

Ver 1.2

16-Chanel High Voltage Analog Multiplexer

Datasheet

Part Number: BM1840AMDRH/AMFRH



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Page of Revise Control

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1. Unique features

- Radiation Environment
 - Irradiation 30Krad(Si)
 - The Single Event Latch-up Immunity
- Low Power Consumption
- Fast Access Time 1000ns
- High Analog Input Impedance During Power Loss(Open)
- Excellent In Hi-Reliable Systems
- Break-Before-Make Switching
- No Latch-Up
- ESD 2000V



2. Description

The BM1840AMDRH/BM1840AMFRH is a radiation hardened, monolithic 16 channel multiplexer. It is designed to provide a high input impedance to the analog source if device power fails (open). One of sixteen channel selection is controlled by a 4-bit binary address plus an Enable-Inhibit input which conveniently controls the ON/OFF operation of several multiplexers in a system. All ports have electrostatic discharge protection. The supply voltage of BM1840AMDRH/ BM1840AMFRH is up to $\pm 12V$, so it is necessary to evaluate the risk of SEGR(Single Event Gate Rupture) when it is used in space environments.

3. Functional block diagram

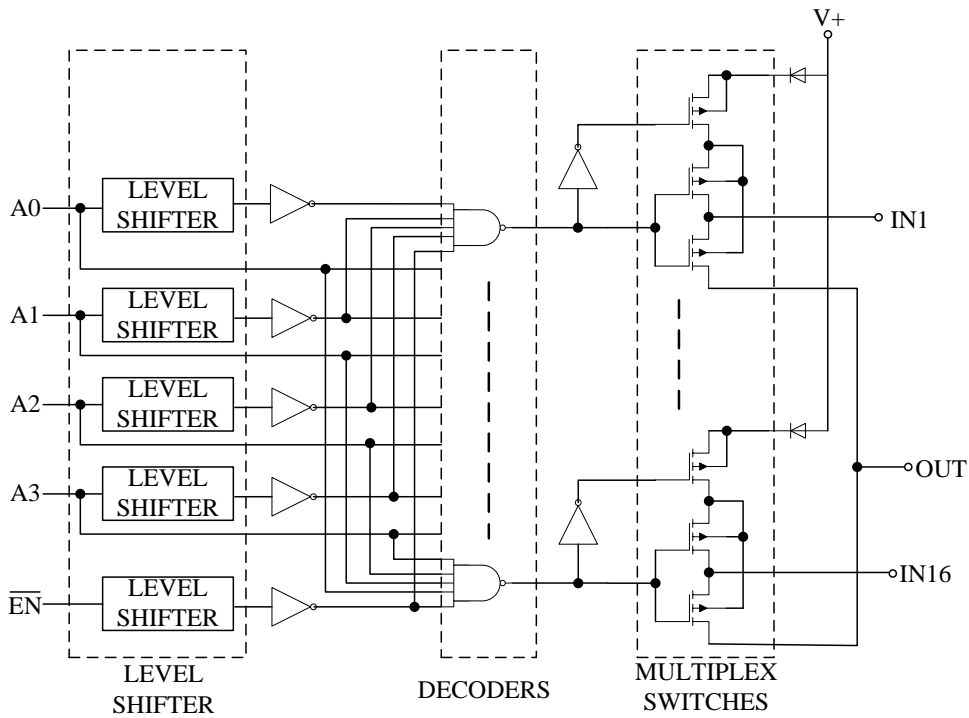


Figure 3-1. Functional block diagram

4. Pin configuration

The pins description of device are shown in figure:

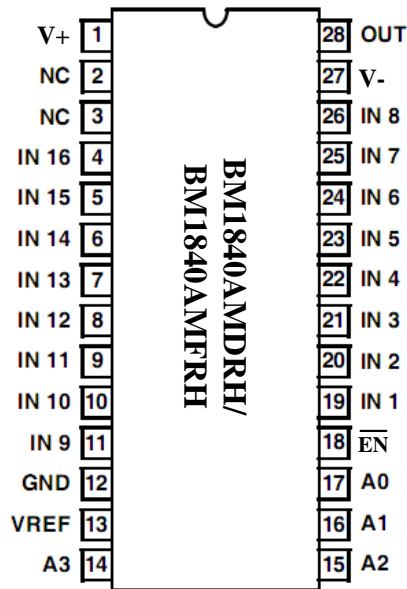


Figure 4-1. Pin description

Table 4-1. Pin Description

Symbol	Description
IN1~IN16	Signal Input

A0~A3	Address Select
\overline{EN}	Chip Enable
V+	Positive Power Supply
V-	Negative Power Supply
OUT	Signal Output
VREF	5V Reference
GND	Ground
NC	No Internal Connect

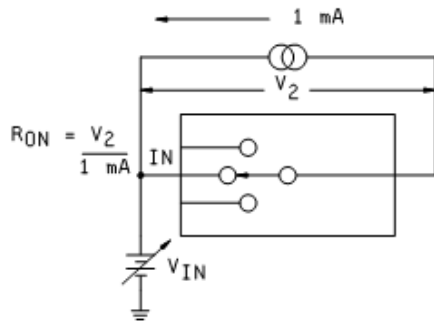
5. Device description

5.1 Truth Table

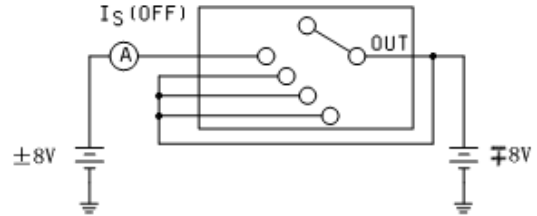
A3	A2	A1	A0	\overline{EN}	“ON”CHANEL
X	X	X	X	1	None
0	0	0	0	0	S1
0	0	0	1	0	S2
0	0	1	0	0	S3
0	0	1	1	0	S4
0	1	0	0	0	S5
0	1	0	1	0	S6
0	1	1	0	0	S7
0	1	1	1	0	S8
1	0	0	0	0	S9
1	0	0	1	0	S10
1	0	1	0	0	S11
1	0	1	1	0	S12
1	1	0	0	0	S13
1	1	0	1	0	S14
1	1	1	0	0	S15
1	1	1	1	0	S16

5.2 Test Circuits

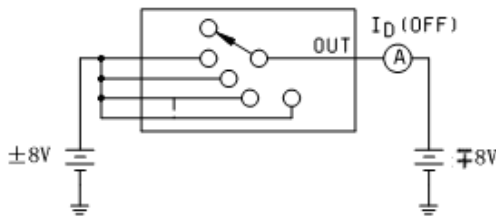
ON RESISTANCE VS. INPUT SIGNAL LEVEL



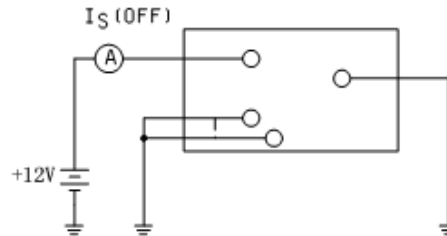
I_S (OFF) LEAKAGE CURRENT



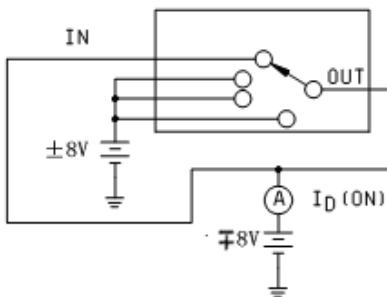
I_D (OFF) LEAKAGE CURRENT



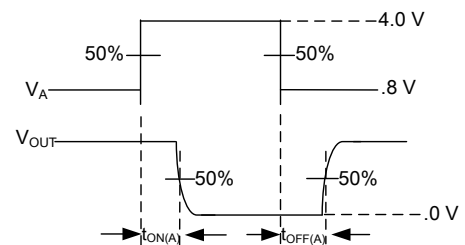
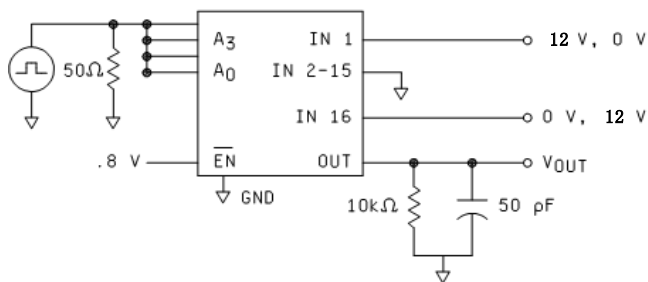
I_S (OFF) WITH POWER OFF



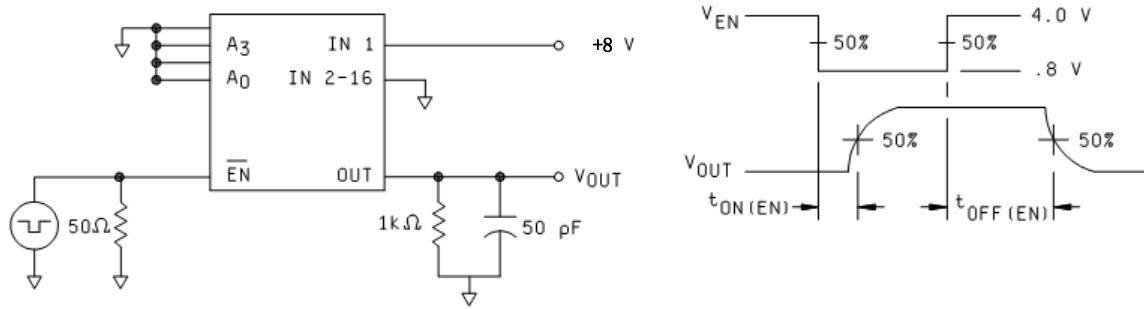
I_D (ON) LEAKAGE CURRENT



ACCESS TIME vs. LOGIC LEVEL

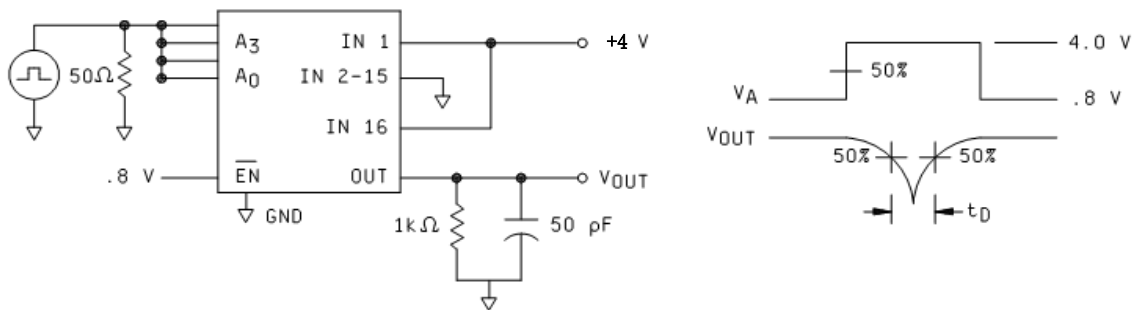


ENABLE DELAY ($t_{ON(EN)}$, $t_{OFF(EN)}$)



BREAK-BEFORE-MAKE DELAY

(t_{OPEN})



5.3 Performance Characteristics

5.3.1 In different power supply, Time vs. Temperature

In different power supply, $T_{ON}(A)$ vs. Temperature

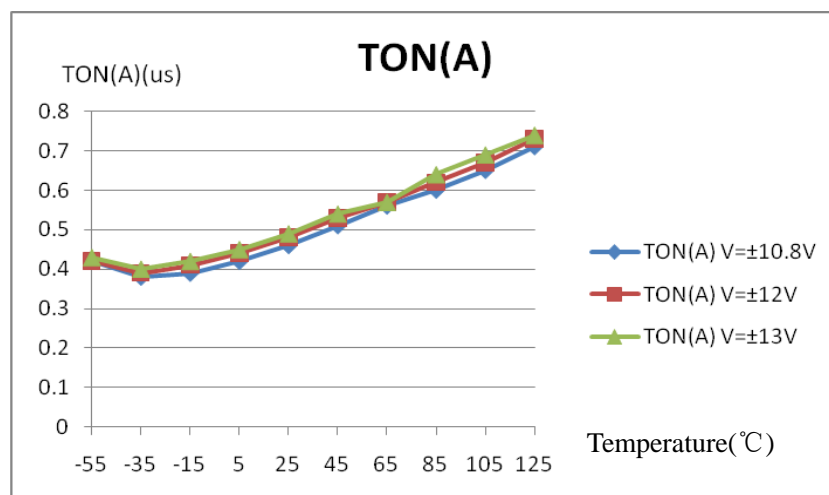


Figure 5-3-1 $T_{ON}(A)$ vs. Temperature

In different power supply, TOFF(A) vs. Temperature

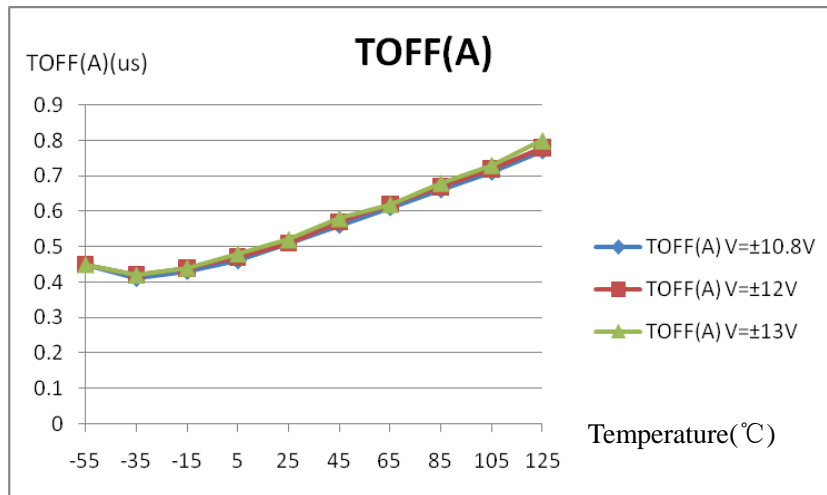


Figure 5-3-2 TOFF(A) vs. Temperature

In different power supply, TON(EN) vs. Temperature

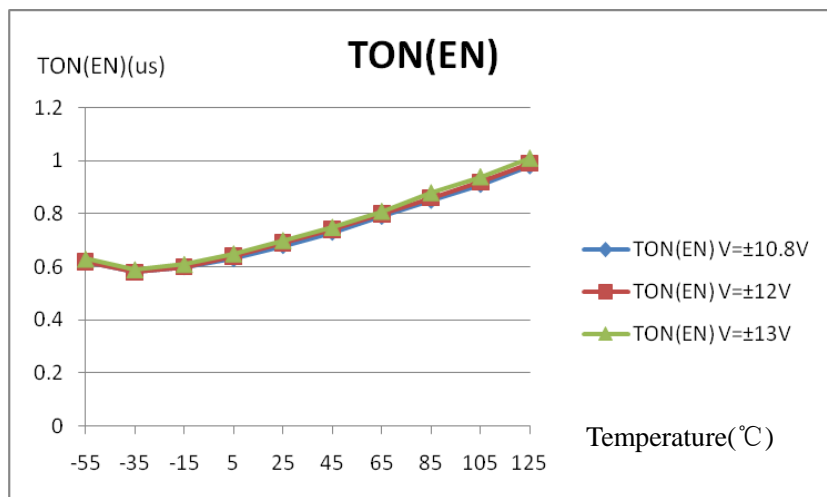


Figure 5-3-3 TON(EN) vs. Temperature

In different power supply, TOFF(EN) vs. Temperature

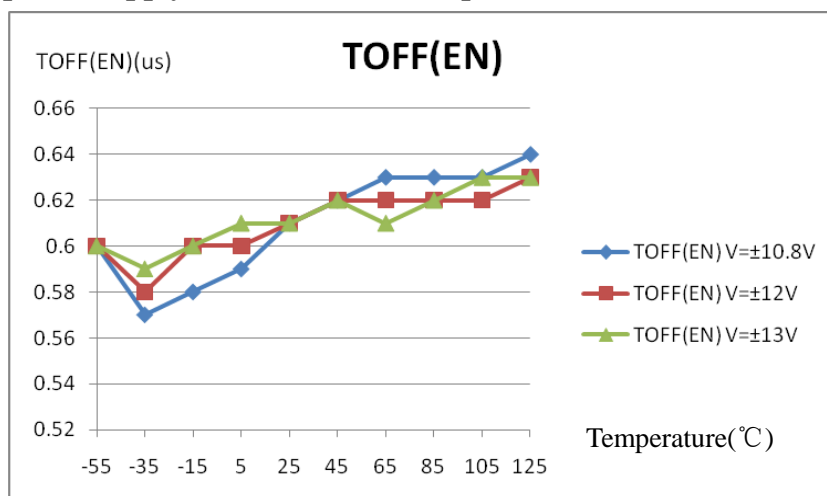


Figure 5-3-4 TOFF(EN) vs. Temperature

In different power supply, TOPEN vs. Temperature

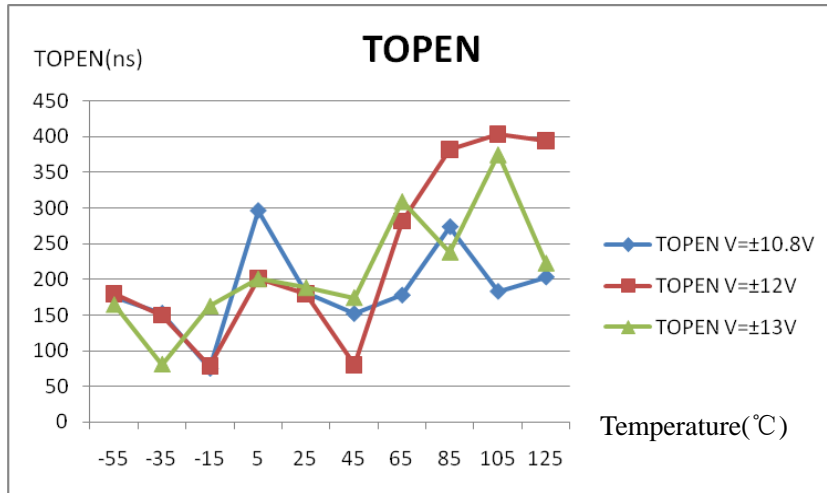


Figure 5-3-5 TOPEN vs. Temperature

5.3.2 In different power supply, Leakage Current vs. Temperature

In different power supply, +ID(ON) vs. Temperature

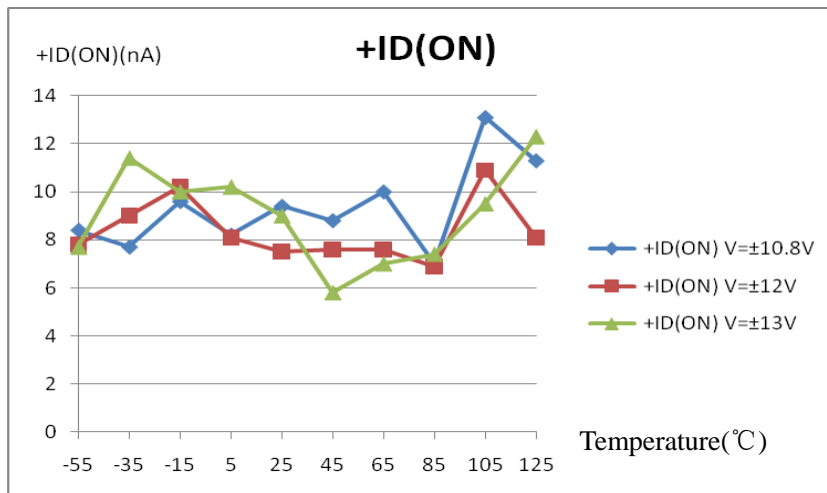


Figure 5-3-6 +ID(ON) vs. Temperature

In different power supply, -ID(ON) vs. Temperature

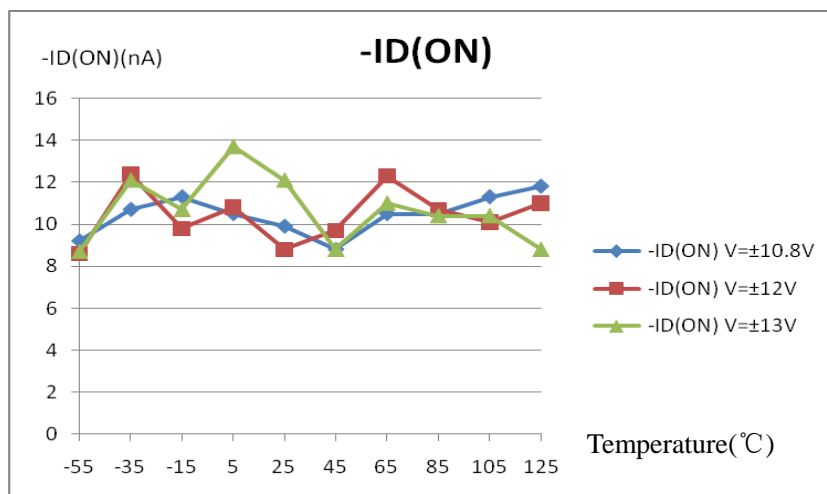


Figure 5-3-7 -ID(ON) vs. Temperature

In different power supply, +IS(OFF) vs. Temperature

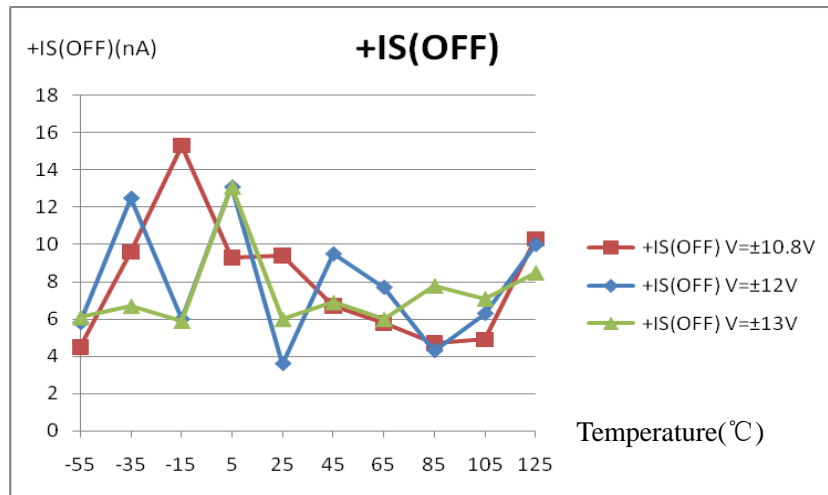


Figure 5-3-8 +IS(OFF) vs. Temperature

In different power supply, -IS(OFF) vs. Temperature

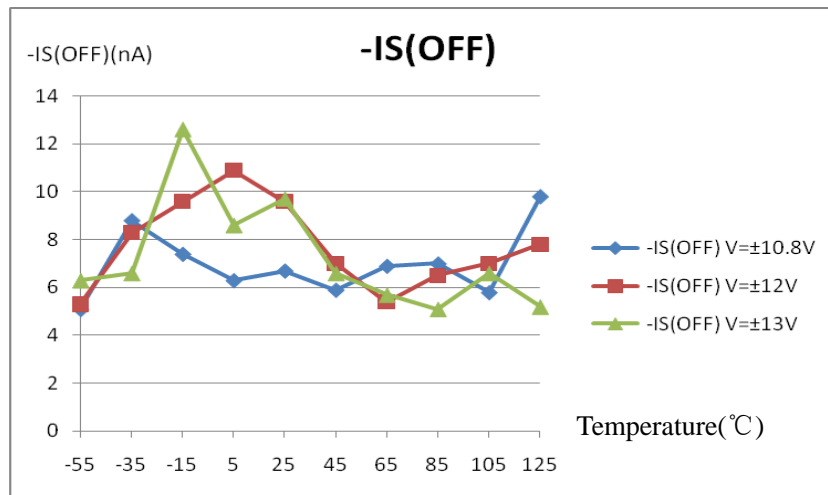


Figure 5-3-9 -IS(OFF) vs. Temperature

In different power supply, IS(OFF)Power Off vs. Temperature

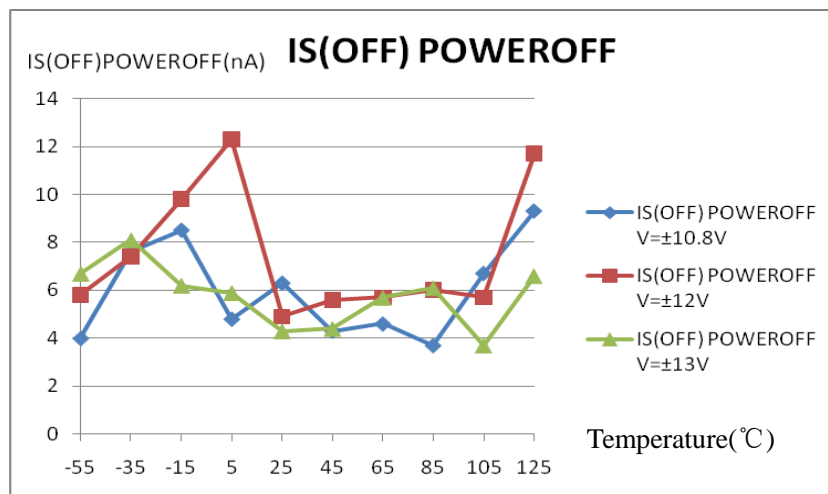


Figure 5-3-10 IS(OFF)Power Off vs. Temperature

In different power supply, +ID(OFF) vs. Temperature

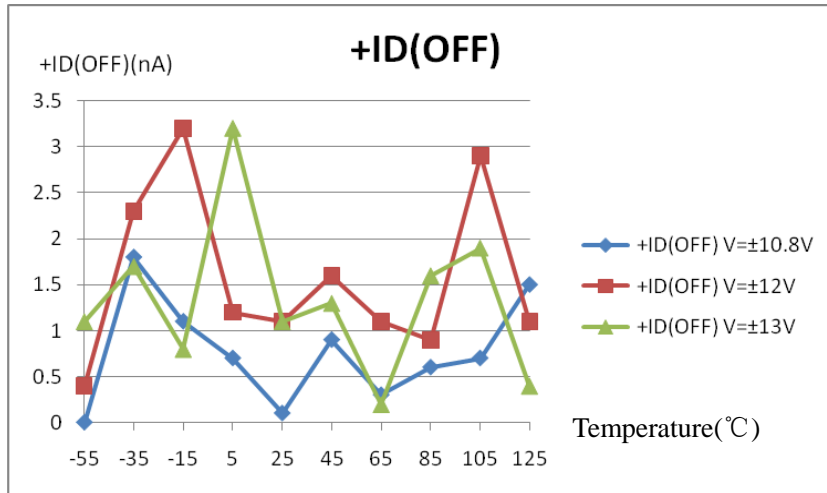


Figure 5-3-11 +ID(OFF) vs. Temperature

In different power supply, -ID(OFF) vs. Temperature

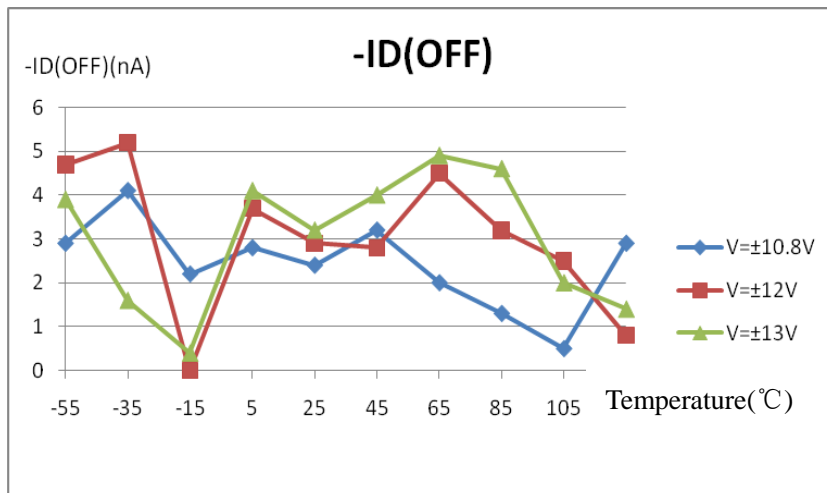


Figure 5-3-12 -ID(OFF) vs. Temperature

5.3.3 In different power supply, Power Current vs. Temperature

In different power supply, I(+) vs. Temperature

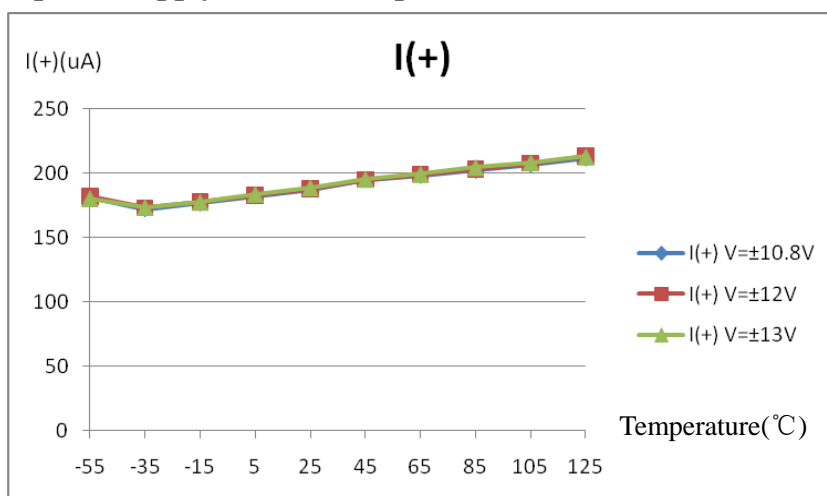


Figure 5-3-13 I(+) vs. Temperature

In different power supply, I(-) vs. Temperature

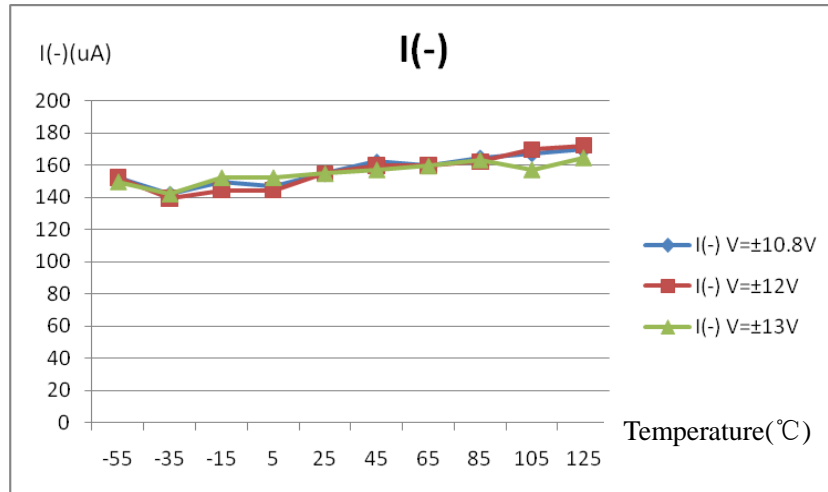


Figure 5-3-14 I(-) vs. Temperature

5.3.4 In different temperature, Power Current vs. Digital Input Signal Frequency

In different temperature, I(+) vs. Digital Input Signal Frequency(Power Supply V+ = 12.0V, V- = -12.0V)

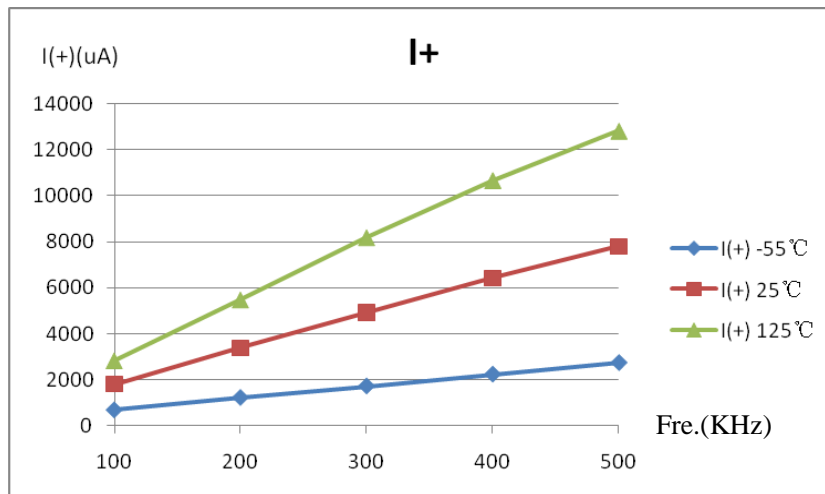


Figure 5-3-15 I(+) vs. Digital Input Signal Frequency

In different temperature, I(-) vs. Digital Input Signal Frequency(Power Supply V+ = 12.0V, V- = -12.0V)

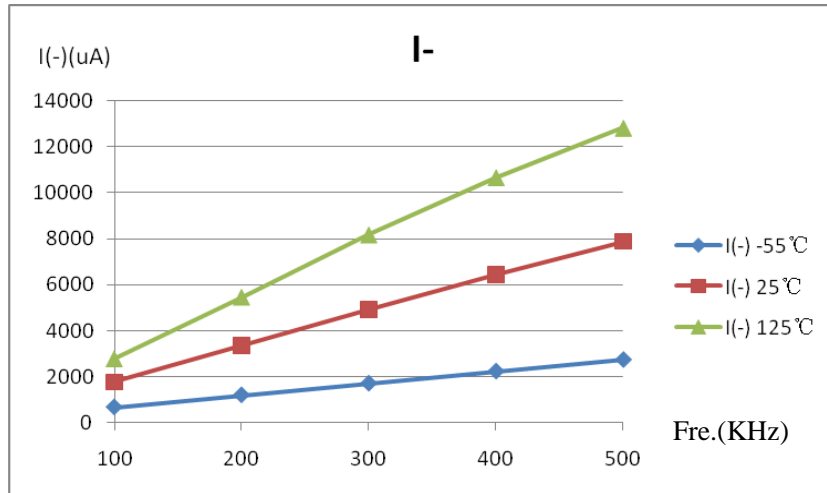


Figure 5-3-16 I(-) vs. Digital Input Signal Frequency

5.3.5 In different temperature, RON vs. Analog Input Voltage

In different temperature, R_{ON} vs. Analog Input Voltage (Power Supply $V_+ = 12.0V$, $V_- = -12.0V$)

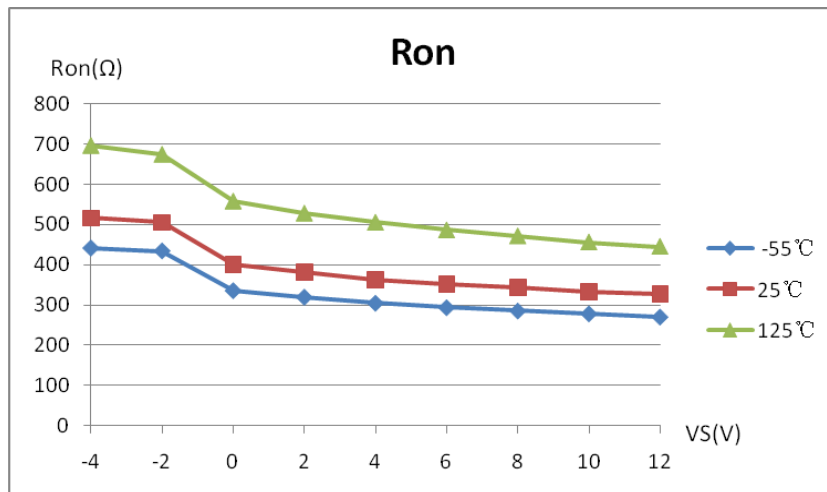


Figure 5-3-17 R_{ON} vs. Analog Input Voltage

5.4 Storage Condition

The warehouse environment of BM1840AMDRH/BM1840AMFRH should be consistent with requirements of the I class warehouse, and comply with the requirements of 4.1.1 of “The Space Component’s effective storage period and extended retest requirements”:

The device must be stored in a warehouse with good ventilation and no acid, alkaline, or other corrosive gas around. The temperature and humidity should be controlled within a certain range as follow:

The Class of Storage Environment

Symbol	Temperature(°C)	Relative Humidity (%)
I	10~25	25~70
II	-5~30	20~75
III	-10~40	20~85

5.5 Absolute Maximum Ratings

- a) +VSUPPLY to Ground(V+).....+13 V
- b) -VSUPPLY to Ground(V-).....-13 V
- c) Digital Input Overvoltage (+V_{EN},+V_A)VREF+4V
- d) Digital Input Overvoltage (-V_{EN},-V_A) GND-4V
- e) Storage Temperature Range (T_{stg})-65°C ~ + 150°C
- f) Junction Temperature(T_j)150°C
- g) Thermal Resistance(R_{th(J-C)})19°C/W(DIP28); 15°C/W(FP28)

5.6 Recommend operating conditions

- a) +VSUPPLY to Ground(V+).....+12 V
- b) -VSUPPLY to Ground(V-).....-12 V
- c) VREF to Ground(V_{REF})+5 V
- d) Analog input Range(V_S)-4V ~ +12 V
- e) Logic Low Level(V_{AL})+0.8V
- f) Logic High Level(V_{AH})+4.0V
- g) Operating Temperature Range.....-55°C ~ +125°C

5.7 Radiation hardened performance

- a) Total Ionizing Dose: ≥30K Rad(Si)
- b) The Single Event Latch-up Immunity

6. Electrical characteristics

Electrical characteristics table

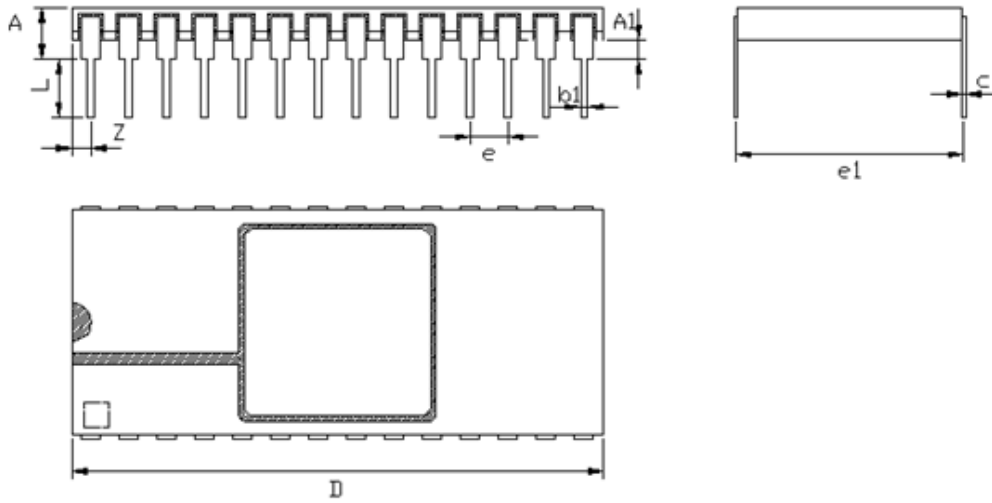
PARAMETER	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	LIMITS		UNITS
		(Unless Otherwise Specified, -55°C ≤ T _A ≤ 125°C, V ₊ =12V, V ₋ =-12V, GND=0V, VREF=5V, V _{AH} =4.0V, V _{AL} =0.8V)		MIN	MAX	
Switch On Resistance	R(ON)	V _S = 4V, I _D = +1mA, V _{EN} = 0.8V	A1,A2,A3	100	1000	Ω

PARAMETER	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	LIMITS		UNITS
		(Unless Otherwise Specified, $-55^{\circ}\text{C} \leq T_A \leq 125^{\circ}\text{C}$, $V_+ = 12\text{V}$, $V_- = -12\text{V}$, $\text{GND} = 0\text{V}$, $V_{\text{REF}} = 5\text{V}$, $V_{\text{AH}} = 4.0\text{V}$, $V_{\text{AL}} = 0.8\text{V}$)		MIN	MAX	
Positive Supply Current	I(+)	$V_A = 0\text{V}$, $V_{\text{EN}} = 0.8\text{V}$	A1,A2,A3	0.05	0.5	mA
Negative Supply Current	I(-)	$V_A = 0\text{V}$, $V_{\text{EN}} = 0.8\text{V}$	A1,A2,A3	-0.5	-0.05	mA
Positive Standby Supply Current	+I(SBY)	$V_A = 0\text{V}$, $V_{\text{EN}} = 4.0\text{V}$	A1,A2,A3	0.05	0.5	mA
Negative Standby Supply Current	-I(SBY)	$V_A = 0\text{V}$, $V_{\text{EN}} = 4.0\text{V}$	A1,A2,A3	-0.5	-0.05	mA
Input Leakage Current, Address, or Enable Pins	IAH	Measure Inputs Sequentially Ground All Unused Pins. $V_{\text{AH,EN}} = 4.0\text{V}$	A1,A2,A3	-1000	+1000	nA
	IAL	Measure Inputs Sequentially Ground All Unused Pins. $V_{\text{AL,EN}} = 0.8\text{V}$	A1,A2,A3			
Leakage Current from an “On” Driver into the Switch (Drain & Source)	+ID(ON)	$V_S = +8\text{V}$, $V_D = +8\text{V}$, $V_{\text{EN}} = 0.8\text{V}$, All unused inputs $= -8\text{V}$	A1	-50	+50	nA
			A2,A3	-100	+100	
	-ID(ON)	$V_S = -8\text{V}$, $V_D = -8\text{V}$, $V_{\text{EN}} = 0.8\text{V}$, All unused inputs $= +8\text{V}$	A1	-50	+50	nA
			A2,A3	-100	+100	
Leakage Current Into the Source Terminal of an “Off” Switch	+IS(OFF)	$V_S = +8\text{V}$, All Unused Inputs and Output $= -8\text{V}$, $V_{\text{EN}} = 4.0\text{V}$	A1	-50	+50	nA
			A2,A3	-100	+100	
	-IS(OFF)	$V_S = -8\text{V}$, All Unused Inputs and Output $= +8\text{V}$, $V_{\text{EN}} = 4.0\text{V}$	A1	-50	+50	nA
			A2,A3	-100	+100	
Leakage Current into the Source Terminal of an “Off” Switch With Power “Off”	+IS(OFF) Power Off	V_+ , V_- , V_{REF} , A0, A1, A2, A3, $V_{\text{EN}} = \text{GND}$, $V_S = +12\text{V}$, All unused inputs $= \text{GND}$	A1	-50	+50	nA
			A2,A3	-100	+100	
Leakage Current Into the Drain Terminal of an “Off” Switch	+ID(OFF)	$V_D = +8\text{V}$, All Unused Inputs $= -8\text{V}$, $V_{\text{EN}} = 4.0\text{V}$	A1	-50	+50	nA
			A2,A3	-100	+100	
	-ID(OFF)	$V_D = -8\text{V}$, All Unused Inputs $= +8\text{V}$, $V_{\text{EN}} = 4.0\text{V}$	A1	-50	+50	nA
			A2,A3	-100	+100	

PARAMETER	SYMBOL	CONDITIONS	GROUP A SUBGROUPS	LIMITS		UNITS
		(Unless Otherwise Specified, $-55^{\circ}\text{C} \leq T_A \leq 125^{\circ}\text{C}$, $V_+ = V_- = 0\text{V}$, $V_{\text{REF}} = 5\text{V}$, $V_{\text{AH}} = 4.0\text{V}$, $V_{\text{AL}} = 0.8\text{V}$)		MIN	MAX	
Capacitance Address Input	CA	$f = 1\text{MHz}$, $T_A = +25^{\circ}\text{C}$, $V_+ = V_- = 0\text{V}$, V_{REF} and V_A OFF	A4	—	15	pF
Capacitance Channel Input	CS(OFF)	$f = 1\text{MHz}$, $T_A = +25^{\circ}\text{C}$, $V_+ = V_- = 0\text{V}$, V_{REF} and V_A OFF	A4	—	15	pF
Capacitance Channel Output	CD(OFF)	$f = 1\text{MHz}$, $T_A = +25^{\circ}\text{C}$, $V_+ = V_- = 0\text{V}$, V_{REF} and V_A OFF	A4	—	50	pF
Off Isolation	VISO	$V_{\text{EN}} = 4.0\text{V}$, $f = 200\text{kHz}$, $C_L = 7\text{pF}$, $R_L = 1\text{k}\Omega$, $V_{\text{SI}} = 2.0\text{V}_{\text{RMS}}$	A4,A5,A6	45	—	dB
Analog Signal Range	VS	$I_D = +1\text{mA}$, $V_{\text{EN}} = 0.8\text{V}$	A7,A8A,A8B	-4	+12	V
Propagation Delay Times: Address Inputs to I/O Channels	TON (A)	$R_L = 10\text{k}\Omega$, $C_L = 50\text{pf}$	A9	—	1.25	us
			A10, A11	—	1.5	us
	TOFF (A)	$R_L = 10\text{k}\Omega$, $C_L = 50\text{pf}$	A9	—	1.25	us
			A10, A11	—	1.5	us
Enable to I/O	TON (EN)	$R_L = 1000\Omega$, $C_L = 50\text{pf}$	A9	—	1.25	us
			A10, A11	—	1.5	us
	TOFF(EN)	$R_L = 1000\Omega$, $C_L = 50\text{pf}$	A9	—	1.25	us
			A10, A11	—	1.5	us
Break-Before-Make Time Delay	TOPEN	$R_L = 1000\Omega$, $C_L = 50\text{pf}$	A9	25	—	ns
			A10,A11	5	—	ns

7. Package outline dimension

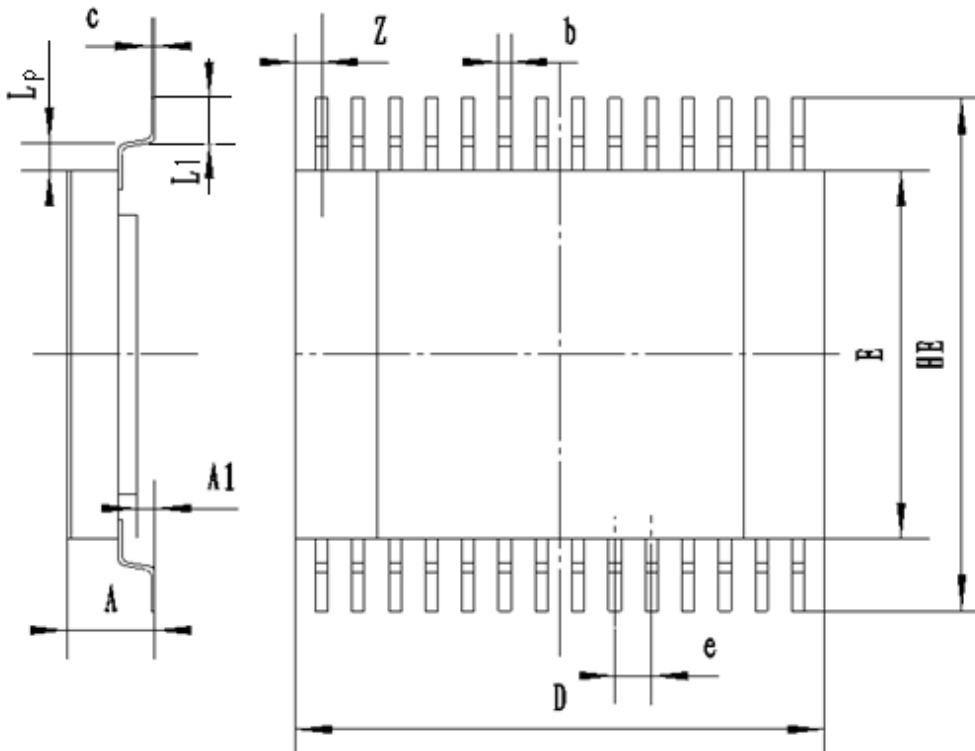
BM1840AMDRH CERAMIC DIP28, the contour dimension is described as follows:



Unit:mm

SYMBOL	MIN	NOMINAL	MAX
A	—	—	5.1
A ₁	0.51	—	—
b ₁	0.35	—	0.59
c	0.20	—	0.36
e	—	2.54	—
e ₁	—	15.24	—
L	2.54	—	5.00
D	35.20	—	35.96
Z	—	—	2.54

BM1840AMFRH CERAMIC FP28, the contour dimension is described as follows:

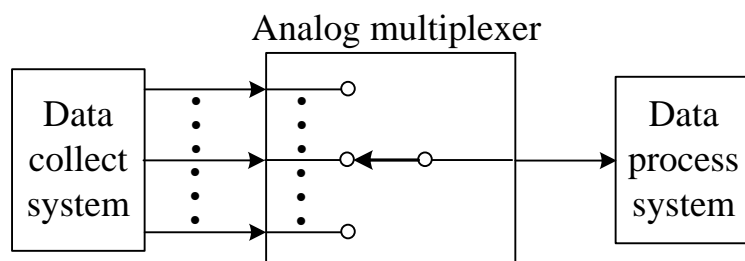


Unit:mm

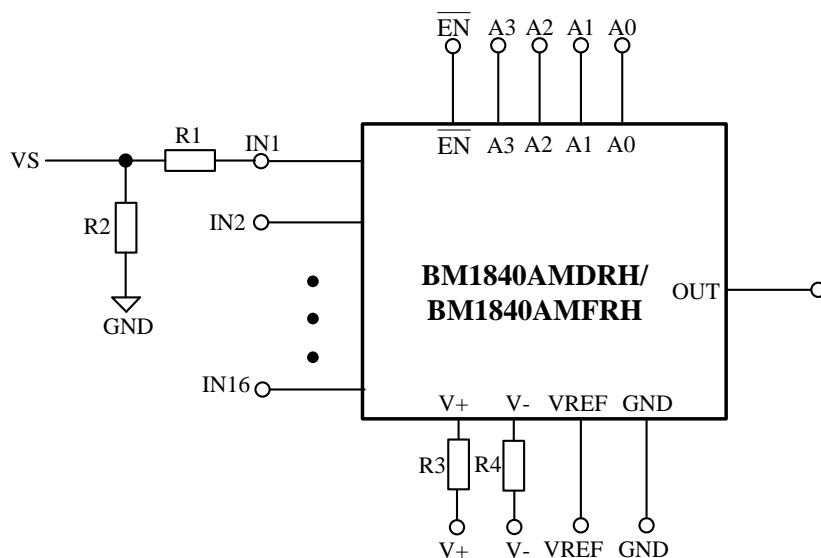
SYMBOL	MIN	NOMINAL	MAX
A	2.9	—	4.1
A1	0.5	0.75	1.01
b	—	0.43	—
c	—	0.13	—
e	—	1.27	—
Z	—	0.89	—
D	—	18.29	—
E	12.5	12.7	12.9
HE	17.5	18.7	19.9
L1	1.5	2	2.4
Lp	1.0	1.0	1.15

Appendix : Typical application

The analog multiplexer is used to control signal channel's open or close in electrical instrument systems. This chip is irradiation hardened, high isolation, low power dissipation. It can be used in many electrical systems, such as data communication system, test instrument system, sensor system, microwave system. Meanwhile, The chip can be used in military integrated circuit systems, such as the channel code debug compiler in data testing system for missile, the plus signal modular or sample-holder in Radar. The typical application is shown in the first figure. In order to enhance the reliability, the next figure shows another typical application mode. R1 is recommended 1K Ω , R2 is recommended 100K Ω ~1M Ω . R3 and R4 are recommended 500 Ω ~1K Ω , and users can adjust the values according to the actual application of BM1840AMDRH/AMFRH. VREF is recommended 5V, as the input voltage reference.



Typical application 1



Typical application 2

Service & Supply

Address: No.2.Siyingmen N.Rd.Donggaodi, Fengtai District, Beijing, PRC

Department: Department of international cooperation

Telephone: +86(0)10-68757343

Email: gjhz@mxtronics.com

Fax: +86(0)10-68757706

Zip code: 100076