General Description

The HM9708A is an ultra-efficiency, 1.5A rated, slew rate control Load Switch. It supports the lowest quiescent current (I_Q) and shutdown current (I_{SD}) in the industry. Low I_Q and I_{SD} solutions help designers to reduce leakage current, improve system efficiency, and increase battery lifetime.

The HM9708A integrated slew rate control can also enhance system reliability by mitigating bus voltage swings during switching events. The slew rate control limits the inrush current for designs with heavy capacitive loads and thereby minimizing any resulting voltage droop at the power rails.

The HM9708A Load Switch device supports a wide input voltage range (1.1 V to 5.5 V) and helps to improve operating life and system robustness. Furthermore, the device supports flexible applications and can be used in multiple voltage rail applications, which helps to reduce costs.

The HM9708A Load Switch device is packaged in a SOT23-5, DFN2X2-6L package.

Features

- Low R_{ON} = 85 mΩ TYP. @ V_{IN} = 4.5V, T_A = 25℃
- Wide Input Range: 1.1 V to 5.5 V
- I_{OUT} Max = 1.5 A
- Ultra-Low I_Q: 6 nA Typ. @ V_{IN} = 4.5V, T_A = 25℃
- Controlled Rise Time: 430 us @ V_{IN} = 3.3V, T_A = 25℃
- Internal EN Pull-Down Resistor
- Integrated Output Discharge Switch
- SOT23-5, DFN2X2-6L
- RoHS and Green Compliant

Applications

- IoT
- Wearable electronics
- SSD
- Mobile Phones
- Low Power Subsystems

Typical Application Diagram

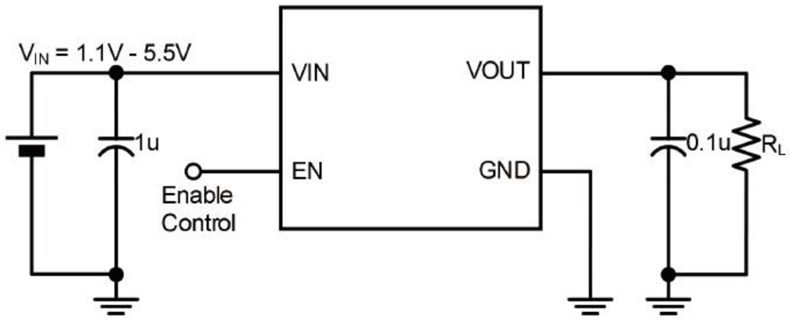


Fig. 1 Typical application diagram

Pin Configuration

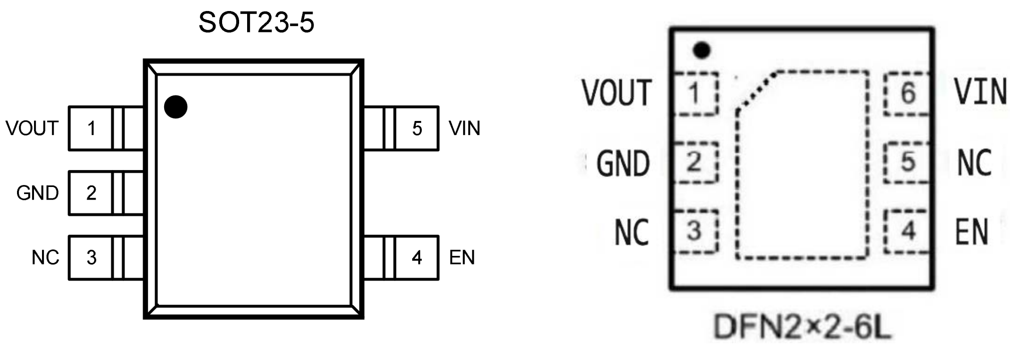


Fig. 2 Pin configuration

Pin Description

Pin	Name	Description
1	VOUT	Switch Output
2	GND	Ground
3	NC	No Connection
4	EN	Enable to control the switch
5	VIN	Switch Input. Supply Voltage for IC

Product Name List

Part Number	R_{ON} @ V_{IN} = 4.5V T_A = 25℃	Output Discharge	EN Activity	Internal EN Resistor	Availability
HM9708A	85mΩ	85Ω	High	Pull-Down	Released

Type Number

Type Number	Package	Number of package	Description
HM9708A	SOT23-5 / DFN2X2-6L	3000 PCS	HM9708A XXXX

Absolute Maximum Ratings (T_A = 25℃)

Symbol	Description	Value	Units
V_{IN}, V_{OUT}, V_{EN}	Each Pin Voltage Range to GND	-0.3 to 6	V
I_{out}	Maximum Continuous Switch Current	1.5	A
P_D	Maximum Power Dissipation at T_A = 25°C	1	W
ESD	Human Body Model, EIA/JESD22-a114	±8	kV
	Charged Device Model, JS-002-2014	±2	
	Machine Model, EIA/JESD22-a115	±300	V
T_A	Operating Temperature Range	-40 to 85	°C
T_{STG}	Storage Junction Temperature	-65 to 150	°C
θ_{JA}	Thermal Resistance, Junction to Ambient (SOT23-5)	220	°C/W

Note: Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions; extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Electrical Characteristics (T_A = 25℃)

Values are at V_{IN} = 3.3 V and T_A = 25℃ unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Basic Operation						
V_{IN}	Supply Voltage		1.1		5.5	V
I_Q	Quiescent Current[*1]	I_{OUT} = 0 mA, V_{IN} = V_{EN} = 4.5 V		6		nA
		I_{OUT} = 0 mA, V_{IN} = V_{EN} = 4.5 V, T_A = 85℃		9		
I_{SD}	Shutdown Current	I_{OUT} = 0 mA, V_{IN} = 1.1 V, V_{EN} = 0 V		2		nA
		I_{OUT} = 0 mA, V_{IN} = 1.8 V, V_{EN} = 0 V		3		
		I_{OUT} = 0 mA, V_{IN} = 3.3 V, V_{EN} = 0 V		7		
		I_{OUT} = 0 mA, V_{IN} = 4.5 V, V_{EN} = 0 V		20		
		I_{OUT} = 0 mA, V_{IN} = 4.5 V, V_{EN} = 0 V, T_A = 55℃		83		
		I_{OUT} = 0 mA, V_{IN} = 4.5 V, V_{EN} = 0 V, T_A = 85℃		440		
R_{ON}	On-Resistance	I_{OUT} = 100 mA, V_{IN} = V_{EN} = 1.1 V		215		mΩ
		I_{OUT} = 100 mA, V_{IN} = V_{EN} = 1.2 V		176		
		I_{OUT} = 300 mA, V_{IN} = V_{EN} = 1.8 V		117		
		I_{OUT} = 500 mA, V_{IN} = V_{EN} = 3.3 V		91	105	
		I_{OUT} = 500 mA, V_{IN} = V_{EN} = 3.3 V, T_A = 85℃		110		
		I_{OUT} = 500 mA, V_{IN} = V_{EN} = 4.5V		85	99	
		I_{OUT} = 500 mA, V_{IN} = V_{EN} = 4.5 V, T_A = 85℃		99		
R_{DSC}	Output Discharge Resistance	V_{EN} = 0 V, I_{FORCE} = 10mA	70	85	100	Ω
V_{IH}	EN Input Logic High Voltage	V_{IN} = 1.1V - 1.8V	0.9			V
		V_{IN} = 1.8V - 5.5V	1.2			V
V_{IL}	EN Input Logic Low Voltage	V_{IN} = 1.1V - 1.8V			0.3	V
		V_{IN} = 1.8V - 5.5V			0.4	V
R_{EN}	EN pull resistance	Internal Pull-Down Resistance	7	10	13	MΩ
I_{EN}	EN Current	V_{EN} = 5.5 V		0.56	0.8	μA

*1: I_Q of HM9708A does not include the EN pin current through the pull-down resistor R_{EN};

Electrical Characteristics (T_A = 25℃)

Values are at V_{IN} = 3.3 V and T_A = 25℃ unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
Switching Characteristics						
t_{dON}	Turn-On Delay*2	R_L = 150Ω, C_{OUT} = 0.1μF		270		μs
t_R	V_{OUT} Rise Time*2			430		
t_{dON}	Turn-On Delay*2	R_L = 510Ω, C_{OUT} = 0.1μF		250		
t_R	V_{OUT} Rise Time*2			405		
t_{dOFF}	Turn-Off Delay*3	R_L = 10Ω, C_{OUT} = 0.1μF		0.42		
t_F	V_{OUT} Fall Time*3			1.8		
t_{dOFF}	Turn-Off Delay*3	R_L = 510Ω, C_{OUT} = 0.1μF		1.1		
t_F	V_{OUT} Fall Time*3			17		

*2： $t_{ON} = t_{dON} + t_R$;

*3： $t_{OFF} = t_{dOFF} + t_F$;

Block Diagram

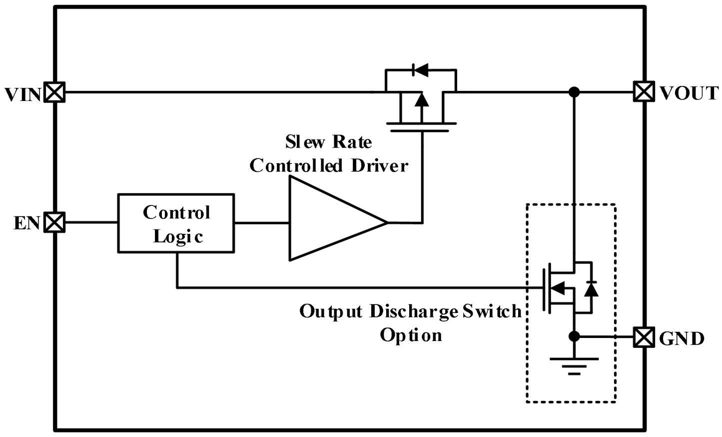


Fig. 3 Block Diagram

Timing Diagram

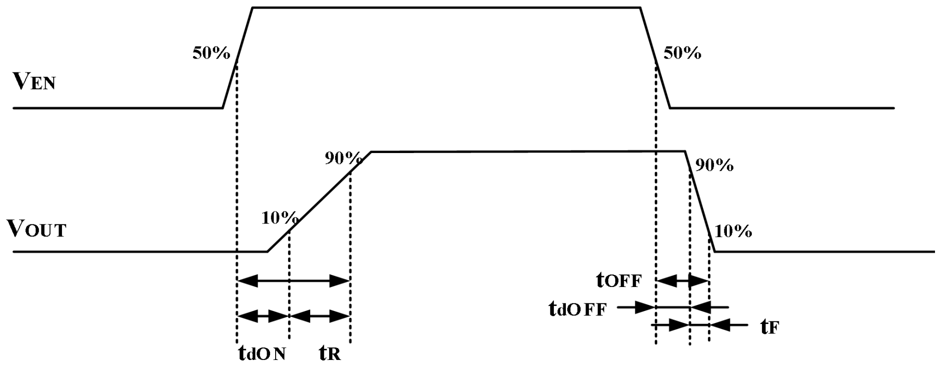


Fig. 4 Timing Diagram

Typical Performance Characteristics

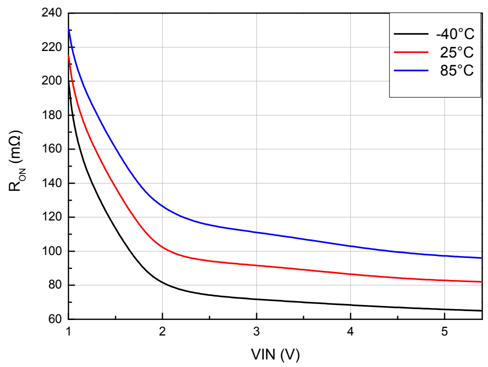


Fig. 5 R_{ON} vs. VIN

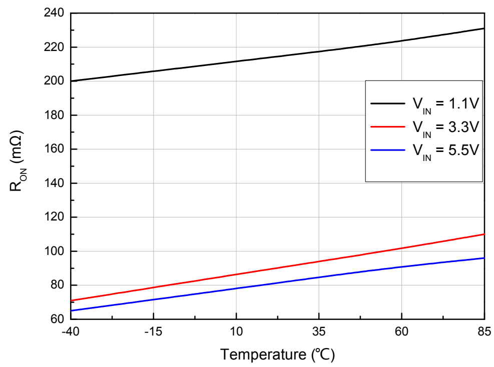


Fig. 6 R_{ON} vs. Temperature

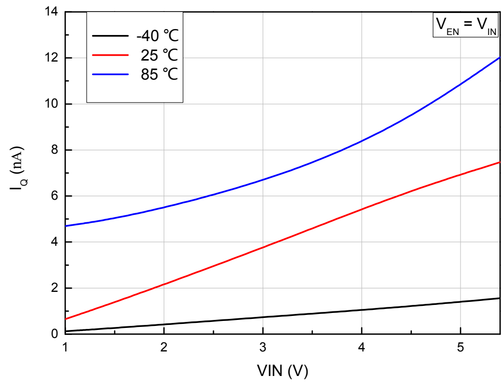


Fig. 7 I_Q vs. VIN (HM9708A)

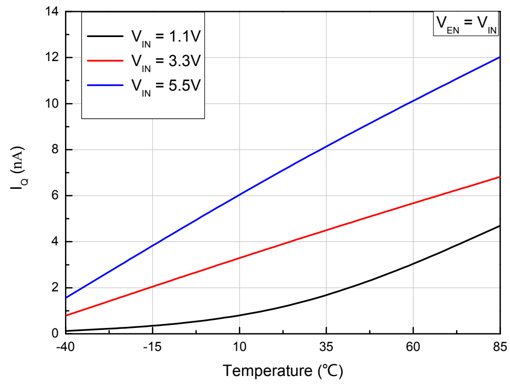


Fig. 8 I_Q vs. Temperature (HM9708A)

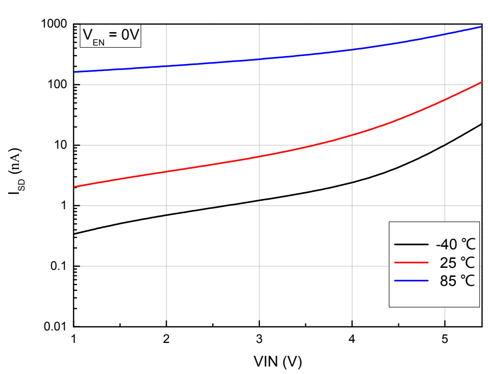


Fig. 9 I_{SD} vs. VIN (HM9708A)

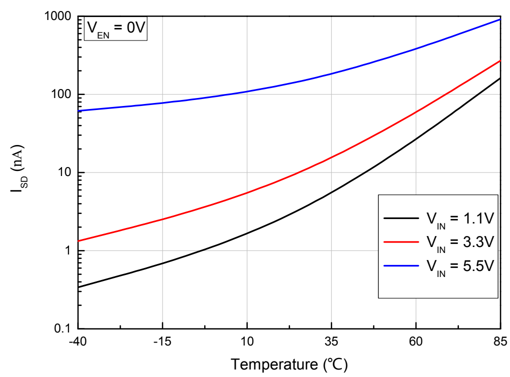


Fig. 10 I_{SD} vs. Temperature (HM9708A)

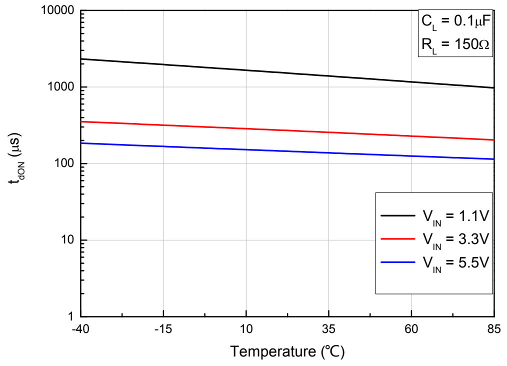


Fig. 11 t_{dON} vs. Temperature (HM9708A)

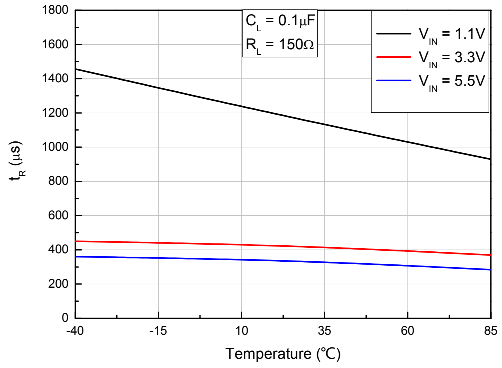


Fig. 12 t_R vs. Temperature (HM9708A)

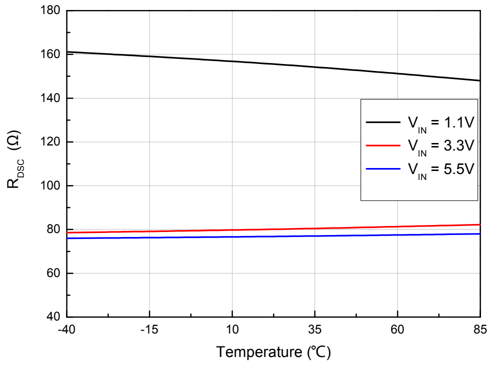


Fig. 13 R_{DSC} vs. Temperature (HM9708A)

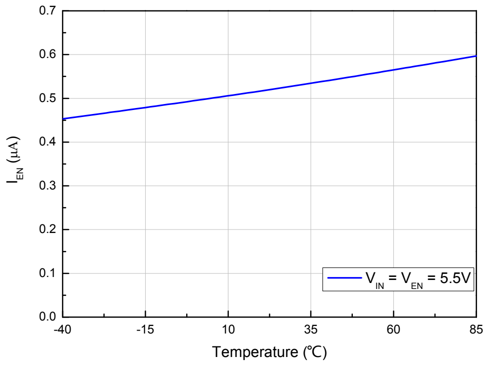


Fig. 14 I_{EN} vs. Temperature (HM9708A)

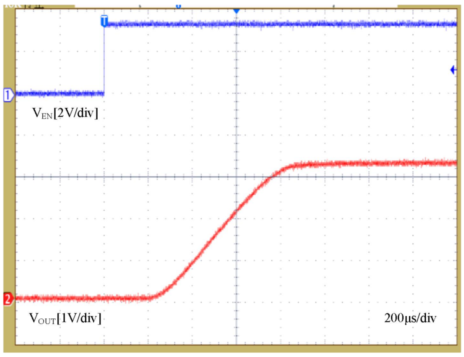


Fig. 15 Turn-On Response (HM9708A)
V_{IN}=3.3V, C_{IN}=1μF, C_{OUT}=0.1μF, R_L=10Ω

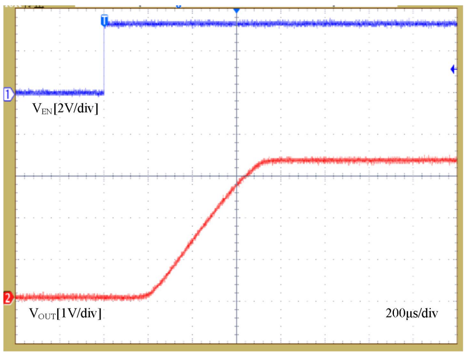


Fig. 16 Turn-On Response (HM9708A)
V_{IN}=3.3V, C_{IN}=1μF, C_{OUT}=0.1μF, R_L=510Ω

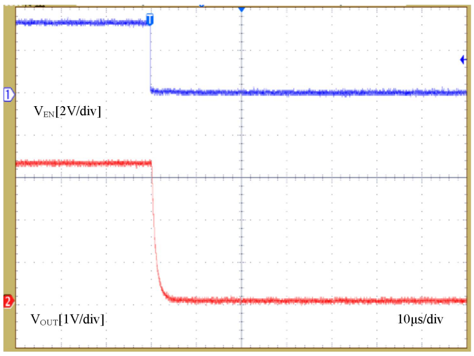


Fig. 17 Turn-Off Response (HM9708A)
V_{IN}=3.3V, C_{IN}=1μF, C_{OUT}=0.1μF, R_L=10Ω

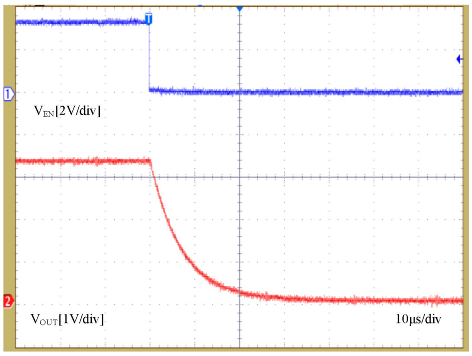


Fig. 18 Turn-Off Response (HM9708A)
V_{IN}=3.3V, C_{IN}=1μF, C_{OUT}=0.1μF, R_L=510Ω

Functional Description

1. Input Capacitor

To limit the voltage drop on the input supply caused by transient inrush currents, an input bypass capacitor is recommended, which is recommended to be placed close to the VIN pin. Higher value capacitors can further help to reduce the voltage drop

2. Output Capacitor

Depending on the sink current during system start-up and system turn-off, a capacitor must be placed on the output. A 1.0μF or larger capacitor across OUT and GND pins is recommended to accommodate load transient condition. This capacitor can also help to prevent parasitic inductance which can force the output voltage to fall below GND during turn-off. Undershoot can be caused by parasitic inductance from board traces or intentional load inductances. If load inductances do exist, use of an output capacitor can improve output voltage stability and system reliability. The COUT capacitor should be placed close to the VOUT and GND pins.

3. EN pin

The EN pin is compatible with active HIGH GPIO and CMOS logic voltage levels and operates over the 1.1V to 5.5V operating voltage range. Note that The HM9708A incorporates an internal pull-down resistor on the enable pin, to ensure that the device remains OFF, in the event that the pin is left floating.

4. Output Discharge Function

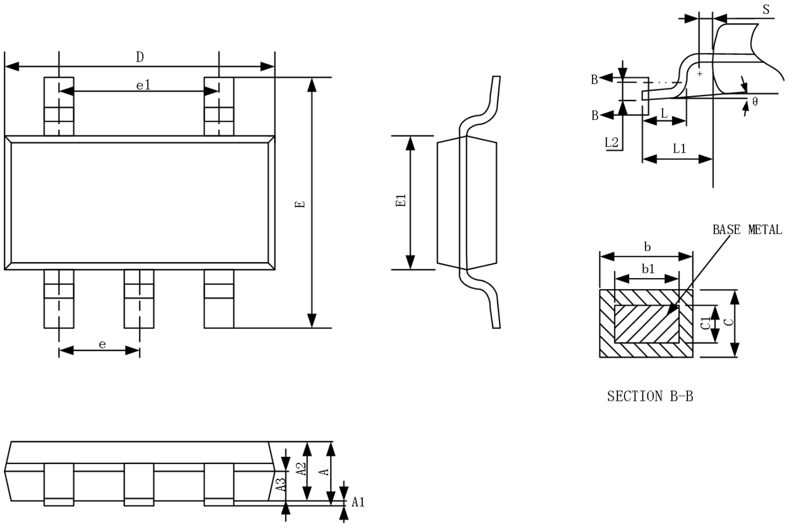
The HM9708A has an internal discharge N-channel FET switch on the VOUT pin. When EN signal turns the main power FET to an off state, the N-channel switch turns on to discharge an output capacitor quickly.

5. Board Layout

For the best performance, all traces should be as short as possible to minimize the inductance and parasitic effects. The input and output capacitors should be kept as close as possible to the input and output pins respectively. Using wide traces for input, output, and GND help reducing the case to ambient thermal impedance.

Package Information

SOT23-5 Package Outline Diagram

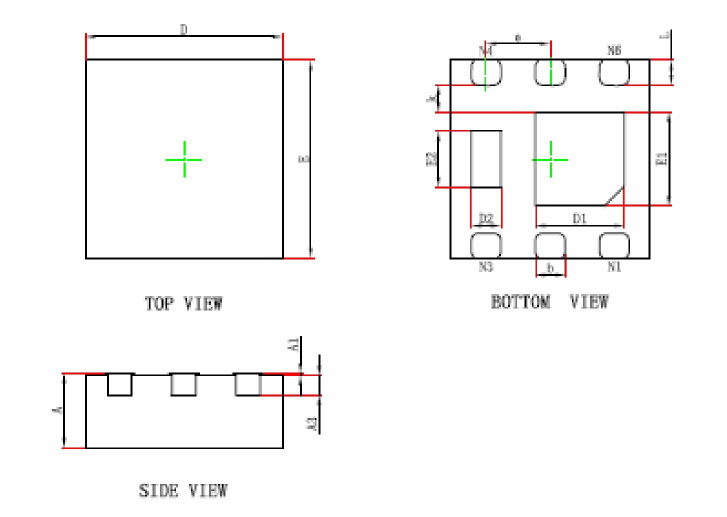


COMMON DIMENSIONS

(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	NOM	MAX
A	-	-	1.25
A1	0.04	-	0.10
A2	1.00	1.10	1.20
A3	0.60	0.65	0.70
b	0.33	-	0.41
b1	0.32	0.35	0.38
c	0.15	-	0.19
c1	0.14	0.15	0.16
D	2.82	2.92	3.02
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95 BSC		
e1	1.90 BSC		
L	0.30	-	0.60
L1	0.60 REF		
L2	0.25 REF		
θ	0°	-	8°

封装说明：5CbH·HπC[



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	1.924	2.076	0.076	0.082
E	1.924	2.076	0.076	0.082
D1	0.800	1.000	0.031	0.039
E1	0.850	1.050	0.033	0.041
D2	0.200	0.400	0.008	0.016
E2	0.460	0.660	0.018	0.026
k	0.200MIN.		0.008MIN.	
b	0.250	0.350	0.010	0.014
e	0.650TYP.		0.026TYP.	
L	0.174	0.326	0.007	0.013

Notes

1. All dimensions are in millimeters.
2. Tolerance ±0.10mm (4 mil) unless otherwise specified
3. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils.
4. Dimension L is measured in gauge plane.
5. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.