64-Chanel High Reliability Analog Multiplexer

Datasheet

Part Number：BM2720MQRH

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# Page of Revise Control

Version No.	Publish Time	Revised Chapter	Revise Introduction	Note
1.0	2017.09	-	-	
1.1	2018.3	-	Changed the template	

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1 Unique features

1） ESD (human model) ≥2000V

2） Low Power Consumption, I_{DD} ≤1mA

3） Fast switching time ≤600ns

4） Break-Before-Make Delay≥40ns

5） Low ON Resistance≤600Ω

6） Low leakage current ≤100nA

7） High isolation ability ≥60dB@f_{in}=200kHz

8） Total Irradiation Dose ≥ 100Krad（Si）

9） Single Event Latchup immune

10) T_A：-55℃～125℃

11) Package：CQFP80；
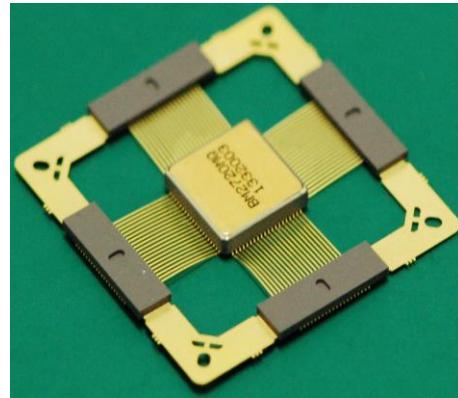
2 General Description

The device is a high reliability, radiation hardened 64 channels analog multiplexer, with a "T" model switch. One of 64 channel selection is controlled by a 6-bit binary address plus an Enable-Inhibit input which conveniently controls the ON/OFF operation of several multiplexers in a system. The device includes 4-branch groups and each branch group includes a firstly 16-channel switch, and a secondly 4-channel switch. These two switches are connected to the "T" model switch, which can be connected to the GND with the GND Switch (shown in diagram). When the device is not in working, all GND switches are controlled to connect to GND, which can isolate the input and output signals effectively.

3 Pin Description

The pins description of BM2720MQRH is shown in figure 1 and Table 1.
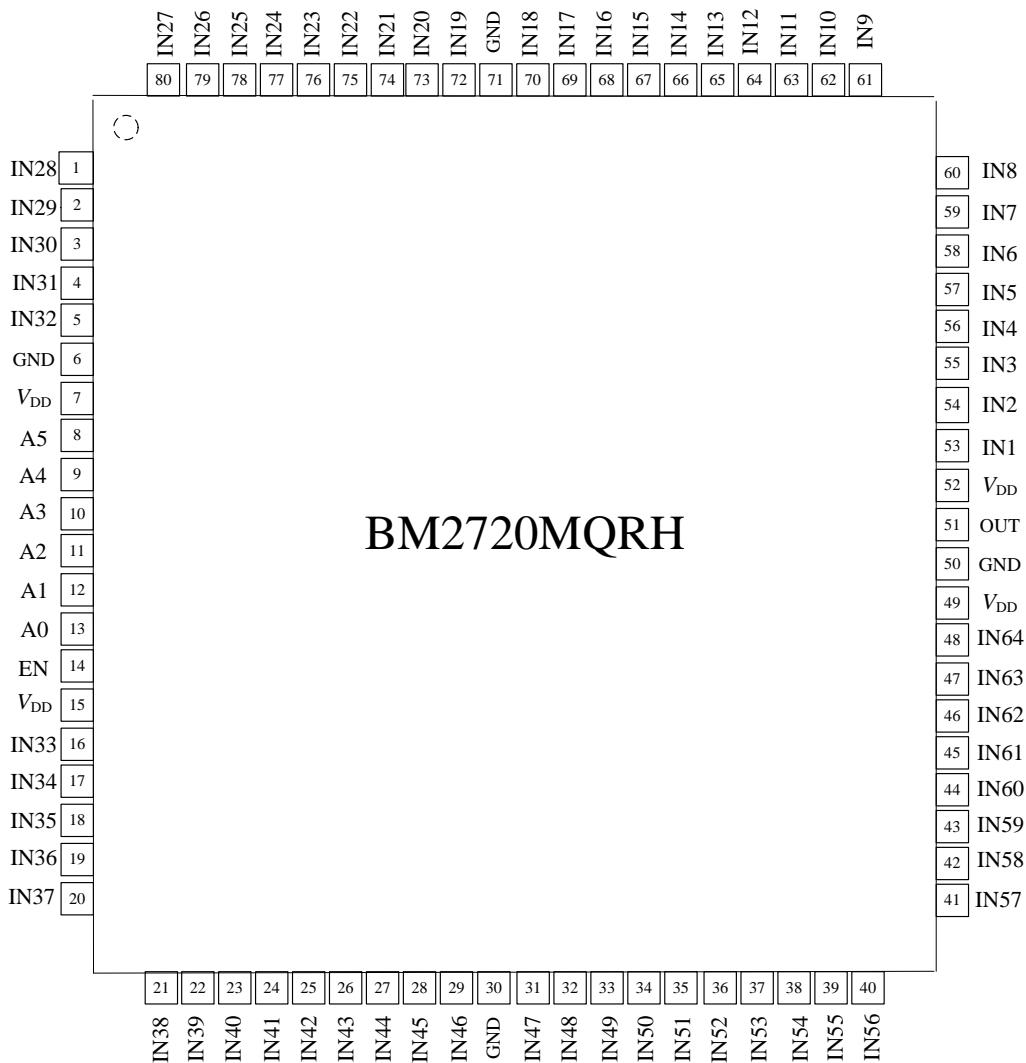
Figure1. BM2720MQRH Pin Configuration（Top View）

Table1 BM2720MQRH Pin Configuration

Symbol	Description
IN1~64	The 1~64 channel input
A0~ 5	Address control point
EN	Enable
OUT	Output
V$_{DD}$	Power
GND	ND

Note: the pins description is listed in the appendix1.

# 4　Function Block Diagram

4.1 Function Block Diagram
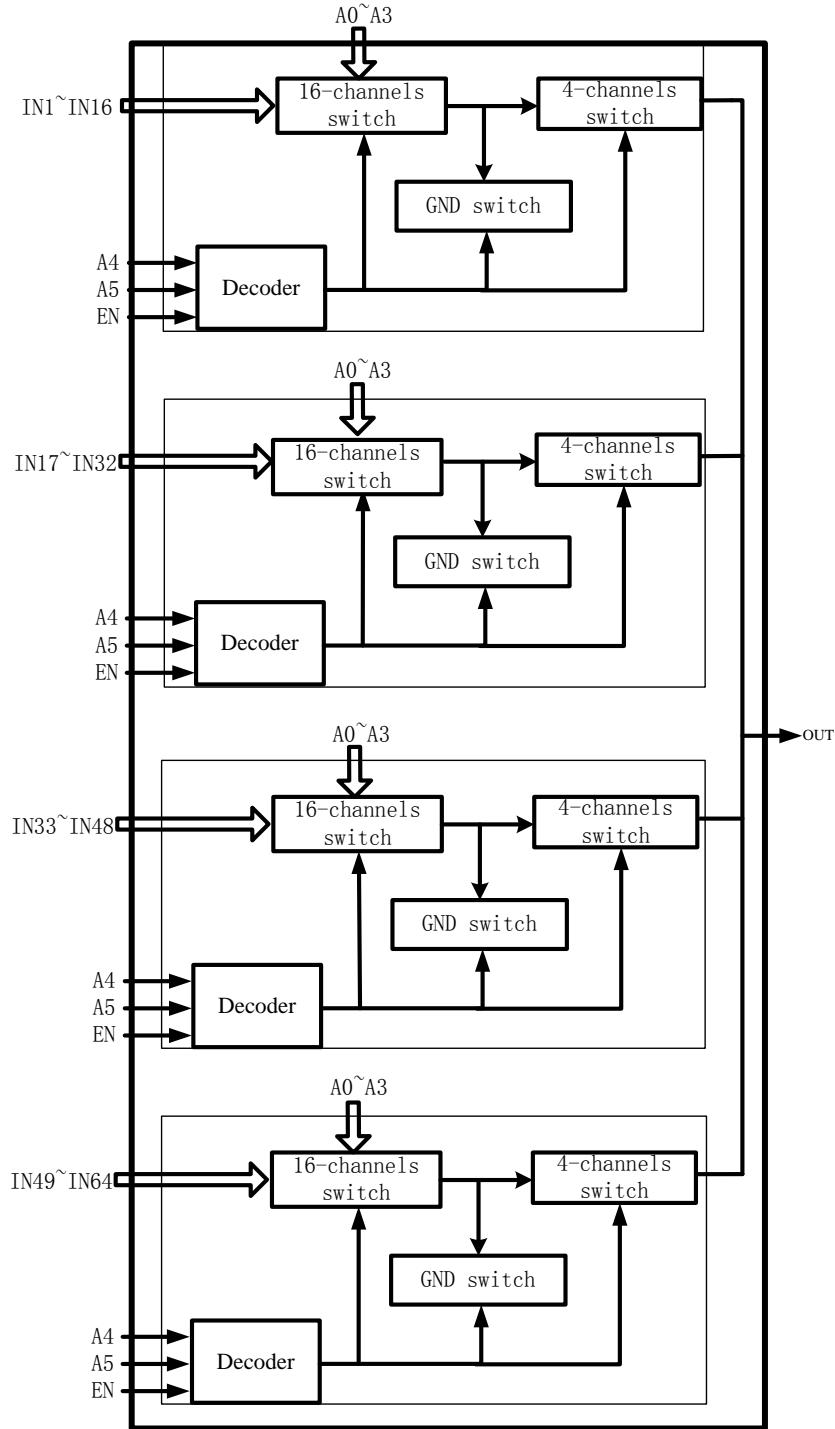
Figure 2．Function Block Diagram

4.2 Truth table

BM2720MQRH has 6 address control signal inputs, 1 EN input, which can select

1 channel signal from 64 channels. The truth table is shown in table2.

Table2 Truth Table

A5	A4	A3	A2	A1	A0	EN	Selected channel
X	X	X	X	X	X	L	NA
L	L	L	L	L	L	H	1
L	L	L	L	L	H	H	2
L	L	L	L	H	L	H	3
L	L	L	L	H	H	H	4
L	L	L	H	L	L	H	5
L	L	L	H	L	H	H	6
L	L	L	H	H	L	H	7
L	L	L	H	H	H	H	8
L	L	H	L	L	L	H	9
L	L	H	L	L	H	H	10
L	L	H	L	H	L	H	11
L	L	H	L	H	H	H	12
L	L	H	H	L	L	H	13
L	L	H	H	L	H	H	14
L	L	H	H	H	L	H	15
L	L	H	H	H	H	H	16
L	H	L	L	L	L	H	17
L	H	L	L	L	H	H	18
L	H	L	L	H	L	H	19
L	H	L	L	H	H	H	20
L	H	L	H	L	L	H	21
L	H	L	H	L	H	H	22
L	H	L	H	H	L	H	23
L	H	L	H	H	H	H	24
L	H	H	L	L	L	H	25
L	H	H	L	L	H	H	26
L	H	H	L	H	L	H	27
L	H	H	L	H	H	H	28
L	H	H	H	L	L	H	29

L	H	H	H	L	H	H	30
L	H	H	H	H	L	H	31
L	H	H	H	H	H	H	32
H	L	L	L	L	L	H	33
H	L	L	L	L	H	H	34
H	L	L	L	H	L	H	35
H	L	L	L	H	H	H	36
H	L	L	H	L	L	H	37
H	L	L	H	L	H	H	38
H	L	L	H	H	L	H	39
H	L	L	H	H	H	H	40
H	L	H	L	L	L	H	41
H	L	H	L	L	H	H	42
H	L	H	L	H	L	H	43
H	L	H	L	H	H	H	44
H	L	H	H	L	L	H	45
H	L	H	H	L	H	H	46
H	L	H	H	H	L	H	47
H	L	H	H	H	H	H	48
H	H	L	L	L	L	H	49
H	H	L	L	L	H	H	50
H	H	L	L	H	L	H	51
H	H	L	L	H	H	H	52
H	H	L	H	L	L	H	53
H	H	L	H	L	H	H	54
H	H	L	H	H	L	H	55
H	H	L	H	H	H	H	56
H	H	H	L	L	L	H	57
H	H	H	L	L	H	H	58
H	H	H	L	H	L	H	59
H	H	H	L	H	H	H	60
H	H	H	H	L	L	H	61
H	H	H	H	L	H	H	62
H	H	H	H	H	L	H	63

H	H	H	H	H	H	H	64

4.3 Typical curve and testing circuit

On resistance

The on resistance of each channel is shown in figure3.

$$R_{ON} = \frac{V}{100uA}$$
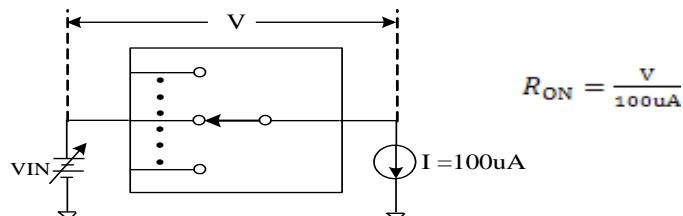
Figure3 Ron test diagram
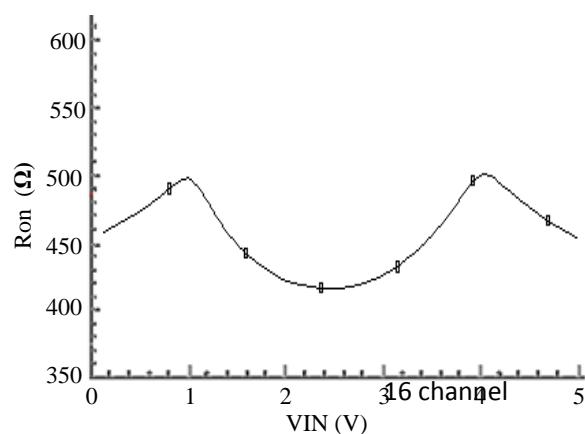

**Figure4 Ron vs V_{IN} curve**

Supply Current
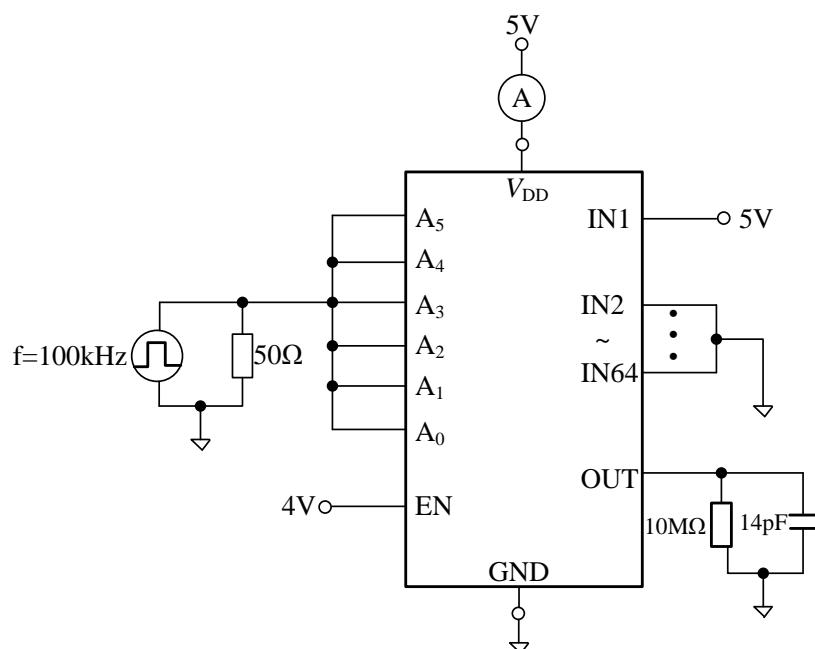
Figure5 Supply current testing circuit

Off leakage current
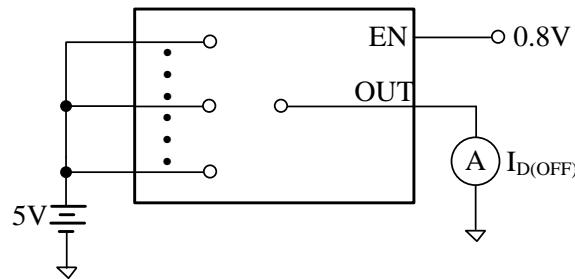
**Figure6 Off leakage current testing circuit**

On leakage current
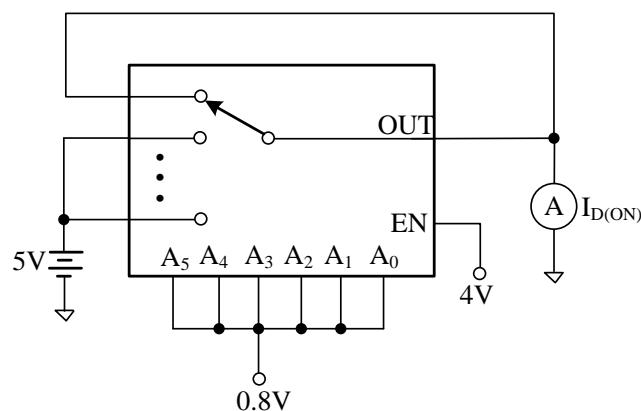
**Figure7 On leakage current testing circuit**

Off isolation ability
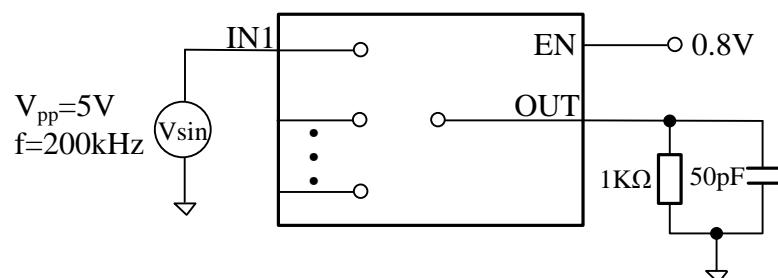
**Figure8 Off isolation ability testing circuit**
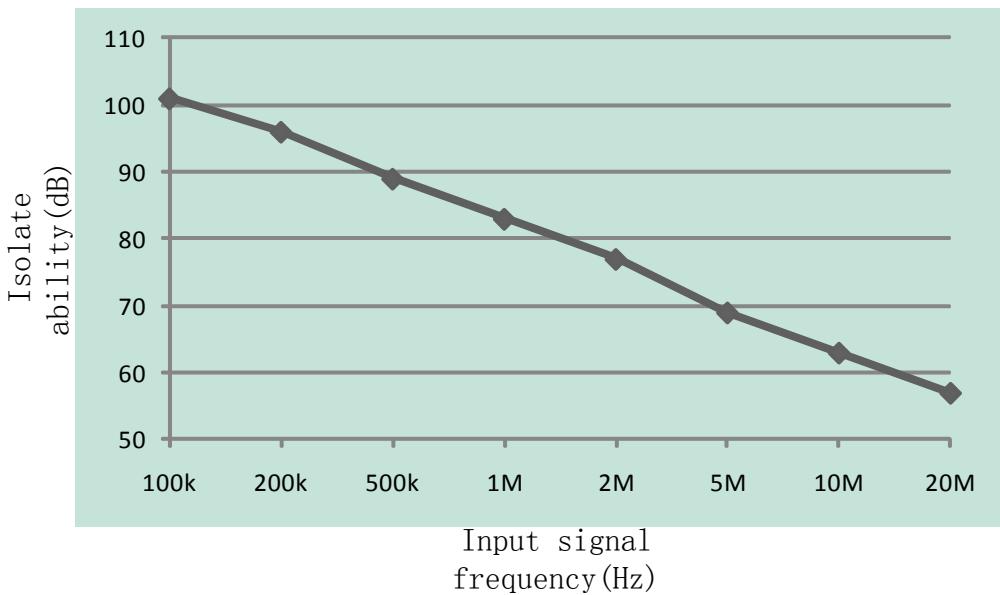
Figure9 Off isolation ability vs Input frequency curve

Propagation Delay Time $t_{ON (A)}$
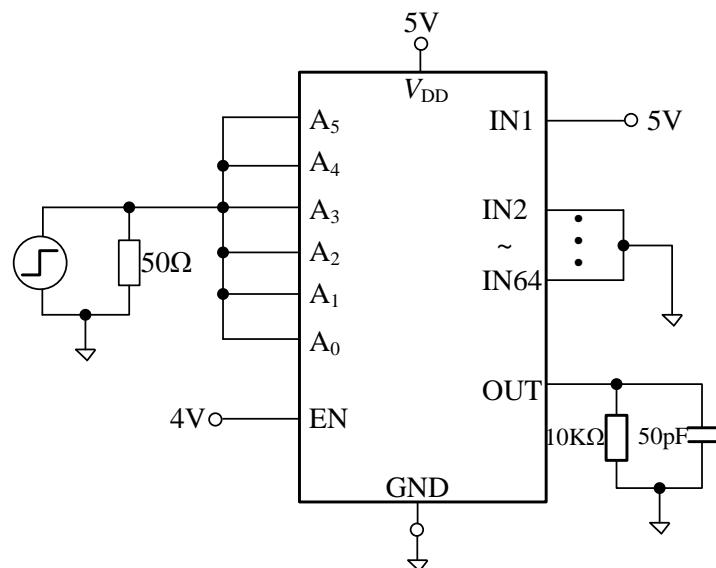
**Figure10 $t_{ON (A)}$ testing circuit**
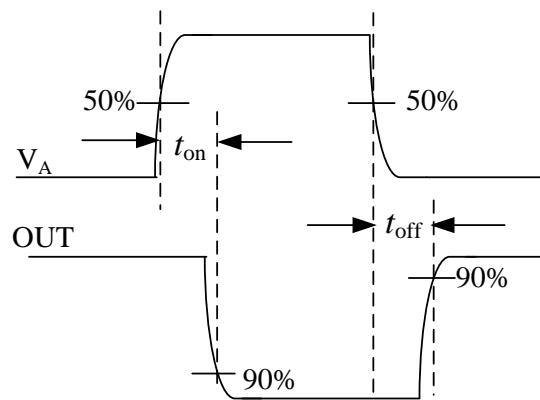
**Figure11 $t_{ON\ (A)}$ and $t_{OFF(A)}$ wave diagram**
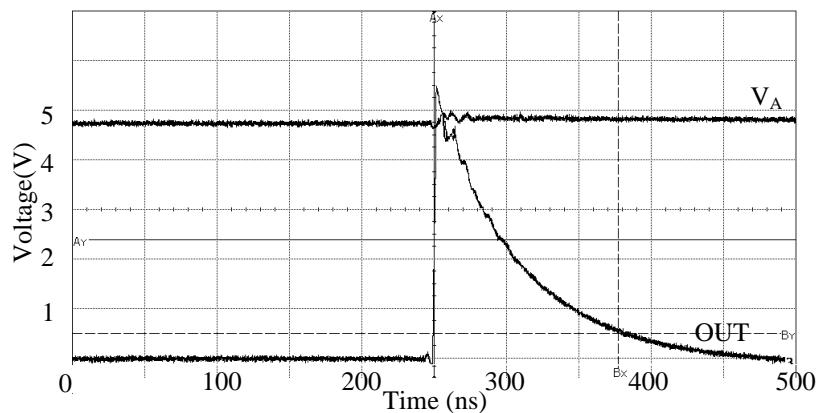
Figure12 $t_{ON\ (A)}$ testing result curve

$t_{OFF(A)}$
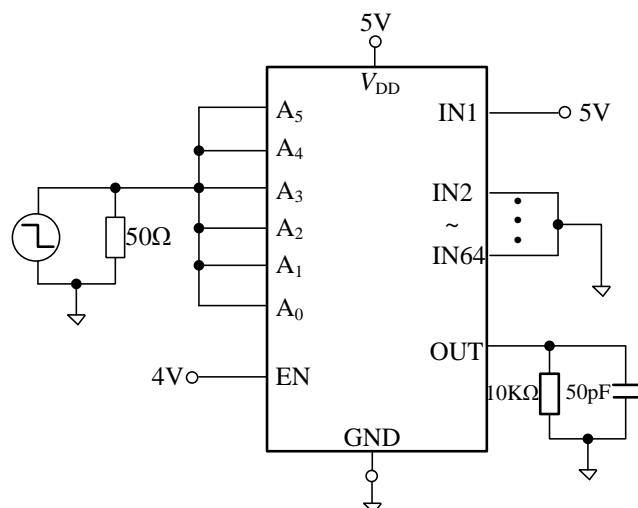
Figure13 $t_{OFF(A)}$ testing circuit
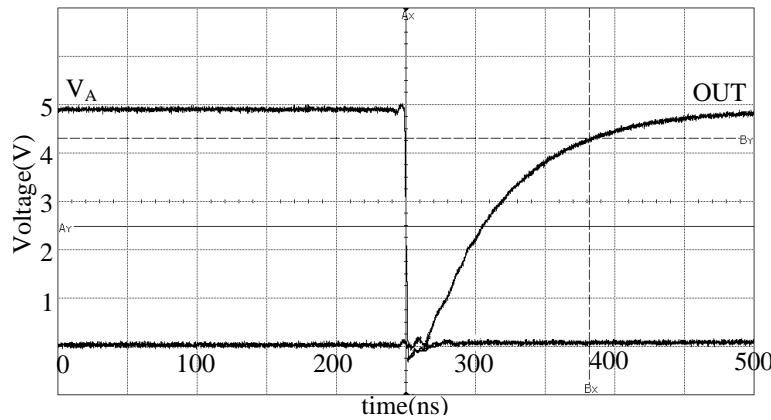
Figure14 $t_{OFF(A)}$ **testing result curve**

Enable delay (ON) $t_{ON(EN)}$
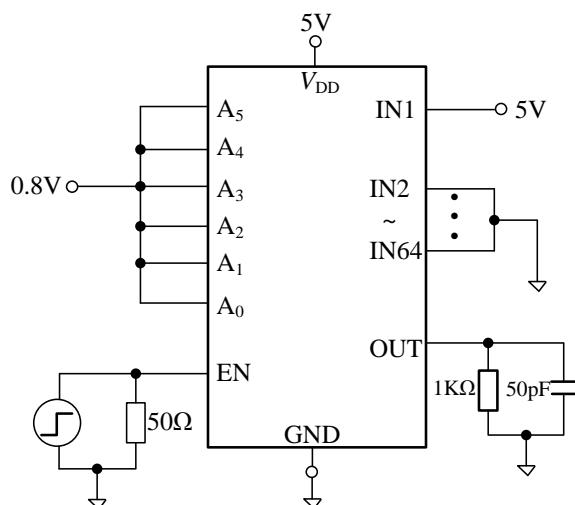
Figure15 $t_{ON(EN)}$ **testing circuit**
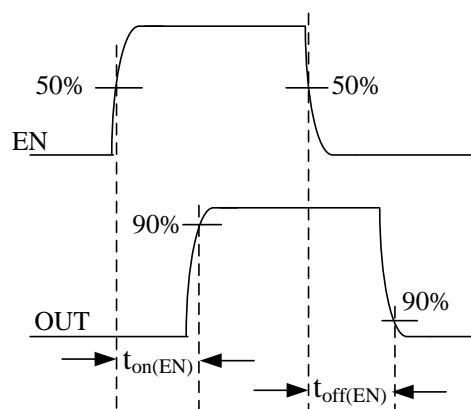
Figure16 $t_{ON(EN)}$ **and** $t_{OFF(EN)}$ **wave diagram**
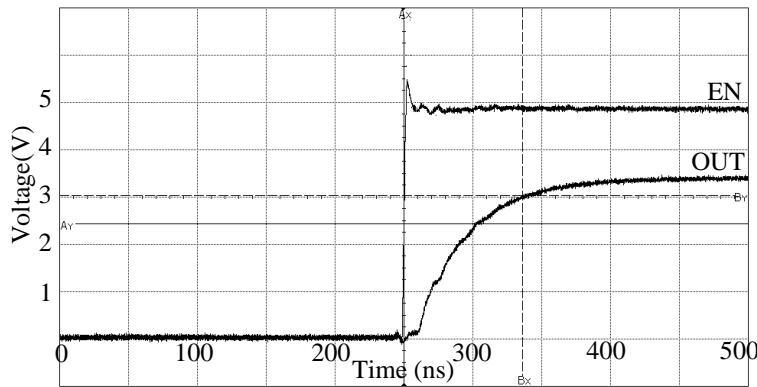
Figure17   t_ON(EN) testing result curve

Enable delay (OFF) t OFF (EN)
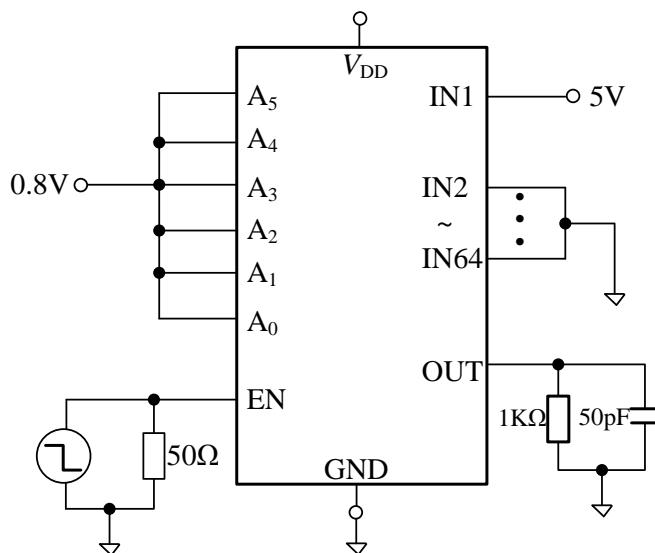
Figure18   t OFF (EN) testing circuit
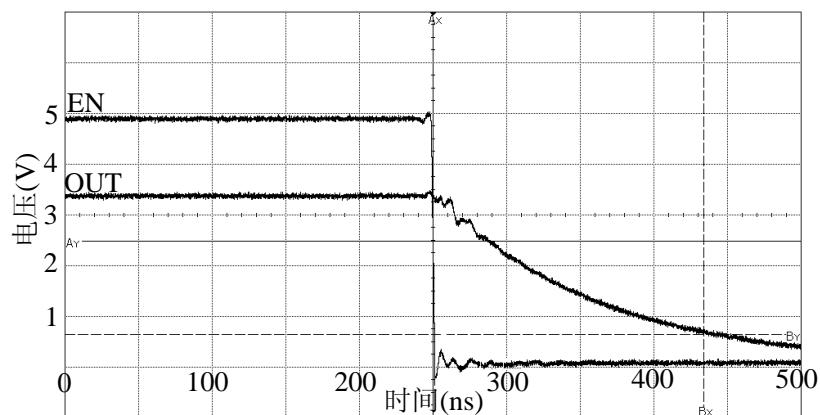
Figure19   t OFF (EN) testing result curve

Break-Before-Make Delay
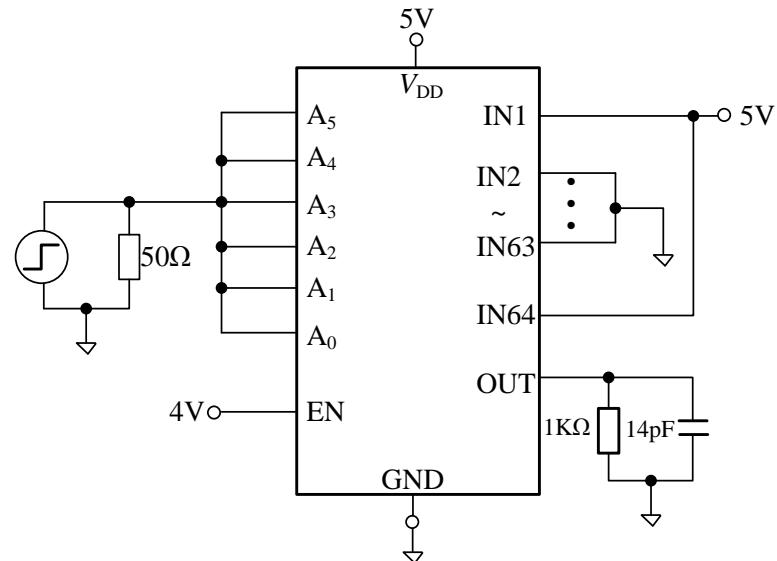
Figure20   Break-Before-Make Delay testing circuit
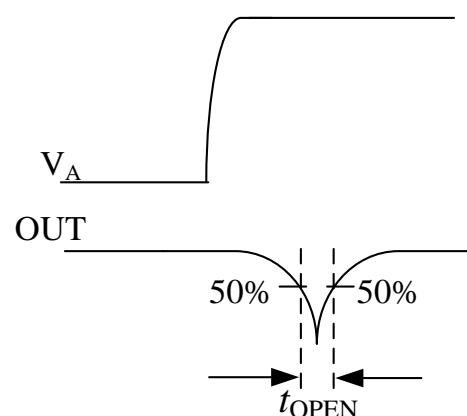
Figure21   Break-Before-Make Delay time wave diagram
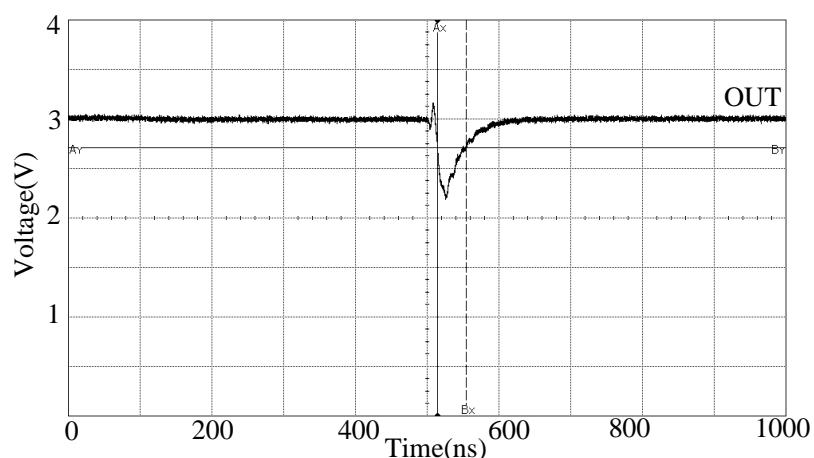
Figure22   Break-Before-Make Delay testing result curve

5 Electrical Characteristic

5.1 Absolute maximum ratings

| Parameter	Symbol	Data		Unit
		Min	Max	
Supply Voltage	V_{DD}	-0.3	6	V
Input Signal Range	V_S	-0.5	V_{DD} +0.5	V
Power Dissipation	P_D	0	500	mW
Storage Temperature Range	T_{stg}	-65	+150	℃
Lead Temperature （10s）	T_h	—	300	℃
Junction Temperature	T_j	—	150	℃

5.2 Recommended Operating Conditions

Parameter	Symbol	Data		Unit
		Min	Max	
Supply Voltage	V_{DD}	4.5	5.5	V
Input Signal Range	V_S	0	V_{DD}	V
Temperature Range	T_A	-55	125	℃

5.3 Electrical Specifications

Typical electrical specification is tested in T_A=25℃.

Table 3. electronic specifications

Parameter	Symbol	Condition	Data			Unit
		-55℃≤ T_A ≤ 125℃ V_{DD}=5V，GND=0V， V_{AH}=4V， V_{AL}=0.8V. unless otherwise noted	Min	Typical	Max	
Supply Voltage	V_{DD}		4.5	5	5.5	V
Analog Input Signal Range	V_S		0	—	V_{DD}	V
Switch On Resistance	R_{ON}	V_{EN}=4V， V_{IN} =5V, I_{OUT}= I_{IN}=100uA	—	500	1000	Ω

Parameter	Symbol	Condition	Data			Unit
		$-55℃\leq T_A \leq 125℃$ V_{DD}=5V, GND=0V, V_{AH}=4V, V_{AL}=0.8V. unless otherwise noted	Min	Typical	Max	
Input High Voltage	V_{AH}		4.0	—	—	V
Input Low Voltage	V_{AL}		—	—	0.8	V
Supply Current	I_{DD}	V_{EN}=4V, V_A=0.8V jump to 4V （Frequency 100kHz）, V_{IN1}=5V, $V_{IN2~IN64}$=0V, R_L=10MΩ, C_L=14pF	—	0.7	2.0	mA
Off Leakage Current	$I_{D（OFF）}$	V_{EN}=0.8V, $V_{IN1~IN64}$=5V, V_{OUT}=0 V, monitor the OUT current	—	25	300	nA
On leakage Current	$I_{D（ON）}$	V_{EN}=4V, V_A=0.8V, $V_{IN2~IN64}$=5V, V_{IN1}=V_{OUT}=0V, monitor OUT and IN1 total currrent	—	25	300	nA
OFF Isolation	VISO	V_{EN}=0.8V, V_{IN1}（Sinwave）: signal range=0~5V, f=200kHz, R_L=1kΩ, C_L=50pF	40	95	—	dB
Propagation Delay Times: Address Inputs to I/O Channels	$t_{ON (A)}$	V_{EN}=4V, V_A=0.8Vjump to4V, $V_{IN2~IN64}$=0V, V_{IN1}=5V, R_L=10 kΩ, C_L=50pF	—	130	1000	ns
	$t_{OFF(A)}$	V_{EN}=4V, V_A=4 jump to0.8V, $V_{IN2~IN64}$=0V, V_{IN1}=5V, R_L=10 kΩ, C_L=50pF	—	135	1000	ns
Enable to I/O	$t_{ON (EN)}$	V_{EN}=0.8Vjump to4V, V_A=0.8V, V_{IN1}=5V, $V_{IN2~IN64}$=0V, R_L=1 kΩ, C_L=50pF	—	90	—	ns
	$t_{OFF(EN)}$	V_{EN}=4Vjump to0.8V, V_A=0.8V, V_{IN1}=5V, $V_{IN2~IN64}$=0V, R_L=1 kΩ, C_L=50pF	—	185	—	ns
Break-Before-Make Delay	t_{OPEN}	V_{EN}=4V, V_A=0.8Vjump to4V, V_{IN1}=V_{IN64}=5V, $V_{IN2~IN63}$=0V, R_L=1 kΩ, C_L=14pF	—	40	—	ns

5.4 ESD caution：

ESD (human model) ≥2000V

5.5 Radiation Environment：

- Irradiation 100Krad(Si)
- Single Event Latch-up Immunity

6　Typical Application

The device is used in electronics system, to open or close the signal as an analog switch(ON/OFF). This 64-channel "T" type analog switch has radiation hardened, high voltage tolerance, high isolation ability, low power dissipation characters. This switch can be used in many electronic systems, such as communication, instrument, sensor, microwave and so on; meanwhile, it can be used in military IC, such as missile data collector's signal-channel error correction decoder, pulse modulator and sample-holder of navigation radar. The typical application is shown in figure23. In order to strengthen the device robustness in application, the recommended connection is shown in the figure24: R1 is recommended to 1KΩ, the load resistor R2 is recommended to 100KΩ ~1MΩ. In this connection environment, if the input signal VS range is -1V~+7.5V, the device will work fine. But considering the entirety and linearity of the signal, the input signal range VS is recommend to 0~VDD.
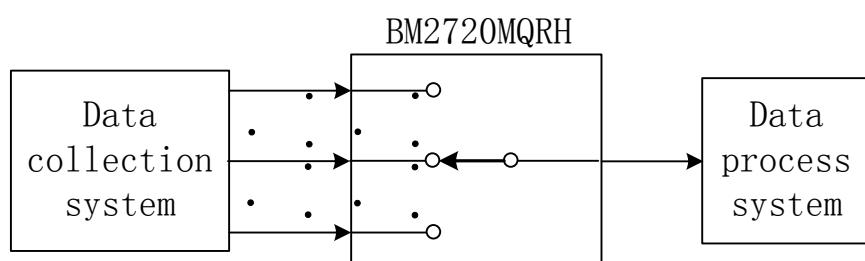

Figure 23 typical application 1
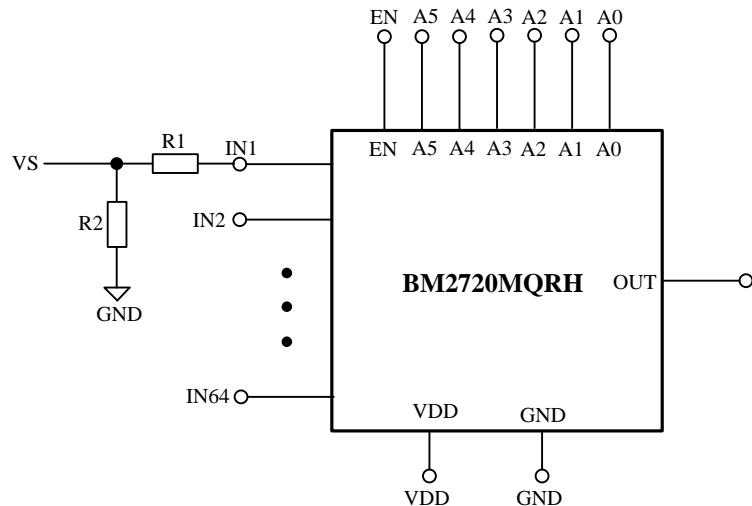
Figure 24 typical application 2

7 Outline dimensions

1、 BM2720MQRH's package type is CQFP80, its physical size is shown in the figure below.
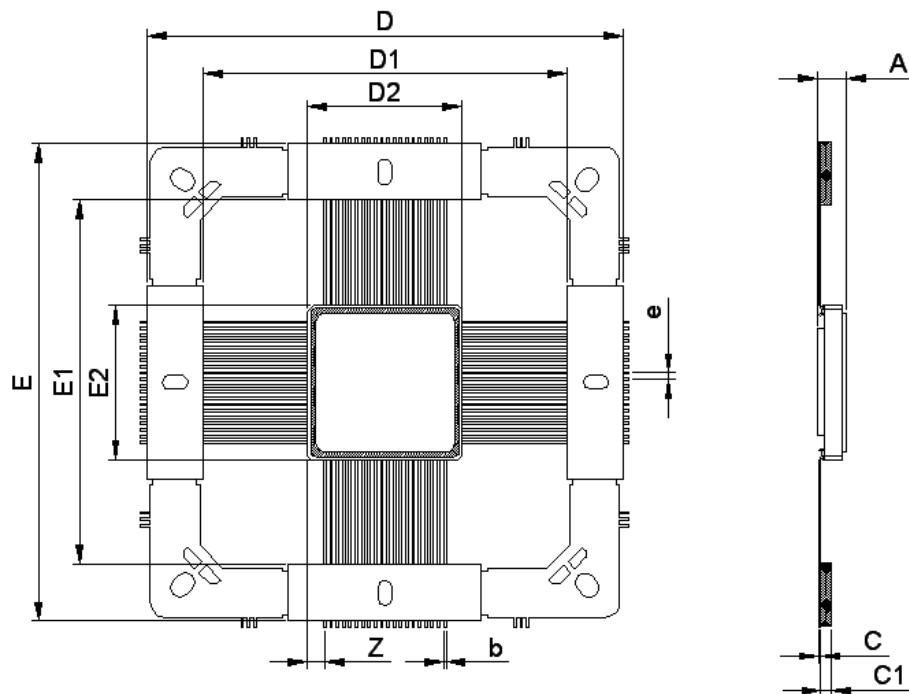
	value（millimeter）		
	min		min
A	1.95	—	2.65
b	0.12	—	0.28

c	0.07	—	0.23
c1	0.66	—	1.12
D/E	37.15	—	38.30
D1/E1	28.00	—	28.85
D2/E2	11.50	—	12.50
e	0.45	—	0.55
Z	1.11	—	1.39

Notes: Customer can make their own shape.

2、The Outline dimensions of CQFP80 which is cut for use(recommended)
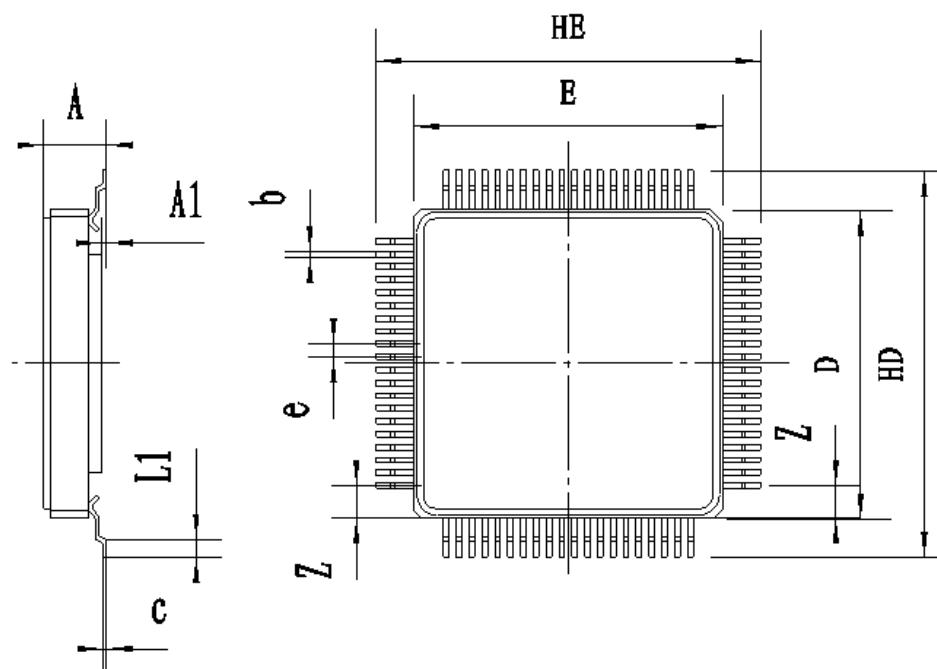
The Outline dimensions of CQFP80

	value（millimeter）		
	min	typical	max
A	2.5	——	3.5
A1	0.5	——	1.01
b	——	0.22	——
c	——	0.15	——
e	——	0.5	——
Z	——	1.25	——
D/E	11.85	12	12.15
HD/HE	15.95	17	17.65
L1	1.25	1.5	1.75

Appendix 1: Pin Description

Appendix table 1 pin description

CQFP80 pin number	symbol	description	CQFP80 pin number	symbol	description
1	IN28	28th input	41	IN57	57th input
2	IN29	29th input	42	IN58	58th input
3	IN30	30th input	43	IN59	59th input
4	IN31	31st input	44	IN60	60th input
5	IN32	32nd input	45	IN61	61st input
6	GND	GND	46	IN62	62nd input
7	V_{DD}	Power	47	IN63	63rd input
8	A5	Address Control input	48	IN64	64th input
9	A4	Address Control input	49	V_{DD}	Power
10	A3	Address Control input	50	GND	GND
11	A2	Address Control input	51	OUT	Output
12	A1	Address Control input	52	V_{DD}	Power
13	A0	Address Control input	53	IN1	1st input
14	EN	Enable input	54	IN2	2nd input
15	V_{DD}	Power	55	IN3	3rd input
16	IN33	33rd input	56	IN4	4th input
17	IN34	34th input	57	IN5	5th input
18	IN35	35th input	58	IN6	6th input
19	IN36	36th input	59	IN7	7th input
20	IN37	37th input	60	IN8	8th input
21	IN38	38th input	61	IN9	9th input
22	IN39	39th input	62	IN10	10th input
23	IN40	40th input	63	IN11	11th input
24	IN41	41st input	64	IN12	12th input

25	IN42	42nd input	65	IN13	13th input
26	IN43	43rd input	66	IN14	14th input
27	IN44	44th input	67	IN15	15th input
28	IN45	45th input	68	IN16	16th input
29	IN46	46th input	69	IN17	17th input
30	GND	GND	70	IN18	18th input
31	IN47	47th input	71	GND	GND
32	IN48	48th input	72	IN19	19th input
33	IN49	49th input	73	IN20	20th input
34	IN50	50th input	74	IN21	21st input
35	IN51	51st input	75	IN22	22nd input
36	IN52	52nd input	76	IN23	23rd input
37	IN53	53rd input	77	IN24	24th input
38	IN54	54th input	78	IN25	25th input
39	IN55	55th input	79	IN26	26th input
40	IN56	56th input	80	IN27	27th input

Service & Supply

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