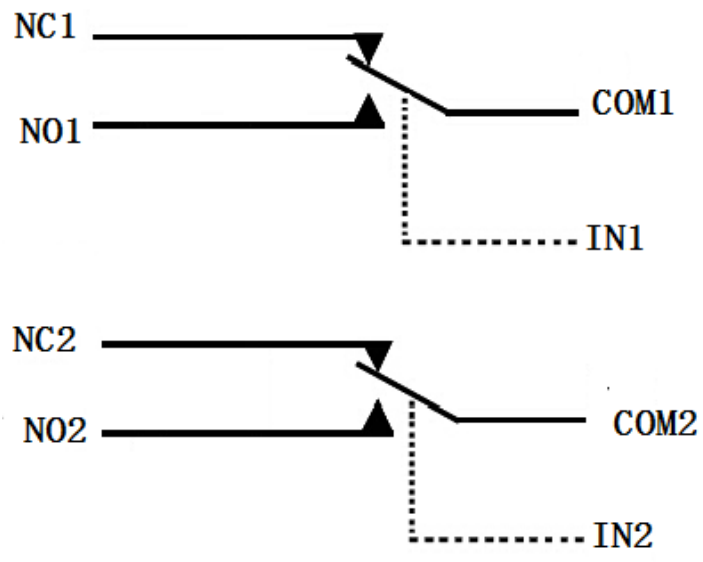
# 0.5Ω Dual SPDT Negative Signal Handing Analog Switch

## General Description

The HM5228 is an advanced CMOS analog switch fabricated in Sub−micron silicon gate CMOS technology. The part also features guaranteed Break Before Make (BBM) switching, assuring the switches never short the driver. The switches can handle negative signal down to -2V.

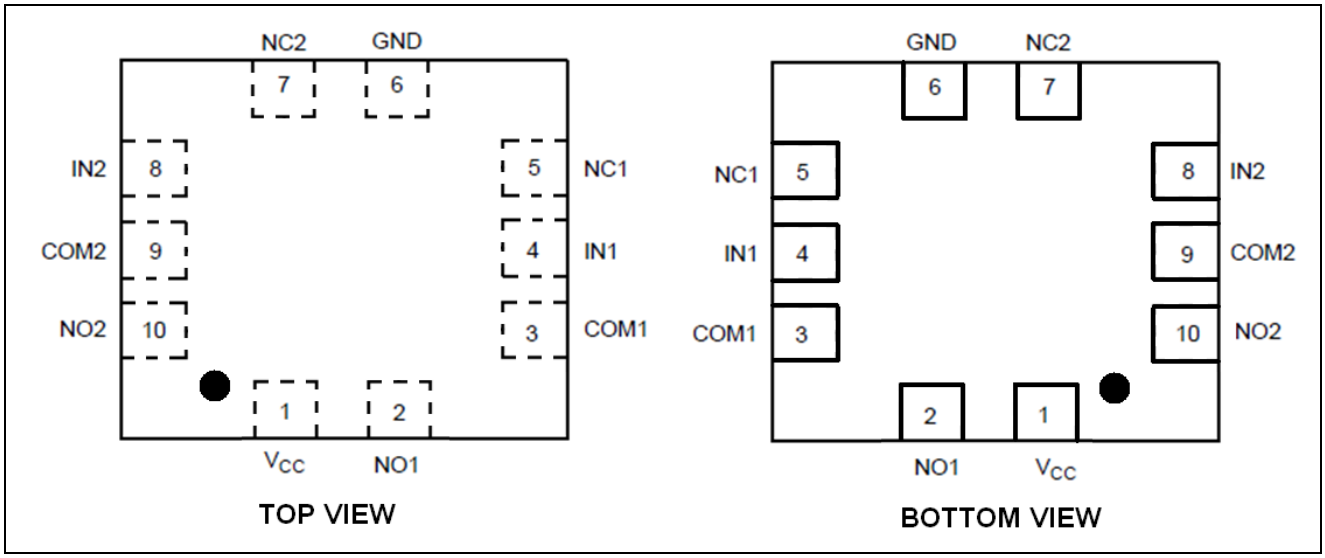
## Features

- Low RON: typical 0.5Ω @ $V_{CC}$ =5V
- Single Supply Operation from 2.5V−5V
- Full -2V−$V_{CC}$ Signal Handling Capability
- High Off−Channel Isolation
- Low Standby Current
- Low Distortion
- Break-Before-Make(BBM) switching
- High Continuous Current Capability: ±300 mA Through Each Switch
- Applications in Cell Phone Audio Block/ Speaker and Earphone Switching Ring−Tone Chip / Amplifier Switching/Modems
- Package :QFN10L(1.8*1.4)




**Analog Symbol**

## Pin Configuration




## Pin Function

| QFN PIN # | Symbol | FUNCTION |
|---|---|---|
| 1 | VCC | Power supply |
| 2 | NO1 | Independent Channels |
| 3 | COM1 | Common Channels |
| 4 | IN1 | Controls |
| 5 | NC1 | Independent Channels |
| 6 | GND | Ground (V) |
| 7 | NC2 | Independent Channels |
| 8 | IN2 | Controls |
| 9 | COM2 | Common Channels |
| 10 | NO2 | Independent Channels |

## Truth Table

| IN1，2 | NO1，2 | NC1，2 |
|---|---|---|
| 0 | OFF | ON |
| 1 | ON | OFF |

## Absolute Maximum Ratings

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Supply Voltage | $V_{CC}$ | -0.5～+6.0 | V |
| Analog Input Voltage | $V_{IS}$ | -2.5～VCC+0.3<br>$\|V_{CC}-V_{IS}\|$ <6.5V | V |
| Digital Select Input Voltage | $V_{IN}$ | -0.5～+6.0 | V |
| Output Voltage | $V_O$ | -2.5～VCC+0.3<br>$\|V_{CC}-V_O\|$ <6.5V | V |
| Continuous DC Current from COM to NC/NO | $I_{an1}$ | ±300 | mA |
| Peak Current from COM to NC/NO, 10 duty cycle (Note 1) | $I_{an1-pk1}$ | ±500 | mA |
| Continuous DC Current into COM/NO/NC with respect to $V_{CC}$ or GND | $I_{clmp}$ | ±100 | mA |

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

Note1. Defined as 10% ON, 90% off duty cycle.

| Characteristic | Symbol | Min | Max | Unit |
|---|---|---|---|---|
| DC Supply Voltag | $V_{CC}$ | 2.5 | 5 | V |
| Digital Select Input Voltage | $V_{IN}$ | GND | 5 | V |
| Analog Input Voltage | $V_{IS}$ | -2 | $V_{CC}$ | V |
| Operating Temperature Range | $T_A$ | -45 | +85 | ℃ |
| Input Rise or Fall Time, SELECT | tr,tf | 0 | 20 | ns/V |

## Electrical Characteristics

| Symbol | Parameter | Test Conditions | $V_{CC}$±10% | $T_A$=25℃ | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | |
| $V_{IH}$ | High−Level Input Voltage, Select Inputs | | 2.5~5 | 1.3 | | | V |
| $V_{IL}$ | Low−Level Input Voltage, Select Inputs | | 2.5~5 | | | 0.5 | V |
| $I_{IN}$ | Maximum Input Leakage Current, Select Inputs | $V_{IN}$ =$V_{CC}$ or GND | 5 | | | ±0.3 | uA |
| $I_{OFF}$ | Power Off Leakage Current | $V_{IN}$ =$V_{CC}$ or GND | 0 | | | ±0.5 | uA |
| $I_{CC}$ | Maximum Quiescent Supply Current (Note 2) | SELECT,<br>$V_{IS}$= $V_{CC}$ or GND | 3.6 | | | 1 | uA |
| $I_{COM(ON)}$ | COM ON leakage Current | $V_{IN}$ = $V_{IL}$ or $V_{IH.}$ | 5 | -20 | | 20 | nA |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | (Note 3) | $V_{NO}$=0.3V or 4.7V<br>$V_{NC}$ floating<br>$V_{NC}$=0.3V or 4.7V<br>$V_{No}$ floating<br>$V_{COM}$=0.3Vor 4.7V | | | | | |
| $R_{ON}$ | On−Resistance<br>(Note 2,Note 3) | $V_{IS}$=GND to VCC<br>$I_{IN}$= 100mA | 5 | | 0.4 | 0.5 | Ω |
| | | | 3.3 | | 0.6 | 0.7 | |
| | | | 2.0 | | 1.5 | 1.7 | |
| $R_{FLAT}$ | On−Resistance Flatness<br>(Note 2,Note 3, Note 5) | $I_{COM}$=100mA<br>$V_{IS}$=GND to VCC | 5 | | | 0.3 | Ω |
| $\Delta R_{ON}$ | On−Resistance Match Between Channels<br>(Note 2,Note 3,Note 4) | $I_{COM}$=100mA<br>$V_{IS}$=1.5V | 5 | | 0.25 | | Ω |
| $t_{ON}$ | Turn−On Time (Figure 1) | $V_{IS}$=1.5V | 2.5~3.3 | | 35 | 45 | ns |
| | | | 2.5~5.0 | | 25 | 30 | |
| $t_{OFF}$ | Turn−Off Time (Figure 1) | $V_{IS}$=1.5V | 2.5~3.3 | | 17 | 20 | ns |
| | | | 3.6~5.0 | | 15 | 20 | |
| $t_{BBM}$ | Break−Before−Make Time(Note6)(Figure 2) | $C_L$=35pF,$R_{IS}$=50Ω<br>$V_{IS}$=1.5V | 2.5~3.3 | 7 | 9 | | ns |
| | | | 3.6~5.0 | 4 | 6 | | |
| BW | On−Channel −3dB Bandwidth or Frequen –cy Response (Figure 4) | $R_{IS}$=50Ω | 2.5~5.0 | | 50 | | MHz |
| $V_{ISO}$ | Off−Channel Isolation<br>(Figure 4) | $F_{IS}$ = 100kHz,<br>$V_{IN}$ =GND to $V_{CC}$<br>$C_L$=5pF，$R_L$= 50Ω<br>$V_{IS}$=1V RMS | 2.5~5.0 | | -66 | | dB |
| Q | Charge Injection Select Input to Common I/O<br>(Figure 3) | $V_{IN}$ = 0 or $V_{CC}$<br>$R_{IS}$=0Ω,$C_L$=100pF<br>$R_L$=1MΩ<br>Q=$C_L$×$\Delta V_{Out}$ | 2.5~3.3 | | 51 | | pC |
| | | | 3.6~5.0 | | 49 | | |
| THD | Total Harmonic Distortion THD +Noise | $F_{IS}$=20Hz to 20KHz<br>$R_L$=600Ω,$C_L$=50pF<br>$V_{IS}$=2V RMS | 3.6 | | 0.08 | | % |
| $V_{CT}$ | Channel−to−Channel Crosstalk<br>(Figure 4) | $F_{IS}$= 100KHz,<br>$V_{IN}$ =GND to $V_{CC}$<br>$R_L$= 50Ω,$C_L$=5pF<br>$V_{IS}$=1V RMS | 3.6~5.0 | | -72 | | dB |
| $C_{IN}$ | Control Pin Input Capacitance | | 3.6 | | 3.5 | | pF |
| $C_{NC}$/$C_{NO}$ | NC/NO Port Capacitance | | 3.6 | | 50 | | pF |
| $C_{COM}$ | COM Port Capacitance When Switch is Enabled | | 3.6 | | 120 | | pF |

Note 2. Guaranteed by design

3. Guaranteed by design. Resistance measurements do not include test circuit or package resistance
4. $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$ between NC1 and NC2 or between NO1 and NO2.
5. Flatness is defined as the difference between the maximum and minimum value of on−resistance as measured over the specified analog signal ranges.
6. Guaranteed by design in -40℃.

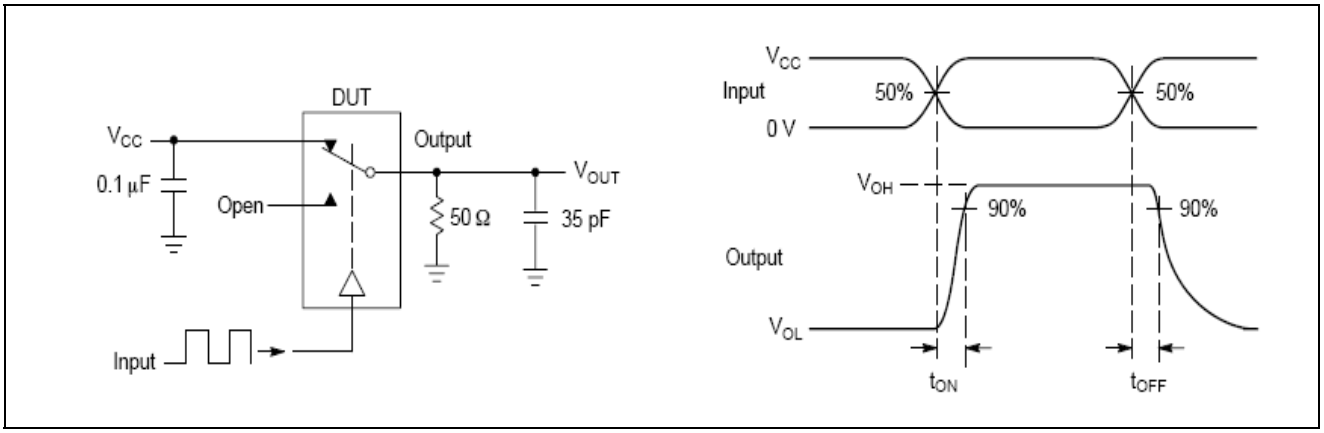



Figure1: $t_{ON}/t_{OFF}$

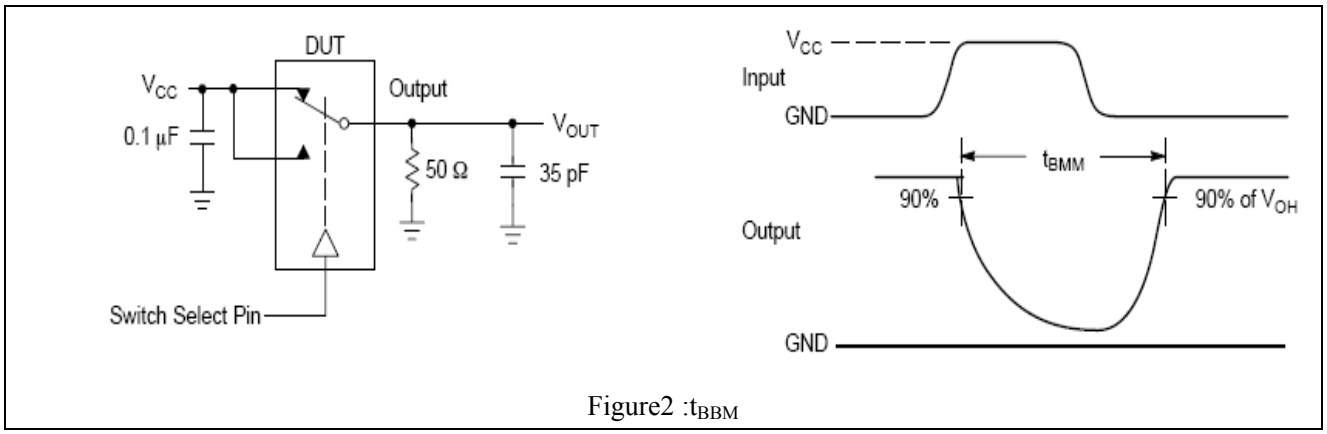



Figure2 :$t_{BBM}$

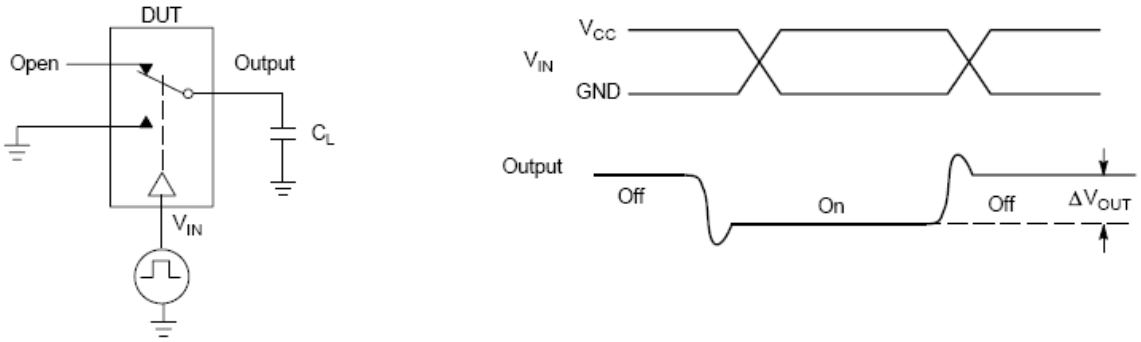
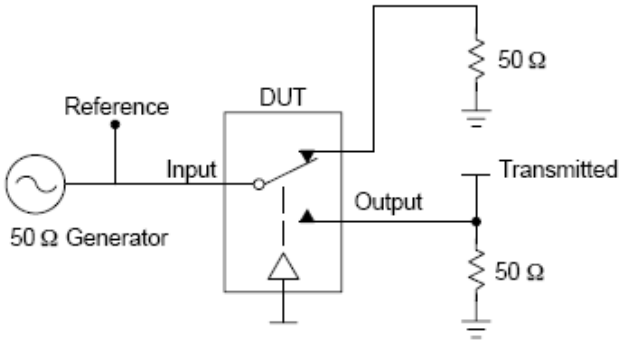



Figure3: Charge Injection




$V_{ISO}$=20log（$V_{OUT}/V_{IN}$）

$V_{ONL}$=20log（$V_{OUT}/V_{IN}$）

$V_{CT}$=20log（$V_{OUT}/V_{IN}$）

BW=the frequency 3dB below $V_{ONL}$

Figure 4. -3dB Bandwidth/Off Channel Isolation/On Channel Loss(BW)/Crosstalk (On Channel to Off Channel)/$V_{ONL}$

## Package Dimension

QFN10L