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# IP4251/52/53/54-TTL

**Integrated 4-, 6- and 8-channel passive filter network with ESD protection**

Rev. 2 — 5 May 2011 **Product data sheet**

## 1. Product profile

### 1.1 General description

The devices are 4-, 6- and 8-channel RC low-pass filter arrays which are designed to provide filtering of undesired RF signals on the I/O ports of portable communication or computing devices. In addition, the devices incorporate diodes to provide protection to downstream components from ElectroStatic Discharge (ESD) voltages as high as ±30 kV.

The devices are fabricated using monolithic silicon technology and integrate up to eight resistors and sixteen diodes in a 0.4 mm pitch 8-, 12- or 16-pin ultra-thin leadless Quad Flat No-leads (QFN) plastic package with a height of 0.55 mm only.

### 1.2 Features and benefits

- Pb-free, Restriction of Hazardous Substances (RoHS) compliant and free of halogen and antimony (Dark Green compliant)
- 4-, 6- and 8-channel integrated $\pi$-type RC filter network
- ESD protection to ±30 kV contact discharge according to IEC 61000-4-2 far exceeding level 4
- QFN plastic package with 0.4 mm pitch and 0.55 mm height

### 1.3 Applications

General-purpose ElectroMagnetic Interference (EMI) and Radio-Frequency Interference (RFI) filtering and downstream ESD protection for:

- Cellular phone and Personal Communication System (PCS) mobile handsets
- Cordless telephones
- Wireless data (WAN/LAN) systems
- Mobile Internet Devices (MID)
- Portable Media Players (PMP)

## 1.4 Quick reference data

**Table 1.    Quick reference data**

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **IP4251CZ8-4-TTL; IP4251CZ12-6-TTL; IP4251CZ16-8-TTL** | | | | | | | |
| $C_{ch}$ | channel capacitance | f = 100 kHz; $V_{bias(DC)}$ = 2.5 V | [1] | - | 10 | - | pF |
| $R_{s(ch)}$ | channel series resistance | | | 80 | 100 | 120 | Ω |
| **IP4252CZ8-4-TTL; IP4252CZ12-6-TTL; IP4252CZ16-8-TTL** | | | | | | | |
| $C_{ch}$ | channel capacitance | f = 100 kHz; $V_{bias(DC)}$ = 2.5 V | [1] | - | 12 | - | pF |
| $R_{s(ch)}$ | channel series resistance | | | 32 | 40 | 48 | Ω |
| **IP4253CZ8-4-TTL; IP4253CZ12-6-TTL; IP4253CZ16-8-TTL** | | | | | | | |
| $C_{ch}$ | channel capacitance | f = 100 kHz; $V_{bias(DC)}$ = 2.5 V | [1] | - | 30 | - | pF |
| $R_{s(ch)}$ | channel series resistance | | | 160 | 200 | 240 | Ω |
| **IP4254CZ8-4-TTL; IP4254CZ12-6-TTL; IP4254CZ16-8-TTL** | | | | | | | |
| $C_{ch}$ | channel capacitance | f = 100 kHz; $V_{bias(DC)}$ = 2.5 V | [1] | - | 30 | - | pF |
| $R_{s(ch)}$ | channel series resistance | | | 80 | 100 | 120 | Ω |
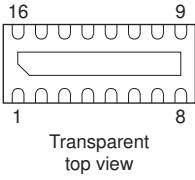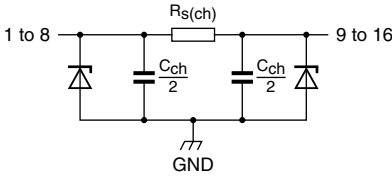
[1]    For the total channel.

# 2.  Pinning information

**Table 2.    Pinning**

| Pin | Description | Simplified outline | Graphic symbol |
|---|---|---|---|
| **IP4251CZ8-4-TTL; IP4252CZ8-4-TTL; IP4253CZ8-4-TTL; IP4254CZ8-4-TTL (SOT1166-1)** | | | |
| 1 and 8 | filter channel 1 | | |
| 2 and 7 | filter channel 2 | | |
| 3 and 6 | filter channel 3 | | |
| 4 and 5 | filter channel 4 | | |
| ground pad | ground | | |
| **IP4251CZ12-6-TTL; IP4252CZ12-6-TTL; IP4253CZ12-6-TTL; IP4254CZ12-6-TTL (SOT1167-1)** | | | |
| 1 and 12 | filter channel 1 | | |
| 2 and 11 | filter channel 2 | | |
| 3 and 10 | filter channel 3 | | |
| 4 and 9 | filter channel 4 | | |
| 5 and 8 | filter channel 5 | | |
| 6 and 7 | filter channel 6 | | |
| ground pad | ground | | |

IP4251_52_53_54-TTL

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**Product data sheet**

**Rev. 2 — 5 May 2011**

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**Table 2.    Pinning** …continued

| Pin | Description | Simplified outline | Graphic symbol |
|---|---|---|---|
| **IP4251CZ16-8-TTL; IP4252CZ16-8-TTL; IP4253CZ16-8-TTL; IP4254CZ16-8-TTL (SOT1168-1)** | | | |
| 1 and 16 | filter channel 1 | | |
| 2 and 15 | filter channel 2 | | |
| 3 and 14 | filter channel 3 | | |
| 4 and 13 | filter channel 4 | | |
| 5 and 12 | filter channel 5 | | |
| 6 and 11 | filter channel 6 | | |
| 7 and 10 | filter channel 7 | | |
| 8 and 9 | filter channel 8 | | |
| ground pad | ground | | |



Transparent top view

018aaa073

# 3.   Ordering information

**Table 3.    Ordering information**

| Type number | Package | | Version |
|---|---|---|---|
| | **Name** | **Description** | |
| IP4251CZ8-4-TTL | HUSON8 | plastic, thermal enhanced ultra thin small outline package; no leads; 8 terminals; body $1.35 \times 1.7 \times 0.55$ mm | SOT1166-1 |
| IP4251CZ12-6-TTL | HUSON12 | plastic, thermal enhanced ultra thin small outline package; no leads; 12 terminals; body $1.35 \times 2.5 \times 0.55$ mm | SOT1167-1 |
| IP4251CZ16-8-TTL | HUSON16 | plastic, thermal enhanced ultra thin small outline package; no leads; 16 terminals; body $1.35 \times 3.3 \times 0.55$ mm | SOT1168-1 |
| IP4252CZ8-4-TTL | HUSON8 | plastic, thermal enhanced ultra thin small outline package; no leads; 8 terminals; body $1.35 \times 1.7 \times 0.55$ mm | SOT1166-1 |
| IP4252CZ12-6-TTL | HUSON12 | plastic, thermal enhanced ultra thin small outline package; no leads; 12 terminals; body $1.35 \times 2.5 \times 0.55$ mm | SOT1167-1 |
| IP4252CZ16-8-TTL | HUSON16 | plastic, thermal enhanced ultra thin small outline package; no leads; 16 terminals; body $1.35 \times 3.3 \times 0.55$ mm | SOT1168-1 |
| IP4253CZ8-4-TTL | HUSON8 | plastic, thermal enhanced ultra thin small outline package; no leads; 8 terminals; body $1.35 \times 1.7 \times 0.55$ mm | SOT1166-1 |
| IP4253CZ12-6-TTL | HUSON12 | plastic, thermal enhanced ultra thin small outline package; no leads; 12 terminals; body $1.35 \times 2.5 \times 0.55$ mm | SOT1167-1 |
| IP4253CZ16-8-TTL | HUSON16 | plastic, thermal enhanced ultra thin small outline package; no leads; 16 terminals; body $1.35 \times 3.3 \times 0.55$ mm | SOT1168-1 |
| IP4254CZ8-4-TTL | HUSON8 | plastic, thermal enhanced ultra thin small outline package; no leads; 8 terminals; body $1.35 \times 1.7 \times 0.55$ mm | SOT1166-1 |
| IP4254CZ12-6-TTL | HUSON12 | plastic, thermal enhanced ultra thin small outline package; no leads; 12 terminals; body $1.35 \times 2.5 \times 0.55$ mm | SOT1167-1 |
| IP4254CZ16-8-TTL | HUSON16 | plastic, thermal enhanced ultra thin small outline package; no leads; 16 terminals; body $1.35 \times 3.3 \times 0.55$ mm | SOT1168-1 |

## 4.  Limiting values

**Table 4.    Limiting values**
*In accordance with the Absolute Maximum Rating System (IEC 60134).*

| Symbol | Parameter | Conditions | Min | Max | Unit |
|---|---|---|---|---|---|
| **IP4251CZ8-4-TTL; IP4251CZ12-6-TTL; IP4251CZ16-8-TTL** | | | | | |
| $V_{ESD}$ | electrostatic discharge voltage | all pins to ground; contact discharge | [1] - | ±15 | kV |
| **IP4252CZ8-4-TTL; IP4252CZ12-6-TTL; IP4252CZ16-8-TTL** | | | | | |
| $V_{ESD}$ | electrostatic discharge voltage | all pins to ground; contact discharge | [1] - | ±15 | kV |
| **IP4253CZ8-4-TTL; IP4253CZ12-6-TTL; IP4253CZ16-8-TTL** | | | | | |
| $V_{ESD}$ | electrostatic discharge voltage | all pins to ground | [2] | | |
| | | contact discharge | - | ±30 | kV |
| | | air discharge | - | ±30 | kV |
| **IP4254CZ8-4-TTL; IP4254CZ12-6-TTL; IP4254CZ16-8-TTL** | | | | | |
| $V_{ESD}$ | electrostatic discharge voltage | all pins to ground | [2] | | |
| | | contact discharge | - | ±30 | kV |
| | | air discharge | - | ±30 | kV |
| **Per device** | | | | | |
| $V_{ESD}$ | electrostatic discharge voltage | IEC 61000-4-2, level 4; all pins to ground | | | |
| | | contact discharge | - | ±8 | kV |
| | | air discharge | - | ±15 | kV |
| $V_{CC}$ | supply voltage | | −0.5 | +5.6 | V |
| $P_{ch}$ | channel power dissipation | $T_{amb}$ = 85 °C | - | 60 | mW |
| $P_{tot}$ | total power dissipation | $T_{amb}$ = 85 °C | - | 200 | mW |
| $T_{stg}$ | storage temperature | | −55 | +150 | °C |
| $T_{amb}$ | ambient temperature | | −40 | +85 | °C |

[1]    Device tested with 1000 pulses of ±15 kV contact discharges, according to the IEC 61000-4-2 model, far exceeding IEC 61000-4-2 level 4 (8 kV contact discharge).

[2]    Device tested with 1000 pulses of ±30 kV contact discharges, according to the IEC 61000-4-2 model, far exceeding IEC 61000-4-2 level 4 (8 kV contact discharge).

## 5. Characteristics

**Table 5.    Channel characteristics**
*$T_{amb}$ = 25 °C unless otherwise specified.*

| Symbol | Parameter | Conditions | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| **IP4251CZ8-4-TTL; IP4251CZ12-6-TTL; IP4251CZ16-8-TTL** | | | | | | | |
| $C_{ch}$ | channel capacitance | f = 100 kHz | [1] | | | | |
| | | $V_{bias(DC)}$ = 2.5 V | | - | 10 | - | pF |
| | | $V_{bias(DC)}$ = 0 V | [2] | - | 15 | - | pF |
| $R_{s(ch)}$ | channel series resistance | | | 80 | 100 | 120 | Ω |
| **IP4252CZ8-4-TTL; IP4252CZ12-6-TTL; IP4252CZ16-8-TTL** | | | | | | | |
| $C_{ch}$ | channel capacitance | f = 100 kHz | [1] | | | | |
| | | $V_{bias(DC)}$ = 2.5 V | | - | 12 | - | pF |
| | | $V_{bias(DC)}$ = 0 V | [2] | - | 18 | - | pF |
| $R_{s(ch)}$ | channel series resistance | | | 32 | 40 | 48 | Ω |
| **IP4253CZ8-4-TTL; IP4253CZ12-6-TTL; IP4253CZ16-8-TTL** | | | | | | | |
| $C_{ch}$ | channel capacitance | f = 100 kHz | [1] | | | | |
| | | $V_{bias(DC)}$ = 2.5 V | | - | 30 | - | pF |
| | | $V_{bias(DC)}$ = 0 V | [2] | - | 45 | - | pF |
| $R_{s(ch)}$ | channel series resistance | | | 160 | 200 | 240 | Ω |
| **IP4254CZ8-4-TTL; IP4254CZ12-6-TTL; IP4254CZ16-8-TTL** | | | | | | | |
| $C_{ch}$ | channel capacitance | f = 100 kHz | [1] | | | | |
| | | $V_{bias(DC)}$ = 2.5 V | | - | 30 | - | pF |
| | | $V_{bias(DC)}$ = 0 V | [2] | - | 45 | - | pF |
| $R_{s(ch)}$ | channel series resistance | | | 80 | 100 | 120 | Ω |
| **Per device** | | | | | | | |
| $I_{LR}$ | reverse leakage current | per channel; $V_I$ = 3.5 V | | - | - | 0.1 | μA |
| $V_{BR}$ | breakdown voltage | positive clamp; $I_I$ = 1 mA | | 5.8 | - | 9 | V |
| $V_F$ | forward voltage | negative clamp; $I_F$ = 1 mA | | 0.4 | - | 1.5 | V |

[1]    For the total channel.

[2]    Guaranteed by design.

**Table 6.    Frequency characteristics**
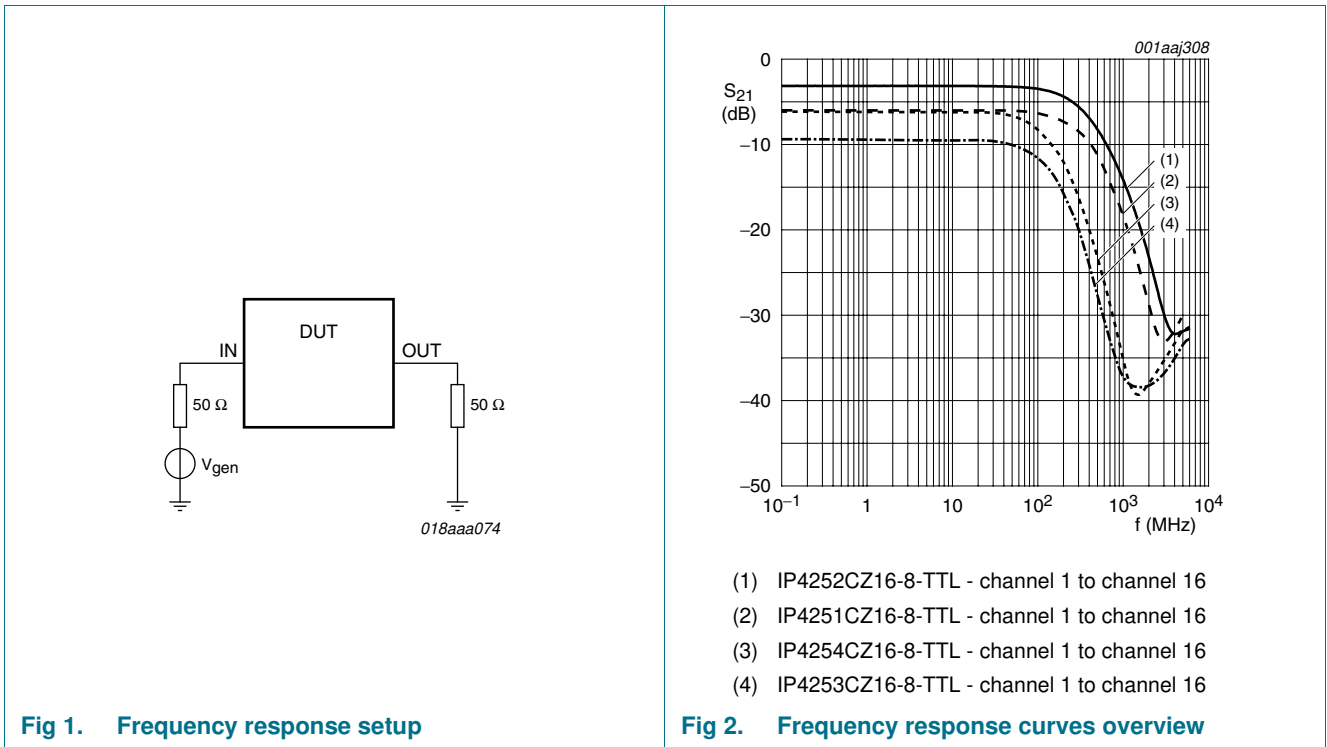*T$_{amb}$ = 25 °C unless otherwise specified.*

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--------|-----------|-----------|-----|-----|-----|------|
| **IP4251CZ8-4-TTL; IP4251CZ12-6-TTL; IP4251CZ16-8-TTL** | | | | | | |
| $\alpha_{il}$ | insertion loss | R$_{source}$ = 50 Ω; R$_L$ = 50 Ω | | | | |
| | | 800 MHz < f < 3 GHz | - | 16 | - | dB |
| | | f = 1 GHz | - | 20 | - | dB |
| $\alpha_{ct}$ | crosstalk attenuation | R$_{source}$ = 50 Ω; R$_L$ = 50 Ω; 800 MHz < f < 3 GHz | - | 30 | - | dB |
| **IP4252CZ8-4-TTL; IP4252CZ12-6-TTL; IP4252CZ16-8-TTL** | | | | | | |
| $\alpha_{il}$ | insertion loss | R$_{source}$ = 50 Ω; R$_L$ = 50 Ω | | | | |
| | | 800 MHz < f < 3 GHz | - | 12 | - | dB |
| | | f = 1 GHz | - | 14 | - | dB |
| $\alpha_{ct}$ | crosstalk attenuation | R$_{source}$ = 50 Ω; R$_L$ = 50 Ω; 800 MHz < f < 3 GHz | - | 40 | - | dB |
| **IP4253CZ8-4-TTL; IP4253CZ12-6-TTL; IP4253CZ16-8-TTL** | | | | | | |
| $\alpha_{il}$ | insertion loss | R$_{source}$ = 50 Ω; R$_L$ = 50 Ω | | | | |
| | | 800 MHz < f < 3 GHz | - | 33 | - | dB |
| | | f = 1 GHz | 35 | - | - | dB |
| $\alpha_{ct}$ | crosstalk attenuation | R$_{source}$ = 50 Ω; R$_L$ = 50 Ω; 800 MHz < f < 3 GHz | - | 30 | - | dB |
| **IP4254CZ8-4-TTL; IP4254CZ12-6-TTL; IP4254CZ16-8-TTL** | | | | | | |
| $\alpha_{il}$ | insertion loss | R$_{source}$ = 50 Ω; R$_L$ = 50 Ω | | | | |
| | | 800 MHz < f < 3 GHz | - | 28 | - | dB |
| | | f = 1 GHz | 30 | - | - | dB |
| $\alpha_{ct}$ | crosstalk attenuation | R$_{source}$ = 50 Ω; R$_L$ = 50 Ω; 800 MHz < f < 3 GHz | - | 30 | - | dB |

IP4251_52_53_54-TTL

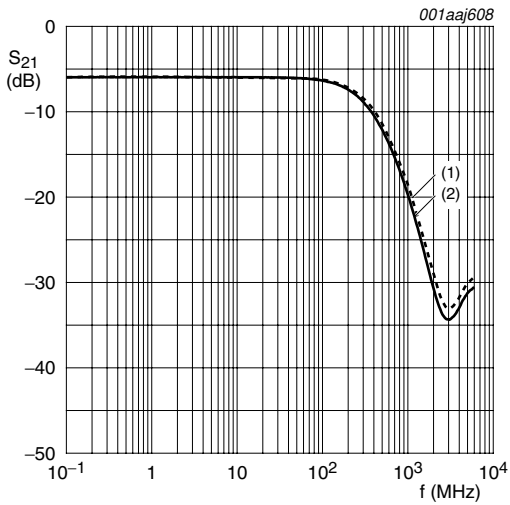**Product data sheet** **Rev. 2 — 5 May 2011** **6 of 18**

## 6. Application information

### 6.1 Insertion loss

The devices are designed as EMI/RFI filters for multichannel interfaces.

The block schematic for measuring insertion loss in a 50 Ω system is shown in Figure 1. Typical measurements results are shown in Figure 2 to Figure 6 for the different devices.



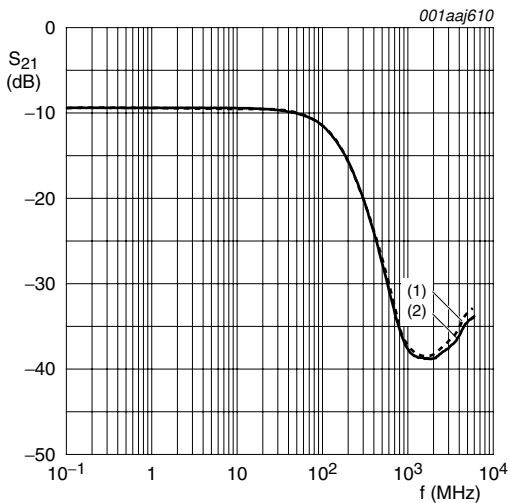**Fig 1.    Frequency response setup**



(1)    IP4252CZ16-8-TTL - channel 1 to channel 16
(2)    IP4251CZ16-8-TTL - channel 1 to channel 16
(3)    IP4254CZ16-8-TTL - channel 1 to channel 16
(4)    IP4253CZ16-8-TTL - channel 1 to channel 16

**Fig 2.    Frequency response curves overview**

IP4251_52_53_54-TTL

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(1) Channel 1 to channel 16

(2) Channel 4 to channel 13

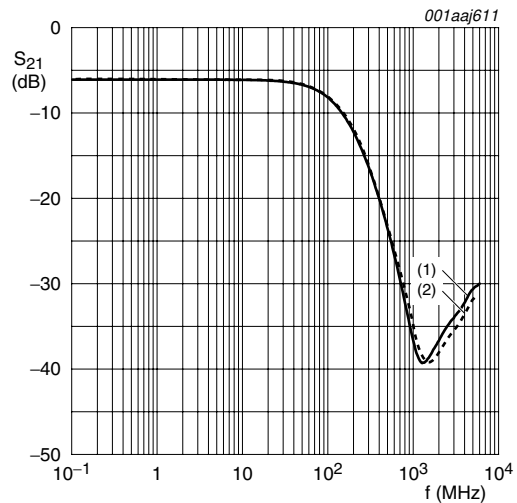**Fig 3.** **IP4251CZ16-8-TTL: frequency response curves**
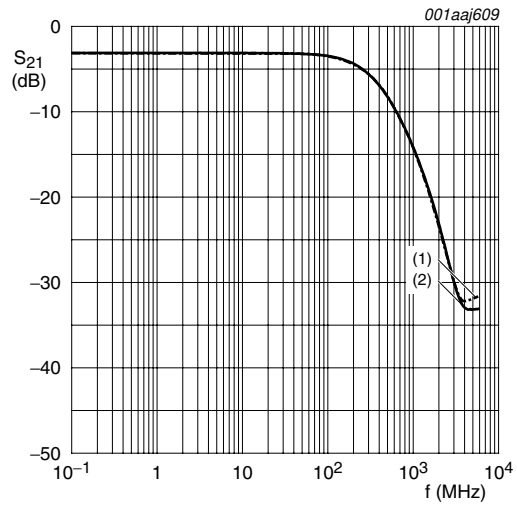


(1) Channel 1 to channel 16

(2) Channel 4 to channel 13

**Fig 4.** **IP4252CZ16-8-TTL: frequency response curves**



(1) Channel 1 to channel 16

(2) Channel 4 to channel 13

**Fig 5.** **IP4253CZ16-8-TTL: frequency response curves**



(1) Channel 4 to channel 13

(2) Channel 1 to channel 16

**Fig 6.** **IP4254CZ16-8-TTL: frequency response curves**

Due to the optimized silicon dice and package design, all channels in a single package show a very good matching performance as the insertion loss for a channel at the package side (e.g. channel 1 to channel 16) is nearly identical with the center channels (e.g. channel 4 to channel 13).

IP4251_52_53_54-TTL

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## 6.2 Selection

The selection of one of the filter devices has to be performed depending on the maximum clock frequency, driver strength, capacitive load of the sink, and also the maximum applicable rise and fall times.

### 6.2.1 SDHC and MMC memory interface

The Secure Digital High Capacity (SDHC) memory card interface standard specification and the Multi Media Card (MMC) (JESD 84A43) standard specification recommend a rise and fall time of 25 % to 62.5 % (62.5 % to 25 % respectively) of 3 ns or less for the input signal of the receiving interface side.

Assuming a typical capacitance of about 20 pF for the SDHC memory card itself, and approximately 4 pF to 7 pF for the Printed-Circuit Board (PCB) and the card holder, IP4252CZ12-6-TTL (6 channels, $R_{s(ch)}$ = 40 $\Omega$, $C_{ch}$ = 12 pF at $V_{bias(DC)}$ = 2.5 V) is a matching selection to filter and protect all relevant interface pins such as CLK, CMD, and DAT0 to DAT3/CD. Please refer to Figure 7 for a general example of the implementation of the device in an SDHC card interface.

In case additional channels such as write-protect or a mechanical card-detection switch are used, the IP4252CZ16-8-TTL (8 channels, $R_{s(ch)}$ = 40 $\Omega$, $C_{ch}$ = 12 pF at $V_{bias(DC)}$ = 2.5 V) offers two additional channels.

**Fig 7.    Example of IP4252 in an SDHC card interface**
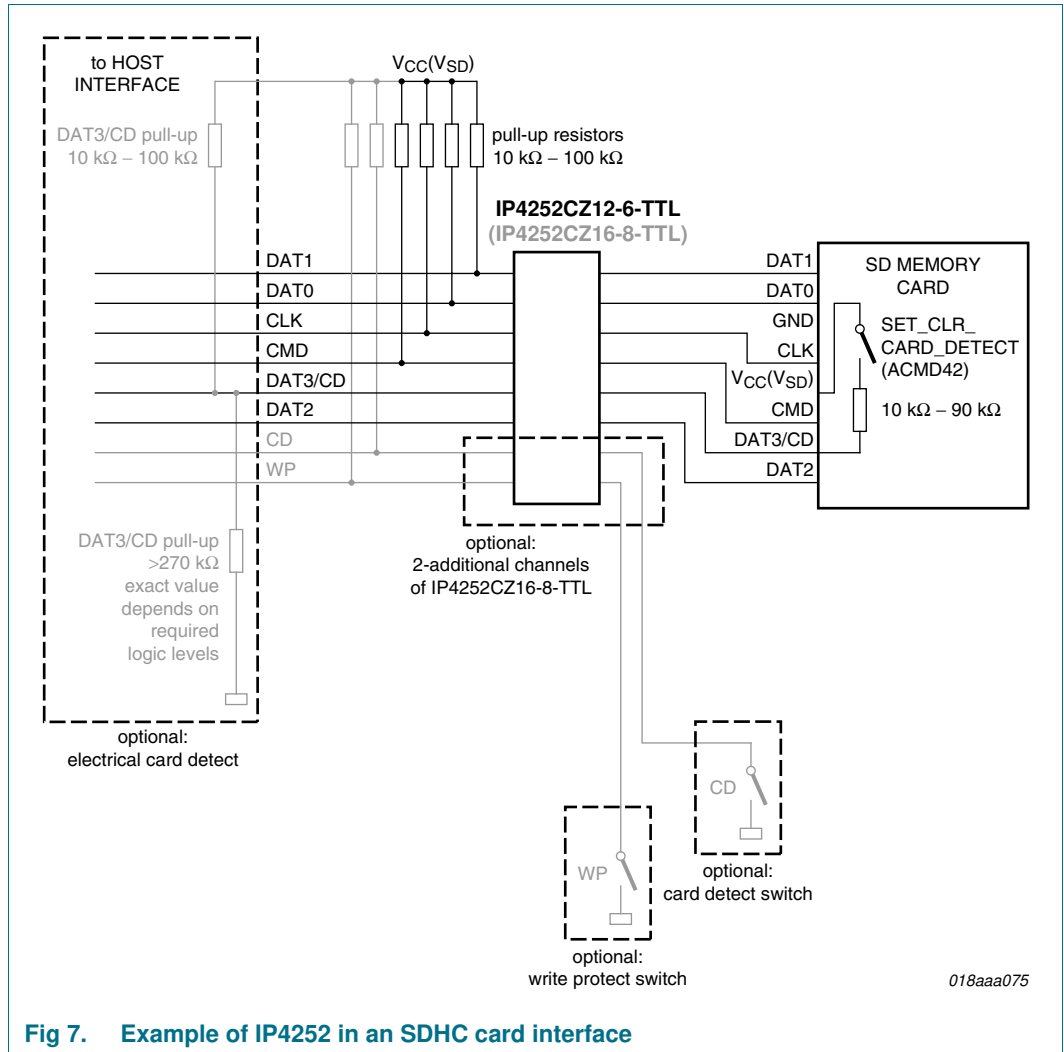
The capacitance values specified for the signal channels of the MMC interface differ from the SDHC specification. The MMC card-side interface is specified to have an intrinsic capacitance of 12 pF to 18 pF and the total channel is limited according to the specification to 30 pF only. Therefore, any filter device capacitance is limited to a maximum of up to 18 pF, including the card holder and PCB traces.

Please refer to Figure 8 for a general example of the implementation of the IP4252 in an MMC interface application.
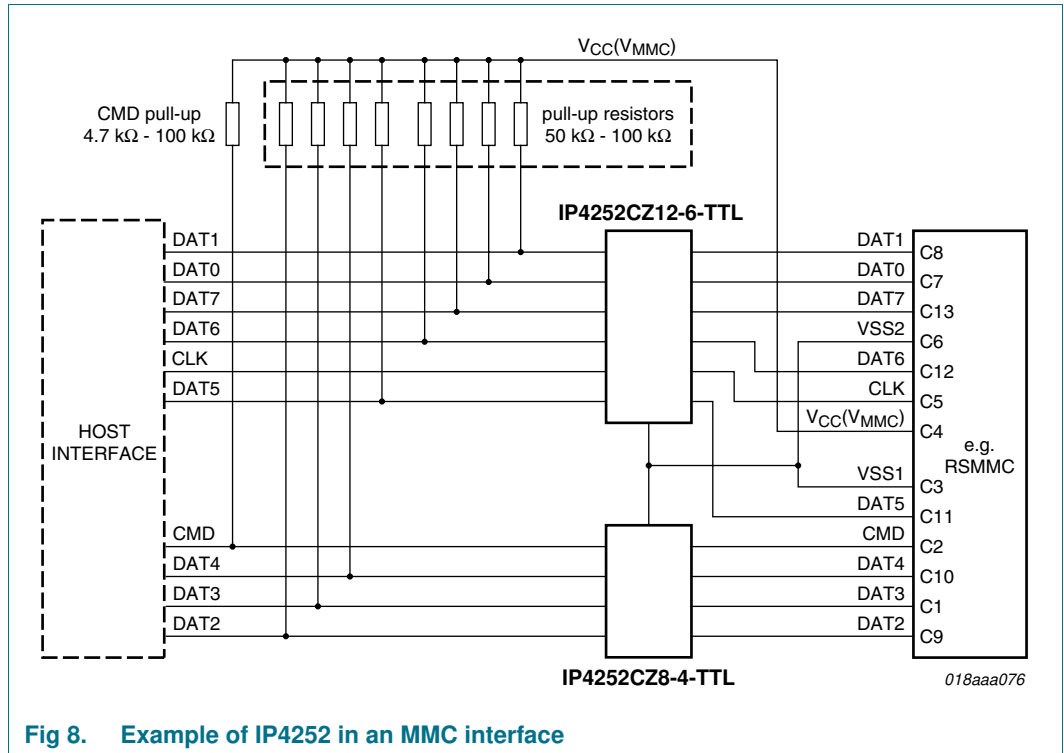
**Fig 8.    Example of IP4252 in an MMC interface**

To generate SDHC and MMC-compliant digital signals, the driver strength should not significantly undercut 8 mA.

### 6.2.2  LCD interfaces, medium-speed interfaces

For digital interfaces such as LCD interfaces running at clock speeds between 10 MHz and 25 MHz or more, IP4251, IP4252 or IP4254 can be used depending on the sink load, clock speed, driver strength and rise and fall time requirements. Also the minimum EMI filter requirements may be a decision-making factor.

### 6.2.3  Keypad, low-speed interfaces

Especially for lower-speed interfaces such as keypads, low-speed serial interfaces (e.g. Recommended Standard (RS) 232) and low-speed control signals, IP4253 ($R_{s(ch)}$ = 200 $\Omega$, $C_{ch}$ = 30 pF at $V_{bias(DC)}$ = 2.5 V) offers a very robust ESD protection and strong suppression of unwanted frequencies (EMI filtering).

# 7. Package outline

**HUSON8: plastic, thermal enhanced ultra thin small outline package; no leads;**
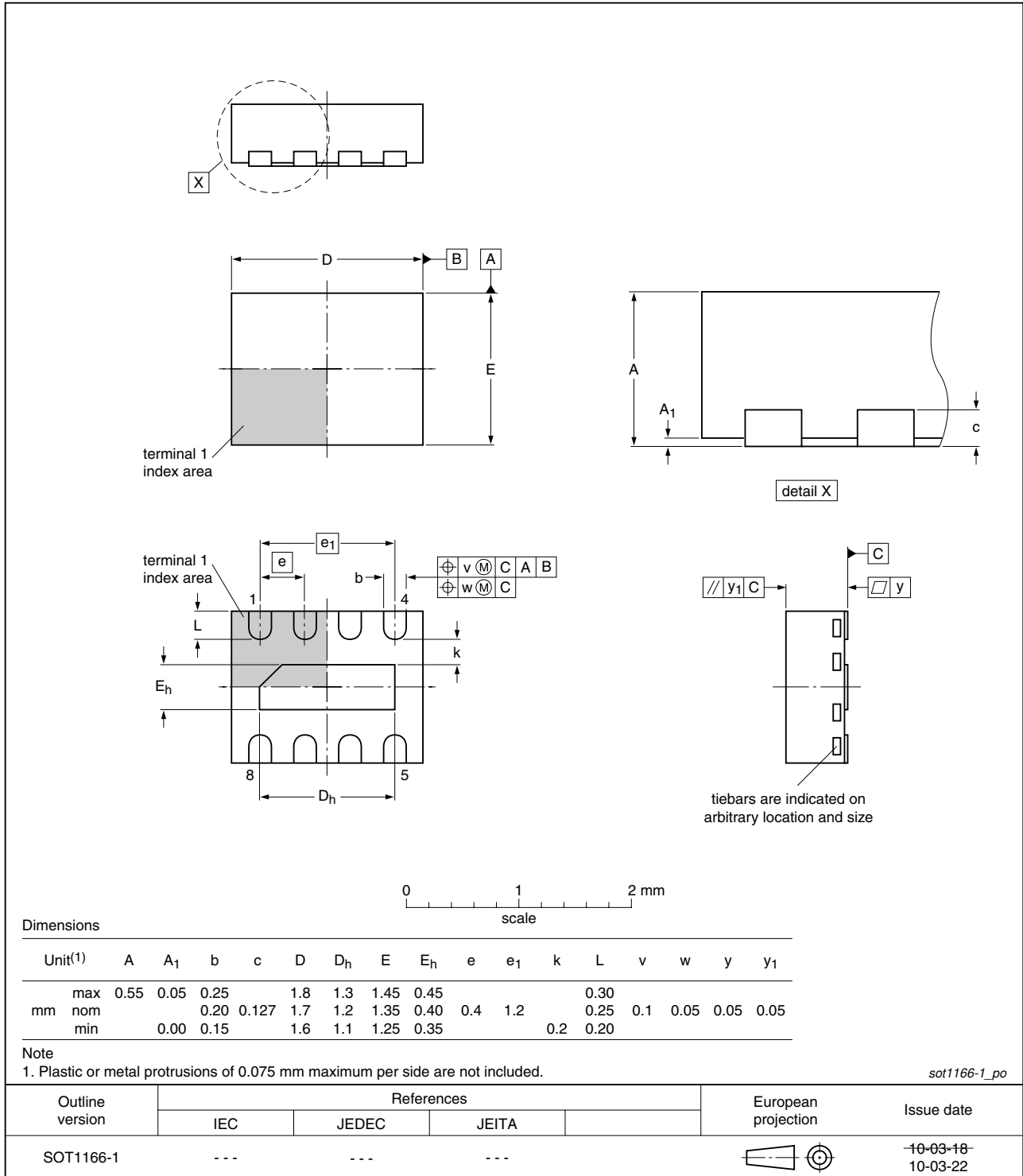**8 terminals; body 1.35 x 1.7 x 0.55 mm**                                              SOT1166-1

terminal 1
index area

detail X

terminal 1
index area

tiebars are indicated on
arbitrary location and size

scale

Dimensions

| Unit[1] | A | $A_1$ | b | c | D | $D_h$ | E | $E_h$ | e | $e_1$ | k | L | v | w | y | $y_1$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm max | 0.55 | 0.05 | 0.25 | | 1.8 | 1.3 | 1.45 | 0.45 | | | | 0.30 | | | | |
| nom | | 0.20 | 0.20 | 0.127 | 1.7 | 1.2 | 1.35 | 0.40 | 0.4 | 1.2 | | 0.25 | 0.1 | 0.05 | 0.05 | 0.05 |
| min | | 0.00 | 0.15 | | 1.6 | 1.1 | 1.25 | 0.35 | | | 0.2 | 0.20 | | | | |

Note
1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot1166-1_po

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT1166-1 | - - - | - - - | - - - | | | ~~10-03-18~~ 10-03-22 |

**Fig 9.    Package outline SOT1166-1 (HUSON8)**

IP4251_52_53_54-TTL

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**HUSON12: plastic, thermal enhanced ultra thin small outline package; no leads;**
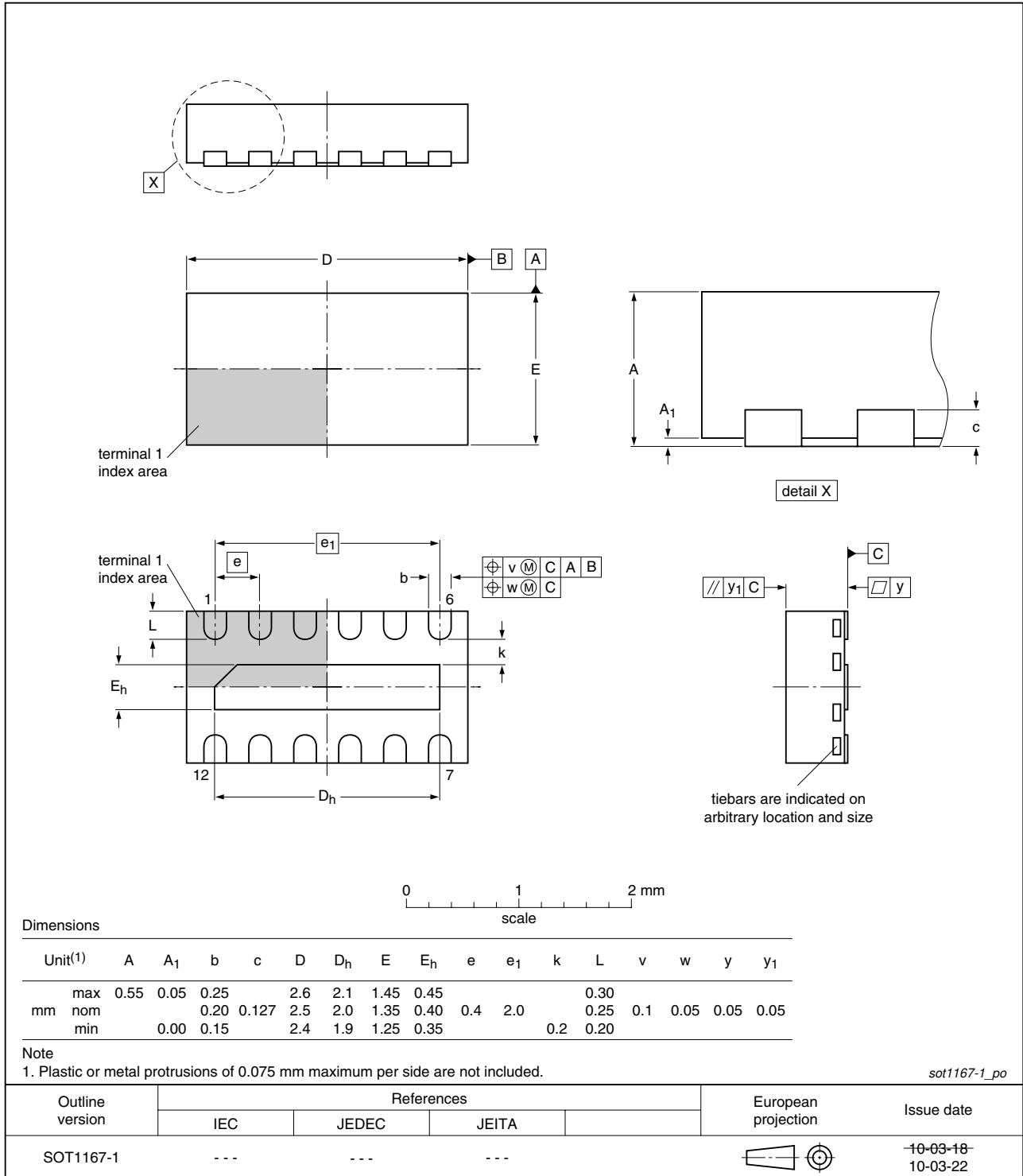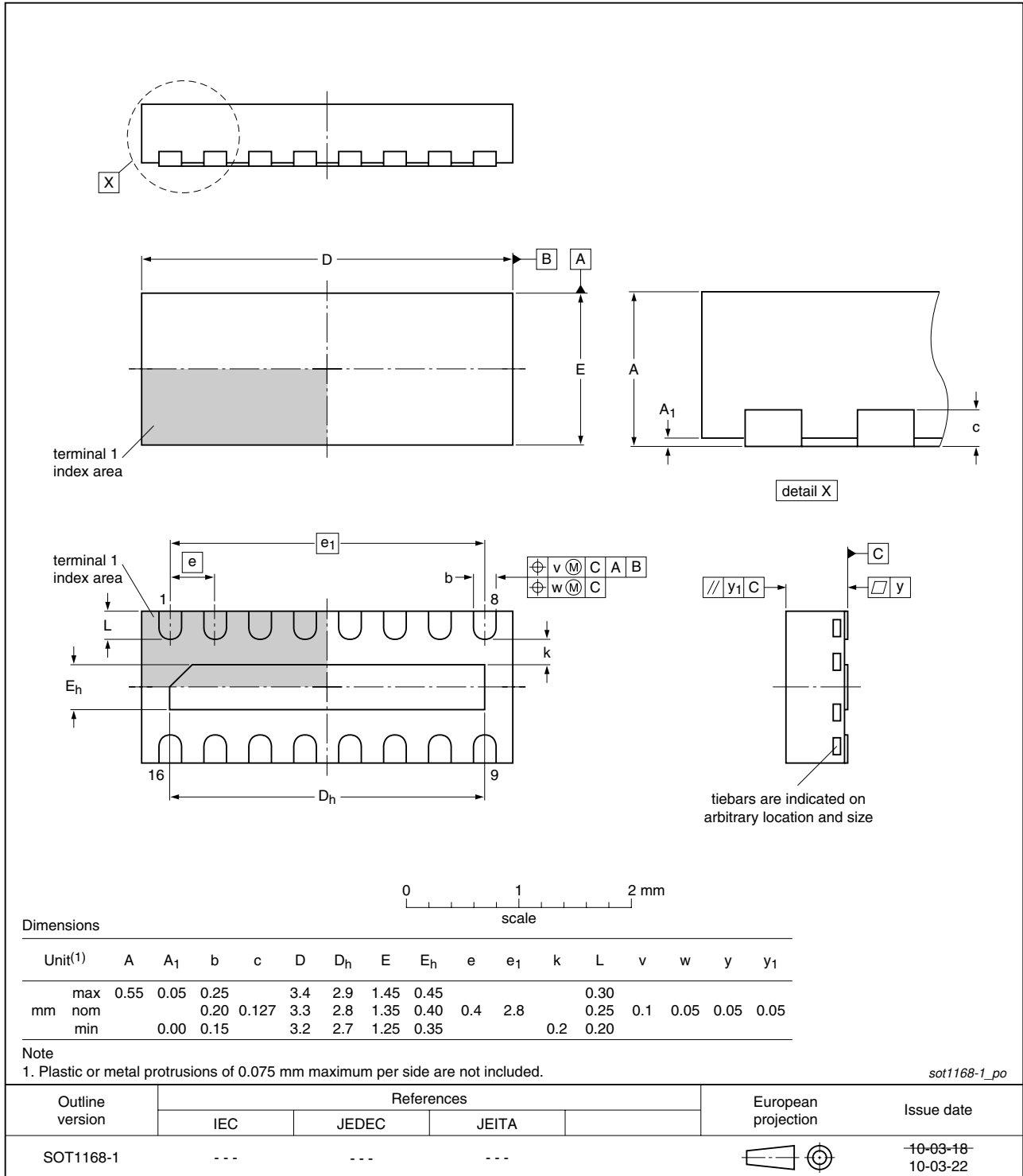**12 terminals; body 1.35 x 2.5 x 0.55 mm**

SOT1167-1



terminal 1 index area

detail X

terminal 1 index area

tiebars are indicated on arbitrary location and size

scale

Dimensions

| Unit[1] | A | A₁ | b | c | D | D_h | E | E_h | e | e₁ | k | L | v | w | y | y₁ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | max | 0.55 | 0.05 | 0.25 | | 2.6 | 2.1 | 1.45 | 0.45 | | | | 0.30 | | | | |
| mm | nom | | | 0.20 | 0.127 | 2.5 | 2.0 | 1.35 | 0.40 | 0.4 | 2.0 | | 0.25 | 0.1 | 0.05 | 0.05 | 0.05 |
| | min | | 0.00 | 0.15 | | 2.4 | 1.9 | 1.25 | 0.35 | | | 0.2 | 0.20 | | | | |

Note

1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot1167-1_po

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT1167-1 | - - - | - - - | - - - | | | ~~10-03-18~~ 10-03-22 |

**Fig 10.   Package outline SOT1167-1 (HUSON12)**

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HUSON16: plastic, thermal enhanced ultra thin small outline package; no leads;
16 terminals; body 1.35 x 3.3 x 0.55 mm

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terminal 1 index area

detail X

terminal 1 index area

tiebars are indicated on arbitrary location and size

Dimensions

| Unit[1] | A | A₁ | b | c | D | Dₕ | E | Eₕ | e | e₁ | k | L | v | w | y | y₁ |
|---------|---|----|---|---|---|----|---|----|---|----|---|---|---|---|---|-----|
| max | 0.55 | 0.05 | 0.25 | | 3.4 | 2.9 | 1.45 | 0.45 | | | | 0.30 | | | | |
| mm nom | | 0.20 | | 0.127 | 3.3 | 2.8 | 1.35 | 0.40 | 0.4 | 2.8 | | 0.25 | 0.1 | 0.05 | 0.05 | 0.05 |
| min | | 0.00 | 0.15 | | 3.2 | 2.7 | 1.25 | 0.35 | | | 0.2 | 0.20 | | | | |

Note
1. Plastic or metal protrusions of 0.075 mm maximum per side are not included.

sot1168-1_po

| Outline version | References | | | | European projection | Issue date |
|---|---|---|---|---|---|---|
| | IEC | JEDEC | JEITA | | | |
| SOT1168-1 | - - - | - - - | - - - | | | ~~10-03-18~~ 10-03-22 |

**Fig 11.   Package outline SOT1168-1 (HUSON16)**

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## 8. Revision history

**Table 7. Revision history**

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---|---|---|---|---|
| IP4251_52_53_54-TTL v.2 | 20110505 | Product data sheet | - | IP4251_52_53_54-TTL v.1 |
| Modifications: | | • Section 1 "Product profile": updated.<br>• Table 2 "Pinning": updated.<br>• Deleted section "Thermal characteristics". | | |
| IP4251_52_53_54-TTL v.1 | 20110131 | Objective data sheet | - | - |

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# 9. Legal information

## 9.1 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 URL http://www.nxp.com.

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# 11. Contents