

USB8131, USB8141

Product Preview

Common Mode Filter with ESD Protection

Functional Description

The USB81x1 is a family of Common Mode Filters (CMF) with integrated ESD protection tailored for USB Application. Differential signaling for USB can now have both common mode filtering and ESD protection, with a dedicated TVS protection in one package.

USB81x1 is well-suited for protecting USB3.x systems

Features

- Large Differential Mode Pass Band Frequency:
 $f_{3dB} > 5$ GHz (USB8141), $f_{3dB} > 2.5$ GHz (USB8131)
- High Common Mode Stop Band Attenuation:
> 30 dB at 2.4 GHz to Protect High-band LTE, WCDMA, Wi-Fi, GPS Antenna (USB8141)
> 30 dB at 750 MHz to Protect Low-band LTE and GSM Antenna (USB8131)
- Low Channel Resistance: 6.0 Ω
- Provides ESD Protection to:
IEC61000-4-2 Level 4, ± 15 kV Contact on D+, D- pins
IEC61000-4-2 Level 4, ± 30 kV Contact on Vbus pin
IEC61000-4-2 Level 4, ± 25 kV Contact on ID pin
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

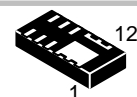
Applications

- USB 3.x



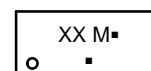
ON Semiconductor®

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UDFN12
CASE 517DE

MARKING DIAGRAM



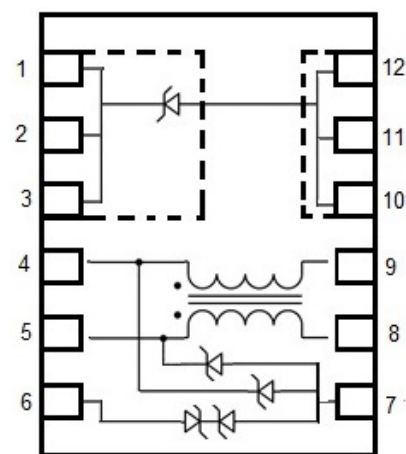
XX = Specific Device Code

M = Date Code

▪ = Pb-Free Package

(Note: Microdot may be in either location)

ELECTRICAL SCHEMATIC



(Top View)

ORDERING INFORMATION

Device	Package	Shipping†
USB8131MUTAG	UDFN12 (Pb-Free)	3000 / Tape & Reel
USB8141MUTAG	UDFN12 (Pb-Free)	3000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

This document contains information on a product under development. ON Semiconductor reserves the right to change or discontinue this product without notice.

USB8131, USB8141

PIN FUNCTION DESCRIPTION

Pin Name	Device Pin		Type	Description
	USB8131	USB8141		
Vbus	1, 2, 3	1, 2, 3	Bus	Uni-Directional Vbus Pin TVS Protection (External)
D+_In	4	4	I/O	CMF Channel 1+ to Connector (External)
D-_In	5	5	I/O	CMF Channel 1- to Connector (External)
Id	6	6	Id	Bi-Directional ID Pin Protection (External)
VN	7, 10-12	7, 10-12	GND	Ground
D-_Out	8	8	I/O	CMF Channel 1- to ASIC (Internal)
D+_Out	9	9	I/O	CMF Channel 1+ to ASIC (Internal)

ABSOLUTE MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Parameter	Symbol	Value	Unit
Operating Temperature Range	T _{OP}	-40 to +85	°C
Storage Temperature Range	T _{STG}	-65 to +150	°C
Maximum Lead Temperature for Soldering Purposes (1/8" from Case for 10 seconds)	T _L	260	°C
DC Current per Line	I _{LINE} – I/O pins	100	mA
IEC61000-4-2 Contact (ESD – External) Pins: D+, D- (Note 1)	ESD – I/O pins	±15	kV
IEC61000-4-2 Contact (ESD – Internal) Pins: D+, D- (Note 1)	ESD – I/O pins	±8	kV
IEC61000-4-2 Contact (ESD) ID Pin (Note 1)	ESD – ID pin	±25	kV
IEC61000-4-2 Contact (ESD) BUS Pin (Note 1)	ESD – Bus pin	±30	kV

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

- Standard IEC61000-4-2 with C_{Discharge} = 150 pF, R_{Discharge} = 330, GND grounded.

USB8131, USB8141

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
I/O Pins						
V_{RWM}	Reverse Working Voltage	(Note 2)		3.3		V
V_{BR}	Breakdown Voltage	$I_T = 1\text{ mA}$; (Note 3)	4.0		9.0	V
I_{LEAK}	Channel Leakage Current	$V_{IN} = 3.3\text{ V}$, $GND = 0\text{ V}$			1.0	μA
R_{CH}	Channel Resistance (Pins 4–9, 5–8)			6.0		Ω
DM_{LOSS}	Differential Mode Insertion Loss USB8131 USB8141	@ 1.0 GHz		1.5 1.2	3.0 3.0	dB
f_{3dB}	Differential Mode Cut-off Frequency USB8131 USB8141	50 Ω Source and Load Termination	1.0 1.0	2.4 5.0		GHz
F_{atten}	Common Mode Stop Band Attenuation USB8131	750 – 900 MHz	25			dB
		1.3 – 2.4 GHz		10		dB
		2.4 – 2.7 GHz	10			dB
	USB8141	750 – 900 MHz	15			dB
		1.3 – 2.4 GHz		20		dB
		2.4 – 2.7 GHz	25			dB
$TLP\ V_{CL}$	TLP Clamping Voltage	$I_{pp} = 8\text{ A}$ $I_{pp} = 16\text{ A}$ $I_{pp} = -8\text{ A}$ $I_{pp} = -16\text{ A}$		7.26 11.8 -3.5 -6.7		V

VBUS Pin

V_{RWM}	Reverse Working Voltage	(Note 2)			10	V
V_{BR}	Breakdown Voltage	$I_T = 1\text{ mA}$; (Note 3)	12			V
I_{LEAK}	Channel Leakage Current	$V_{IN} = 10\text{ V}$, $GND = 0\text{ V}$			1.0	μA
I_{pp}	Surge 8/20 μs	Surge 8/20 μs	70			A
V_{CL}	Clamping Voltage Surge 8/20 μs	@ 1 A @ 70 A			15 25	V

ID Pin

V_{RWM}	Reverse Working Voltage	(Note 2)			± 5.0	V
V_{BR}	Breakdown Voltage	$I_T = 1\text{ mA}$; (Note 3)	± 6.0			V
I_{LEAK}	Channel Leakage Current	$V_{IN} = \pm 5\text{ V}$, $GND = 0\text{ V}$			1.0	μA
C_J	Junction Capacitance	$V_R = 0\text{ V}$, $f = 1\text{ MHz}$			20	pF
I_{pp}	Surge 8/20 μs	Surge 8/20 μs	6.0			A
V_{CL}	Clamping Voltage Surge 8/20 μs	@ 6 A			12	V
$TLP\ V_{CL}$	TLP Clamping Voltage	@ 16 A			12	V

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

- TVS devices are normally selected according to the working peak reverse voltage (V_{RWM}), which should be equal to or greater than the DC or continuous peak operating voltage level.
- V_{BR} is measured at pulse test current I_T .

USB8131, USB8141

TYPICAL CHARACTERISTICS

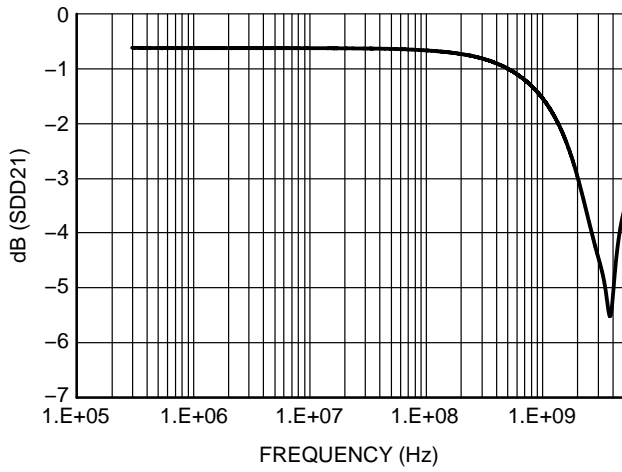


Figure 1. Typical Differential Mode Attenuation vs. Frequency (USB8131)

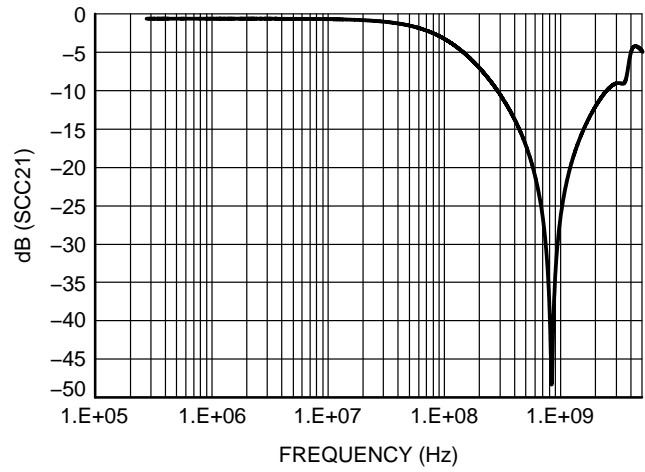


Figure 2. Typical Common Mode Attenuation vs. Frequency (USB8131)

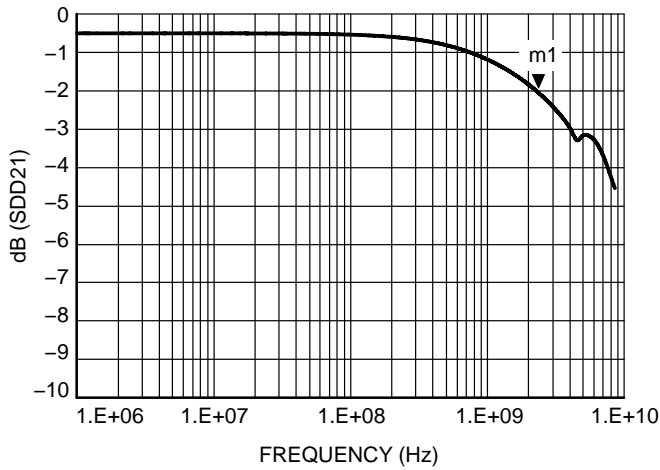


Figure 3. Typical Differential Mode Attenuation vs. Frequency (USB8141)

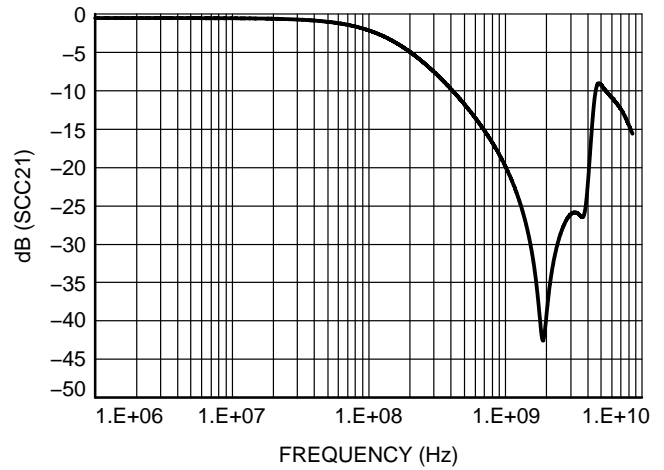


Figure 4. Typical Common Mode Attenuation vs. Frequency (USB8141)

TRANSMISSION LINE PULSE (TLP) MEASUREMENTS

Transmission Line Pulse (TLP) provides current versus voltage (I-V) curves in which each data point is obtained from a 100 ns long rectangular pulse from a charged transmission line. A simplified schematic of a typical TLP system is shown in Figure 5. TLP I-V curves of ESD protection devices accurately demonstrate the product’s ESD capability because the 10 s of amps current levels and under 100 ns time scale match those of an ESD event. This is illustrated in Figure 6 where an 8 kV IEC61000-4-2 current waveform is compared with TLP current pulses at 8 A and 16 A. A TLP curve shows the voltage at which the device turns on as well as how well the device clamps voltage over a range of current levels. Typical TLP I-V curves for the EMI814x are shown in Figure 5.

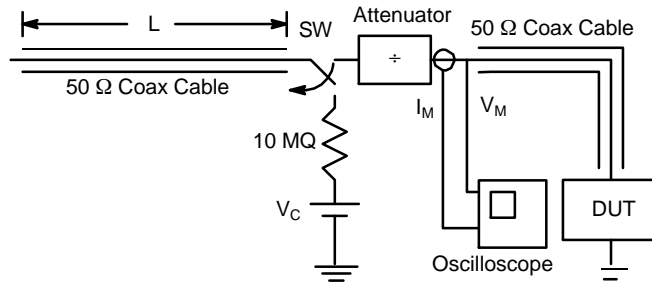


Figure 5. Simplified Schematic of a Typical TLP System

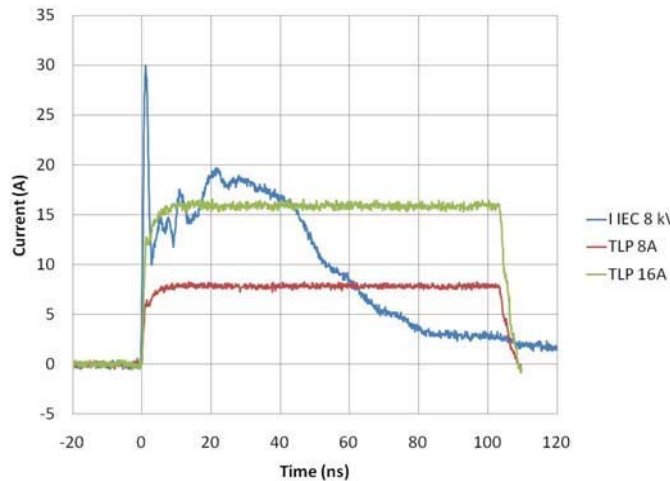


Figure 6. Comparison Between 8 kV IEC61000-4-2 and 8 A and 16 A TLP Waveforms

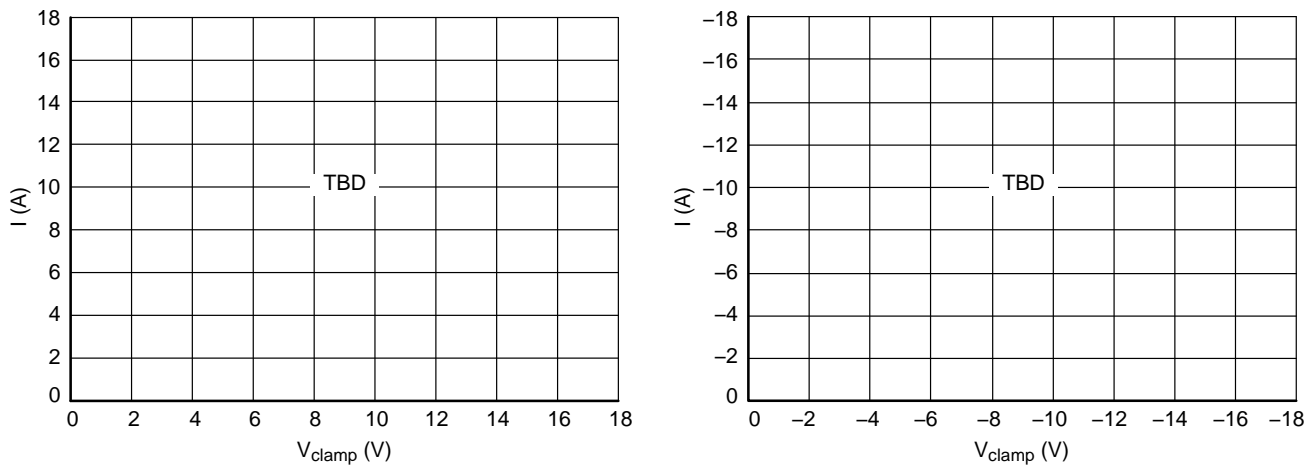
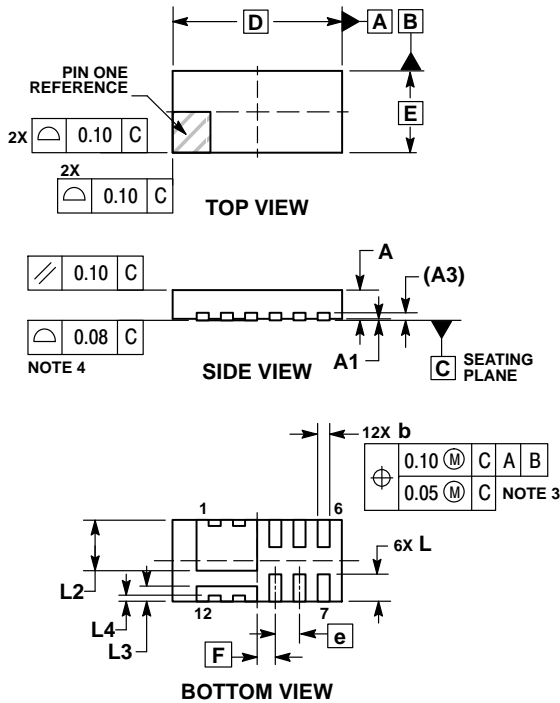


Figure 7. Positive and Negative TLP Waveforms

USB8131, USB8141

PACKAGE DIMENSIONS

UDFN12, 2.8x1.35, 0.4P
CASE 517DE
ISSUE 0

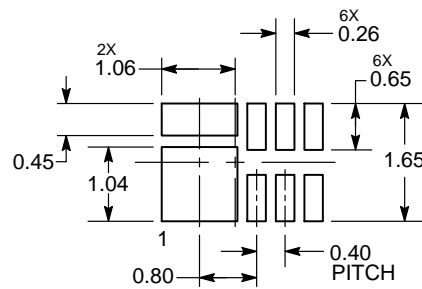


NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 MM FROM TERMINAL TIP.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

DIM	MILLIMETERS	
	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.125 REF	
b	0.15	0.25
D	2.80 BSC	
E	1.35 BSC	
e	0.40 BSC	
F	0.30 BSC	
L	0.35	0.55
L2	0.74	0.94
L3	0.15	0.35
L4	0.10 REF	

RECOMMENDED SOLDERING FOOTPRINT*



DIMENSION: MILLIMETERS

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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