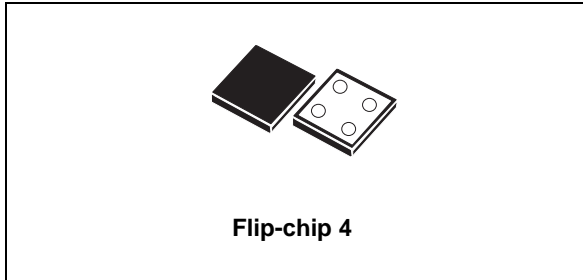


150 mA low quiescent current low noise voltage regulator

Datasheet - production data



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 μ A typ. at no load, 35 μ A typ. at 150 mA load, 1 μ A max in off mode)
- Very low noise (33 μ V_{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 $C_{OUT} = 1$ μ F

- Internal current and thermal limit
- Flip-chip 4 bumps 0.8 x 0.8 mm. pitch 0.4 mm
- Temperature range: -40 °C to 125 °C

Applications

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

Description

The LD39115J 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 LD39115J in shutdown mode allowing a total current consumption lower than 1 μ A. The device also includes a short-circuit constant current limiting and thermal protection.

Table 1. Device summary

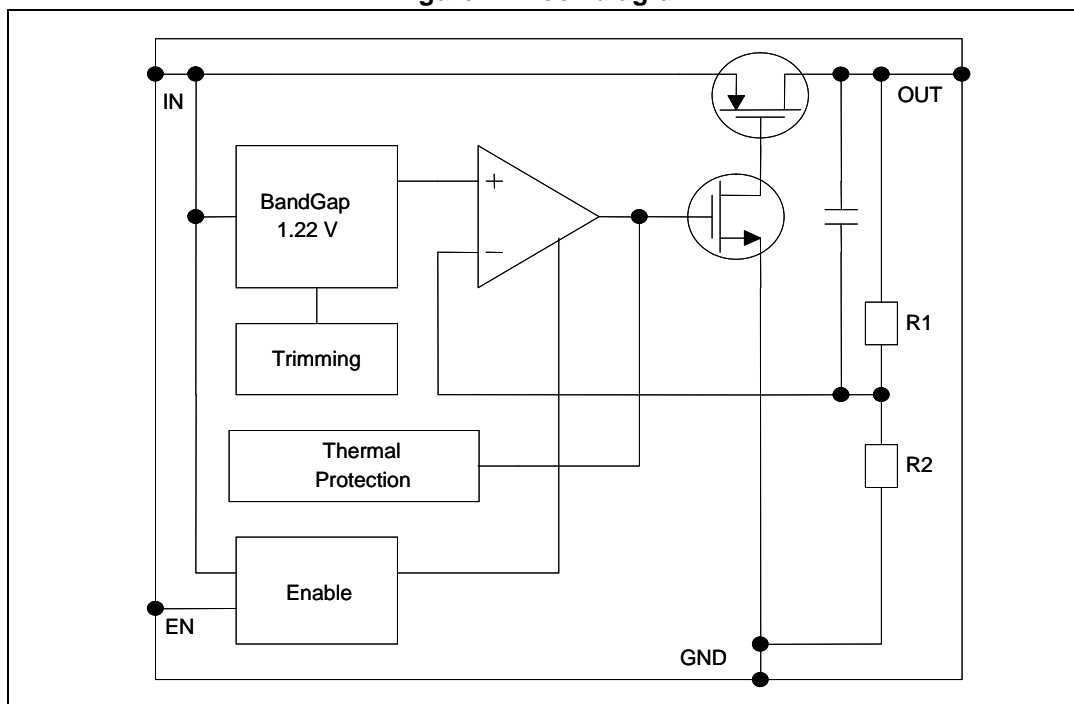
| Order codes | Output voltages |
|-------------|-----------------|
| LD39115J10R | 1 V |
| LD39115J12R | 1.2 V |
| LD39115J14R | 1.4 V |
| LD39115J15R | 1.5 V |
| LD39115J18R | 1.8 V |
| LD39115J25R | 2.5 V |
| LD39115J28R | 2.8 V |
| LD39115J30R | 3.0 V |
| LD39115J33R | 3.3 V |

Contents

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1 Diagram

Figure 1. Block diagram



2 Pin configuration

Figure 2. Pin connection (top view)

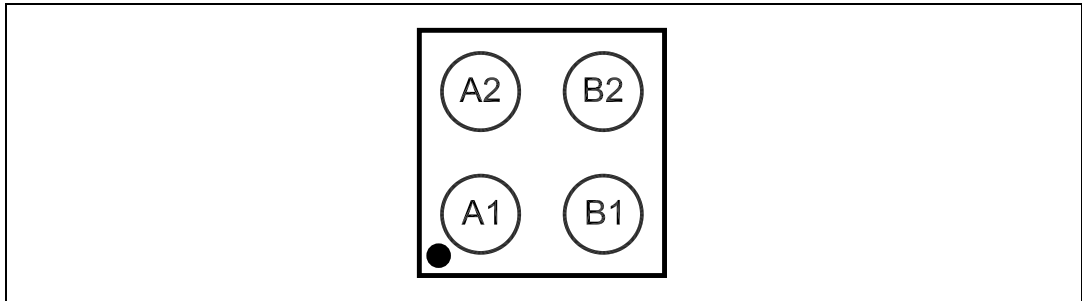
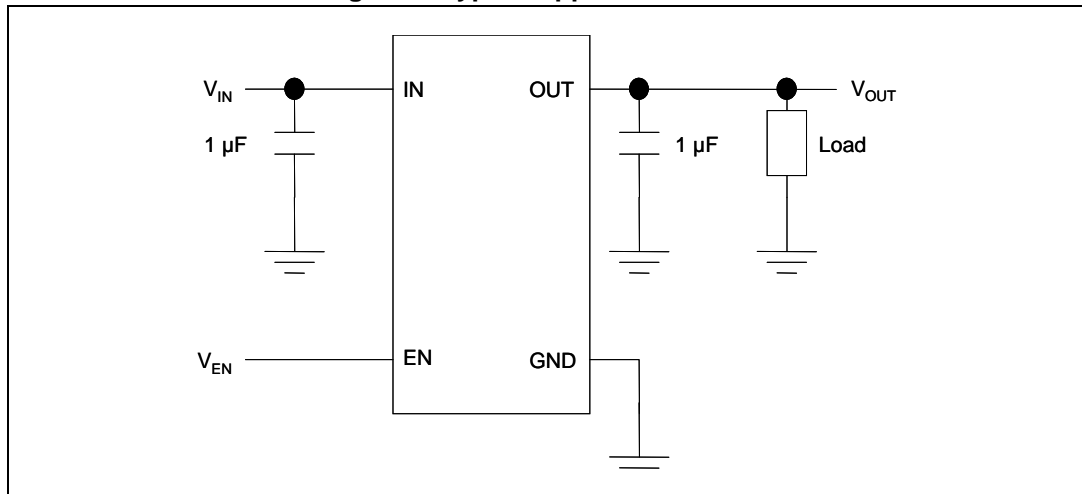


Table 2. Pin description

| 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

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

Table 5. Electrical characteristics for LD39115J (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 | $V_{OUT} > 1.5\text{ V}$, $I_{OUT} = 1\text{ mA}$, $T_J = 25\text{ °C}$ | -2.0 | | 2.0 | % |
| | | $V_{OUT} > 1.5\text{ V}$, $I_{OUT} = 1\text{ mA}$, $-40\text{ °C} < T_J < 125\text{ °C}$ | -3.0 | | 3.0 | % |
| | | $V_{OUT} \leq 1.5\text{ V}$, $I_{OUT} = 1\text{ mA}$ | | ± 10 | | mV |
| | | $V_{OUT} \leq 1.5\text{ V}$, $I_{OUT} = 1\text{ mA}$, $-40\text{ °C} < T_J < 125\text{ °C}$ | | ± 30 | | mV |
| ΔV_{OUT} | Static line regulation | $V_{OUT} + 1\text{ V} \leq V_{IN} \leq 5.5\text{ V}$, $I_{OUT} = 1\text{ mA}$ | | 0.01 | | %/V |
| ΔV_{OUT} | Transient line regulation ⁽²⁾ | $\Delta V_{IN} = +500\text{ mV}$, $I_{OUT} = 1\text{ mA}$, $T_R = T_F = 5\text{ }\mu\text{s}$ | | 10 | | mVpp |
| ΔV_{OUT} | Static load regulation | $I_{OUT} = 1\text{ mA}$ to 150 mA | | 0.002 | | %/mA |
| ΔV_{OUT} | Transient load regulation ⁽²⁾ | $I_{OUT} = 1\text{ mA}$ to 150 mA , $t_R = t_F = 5\text{ }\mu\text{s}$ | | 40 | | mVpp |
| V_{DROP} | Dropout voltage ⁽³⁾ | $I_{OUT} = 100\text{ mA}$, $V_{OUT} > 1.5\text{ V}$ $-40\text{ °C} < T_J < 125\text{ °C}$ | | 80 | 110 | mV |
| e_N | Output noise voltage | 10 Hz to 100 kHz, $I_{OUT} = 10\text{ mA}$ | | 30 | | $\mu\text{V}_{RMS}/\text{V}$ |
| SVR | Supply voltage rejection $V_{OUT} = 1.5\text{ V}$ | $V_{IN} = V_{OUTNOM} + 1\text{ V} + /-V_{RIPPLE}$ $V_{RIPPLE} = 0.1\text{ V}$ Freq. = 1 kHz $I_{OUT} = 10\text{ mA}$ | | 74 | | dB |
| | | $V_{IN} = V_{OUTNOM} + 0.5\text{ V} + /-V_{RIPPLE}$ $V_{RIPPLE} = 0.1\text{ V}$ Freq. = 10 kHz $I_{OUT} = 10\text{ mA}$ | | 67 | | |
| I_Q | Quiescent current | $I_{OUT} = 0\text{ mA}$ | | 20 | | μA |
| | | $I_{OUT} = 0\text{ mA}$, $-40\text{ °C} < T_J < 125\text{ °C}$ | | | 50 | |
| | | $I_{OUT} = 0$ to 150 mA | | 35 | | |
| | | $I_{OUT} = 0$ to 150 mA , $-40\text{ °C} < T_J < 125\text{ °C}$ | | | 70 | |
| | | V_{IN} input current in OFF MODE: $V_{EN} = \text{GND}$ | | 0.001 | 1 | |

Table 5. Electrical characteristics for LD39115J (continued)⁽¹⁾

| Symbol | Parameter | Test conditions | Min. | Typ. | Max. | Unit |
|-------------------|-----------------------------|---|------|------|------|------|
| I _{SC} | Short circuit current | R _L = 0 | 200 | | | mA |
| V _{EN} | Enable input logic low | V _{IN} = 1.5 V to 5.5 V, -40 °C < T _J < 125 °C | | | 0.4 | V |
| | Enable input logic high | V _{IN} = 1.5 V to 5.5 V, -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 |
| 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

$C_{IN} = C_{OUT} = 1 \mu\text{F}$, V_{EN} to V_{IN} .

Figure 4. Output voltage vs. temperature ($V_{OUT} = 1.2 \text{ V}$)

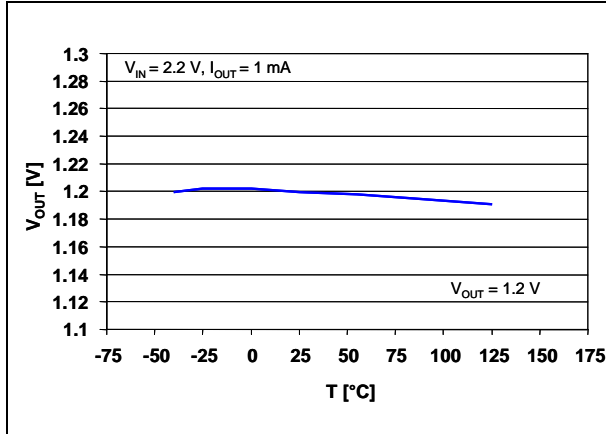


Figure 5. Output voltage vs. temperature ($V_{OUT} = 2.8 \text{ V}$)

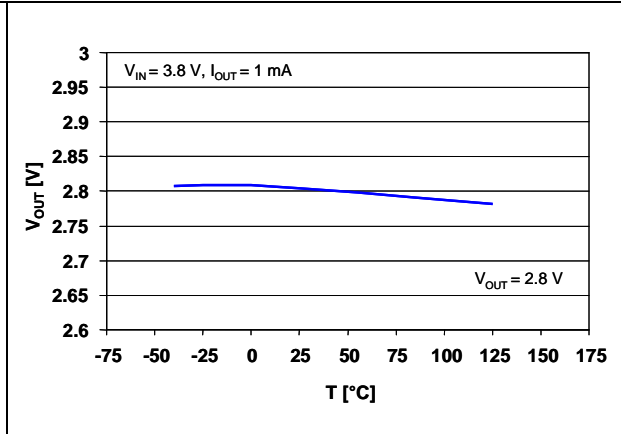


Figure 6. Line regulation vs. temperature

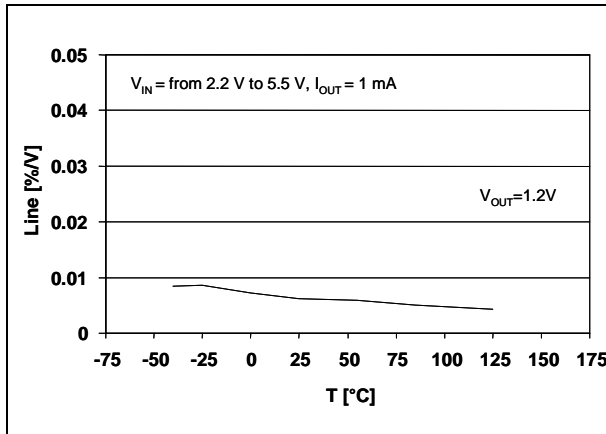


Figure 7. Load regulation vs. temperature

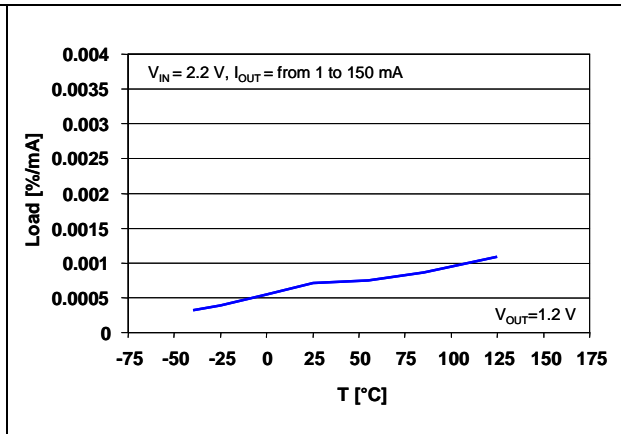


Figure 8. Short-circuit current vs. drop voltage

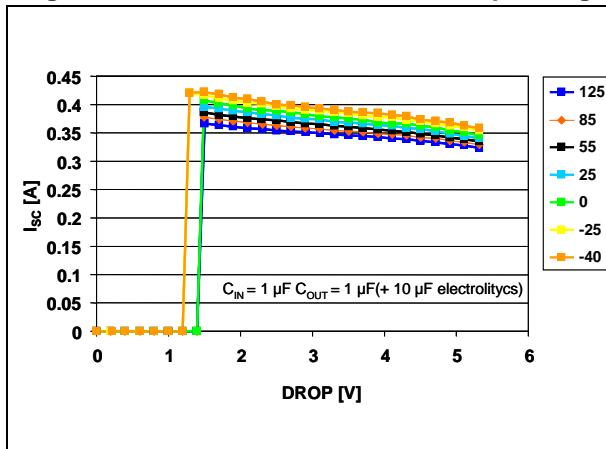


Figure 9. Dropout voltage vs. temperature

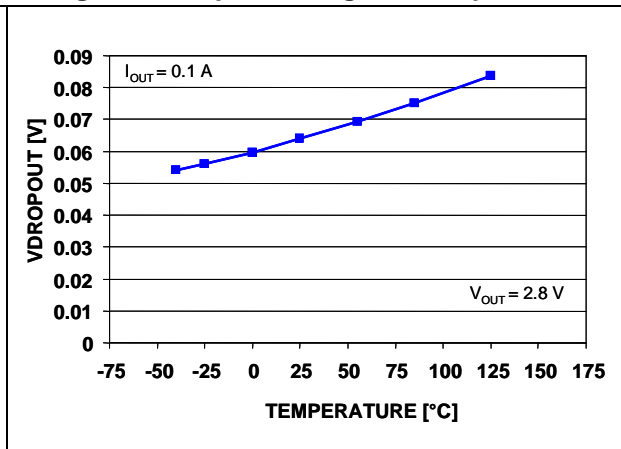


Figure 10. Dropout voltage vs. output current

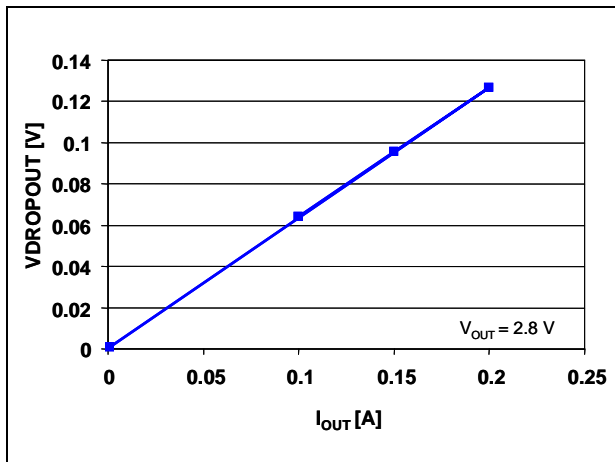


Figure 11. Output voltage vs. input voltage ($V_{OUT} = 1.3$ V)

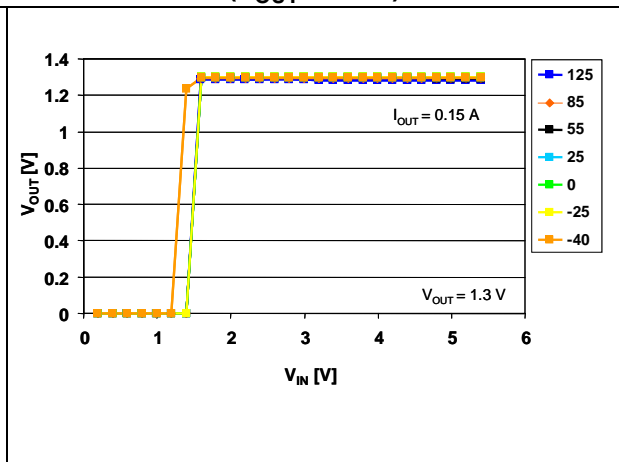


Figure 12. Output voltage vs. input voltage ($V_{OUT} = 2.8$ V)

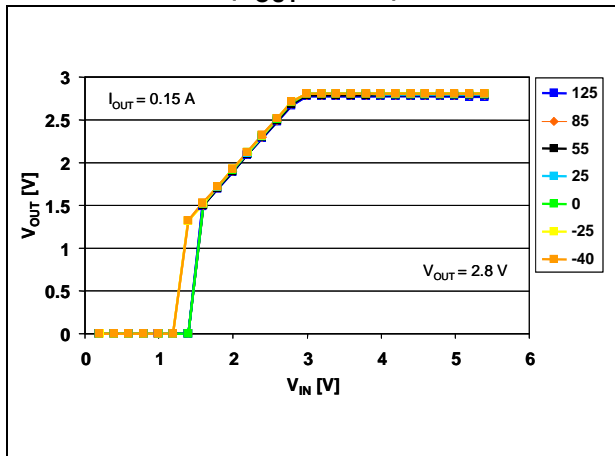


Figure 13. Enable threshold vs. temperature

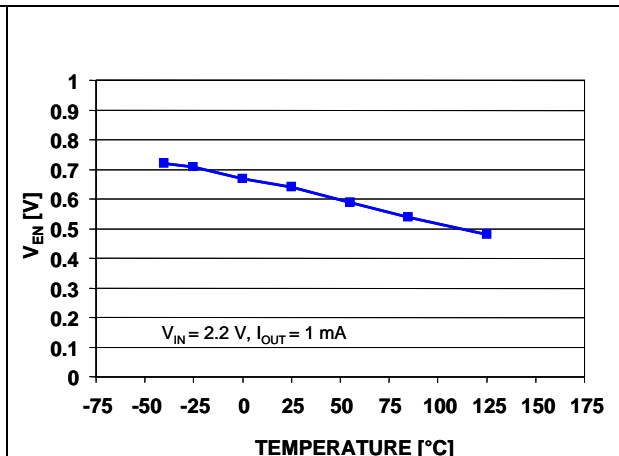


Figure 14. Quiescent current vs. temperature ($V_{OUT} = 1.2$ V, $I_{OUT} = 0$ mA)

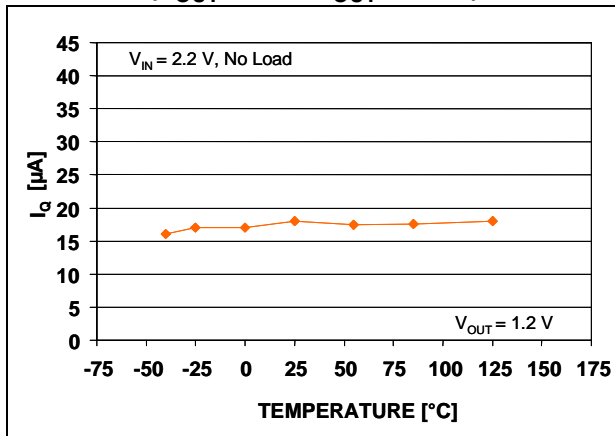


Figure 15. Quiescent current vs. temperature ($V_{OUT} = 1.2$ V, $I_{OUT} = 0.15$ A)

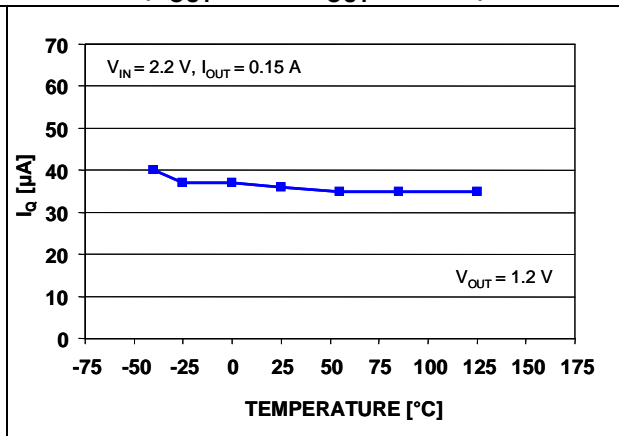


Figure 16. Quiescent current vs. temperature
($V_{OUT} = 2.8\text{ V}$, $I_{OUT} = 0.15\text{ A}$)

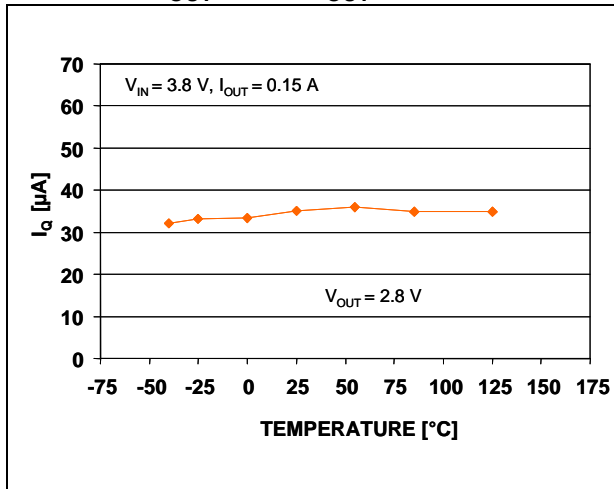


Figure 17. Quiescent current vs. input voltage

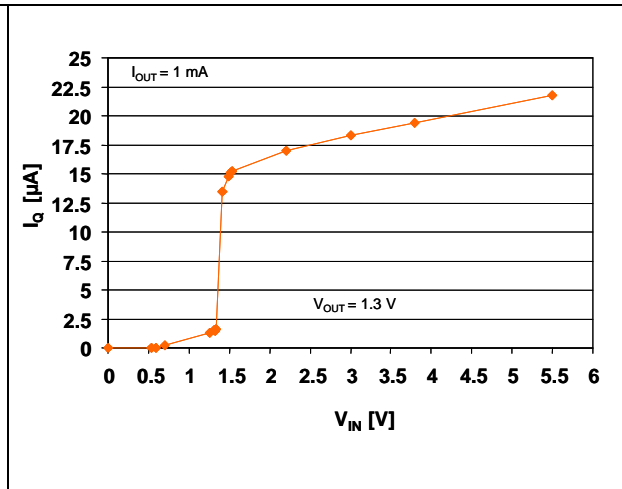


Figure 18. Quiescent current vs. output current

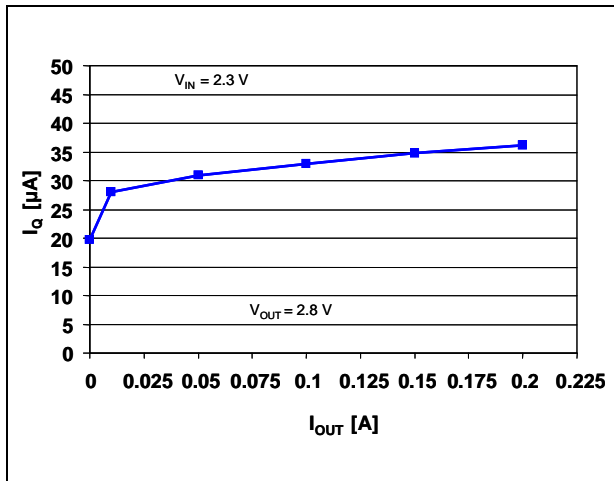


Figure 19. Supply voltage rejection vs. temperature
($V_{OUT} = 1.2\text{ V}$)

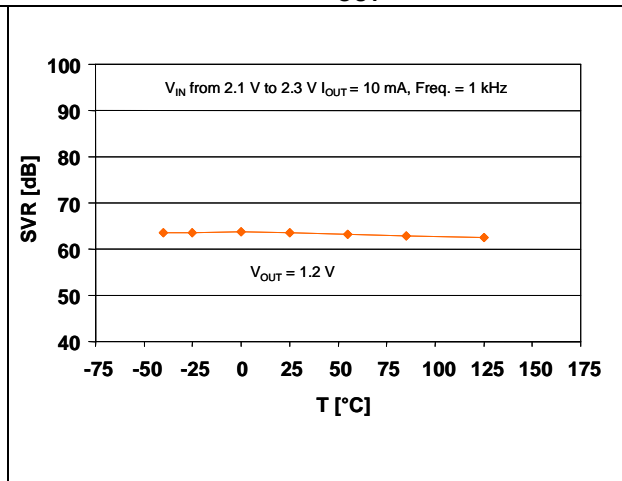


Figure 20. Supply voltage rejection vs. temperature ($V_{OUT} = 1.3\text{ V}$)

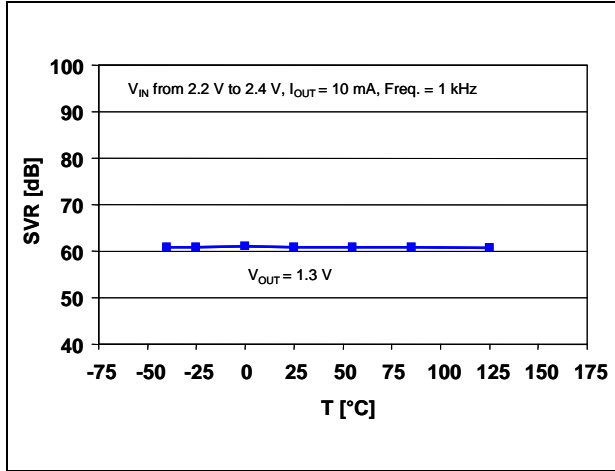


Figure 21. Supply voltage rejection vs. temperature (Freq. = 1 kHz)

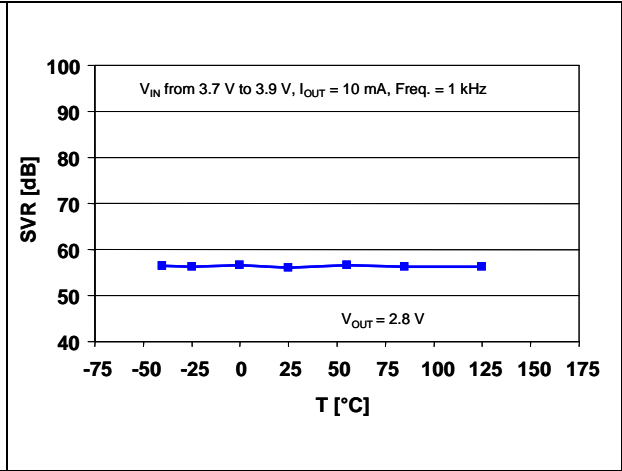


Figure 22. Supply voltage rejection vs. temperature (Freq. = 10 kHz)

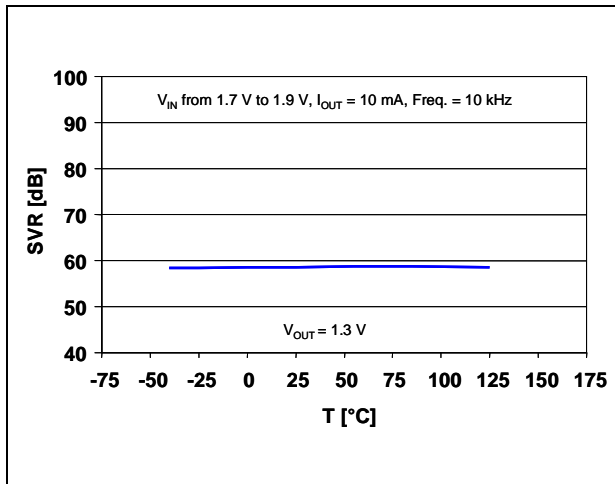


Figure 23. Supply voltage rejection vs. temperature ($V_{OUT} = 2.8\text{ V}$)

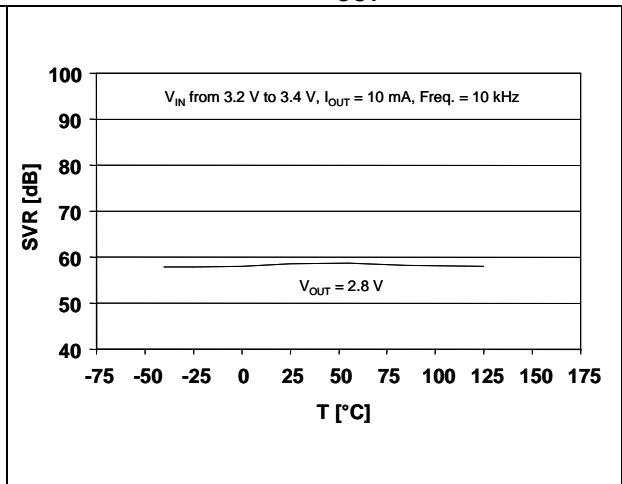


Figure 24. Supply voltage rejection vs. frequency ($V_{OUT} = 1.2\text{ V}$)

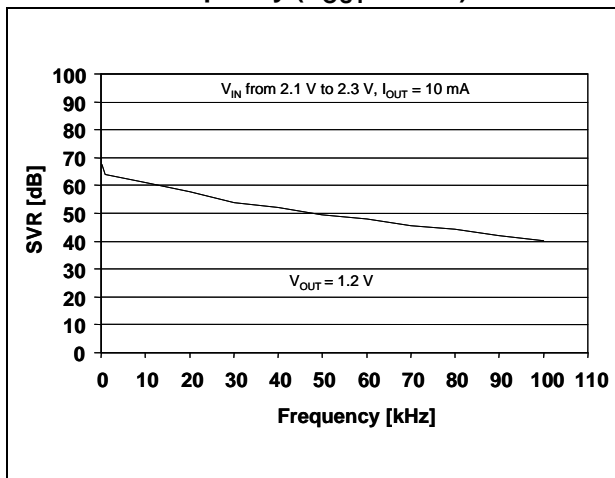


Figure 25. Supply voltage rejection vs. frequency ($V_{OUT} = 1.3\text{ V}$)

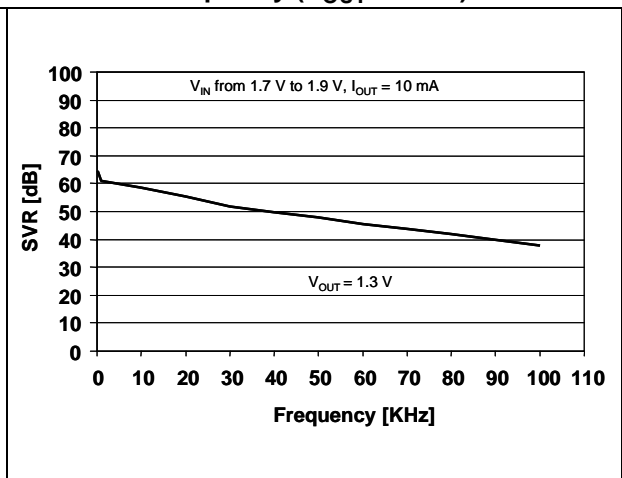


Figure 26. Supply voltage rejection vs. frequency ($V_{OUT} = 2.8\text{ V}$)

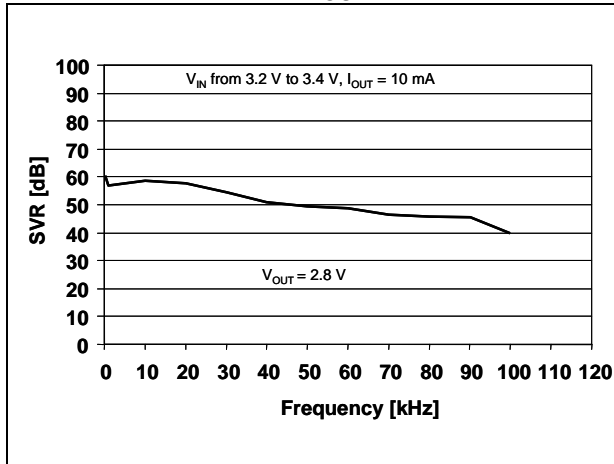


Figure 27. Supply voltage rejection vs. output current

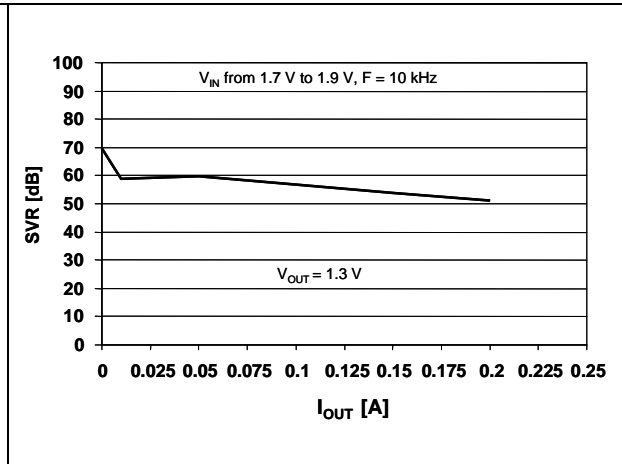


Figure 28. LD39115J noise

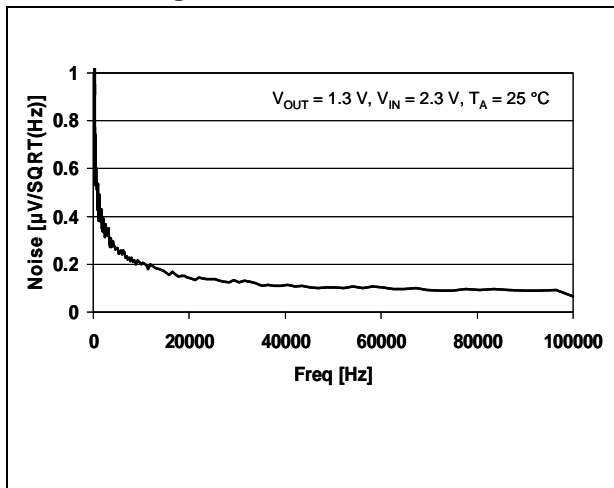


Figure 29. Line regulation transient

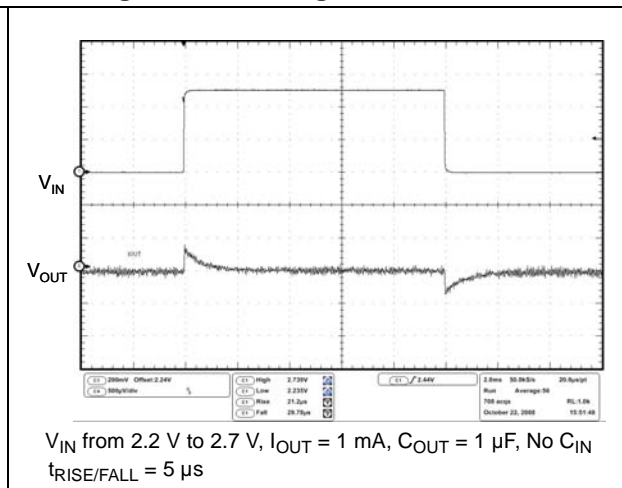


Figure 30. Start up transient

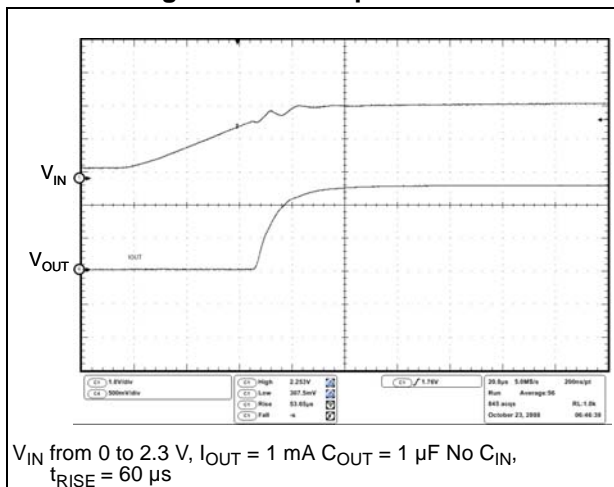


Figure 31. Enable transient ($V_{OUT} = 1.2\text{ V}$)

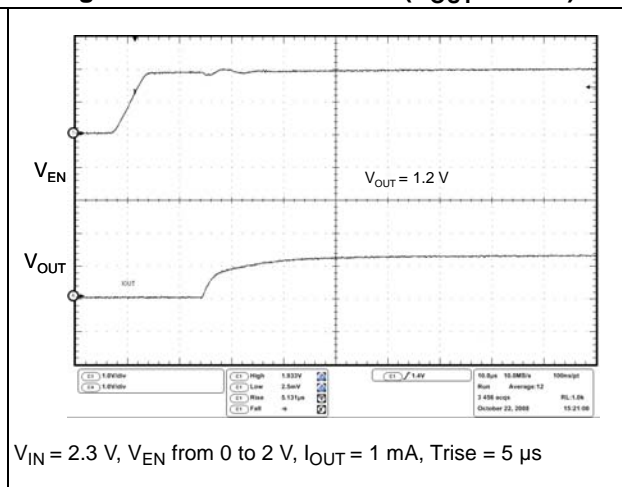


Figure 32. Enable transient ($V_{OUT} = 2.8\text{ V}$)

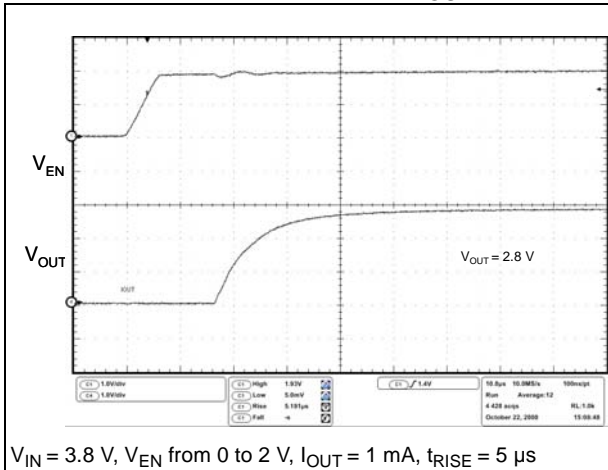


Figure 33. Load transient ($V_{OUT} = 1.2\text{ V}$)

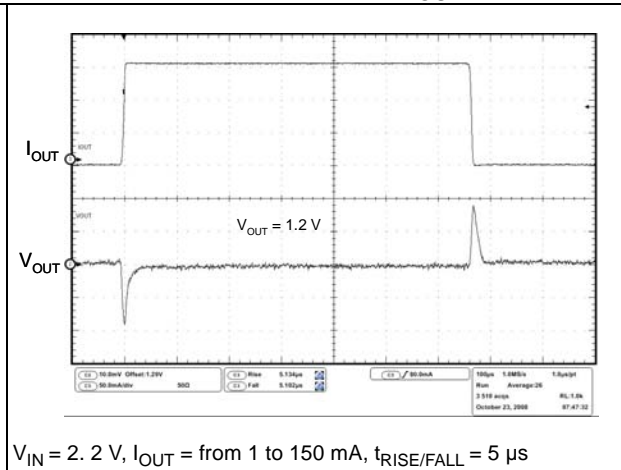


Figure 34. Load transient ($V_{OUT} = 2.8\text{ V}$)

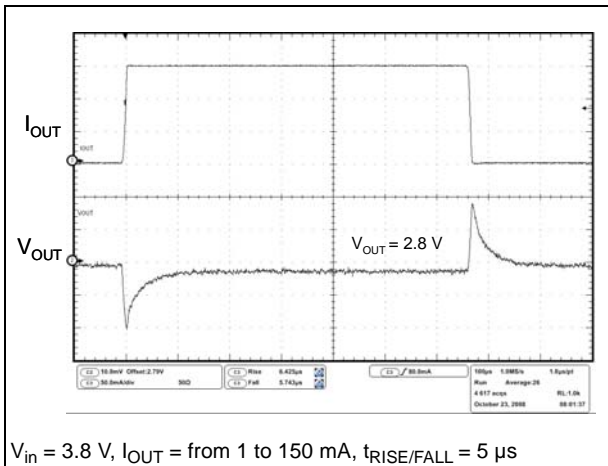
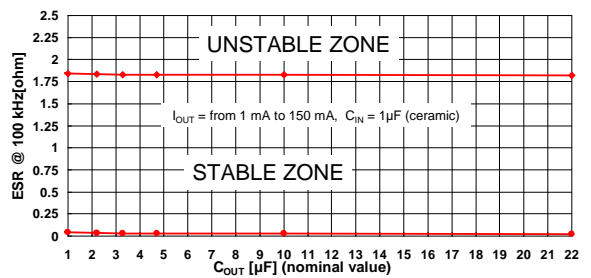


Figure 35. ESR required for stability with ceramics capacitors



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.

Figure 36. Flip-chip 4 drawings

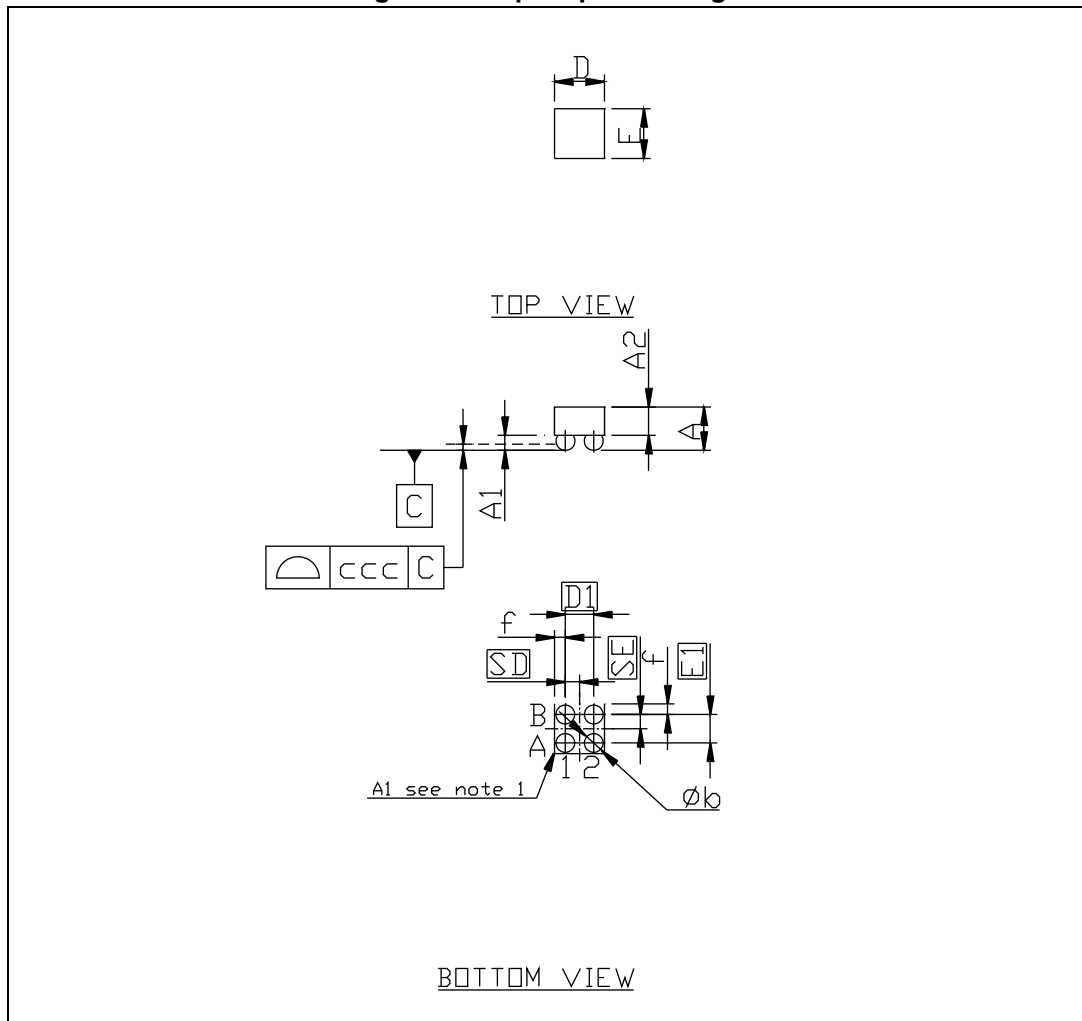
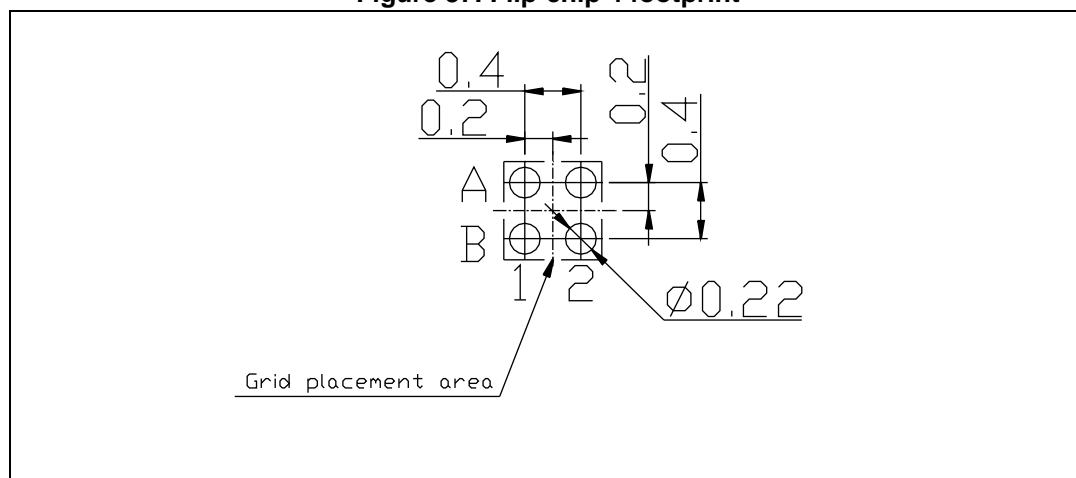


Table 6. Flip-chip 4 mechanical data

| 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 | |

Figure 37. Flip-chip 4 footprint



8 Packaging mechanical data

Figure 38. Flip-chip 4 tape and reel drawing

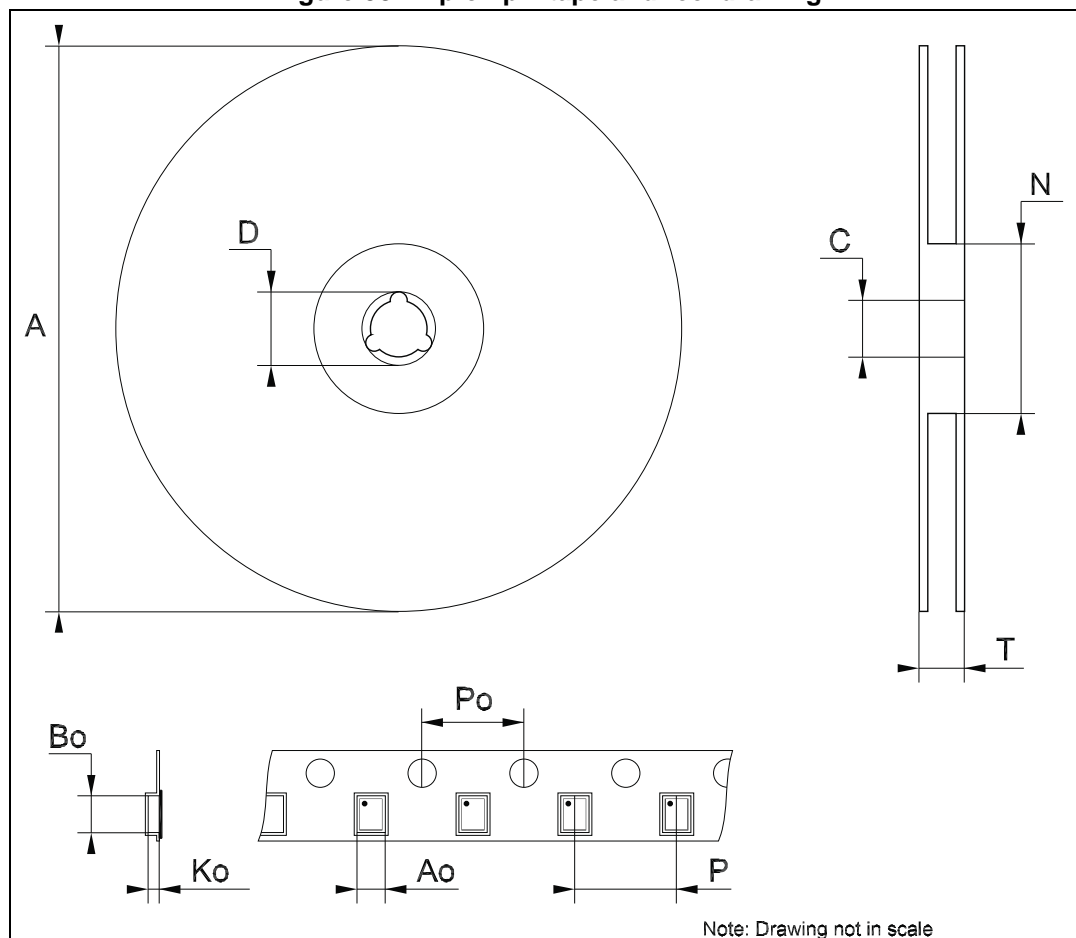


Table 7. Flip-chip 4 tape and reel mechanical data

| Dim. | mm | | |
|------|------|------|------|
| | Min. | Typ. | Max. |
| A | | | 178 |
| C | 12.8 | | 13.2 |
| D | 20.2 | | |
| N | 59 | 60 | 61 |
| T | | | 8.4 |
| Ao | 0.82 | 0.87 | 0.92 |
| Bo | 0.82 | 0.87 | 0.92 |
| Ko | 0.64 | 0.69 | 0.74 |
| Po | 3.9 | 4.0 | 4.1 |
| P | 3.9 | 4.0 | 4.1 |

9 Different output voltage versions of the LD39115J available on request

Table 8. Options available on request

| Order codes | Output voltages |
|-------------|-----------------|
| LD39115J08R | 0.8 V |
| LD39115J10R | 1.0 V |

10 Revision history

Table 9. Document revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 26-Mar-2009 | 1 | Initial release. |
| 12-Jun-2009 | 2 | Modified: Table 1 on page 1 and Table 8 on page 19 . |
| 05-Aug-2009 | 3 | Modified: tape and reel mechanical data on page 18 . |
| 17-May-2011 | 4 | Modified: Table 1 on page 1 and Table 8 on page 19 . |
| 20-Dec-2011 | 5 | Added: new order code LD39115J25R Table 1 on page 1 . |
| 16-Jan-2014 | 6 | Part number LD39115Jxx changed to LD39115J. Updated the Description in cover page, Section 7: Package mechanical data . Added Section 8: Packaging mechanical data . Minor text changes. |

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