<HVIC>

M81776FP

600V HIGH VOLTAGE HALF BRIDGE DRIVER

DESCRIPTION

M81776FP is high voltage Power MOSFET and IGBT gate driver for half bridge applications.

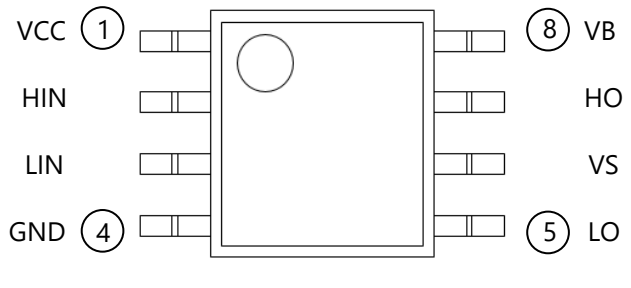
FEATURES

- ●Floating Supply Voltage ····· 600V
- ●Output Current ····· ···· +200mA/-350mA
- ●Half Bridge Driver
- ●Protect supply voltage drop
- ●SOP-8 Package

APPLICATIONS

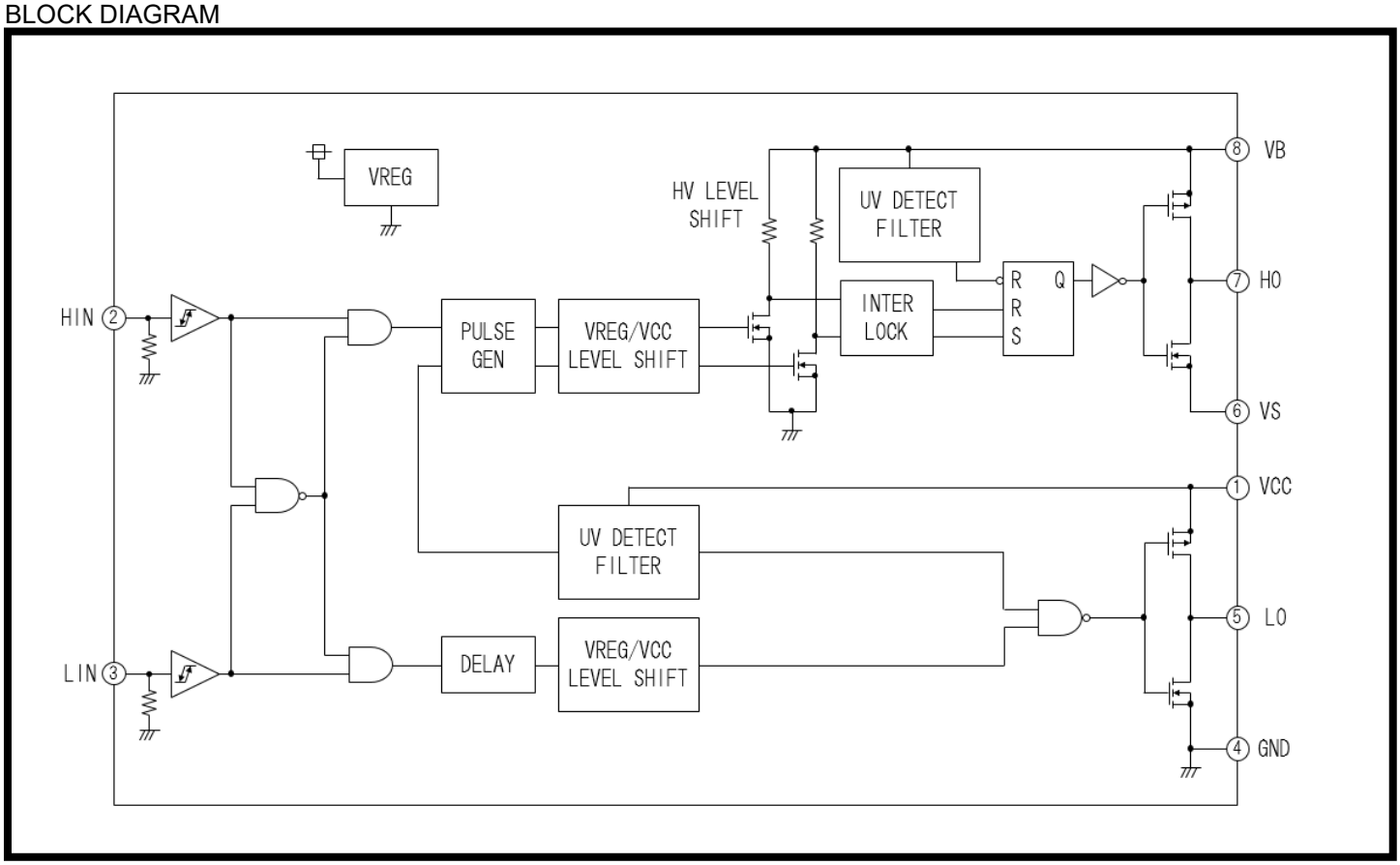
MOSFET and IGBT module driver.

PIN CONFIGURATION (TOP VIEW)



Outline:SOP8

BLOCK DIAGRAM



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

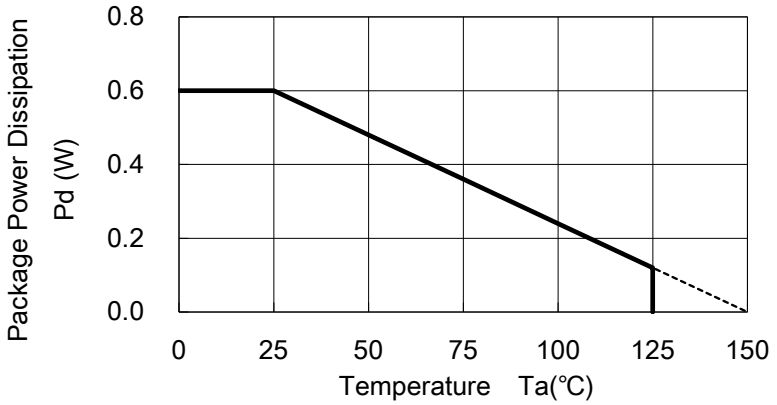
Symbol	Parameter	Test conditions	Ratings	Unit
V_B	High Side Floating Supply Absolute Voltage		- 0.5 ~ 624	V
V_S	High Side Floating Supply Offset Voltage		V_B - 24 ~ V_B + 0.5	V
V_{BS}	High Side Floating Supply Voltage	$V_{BS} = V_B - V_S$	- 0.5 ~ 24	V
V_{HO}	High Side Output Voltage		V_S - 0.5 ~ V_B + 0.5	V
V_{CC}	Low Side Fixed Supply Voltage		- 0.5 ~ 24	V
V_{LO}	Low Side Output Voltage		- 0.5 ~ Vcc + 0.5	V
V_{IN}	Logic Input Voltage	HIN,LIN Terminal	- 0.5 ~ Vcc + 0.5	V
Pd	Package Power Dissipation	Ta = 25°C ,On Board	0.6	W
Kθ	Linear Derating Factor	Ta > 25°C ,On Board	4.8	mW/℃
Rth(j-c)	Junction-Case Thermal Resistance		50	℃/W
Tj	Junction Temperature		- 40 ~ 150	℃
Topr	Operation Temperature		- 40 ~ 125	℃
Tstg	Storage Temperature	On Board	- 40 ~ 150	℃
TL	Solder Reflow Condition	Pb-free	255:10s, max 260	℃

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.	Max.	
V_B	High Side Floating Supply Absolute Voltage		V_S + 10	—	V_S + 20	V
V_S	High Side Floating Supply Offset Voltage		0	—	500	V
V_{BS}	High Side Floating Supply Voltage	$V_{BS} = V_B - V_S$	10	—	20	V
V_{HO}	High Side Output Voltage		V_S	—	V_B	V
V_{CC}	Low Side Fixed Supply Voltage		10	—	20	V
V_{LO}	Low Side Output Voltage		0	—	V_{CC}	V
V_{IN}	Logic Input Voltage	HIN,LIN Terminal	0	—	V_{CC}	V

Note : For proper operation, the device should be used within the recommended conditions

THERMAL DERATING FACTOR CHARACTERISTIC (MAXIMUM RATING)

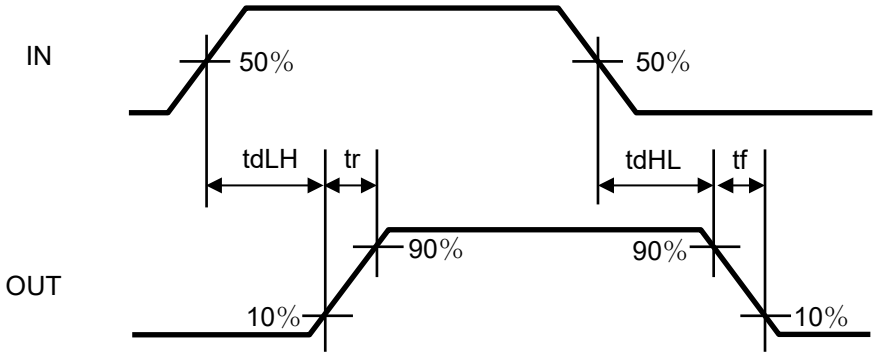


ELECTRICAL CHARACTERISTICS (Ta=25℃, VCC=VBS (=VB–VS)=15V, unless otherwise specified)

Symbol	Parameter	Test conditions	Limits			Unit
			Min.	Typ.*	Max.	
I_{FS}	Floating Supply Leakage Current	$V_B = V_S = 600V$	—	—	1.0	uA
I_{BS}	V_{BS} Standby Current	HIN = LIN = 0V	—	0.2	0.5	mA
I_{CC}	V_{CC} Standby Current	HIN = LIN = 0V	0.2	0.5	1.0	mA
V_{OH}	High Level Output Voltage	I_O = -20mA HO,LO Terminal	13.6	14.2	—	V
V_{OL}	Low Level Output Voltage	I_O = 20mA HO,LO Terminal	—	0.3	0.6	V
V_{IH}	High Level Input Threshold Voltage	HIN,LIN Terminal	2.7	—	—	V
V_{IL}	Low Level Input Threshold Voltage	HIN,LIN Terminal	—	—	0.8	V
I_{IH}	High Level Input Bias Current	V_{IN} = 5V	—	25	100	uA
I_{IL}	Low Level Input Bias Current	V_{IN} = 0V	—	—	2	uA
V_{BSuvr}	V_{BS} Supply UV Reset Voltage		7.0	8.4	9.8	V
V_{BSuvt}	V_{BS} Supply UV Trip Voltage		6.5	7.85	9.0	V
V_{BSuvh}	V_{BS} Supply UV Hysteresis Voltage		0.3	0.55	—	V
t_{VBSuv}	V_{BS} Supply UV Filter Time		—	7.5	—	us
V_{CCuvr}	V_{CC} Supply UV Reset Voltage		7.0	8.4	9.8	V
V_{CCuvt}	V_{CC} Supply UV Trip Voltage		6.5	7.85	9.0	V
V_{CCuvh}	V_{CC} Supply UV Hysteresis Voltage		0.3	0.55	—	V
t_{VCCuv}	V_{CC} Supply UV Filter Time		—	7.5	—	us
I_{OH}	Output High Level Short Circuit Pulsed Current	V_O = 0V, V_{IN} = 5V, PW < 10ms	120	200	—	mA
I_{OL}	Output Low Level Short Circuit Pulsed Current	V_O = 15V, V_{IN} = 0V, PW < 10ms	250	350	—	mA
R_{OH}	Output High Level On Resistance	I_O = -20mA, $R_{OH} = (V_{OH} - V_O) / I_O$	—	40	70	Ω
R_{OL}	Output Low Level On Resistance	I_O = 20mA, $R_{OL} = V_{OL} / I_O$	—	15	30	Ω
t_{dLH}(HO)	High Side Turn-On Propagation Delay	CL = 1000pF between HO - V_S	—	150	300	ns
t_{dHL}(HO)	High Side Turn-Off Propagation Delay	CL = 1000pF between HO - V_S	—	130	230	ns
t_{rH}	High Side Turn-On Rise Time	CL = 1000pF between HO - V_S	—	130	220	ns
t_{fH}	High Side Turn-Off Fall Time	CL = 1000pF between HO - V_S	—	50	80	ns
t_{dLH}(LO)	Low Side Turn-On Propagation Delay	CL = 1000pF between LO - GND	—	150	300	ns
t_{dHL}(LO)	Low Side Turn-Off Propagation Delay	CL = 1000pF between LO - GND	—	130	230	ns
t_{rL}	Low Side Turn-On Rise Time	CL = 1000pF between LO - GND	—	130	220	ns
t_{fL}	Low Side Turn-Off Fall Time	CL = 1000pF between LO - GND	—	50	80	ns
DtdLH	Turn-On Propagation Delay Matching	|tdLH(HO) - tdLH(LO)|	—	0	30	ns
DtdHL	Turn-Off Propagation Delay Matching	|tdHL(HO) - tdHL(LO)|	—	0	30	ns

* Typ is not specified

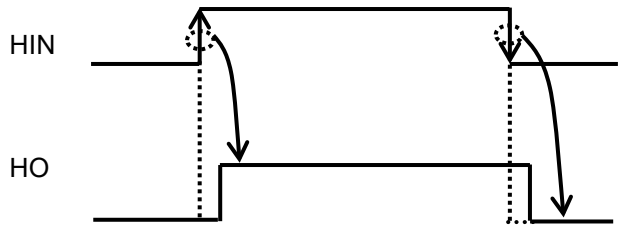
INPUT/OUTPUT TIMING DIAGRAM



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	HO = L, LO = L
H→L	H	H	H	L	H	LO = H
L→H	L	H	H	H	L	HO = H
L→H	H	H	H	L	L	HO = L, LO = L
X	L	L	H	L	L	LO=L,HO=L when V_{BS}UV is detected
X	H	L	H	L	H	LO=H,HO=L when V_{BS}UV is detected
H→L	X	H	L	L	L	LO=L,HO=L when V_{CC}UV is detected
L→H	X	H	L	L	L	LO=L,HO=L when V_{CC}UV is detected

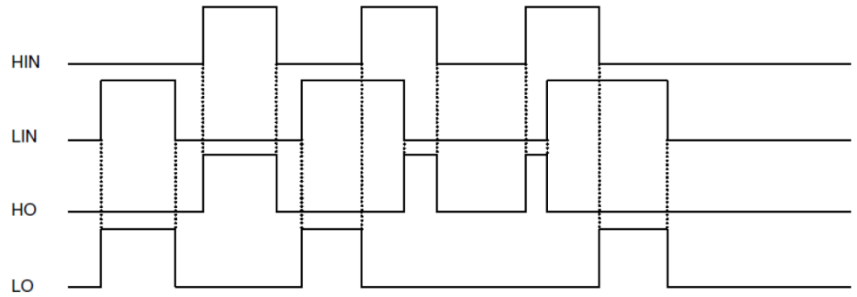
Note1 : “L” state of V_{BS} UV, V_{CC} UV means that V_{CC} (V_{BS}) Supply become under UV trip voltage.
Note2 : In the case of both input signals (HIN and LIN) are “H”, output signals (HO and LO) become “L”.
Note3 : X(HIN):L→H or H→L X(LIN):H or L
Note3 : Output Signal (HO) is triggered by the edge of input signal.



FUNCTION TIMING DIAGRAM

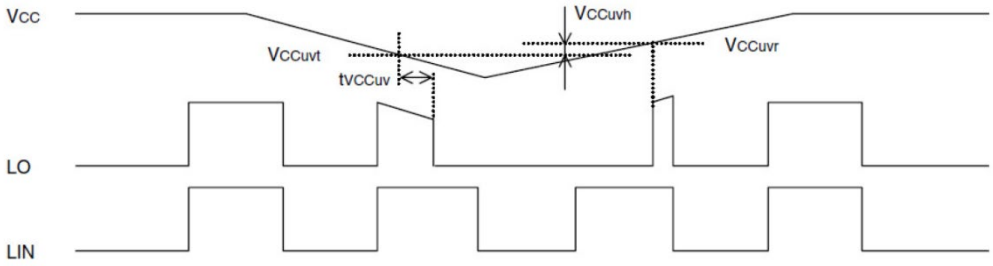
1. Input/Output Timing Diagram

High Active (When input signal (HIN or LIN) is "H", then output signal (HO or LO) is "H".)
In the case of both input signal (HIN and LIN) are "H", output signals (HO and LO) become "L".

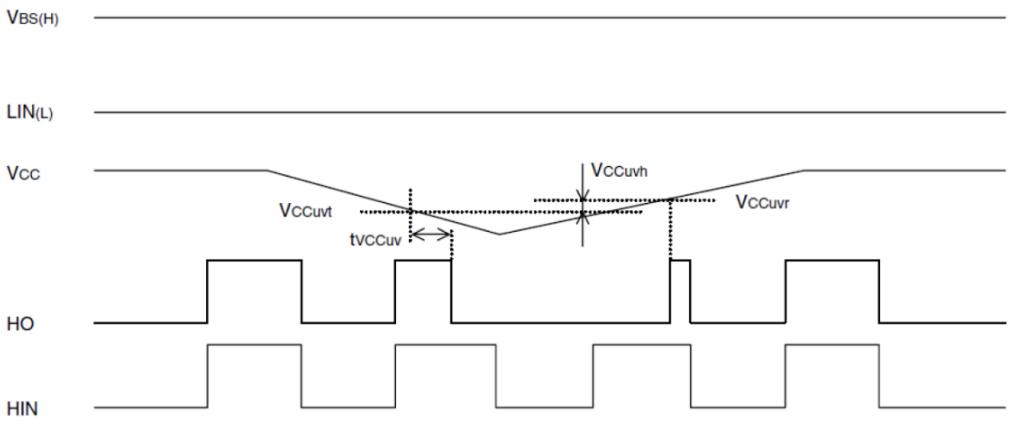


2. V_{CC} (V_{BS}) Supply Under Voltage (UV) Lockout Timing Diagram

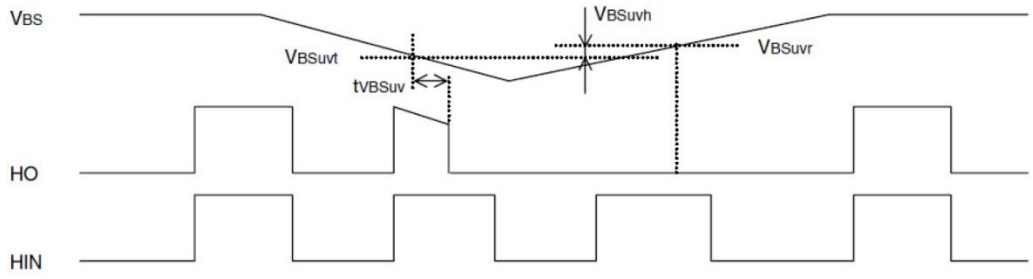
If V_{CC} supply voltage drops below UV trip voltage ($V_{CC}uvt$) for V_{CC} supply UV filter time, LO output signal is shut down. And then, if V_{CC} supply voltage rises over UV reset voltage, LO will return to the usual operation mode.



If V_{CC} supply voltage drops below UV trip voltage ($V_{CC}uvt$) for V_{CC} supply UV filter time, HO output signal is shut down. And then, if V_{CC} supply voltage rises over UV reset voltage, HO will return to the usual operation mode.



If V_{BS} supply voltage drops below UV trip voltage (V_{BS}uvt) for V_{BS} supply UV filter time, HO output signal is shut down. And then, if V_{BS} supply voltage rises over UV reset voltage, HO will respond to the next active HIN signal(L→H).



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 VCC and VBS, 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.

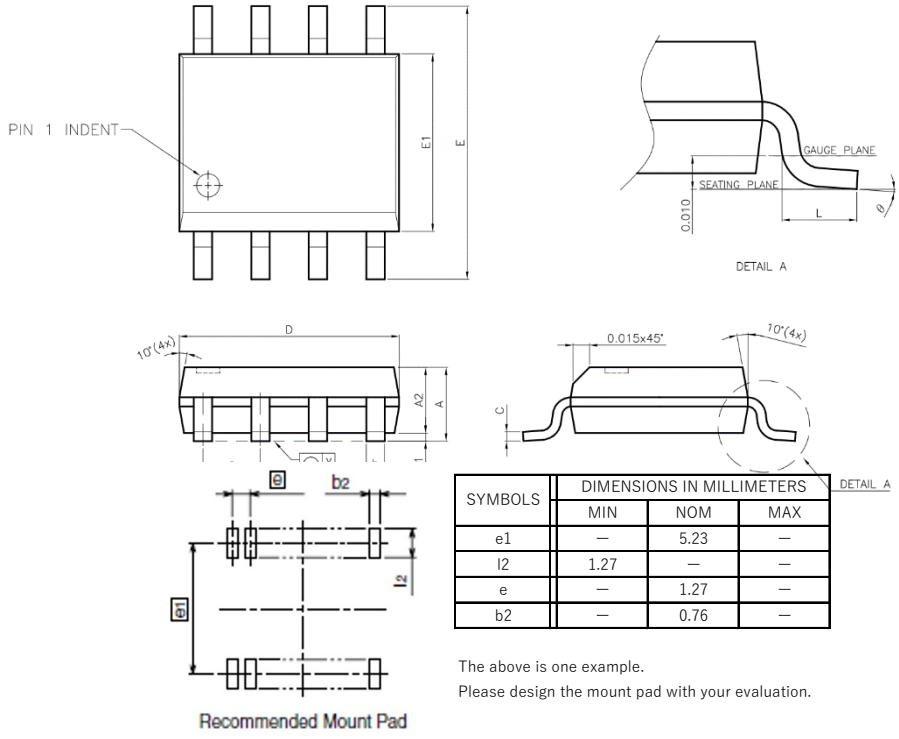
3) V_B supply voltage
Please use V_B supply voltage within RECOMMENDED OPERATING CONDITIONS
(V_S +10V < V_B < V_S + 20V : V_S = 0V minimum)
If V_B supply voltage is used on the other conditions, output signal HO may be malfunction.
Please evaluate carefully about V_B supply voltage in your application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

4) Inter-terminal processing
In this product, the terminal of the low voltage part and the high voltage part are adjacent (No.5:V_{CC}, No.6:V_S). There may be cases where there is insufficient insulation clearance distance between the pins.
Please use such as coating between the terminals.

ENVIRONMENTAL CONSCIOUSNESS

M81776FP is compliant with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) directive 2011/65/EU+(EU)2015/863.

PACKAGE OUTLINE



SYMBOLS	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	1.47	1.60	1.73
A1	0.10	——	0.25
A2	——	1.45	——
b	0.33	0.41	0.51
C	0.19	0.20	0.25
D	4.80	4.85	4.95
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	——	1.27	——
L	0.40	0.71	1.27
y	——	——	0.076
θ	0°	——	8°

SYMBOLS	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
e1	—	5.23	—
l2	1.27	—	—
e	—	1.27	—
b2	—	0.76	—

The above is one example.
Please design the mount pad with your evaluation.

Main Revision for this Edition

Rev.	Date	Revision	
		Pages	Points
A	2 Apr. 2018	-	New
B	28 Apr. 2021	-	Delete “PRELIMINARY”. Update format.

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