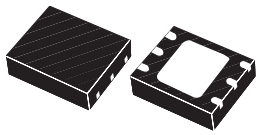
STLA01

50 mA stand-alone linear LED driver

Features

- Programmable LED current up to 50 mA with ± 5% accuracy
- No external sense resistor
- Constant current source
- Supply voltage range from 3.75 V to 6 V
- Single LED
- 10 µA max supply current in shutdown mode
- DFN6 (2 x 2 mm) package



DFN6 (2 x 2 mm)

Description

The STLA01 is a constant current LED driver.

No external sense resistor is required and the DFN6 2 x 2 mm package makes it ideal for portable applications.

The LED current limitation can be programmed using a single resistor connected between the PROG pin and GND. Using the enable pin the device can be put into shutdown mode, reducing the supply current to less than 10 µA.

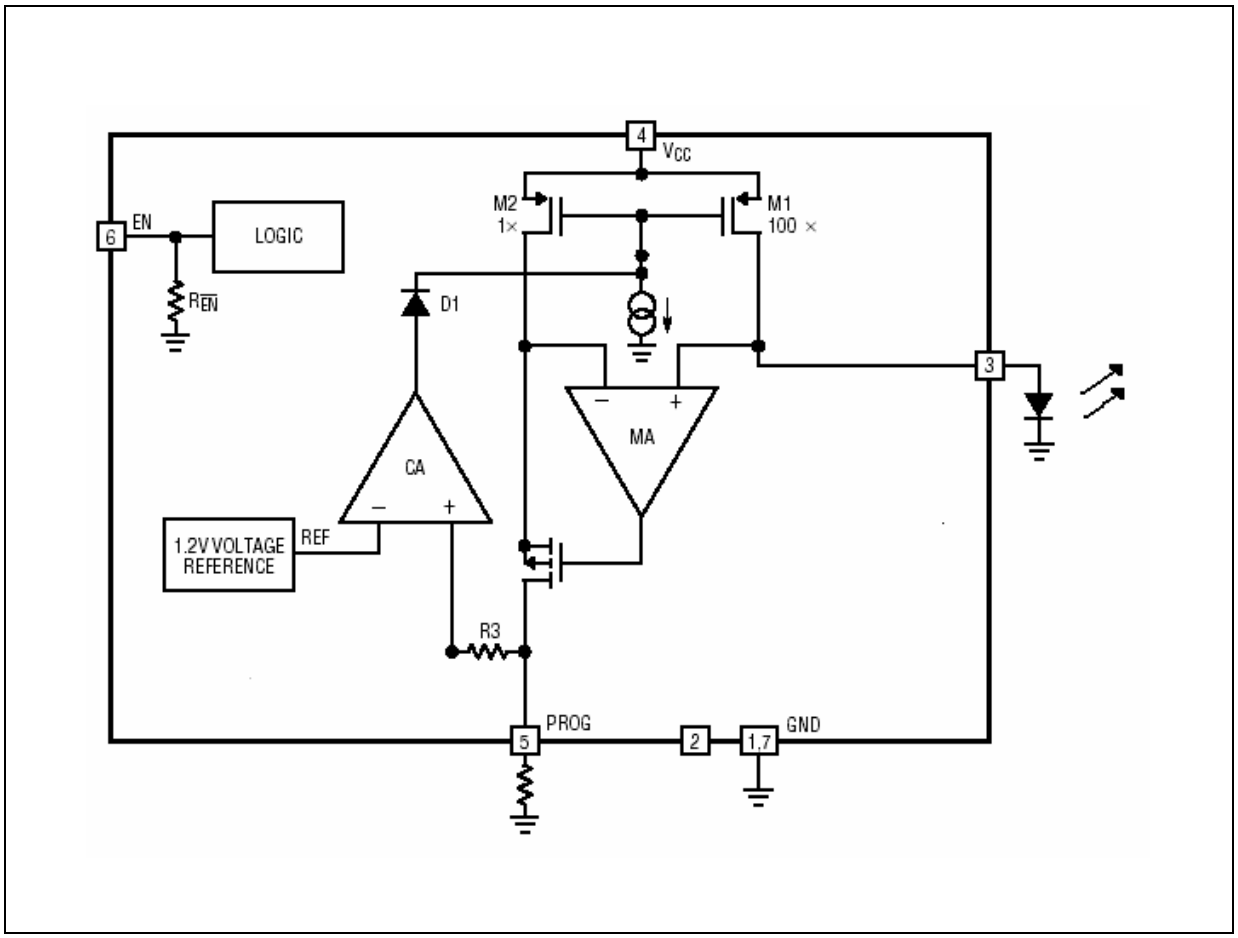
Table 1. Device summary

Part number	Order code	Package
STLA01	STLA01PUR	DFN6 (2x2 mm)

Contents

1 Diagram

Figure 1. Block diagram



2 Pin configuration

Figure 2. Pin connections (top view)

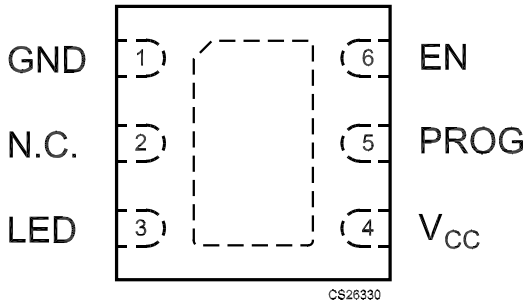


Table 2. Pin description

Pin n°	Symbol	Name and function
1	GND	Ground
2	NC	Not connected
3	LED	This pin provide an accurate output limited current. In shutdown mode no current can flow to the LED.
4	V_{CC}	Input supply voltage. The input range is from 3.75 V to 6 V.
5	PROG	Current limitation program. (1)
6	EN	Enable pin. Tie to V_{CC} if unused.
Exposed Pad	GND	To be connected to PCB ground plane for optimal electrical and thermal performance.

1. The PROG pin is a high impedance pin, It is possible to connect only the programming resistor.

3 Maximum ratings

Table 3. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CC}	Input supply voltage	From -0.3 to 7	V
V_{LED}	LED pin voltage	From -0.3 to 7	V
V_{PROG}	PROG pin voltage	From -0.3 to 3	V
V_{EN}	EN pin voltage	From -0.3 to 7	V
I_{LED}	LED pin current	80	mA
I_{PROG}	PROG pin current	800	µA
	LED short-circuit duration	Continuous	
P_D	Power dissipation	Internally limited	
T_J	Max junction temperature	125	°C
T_{STG}	Storage temperature range	-65 to 125	°C
T_{OP}	Operating junction temperature range	-40 to 85	°C
T_L	Lead temperature (10 sec)	260 (JEDEC 020C)	°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	Value	Unit
R_{thJA}	Thermal resistance junction-ambient	100 (1)	°C/W

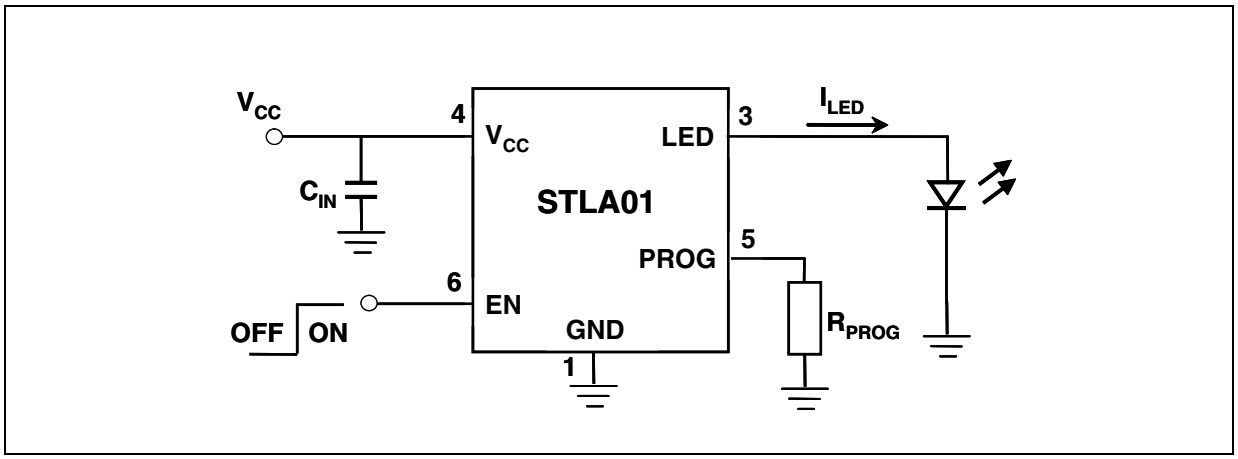
1. This value depends on whether the exposed backside of the package is soldered to the PC board. If it is not, the value could be considerably higher.

Table 5. ESD performance

Symbol	Parameter	Test conditions	Value	Unit
ESD	ESD protection voltage	HBM (EIA/JESD22/A114)	3	kV
		MM (EIA/JESD22/A115)	200	V

4 Application

Figure 3. Typical application



5 Electrical characteristics

Table 6. Electrical characteristics (V_{CC} = V_{EN} = 5 V, C_{IN} = 1 µF, T_J = -40° to 85°C unless otherwise specified)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{CC}	Supply voltage		3.75		6	V
I_{CC}	Supply current	R_{PROG} = 2.4 kΩ			750	µA
		R_{PROG} = 6.2 kΩ (1)			300	
		R_{PROG} =12.4 kΩ (1)			200	
		Shutdown mode V_{EN} = GND		5	10	
$I_{LED-MIN}$	Minimum LED pin current	Current mode R_{PROG}=65 kΩ, V_{LED}=3 V		2		mA
I_{LED}	LED pin current	Current mode R_{PROG}=2.4 kΩ, V_{LED}=3 V	47.5	50	52.5	mA
		Current mode R_{PROG}=6.2 kΩ, V_{LED}=3 V (1)	19	20	21	
		Current mode R_{PROG}=12.4 kΩ, V_{LED}=3 V (1)	9.5	10	10.5	
		Shutdown mode V_{EN}=GND, T_J = 25 °C		0	±1	µA
V_{PROG}	PROG pin voltage	R_{PROG} = 2.4 kΩ		1.22		V
		R_{PROG} = 6.2 kΩ (1)		1.22		
		R_{PROG} = 12.4 kΩ (1)		1.22		
V_{EN}	EN threshold high	V_{CC} = 3.75 V to 6 V	0.3	0.92	1.2	V
	EN hysteresis			120		mV
$R_{\overline{EN}}$	EN pin input resistance	V_{EN} = 5 V		2		MΩ
R_{ON}	Power FET ON resistance (between V_{CC} and LED)	I_{LED} = 50 mA		8		Ω

1. Guaranteed by design, but not tested in production.

6 Application information

The STLA01 is a single LED driver using a constant-current topology. It can deliver up to 80 mA of output current.

If a 1% program resistor is connect from the PROG pin to the GND pin and the EN pin is higher than 0.92 V, the device will supply the LED with the programmed constant current. Putting the EN pin below 0.80 V results in no current flow into the LED diode.

6.1 V_{CC} pin

A positive input supply voltage provides power to the driver. V_{CC} can range from 3.75 V to 6 V and should be bypassed with at least a 1 µF capacitor. In shutdown mode, the $I_{LED} = 0$.

6.2 EN pin

The enable input pin is used to shut down the device when the value of the pin is below 0.80 V. In shutdown condition, the device has less than 10 µA supply current. The enable pin has an internal pull down ($R_{\overline{EN}}$).

If unused, the pin should be tied to V_{CC}.

6.3 Programming charge current

The LED current is programmed using a single resistor from the PROG pin to ground. The LED current is 100 times the current out of the PROG pin. The program resistor and the led current are calculated using, in first approximation, the following equations:

$R_{PROG} = 100 \times (1.22\ V / I_{LED})$

6.4 Power dissipation

A good thermal PCB layout is very important to maximize the available output current. The thermal path for the heat generated by the IC is from the die to the copper lead frame through the package leads and exposed pad to the PC board copper. The PC board copper acts as the heat sink. The copper pad footprints should be as wide as possible and expand to larger copper areas in order to spread and dissipate the heat to the surrounding ambient. Feed-through vias to inner or backside copper layers are also useful in improving the overall thermal performance of the device. Other heat sources on the board, not related to the device, must also be considered when designing a PC board layout because they will affect overall temperature rise and the maximum output current.

7 Typical performance characteristics

Figure 4. LED pin current vs temperature

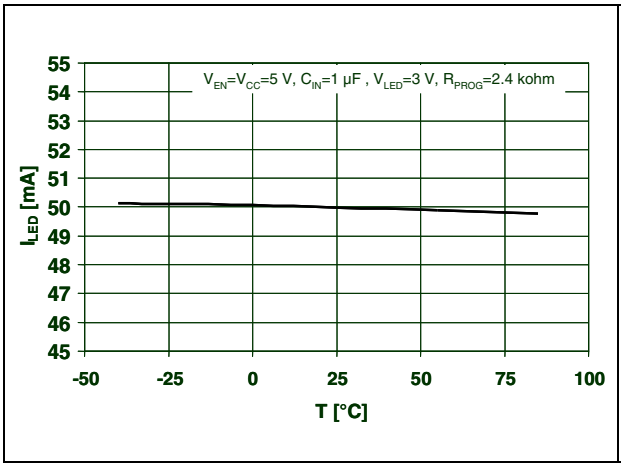


Figure 5. LED pin current vs temperature

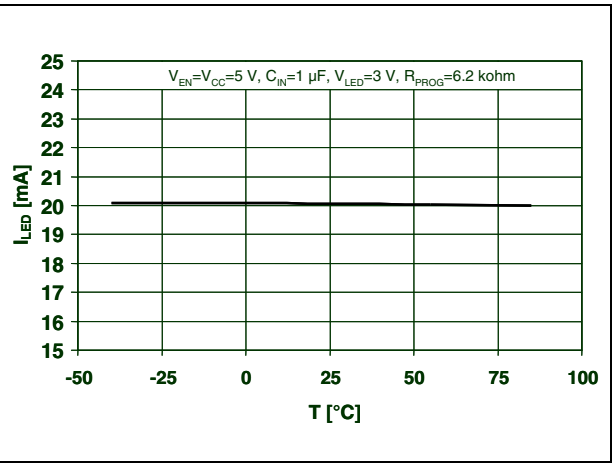


Figure 6. LED pin current vs temperature

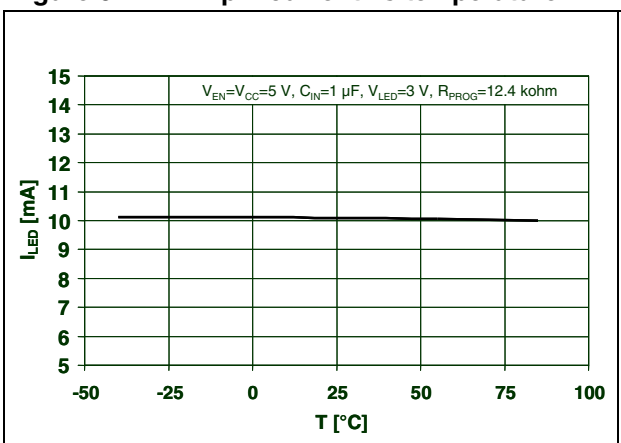


Figure 7. LED pin current vs R_{PROG}

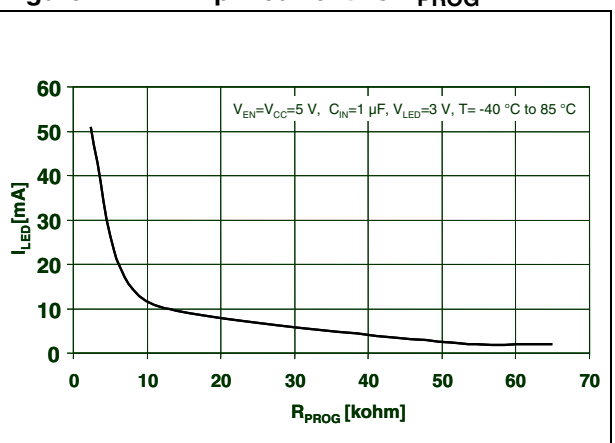


Figure 8. Supply current vs temperature

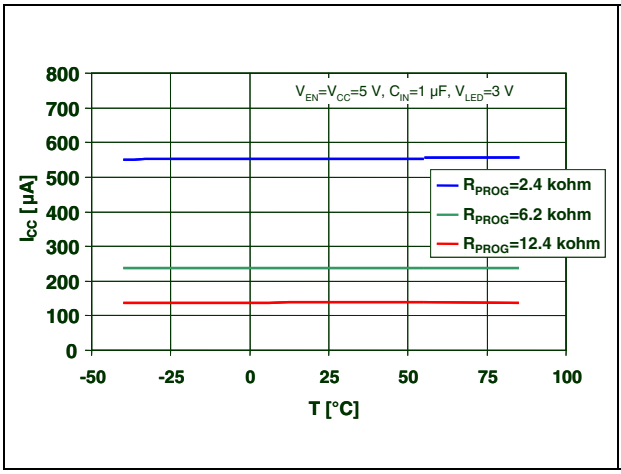


Figure 9. Supply current vs R_{PROG}

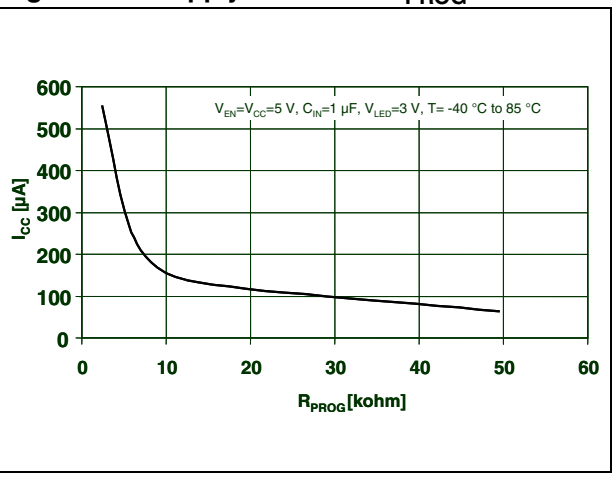


Figure 10. PROG pin voltage vs temperature

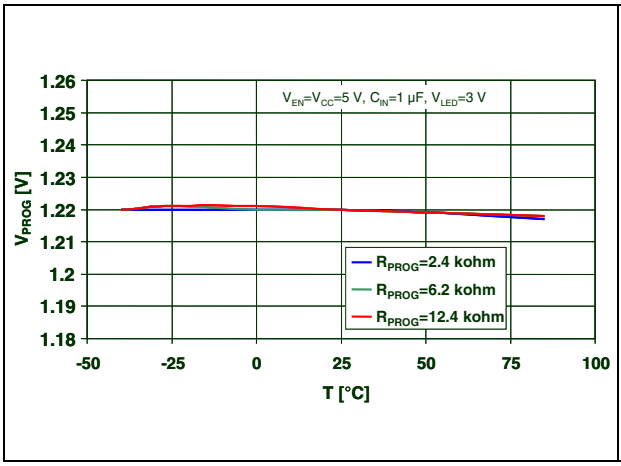


Figure 11. PROG pin voltage vs R_{PROG}

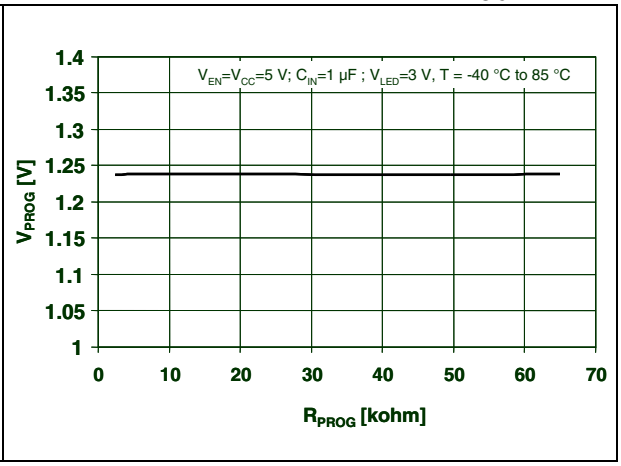


Figure 12. Enable pin voltage vs temperature

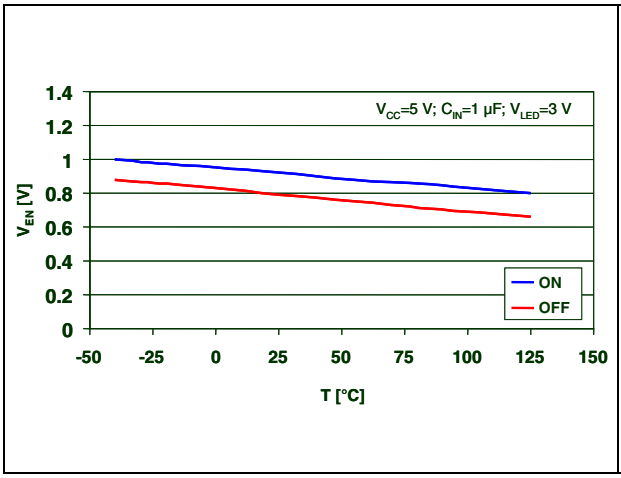


Figure 13. Enable pin input resistance vs temperature

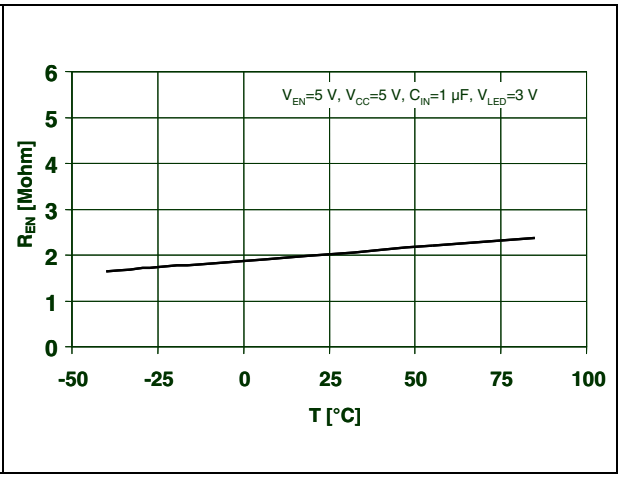
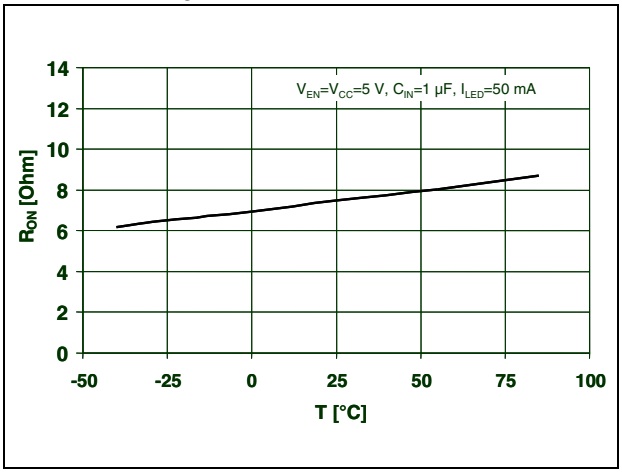


Figure 14. R_{ON} vs temperature

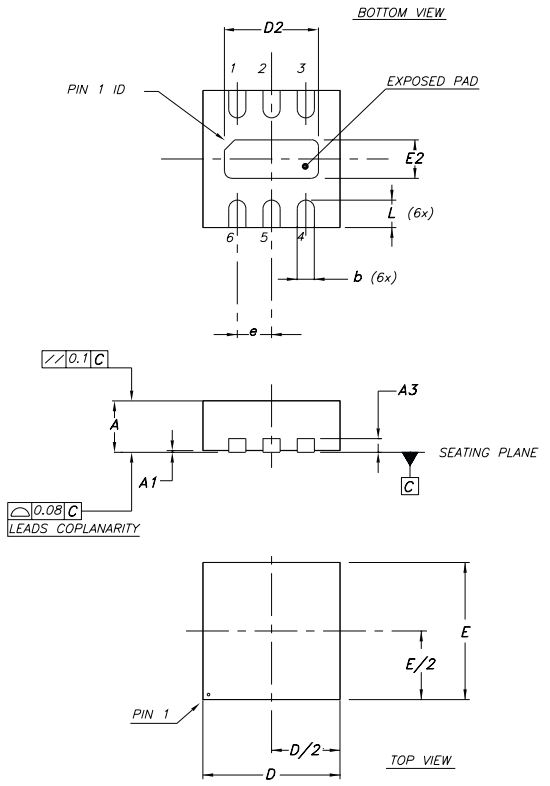


8 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a lead-free second level interconnect. The category of second level Interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com.

DFN6 (2x2 mm) mechanical data

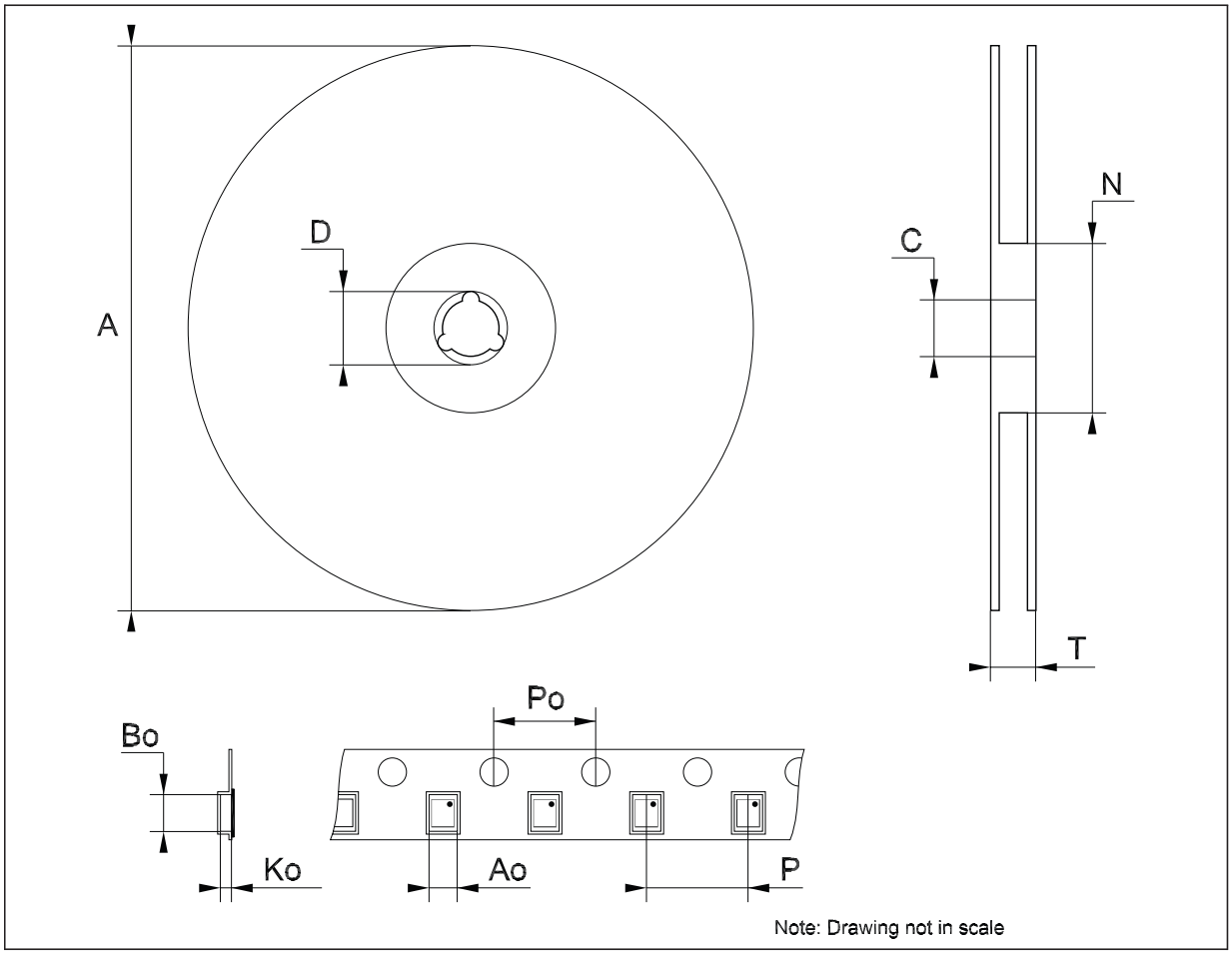
Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	0.70	0.75	0.80	27.6	29.5	31.5
A1	0	0.02	0.05	0.0	0.8	2.0
A3		0.20			7.9	
b	0.20	0.25	0.32	7.9	9.8	12.6
D	1.90	2.00	2.10	74.8	78.7	82.7
D2	1.22	1.37	1.47	48.0	53.9	57.9
E	1.90	2.00	2.10	74.8	78.7	82.7
E2	0.41	0.56	0.66	16.1	22.0	26.0
e		0.50			19.7	
L	0.30	0.40	0.50	11.8	15.7	19.7



7733060B

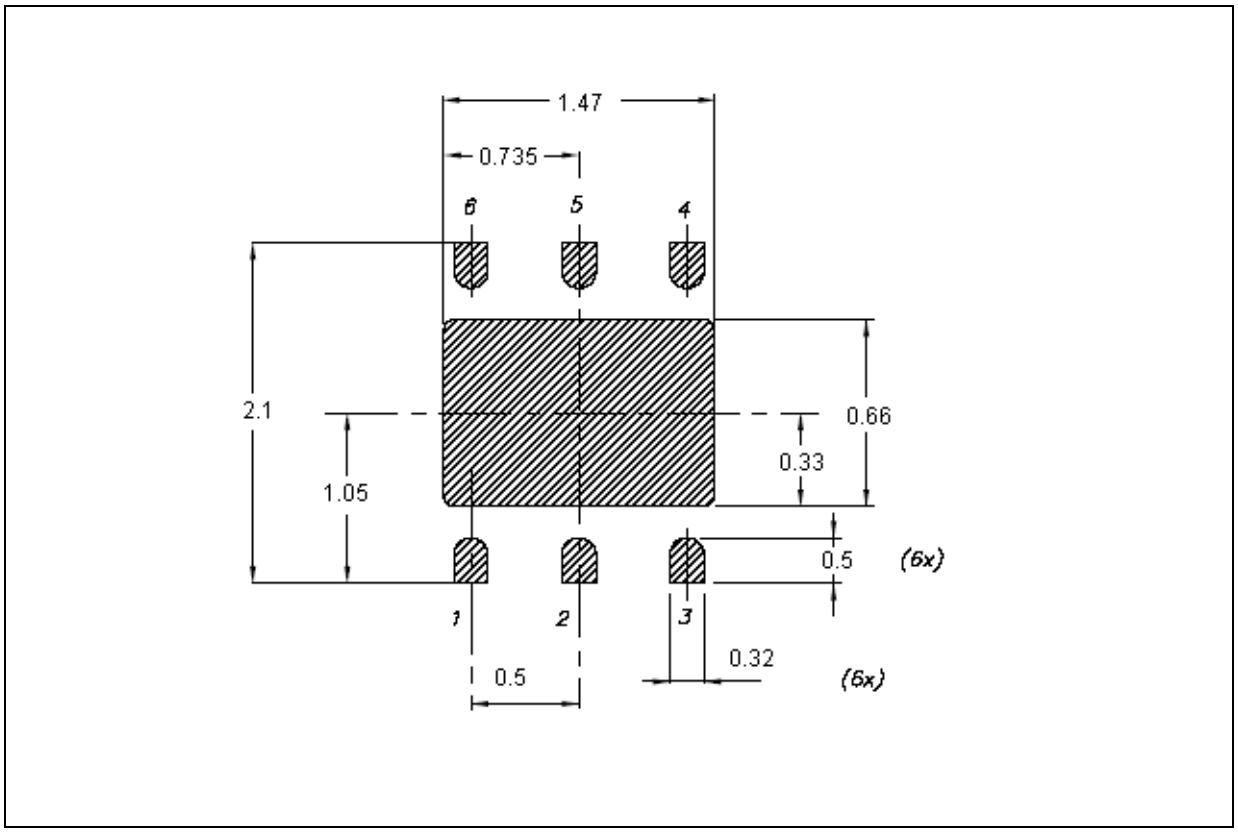
Tape & reel QFNxx/DFNxx (2x2 mm) mechanical data

Dim.	mm.			inch.		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A			180			7.087
C	12.8		13.2	0.504		0.519
D	20.2			0.795		
N	60			2.362		
T			14.4			0.567
Ao		2.3			0.091	
Bo		2.3			0.091	
Ko		1.0			0.039	
Po		4			0.157	
P		8			0.315	



Note: Drawing not in scale

Figure 15. DFN6 (2x2 mm) footprint recommended data



9 Revision history

Table 7. Document revision history

Date	Revision	Changes
27-Nov-2007	1	Initial release.

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