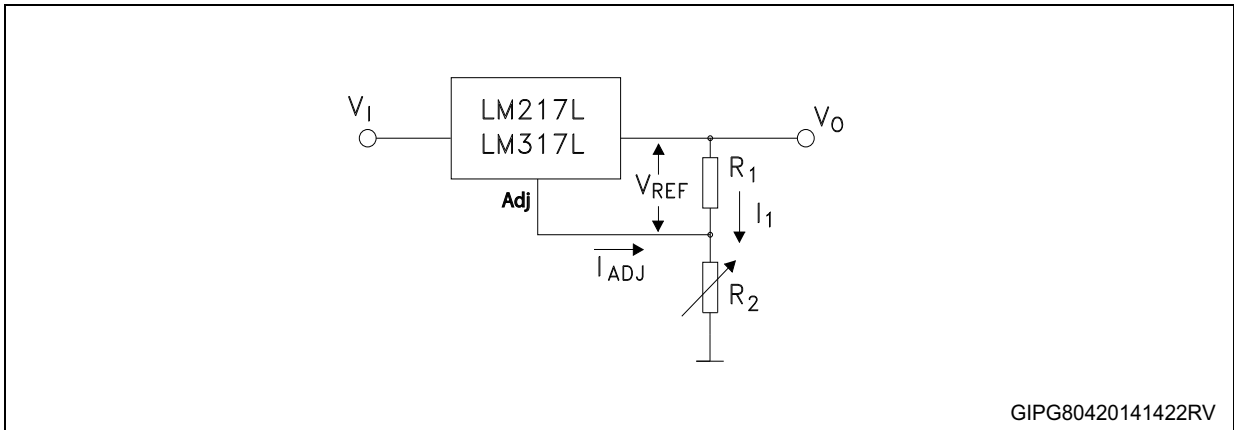


Figure 8. Slow turn-on 15 V regulator

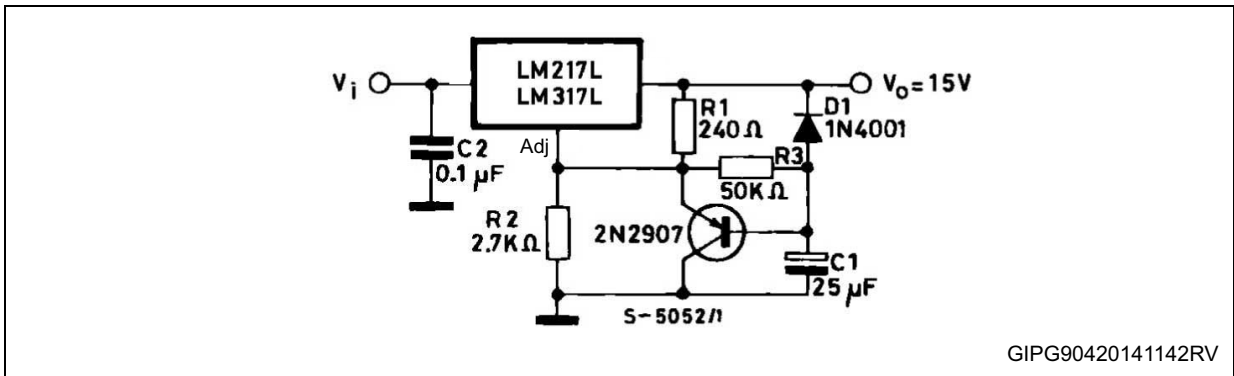


Figure 9. Current regulator

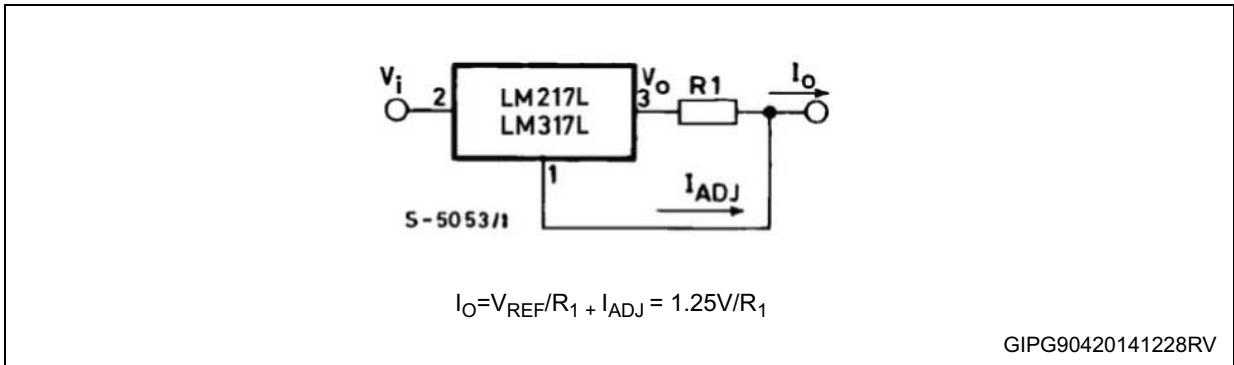


Figure 10. 5 V Electronic shut-down regulator

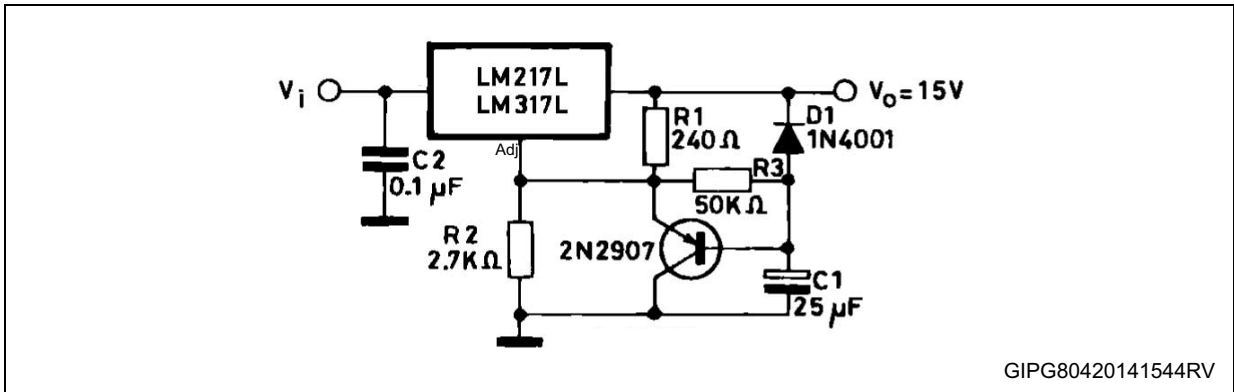
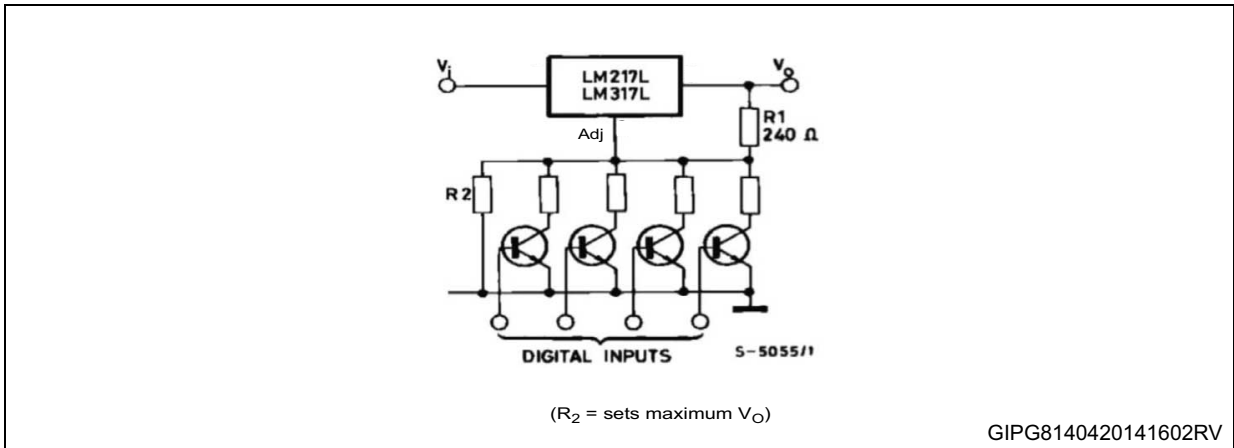


Figure 11. Digitally selected outputs



8 Package mechanical data

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.

Figure 12. SO-8 drawing

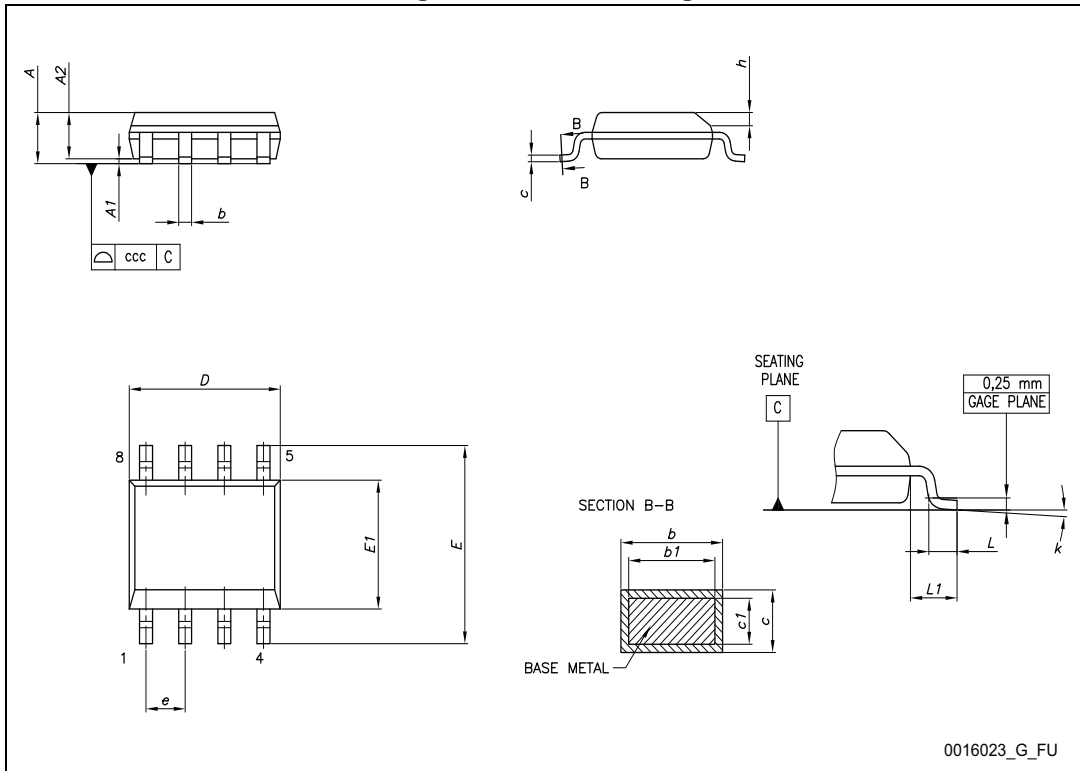


Table 5. SO-8 mechanical data

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 13. SO-8 recommended footprint

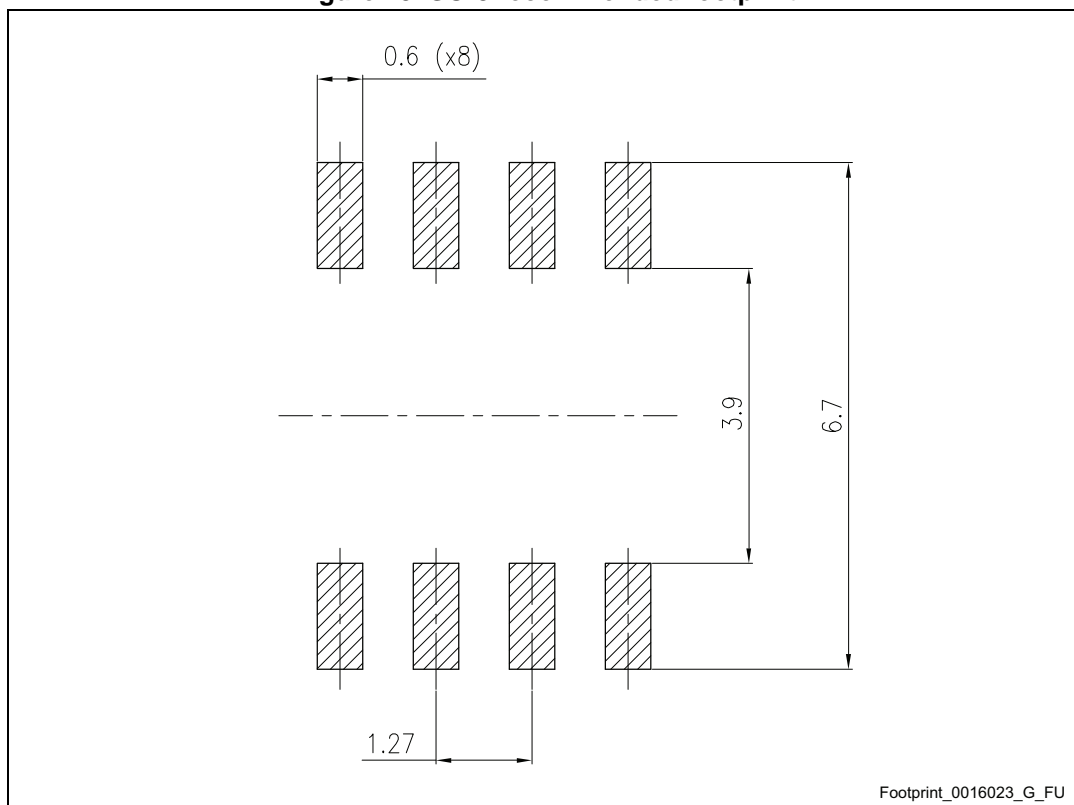


Figure 14. TO-92 Bag drawing

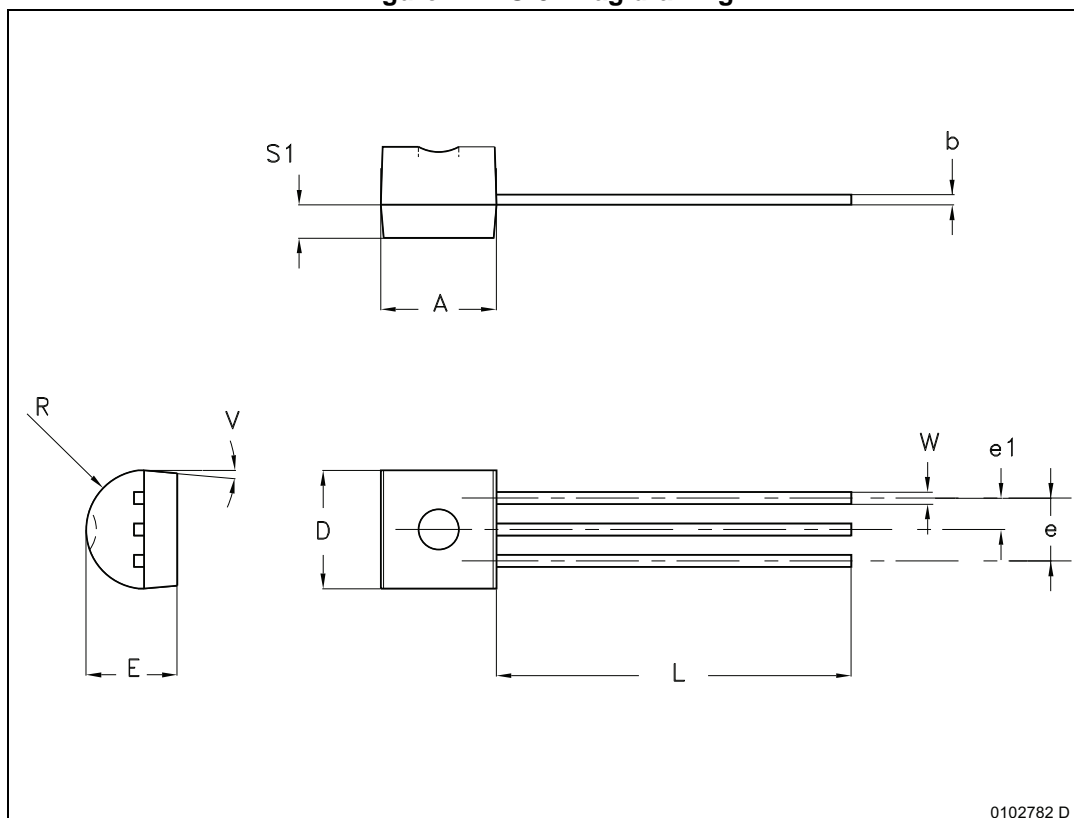


Table 6 TO-92 Bag mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.32		4.95
b	0.36		0.51
D	4.45		4.95
E	3.30		3.94
e	2.41		2.67
e1	1.14		1.40
L	12.70		15.49
R	2.16		2.41
S1	0.92		1.52
W	0.41		0.56
V		5°	

9 Packaging information

Figure 15. SO-8 tape and reel drawing

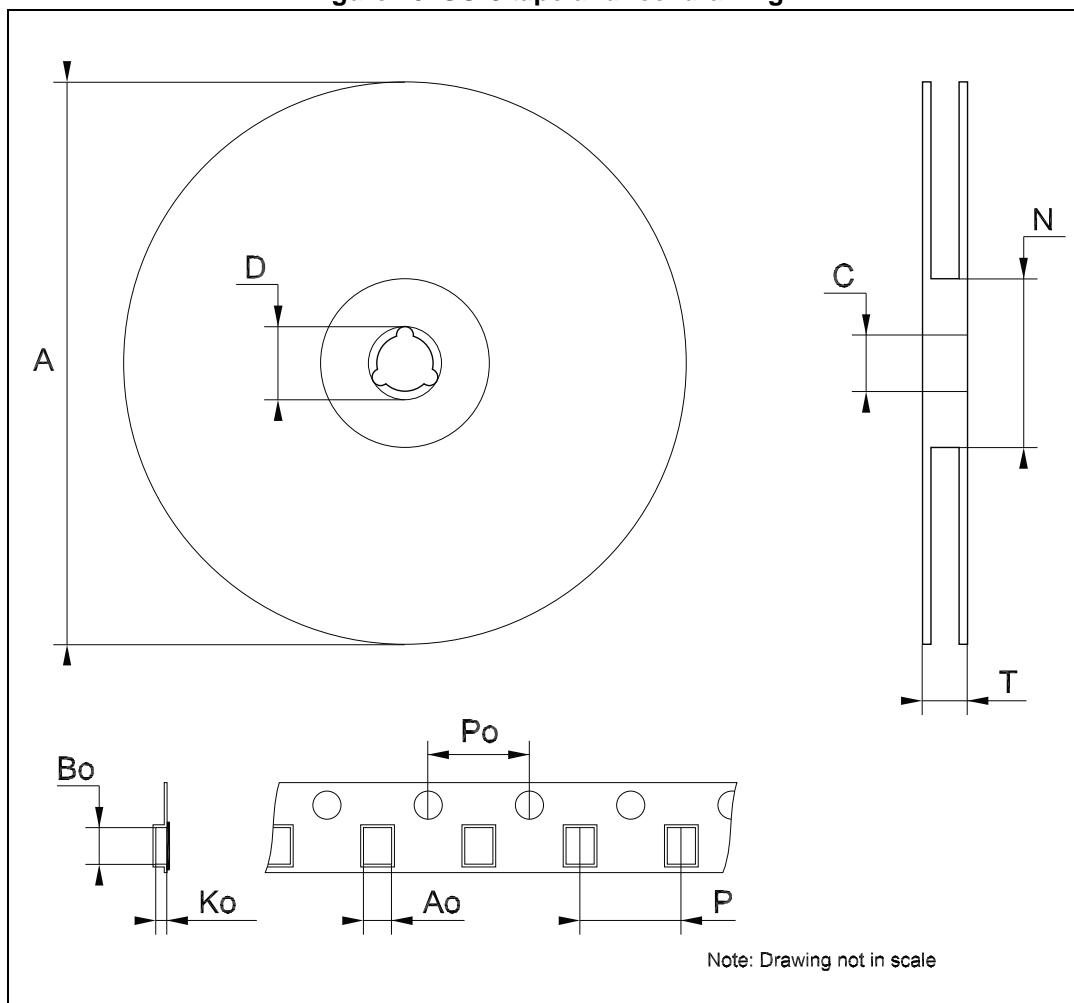


Table 7 SO-8 tape and reel mechanical data

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

Figure 16. TO-92 tape and reel drawing

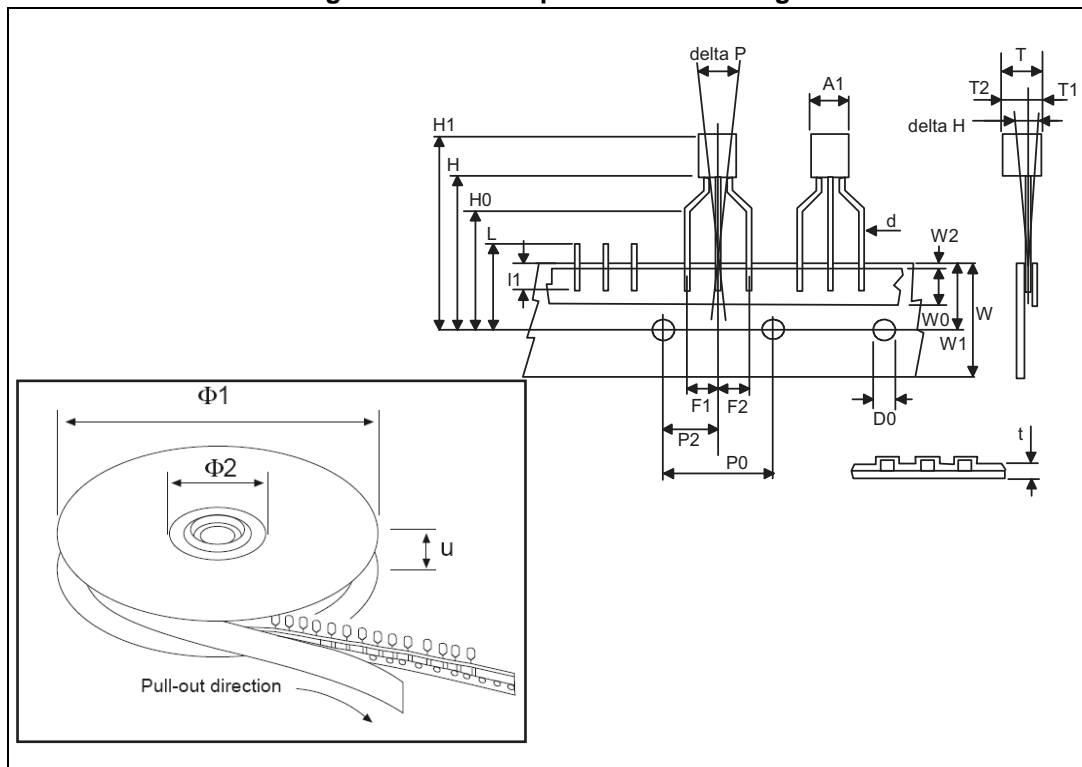


Table 8. TO-92 tape and reel mechanical data

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
l1	3.00		
delta P	-1.00		1.00
Ø1	352	355	358
Ø2	28	30	32
u	44	47	50

Figure 17. TO-92 Ammopack

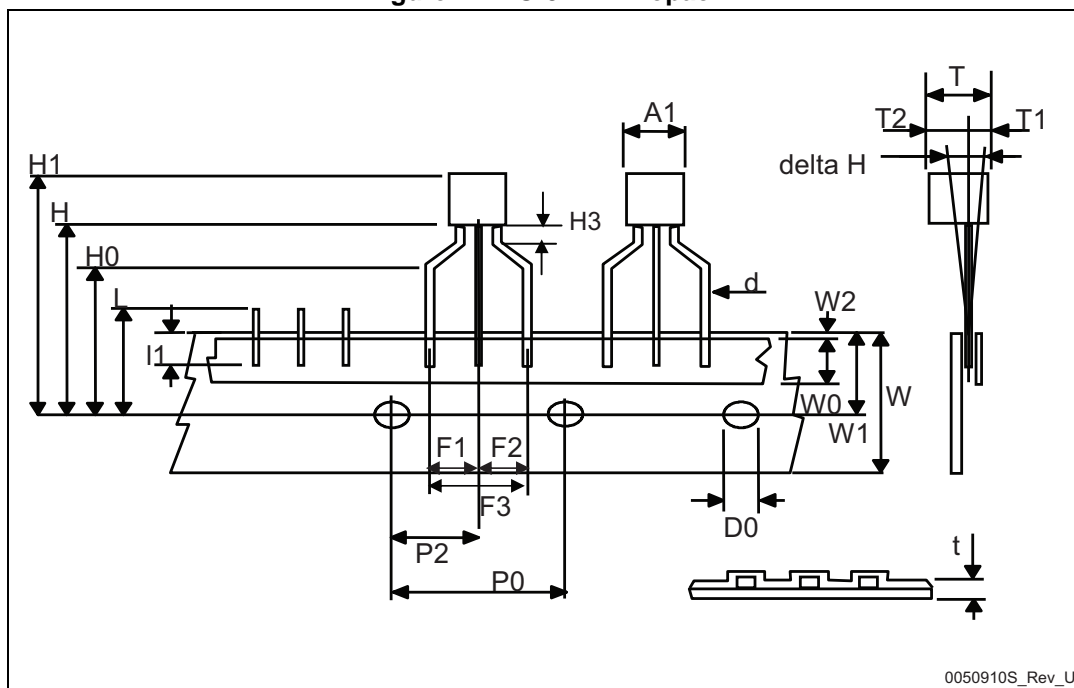


Table 9. TO-92 Ammopack mechanical data

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
l1	3.00		
delta P	-1.00		1.00

10 Revision history

Table 10. Revision history

Date	Revision	Changes
16-Mar-2005	2	Add Tape & reel for TO-92.
23-Dec-2005	3	Mistake on ordering table in header.
18-May-2007	4	Order codes has been updated and the document has been reformatted.
20-May-2014	5	Added TO-92 Ammopack package. Updated Section 6: Application information and Section 8: Package mechanical data . Added Section 9: Packaging information . Minor text changes.

Please Read Carefully:

Information in this document is provided solely in connection with ST products. STMicroelectronics NV and its subsidiaries ("ST") reserve the right to make changes, corrections, modifications or improvements, to this document, and the products and services described herein at any time, without notice.

All ST products are sold pursuant to ST's terms and conditions of sale.

Purchasers are solely responsible for the choice, selection and use of the ST products and services described herein, and ST assumes no liability whatsoever relating to the choice, selection or use of the ST products and services described herein.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted under this document. If any part of this document refers to any third party products or services it shall not be deemed a license grant by ST for the use of such third party products or services, or any intellectual property contained therein or considered as a warranty covering the use in any manner whatsoever of such third party products or services or any intellectual property contained therein.

UNLESS OTHERWISE SET FORTH IN ST'S TERMS AND CONDITIONS OF SALE ST DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY WITH RESPECT TO THE USE AND/OR SALE OF ST PRODUCTS INCLUDING WITHOUT LIMITATION IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION), OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT.

ST PRODUCTS ARE NOT DESIGNED OR AUTHORIZED FOR USE IN: (A) SAFETY CRITICAL APPLICATIONS SUCH AS LIFE SUPPORTING, ACTIVE IMPLANTED DEVICES OR SYSTEMS WITH PRODUCT FUNCTIONAL SAFETY REQUIREMENTS; (B) AERONAUTIC APPLICATIONS; (C) AUTOMOTIVE APPLICATIONS OR ENVIRONMENTS, AND/OR (D) AEROSPACE APPLICATIONS OR ENVIRONMENTS. WHERE ST PRODUCTS ARE NOT DESIGNED FOR SUCH USE, THE PURCHASER SHALL USE PRODUCTS AT PURCHASER'S SOLE RISK, EVEN IF ST HAS BEEN INFORMED IN WRITING OF SUCH USAGE, UNLESS A PRODUCT IS EXPRESSLY DESIGNATED BY ST AS BEING INTENDED FOR "AUTOMOTIVE, AUTOMOTIVE SAFETY OR MEDICAL" INDUSTRY DOMAINS ACCORDING TO ST PRODUCT DESIGN SPECIFICATIONS. PRODUCTS FORMALLY ESCC, QML OR JAN QUALIFIED ARE DEEMED SUITABLE FOR USE IN AEROSPACE BY THE CORRESPONDING GOVERNMENTAL AGENCY.

Resale of ST products with provisions different from the statements and/or technical features set forth in this document shall immediately void any warranty granted by ST for the ST product or service described herein and shall not create or extend in any manner whatsoever, any liability of ST.

ST and the ST logo are trademarks or registered trademarks of ST in various countries.

Information in this document supersedes and replaces all information previously supplied.

The ST logo is a registered trademark of STMicroelectronics. All other names are the property of their respective owners.

© 2014 STMicroelectronics - All rights reserved

STMicroelectronics group of companies

Australia - Belgium - Brazil - Canada - China - Czech Republic - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco - Philippines - Singapore - Spain - Sweden - Switzerland - United Kingdom - United States of America

www.st.com

