

## CMOS Multiplexer for Keypad Switches

### Features

- Functionally equivalent to a five-diode pair network
- Up to 60% space saving vs. discrete solution
- Flexibility in design with "separate" outputs
- 100k $\Omega$  pull-up resistors on outputs
- Voltage drop of less than 10mV under light loads
- 16-lead QFN package - 3mm x 3mm, 0.5mm pitch
- Lead-free version available

### Applications

- Enables more keys from current keyboard controller without extra I/O from chipset
- Keypad switches in mobile electronics
- Roller pad or joystick in mobile electronic products
- Wireless Handsets
- MP3 Players
- Digital Cameras

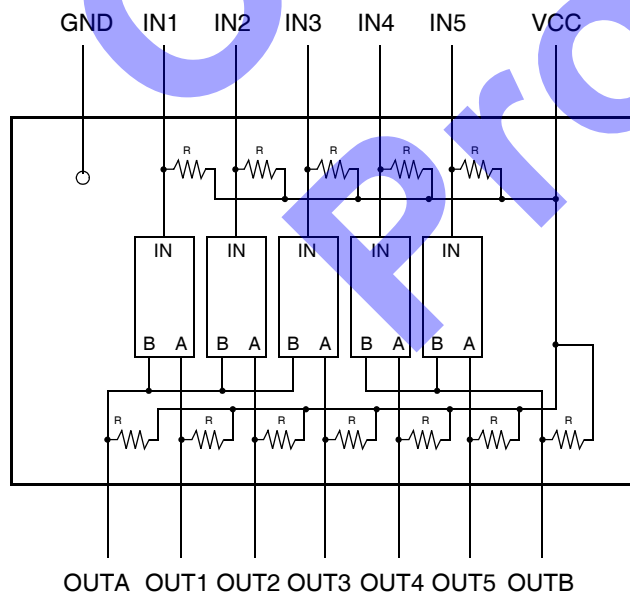
### Product Description

The CM2500-05 is a CMOS multiplexer for keypad switches. The device is functionally equivalent to a five-diode pair network. However, each channel in this network has virtually no voltage drop from input to output under light load. All inputs and outputs have an internal pull up to  $V_{CC}$ .

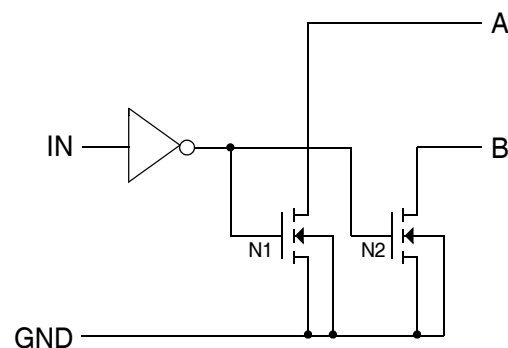
This device is particularly well suited for portable electronics (e.g. mobile handsets, PDAs, notebook computers) because of its small package format. This product is ideal for converting the logic of keypad switches where each switch pulls two sense lines low. The keypad multiplexer channels are set up in series on the keypad sense lines such that it will interface directly to the CPU chipset.

The CM2500-05 is available in a space-saving, low-profile 16-lead QFN package. This presents a 60% saving in space when compared with a discrete implementation. The CM2500-05 is available with optional lead-free finishing.

### Simplified Block Schematic

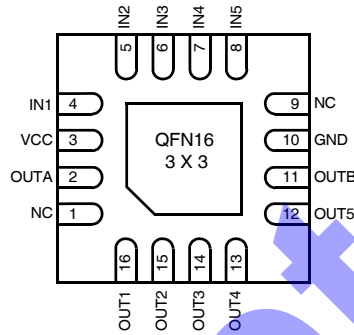


### Simplified Module Schematic (One channel pair only)



**PACKAGE / PINOUT DIAGRAM**

Bottom View



16-Lead QFN Package

Note: This drawing is not to scale.

**PIN DESCRIPTIONS**

PINS	NAME	DESCRIPTION
1	NC	No internal connection.
2	OUTA	Combined "Functional OR" output of IN1, IN2 and IN3.
3	VCC	Positive supply voltage.
4	IN1	Input 1 from switch to be multiplexed.
5	IN2	Input 2 from switch to be multiplexed.
6	IN3	Input 3 from switch to be multiplexed.
7	IN4	Input 4 from switch to be multiplexed.
8	IN5	Input 5 from switch to be multiplexed.
9	NC	No internal connection.
10	GND	Negative supply voltage.
11	OUTB	Combined "Functional OR" output of IN4 and IN5.
12	OUT5	Output 5 to keypad interface lines.
13	OUT4	Output 4 to keypad interface lines.
14	OUT3	Output 3 to keypad interface lines.
15	OUT2	Output 2 to keypad interface lines.
16	OUT1	Output 1 to keypad interface lines.

**Ordering Information**
**PART NUMBERING INFORMATION**

Pads	Package	Standard Finish		Lead-free Finish	
		Ordering Part Number <sup>1</sup>	Part Marking	Ordering Part Number <sup>1</sup>	Part Marking
16	QFN-16	CM2500-05QF	CM250005QF	CM2500-05QE	CM250005QE

Note 1: Parts are shipped in Tape &amp; Reel form unless otherwise specified.

## Specifications

### ABSOLUTE MAXIMUM RATINGS

PARAMETER	RATING	UNITS
ESD Protection (HBM, All Pins, See Note 1)	$\pm 2000$	V
$V_{CC}$	[GND - 0.5] to +6.0	V
$V_I$ (Inputs and Outputs)	[GND - 0.5] to [ $V_{CC} + 0.5$ ]	V
Storage Temperature Range	-65 to +150	$^{\circ}\text{C}$
Operating Temperature Range - Junction	-40 to +150	$^{\circ}\text{C}$
DC Package Power rating	0.5	W

Note 1: Equivalent to discharging a 100pF capacitor via a 1.5k $\Omega$  resistor (Human body model).

### STANDARD (RECOMMENDED) OPERATING CONDITIONS

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS
$V_{CC}$	Supply Voltage	1.5		5.5	V
$V_I$	DC Input Voltage	0	-	$V_{CC}$	V
$T_{AMB}$	Ambient Operating Temperature Range	-40	-	85	$^{\circ}\text{C}$

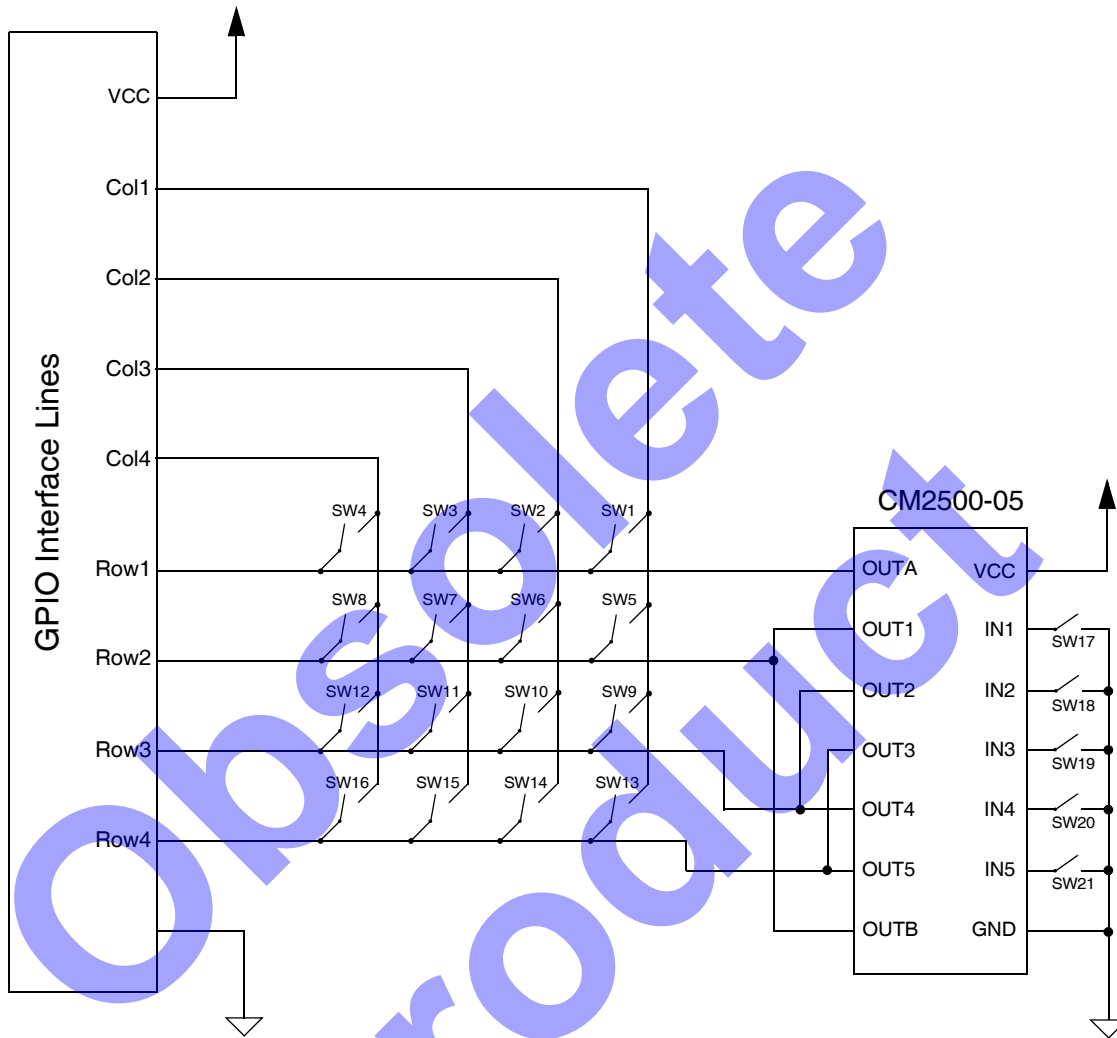
### ELECTRICAL OPERATING CHARACTERISTICS (NOTE 1)

Supply Pins ( $V_{BUS} = 4.1\text{V to }5.5\text{V}$ ;  $V_{CC} = 1.65\text{V to }3.6\text{V}$ )

SYM-BOL	PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
$I_{CC}$	Supply quiescent current	All inputs/outputs floating		0.1	10.0	$\mu\text{A}$
$R_{OUT}$	OUTx Pull-up Resistance		50	100	150	k $\Omega$
$R_{IN2.7}$	INx Pull-up Resistance	$V_{CC}=2.7\text{V}$ , PIN at GND	50	100	150	k $\Omega$
$R_{IN1.8}$	INx Pull-up Resistance	$V_{CC}=1.8\text{V}$ , PIN at GND	100	240	500	k $\Omega$
$V_D$	Voltage Drop (OUTx to GND)	$V_{CC}=2.7\text{V}$ , INx = GND		10	100	mV
$V_{IL}$	Maximum Low-level Input Voltage				$V_{CC} \times 0.3$	V
$V_{IH}$	Minimum High-level Input Voltage		$V_{CC} \times 0.7$			V
$I_L$	OUTx Leakage Current	INx floating			1.0	$\mu\text{A}$
$C_P$	OUTx / INx Pin Capacitance	At 2.5 Volt bias, 1 MHz			15	pF

Note 1: Operating Characteristics are over Standard Operating Conditions unless otherwise specified.

## Applications Information



**Figure 1. Typical Application for Extended 4X4 Keyboard**

The CM2500-05 can be used with just about any keypad configuration. The diagram below gives an example of an interface for a 4 column x 4 row implementation. The outputs of the CM2500-05 have been designed to interface with nearly any type of keyboard setup provided the same methodology is used.

Basically if any one of the switches 17 to 21 are closed, it will pull down 2 row lines rather than 1. All outputs on the CM2500-05 are open drain.

It follows in the above implementation that:

- If SW17 is closed, row 1 and 2 are pulled low.
- If SW18 is closed, row 1 and 3 are pulled low.
- If SW19 is closed, row 1 and 4 are pulled low.
- If SW20 is closed, row 2 and 3 are pulled low.
- If SW21 is closed, row 2 and 4 are pulled low.
- If SW17-SW21 are not closed, the standard scan routine is in effect (i.e., one row is pulled low)

In larger keypad implementations, multiple CM2500-05 can be used to yield more switches.

## Mechanical Details

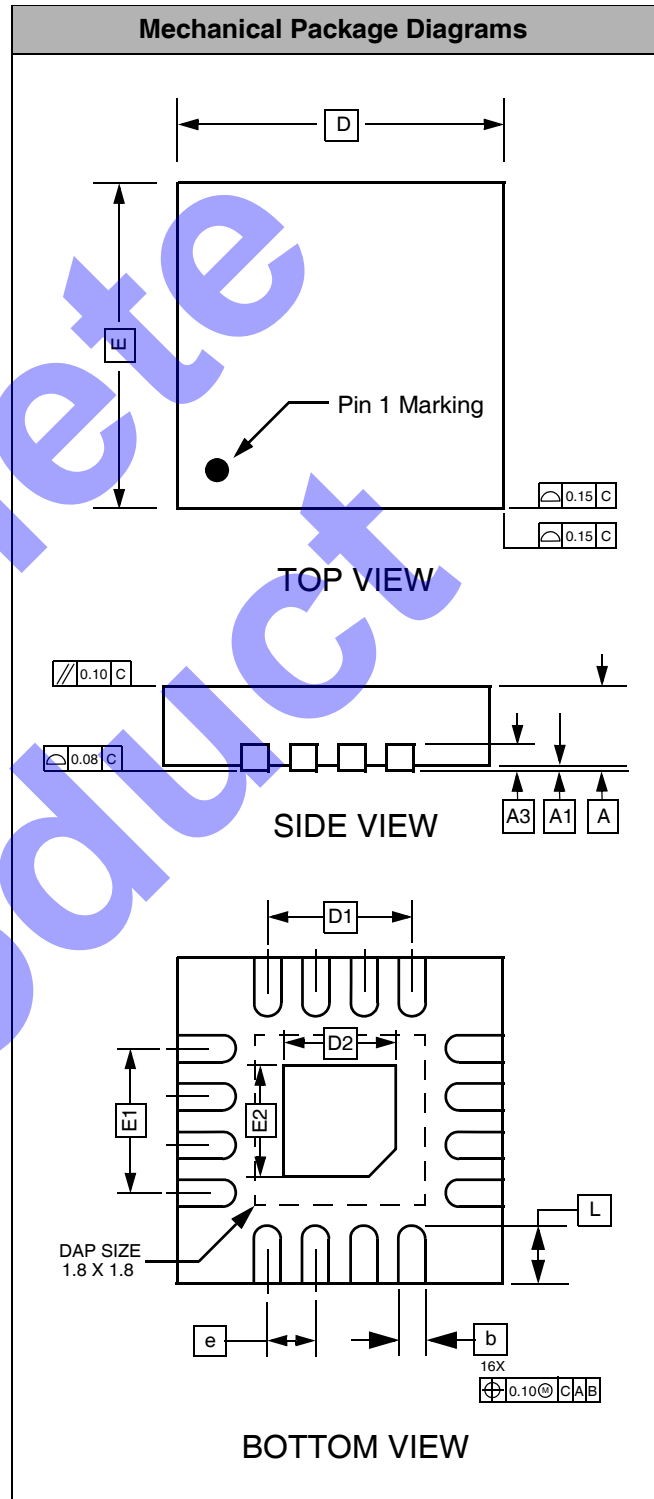
### QFN-16 Mechanical Specifications

Dimensions for CM2500-05 devices supplied in 16-lead QFN packages are presented below.

For complete information on the QFN-16 package, see the California Micro Devices QFN Package Information document.

PACKAGE DIMENSIONS						
Package	QFN					
Leads	16					
Dim.	Millimeters			Inches		
	Min	Nom	Max	Min	Nom	Max
A	0.70	0.75	0.80	.028	.030	.031
A1	0.00	0.02	0.05	0.00	.001	.002
A3	0.20 REF			.008		
b	0.20	0.25	0.30	.008	.010	.012
D	2.9	3.0	3.1	.114	.118	.122
D1	1.50 REF			.059 REF		
D2	1.00	1.10	1.20	.039	.043	.047
E	2.9	3.0	3.1	.114	.118	.122
E1	1.50 REF			.059 REF		
E2	1.00	1.10	1.20	.039	.043	.047
e	0.50 TYP.			.020 TYP.		
L	0.30	0.40	0.50	.012	.016	.020
# per tape and reel	2500 pieces*					
Controlling dimension: millimeters						

\* This is an approximate number which may vary.



Package Dimensions for 16-Lead QFN