Ignition Gate Driver IC

Preliminary Document

FAD1101A-F085

SOIC8
CASE 751EB

The FAD1101A-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 FAD1101A-F085 is enabled to turn on the IGBT and start charging the coil.

An input spike filter suppresses input signals of less then 13 μs in duration. A Max Dwell timer is included in the FAD1101A-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 Max dwell pin. When the Max Dwell timer is exceeded, the FAD1101A-F085 will enter a Hard-Shut-Down mode quickly shutting off the collector current. The FAD1101A-F085 will also limit the collector current of the IGBT to Ic(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 FAD1101A-F085. The collector current level is relayed to the ECU via a current flag output.

Features

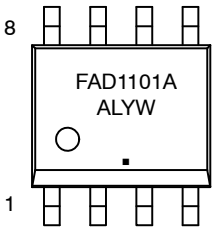
- Signal Line Input Buffer
- Input Spike Filter
- Ground Shift Tolerance ±1.5 V
- Programmable Maximum Dwell Time
- Current Flag Output
- Control IGBT Current Limiting through Vsense Pin
- Hard Shutdown following Max Dwell Time Out
- This Device is Pb-Free and is RoHS Compliant

Typical Applications

- Switch on Coil

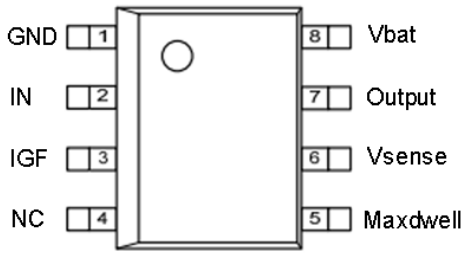
This Preliminary document is for informational purposes only. **onsemi** may update or withdraw it without notice. Content and referenced products are under development and subject to change.

MARKING DIAGRAM



FAD1101A	= Specific Device Code
AL	= Assembly Lot Code
Y	= Year
W	= Work Week
▪	= Pb-Free Package

PIN CONNECTIONS



ORDERING INFORMATION

Device	Package	Shipping†
FAD1101A-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

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	100	nF
C_{IN}	Noise immunity		C	10	nF
C_{IGF}	Noise filter		C	10	nF
R_{SENSE}	Sense the collector current		R	18	mΩ

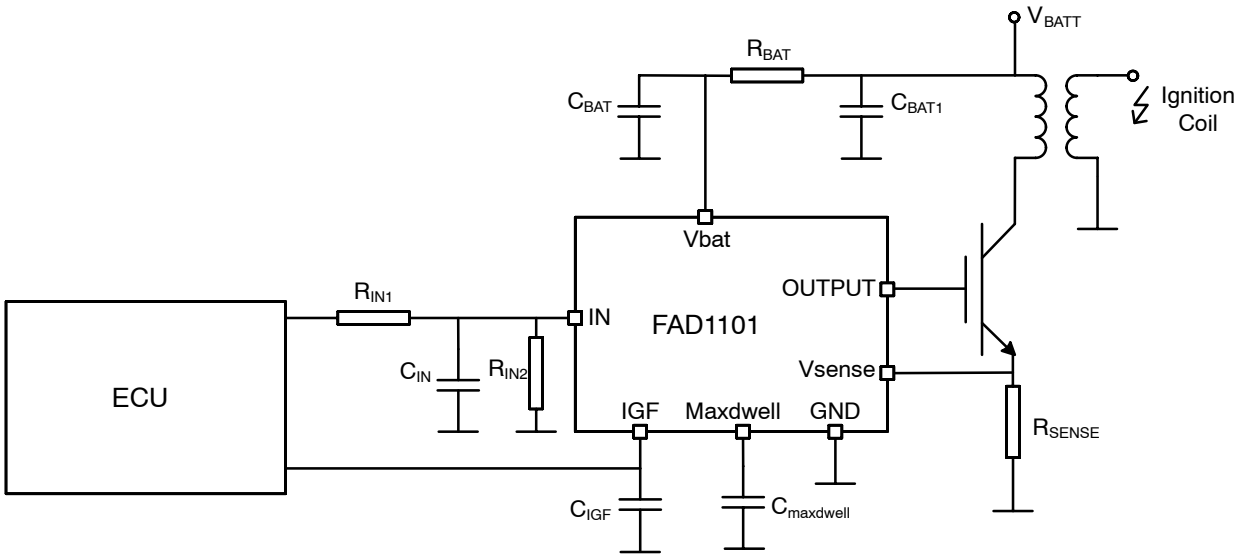


Figure 1. Typical Application Schematic

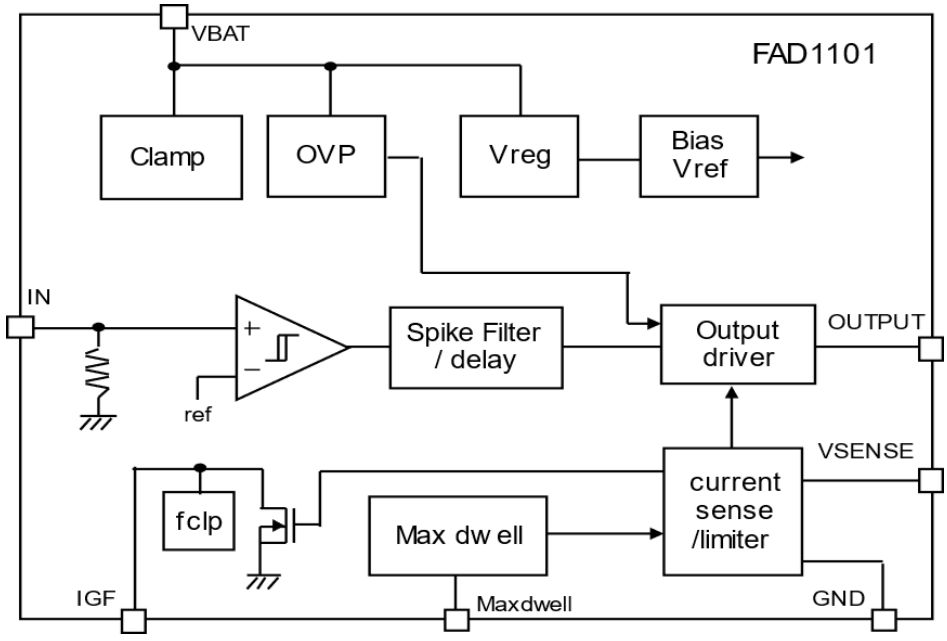


Figure 2. Simplified Block Diagram

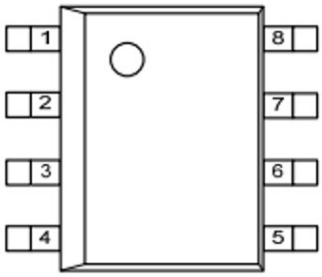


Figure 3. Pin Assignment (Top View)

PIN DESCRIPTION

Name	Type	Description
Pin1	GND	Ground reference of the IC
Pin2	IN	Input signal
Pin3	IGF	Collector Current Flag diagnosis and feedback signal
Pin4	NC	Connect to GND or floating
Pin5	Maxdwell	External Maxdwell cap to adjust the Maxdwell time
Pin6	V_{SENSE}	Sense Input used for Ilim function
Pin7	Output	Gate Drive to the IGBT
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
$V_{Maxdwell}$	Voltage at Maxdwell and Output pins	−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

Symbol	Characteristic	Min.	Typ.	Max.	Unit
V_{BAT}	Voltage at Vbat pin		14		V
V_{IN}	Voltage at Input pin		5		V
V_{IGF}	Voltage at IGF pin		5		V
Freq	Operating frequency			200	Hz
Rload	Load Resistance (for delay time measurements)		16		kΩ

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.

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, 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
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	1.7	V
V_{INH}	Input high voltage		1.5	1.8	2.0	V
V_{INHys}	Input voltage hysteresis			0.3		V
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
R_{IN}	Input Impedance	V_{IN} = 0 to 5 V	260	350	440	Ω
		V_{IN} = 0 to 6 V	250		450	
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
IGF V_{BAT} = 6 to 28 V; T_J = −40 °C to 150 °C (unless otherwise specified)						
VGF_H	Collector Current flag High Sense Trigger Voltage		87	104	115	mV
VGF_L	Collector Current flag Low Sense Trigger Voltage		34	47	65	mV
IGF_H	Collector Current flag High	Sense Resistor 18 mΩ (resistance tolerance not included)	4.8	5.8	6.4	A
IGF_L	Collector Current flag Low	Sense Resistor 18 mΩ (resistance tolerance not included)	1.9	2.6	3.6	A
V_{FCLAMP}	Flag Clamp Voltage	I = 12 mA		25		V
R_{FCLAMP}	Flag Clamp Resistance	Flag = 1 V	30		60	Ω

ELECTRICAL CHARACTERISTICS (continued)

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
DIAGNOSTIC FUNCTIONS AND PROTECTION V_{BAT} = 6 to 28 V ; T_J = −40 °C to 150 °C (unless otherwise specified)						
$Cmaxd_{MIN}$	Minimum dwell time capacitor		2.3			nF
T_{DMAX}	Maximum dwell time	$C_{maxdwell}$ = 47 nF	50	94	130	ms
$I_{maxdwell}$	Maxdwell Pin current for T_{DMAX}		0.75	1.0	1.25	μA
V_{OVS}	Over voltage shutdown		29		35	V
T_{OVD}	Over voltage shutdown delay			13		μs

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 FAD1101A-F085 is in Maxdwell mode, the input signal control is disabled. After an Maxdwell 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.

Flag Output

The current sensing flag function communicates the IGBT collector current value to the main engine control device. The flag pin is an open drain output and requires an external pull up impedance to a nominal 5.0 V supply. Like the signal pin it has a protection clamp circuit which allows the flag to go up to 16 V before being activated.

A collector low and collector high current is detected and signaled at the flag pin. When the input is first enabled the flag pin is in a tri-state condition (or off). When the collector current reaches the specified low value the flag is enabled and goes low. The flag remains low until the collector current reaches the Collector high value at which time the flag is placed back in the tri-state condition (Figure 4).

Maximum Dwell Time and Hard-Shutdown (HSD)

When the IGBT is turned on, a delay timer, dependent on the value of the external Maxdwell capacitor, is started. If a valid falling edge has not been received after the time T_{DMAX}, the IGBT will be turned off. The IGBT cannot be subsequently turned on until a valid rising edge is detected (Figure 5). If the Maxdwell capacitor has a value of < 2.3 nF or the Maxdwell pin is shorted to ground, the maximum dwell time functions will be disabled.

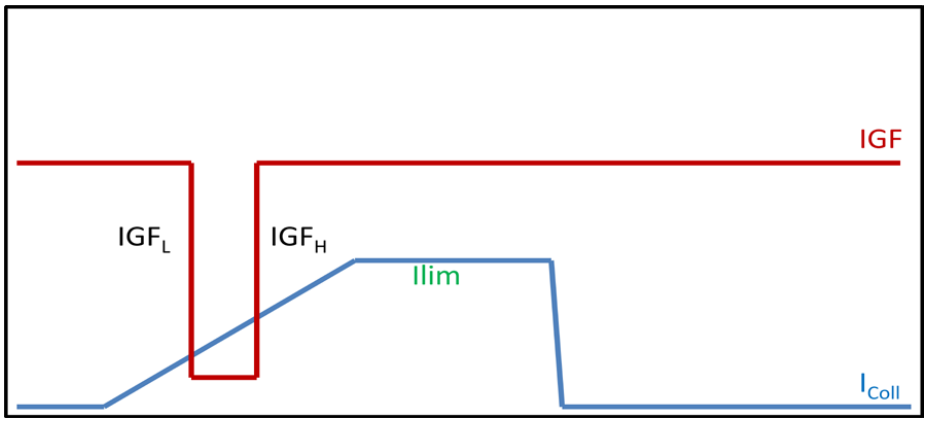


Figure 4. Current Limit and Flag Operation

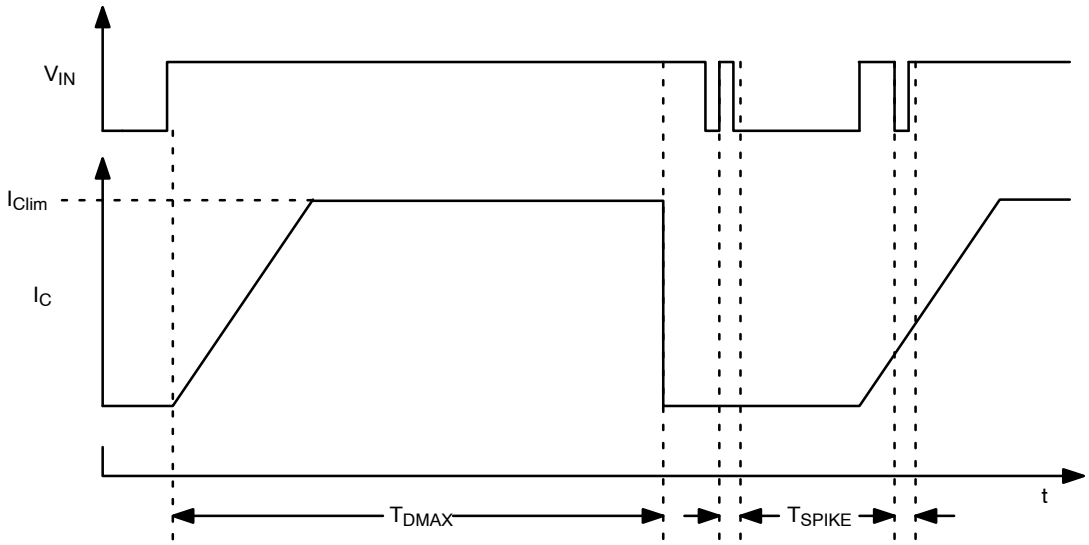


Figure 5. Dwell Time and Hard-Shutdown

Figure 6 shows the Relationship between the Maxdwell capacitor and Max Dwell Time

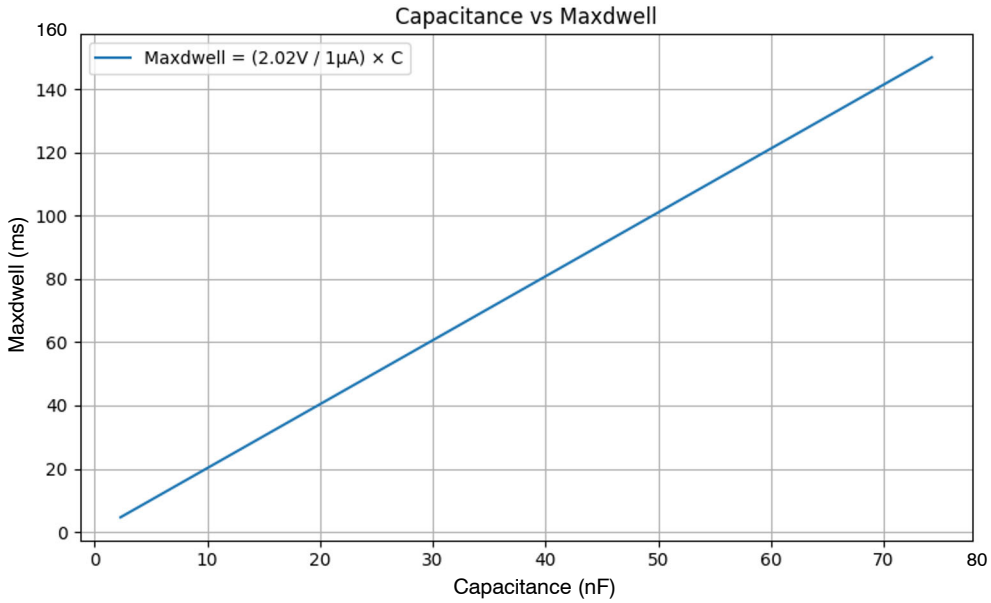


Figure 6. T_{DMAX} as Function of External Maxdwell Capacitor

Over Voltage Protection

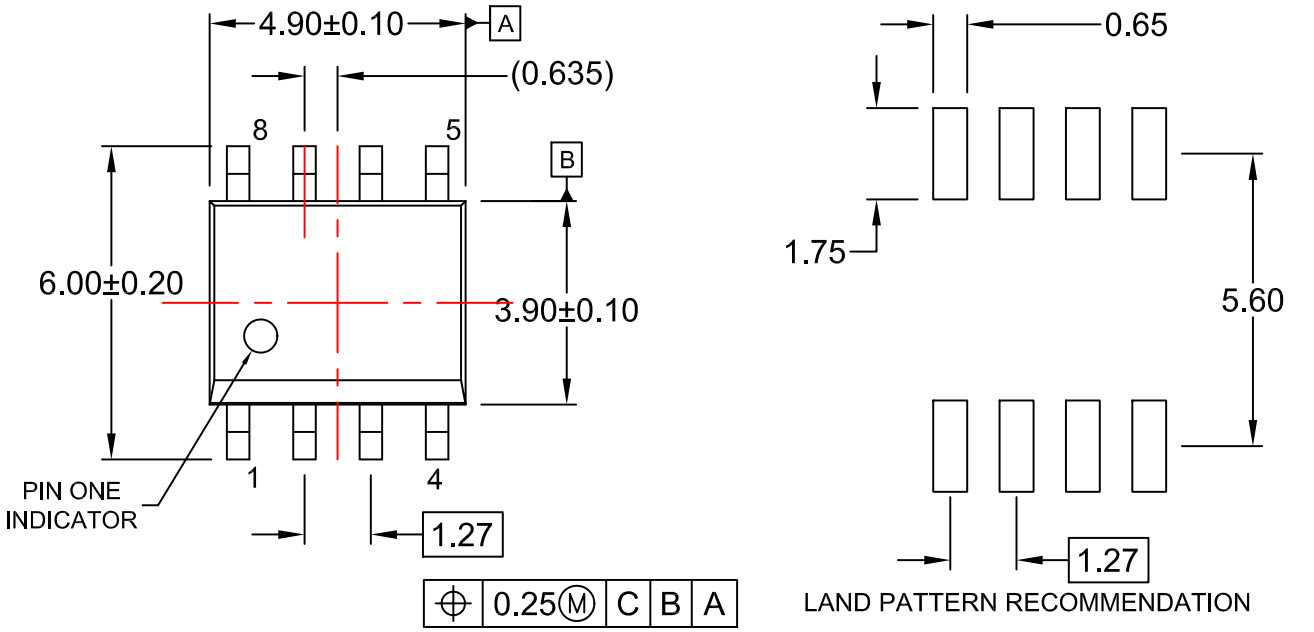
To protect the coil and the IGBT from stress due to over voltage at the battery line, the driver IC hard turns off its gate output if the battery voltage remains above the Over Voltage Shutdown threshold for longer than T_{OVD} (typ. 13 µs).

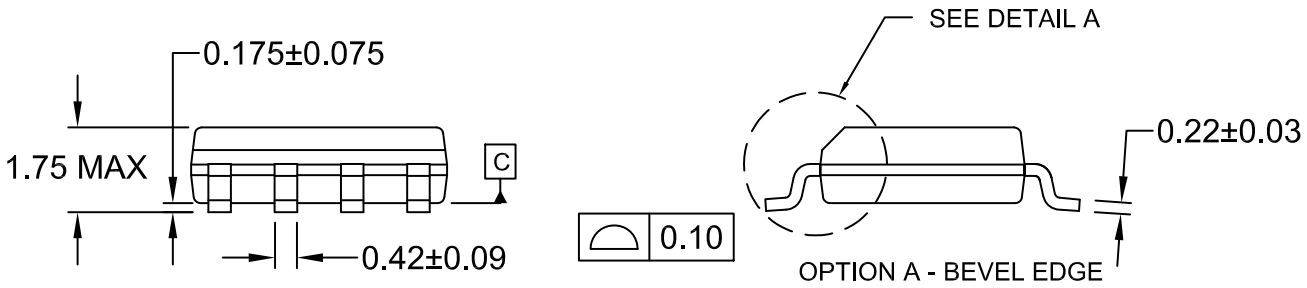
REVISION HISTORY

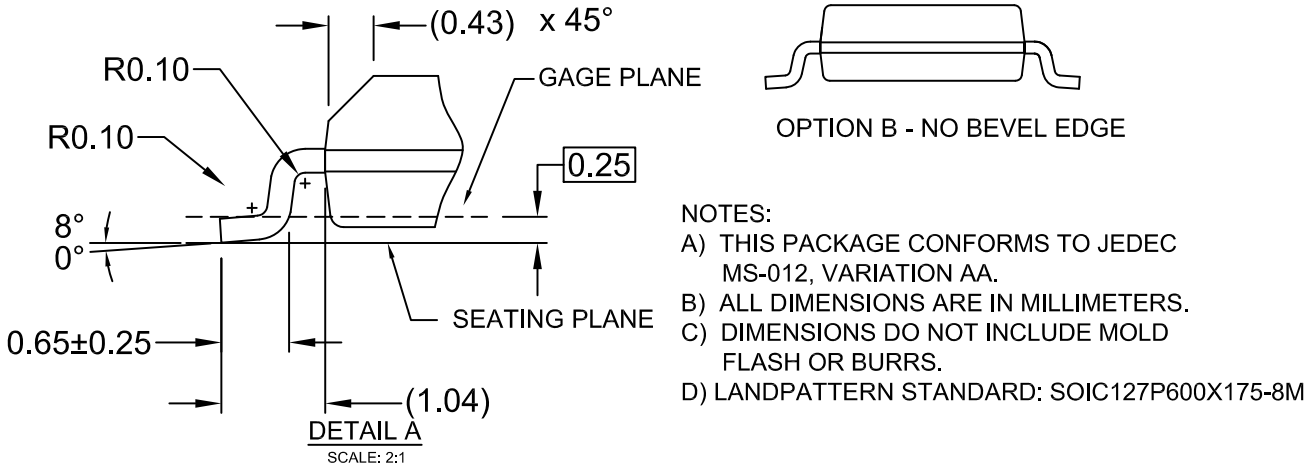
Revision	Description of Changes	Date
P0	Initial Preliminary document release.	10/22/2025

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

◊