

Ver 1.1

64-Chanel High Reliability Analog Multiplexer

Datasheet

Part Number: **BM2720MQRH**



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Page of Revise Control

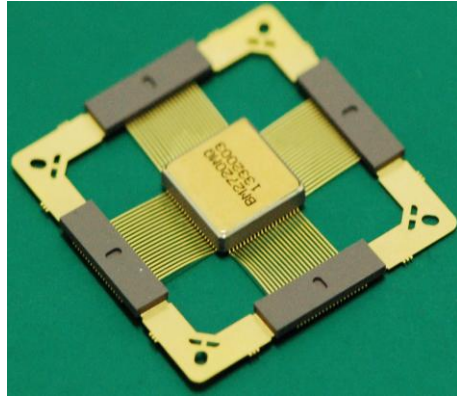
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1 Unique features

- 1) ESD (human model) $\geq 2000V$
- 2) Low Power Consumption, $I_{DD} \leq 1mA$
- 3) Fast switching time $\leq 600ns$
- 4) Break-Before-Make Delay $\geq 40ns$
- 5) Low ON Resistance $\leq 600\Omega$
- 6) Low leakage current $\leq 100nA$
- 7) High isolation ability $\geq 60dB @ f_{in}=200kHz$
- 8) Total Irradiation Dose $\geq 100Krad$ (Si)
- 9) Single Event Latchup immune
- 10) T_A : $-55^{\circ}C \sim 125^{\circ}C$
- 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.

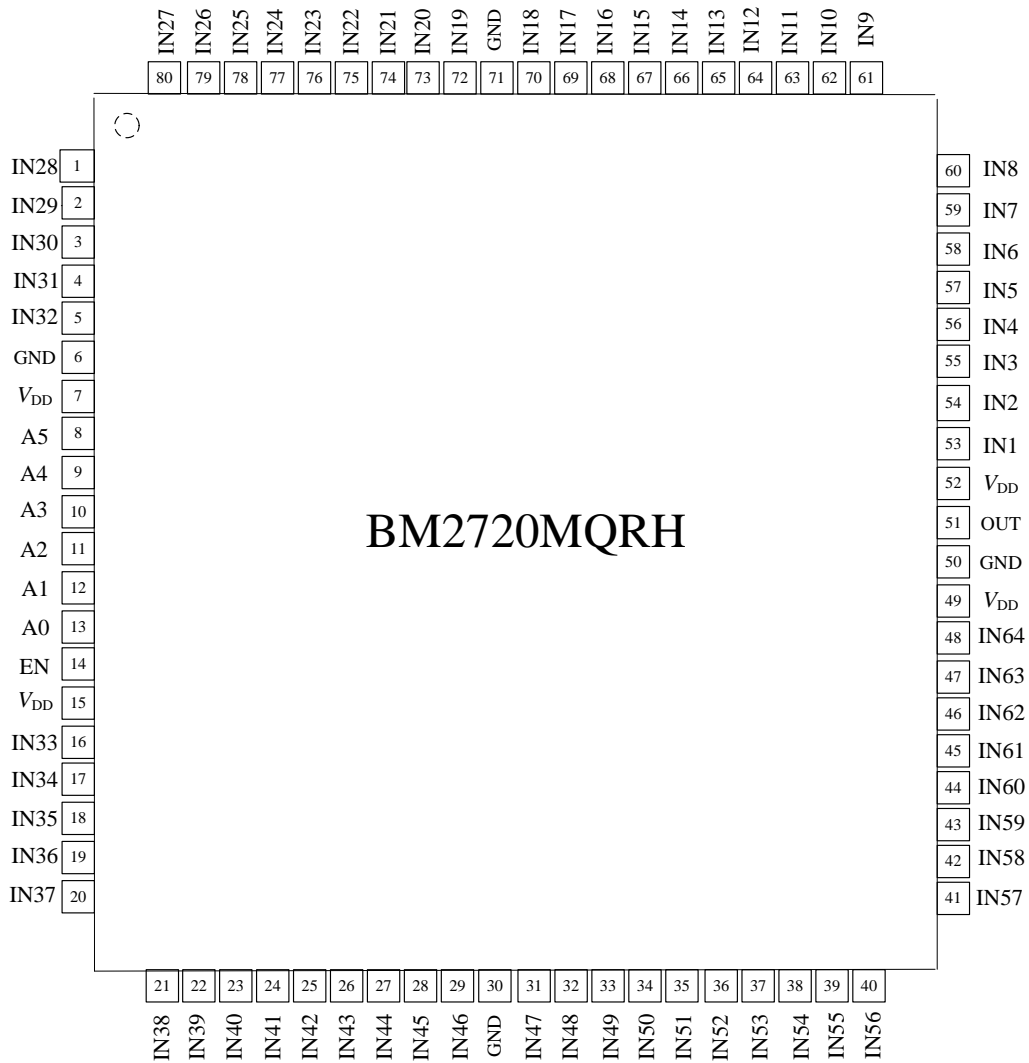


Figure1. BM2720MQRH Pin Configuration (Top View)

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 appendix 1.

4 Function Block Diagram

4.1 Function Block Diagram

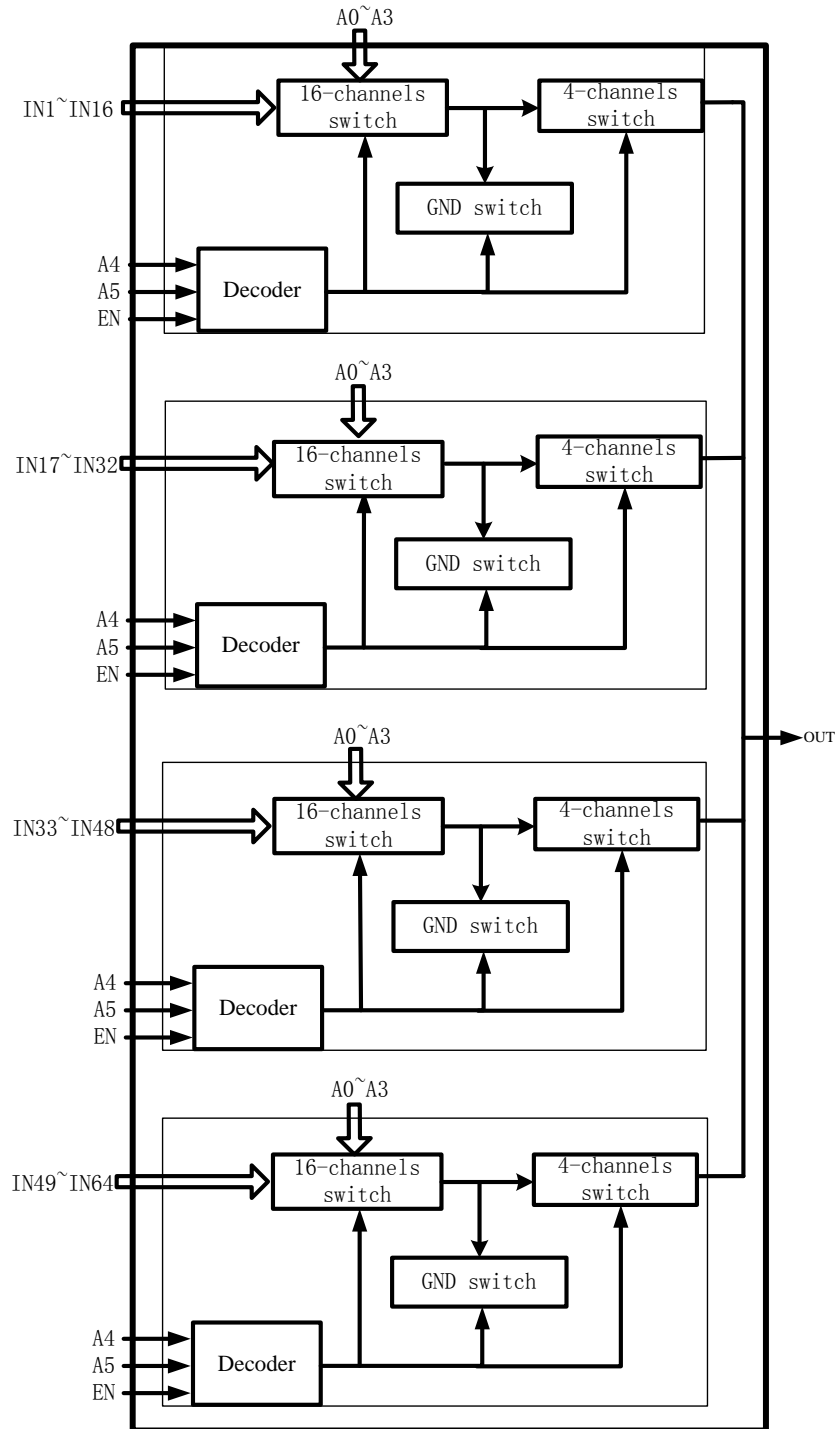


Figure 2. Function Block Diagram

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
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4.3 Typical curve and testing circuit

On resistance

The on resistance of each channel is shown in figure3.

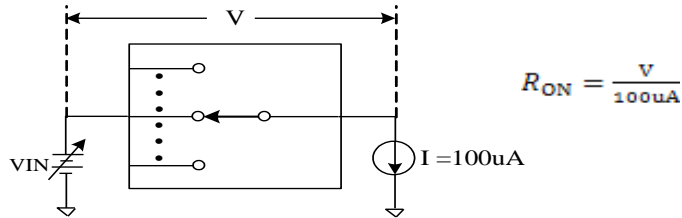


Figure3 Ron test diagram

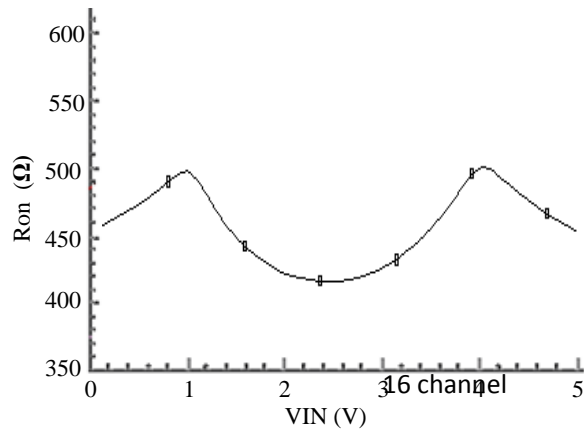


Figure4 Ron vs VIN curve

Supply Current

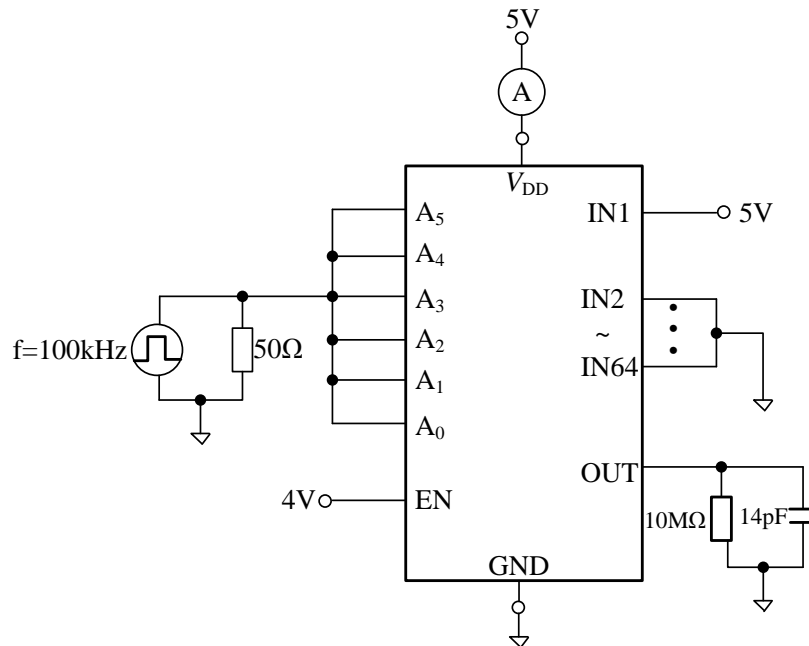


Figure5 Supply current testing circuit

Off leakage current

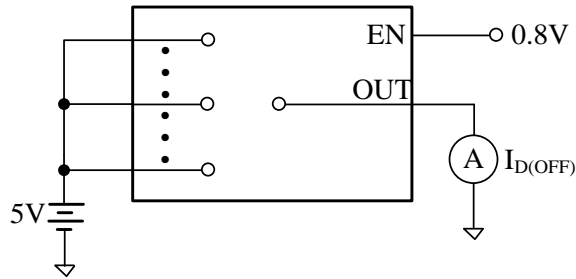


Figure6 Off leakage current testing circuit

On leakage current

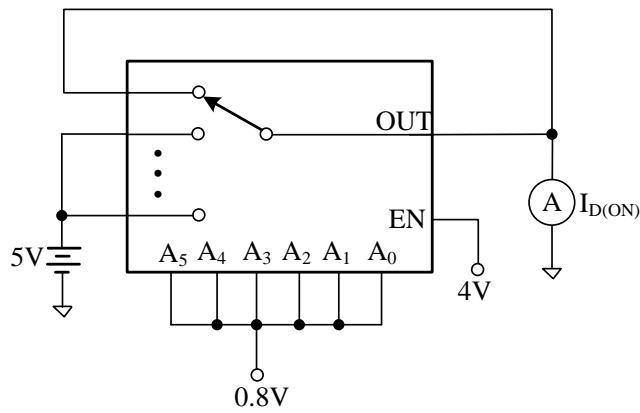


Figure7 On leakage current testing circuit

Off isolation ability

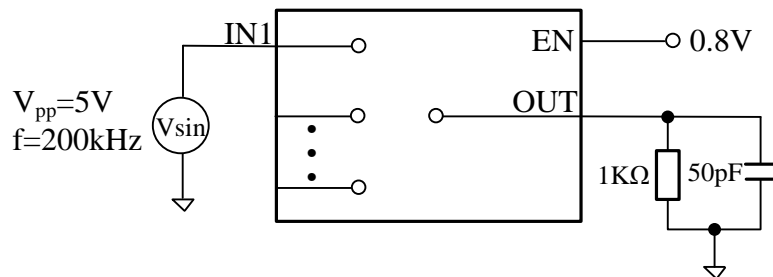


Figure8 Off isolation ability testing circuit

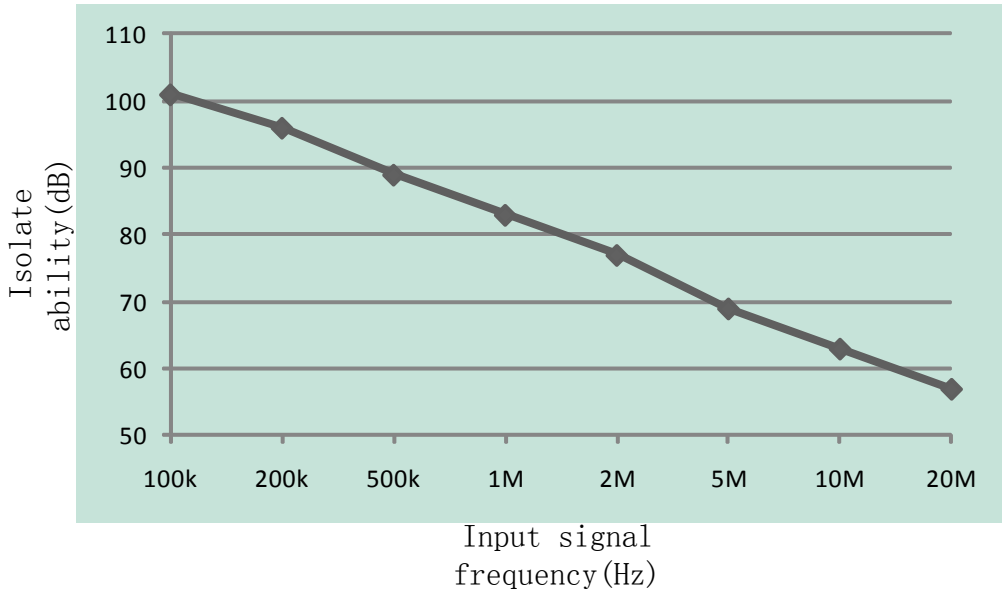


Figure9 Off isolation ability vs Input frequency curve

Propagation Delay Time $t_{ON(A)}$

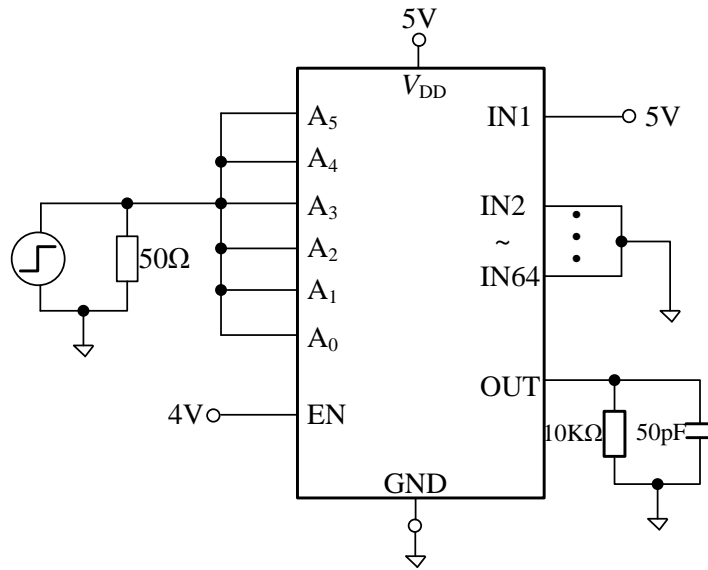


Figure10 $t_{ON(A)}$ testing circuit

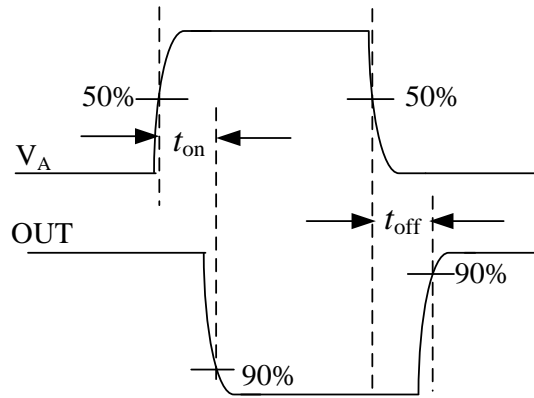


Figure11 $t_{ON(A)}$ and $t_{OFF(A)}$ wave diagram

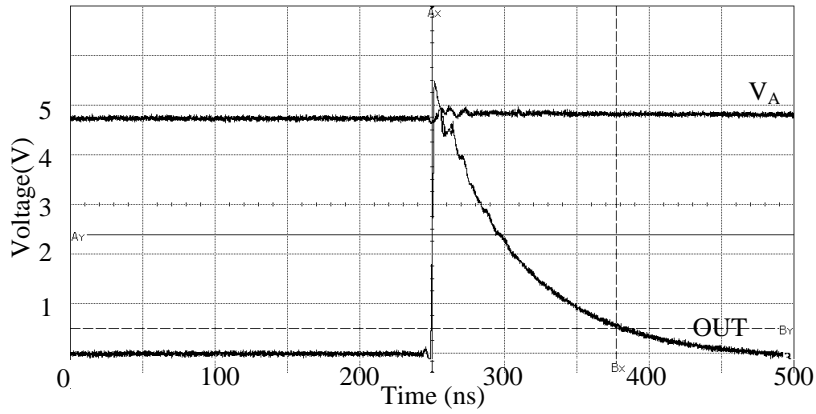


Figure12 $t_{ON(A)}$ testing result curve

$t_{OFF(A)}$

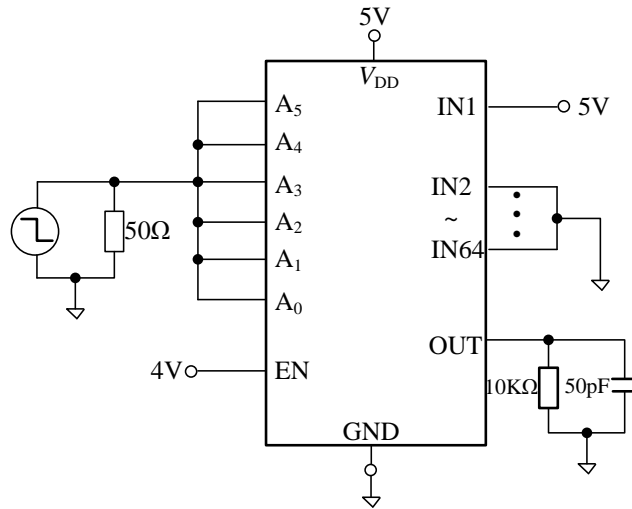


Figure13 $t_{OFF(A)}$ testing circuit

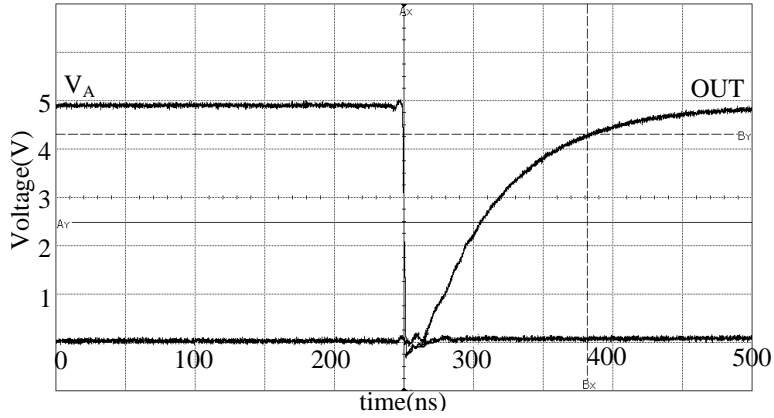


Figure14 $t_{OFF(A)}$ testing result curve

Enable delay (ON) $t_{ON(EN)}$

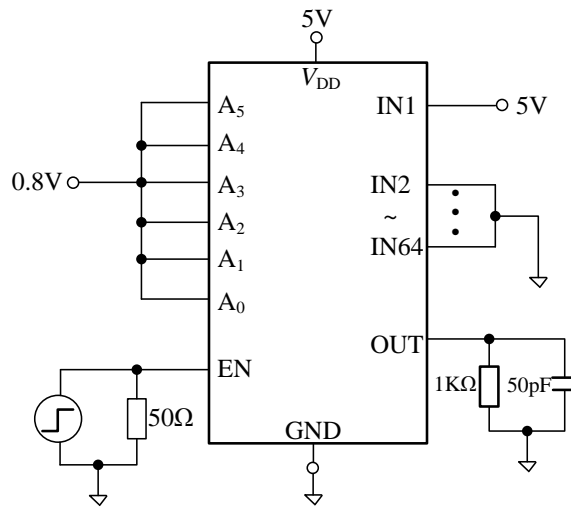


Figure15 $t_{ON(EN)}$ testing circuit

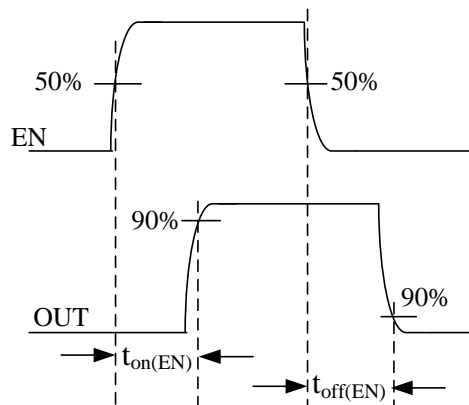


Figure16 $t_{ON(EN)}$ and $t_{OFF(EN)}$ wave diagram

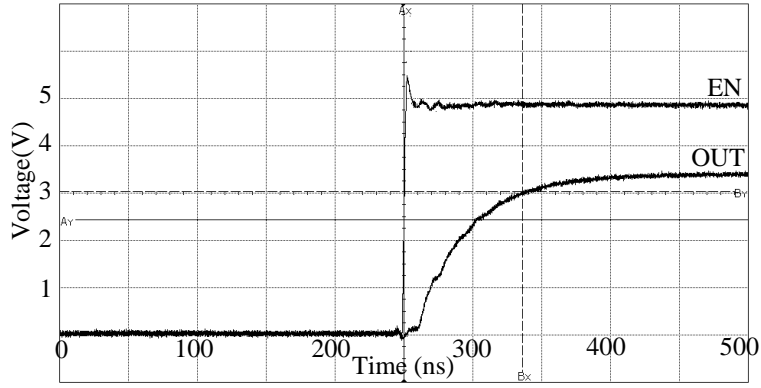


Figure17 $t_{ON(EN)}$ testing result curve

Enable delay (OFF) $t_{OFF(EN)}$

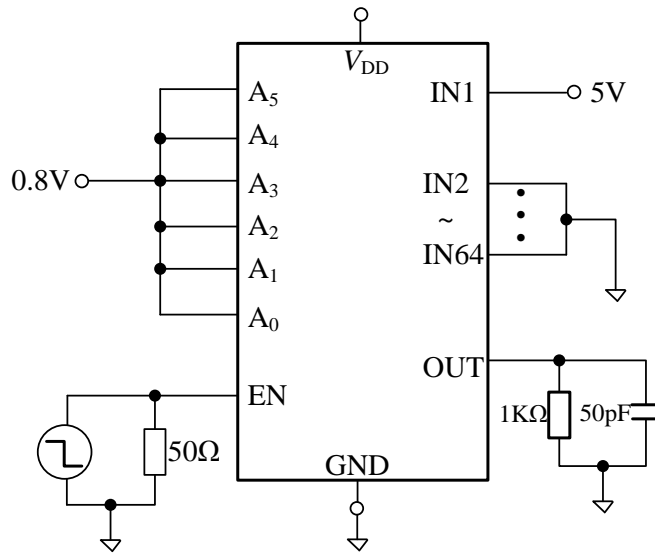


Figure18 $t_{OFF(EN)}$ testing circuit

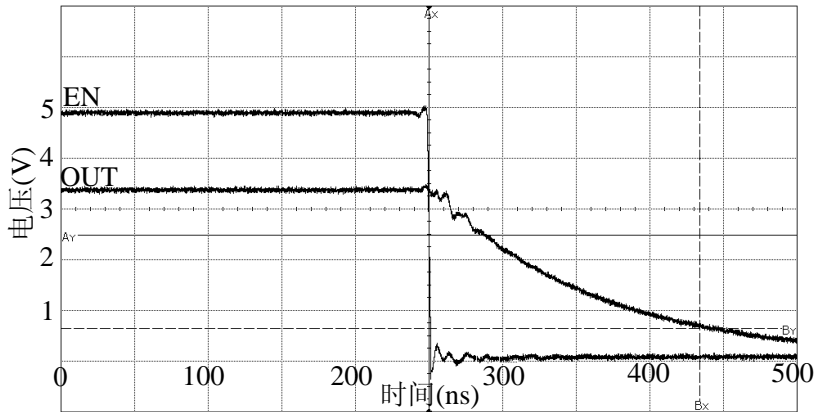


Figure19 $t_{OFF(EN)}$ testing result curve

Break-Before-Make Delay

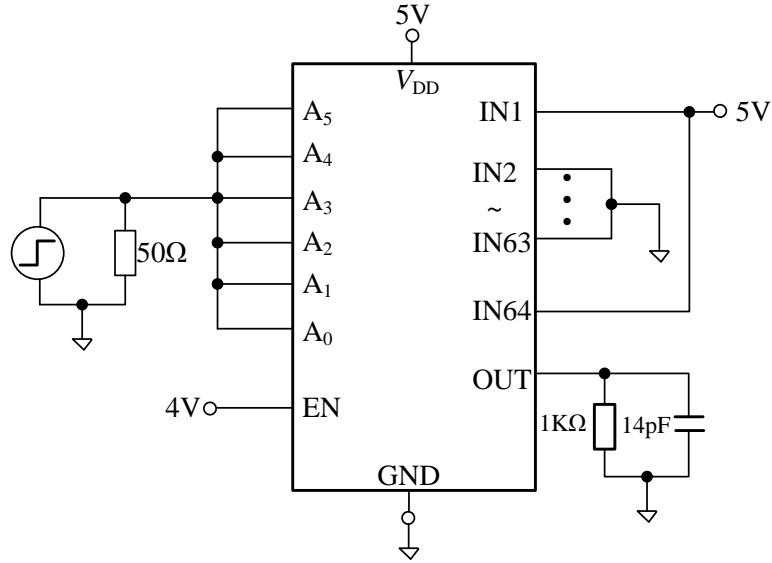


Figure20 Break-Before-Make Delay testing circuit

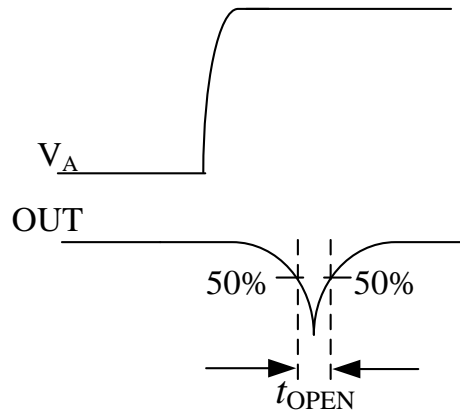


Figure21 Break-Before-Make Delay time wave diagram

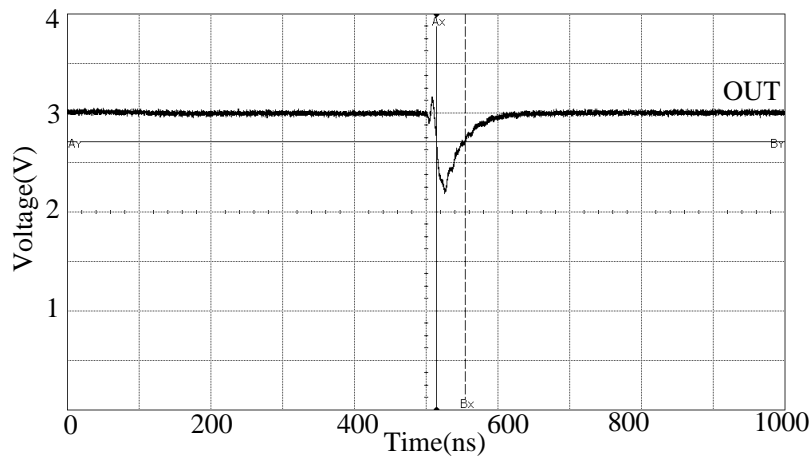


Figure22 Break-Before-Make Delay testing result curve

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	°C
Lead Temperature (10s)	T_h	—	300	°C
Junction Temperature	T_j	—	150	°C

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	°C

5.3 Electrical Specifications

Typical electrical specification is tested in $T_A=25^\circ\text{C}$.

Table 3. electronic specifications

Parameter	Symbol	Condition	Data			Unit
		$-55^\circ\text{C} \leq T_A \leq 125^\circ\text{C}$ $V_{DD}=5\text{V}$, $\text{GND}=0\text{V}$, $V_{AH}=4\text{V}$, $V_{AL}=0.8\text{V}$. 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}	$V_{EN}=4\text{V}$, $V_{IN}=5\text{V}$, $I_{OUT}=I_{IN}=100\mu\text{A}$	—	500	1000	Ω

Parameter	Symbol	Condition	Data			Unit
		-55°C ≤ T _A ≤ 125°C 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 current	—	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 =0.8V jump to 4V, 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 to 0.8V, 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} =0.8V jump to 4V, 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} =4V jump to 0.8V, 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 =0.8V jump to 4V, 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) $\geq 2000V$

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 1K Ω , the load resistor R2 is recommended to 100K Ω ~1M Ω . 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.

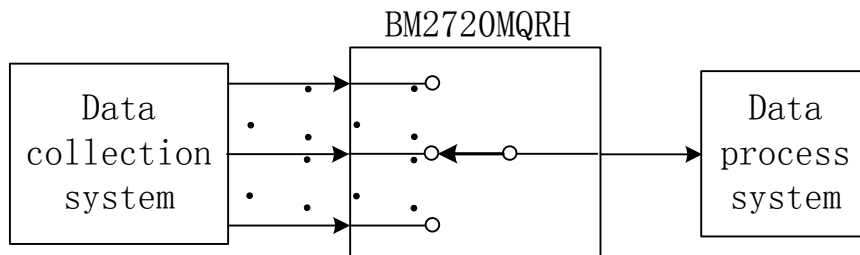


Figure 23 typical application 1

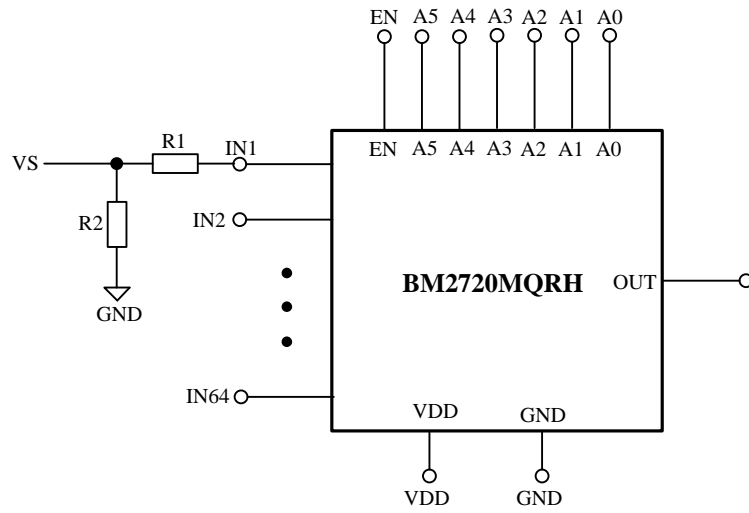
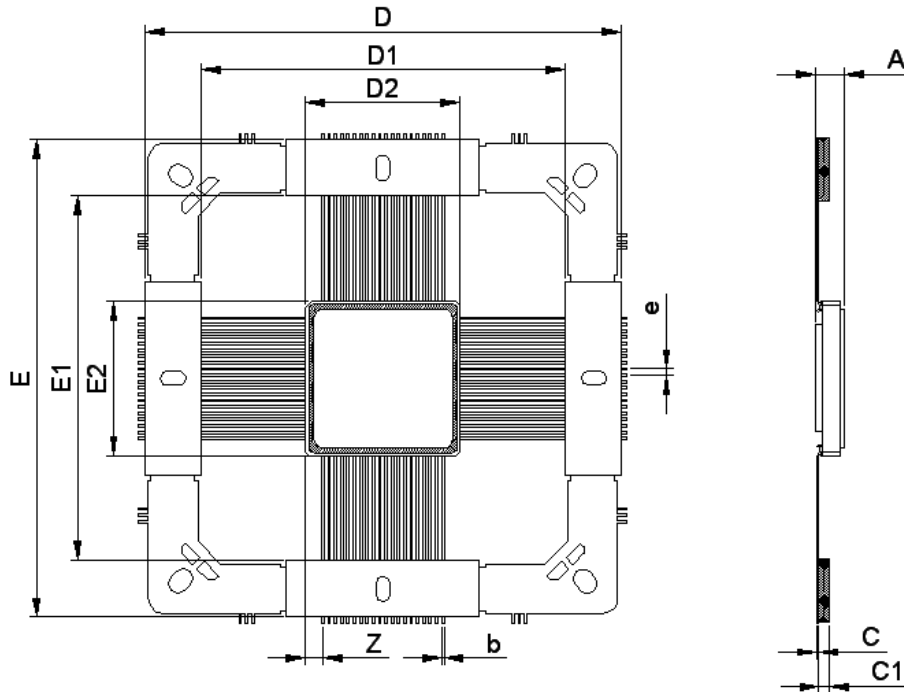


Figure 24 typical application 2

7 Outline dimensions

1、BM2720MQRH's package type is CQFP80, its physical size is shown in the figure below.

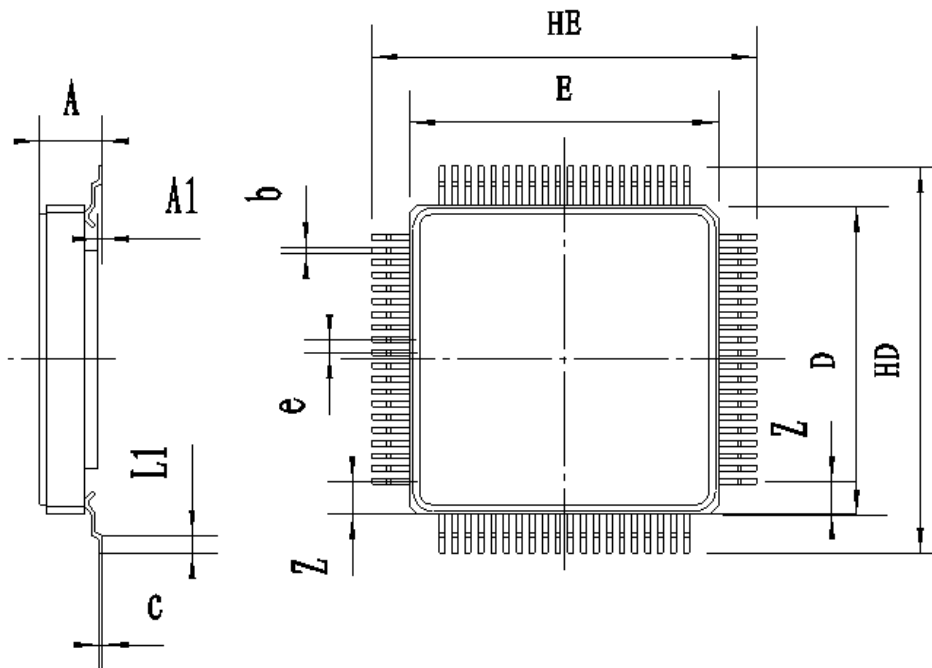


	value (millimeter)		
	min	—	min
A	1.95	—	2.65
b	0.12	—	0.28

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

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

Service & Supply

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