LD39115Jxx

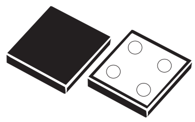
150 mA low quiescent current low noise voltage regulator

Features

- Input voltage from 1.5 to 5.5 V
- Ultra low dropout voltage (80 mV typ. at 100 mA load)
- Very low quiescent current (20 µA typ. at no load, 35 µA typ. at 150 mA load, 1 µA max in off mode)
- Very low noise (33 μV_{RMS} from 1 kHz to 100 kHz at V_{OUT} = 1.8 V)
- Output voltage tolerance: ± 2.0 % @ 25 °C
- 150 mA guaranteed output current
- Wide range of output voltages available on request: 0.8 V to 4.5 V with 100 mV step
- Logic-controlled electronic shutdown
- Compatible with ceramic capacitor C_{OUT} = 1 µF
- Internal current and thermal limit
- Flip-chip 4 bumps 0.8 x 0.8 mm. pitch
- Temperature range: -40 °C to 125 °C

Applications

- Mobile phones
- Personal digital assistants (PDAs)
- Cordless phones and similar battery-powered systems



Flip-chip 4

Description

The LD39115Jxx provides 150 mA maximum current from an input voltage ranging from 1.5 V to 5.5 V with a typical dropout voltage of 80 mV. It is stabilized with a ceramic capacitor. The ultra low drop voltage, low quiescent current and low noise features make it suitable for low power battery-powered applications. Power supply rejection is 65 dB at low frequencies and starts to roll off at 10 kHz. An enable logic control function puts the LD39115Jxx in shutdown mode allowing a total current consumption lower than 1 µA. The device also includes a short-circuit constant current limiting and thermal protection.

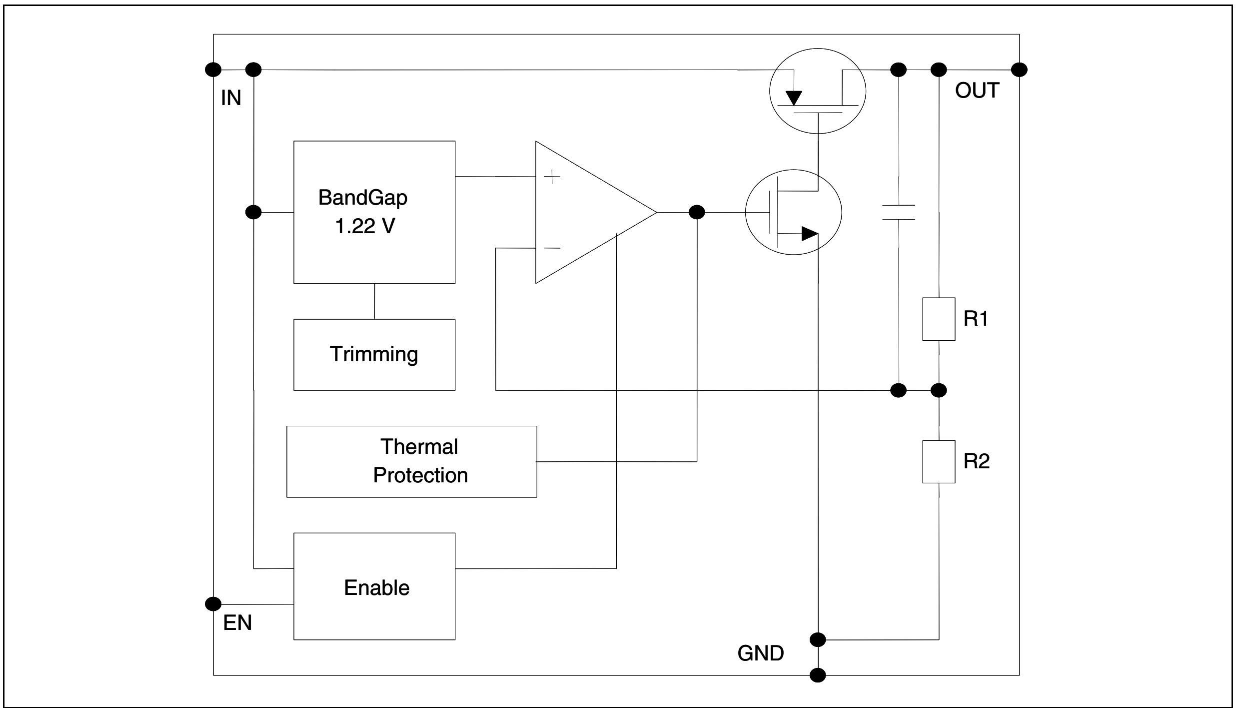
Table 1. Device summary

Part numbers	Order codes	Output voltages
LD39115JXX12	LD39115J12R	1.2 V
LD39115JXX15	LD39115J15R	1.5 V
LD39115JXX18	LD39115J18R	1.8 V
LD39115JXX25	LD39115J25R	2.5 V
LD39115JXX28	LD39115J28R	2.8 V
LD39115JXX30	LD39115J30R	3.0 V
LD39115JXX33	LD39115J33R	3.3 V

Contents

1 Diagram

Figure 1. Block diagram



2 Pin configuration

Figure 2. Pin connection (top view)

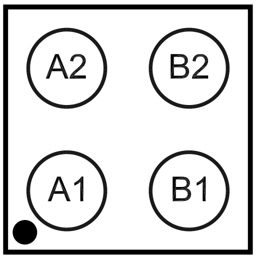
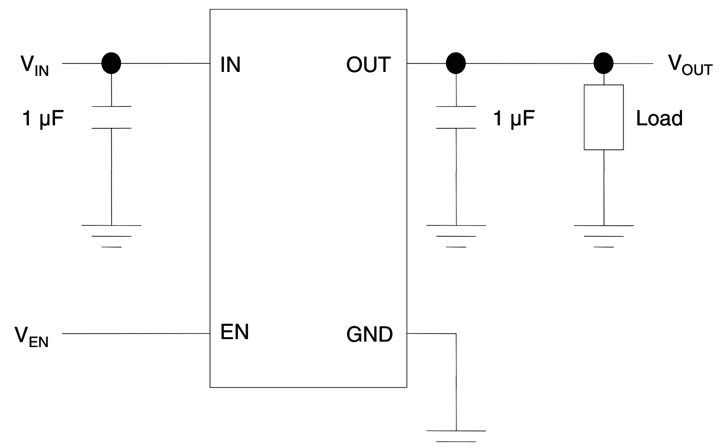


Table 2. Pin description

Pin n°	Symbol	Function
A2	EN	Enable pin logic input: Low = shutdown, High = active
A1	GND	Common ground
B2	IN	Input voltage of the LDO
B1	OUT	Output voltage

3 Typical application

Figure 3. Typical application circuit



4 Maximum ratings

Table 3. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{IN}	DC input voltage	- 0.3 to 6	V
V_{OUT}	DC output voltage	- 0.3 to V_I + 0.3	V
V_{EN}	Enable input voltage	- 0.3 to V_I + 0.3	V
I_{OUT}	Output current	Internally limited	mA
P_D	Power dissipation	Internally limited	mW
T_{STG}	Storage temperature range	- 65 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	180	°C/W

5 Electrical characteristics

T_J = 25 °C, V_{IN} = $V_{OUT(NOM)}$ + 1 V, C_{IN} = C_{OUT} = 1 µF, I_{OUT} = 1 mA, V_{EN} = V_{IN}, unless otherwise specified.

Table 5. Electrical characteristics for LD39115Jxx (1)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{IN}	Operating input voltage		1.5		5.5	V
V_{UVLO}	Turn-on threshold			1.45	1.48	V
	Turn-off threshold		1.30	1.35		mV
V_{OUT}	V_{OUT} accuracy	V_{OUT}>1.5V, I_{OUT}=1mA, T_J=25°C	-2.0		2.0	%
		V_{OUT}>1.5V, I_{OUT}=1mA, -40°C<T_J<125°C	-3.0		3.0	%
		$V_{OUT} \leq$ 1.5V, I_{OUT}=1mA		±10		mV
		$V_{OUT} \leq$ 1.5V, I_{OUT}=1mA, -40°C<T_J<125°C		±30		mV
ΔV_{OUT}	Static line regulation	V_{OUT} +1V $\leq V_{IN} \leq$ 5.5V, I_{OUT}=1mA		0.01		%/V
ΔV_{OUT}	Transient line regulation (2)	ΔV_{IN}=+500mV, I_{OUT}=1mA, T_R=T_F=5µs		10		mVpp
ΔV_{OUT}	Static load regulation	I_{OUT}=1mA to 150mA		0.002		%/mA
ΔV_{OUT}	Transient load regulation (2)	I_{OUT}=1mA to 150mA, t_R=t_F=5µs		40		mVpp
V_{DROP}	Dropout voltage (3)	I_{OUT}=100mA, V_{OUT}>1.5V -40°C<T_J<125°C		80	110	mV
e_N	Output noise voltage	10Hz to 100kHz, I_{OUT}=10mA		30		$\mu V_{RMS}/V$
SVR	Supply voltage rejection V_{OUT} = 1.5V	V_{IN}=V_{OUTNOM}+1V+/-V_{RIPPLE} V_{RIPPLE}=0.1V Freq.=1kHz I_{OUT} = 10mA		74		dB
		V_{IN}=V_{OUTNOM}+0.5V+/-V_{RIPPLE} V_{RIPPLE}=0.1V Freq.=10kHz I_{OUT}=10mA		67		
I_Q	Quiescent current	I_{OUT}=0mA		20		µA
		I_{OUT}=0mA, -40°C<T_J<125°C			50	
		I_{OUT}=0 to 150mA		35		
		I_{OUT}=0 to 150mA, -40°C<T_J<125°C			70	
		V_{IN} input current in OFF MODE: V_{EN}=GND		0.001	1	
I_{SC}	Short circuit current	R_L=0	200			mA
V_{EN}	Enable input logic low	V_{IN}=1.5V to5.5V, -40°C<T_J<125°C			0.4	V
	Enable input logic high	V_{IN}=1.5V to 5.5V, -40°C<T_J<125°C	0.9			
I_{EN}	Enable pin input current	V_{SHDN}=V_{IN}		0.1	100	nA
T_{ON}	Turn on time (4)			30		µs

Table 5. Electrical characteristics for LD39115Jxx (continued) [(1)]

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
T_{SHDN}	Thermal shutdown			160		°C
	Hysteresis			20		
C_{OUT}	Output capacitor	Capacitance (see *Section 6: Typical performance characteristics*)	1		22	µF

1. For $V_{OUT(NOM)} < 1.2$ V, $V_{IN} = 1.5$ V.
2. All transient values are guaranteed by design, not production tested.
3. Dropout voltage is the input-to-output voltage difference at which the output voltage is 100 mV below its nominal value. This specification does not apply for output voltages below 1.5 V.
4. Turn-on time is time measured between the enable input just exceeding V_{EN} high value and the output voltage just reaching 95 % of its nominal value.

T_J = 25 °C, $V_{IN} = V_{OUT(NOM)}$ + 1 V, $C_{IN} = C_{OUT}$ = 1 µF, I_{OUT} = 1 mA, $V_{EN} = V_{IN}$, unless otherwise specified.

Table 6. Electrical characteristics for LD39115SJxx (1)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{IN}	Operating input voltage		1.5		5.5	V
V_{UVLO}	Turn-on threshold			1.45	1.48	V
	Turn-off threshold		1.30	1.35		mV
V_{OUT}	V_{OUT} accuracy	V_{OUT} >1.5V, I_{OUT}=1mA, T_J=25°C	-2.0		2.0	%
		V_{OUT} >1.5V, I_{OUT}=1mA, -40°C<T_J<125°C	-3.0		3.0	%
		V_{OUT} ≤ 1.5V, I_{OUT}=1mA		±10		mV
		V_{OUT} ≤ 1.5V, I_{OUT}=1mA, -40°C<T_J<125°C		±30		mV
ΔV_{OUT}	Static line regulation	V_{OUT} +1V ≤ V_{IN} ≤ 5.5V, I_{OUT}=1mA		0.01		%/V
ΔV_{OUT}	Transient line regulation (2)	ΔV_{IN}=+500mV, I_{OUT}=1mA, T_R=T_F=5µs		10		mVpp
ΔV_{OUT}	Static load regulation	I_{OUT} = 1mA to 150mA		0.002		%/mA
ΔV_{OUT}	Transient load regulation (2)	I_{OUT} = 1mA to 150mA, T_R=T_F=5µs		40		mVpp
V_{DROP}	Dropout voltage (3)	I_{OUT} = 100mA, V_{OUT}>1.5V -40°C<T_J<125°C		80	110	mV
e_N	Output noise voltage	10Hz to 100kHz, I_{OUT}=10mA		30		μV_{RMS} /V
SVR	Supply voltage rejection V_{OUT} = 1.5V	$V_{IN} = V_{OUTNOM}$+1V+/-V_{RIPPLE} V_{RIPPLE} = 0.1V Freq.=1kHz I_{OUT}=10mA		74		dB
		$V_{IN} = V_{OUTNOM}$+0.5V+/-V_{RIPPLE} V_{RIPPLE}=0.1V Freq.=10kHz I_{OUT}=10mA		67		
I_Q	Quiescent current	I_{OUT}=0mA		20		µA
		I_{OUT}=0mA, -40°C<T_J<125°C			50	
		I_{OUT}=0 to 150mA		35		
		I_{OUT}=0 to 150mA, -40°C<T_J<125°C			70	
		V_{IN} input current in OFF MODE: V_{EN}=GND		0.001	1	
I_{SC}	Short circuit current	R_L=0	200			mA
V_{EN}	Enable input logic low	V_{IN}=1.5V to 5.5V, -40°C<T_J<125°C			0.4	V
	Enable input logic high	V_{IN} = 1.5V to 5.5V, -40°C<T_J<125°C	0.9			
I_{EN}	Enable pin input current	V_{SHDN}=V_{IN}		0.1	100	nA
T_{ON}	Turn on time (4)			100		µs

Table 6. Electrical characteristics for LD39115SJxx (continued) (1)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
T_{SHDN}	Thermal shutdown			160		°C
	Hysteresis			20		
C_{OUT}	Output capacitor	Capacitance (see *Section 6: Typical performance characteristics*)	1		22	µF

1. For $V_{OUT(NOM)} < 1.2$ V, $V_{IN} = 1.5$ V.
2. All transient values are guaranteed by design, not production tested.
3. Dropout voltage is the input-to-output voltage difference at which the output voltage is 100 mV below its nominal value. This specification does not apply for output voltages below 1.5 V.
4. Turn-on time is time measured between the enable input just exceeding V_{EN} high value and the output voltage just reaching 95 % of its nominal value.

6 Typical performance characteristics

$C_{IN} = C_{OUT} = 1$ µF, V_{EN} to V_{IN}.

Figure 4. Output voltage vs. temperature (V_{IN} = 2.2 V)

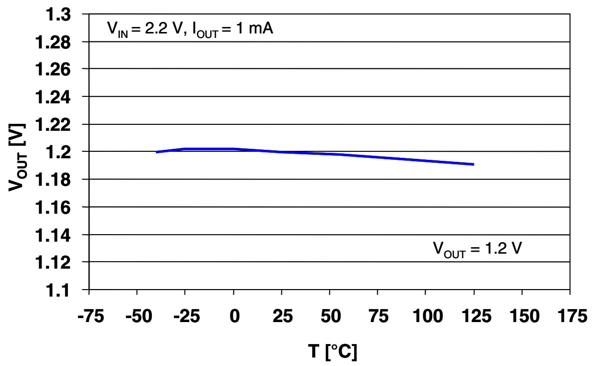


Figure 5. Output voltage vs. temperature (V_{IN} = 3.8 V)

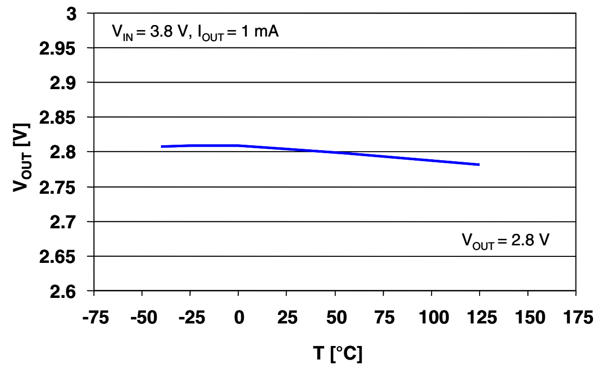


Figure 6. Line regulation vs. temperature

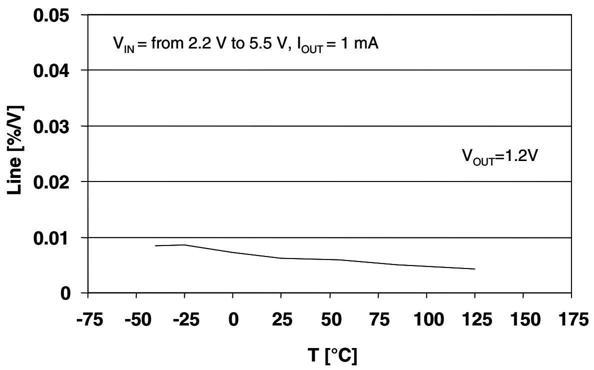


Figure 7. Load regulation vs. temperature

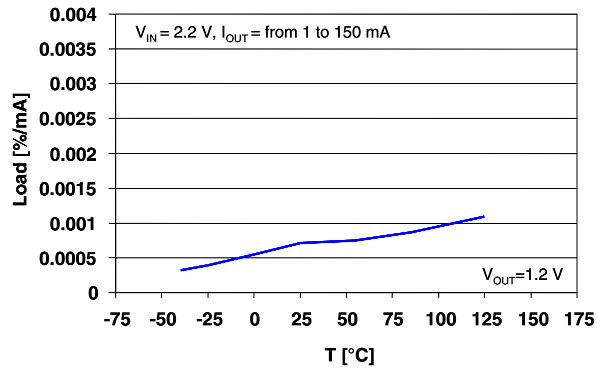


Figure 8. Short-circuit current vs. drop voltage

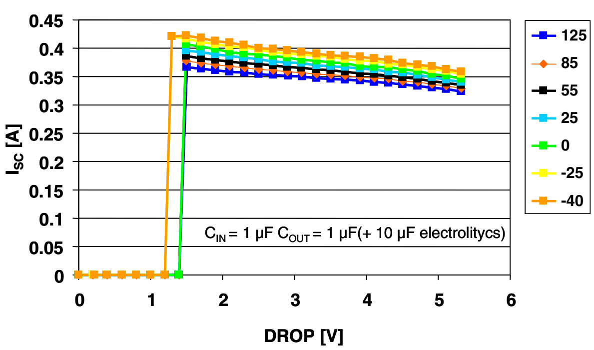


Figure 9. Dropout voltage vs. temperature

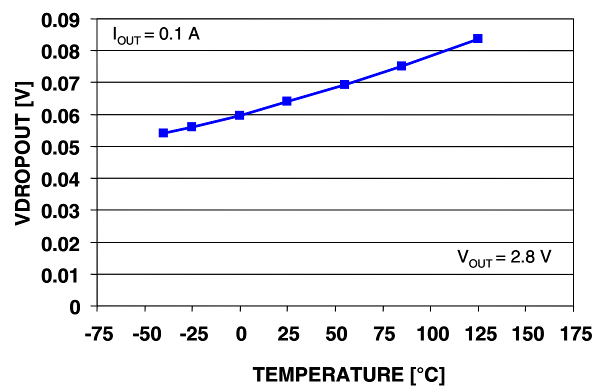


Figure 10. Dropout voltage vs. output current

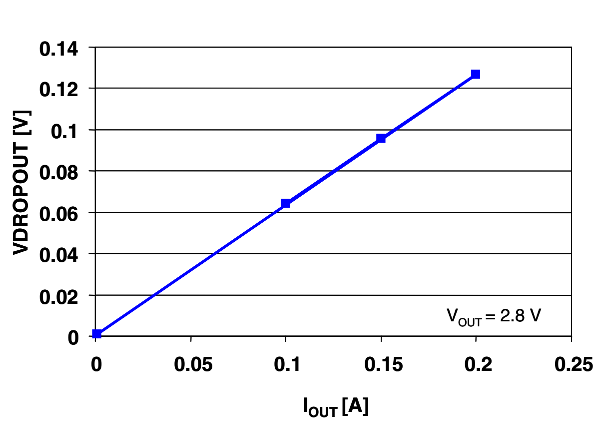


Figure 11. Output voltage vs. input voltage (I_{OUT} = 0.15 A)

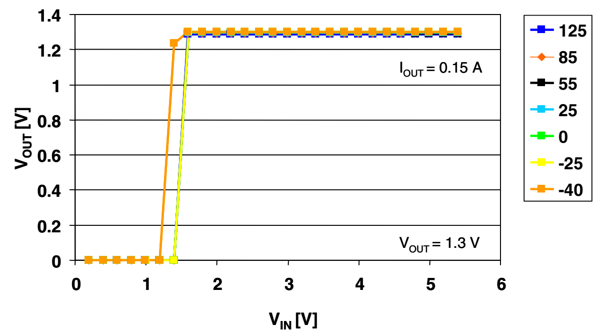


Figure 12. Output voltage vs. input voltage (V_{OUT} = 1.3 V)

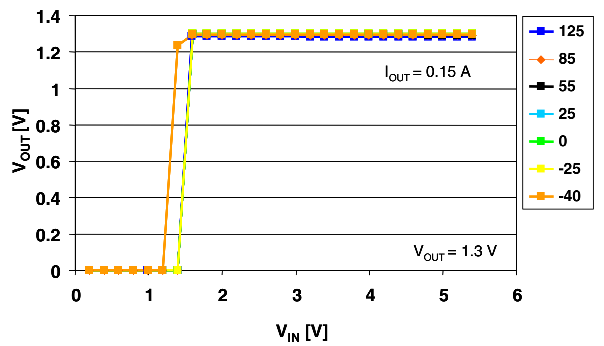


Figure 13. Output voltage vs. input voltage (V_{OUT} = 2.8 V)

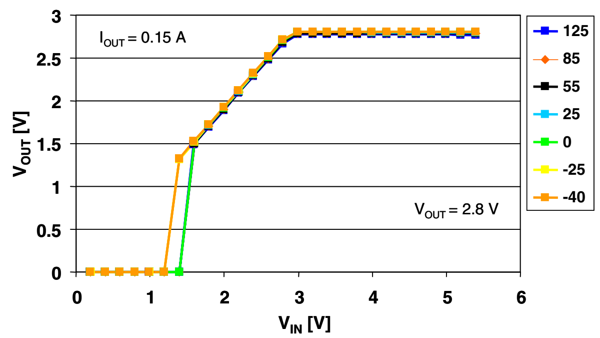


Figure 14. Enable threshold vs. temperature

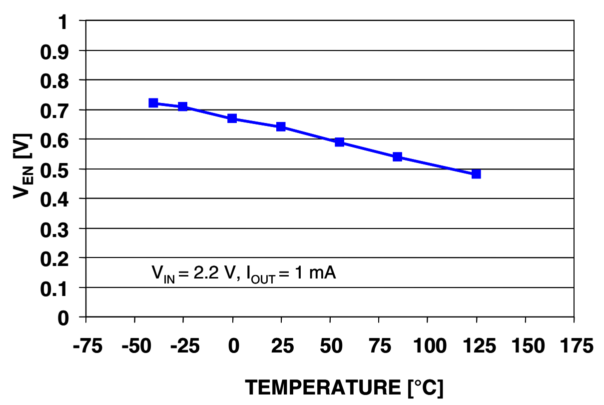


Figure 15. Quiescent current vs. temperature (V_{OUT} = 1.2 V)

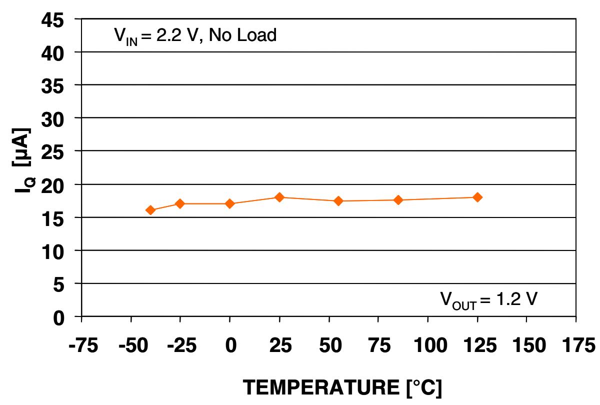


Figure 16. Quiescent current vs. temperature (V_{IN} = 2.2 V)

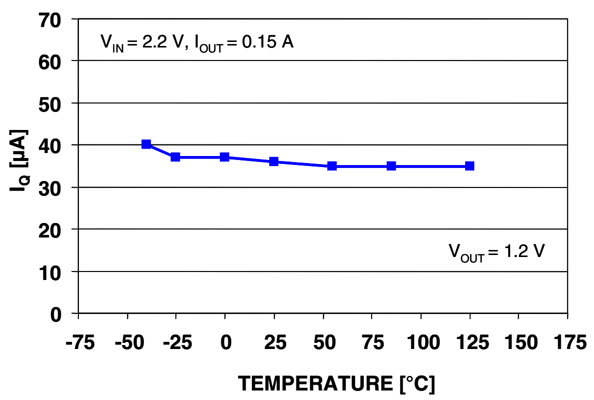


Figure 17. Quiescent current vs. temperature (V_{IN} = 3.8 V)

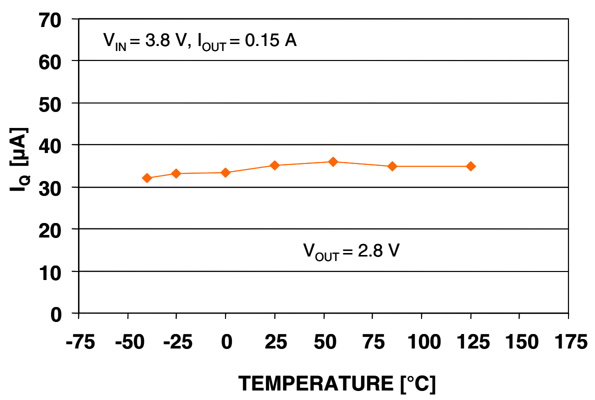


Figure 18. Quiescent current vs. input voltage

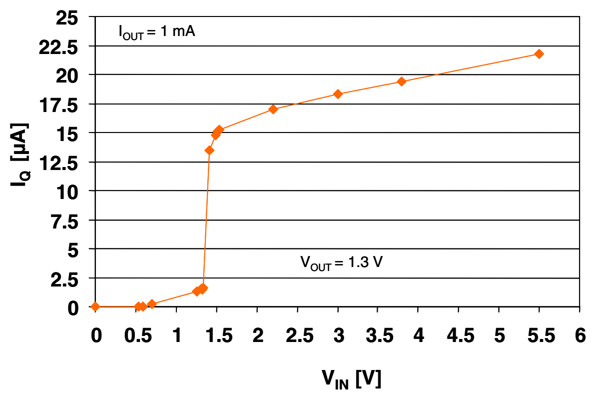


Figure 19. Quiescent current vs. output current

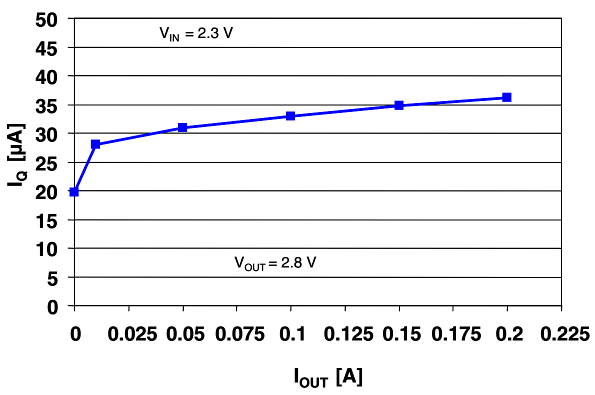


Figure 20. Supply voltage rejection vs. temperature (V_{OUT} = 1.2 V)

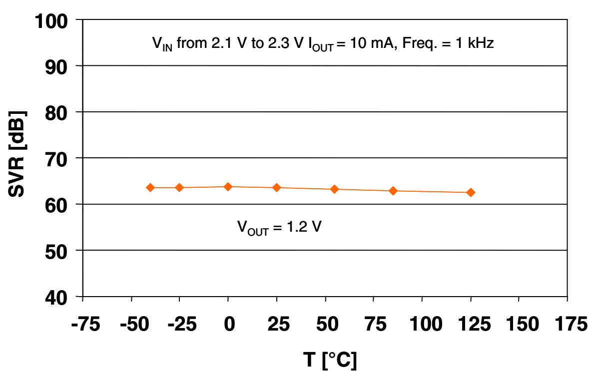


Figure 21. Supply voltage rejection vs. temperature (V_{OUT} = 1.3 V)

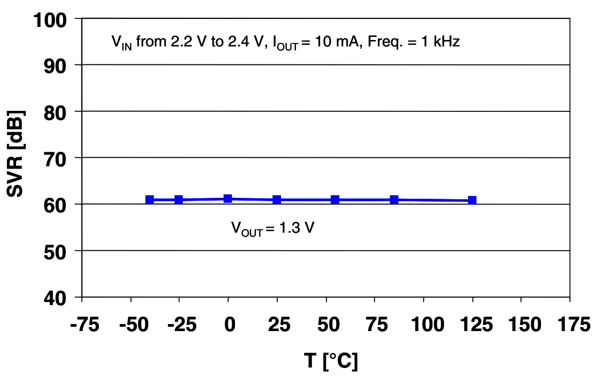


Figure 22. Supply voltage rejection vs. temperature (Freq. = 1 kHz)

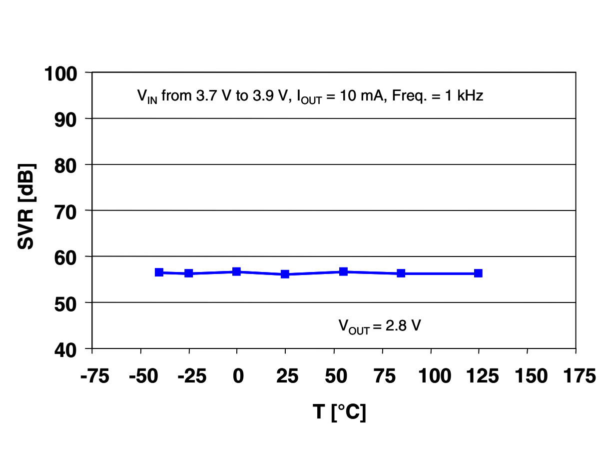


Figure 23. Supply voltage rejection vs. temperature (Freq. = 10 kHz)

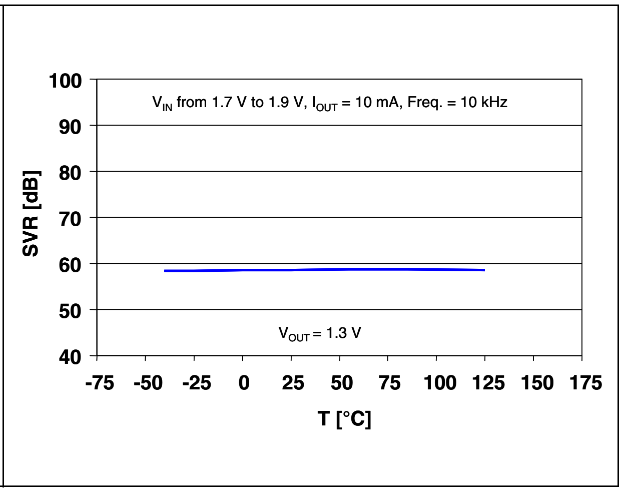


Figure 24. Supply voltage rejection vs. temperature (V_{OUT} = 2.8 V)

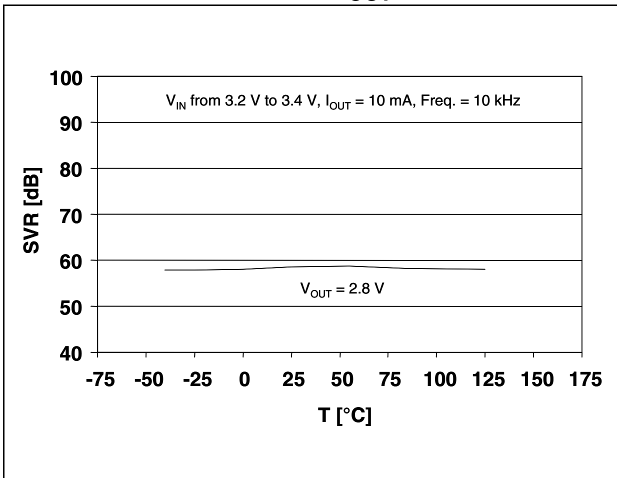


Figure 25. Supply voltage rejection vs. frequency (V_{OUT} = 1.2 V)

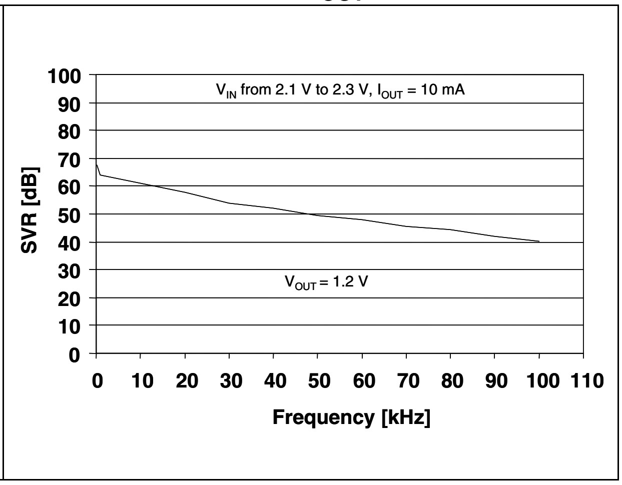


Figure 26. Supply voltage rejection vs. frequency (V_{OUT} = 1.3 V)

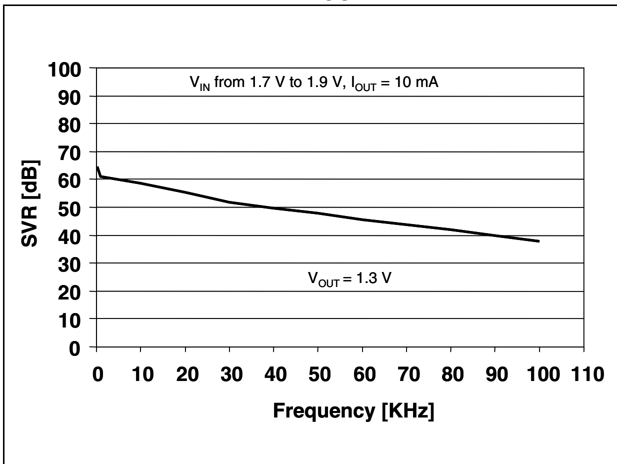


Figure 27. Supply voltage rejection vs. frequency (V_{OUT} = 2.8 V)

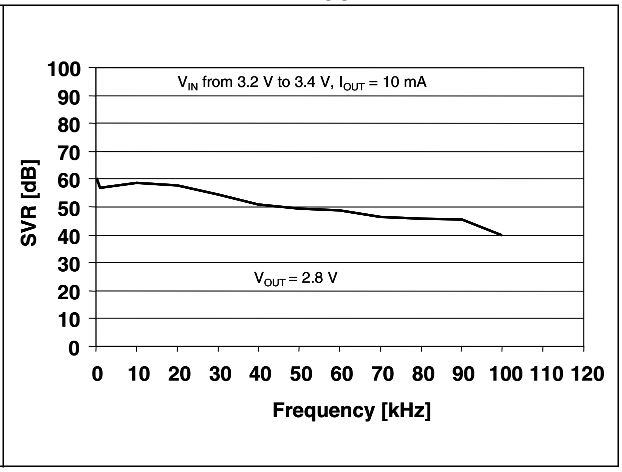


Figure 28. Supply voltage rejection vs. output current

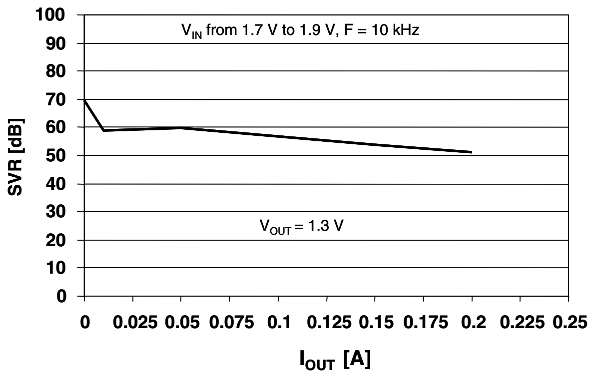


Figure 29. LD39115J noise

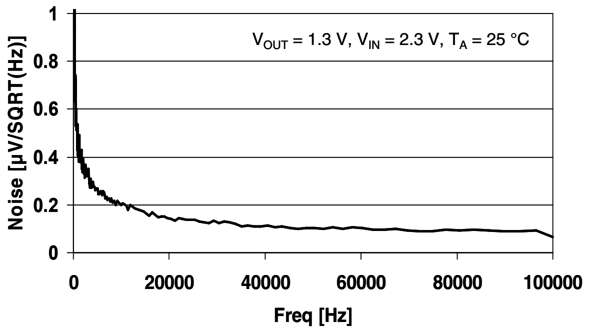
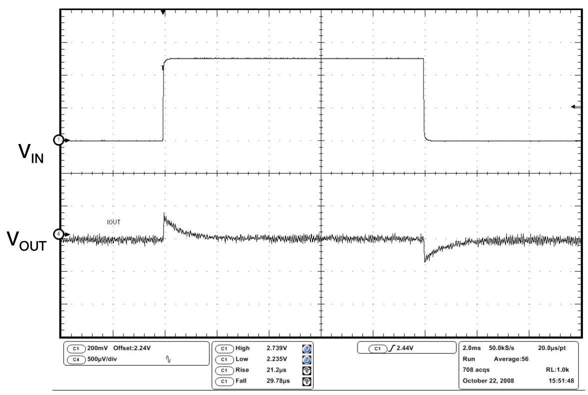
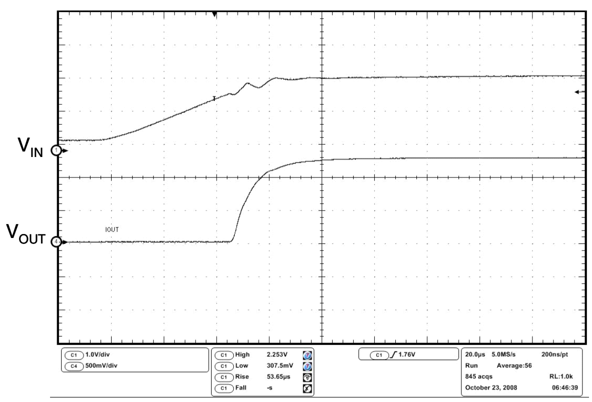


Figure 30. Line regulation transient



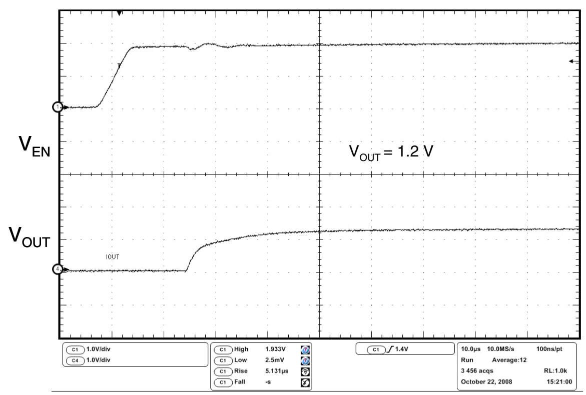
V_{IN} from 2.2 V to 2.7 V, I_{OUT} = 1 mA, C_{OUT} = 1 µF, No C_{IN} $t_{RISE/FALL}$ = 5 µs

Figure 31. Start up transient



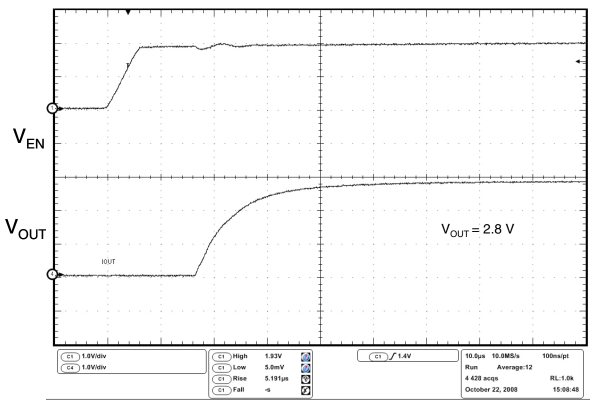
V_{IN} from 0 to 2.3 V, I_{OUT} = 1 mA C_{OUT} = 1 µF No C_{IN}, t_{RISE} = 60 µs

Figure 32. Enable transient (V_{OUT} = 1.2 V)



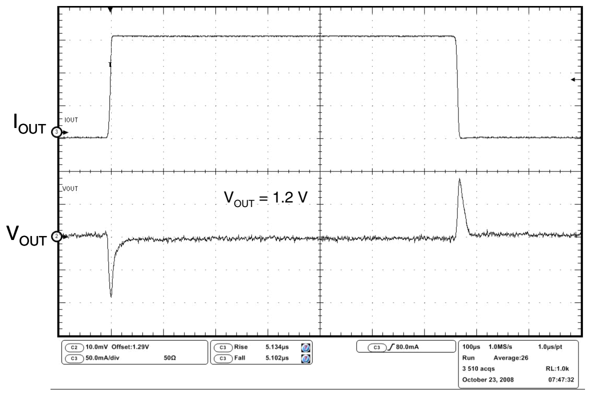
V_{IN} = 2.3 V, V_{EN} from 0 to 2 V, I_{OUT} = 1 mA

Figure 33. Enable transient (V_{OUT} = 2.8 V)



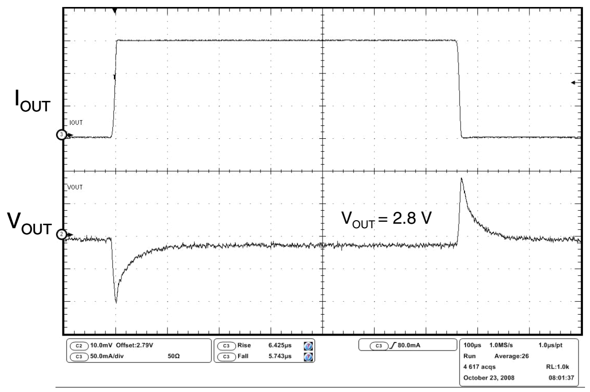
V_{IN} = 2.3 V, V_{EN} from 0 to 2 V, I_{OUT} = 1 mA, t_{RISE} = 6 µs

Figure 34. Load transient (V_{OUT} = 1.2 V)



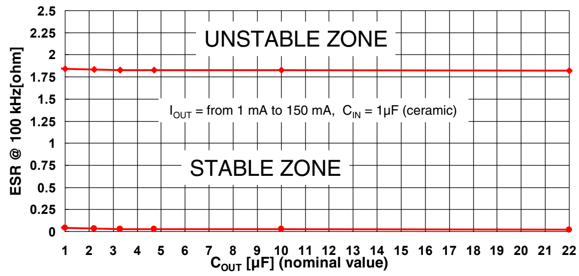
V_{IN} = 2. 2 V, I_{OUT} = from 1 to 150 mA, $t_{RISE/FALL}$ = 5 µs

Figure 35. Load transient (V_{OUT} = 2.8 V)



V_{in} = 3.8 V, I_{OUT} = from 1 to 150 mA, $t_{RISE/FALL}$ = 5 µs

Figure 36. ESR required for stability with ceramics capacitors

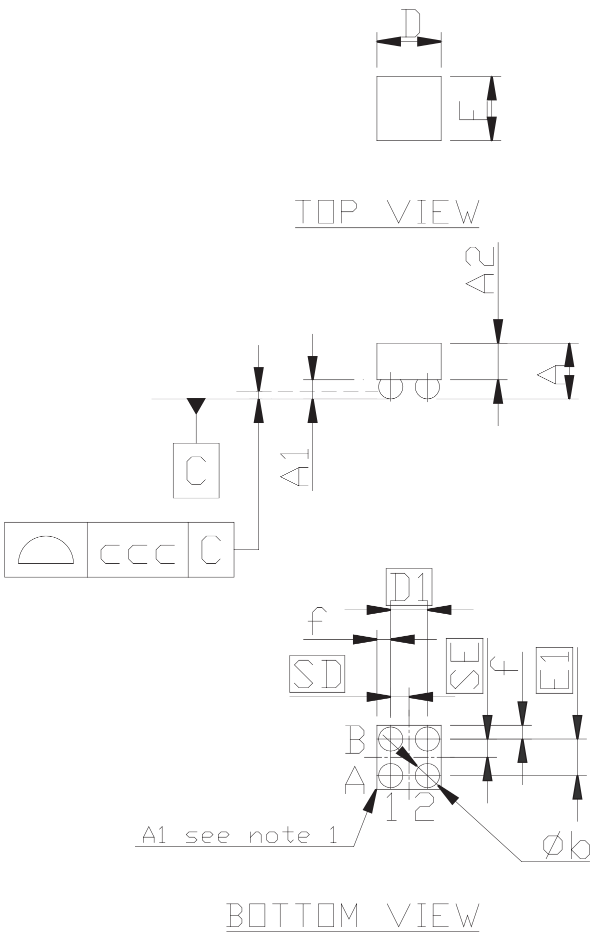


7 Package mechanical data

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.

Flip-chip 4 mechanical data

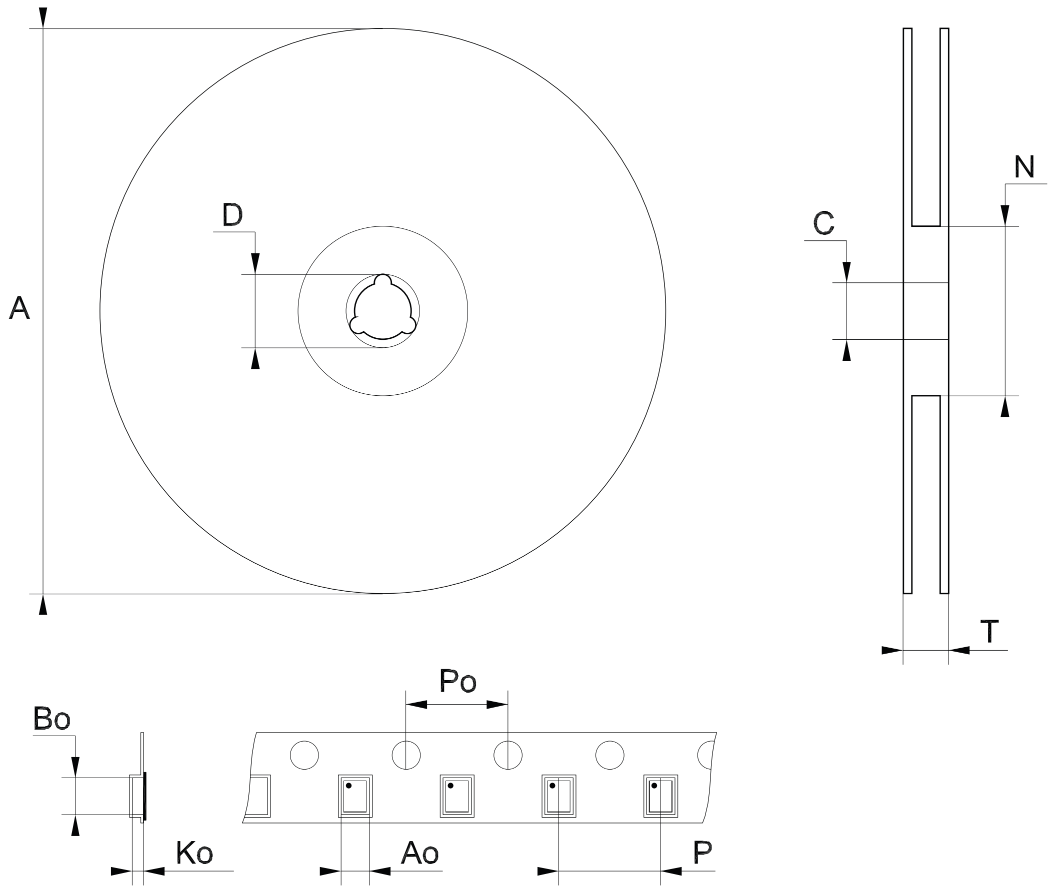
Dim.	mm.		
	Min.	Typ.	Max.
A	0.52	0.56	0.60
A1	0.17	0.20	0.23
A2	0.35	0.36	0.37
b	0.23	0.25	0.29
D	0.758	0.788	0.818
D1		0.4	
E	0.758	0.788	0.818
E1		0.4	
SD	0.18	0.2	0.22
SE	0.18	0.2	0.22
f		0.199	
ccc		0.075	



7504896/M

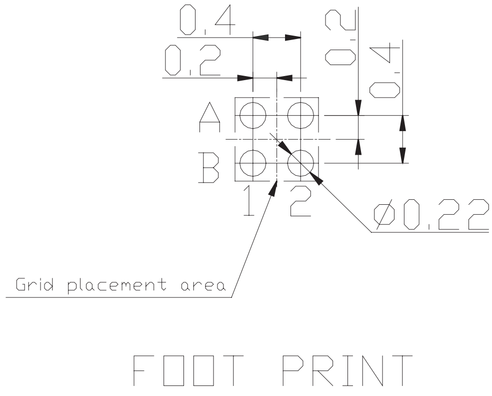
Tape and reel Flip-chip 4 mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			178			6.926
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	59	60	61	2.323	2.362	2.401
T			8.4			0.331
Ao	0.82	0.87	0.92	0.032	0.034	0.036
Bo	0.82	0.87	0.92	0.032	0.034	0.036
Ko	0.64	0.69	0.74	0.025	0.027	0.029
Po	3.9	4	4.1	0.153	0.157	0.161
P	3.9	4	4.1	0.153	0.157	0.161



Note: Drawing not in scale

Figure 37. Foot print data



8 Different output voltage versions of the LD39115Jxx available on request

Table 7. Options available on request

Order codes	Output voltages
LD39115J08R	0.8 V
LD39115J10R	1.0 V

9 Revision history

Table 8. Document revision history

Date	Revision	Changes
26-Mar-2009	1	Initial release.
12-Jun-2009	2	Modified: *Table 1 on page 1* and *Table 7 on page 21*.
05-Aug-2009	3	Modified: tape and reel mechanical data *on page 19*.
17-May-2011	4	Modified: *Table 1 on page 1* and *Table 7 on page 21*.
20-Dec-2011	5	Added: new order code LD39115J25R *Table 1 on page 1*.

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