

# HFA40HF60

PD-20381E

## Ultrafast, Soft Recovery Diode Surface Mount (SMD-1) 600V, 22A

### Features

- Single diode configuration
- Reduced RFI and EMI
- Reduced snubbing
- Extensive characterization of recovery parameters
- Hermetic package
- Surface mount
- ESD Rating: Class 3B per MIL-STD-750, Method 1020

### Product Summary

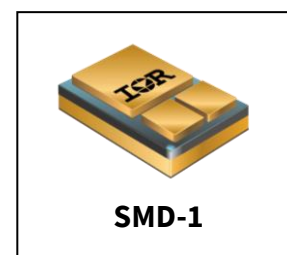
- $V_R$ : 600V
- $V_F$ : 1.75V
- $t_{rr}$ : 97ns
- $di_{(rec)M}/dt$ : 270A/ $\mu$ S

### Potential Applications

- DC-DC converter
- Motor drives

### Product Validation

Qualified according to MIL-PRF-19500 for space applications



### Description

These diodes are optimized to reduce losses and EMI/RFI in high frequency power conditioning systems. An extensive characterization of the recovery behavior for different values of current, temperature and di/dt simplifies the calculations of losses in the operating conditions. The softness of the recovery eliminates the need for a snubber in most applications. These devices are ideally suited for power converters, motor drives and other applications where switching losses are significant portion of the total losses.

### Ordering Information

**Table 1**      **Ordering options**

Part number	Package	Screening Level
HFA40HF60	SMD-1	COTS
HFA40HF60SCV	SMD-1	JANTXV-equivalent
HFA40HF60SCX	SMD-1	JANTX-equivalent
HFA40HF60SCS	SMD-1	S-level

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## FRED Ultrafast, Soft Recovery Diode

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**Absolute Maximum Ratings****1 Absolute Maximum Ratings****Table 2 Absolute Maximum Ratings**

<b>Symbol</b>	<b>Parameter</b>	<b>Value</b>	<b>Unit</b>
$V_R$	DC Reverse Voltage	600	V
$I_F$	Continuous Forward Current, $T_C = 100\text{ }^\circ\text{C}$ <sup>1</sup>	22	A
$I_{FSM}$	Single pulse Forward Current, $T_C = 25\text{ }^\circ\text{C}$ <sup>2</sup>	225	A
$P_D @ T_C = 25\text{ }^\circ\text{C}$	Maximum Power Dissipation	83	W
$T_J$ $T_{STG}$	Operating Junction and Storage Temperature Range	-55 to 150	$^\circ\text{C}$
$Wt$	Weight	2.6 (Typical)	g

<sup>1</sup> DC = 50% rect. wave<sup>2</sup> 1/2 sine wave, 60 Hz, Pulse width = 8.33 ms

## Device Characteristics

## 2 Device Characteristics

### 2.1 Electrical Characteristics

**Table 3 Electrical Characteristics @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)**

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$V_{BR}$	Cathode Anode Breakdown Voltage	600	—	—	V	$I_R = 100\mu\text{A}$
$V_F$	Forward Voltage Drop See Fig. 1	—	—	1.61	V	$I_F = 22\text{A}, T_J = -55^\circ\text{C}$
		—	1.63	1.75		$I_F = 22\text{A}, T_J = 25^\circ\text{C}$
		—	2.07	2.25		$I_F = 45\text{A}, T_J = 25^\circ\text{C}$
		—	1.52	1.64		$I_F = 22\text{A}, T_J = 125^\circ\text{C}$
$I_R$	Reverse Leakage Current See Fig. 2	—	—	10	$\mu\text{A}$	$V_R = V_R \text{ Rated}$
		—	—	1.0	$\text{mA}$	$V_R = 480\text{V}, T_J = 125^\circ\text{C}$
$C_T$	Junction Capacitance See Fig. 3	—	56	59	$\text{pF}$	$V_R = 200\text{V}, f = 1.0\text{MHz}$
$L_S$	Series Inductance	—	5.9	—	$\text{nH}$	Measured from center of cathode pad the center of anode pad

### 2.2 Dynamic Recovery Characteristics

**Table 4 Dynamic Recovery Characteristics @  $T_J = 25^\circ\text{C}$  (unless otherwise specified)**

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{rr1}$	Reverse Recovery Time See Fig. 5	—	60	97	ns	$T_J = 25^\circ\text{C}$
$t_{rr2}$		—	110	—		$T_J = 125^\circ\text{C}$
$I_{RRM1}$	Peak Recovery Current See Fig. 6	—	5.2	—	A	$T_J = 25^\circ\text{C}$
$I_{RRM2}$		—	8.5	—		$T_J = 125^\circ\text{C}$
$Q_{rr1}$	Reverse Recovery Charge See Fig. 7	—	190	—	nC	$T_J = 25^\circ\text{C}$
$Q_{rr2}$		—	560	—		$T_J = 125^\circ\text{C}$
$di_{(rec)M}/dt_1$	Peak Rate of Fall of Recovery Current During $t_b$ See Fig. 8	—	270	—	$\text{A}/\mu\text{s}$	$T_J = 25^\circ\text{C}$
$di_{(rec)M}/dt_2$		—	170	—		$T_J = 125^\circ\text{C}$

### 2.3 Thermal-Mechanical Characteristics

**Table 5 Thermal-Mechanical Characteristics**

Symbol	Parameter	Typ.	Max.	Unit
$R_{\theta JC}$	Junction to Case, Single Leg Conducting	—	1.5	$^\circ\text{C}/\text{W}$

### 3 Electrical Characteristics Curves

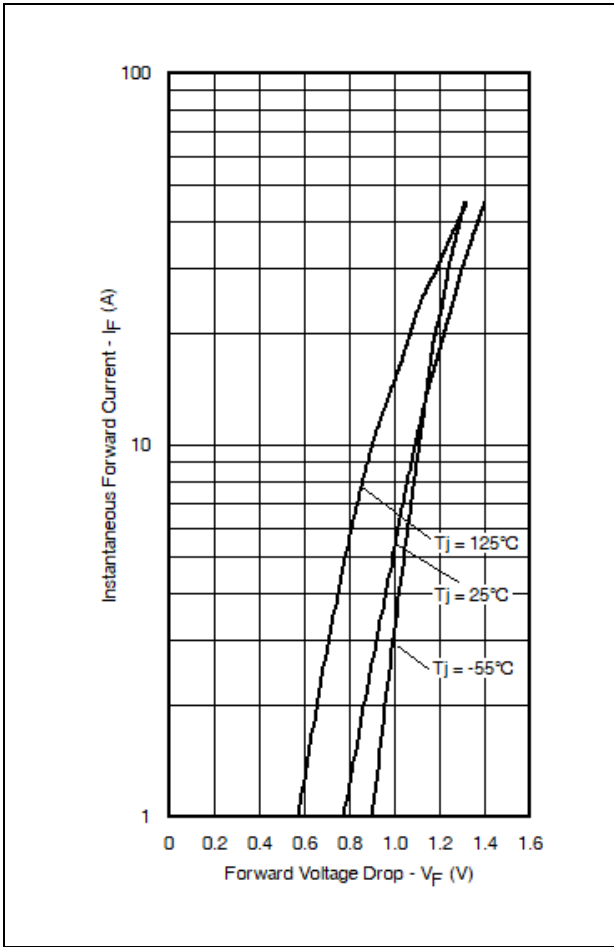


Figure 1 Maximum Forward Voltage Drop Characteristics

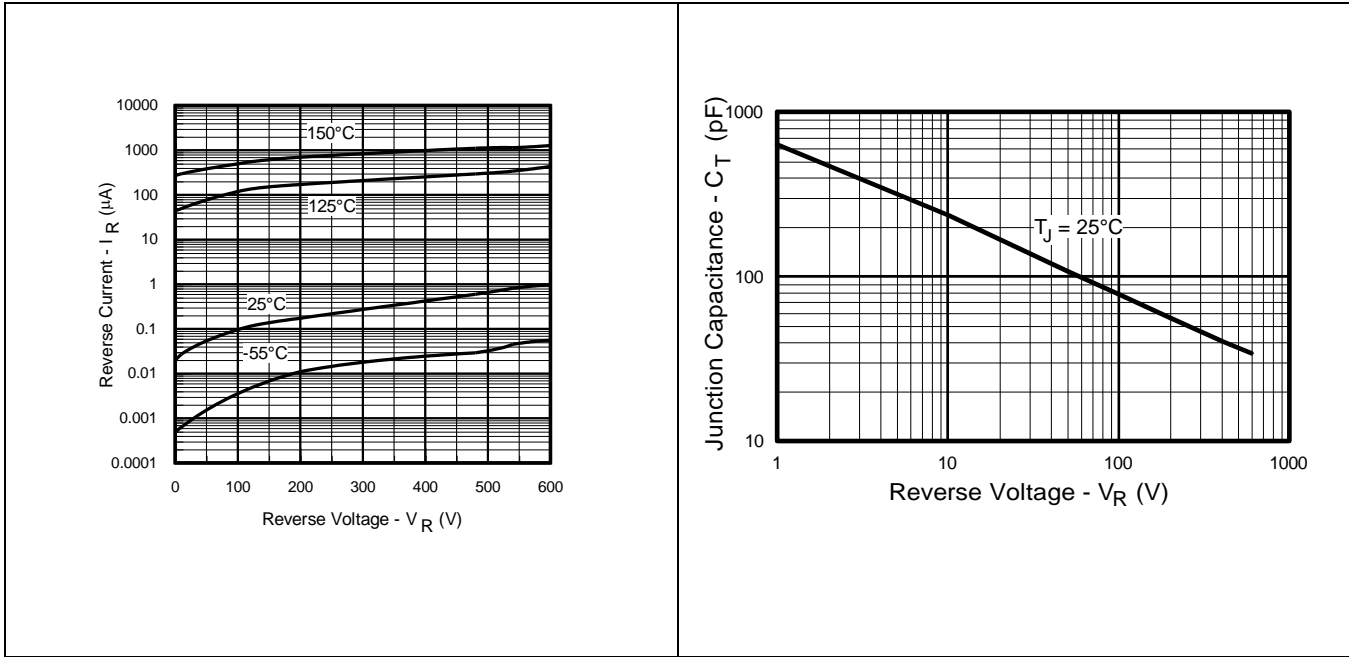
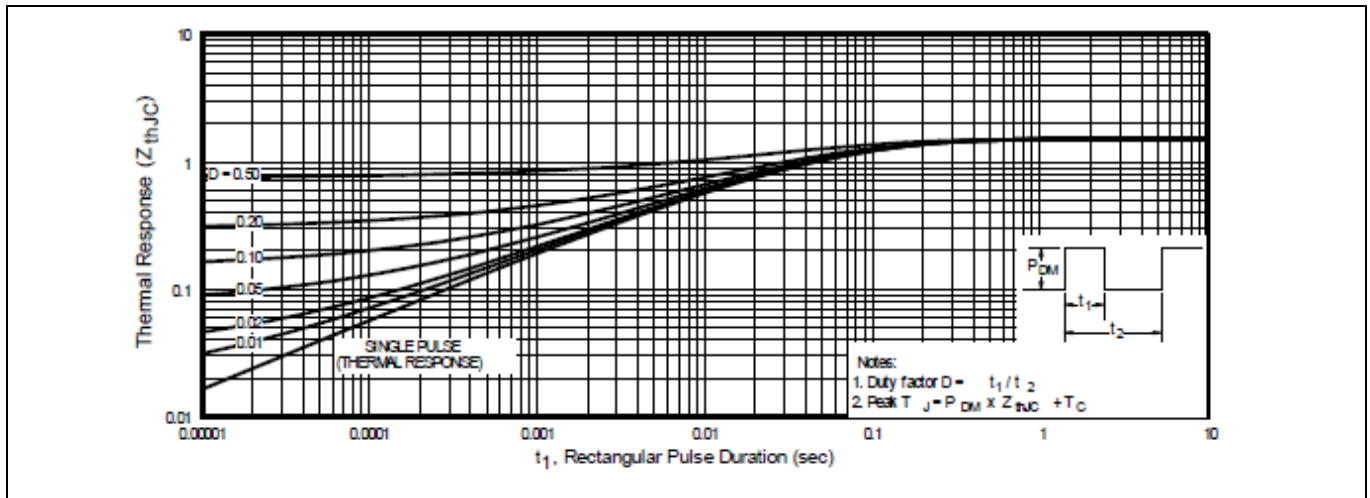


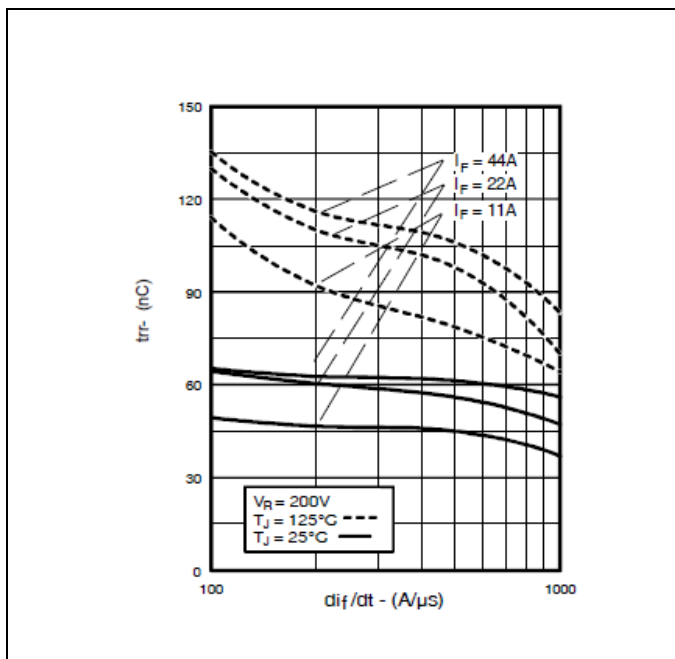
Figure 2 Typical Values of Reverse Current Vs. Reverse Voltage

Figure 3 Typical Junction Capacitance Vs. Reverse Voltage

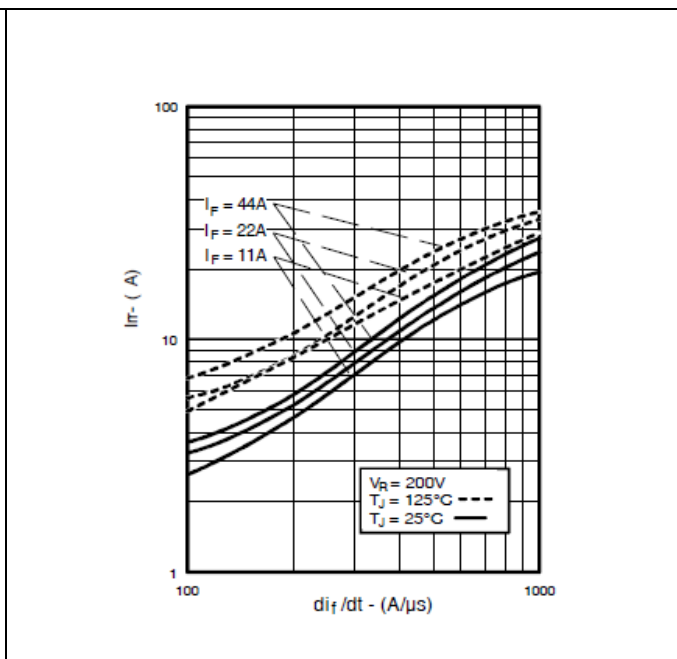
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**Electrical Characteristics Curves**



**Figure 4** Maximum Thermal Impedance  $Z_{thJC}$  Characteristics



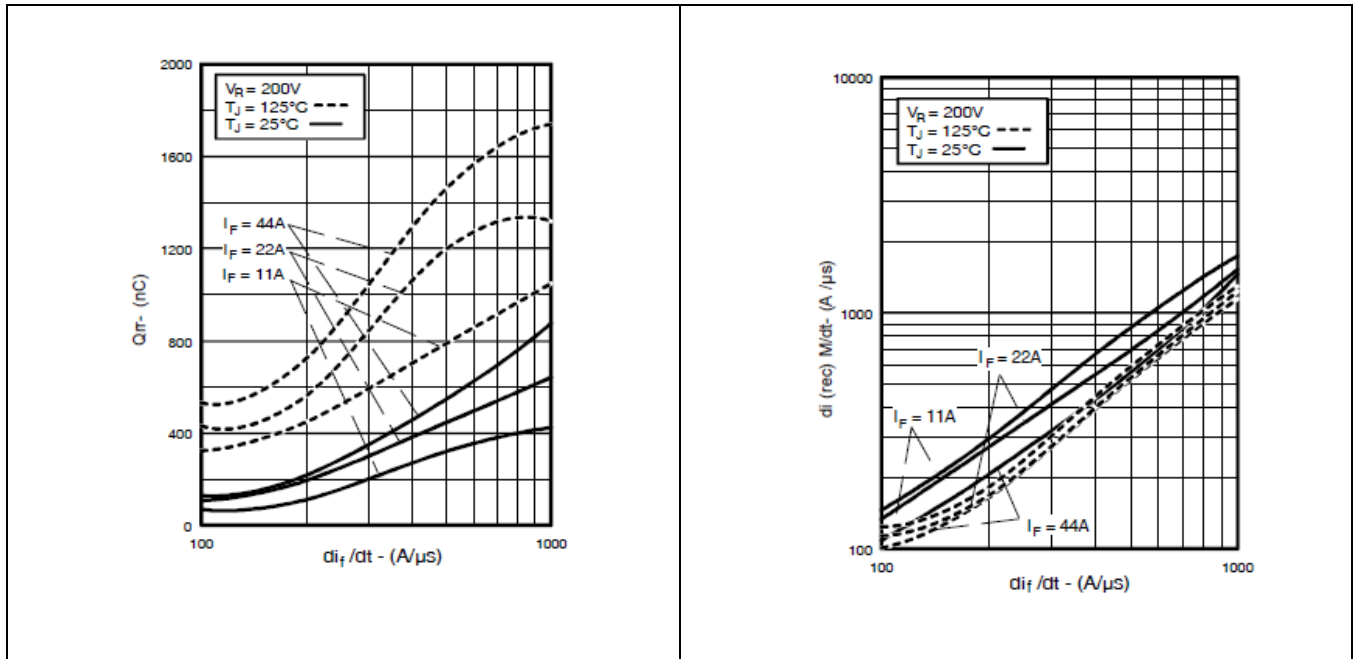
**Figure 5** Typical Reverse Recovery Vs.  $di_f/dt$



**Figure 6** Typical Recovery Current Vs.  $di_f/dt$

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**Electrical Characteristics Curves**



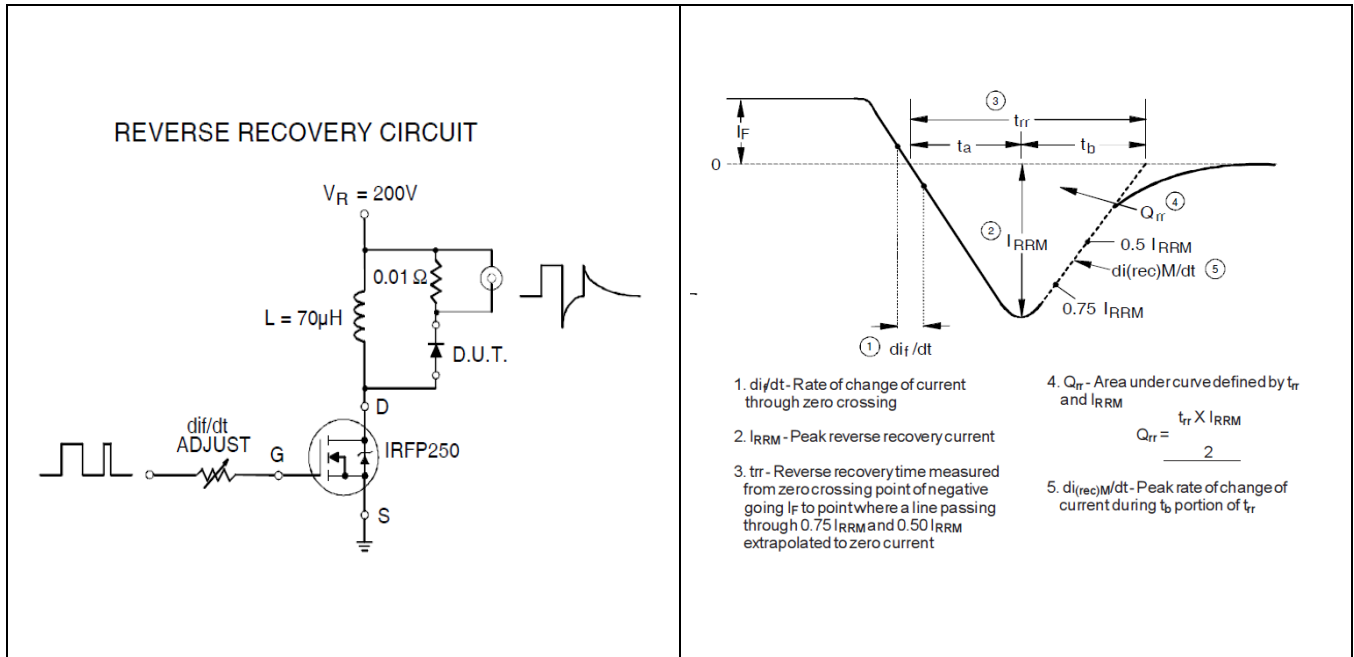
**Figure 7** Typical Stored Charge Vs.  $di_f/dt$

**Figure 8** Typical  $di_{(rec)M}/dt$  Vs.  $di_f/dt$

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**Test Circuit**

**4 Test Circuit**



**Figure 9 Reverse Recovery Parameter Test Circuit**

**Figure 10 Reverse Recovery Waveform and Definitions**



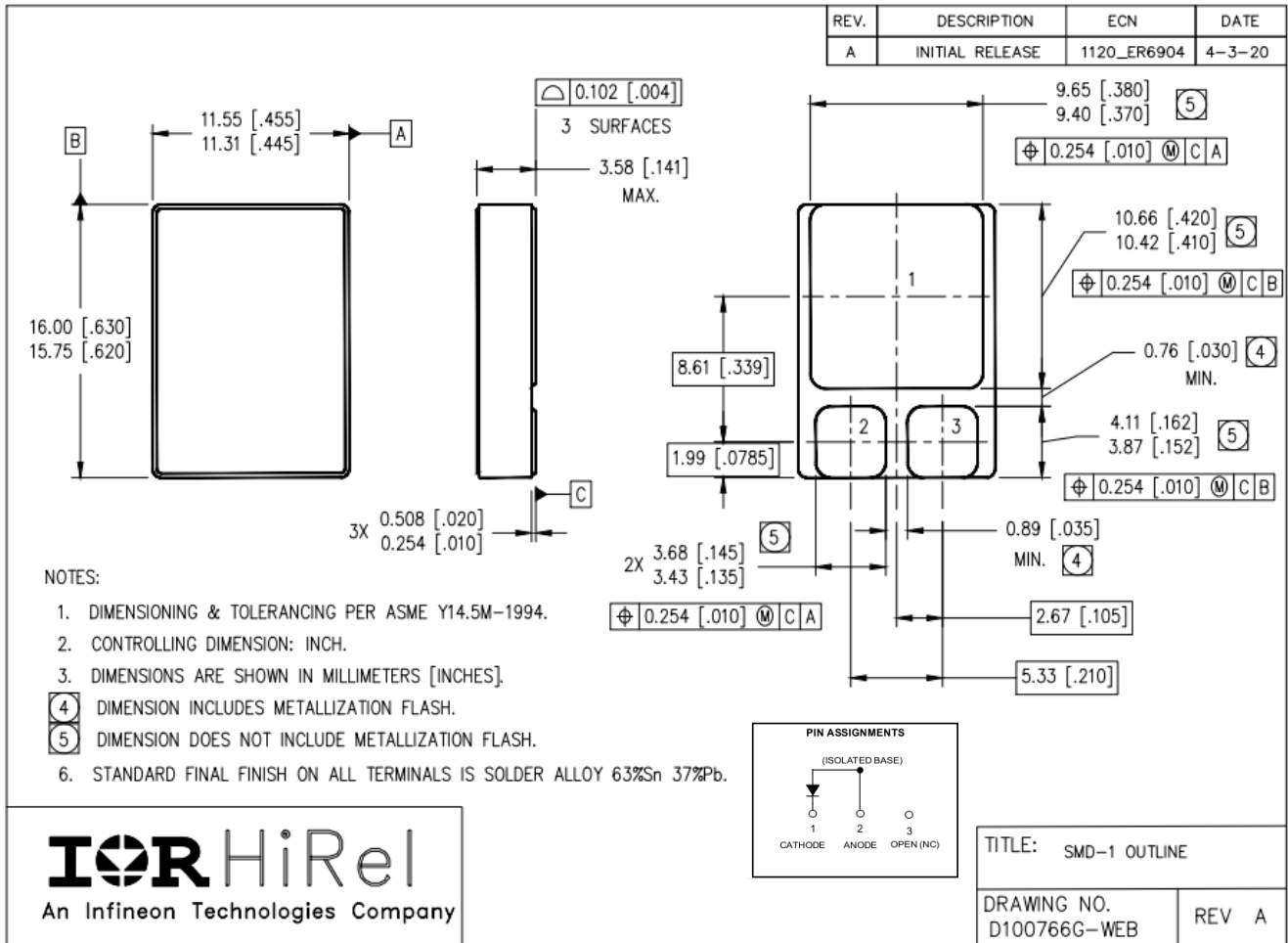
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### Package Outline

# 5 Package Outline

Note: For the most updated package outline, please see the website: [SMD-1](#)



**Revision history****Revision history**

<b>Document version</b>	<b>Date of release</b>	<b>Description of changes</b>
	6/30/1999	Final datasheet (PD-20381)
Rev A	04/10/2010	Updated per ECN-17456
Rev B	03/04/2013	Updated per ECN-1120-0911
Rev C	10/14/2016	Updated per ECN-1120-04754
Rev D	06/02/2022	Updated per ECN-1120-08972
Rev E	08/02/2023	Updated per ECN-1120-09610

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