



500V Half-Bridge Drivers

1. Description

iT62241A 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. iT62241A 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 $R_{DS(on)} = 2.0\Omega(\text{Max})$ 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

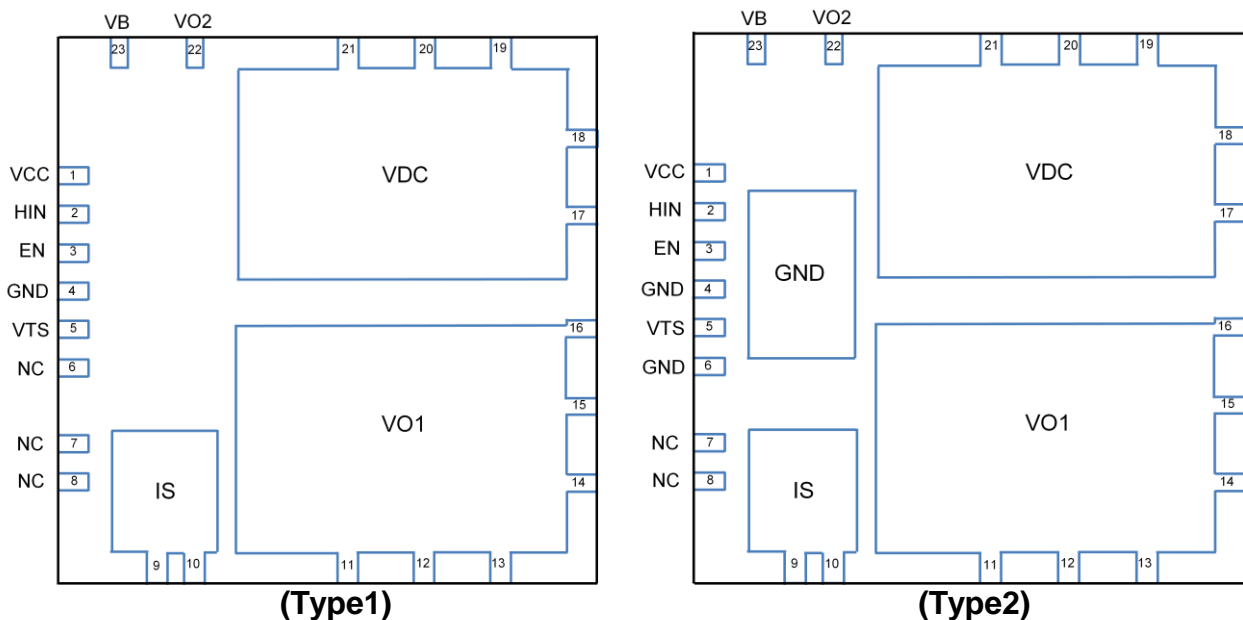


Fig. 1 - QFN7x7 (Top View)

iT62241A



5. Marking Information

Product Name	Marking		
iT62241A		iNERGY iT62241A XXXXX	X : Date Code

6. Ordering Code

iT62241A <input type="checkbox"/>	Package Type G: Type1 C: Type2
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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



1. Block Diagram

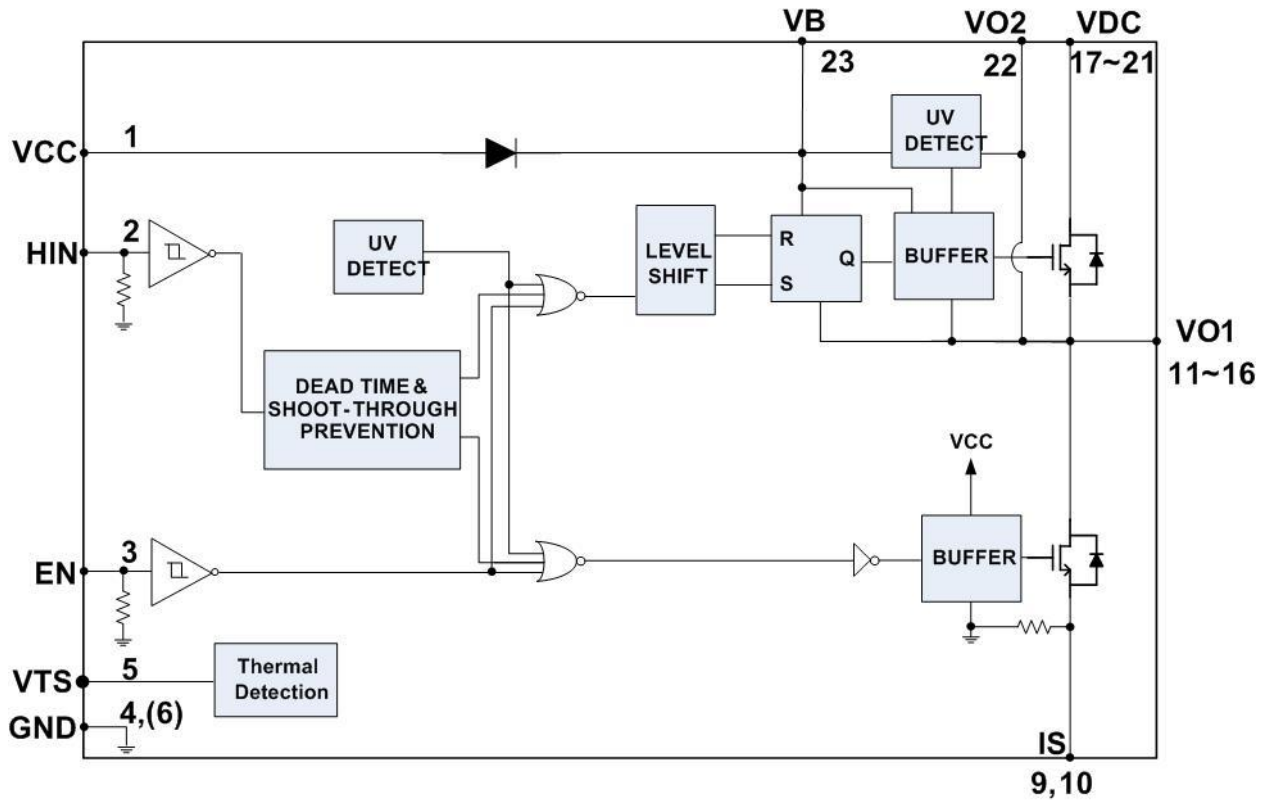


Fig. 2 - Pin Configuration and Internal Block Diagram

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.

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9. Absolute Maximum Ratings (T_j= 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	2.2	A
*I _{D80}	Each MOSFET Drain Current (Continuous)	T _C = 80°C	1.65	A
*I _{DP}	Each MOSFET Drain Current (Peak)	T _C = 25°C, PW < 100 us	5.5	A
*I _{DRMS}	Each MOSFET Drain Current (RMS)	T _C = 80°C, F _{PWM} < 20 kHz	0.24	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 ~ V _{CC} + 0.3	V

Thermal Resistance

Symbol	Parameter	Conditions	Ratings	Unit
R _{θJA}	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.

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10. Electrical Characteristics ($T_J = 25^\circ\text{C}$, $V_{CC} = V_{BS} = 15\text{ V}$ unless otherwise specified.)

Inverter Part (each MOSFET unless otherwise specified.)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain - Source Breakdown Voltage	$V_{EN} = 0\text{ V}$, $I_D = 1\text{ mA}$	500	-	-	V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{EN} = 0\text{ V}$, $V_{DC} = 400\text{ V}$	-	10	40	μA
$R_{DS(on)}$	Static Drain - Source Turn-On Resistance	$V_{CC} = V_{BO} = 15\text{ V}$, $V_{HIN} = 0\text{V or } 5\text{ V}$, $V_{EN} = 5\text{ V}$, $I_D = 0.5\text{ A}$	-		2.0	Ω
V_F	Drain - Source Diode Forward Voltage	V_{HIN} and $V_{EN} = 0\text{ V}$, $I_D = -0.5$	-	0.8	-	V
E_{ON}	Power loss	$V_{DC} = 310\text{ V}$, $V_{CC} = V_{BO} = 15\text{ V}$, $I_D = 1.0\text{ A}$ $V_{EN} = 2\text{ cycle pulse } 5\text{V}/0\text{V}$, $V_{HIN} = 0\text{V or } 5\text{ V}$ Inductive Load $L = 1.5\text{ mH}$ High and Low Side MOSFET Switching	-	33	-	μJ
E_{OFF}			-	5	-	μJ
$t_{FIL,IN}$	Input filter time(short pulse)	$V_{CC} = 15\text{ V}$, $V_{BO} = 15\text{ V}$, $V_{DC} = 310\text{ V}$, $V_{EN} = 5\text{ V}$, $V_{HIN} = \text{pulse } 10\text{KHz}/5\text{V}$	-	850	-	ns
t_{ONHIN}	HIN turn-on propagation delay	$V_{CC} = 15\text{ V}$, $V_{BO} = 15\text{ V}$, $V_{DC} = 310\text{ V}$, $V_{EN} = 5\text{ V}$, $V_{HIN} = 10\text{KHz}/5\text{V}/50\%$	-	350	-	ns
t_{OFFHIN}	HIN turn-off propagation delay	$V_{CC} = 15\text{ V}$, $V_{BO} = 15\text{ V}$, $V_{DC} = 310\text{ V}$, $V_{EN} = 5\text{ V}$, $V_{HIN} = 10\text{KHz}/5\text{V}/50\%$	-	500	-	ns
t_{ONEN}	EN turn-on propagation delay	$V_{CC} = 15\text{ V}$, $V_{BO} = 15\text{ V}$, $V_{DC} = 310\text{ V}$, $V_{HIN} = 5\text{ V}$, $V_{EN} = 10\text{KHz}/5\text{V}/50\%$	-	1700	-	ns
t_{OFFEN}	EN turn-off propagation delay	$V_{CC} = 15\text{ V}$, $V_{BO} = 15\text{ V}$, $V_{DC} = 310\text{ V}$, $V_{HIN} = 5\text{ V}$, $V_{EN} = 10\text{KHz}/5\text{V}/50\%$	-	550	-	ns
T_d	Dead time	HO/LO turn off dead time		1		μs



Control Part (each HVIC unless otherwise specified.)

Symbol	Parameter	Conditions		Min	Typ	Max	Unit
I_{QCC}	Quiescent V_{CC} Current	$V_{CC} = 15\text{ V}$, $V_{HIN}, V_{EN} = 0\text{ V}$	Applied between V_{CC} and GND	-	-	300	μA
I_{QBS}	Quiescent V_{BO} Current	$V_{BO} = 15\text{ V}$, $V_{HIN}, V_{EN} = 0\text{ V}$	Applied between $V_{B(U)} - VO$	-	-	120	μA
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, $T_{HVIC} = 25^\circ\text{C}$ (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:

- 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 definition with the switching test circuit of Figure 6.
- V_{TS} is only for sensing-temperature of module and cannot shutdown MOSFETs automatically. Related curve refer to Fig. 3

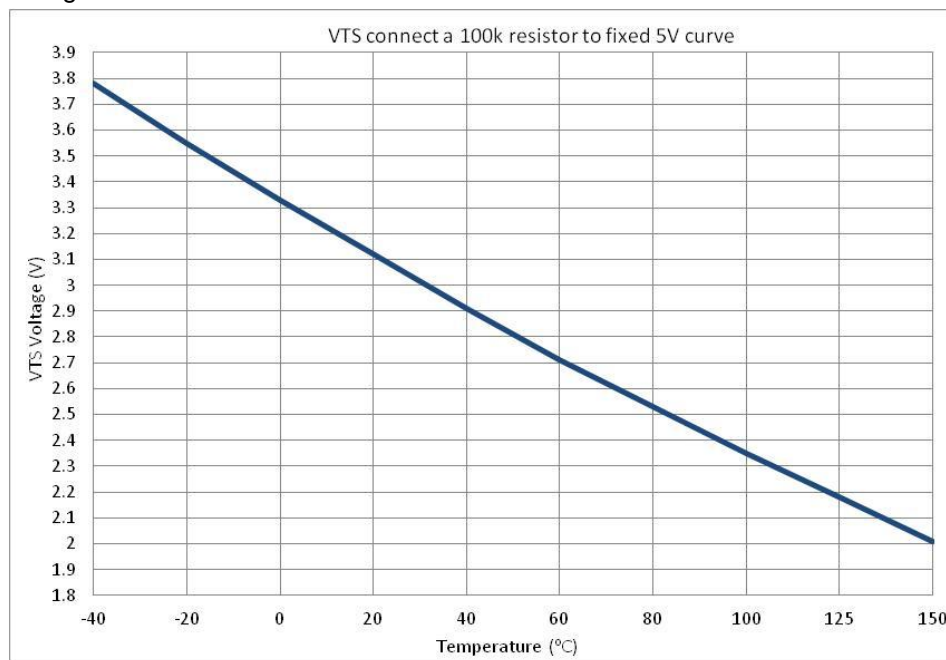


Fig. 3 – VTS voltage vs. IC Junction Temperature



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
T _{j-op}	Operation Max. T _j	Normal operation Max. T _j .	-	-	125	°C

12. Function and Timing Diagram

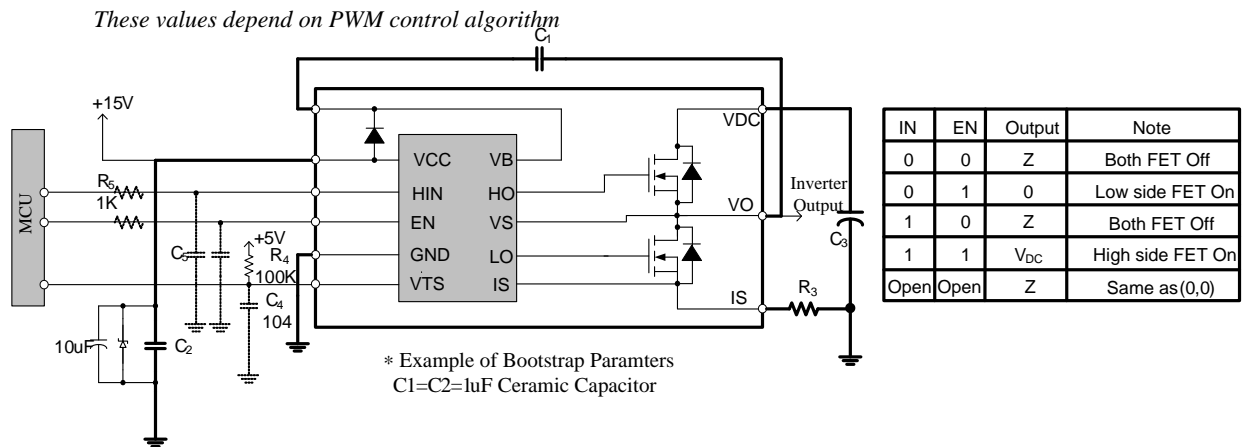


Figure 4. Recommended MCU Interface and Bootstrap Circuit with Parameters

Notes:

- Parameters for bootstrap circuit elements are dependent on PWM algorithm. For 15 kHz of switching frequency, typical example of parameters is shown above.
- RC-coupling (R₅ and C₅) and C₄ at each input of IPM and MCU (Indicated as Dotted Lines) may be used to prevent improper signal due to surge-noise.
- 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 C₁, C₂ and C₃ should have good high-frequency characteristics to absorb high-frequency ripple-current.

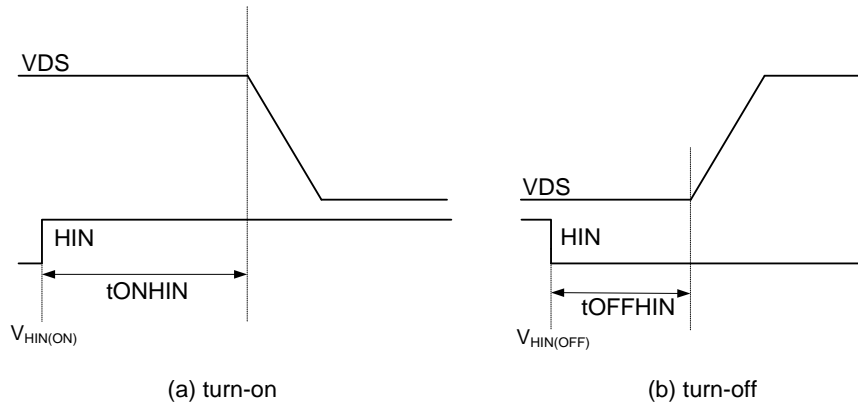


Figure 5. Switching Time Definitions

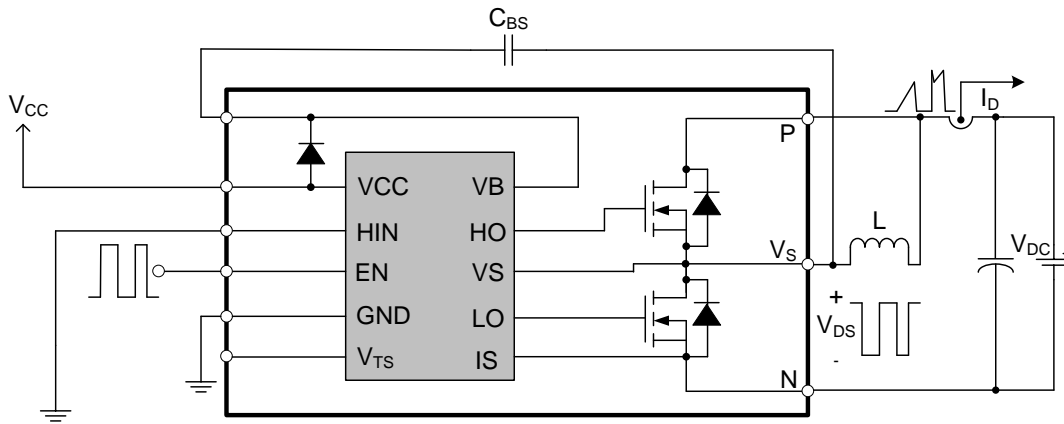


Figure 6. Switching Test Circuit (Low-side)

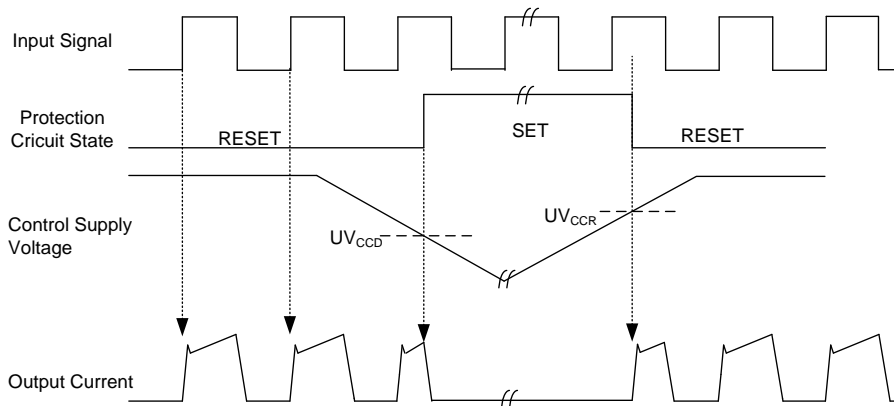


Figure 7. Under-Voltage Protection (Low-side)

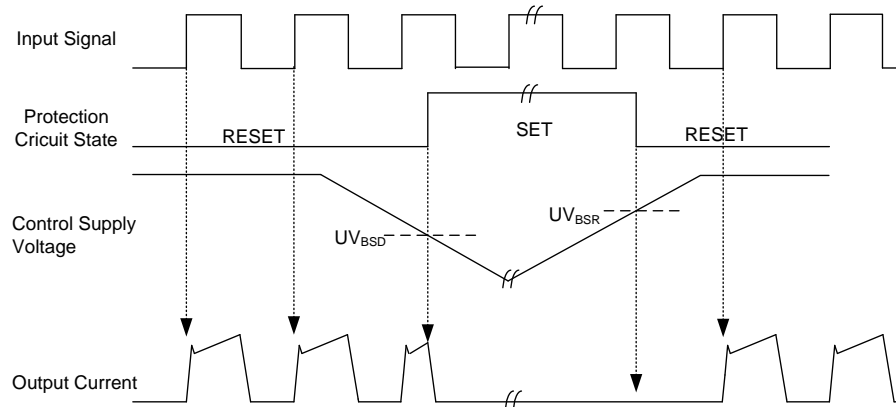


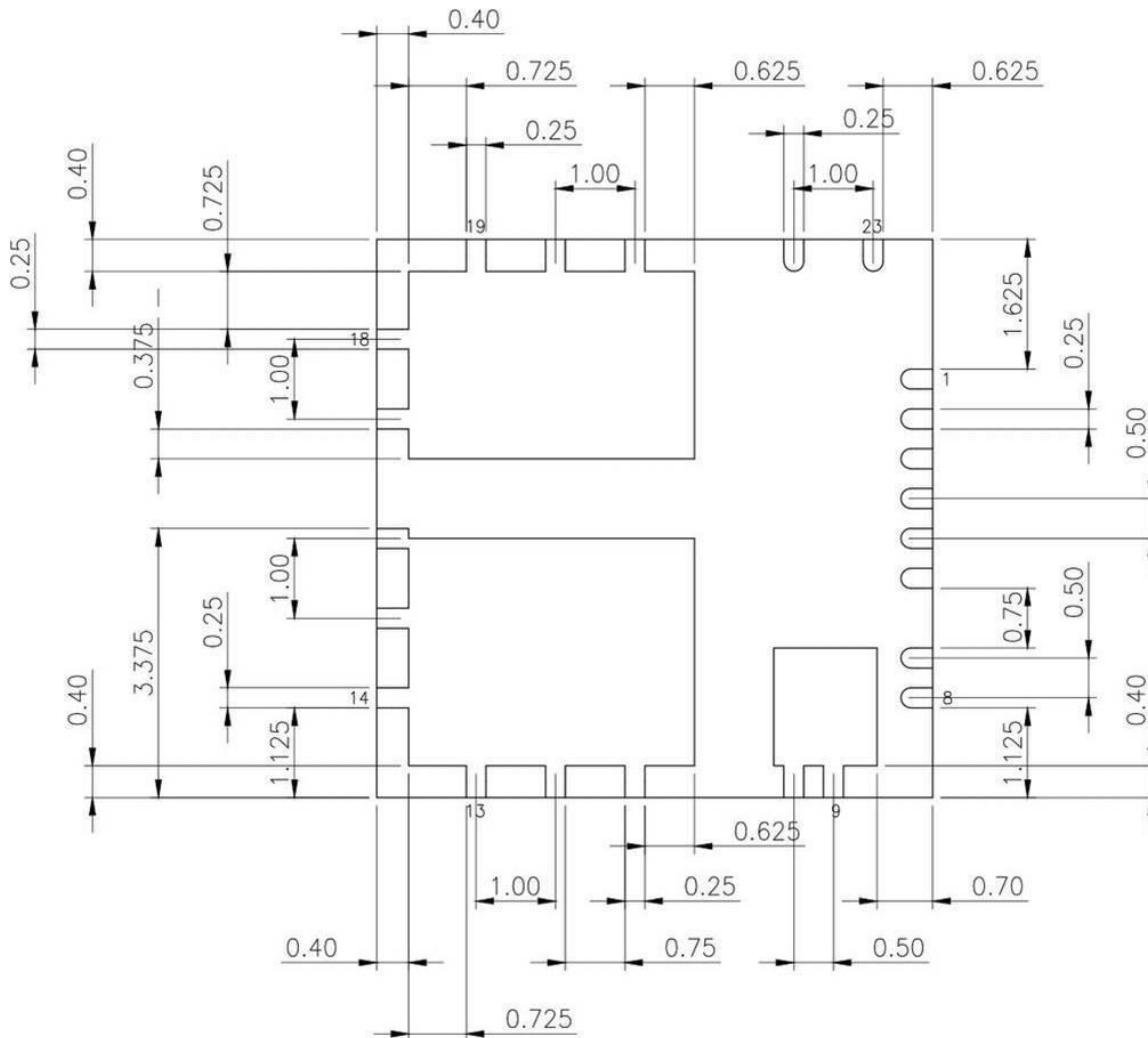
Figure 8. Under-Voltage Protection (High-side)

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.



13.1 Additional Package Detail Dimensions



All Dimensional tolerance $\pm 0.05\text{mm}$
 All lead width $0.25 \pm 0.05\text{mm}$
 All lead length $0.40 \pm 0.05\text{mm}$

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