iT62242A

500V Half-Bridge Drivers

1. Description

iT62242A is a half-bridge gate driver IC integrated with power MOSFET; it is designed for motor driver applications.

The IC integrates driver, FWD (Free Wheeling Diodes) and high side bootstrap diode. iT62242A offers an extremely compact high performance half-bridge inverter in a small QFN7X7 package.

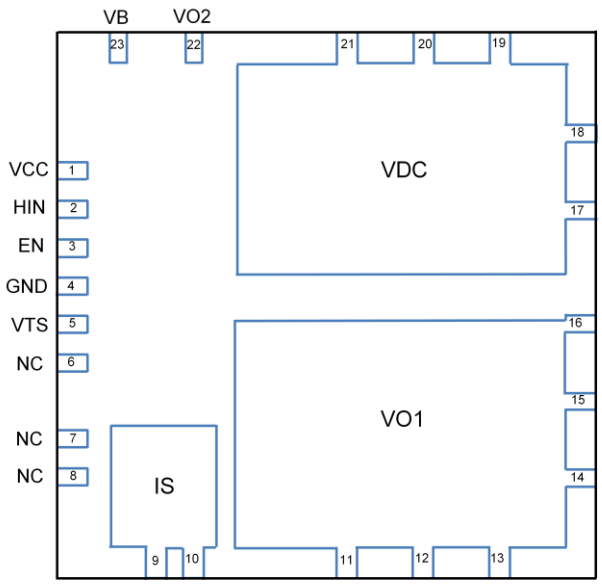
2. Features

- Floating channel designed for bootstrap operation to +500V
- Bootstrap diodes built-in with current limiting resistor
- 500V $R_{DS(on)}$ = 1.2Ω(Max) MOSFET 1-Phase Inverter with Gate Drivers
- Under-Voltage (UVLO) protection.
- Input interface: 3.3V, 5V line (High Active)

3. Applications

- 1 or 3-Phase Inverter Driver for DC Brushless Motor Drivers

4. Pin Assignments



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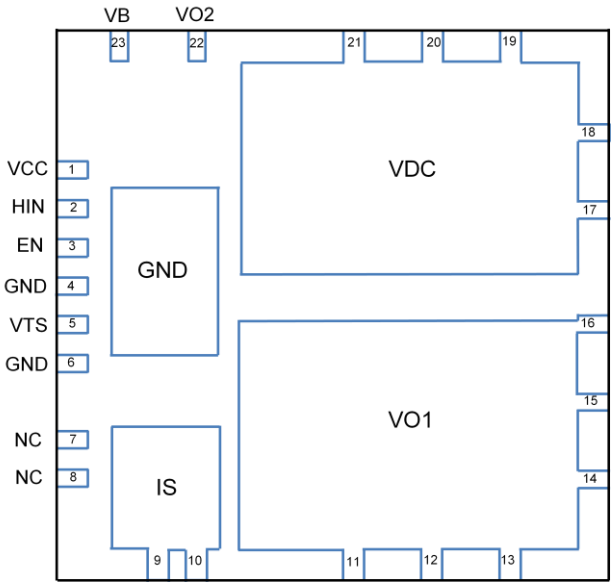


(Type2)

Fig. 1 - QFN7x7 (Top View)

5. Marking Information

Product Name	Marking		
iT62242A		**iT62242A** **xxxxx**	**X : Date Code**

6. Ordering Code

iT62242A ☐	Package Type G: Type1 C: Type2

7. Pin Definitions

Pin No.	Symbol	Description
1	VCC	Analog/Logic power supply
2	HIN	Signal input high active for high side
3	EN	Output Enable
4	GND	Analog/Logic ground
5	VTS	Temperature Sensing
6	NC/GND	Type1=NC, Type2=GND
9,10	IS	Low side MOSFET source
11~16	VO1	Phase output (to BLDC motor coil)
17~21	VDC	System Power Supply
22	VO2	High Side Reference Voltage
23	VB	Bias voltage for high side switch driving

8. Block Diagram

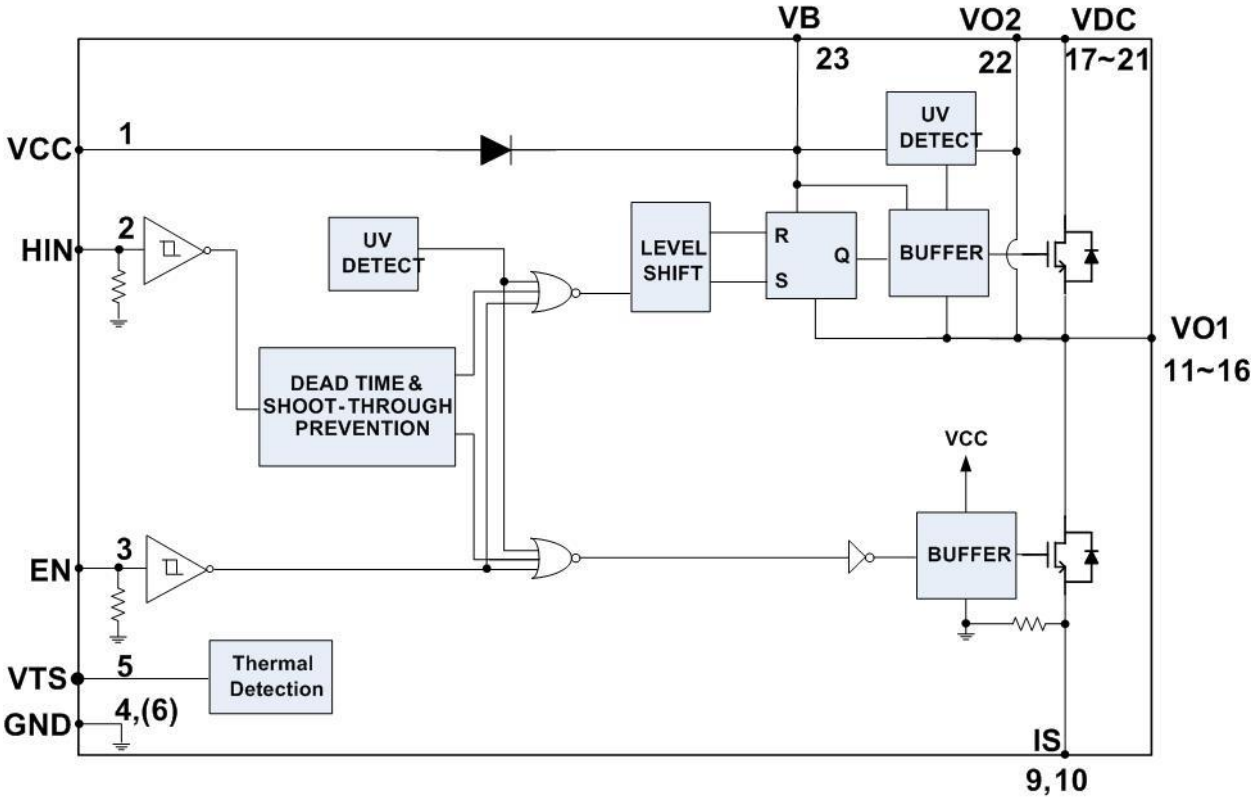


Fig. 2 - Pin Configuration and Internal Block Diagram

Note:

1. Source terminal of each low-side MOSFET is not connected to supply ground or bias voltage ground inside IPM. External connections should be made as indicated in Figure 4.

9. Absolute Maximum Ratings (Tj= 25°C, Unless Otherwise Specified)

Inverter Part (each MOSFET unless otherwise specified.)

Symbol	Parameter	Conditions	Ratings	Unit
V_{DSS}	Drain-Source Voltage of Each MOSFET		500	V
*I_{D25}	Each MOSFET Drain Current (Continuous)	T_C=25°C	2.85	A
*I_{D80}	Each MOSFET Drain Current (Continuous)	T_C = 80°C	2.15	A
*I_{DP}	Each MOSFET Drain Current (Peak)	T_C = 25°C, PW < 100 us	7.1	A
*I_{DRMS}	Each MOSFET Drain Current (RMS)	T_C = 80°C, F_{PWM}< 20 kHz	0.31	A
*P_D	Maximum Power Dissipation	T_C = 25°C, For Each MOSFET	25	W

Control Part (each HVIC unless otherwise specified.)

Symbol	Parameter	Conditions	Ratings	Unit
V_{CC}	Control Supply Voltage	Applied between V_{CC} and COM	16.5	V
V_{BS}	High-side Bias Voltage	Applied between V_B and V_S	16.5	V
V_{IN}	Input Signal Voltage	Applied between V_{IN},V_{EN} and COM	-0.3 ~ VCC + 0.3	V

Thermal Resistance

Symbol	Parameter	Conditions	Ratings	Unit
$R_{\theta JA}$	Junction to Ambient Thermal Resistance	Each MOSFET under Inverter Operating Condition (Note 2)	30	°C/W

Total System

Symbol	Parameter	Conditions	Ratings	Unit
T_J	Operation Junction Temperature		-40 ~ 150	°C
T_{STG}	Storage Temperature		-55 ~ 150	°C

Note:
2. Marking " * " is calculation value or design factor.

10. Electrical Characteristics (T_J= 25°C, V_{CC}= V_{BS}= 15 V unless otherwise specified.)

Inverter Part (each MOSFET unless otherwise specified.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain - Source Breakdown Voltage	V_{EN} = 0 V, I_D = 1 mA	500	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	V_{EN} = 0 V, V_{DC} = 400 V	-	10	40	uA
$R_{DS(on)}$	Static Drain - Source Turn-On Resistance	V_{CC} = V_{BO} = 15 V, V_{HIN} =0V or 5V ,V_{EN}=5V, I_D = 0.5A	-		1.2	Ω
V_F	Drain - Source Diode Forward Voltage	V_{HIN} and V_{EN} = 0 V, I_D = -0.5	-	0.8	-	V
E_{ON}	Power loss	V_{DC} = 310 V, V_{CC} = V_{BO} = 15 V, I_D = 1.0 A V_{EN} = 2 cycle pulse 5V/0V,V_{HIN}=0V or 5V Inductive Load L = 1.5 mH High and Low Side MOSFET Switching	-	47	-	uJ
E_{OFF}			-	7	-	uJ
$t_{FIL,IN}$	Input filter time(short pulse)	V_{cc}=15V,V_{BO}=15V, V_{DC}=310V,V_{EN}=5V,V_{HIN}=pulse 10KHz/5V	-	850	-	ns
t_{ONHIN}	HIN turn-on propagation delay	V_{cc}=15V,V_{BO}=15V, V_{DC}=310V,V_{EN}=5V,V_{HIN}=10KHz/5V/50%	-	300	-	ns
t_{OFFHIN}	HIN turn-off propagation delay	V_{cc}=15V,V_{BO}=15V, V_{DC}=310V, V_{EN}=5V,V_{HIN}=10KHz/5V/50%	-	500	-	ns
t_{ONEN}	EN turn-on propagation delay	V_{cc}=15V,V_{BO}=15V,V_{DC}=310V,V_{HIN}=5V, V_{EN}=10KHz/5V/50%	-	1900	-	ns
t_{OFFEN}	EN turn-off propagation delay	V_{cc}=15V,V_{BO}=15V, V_{DC}=310V , V_{HIN}=5V, V_{EN}=10KHz/5V/50%	-	500	-	ns
T_d	Dead time	HO/LO turn off dead time		1		us

Control Part (each HVIC unless otherwise specified.)

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{QCC}	Quiescent V_{CC} Current	V_{CC} = 15 V, V_{HIN},V_{EN}= 0 V	Applied between V_{CC} and GND	-	-	300	uA
I_{QBS}	Quiescent V_{BO} Current	V_{BO} = 15 V, V_{HIN},V_{EN}= 0 V	Applied between $V_{B(U)}$ - VO	-	-	120	uA
UV_{CCD}	Low-Side Under-Voltage Protection (Figure 7)	V_{CC} Under-Voltage Protection Detection Level		7.5	9.0	10.5	V
UV_{CCR}		V_{CC} Under-Voltage Protection Reset Level		8.0	9.5	11.0	V
UV_{BSD}	High-Side Under-Voltage Protection (Figure 8)	V_{BO} Under-Voltage Protection Detection Level		7.5	9.0	10.5	V
UV_{BSR}		V_{BO} Under-Voltage Protection Reset Level		8.0	9.5	11.0	V
V_{TS}	HVIC Temperature Sensing Voltage Output	Connect a 100k Resistor to 5V,T_{HVIC} = 25°C (Note 4)		3.06	3.16	3.26	V
V_{IH}	ON Threshold Voltage	Logic HIGH Level	Applied between V_{HIN}(V_{EN}) and GND	-	-	2.9	V
V_{IL}	OFF Threshold Voltage	Logic LOW Level		0.35	-	-	V

Notes:

3. t_{ON} and t_{OFF} include the propagation delay 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 Figure 5 for the switching time definitionwith the switching test circuit of Figure 6.
4. V_{TS} is only for sensing-temperature of module and cannot shutdown MOSFETs automatically. Related curve refer to Fig. 3

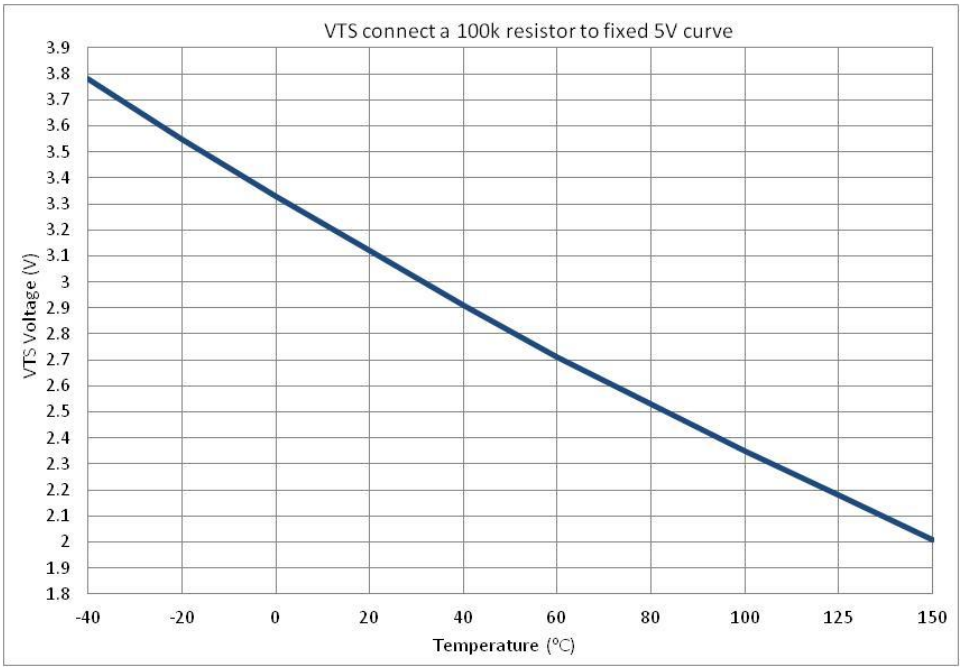
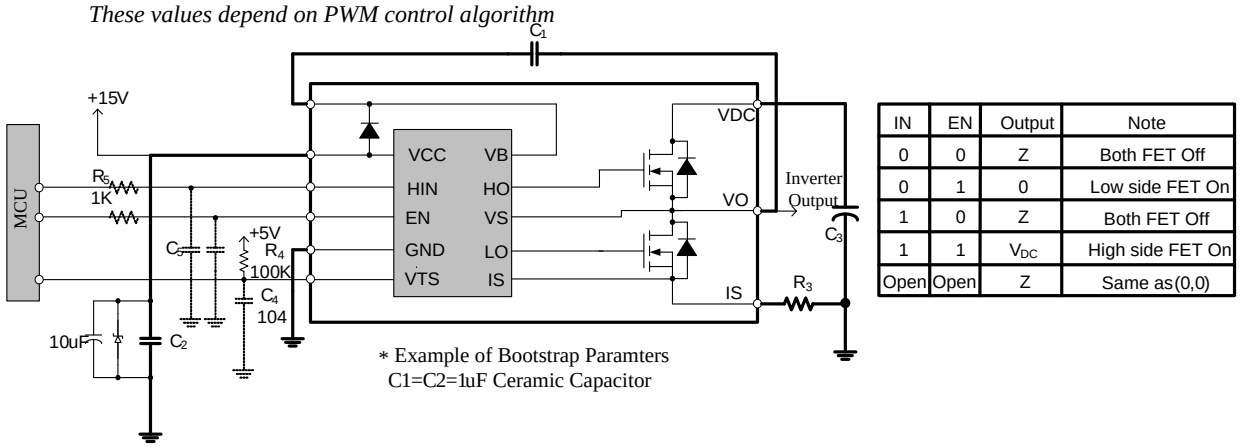


Fig. 3 – VTS voltage vs. IC Junction Temperature

11. Recommended Operating Condition

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{PN}	Supply Voltage	Applied between V_{DC} and GND	-		400	V
V_{CC}	Control Supply Voltage	Applied between V_{CC} and GND	12	13.5	15	V
W_{PWM}	HIN Input Signal Pulse Width	Applied HIN input pulse width	2	-	-	us
Tj-op	Operation Max. Tj	Normal operation Max.Tj.	-	-	125	^{o}C

12. Function and Timing Diagram

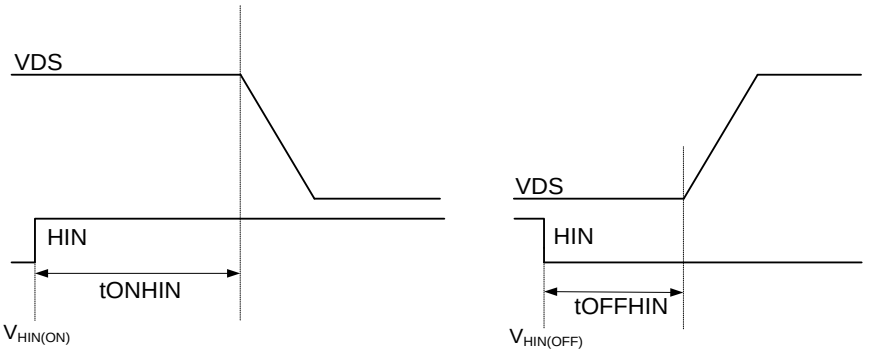


IN	EN	Output	Note
0	0	Z	Both FET Off
0	1	0	Low side FET On
1	0	Z	Both FET Off
1	1	V_{DC}	High side FET On
Open	Open	Z	Same as(0,0)

Figure 4.Recommended MCU Interface and Bootstrap Circuit with Parameters

Notes:

5. Parameters for bootstrap circuit elements are dependent on PWM algorithm. For 15 kHz of switching frequency, typical example of parameters is shown above.
6. RC-coupling (R_5 and C_5) and C_4 at each input of IPM and MCU (Indicated as Dotted Lines) may be used to prevent improper signal due to surge-noise.
7. Bold lines should be short and thick in PCB pattern to have small stray inductance of circuit, which results in the reduction of surge-voltage. Bypass capacitors such as C_1, C_2 and C_3 should have good high-frequency characteristics to absorb high-frequency ripple-current.



(a) turn-on (b) turn-off

Figure 5.Switching Time Definitions

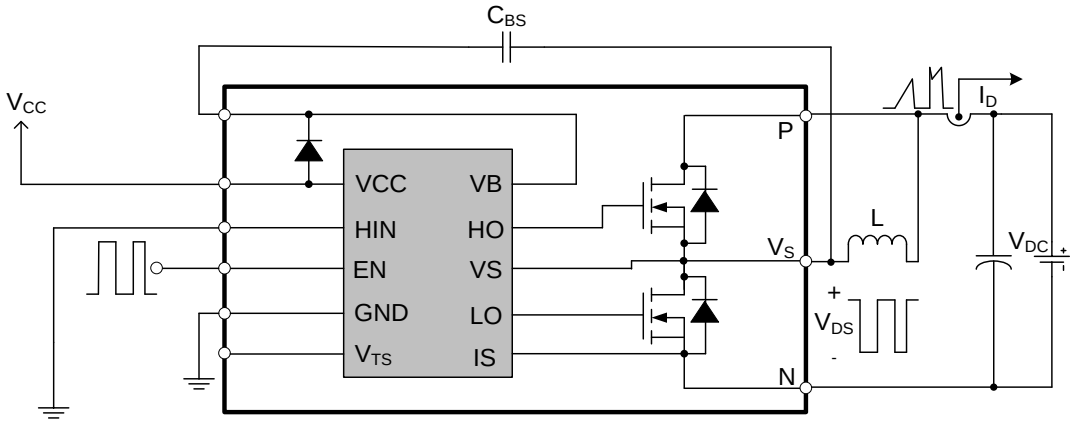


Figure 6.Switching Test Circuit (Low-side)

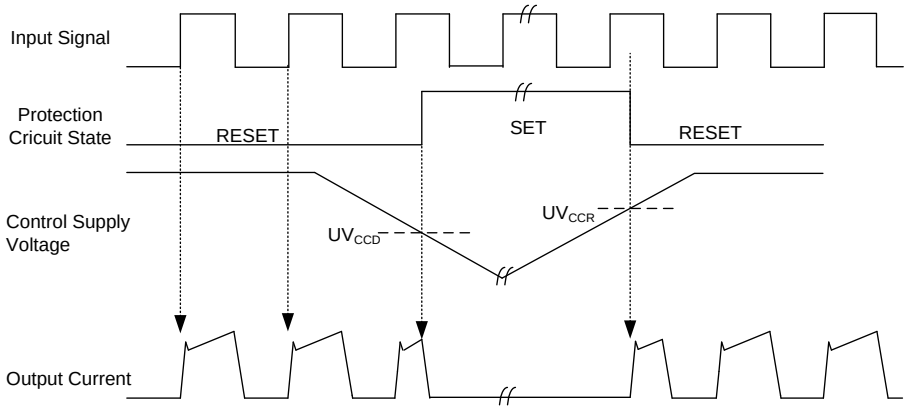


Figure 7. Under-Voltage Protection (Low-side)

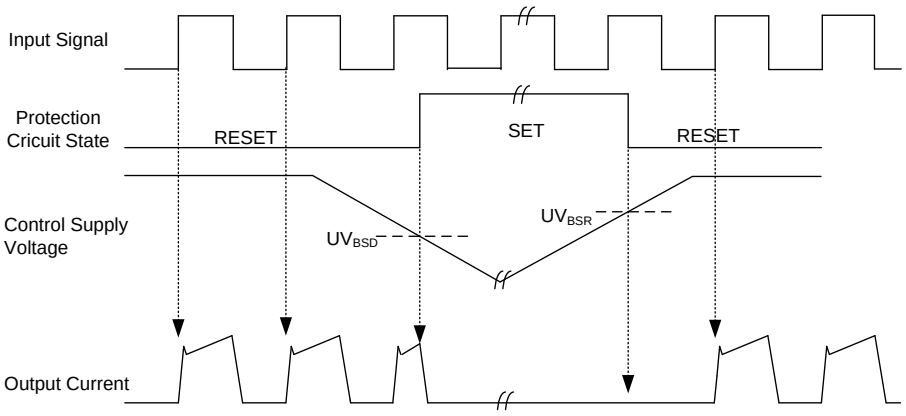
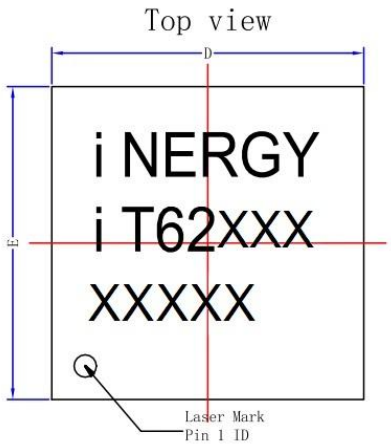


Figure 8. Under-Voltage Protection (High-side)

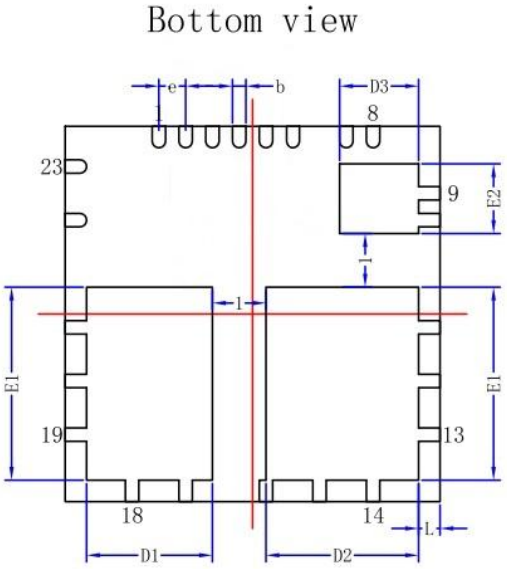
Note:

8. About pin position, refer to Figure 1.
9. RC-coupling (R_5 and C_5, R_4 and C_6) and C_4 at each input of IPM and MCU are useful to prevent improper input signal caused by surge-noise.
10. The voltage-drop across R_3 affects the low-side switching performance and the bootstrap characteristics since it is placed between COM and the source terminal of the low-side MOSFET. For this reason, the voltage-drop across R_3 should be less than 1 V in the steady-state.
11. Ground-wires and output terminals should be thick and short in order to avoid surge-voltage and malfunction of HVIC.
12. All the filter capacitors should be connected close to IPM, and they should have good characteristics for rejecting high-frequency ripple current.

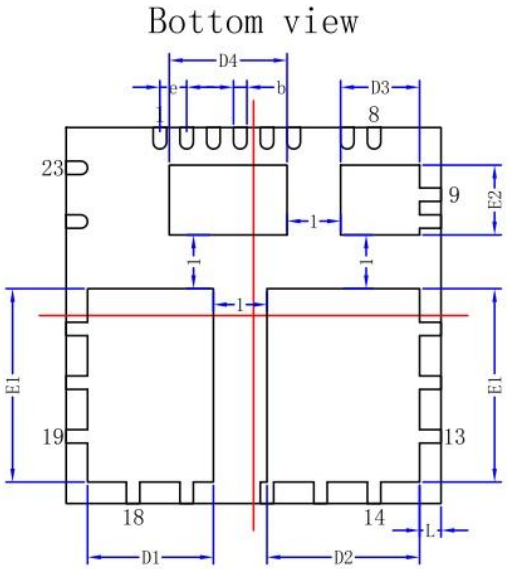
13. Package Dimensions



SYMBOLS	Dimensions In Millimeters		
	MIN.	NOM.	MAX.
A	0.70	0.75	0.80
A1	0.00	0.02	0.05
A2		0.203REF	
b	0.20	0.25	0.30
D		7.00BSC	
D1	2.30	2.35	2.40
D2	2.80	2.85	2.90
D3	1.425	1.475	1.525
D4	2.15	2.20	2.25
E		7.00BSC	
E1	3.55	3.60	3.65
E2	1.25	1.30	1.35
e		0.50BSC	
L	0.35	0.40	0.45



(Type1)



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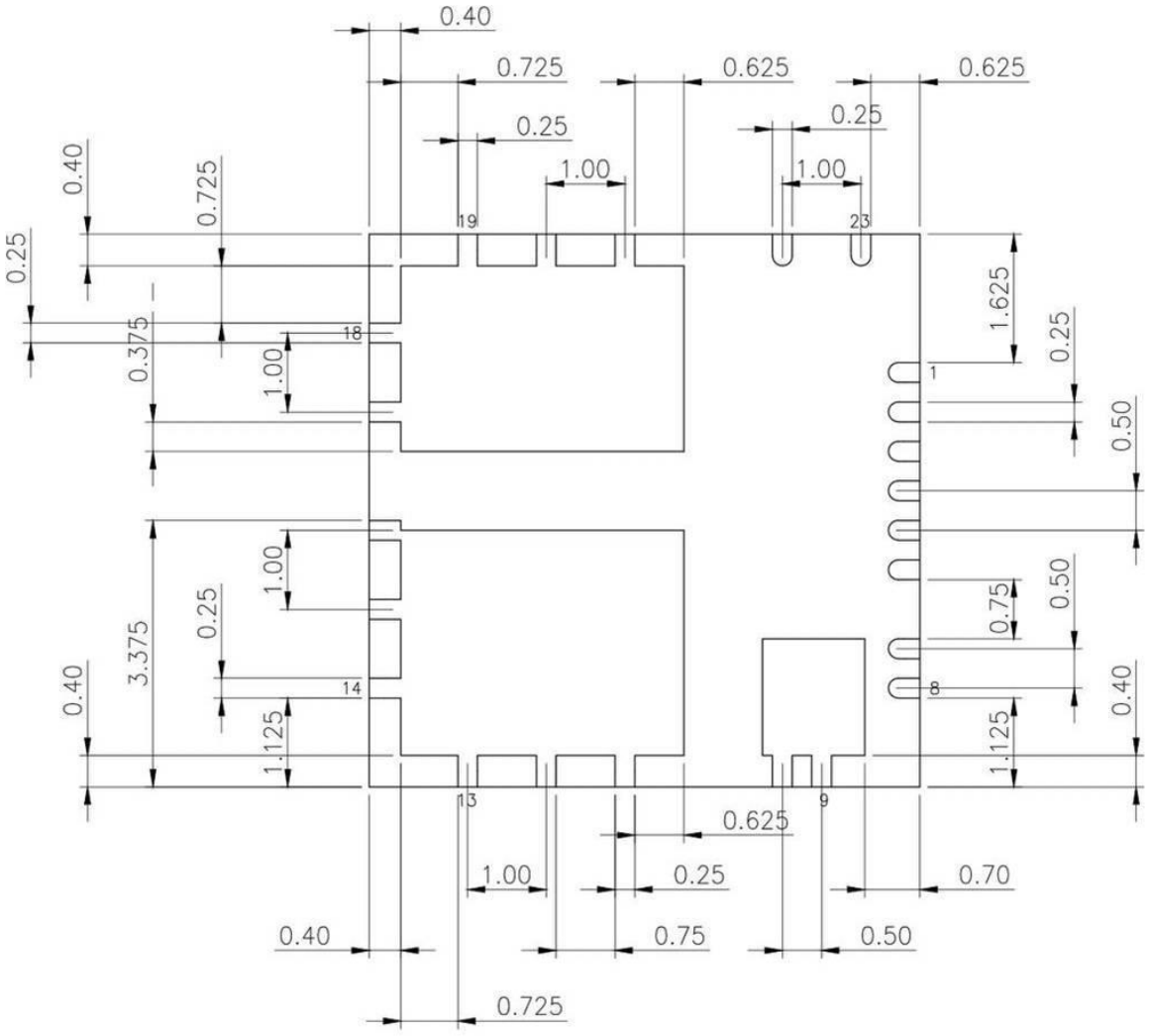
13.1 Additional Package Detail Dimensions



All Dimensional tolerance ± 0.05mm
All lead width 0.25 ± 0.05mm
All lead length 0.40 ± 0.05mm

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