74LVC1G38

2-input NAND gate; open drain

Rev. 10 — 12 January 2022 Product data sheet

1. General description

The 74LVC1G38 is a single 2-input NAND gate with open-drain output. Inputs can be driven from either 3.3 V or 5 V devices. This feature allows the use of these devices as translators in mixed 3.3 V and 5 V environments.

Schmitt-trigger action at all inputs makes the circuit tolerant of slower input rise and fall times.

This device is fully specified for partial power down applications using I_{OFF}. The I_{OFF} circuitry disables the output, preventing the potentially damaging backflow current through the device when it is powered down.

2. Features and benefits

- Wide supply voltage range from 1.65 V to 5.5 V
- 5 V tolerant outputs for interfacing with 5 V logic
- High noise immunity
- ±24 mA output drive (V_{CC} = 3.0 V)
- CMOS low power consumption
- Open drain outputs
- Direct interface with TTL levels
- Inputs accept voltages up to 5 V
- Latch-up performance exceeds 250 mA
- Complies with JEDEC standard:
  - JESD8-7 (1.65 V to 1.95 V)
  - JESD8-5 (2.3 V to 2.7 V)
  - JESD8-B/JESD36 (2.7 V to 3.6 V).
- ESD protection:
  - HBM JESD22-A114F exceeds 2000 V
  - MM JESD22-A115-A exceeds 200 V
- Multiple package options
- Specified from -40 °C to +125 °C.

3. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
74LVC1G38GW	-40 °C to +125 °C	TSSOP5	plastic thin shrink small outline package; 5 leads; body width 1.25 mm	SOT353-1
74LVC1G38GV	-40 °C to +125 °C	SC-74A	plastic surface-mounted package; 5 leads	SOT753
74LVC1G38GM	-40 °C to +125 °C	XSON6	plastic extremely thin small outline package; no leads; 6 terminals; body 1 × 1.45 × 0.5 mm	SOT886
74LVC1G38GN	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 0.9 × 1.0 × 0.35 mm	SOT1115
74LVC1G38GS	-40 °C to +125 °C	XSON6	extremely thin small outline package; no leads; 6 terminals; body 1.0 × 1.0 × 0.35 mm	SOT1202
74LVC1G38GX	-40 °C to +125 °C	X2SON5	plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 × 0.8 × 0.32 mm	SOT1226-3

4. Marking

Table 2. Marking

Type number	Marking code[1]
74LVC1G38GW	YB
74LVC1G38GV	YB
74LVC1G38GM	YB
74LVC1G38GN	YB
74LVC1G38GS	YB
74LVC1G38GX	YB

[1] The pin 1 indicator is located on the lower left corner of the device, below the marking code.

5. Functional diagram

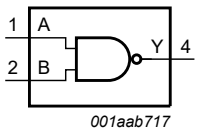


Fig. 1. Logic symbol

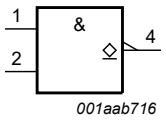


Fig. 2. IEC logic symbol

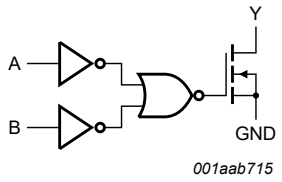


Fig. 3. Logic diagram

6. Pinning information

6.1. Pinning

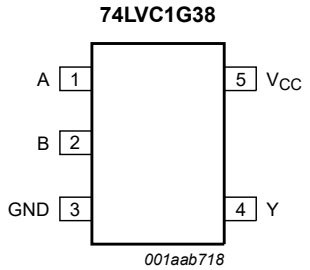
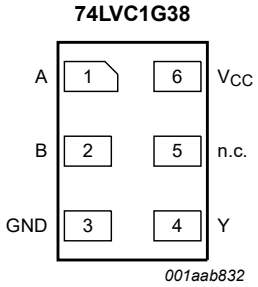
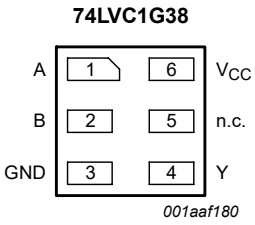


Fig. 4. Pin configuration SOT353-1 (TSSOP5) and SOT753 (SC-74A)



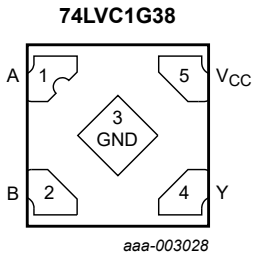
Transparent top view

Fig. 5. Pin configuration SOT886 (XSON6)



Transparent top view

Fig. 6. Pin configuration SOT1115 and SOT1202 (XSON6)



Transparent top view

Fig. 7. Pin configuration SOT1226-3 (X2SON5)

6.2. Pin description

Table 3. Pin description

Symbol	Pin		Description
	TSSOP5, SC-74A and X2SON5	XSON6	
A	1	1	data input
B	2	2	data input
GND	3	3	ground (0 V)
Y	4	4	data output
n.c.	-	5	not connected
V_{CC}	5	6	supply voltage

7. Functional description

Table 4. Function table

H = HIGH voltage level; L = LOW voltage level; Z = high-impedance OFF state.

Input		Output
A	**B**	**Y**
L	L	Z
L	H	Z
H	L	Z
H	H	L

8. Limiting values

Table 5. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions		Min	Max	Unit
V_{CC}	supply voltage			-0.5	+6.5	V
I_{IK}	input clamping current	$V_I < 0$ V		-50	-	mA
V_I	input voltage		[1]	-0.5	+6.5	V
I_{OK}	output clamping current	$V_O > V_{CC}$ or $V_O < 0$ V		-	±50	mA
V_O	output voltage	Active mode	[1]	-0.5	+6.5	V
		Power-down mode; $V_{CC} = 0$ V	[1]	-0.5	+6.5	V
I_O	output current	$V_O = 0$ V to V_{CC}		-	±50	mA
I_{CC}	supply current			-	100	mA
I_{GND}	ground current			-100	-	mA
T_{stg}	storage temperature			-65	+150	°C
P_{tot}	total power dissipation	T_{amb} = -40 °C to +125 °C	[2]	-	250	mW

[1] The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

[2] For SOT353-1 (TSSOP5) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.
For SOT753 (SC-74A) package: P_{tot} derates linearly with 3.8 mW/K above 85 °C.
For SOT886 (XSON6) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.
For SOT1115 (XSON6) package: P_{tot} derates linearly with 3.2 mW/K above 71 °C.
For SOT1202 (XSON6) package: P_{tot} derates linearly with 3.3 mW/K above 74 °C.
For SOT1226-3 (X2SON5) package: P_{tot} derates linearly with 3.0 mW/K above 67 °C.

9. Recommended operating conditions

Table 6. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{CC}	supply voltage		1.65	-	5.5	V
V_I	input voltage		0	-	5.5	V
V_O	output voltage	Active mode	0	-	5.5	V
		Disable mode; V_{CC} = 1.65 V to 5.5 V	0	-	5.5	V
		Power-down mode; V_{CC} = 0 V	0	-	5.5	V
T_{amb}	ambient temperature		-40	-	+125	°C
$\Delta t/\Delta V$	input transition rise and fall rate	V_{CC} = 1.65 V to 2.7 V	-	-	20	ns/V
		V_{CC} = 2.7 V to 5.5 V	-	-	10	ns/V

10. Static characteristics

Table 7. Static characteristics

At recommended operating conditions; voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
T_{amb} = -40 °C to +85 °C						
V_{IH}	HIGH-level input voltage	V_{CC} = 1.65 V to 1.95 V	0.65 × V_{CC}	-	-	V
		V_{CC} = 2.3 V to 2.7 V	1.7	-	-	V
		V_{CC} = 2.7 V to 3.6 V	2.0	-	-	V
		V_{CC} = 4.5 V to 5.5 V	0.7 × V_{CC}	-	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 1.65 V to 1.95 V	-	-	0.35 × V_{CC}	V
		V_{CC} = 2.3 V to 2.7 V	-	-	0.7	V
		V_{CC} = 2.7 V to 3.6 V	-	-	0.8	V
		V_{CC} = 4.5 V to 5.5 V	-	-	0.3 × V_{CC}	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}				
		I_O = 100 µA; V_{CC} = 1.65 V to 5.5 V	-	-	0.1	V
		I_O = 4 mA; V_{CC} = 1.65 V	-	-	0.45	V
		I_O = 8 mA; V_{CC} = 2.3 V	-	-	0.3	V
		I_O = 12 mA; V_{CC} = 2.7 V	-	-	0.4	V
		I_O = 24 mA; V_{CC} = 3.0 V	-	-	0.55	V
		I_O = 32 mA; V_{CC} = 4.5 V	-	-	0.55	V
I_I	input leakage current	V_I = 5.5 V or GND; V_{CC} = 0 V to 5.5 V	-	±0.1	±1	µA
I_{OZ}	OFF-state output current	V_I = V_{IH} or V_{IL}; V_O = V_{CC} or GND; V_{CC} = 5.5 V	-	±0.1	±2	µA
I_{OFF}	power-off leakage current	V_I or V_O = 5.5 V; V_{CC} = 0 V	-	±0.1	±2	µA
I_{CC}	supply current	V_I = 5.5 V or GND; V_{CC} = 1.65 V to 5.5 V; I_O = 0 A	-	0.1	4	µA
ΔI_{CC}	additional supply current	V_I = V_{CC} - 0.6 V; I_O = 0 A; V_{CC} = 2.3 V to 5.5 V; per pin	-	5	500	µA
C_I	input capacitance		-	2.5	-	pF

Symbol	Parameter	Conditions	Min	Typ[1]	Max	Unit
T_{amb} = -40 °C to +125 °C						
V_{IH}	HIGH-level input voltage	V_{CC} = 1.65 V to 1.95 V	0.65 × V_{CC}	-	-	V
		V_{CC} = 2.3 V to 2.7 V	1.7	-	-	V
		V_{CC} = 2.7 V to 3.6 V	2.0	-	-	V
		V_{CC} = 4.5 V to 5.5 V	0.7 × V_{CC}	-	-	V
V_{IL}	LOW-level input voltage	V_{CC} = 1.65 V to 1.95 V	-	-	0.35 × V_{CC}	V
		V_{CC} = 2.3 V to 2.7 V	-	-	0.7	V
		V_{CC} = 2.7 V to 3.6 V	-	-	0.8	V
		V_{CC} = 4.5 V to 5.5 V	-	-	0.3 × V_{CC}	V
V_{OL}	LOW-level output voltage	V_I = V_{IH} or V_{IL}				
		I_O = 100 µA; V_{CC} = 1.65 V to 5.5 V	-	-	0.1	V
		I_O = 4 mA; V_{CC} = 1.65 V	-	-	0.70	V
		I_O = 8 mA; V_{CC} = 2.3 V	-	-	0.45	V
		I_O = 12 mA; V_{CC} = 2.7 V	-	-	0.60	V
		I_O = 24 mA; V_{CC} = 3.0 V	-	-	0.80	V
		I_O = 32 mA; V_{CC} = 4.5 V	-	-	0.80	V
I_I	input leakage current	V_I = 5.5 V or GND; V_{CC} = 0 V to 5.5 V	-	-	±1	µA
I_{OZ}	OFF-state output current	V_I = V_{IH} or V_{IL}; V_O = V_{CC} or GND; V_{CC} = 5.5 V	-	-	±2	µA
I_{OFF}	power-off leakage current	V_I or V_O = 5.5 V; V_{CC} = 0 V	-	-	±2	µA
I_{CC}	supply current	V_I = 5.5 V or GND; V_{CC} = 1.65 V to 5.5 V; I_O = 0 A	-	-	4	µA
ΔI_{CC}	additional supply current	V_I = V_{CC} - 0.6 V; I_O = 0 A; V_{CC} = 2.3 V to 5.5 V; per pin	-	-	500	µA

[1] All typical values are measured at V_{CC} = 3.3 V and T_{amb} = 25 °C.

11. Dynamic characteristics

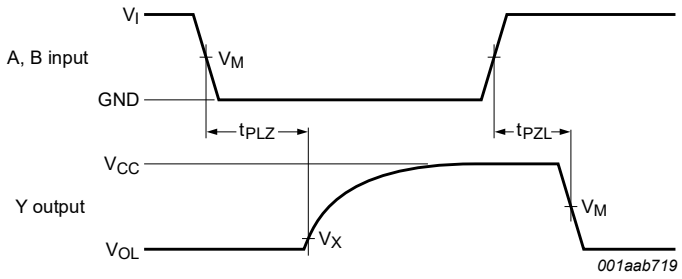
Table 8. Dynamic characteristics

Voltages are referenced to GND (ground = 0 V). For test circuit see Fig. 9.

Symbol	Parameter	Conditions	-40 °C to +85 °C			-40 °C to +125 °C		Unit
			Min	Typ[1]	Max	Min	Max	
t_{pd}	propagation delay	A, B to Y; see Fig. 8 [2]						
		V_{CC} = 1.65 V to 1.95 V	1.0	3.0	10.0	1.0	12.5	ns
		V_{CC} = 2.3 V to 2.7 V	0.5	1.8	6.0	0.5	7.5	ns
		V_{CC} = 2.7 V	0.5	2.5	5.0	0.5	6.5	ns
		V_{CC} = 3.0 V to 3.6 V	0.5	2.3	4.5	0.5	5.7	ns
		V_{CC} = 4.5 V to 5.5 V	0.5	1.5	3.9	0.5	4.9	ns
C_{PD}	power dissipation capacitance	V_{CC} = 3.3 V; V_I = GND to V_{CC} [3]	-	6	-	-	-	pF

[1] Typical values are measured at T_{amb} = 25 °C and V_{CC} = 1.8 V, 2.5 V, 2.7 V, 3.3 V and 5.0 V respectively.
[2] t_{pd} is the same as t_{PZL} and t_{PLZ}.
[3] C_{PD} is used to determine the dynamic power dissipation (P_D in µW).
$P_D = C_{PD} \times V_{CC}^2 \times f_i \times N + \sum(C_L \times V_{CC}^2 \times f_o)$ where:
f_i = input frequency in MHz;
f_o = output frequency in MHz;
C_L = output load capacitance in pF;
V_{CC} = supply voltage in V;
N = number of inputs switching;
$\sum(C_L \times V_{CC}^2 \times f_o)$ = sum of outputs.

11.1. Waveforms and test circuit

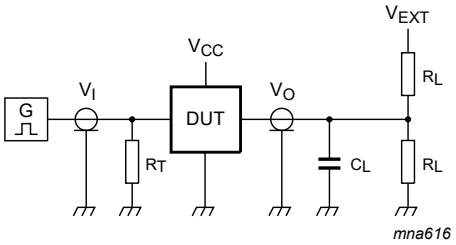


Measurement points are given in Table 9.
Logic levels: V_{OL} and V_{OH} are typical output voltage levels that occur with the output load.

Fig. 8. The input (A, B) to output (Y) propagation delays

Table 9. Measurement points

Supply voltage	Input	Output	
V_{CC}	V_M	V_M	V_X
1.65 V to 1.95 V	0.5 x V_{CC}	0.5 x V_{CC}	V_{OL} + 0.15 V
2.3 V to 2.7 V	0.5 x V_{CC}	0.5 x V_{CC}	V_{OL} + 0.15 V
2.7 V	1.5 V	1.5 V	V_{OL} + 0.3 V
3.0 V to 3.6 V	1.5 V	1.5 V	V_{OL} + 0.3 V
4.5 V to 5.5 V	0.5 x V_{CC}	0.5 x V_{CC}	V_{OL} + 0.3 V



Test data is given in Table 10.

Definitions for test circuit:

R_L = Load resistance;

C_L = Load capacitance including jig and probe capacitance;

R_T = Termination resistance should be equal to the output impedance Z_o of the pulse generator;

V_{EXT} = External voltage for measuring switching times.

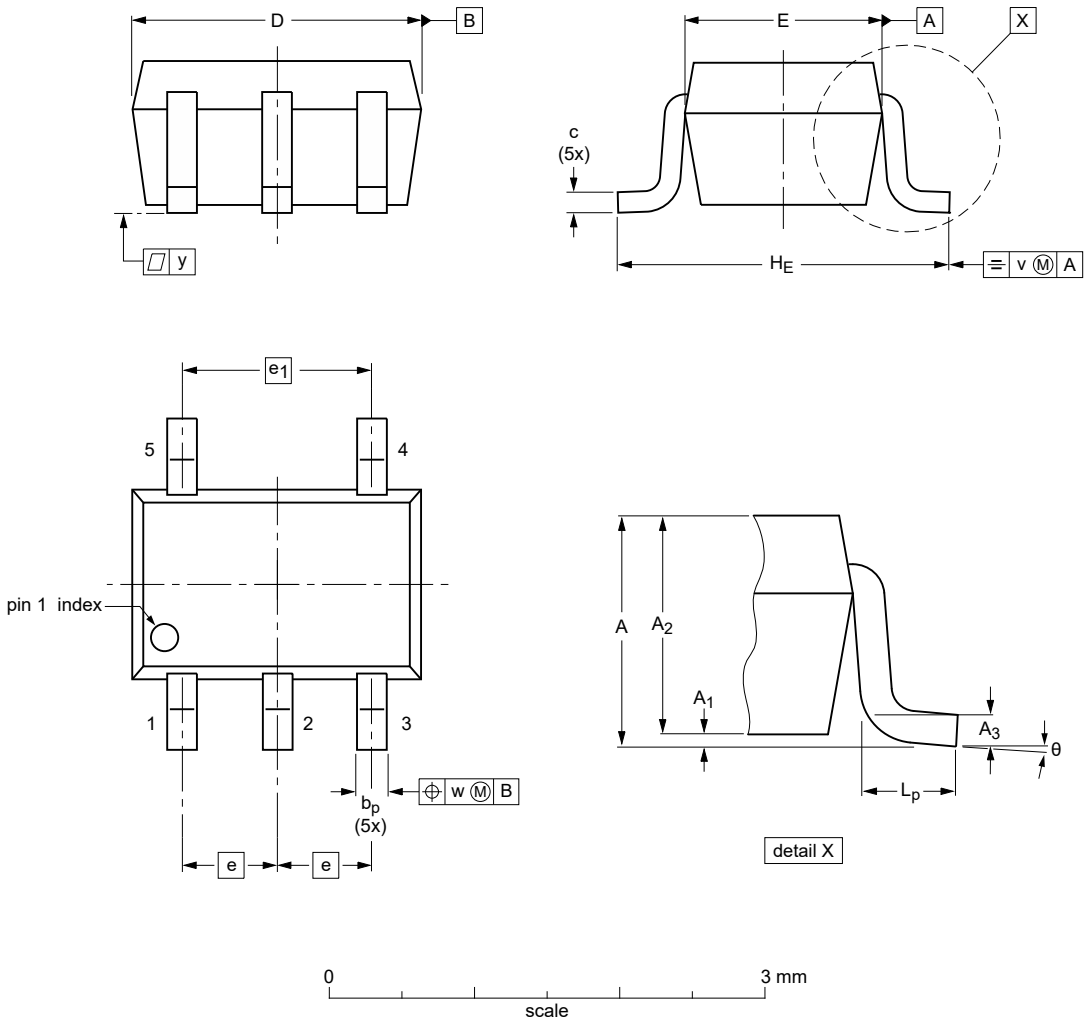
Fig. 9. Test circuit for measuring switching times

Table 10. Test data

Supply voltage	Input		Load		V_{EXT}
V_{CC}	V_I	t_r, t_f	C_L	R_L	t_{PZL}, t_{PLZ}
1.65 V to 1.95 V	V_{CC}	≤ 2.0 ns	30 pF	1 kΩ	V_{CC}
2.3 V to 2.7 V	V_{CC}	≤ 2.0 ns	30 pF	500 Ω	V_{CC}
2.7 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	V_{CC}
3.0 V to 3.6 V	2.7 V	≤ 2.5 ns	50 pF	500 Ω	V_{CC}
4.5 V to 5.5 V	V_{CC}	≤ 2.5 ns	50 pF	500 Ω	V_{CC}

12. Package outline

TSSOP5: plastic thin shrink small outline package; 5 leads; body width 1.25 mm **SOT353-1**



Dimensions (mm are the original dimensions)

Unit		A	A_1	A_2	A_3	b_p	c	$D^{(1)}$	$E^{(1)}$	e	e_1	H_E	L_p	v	w	y	θ
mm	max	1.1	0.1	1.0	0.15	0.30	0.25	2.2	1.35	0.65	1.3	2.4	0.46	0.3	0.1	0.1	8°
	min	0.8	0	0.8		0.15	0.08	1.8	1.15			1.8	0.26				0°

Note

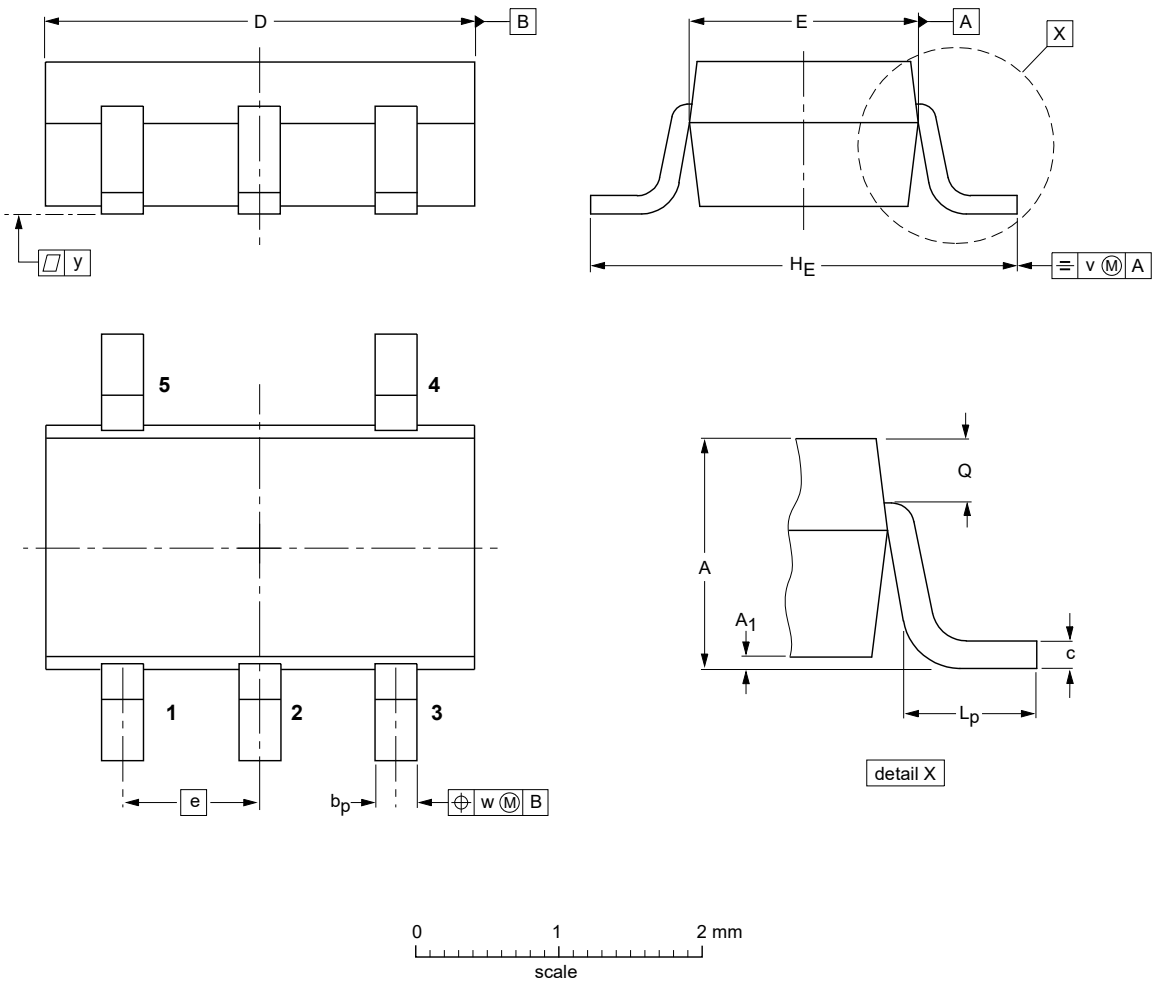
1. Plastic or metal protrusions of 0.2 mm maximum per side are not included.

sot353-1_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT353-1		MO-203	SC-88A			~~21-12-15~~ 21-12-16

Fig. 10. Package outline SOT353-1 (TSSOP5)

Plastic surface-mounted package; 5 leads **SOT753**



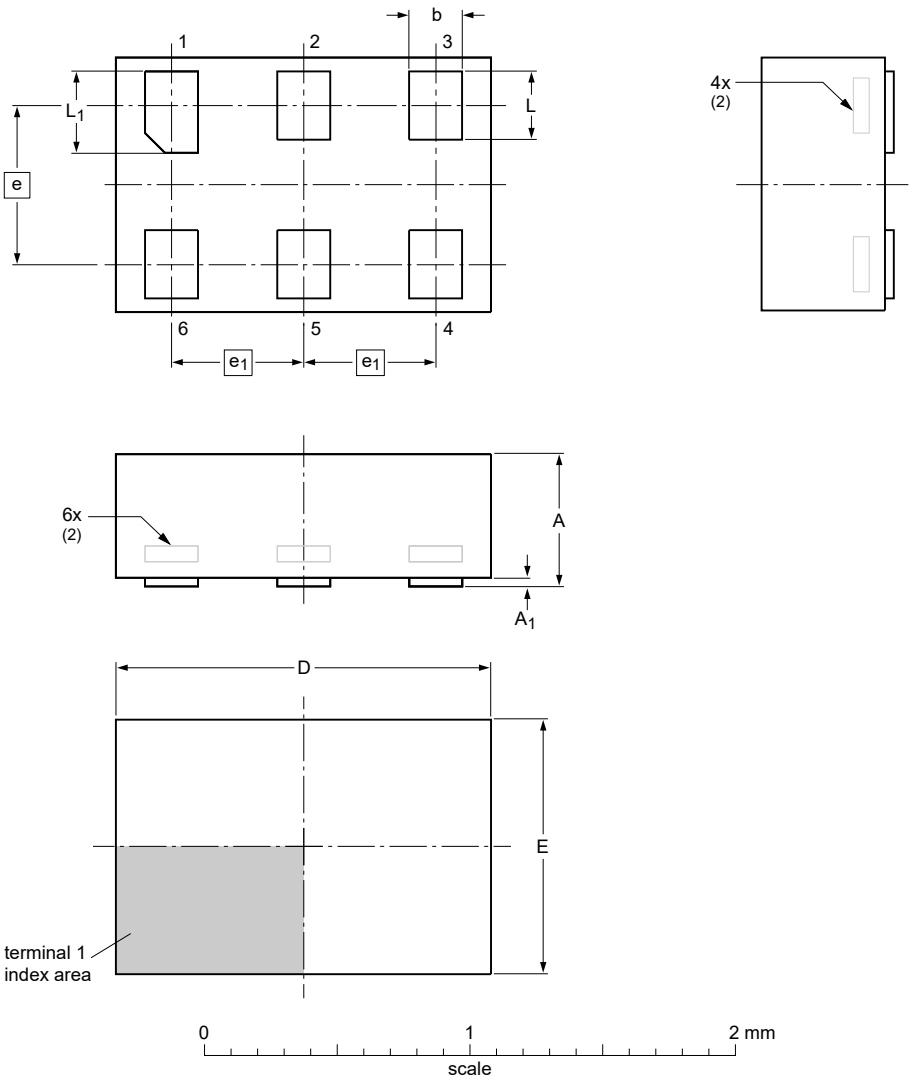
DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	c	D	E	e	H_E	L_p	Q	v	w	y
mm	1.1 0.9	0.100 0.013	0.40 0.25	0.26 0.10	3.1 2.7	1.7 1.3	0.95	3.0 2.5	0.6 0.2	0.33 0.23	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT753			SC-74A			~~02-04-16~~ 06-03-16

Fig. 11. Package outline SOT753 (SC-74A)

XSON6: plastic extremely thin small outline package; no leads; 6 terminals; body 1 x 1.45 x 0.5 mm SOT886



Dimensions (mm are the original dimensions)

Unit		A(1)	A_1	b	D	E	e	e_1	L	L_1
mm	max	0.5	0.04	0.25	1.50	1.05			0.35	0.40
	nom			0.20	1.45	1.00	0.6	0.5	0.30	0.35
	min			0.17	1.40	0.95			0.27	0.32

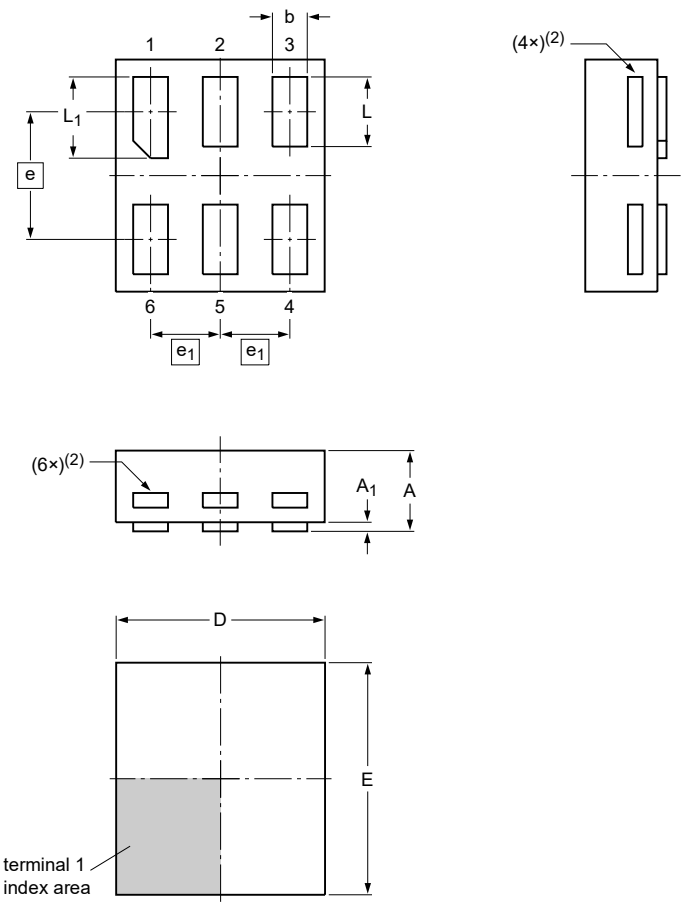
Notes
1. Including plating thickness.
2. Can be visible in some manufacturing processes.

sot886_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT886		MO-252				~~04-07-22~~ 12-01-05

Fig. 12. Package outline SOT886 (XSON6)

XSON6: extremely thin small outline package; no leads; 6 terminals; body 0.9 x 1.0 x 0.35 mm **SOT1115**



Dimensions

Unit		$A^{(1)}$	A_1	b	D	E	e	e_1	L	L_1
mm	max	0.35	0.04	0.20	0.95	1.05			0.35	0.40
	nom			0.15	0.90	1.00	0.55	0.3	0.30	0.35
	min			0.12	0.85	0.95			0.27	0.32

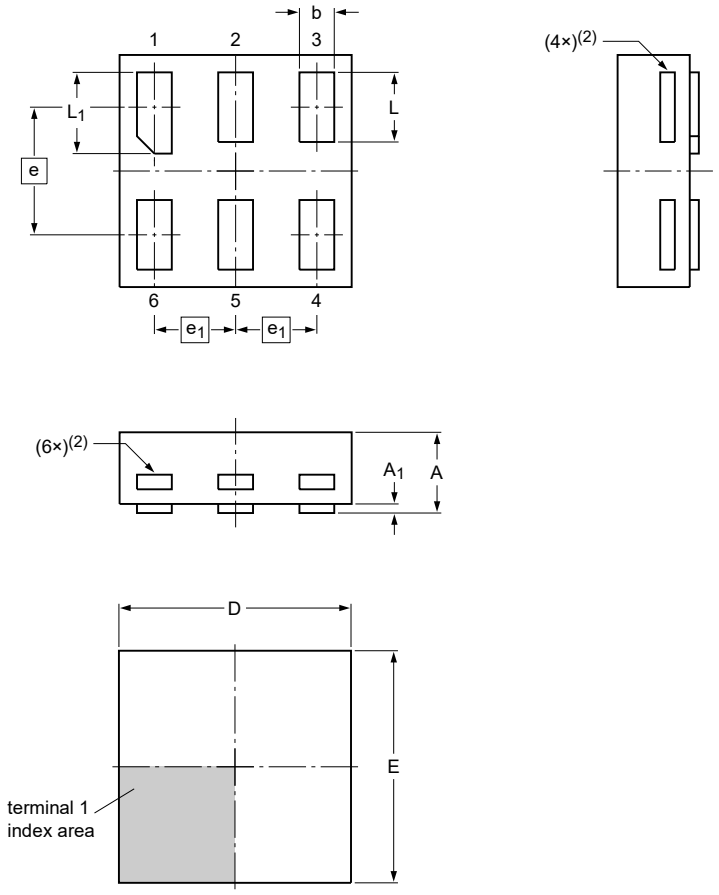
Note
1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

sot1115_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1115						~~10-04-02~~ 10-04-07

Fig. 13. Package outline SOT1115 (XSON6)

XSON6: extremely thin small outline package; no leads; 6 terminals; body 1.0 x 1.0 x 0.35 mm **SOT1202**



Dimensions

Unit		$A^{(1)}$	A_1	b	D	E	e	e_1	L	L_1
mm	max	0.35	0.04	0.20	1.05	1.05			0.35	0.40
	nom			0.15	1.00	1.00	0.55	0.35	0.30	0.35
	min			0.12	0.95	0.95			0.27	0.32

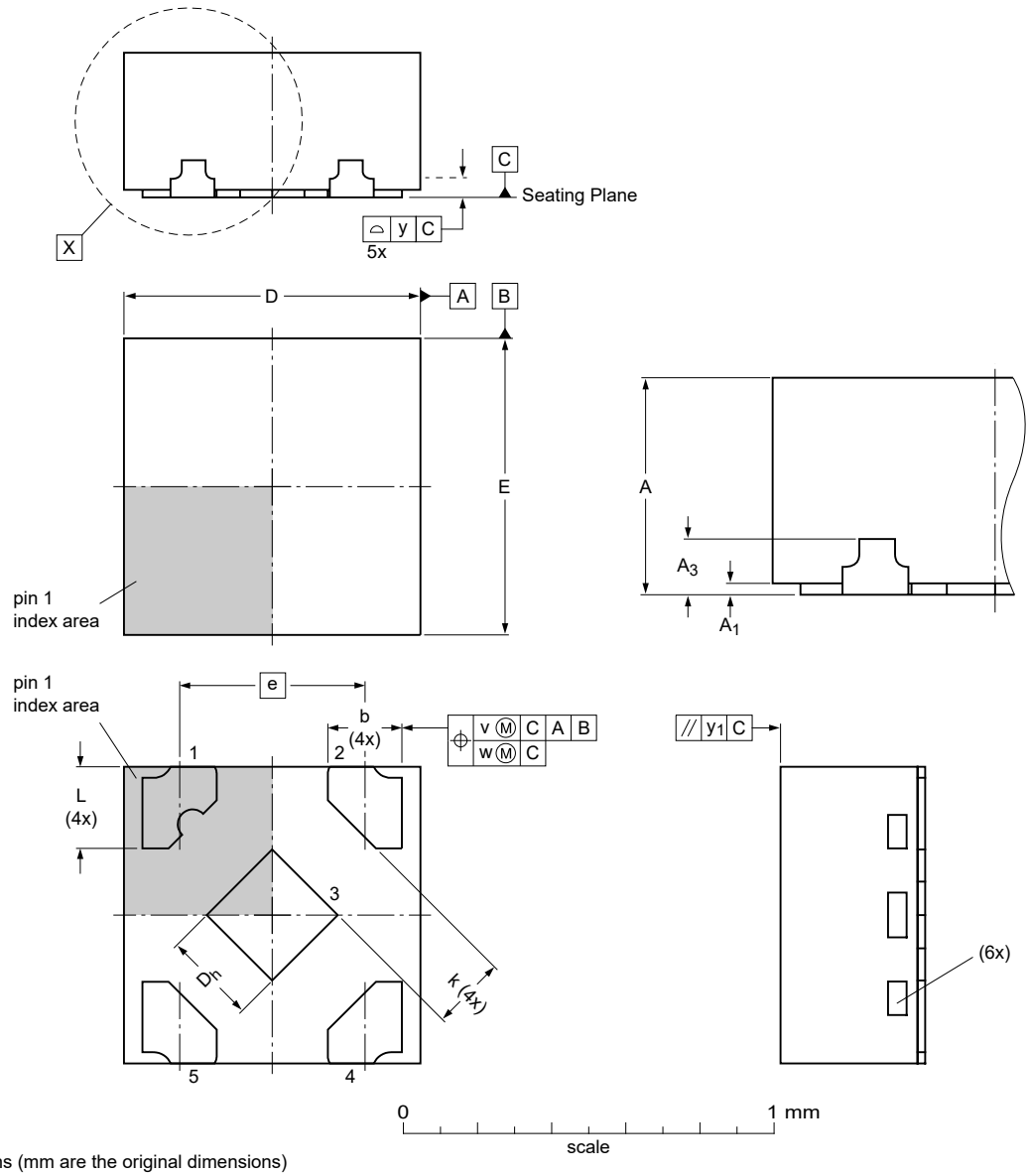
Note
1. Including plating thickness.
2. Visible depending upon used manufacturing technology.

sot1202_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	JEITA			
SOT1202						~~10-04-02~~ 10-04-06

Fig. 14. Package outline SOT1202 (XSON6)

X2SON5: plastic thermal enhanced extremely thin small outline package; no leads; 5 terminals; body 0.8 x 0.8 x 0.32 mm **SOT1226-3**



Dimensions (mm are the original dimensions)

Unit		A	A_1	A_3	D	D_h	E	b	e	K	L	v	w	y	y_1
mm	max	0.35	0.04	0.10 (Typ.)	0.85	0.30	0.85	0.25	0.50		0.27	0.1	0.05	0.05	0.05
	nom	0.32	0.02		0.80	0.25	0.80	0.20			0.22				
	min	0.30	0.00		0.75	0.20	0.75	0.15		0.20	0.17				

sot1226-3_po

Outline version	References				European projection	Issue date
	IEC	JEDEC	EIAJ			
SOT1226-3		---				~~19-11-06~~ 19-11-07

Fig. 15. Package outline SOT1226-3 (X2SON5)

13. Abbreviations

Table 11. Abbreviations

Acronym	Description
CMOS	Complementary Metal Oxide Semiconductor
DUT	Device Under Test
ESD	ElectroStatic Discharge
HBM	Human Body Model
MM	Machine Model
TTL	Transistor-Transistor Logic

14. Revision history

Table 12. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
74LVC1G38 v.10	20220112	Product data sheet	-	74LVC1G38 v.9
Modifications:	• Fig. 10: Package outline drawing SOT353-1 (TSSOP5) has changed.			
74LVC1G38 v.9	20210518	Product data sheet	-	74LVC1G38 v.8
Modifications:	• SOT1226 (X2SON5) package changed to SOT1226-3 (X2SON5) package. • Type number 74LVC1G38GF (SOT891/XSON6) removed. • Section 1 updated. • Table 5: P_{tot} total power dissipation and derating values updated.			
74LVC1G38 v.8	20161207	Product data sheet	-	74LVC1G38 v.7
Modifications:	• Table 7: The maximum limits for leakage current and supply current have changed.			
74LVC1G38 v.7	20121004	Product data sheet	-	74LVC1G38 v.6
Modifications:	• Pin configuration SOT1226 (Fig. 7) modified.			
74LVC1G38 v.6	20120702	Product data sheet	-	74LVC1G38 v.5
Modifications:	• Added type number 74LVC1G38GX (SOT1226) • Package outline drawing of SOT886 (Fig. 12) modified.			
74LVC1G38 v.5	20111206	Product data sheet	-	74LVC1G38 v.4
Modifications:	• Legal pages updated.			
74LVC1G38 v.4	20101005	Product data sheet	-	74LVC1G38 v.3
74LVC1G38 v.3	20070827	Product data sheet	-	74LVC1G38 v.2
74LVC1G38 v.2	20060913	Product data sheet	-	74LVC1G38 v.1
74LVC1G38 v.1	20041018	Product data sheet	-	-

15. Legal information

Data sheet status

Document status [1][2]	Product status [3]	Definition
Objective [short] data sheet	Development	This document contains data from the objective specification for product development.
Preliminary [short] data sheet	Qualification	This document contains data from the preliminary specification.
Product [short] data sheet	Production	This document contains the product specification.

[1] Please consult the most recently issued document before initiating or completing a design.
[2] The term 'short data sheet' is explained in section "Definitions".
[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the internet at https://www.nexperia.com.

Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. Nexperia does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local Nexperia sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between Nexperia and its customer, unless Nexperia and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the Nexperia product is deemed to offer functions and qualities beyond those described in the Product data sheet.

Disclaimers

Limited warranty and liability — Information in this document is believed to be accurate and reliable. However, Nexperia does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information. Nexperia takes no responsibility for the content in this document if provided by an information source outside of Nexperia.

In no event shall Nexperia be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, Nexperia's aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the Terms and conditions of commercial sale of Nexperia.

Right to make changes — Nexperia reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — Nexperia products are not designed, authorized or warranted to be suitable for use in life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an Nexperia product can reasonably be expected to result in personal injury, death or severe property or environmental damage. Nexperia and its suppliers accept no liability for inclusion and/or use of Nexperia products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Quick reference data — The Quick reference data is an extract of the product data given in the Limiting values and Characteristics sections of this document, and as such is not complete, exhaustive or legally binding.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. Nexperia makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Customers are responsible for the design and operation of their applications and products using Nexperia products, and Nexperia accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the Nexperia product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

Nexperia does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using Nexperia products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). Nexperia does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial sale — Nexperia products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nexperia.com/profile/terms, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. Nexperia hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of Nexperia products by customer.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Non-automotive qualified products — Unless this data sheet expressly states that this specific Nexperia product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. Nexperia accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without Nexperia's warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond Nexperia's specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies Nexperia for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond Nexperia's standard warranty and Nexperia's product specifications.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.