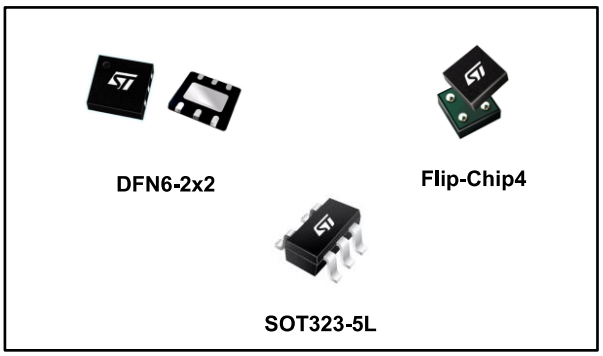
STLQ020

200 mA ultra-low quiescent current LDO

Datasheet - preliminary data



Features

- Operating input voltage range: 2 V to 5.5 V
- Output current up to 200 mA
- Ultra-low quiescent current:
  - 300 nA typ. at no load
  - 100 µA typ. at 200 mA load
- Controlled I_q in dropout conditions
- Very low-dropout voltage: 160 mV at 200 mA
- Output voltage accuracy: 2% at room temperature, 3% in full temperature range
- Output voltage versions: from 0.8 V to 4.5 V, with 50 mV step and adjustable
- Logic-controlled electronic shutdown
- Output discharge feature (optional)
- Internal overcurrent and thermal protections
- Temperature range: from -40 °C to +125 °C
- Packages: DFN6-2x2, SOT323-5L, Flip-Chip4

Applications

- Smartphones/tablets
- Image sensors
- Wearable accessories
- Healthcare devices
- Metering

Description

The STLQ020 is a 200 mA low-dropout voltage regulator, which can work with an input voltage range from 2 V to 5.5 V. The typical dropout voltage at maximum load is 160 mV.

The ultra-low quiescent current is just 0.3 µA at no-load and extends battery life of applications requiring very long standby time. The enable logic control function allows the STLQ020 to go to shutdown mode, reducing the total current consumption to 1 nA. The STLQ020 is designed to keep the quiescent current under control and at a low value also during dropout operations, further extending the operating time of battery-powered devices. It also includes short-circuit constant-current limiting and thermal protections. Several small package options are available.

Contents

1 Diagram

Figure 1: Block diagram (fixed version)

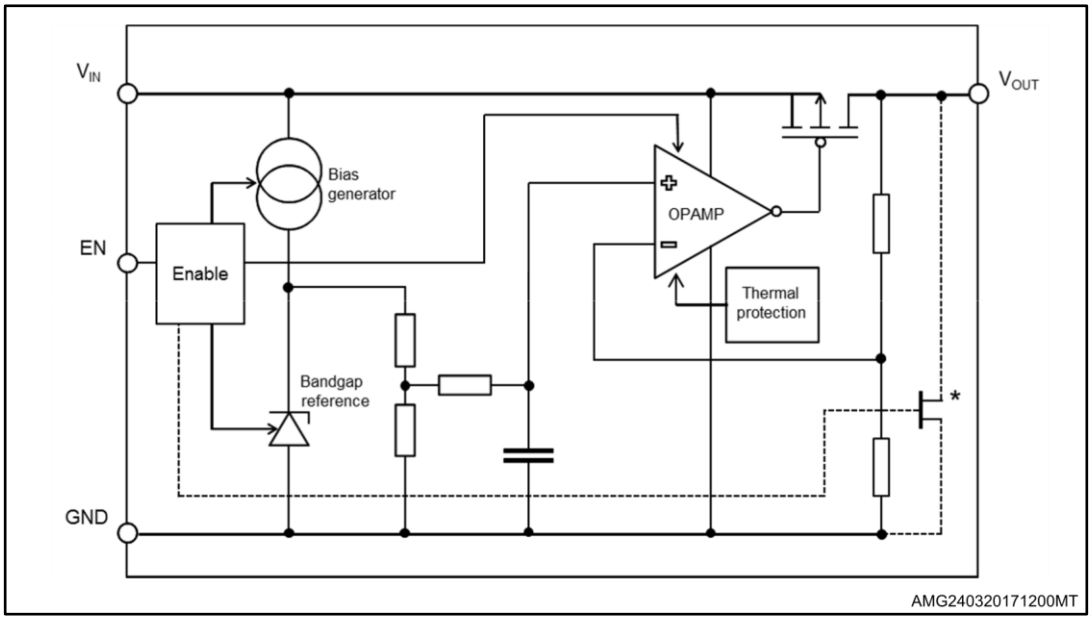
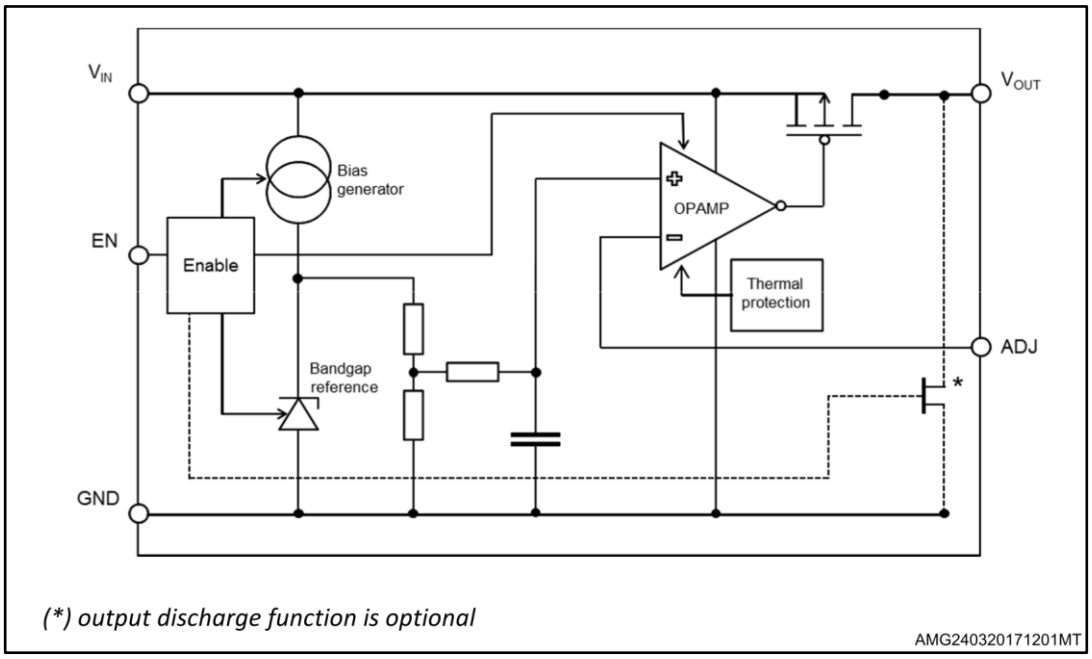


Figure 2: Block diagram (adjustable version)



2 Pin configuration

Figure 3: Pin configuration

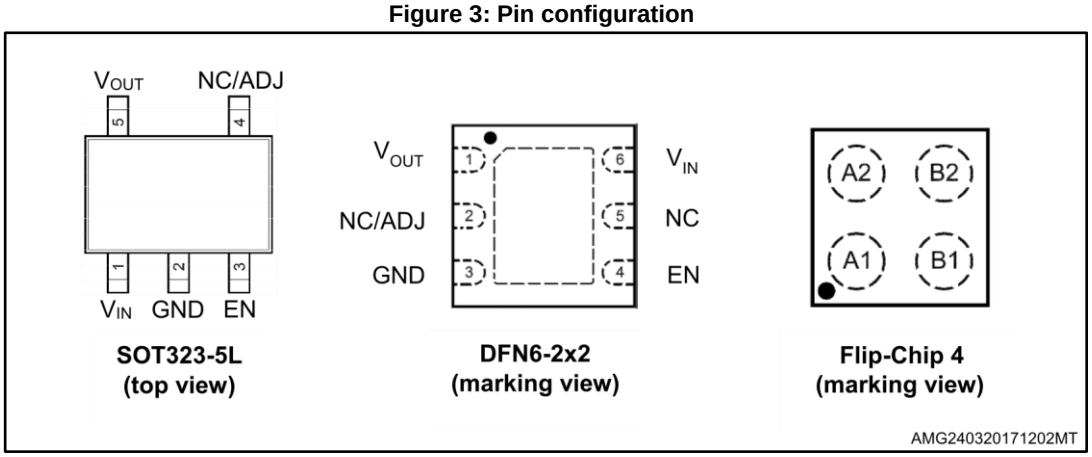


Table 1: Pin description

Symbol	SOT323-5L	DFN6-2x2	Flip-Chip4	Description
V_{IN}	1	6	A1	LDO supply voltage
V_{OUT}	5	1	A2	LDO output voltage
GND	2	3	B2	Ground
EN	3	4	B1	Enable input: set V_{EN} = high to turn on the device; V_{EN} = low to turn off the device
NC/ADJ	4	2	-	Adjustable pin (only on ADJ version). Connect to external resistor divider. Not connected on the fixed version
NC	-	5	-	Not internally connected: it can be connected to GND
Exposed pad	-	Exposed pad	-	Must be connected to GND

3 Typical application

Figure 4: Typical application diagram (fixed version)

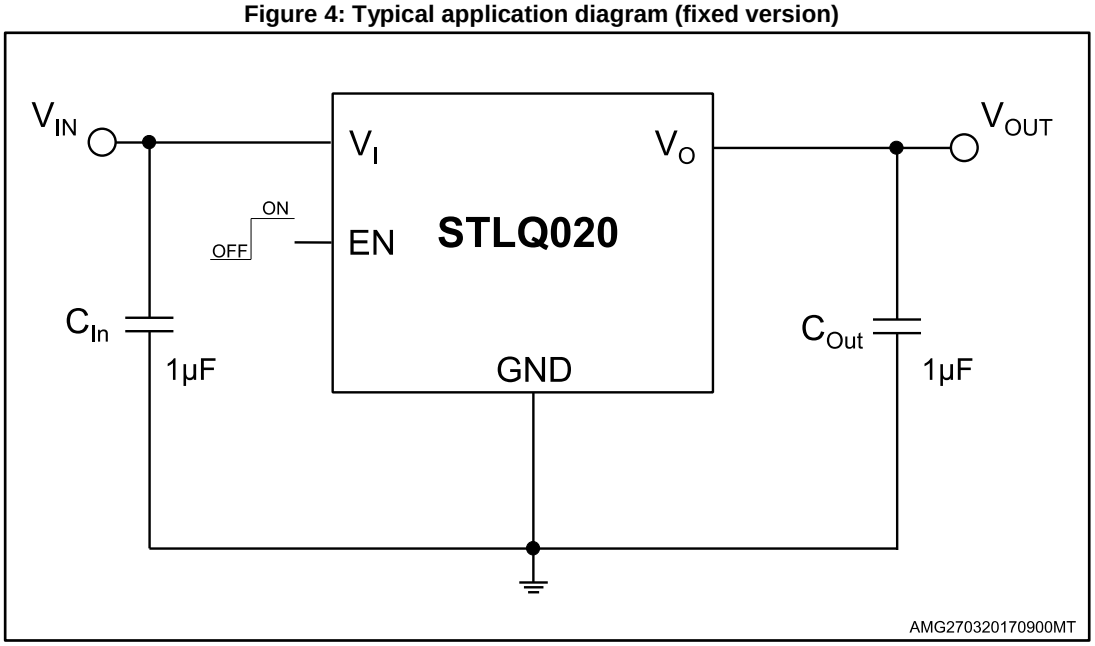
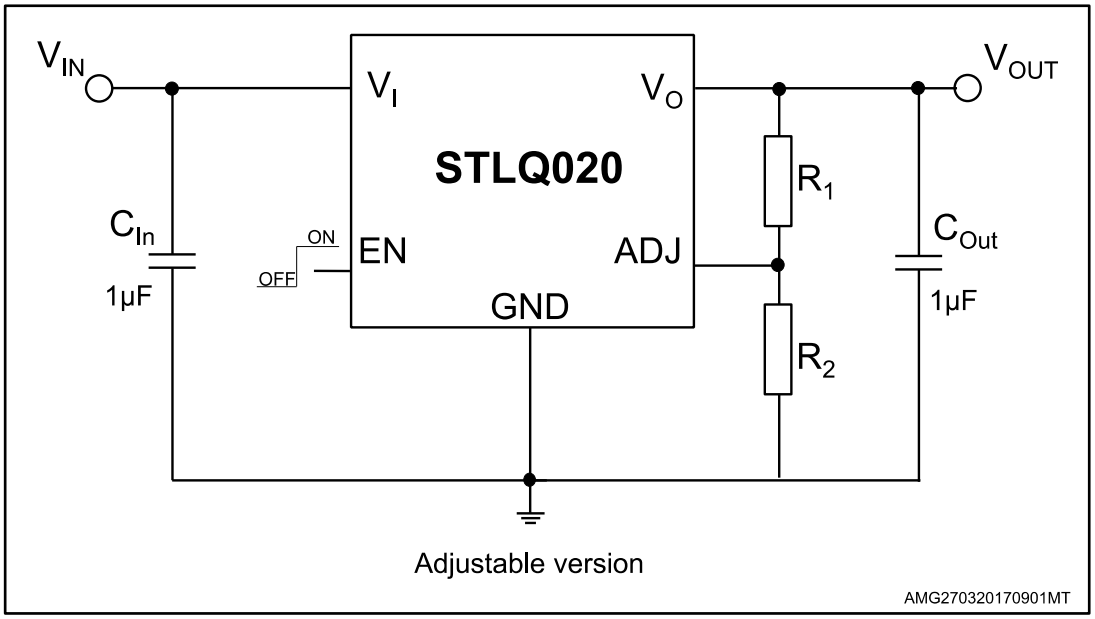


Figure 5: Typical application diagram (adjustable version)



R_1 and R_2 are calculated according to the following formula:
$R_1 = R_2 \times (V_{OUT} / V_{ADJ} - 1)$.

4 Maximum ratings

Table 2: Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{IN}	Input supply voltage	-0.3 to 7	V
V_{OUT}	Output voltage	-0.3 to V_{IN} +0.3	V
V_{ADJ}	Adjustable pin voltage	-0.3 to 2	V
I_{OUT}	Output current	Internally limited	A
EN	Enable pin voltage	-0.3 to V_{IN} +0.3	V
P_D	Power dissipation	Internally limited	W
ESD	Charged device model	±500	V
	Human body model	±2000	
T_{J-OP}	Operating junction temperature	-40 to 125	°C
T_{J-MAX}	Maximum junction temperature	150	°C
T_{STG}	Storage temperature	-55 to 150	°C

Table 3: Thermal data

Symbol	Parameter	DFN6-2x2	Flip-Chip4	SOT323-5L	Unit
R_{thjc}	Thermal resistance, junction-to-case	TBD	TBD	TBD	°C/W
R_{thja}	Thermal resistance, junction-to-ambient	TBD	TBD	TBD	°C/W

5 Electrical characteristics

T_J = 25 °C, V_{IN} = V_{OUT} + 0.5 V or 2 V, whichever is greater; V_{EN} = V_{IN}; C_{IN} = 1 µF; C_{OUT} = 1 µF; I_{OUT} = 1 mA.

Table 4: Electrical characteristics (fixed version)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{IN}	Operating input voltage range		2		5.5	V
V_{OUT}	Output voltage accuracy	T_J = 25 °C	-2		2	%
		-40 °C < T_J < 125 °C	-3		3	
$\Delta V_{OUT\%}/\Delta V_{IN}$	Static line regulation	V_{OUT} + 0.5 V(1) < V_{IN} < 5.5 V		0.004		%/V
		-40 °C < T_J < 125 °C			0.05	
$\Delta V_{OUT\%}/\Delta I_{OUT}$	Static load regulation	1 mA < I_{OUT} < 0.2 A; T_J = 25 °C		0.0025		%/mA
		-40 °C < T_J < 125 °C			0.005	
V_{DROP}	Dropout voltage(2)	V_{OUT} = 2.5 V; I_{OUT} = 0.2 A		160		mV
		V_{OUT} = 2.5 V; I_{OUT} = 20 mA		15		mV
eN	Output noise voltage	f = 10 Hz to 100 kHz		135		$\mu V_{RMS}/V_{OUT}$
SVR	Supply voltage rejection	V_{OUT} = 2.5 V; V_{RIPPLE} = 0.2 Vpp		60		dB
		I_{OUT} = 10 mA; f = 100 Hz				
		V_{OUT} = 2.5 V; V_{RIPPLE} = 0.2 Vpp		40		
		I_{OUT} = 10 mA ; f = 1 kHz				
		V_{OUT} = 2.5 V; V_{RIPPLE} = 0.2 Vpp		50		
		I_{OUT} = 10 mA; f = 10 kHz				
I_q	Quiescent current	I_{OUT} = 0 A		300		nA
		I_{OUT} = 0 A; -40 °C < T_J < 125 °C			1000	
		I_{OUT} = 0.2 A		100		µA
		I_{OUT} = 0.2 A; -40 °C < T_J < 125 °C			150	
	Shutdown current	V_{EN} = 0 V, V_{IN} =5.5 V		0.01	1	µA

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SC}	Short-circuit current	V_{OUT} = 0 V		350		mA
R_{LOW}(3)	Output discharge resistance	V_{EN} = 0 V		100		Ω
V_{EN}	Enable input logic low	-40 °C < T_J < 125 °C			0.4	V
	Enable input logic high		1.2			
I_{EN}	Enable pin input current	V_{EN} = V_{IN}; 1.25 < V_{IN} < 6.0 V		1		nA
T_{SHDN}	Thermal shutdown(4)	I_{OUT} > 1 mA		160		°C
	Hysteresis			20		

Notes:

(1)V_{IN} = V_{OUT} + 0.5 V or 2 V, whichever is greater.

(2)Dropout voltage is the input-to-output voltage difference at which the output voltage is 100 mV below its nominal value.

(3)On specific version only.

(4)The thermal protection is not active when the load current is lower than 1 mA.

T_J = 25 °C, V_{IN} = 2 V, V_{EN} = V_{IN}; C_{IN} = 1 µF; C_{OUT} = 1 µF; I_{OUT} = 1 mA.

Table 5: Electrical characteristics (adjustable version)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{IN}	Operating input voltage range		2		5.5	V
V_{ADJ}	Reference voltage accuracy	T_J = 25 °C	0.784	0.8	0.816	V
		-40 °C < T_J < 125 °C	-3		3	%
I_{ADJ}	Adjustable pin current			1		nA
$\Delta V_{ADJ\%}/\Delta V_{IN}$	Static line regulation	2 V< V_{IN} < 5.5 V		0.001		%/V
		-40 °C < T_J < 125 °C			0.03	
$\Delta V_{ADJ\%}/\Delta I_{OUT}$	Static load regulation	1 mA < I_{OUT} < 0.2 A; T_J = 25 °C		0.0004		%/mA
		-40 °C < T_J < 125 °C			0.001	
V_{DROP}	Dropout voltage(1)	V_{OUT} = 2.0 V; I_{OUT} = 0.2 A		200		mV
		V_{OUT} = 2.0 V; I_{OUT} = 20 mA		15		mV
eN	Output noise voltage	f = 10 Hz to 100 kHz		135		$\mu V_{RMS}/V_{OUT}$
SVR	Supply voltage rejection	V_{OUT} = 2.5 V; V_{RIPPLE} = 0.2 Vpp		60		dB
		I_{OUT} = 10 mA; f = 100 Hz				
		V_{OUT} = 2.5 V; V_{RIPPLE} = 0.2 Vpp		40		
		I_{OUT} = 10 mA ; f = 1 kHz				
		V_{OUT} = 2.5 V; V_{RIPPLE} = 0.2 Vpp		50		
		I_{OUT} = 10 mA; f = 10 kHz				
I_q	Quiescent current	I_{OUT} = 0 A		300		nA
		I_{OUT} = 0 A; -40 °C < T_J < 125 °C			1000	
		I_{OUT} = 0.2 A		80		µA
		I_{OUT} = 0.2 A; -40 °C < T_J < 125 °C			150	
	Shutdown current	V_{EN} = 0 V, V_{IN} = 5.5 V		0.005	1	µA
I_{SC}	Short-circuit current	V_{OUT} = 0 V		350		mA
R_{LOW}(2)	Output discharge resistance	V_{EN} = 0 V		100		Ω

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{EN}	Enable input logic low	-40 °C < T_J < 125 °C			0.4	V
	Enable input logic high		1.2			
I_{EN}	Enable pin input current	V_{EN} = V_{IN}; 1.25 < V_{IN} < 6.0 V		10		nA
T_{SHDN}	Thermal shutdown(3)	I_{OUT} > 1 mA		160		°C
	Hysteresis			20		

Notes:

(1)Dropout voltage is the input-to-output voltage difference at which the output voltage is 100 mV below its nominal value.

(2)The thermal protection is not active when the load current is lower than 1 mA.

(3)On specific version only.

6 Package information

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.

6.1 SOT323-5L package information

Figure 6: SOT323-5L package outline

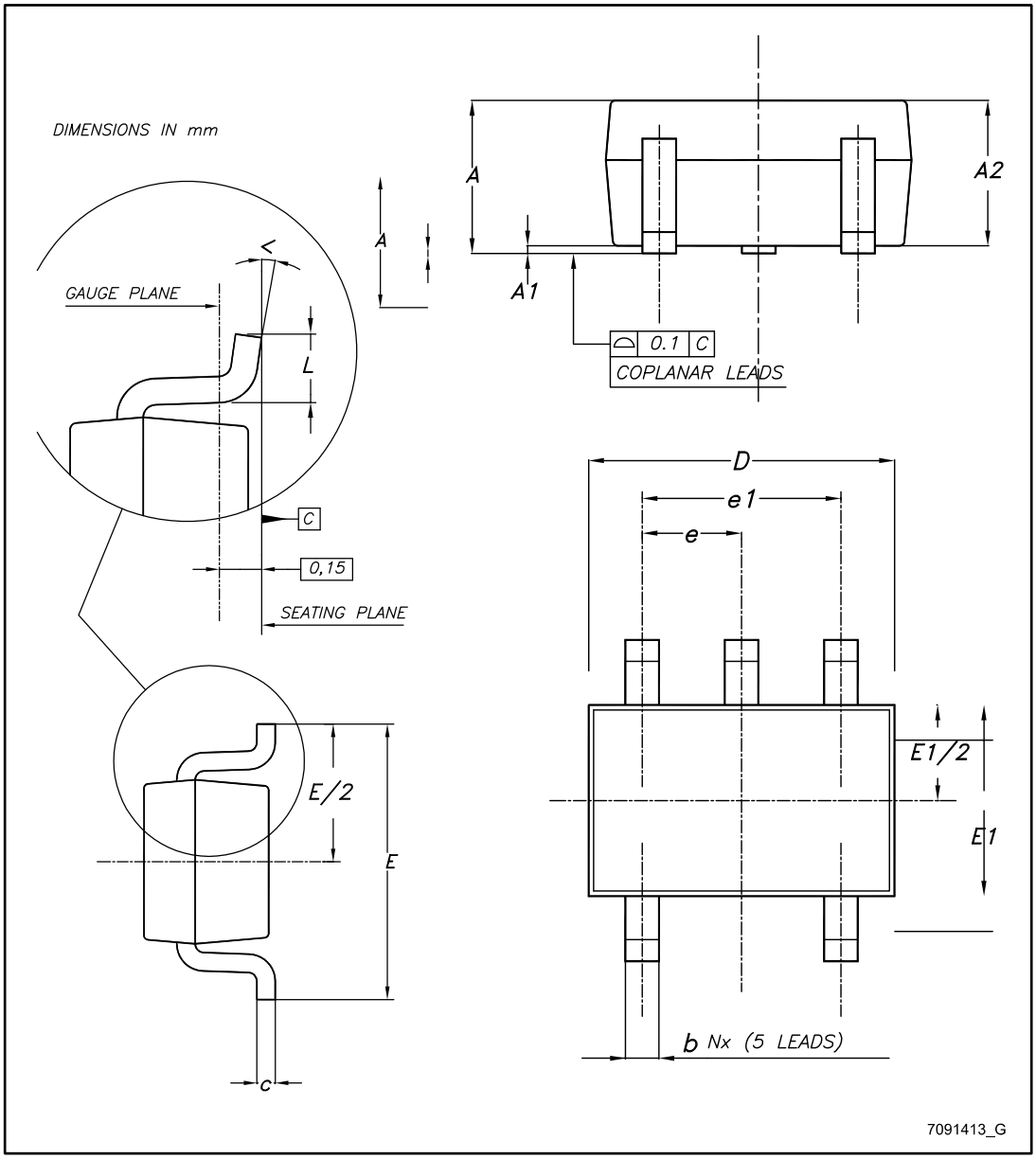
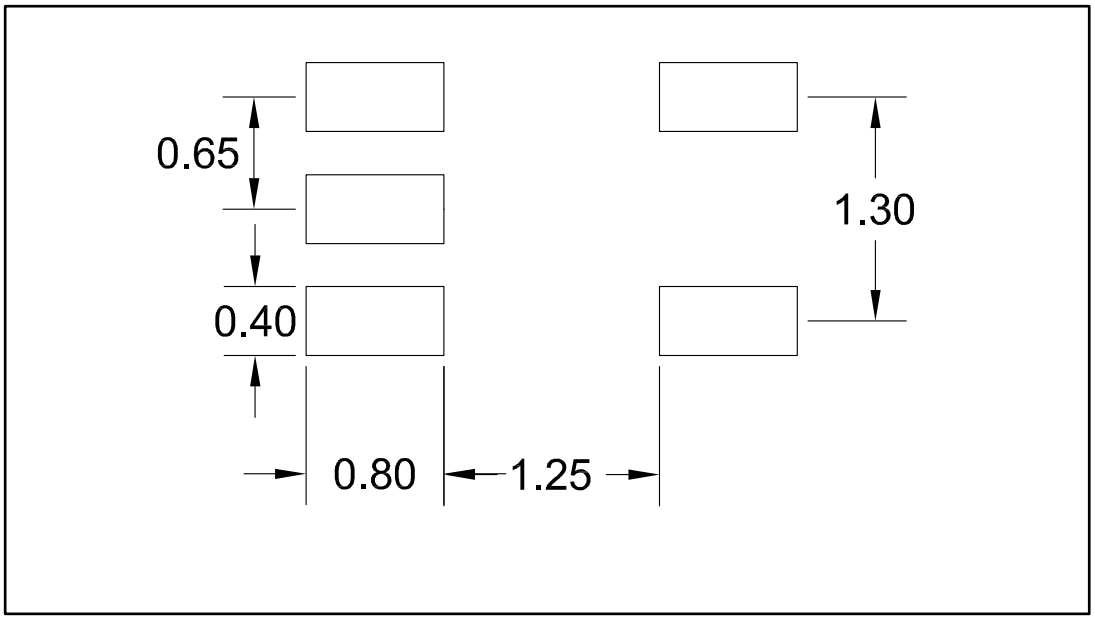


Table 6: SOT323-5L package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.10
A1	0		0.10
A2	0.80	0.90	1
b	0.15		0.30
c	0.10		0.22
D	1.80	2	2.20
E	1.80	2.10	2.40
E1	1.15	1.25	1.35
e		0.65	
e1		1.30	
L	0.26	1.36	0.46
<	0°		8°

Figure 7: SOT323-5L recommended footprint



6.2 Flip-Chip4 package information

Figure 8: Flip-Chip4 package outline

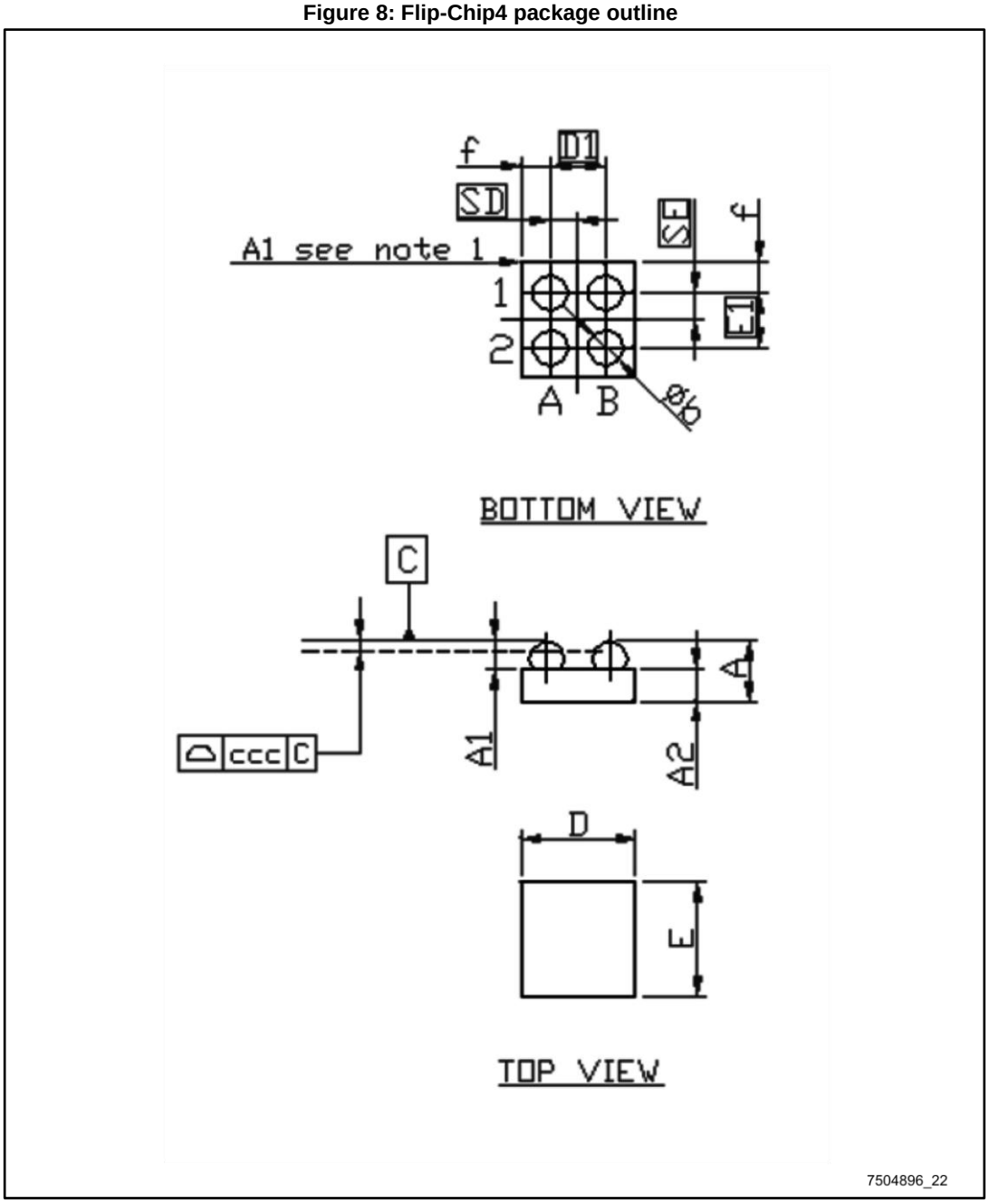
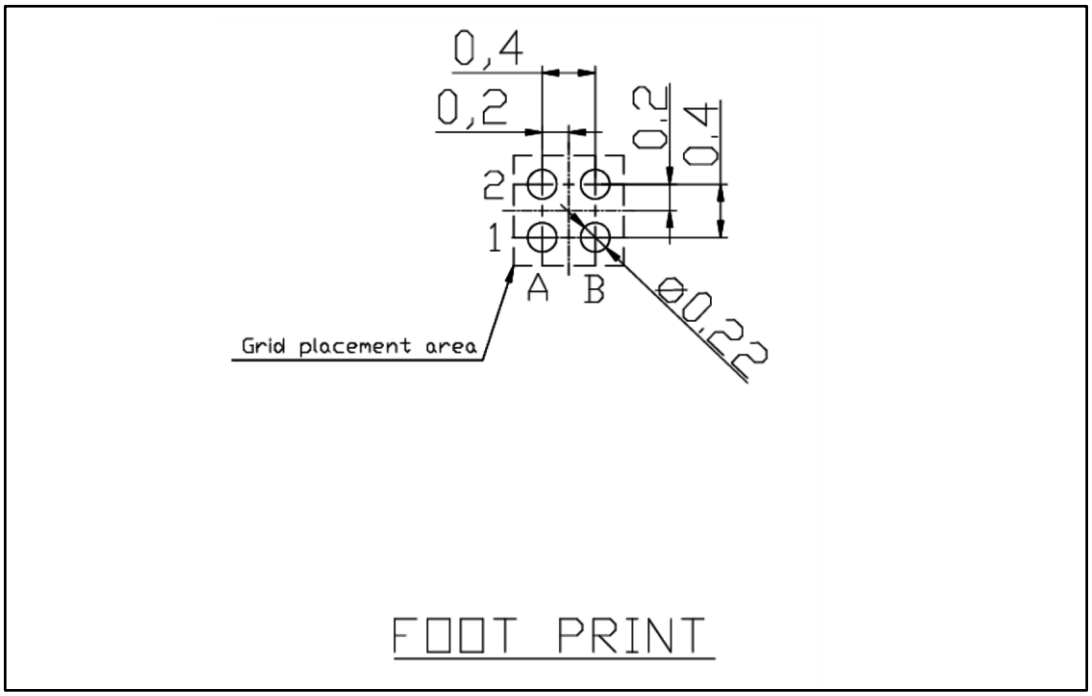


Table 7: Flip-Chip4 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.51	0.56	0.61
A1	0.17	0.20	0.23
A2	0.34	0.36	0.38
b	0.23	0.26	0.29
D	0.743	0.773	0.803
D1		0.40	
E	0.743	0.773	0.803
E1		0.40	
SD		0.20	
SE		0.20	
f		0.187	
ccc		0.075	

Figure 9: Flip-Chip4 recommended footprint



6.3 DFN6 2x2 package information

Figure 10: DFN6 2x2 package outline

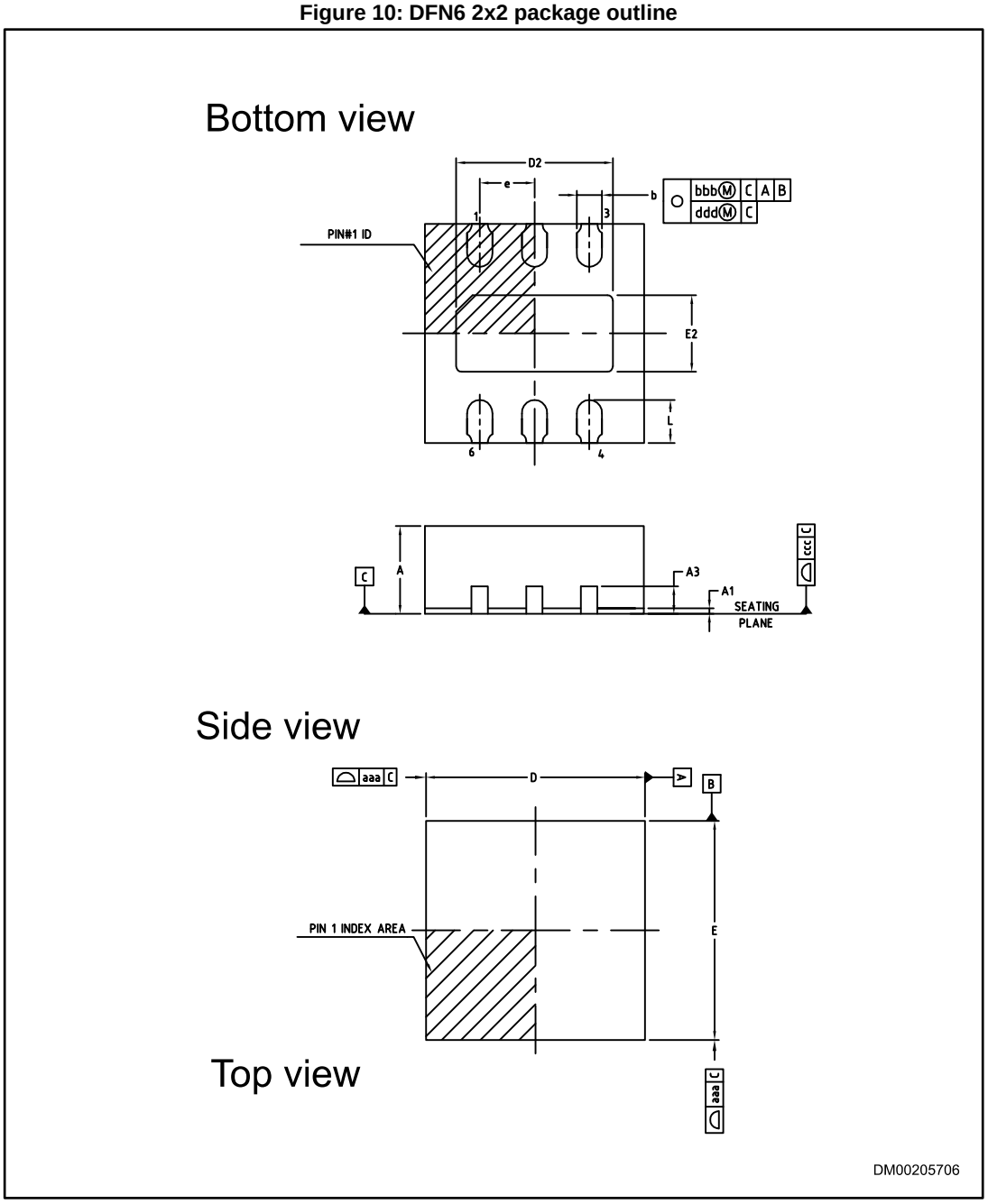
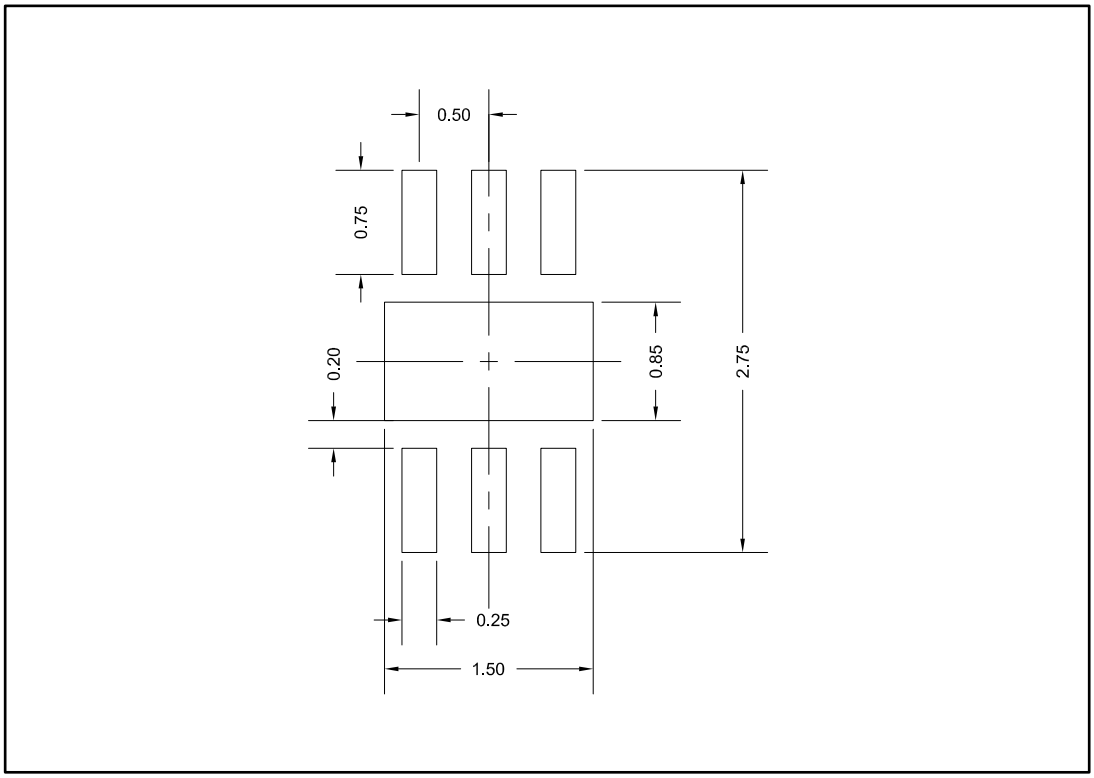


Table 8: DFN6 2x2 package mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	0.75	0.85	0.95
A1	0.00	0.02	0.05
A3	0.10	0.20	0.30
b	0.18	0.23	0.28
D	1.90	2.00	2.10
D2	1.33	1.43	1.53
E2	0.68	0.78	0.88
e		0.50	
E	1.90	2.00	2.10
L	0.25	0.35	0.45
N	6		

Figure 11: DFN6 2x2 recommended footprint



7 Ordering information

Table 9: Order code

Order code	Package	Output voltage	Marking	Packing
STLQ020PUxxR	DFN6-2x2	x.x V		Tape and reel
STLQ020CxxR	SOT323-5L			
STLQ020JxxR	Flip-Chip4			

8 Revision history

Table 10: Document revision history

Date	Revision	Changes
27-Mar-2017	1	Initial release.

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