Advance Info

# TF2104A

## Half-Bridge Gate Driver

TELEFUNKEN Semiconductors

## Features

- **Floating high-side driver in bootstrap operation to 600V**
- **Drives two N-channel MOSFETs or IGBTs in a half bridge configuration**
- **210mA source/360mA sink output current capability**
- **Outputs tolerant to negative transients**
- **Internal dead time of 520ns to protect MOSFETs**
- **Wide low side gate driver supply voltage: 10V to 20V**
- **Logic input (IN and SD*) 3.3V capability**
- **Schmitt triggered logic inputs**
- **Undervoltage lockout for $V_{CC}$ (logic and low side supply)**
- **Extended temperature range: -40°C to +125°C**

## Description

The TF2104A is a high voltage, high speed gate driver capable of driving N-channel MOSFETs and IGBTs in a half bridge configuration. Telefunken's high voltage process enables the TF2104A's high side to switch to 600V in a bootstrap operation.

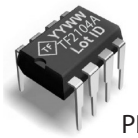
The TF2104A logic inputs are compatible with standard TTL and CMOS levels (down to 3.3V) to interface easily with controlling devices. The driver outputs feature high pulse current buffers designed for minimum driver cross conduction. TF2104A has a fixed internal deadtime of 520ns (typical).

The TF2104A is offered in PDIP-8 and SOIC-8(N) packages and operate over an extended -40 °C to +125 °C temperature range.

## Applications

- DC-DC Converters
- AC-DC Inverters
- Motor Controls
- Class D Power Amplifiers

SOIC-8(N)

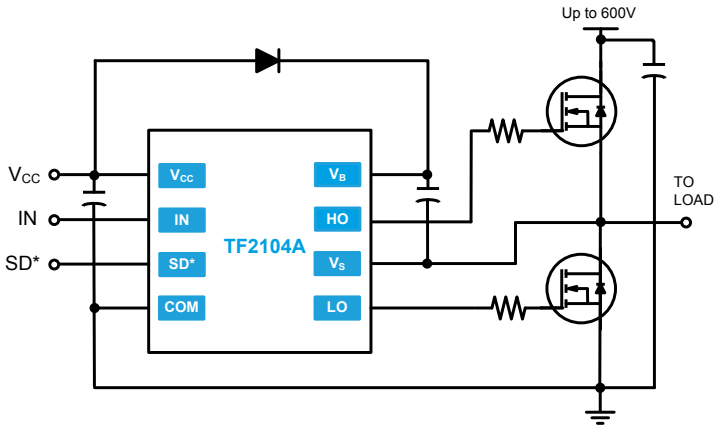

PDIP-8

## Ordering Information

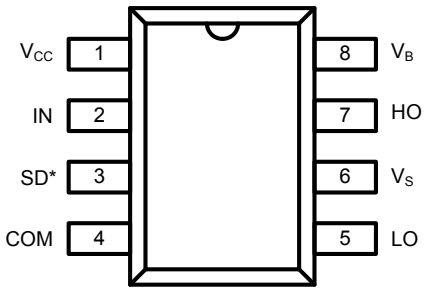
Year Year Week Week

| PART NUMBER | PACKAGE | PACK / Qty | MARK |
|---|---|---|---|
| TF2104A-3AS | PDIP-8 | Tube / 50 | TF YYWW TF2104 Lot ID |
| TF2104A-TAU | SOIC-8(N) | Tube / 100 | TF YYWW TF2104 Lot ID |
| TF2104A -TAH | SOIC-8(N) | T&R / 2500 | |

## Typical Application



## Pin Diagrams



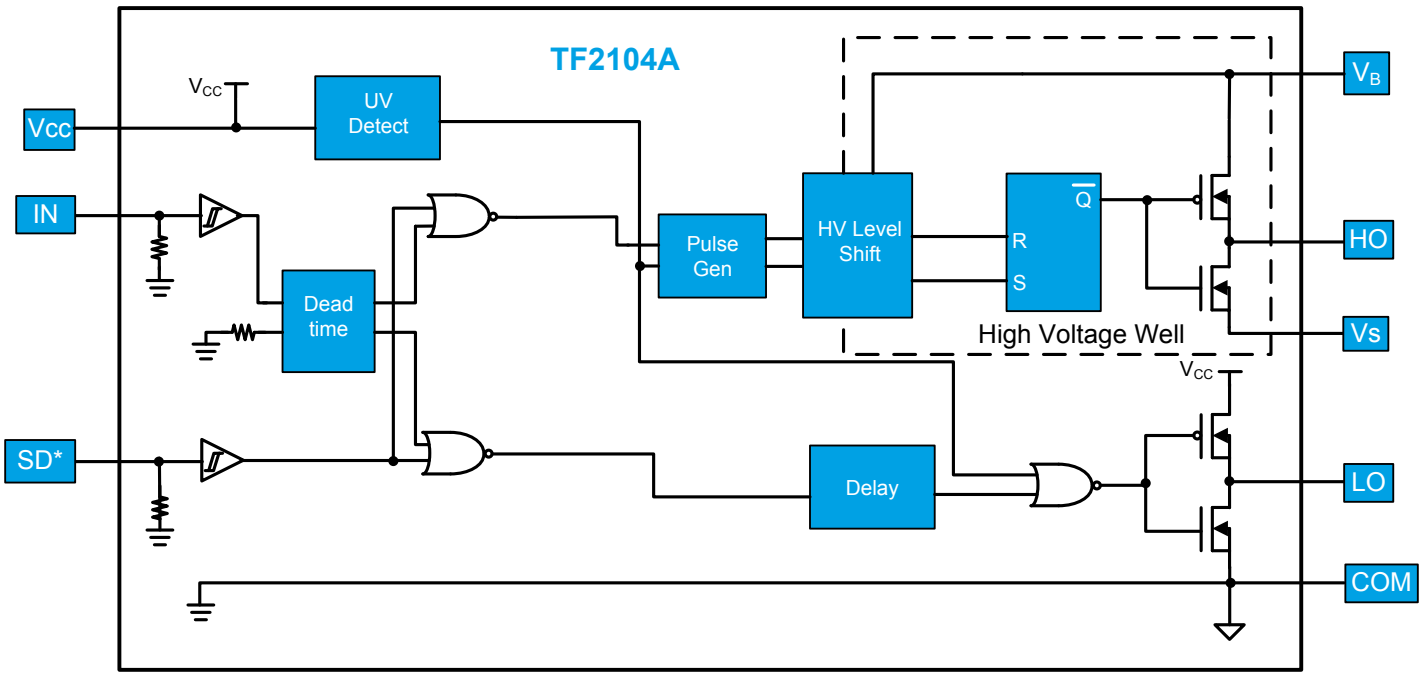

**Top View:** PDIP-8, SOIC-8

**TF2104A**

## Pin Descriptions

| PIN NAME | PIN NUMBER | PIN DESCRIPTION |
|---|---|---|
| $V_{CC}$ | 1 | Logic and low side supply |
| IN | 2 | Logic input for high-side and low-side gate driver outputs (HO and LO), in phase with HO |
| SD* | 3 | Logic input for shutdown, enabled low |
| COM | 4 | Low-side and logic return |
| LO | 5 | Low-side gate drive output |
| $V_S$ | 6 | High-side floating supply return |
| HO | 7 | High-side gate drive output |
| $V_B$ | 8 | High-side floating supply |

## Functional Block Diagram



## Absolute Maximum Ratings *(NOTE1)*

$V_B$ - High side floating supply voltage.....-0.3V to +624V
$V_S$ - High side floating supply offset voltage....$V_B$-24V to $V_B$+0.3V
$V_{HO}$ - High side floating output voltage.....$V_S$-0.3V to $V_B$+0.3V
$dV_S/dt$ - Offset supply voltage transient.....50 V/ns

$V_{CC}$ - Low-side fixed supply voltage.....-0.3V to +24V
$V_{LO}$ - Low-side output voltage.....-0.3V to $V_{CC}$ +0.3V
$V_{IN}$ - Logic input voltage (IN and SD*).....-0.3V to $V_{CC}$ +0.3V

***NOTE1*** *Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.*

$P_D$ - Package power dissipation at $T_A \leq 25$ °C
SOIC-8.....0.625W
PDIP-8.....1.0W

SOIC-8(N) Thermal Resistance ***(NOTE2)***
$\theta_{JA}$.....200 °C/W
PDIP-8 Thermal Resistance ***(NOTE2)***
$\theta_{JA}$.....125 °C/W

$T_J$ - Junction operating temperature.....+150 °C
$T_L$ - Lead Temperature (soldering, 10 seconds).....+300 °C
$T_{stg}$ - Storage temerature .....-55 to 150 °C

***NOTE2*** *Thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.*

## Recommended Operating Conditions

| Symbol | Parameter | MIN | MAX | Unit |
|---|---|---|---|---|
| $V_B$ | High side floating supply absolute voltage | $V_S$ + 10 | $V_S$ + 20 | V |
| $V_S$ | High side floating supply offset voltage | ***NOTE3*** | 600 | V |
| $V_{HO}$ | High side floating output voltage | $V_S$ | $V_B$ | V |
| $V_{CC}$ | Low side fixed supply voltage | 10 | 20 | V |
| $V_{LO}$ | Low side output voltage | 0 | $V_{CC}$ | V |
| $V_{IN}$ | Logic input voltage (IN and SD*) | 0 | $V_{CC}$ | V |
| $T_A$ | Ambient temperature | -40 | 125 | °C |

***NOTE3*** *Logic operational for $V_S$ of -5V to +600V. Logic state held for $V_S$ of -5V to $-V_{BS}$*

## DC Electrical Characteristics *(NOTE4)*

$V_{BIAS}$ ($V_{CC}$, $V_{BS}$) = 15V, $T_A$ = 25 °C , unless otherwise specified.

| Symbol | Parameter | Conditions | MIN | TYP | MAX | Unit |
|---|---|---|---|---|---|---|
| $V_{IH}$ | Logic "1" (IN) & Logic "0" (SD*) input voltage | $V_{CC}$ = 10V to 20V | 2.5 | | | V |
| $V_{IL}$ | Logic "0" (IN) & Logic "1" (SD*) input voltage | | | | 0.8 | |
| $V_{OH}$ | High level output voltage, $V_{BIAS}$ - $V_O$ | $I_O$ = 2mA | | 0.05 | 0.2 | |
| $V_{OL}$ | Low level output voltage, $V_O$ | $I_O$ = 2mA | | 0.02 | 0.1 | |
| $I_{LK}$ | Offset supply leakage current | VB = VS = 600V | | | 50 | µA |
| $I_{BSQ}$ | Quiescent $V_{BS}$ supply current | $V_{IN}$ = 0V or 5V | | 30 | 55 | |
| $I_{CCQ}$ | Quiescent $V_{CC}$ supply current | $V_{IN}$ = 0V or 5V | | 370 | 500 | |
| $I_{IN+}$ | Logic "1" input bias current | $V_{IN}$ = 5V, SD* = 0V | | 3 | 10 | |
| $I_{IN-}$ | Logic "0" input bias current | $V_{IN}$ = 0V, SD* = 5V | | | 5 | |
| $V_{CCUV+}$ | $V_{CC}$ supply under-voltage positive going threshold | | 8.0 | 8.9 | 9.8 | V |
| $V_{CCUV-}$ | $V_{CC}$ supply under-voltage negative going threshold | | 7.4 | 8.2 | 9.0 | |
| $I_{O+}$ | Output high short circuit pulsed current | $V_O$ = 0V, PW ≤ 10 µs | 130 | 210 | | mA |
| $I_{O-}$ | Output low short circuit pulsed current | $V_O$ = 15V, PW ≤ 10 µs | 270 | 360 | | |

***NOTE4*** *The $V_{IN}$, $V_{TH}$, and $I_{IN}$ parameters are applicable to the two logic input pins: IN and SD*. The $V_0$ and $I_0$ parameters are applicable to the respective output pins: HO and LO*

## AC Electrical Characteristics

$V_{BIAS}$ ($V_{CC}$, $V_{BS}$) = 15V, $C_L$ = 1000pF, and $T_A$ = 25 °C , unless otherwise specified.

| Symbol | Parameter | Conditions | MIN | TYP | MAX | Unit |
|---|---|---|---|---|---|---|
| $t_{on}$ | Turn-on propagation delay | $V_S$ = 0V | | 680 | 820 | ns |
| $t_{off}$ | Turn-off propagation delay | $V_S$ = 600V | | 150 | 220 | |
| $t_{SD}$ | Shutdown propagation delay | | | 160 | 220 | |
| $t_{DM}$ | Delay matching, HS & LS turn-on/turn-off | | | | 60 | |
| $t_r$ | Turn-on rise time | $V_S$ = 0V | | 100 | 170 | |
| $t_f$ | Turn-off fall time | | | 50 | 60 | |
| $t_{DT}$ | Deadtime: $t_{DT\ LO\text{-}HO}$ & $t_{DT\ HO\text{-}LO}$ | | 400 | 520 | 650 | |

## Timing Waveforms

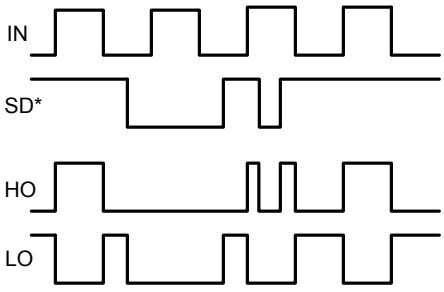



**Figure 1.** Input / Output Timing Diagram

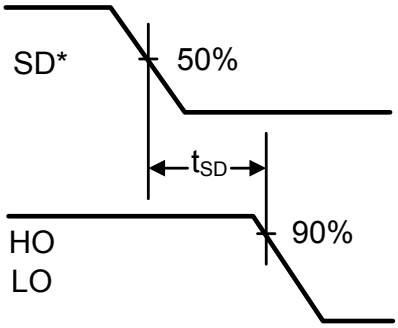
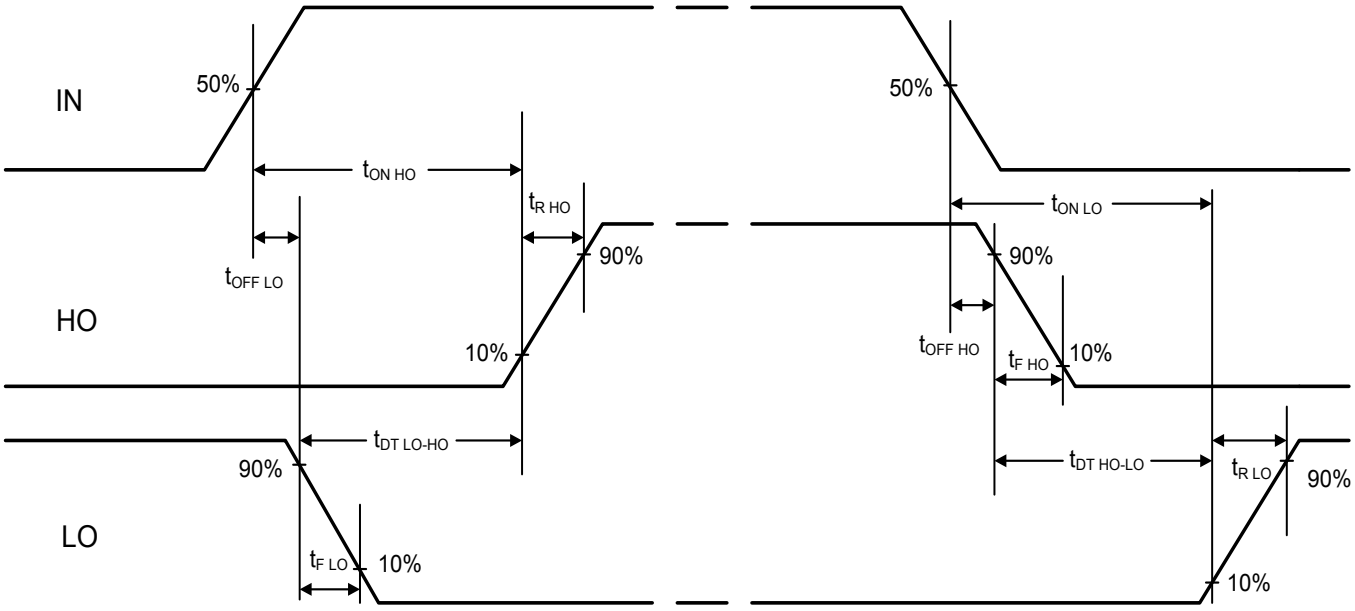



**Figure 2.** Shutdown Waveform Definition




Deadtime $t_{DT\ LO\text{-}HO} = t_{ON\ HO} - t_{OFF\ LO}$

$t_{DT\ HO\text{-}LO} = t_{ON\ LO} - t_{OFF\ HO}$

Deadtime matching

$t_{MDT} = t_{DT\ LO\text{-}HO} - t_{DT\ HO\text{-}LO}$

Delay matching

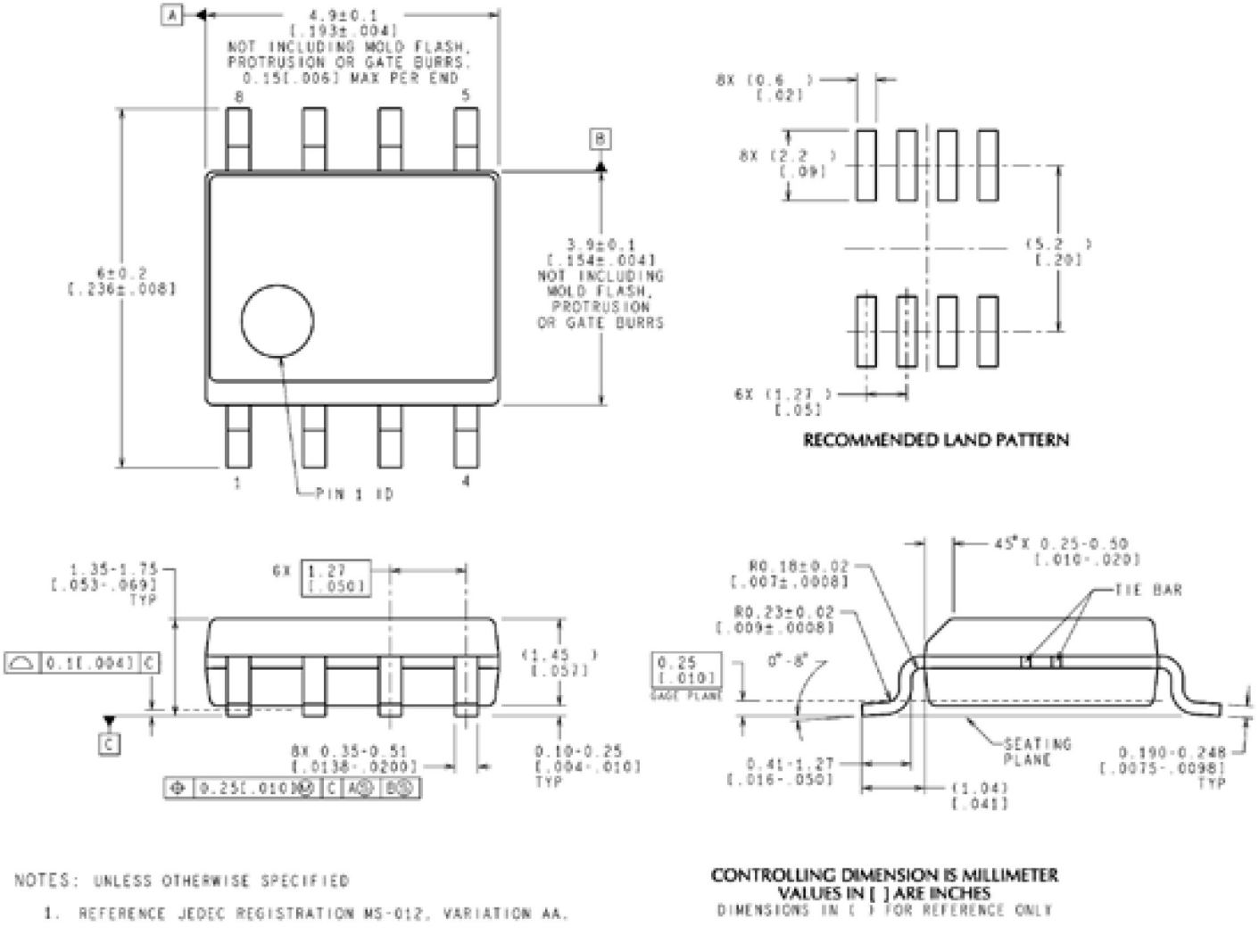
$t_{DM\ OFF} = t_{OFF\ LO} - t_{OFF\ HO}$

$t_{DM\ ON} = t_{ON\ LO} - t_{ON\ HO}$

**Figure 3.** Switching Time Waveform Definitions

# Package Dimensions (SOIC-8 N)

Please contact support@tfsemi.com for package availability.



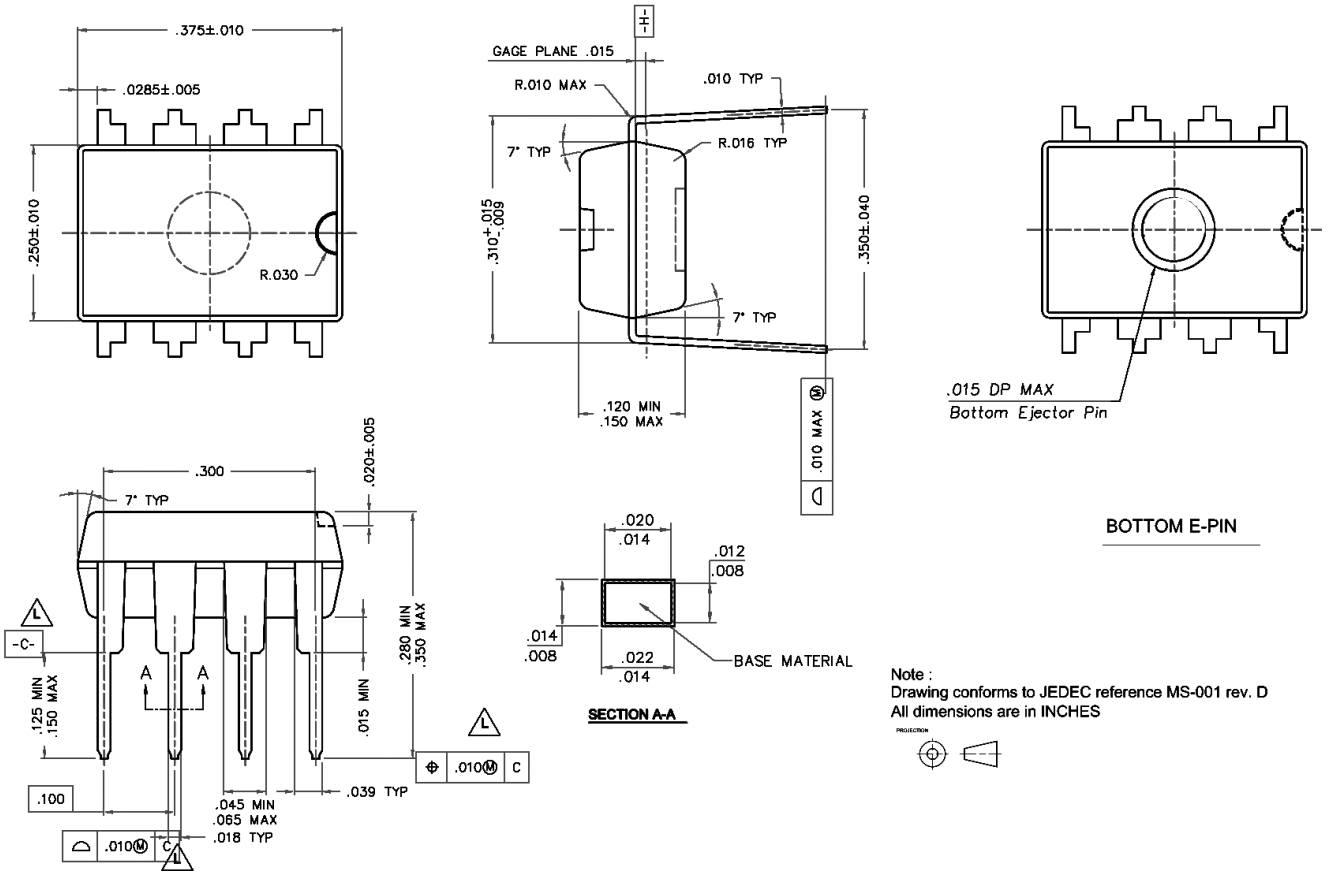

NOTES: UNLESS OTHERWISE SPECIFIED

1. REFERENCE JEDEC REGISTRATION MS-012, VARIATION AA.

CONTROLLING DIMENSION IS MILLIMETER
VALUES IN [ ] ARE INCHES
DIMENSIONS IN ( ) FOR REFERENCE ONLY

# Package Dimensions (PDIP-8)

Please contact support@tfsemi.com for package availability.



## Notes

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