Ver 1.1

Radiation Hardened 16-Channel Current Negative Driver

Datasheet

Part Number：BM2711MQRH

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Page of Revise Control

Version No.	Publish Time	Revised Chapter	Revise Introduction	Note
1.0	2017.12	-	-	
1.1	2018.3	-	Changed the template	

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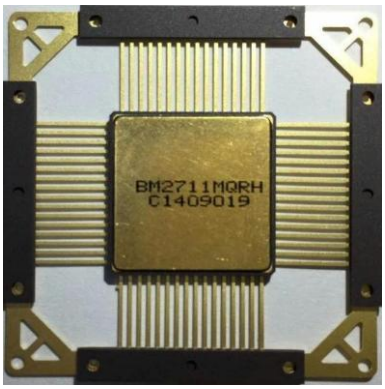
1. Unique Features



1）16 Channels
2）Supply Voltage（V_{DD}）……4.5V～5.5V
3）Higher than 200mA driver ability for each channel
4）Dual enable control signal
5）T_A……-55℃～125℃
6）Package……CQFP64
7）Total Ionizing Dose ≥ 100 krad（Si）
8）The Single Event Latch-up Immunity

2. General Description

The device implements 16-channel switch instruction driver. Each channel can be controlled by two independent signals. When these two signals are simultaneously active (high level), the instruction signal will be presented at the output. The power loop can be switched on or off by the instruction signal. Each channel's pre-driver and post-switch circuits are designed by redundant structure that can improve circuit's reliability and robustness. There is an excellent isolation between each channel. If one channel is abnormal, the other channels won't be affected and can output exactly.

3. Pin Description

The pins description of BM2711MQRH is shown in figure 1, Table 1.

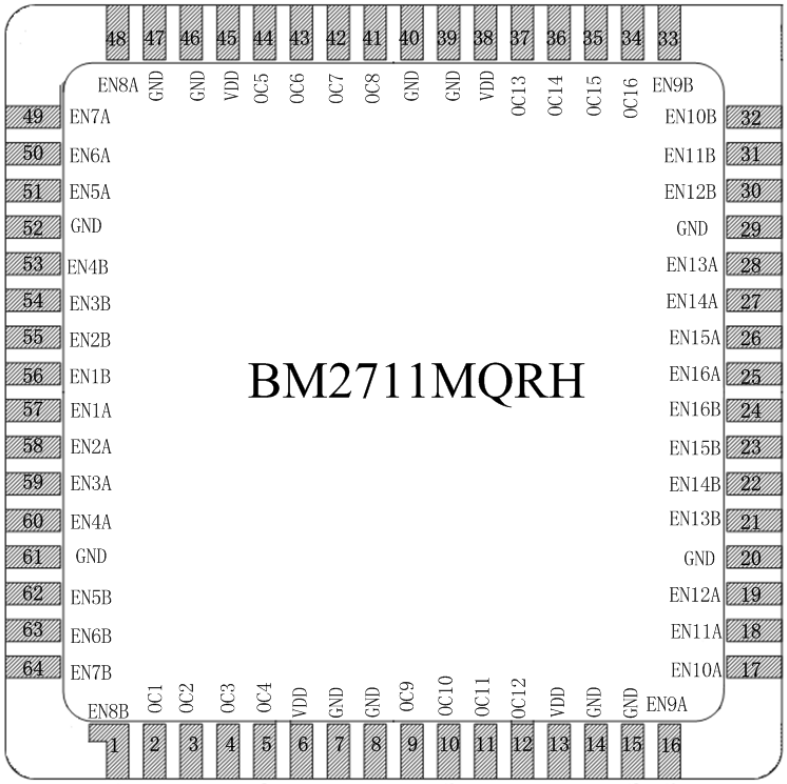


Figure1. BM2711MQRH Pin Configuration（Top View）

Table1. BM2711MQRH Pin Configuration

Pin	Description	Symbol	Pin	Description	Symbol
1	8th B Input	EN8B	33	9th B Input	EN9B
2	1st Output	OC1	34	16th Output	OC16
3	2nd Output	OC2	35	15th Output	OC15
4	3rd Output	OC3	36	14th Output	OC14
5	4th Output	OC4	37	13th Output	OC13
6	Power Supply	VDD	38	Power Supply	VDD
7	Ground	GND	39	Ground	GND
8	Ground	GND	40	Ground	GND
9	9th Output	OC9	41	8th Output	OC8
10	10th Output	OC10	42	7th Output	OC7
11	11th Output	OC11	43	6th Output	OC6
12	12th Output	OC12	44	5th Output	OC5
13	Power Supply	VDD	45	Power Supply	VDD

Pin	Description	Symbol	Pin	Description	Symbol
14	Ground	GND	46	Ground	GND
15	Ground	GND	47	Ground	GND
16	9th A Input	EN9A	48	8th A Input	EN8A
17	10th A Input	EN10A	49	7th A Input	EN7A
18	11th A Input	EN11A	50	6th A Input	EN6A
19	12th A Input	EN12A	51	5th A Input	EN5A
20	Ground	GND	52	Ground	GND
21	13th B Input	EN13B	53	4th B Input	EN4B
22	14th B Input	EN14B	54	3rd B Input	EN3B
23	15th B Input	EN15B	55	2nd B Input	EN2B
24	16th B Input	EN16B	56	1st B Input	EN1B
25	16th A Input	EN16A	57	1st A Input	EN1A
26	15th A Input	EN15A	58	2nd A Input	EN2A
27	14th A Input	EN14A	59	3rd A Input	EN3A
28	13th A Input	EN13A	60	4th A Input	EN4A
29	Ground	GND	61	Ground	GND
30	12th B Input	EN12B	62	5th B Input	EN5B
31	11th B Input	EN11B	63	6th B Input	EN6B
32	10th B Input	EN10B	64	7th B Input	EN7B

4. Function Description

4.1 Function Block Diagram

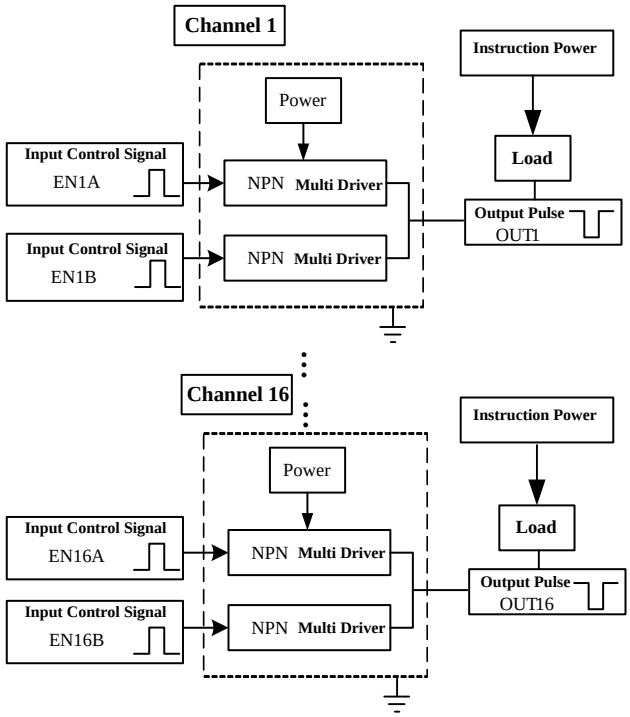


Figure 2. Function Block Diagram

4.2 Truth Table

Table 2. Truth Table for Single Channel

Input		Output
ENiA	ENiB	OCi
0	0	High-Z
0	1	High-Z
1	0	High-Z
1	1	0

Note：The table2 indicates the logic relationship between output and input of each channel; the supply current will be different when input signals are in different logic configuration, and the details will be shown in section 6.3.

4.3 Logical Relationships

Table 3. Logical Relationships

Input ENiA&ENiB		Output															
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
EN1A&EN1B	1	0	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×
EN2A&EN2B	1	×	0	×	×	×	×	×	×	×	×	×	×	×	×	×	×
EN3A&EN3B	1	×	×	0	×	×	×	×	×	×	×	×	×	×	×	×	×
EN4A&EN4B	1	×	×	×	0	×	×	×	×	×	×	×	×	×	×	×	×
EN5A&EN5B	1	×	×	×	×	0	×	×	×	×	×	×	×	×	×	×	×
EN6A&EN6B	1	×	×	×	×	×	0	×	×	×	×	×	×	×	×	×	×
EN7A&EN7B	1	×	×	×	×	×	×	0	×	×	×	×	×	×	×	×	×
EN8A&EN8B	1	×	×	×	×	×	×	×	0	×	×	×	×	×	×	×	×
EN9A&EN9B	1	×	×	×	×	×	×	×	×	0	×	×	×	×	×	×	×
EN10A&EN10B	1	×	×	×	×	×	×	×	×	×	0	×	×	×	×	×	×
EN11A&EN11B	1	×	×	×	×	×	×	×	×	×	×	0	×	×	×	×	×
EN12A&EN12B	1	×	×	×	×	×	×	×	×	×	×	×	0	×	×	×	×
EN13A&EN13B	1	×	×	×	×	×	×	×	×	×	×	×	×	0	×	×	×
EN14A&EN14B	1	×	×	×	×	×	×	×	×	×	×	×	×	×	0	×	×
EN15A&EN15B	1	×	×	×	×	×	×	×	×	×	×	×	×	×	×	0	×
EN16A&EN16B	1	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	0

[1] × indicate the channel i's output is link to the channel i's input only.
[2] There are 2 channels can be driven at the same time.(When the output drive current is 200mA)

5. Electrical Characteristic

5.1 Absolute Maximum Ratings

Parameter	Symbol	Data		Unit
		Min	Max	
Supply Voltage	V_{DD}	-0.3	12	V
Load Voltage	V_{CC}	-0.3	50	V
Output Current	I_O	0	360	mA
Power Consumption	P_T	0	1.5	W
Input Signal Range	V_{EN}	0	12	V
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	
Output Current	V_{DD}	4.5	5.5	V
Power Dissipation	V_{CC}	3.3	33	V
Output Current	I_O	0	200	mA
Input Voltage	V_{EN}	0	5.5	V
Temperature Range	T_A	-55	125	℃

5.3 Electrical Specifications

V_{CC}=28V，V_{DD}=4.5V， -55℃≤T_A≤125℃, unless otherwise noted

Table 4. Electronic Specifications

Parameter	Symbol	Condition (VDD=5V，GND=0V，-55℃≤TA≤125℃,unless otherwise noted)	Data Min	Data Max	Unit
Output Leakage Current	I_{OD}	V_{ENXA}=V_{ENXB}=0.6V（x=1……16），R_L=120Ω，Measured Output | I_{ODX}|（Measured all 16 channels）	--	20	uA
		V_{ENXA}=0.6V，V_{ENXB}=3.0V（x=1……16），R_L=120Ω，Measured Output | I_{ODX}|（Measured all 16 channels）	--	20	
		V_{ENXA}=3.0V，V_{ENXB}=0.8V（x=1……16），R_L=120Ω，Measured Output | I_{ODX}|（Measured all 16 channels）	--	20	
Output Saturation Voltage Drop	V_{CESAT}	V_{ENXA}=3.0V，V_{ENXB}=3.0V（x=1……16），I_{OL}=200mA，Measured Output | V_{OUTX}|（Measured all 16 channels）	--	1.2	V
Output Current	I_O	V_{ENXA}=3.0V，V_{ENXB}=3.0V（x=1……16），V_{CESAT}=1.2V，Measured Output | I_{OUTX}|（Measured all 16 channels）	200	--	mA
High Level Input Voltage	V_{IH}	I_{OL}=200mA ， V_{CESAT}=1.2V	3.0	--	V
Low Level Input Voltage	V_{IL}		--	0.6	V
High Level Input Current	I_{IH}	V_{ENXA}=3.0V，V_{ENXB}=3.0V（x=1……16）（V_{ENYA}= V_{ENYB} = 0.8V,other channels is not x），I_{OL}=200mA，Measured Input |I_{IHX}|（Measured all 16 channels）	--	2	mA
Static Current	I_D	V_{ENXA}=0.6V，V_{ENXB}=0.6V（x=1……16）（V_{ENYA}= V_{ENYB} = 0.6V, other channels is not x），Measured Power	--	1	mA
Operating Current	I_{VDD}	V_{ENXA}=3.0V，V_{ENXB}=3.0V（x=1……16）（V_{ENYA}= V_{ENYB} = 0.8V,other channels is not x），I_{OL}=200mA，Measured Power| I_{VDD}|（Measured all 16 channels）	--	50	mA
Turn-on Time	t_{ON}	f=1kHz，R_L=120Ω, Measured according to figure 3	--	10	us
Turn-off Time	t_{OFF}	f=1kHz，R_L=120Ω, Measured according to figure 3	--	70	us
Rise Time	t_{UP}	f=1kHz，R_L=120Ω, Measured according to figure 4	--	65	us

Parameter	Symbol	Condition	Data		Unit
		（VDD=5V，GND=0V， -55℃≤TA≤125℃,unless otherwise noted）	Min	Max	
Fall Time	t_{DOWN}	f=1kHz，R_L=120Ω, Measured according to figure 4	--	8	us

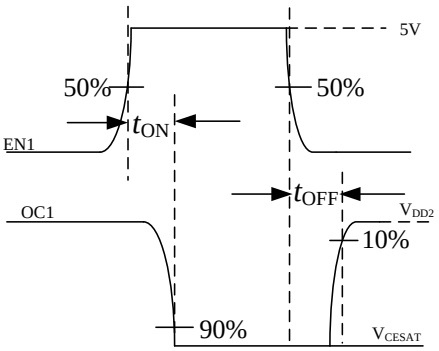


Figure 3. Turn-on, Turn-off Time Waveform

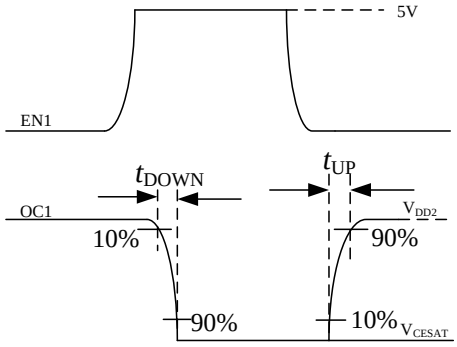


Figure 4. Rise Time, Fall Time Waveform

5.4 ESD Cautions

ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 2000 V readily accumulated on the human body fits the 2nd Level of 3015 in GJB548B-2005.

6. Typical Application

6.1 Typical Application Circuit

The typical application circuit of BM2711MQRH is shown in figure 5.

In figure 5, V_{DD} is the device power supply voltage，GND is ground of power supply, Ri is instruction load，the end of Ri are connected to the OCi and instruction power(V_{CC}) individual.

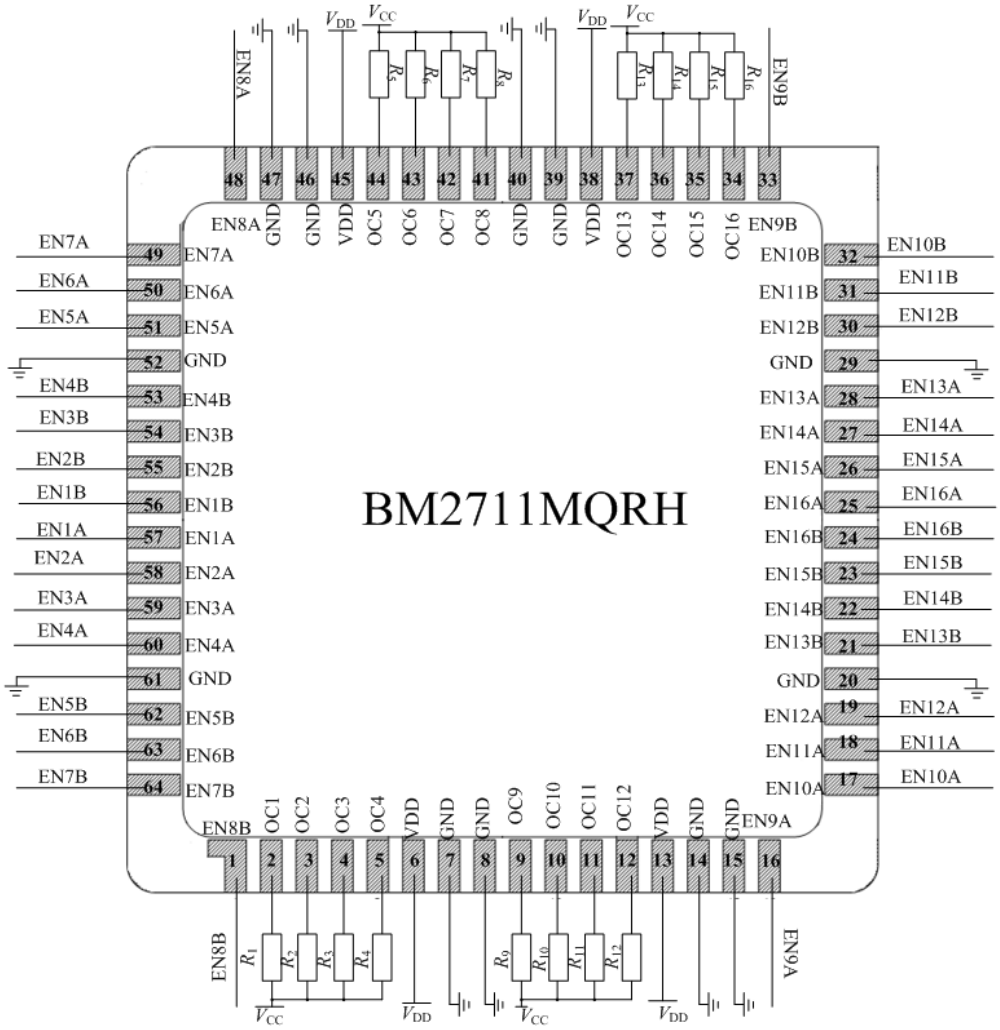


Figure 5. BM2711MQRH typical application circuit

6.2 Power Consumption Expression

The number of active channel is limited by the device's maximum power consumption.

The device's power consumption is composed by three parts: the power consumption of input drives, power supplies and output drives. And the device's power consumption expression can be written as below:

$$P=I_{EN}\times V_{EN}+I_{VDD}\times V_{DD}+I_{O}\times V_{CESAT}$$

The maximum power consumption of the device is 1.5W, and each channel's power consumption could be derived by the parameters of the electrical characteristics table as following:

$$P1=0.002\times 5.5\times 2+0.05\times 5.5+0.2\times 1.2=0.537W$$

So the number of active channels is two because the whole power consumption of

the device is all channels' power summation.

6.3 Supply Current with Input Signals

The typical work condition of BM2711MQRH is:

ENiA=ENiB=1: The channel i is in ON-state, output terminal OCi output is in low level and it can provide driver current;

ENiA&ENiB=0: The channel i is in OFF-state, output terminal OCi output is in high level (load terminal voltage).

The relationship with supply current and input signal is:

1)ENiA=ENiB=1:The forestage driver circuit of part A and part B of channel i is in ON-state, and the supply current is about 40mA at room temperature. Output driver transistors of part A and part B are turned on, output terminal can provides driver current.

2) ENiA =1, ENiB=0: The forestage driver circuit of part A and part B of channel i is in OFF-state, and there is no supply current. Output driver transistors of part A and part B are turned off, output terminal is turned off.

3) ENiA =0, ENiB=1: The forestage driver circuit of part A of channel i is in OFF-state, but there is an access between the forestage driver circuit of part B of channel i and GND, and the supply current is about 20mA at room temperature. Output driver transistors of part A and part B of channel i are turned off due to the output driver transistors' series connection, so output terminal of channel i is also in OFF-state.

The relationship between supply current and single channel input voltage level is as follows:

Input Voltage Level		Supply Current	Output
ENiA	ENiB	I_{VDD}	OCi
0	0	⩽1mA	High-Z
0	1	⩽25mA	High-Z
1	0	⩽1mA	High-Z
1	1	⩽1mA	0

7. Package Outline Dimensions

7.1 BM2711MQRH's packaging is CQFP64 which is shown as follows.

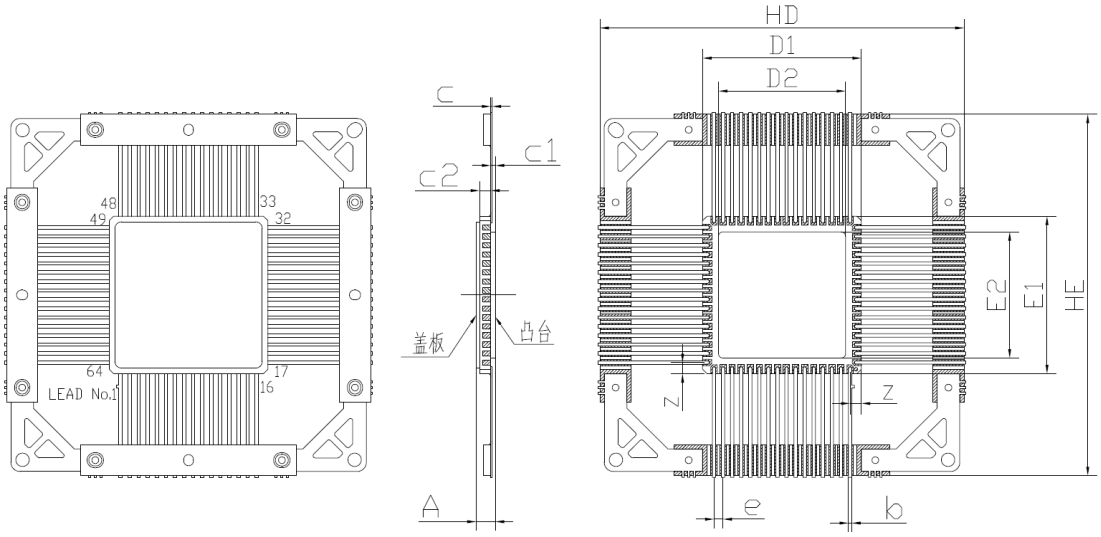


Figure 6. BM2711MQRH's Packaging(CQFP64)

Table 5. Dimensions

Symbol	Data(Unit：mm)		
	Min	typical	Max
A	1.85	—	2.50
b	0.3	—	0.46
c	0.09	—	0.21
c1	0.35	—	0.57
c2	1.05	—	1.93
HD/HE	39.90	—	41.60
D1/E1	17.40	—	18.15
D2/E2	13.95	—	14.55
e	—	1.016	—
Z	1.09	—	1.45

7.2 The Outline dimensions of CQFP64 which is cut for use.

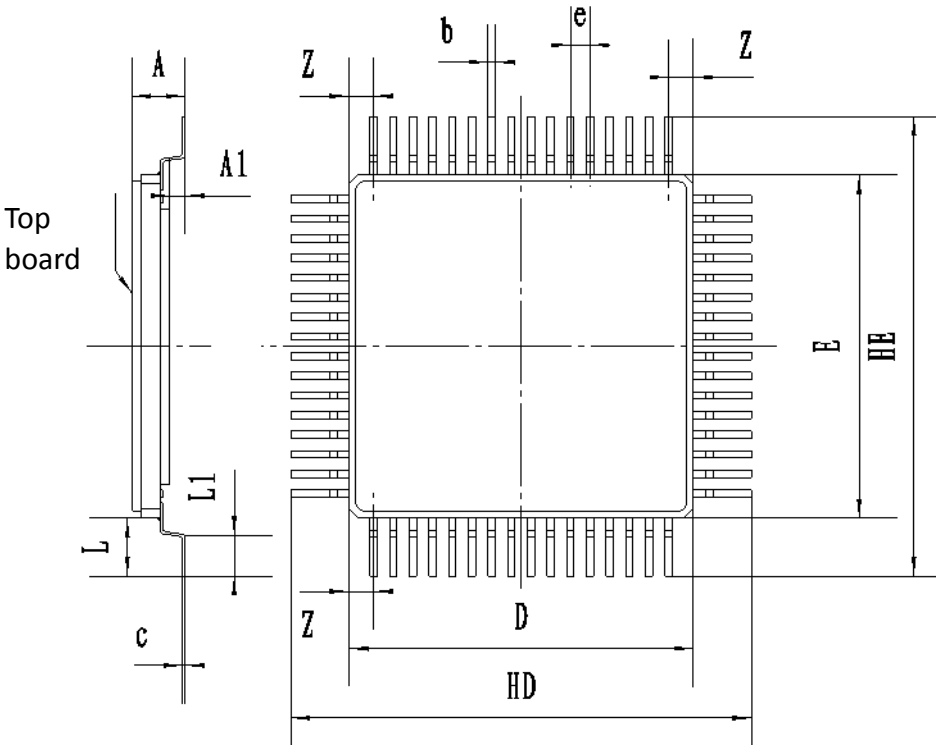


Figure 7. Cutting Forming Diagram

Table 6. Cutting Forming Dimensions

Symbol	Data（Unit：mm）		
	Min	typical	Max
A	2.3		3.2
A1	0.5	0.75	1.01
b		0.381	
c		0.152	
e		1.016	
Z		1.27	
D/E		17.78	
HD/HE	21.58	22.78	23.98
L1	1.25	1.5	1.75
L	2.0	2.5	3.0

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