1.General Description

The EMS3800 is dual SPDT low on-resistance analog switch. It can operate from 1.5V to 5.5V power supply. The device offers low ON-state resistance and excellent ON-state resistance matching with break-before-make feature, to prevent signal distortion during the transferring of a signal from one channel to another. The device is capable of true isolation. Even when COMx overrides V_{CC}, very little current will flow back to the supply.

2.Features and Benefits

- Low Quiescent Current (<2uA) With Very Wide Supply Range (1.5V ~ 5.5V)
- Low On-resistance, Ron=1.5Ω when COM_X=5V
- 1.8V Logic Compatible Control Pin
- High Off-Isolation: -100dB @ 100KHz
- Low Channel-to-Channel Crosstalk: -97dB @ 100KHz
- High Bandwidth (-3dB @700MHz) Suitable For USB2.0 High-Speed Routing

3.Applications

- Audio, Video, UART, USB2.0 Signal and Supply Routing
- Cell phones and TWS headset
- USB Type-C Mic/Gnd Switch
- DC Motor Drive

4.Ordering Information

Table 1. Ordering information

Type number	Topside marking	Package		
		Name	Description	Quantity
EMS3800RSW	A50TYW	QFN1.4×1.8-10L	QFN package, 10 pins 1.4 mm × 1.8 mm; 0.55 mm (Max) height	3000

5.Pinning Information

5.1. Pin map

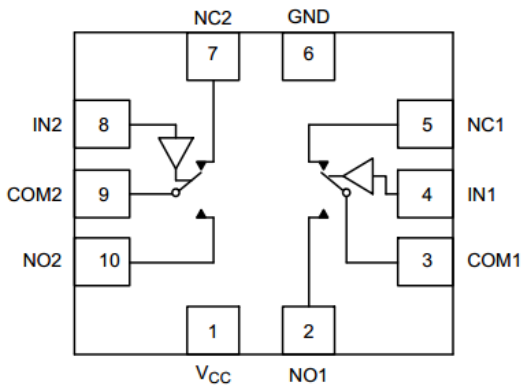


Fig 1. Top view pin configuration
QFN 1.4x1.8-10L

5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
V_{CC}	1	Single Power Supply
NOx	2, 10	Analog/Digital Signal Ports (Normally open)
COMx	3, 9	Common Signal Ports
NCx	5, 7	Analog/Digital Signal Ports (Normally closed)
GND	6	Ground
INx	4, 8	Logic Input Control

6.Functional Description

Table 3. Function table

H = HIGH voltage level; L = LOW voltage level.

Input INx	Switch
L	NC1 to COM1, NC2 to COM2
H	NO1 to COM1, NO2 to COM2

7.Typical Application

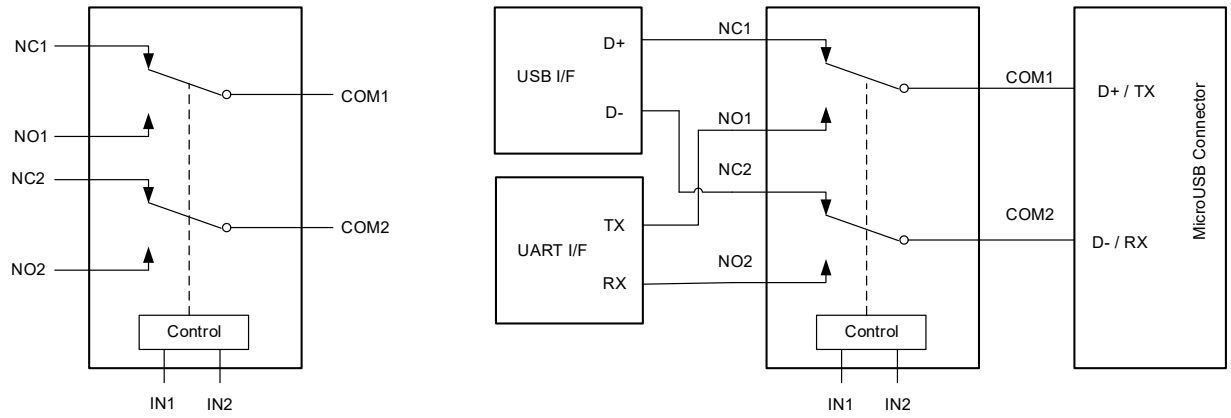


Fig 2. Configured as USB2.0 Mux

8.Absolute Maximum Ratings

Absolute Maximum Ratings may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied.

Table 4 Absolute Maximum Ratings

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		-0.3	6.5	V
V_{IN}	control input voltage		-0.3	6.5	V
I_C	Continuous Current Through NO, NC, COM			±100	mA
I_P	Peak Current Through NO, NC, COM (pulsed at 1ms 50% duty cycle)			±200	mA
P_D	power dissipation			250	mW
T_{stg}	storage temperature		-55	150	°C
T_J	junction Temperature under Bias			150	°C
T_L	lead Temperature (Soldering, 10 seconds)			260	°C

9.Recommended Operating Conditions

Table 5 Recommend operating ratings

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage operating		1.5	5.5	V
V_{IN}	control input voltage		-0.3	5.5	V
V_{COM}	input signal voltage			±100	mA
T_A	operating temperature			150	°C
$R_{\theta JA}$	thermal resistance			360	°C/W

10. Electrical Characteristics

Table 6. Static characteristics

T_a=25℃, V_{DD}=3.3V, unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
DC Characteristics						
V_{IH}	Input logic high level	V_{CC} = 3.3 V to 5.5 V	1.6			V
		V_{CC} = 1.5 V to 3.3 V	1.4			V
V_{IL}	Input logic low level	V_{CC} = 3.3 V to 5.5 V			0.6	V
		V_{CC} = 1.5 V to 3.3 V			0.4	V
I_{CC}	Supply quiescent current	I_{COM}=0, V_{IN} =0 or V_{IN} =VCC			1.0	μA
I_{CCT}	Increase in I_{CC} per input	I_{COM} = 0, V_{CC} = 4.5 V V_{IN} > 1.8 V or V_{IN} < 0.5 V			1.0	μA
I_{COMx}	Off state leakage from COMx to NCx (or NOx)	V_{COM} = 5.5V , $V_{NC(or\ NO)}$ = 0V			±2.0	μA
R_{ON}	On-Resistance	V_{COM}=0 ~ 0.5V, I_{COM}=30mA		3.0	3.5	Ω
		V_{COM}=0.5 ~ 2.0V, I_{COM}=30mA		3.6	3.9	Ω
		V_{COM}=2.0 ~ 4.0V, I_{COM}=30mA		2.5	3.5	Ω
		V_{COM}=4.0 ~ 5.5V, I_{COM}=30mA		1.5	1.8	Ω
R_{FLAT}	On-Resistance Flatness	V_{COM}=0 ~ 0.5V, I_{COM}=30mA		0.7		Ω
		V_{COM}=0.5 ~ 2.0V, I_{COM}=30mA		0.5		Ω
		V_{COM}=2.0 ~ 4.0V, I_{COM}=30mA		1.6		Ω
		V_{COM}=4.0 ~ 5.5V, I_{COM}=30mA		0.3		Ω
ΔR_{ON}	On-Resistance Matching Between Channels	V_{COM}=0~5.5V, I_{COM}=30mA		0.1	0.2	Ω
AC Characteristics						
C_{ON}	On Capacitance	F= 100kHz		5		pF
C_{OFF}	Off Capacitance	F= 100kHz		7		pF
OIRR	Off Isolation	f = 1kHz, R_T = 50Ω		-81		dB

		f = 10kHz, R_T = 50Ω		-80		dB
X_{TALK}	Crosstalk	f = 1kHz, R_T = 50Ω		-83		dB
		f = 10kHz, R_T = 50Ω		-82		dB
BW	-3dB Bandwidth	R_T=50Ω, C_L=0pF		850		MHz
t_{BBM}	Break-Before-Make Time	V_{COM}=1.5V, C_L=35pF, R_L=50Ω		500		ns
t_{ON}	Turn-on Time	V_{COM}=1.5V, C_L=35pF, R_L=50Ω		200		ns
t_{OFF}	Turn-off Time	V_{COM}=1.5V, C_L=35pF, R_L=50Ω		200		ns
THD	Total Harmonic Distortion	F=20Hz to 20KHz, V_{COM}=600mVp-p, R_L=32Ω		-80		dB

11. Typical Performance Curves

Ta=25°C, VDD=3.0V, CAP=0.1uF, unless otherwise noted

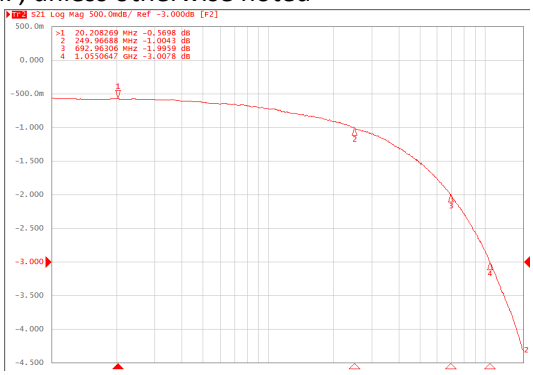


Fig 3. Bandwidth

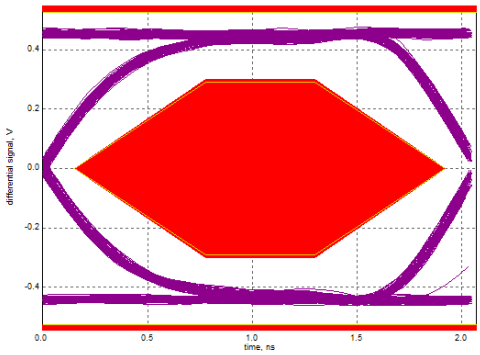


Fig 4. Eye Diagram (480Mbps)

12. Test Circuits

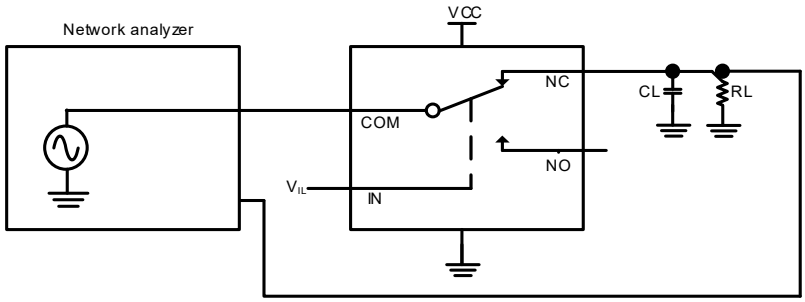


Fig 5. Bandwidth

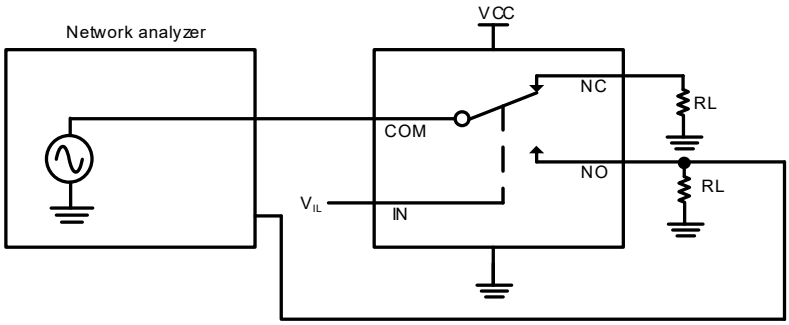


Fig 6. Off isolation

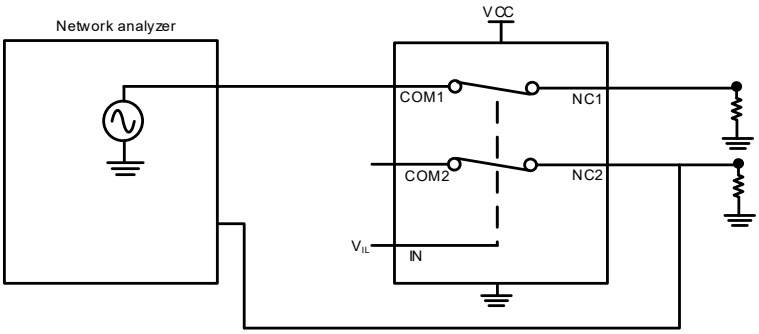
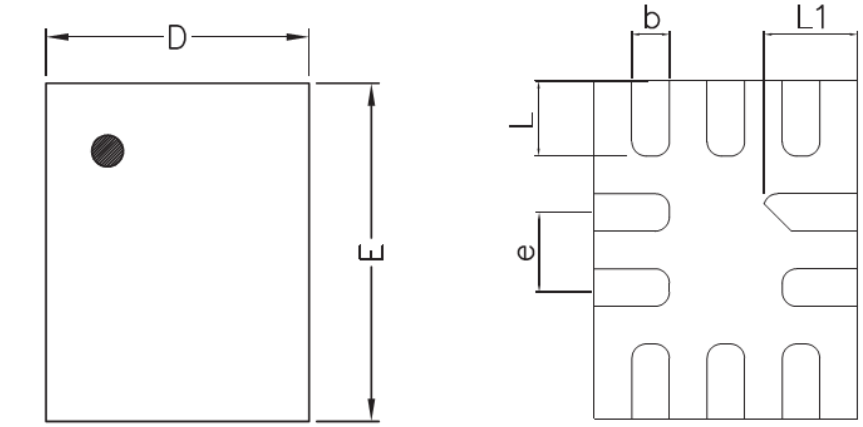
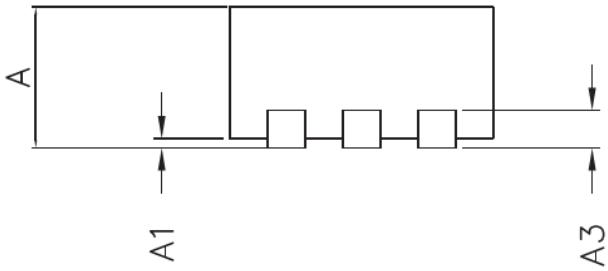


Fig 7. Crosstalk

13. Package Outline

QFN 1.4x1.8 -10L





Symbol	Dimension in Millimeters	
	Min.	Max.
A	0.450	0.550
A1	0.000	0.050
A3	0.152 Ref.	
D	1.350	1.450
E	1.750	1.850
b	0.150	0.250
e	0.400 Typ.	
L	0.350	0.450
L1	0.450	0.550

14. Revision History

Table 7. Revision history

Document ID	Release Date	Data sheet status	Change notice	Supersedes
EMS3800 Rev1.0	Oct 30, 2023	Product datasheet		