MP34DTW01

MEMS audio sensor ultra-wide dynamic range omnidirectional digital microphone

Datasheet - production data

HCLGA (3 x 4 x 1) 4LD

Features

- Ultra-wide dynamic range 140 dBSPL AOP
- Wide dynamic operation and high SNR
- Single low-voltage supply operation
- Low power consumption
- Sleep mode for extended battery life
- PDM output
- Omnidirectional sensitivity
- HCLGA package
  - SMD-compliant
  - EMI-shielded
  - ECOPACK®, RoHS, and “Green” compliant

Applications

- Mobile terminals
- Laptop and notebook computers
- Portable media players
- VoIP
- Speech recognition
- A/V eLearning devices
- Gaming and virtual reality input devices
- Digital still and video cameras
- Antitheft systems

Description

The MP34DTW01 is an ultra-compact, ultra-wide dynamic range, low-power MEMS microphone.

The MEMS microphone is capable of sensing both moderate and high sound pressure level of acoustic signals, exhibiting the widest ever, and thus, sound dynamic range in the digital domain. The sensing element, capable of detecting acoustic waves, is manufactured using a specialized silicon micromachining process to produce audio sensors.

The MP34DTW01 interface is manufactured using a CMOS process that allows designing a dedicated circuit able to output a PDM digital signal.

The MP34DTW01 has an acoustic overload point of 140 dB SPL with a 60 dB signal-to-noise ratio. The MP34DTW01 is available in an SMD-compliant, EMI-shielded package and is guaranteed to operate over an extended temperature range from -40 °C to +85 °C

Table 1. Device summary

Order codes	Temperature range [°C]	Package	Packing
MP34DTW01	-40 °C to +85 °C	HCLGA (3 x 4 x 1) mm 4LD	Tray
MP34DTW01TR	-40 °C to +85 °C	HCLGA (3 x 4 x 1) mm 4LD	Tape and reel

Contents

1 Pin description

Figure 1. Pin connections

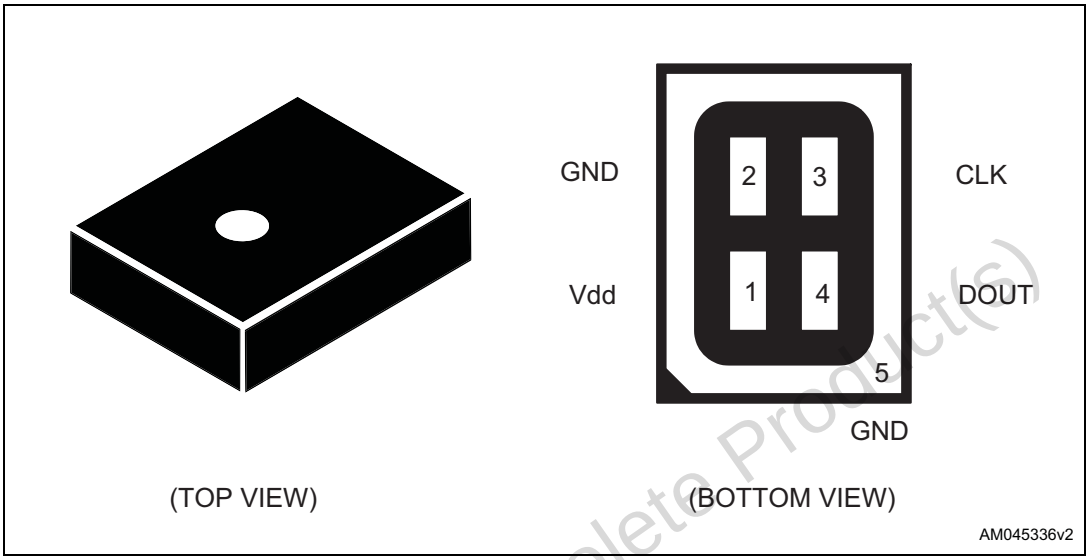


Table 2. Pin description

Pin #	Pin name	Function
1	Vdd	Power supply
2	GND	0 V supply
3	CLK	Synchronization input clock
4	DOUT	PDM data output
5 (ground ring)	GND	0 V supply

2 Acoustic and electrical specifications

2.1 Acoustic and electrical characteristics

The values listed in the table below are specified for Vdd = 1.8 V, Clock = 2.4 MHz, T = 25 °C, unless otherwise noted.

Table 3. Acoustic and electrical characteristics

Symbol	Parameter	Test condition	Min.	Typ.(1)	Max.	Unit
Vdd	Supply voltage		1.62	1.8	3.6	V
Idd_D	Current consumption in normal mode			1.0	1.15	mA
Idd_sleep	Current consumption in sleep mode(2)				45	µA
Icc	Short-circuit current		1		10	mA
Membrane characteristics						
AOP	Acoustic overload point			140		dBSPL
SNR	Signal-to-noise ratio	A-weighted at 1 kHz, 1 Pa		60		dB
So	Sensitivity		-23	-26	-29	dBFS
PSR	Power supply rejection	Guaranteed by design			-70	dBFS
Clock	Input clock frequency (3)		1	2.4	3.25	MHz
Ton	Turn-on time (4)	Guaranteed by design			10	ms
Top	Operating temperature range		-40		+85	°C
V_{IOL}	Low level logic input/output voltage	I_{out} = 1 mA	-0.3		0.35xVdd	V
V_{IOH}	High level logic input/output voltage	I_{out} = 1 mA	0.65xVdd		Vdd+0.3	V

1. Typical specifications are not guaranteed.
2. Input clock in static mode.
3. Duty cycle: min = 40% max = 60%.
4. Time from the first clock edge to valid output data.

Table 4. Distortion specifications

Parameter	Test condition	Value
Distortion	120 dBSPL (200 Hz)	< 1% THD + N
Distortion	135 dBSPL (200 Hz)	< 5% THD + N
Distortion	140 dBSPL (200 Hz)	< 10% THD + N

2.2 Timing characteristics

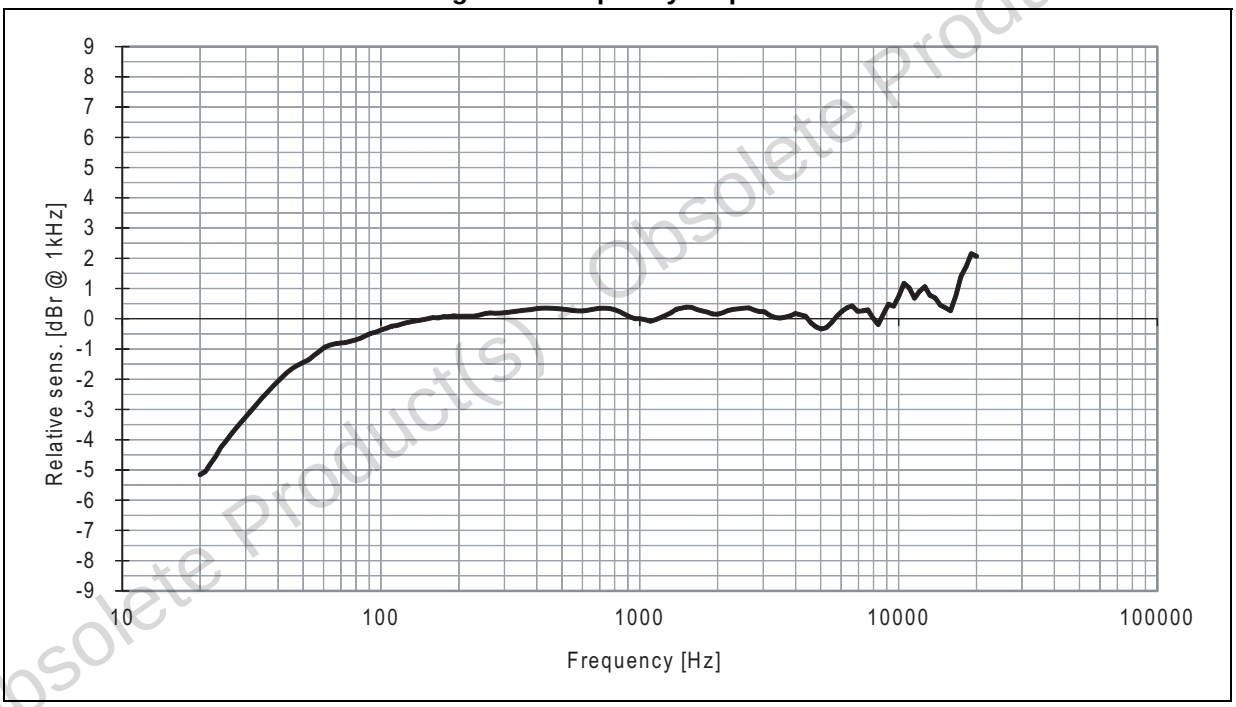
Table 5. Timing characteristics

Parameter	Description	Min.	Max.	Unit
f_{CLK}	Clock frequency for normal mode	1	3.25	MHz
f_{PD}	Clock frequency for power-down mode		0.23	MHz
T_{CLK}	Clock period for normal mode (1)	308	1000	ns

1. From design simulations

2.3 Frequency response

Figure 2. Frequency response



3 Sensing element

The sensing element shall mean the acoustic sensor consisting of a conductive movable plate and a fixed plate placed in a tiny silicon chip. This sensor transducers the sound pressure into the changes of coupled capacity between those two plates.

Omron Corporation supplies this element for STMicroelectronics.

4 Absolute maximum ratings

Stresses above those listed as “Absolute maximum ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device under these conditions is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

Table 6. Absolute maximum ratings

Symbol	Ratings	Maximum value	Unit
Vdd	Supply voltage	-0.3 to 4.8	V
Vin	Input voltage on any control pin	-0.3 to Vdd +0.3	V
T_{STG}	Storage temperature range	-40 to +125	°C
ESD	Electrostatic discharge protection	2 (HBM)	kV

This device is sensitive to mechanical shock, improper handling can cause permanent damage to the part.

This device is ESD-sensitive, improper handling can cause permanent damage to the part.

5 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.

Soldering information

The HCLGA 3x4x1 4LD + GND ring package is also compliant with the RoHS and “Green” standards and is qualified for soldering heat resistance according to JEDEC J-STD-020.

Land pattern and soldering recommendations are available at *www.st.com*.

Figure 3. Recommended soldering profile limits

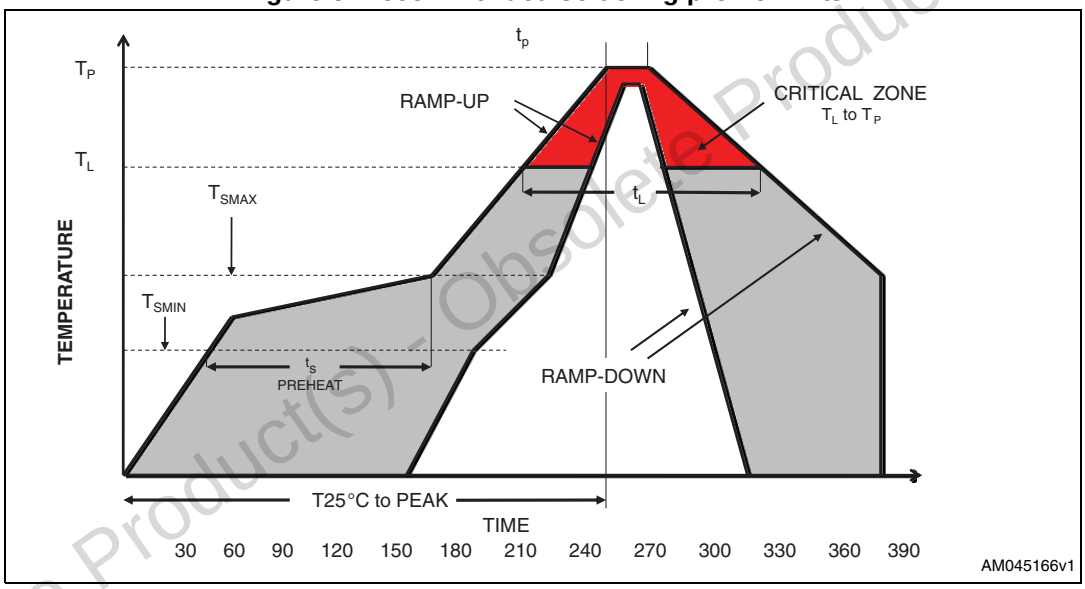


Table 7. Recommended soldering profile limits

Description	Parameter	Pb free
Average ramp rate	T_L to T_P	3 °C/sec max
Preheat Minimum temperature Maximum temperature Time (T_{SMIN} to T_{SMAX})	 T_{SMIN} T_{SMAX} t_S	 150 °C 200 °C 60 sec to 120 sec
Ramp-up rate	T_{SMAX} to T_L	
Time maintained above liquidus temperature Liquidus temperature	t_L T_L	60 sec to 150 sec 217 °C
Peak temperature	T_P	260 °C max
Time within 5 °C of actual peak temperature		20 sec to 40 sec
Ramp-down rate		6 °C/sec max
Time 25 °C (t25 °C) to peak temperature		8 minutes max

6 Carrier tape mechanical specifications

Figure 4. Carrier tape without microphone-top view

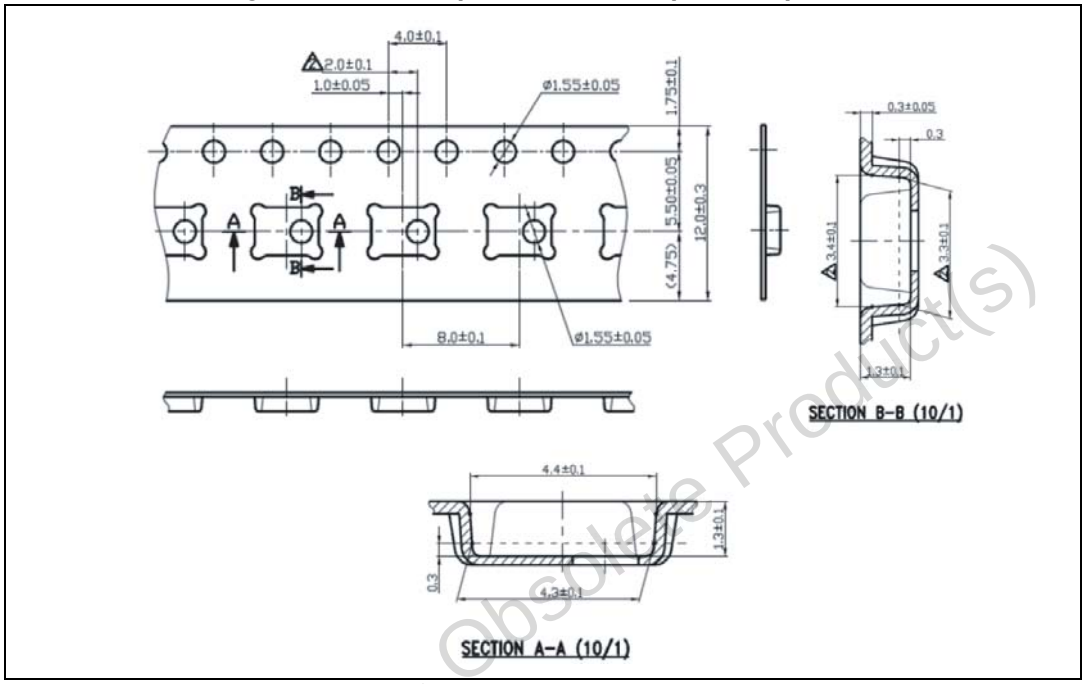
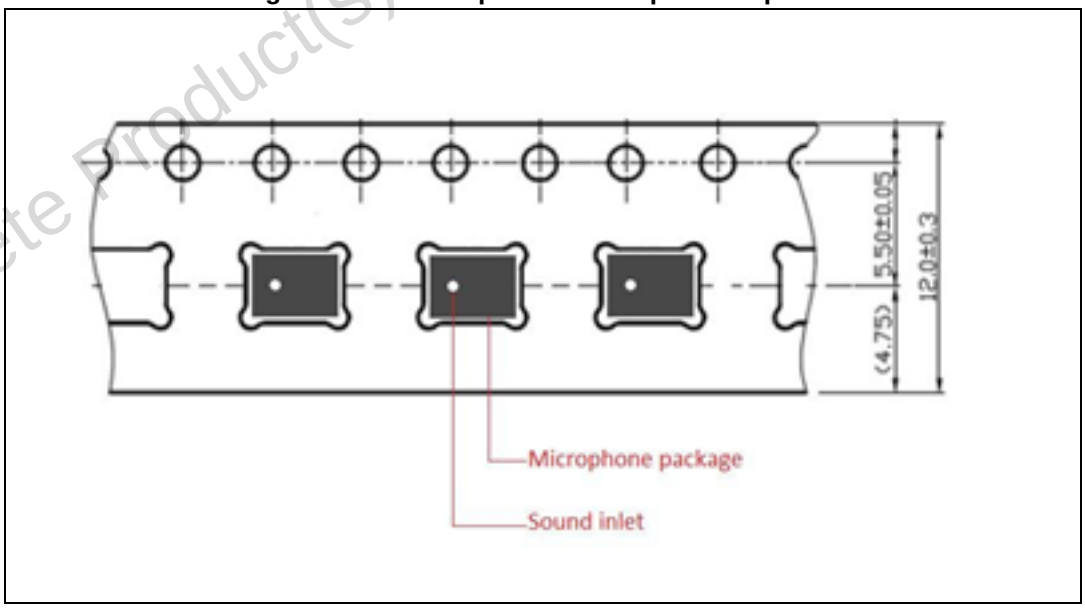


Figure 5. Carrier tape with microphone-top view

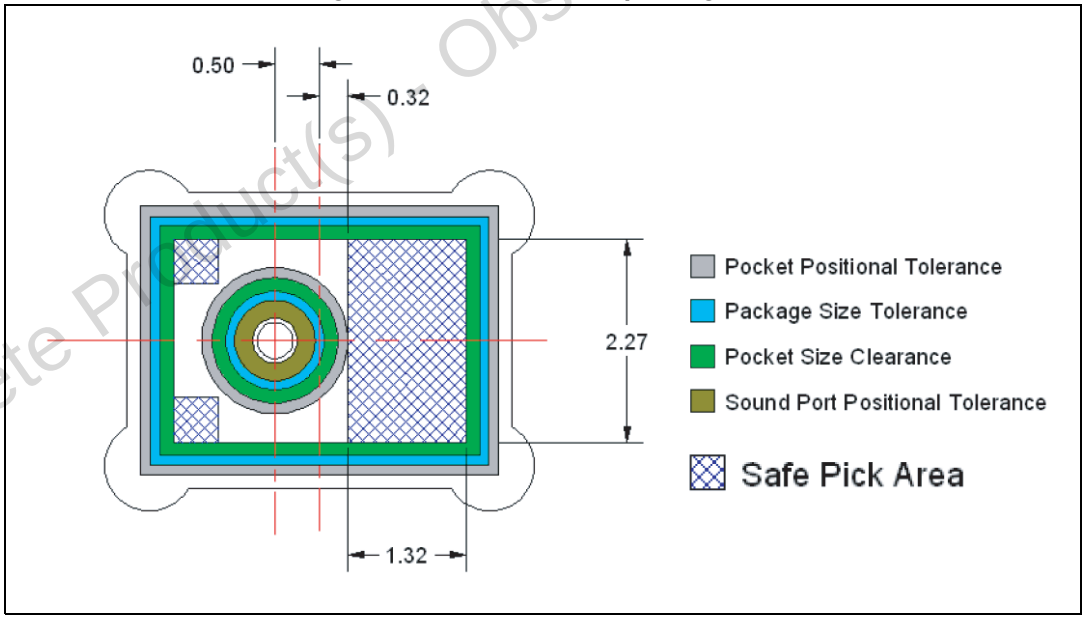


7 Process recommendations

To ensure a consistent manufacturing process it is strongly advised to comply with following recommendations:

- The recommended pick-up area for the MP34DTW01 package must be defined using the worst case (ie. no device alignment during picking process). This area has been defined considering all the tolerances of the components involved (reel, package, sound inlet). Picker tolerance shall be considered as well.
- To prevent damage to the MEMS membrane or incorrect pick-up and placement, do not pick up the component on the inlet area
- For the package outline please refer to *Figure 5*. Nozzle shape, size, and placement accuracy are the other key factors to consider when deciding on the coordinates for the picking.
- Device alignment before picking is highly recommended.
- A vacuum force greater than 7 psi must be avoided
- 1 kPa = 0.145 psi (lb/in2) = 0.0102 kgf/cm² = 0.0098 atm
- All the recommended dimensions (device safe pick area) do not include the pick and place equipment tolerances

Figure 6. Recommended picking area



To have a safe pick-up "by design", ST it is strongly advised to an ad hoc nozzle.

Following picker ensures that the holes for the vacuum and the air blow are ALWAYS away from the porthole of the device (4 vacuum ports located at the corner of the device).

The suggested nozzle has also a recess, in the form of a cross, that guarantees the porthole to be always left at atmospheric pressure. By using the suggested nozzle the membrane will not suffer any sudden air disturbances during the picking or placing of the devices in the tape and reel.

Figure 7. Recommended picker design

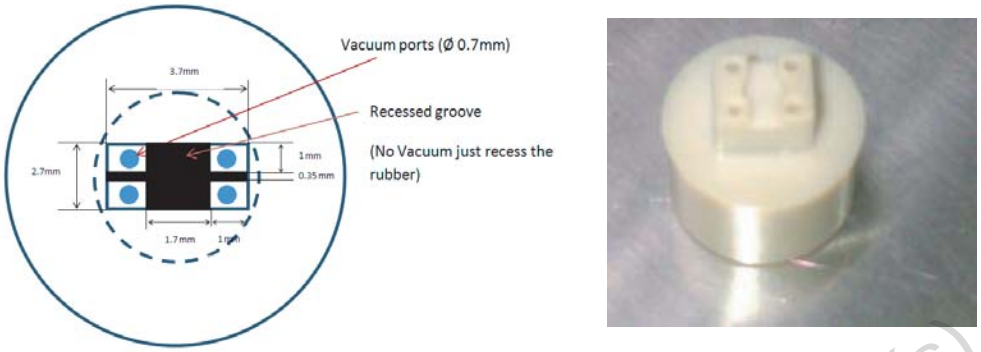


Figure 8. HCLGA (3 x 4 x 1 mm) 4LD package outline

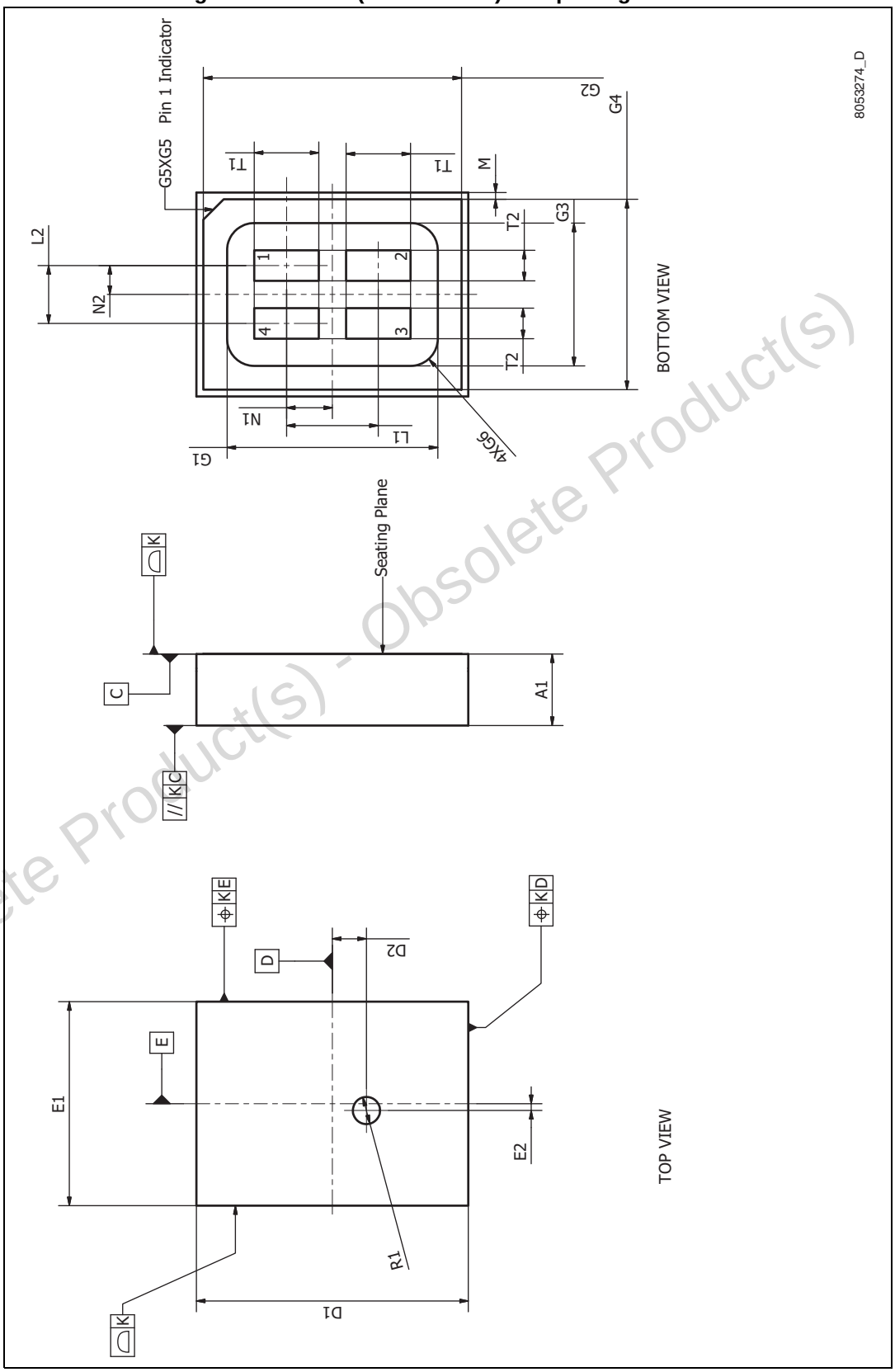
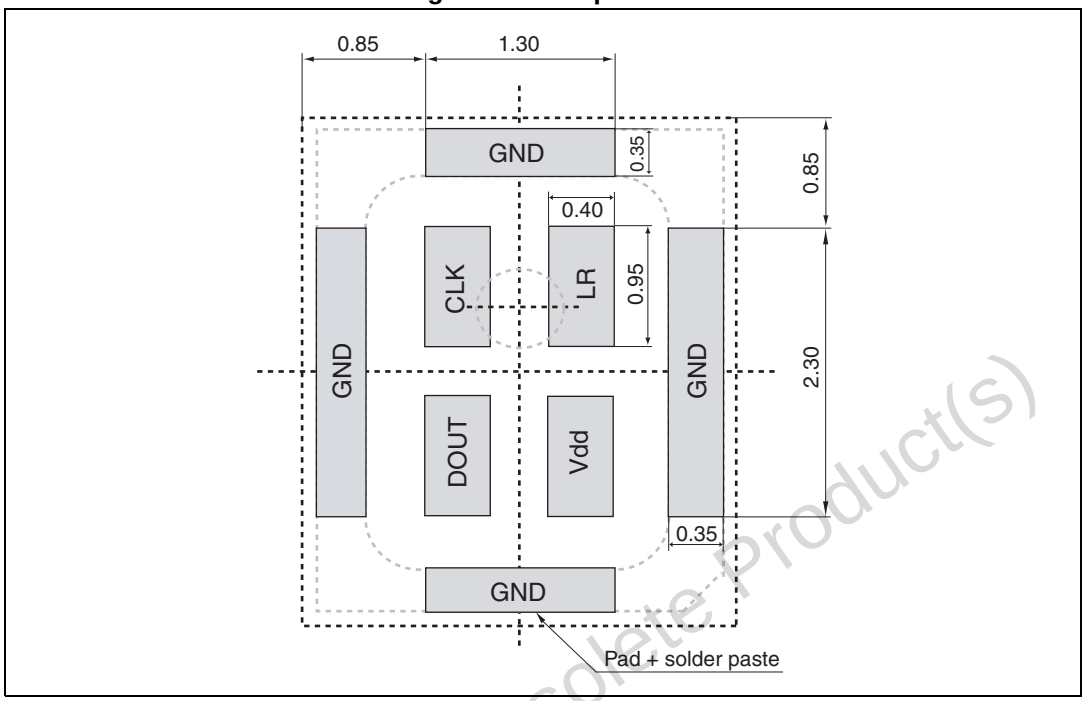


Table 8. HCLGA (3 x 4 x 1 mm) 4LD package dimensions

Symbol	mm.		
	Min.	Typ.	Max.
A1	0.900	1.000	1.100
D1	3.900	4.000	4.100
D2	0.300	0.500	0.700
R1	0.300	0.400	0.500
E1	2.900	3.000	3.100
E2		0.000	±0.200
L1	1.300	1.350	1.400
L2	0.800	0.850	0.900
N1	0.625	0.675	0.725
N2	0.375	0.425	0.475
T1	0.900	0.950	1.000
T2	0.400	0.450	0.500
G1	3.050	3.100	3.150
G2	3.750	3.800	3.850
G3	2.050	2.100	2.150
G4	2.750	2.800	2.850
G5	0.250	0.300	0.350
G6		0.400	
M		0.100	
K		0.050	

Figure 9. Land pattern



8 Revision history

Table 9. Document revision history

Date	Revision	Changes
05-Apr-2013	1	Initial release
21-Jul-2014	2	Added *Section 6 on page 9* and *Section 7 on page 10*

IMPORTANT NOTICE – PLEASE READ CAREFULLY

STMicroelectronics NV and its subsidiaries (“ST”) reserve the right to make changes, corrections, enhancements, modifications, and improvements to ST products and/or to this document at any time without notice. Purchasers should obtain the latest relevant information on ST products before placing orders. ST products are sold pursuant to ST’s terms and conditions of sale in place at the time of order acknowledgement.

Purchasers are solely responsible for the choice, selection, and use of ST products and ST assumes no liability for application assistance or the design of Purchasers’ products.

No license, express or implied, to any intellectual property right is granted by ST herein.

Resale of ST products with provisions different from the information set forth herein shall void any warranty granted by ST for such product.

ST and the ST logo are trademarks of ST. All other product or service names are the property of their respective owners.

Information in this document supersedes and replaces information previously supplied in any prior versions of this document.