

## ISL9R460PF2

### 4A, 600V Stealth™ Diode

#### General Description

The ISL9R460PF2 is a Stealth™ diode optimized for low loss performance in high frequency hard switched applications. The Stealth™ family exhibits low reverse recovery current ( $I_{RRM}$ ) and exceptionally soft recovery under typical operating conditions.

This device is intended for use as a free wheeling or boost diode in power supplies and other power switching applications. The low  $I_{RRM}$  and short  $t_a$  phase reduce loss in switching transistors. The soft recovery minimizes ringing, expanding the range of conditions under which the diode may be operated without the use of additional snubber circuitry. Consider using the Stealth™ diode with an SMPS IGBT to provide the most efficient and highest power density design at lower cost.

Formerly developmental type TA49408.

#### Features

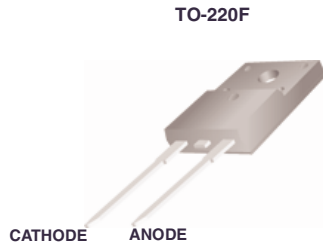
- Soft Recovery .....  $t_b / t_a > 3$
- Fast Recovery .....  $t_{rr} < 20ns$
- Operating Temperature ..... 150°C
- Reverse Voltage ..... 600V
- Avalanche Energy Rated

#### Applications

- Switch Mode Power Supplies
- Hard Switched PFC Boost Diode
- UPS Free Wheeling Diode
- Motor Drive FWD
- SMPS FWD
- Snubber Diode

#### Package

#### Symbol



#### Device Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Ratings	Units
$V_{RRM}$	Peak Repetitive Reverse Voltage	600	V
$V_{RWM}$	Working Peak Reverse Voltage	600	V
$V_R$	DC Blocking Voltage	600	V
$I_{F(AV)}$	Average Rectified Forward Current ( $T_C = 108^\circ\text{C}$ )	4	A
$I_{FRM}$	Repetitive Peak Surge Current (20kHz Square Wave)	8	A
$I_{FSM}$	Nonrepetitive Peak Surge Current (Halfwave 1 Phase 60Hz)	50	A
$P_D$	Power Dissipation	22	W
$E_{AVL}$	Avalanche Energy (0.5A, 80mH)	10	mJ
$T_J, T_{STG}$	Operating and Storage Temperature Range	-55 to 150	°C
$T_L$	Maximum Temperature for Soldering		
$T_{PKG}$	Leads at 0.063in (1.6mm) from Case for 10s	300	°C
	Package Body for 10s, See Techbrief TB334	260	°C

CAUTION: Stresses above those listed in "Device Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

## Package Marking and Ordering Information

Device Marking	Device	Package	Tape Width	Quantity
R460PF2	ISL9R460PF2	TO-220F	N/A	50 Units

## Electrical Characteristics $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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### Off State Characteristics

Symbol	Parameter	Test Conditions	$T_C = 25^\circ\text{C}$	$T_C = 125^\circ\text{C}$	Units	
			$I_R$	Instantaneous Reverse Current	$V_R = 600\text{V}$	-

### On State Characteristics

Symbol	Parameter	Test Conditions	$T_C = 25^\circ\text{C}$	$T_C = 125^\circ\text{C}$	Units	
			$V_F$	Instantaneous Forward Voltage	$I_F = 4\text{A}$	-

### Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$C_J$	Junction Capacitance	$V_R = 10\text{V}, I_F = 0\text{A}$	-	19	-	pF

### Switching Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{rr}$	Reverse Recovery Time	$I_F = 1\text{A}, di_F/dt = 100\text{A}/\mu\text{s}, V_R = 30\text{V}$	-	17	20	ns
$t_{rr}$	Reverse Recovery Time	$I_F = 4\text{A}, di_F/dt = 100\text{A}/\mu\text{s}, V_R = 30\text{V}$	-	19	22	ns
$I_{RRM}$	Maximum Reverse Recovery Current	$I_F = 4\text{A}, di_F/dt = 200\text{A}/\mu\text{s}, V_R = 390\text{V}, T_C = 25^\circ\text{C}$	-	2.6	-	A
$Q_{RR}$	Reverse Recovered Charge	$I_F = 4\text{A}, di_F/dt = 200\text{A}/\mu\text{s}, V_R = 390\text{V}, T_C = 25^\circ\text{C}$	-	22	-	nC
$t_{rr}$	Reverse Recovery Time	$I_F = 4\text{A}, di_F/dt = 200\text{A}/\mu\text{s}, V_R = 390\text{V}, T_C = 125^\circ\text{C}$	-	77	-	ns
S	Softness Factor ( $t_b/t_a$ )	$I_F = 4\text{A}, di_F/dt = 200\text{A}/\mu\text{s}, V_R = 390\text{V}, T_C = 125^\circ\text{C}$	-	4.2	-	
$I_{RRM}$	Maximum Reverse Recovery Current	$I_F = 4\text{A}, di_F/dt = 400\text{A}/\mu\text{s}, V_R = 390\text{V}, T_C = 125^\circ\text{C}$	-	2.8	-	A
$Q_{RR}$	Reverse Recovered Charge	$I_F = 4\text{A}, di_F/dt = 400\text{A}/\mu\text{s}, V_R = 390\text{V}, T_C = 125^\circ\text{C}$	-	100	-	nC
$t_{rr}$	Reverse Recovery Time	$I_F = 4\text{A}, di_F/dt = 400\text{A}/\mu\text{s}, V_R = 390\text{V}, T_C = 125^\circ\text{C}$	-	54	-	ns
S	Softness Factor ( $t_b/t_a$ )	$I_F = 4\text{A}, di_F/dt = 400\text{A}/\mu\text{s}, V_R = 390\text{V}, T_C = 125^\circ\text{C}$	-	3.5	-	
$I_{RRM}$	Maximum Reverse Recovery Current	$I_F = 4\text{A}, di_F/dt = 400\text{A}/\mu\text{s}, V_R = 390\text{V}, T_C = 125^\circ\text{C}$	-	4.3	-	A
$Q_{RR}$	Reverse Recovered Charge	$I_F = 4\text{A}, di_F/dt = 400\text{A}/\mu\text{s}, V_R = 390\text{V}, T_C = 125^\circ\text{C}$	-	110	-	nC
$di_M/dt$	Maximum $di/dt$ during $t_b$	$I_F = 4\text{A}, di_F/dt = 400\text{A}/\mu\text{s}, V_R = 390\text{V}, T_C = 125^\circ\text{C}$	-	500	-	A/ $\mu\text{s}$

### Thermal Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance Junction to Case		-	-	5.7	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient	TO-220F	-	-	70	$^\circ\text{C}/\text{W}$

**Typical Performance Curves**  $T_C = 25^\circ\text{C}$  unless otherwise noted

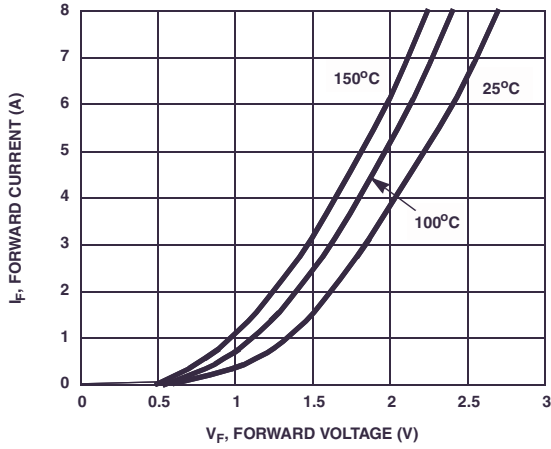


Figure 1. Forward Current vs Forward Voltage

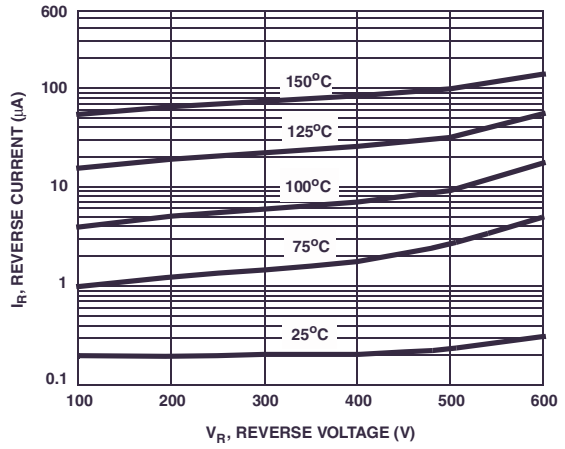


Figure 2. Reverse Current vs Reverse Voltage

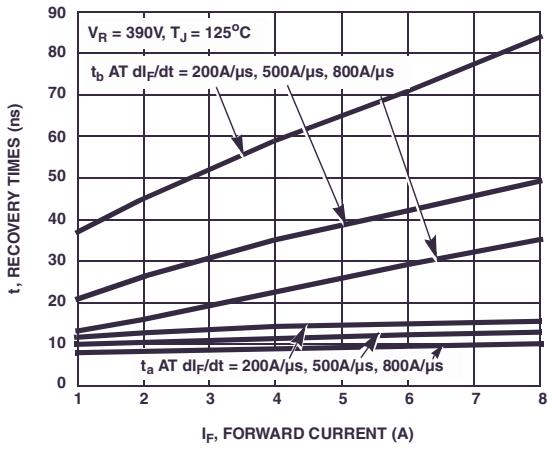


Figure 3.  $t_a$  and  $t_b$  Curves vs Forward Current

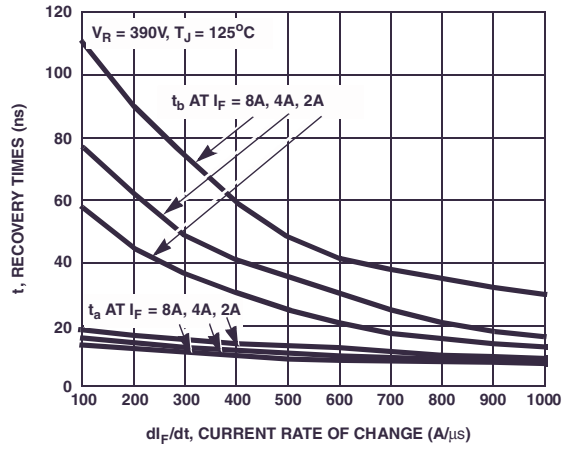


Figure 4.  $t_a$  and  $t_b$  Curves vs  $di_F/dt$

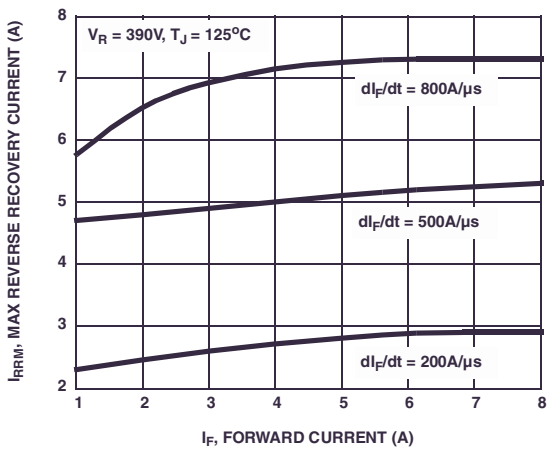


Figure 5. Maximum Reverse Recovery Current vs Forward Current

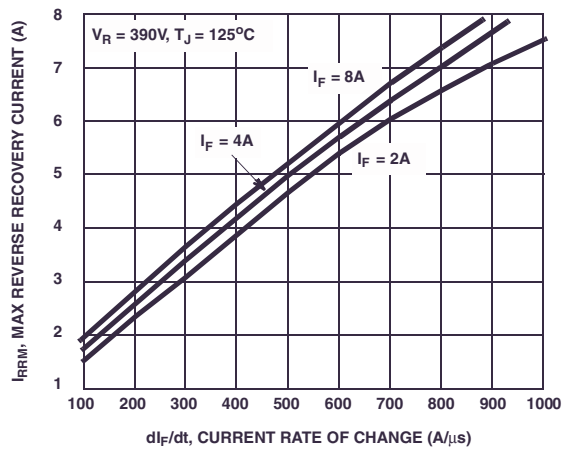


Figure 6. Maximum Reverse Recovery Current vs  $di_F/dt$

Typical Performance Curves  $T_C = 25^\circ\text{C}$  unless otherwise noted

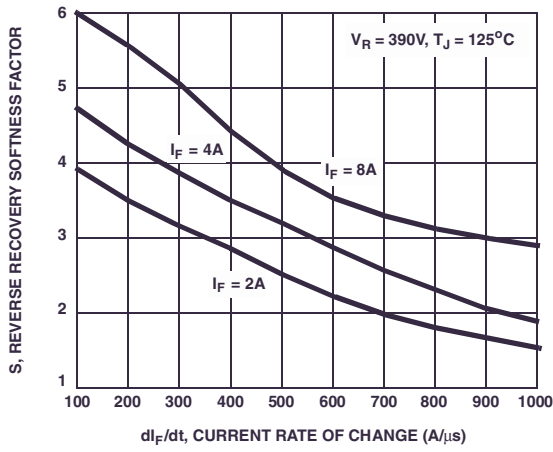


Figure 7. Reverse Recovery Softness Factor vs  $di_F/dt$

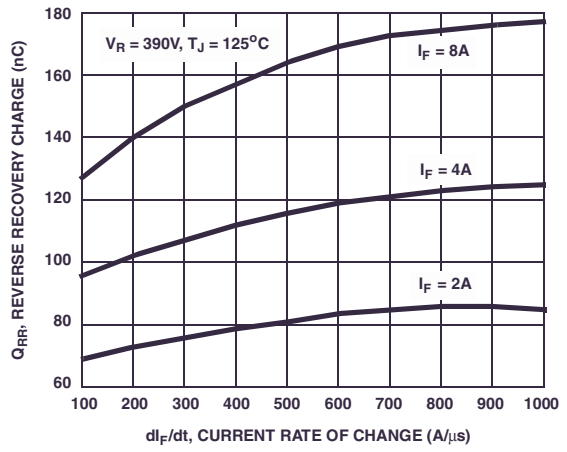


Figure 8. Reverse Recovery Charge vs  $di_F/dt$

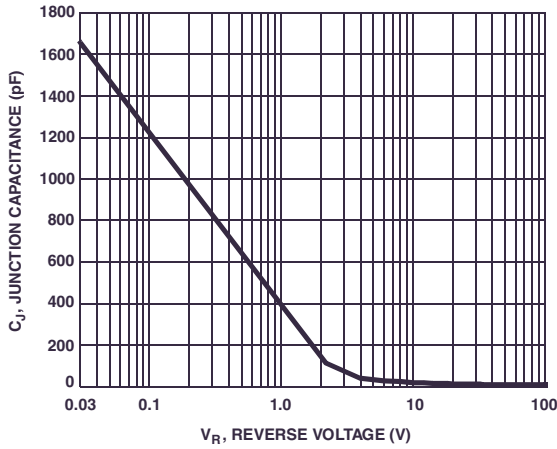


Figure 9. Junction Capacitance vs Reverse Voltage

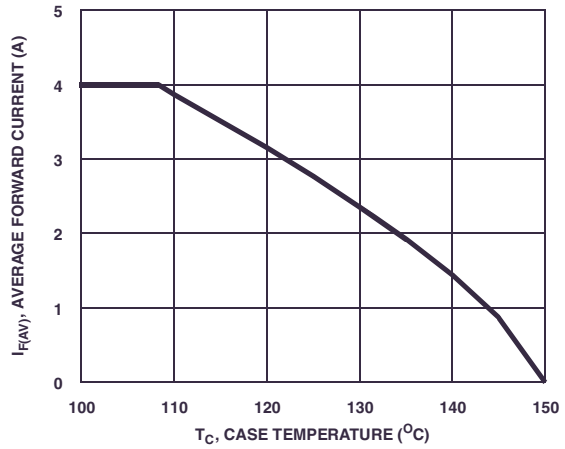


Figure 10. DC Current Derating Curve

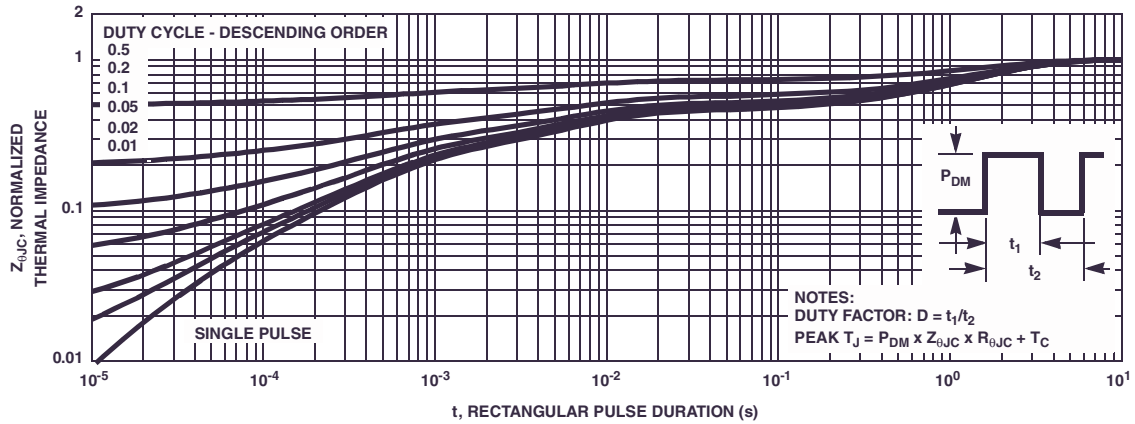
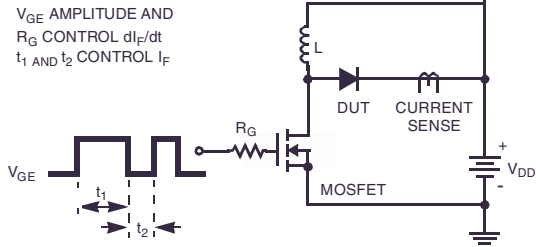
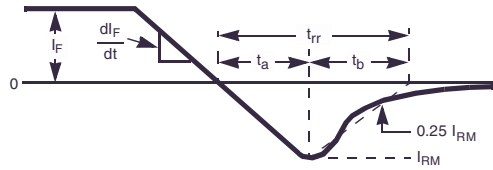


Figure 11. Normalized Maximum Transient Thermal Impedance

**Test Circuit and Waveforms**

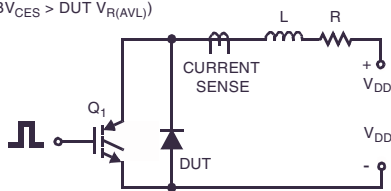


**Figure 12.  $I_{t_{rr}}$  Test Circuit**

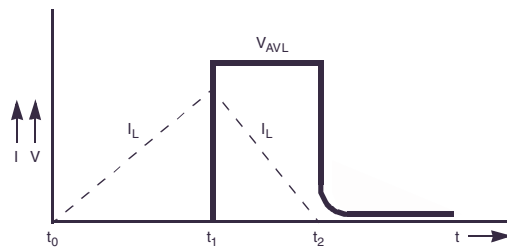


**Figure 13.  $t_{rr}$  Waveforms and Definitions**

$I = 0.5A$   
 $L = 80mH$   
 $R < 0.1\Omega$   
 $V_{DD} = 200V$   
 $E_{AVL} = 1/2LI^2 [V_{R(AVL)}/(V_{R(AVL)} - V_{DD})]$   
 $Q_1 = IGBT (BV_{CES} > DUT V_{R(AVL)})$



**Figure 14. Avalanche Energy Test Circuit**



**Figure 15. Avalanche Current and Voltage Waveforms**

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