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# M81729JFP

**HIGH VOLTAGE HALF BRIDGE DRIVER FOR AUTOMOTIVE APPLICATIONS**

**DESCRIPTION**

M81729JFP is high voltage Power MOSFET and IGBT gate driver for half bridge applications.

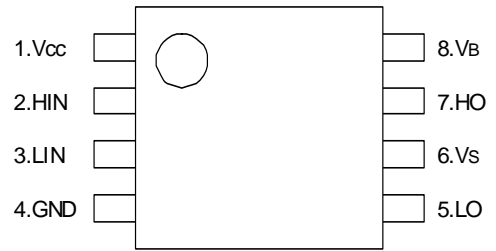
**FEATURES**

- Floating Supply Voltage ..... 600V
- Output Current ..... +120mA/-250mA (min)
- Half Bridge Driver
- SOP-8 Package

**APPLICATIONS**

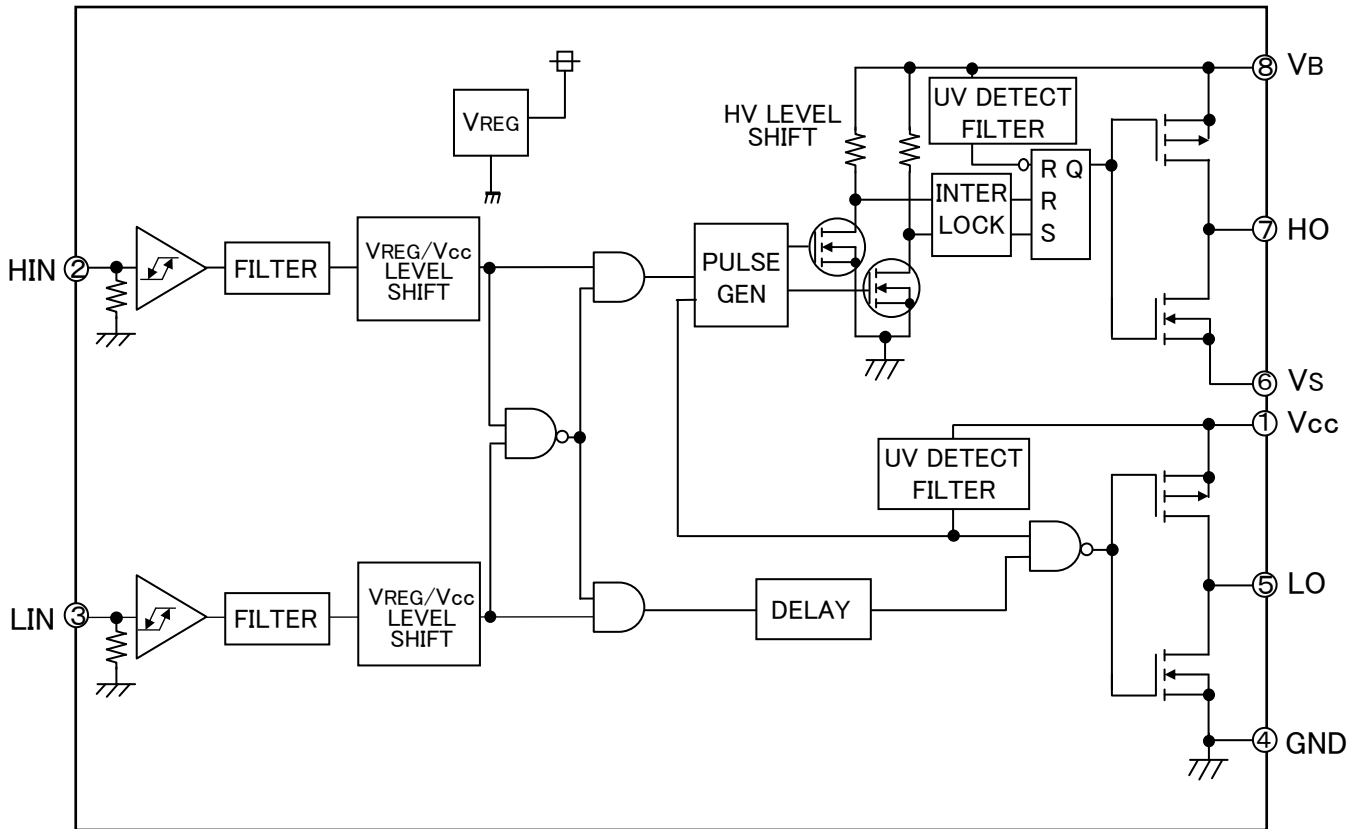
MOSFET and IGBT gate driver.

**PIN CONFIGURATION (TOP VIEW)**



Outline:8P2S

**BLOCK DIAGRAM**



**ABSOLUTE MAXIMUM RATINGS (Ta=25°C unless otherwise specified)**

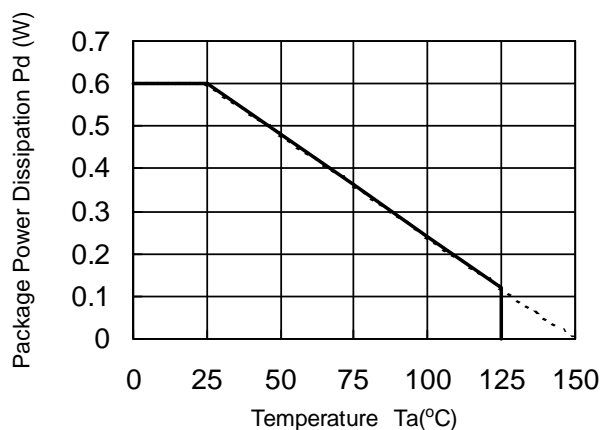
Symbol	Parameter	Test conditions	Ratings	Unit
V <sub>B</sub>	High Side Floating Supply Absolute Voltage		-0.5 ~ 624	V
V <sub>S</sub>	High Side Floating Supply Offset Voltage		V <sub>B</sub> -24 ~ V <sub>B</sub> +0.5	V
V <sub>BS</sub>	High Side Floating Supply Voltage	V <sub>BS</sub> =V <sub>B</sub> -V <sub>S</sub>	-0.5 ~ 24	V
V <sub>HO</sub>	High Side Output Voltage		V <sub>S</sub> -0.5 ~ V <sub>B</sub> +0.5	V
V <sub>CC</sub>	Low Side Fixed Supply Voltage		-0.5 ~ 24	V
V <sub>LO</sub>	Low Side Output Voltage		-0.5 ~ V <sub>CC</sub> +0.5	V
V <sub>IN</sub>	Logic Input Voltage	HIN,LIN	-0.5 ~ V <sub>CC</sub> +0.5	V
P <sub>D</sub>	Package Power Dissipation	Ta= 25 °C ,On Board	0.6	W
Kθ	Linear Derating Factor	Ta> 25 °C ,On Board	4.8	mW/°C
Rth(j-c)	Junction-Case Thermal Resistance		50	°C/W
T <sub>J</sub>	Junction Temperature		-40 ~ +150 *	°C
T <sub>opr</sub>	Operation Temperature		-40 ~ +125	°C
T <sub>stg</sub>	Storage Temperature		-40 ~ +150	°C
TL	Solder Heatproof	RoHS Correspondence	255:10s,max 260	°C

\*When temperature exceeds 125 °C, please make VS voltage less than 500V.

**RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
V <sub>B</sub>	High Side Floating Supply Absolute Voltage		V <sub>S</sub> +10	—	V <sub>S</sub> +20	V
V <sub>S</sub>	High Side Floating Supply Offset Voltage	T <sub>J</sub> ≤ 125 °C	0	—	550	V
		T <sub>J</sub> > 125 °C	0	—	500	V
V <sub>BS</sub>	High Side Floating Supply Voltage	V <sub>BS</sub> =V <sub>B</sub> -V <sub>S</sub>	10	—	20	V
V <sub>HO</sub>	High Side Output Voltage		V <sub>S</sub>	—	V <sub>B</sub>	V
V <sub>CC</sub>	Low Side Fixed Supply Voltage		10	—	20	V
V <sub>LO</sub>	Low Side Output Voltage		0	—	V <sub>CC</sub>	V
V <sub>IN</sub>	Logic Input Voltage	HIN,LIN	0	—	7	V

\* For proper operation, the device should be used within the recommended conditions

**THERMAL DERATING FACTOR CHARACTERISTIC (MAXIMUM RATING)**

**ELECTRICAL CHARACTERISTICS (Ta=-40~125°C, V<sub>CC</sub>=V<sub>BS</sub>(=V<sub>B</sub>-V<sub>S</sub>)=15V, unless otherwise specified)**

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.*	Max.	
I <sub>FS</sub>	Floating Supply Leakage Current	V <sub>B</sub> = V <sub>S</sub> = 600V	—	—	1.0	μA
I <sub>BS</sub>	V <sub>BS</sub> Standby Current	HIN= LIN= 0V	—	0.2	0.5	mA
I <sub>CC</sub>	V <sub>CC</sub> Standby Current	HIN= LIN= 0V	0.2	0.6	1.0	mA
V <sub>OH</sub>	High Level Output Voltage	I <sub>O</sub> = -20mA, LO, HO	13.6	14.2	—	V
V <sub>OL</sub>	Low Level Output Voltage	I <sub>O</sub> = 20mA, LO, HO	—	0.3	0.6	V
V <sub>IH</sub>	High Level Input Threshold Voltage		2.7	—	—	V
V <sub>IL</sub>	Low Level Input Threshold Voltage		—	—	0.8	V
I <sub>IH</sub>	High Level Input Bias Current	V <sub>IN</sub> = 5V	—	25	100	μA
I <sub>IL</sub>	Low Level Input Bias Current	V <sub>IN</sub> = 0V	—	—	2	μA
V <sub>BSuvr</sub>	V <sub>BS</sub> Supply UV Reset Voltage		8.0	8.9	9.8	V
V <sub>BSuvt</sub>	V <sub>BS</sub> Supply UV Trip Voltage		7.4	8.2	9.0	V
V <sub>BSuvh</sub>	V <sub>BS</sub> Supply UV Hysteresis Voltage		0.5	0.7	—	V
t <sub>VBSuv</sub>	V <sub>BS</sub> Supply UV Filter Time		—	7.5	—	μs
V <sub>CCuvr</sub>	V <sub>CC</sub> Supply UV Reset Voltage		8.0	8.9	9.8	V
V <sub>CCuvt</sub>	V <sub>CC</sub> Supply UV Trip Voltage		7.4	8.2	9.0	V
V <sub>CCuvh</sub>	V <sub>CC</sub> Supply UV Hysteresis Voltage		0.5	0.7	—	V
t <sub>VCCuv</sub>	V <sub>CC</sub> Supply UV Filter Time		—	7.5	—	μs
I <sub>OH</sub>	Output High Level Short Circuit Pulsed Current	V <sub>O</sub> = 0V, V <sub>IN</sub> = 5V, PW < 10μs**	120	200	—	mA
I <sub>OL</sub>	Output Low Level Short Circuit Pulsed Current	V <sub>O</sub> = 15V, V <sub>IN</sub> = 0V, PW < 10μs ** (T <sub>j</sub> ≤ 125 °C)	250	350	—	mA
R <sub>OH</sub>	Output High Level On Resistance	I <sub>O</sub> = -20mA, R <sub>OH</sub> = (V <sub>CC</sub> - V <sub>O</sub> ) / I <sub>O</sub>	—	40	70	Ω
R <sub>OL</sub>	Output Low Level On Resistance	I <sub>O</sub> = 20mA, R <sub>OL</sub> = V <sub>O</sub> / I <sub>O</sub>	—	15	30	Ω
t <sub>dLH(HO)</sub>	High Side Turn-On Propagation Delay	CL = 1000pF between HO-V <sub>S</sub> , 25 °C CL = 1000pF between HO-V <sub>S</sub>	—	450	650	ns
t <sub>dHL(HO)</sub>	High Side Turn-Off Propagation Delay	CL = 1000pF between HO-V <sub>S</sub> , 25 °C CL = 1000pF between HO-V <sub>S</sub>	—	450	650	ns
t <sub>rH</sub>	High Side Turn-On Rise Time	CL = 1000pF between HO-V <sub>S</sub>	—	130	220	ns
t <sub>fH</sub>	High Side Turn-Off Fall Time	CL = 1000pF between HO-V <sub>S</sub>	—	50	80	ns
t <sub>dLH(LO)</sub>	Low Side Turn-On Propagation Delay	CL = 1000pF between LO-GND, 25 °C CL = 1000pF between LO-GND	—	450	650	ns
t <sub>dHL(LO)</sub>	Low Side Turn-Off Propagation Delay	CL = 1000pF between LO-GND, 25 °C CL = 1000pF between LO-GND	—	450	650	ns
t <sub>rL</sub>	Low Side Turn-On Rise Time	CL = 1000pF between LO-GND	—	130	220	ns
t <sub>fL</sub>	Low Side Turn-Off Fall Time	CL = 1000pF between LO-GND	—	50	80	ns
Δt <sub>dLH</sub>	Turn-On Propagation Delay Matching	t <sub>dLH(HO)</sub> - t <sub>dLH(LO)</sub>  , 25 °C  t <sub>dLH(HO)</sub> - t <sub>dLH(LO)</sub>	—	0	30	ns
Δt <sub>dHL</sub>	Turn-Off Propagation Delay Matching	t <sub>dHL(HO)</sub> - t <sub>dHL(LO)</sub>  , 25 °C  t <sub>dHL(HO)</sub> - t <sub>dHL(LO)</sub>	—	0	30	ns
t <sub>inon</sub>	On Input Filter Time	Convex Pulse	150	250	350	ns
		Concave Pulse	250	350	450	ns
t <sub>inoff</sub>	Off Input Filter Time	Convex Pulse	150	250	350	ns
		Concave Pulse	250	350	450	ns
ΔP <sub>WIO</sub>	Difference of Input Pulse Width and Output Pulse Width	P <sub>W(IN)</sub> - P <sub>W(OUT)</sub>	—	—	100	ns

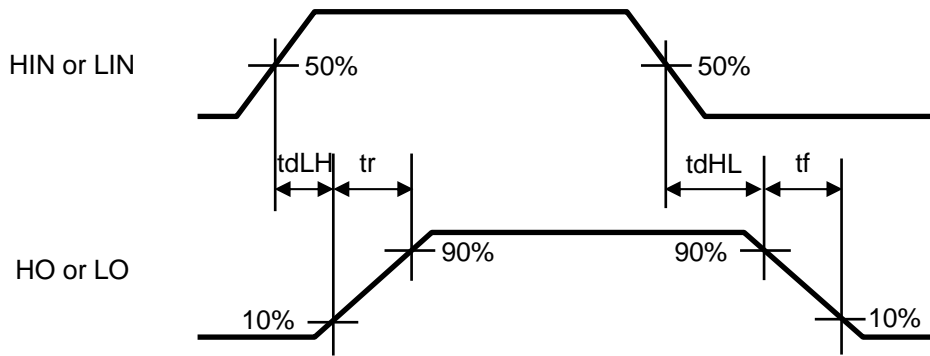
\*Typ. is not specified.

\*\*The short circuit pulse cannot be entered continuously.

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## HIGH VOLTAGE HALF BRIDGE DRIVER FOR AUTOMOTIVE APPLICATIONS

**TIMING REQUIREMENT** (INPUT FUREQUENCY : 200kHz(duty50%) or less)



**FUNCTION TABLE** (X:H or L)

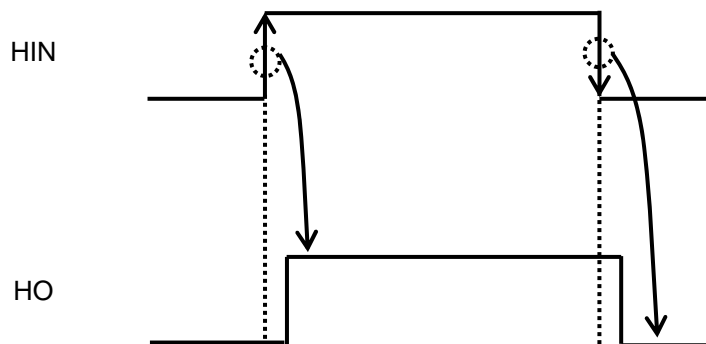
HIN	LIN	$V_{BS}$ UV	$V_{CC}$ UV	HO	LO	Behavioral state
H → L	L	H	H	L	L	LO = HO = LOW
H → L	H	H	H	L	H	LO = HIGH
L → H	L	H	H	H	L	HO = HIGH
L → H	H	H	H	L	L	LO = HO = LOW
X	L	L	H	L	L	HO = LOW , $V_{BS}$ UV tripped
X	H	L	H	L	H	LO = HIGH , $V_{BS}$ UV tripped
H → L	X	H	L	L	L	LO = LOW , $V_{CC}$ UV tripped
L → H	X	H	L	L	L	HO = LO = LOW , $V_{CC}$ UV tripped

Note1 : "L" state of  $V_{BS}$  UV,  $V_{CC}$  UV means that UV trip voltage.

2 : IN the case of both input signals (LIN and HIN) are "H", output signals (LO and HO) become "L".

3. X(HIN):L→H or H→L. X(LIN):H or L.

4. Output signal (HO) is triggered by the edge of input signal.

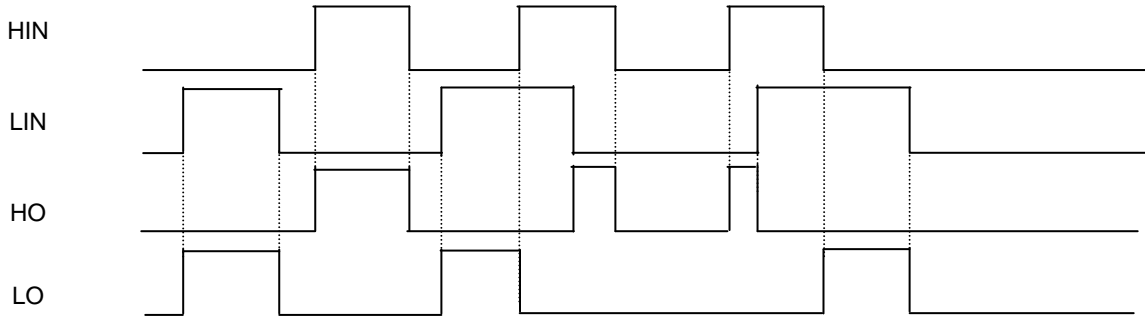


### TIMING DIAGRAM

#### 1. Input/Output Timing Diagram

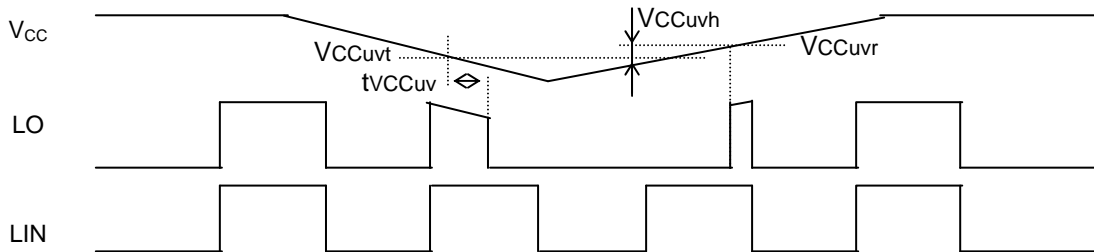
HIGN ACTHVE (When input signal (HIN or LIN) is "H", then output signal (HO or LO) is "H".)

In the case of both input signals (HIN and LIN) are "H", output signals (HO and LO) become "L".

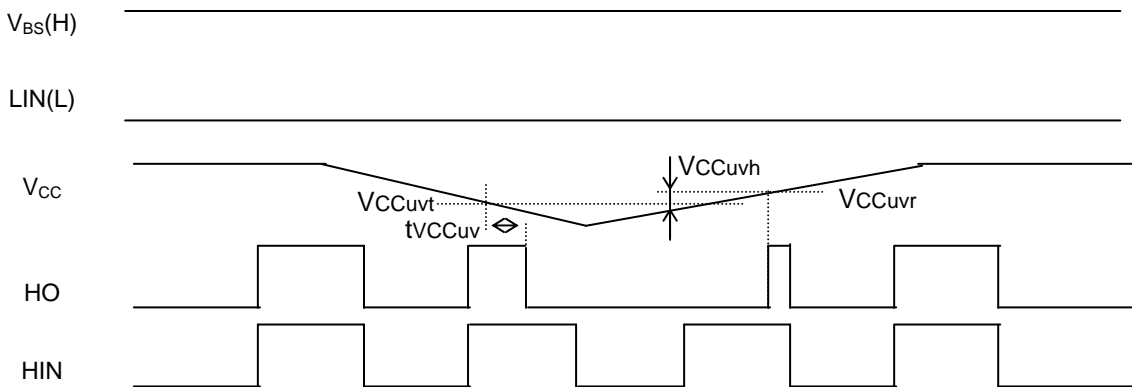


#### 2. $V_{CC}$ ( $V_{BS}$ ) Supply Under Voltage Lockout Timing Diagram

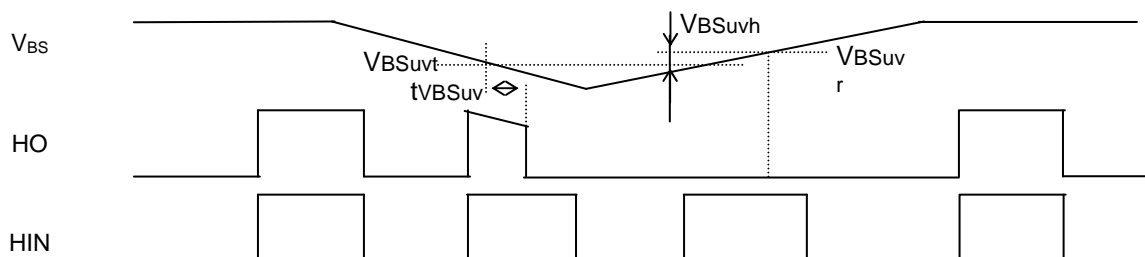
If  $V_{CC}$  Supply voltage drops below UV trip voltage ( $V_{CCuvt} = V_{CCuvr} - V_{CCuvh}$ ) for  $V_{CC}$  supply UV filter time, output signal LO becomes "L". As soon as  $V_{CC}$  supply voltage rises over UV reset voltage, output signal LO becomes "H" if input signal is "H".



If  $V_{CC}$  Supply voltage drops below UV trip voltage ( $V_{CCuvt} = V_{CCuvr} - V_{CCuvh}$ ) for  $V_{CC}$  supply UV filter time, output signal HO becomes "L". As soon as  $V_{CC}$  supply voltage rises over UV reset voltage, output signal HO becomes "H" if input signal is "H".



If  $V_{BS}$  Supply voltage drops below UV trip voltage ( $V_{BSuvt} = V_{BSuvr} - V_{BSuvh}$ ) for  $V_{BS}$  supply UV filter time, output signal HO becomes "L". As soon as  $V_{BS}$  supply voltage rises over UV reset voltage, output signal HO becomes "H" at following "H" edge of input signal.



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## HIGH VOLTAGE HALF BRIDGE DRIVER FOR AUTOMOTIVE APPLICATIONS

### 3. NOTES

#### 1) Allowable supply voltage transient

It is recommended to supply  $V_{CC}$  firstly and supply  $V_{BS}$  secondly. In the case of shutting off supply voltage, please shut off  $V_{BS}$  firstly and shut off  $V_{CC}$  secondly. When applying  $V_{CC}$  and  $V_{BS}$ , power supply should be applied slowly. If it rises rapidly, output signal (HO or LO) may be malfunction.

#### 2) Supply voltage start up or restart after shut down

If  $V_{CC}$  supply is less than 10V(outside of RECOMMENDED OPERATING CONDITIONS), there is some possibility that output does not change in response to input. Please evaluate carefully about supply start up or restart after shut down in your application systems.

#### 3) $V_B$ supply voltage

Please use  $V_B$  supply voltage within RECOMMENDED OPERATING CONDITIONS ( $V_S+10V < V_B < V_S +20V : V_S \text{ Min} = 0V$ ). When  $V_B$  supply voltage is used on the other conditions, output signal HO may be malfunction. Please evaluate carefully about  $V_B$  supply voltage in your application systems.

#### 4) $dV/dt$ of $V_S$ supply voltage

Please rises or falls  $V_S$  supply voltage by less than  $6KV/\mu s$ . If it rises or falls rapidly, output signal HO may be malfunction.

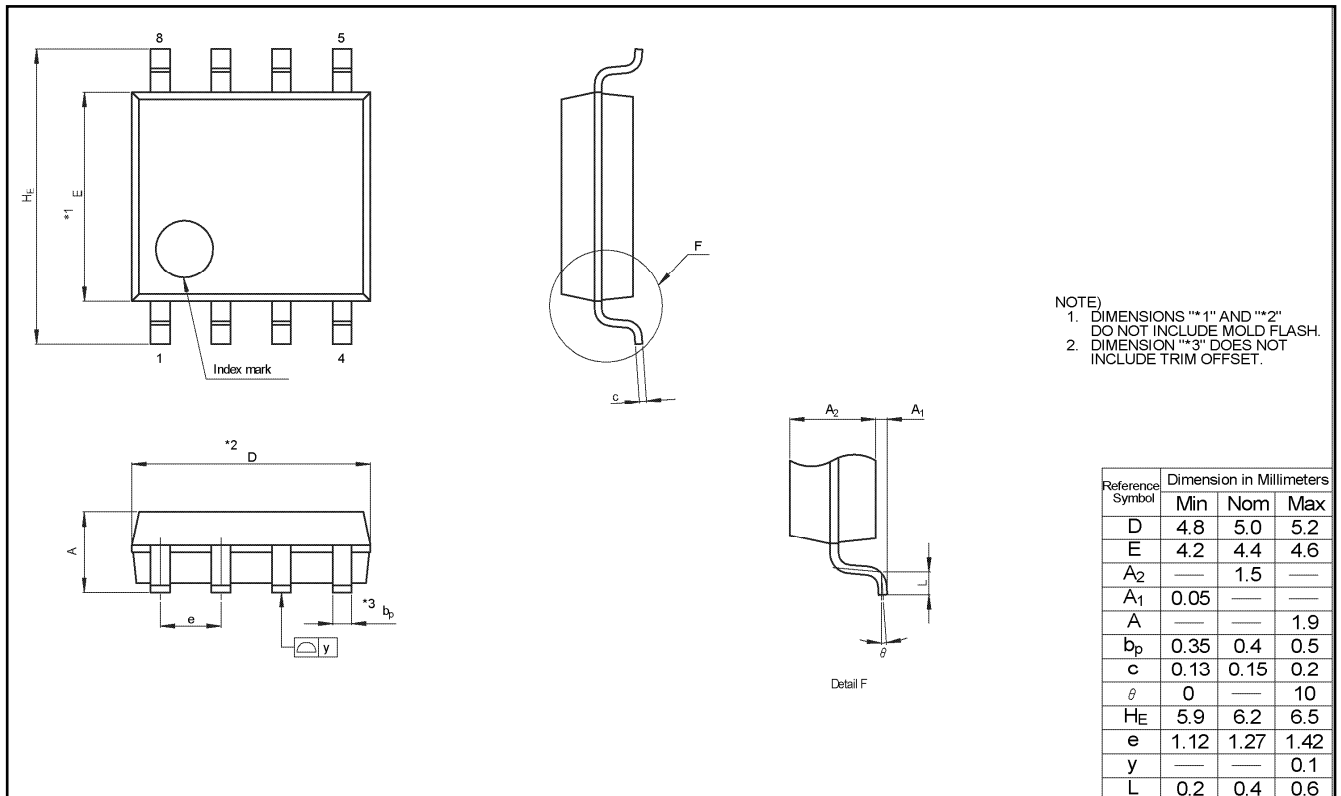
#### 5) Narrow pulse input dead time of HIN and LIN

Please set up "H" input dead time of HIN and LIN more than 300ns.

#### 6) Processing between IC terminals

As for this product, the terminal of low voltage part and high voltage part is very clear (The Fifth: LO, The Sixth:  $V_S$ ). Therefore, pin insulation space distance should be taken enough.

### PACKAGE OUTLINE



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HIGH VOLTAGE HALF BRIDGE DRIVER FOR AUTOMOTIVE APPLICATIONS

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## Main Revision for this Edition

No.	Date	Revision	
		Pages	Points
A	2012.03.27	-	New

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