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## FAN1100\_F085 Ignition Gate Driver IC

### Features

- Signal Line Input Buffer
- Input spike filter
- Operation from Ignition or Battery line
- Ground shift tolerance +/- 1.5 V
- Programmable maximum dwell time
- Programmable Input Pull down current
- Control IGBT current limiting through Vsense pin
- Soft Shutdown following Max Dwell Time out

### Applications

- The FAN1100\_F085 is an advanced Ignition IGBT control IC available in a SO8 package or die sales. This full featured Smart Ignition IGBT Driver is particularly advantageous in “switch on coil” applications where size and system performance of the ignition driver are important.

### Description

The FAN1100\_F085 is designed to directly drive an ignition IGBT and control the current and spark event of the coil. The coil current is controlled via the input pin. When the input is driven high, the output of the FAN1100\_F085 is enabled to turn on the IGBT and start charging the coil. The FAN1100\_F085 will sink a current (IIN) into the input pin based on programmed current on the RA line.

An input spike filter suppresses input signals of less than 13  $\mu$ sec in duration. A Max Dwell timer is included in the FAN1100\_F085 which will turn off the IGBT if the input stays active for longer than the programmed time. This time interval can be modified through an external capacitor on the CSSD pin. When the Max Dwell timer is exceeded, the FAN1100\_F085 will enter a Soft-Shut-Down mode (SSD) slowly dropping the collector current by lowering the gate drive to the IGBT thereby discharging the coil such as to inhibit a spark event. Once the soft shutdown operation has started, any transitions on the input signal are ignored until after completion of the soft shutdown function. The FAN1100\_F085 will also limit the collector current of the IGBT to  $I_{c(lim)}$  during charging. This again is done through the sense resistor in the emitter leg of the Ignition IGBT developing a signal input to the Vsense pin of the FAN1100\_F085.

### Ordering Information

| Part Number  | Operating Temperature Range | Package | Packing Method |
|--------------|-----------------------------|---------|----------------|
| FAN1100_F085 | -40C to 150C                | 8-SOIC  | Tape & Reel    |

## Recommended External Components

Table 1. Recommended External Components

| Component   | Description                                | Vendor | Parameter | Typ.       | Unit       |
|-------------|--------------------------------------------|--------|-----------|------------|------------|
| $R_{BAT}$   | Limits transient currents during load dump |        | R         | 200 to 300 | $\Omega$   |
| $C_{BAT1}$  | Battery or Ignition voltage filtering      |        | C         | 0.47       | $\mu F$    |
| $C_{BAT}$   | Battery noise transients                   |        | C         | 10         | nF         |
| $C_{IN}$    | Noise immunity                             |        | C         | 10         | nF         |
| $R_{SENSE}$ | Sense the collector current                |        | R         | 20         | m $\Omega$ |

## Typical Application

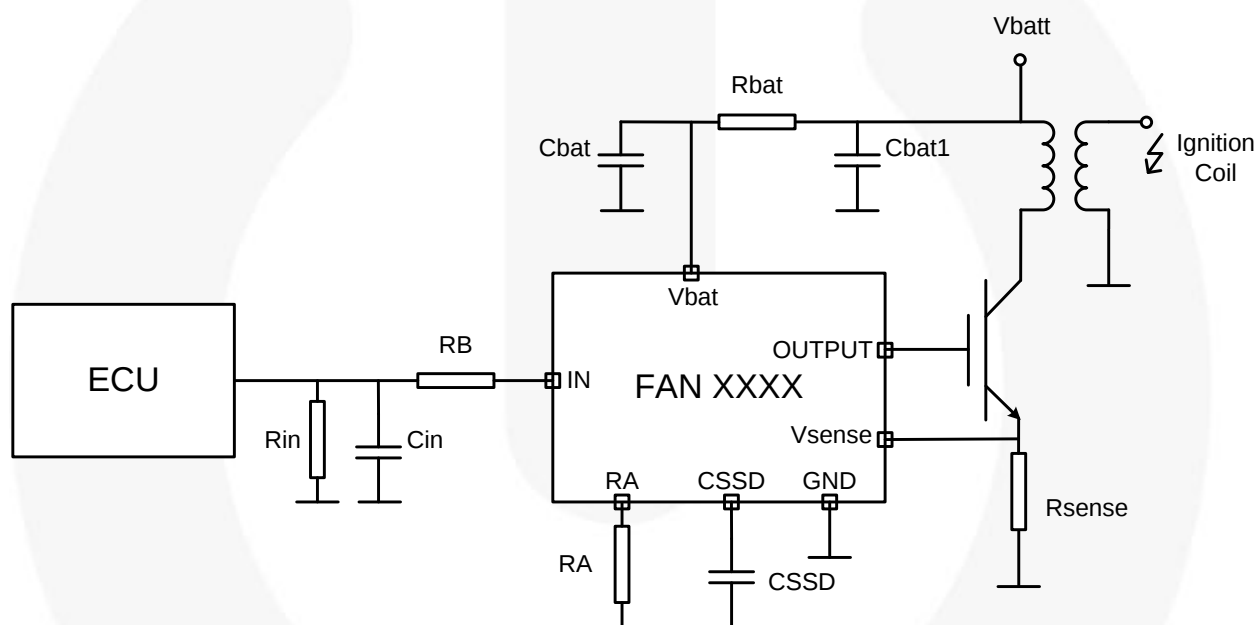
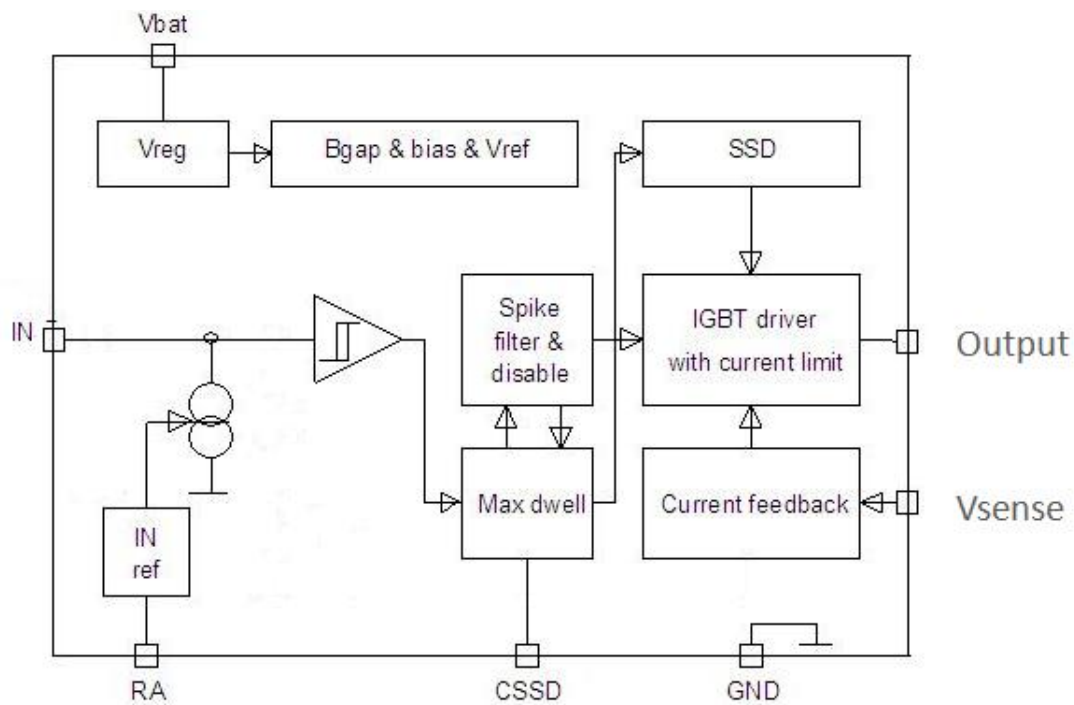


Figure 1. Typical Application

## Block Diagram



## Package Outline

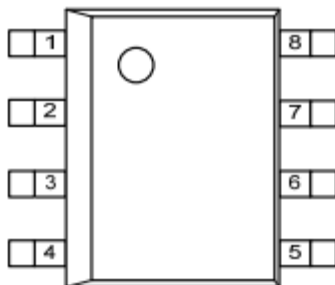


Figure 2. Pin Assignment (Top View)

## Pin Descriptions

| Name  | Type   | Description                                                                  |
|-------|--------|------------------------------------------------------------------------------|
| Pin1  | GND    | Ground Reference of the Control IC                                           |
| Pin2  | Input  | Signal input                                                                 |
| Pin3  | NC     |                                                                              |
| Pin4  | CSSD   | Maximum dwell time and Soft-Shut-Down current output (to external capacitor) |
| Pin5  | RA     | Input reference current output (to external resistor)                        |
| Pin6  | Output | Gate Drive to the IGBT                                                       |
| Pin7  | Vsense | Sense Input used for Ilim function                                           |
| Pin 8 | Vbat   | Supply voltage                                                               |

## Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

| Symbol                    | Parameter                                                                                                                          | Min.  | Max.  | Unit  |
|---------------------------|------------------------------------------------------------------------------------------------------------------------------------|-------|-------|-------|
| $V_{bat}$                 | Voltage at $V_{bat}$ pin (excl. EMC transients)                                                                                    | -0.3  | 28    | V     |
| $V_{IN}$                  | Voltage at Input pin with external $R_{in}$                                                                                        | - 2   | 16    | V     |
| $V_{RA},$<br>$V_{CSSD}$   | Voltage at $RA$ & $C_{SSD}$ and Output pins                                                                                        | - 0.3 | 5     | V     |
| $V_{OUTPUT}$              | Voltage at Gate Output                                                                                                             | -0.3  | 6.5   | V     |
| $V_{sense}$               | Voltage on $V_{sense}$ pin                                                                                                         | 0     | 400   | mV    |
| $T_J,$<br>$T_{STG}$       | Operating and Storage Temperature Range                                                                                            | -40   | 150   | °C    |
| $P_{max}$                 | Maximum power dissipation (continuous) at $T_C = 25\text{ °C}$                                                                     |       | 0.625 | W     |
| $R_{\theta JA}$           | Thermal Resistance junction–case (typical)                                                                                         |       | 200   | °C /W |
| $V_{ESD}$<br>(pin to pin) | Electrostatic Discharge Voltage (Human Body Model) according to MIL STD 883D, method 3015.7 and EOS/ESD Assn. standard S5.1 - 1993 |       | 2     | kV    |

## Recommended Operating Conditions (Reference load characteristics)

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

| Symbol     | Characteristic                                | Min. | Typ. | Max. | Units    |
|------------|-----------------------------------------------|------|------|------|----------|
| $I_{ctyp}$ | Collector (Coil) Operating Current            |      | 12   |      | A        |
| $L_p$      | Coil Primary Inductance                       |      | 1.5  |      | mH       |
| $R_p$      | Coil Primary Resistance (25 °C)               |      | 0.4  |      | $\Omega$ |
| $R_{load}$ | Load Resistance (for delay time measurements) |      | 2    |      | $\Omega$ |

## Electrical Characteristics

| Symbol                                                                                                          | Parameter                            | Conditions                                   | Min. | Typ. | Max. | Unit |
|-----------------------------------------------------------------------------------------------------------------|--------------------------------------|----------------------------------------------|------|------|------|------|
| <b>Power Supply Conditions</b> Vbat = 6 to 28 V ; TJ= -40 °C to 150 °C (unless otherwise specified)             |                                      |                                              |      |      |      |      |
| Vbat1                                                                                                           | Operating voltage                    | Coil switching function                      | 4    |      | 28   | V    |
| Vbat2                                                                                                           | Operating voltage                    | All functions                                | 6    |      | 28   | V    |
| Ibat                                                                                                            | Supply current                       | TJ=150 °C, Vbat = 28 V, RA open, Input = 5 V |      |      | 5    | mA   |
| Vclamp                                                                                                          | Vbattery clamp                       | Ibatt = 10 mA                                | 35   |      | 50   | V    |
| <b>Sense Pin Conditions</b> Vbat = 6 to 28 V ; TJ= -40 °C to 150 °C (unless otherwise specified)                |                                      |                                              |      |      |      |      |
| Vlimit                                                                                                          | Sense Voltage at current limit       | TJ = -40 °C to 150 °C (Vbat>8V)              | 185  |      | 215  | mV   |
| Vlimit                                                                                                          | Sense Voltage at current limit       | TJ = -40 °C to 150 °C (6V<Vbat<8V)           | 170  |      |      | mV   |
| Tspike                                                                                                          | Input spike filter                   | Delay on rising and falling edge of Input    |      | 13   |      | μs   |
| TD1                                                                                                             | Turn on delay time                   | (Time from Input =4.0 V to Vout=4.0 V)       |      | 15   |      | μs   |
| TD2                                                                                                             | Turn off delay time                  | (Time from Input=0.5 V to Vc-gnd=1.0 V)      |      | 15   |      | μs   |
| <b>Input Control Conditions</b> Vbat = 6 to 28 V ; TJ= -40 °C to + 150 °C (unless otherwise specified)          |                                      |                                              |      |      |      |      |
| VINL                                                                                                            | Input low voltage                    |                                              | 1.2  |      | 1.7  | V    |
| VINH                                                                                                            | Input high voltage                   |                                              | 1.5  |      | 2    | V    |
| VINHys                                                                                                          | Input voltage hysteresis             |                                              | 0.25 |      | 0.6  | V    |
| IIN                                                                                                             | Input current ( see fig 6)           |                                              | 0.5  |      | 15   | mA   |
| <b>Gate Output Voltage Max</b> Vbat = 6 to 28 V ; TJ= -40 °C to 150 °C (unless otherwise specified)             |                                      |                                              |      |      |      |      |
| Vgmax                                                                                                           | Vgate max                            | 16KΩ pulldown resistor                       | 4.5  | 5.25 | 6    | V    |
| Vglow                                                                                                           | Vgate low                            | (0mA<Igate<0.4mA @ T=25 °C)                  | 0.0  |      | 0.2  | V    |
| <b>Diagnostic Functions and Protection</b> Vbat = 6 to 28 V ; TJ= -40 °C to 150 °C (unless otherwise specified) |                                      |                                              |      |      |      |      |
| RA                                                                                                              | Resistor for input reference current |                                              | 5.2  |      | 200  | kΩ   |
| CSSDMIN                                                                                                         | Minimum dwell time capacitor         |                                              | 2.3  |      |      | nF   |
| TDMAX                                                                                                           | Maximum dwell time                   | (CSSD=20 nF)                                 | 30   |      | 60   | ms   |
| ISLEW                                                                                                           | Soft-Shut-Down slew rate             | (Ic: 80-20%IClim)                            | 0.7  | 1.5  | 2.5  | A/ms |
| ICSSD1                                                                                                          | CSSD Pin current for TDMAX           |                                              | 0.8  | 1.25 | 1.5  | μA   |

## Typical Performance Characteristics

### Input and spike filter

When the input signal voltage reaches  $V_{INH}$ , the IGBT will be switched on charging the coil. When the input voltage goes below  $V_{INL}$ , the coil current through the IGBT will be turned off. If the FAN1100\_F085 is in SSD mode, the input signal control is disabled. After an SSD sequence input control will be re-enabled after the input has reached a valid low. Positive and negative spikes of less than  $T_{spike}$  duration at the input line will be filtered out and will not turn on/off the IGBT.

### Maximum dwell time and soft-shutdown (SSD)

When the IGBT is turned on, a delay timer, dependent on the value of the external CSSD capacitor (see Fig. 5), is started. If a valid falling edge has not been received after the time  $T_{DMAX}$ , the IGBT will be turned off slowly as shown in Fig. 4. The coil current will not exceed a slew rate of typical 1.5A/ms. (Based on ISL9V3040 Ignition IGBT). If a valid falling edge is received after the time  $T_{DMAX}$ , the edge will be ignored and the soft shutdown will be completed. The IGBT cannot be subsequently turned on until a valid rising edge is detected. If the CSSD capacitor has a value of  $< 2.2\text{nF}$  or the CSSD pin is shorted to ground, the maximum dwell time and SSD functions will be disabled.

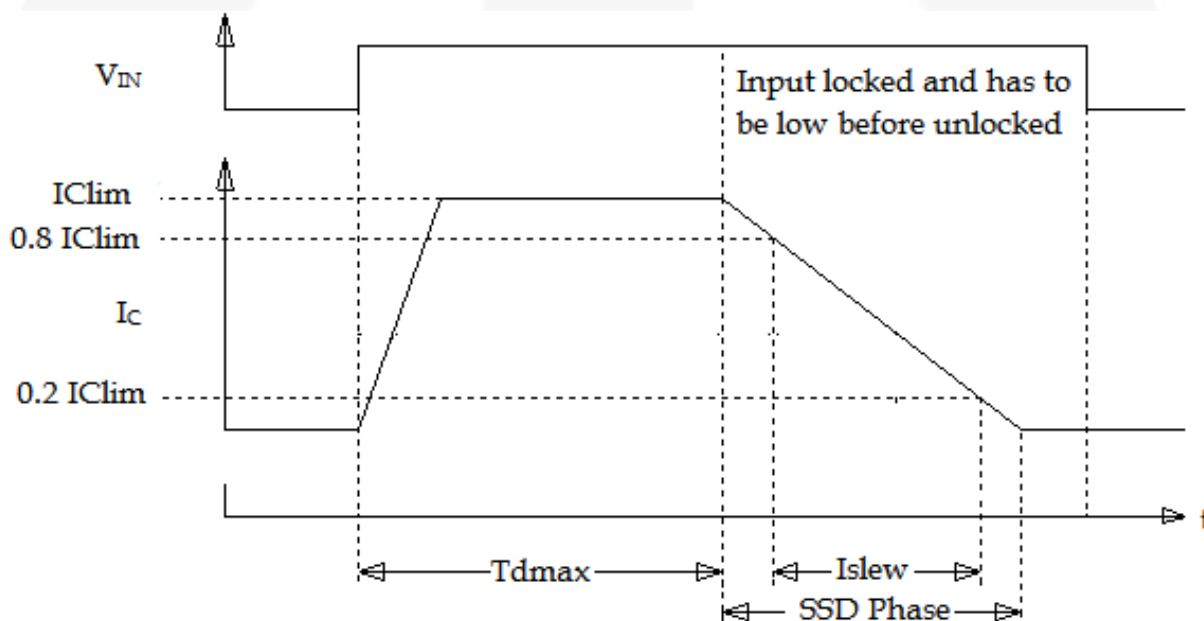


Figure 4: Dwell time and Soft-Shut-Down

Figure 5 shows the Relationship between the CSSD capacitor and Max Dwell Time

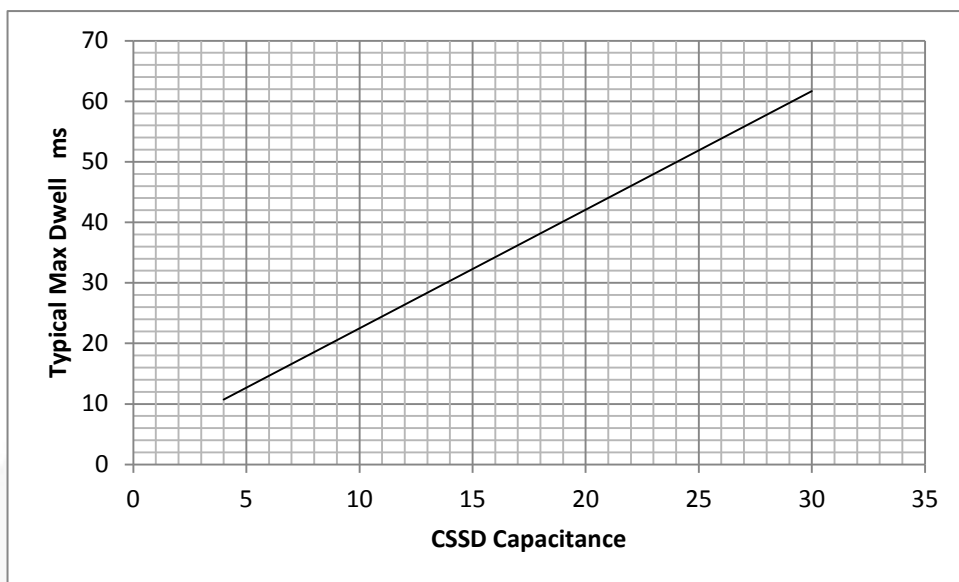


Figure 5:  $T_{DMAX}$  as function of external CSSD capacitor

Figure 6 shows the Signal input current vs. IRA current

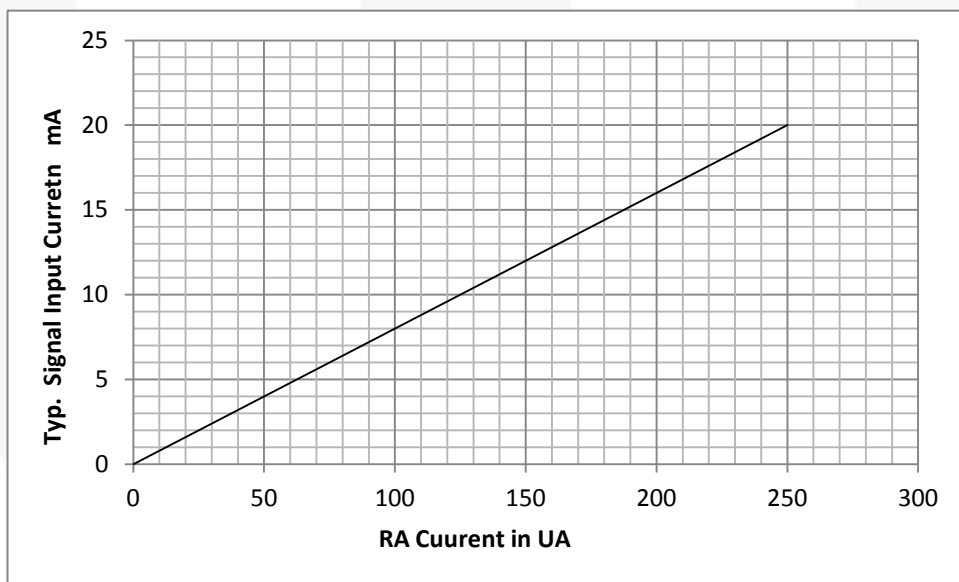


Figure 6: Interrelationship between Signal Input Current and IRA



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Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А