

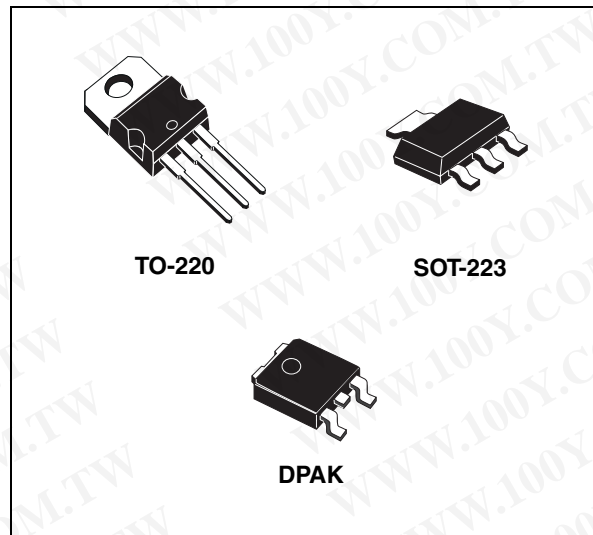


# LD1117AXX12, LD1117AXX18 LD1117AXX33, LD1117AXX

## Low drop fixed and adjustable positive voltage regulators

### Features

- Low dropout voltage:
  - 1.15 V typ. @  $I_{OUT} = 1\text{ A}$ , 25 °C
- Very low quiescent current:
  - 5 mA typ. @ 25 °C
- Output current up to 1 A
- Fixed output voltage of:
  - 1.2 V, 1.8 V, 2.5 V, 3.3 V
- Adjustable version availability ( $V_{REL} = 1.25\text{ V}$ )
- Internal current and thermal limit
- Only 10  $\mu\text{F}$  for stability
- Available in  $\pm 2\%$  (at 25 °C) and 4 % in full temperature range
- High supply voltage rejection:
  - 80 dB typ. (at 25 °C)
- Temperature range: 0 °C to 125 °C



common 10  $\mu\text{F}$  minimum capacitor is needed for stability. Only chip trimming allows the regulator to reach a very tight output voltage tolerance, within  $\pm 2\%$  at 25 °C.

### Description

The LD1117Axx is a low drop voltage regulator able to provide up to 1 A of output current, available even in adjustable version ( $V_{REF} = 1.25\text{ V}$ ). Concerning fixed versions, are offered the following output voltages: 1.2 V, 1.8 V, 2.5 V and 3.3 V. The device is supplied in: SOT-223, DPAK and TO-220. Surface mount packages optimize the thermal characteristics even offering a relevant space saving effect. High efficiency is assured by NPN pass transistor. Only a very

**Table 1. Device summary**

Order codes			Output voltage
SOT-223	DPAK	TO-220	
LD1117AS12TR	LD1117ADT12TR		1.2 V
LD1117AS18TR	LD1117ADT18TR		1.8 V
LD1117AS33TR	LD1117ADT33TR	LD1117AV33	3.3 V
LD1117ASTR	LD1117ADT-TR		Adjustable from 1.25 to 15 V

# Contents

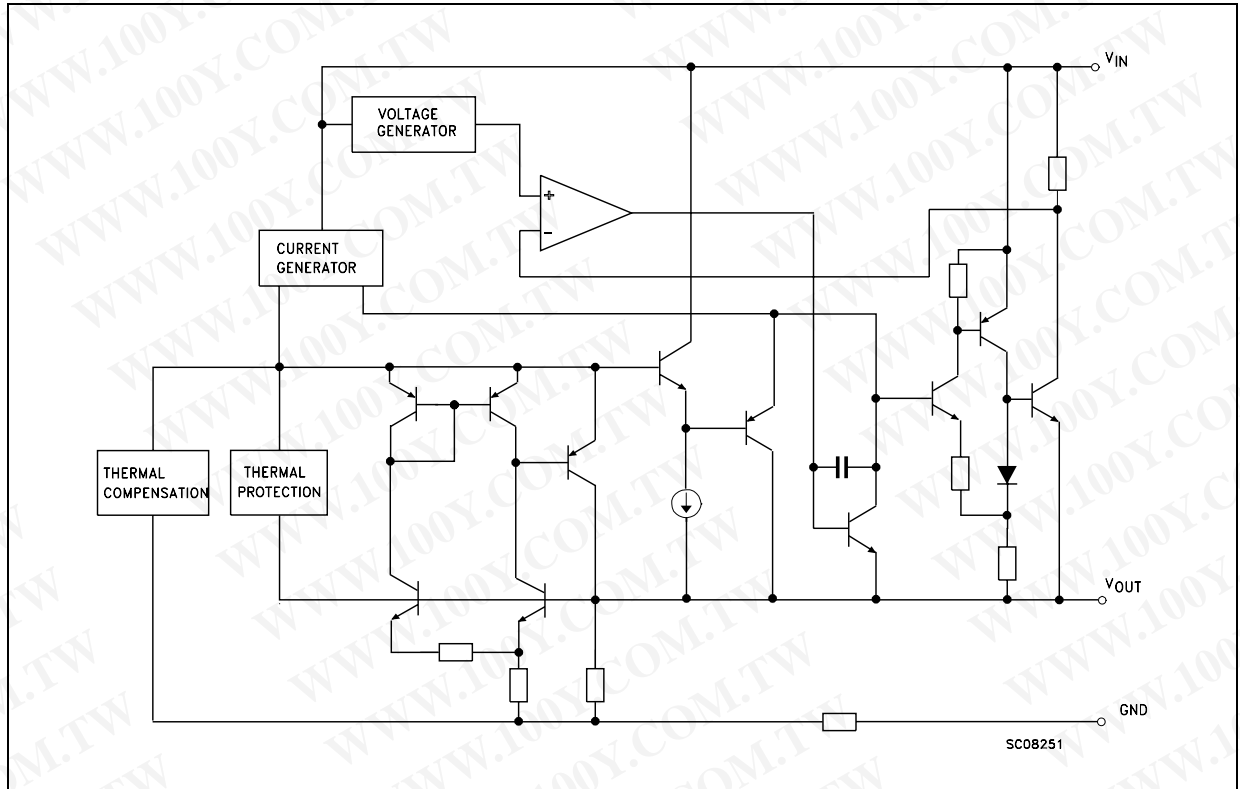
1	Diagram .....	3
2	Pin configuration .....	4
3	Maximum ratings .....	5
4	Schematic application .....	6
5	Electrical characteristics .....	7
6	Typical application .....	11
7	LD1117A adjustable: application note .....	14
8	Package mechanical data .....	15
9	Revision history .....	23

勝特力材料 886-3-5753170  
勝特力电子(上海) 86-21-34970699  
勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)



# 1 Diagram

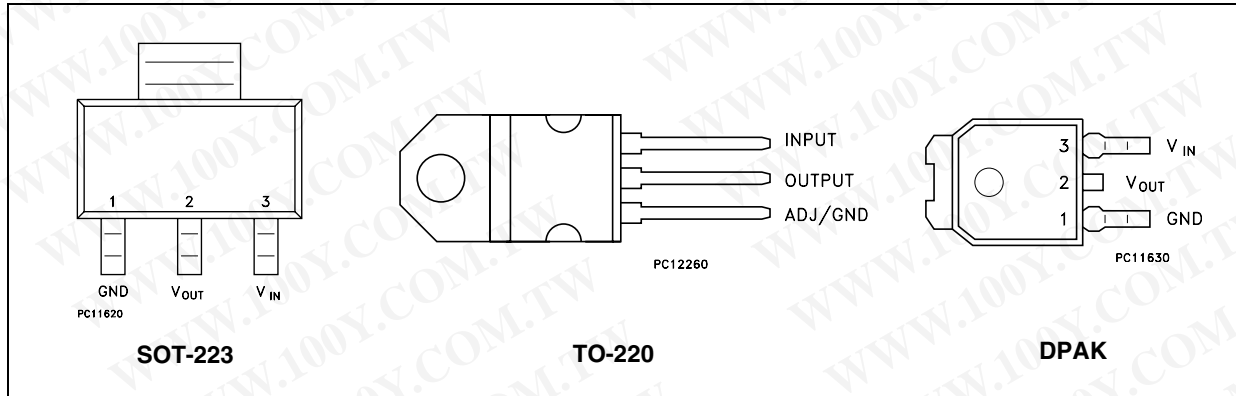
Figure 1. Block diagram



勝特力材料 886-3-5753170  
勝特力电子(上海) 86-21-34970699  
勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

## 2 Pin configuration

Figure 2. Pin connections (top view)



Note: The TAB is connected to the V<sub>OUT</sub>.

勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

### 3 Maximum ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{IN}$	DC input voltage	15	V
$P_D$	Power dissipation	12	W
$T_{STG}$	Storage temperature range	-40 to +150	°C
$T_{OP}$	Operating junction temperature range	0 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. Over the above suggested max power dissipation a short circuit could definitively damage the device.

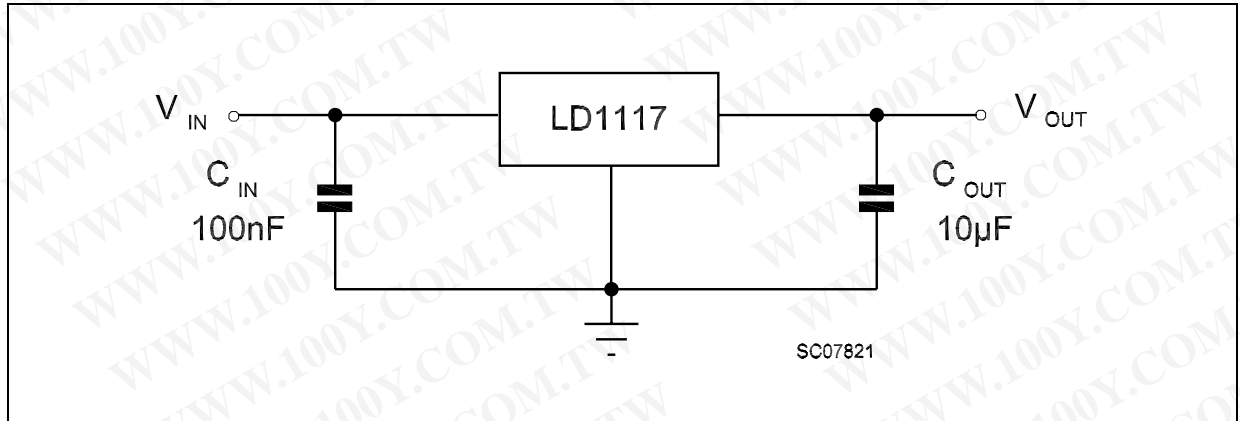
**Table 3. Thermal data**

Symbol	Parameter	SOT-223	DKPAK	TO-220	Unit
$R_{thJC}$	Thermal resistance junction-case	15	8	5	°C/W
$R_{thJA}$	Thermal resistance junction-ambient			50	°C/W

勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

## 4 Schematic application

Figure 3. Application circuit (for other fixed output voltages)



勝特力材料 886-3-5753170  
勝特力电子(上海) 86-21-34970699  
勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

## 5 Electrical characteristics

Refer to the test circuits,  $T_J = 0$  to  $125\text{ }^\circ\text{C}$ ,  $C_O = 10\text{ }\mu\text{F}$ ,  $C_I = 10\text{ }\mu\text{F}$ ,  $R = 120\text{ }\Omega$  between OUT-GND, unless otherwise specified.

**Table 4. Electrical characteristics of LD1117A#12**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage	$V_I = 5.3\text{V}$ , $I_O = 10\text{mA}$ , $T_J = 25^\circ\text{C}$	1.176	1.2	1.224	V
$V_O$	Output voltage	$I_O = 0$ to $1\text{A}$ , $V_I = 2.75$ to $10\text{V}$	1.152	1.2	1.248	V
$\Delta V_O$	Line regulation	$V_I = 2.75$ to $8\text{V}$ , $I_O = 0\text{mA}$		1	6	mV
$\Delta V_O$	Load regulation	$V_I = 2.75\text{V}$ , $I_O = 0$ to $1\text{A}$		1	10	mV
$\Delta V_O$	Temperature stability			0.5		%
$\Delta V_O$	Long term stability	1000 hrs, $T_J = 125^\circ\text{C}$		0.3		%
$V_I$	Operating input voltage	$I_O = 100\text{mA}$			10	V
$I_d$	Quiescent current	$V_I \leq 8\text{V}$ , $I_O = 0\text{mA}$		5	10	mA
$I_O$	Output current	$V_I - V_O = 5\text{V}$ , $T_J = 25^\circ\text{C}$	1000	1200		mA
eN	Output noise voltage	$B = 10\text{Hz}$ to $10\text{kHz}$ , $T_J = 25^\circ\text{C}$		100		$\mu\text{V}$
SVR	Supply voltage rejection	$I_O = 40\text{mA}$ , $f = 120\text{Hz}$ $V_I - V_O = 3\text{V}$ , $V_{\text{ripple}} = 1\text{V}_{\text{PP}}$	60	80		dB
$V_D$	Dropout voltage	$I_O = 100\text{mA}$		1	1.10	V
		$I_O = 500\text{mA}$		1.05	1.15	
		$I_O = 1\text{A}$		1.15	1.30	
$\Delta V_{O(\text{pwr})}$	Thermal regulation	$T_a = 25^\circ\text{C}$ , 30 ms Pulse		0.08	0.2	%/W

勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

Refer to the test circuits,  $T_J = 0$  to  $125^\circ\text{C}$ ,  $C_O = 10\ \mu\text{F}$ ,  $C_I = 10\ \mu\text{F}$  unless otherwise specified.

**Table 5. Electrical characteristics of LD1117A#18**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage	$V_I = 3.8\text{V}$ , $I_O = 10\text{mA}$ , $T_J = 25^\circ\text{C}$	1.764	1.8	1.836	V
$V_O$	Output voltage	$I_O = 0$ to $1\text{A}$ , $V_I = 3.3$ to $8\text{V}$	1.728		1.872	V
$\Delta V_O$	Line regulation	$V_I = 3.3$ to $8\text{V}$ , $I_O = 0\text{mA}$		1	6	mV
$\Delta V_O$	Load regulation	$V_I = 3.3\text{V}$ , $I_O = 0$ to $1\text{A}$		1	10	mV
$\Delta V_O$	Temperature stability			0.5		%
$\Delta V_O$	Long term stability	1000 hrs, $T_J = 125^\circ\text{C}$		0.3		%
$V_I$	Operating input voltage	$I_O = 100\text{mA}$			10	V
$I_d$	Quiescent current	$V_I \leq 8\text{V}$ , $I_O = 0\text{mA}$		5	10	mA
$I_O$	Output current	$V_I - V_O = 5\text{V}$ , $T_J = 25^\circ\text{C}$	1000			mA
eN	Output noise voltage	$B = 10\text{Hz}$ to $10\text{kHz}$ , $T_J = 25^\circ\text{C}$		100		$\mu\text{V}$
SVR	Supply voltage rejection	$I_O = 40\text{mA}$ , $f = 120\text{Hz}$ $V_I - V_O = 3\text{V}$ , $V_{\text{ripple}} = 1V_{\text{PP}}$	60	80		dB
$V_D$	Dropout voltage	$I_O = 100\text{mA}$		1	1.10	V
		$I_O = 500\text{mA}$		1.05	1.15	
		$I_O = 1\text{A}$		1.15	1.30	
$\Delta V_{O(\text{pwr})}$	Thermal regulation	$T_a = 25^\circ\text{C}$ , 30 ms Pulse		0.08	0.2	%/W

勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

Refer to the test circuits,  $T_J = 0$  to  $125^\circ\text{C}$ ,  $C_O = 10\ \mu\text{F}$ ,  $C_I = 10\ \mu\text{F}$  unless otherwise specified.

**Table 6. Electrical characteristics of LD1117A#33**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage	$V_I = 5.3\text{V}$ , $I_O = 10\text{mA}$ , $T_J = 25^\circ\text{C}$	3.234	3.3	3.366	V
$V_O$	Output voltage	$I_O = 0$ to $1\text{A}$ , $V_I = 4.75$ to $10\text{V}$	3.168		3.432	V
$\Delta V_O$	Line regulation	$V_I = 4.75$ to $8\text{V}$ , $I_O = 0\text{mA}$		1	6	mV
$\Delta V_O$	Load regulation	$V_I = 4.75\text{V}$ , $I_O = 0$ to $1\text{A}$		1	10	mV
$\Delta V_O$	Temperature stability			0.5		%
$\Delta V_O$	Long term stability	1000 hrs, $T_J = 125^\circ\text{C}$		0.3		%
$V_I$	Operating input voltage	$I_O = 100\text{mA}$			10	V
$I_d$	Quiescent current	$V_I \leq 10\text{V}$ , $I_O = 0\text{mA}$		5	10	mA
$I_O$	Output current	$V_I - V_O = 5\text{V}$ , $T_J = 25^\circ\text{C}$	1000	1200		mA
eN	Output noise voltage	$B = 10\text{Hz}$ to $10\text{kHz}$ , $T_J = 25^\circ\text{C}$		100		$\mu\text{V}$
SVR	Supply voltage rejection	$I_O = 40\text{mA}$ , $f = 120\text{Hz}$ $V_I - V_O = 3\text{V}$ , $V_{\text{ripple}} = 1\text{V}_{\text{PP}}$	60	75		dB
$V_D$	Dropout voltage	$I_O = 100\text{mA}$		1	1.10	V
		$I_O = 500\text{mA}$		1.05	1.15	
		$I_O = 1\text{A}$		1.15	1.30	
$\Delta V_{O(\text{pwr})}$	Thermal regulation	$T_a = 25^\circ\text{C}$ , 30 ms Pulse		0.08	0.2	%/W

勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

Refer to the test circuits,  $T_J = 0$  to  $125^\circ\text{C}$ ,  $C_O = 10\ \mu\text{F}$ ,  $C_I = 10\ \mu\text{F}$  unless otherwise specified.

**Table 7. Electrical characteristics of LD1117A (Adjustable)**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_O$	Output voltage	$V_I = 5.3\text{V}$ , $I_O = 10\text{mA}$ , $T_J = 25^\circ\text{C}$	1.225	1.25	1.275	V
$V_O$	Output voltage	$I_O = 0$ to $1\text{A}$ , $V_I = 2.75$ to $10\text{V}$	1.2		1.3	V
$\Delta V_O$	Line regulation	$V_I = 2.75$ to $8\text{V}$ , $I_O = 0\text{mA}$		1	6	mV
$\Delta V_O$	Load regulation	$V_I = 2.75\text{V}$ , $I_O = 0$ to $1\text{A}$		1	10	mV
$\Delta V_O$	Temperature stability			0.5		%
$\Delta V_O$	Long term stability	1000 hrs, $T_J = 125^\circ\text{C}$		0.3		%
$V_I$	Operating input voltage	$I_O = 100\text{mA}$			10	V
$I_{\text{adj}}$	Adjustment pin current	$V_{\text{in}} \leq 10\text{V}$		60	120	$\mu\text{A}$
$\Delta I_{\text{adj}}$	Adjustment pin current change	$V_{\text{in}} - V_O = 1.4$ to $10\text{V}$ , $I_O = 10\text{mA}$ to $1\text{A}$		1	5	$\mu\text{A}$
$I_{O(\text{min})}$	Minimum load current	$V_{\text{in}} = 10\text{V}$		2	5	mA
$I_O$	Output current	$V_I - V_O = 5\text{V}$ , $T_J = 25^\circ\text{C}$	1000	1200		mA
eN	Output noise voltage	$B = 10\text{Hz}$ to $10\text{kHz}$ , $T_J = 25^\circ\text{C}$		100		$\mu\text{V}$
SVR	Supply voltage rejection	$I_O = 40\text{mA}$ , $f = 120\text{Hz}$ $V_I - V_O = 3\text{V}$ , $V_{\text{ripple}} = 1\text{V}_{\text{PP}}$	60	80		dB
$V_D$	Dropout voltage	$I_O = 100\text{mA}$		1	1.10	V
		$I_O = 500\text{mA}$		1.05	1.15	
		$I_O = 1\text{A}$		1.15	1.30	
$\Delta V_{O(\text{pwr})}$	Thermal regulation	$T_a = 25^\circ\text{C}$ , 30 ms Pulse		0.08	0.2	%/W

勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

## 6 Typical application

Figure 4. Negative supply

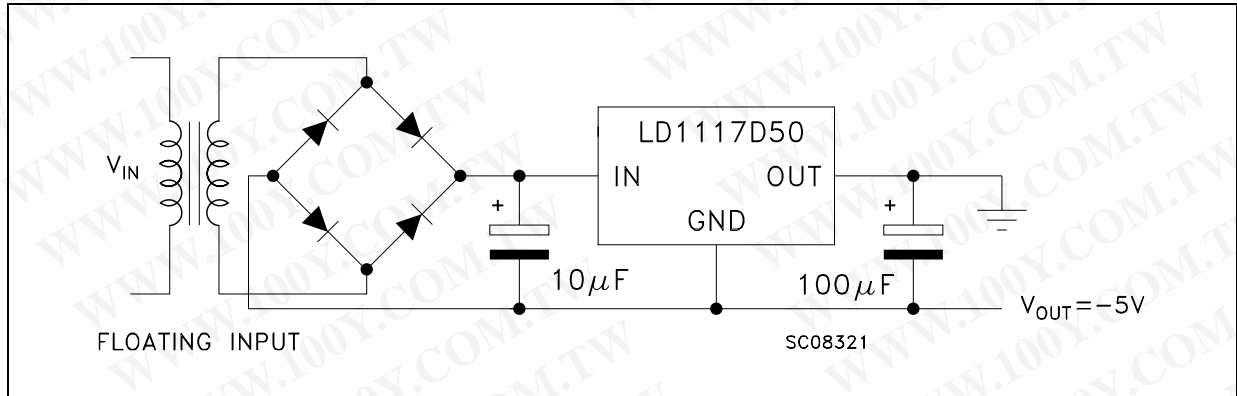


Figure 5. Active terminator for SCSI-2 bus

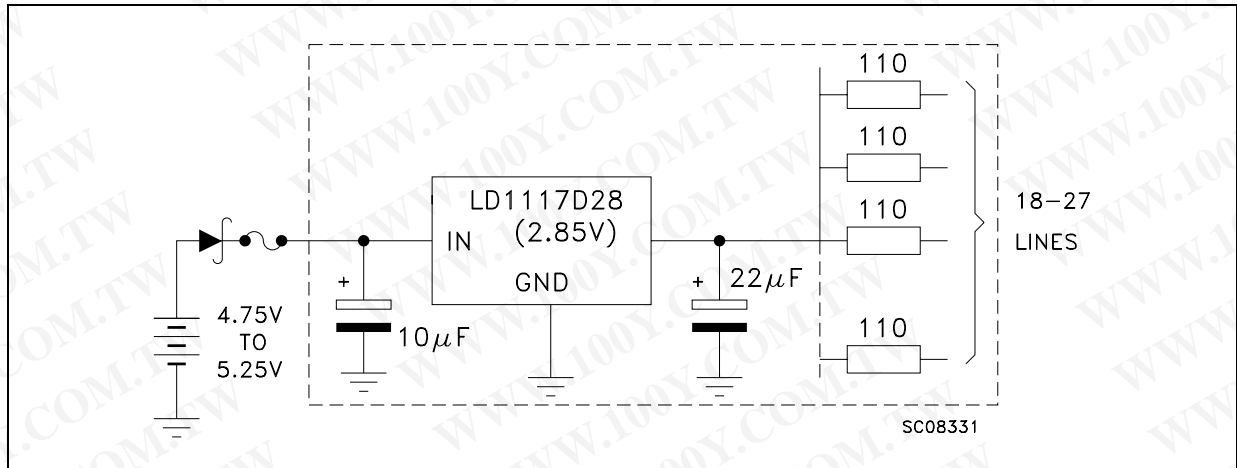


Figure 6. Circuit for increasing output voltage

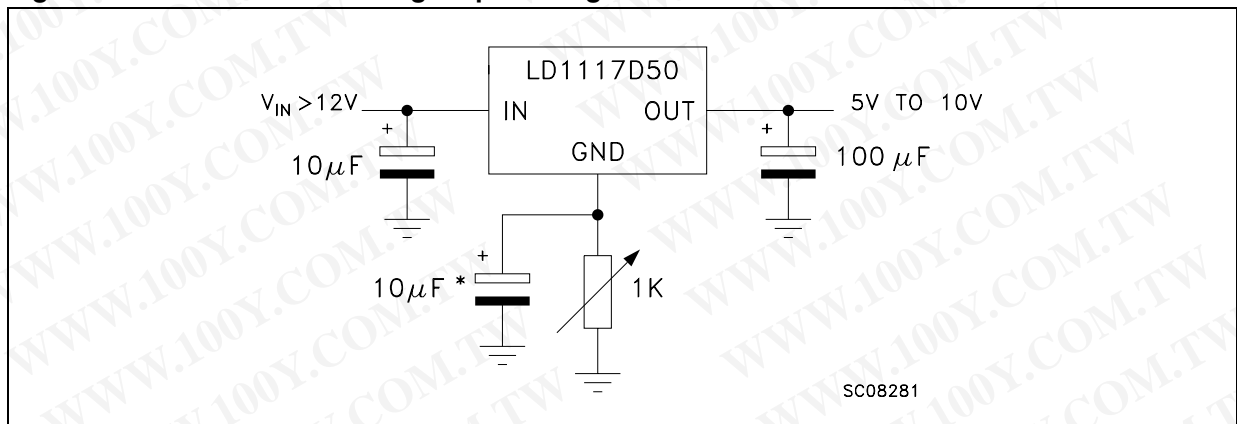


Figure 7. Voltage regulator with reference

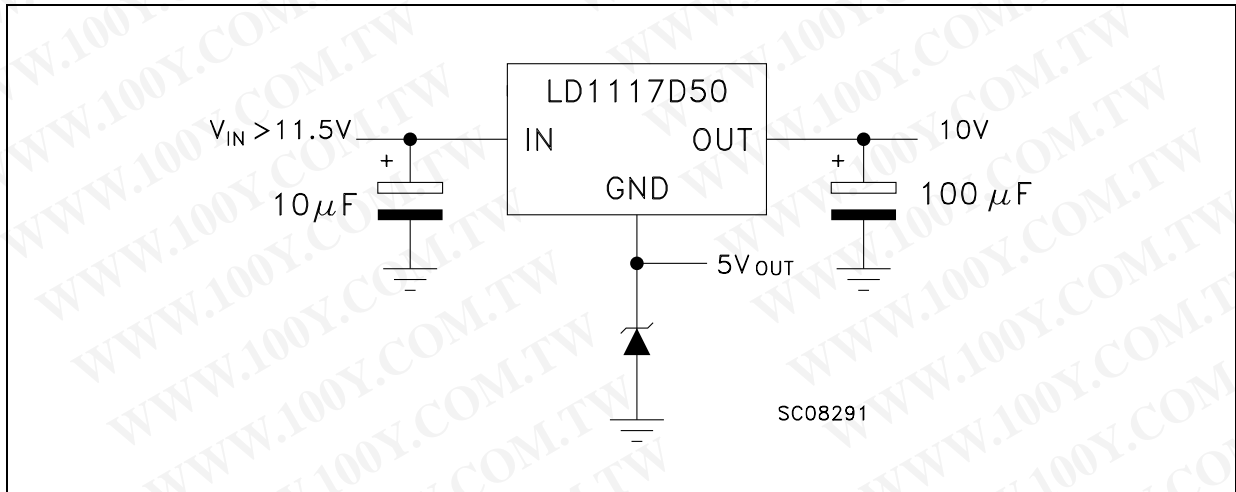
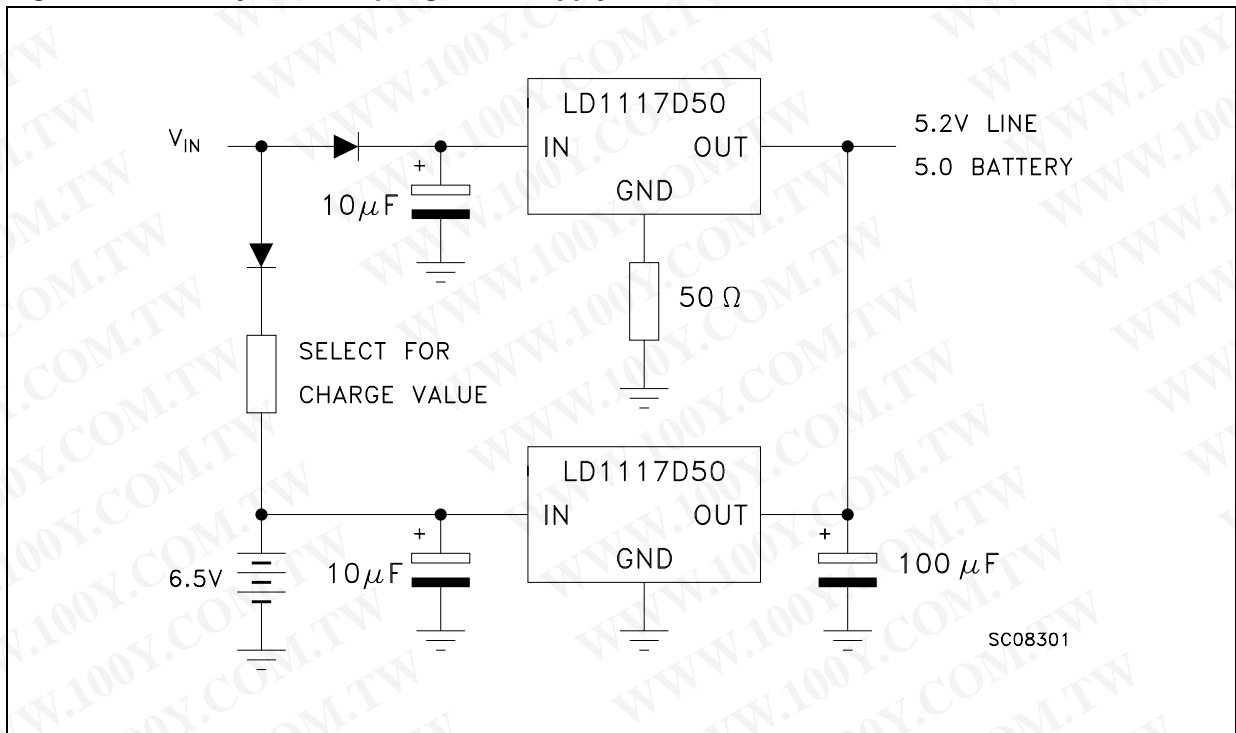
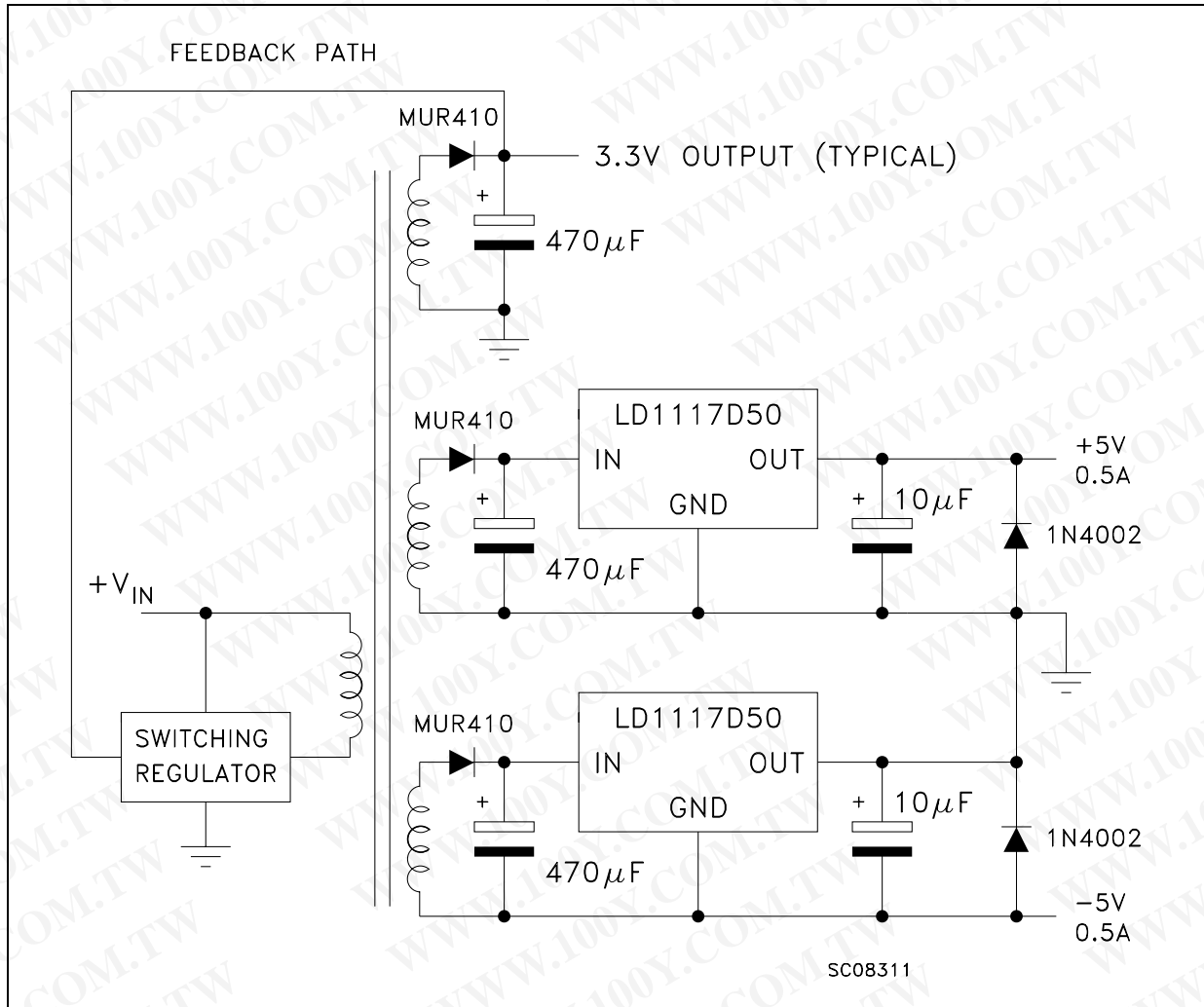


Figure 8. Battery backed-up regulated supply



勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

Figure 9. Post-regulated dual supply



勝特力材料 886-3-5753170  
勝特力电子(上海) 86-21-34970699  
勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

## 7 LD1117A adjustable: application note

The LD1117A adjustable has a thermal stabilized  $1.25 \pm 0.012$  V reference voltage between the OUT and ADJ pins.  $I_{ADJ}$  is 60  $\mu$ A typ. (120  $\mu$ A max.) and  $\Delta I_{ADJ}$  is 1  $\mu$ A typ. (5  $\mu$ A max.).

$R_1$  is normally fixed to 120  $\Omega$ . From *Figure 7* we obtain:

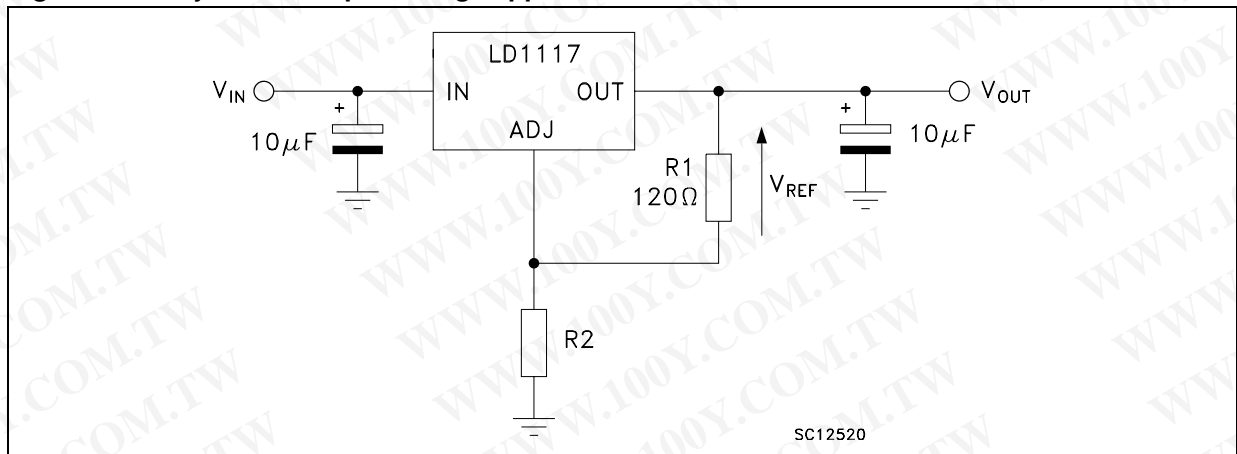
$$V_{OUT} = V_{REF} + R_2 (I_{ADJ} + I_{R1}) = V_{REF} + R_2 (I_{ADJ} + V_{REF} / R_1) = V_{REF} (1 + R_2 / R_1) + R_2 \times I_{ADJ}$$

In normal application  $R_2$  value is in the range of few k $\Omega$ , so the  $R_2 \times I_{ADJ}$  product could not be considered in the  $V_{OUT}$  calculation; then the above expression becomes:

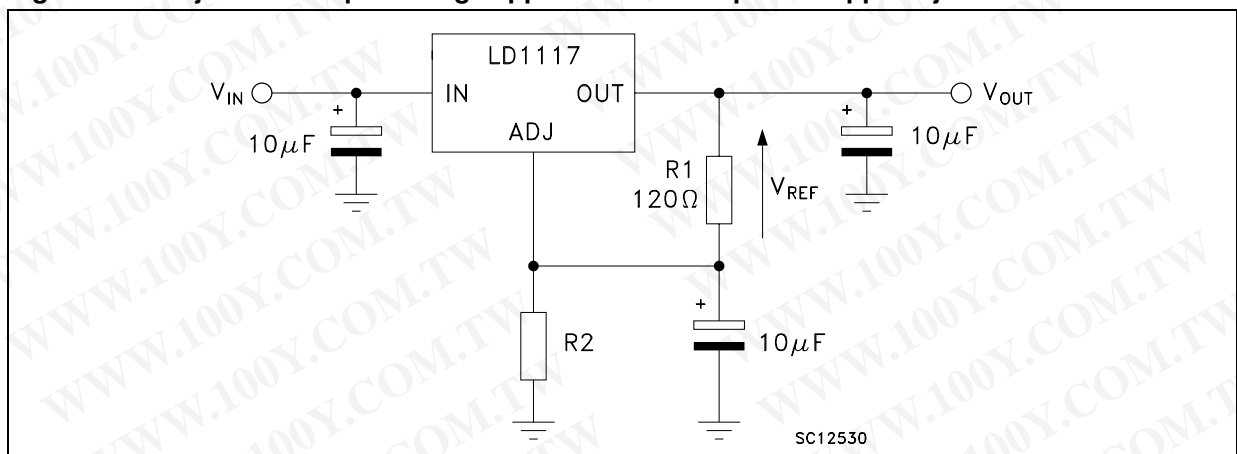
$$V_{OUT} = V_{REF} (1 + R_2 / R_1).$$

In order to have the better load regulation it is important to realize a good Kelvin connection of  $R_1$  and  $R_2$  resistors. In particular  $R_1$  connection must be realized very close to OUT and ADJ pin, while  $R_2$  ground connection must be placed as near as possible to the negative Load pin. Ripple rejection can be improved by introducing a 10  $\mu$ F electrolytic capacitor placed in parallel to the  $R_2$  resistor (see *Figure 10*).

**Figure 10. Adjustable output voltage application**



**Figure 11. Adjustable output voltage application with improved ripple rejection**



## 8 Package mechanical data

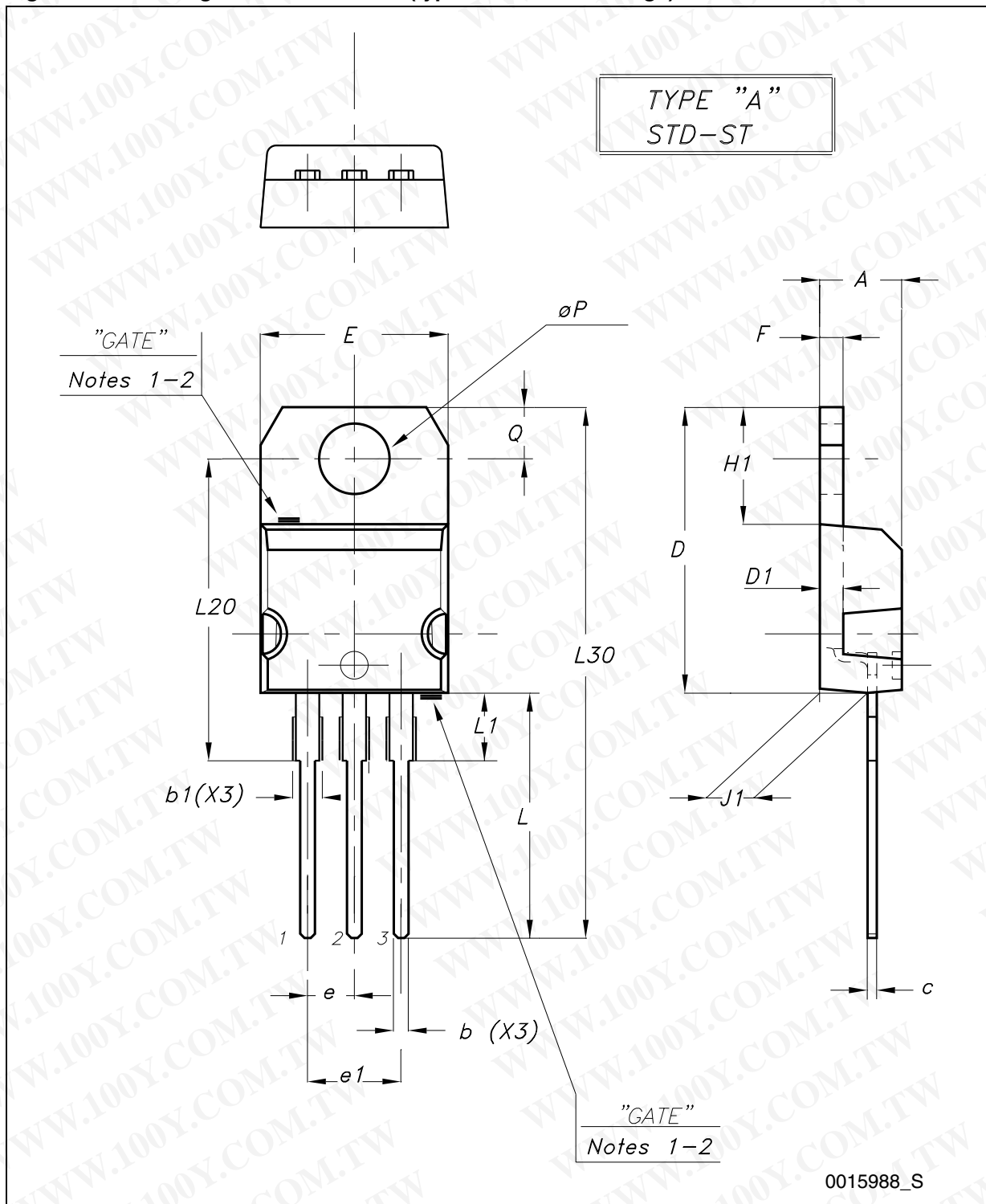
In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK® is an ST trademark.

**Table 8. TO-220 mechanical data**

Dim.	Type STD - ST Dual Gauge			Type STD - ST Single Gauge		
	mm.			mm.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40		4.60	4.40		4.60
b	0.61		0.88	0.61		0.88
b1	1.14		1.70	1.14		1.70
c	0.48		0.70	0.48		0.70
D	15.25		15.75	15.25		15.75
D1		1.27				
E	10.00		10.40	10.00		10.40
e	2.40		2.70	2.40		2.70
e1	4.95		5.15	4.95		5.15
F	1.23		1.32	0.51		0.60
H1	6.20		6.60	6.20		6.60
J1	2.40		2.72	2.40		2.72
L	13.00		14.00	13.00		14.00
L1	3.50		3.93	3.50		3.93
L20		16.40			16.40	
L30		28.90			28.90	
∅P	3.75		3.85	3.75		3.85
Q	2.65		2.95	2.65		2.95

*In spite of some difference in tolerances, the packages are compatible.*

Figure 12. Drawing dimension TO-220 (type STD-ST Dual Gauge)



- Note: 1 Maximum resin gate protrusion: 0.5 mm.  
 2 Resin gate position is accepted in each of the two positions shown on the drawing, or their symmetrical.



勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)



Figure 14. Drawing dimension tube for TO-220 Dual Gauge (mm.)

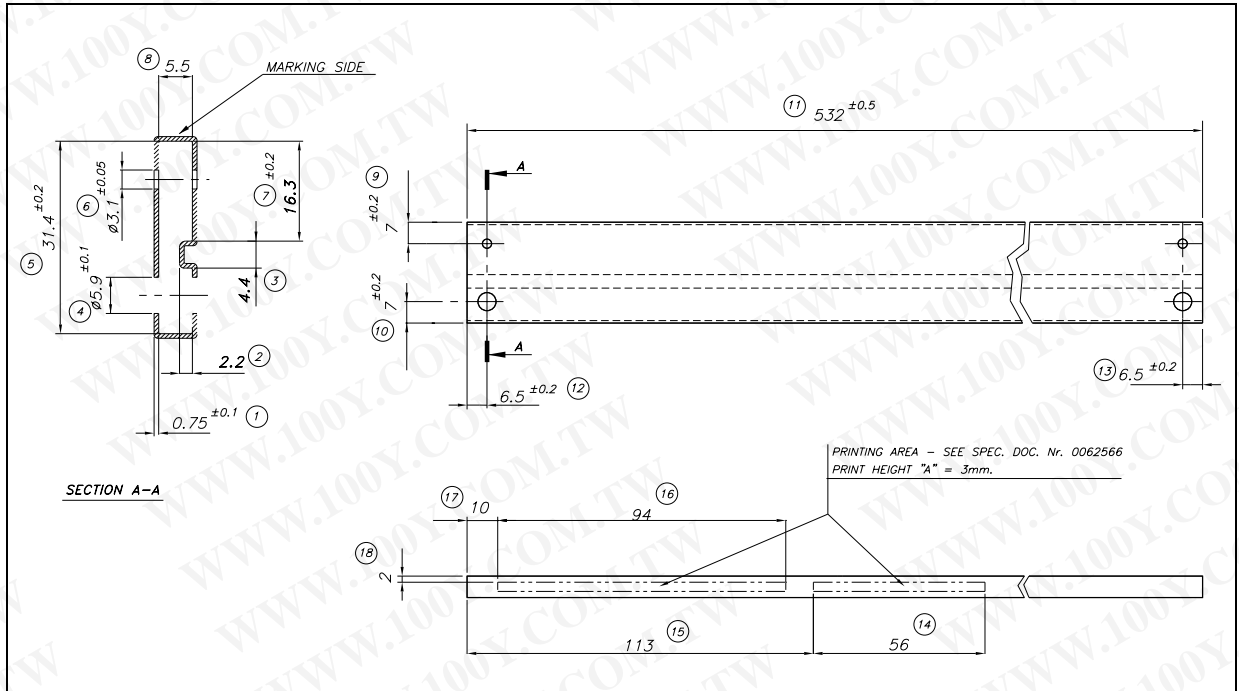
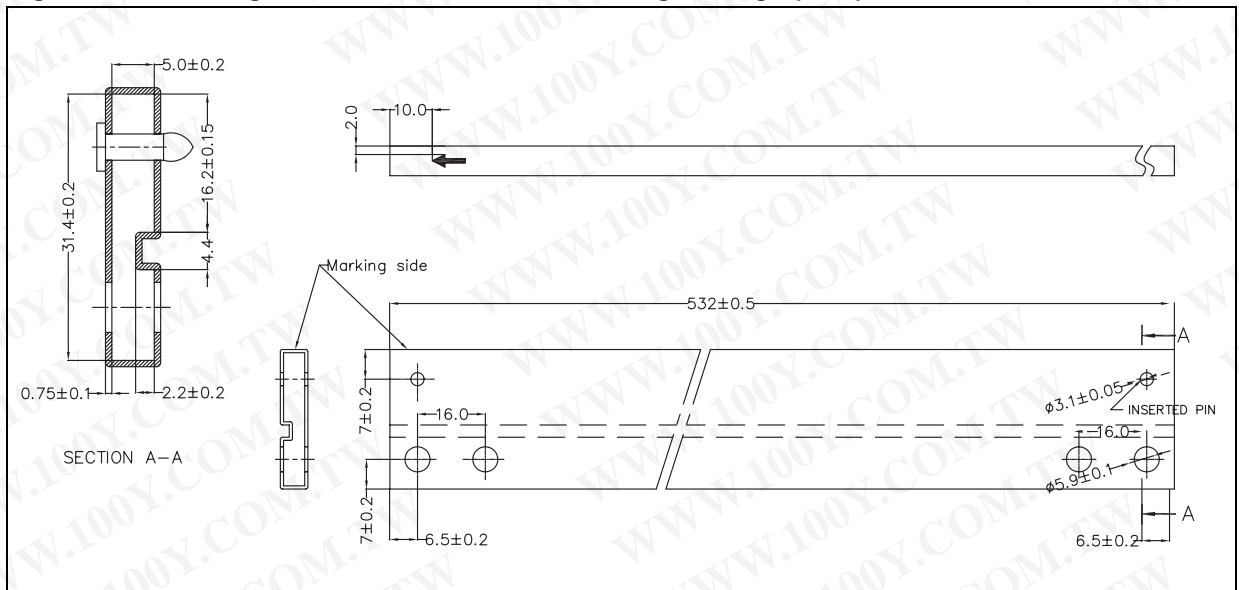


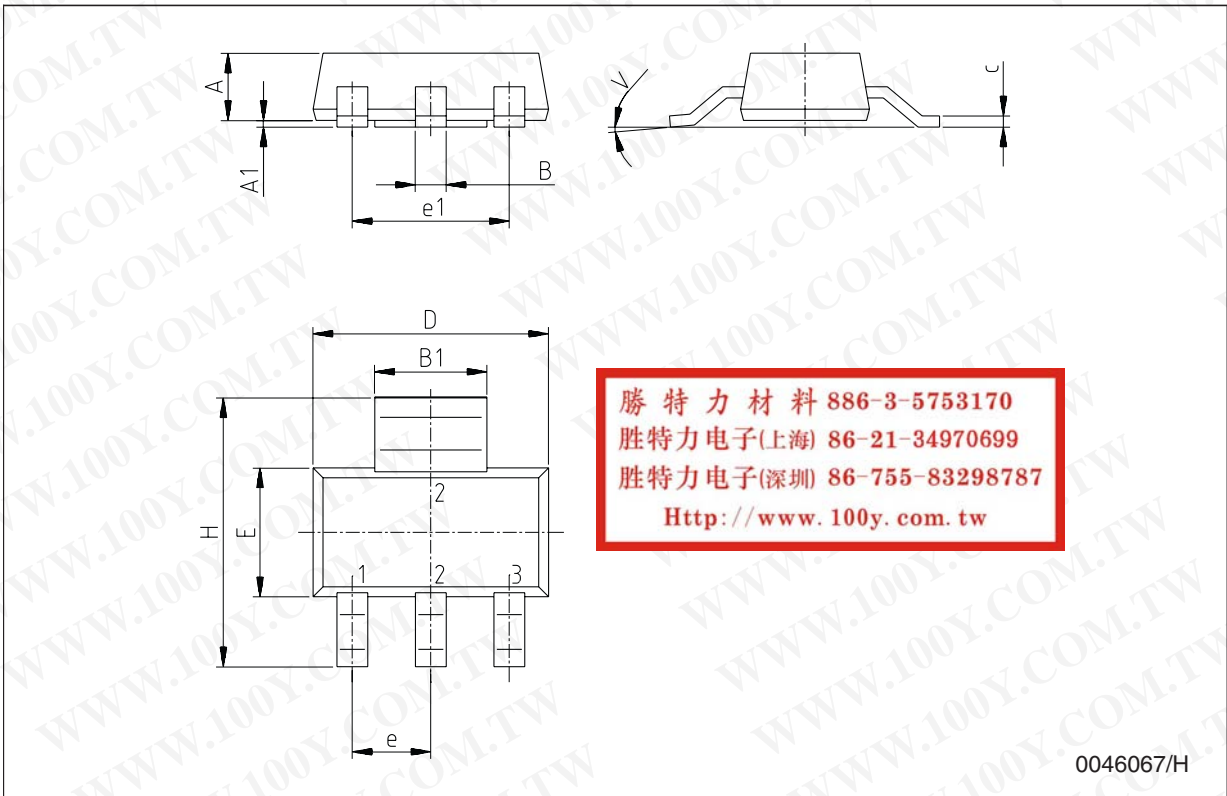
Figure 15. Drawing dimension tube for TO-220 Single Gauge (mm.)



勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

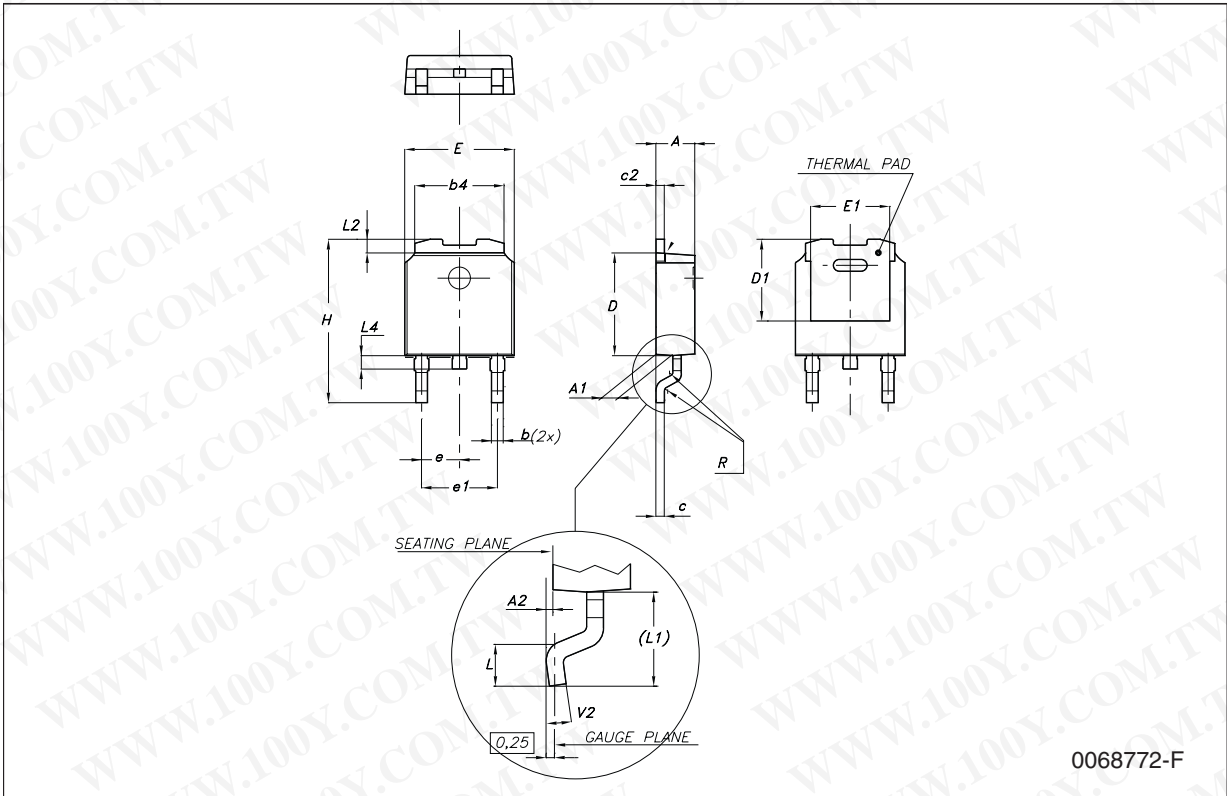
**SOT-223 mechanical data**

Dim.	mm.			mils.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			1.8			70.9
A1	0.02		0.1	0.8		3.9
B	0.6	0.7	0.85	23.6	27.6	33.5
B1	2.9	3	3.15	114.2	118.1	124.0
c	0.24	0.26	0.35	9.4	10.2	13.8
D	6.3	6.5	6.7	248.0	255.9	263.8
e		2.3			90.6	
e1		4.6			181.1	
E	3.3	3.5	3.7	129.9	137.8	145.7
H	6.7	7	7.3	263.8	275.7	287.5
V			10°			10°



**DPAK mechanical data**

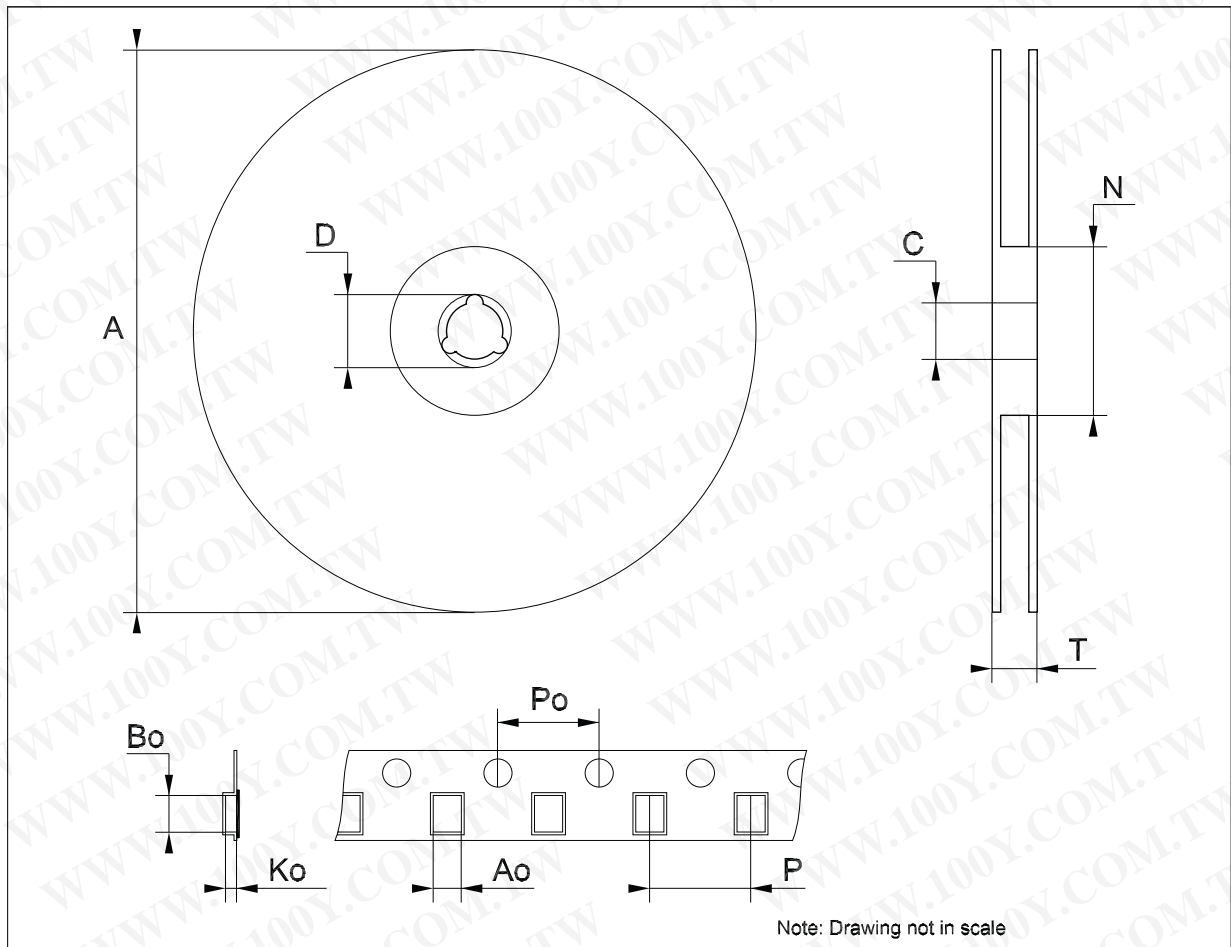
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.9	0.025		0.035
b4	5.2		5.4	0.204		0.212
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
D1		5.1			0.200	
E	6.4		6.6	0.252		0.260
E1		4.7			0.185	
e		2.28			0.090	
e1	4.4		4.6	0.173		0.181
H	9.35		10.1	0.368		0.397
L	1			0.039		
(L1)		2.8			0.110	
L2		0.8			0.031	
L4	0.6		1	0.023		0.039
R		0.2			0.008	
V2	0°		8°	0°		8°



勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

**Tape & reel SOT223 mechanical data**

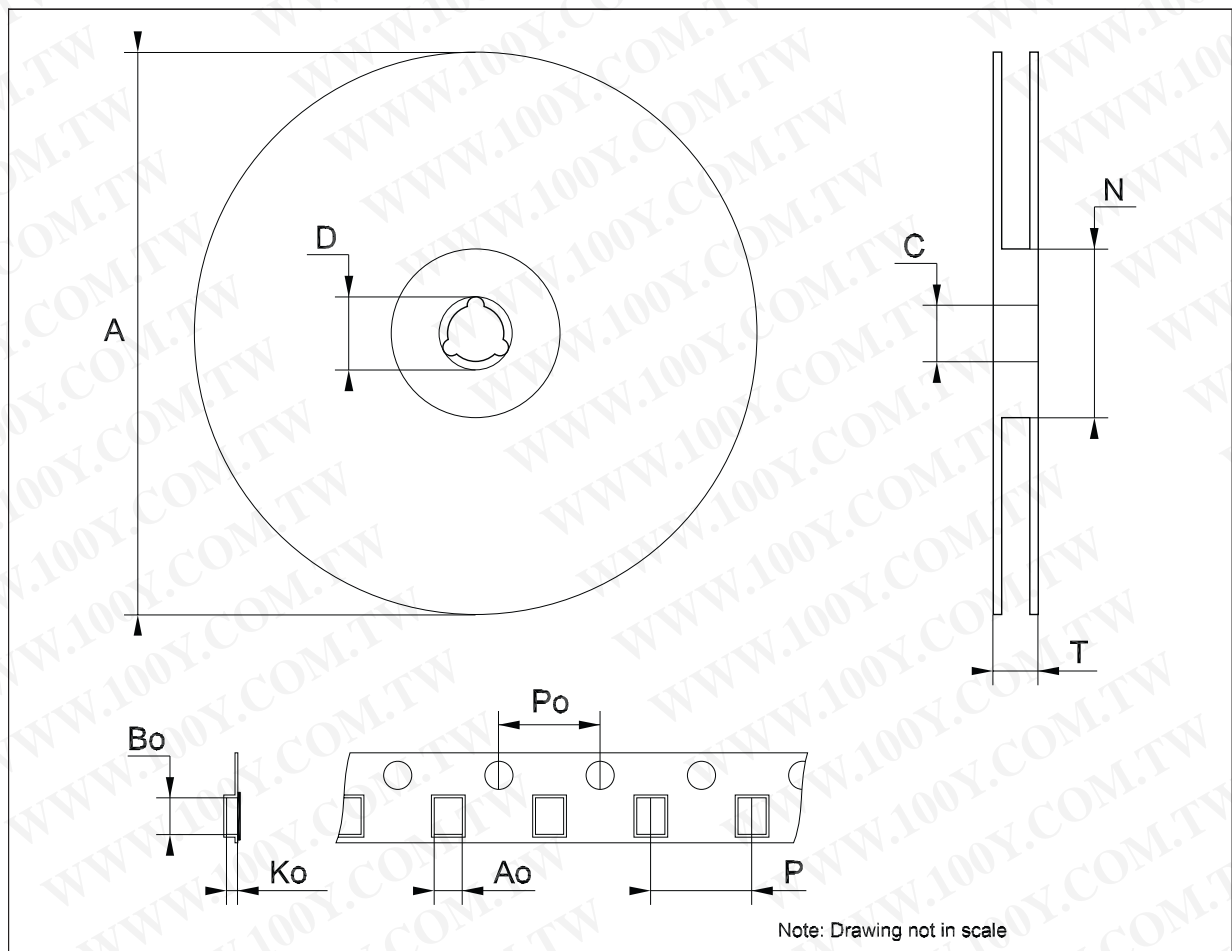
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			330			12.992
C	12.8	13.0	13.2	0.504	0.512	0.519
D	20.2			0.795		
N	60			2.362		
T			14.4			0.567
Ao	6.73	6.83	6.93	0.265	0.269	0.273
Bo	7.32	7.42	7.52	0.288	0.292	0.296
Ko	1.78		2	0.070		0.078
Po	3.9	4.0	4.1	0.153	0.157	0.161
P	7.9	8.0	8.1	0.311	0.315	0.319



勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

**Tape & reel DPAK-PPAK mechanical data**

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			330			12.992
C	12.8	13.0	13.2	0.504	0.512	0.519
D	20.2			0.795		
N	60			2.362		
T			22.4			0.882
Ao	6.80	6.90	7.00	0.268	0.272	0.276
Bo	10.40	10.50	10.60	0.409	0.413	0.417
Ko	2.55	2.65	2.75	0.100	0.104	0.105
Po	3.9	4.0	4.1	0.153	0.157	0.161
P	7.9	8.0	8.1	0.311	0.315	0.319



勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

## 9 Revision history

**Table 9. Document revision history**

Date	Revision	Changes
29-Sep-2004	11	Add new part number.
12-Oct-2004	12	Mistake $V_O$ max. - Table 4.
21-Apr-2005	13	Add new package - D <sup>2</sup> PAK/A.
05-Jul-2005	14	The DPAK mechanical data updated.
10-Feb-2006	15	Add new package - D <sup>2</sup> PAK/A (B Type).
20-Dec-2006	16	Change value $V_{IN}$ on <a href="#">Table 2</a> .
19-Jan-2007	17	D <sup>2</sup> PAK/A mechanical data updated and add footprint data.
28-May-2007	18	Add $I_{ADJ}$ and $\Delta I_{ADJ}$ values on <a href="#">Table 7</a> .
07-Jun-2007	19	Add $I_{O(min)}$ value on <a href="#">Table 7</a> .
15-Apr-2008	20	Modified: Table 10.
28-Jul-2009	21	Modified: Table 10.
05-Jul-2010	22	Added: <a href="#">Table 8 on page 15</a> , <a href="#">Figure 12 on page 16</a> , <a href="#">Figure 13 on page 17</a> , <a href="#">Figure 14</a> and <a href="#">Figure 15 on page 18</a> .
16-Nov-2010	23	Modified: <a href="#">Table 1 on page 1</a> , $R_{thJC}$ value for TO-220 <a href="#">Table 3 on page 5</a> .

勝特力材料 886-3-5753170  
 勝特力电子(上海) 86-21-34970699  
 勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

勝特力材料 886-3-5753170  
勝特力电子(上海) 86-21-34970699  
勝特力电子(深圳) 86-755-83298787  
[Http://www.100y.com.tw](http://www.100y.com.tw)

**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.**

**UNLESS EXPRESSLY APPROVED IN WRITING BY AN AUTHORIZED ST REPRESENTATIVE, ST PRODUCTS ARE NOT RECOMMENDED, AUTHORIZED OR WARRANTED FOR USE IN MILITARY, AIR CRAFT, SPACE, LIFE SAVING, OR LIFE SUSTAINING APPLICATIONS, NOR IN PRODUCTS OR SYSTEMS WHERE FAILURE OR MALFUNCTION MAY RESULT IN PERSONAL INJURY, DEATH, OR SEVERE PROPERTY OR ENVIRONMENTAL DAMAGE. ST PRODUCTS WHICH ARE NOT SPECIFIED AS "AUTOMOTIVE GRADE" MAY ONLY BE USED IN AUTOMOTIVE APPLICATIONS AT USER'S OWN RISK.**

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.

© 2010 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](http://www.st.com)