

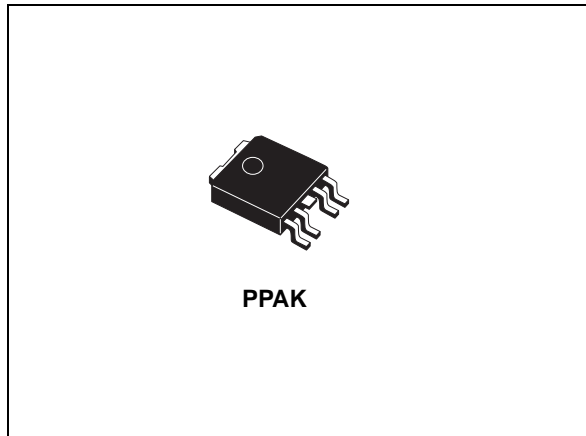


**THE DATASHEET OF  
LD39080PT33-R**



## Ultra low drop BiCMOS voltage regulator

Datasheet - production data



### Features

- 0.8 A guaranteed output current
- Ultra low-dropout voltage (150 mV typ. @ 0.8 A load, 20 mV typ. @ 150 mA load)
- Very low quiescent current (1 mA typ. @ 0.8 A load, 1  $\mu$ A max. @ 25 °C in off mode)
- Logic-controlled electronic shutdown
- Current and thermal internal limit
- $\pm 1.5\%$  output voltage tolerance @ 25 °C
- ADJ output voltage: 1.22 V to 5.0 V
- Temperature range: - 40 to 125 °C
- Fast dynamic response to line and load changes
- Stable with ceramic capacitor
- Available in PPAK

### Applications

- Microprocessor power supply
- DSP power supply
- Post regulators for switching suppliers
- High efficiency linear regulator

### Description

The LD39080 is a fast, ultra low drop linear regulator which operates from 2.5 V to 6 V input supply.

A wide range of output options is available. The low drop voltage, low noise, and ultra low quiescent current make it suitable for low voltage microprocessors and memory applications. The device is developed on the BiCMOS process which allows the low quiescent current operation regardless of the output load current.

**Table 1. Device summary**

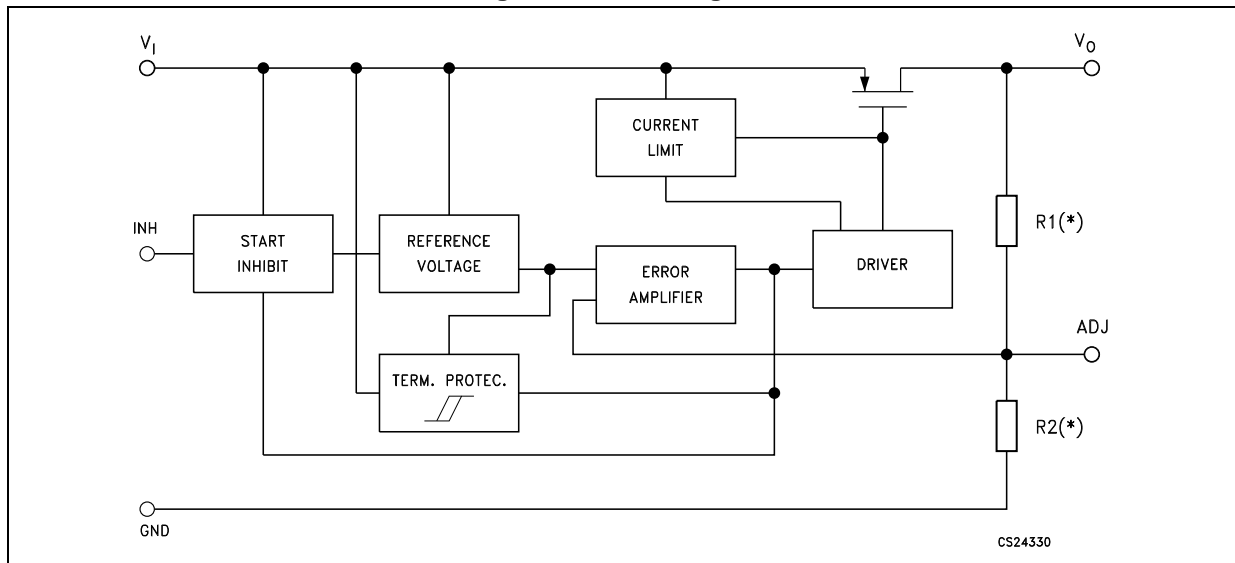
PPAK (tape and reel)	Output voltage
LD39080PT-R	ADJ from 1.22 to 5.0 V

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# 1 Diagram

Figure 1. Block diagram



(\*) Not present on ADJ version.

## 2 Pin configuration

Figure 2. Pin connections (top view)

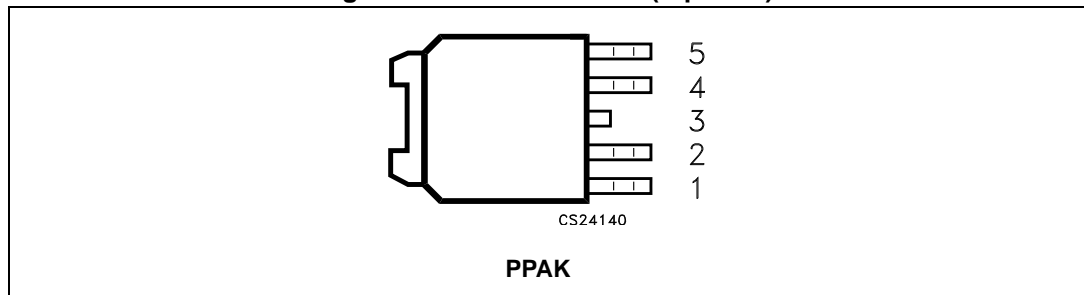


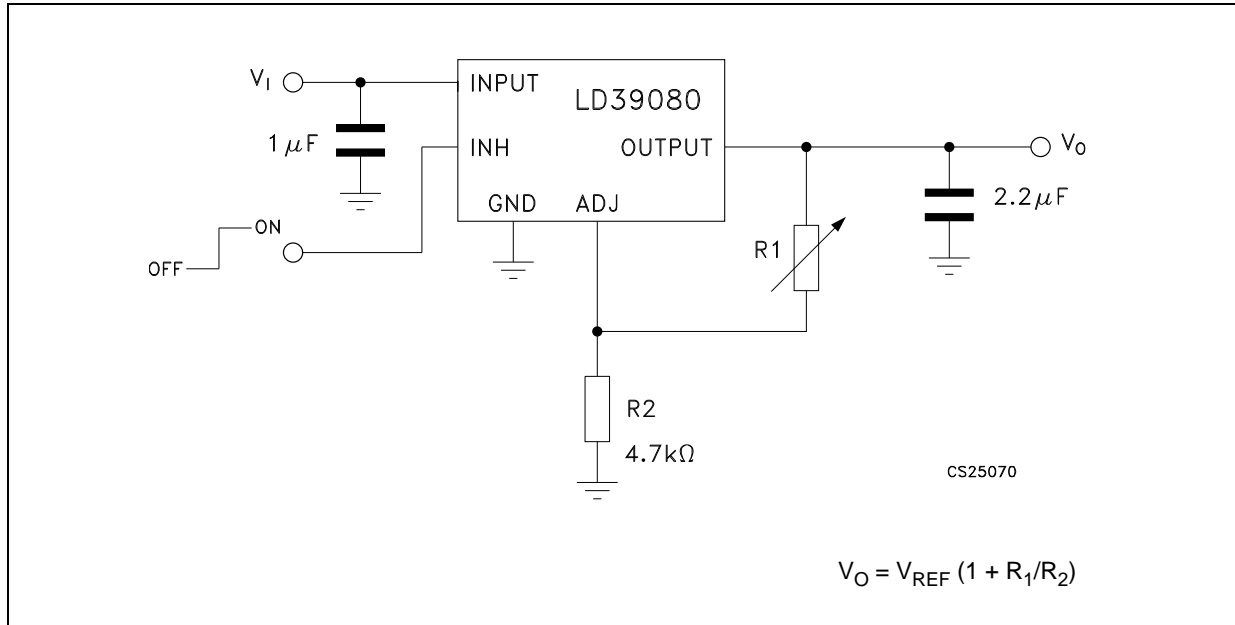
Table 2. Pin description

Pin	Symbol	Note
5	ADJ	Error amplifier input pin for $V_O$ from 1.22 to 5.0 V
2	$V_I$	LDO input voltage: $V_I$ from 2.5 V to 6 V, $C_I=1 \mu\text{F}$ not farther than 1 cm from input pin
4	$V_O$	LDO output voltage pins, with minimum $C_O = 2.2 \mu\text{F}$ needed for stability (refer to $C_O$ vs ESR stability chart)
1	$V_{INH}$	Inhibit input voltage: on mode when $V_{INH} \geq 2 \text{ V}$ , off mode when $V_{INH} \leq 0.3 \text{ V}$ (do not leave it floating, not internally pulled down/up)
3	GND	Common ground

### 3 Typical application circuits

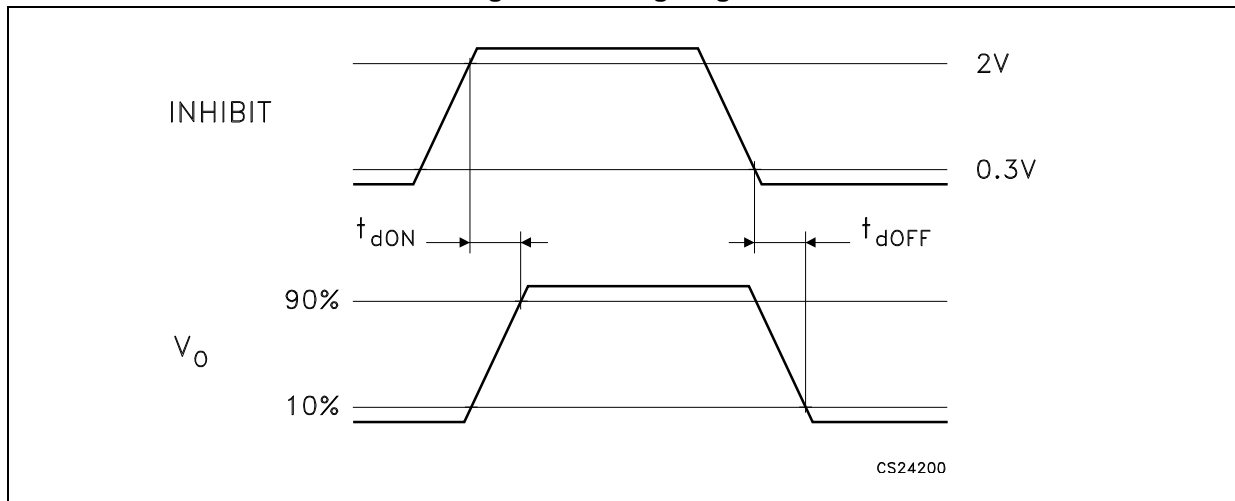
(C<sub>I</sub> and C<sub>O</sub> capacitors have to be placed as closer as possible to the IC pin).

Figure 3. LD39080 adjustable version



Note: Set R2 as closer as possible to 4.7 KΩ.

Figure 4. Timing diagram



## 4 Maximum ratings

**Table 3. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_I$	DC input voltage	-0.3 to 6.5	V
$V_{INH}$	Inhibit input voltage	-0.3 to $V_I + 0.3$ (6.5 V max.)	V
$V_O$	DC output voltage	-0.3 to $V_I + 0.3$ (6.5 V max.)	V
$V_{ADJ}$	ADJ pin voltage	-0.3 to $V_I + 0.3$ (6.5 V max.)	V
$I_O$	Output current	Internally limited	mA
$P_D$	Power dissipation	Internally limited	mW
$T_{STG}$	Storage temperature range	-50 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 conditions is not implied. All values are referred to GND.*

**Table 4. Thermal data**

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

## 5 Electrical characteristics

$T_J = 25\text{ °C}$ ,  $V_I = V_O + 1\text{ V}$ ,  $C_I = 1\text{ }\mu\text{F}$ ,  $C_O = 2.2\text{ }\mu\text{F}$ ,  $I_{LOAD} = 10\text{ mA}$ ,  $V_{INH} = 2\text{ V}$ , unless otherwise specified.

**Table 5. Electrical characteristics**

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_I$	Operating input voltage		2.5		6	V
$V_O$	Output voltage tolerance	$V_I = V_O + 1\text{ V}$ , $I_{LOAD} = 10\text{ mA to }0.8\text{ A}$	-1.5		1.5	% of $V_{O(NOM)}$
		$V_I = V_O + 1\text{ V to }6\text{ V}$ , $I_{LOAD} = 10\text{ mA to }0.8\text{ A}$ $T_J = -40\text{ to }125\text{ °C}$	-3		3	
$V_{REF}$	Reference voltage			1.22		V
$\Delta V_O$	Output voltage line regulation	$V_I = V_O + 1\text{ V to }6\text{ V}$		0.04		%
		$V_I = V_O + 1\text{ V to }6\text{ V}$ , $T_J = -40\text{ to }125\text{ °C}$		0.1	0.2	%
$\Delta V_O / \Delta I_{LOAD}$	Output voltage load regulation	$I_{LOAD} = 10\text{ mA to }0.8\text{ A}$		0.06		% / A
		$I_{LOAD} = 10\text{ mA to }0.8\text{ A}$ , $T_J = -40\text{ to }125\text{ °C}$		0.2	0.4	
$V_{DROP}$	Dropout voltage ( $V_I - V_O$ )	$I_{LOAD} = 150\text{ mA}$ , $T_J = -40\text{ to }125\text{ °C}$		20	40	mV
		$I_{LOAD} = 0.8\text{ A}$ , $T_J = -40\text{ to }125\text{ °C}$		150	300	
$I_Q$	Quiescent current: on mode	$I_{LOAD} = 10\text{ mA to }0.8\text{ A}$ , $V_{INH} = 2\text{ V}$ $T_J = -40\text{ to }125\text{ °C}$		1	2.5	mA
	Quiescent current: off mode	$V_{INH} = 0.3\text{ V}$			1	$\mu\text{A}$
		$V_{INH} = 0.3\text{ V}$ , $T_J = -40\text{ to }125\text{ °C}$			5	
<b>Short-circuit protection</b>						
$I_{SC}$	Short-circuit protection	$R_L = 0$		1.6		A
<b>Inhibit Input</b>						
$V_{INH}$	Inhibit threshold low	$V_I = 2.5\text{ to }6\text{ V off}$ $T_J = -40\text{ to }125\text{ °C}$			0.3	V
	Inhibit threshold high		2			
$T_{D-OFF}$	Current limit	$I_{LOAD} = 0.8\text{ A}$ , $V_O = 3.3\text{ V}$		15		$\mu\text{s}$
$T_{D-ON}$	Current limit	$I_{LOAD} = 0.8\text{ A}$ , $V_O = 3.3\text{ V}$		15		
$I_{INH}$	Inhibit input current <sup>(1)</sup>	$V_I = 6\text{ V}$ , $V_{INH} = 0\text{ to }6\text{ V}$		$\pm 0.1$	$\pm 1$	$\mu\text{A}$
<b>AC parameters</b>						
SVR	Supply voltage rejection	$V_I = 4.5 \pm 1\text{ V}$ , $V_O = 3.3\text{ V}$ , $I_{LOAD} = 10\text{ mA}$ ,	$f = 120\text{ Hz}$		65	dB
			$f = 1\text{ kHz}$		55	

Table 5. Electrical characteristics (continued)

Symbol	Parameter	Conditions		Min.	Typ.	Max.	Unit
$e_N$	Output noise voltage	$B_W = 10 \text{ Hz to } 100 \text{ kHz}$ , $C_O = 2.2 \text{ } \mu\text{F}$ , $V_O = 2.5 \text{ V}$			100		$\mu\text{V}_{\text{RMS}}$
$T_{\text{SHDN}}$	Thermal shutdown off				170		$^{\circ}\text{C}$
	Hysteresis				10		

1. Guaranteed by design.

## 6 Typical performance characteristics

$T_J = 25\text{ }^\circ\text{C}$ ,  $V_I = V_O + 1\text{ V}$ ,  $C_I = 1\text{ }\mu\text{F}$ ,  $C_O = 2.2\text{ }\mu\text{F}$ ,  $I_{LOAD} = 10\text{ mA}$ ,  $V_{INH} = V_I$ , unless otherwise specified.

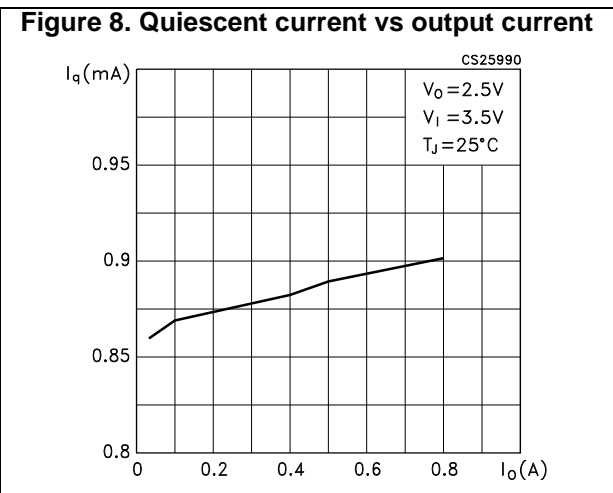
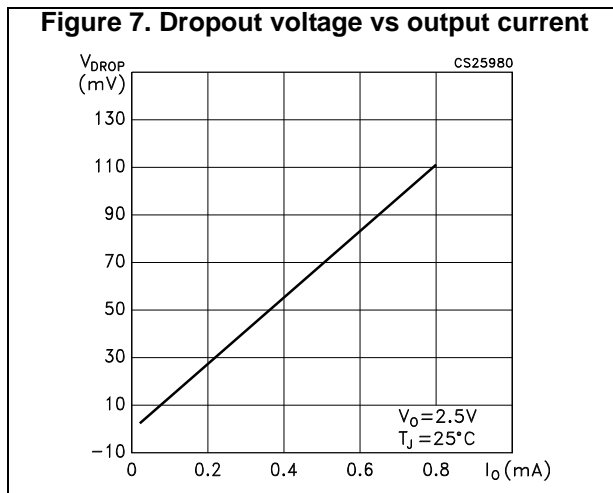
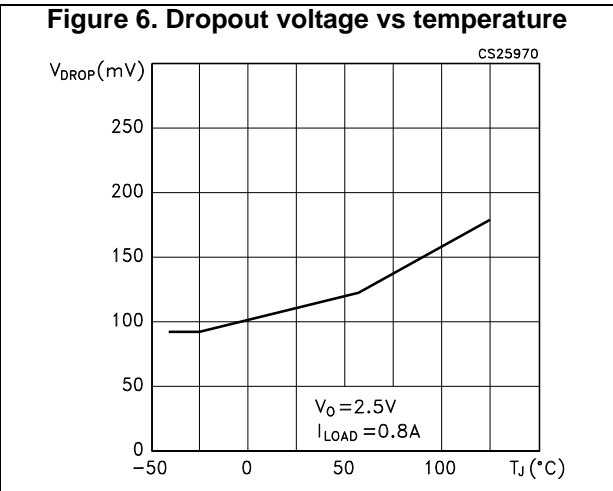
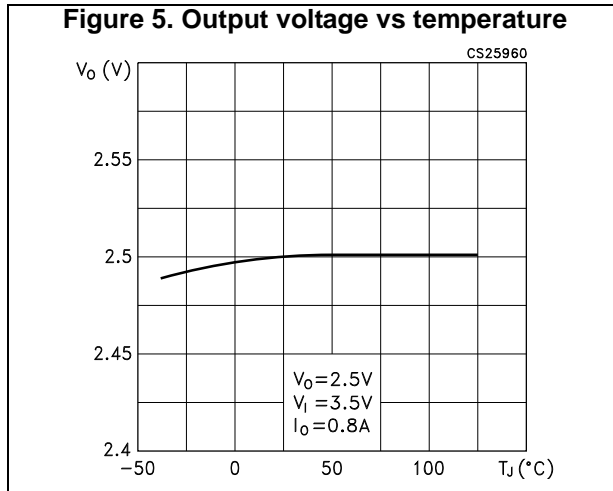


Figure 9. Quiescent current vs supply voltage

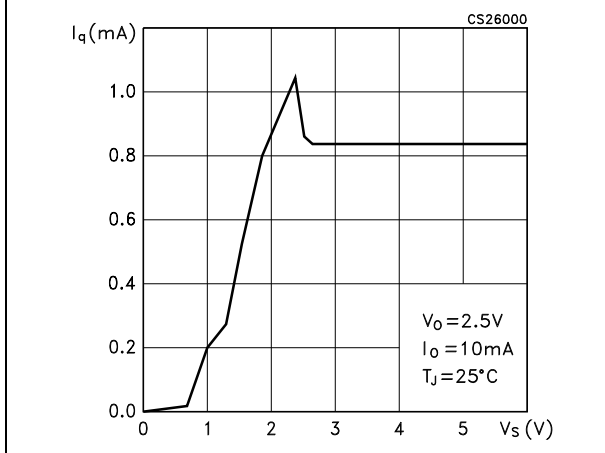


Figure 10. Off-state current vs temperature

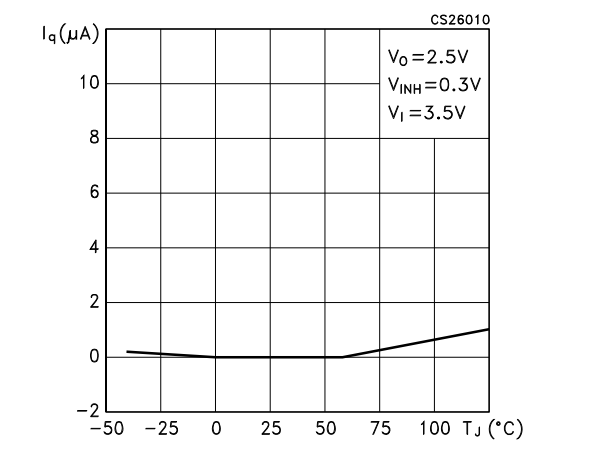


Figure 11. Quiescent current vs temperature

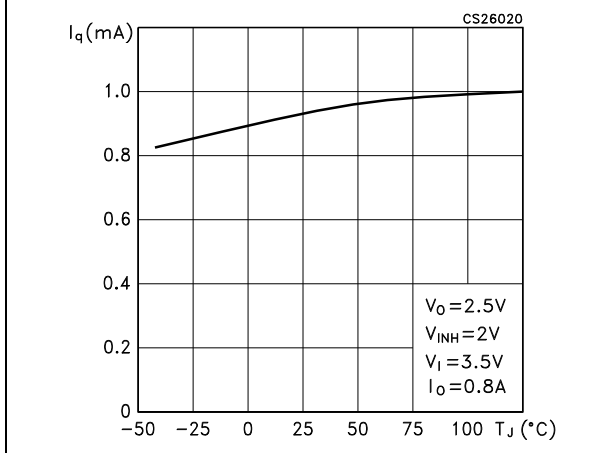


Figure 12. Short-circuit current vs temperature

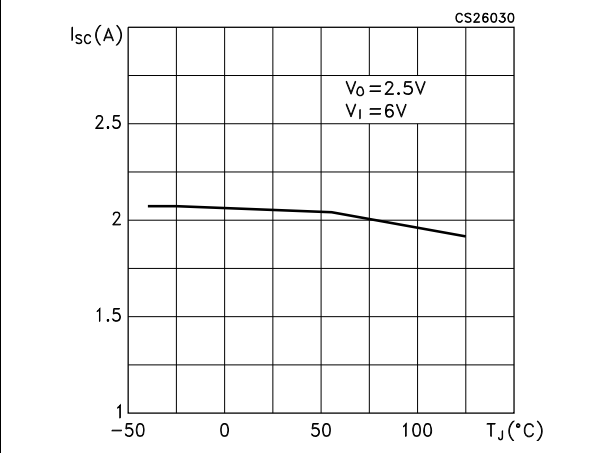


Figure 13. Output voltage vs input voltage

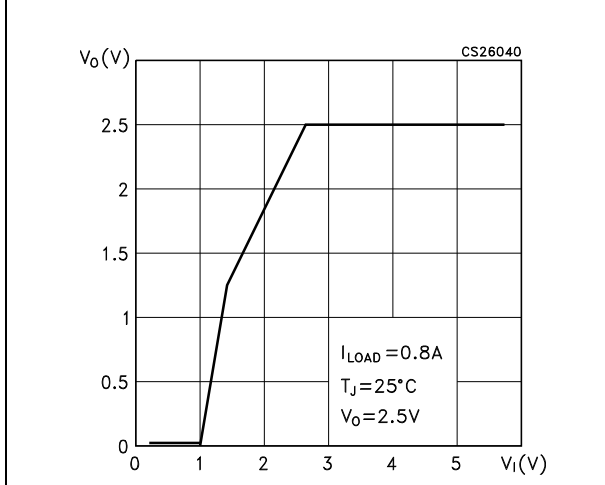
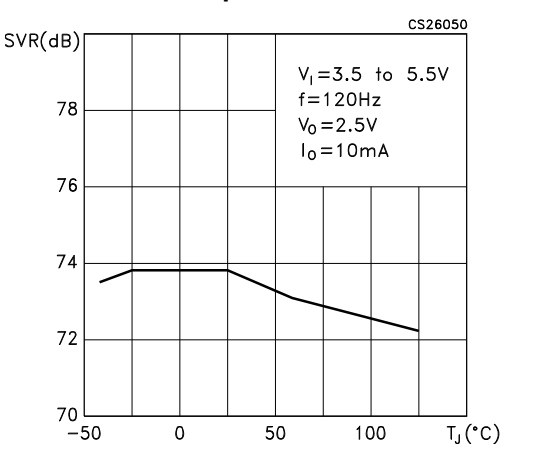
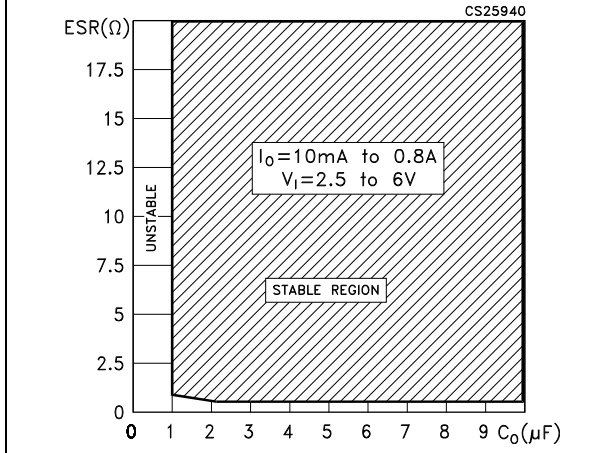


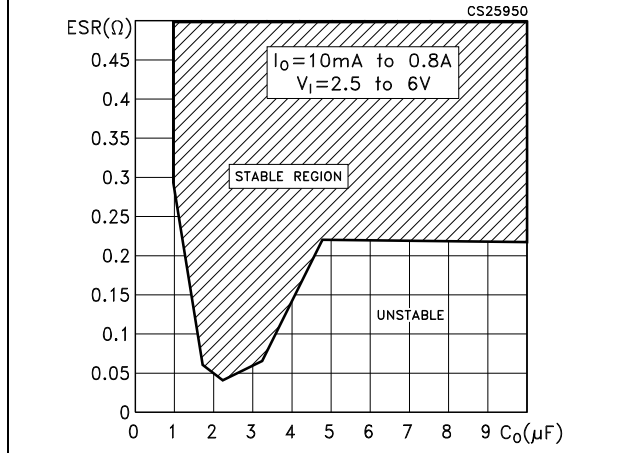
Figure 14. Supply voltage rejection vs temperature



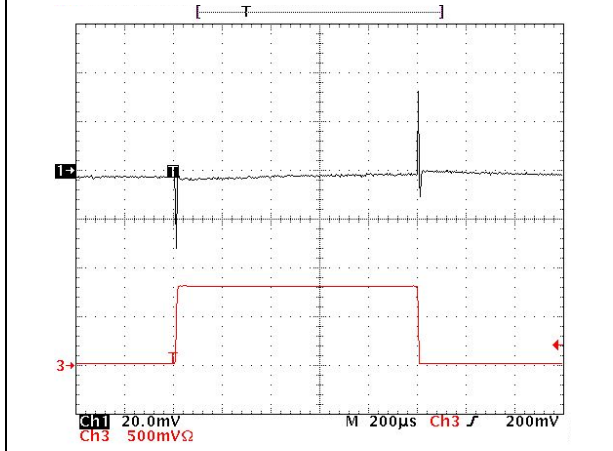
**Figure 15. Stability region vs Co and ESR (at 100 kHz)**



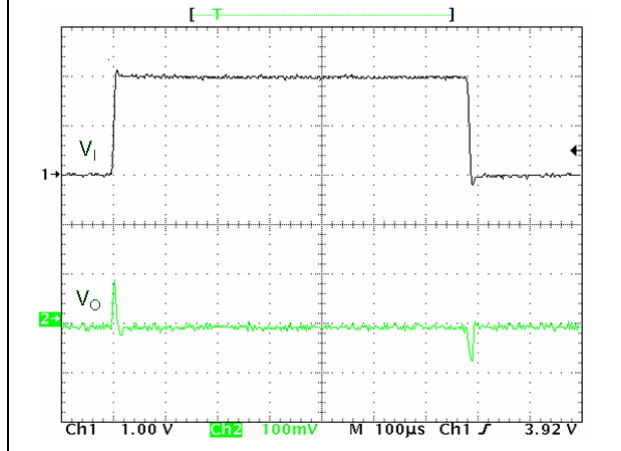
**Figure 16. Stability region vs Co and low ESR (at 100 kHz)**



**Figure 17. Load transient**



**Figure 18. Line transient**



## 7 Application notes

### 7.1 External capacitor

The LD39080 requires external capacitors to assure the stability. These capacitors have to meet the requirements of minimum capacitance and equivalent series resistance (see [Figure 16](#) [Figure 17](#)). The input/output capacitors cannot be farther than 1 cm from the relative pins and have to be connected directly to the input/output ground pins using traces without any current flowing through them. Ceramic or electrolytic capacitors can be used.

### 7.2 Input capacitor

An input capacitor, whose minimum value is 1  $\mu\text{F}$ , is required (the amount of capacitance can be increased without any limit). This capacitor cannot be farther than 1 cm from the input pin of the device and has to return to clean analog ground. Ceramic, tantalum or film capacitors can be used.

### 7.3 Output capacitor

Ceramic or tantalum capacitors can be used but the output capacitor has to meet the requirements of minimum capacitance and ESR (equivalent series resistance) value. A minimum capacitance of 2.2  $\mu\text{F}$  is a good choice to guarantee the stability of the regulator. Anyway, other  $C_O$  values can be used as per [Figure 16](#) [Figure 17](#), where the allowable ESR range is seen as a function of the output capacitance. The curve represents the stability region over the full temperature and  $I_O$  range.

### 7.4 Thermal note

The output capacitor has to maintain its ESR in the stable region over the operating temperature range to assure the stability. Besides, capacitor tolerance and temperature variation have to be taken into account to assure the minimum amount of capacitance all time.

### 7.5 Inhibit input operation

The inhibit pin can be used to turn off the regulator when pulled down, therefore by reducing the current consumption below 1  $\mu\text{A}$ . When the inhibit feature is not used, this pin has to be tied to  $V_I$  to turn on the regulator output all the time. To assure the right operation, the signal source, used to drive the inhibit pin, has to swing above and below the specified thresholds listed in [Section 5: Electrical characteristics](#) ( $V_{IH}$   $V_{IL}$ ). The inhibit pin must not be left floating because it is not internally pulled down/up.

# 8 Package mechanical data

Figure 19. PPAK drawings

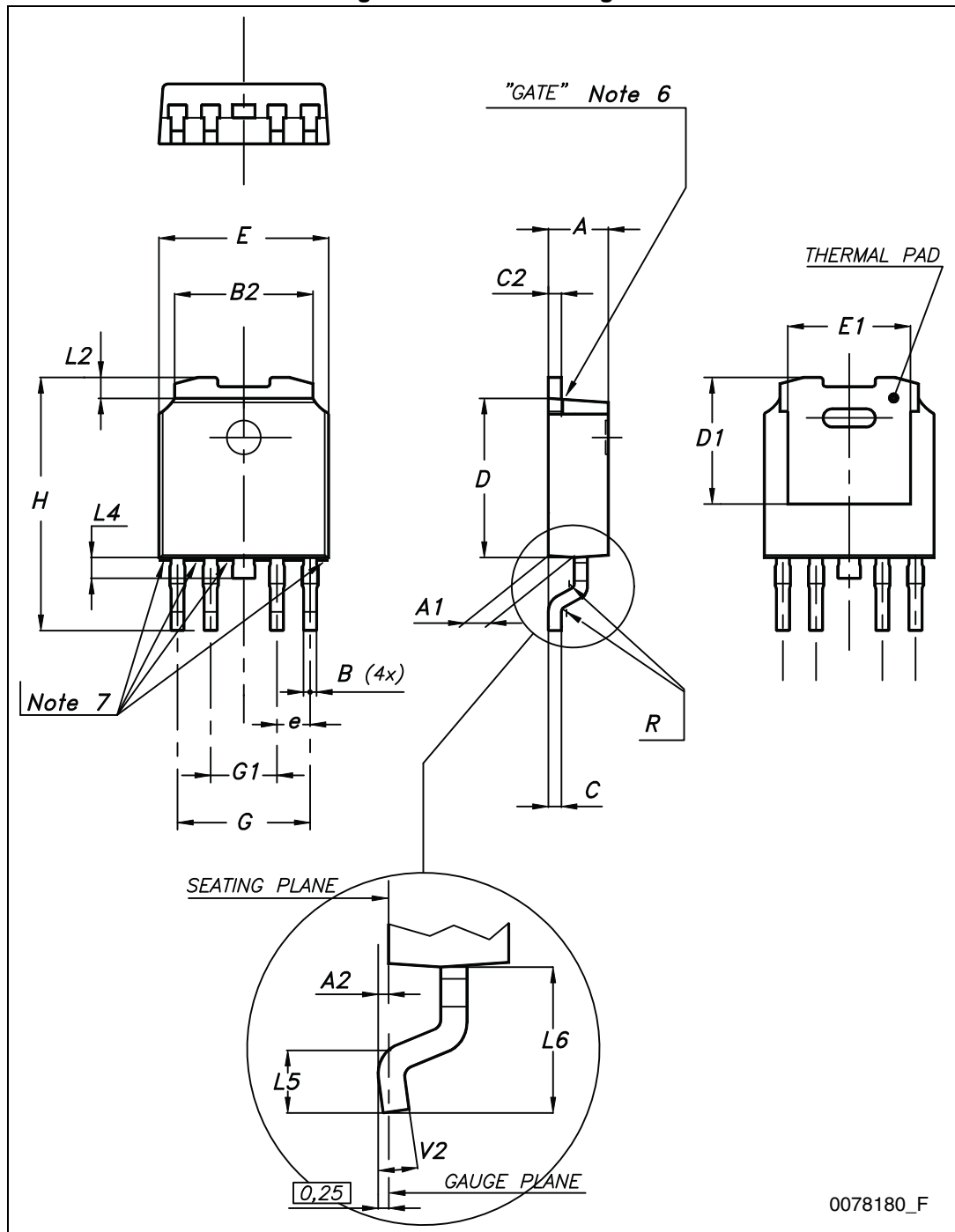


Table 6. PPAK mechanical data

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°

# 9 Packaging mechanical data

Figure 20. PPAK tape

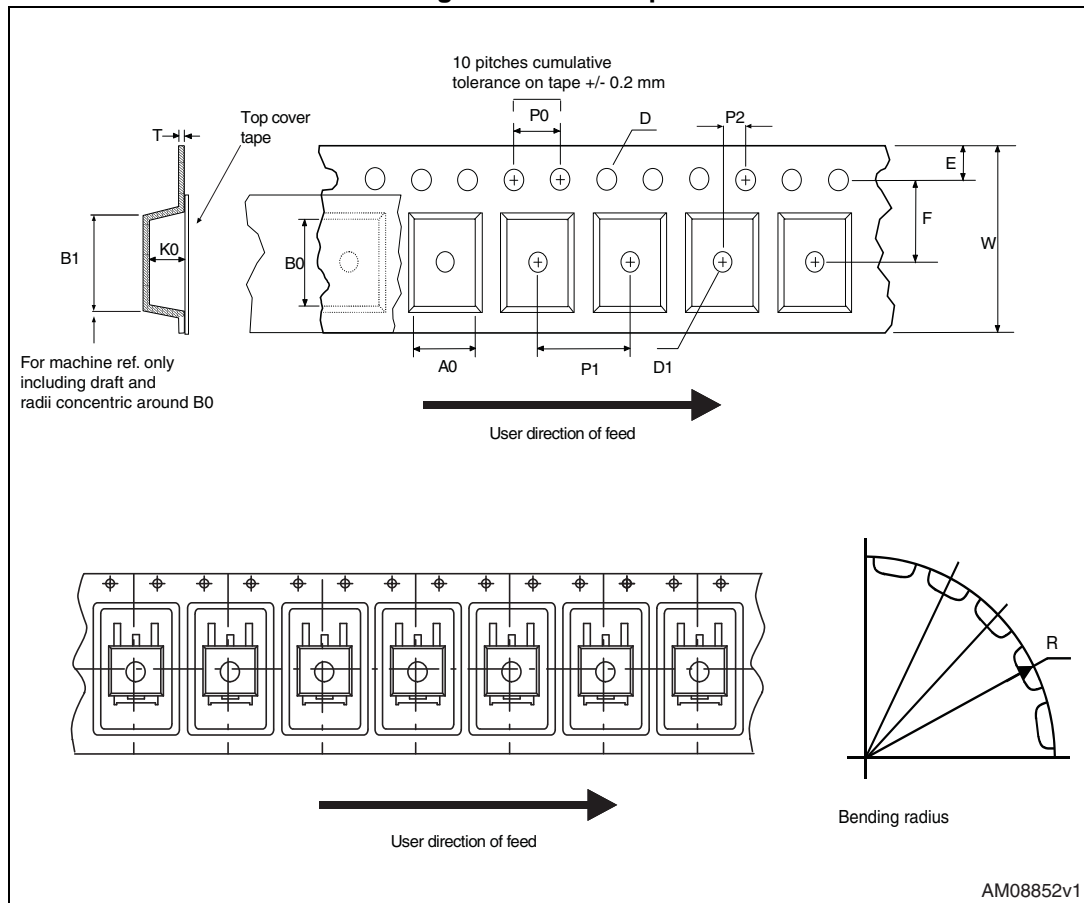


Figure 21. PPAK reel

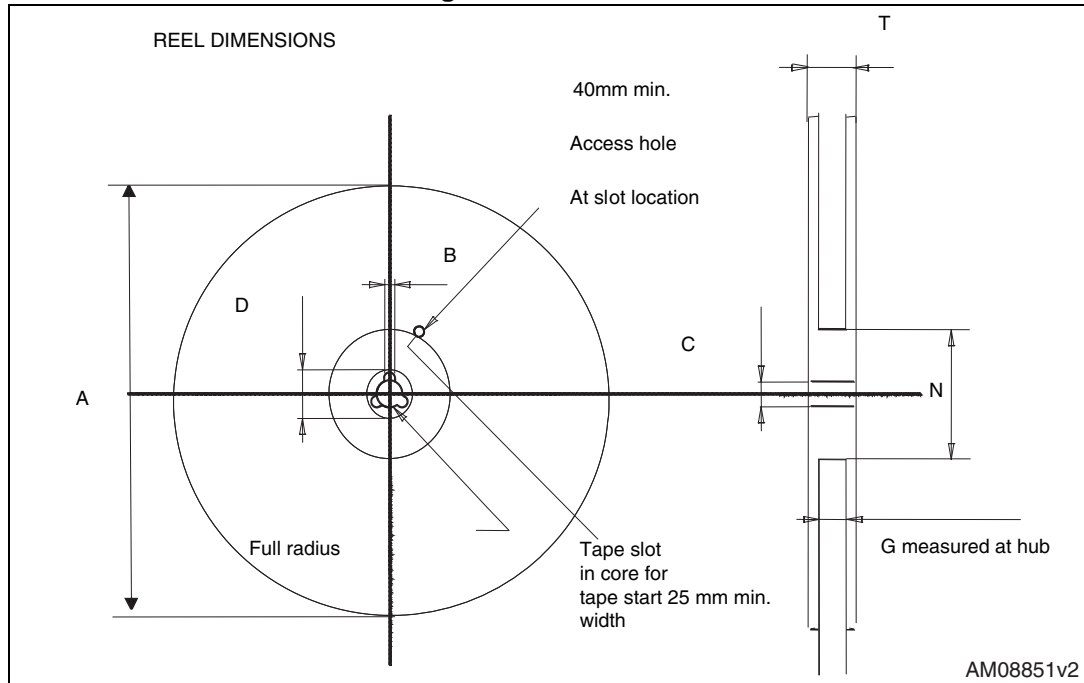


Table 7. PPAK tape and reel mechanical data

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 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			

## 10 Revision history

**Table 8. Document revision history**

Date	Revision	Changes
26-Jan-2007	1	Initial release.
25-Mar-2014	2	Updated features in cover page, <i>Section 5: Electrical characteristics</i> , <i>Section 6: Typical performance characteristics</i> , <i>Section 7: Application notes</i> , <i>Section 8: Package mechanical data</i> . Added <i>Section 9: Packaging mechanical data</i> . Minor text changes.
01-Aug-2017	3	Updated <a href="#">Table 1: Device summary</a> on the cover page.

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