1.General Description

The EMS4899 is a high performance, quad, Single Pole Double Throw (SPDT) analog switch that features ultra-low Ron of 1.9 Ω (typical) at 5.5V V_{CC}. The EMS4899 operates over a wide V_{CC} range of 1.5V to 5.5V and is designed for break-before-make operation. The select input is TTL-level compatible.

EMS4899 is also featured with smart circuitry to minimize V_{CC} leakage current even when the control voltage is lower than V_{CC} supply voltage. This feature suits mobile handset applications by allowing direct interface with baseband processor general-purpose IO with minimal battery consumption. In other word, there is no need of additional device to shift control level to be the same as that of V_{CC} in real application.

The EMS4899 is available in QFN3x3-16L package. Standard Products are Pb-free and halogen-free.

2.Features and Benefits

- Wide supply voltage range from 1.5 V to 5.5 V
- Low On-resistance, R_{ON} = 1.9 Ω when V_{CC} = 5.5 V
- High Bandwidth: -3 dB @ 700 MHz
- Rail-to-Rail Signal Range
- Break-Before-Make Switching
- Low quiescent current over an Expanded Control Input Range
- ESD protection: HBM ESDA/JEDEC JS-001 Class 2 exceeds 2000 V

3.Applications

- Cell phones, PDA, Digital Camera and Notebook
- LCD Monitor, TV and Set-Top Box
- Audio and Video Signal Routing
- Other electronic equipment

4. Ordering Information

Table 1. Ordering information

Type number	Topside marking	Package		
		Name	Description	Quantity
EMS4899UD	S4899 XYYWW	QFN3x3-16L	QFN package, 16 pins 3 mm × 3 mm; 0.6 mm (Max) height	3000

MARKING INFORMATION

NOTE: XYYWW = Vendor Code and Data Code.

X YY WW

- WW — Data Code -Week
- YY — Data Code -Year
- X — Vendor Code

5. Pinning Information

5.1. Pinning

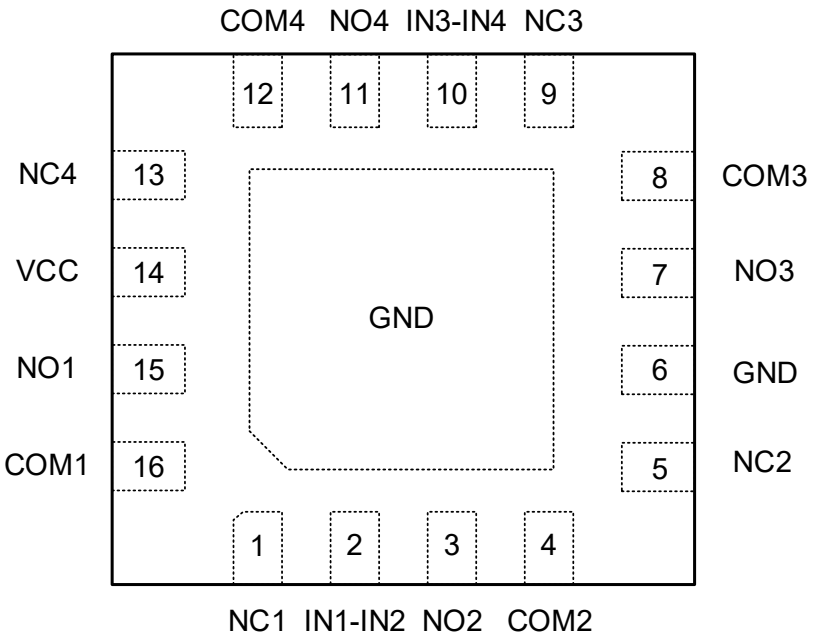


Fig. 1. Top view pin configuration QFN

5.2. Pin description

Table 2. Pin description

Symbol	Pin	Description
NC1, NC2, NC3, NC4	1, 5, 9, 13	Normally Closed Pins.
IN1-IN2, IN3-IN4	2, 10	Digital Control Input Pin to Connect the COM Pins to the NO or NC Pins.
NO1, NO2, NO3, NO4	3,7,11,15	Normally Open Pins
COM1,COM2,COM3,COM4	4, 8, 12, 16	Common Pins.
GND	6	Positive Power Supply
VCC	14	Ground
GND	Exposed Pad	Exposed Pad. Connect exposed pad to GND or left floating.

6.Functional Description

Table 3. Function table

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

IN1-IN2	NC1 and NC2 TO COM, COM TO NC1 and NC2	NO1 and NO2 TO COM, COM TO NO1 and NO2
L	ON	OFF
H	OFF	ON

IN3-IN4	NC3 and NC4 TO COM, COM TO NC3 and NC4	NO3 and NO4 TO COM, COM TO NO3 and NO4
L	ON	OFF
H	OFF	ON

7.Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Table 4. Absolute Maximum Ratings

In accordance with the Absolute Maximum Rating System (IEC 60134). Voltages are referenced to GND.

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
V_A	signal input voltage		-0.3	6.5	V
I_A	continuous Current Through COM, NC, NO			±100	mA
	peak Current Through COM, NC, NO (pulsed at 1ms 50% duty cycle)			±200	mA
T_J	junction Temperature under Bias			150	°C
T_L	lead Temperature (Soldering, 10 seconds)			260	°C
$R_{\theta JA}$	thermal resistance			350	°C/W

8.Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. EnergyMath does not recommend exceeding them or designing to Absolute Maximum Ratings.

Table 5. Recommended Operating Conditions

Symbol	Parameter	Conditions	Min	Max	Unit
V_{CC}	supply voltage		1.5	5.5	V
V_{IN}	control input voltage		0	5.5	V
V_A	signal input voltage		0	V_{CC}	V
T_{amb}	ambient temperature		-40	125	°C

9. Electrical Characteristics

Table 6. Static characteristics

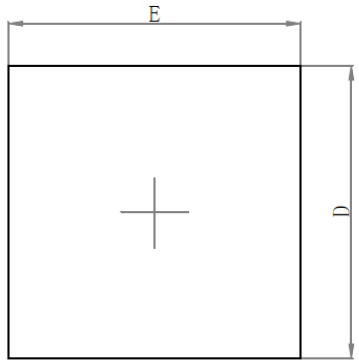
T_{amb}=25 ℃, V_{CC}=3.3 V, unless otherwise specified

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
DC Electrical Characteristics						
V_{IH}	input logic high level	V_{CC} = 3.4 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} = 3.4 V to 5.5 V			0.6	V
		V_{CC} = 1.5 V to 3.3 V			0.4	V
I_{CC}	supply current	I_A = 0, V_{SEL} = 0 or V_{SEL} = V_{CC}			1.0	µA
ΔI_{CC}	additional supply current	I_A = 0, V_{CC} = 2.5 V or 4.2 V V_{SEL} = 1.6 V			3.0	µA
I_{off}	OFF-state switch leakage current from COM to NC (or NO)	V_A = 5 V , V_{NC} or V_{NO} = 0 V			±2.0	µA
R_{ON}	on-resistance	V_{CC} = 3.5 V , V_A = 0.8 V to 2.0 V, I_A = 10 mA		3.4	4.0	Ω
		V_{CC} = 4.5 V , V_A = 0.8 V to 2.3 V, I_A = 10 mA		2.4	3.0	Ω
		V_{CC} = 5.5 V , V_A = 0.8 V to 2.6 V, I_A = 10 mA		1.9	2.5	Ω
R_{FLAT}	on-resistance flatness	V_{CC} = 3.5 V , V_A = 0.8 V to 2.0 V, I_A = 10 mA		0.2	0.4	Ω
		V_{CC} = 4.5 V , V_A = 0.8 V to 2.3 V, I_A = 10 mA		0.25	0.45	Ω
		V_{CC} = 5.5 V , V_A = 0.8 V to 2.6 V, I_A = 10 mA		0.3	0.5	Ω
ΔR_{ON}	on-resistance matching between channels	V_{CC} = 3.5 V , V_A = 0.8 V to 2.0 V, I_A = 10 mA		0.1	0.2	Ω
		V_{CC} = 4.5 V , V_A = 0.8 V to 2.3 V, I_A = 10 mA		0.1	0.2	Ω
		V_{CC} = 5.5 V , V_A = 0.8 V to 2.6 V, I_A = 10 mA		0.1	0.2	Ω

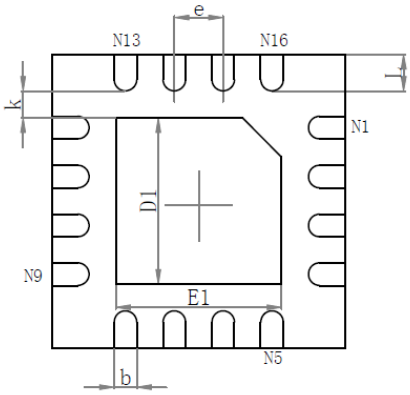
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
AC Electronics Characteristics						
t_{ON}	turn-On Time	V_A=1.5V, C_L=50pF, R_L=50Ω		470		ns
t_{OFF}	turn-Off Time	V_A=1.5V, C_L=50pF, R_L=50Ω		120		ns
t_{BBM}	break-before-make time	V_A=1.5V, C_L=50pF, R_L=50Ω		600		ns
BW	-3dB Bandwidth	C_L=0pF		800		MHz
OIRR	off isolation	f=10 KHz		-80		dB
		f=240 MHz		-31		dB
X_{TALK}	crosstalk	f=10 KHz		-82		dB
		f=240 MHz		-26		dB
THD	total harmonic distortion	f=20Hz to 20KHz V_A=600mVpp, R_L=32Ω		-80		dB
Capacitance						
C_{ON}	On Capacitance	f=100KHz		12		pF
C_{OFF}	Off Capacitance	f=100KHz		4		pF

10. Package Outline

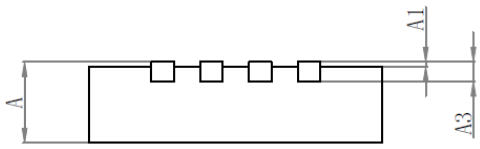
QFN3x3-16L



Top View



Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A3	0.203REF		0.008REF	
D	2.900	3.100	0.114	0.122
E	2.900	3.100	0.114	0.122
D1	1.600	1.800	0.063	0.071
E1	1.600	1.800	0.063	0.071
k	0.200MIN.		0.008MIN.	
b	0.180	0.300	0.007	0.012
e	0.500TYP.		0.500TYP.	
L	0.300	0.500	0.012	0.020

11. Revision History

Table 7. Revision history

Document ID	Release Date	Data sheet status	Change notice	Supersedes
EMS4899 Rev. 1.1	Jan 30, 2025	Product datasheet		EMS4899 Rev. 1.0
Modifications:	• Update the type number and marking information.			
EMS4899 Rev. 1.0	Oct 30, 2024	Product datasheet		