## Description

The LSF0106/0108 is 6/8-CH bi-directional multi-voltage level translator for open-drain and push-pull applications. This device is a universal level translator with A port operating from 0.65V to 4.5V (Vref_A) and B port 1.5V to 5.5V (Vref_B). This range allows for bi-directional voltage translations between 0.65V and 5.0V. Meanwhile, Vref_B is recommended to be at 1V higher than Vref_A for best signal integrity.

The EN pin is used to activate the device. When EN is HIGH, the translator switch is on. Otherwise, EN is LOW, the translator switch is off, and a high-impedance state exists between ports. The EN input must be connected to Vref_B and both pins pulled to HIGH through a pullup resistor (typically 200kΩ). EN must be LOW to ensure the high-impedance state during power-up or power-down.

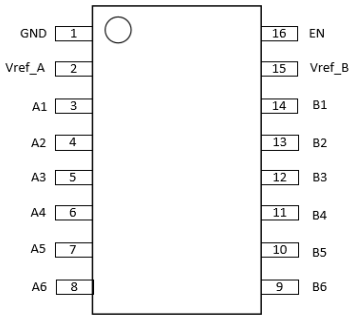
Be aware that external Rpu (pullup resistor) is required on each signal in both A and B ports for push-pull application because a pull-high state can avoid misoperation during power-up or power-down. As same as open-drain application, the smaller Rpu results in the larger driving current. For bi-directional signal flows, there is no need for a direction pin to minimize system effort. This device supports 5V tolerant I/O pins in a variety of applications which require different voltage translation levels.

## Features

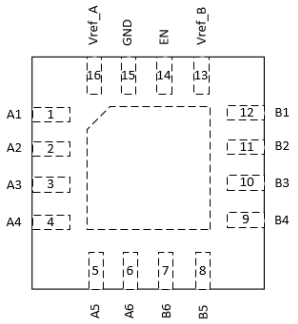
- Bi-directional level shifter for both push-pull and open-drain
- Maximum data rate is dominated by the system capacitance and pullup resistors
  - ≤ 100MHz; $C_L$ = 15pF, 30pF, Rpu ≤ 300Ω
  - ≤ 50MHz; $C_L$ = 50pF, Rpu ≤ 300Ω
- Bi-directional voltage level translation between:
  - 0.65V and 1.5V, 1.8V, 2.5V, 3.3V and 5.0V
  - 1.2V and 1.8V, 2.5V, 3.3V and 5.0V
  - 1.8V and 2.5V, 3.3V and 5.0V
  - 2.5V and 3.3V and 5.0V
  - 3.3V and 5.0V
- ESD protection exceeds JESD 22
  - 3500V HBM (A114)
  - 1500V CDM (C101)
- Latchup exceeds 100mA per JESD 17
- 5V tolerant I/O pins to support TTL
- Specified from -40°C to +125°C
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

## Pin Assignments

**LSF0106 Packages**

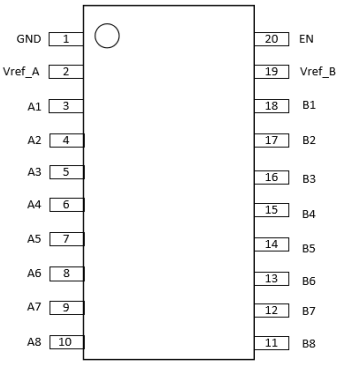



**TSSOP-16**

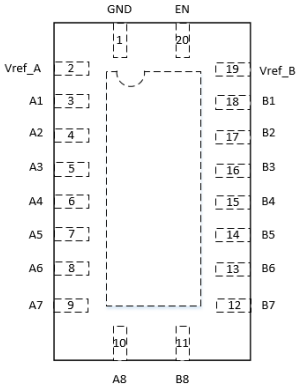



**W-QFN3030-16 (Type CJ)**

**LSF0108 Packages**




**TSSOP-20**




**V-QFN4525-20**

## Applications

- GPIO, MDIO, SDIO, SVID, UART
- PMBus, SMBus, I2C, and other interfaces
- Telecom infrastructures
- Industrials
- High-performance computing
- Wide array of products such as:
  - PCs, networking, notebooks
  - Smart phones
  - Tablets

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

## Pin Descriptions

**LSF0106 Pin Descriptions**

| Pin Name | Pin Number | | Function |
|---|---|---|---|
| | TSSOP-16 | W-QFN3030-16 (Type CJ) | |
| GND | 1 | 15 | Ground |
| Vref_A | 2 | 16 | Reference supply voltage; A port |
| A1 | 3 | 1 | Input/output 1 |
| A2 | 4 | 2 | Input/output 2 |
| A3 | 5 | 3 | Input/output 3 |
| A4 | 6 | 4 | Input/output 4 |
| A5 | 7 | 5 | Input/output 5 |
| A6 | 8 | 6 | Input/output 6 |
| B6 | 9 | 7 | Output/input 6 |
| B5 | 10 | 8 | Output/input 5 |
| B4 | 11 | 9 | Output/input 4 |
| B3 | 12 | 10 | Output/input 3 |
| B2 | 13 | 11 | Output/input 2 |
| B1 | 14 | 12 | Output/input 1 |
| Vref_B | 15 | 13 | Reference supply voltage; B port |
| EN | 16 | 14 | Enable input (Active HIGH) |

**LSF0108 Pin Descriptions**

| Pin Name | Pin Number | | Function |
|---|---|---|---|
| | TSSOP-20 | V-QFN4525-20 | |
| GND | 1 | 1 | Ground |
| Vref_A | 2 | 2 | Reference supply voltage; A port |
| A1 | 3 | 3 | Input/output 1 |
| A2 | 4 | 4 | Input/output 2 |
| A3 | 5 | 5 | Input/output 3 |
| A4 | 6 | 6 | Input/output 4 |
| A5 | 7 | 7 | Input/output 5 |
| A6 | 8 | 8 | Input/output 6 |
| A7 | 9 | 9 | Input/output 7 |
| A8 | 10 | 10 | Input/output 8 |
| B8 | 11 | 11 | Output/input 8 |
| B7 | 12 | 12 | Output/input 7 |
| B6 | 13 | 13 | Output/input 6 |
| B5 | 14 | 14 | Output/input 5 |
| B4 | 15 | 15 | Output/input 4 |
| B3 | 16 | 16 | Output/input 3 |
| B2 | 17 | 17 | Output/input 2 |
| B1 | 18 | 18 | Output/input 1 |
| Vref_B | 19 | 19 | Reference supply voltage; B port |
| EN | 20 | 20 | Enable input (Active HIGH) |

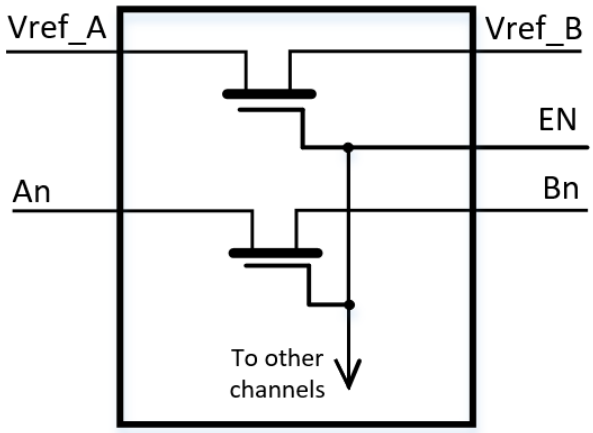
## Absolute Maximum Ratings (Note 4)

| Symbol | Parameter | Rating | Unit |
|---|---|---|---|
| ESD HBM | Human Body Model ESD Protection | ±3.5 | kV |
| ESD CDM | Charged Device Model ESD Protection | ±1.5 | kV |
| $V_{REF}$ | Supply Reference Voltage Range | -0.5 to +7.0 | V |
| $V_{I/O}$ | Input-Output Voltage Range | -0.5 to +7.0 | V |
| $I_{CH}$ | Continuous Channel Current | 128 | mA |
| $I_{IK}$ | Input Clamp Current, $V_I < 0$ | -50 | mA |
| $T_J$ | Junction Temperature | +150 | °C |
| $T_{STG}$ | Storage Temperature | -65 to +150 | °C |

Note: 4. Stresses greater than those listed under *Absolute Maximum Ratings* can cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to *Absolute Maximum Ratings* for extended periods can affect device reliability.

## Functional Diagram

**NOTE:**
**See Load Circuit**
Suggest to connect EN to Vref_B and both pins pulled to HIGH through a pullup resistor (typically 200kΩ)




## Recommended Operating Conditions

| Symbol | Parameter | Min | Max | Unit |
|---|---|---|---|---|
| Vref_A | Reference Voltage, A Port | 0.65 | 4.5 | V |
| Vref_B | Reference Voltage, B Port, when Vref_A ≥ 1V | Vref_A + 0.6 | 5.5 | V |
| | Reference Voltage, B Port, when Vref_A < 1V | Vref_A + 0.8 | 5.5 | V |
| $V_{I/O}$ | Input/Output Voltage | 0 | 5.5 | V |
| $V_{EN}$ | Enable Voltage when Vref_A ≥ 1V | Vref_A + 0.6 | 5.5 | V |
| | Enable Voltage when Vref_A < 1V | Vref_A + 0.8 | 5.5 | V |
| $I_{PASS}$ | Pass Transistor Current | — | 64 | mA |
| $T_A$ | Operating Free-Air Temperature | -40 | +125 | °C |

## Electrical Characteristics (Over operating free-air temperature range, unless otherwise specified.)

| Symbol | Parameter | Test Conditions | | Min | Typ (Note 5) | Max | Unit |
|---|---|---|---|---|---|---|---|
| Vref_A | A port supply voltage | What if config to be low voltage side | | 0.65 | — | 4.5 | V |
| Vref_B | B port supply voltage | What if config to be high voltage side | | 1.5 | — | 5.5 | V |
| $V_{IK}$ | Input clamping voltage | $I_I$ = -18mA, $V_{EN}$ = 0 | | -1.2 | — | 0 | V |
| $I_L$ | Leakage current | Pins An, Bn, Vref_A, Vref_B and EN; $V_I$ = GND to 5.0V | | 0.001 | 0.1 | 3 | µA |
| $I_{CC}$ | Supply current | Vref_B = EN = 5.5V, Vref_A = 4.5V, $I_O$ = 0, $V_I$ = 0V or $V_{CC}$ | | — | 0.05 | 5 | µA |
| $C_I$(Vref_A/B/EN) | | $V_I$ = 3V or 0 | | — | 10 | — | pF |
| $C_{IO(off)}$ | | $V_O$ = 3V or 0, EN = 0 | | — | 5 | 6 | pF |
| $C_{IO(on)}$ | | $V_O$ = 3V or 0, EN = 3 V | | — | 10 | 13 | pF |
| $R_{on}$ (Note 6) | | $V_I$ = 0, $I_O$ = 64mA | Vref_A = 3.3V; Vref_B = EN = 5V | — | 3 | — | Ω |
| | | | Vref_A = 2.5V; Vref_B = EN = 5V | — | 3 | — | |
| | | | Vref_A = 1.8V; Vref_B = EN = 5V | — | 4 | — | |
| | | | Vref_A = 1.0V; Vref_B = EN = 5V | — | 5 | — | |
| | | $V_I$ = 0, $I_O$ = 32mA | Vref_A = 3.3V; Vref_B = EN = 5V | — | 3 | — | |
| | | | Vref_A = 2.5V; Vref_B = EN = 5V | — | 3 | — | |
| | | | Vref_A = 1.8V; Vref_B = EN = 5V | — | 4 | — | |
| | | | Vref_A = 1.0V; Vref_B = EN = 5V | — | 5 | — | |
| | | $V_I$ = 0, $I_O$ = 20mA | Vref_A = 0.65V; Vref_B = EN = 5V | — | 15 | — | |
| | | $V_I$ = 1.8V, $I_O$ = 15mA, Vref_A = 3.3V; Vref_B = EN = 5V | | — | 4 | — | |
| | | $V_I$ = 1.0V, $I_O$ = 10mA, Vref_A = 1.8V; Vref_B = EN = 3.3V | | — | 7 | — | |
| | | $V_I$ = 0V, $I_O$ = 10mA | Vref_A = 1.0V; Vref_B = EN = 3.3V | — | 5 | — | |
| | | | Vref_A = 0.65V; Vref_B = EN = 3.3V | — | 15 | — | |
| | | | Vref_A = 1.0V; Vref_B = EN = 1.8V | — | 6 | — | |
| | | | Vref_A = 0.65V; Vref_B = EN = 1.8V | — | 15 | — | |

Notes: 5. All typical values are measured at $T_A$ = +25°C.
6. Measured by the voltage drop between the A and B pins at the indicated current through the switch. On-state resistance is determined by the lowest voltage of the two (A or B) pins.

## Translating Down Switching Characteristics (Note 7, $T_A$ = +25°C, unless otherwise specified.)

**Translating Down, 5.0V to 1.8V**

| Parameter | From (Input) | To (Output) | $C_L$ = 50pF | $C_L$ = 30pF | $C_L$ = 15pF | Unit |
|---|---|---|---|---|---|---|
| | | | Typ | Typ | Typ | |
| $t_{PLH}$ | B | A | 0.5 | 0.3 | 0.2 | ns |
| $t_{PHL}$ | | | 0.9 | 0.7 | 0.5 | ns |
| Test conditions: Vref_A = 1.8V, $V_{PU}$ = $V_{IH}$ = 5.0V, $V_M$ = 0.9V, PRR = 10MHz (unless otherwise noted, see load circuit) | | | | | | |

**Translating Down, 3.3V to 1.8V**

| Parameter | From (Input) | To (Output) | $C_L$ = 50pF | $C_L$ = 30pF | $C_L$ = 15pF | Unit |
|---|---|---|---|---|---|---|
| | | | Typ | Typ | Typ | |
| $t_{PLH}$ | B | A | 0.4 | 0.2 | 0.1 | ns |
| $t_{PHL}$ | | | 1.0 | 0.7 | 0.4 | ns |
| Test conditions: Vref_A = 1.8V, $V_{PU}$ = $V_{IH}$ = 3.3V, $V_M$ = 0.9V, PRR = 10MHz (unless otherwise noted, see load circuit) | | | | | | |

**Translating Down, 3.3V to 1.2V**

| Parameter | From (Input) | To (Output) | $C_L$ = 50pF | $C_L$ = 30pF | $C_L$ = 15pF | Unit |
|---|---|---|---|---|---|---|
| | | | Typ | Typ | Typ | |
| $t_{PLH}$ | B | A | 0.6 | 0.4 | 0.2 | ns |
| $t_{PHL}$ | | | 1.1 | 0.8 | 0.6 | ns |
| Test conditions: Vref_A = 1.2V, $V_{PU}$ = $V_{IH}$ = 3.3V, $V_M$ = 0.6V, PRR = 10MHz (unless otherwise noted, see load circuit) | | | | | | |

**Translating Down, 1.8V to 1.2V**

| Parameter | From (Input) | To (Output) | $C_L$ = 50pF | $C_L$ = 30pF | $C_L$ = 15pF | Unit |
|---|---|---|---|---|---|---|
| | | | Typ | Typ | Typ | |
| $t_{PLH}$ | B | A | 0.5 | 0.3 | 0.1 | ns |
| $t_{PHL}$ | | | 1.8 | 1.4 | 1.1 | ns |
| Test conditions: Vref_A = 1.2V, $V_{PU}$ = $V_{IH}$ = 1.8V, $V_M$ = 0.6V, PRR = 10MHz (unless otherwise noted, see load circuit) | | | | | | |

**Translating Down, 1.8V to 0.8V**

| Parameter | From (Input) | To (Output) | $C_L$ = 50pF | $C_L$ = 30pF | $C_L$ = 15pF | Unit |
|---|---|---|---|---|---|---|
| | | | Typ | Typ | Typ | |
| $t_{PLH}$ | B | A | 0.7 | 0.4 | 0.2 | ns |
| $t_{PHL}$ | | | 1.5 | 1.2 | 0.9 | ns |
| Test conditions: Vref_A = 0.8V, $V_{PU}$ = $V_{IH}$ = 1.8V, $V_M$ = 0.4V, PRR = 10MHz (unless otherwise noted, see load circuit) | | | | | | |

**Translating Down, 1.8V to 0.65V**

| Parameter | From (Input) | To (Output) | $C_L$ = 50pF | $C_L$ = 30pF | $C_L$ = 15pF | Unit |
|---|---|---|---|---|---|---|
| | | | Typ | Typ | Typ | |
| $t_{PLH}$ | B | A | 0.8 | 0.5 | 0.3 | ns |
| $t_{PHL}$ | | | 1.6 | 1.2 | 1.0 | ns |
| Test conditions: Vref_A = 0.65V, $V_{PU}$ = $V_{IH}$ = 1.5V, $V_M$ = 0.32V, PRR = 10MHz (unless otherwise noted, see load circuit) | | | | | | |

**Translating Down, 1.5V to 0.65V**

| Parameter | From (Input) | To (Output) | $C_L$ = 50pF | $C_L$ = 30pF | $C_L$ = 15pF | Unit |
|---|---|---|---|---|---|---|
| | | | Typ | Typ | Typ | |
| $t_{PLH}$ | B | A | 1.0 | 0.6 | 0.4 | ns |
| $t_{PHL}$ | | | 1.9 | 1.5 | 1.1 | ns |
| Test conditions: Vref_A = 0.65V, $V_{PU}$ = $V_{IH}$ = 1.5V, $V_M$ = 0.4V, PRR = 10MHz (unless otherwise noted, see load circuit) | | | | | | |

Note: 7. All typical values are measured at $T_A$ = +25°C. Logic levels: $V_{OL}$ and $V_{OH}$ are typical output voltage levels that occur with the output load. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10MHz; ZO = 50Ω. Definitions test circuit: $C_L$ = Load capacitance including jig and probe capacitance; $R_L$ = Load resistance = 300Ω; Rpu = ext. pullup resistance = 200kΩ.

## Translating Up Switching Characteristics (Note 7, $T_A$ = 25°C, unless otherwise specified.)

**Translating Up, 1.8V to 5.0V**

| Parameter | From (Input) | To (Output) | $C_L$ = 50pF | $C_L$ = 30pF | $C_L$ = 15pF | Unit |
|---|---|---|---|---|---|---|
| | | | Typ | Typ | Typ | |
| $t_{PLH}$ | A | B | 0.4 | 0.3 | 0.3 | ns |
| $t_{PHL}$ | | | 2.3 | 1.7 | 1.0 | ns |
| Test conditions: $V_{IH}$ = Vref_A = 1.8V, $V_{EXT}$ = $V_{PU}$ = 5.0V, $R_L$ = 300Ω, $V_M$ = 0.9V, PRR = 10MHz (unless otherwise noted, see load circuit) | | | | | | |

**Translating Up, 1.8V to 3.3V**

| Parameter | From (Input) | To (Output) | $C_L$ = 50pF | $C_L$ = 30pF | $C_L$ = 15pF | Unit |
|---|---|---|---|---|---|---|
| | | | Typ | Typ | Typ | |
| $t_{PLH}$ | A | B | 0.4 | 0.3 | 0.3 | ns |
| $t_{PHL}$ | | | 1.7 | 1.2 | 0.6 | ns |
| Test conditions: $V_{IH}$ = Vref_A = 1.8V, $V_{EXT}$ = $V_{PU}$ = 3.3V, $R_L$ = 300Ω, $V_M$ = 0.9V, PRR = 10MHz (unless otherwise noted, see load circuit) | | | | | | |

**Translating Up, 1.2V to 3.3V**

| Parameter | From (Input) | To (Output) | $C_L$ = 50pF | $C_L$ = 30pF | $C_L$ = 15pF | Unit |
|---|---|---|---|---|---|---|
| | | | Typ | Typ | Typ | |
| $t_{PLH}$ | A | B | 0.4 | 0.3 | 0.2 | ns |
| $t_{PHL}$ | | | 2.9 | 2.2 | 1.6 | ns |
| Test conditions: $V_{IH}$ = Vref_A = 1.2V, $V_{EXT}$ = $V_{PU}$ = 3.3V, $R_L$ = 300Ω, $V_M$ = 0.6V, PRR = 10MHz (unless otherwise noted, see load circuit) | | | | | | |

**Translating Up, 1.2V to 1.8V**

| Parameter | From (Input) | To (Output) | $C_L$ = 50pF | $C_L$ = 30pF | $C_L$ = 15pF | Unit |
|---|---|---|---|---|---|---|
| | | | Typ | Typ | Typ | |
| $t_{PLH}$ | A | B | 0.6 | 0.3 | 0.2 | ns |
| $t_{PHL}$ | | | 2.8 | 2.3 | 1.8 | ns |
| Test conditions: $V_{IH}$ = Vref_A = 1.2V, $V_{EXT}$ = $V_{PU}$ = 1.8V, $R_L$ = 300Ω, $V_M$ = 0.6V, PRR = 10MHz (unless otherwise noted, see load circuit) | | | | | | |

**Translating Up, 0.8V to 1.8V**

| Parameter | From (Input) | To (Output) | $C_L$ = 50pF | $C_L$ = 30pF | $C_L$ = 15pF | Unit |
|---|---|---|---|---|---|---|
| | | | Typ | Typ | Typ | |
| $t_{PLH}$ | A | B | 0.6 | 0.3 | 0.2 | ns |
| $t_{PHL}$ | | | 3.7 | 2.9 | 2.1 | ns |
| Test conditions: $V_{IH}$ = Vref_A = 0.8V, $V_{EXT}$ = $V_{PU}$ = 1.8V, $R_L$ = 300Ω, $V_M$ = 0.4V, PRR = 10MHz (unless otherwise noted, see load circuit) | | | | | | |

**Translating Up, 0.65V to 1.8V**

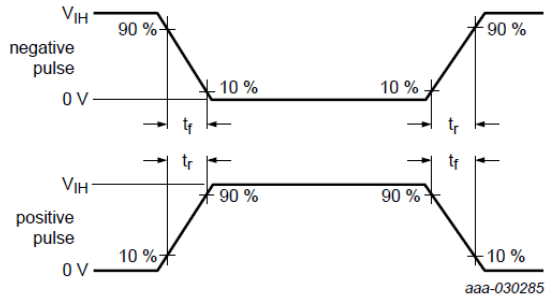
| Parameter | From (Input) | To (Output) | $C_L$ = 50pF | $C_L$ = 30pF | $C_L$ = 15pF | Unit |
|---|---|---|---|---|---|---|
| | | | Typ | Typ | Typ | |
| $t_{PLH}$ | A | B | 0.7 | 0.3 | 0.2 | ns |
| $t_{PHL}$ | | | 5.0 | 3.8 | 2.7 | ns |
| Test conditions: $V_{IH}$ = Vref_A = 0.65V, $V_{EXT}$ = $V_{PU}$ = 1.8V, $R_L$ = 300Ω, $V_M$ = 0.32V, PRR = 10MHz (unless otherwise noted, see load circuit) | | | | | | |

**Translating Up, 0.65V to 1.5V**

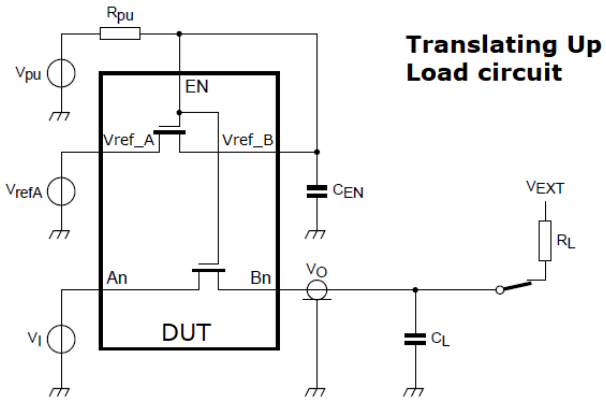
| Parameter | From (Input) | To (Output) | $C_L$ = 50pF | $C_L$ = 30pF | $C_L$ = 15pF | Unit |
|---|---|---|---|---|---|---|
| | | | Typ | Typ | Typ | |
| $t_{PLH}$ | A | B | 0.7 | 0.3 | 0.2 | ns |
| $t_{PHL}$ | | | 5.0 | 3.8 | 2.7 | ns |
| Test conditions: $V_{IH}$ = Vref_A = 0.65V, $V_{EXT}$ = $V_{PU}$ = 1.8V, $R_L$ = 300Ω, $V_M$ = 0.32V, PRR = 10MHz (unless otherwise noted, see load circuit) | | | | | | |

Note: 7. All typical values are measured at $T_A$ = +25°C. Logic levels: $V_{OL}$ and $V_{OH}$ are typical output voltage levels that occur with the output load. All input pulses are supplied by generators having the following characteristics: PRR ≤ 10MHz; ZO = 50Ω. Definitions test circuit: $C_L$ = Load capacitance including jig and probe capacitance; $R_L$ = Load resistance = 300Ω; Rpu = ext. pullup resistance = 200kΩ.

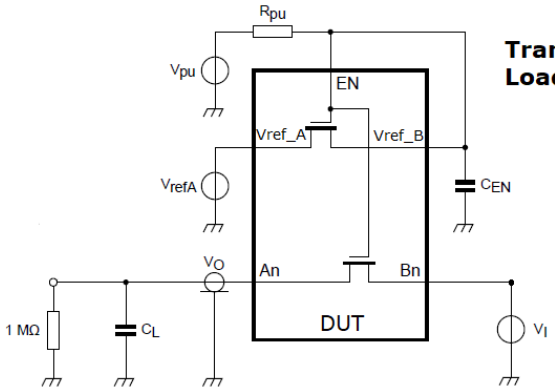
## Parameter Measurement Information



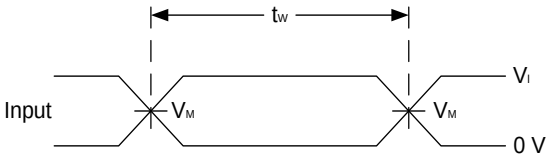

$V_I$ source waveform



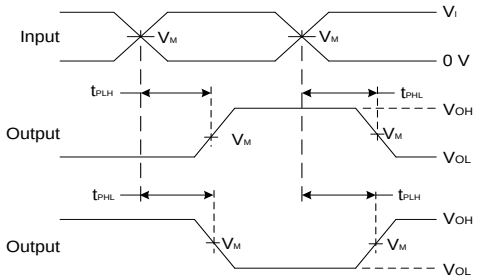

**Translating Up Load circuit**




**Translating Down Load circuit**




**Voltage Waveform Pulse Duration**




Voltage Waveform Propagation Delay Times
Inverting and Non-Inverting Outputs

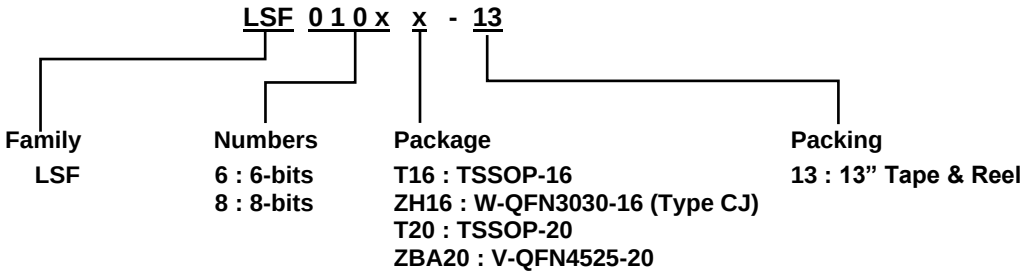
**Figure 1. Load Circuit and Voltage Waveforms, Rpu = 200kΩ, $C_{EN}$ = 0.1µF, $R_L$ = 300Ω, $C_L$ = 15pF, 30pF, 50pF**

## Package Characteristics

| Symbol | Parameter | Package | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| $\theta_{JA}$ | Thermal Resistance Junction-to-Ambient | TSSOP-16 | Note 8 | — | 136 | — | °C/W |
| | | W-QFN3030-16 (Type CJ) | | — | 89 | — | |
| | | TSSOP-20 | | — | 95 | — | |
| | | V-QFN4525-20 | | — | 59 | — | |
| $\theta_{JC}$ | Thermal Resistance Junction-to-Case | TSSOP-16 | Note 8 | — | 57 | — | |
| | | W-QFN3030-16 (Type CJ) | | — | 26 | — | |
| | | TSSOP-20 | | — | 22 | — | |
| | | V-QFN4525-20 | | — | 22 | — | |

Note: 8. Test condition for each of the 3 package types: device mounted on JEDEC standard PCB per JESD51, with minimum recommended pad layout.

## Ordering Information




| Orderable Part Number | Part Number Suffix | Package Code | Package | Packing (Note 9) | |
|---|---|---|---|---|---|
| | | | | Qty. | Carrier |
| LSF0106T16-13 | -13 | T16 | TSSOP-16 | 2500 | 13" Tape and Reel |
| LSF0106ZH16-13 | -13 | ZH16 | W-QFN3030-16 (Type CJ) | 5000 | 13" Tape and Reel |
| LSF0108T20-13 | -13 | T20 | TSSOP-20 | 4000 | 13" Tape and Reel |
| LSF0108ZBA20-13 | -13 | ZBA20 | V-QFN4525-20 | 2500 | 13" Tape and Reel |

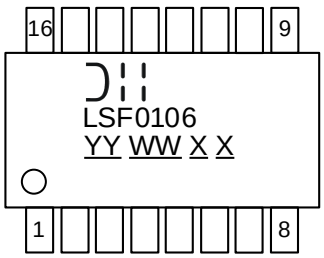
Notes: 9. The taping orientation is located on our website at https://www.diodes.com/assets/Packaging-Support-Docs/ap02007.pdf
10. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/.
11. Pad layout as shown in Diodes Incorporated's package outline PDFs, which can be found on our website at http://www.diodes.com/package-outlines.html.

## Marking Information

**For LSF0106**

**(1) TSSOP-16**

**(Top View)**



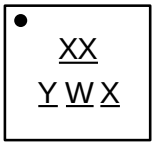

YY : Year (ex: 24 = 2024)
WW : Week : 01 to 52; 52 represents week 52 and 53
X X : Internal Code

| Orderable Part Number | Package | Identification Code |
|---|---|---|
| LSF0106T16-13 | TSSOP-16 | LSF0106 |

## Marking Information (continued)

**(2) W-QFN3030-16 (Type CJ)**

**(Top View)**



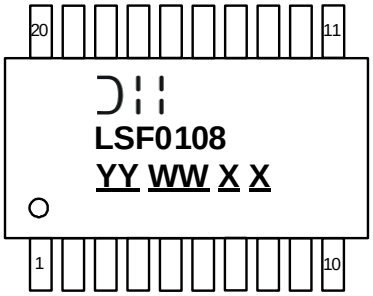

XX : Identification Code
Y : Year : 0 to 9 (ex: 4 = 2024)
W : Week : A to Z : week 1 to 26;
a to z : week 27 to 52; z represents
week 52 and 53
X : Internal Code

| Orderable Part Number | Package | Identification Code |
|---|---|---|
| LSF0106ZH16-13 | W-QFN3030-16 (Type CJ) | JG |

**For LSF0108**

**(1) TSSOP-20**

**(Top View)**

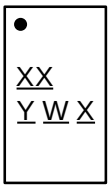



YY : Year (ex: 24 = 2024)
WW : Week : 01 to 52; 52
represents week 52 and 53
XX : Internal Code

| Orderable Part Number | Package | Identification Code |
|---|---|---|
| LSF0108T20-13 | TSSOP-20 | LSF0108 |

**(2) V-QFN4525-20**

**(Top View)**



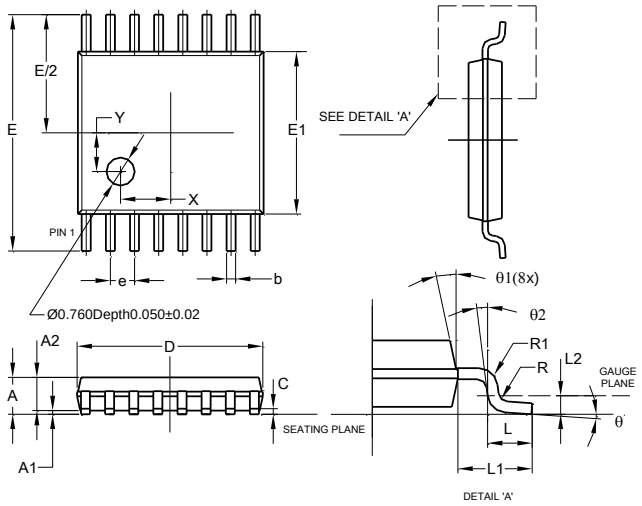

XX : Identification Code
Y : Year : 0 to 9 (ex: 4 = 2024)
W : Week : A to Z : week 1 to 26;
a to z : week 27 to 52; z represents
week 52 and 53
X : Internal Code

| Orderable Part Number | Package | Identification Code |
|---|---|---|
| LSF0108ZBA20-13 | V-QFN4525-20 | JH |

## Package Outline Dimensions (LSF0106)

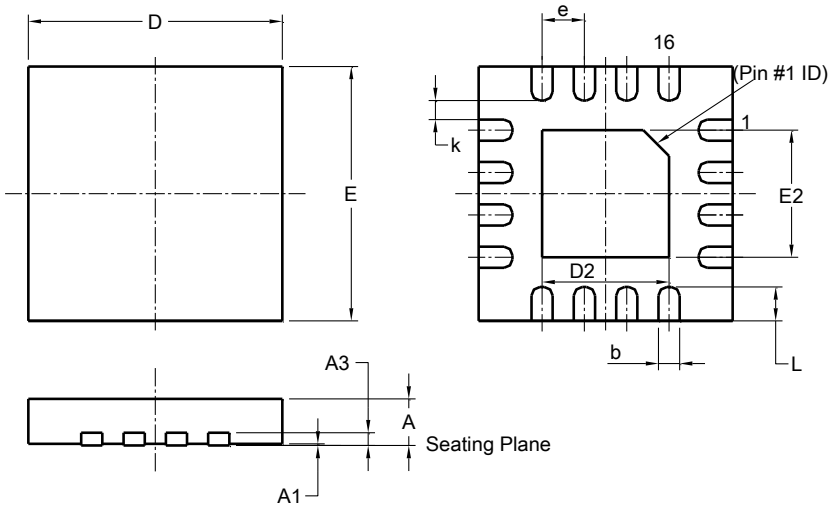
Please see http://www.diodes.com/package-outlines.html for the latest version.

**TSSOP-16**




| TSSOP-16 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | - | 1.08 | - |
| **A1** | 0.05 | 0.15 | - |
| **A2** | 0.80 | 0.93 | - |
| **b** | 0.19 | 0.30 | - |
| **c** | 0.09 | 0.20 | - |
| **D** | 4.90 | 5.10 | - |
| **E** | 6.40 BSC | | |
| **E1** | 4.30 | 4.50 | - |
| **e** | 0.65 BSC | | |
| **L** | 0.45 | 0.75 | - |
| **L1** | 1.00 REF | | |
| **L2** | 0.25 BSC | | |
| **R / R1** | 0.09 | - | - |
| **X** | - | - | 1.350 |
| **Y** | - | - | 1.050 |
| **θ** | 0° | 8° | - |
| **θ1** | 5° | 15° | - |
| **θ2** | 0° | - | - |
| **All Dimensions in mm** | | | |

**W-QFN3030-16 (Type CJ)**

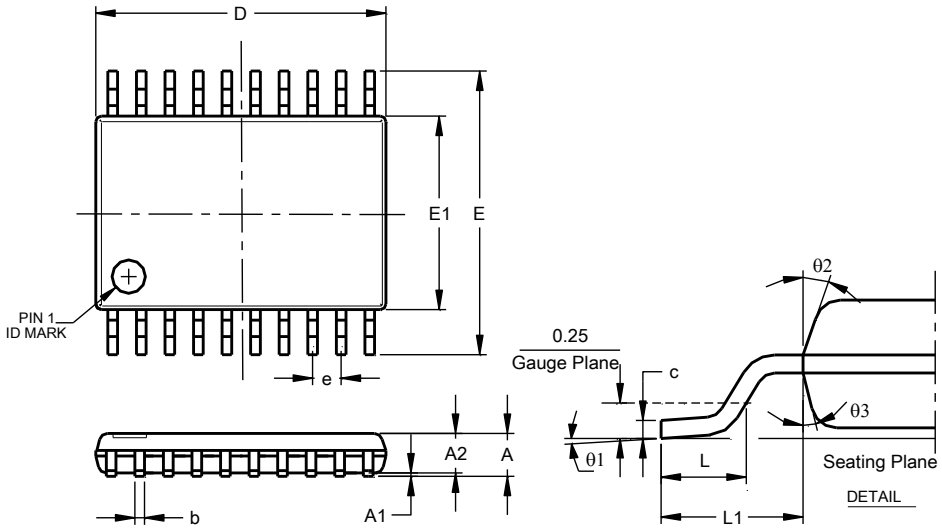



| W-QFN3030-16 (Type CJ) | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.700 | 0.800 | -- |
| **A1** | 0.000 | 0.050 | -- |
| **A3** | 0.203 REF | | |
| **b** | 0.180 | 0.300 | -- |
| **D** | 3.00 BSC | | |
| **D2** | 1.600 | 1.800 | -- |
| **E** | 3.00 BSC | | |
| **E2** | 1.600 | 1.800 | -- |
| **e** | 0.500 TYP | | |
| **k** | 0.200 MIN | | |
| **L** | 0.300 | 0.500 | -- |
| **All Dimensions in mm** | | | |

## Package Outline Dimensions (LSF0108)

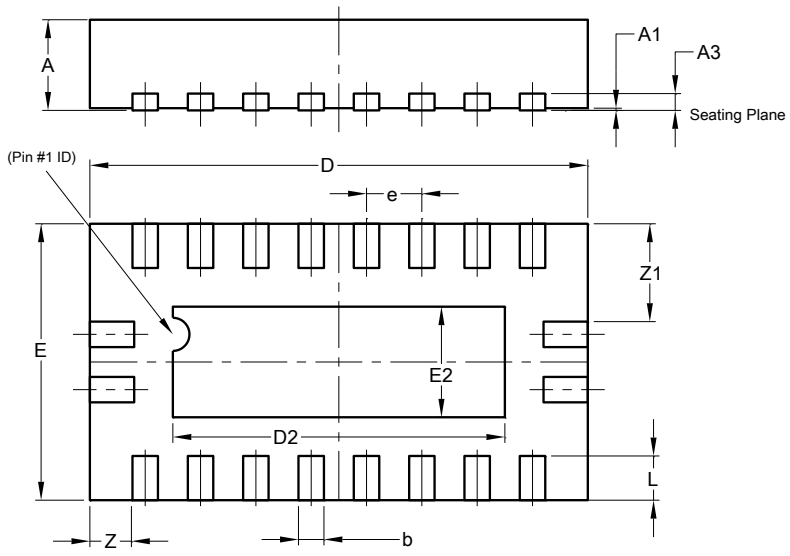
Please see http://www.diodes.com/package-outlines.html for the latest version.

**TSSOP-20**




| TSSOP-20 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | - | 1.20 | - |
| **A1** | 0.05 | 0.15 | - |
| **A2** | 0.80 | 1.05 | - |
| **b** | 0.19 | 0.30 | - |
| **c** | 0.09 | 0.20 | - |
| **D** | 6.40 | 6.60 | 6.50 |
| **E** | 6.20 | 6.60 | 6.40 |
| **E1** | 4.30 | 4.50 | 4.40 |
| **e** | 0.65 BSC | | |
| **L** | 0.45 | 0.75 | 0.60 |
| **L1** | 1.0 REF | | |
| **θ1** | 0° | 8° | - |
| **θ2** | 10° | 14° | 12° |
| **θ3** | 10° | 14° | 12° |
| **All Dimensions in mm** | | | |

**V-QFN4525-20**

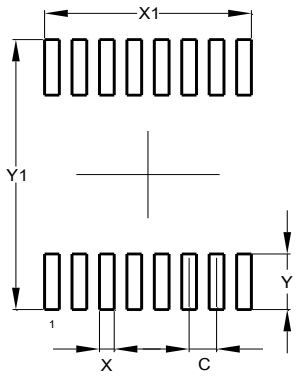



| V-QFN4525-20 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.75 | 0.85 | 0.80 |
| **A1** | 0.00 | 0.05 | 0.02 |
| **A3** | - | - | 0.15 |
| **b** | 0.18 | 0.30 | 0.23 |
| **D** | 4.45 | 4.55 | 4.50 |
| **D2** | 2.85 | 3.15 | 3.00 |
| **E** | 2.45 | 2.55 | 2.50 |
| **E2** | 0.85 | 1.15 | 1.00 |
| **e** | 0.50BSC | | |
| **L** | 0.30 | 0.50 | 0.40 |
| **Z** | - | - | 0.385 |
| **Z1** | - | - | 0.885 |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout (LSF0106)

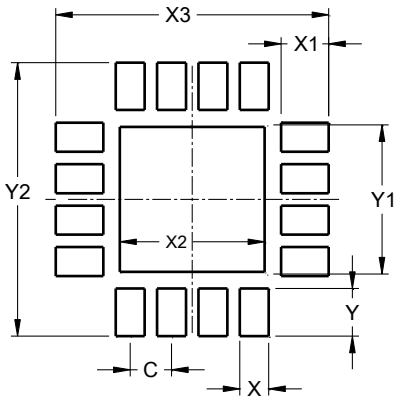
Please see http://www.diodes.com/package-outlines.html for the latest version.

**TSSOP-16**




| Dimensions | Value (in mm) |
|---|---|
| C | 0.650 |
| X | 0.350 |
| X1 | 4.900 |
| Y | 1.400 |
| Y1 | 6.800 |

**W-QFN3030-16 (Type CJ)**

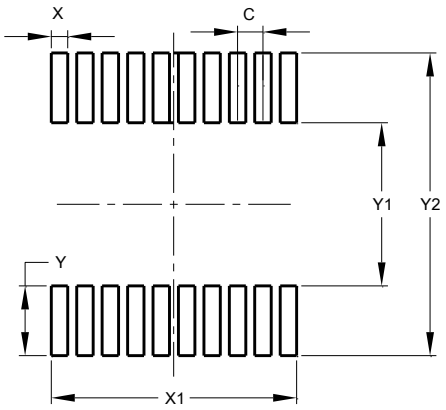



| Dimensions | Value (in mm) |
|---|---|
| C | 0.500 |
| X | 0.350 |
| X1 | 0.570 |
| X2 | 1.800 |
| X3 | 3.300 |
| Y | 0.570 |
| Y1 | 1.800 |
| Y2 | 3.300 |

## Suggested Pad Layout (LSF0108)

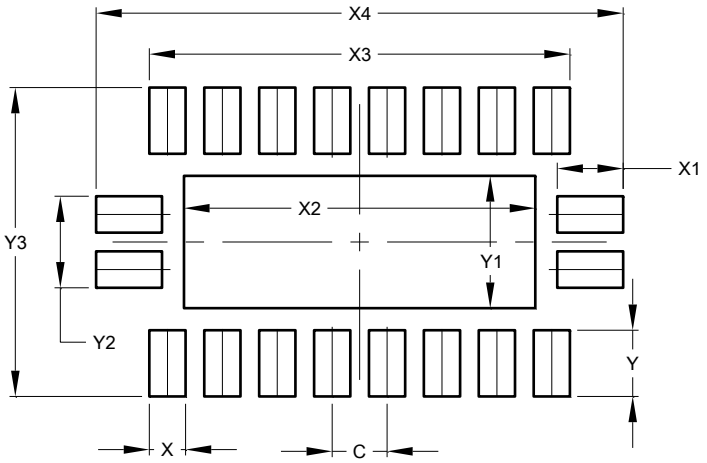
Please see http://www.diodes.com/package-outlines.html for the latest version.

**TSSOP-20**




| Dimensions | Value (in mm) |
|---|---|
| C | 0.650 |
| X | 0.420 |
| X1 | 6.270 |
| Y | 1.780 |
| Y1 | 4.160 |
| Y2 | 7.720 |

**V-QFN4525-20**




| Dimensions | Value (in mm) |
|---|---|
| C | 0.500 |
| X | 0.330 |
| X1 | 0.600 |
| X2 | 3.200 |
| X3 | 3.830 |
| X4 | 4.800 |
| Y | 0.600 |
| Y1 | 1.200 |
| Y2 | 0.830 |
| Y3 | 2.800 |

## Mechanical Data

- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 e3
- Max Soldering Temperature +260°C for 30 secs as per JEDEC J-STD-020
- Weight:
  - TSSOP-16: 0.054811 grams (Approximate)
  - W-QFN3030-16 (Type CJ): 0.035 grams (Approximate)
  - TSSOP-20: 0.071 grams (Approximate)
  - V-QFN4525-20: 0.024 grams (Approximate)

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