

# Ultrafast Diode

## 60 A, 400 V

### FFH60UP40S, FFH60UP40S3

#### Description

The FFH60UP40S, FFH60UP40S3 is an ultrafast diode with low forward voltage drop and rugged UIS capability. This device is intended for use as freewheeling and clamping diodes in a variety of switching power supplies and other power switching applications. It is specially suited for use in switching power supplies and industrial applications as welder and UPS application.

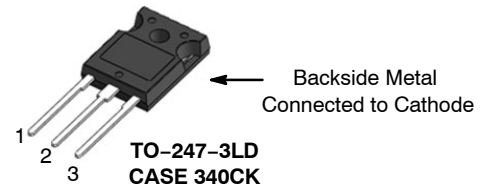
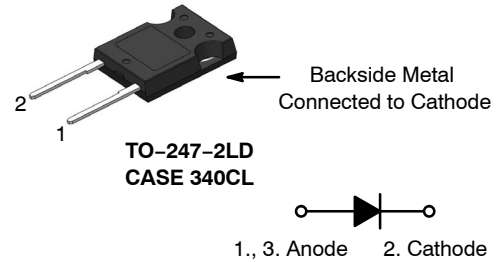
#### Features

- Ultrafast Recovery,  $T_{rr} = 85 \text{ ns}$  (@  $I_F = 60 \text{ A}$ )
- Max Forward Voltage,  $V_F = 1.3 \text{ V}$  (@  $T_C = 25^\circ\text{C}$ )
- Avalanche Energy Rated
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

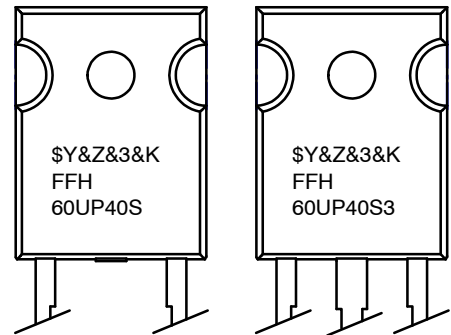
#### Applications

- General Purpose
- SMPS, Welder, UPS
- Free-wheeling Diode for Motor Application
- Power Switching Circuits

#### PIN ASSIGNMENTS



#### MARKING DIAGRAM



\$Y	= onsemi Logo
&Z	= Assembly Plant Code
&3	= Numeric Date Code
&K	= Lot Code
FFH60UP40Sx	= Specific Device Code

#### ORDERING INFORMATION

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

## FFH60UP40S, FFH60UP40S3

### ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Value	Unit
V <sub>RRM</sub>	Peak Repetitive Reverse Voltage	400	V
V <sub>RWM</sub>	Working Peak Reverse Voltage	400	V
V <sub>R</sub>	DC Blocking Voltage	400	V
I <sub>F(AV)</sub>	Average Rectified Forward Current @ T <sub>C</sub> = 139°C	60	A
I <sub>FSM</sub>	Non-repetitive Peak Surge Current 60 Hz Single Half-Sine Wave	600	A
T <sub>J</sub> , T <sub>STG</sub>	Operating and Storage Temperature Range	-65 to +150	°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.

### THERMAL CHARACTERISTICS

Symbol	Parameter	Value	Unit
R <sub>θJC</sub>	Maximum Thermal Resistance, Junction to Case	0.2	°C/W

### ELECTRICAL CHARACTERISTICS (T<sub>C</sub> = 25°C unless otherwise noted)

Symbol	Parameter	Min	Typ	Max	Unit	
V <sub>F</sub> (Note 1)	I <sub>F</sub> = 60 A	T <sub>C</sub> = 25°C	-	1.06	1.3	V
		T <sub>C</sub> = 100°C	-	0.99	-	
I <sub>R</sub> (Note 1)	V <sub>R</sub> = 400 V	T <sub>C</sub> = 25°C	-	-	100	μA
		T <sub>C</sub> = 100°C	-	-	500	
t <sub>rr</sub>	I <sub>F</sub> = 60 A, di <sub>F</sub> /dt = 200 A/μs, V <sub>R</sub> = 260 V	T <sub>C</sub> = 25°C	-	59	85	ns
		T <sub>C</sub> = 100°C	-	96	-	
W <sub>AVL</sub>	Avalanche Energy (L = 40 mH)	50	-	-	mJ	

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.

1. Pulse: Test Pulse Width = 300 μs, Duty Cycle = 2%

### ORDERING INFORMATION

Part Number	Device Marking	Package	Shipping
FFH60UP40S	FFH60UP40S	TO-247-2LD (Pb-Free / Halogen Free)	450 Units / Tube
FFH60UP40S3	FFH60UP40S3	TO-247-3LD (Pb-Free / Halogen Free)	450 Units / Tube

# FFH60UP40S, FFH60UP40S3

## TEST CIRCUIT AND WAVEFORM

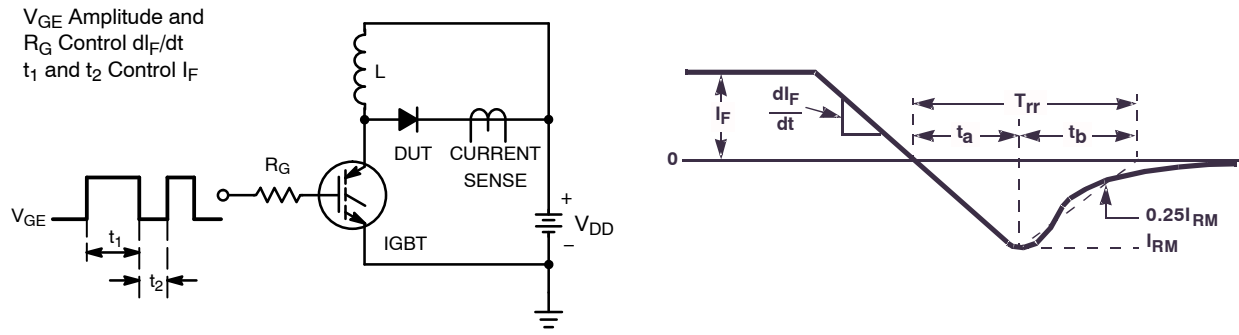


Figure 1. Diode Reverse Recovery Test Circuit and Waveform

$L = 40 \text{ mH}$   
 $R < 0.1 \Omega$   
 $V_{DD} = 50 \text{ V}$   
 $E_{AVL} = 1/2LI^2 [V_{R(AVL)} / (V_{R(AVL)} - V_{DD})]$   
 $Q1 = \text{IGBT (} BV_{CES} > \text{DUT } V_{R(AVL)})$

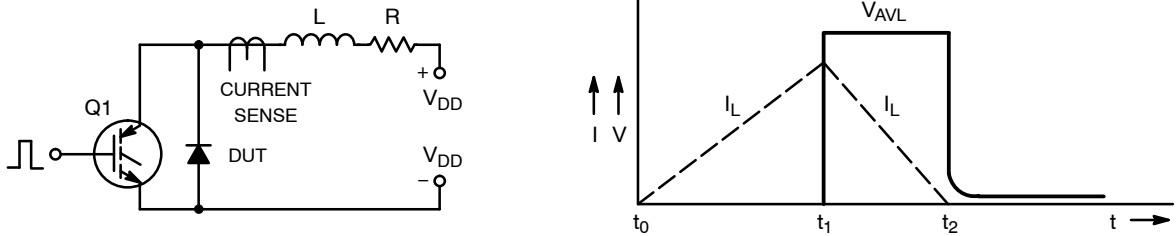
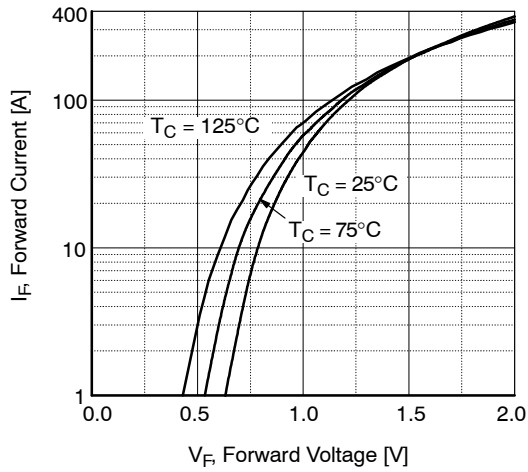


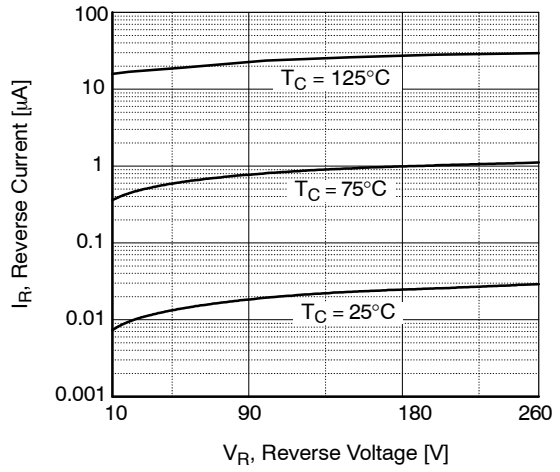
Figure 2. Unclamped Inductive Switching Test Circuit & Waveform

# FFH60UP40S, FFH60UP40S3

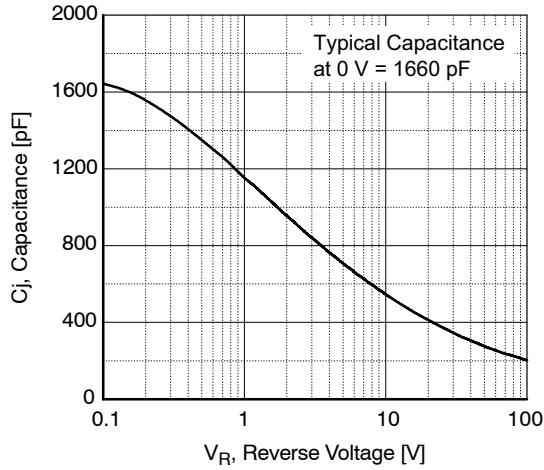
## TYPICAL PERFORMANCE CHARACTERISTICS



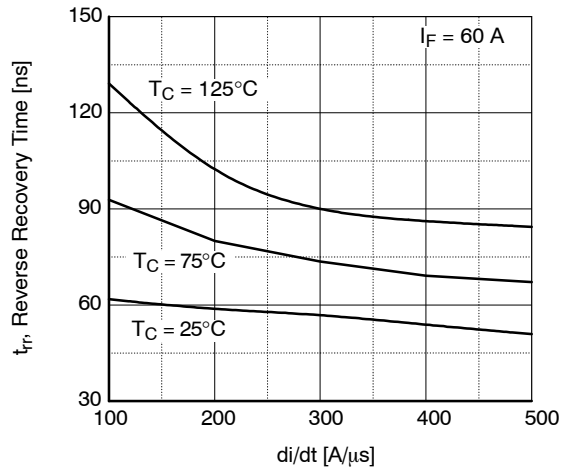
**Figure 3. Typical Forward Voltage Drop vs. Forward Current**



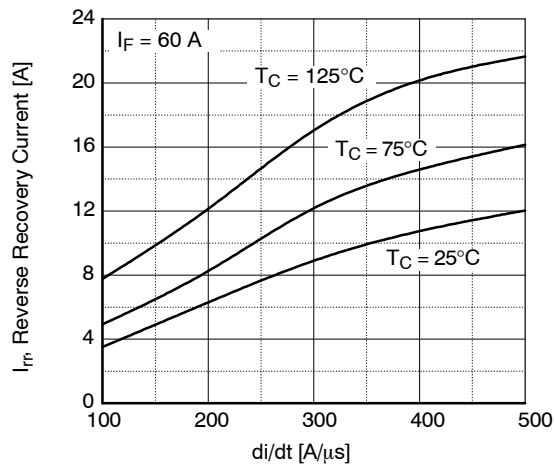
**Figure 4. Typical Reverse Current vs. Reverse Voltage**



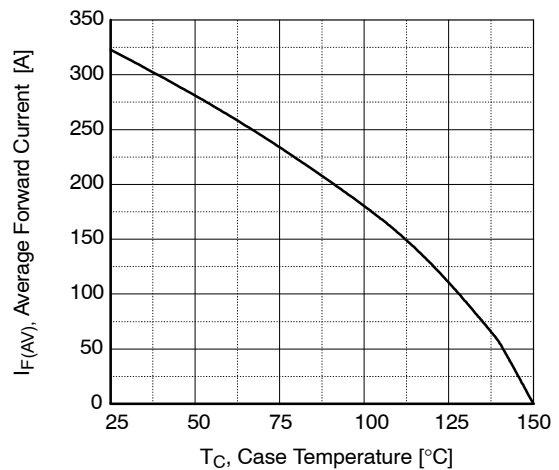
**Figure 5. Typical Junction Capacitance**



**Figure 6. Typical Reverse Recovery Time vs. di/dt**



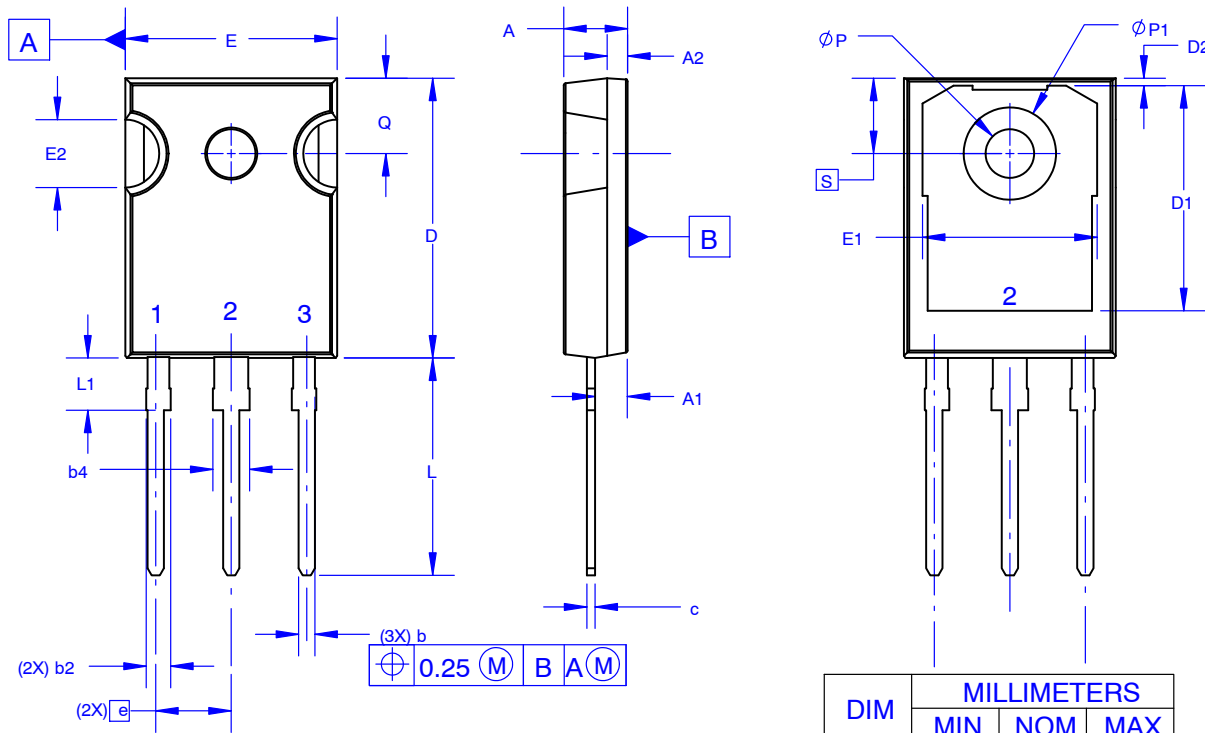
**Figure 7. Typical Reverse Recovery Current vs. di/dt**



**Figure 8. Forward Current Derating Curve**

**TO-247-3LD SHORT LEAD**  
**CASE 340CK**  
**ISSUE A**

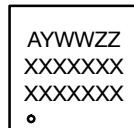
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- E. LEAD FINISH IS UNCONTROLLED IN THE REGION DEFINED BY L1.

**GENERIC MARKING DIAGRAM\***



XXXX = Specific Device Code  
 A = Assembly Location  
 Y = Year  
 WW = Work Week  
 ZZ = Assembly Lot Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "•", may or may not be present. Some products may not follow the Generic Marking.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	4.58	4.70	4.82
A1	2.20	2.40	2.60
A2	1.40	1.50	1.60
b	1.17	1.26	1.35
b2	1.53	1.65	1.77
b4	2.42	2.54	2.66
c	0.51	0.61	0.71
D	20.32	20.57	20.82
D1	13.08	~	~
D2	0.51	0.93	1.35
E	15.37	15.62	15.87
E1	12.81	~	~
E2	4.96	5.08	5.20
e	~	5.56	~
L	15.75	16.00	16.25
L1	3.69	3.81	3.93
ØP	3.51	3.58	3.65
ØP1	6.60	6.80	7.00
Q	5.34	5.46	5.58
S	5.34	5.46	5.58

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# MECHANICAL CASE OUTLINE

## PACKAGE DIMENSIONS

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TO-247-2LD  
CASE 340CL  
ISSUE A

DATE 03 DEC 2019

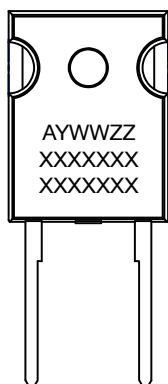


⊕ 0.25 (M) B A (M)

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E1	12.81	~	~
E2	4.96	5.08	5.20
e	~	11.12	~
L	15.75	16.00	16.25
L1	3.69	3.81	3.93
∅P	3.51	3.58	3.65
∅P1	6.61	6.73	6.85
Q	5.34	5.46	5.58
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