

LSF0108-Q100

8-bit bidirectional multi-voltage level translator; open-drain;
push-pull

Rev. 3.1 — 25 July 2024

Product data sheet

1. General description

The LSF0108-Q100 is an 8 Channel bidirectional multi-voltage level translator for open-drain and push-pull applications. It supports up to 100 MHz up translation and ≥ 100 MHz down translation at ≤ 30 pF capacitive load. There is no need for a direction pin which minimizes system effort.

The LSF0108-Q100 supports 5 V tolerant I/O pins for compatibility with TTL levels in a variety of applications. The ability to set up different voltage translation levels on each channel makes the device very flexible and suitable for a lot of different applications.

This product has been qualified to the Automotive Electronics Council (AEC) standard Q100 (Grade 1) and is suitable for use in automotive applications.

2. Features and benefits

- Automotive product qualification in accordance with AEC-Q100 (Grade 1)
 - Specified from -40°C to $+125^{\circ}\text{C}$
- Bidirectional voltage translation with no direction pin
- Up translation
 - ≤ 100 MHz; $C_L = 30$ pF
 - ≤ 50 MHz; $C_L = 50$ pF
- Down translation
 - ≥ 100 MHz; $C_L = 30$ pF
 - ≥ 50 MHz; $C_L = 50$ pF
- Hot insertion
- Bidirectional voltage level translation between:
 - 0.95 V and 1.8 V, 2.5 V, 3.3 V and 5.0 V
 - 1.2 V and 1.8 V, 2.5 V, 3.3 V and 5.0 V
 - 1.8 V and 2.5 V, 3.3 V and 5.0 V
 - 2.5 V and 3.3 V and 5.0 V
 - 3.3 V and 5.0 V
- Low standby current
- 5 V tolerant I/O pins to support TTL
- Low R_{ON} provides less signal distortion
- High-impedance I/O pins for $EN = \text{Low}$.
- Flow-through pinout for easy PCB trace routing.
- Latch-up performance exceeds 100 mA per JESD78 class II level A
- ESD protection:
 - HBM: ANSI/ESDA/JEDEC JS-001 class 2 exceeds 2000 V
 - CDM: ANSI/ESDA/JEDEC JS-002 class C3 exceeds 1000 V
- DHVQFN package with Side-Wettable Flanks enabling Automated Optical Inspection (AOI) of solder joints

3. Applications

- GPIO, MDIO, PMBus, SMBus, SDIO, UART, I²C, and other interfaces in Telecom infrastructure
- Industrial
- Personal computing
- Automotive

4. Ordering information

Table 1. Ordering information

Type number	Package			
	Temperature range	Name	Description	Version
LSF0108PW-Q100	-40 °C to +125 °C	TSSOP20	plastic thin shrink small outline package; 20 leads; body width 4.4 mm	SOT360-1
LSF0108BQ-Q100	-40 °C to +125 °C	DHVQFN20	plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads; 20 terminals; body 2.5 × 4.5 × 0.85 mm	SOT764-1

5. Functional diagram

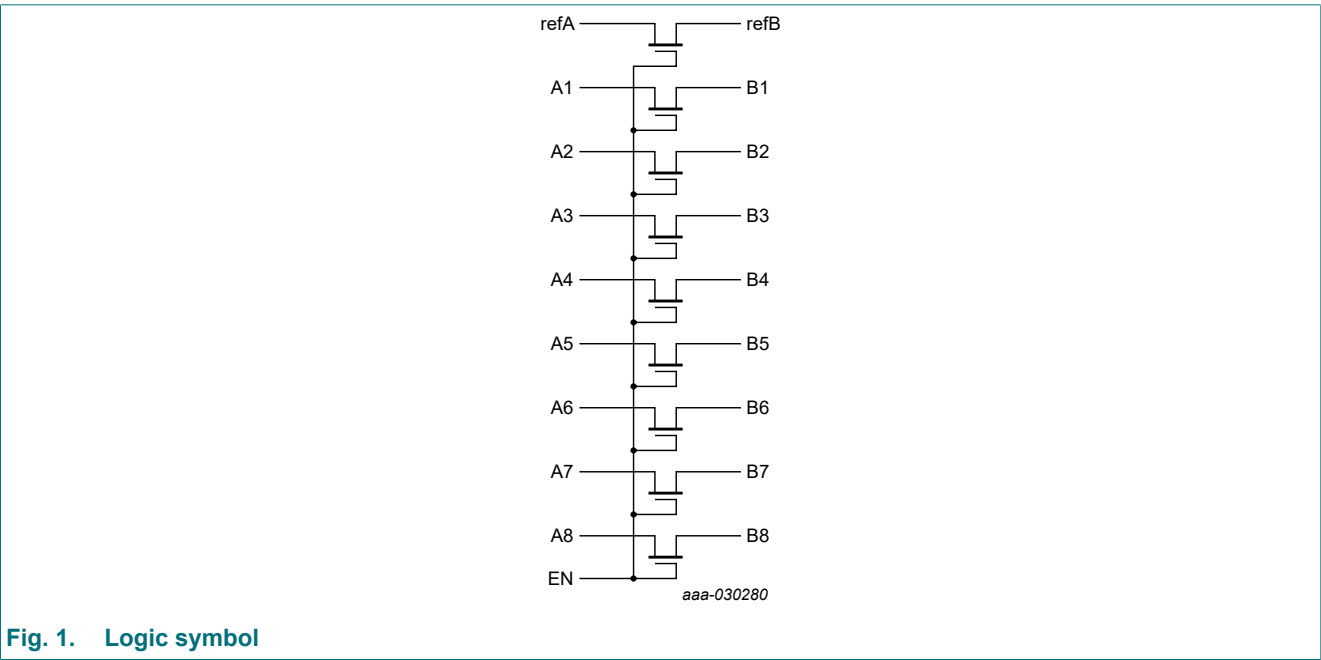


Fig. 1. Logic symbol

6. Pinning information

6.1. Pinning

PW package
SOT360-1 (TSSOP20)

aaa-035370

BQ package
SOT764-1 (DHVQFN20)

aaa-035667

Transparent top view

(1) This is not a ground pin. There is no electrical or mechanical requirement to solder the pad. In case soldered, the solder land should remain floating or connected to GND.

6.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
GND	1	ground (0 V)
refA	2	reference voltage A
A1, A2, A3, A4, A5, A6, A7, A8	3, 4, 5, 6, 7, 8, 9, 10	data input/output A
B1, B2, B3, B4, B5, B6, B7, B8	18, 17, 16, 15, 14, 13, 12, 11	data input/output B
refB	19	reference voltage B
EN	20	enable input (active HIGH)

7. Functional description

Table 3. Function table

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

Input	input/output
EN	An, Bn channel
H	An = Bn
L	Z

8. Limiting values

Table 4. 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 _I	input voltage	pins refA, refB, An, Bn and EN [1]	-0.5	+7.0	V
I _{I/O}	input/output current	pins refA, refB, An and Bn; continuous channel current	-	+128	mA
I _{IK}	input clamping current	V _I < 0 V	-50	-	mA
T _{stg}	storage temperature		-65	+150	°C
P _{tot}	total power dissipation	[2]	-	500	mW

- [1] The minimum input voltage rating may be exceeded if the input current rating is observed.
[2] For SOT360-1 (TSSOP20) package: P_{tot} derates linearly with 10.0 mW/K above 100 °C.
For SOT764-1 (DHVQFN20) package: P_{tot} derates linearly with 12.9 mW/K above 111 °C.

9. Recommended operating conditions

Table 5. Recommended operating conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V _I	input voltage	pins refA, refB, An, Bn and EN	0.0	5.0	V
I _{I/O}	input/output current	pins refA, refB, An and Bn; continuous channel current	-	+64	mA
T _{amb}	ambient temperature		-40	+125	°C

10. Static characteristics

Table 6. Static characteristics

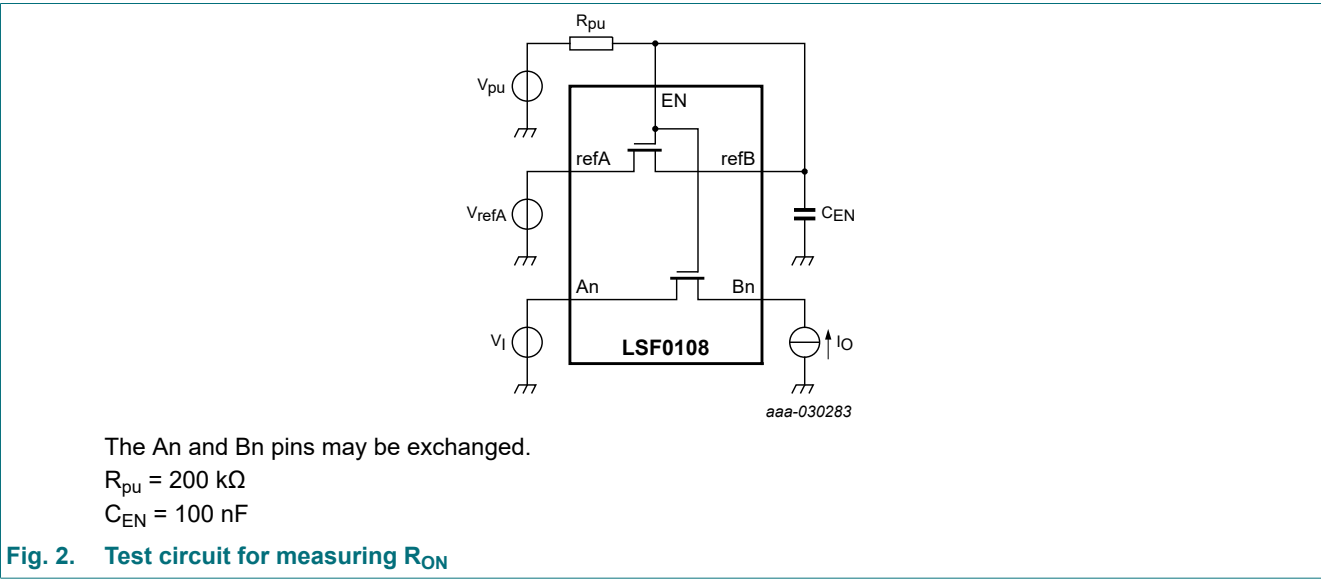
At recommended operating conditions. Voltages are referenced to GND (ground = 0 V).

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +125 °C			Unit
			Min	Typ[1]	Max	
V _{IK}	input clamping voltage	V _{EN} = 0 V; I _I = -18 mA	-1.2	-	-	V
I _I	leakage current	pins An, Bn, refA, refB and EN; V _I = GND to 5.0 V	-	1	5	µA
C _I	input capacitance	pins refA, refB and EN; V _I = 0 V or 3 V	-	11	-	pF
C _{io(off)}	OFF-state input/output capacitance	pins An, Bn; V _O = 0 V or 3 V; V _{EN} = 0.0 V	-	2.6	6.0	pF
C _{io(on)}	ON-state input/output capacitance	pins An, Bn; V _O = 0 V or 3 V; V _{EN} = 3.0 V	-	5.3	12.5	pF

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Symbol	Parameter	Conditions	T _{amb} = -40 °C to +125 °C			Unit
			Min	Typ[1]	Max	
R _{ON}	ON resistance	see Fig. 2 [2]				
		V _I = 0 V; V _{pu} = 5.0 V; I _O = 64 mA				
		V _{refA} = 3.3 V	-	3	-	Ω
		V _{refA} = 1.8 V	-	4	-	Ω
		V _{refA} = 1.0 V	-	7	-	Ω
		V _I = 0 V; V _{pu} = 5.0 V; I _O = 32mA				
		V _{refA} = 1.8 V	-	4	-	Ω
		V _{refA} = 2.5 V	-	3	-	Ω
		V _I = 1.8 V; V _{pu} = 5.0 V; I _O = 15 mA				
		V _{refA} = 3.3 V	-	4	-	Ω
		V _I = 1.0 V; V _{pu} = 3.3 V; I _O = 10 mA				
		V _{refA} = 1.8 V	-	7	-	Ω
		V _I = 0 V; V _{pu} = 3.3 V; I _O = 10 mA				
		V _{refA} = 1.0 V	-	5	-	Ω
		V _I = 0 V; V _{pu} = 1.8 V; I _O = 10 mA				
		V _{refA} = 1.0 V	-	6	-	Ω

- [1] All typical values are measured at T_{amb} = 25 °C.
- [2] Measured by the voltage drop between the An and Bn pins at the indicated current through the switch. ON resistance is determined by the lowest voltage of the two (An or Bn) pins.



11. Dynamic characteristics

Table 7. Switching characteristics

$GND = 0\text{ V}$; for waveform see [Fig. 3](#); for test circuit see [Fig. 4](#).

Symbol	Parameter	Conditions	T _{amb} = -40 °C to +125 °C			Unit
			Min	Typ [1]	Max	
Translating down						
t _{PLH}	LOW to HIGH propagation delay	An to Bn or Bn to An; V _{IH} = V _{pu} = V _{refA} + 1 V				
		V _{refA} = 1.5 V; C _L = 15 pF	-	0.8	-	ns
		V _{refA} = 1.5 V; C _L = 30 pF	-	1.45	-	ns
		V _{refA} = 1.5 V; C _L = 50 pF	-	2.0	-	ns
		V _{refA} = 2.3 V; C _L = 15 pF	-	0.75	-	ns
		V _{refA} = 2.3 V; C _L = 30 pF	-	1.4	-	ns
		V _{refA} = 2.3 V; C _L = 50 pF	-	1.9	-	ns
t _{PHL}	HIGH to LOW propagation delay	An to Bn or Bn to An; V _{IH} = V _{pu} = V _{refA} + 1 V				
		V _{refA} = 1.5 V; C _L = 15 pF	-	0.9	-	ns
		V _{refA} = 1.5 V; C _L = 30 pF	-	1.55	-	ns
		V _{refA} = 1.5 V; C _L = 50 pF	-	2.1	-	ns
		V _{refA} = 2.3 V; C _L = 15 pF	-	0.85	-	ns
		V _{refA} = 2.3 V; C _L = 30 pF	-	1.5	-	ns
		V _{refA} = 2.3 V; C _L = 50 pF	-	2.0	-	ns
Translating up						
t _{PLH}	LOW to HIGH propagation delay	An to Bn or Bn to An; V _{IH} = V _{refA} ; V _{EXT} = V _{pu} = V _{refA} + 1 V				
		V _{refA} = 1.5 V; C _L = 15 pF	-	0.8	-	ns
		V _{refA} = 1.5 V; C _L = 30 pF	-	1.35	-	ns
		V _{refA} = 1.5 V; C _L = 50 pF	-	1.8	-	ns
		V _{refA} = 2.3 V; C _L = 15 pF	-	0.9	-	ns
		V _{refA} = 2.3 V; C _L = 30 pF	-	1.55	-	ns
		V _{refA} = 2.3 V; C _L = 50 pF	-	2.1	-	ns
t _{PHL}	HIGH to LOW propagation delay	An to Bn or Bn to An; V _{IH} = V _{refA} ; V _{EXT} = V _{pu} = V _{refA} + 1 V				
		V _{refA} = 1.5 V; C _L = 15 pF	-	0.9	-	ns
		V _{refA} = 1.5 V; C _L = 30 pF	-	1.45	-	ns
		V _{refA} = 1.5 V; C _L = 50 pF	-	1.9	-	ns
		V _{refA} = 2.3 V; C _L = 15 pF	-	1.0	-	ns
		V _{refA} = 2.3 V; C _L = 30 pF	-	1.65	-	ns
		V _{refA} = 2.3 V; C _L = 50 pF	-	2.1	-	ns

[1] All typical values are measured at $T_{\text{amb}} = 25\text{ °C}$.

11.1. Waveforms and test circuit

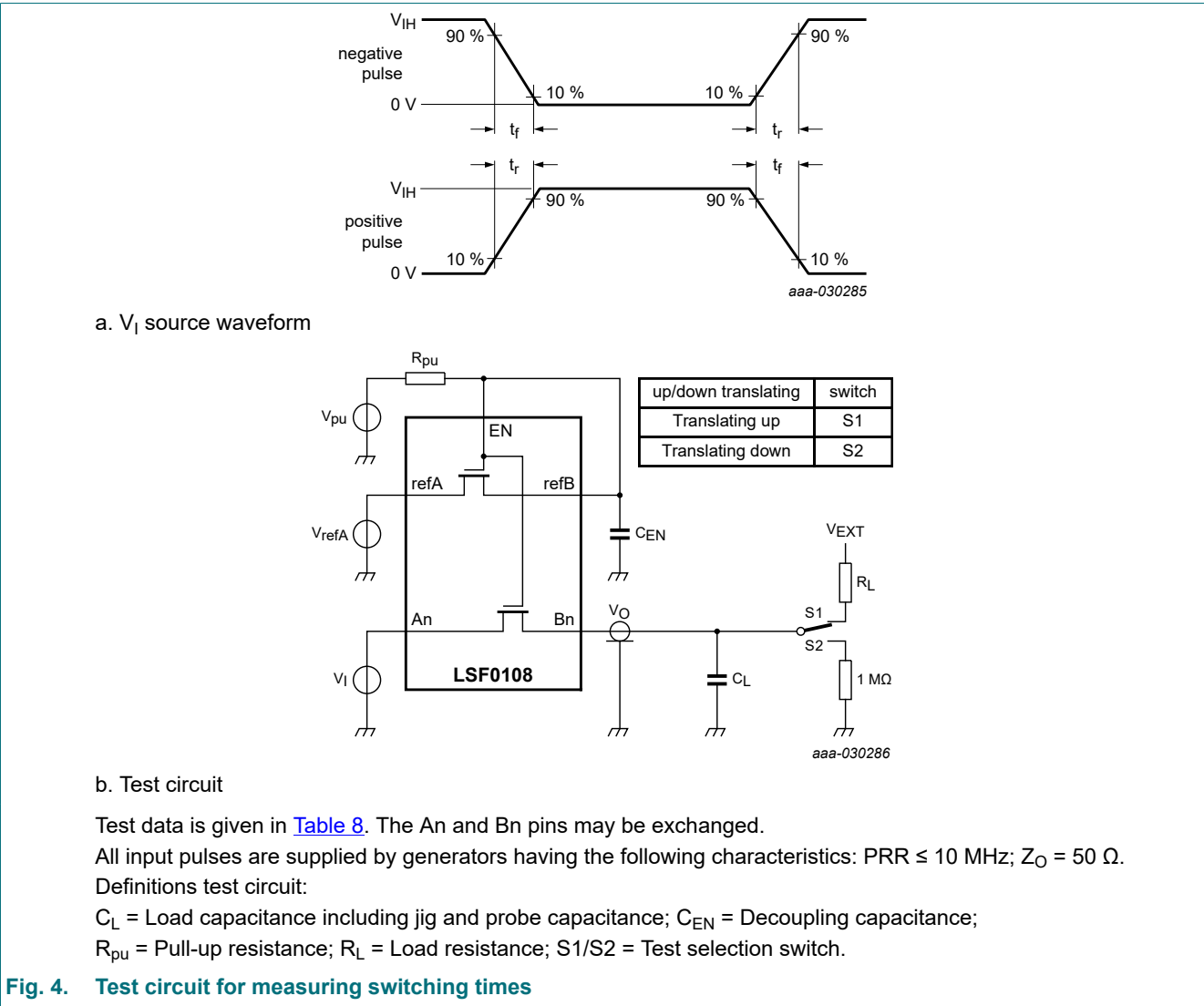
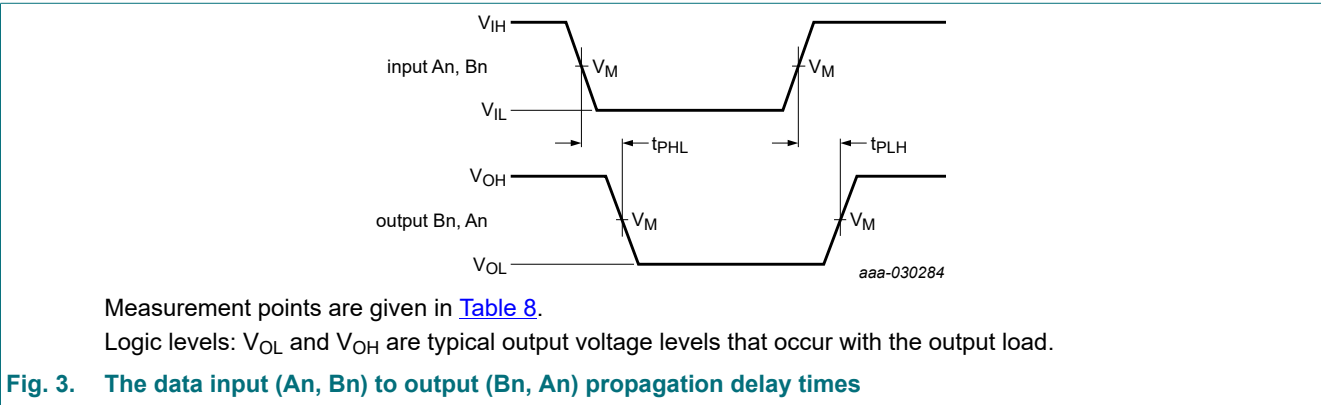


Fig. 4. Test circuit for measuring switching times

Table 8. Test data

Input		Output	Load			
t_r, t_f	V_M	V_M	C_L	C_{EN}	R_L	R_{pu}
$\leq 2\text{ ns}$	$0.5V_{refA}$	$0.5V_{refA}$	15 pF, 30 pF, 50 pF	100 nF	300 Ω	200 k Ω

12. Package outline

TSSOP20: plastic thin shrink small outline package; 20 leads; body width 4.4 mm

SOT360-1

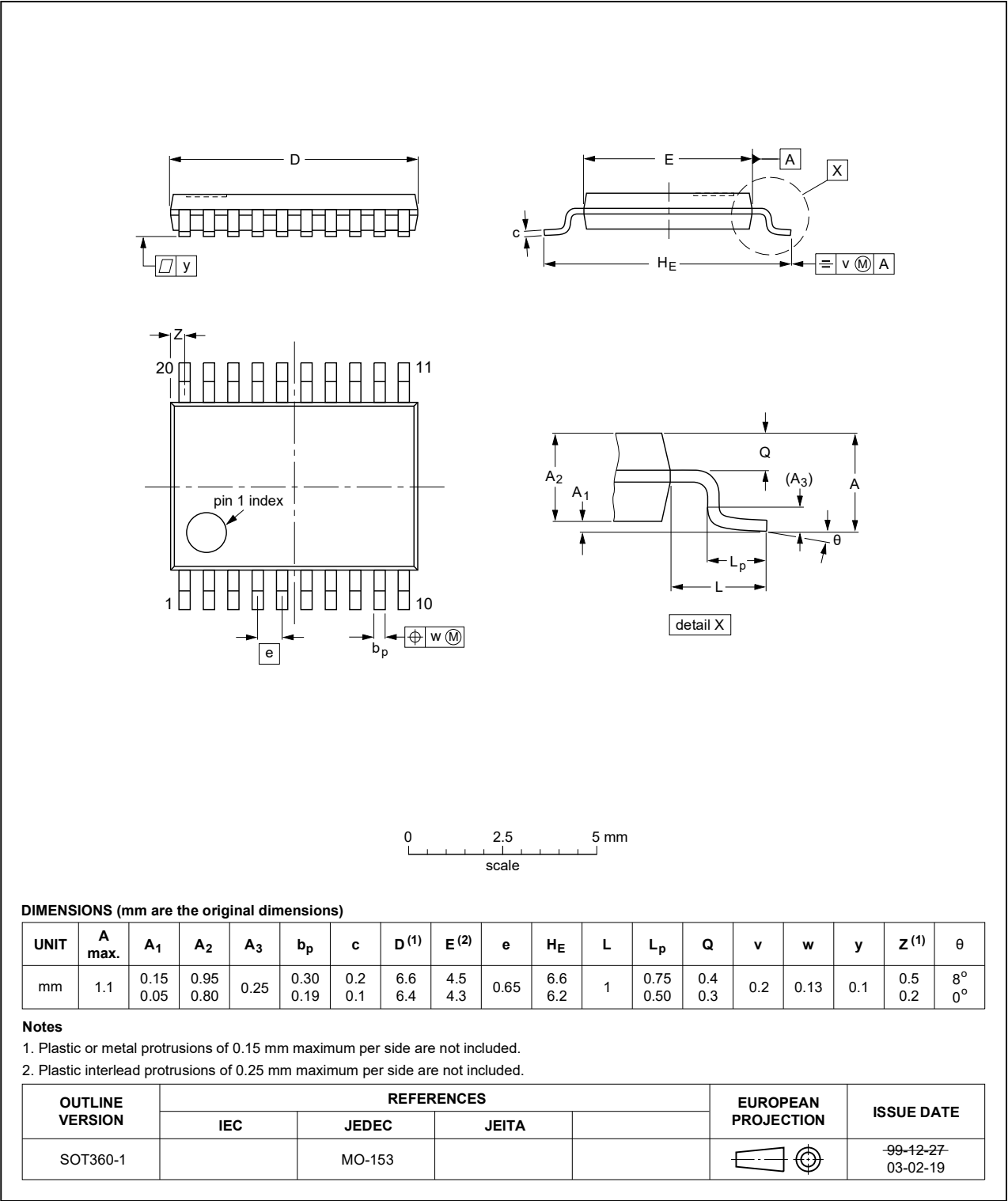


Fig. 5. Package outline SOT360-1 (TSSOP20)

DHVQFN20: plastic dual in-line compatible thermal enhanced very thin quad flat package; no leads;
20 terminals; body 2.5 x 4.5 x 0.85 mm

SOT764-1

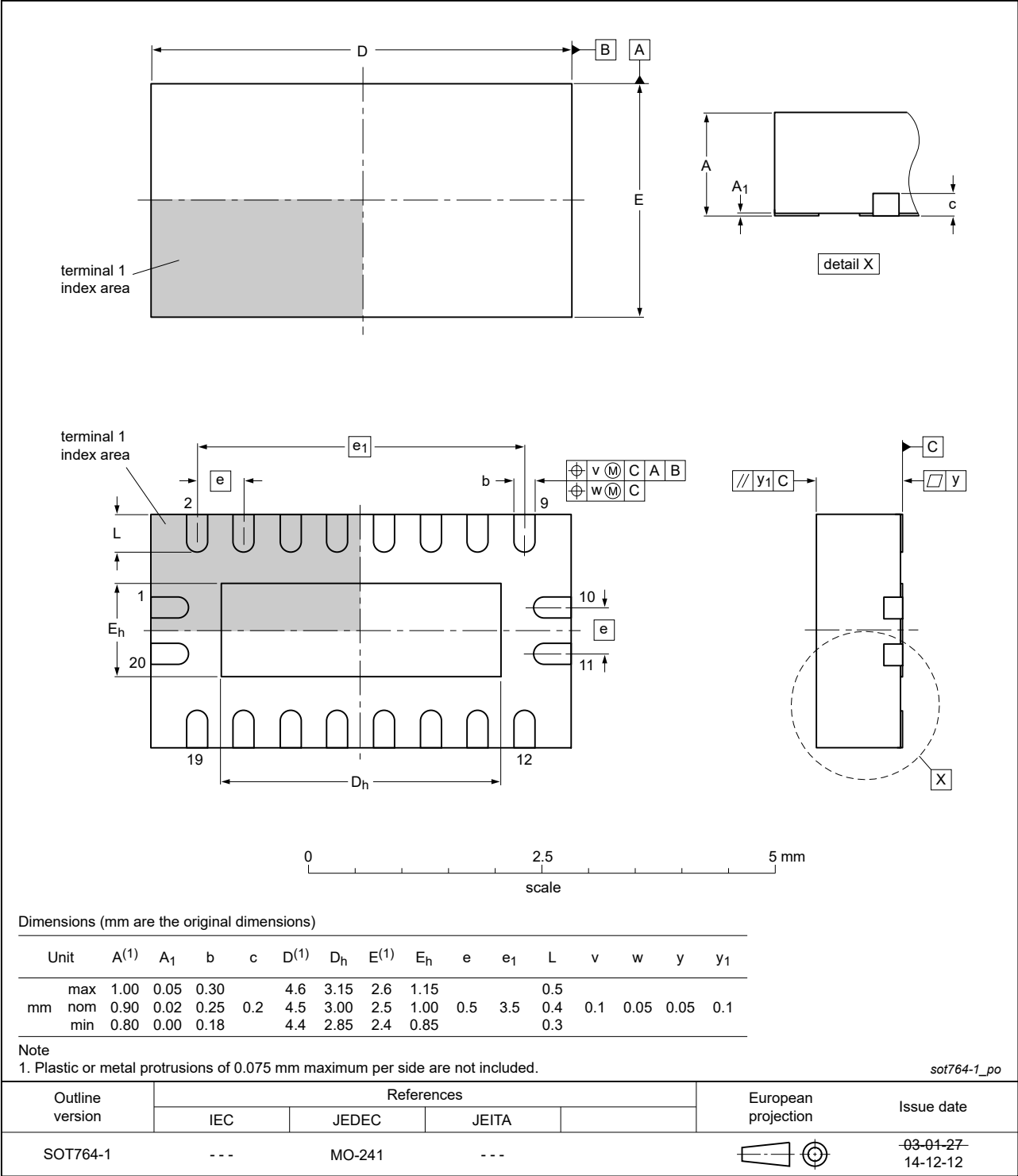


Fig. 6. Package outline SOT764-1 (DHVQFN20)

13. Abbreviations

Table 9. Abbreviations

Acronym	Description
ANSI	American National Standards Institute
CDM	Charged Device Model
ESD	ElectroStatic Discharge
ESDA	ElectroStatic Discharge Association
HBM	Human Body Model
JEDEC	Joint Electron Device Engineering Council
PRR	Pulse Rate Repetition
TTL	Transistor-Transistor Logic

14. Revision history

Table 10. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
LSF0108_Q100 v.3.1	20240725	Product data sheet	-	LSF0108_Q100 v.3
LSF0108_Q100 v.3	20231128	Product data sheet	-	LSF0108_Q100 v.2
Modifications:	• Section 2 : up- and down-translation typo corrected.			
LSF0108_Q100 v.2	20200730	Product data sheet	-	LSF0108_Q100 v.1
Modifications:	• Section 2 updated.			
LSF0108_Q100 v.1	20190918	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.

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- [2] The term 'short data sheet' is explained in section "Definitions".
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