

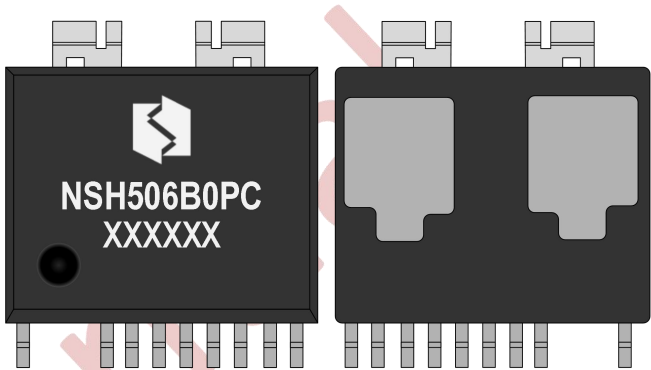


NSH506B0PC 5A, 650V Half-Bridge IPM

1. Features

- Under-voltage lockout for both channels
- High-level effective, supported 3.3V, 5V and 15V input
- Integrated gate drivers and bootstrap functionality
- Temperature detected output for MCU control
- Cross-conduction prevention logic
- Isolation 1500 VRMS min
- 650V maximum operating voltage
- Maximum Power Dissipation for each IGBT
--14.2W
- High-Side Under-Voltage Protection
--Trigger level=7.7V
--Reset level= 8.7V

NSH506B0PC is a 5A, 650V half-bridge intelligence power module designed for motor drive applications, integrated 5A/650V IGBT gate driver and bootstrap functionality in a small ESOP13 package. It can be flexibly applied to single-phase and three-phase DC brushless motor drive.



2. Applications

- BLDC Motor control

3. Description

Internal Electrical Schematic

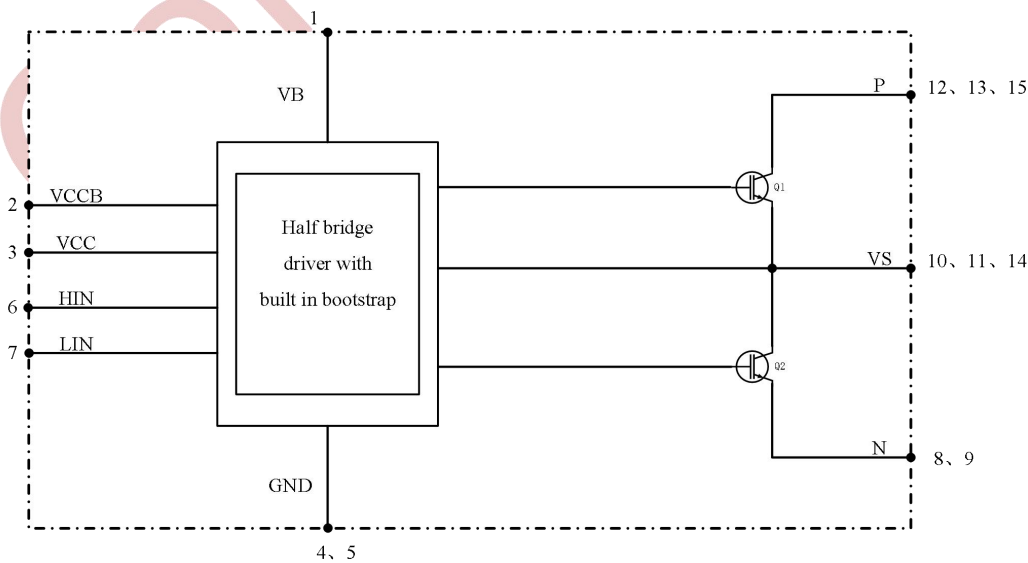


Fig.1 Internal Electrical Schematic

Device Information		
Part Number	Package	Body size
NSH506B0PC	ESOP13	7.5mm x 9mm

4. Selection Guide

PART No.	Input signal	UVLO	Built in BSD	BV _{DSS}	Pulse Current
NSH506B0PC	HIN, LIN	7.7/8.7V	YES	650V	5A

5. Order Information

PART No.	Marking	Package Type	packing of products	SPQ
NSH506B0PC	 NSH506B0PC XXXXX	ESOP13	Tape and reel	2.5K

6. Revision History

Version	Items	Time
V1.0	Created	2023.04.01
V1.1	Advanced EMI performance	2024.05.29



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7. Pin-Out Description

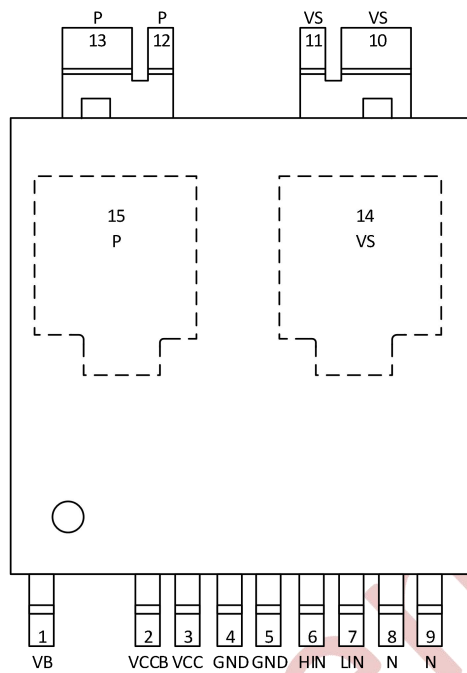


Fig2 Footprint Description

Table7-1 Pin description

PIN	Name	Description
1	VB	High Side Floating Supply
2	VCCB	Internal Diode Input
3	VCC	Gate Drive Supply
4-5	GND	Low Side Gate Drive Return
6	HIN	Logic Input for High Side
7	LIN	Logic Input for Low Side
8-9	N	Low Side Source Connection
10-11,14	VS	Phase Output
12-13,15	P	DC Bus



8. Absolute Maximum Ratings

T_j = 25°C, Unless Otherwise Specified

8.1 Inverter Part

Symbol	Parameter	Conditions	Ratings	Unit
V _{CES}	Collector-Emitter Voltage of Each IGBT	T _C = 25°C	650	V
I _C	Each IGBT Current, Continuous	T _C = 25°C	5	A
		T _C = 75°C	3.5	A
I _{CP}	Each IGBT Pulse Current, Peak	T _C = 25°C, less than 100us	10	A
		T _C = 75°C	7.5	A
I _F	Diode Continuous Forward Current	T _C = 100°C	5	A
I _{FM}	Diode Maximum Forward Current		15	A
P _D	Maximum Power Dissipation	T _C = 25°C, For Each IGBT	TBD	W

8.2 Control Part

Symbol	Parameter	Conditions	Ratings	Unit
V _{CC}	Control Supply Voltage	Applied between V _{CC} and COM	20	V
V _{BS}	High-side Bias Voltage	Applied between V _B and V _S	20	V
V _{IN}	Input Signal Voltage	Applied between V _{IN} and COM	-0.3~V _{CC} +0.3	V

8.3 Bootstrap Functionality

Symbol	Description	Conditions	Rating	Unit
V _{RRMB}	Maximum Repetitive Reverse Voltage	T _C = 25°C	650	V
I _{FB}	Forward Current	T _C = 25°C	0.25	A
I _{FPB}	Forward Peak Current, Peak	T _C = 25°C, Less than 1mS	0.5	A

8.4 Total System

Symbol	Parameter	Conditions	Ratings	Unit
T _j	Operating Junction Temperature		-40~150	°C
T _{STG}	Storage Temperature	T _C = 25°C	-40~125	°C
V _{ISO}	Isolation Voltage	60Hz, Sinusoidal, AC 1 min, between pins and heat-sink plate	1500	V _{rms}

NOTE1: To insure safe operation of the IPM, the average junction temperature should be limited to T_J ≤ 150°C (@T_C ≤ 100°C).

8.5 Thermal and Mechanical Characteristics

Symbol	Parameter	Conditions	Ratings	Unit
R _{th} (J-B)	Thermal resistance, junction to mounting pad, each IGBT	For Each IGBT	1.0	°C/W
R _{th} (J-A)	Thermal resistance, junction to ambient, each IGBT	For Each IGBT	40	°C/W

9. Recommended Operating Conditions

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V _{PN}	Supply Voltage	Applied between P and N	-	300	400	V
V _{CC}	Control Supply Voltage	Applied between VCC and COM	13.5	-	18.5	V
V _{BS}	High-Side Bias Voltage	Applied between VB and VS	13.5	-	18.5	V
V _{IN(ON)}	Input ON Threshold Voltage	Applied between VIN and COM	3.0	-	V _{CC}	V
V _{IN(OFF)}	Input OFF Threshold Voltage		0	-	0.6	V
t _{dead}	Blanking Time for Preventing Arm-Shor	V _{CC} = V _{BS} = 13.5 ~ 16.5 V, T _J <150°C	1.0	-	-	μs
F _{PWM}	PWM Switching Frequency	T _J <150°C	-	15	-	kHz



10. Electrical Characteristics

TJ= 25°C, Unless Otherwise Specified

10.1 Convert Part

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)CES}$	Collector-Emitter Voltage	$V_{GE} = 0\text{ V}$, $I_{CE} = 250\mu\text{A}$ (NOTE 2)	650	-	-	V
I_{CES}	Collector-Emitter Leakage Current	$V_{GE} = 0\text{ V}$, $V_{CE} = 650\text{ V}$	-	-	2	μA
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE}=15\text{V}$, $I_C=5\text{A}$, $T_J=25^\circ\text{C}$	-	1.45		V
t_{ON}	Switching Times	$V_{PN} = 300\text{ V}$, $V_{CC} = V_{BS} = 15\text{ V}$, $I_D = 0.5\text{ A}$ $V_{IN} = 0/5\text{ V}$, Inductive Load $L = 3\text{ mH}$ (NOTE 3)	-	1020	-	ns
t_{OFF}			-	620	-	ns
t_{rr}			-	110	-	ns
E_{ON}			-	60	-	μJ
E_{OFF}			-	50	-	μJ
R_{BSOA}	Reverse Bias Safe Operating Area	$V_{PN} = 400\text{ V}$, $V_{CC} = V_{BS} = 15\text{ V}$, $I_C = I_{CP}$, $V_{CE} = BV_{DSS}$, $T = 150^\circ\text{C}$	Full Square			

NOTE 2: $V_{(BR)CES}$ is the absolute maximum voltage rating between collector and emitter terminal of each FRFET inside IPM.

NOTE 3: t_{ON} and t_{OFF} include the propagation delay time of the internal drive IC. Listed values are measured at the laboratory test condition, and they can be different according to the field applications due to the effect of different printed circuit boards and wirings.

Please see Fig 3 for the switching time definition.

10.2 Control Part

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{QCC}	Quiescent VCC Supply Current	$V_{CC} = 15\text{V}$ $V_{IN} = 5\text{V}$ Applied between VCC and COM	-	100	220	μA
I_{QB}	Quiescent VBS Supply Current	$V_{DB} = 15\text{V}$ $V_{IN} = 5\text{V}$ Applied between VB -VS	-	50	100	μA
UV_{CCD}	Low-Side Under-Voltage Protection	VCC Under-Voltage Protection Detection Level	-	7.7	-	V
UV_{CCR}		VCC Under-Voltage Protection Reset Level	-	8.7	-	V
UV_{BSD}	High-Side Under-Voltage Protection	VBS Under-Voltage Protection Detection Level	-	7.7	-	V
UV_{BSR}		VBS Under-Voltage Protection Reset Level	-	8.7	-	V
V_{IH}	ON Threshold Voltage	Logic HIGH Level, Applied between VIN and COM	-	-	2.6	V
V_{IL}	OFF Threshold Voltage	Logic Low Level, Applied between VIN and COM	-	-	0.8	V

11. Function Description

11.1 Basic Function description

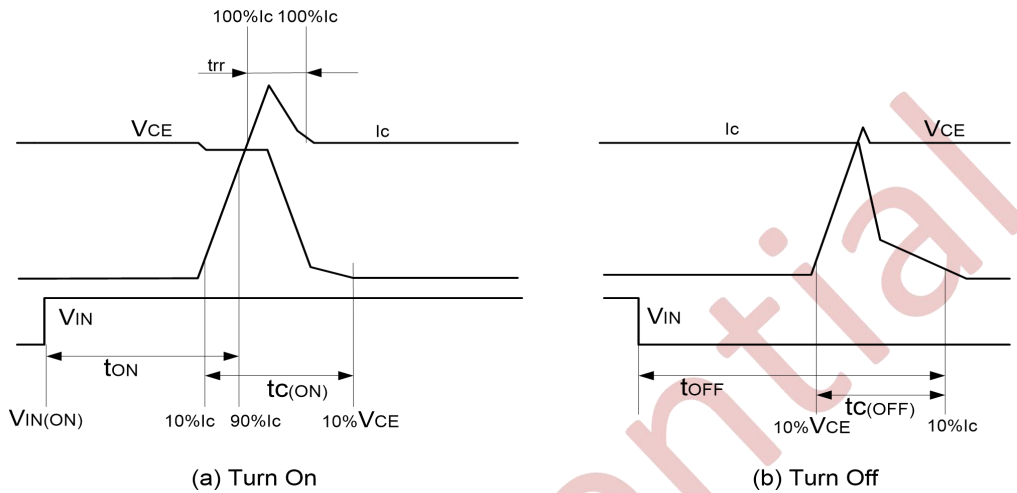


Fig. 3 Switching Time Definitions

11.2 Time Charts of Protective Function

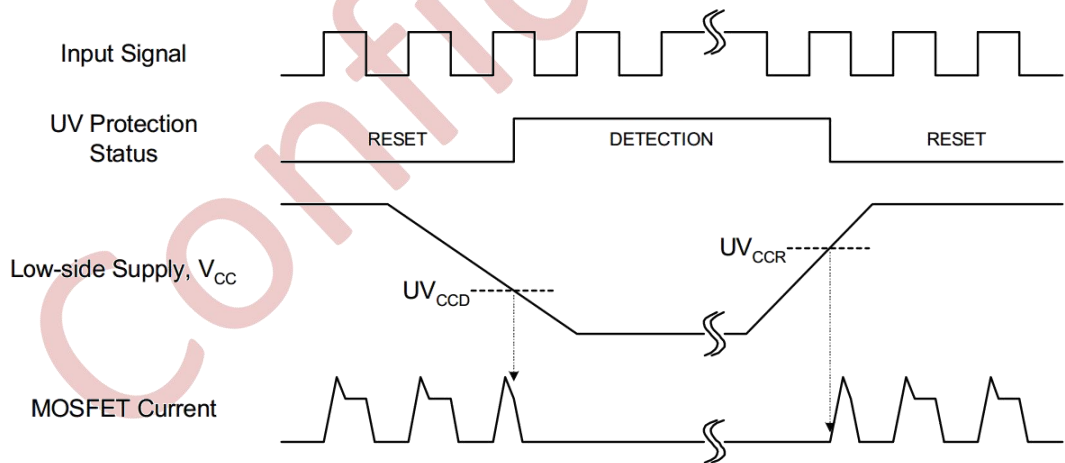


Fig. 4 Under voltage Protection (Low-side)

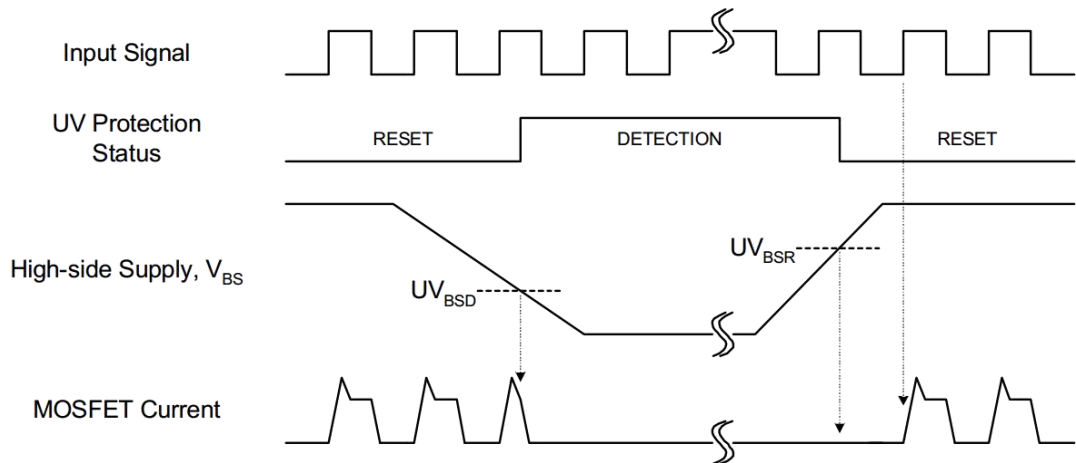


Fig. 5 Under voltage Protection (High-side)

12. NSH506B0PC Typical Application Circuit

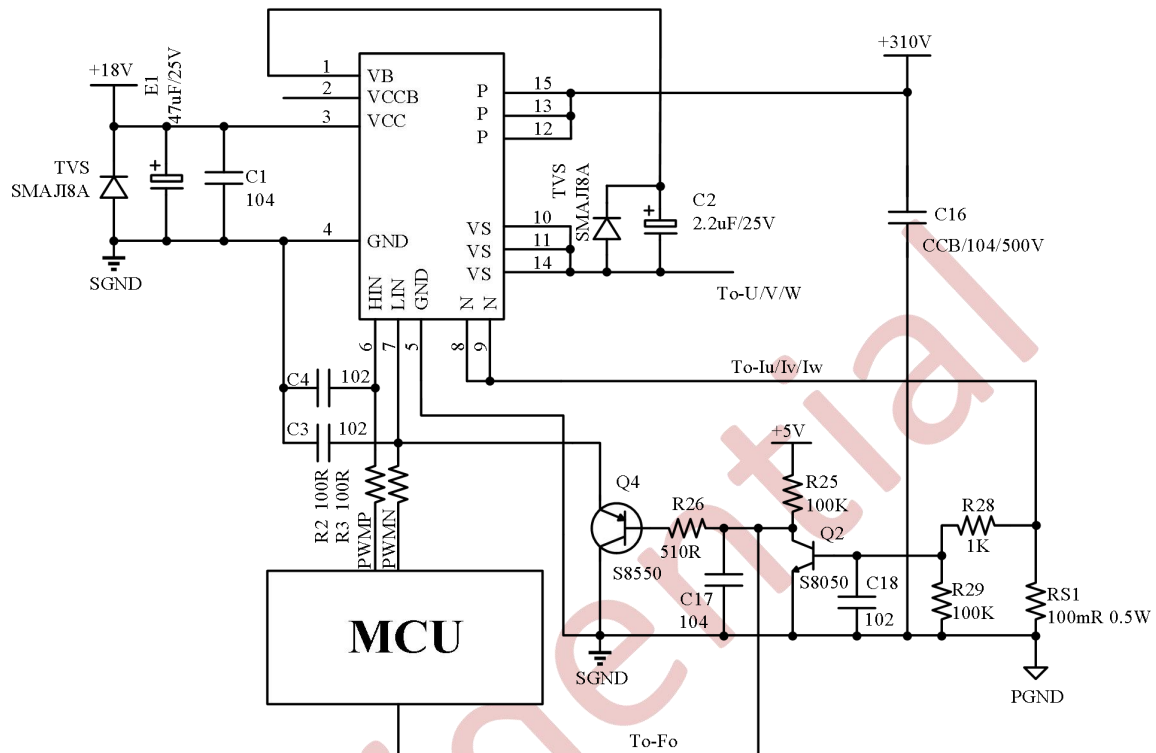
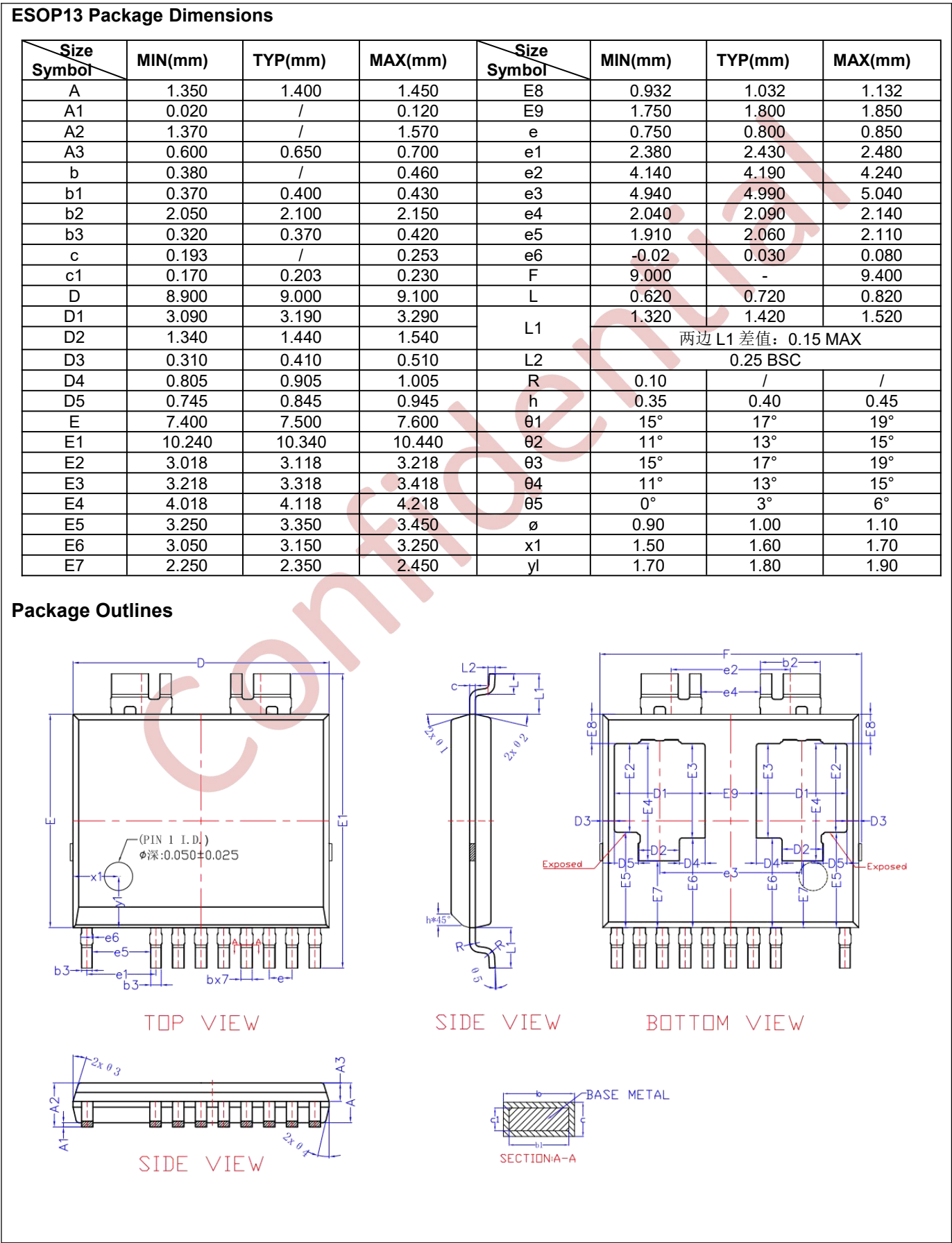


Fig.6 Typical Application Connection NSH506B0PC

HIN	LIN	Output	Note
0	0	High Resistance	Both IGBT Off
0	1	0	Low side IGBT On
1	0	VDC	High side IGBT On
1	1	High Resistance	Both IGBT Off
open	open	High Resistance	Both IGBT Off

13. Detailed Package Outline Drawing





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