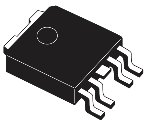
ST1L04

Low quiescent current voltage regulator

Datasheet - production data



PPAK

Features

- Adjustable output voltage from 0.8 V to V_I -V_D
- Internal reference voltage
- Accuracy ± 2% at 25 °C
- Output current capability: 1 A minimum
- Very low quiescent current: max. 3 mA over the whole temperature range
- Maximum dropout 1 V @ I_O = 1 A
- Stable with low ESR ceramic capacitors only
- Thermal shutdown protection with hysteresis
- Overcurrent protection
- Operating junction temperature range: from 0 to 125 °C

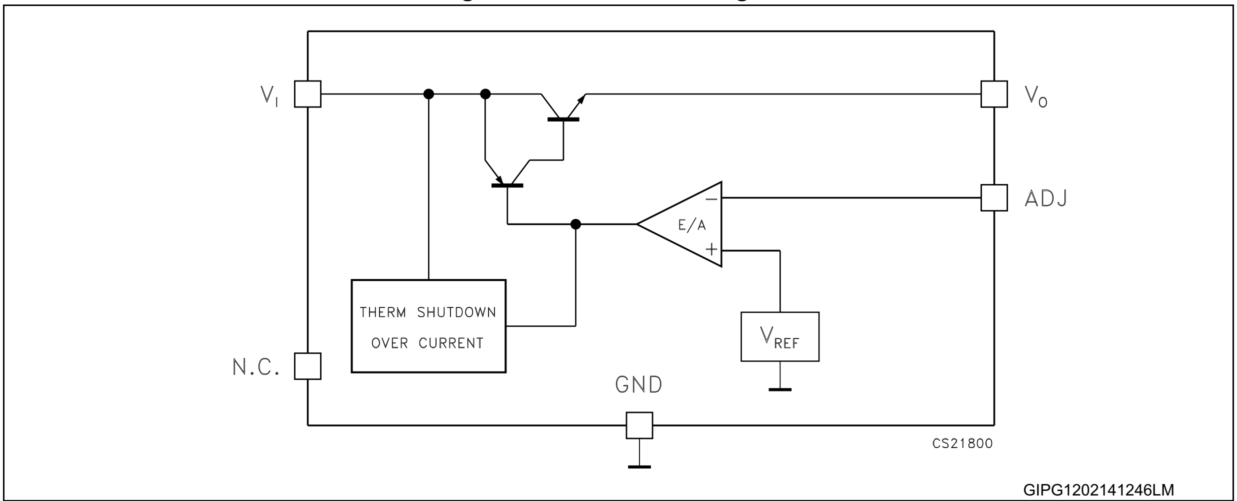
Description

The ST1L04 is a low drop adjustable linear voltage regulator, which supplies up to 1 A output current. The output voltage can be as low as 0.8 V. The quiescent current is controlled and maintained well below 3 mA over the whole allowed junction temperature range. The ST1L04 is stable with low ESR output ceramic capacitors only. Internal protection circuitry includes thermal protection with hysteresis and overcurrent limiting. The ST1L04 is especially suitable for applications requiring low voltage outputs from low voltage inputs. Typical applications for this product are: notebook PCs, low voltage ASIC, VID power supplies and low cost post regulation for 3.3 V output voltage switching regulators.

Table 1. Device summary

Order code	Package
ST1L04PT	PPAK

Figure 1. Schematic diagram



Contents

1 Pin description

Figure 2. Pin connection (top view)

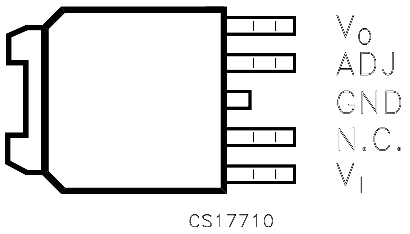
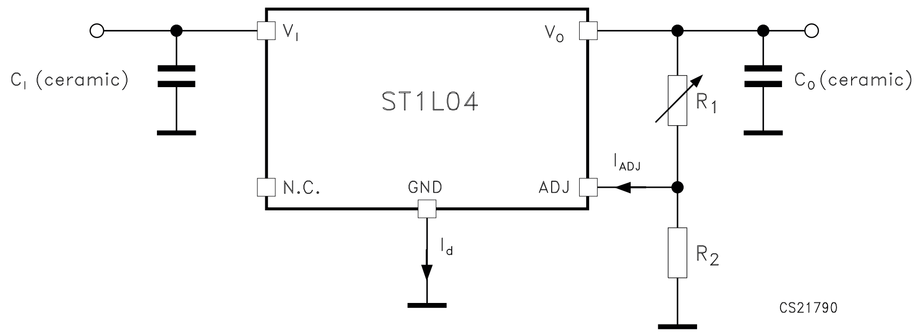


Table 2. Pin description

Pin	Name	Function
1	V_I	Supply voltage input pin. Bypass with a ceramic capacitor to GND
2	N.C.	Not connected
3	GND	Ground. The exposed metallic pad of the package is connected to GND
4	ADJ	Adjust voltage pin. External resistor divider connection
5	V_O	Output voltage pin. Bypass with a ceramic capacitor to GND

Figure 3. Typical application schematic



The adjustable output voltage is set by a resistor divider connected between V_O and GND with its centre tap connected to ADJ. The voltage divider resistors are: R1 connected between V_O and ADJ and R2 connected between ADJ and GND. V_O is given by V_{REF}, R_1, R_2, I_{ADJ}, as follows:

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

since I_{ADJ} is very small and stable, it can be ignored and the output voltage can be simply calculated as follows:

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

2 Maximum ratings

Table 3. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_I	DC supply voltage	From GND -0.3 to 10	V
P_{TOT}	Power dissipation	Internally limited	W
I_O	Output current	Internally limited	A
T_{OP}	Operating junction temperature range	0 to + 125	°C
T_{STG}	Storage temperature range	-40 to +150	°C

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

Table 4. Thermal data

Symbol	Parameter	PPAK	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	8	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	100	°C/W

3 Electrical characteristics

Refer to the typical application schematic, V_{IN} from 2.9 to 5.5 V, I_O from 10 mA to 1 A, C_{IN} = 4.7 µF, C_{OUT} = 4.7 µF, T_j = 0 to 125 °C, unless otherwise specified. T_J = 25 °C unless otherwise specified.

Table 5. Electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ.	Max.	Unit
V_I	Operating input voltage			2.8			V
I_d	Quiescent current					3	mA
V_{REF}	Reference voltage	T_J = 25 °C		0.784	0.8	0.816	V
				0.776	0.8	0.824	
ΔV_O	Line regulation	I_O = 10 mA				0.8	%
	Load regulation	V_I = 3.3 V				0.8	%
I_{ADJ}	Adjustment current	I_O = 10 mA				1	µA
$I_{\Delta ADJ}$	Adjustment current change					200	nA
I_{Omin}	Minimum output current for regulation					100	µA
I_O	Output current limit			1		1.4	A
V_d	Dropout voltage(1) (2)	I_O = 1 A, V_O = from 1.8 to 3.3 V				1	V
SVR	Supply voltage rejection (2)	V_I = 3.3 ± 0.5 V, I_O = 10 mA, T_J = 25 °C	f = 120 Hz	50			dB
			f = 100 kHz	20			
C_O	Ceramic output capacitor value			2.2			µF
C_{ESR}	Output capacitor ESR value					200	mΩ
eN	Output noise voltage(2)	B = from 10 Hz to 10 kHz, V_I = 3.3 V, I_O = 10 mA, T_j = 25 °C			0.003		$\%V_O$
T_{SH}	Thermal shutdown trip point (2)	V_I = 3.3 V			165		°C
T_{HY}	Thermal shutdown hysteresis (2)	V_I = 3.3 V			5		°C

1. This parameter is the minimum input-to-output differential voltage required to maintain 1% regulation with respect to the V_O nominal value. As to V_O between 0.8 V and 1.8 V included, the V_d value is overridden by the minimum operating input voltage.
2. Guaranteed by design. Not tested in production.

4 Typical characteristics

Figure 4. Output voltage vs. temperature V_I=2.9 V

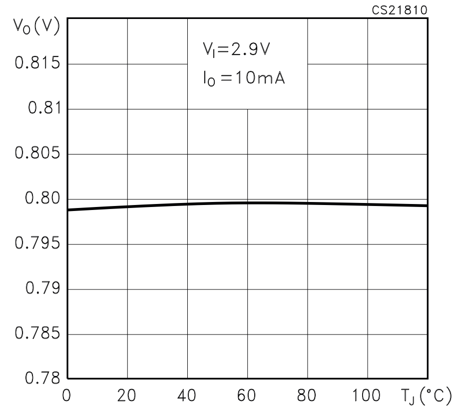


Figure 5. Load regulation vs. temperature

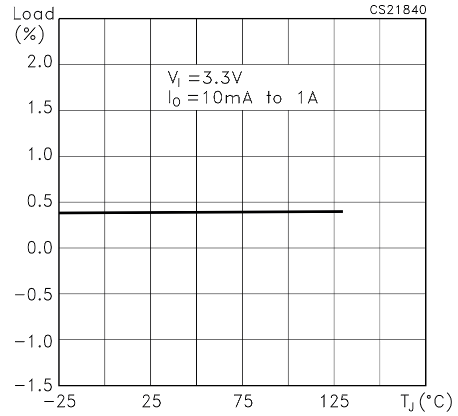


Figure 6. Output voltage vs. temperature V_I = 3.3 V

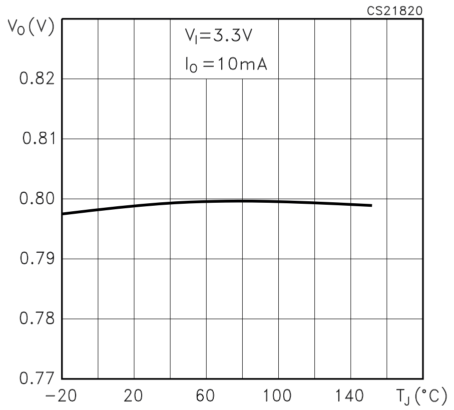


Figure 7. Quiescent current vs. temperature I_O = 1 A

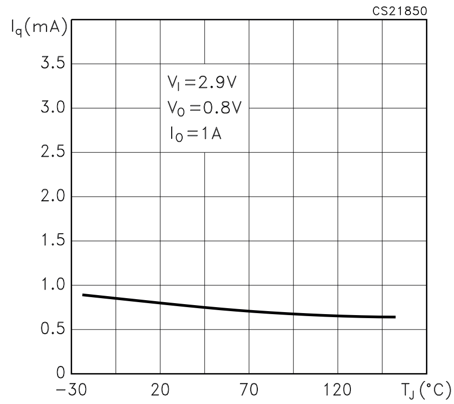


Figure 8. Line regulation vs. temperature

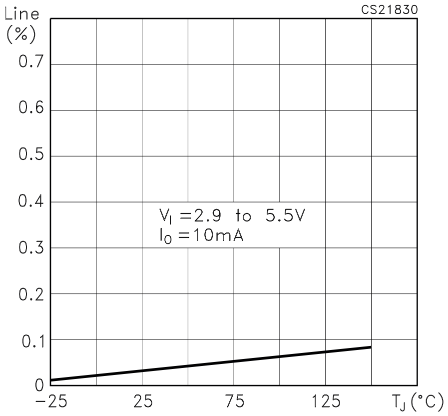


Figure 9. Quiescent current vs. temperature I_O = 10 mA

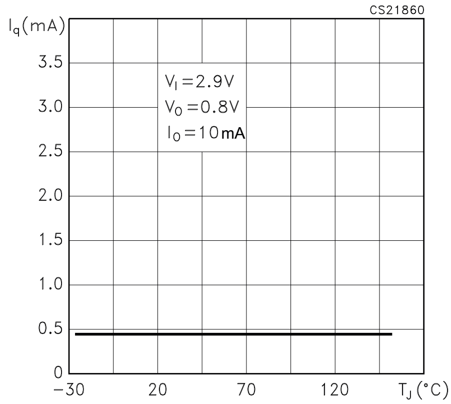


Figure 10. Quiescent current vs. output current

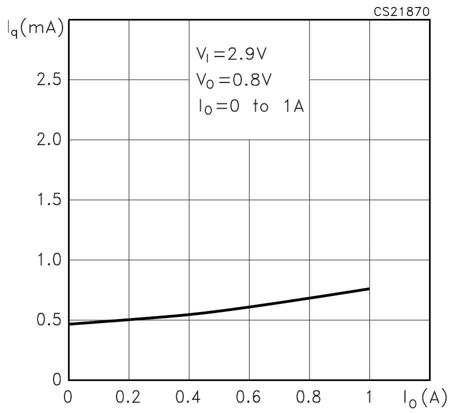


Figure 11. Dropout voltage vs. output current

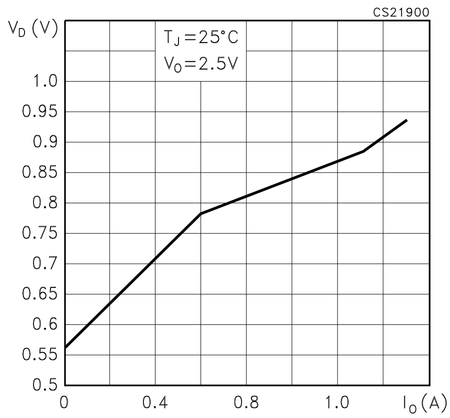


Figure 12. Quiescent current vs. input voltage

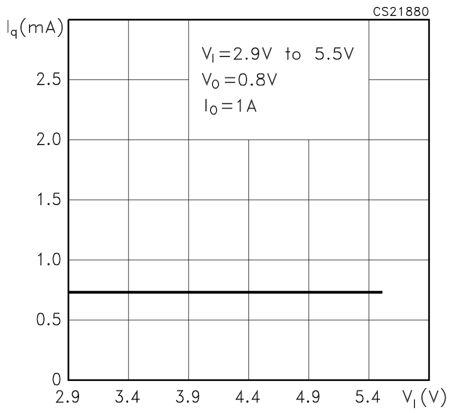


Figure 13. Supply ripple rejection vs. temperature f= 100 kHz

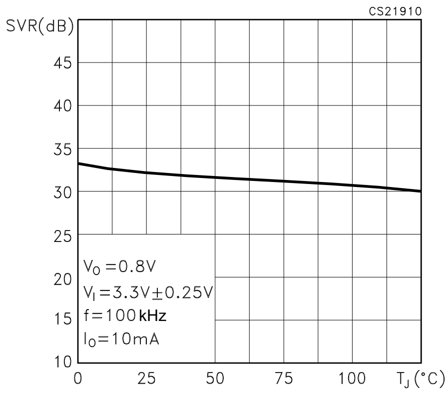


Figure 14. Dropout voltage vs. temperature

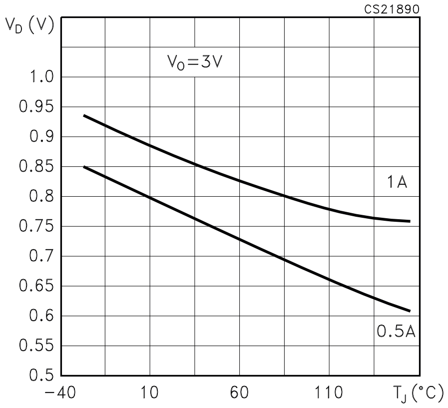


Figure 15. Supply ripple rejection vs. temperature f=102 Hz

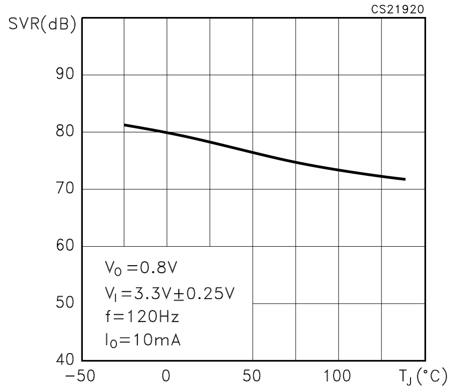


Figure 16. Supply ripple rejection vs. output current

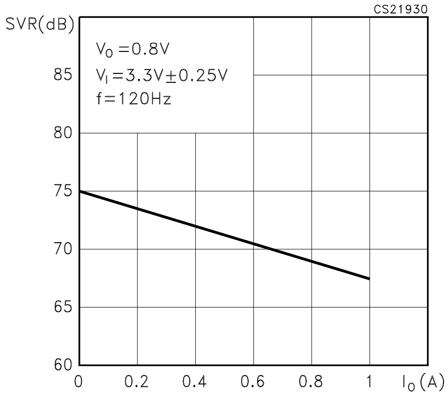


Figure 17. Adjustment current change vs. temperature

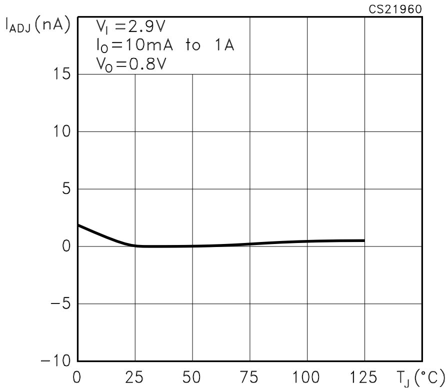


Figure 18. Supply ripple rejection vs. frequency

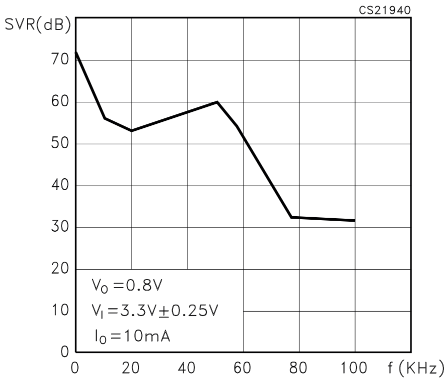


Figure 19. Minimum output current for regulation vs. temperature V_I= 5.5 V

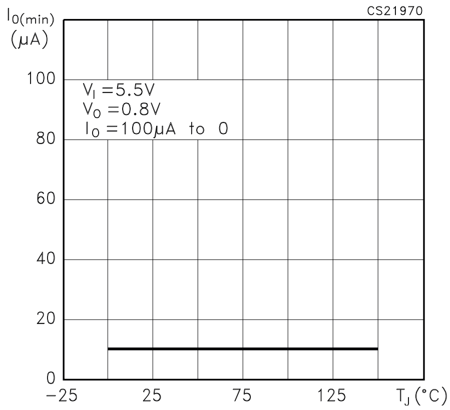


Figure 20. Adjustment current vs. temperature

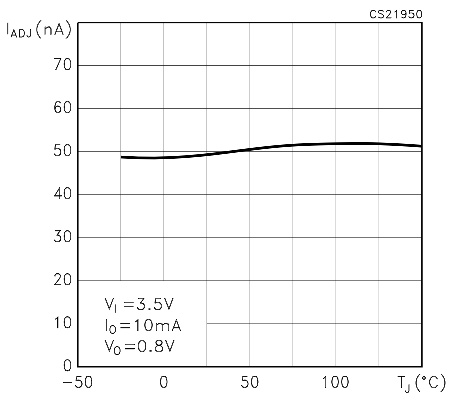


Figure 21. Minimum output current for regulation vs. temperature V_I= 2.6 V

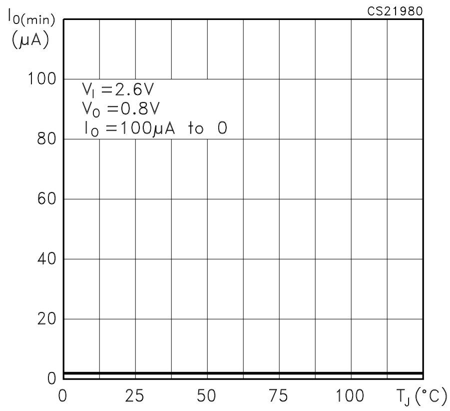
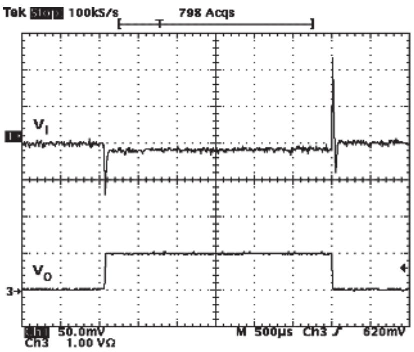


Figure 22. Load transient



V_I=4 V, I_O=10mA to 1A, C_O=4.7µF, C_I=4.7µF, T_J=25°C

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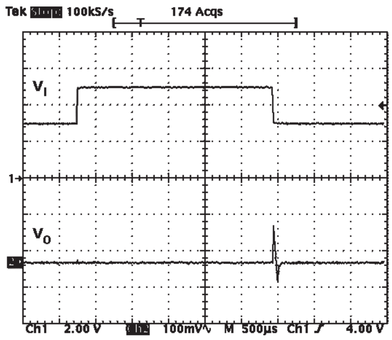
Figure 23. Line transient



V_I=3V to 5V, I_O=250mA, NO C_I, T_J=25°C, t_{RISE}=t_{FALL}=3µs

GIPG1302141155LM

5 ECOPACK®

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 24. PPAK drawings

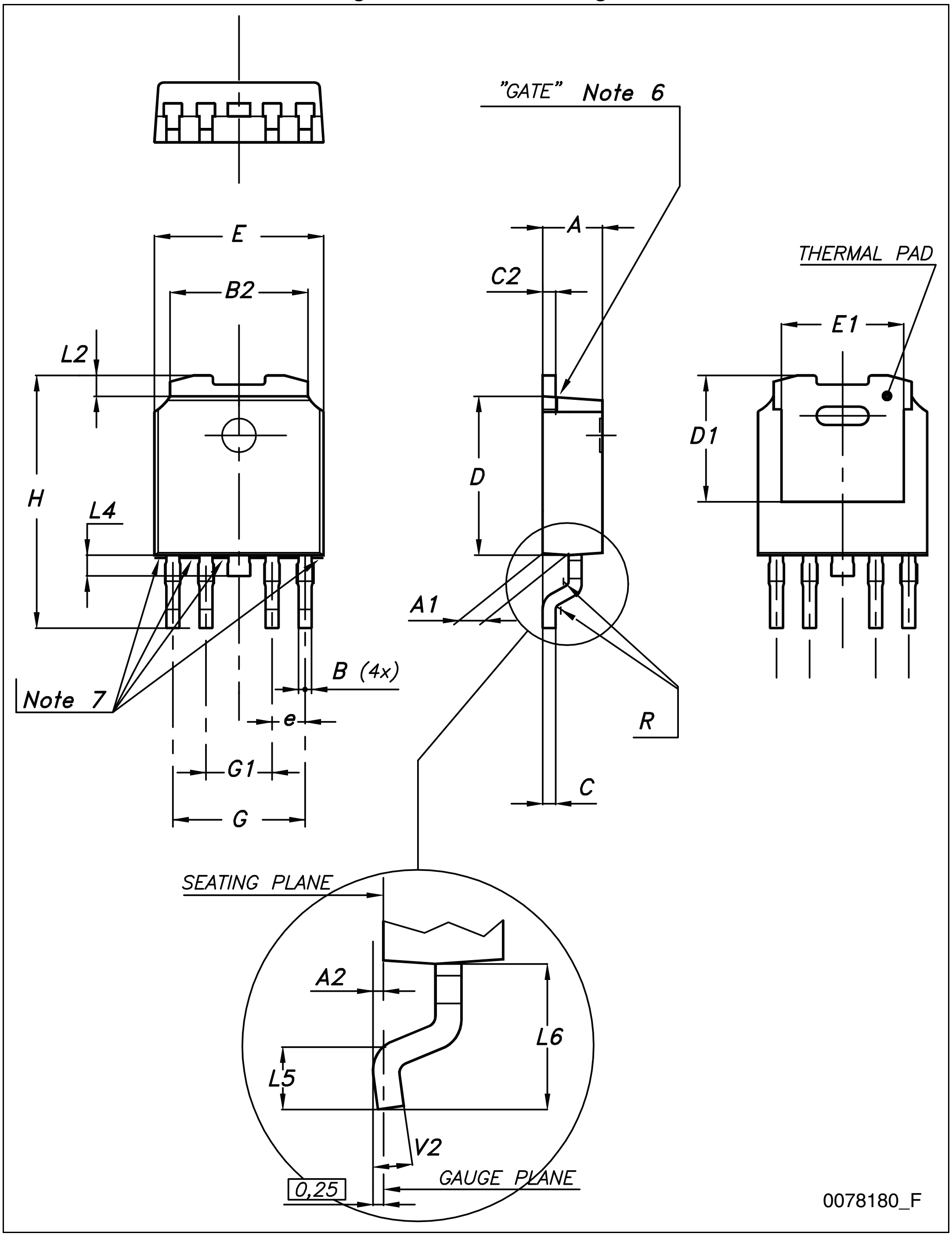


Table 6. PPAK mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	2.2		2.4
A1	0.9		1.1
A2	0.03		0.23
B	0.4		0.6
B2	5.2		5.4
C	0.45		0.6
C2	0.48		0.6
D	6		6.2
D1		5.1	
E	6.4		6.6
E1		4.7	
e		1.27	
G	4.9		5.25
G1	2.38		2.7
H	9.35		10.1
L2		0.8	1
L4	0.6		1
L5	1		
L6		2.8	
R		0.20	
V2	0°		8°

6 Packaging mechanical data

Figure 25. Tape for PPAK

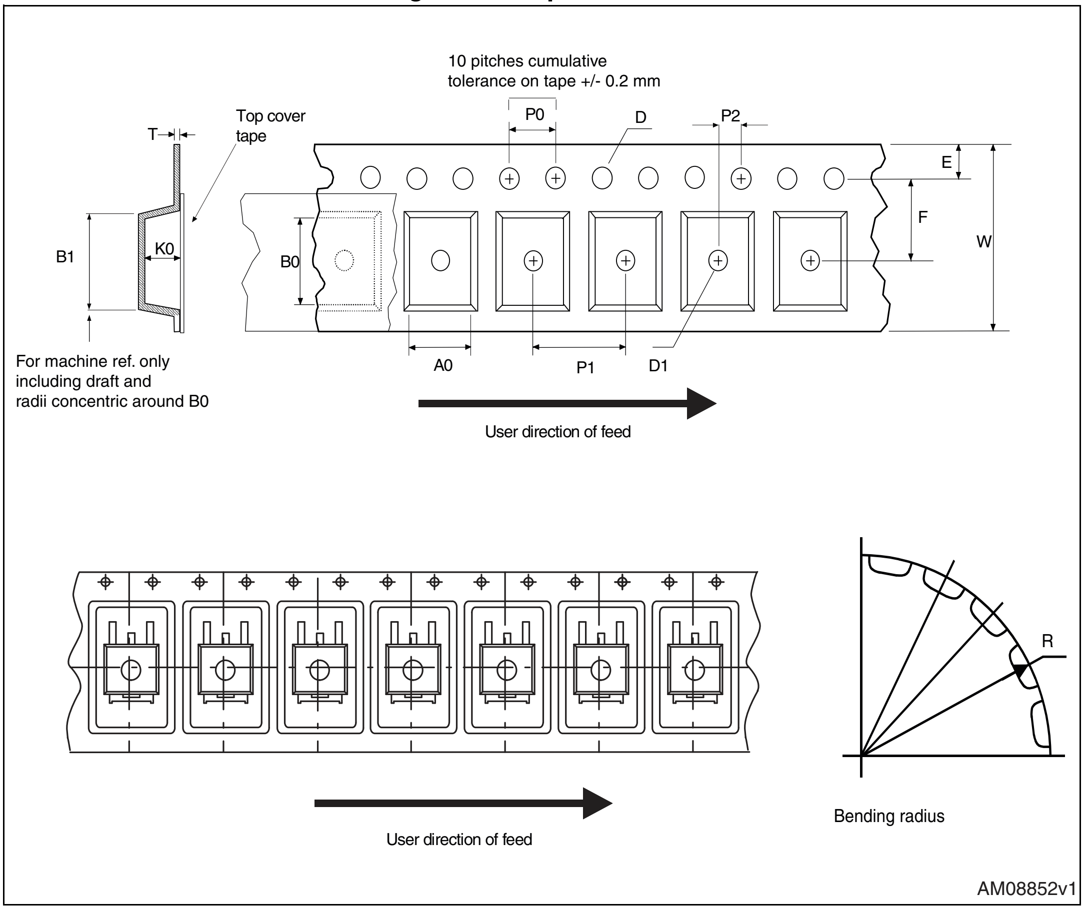


Figure 26. Reel for PPAK

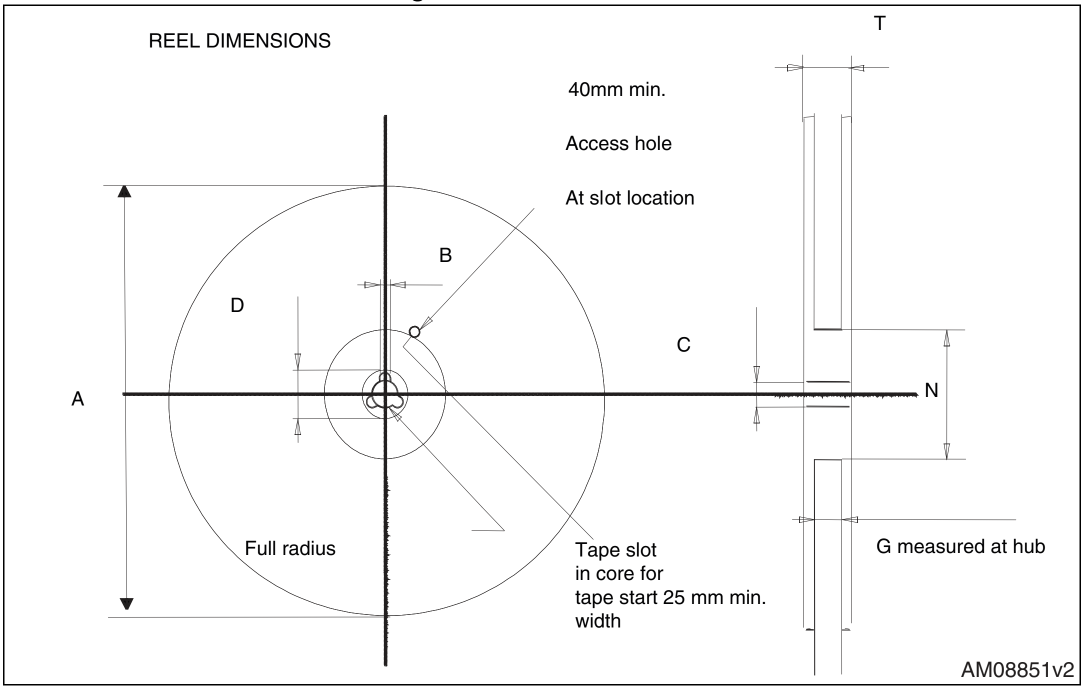


Table 7. PPAK tape and reel mechanical data

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 quantity		2500
P1	7.9	8.1	Bulk quantity		2500
P2	1.9	2.1			
R	40				
T	0.25	0.35			
W	15.7	16.3			

7 Revision history

Table 8. Document revision history

Date	Revision	Changes
10-Feb-2005	1	Initial release.
05-Mar-2014	2	Updated *Features*. Updated *Table 5*. Changed title of *Figure 4*, *Figure 6*, *Figure 7*, *Figure 15*, *Figure 19* and *Figure 21*. Updated *Figure 9* and *Figure 13*. Minor text changes.