# FSA2270TUMX-TP

## Low-Voltage, 1.2Ω Dual-SPDT Analog Switch



## GENERAL DESCRIPTION

The is a high-performance, dual single-pole double-throw (SPDT) analog switch. Specified over a wide operating power supply voltage range 1.65V to 5.0V, Targeted applications include battery powered equipment that benefit from ultra-low ON-resistance (1.2Ω) and fast switching speeds.

Break-before-make switching prevents both switches being enabled simultaneously. This eliminates signal disruption during switching.

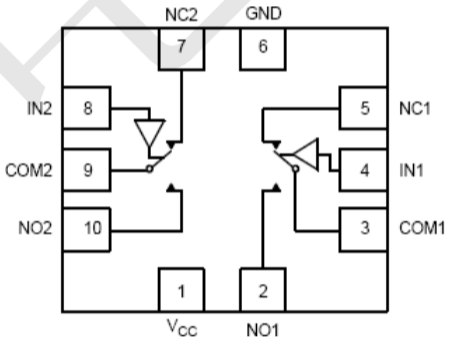
## FEATURES

- Low ON Resistance: 1.2 Ω at 4.2V
- Wide VCC Range: 1.65V to 5.0V
- Rail-to-Rail Signal Range
- ON-Resistance Matching: 0.1 Ω (TYP)
- ON-Resistance Flatness: 0.2Ω (TYP)
- Break-Before-Make Switching
- -3dB Bandwidth: 100 MHz
- High Off Isolation: 58dB at 1MHz
- Extended Industrial Temperature Range: –40°C to 85°C
- Packaging (Pb-free & Green available): QFN1.8x1.4-10L

## APPLICATIONS

- Cell Phones
- PDAs
- Portable Instrumentation
- Battery Powered Communications

## PIN CONFIGURATION (TOP VIEW)




## PIN DESCRIPTION

| PIN | NAME | FUNCTION |
|---|---|---|
| 2 , 10 | NO1,NO2 | Data Port (Normally Opened) |
| 6 | GND | Ground |
| 5 , 7 | NC1,NC2 | Data Port (Normally Closed) |
| 3 , 9 | COM1,COM2 | Data Port (Common Port) |
| 1 | VCC | Power Supply |
| 4 , 8 | IN1,IN2 | Logic Control |

## FUNCTION TABLE

| IN1,IN2 INPUT | ON SWITCHES |
|---|---|
| 0 | NC1/NC2 Connected to COM1/COM2 |
| 1 | NO1/NO2 Connected to COM1/COM2 |

## ABSOLUTE MAXIMUM RATINGS

$V_{CC}$, IN1, IN2 to GND .....-0.3V to +5.25V
Analog Input Voltage
($V_{NO}$, $V_{NC}$, or $V_{COM}$).....-0.3V to ($V_{CC}$+ 0.3V)
Continuous Current into COM to NC/NO .....±300mA
Peak Current COM to NC/NO
(Pulsed at 1ms, 10% duty cycle).....±500mA
Storage Temperature Range.....-65℃ to +150℃
Junction Temperature.....150℃
Operating Temperature Range.....-40℃ to +85℃
Lead Temperature (Soldering, 10 sec).....260℃

NOTE:
Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

## CAUTION

This integrated circuit can be damaged by ESD if you don’t pay attention to ESD protection. Broadchip recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

Broadchip reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact Broadchip sales office to get the latest datasheet.

## ELECTRICAL CHARACTERISTICS

(Typical values are at Vcc = +4.2V, TA = +25°C, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TPY | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| ANALOG SWITCH | | | | | | | | |
| Analog Signal Range | $V_{NO}$, $V_{NC}$, $V_{COM}$ | | | - 40°C to +85°C | 0 | | VCC | V |
| On-Resistance | $R_{ON}$ | $V_{cc}$ = 4.2 V, $V_{NO}$, $V_{NC}$ or $V_{COM}$ = 1 V, $I_{COM}$ = -100 mA, Test Circuit 1 | | +25°C | | 1.2 | 1.8 | Ω |
| | | | | - 40°C to +85°C | | | 2.0 | Ω |
| On-Resistance Match Between Channels | $\Delta R_{ON}$ | $V_{cc}$ = 4.2 V, $V_{NO}$, $V_{NC}$ or $V_{COM}$ = 1 V, $I_{COM}$ = -100 mA, Test Circuit 1 | | +25°C | | 0.1 | 0.3 | Ω |
| | | | | - 40°C to +85°C | | | 0.4 | Ω |
| On-Resistance Flatness | $R_{FLAT(ON)}$ | $V_{cc}$ = 4.2 V, $V_{NO}$, $V_{NC}$ or $V_{COM}$ = 0V, 1 V, 2V, $I_{COM}$ = -100 mA, Test Circuit 1 | | +25°C | | 0.2 | 0.4 | Ω |
| | | | | - 40°C to +85°C | | | 0.5 | Ω |
| Source OFF Leakage current | $I_{NC(OFF)}$, $I_{NO(OFF)}$ | $V_{cc}$ = 4.2 V, $V_{NO}$ or $V_{NC}$ = 3.3 V/ 0.3 V, $V_{COM}$ = 0.3 V/ 3.3 V | | - 40°C to +85°C | | | 1 | μA |
| Channel ON Leakage current | $I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$ | $V_{cc}$ = 4.2 V, $V_{COM}$ = 0.3 V/ 3.3 V, $V_{NO}$ or $V_{NC}$ = 0.3 V/ 3.3 V, or floating | | - 40°C to +85°C | | | 1 | μA |
| DIGITAL INPUTS | | | | | | | | |
| Input High Voltage | $V_{INH}$ | | | - 40°C to +85°C | 1.6 | | | V |
| Input Low Voltage | $V_{INL}$ | | | - 40°C to +85°C | | | 0.5 | V |
| Input Leakage Current | $I_{IN}$ | $V_{cc}$ = 4.2 V, $V_{IN}$ = 0 V or 4.2 V | | - 40°C to +85°C | | | 1 | μA |
| DYNAMIC CHARACTERISTICS | | | | | | | | |
| Turn-On Time | $t_{ON}$ | $V_{IN}$ = 2.1 V to 0 V, $R_L$ = 50 Ω, $C_L$ = 35 pF, $V_{NO1}$ or $V_{NC1}$ = $V_{NO2}$ or $V_{NC2}$ = 2.1 V, Test Circuit2 | | +25°C | | 88 | | ns |
| Turn-Off Time | $t_{OFF}$ | $V_{IN}$ = 2.1 V to 0 V, $R_L$ = 50 Ω, $C_L$ = 35 pF, $V_{NO1}$ or $V_{NC1}$ = $V_{NO2}$ or $V_{NC2}$ = 2.1 V, Test Circuit2 | | +25°C | | 16 | | ns |
| Break-Before-Make Time Delay | $t_D$ | $V_{IN}$ = 2.1 V to 0 V, $R_L$ = 50 Ω, $C_L$ = 35 pF, $V_{NO1}$ or $V_{NC1}$ = $V_{NO2}$ or $V_{NC2}$ = 2.1 V, Test Circuit3 | | +25°C | | 6.0 | | ns |
| Off Isolation | $O_{ISO}$ | $V_{BIAS}$ = 2.1 V, $V_{IN}$ = 0 dBm, Test Circuit4 | 100KHz | +25°C | | -78 | | dB |
| | | | 1MHz | +25°C | | -58 | | dB |

**(Continued)**

| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TPY | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| Channel-to-Channel Crosstalk | $X_{TALK}$ | $V_{BIAS}$ = 2.1 V, $V_{IN}$ = 0dBm, Test Circuit5 | 100KHz | +25°C | | -103 | | dB |
| | | | 1MHz | +25°C | | -90 | | dB |
| Bandwidth –3 dB | BW | $V_{BIAS}$ = 2.1 V, $V_{IN}$ = 0 dBm, Test Circuit6 | | +25°C | | 100 | | MHz |
| Charge Injection Select Input to Common I/O | Q | $V_{NO1}$ or $V_{NC1}$ = $V_{NO2}$ or $V_{NC2}$ = 0 V, $C_L$ = 1.0 nF, Test Circuit7 | | +25°C | | 4.0 | | pC |
| Channel ON Capacitance | $C_{ON}$ | | | +25°C | | 50 | | pF |
| POWER REQUIREMENTS | | | | | | | | |
| Power Supply Range | VCC | | | - 40°C to +85°C | 1.65 | | 5.0 | V |
| Power Supply Current | $I_+$ | VCC = 4.2 V, $V_{IN}$ = 0 V or $V_{cc}$ | | - 40°C to +85°C | | | 1 | μA |

(Typical values are at Vcc = +2.7V, TA = +25°C, unless otherwise noted.)

| PARAMETER | SYMBOL | CONDITIONS | TEMP | MIN | TPY | MAX | UNITS |
|---|---|---|---|---|---|---|---|
| ANALOG SWITCH | | | | | | | |
| Analog Signal Range | $V_{NO}$, $V_{NC}$, $V_{COM}$ | | - 40°C to +85°C | 0 | | VCC | V |
| On-Resistance | $R_{ON}$ | Vcc = 2.7 V, $V_{NO}$, $V_{NC}$ or $V_{COM}$ = 1 V, $I_{COM}$ = -100 mA, Test Circuit 1 | +25°C | | 1.5 | 2.0 | Ω |
| | | | - 40°C to +85°C | | | 2.2 | Ω |
| On-Resistance Match Between Channels | $\Delta R_{ON}$ | Vcc = 2.7 V, $V_{NO}$, $V_{NC}$ or $V_{COM}$ = 1 V, $I_{COM}$ = -100 mA, Test Circuit 1 | +25°C | | 0.1 | 0.4 | Ω |
| | | | - 40°C to +85°C | | | 0.5 | Ω |
| On-Resistance Flatness | $R_{FLAT(ON)}$ | Vcc = 2.7 V, $V_{NO}$, $V_{NC}$ or $V_{COM}$ = 0V, 1 V, 2V , $I_{COM}$ = -100 mA, Test Circuit 1 | +25°C | | 0.3 | 0.6 | Ω |
| | | | - 40°C to +85°C | | | 0.7 | Ω |
| Source OFF Leakage current | $I_{NC(OFF)}$, $I_{NO(OFF)}$ | Vcc = 3.6 V, $V_{NO}$ or $V_{NC}$ = 3.3 V / 0.3 V, $V_{COM}$ = 0.3 V/ 3.3 V | - 40°C to +85°C | | | 1 | μA |
| Channel ON Leakage current | $I_{NC(ON)}$, $I_{NO(ON)}$, $I_{COM(ON)}$ | Vcc = 3.6 V, $V_{COM}$ = 0.3 V/ 3.3 V, $V_{NO}$ or $V_{NC}$ = 0.3 V/ 3.3 V, or floating | - 40°C to +85°C | | | 1 | μA |
| DIGITAL INPUTS | | | | | | | |
| Input High Voltage | $V_{INH}$ | | - 40°C to +85°C | 1.5 | | | V |
| Input Low Voltage | $V_{INL}$ | | - 40°C to +85°C | | | 0.4 | V |
| Input Leakage Current | $I_{IN}$ | Vcc = 2.7 V, $V_{IN}$ = 0 V or 2.7 V | - 40°C to +85°C | | | 1 | μA |
| DYNAMIC CHARACTERISTICS | | | | | | | |
| Turn-On Time | $t_{ON}$ | $V_{IN}$ =1.5 V to 0 V, $R_L$ = 50 Ω, $C_L$ = 35 pF, $V_{NO1}$ or $V_{NC1}$ = $V_{NO2}$ or $V_{NC2}$ = 1.5 V, Test Circuit2 | +25°C | | 100 | | ns |
| Turn-Off Time | $t_{OFF}$ | $V_{IN}$ = 1.5 V to 0 V, $R_L$ = 50 Ω, $C_L$ = 35 pF, $V_{NO1}$ or $V_{NC1}$ = $V_{NO2}$ or $V_{NC2}$ = 1.5 V, Test Circuit2 | +25°C | | 20 | | ns |
| Break-Before-Make Time Delay | $t_D$ | $V_{IN}$ = 1.5 V to 0 V, $R_L$ = 50 Ω, $C_L$ = 35 pF, $V_{NO1}$ or $V_{NC1}$ = $V_{NO2}$ or $V_{NC2}$ =1.5 V, Test Circuit3 | +25°C | | 9.2 | | ns |

**(Continued)**

| PARAMETER | SYMBOL | CONDITIONS | | TEMP | MIN | TPY | MAX | UNITS |
|---|---|---|---|---|---|---|---|---|
| ANALOG SWITCH | | | | | | | | |
| Off Isolation | $O_{ISO}$ | $V_{BIAS}$ = 2.1 V, $V_{IN}$ = 0 dBm, Test Circuit4 | 100KHz | +25°C | | -78 | | dB |
| | | | 1MHz | +25°C | | -58 | | dB |
| Channel-to-Channel Crosstalk | XTALK | VBIAS = 2.1 V, VIN = 0 dBm, Test Circuit5 | 100KHz | +25°C | | -103 | | dB |
| | | | 1MHz | +25°C | | -90 | | dB |
| Bandwidth –3 dB | BW | VBIAS = 2.1 V, VIN = 0 dBm, Test Circuit6 | | +25°C | | 100 | | MHz |
| Charge Injection Select Input to Common I/O | Q | VNO1 or VNC1 = VNO2 or VNC2 =0 V, CL=1.0nF Test Circuit7 | | +25°C | | 3.0 | | pC |
| Channel ON Capacitance | CON | | | +25°C | | 50 | | pF |

## TEST CIRCUITS

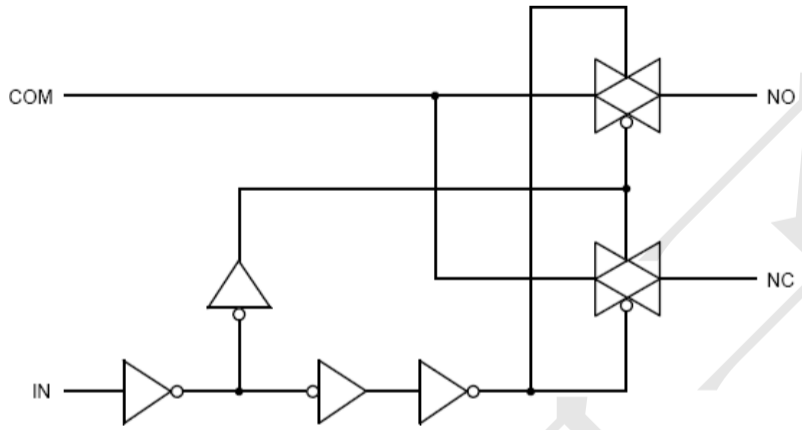



**Figure 1. Logic equivalent circuit**

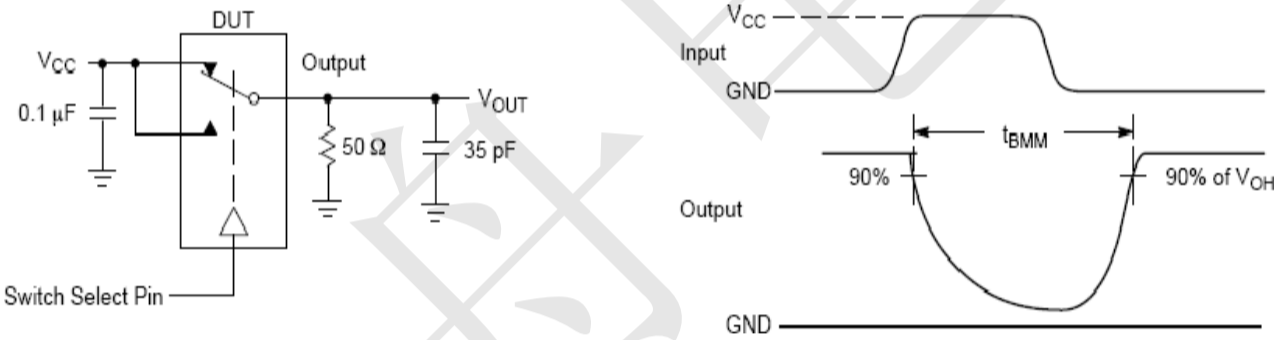



**Figure 2. tBBM (Time Break-Before-Make)**

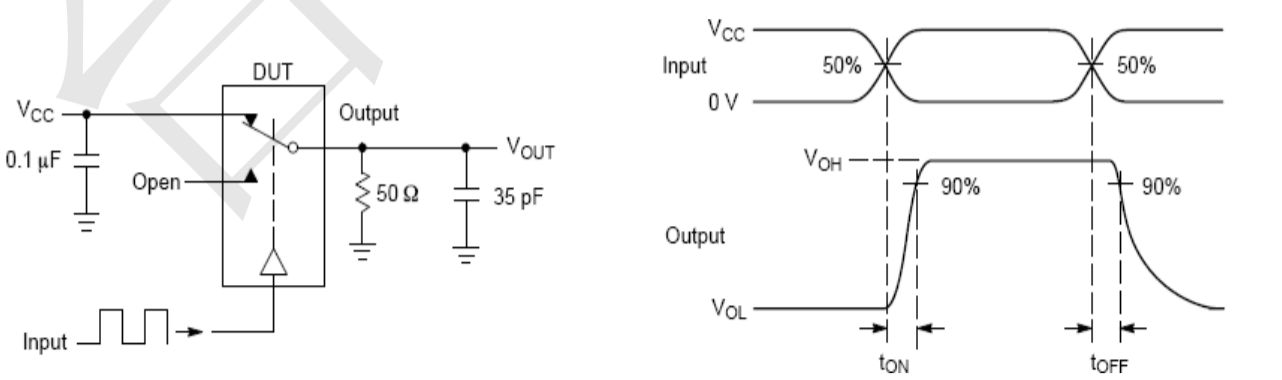



**Figure 3. $t_{ON/OFF}$**

## TEST CIRCUITS

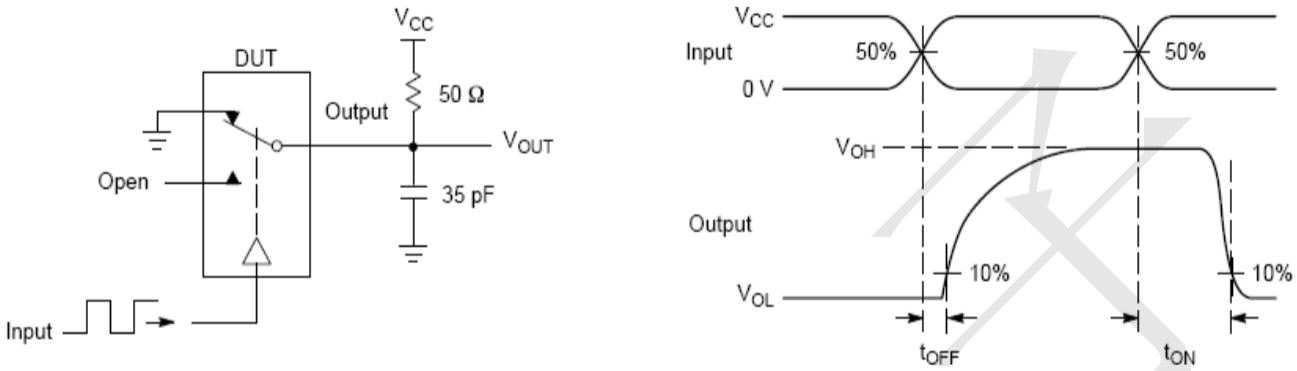



**Figure 4. tON/OFF**

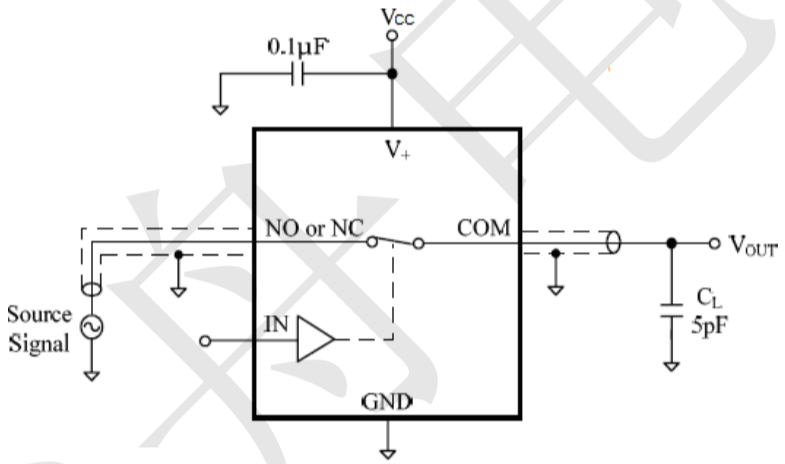



**Figure 5. Bandwidth -3dB**

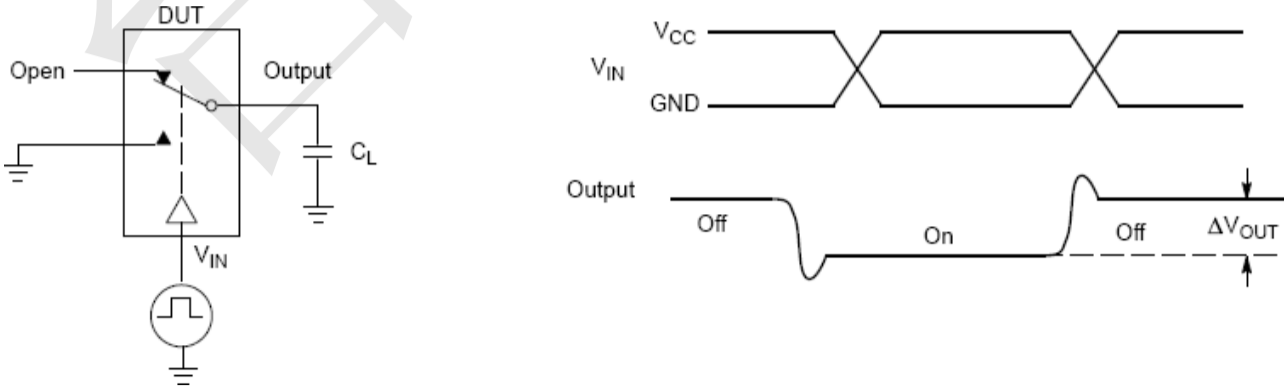
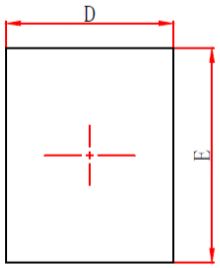


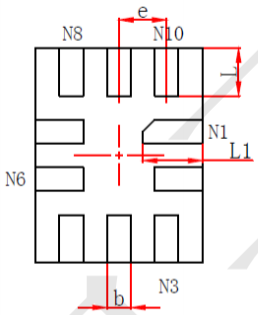

**Figure 6. Charge Injecting (Q)**

## PACKAGE OUTLINE DIMENSIONS

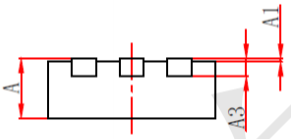
### QFN1.8x1.4-10L




Top View




Bottom View




Side View

| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min. | Max. | Min. | Max. |
| A | 0.500 | 0.600 | 0.020 | 0.024 |
| A1 | 0.000 | 0.050 | 0.000 | 0.002 |
| A3 | 0.152REF. | | 0.006REF. | |
| D | 1.350 | 1.450 | 0.053 | 0.057 |
| E | 1.750 | 1.850 | 0.069 | 0.073 |
| D1 | — | — | — | — |
| E1 | — | — | — | — |
| k | — | | — | |
| b | 0.150 | 0.250 | 0.006 | 0.010 |
| e | 0.400TYP. | | 0.016TYP. | |
| L | 0.350 | 0.450 | 0.014 | 0.018 |
| L1 | 0.450 | 0.550 | 0.018 | 0.022 |