

Ignition Gate Drive IC

FAN1100-F085



SOIC8
CASE 751EB

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 μ s 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.

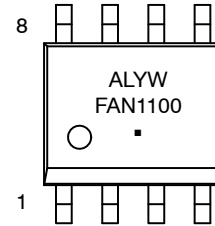
Features

- 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 V_{SENSE} Pin
- Soft Shutdown following Max Dwell Time Out
- This is a Pb-Free Device

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.

MARKING DIAGRAM



| | |
|---------|------------------------|
| FAN1100 | = Specific Device Code |
| AL | = Assembly Lot Code |
| Y | = Year |
| W | = Work Week |
| ▪ | = Pb-Free Package |

ORDERING INFORMATION

See detailed ordering and shipping information on page 2 of this data sheet.

FAN1100-F085

ORDERING INFORMATION

| Part Number | Operating Temperature Range | Package | Shipping [†] |
|--------------|-----------------------------|---------|--------------------------|
| FAN1100-F085 | -40°C to 150°C | 8-SOIC | 2500 units / Tape & Reel |

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

Recommended External Components

TYPICAL EXTERNAL COMPONENTS

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

Typical Application

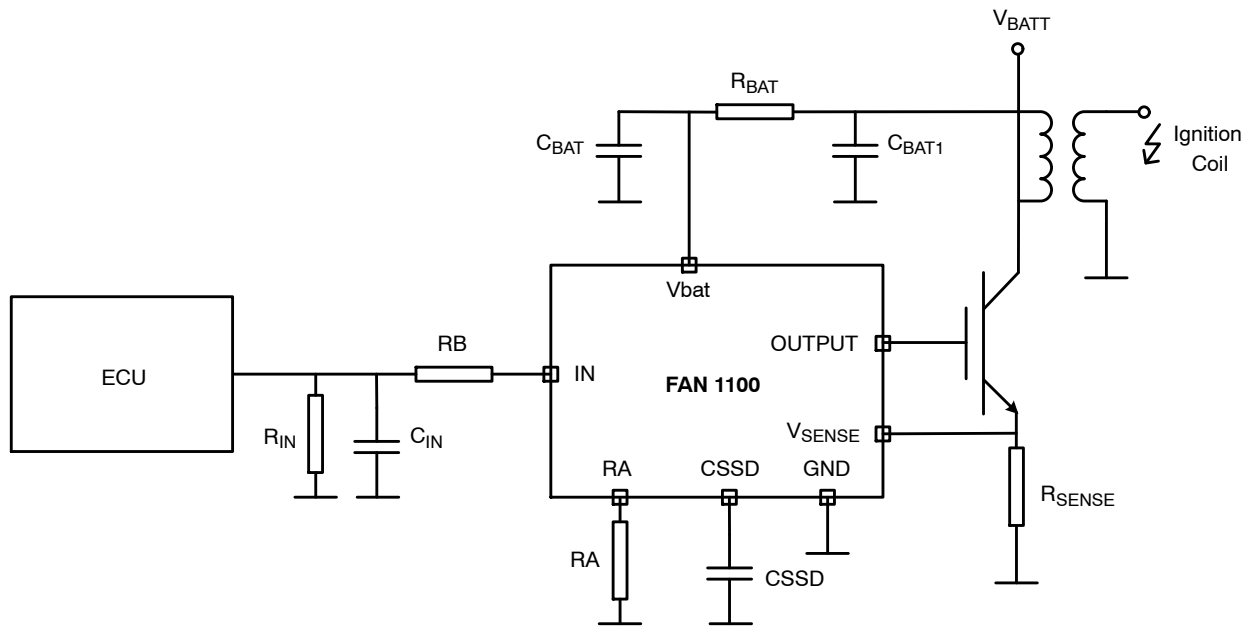


Figure 1. Typical Application

Block Diagram

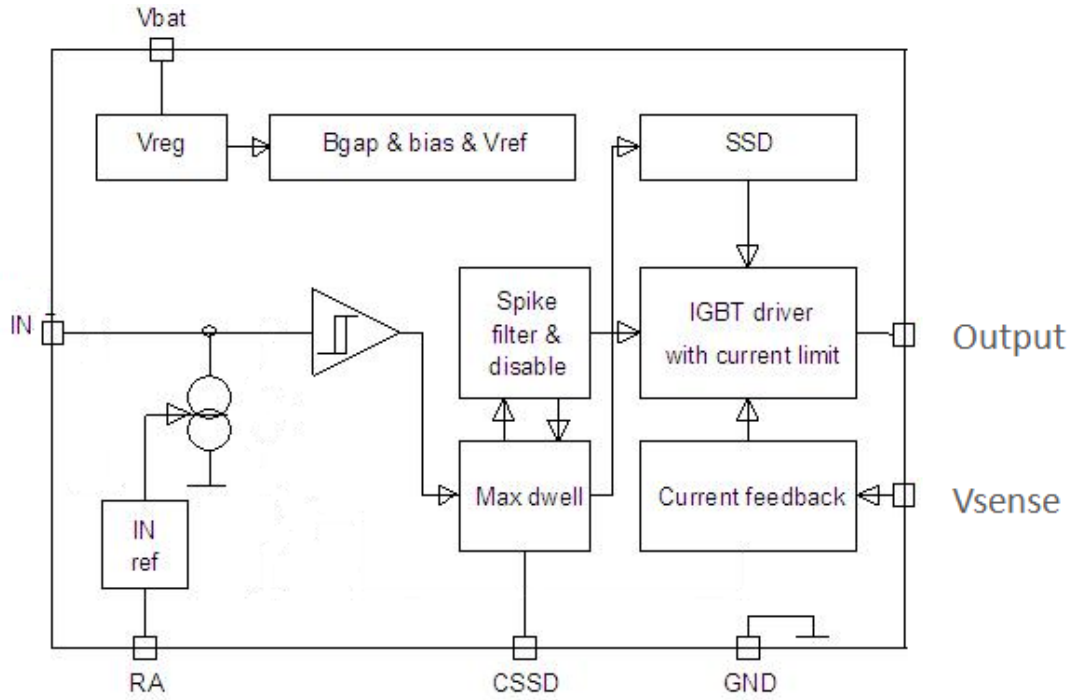


Figure 2. Block Diagram

FAN1100-F085

Package Outline

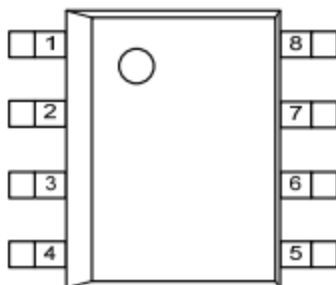


Figure 3. Pin Assignment (Top View)

PIN DESCRIPTION

| 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 | V _{SENSE} | Sense Input used for Ilim function |
| Pin 8 | V _{BAT} | Supply voltage |

ABSOLUTE MAXIMUM RATINGS

| 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} , 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 , T _{STG} | Operating and Storage Temperature Range | -40 | 150 | °C |
| P _{MAX} | Maximum power dissipation (continuous) at T _C = 25°C | | 0.625 | W |
| R _{θJC} | Thermal Resistance – Junction-to-Case (typical) | | 200 | °C/W |
| V _{ESD} (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 |

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

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RECOMMENDED OPERATING CONDITIONS (Reference Load Characteristics) (Note 1)

| 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 | | Ω |
| R_{LOAD} | Load Resistance (for delay time measurements) | | 2 | | Ω |

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

1. **onsemi** does not recommend exceeding them or designing to Absolute Maximum Ratings.

ELECTRICAL CHARACTERISTICS

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|--------|-----------|------------|------|------|------|------|
|--------|-----------|------------|------|------|------|------|

POWER SUPPLY CONDITIONS $V_{BAT} = 6$ to 28 V ; $T_J = -40^\circ\text{C}$ to 150°C (unless otherwise specified)

| | | | | | | |
|-------------|---------------------|--|----|--|----|----|
| V_{BAT1} | Operating voltage | Coil switching function | 4 | | 28 | V |
| V_{BAT2} | Operating voltage | All functions | 6 | | 28 | V |
| I_{BAT} | Supply current | $T_J = 150^\circ\text{C}$, $V_{BAT} = 28$ V, RA open, Input = 5 V | | | 5 | mA |
| V_{CLAMP} | $V_{BATTERY}$ clamp | $I_{BATT} = 10$ mA | 35 | | 50 | V |

SENSE PIN CONDITIONS $V_{BAT} = 6$ to 28 V ; $T_J = -40^\circ\text{C}$ to 150°C (unless otherwise specified)

| | | | | | | |
|-------------|--------------------------------|--|-----|----|-----|---------------|
| V_{LIMIT} | Sense Voltage at current limit | $V_{BAT} > 8$ V | 185 | | 215 | mV |
| | | 6 V < $V_{BAT} < 8$ V | 170 | | | |
| T_{SPIKE} | Input spike filter | Delay on rising and falling edge of Input | | 13 | | μs |
| T_{D1} | Turn on delay time | 50% at the input to 10% change at the output | | 15 | | μs |
| T_{D2} | Turn off delay time | 50% at the input to 10% change at the output | | 15 | | μs |

INPUT CONTROL CONDITIONS $V_{BAT} = 6$ to 28 V ; $T_J = -40^\circ\text{C}$ to $+150^\circ\text{C}$ (unless otherwise specified)

| | | | | | | |
|-------------|------------------------------|--|------|--|-----|----|
| V_{INL} | Input low voltage | | 1.2 | | 1.7 | V |
| V_{INH} | Input high voltage | | 1.5 | | 2 | V |
| V_{INHys} | Input voltage hysteresis | | 0.25 | | 0.6 | V |
| I_{IN} | Input current (see Figure 6) | | 0.5 | | 15 | mA |

GATE OUTPUT VOLTAGE MAX $V_{BAT} = 6$ to 28 V ; $T_J = -40^\circ\text{C}$ to 150°C (unless otherwise specified)

| | | | | | | |
|------------|-----------|---|-----|------|-----|---|
| V_{GMAX} | Vgate max | 16 K Ω pulldown resistor | 4.5 | 5.25 | 6 | V |
| V_{GLOW} | Vgate low | (0 mA < $I_{GATE} < 0.4$ mA @ T = 25°C) | 0.0 | | 0.2 | V |

DIAGNOSTIC FUNCTIONS AND PROTECTION $V_{BAT} = 6$ to 28 V ; $T_J = -40^\circ\text{C}$ to 150°C (unless otherwise specified)

| | | | | | | |
|---------------------|--|-------------------------------|-----|------|-----|---------------|
| RA | Resistor for input reference current | | 5.2 | | 200 | k Ω |
| CSSD _{MIN} | Minimum dwell time capacitor | Note 2 | | 10 | | nF |
| TD _{MAX} | Maximum dwell time | (CSSD = 50 nF) | 30 | | 60 | ms |
| I_{SLEW} | Soft-Shut-Down slew rate | (I_C : 80–20% I_{Clim}) | 0.7 | 1.5 | 2.5 | A/ms |
| I_{CSSD1} | CSSD Pin current for TD _{MAX} | | 0.8 | 1.25 | 1.5 | μA |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

2. Refer to section Maximum Dwell Time and Soft-Shutdown (SSD)

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 Figure 5), is started. If a valid falling edge has not been received after the time $T_{D_{MAX}}$, the IGBT will be turned off slowly as shown

in Figure 4. The coil current will not exceed a slew rate of typical 1.5 A/ms. (Based on ISL9V3040 Ignition IGBT). If a valid falling edge is received after the time $T_{D_{MAX}}$, 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 below 2.2 nF or the CSSD pin is shorted to ground, the maximum dwell time and SSD functions are disabled. The maximum dwell time is active for a capacitance value above 10 nF typical. The maxdwell might be indeterminate for capacitance value between 2.2 nF and 10 nF.

The maximum dwell time is also disabled in case the input signal is set to high before or at the same time as the battery voltage. It is recommended to apply the battery voltage typically 50 μ s before the input signal goes high.

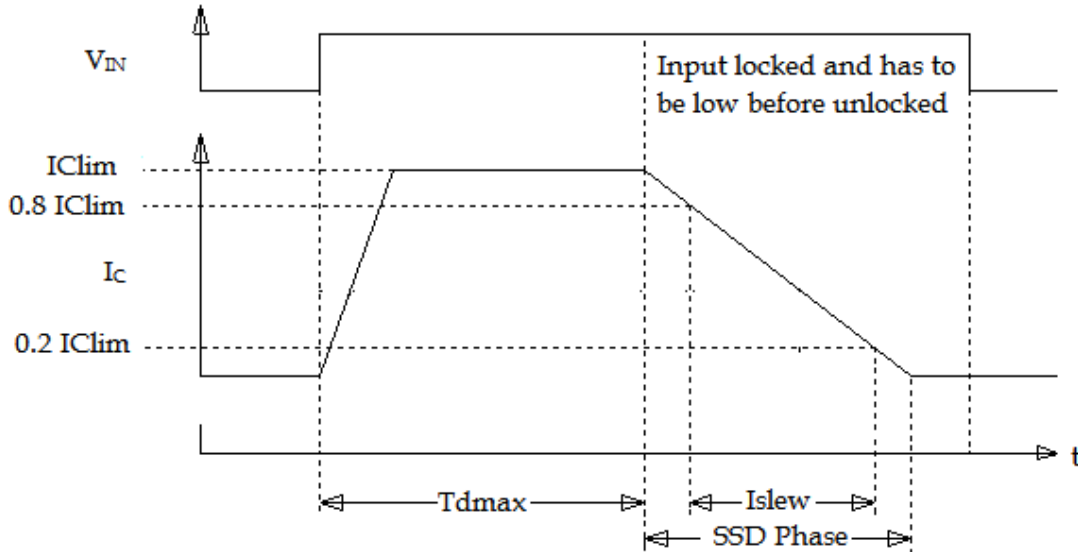


Figure 4. Dwell Time and Soft-Shut-Down

FAN1100-F085

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

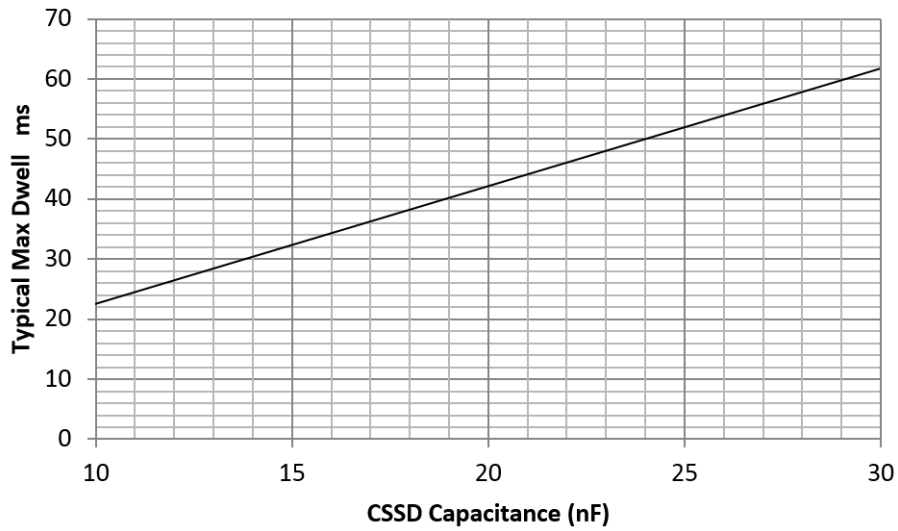


Figure 5. T_{DMAX} as Function of External CSSD Capacitor

Figure 6 shows the Signal input current vs. IRA current

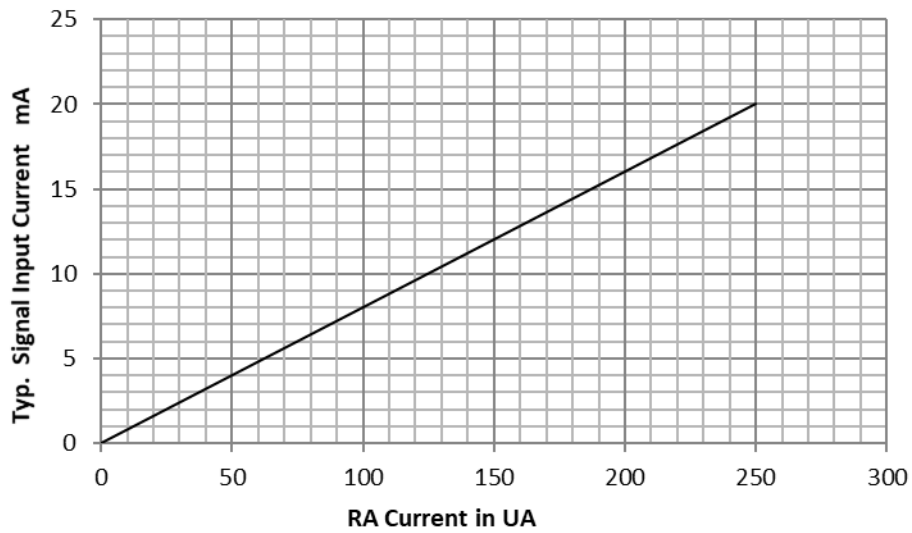


Figure 6. Interrelationship between Signal Input Current and IRA

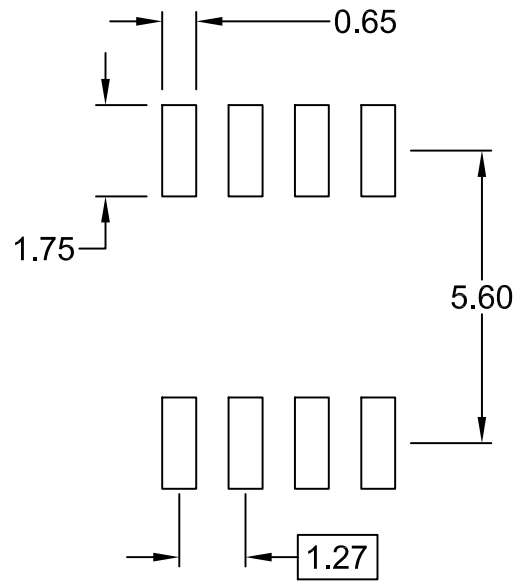
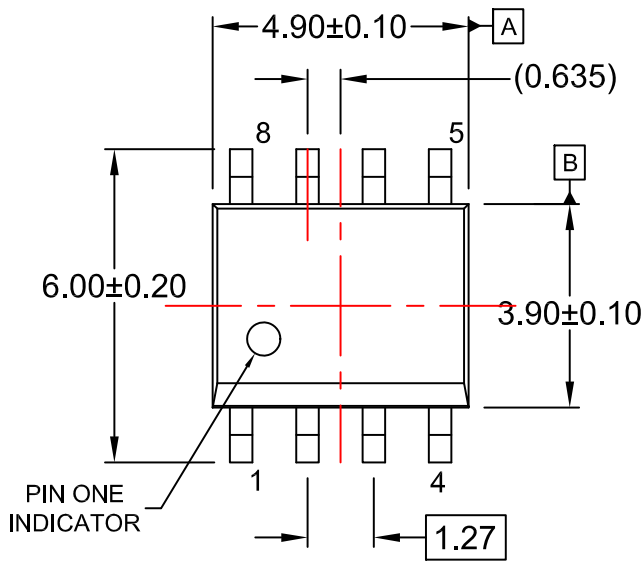
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

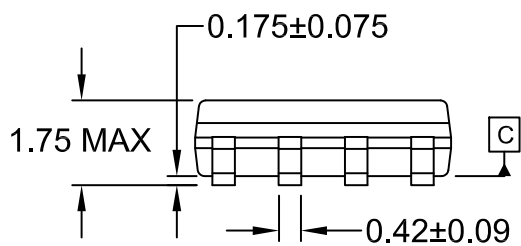


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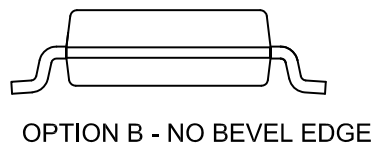
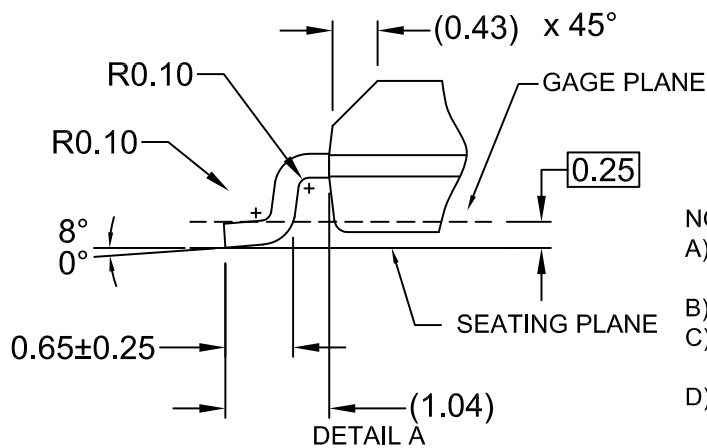
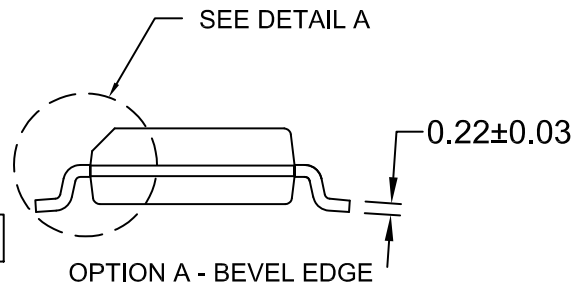
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⊕ 0.25 (M) C B A



⌒ 0.10



NOTES:

- A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AA.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE MOLD FLASH OR BURRS.
- D) LANDPATTERN STANDARD: SOIC127P600X175-8M

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