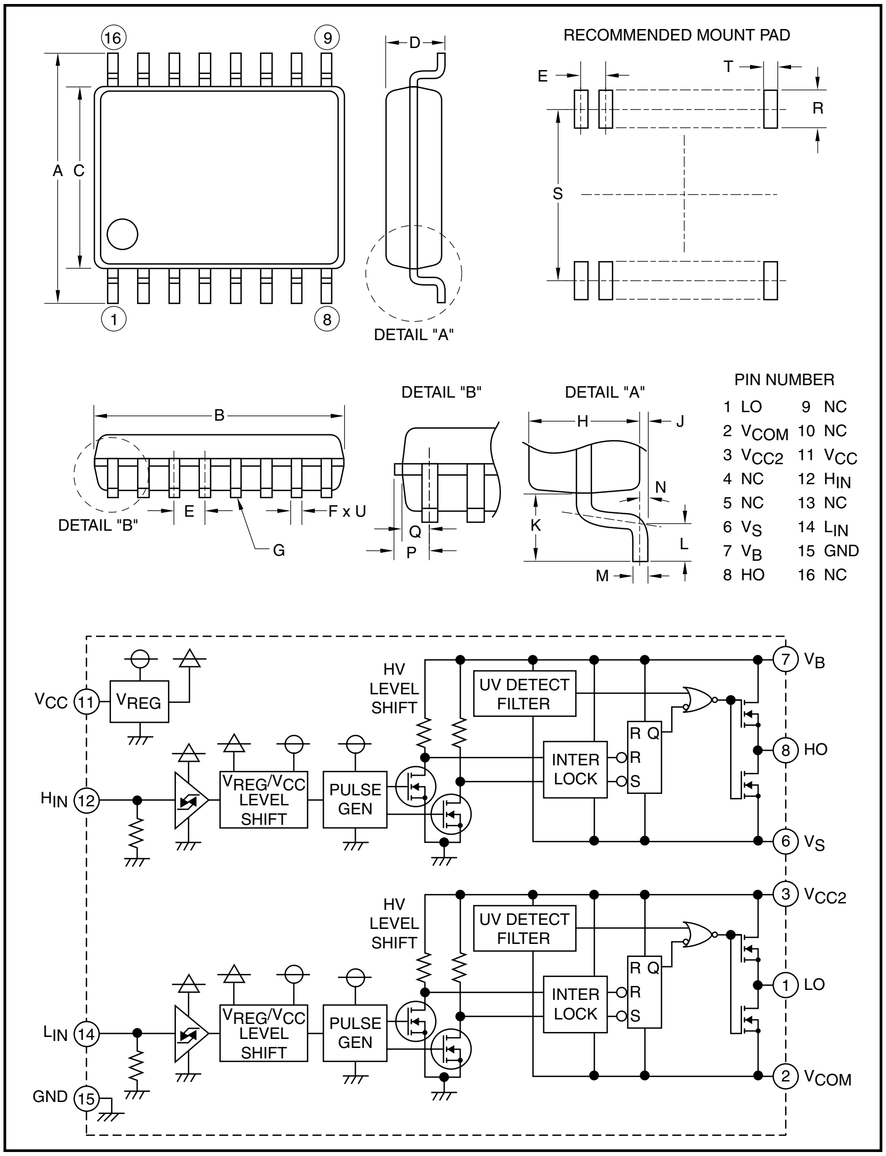
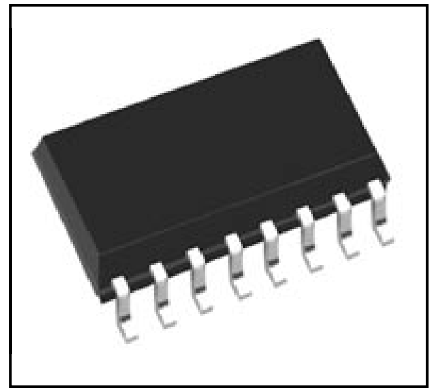
Powerex, Inc., 200 E. Hillis Street, Youngwood, Pennsylvania 15697-1800 (724) 925-7272

# HVIC

### *High Voltage Half-Bridge Driver 600 Volts/±100mA*




**Outline Drawing and Circuit Diagram**



| Dimensions | Inches | Millimeters |
|---|---|---|
| A | 0.31±0.01 | 7.8±0.3 |
| B | 0.41±0.004 | 10.1±0.1 |
| C | 0.21±0.004 | 5.3±0.1 |
| D | 0.12 | 2.10 |
| E | 0.05 | 1.27 |
| F | 0.02±0.002 | 0.4±0.05 |
| G | 0.004 | 0.1 |
| H | 0.07 | 1.8 |
| J | 0.01±0.004 | 0.1±0.1 |
| K | 0.05 | 1.25 |

| Dimensions | Inches | Millimeters |
|---|---|---|
| L | 0.024±0.008 | 0.6±0.2 |
| M | 0.1±0.002 | 0.2±0.05 |
| N | 8° | 8° |
| P | 0.03 | 0.755 |
| Q | 0.023 | 0.605 |
| R | 0.05 Min. | 1.27 Min. |
| S | 0.30 | 7.62 |
| T | 0.029 | 0.76 |
| U | 0.098 Dia. | 0.25 Dia. |

## Description:

M81707FP is a high voltage Power MOSFET and IGBT module driver for half-bridge applications.

## Features:

- ☐ Output Current ±100mA
- ☐ Half-Bridge Driver
- ☐ SOP-16 Package

## Applications:

- ☐ HID Ballast
- ☐ PDP
- ☐ MOSFET Driver
- ☐ IGBT Driver
- ☐ Inverter Module Control

## Ordering Information:

M81707FP is a ±100mA, 600 Volt HVIC, High Voltage Half-Bridge Driver

## Absolute Maximum Ratings, $T_a$ = 25°C unless otherwise specified

| Characteristics | Symbol | M81707FP | Units |
|---|---|---|---|
| High Side Floating Supply Absolute Voltage | $V_B$ | -0.5 ~ 624 | Volts |
| High Side Floating Supply Offset Voltage | $V_S$ | $V_B$-24 ~ $V_B$+0.5 | Volts |
| High Side Floating Supply Voltage ($V_{BS} = V_B - V_S$) | $V_{BS}$ | -0.5 ~ 24 | Volts |
| High Side Output Voltage | $V_{HO}$ | $V_S$-0.5 ~ $V_B$+0.5 | Volts |
| Low Side Floating Supply Absolute Voltage | $V_{CC2}$ | -0.5 ~ 624 | Volts |
| Output Standard Voltage | $V_{com}$ | $V_{CC2}$-24 ~ $V_{CC2}$+0.5 | Volts |
| Low Side Floating Supply Voltage ($V_{CC2com} = V_{CC2} - V_{com}$) | $V_{CC2com}$ | -0.5 ~ 24 | Volts |
| Low Side Output Voltage | $V_{LO}$ | $V_{com}$-0.5 ~ $V_{CC2}$+0.5 | Volts |
| Low Side Fixed Supply Voltage | $V_{CC}$ | -0.5 ~ 24 | Volts |
| Logic Input Voltage ($H_{IN}$, $L_{IN}$) | $V_{IN}$ | -0.5 ~ $V_{CC}$+0.5 | Volts |
| Allowable Offset Voltage Transient | $dV_S/dt$ | ±50 | Volts/ns |
| Package Power Dissipation ($T_a$ = 25°C, On Board) | $P_d$ | 0.89 | Watts |
| Linear Derating Factor ($T_a$ > 25°C, On Board) | $K\theta$ | -8.9 | mW/°C |
| Junction to Case Thermal Resistance | $R_{th(j-c)}$ | 45 | °C/W |
| Junction Temperature | $T_j$ | -40 ~ 125 | °C |
| Operation Temperature | $T_{opr}$ | -40 ~ 100 | °C |
| Storage Temperature | $T_{stg}$ | -55 ~ 125 | °C |
| Solder Heat Resistance (Pb Free) | $T_L$ | 255 : 10s, Max. 260 | °C |

## Recommended Operating Conditions

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| High Side Floating Supply Absolute Voltage | $V_B$ | | $V_S$+10 | — | $V_S$+20 | Volts |
| High Side Floating Supply Offset Voltage | $V_S$ | $V_B$ > 10V | -5 | — | 500 | Volts |
| High Side Floating Supply Voltage | $V_{BS}$ | $V_B = V_B - V_S$ | 10 | — | 20 | Volts |
| High Side Output Voltage | $V_{HO}$ | | $V_S$ | — | $V_B$ | Volts |
| Low Side Floating Supply Absolute Voltage | $V_{CC2}$ | | $V_{com}$+10 | — | $V_{com}$+20 | Volts |
| Output Standard Voltage | $V_{com}$ | $V_{CC2}$ > 10V | -5 | — | 500 | Volts |
| Low Side Floating Supply Voltage | $V_{CC2com}$ | $V_{CC2com} = V_{CC2} - V_{com}$ | 10 | — | 20 | Volts |
| Low Side Output Voltage | $V_{LO}$ | | $V_{com}$ | — | $V_{CC2}$ | Volts |
| Low Side Fixed Supply Voltage | $V_{CC}$ | | 10 | — | 20 | Volts |
| Logic Input Voltage | $V_{IN}$ | $H_{IN}$, $L_{IN}$ | 0 | — | $V_{CC}$ | Volts |

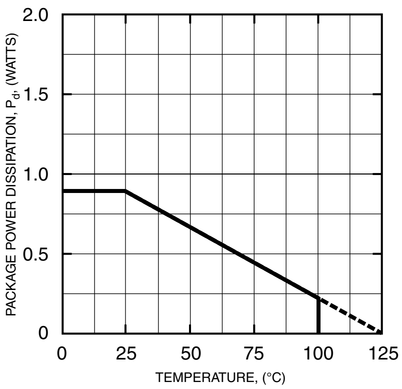
## Electrical Characteristics

### $T_a$ = 25°C, $V_{CC}$ = $V_{BS}$ (= $V_B$ – $V_S$) = 15V unless otherwise specified

| Characteristics | Symbol | Test Conditions | Min. | Typ. | Max. | Units |
|---|---|---|---|---|---|---|
| Floating Supply Leakage Current | $I_{FS}$ | $V_B$ = $V_S$ = 600V | — | — | 1.0 | µA |
| $V_{com}$ Floating Supply Leakage Current | $I_{FScom}$ | $V_{CC2}$ = $V_{com}$ = 600V | — | — | 1.0 | µA |
| $V_{BS}$ Standby Current | $I_{BS}$ | $H_{IN}$ = $L_{IN}$ = 0V | — | 0.18 | 0.4 | mA |
| $V_{CC}$ Standby Current | $I_{CC}$ | $H_{IN}$ = $L_{IN}$ = 0V | — | 0.30 | 0.6 | mA |
| $V_{CC2}$ Standby Current | $I_{CC2}$ | $H_{IN}$ = $L_{IN}$ = 0V | — | 0.18 | 0.4 | mA |
| $V_{BS}$ Standby Current H | $I_{BSH}$ | $H_{IN}$ = 5V | — | 0.25 | 0.5 | mA |
| $V_{CC}$ Standby Current H | $I_{CCH}$ | $H_{IN}$ = 5V | — | 0.37 | 0.75 | mA |
| $V_{CC2}$ Standby Current H | $I_{CC2H}$ | $H_{IN}$ = 5V | — | 0.18 | 0.4 | mA |
| $V_{BS}$ Standby Current L | $I_{BSL}$ | $L_{IN}$ = 5V | — | 0.18 | 0.4 | mA |
| $V_{CC}$ Standby Current L | $I_{CCL}$ | $L_{IN}$ = 5V | — | 0.37 | 0.75 | mA |
| $V_{CC2}$ Standby Current H | $I_{CC2L}$ | $L_{IN}$ = 5V | — | 0.25 | 0.5 | mA |
| High Level Output Voltage | $V_{OH}$ | $I_O$ = 0A, LO, HO | 14.9 | — | — | Volts |
| Low Level Output Voltage | $V_{OL}$ | $I_O$ = 0A, LO, HO | — | — | 0.1 | Volts |
| High Level Input Threshold Voltage | $V_{IH}$ | $H_{IN}$, $L_{IN}$ | 2.0 | 3.0 | 4.0 | Volts |
| Low Level Input Threshold Voltage | $V_{IL}$ | $H_{IN}$, $L_{IN}$ | 0.6 | 1.5 | 2.5 | Volts |
| Input Hysteresis Voltage | $V_{INh}$ | $V_{INh}$ = $V_{IH}$ – $V_{IL}$ | 1.0 | 1.5 | 2.0 | Volts |
| High Level Input Bias Current 5 | $I_{IH5}$ | $V_{IN}$ = 5V | — | 25 | 75 | µA |
| High Level Input Bias Current 15 | $I_{IH15}$ | $V_{IN}$ = 15V | — | 75 | 150 | µA |
| Low Level Input Bias Current | $I_{IL}$ | $V_{IN}$ = 0V | — | — | 1.0 | µA |
| $V_{BS}$ Supply UV Reset Voltage | $V_{BSuvr}$ | | 7.5 | 8.6 | 9.7 | Volts |
| $V_{BS}$ Supply UV Hysteresis Voltage | $V_{BSuvh}$ | | 0.1 | 0.4 | 0.7 | Volts |
| $V_{BS}$ Supply UV Filter Time | $tV_{BSuv}$ | | — | 7.5 | — | µs |
| $V_{CC}$ Supply UV Reset Voltage | $V_{CCuvr}$ | | 7.5 | 8.6 | 9.7 | Volts |
| $V_{CC}$ Supply UV Hysteresis Voltage | $V_{CCuvh}$ | | 0.1 | 0.4 | 0.7 | Volts |
| $V_{CC}$ Supply UV Filter Time | $tV_{CCuv}$ | | — | 7.5 | — | µs |
| Output High Level Short Circuit Pulsed Current | $I_{OH}$ | $V_O$ = 0V, $V_{IN}$ = 5V, $P_W$ < 10µs | -60 | -100 | -140 | mA |
| Output Low Level Short Circuit Pulsed Current | $I_{OL}$ | $V_O$ = 15V, $V_{IN}$ = 0V, $P_W$ < 10µs | 60 | 100 | 140 | mA |
| Output High Level ON Resistance | $R_{OH}$ | $I_O$ = -20mA, $R_{OH}$ = ($V_{OH}$ – $V_O$)/$I_O$ | — | 35 | 70 | Ω |
| Output Low Level ON Resistance | $R_{OL}$ | $I_O$ = 20mA, $R_{OL}$ = $V_O$ /$I_O$ | — | 50 | 100 | Ω |
| High Side Turn-On Propagation Delay | $t_{dLH(HO)}$ | $C_L$ = 200pF between HO – $V_S$ | 85 | 110 | 135 | ns |
| High Side Turn-Off Propagation Delay | $t_{dHL(HO)}$ | $C_L$ = 200pF between HO – $V_S$ | 100 | 130 | 160 | ns |
| High Side Turn-On Rise Time | $t_{rH}$ | $C_L$ = 200pF between HO – $V_S$ | 15 | 30 | 70 | ns |
| High Side Turn-Off Fall Time | $t_{fH}$ | $C_L$ = 200pF between HO – $V_S$ | 20 | 45 | 90 | ns |
| LowSide Turn-On Propagation Delay | $t_{dLH(LO)}$ | $C_L$ = 200pF between LO – GND | 85 | 110 | 135 | ns |
| Low Side Turn-Off Propagation Delay | $t_{dHL(LO)}$ | $C_L$ = 200pF between LO – GND | 100 | 130 | 160 | ns |
| Low Side Turn-On Rise Time | $t_{rL}$ | $C_L$ = 200pF between LO – GND | 15 | 30 | 70 | ns |
| Low Side Turn-Off Fall Time | $t_{fL}$ | $C_L$ = 200pF between LO – GND | 20 | 45 | 90 | ns |
| Delay Matching, High Side and Low Side Turn-On | $\Delta t_{dLH}$ | $\lvert t_{dLH(HO)} - t_{dLH(LO)} \rvert$ | — | — | 15 | ns |
| Delay Matching, High Side and Low Side Turn-Off | $\Delta t_{dHL}$ | $\lvert t_{dHL(HO)} - t_{dHL(LO)} \rvert$ | — | — | 15 | ns |
| Output Pulse Width | $V_{OPW}$ | $V_{IN}$ : PW = 200ns | 200 | 220 | 240 | ns |

***M81707FP***
***HVIC, High Voltage Half-Bridge Driver***
*600 Volts/±100mA*

**THERMAL DERATING FACTOR CHARACTERISTICS**




FUNCTION TABLE (X : HORL)

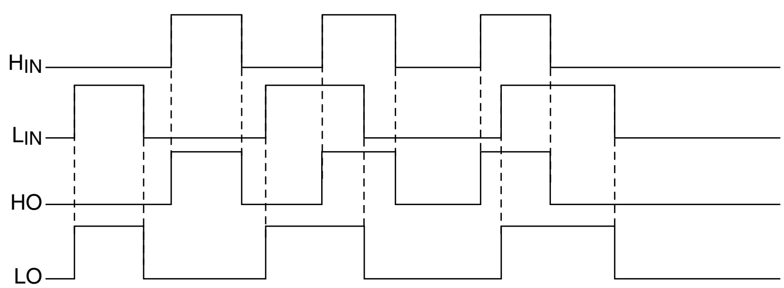
| $H_{IN}$ | $L_{IN}$ | $V_{BS}$ UV | $V_{CC2COM}$ UV | HO | LO | Behavorial State |
|---|---|---|---|---|---|---|
| L | L | H | H | L | L | LO = HO = Low |
| L | H | H | H | L | H | LO = High |
| H | L | H | H | H | L | HO = High |
| H | H | H | H | H | H | LO = HO = High |
| X | L | L | H | L | L | HO = Low, $V_{BS}$ $U_V$ Tripped |
| X | H | L | H | L | H | LO = High, $V_{BS}$ $U_V$ Tripped |
| L | X | H | L | L | L | LO = Low, $V_{CC2COM}$ $U_V$ Tripped |
| H | X | H | L | H | L | HO = High, $V_{CC2COM}$ $U_V$ Tripped |

NOTE: "L" state of $V_{BS}$ $U_V$, $V_{CC2COM}$ $U_V$ means that $U_V$ trip voltage.
In the case of both input signals ($H_{IN}$ and $L_{IN}$) are "H", output signals (HO and LO) become "H".

TIMING DIAGRAM

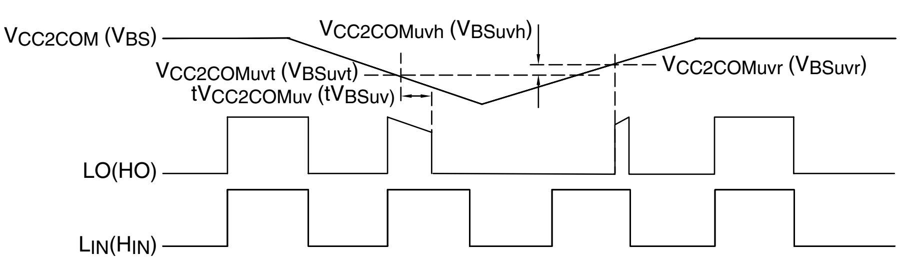
1. Input/Output Timing Diagram

   HIGH ACTIVE – When input signal ($H_{IN}$ or $L_{IN}$) is "H", then output signal (HO or LO) is "H". In the case of both input signals ($H_{IN}$ and $L_{IN}$) are "H", then output signals (HO and LO) become "H".




2. $V_{CC2COM}$($V_{BS}$) Supply Under Voltage Lockout Timing Diagram

   When $V_{CC2COM}$ supply voltage keeps lower $U_V$ trip voltage ($V_{CC2COMuvt}$ = $V_{CC2COMuvr}$ – $V_{CC2COMuvh}$) for $V_{CC2COM}$ supply $U_V$ filter time, output signal becomes "L". And then, when $V_{CC2COM}$ supply voltage is higher than $U_V$ reset voltage, output signal becomes normal.




Consideration – Allowable Supply Voltage Transient

It is recommended supplying $V_{CC}$ first, $V_{CC2COM}$ second and $V_{BS}$ last. In the case of shutting off supply voltage, shut off $V_{BS}$ supply voltage first. Second, shut off $V_{CC2COM}$ supply voltage, and last, shut off $V_{CC}$ supply voltage.

At the time of starting $V_{CC2COM}$ and $V_{BS}$, power supply should be increased slowly. If it is increased rapidly, output signal (HO and LO) may be "H".