L9800

Automotive 8-channel LS driver

TFQFN24 4x4x0.9

Features

Symbol	Parameter	Values
V_{BATT}	Supply voltage	3 V to 28 V
V_{DDIO}	Supply and SO buffer voltage	3 V to 5.5 V
$R_{DS(ON)}$	Maximum on-state resistance at T_J = 150 °C	1.7 Ω
$I_{L(NOM)}$	Nominal load current (T_A = 85 °C, all channels)	330 mA
E_{AR}	Maximum energy dissipation - repetitive	10 mJ at I_L = 220 mA
$V_{DS(CL)}$	Minimum drain-source clamping voltage	42 V
$I_{L(OVL0)}$	Maximum overload switch OFF threshold	3 A
f_{SCLK}	Maximum SPI clock frequency	8 MHz

Product status link

L9800

Product summary

Order code	L9800
Package	TFQFN24 4x4x0.9
Packing	Tray
Order code	L9800-TR
Package	TFQFN24 4x4x0.9
Packing	Tape and reel

- AEC-Q100 qualified
- Full ISO26262 compliant, ASIL-B systems ready
- General
  - Eight LS drivers
  - 16-bit SPI interface for outputs control and for diagnosis data communication
  - Daisy chain compatible and available even with 8-bit SPI
  - 2 parallel input pins with input mapping functionality
  - Cranking capability down to V_{BATT} = 3 V
  - Digital supply voltage range compatible with 3.3 V and 5 V MCU
  - LED mode
  - Bulb inrush mode (BIM) with two channels in parallel mode and enhanced capacitive loads driving capability to drive 2 W lamps, 5 W lamps and electronic loads
  - Two independent internal PWM generators for MCU offloads and to drive LEDs
  - Very low quiescent current (with usage of IDLE pin)
  - Limp-home mode (with usage of IDLE and IN pins)
  - Safety features
    ◦ Temperature sensor and monitoring
    ◦ Serial communications using address feedback, 1 parity bit, frame counter and short frame detection
  - Fail-safe activation via input pins
  - Safe operation at low battery voltage (cranking)
- Protective functions
  - Overcurrent latch OFF
  - Lower supply voltage range for extended operation
  - Electrostatic discharge (ESD) protection
  - Reverse battery protection on VBATT without external components
  - Short circuit battery protection
  - Thermal shutdown latch OFF

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- Diagnostic features
    - Latched diagnostic information via SPI register
    - Overcurrent and overtemperature detection at ON state
    - OFF state diagnosis, able to detect and distinguish open load and short to GND conditions

Applications

- Low-side switches for 12 V in automotive or industrial applications such as lighting, heating, motor driving, energy and power distribution
- Especially designed for driving relays, LEDs and motors

Description

The L9800 is an 8-channel LS driver designed for automotive applications (LEDs and relays) and compatible with resistive, inductive and capacitive loads. The device offers advanced diagnostic and protection functionalities such as open load, overcurrent and overtemperature detections, short to GND. The eight output channels can be driven by SPI or by dedicated parallel inputs. Limp-home functionality is present. Daisy chain available (no constraint on SPI number of bits of devices in chain). The device is able to guarantee cranking scenario down to V_{BATT} = 3 V and ensures very low-quiescent current under RESET.

The device is an 8-channel low-side power switch in a TFQFN24 4x4x0.9 package providing embedded protective functions. It is specially designed to control relays and LEDs in automotive and industrial applications.

A serial peripheral interface (SPI) is used for control and diagnosis of the loads as well as of the device. For direct control and PWM there are two input pins (IN0 and IN1) available, connected to two outputs by default (OUT2 and OUT3). Additional or different outputs can be controlled by the same input pins if programmed by SPI.

1 Block diagram and pin description
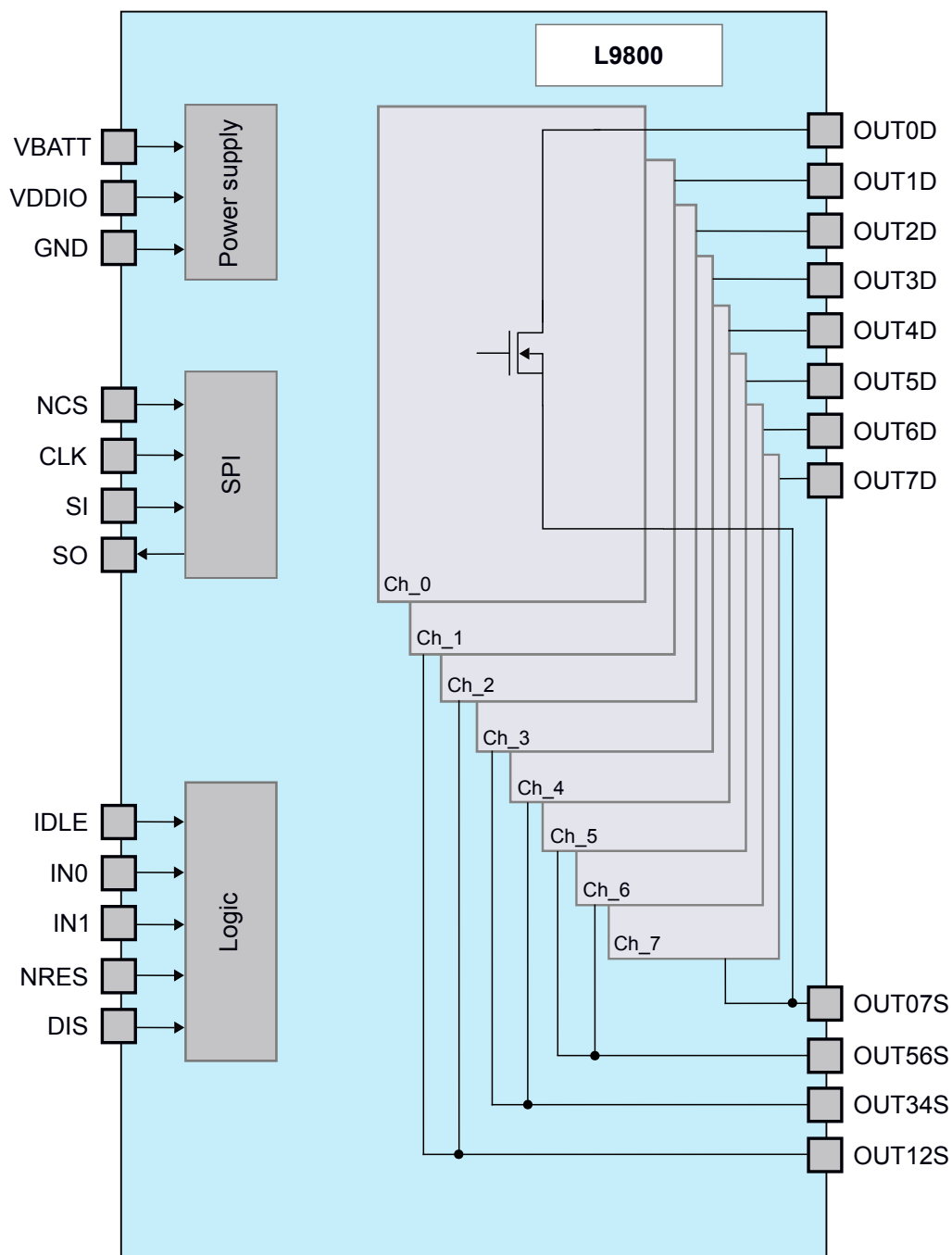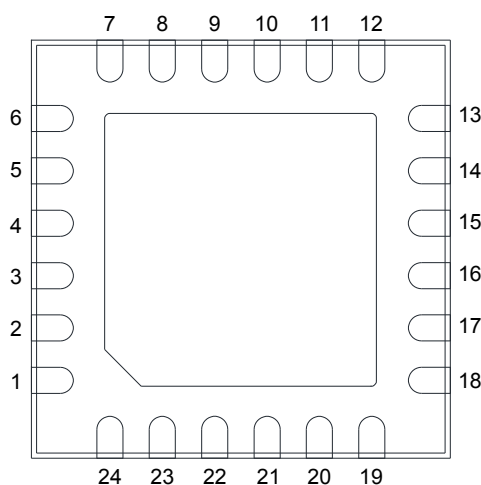
Figure 1. Block diagram

Figure 2. **Pin configuration (bottom view)**

Table 1. **Pin description**

Pin #	Pin name	Description	I/O type
1	OUT7D	Drain 7	O
2	OUT6D	Drain 6	O
3	OUT56S	Source 5–6	O
4	OUT5D	Drain 5	O
5	NRES	NRES function	I
6	IN1	Parallel command input 1	I
7	IN0	Parallel command input 2	I
8	GND	Ground pin	
9	IDLE	Idle function	I
10	VDDIO	IO supply	
11	SO	SPI output stream	O
12	CLK	SPI clock	I
13	NCS	SPI chip select	I
14	SI	SPI input stream	I
15	OUT4D	Drain 4	O
16	OUT34S	Source 4	O
17	OUT3D	Drain 3	O
18	DIS	Channel disable	I
19	OUT2D	Drain 2	O
20	OUT12S	Source 1–2	O
21	OUT1D	Drain 1	O
22	VBATT	Battery voltage	
23	OUT07S	Source 0–7	O
24	OUT0D	Drain 0	O

2 Application circuit

Here below a general application circuit with the TFQFN24 package.
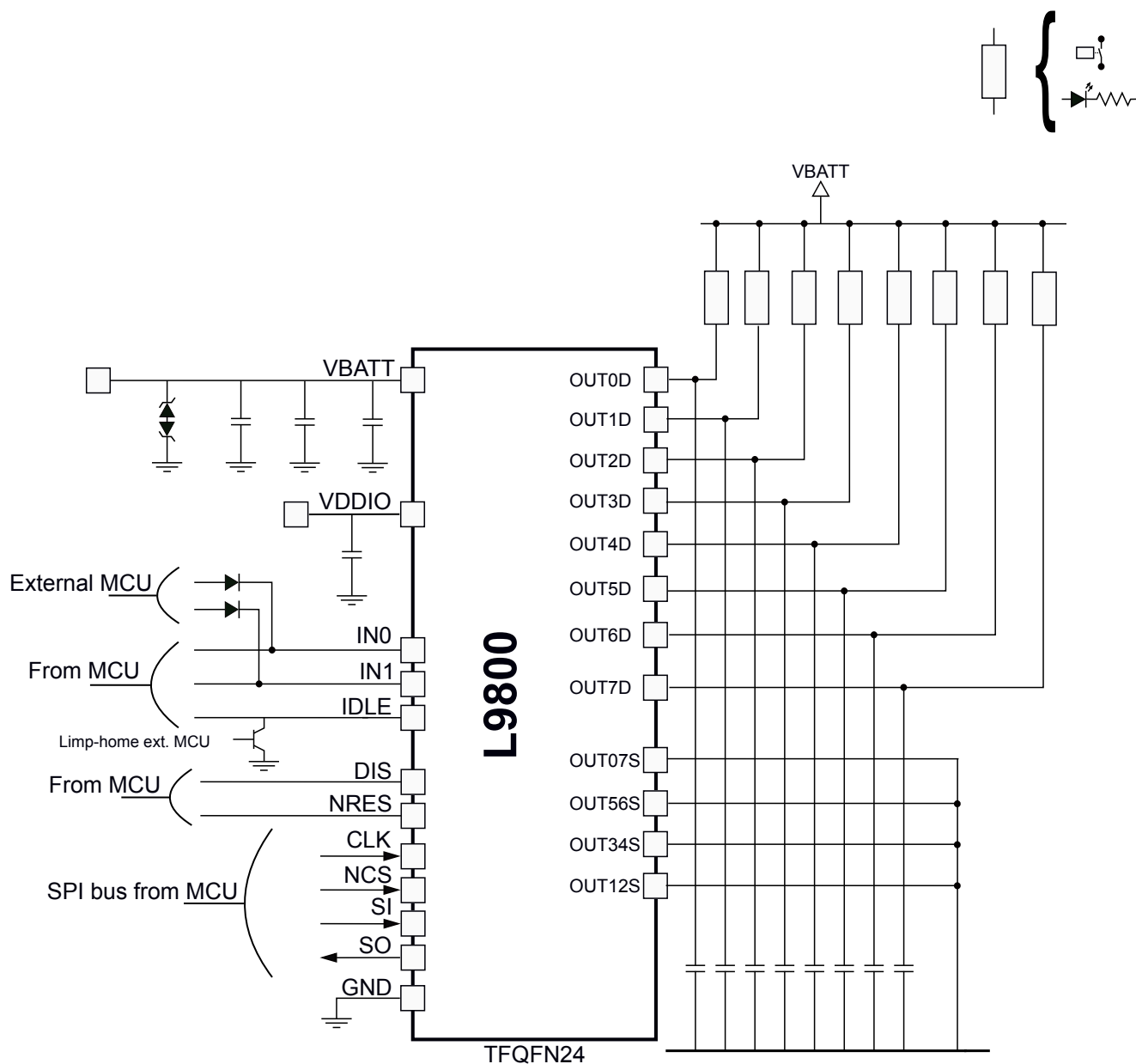
Figure 3. L9800 application circuit

Table 2. External components list

Pin	External components					Requirement[1]	Comment
	Type	Min.	Typ.	Max.	Unit		
VBATT	Capacitor		120		nF	2., 3.	Tolerance ±20% 50 V
	Capacitor		100		µF	2.	50 V, Transient and load dump protection
	TVS	-15		38	V	4.	Transient voltage suppressor
	Capacitor		10		µF	2., 3.	Tolerance ±20% 50 V, Transient and load dump protection
VDDIO	Capacitor		100		nF	2.	Tolerance ±10% 50 V
OUT2D–OUT7D	Capacitor			12	nF	3.	Maximum total capacitance value at output load (channel configured as low side)
OUT0D–OUT7D		47				4.	Minimum capacitance value at load supply (channel configured as high side, DRAIN0 and DRAIN1 if available)
OUT07S–OUT12S	Capacitor			12	nF	3.	Maximum total capacitance value as output load (channel configured as high side)

1.   *Refer to the following Items.*

In the list of external components, the different parts are marked following the items reported below:
1.   Mandatory components for L9800 functionality.
2.   Recommended components for EMC robustness.
3.   Recommended components for ESD trials.
4.   Recommended system component.

Note: *Recommended components may depend on the requirements at system level and shall be confirmed by specific tests on the final applications.*

3 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.

3.1 TFQFN24 4x4x0.9 wettable flanks package information

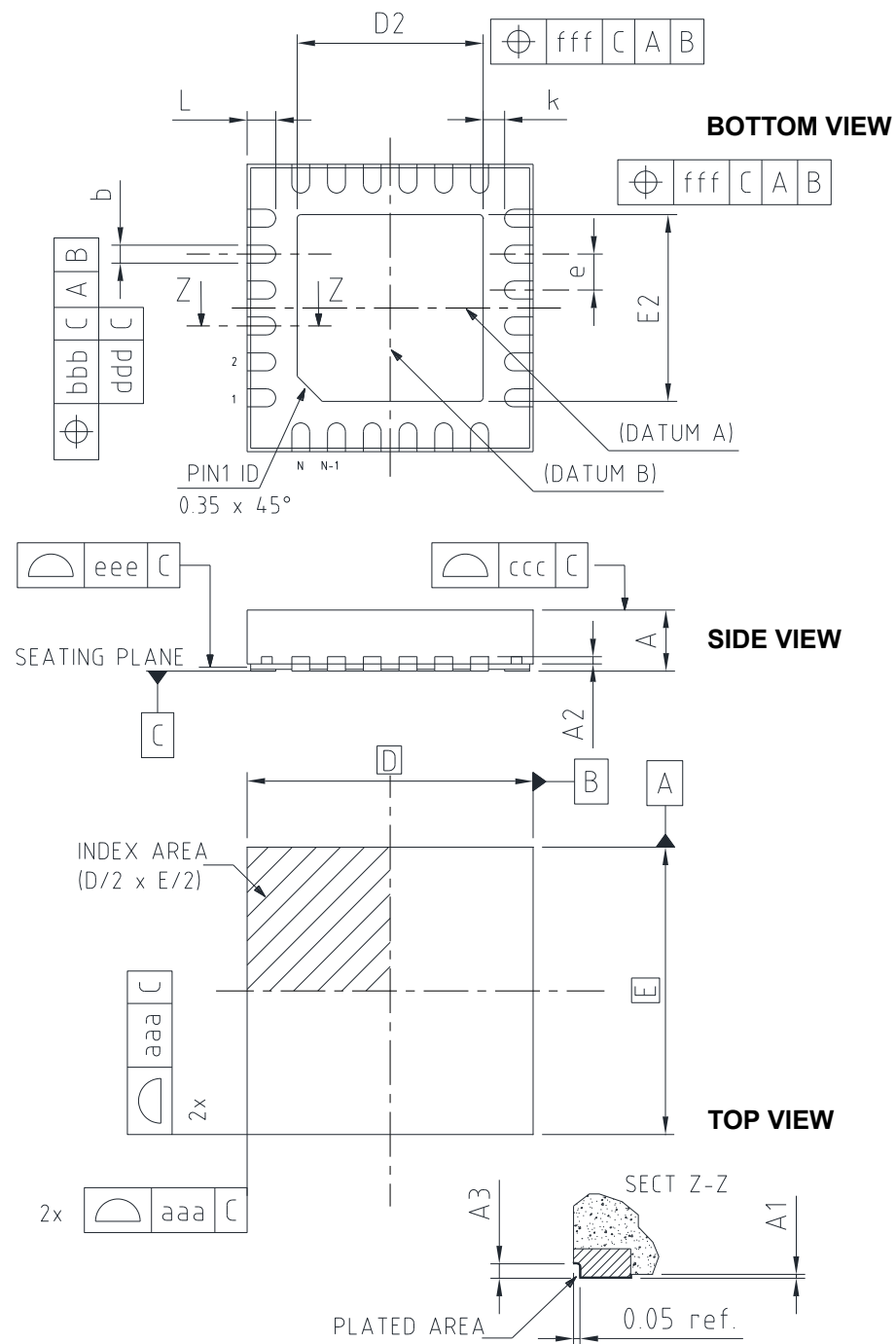**Figure 4. TFQFN24 4x4x0.9 wettable flanks package dimension**

Table 3. TFQFN24 4x4x0.9 wettable flanks mechanical data

Symbol	Dimensions			Note
	Min.	Typ.	Max.	
A	0.80	0.90	1.00	(1)
A1	0.00	0.02	0.05	(2)
A2	0.20 REF			
A3	0.1			
b	0.20	0.25	0.30	(1), (3)
D	4.00			(1)
D2	2.75	2.80	2.85	
e	0.50			(1)
E	4.00			(1)
E2	2.75	2.80	2.85	
L	0.35	0.40	0.45	(1)
k	0.25			
N	24			(4)
Tolerance of form and position				
aaa	0.15			
bbb	0.10			
ccc	0.08			(1), (5)
ddd	0.05			
eee	0.10			

1. *To be determined at setting datum plane C.*
2. *A1 is defined as the distance from the seating plane to the lowest point on the package body.*
3. *Dimension "b" does not include dambar protrusion. Allowable dambar protrusion shall not cause the lead width to exceed the maximum "b" dimension by more than 0.08 mm. Dambar cannot be located on the lower radius or the foot. Minimum space between protrusion and an adjacent lead is 0.07 mm for 0.4 mm and 0.5 mm pitch packages.*
4. *"N" is the maximum number of terminal positions for the specified body size.*
5. *Dimensioning and tolerancing schemes conform to ASME Y14.5M-1994.*

Revision history

Table 4. Document revision history

Date	Revision	Changes
04-May-2022	1	Initial release.
09-Nov-2023	2	Removed "ST Restricted" watermark. Updated Device summary, Features and Description on cover page. Updated Section 2 Application circuit.

Contents

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