Ignition Gate Drive IC

Product Preview
FAD1100-F085

SOIC8
CASE 751EB

The FAD1100-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 FAD1100-F085 is enabled to turn on the IGBT and start charging the coil. The FAD1100-F085 will sink a current (I_{IN}) into the input pin based on programmed current on the RA line.

An input spike filter suppresses input signals of less than 13 μs in duration. A Max Dwell timer is included in the FAD1100-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 FAD1100-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 FAD1100-F085 will also limit the collector current of the IGBT to $I_{c(lim)}$ during charging. This is done through the sense resistor in the emitter leg of the Ignition IGBT developing a signal input to the V_{SENSE} pin of the FAD1100-F085.

Features

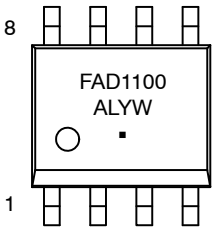
- 5 V Output Level Optimized to Drive Ignition IGBTs
- Programmable Input Current through RA Line with 13 μs Input Spike Filter
- IGBT Current Sense and Current Limit
- Configurable Maximum Dwell Time with Soft Shut Down Protection
- Operation from Ignition on Battery Line down to 6 V
- 28 V Battery Capable for Jump Start
- Over Voltage Protection
- Ground Shift Tolerance ±1.5 V
- SO8 Package or Die Sales
- AEC-Q100 Grade 0 Qualified
- This Device is Pb-Free and is RoHS Compliant

Typical Applications

- 12 V Automotive Ignition Systems

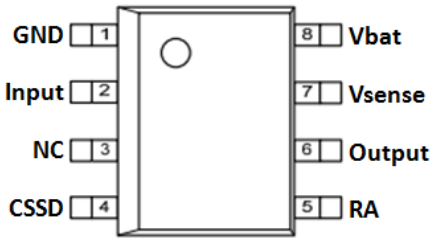
This document contains information on a product under development. **onsemi** reserves the right to change or discontinue this product without notice.

MARKING DIAGRAM



FAD1100	= Specific Device Code
AL	= Assembly Lot Code
Y	= Year
W	= Work Week
▪	= Pb-Free Package

PIN CONNECTIONS



ORDERING INFORMATION

Device	Package	Shipping†
FAD1100-F085	SOIC8 (Pb-Free)	2500 / 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	Vishay (0603 or bigger)	R	200 to 300	Ω
C_{BAT1}	Battery or Ignition voltage filtering	TDK (dielectric material X7R)	C	0.47	μF
C_{BAT}	Battery noise transients	TDK (dielectric material X7R)	C	10	nF
C_{IN}	Noise immunity	TDK (dielectric material X7R)	C	10 to 1000	pF
R_{SENSE}	Sense the collector current	Bourns (1206 or bigger)	R	20	mΩ
RB	Input resistor	Vishay 0603	R	10−200	Ω
R_{IN}	Input resistor	Vishay 0603	R	>100 kΩ, or disconnected	kΩ

Typical Application

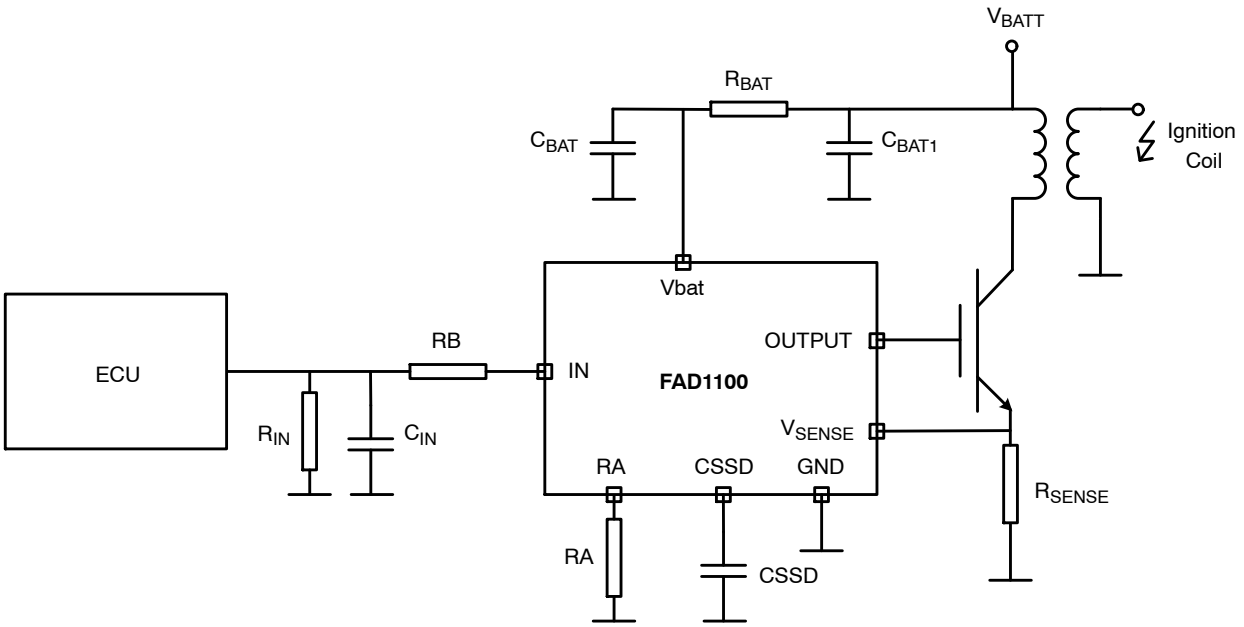


Figure 1. Typical Application Schematic

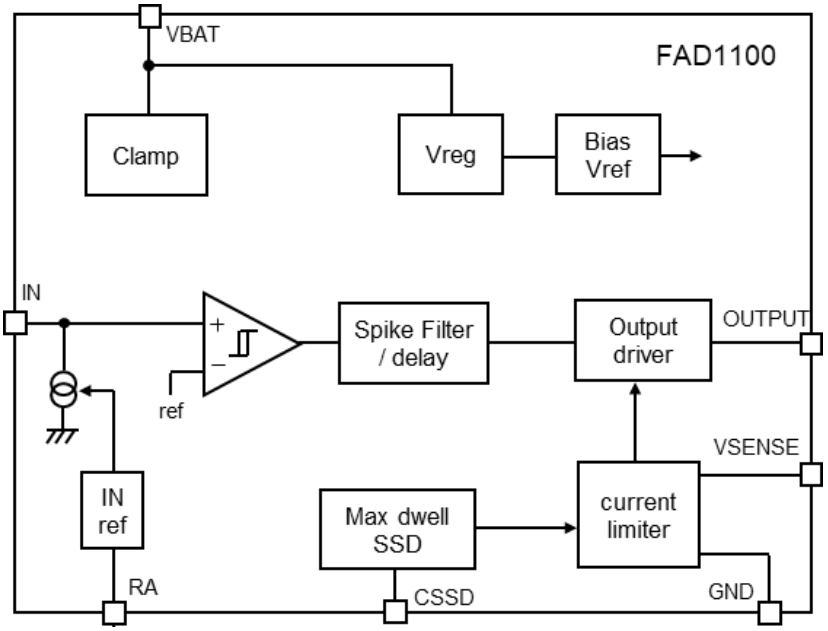


Figure 2. Simplified Block Diagram

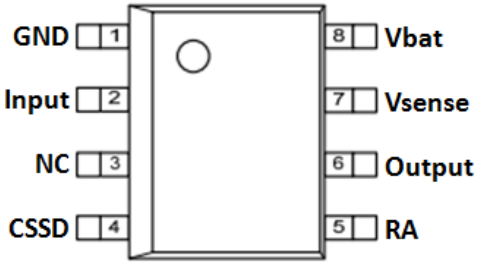


Figure 3. Pin Assignment (Top View)

PIN DESCRIPTION

Name	Type	Description
Pin1	GND	Ground Reference of the Control IC
Pin2	Input	Signal input
Pin3	NC	No Connection
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 (T_A = 25 °C unless otherwise specified)

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 and at C_{SSD}	−0.3	3.6	V
V_{OUTPUT}	Voltage at Gate Output	−0.3	6.5	V
V_{SENSE}	Voltage on V_{SENSE} pin	0	400	mV
T_A	Maximum Ambient Operating Temperature	−40	150	°C
T_{STG}	Storage Temperature Range	−55	150	°C
P_{MAX}	Maximum continuous power dissipation at T_A = 25 °C		0.625	W
$R_{\theta JA}$	Thermal Resistance Junction-to-Ambient (Note 1)		200	°C /W
ESD_{HBM}	Electrostatic Discharge Voltage Capability (Human Body Model) (Note 2)		2	kV
T_{SLD}	Lead Temperature Soldering (Note 3)		260	°C

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.

1. Refer to the following standards
   - JESD51−2: Integral circuits thermal test method environmental conditions − natural convection
   - JESD51−3: Low effective thermal conductivity test board for leaded surface mount packages
2. This device series incorporates ESD protection and is tested by the following methods
   - ESD Human Body Model tested per EIA/JESD22−A114
3. For information, please refer to our Soldering and Mounting Techniques Reference Manual, SOLDERRM/D
   - Reflow (SMD Styles Only), Pb-Free Versions

RECOMMENDED OPERATING CONDITIONS (Reference Load Characteristics) (Note 4)

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.

4. **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 °C to 150 °C (unless otherwise specified)						
V_{BAT1}	Operating voltage	Coil switching function only	4		28	V
V_{BAT2}	Operating voltage	All functions	6		28	V
I_{BAT}	Supply current	T_J = 150 °C, V_{BAT} = 28 V, RA open, Input = 5 V			5	mA
V_{CLAMP}	Battery clamp voltage	I_{BAT} = 10 mA	33		40	V
SENSE PIN CONDITIONS V_{BAT} = 6 to 28 V ; T_J = −40 °C to 150 °C (unless otherwise specified)						
V_{LIMIT}	Sense Voltage threshold at current limit	V_{BAT} > 8 V	185		215	mV
		6 V < V_{BAT} < 8 V	170			
I_{SENSE}	Current sourced out of V_{SENSE} pin			50	70	μA
T_{SPIKE}	Input spike filter	Delay on rising and falling edge of Input		13		μs
T_{ON}	Turn on delay time	50% at the input to 10% change at the output		15		μs
T_{OFF}	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 °C to + 150 °C (unless otherwise specified)						
V_{INL}	Input low voltage		1.2	1.5		V
V_{INH}	Input high voltage			1.8	2.0	V
V_{INHys}	Input voltage hysteresis			0.3		V
I_{IN}	Input current (see Figure 6)	R_A = 200 kΩ		0.5		mA
		R_A = 5.2 kΩ		15		mA
GATE OUTPUT VOLTAGE MAX V_{BAT} = 6 to 28 V; T_J = −40 °C to 150 °C (unless otherwise specified)						
$V_{OUTPUT(MAX)}$	Max Gate Output Voltage	16 KΩ pulldown resistor	4.5	5.25	6	V
$V_{OUTPUT(LOW)}$	Min Gate Output Voltage	(0 mA < I_{GATE} < 0.4 mA at T_A = 25 °C)	0.0		0.4	V
DIAGNOSTIC FUNCTIONS AND PROTECTION V_{BAT} = 6 to 28 V ; T_J = −40 °C to 150 °C (unless otherwise specified)						
R_A	Resistor for input reference current (Figure 6)		5.2		200	kΩ
$CSSD_{MIN}$	Minimum dwell time capacitor		2.3			nF
T_{DMAX}	Maximum dwell time	(CSSD = 20 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 T_{DMAX}		0.75	1.0	1.25	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.

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 FAD1100-F085 is in SSD (Soft Shut Down) 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 Tspike 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_{DMAX}, 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 FGD3040G2 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 pin is shorted to ground, the maximum dwell time and SSD functions will be disabled. For CSSD capacitor smaller than 2.3 nF the maximum dwell time and SSD functions might be disabled and cannot be guaranteed.

For CSSD capacitor above 2.3 nF, the maximum dwell time is active.

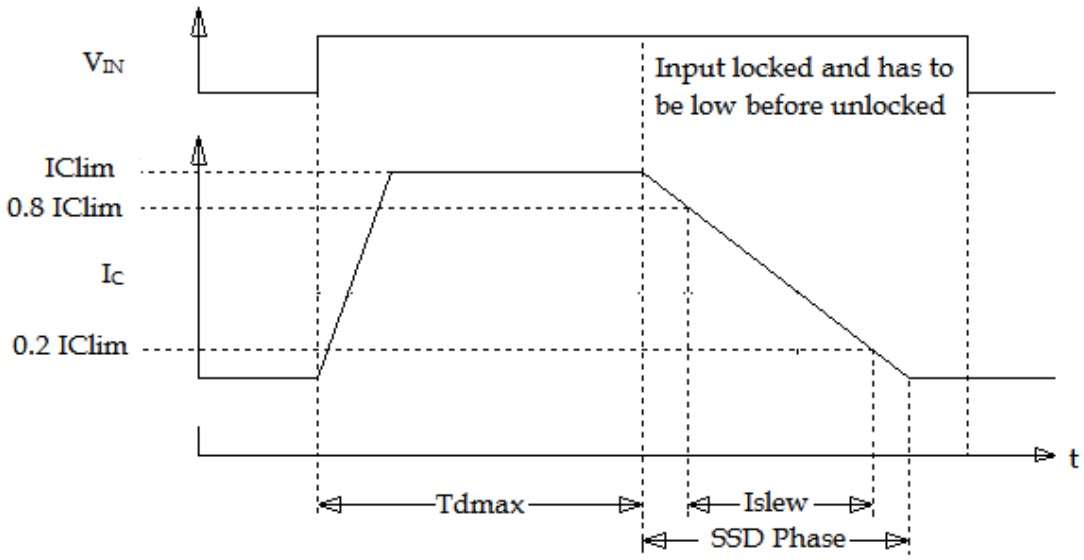


Figure 4. Dwell Time and Soft-Shut-Down

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

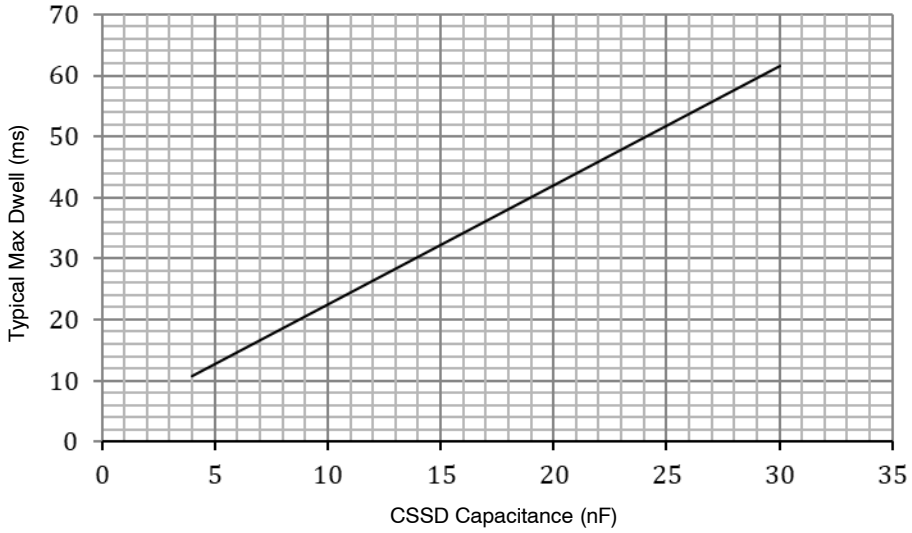


Figure 5. T_{DMAX} as Function of External CSSD Capacitor

Figure 6 shows the Signal input current vs. RA resistance

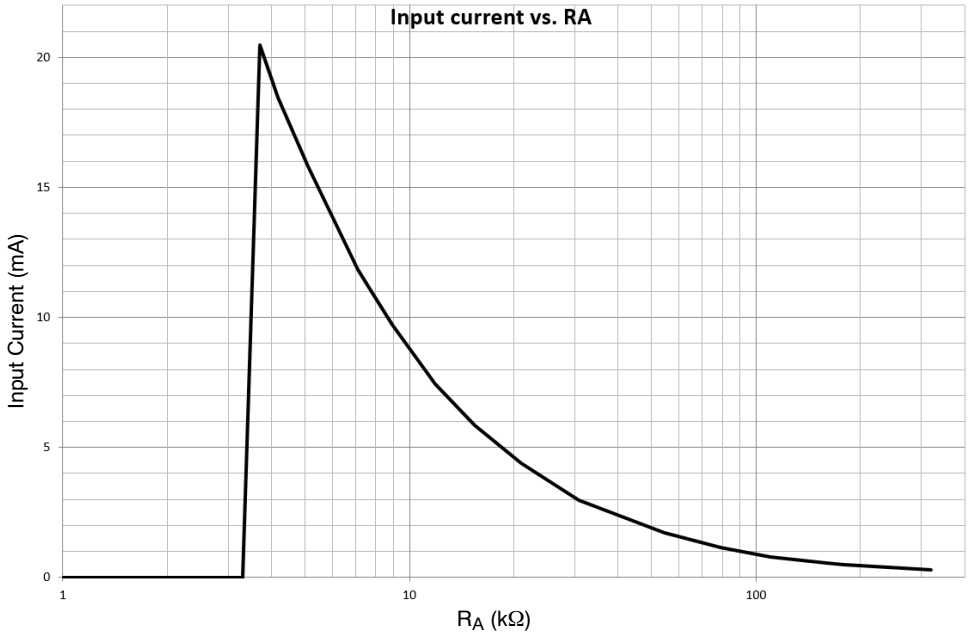


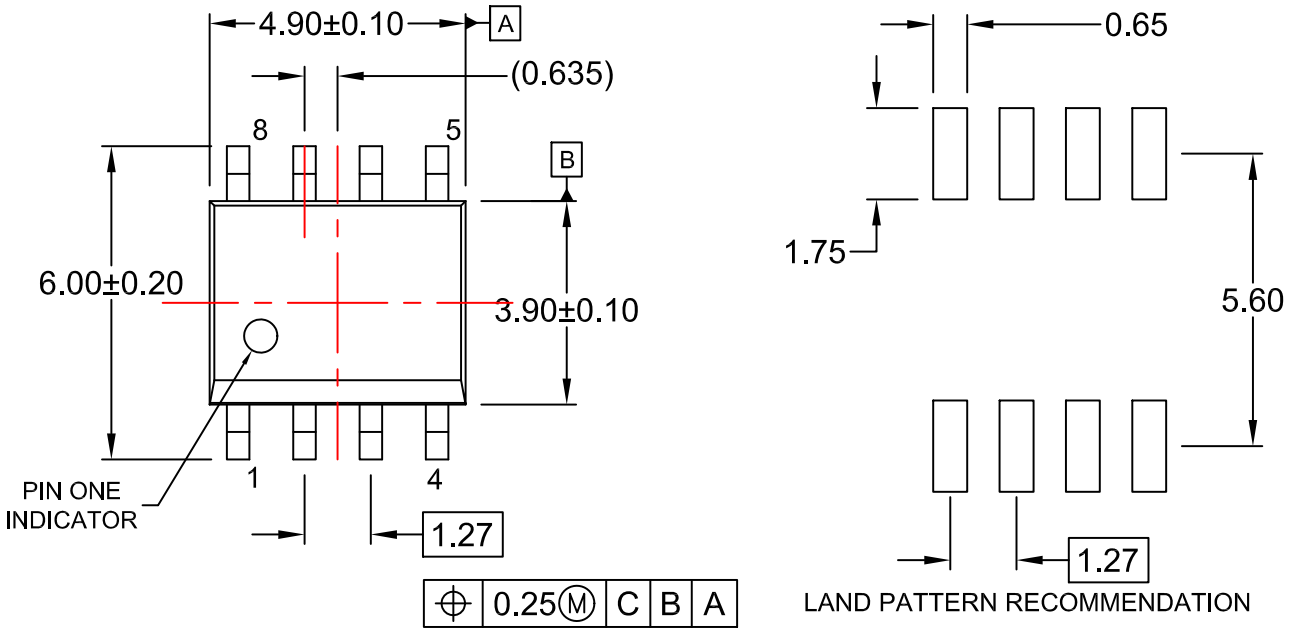
Figure 6. Relationship between Signal Input Current and RA Resistance

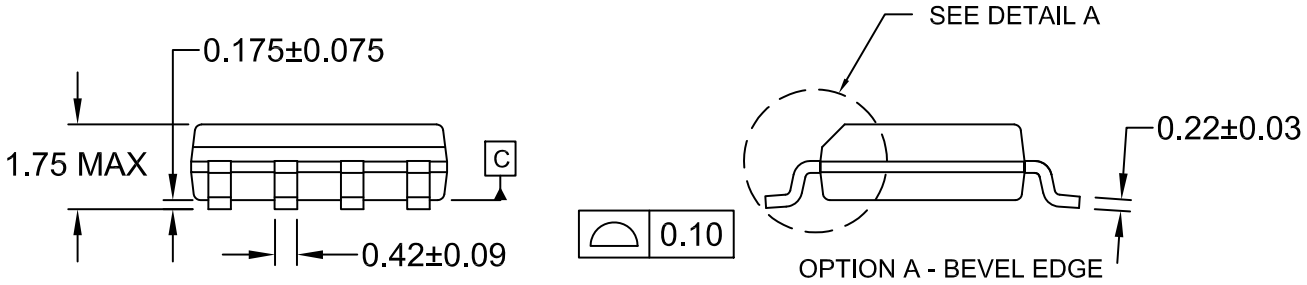
REVISION HISTORY

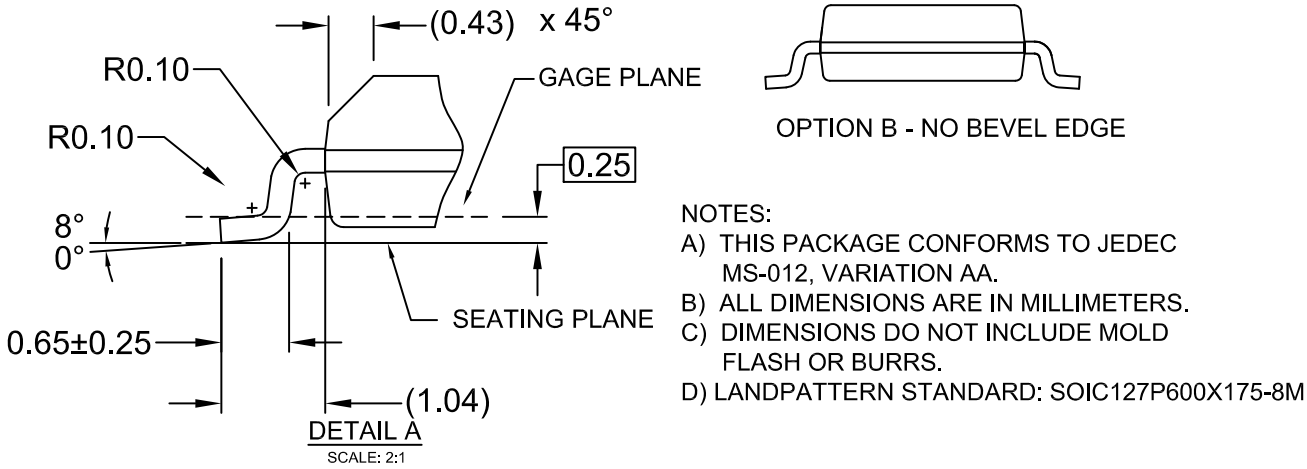
Revision	Description of Changes	Date
P0	Initial document version release.	7/15/2025

PACKAGE DIMENSIONS

SOIC8
CASE 751EB
ISSUE A







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

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical−documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support
For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales

◊