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ISL9R1560PF2 15A, 600V, STEALTH™ Diode

Feature

- Stealth Recovery $t_{rr} = 29.4$ ns (@ $I_F = 15$ A)
- Max Forward Voltage, $V_F = 2.2$ V (@ $T_C = 25^\circ\text{C}$)
- 600 V Reverse Voltage and High Reliability
- Avalanche Energy Rated
- RoHS Compliant

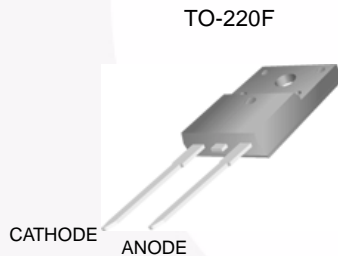
Applications

- Hard Switched PFC Boost Diode
- UPS Free Wheeling Diode
- Motor Drive FWD
- SMPS FWD
- Snubber Diode

Description

The ISL9R1560PF2 is a STEALTH™ diode optimized for low loss performance in high frequency hard switched applications. The STEALTH™ family exhibits low reverse recovery current (I_{RR}) 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_{RR} 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.

Package



Symbol



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

Symbol	Parameter	Rating	Unit
V_{RRM}	Repetitive Peak 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 ($T_C = 25^\circ\text{C}$)	15	A
I_{FRM}	Repetitive Peak Surge Current (20 kHz Square Wave)	30	A
I_{FSM}	Nonrepetitive Peak Surge Current (Halfwave 1 Phase 60 Hz)	200	A
P_D	Power Dissipation	30	W
E_{AVL}	Avalanche Energy (1 A, 40 mH)	20	mJ
T_J, T_{STG}	Operating and Storage Temperature Range	-55 to 150	$^\circ\text{C}$
T_L	Maximum Temperature for Soldering Leads at 0.063in (1.6 mm) from Case for 10s	300	$^\circ\text{C}$

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
R1560PF2	ISL9R1560PF2	TO-220F-2L	N/A	50

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	$T_C = 25^\circ\text{C}$				$T_C = 125^\circ\text{C}$		
			Min	Typ	Max	Units	Min	Max	Units
I_R	Instantaneous Reverse Current	$V_R = 600\text{ V}$	-	-	100	μA	-	1.0	mA
			-	-	-	-	-	-	-

On State Characteristics

Symbol	Parameter	Test Conditions	$T_C = 25^\circ\text{C}$				$T_C = 125^\circ\text{C}$			
			Min	Typ	Max	Units	Min	Max	Units	
V_F	Instantaneous Forward Voltage	$I_F = 15\text{ A}$	-	1.8	2.2	V	-	1.65	2.0	V
			-	-	-	-	-	-	-	

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_J	Junction Capacitance	$V_R = 10\text{ V}, I_F = 0\text{ A}$	-	62	-	pF

Switching Characteristics

Symbol	Parameter	Test Conditions	$T_C = 25^\circ\text{C}$			
			Min	Typ	Max	Units
t_{rr}	Reverse Recovery Time	$I_F = 1\text{ A}, di_F/dt = 100\text{ A}/\mu\text{s}, V_R = 30\text{ V}$	-	25	30	ns
		$I_F = 15\text{ A}, di_F/dt = 100\text{ A}/\mu\text{s}, V_R = 30\text{ V}$	-	35	40	ns
t_{rr}	Reverse Recovery Time	$I_F = 15\text{ A},$	-	29.4	-	ns
I_{rr}	Maximum Reverse Recovery Current	$di_F/dt = 200\text{ A}/\mu\text{s},$	-	3.5	-	A
Q_{rr}	Reverse Recovered Charge	$V_R = 390\text{ V}, T_C = 25^\circ\text{C}$	-	57	-	nC
t_{rr}	Reverse Recovery Time	$I_F = 15\text{ A},$	-	90	-	ns
S	Softness Factor (t_b/t_a)	$di_F/dt = 200\text{ A}/\mu\text{s},$	-	2.0	-	
I_{rr}	Maximum Reverse Recovery Current	$V_R = 390\text{ V},$	-	5.0	-	A
Q_{rr}	Reverse Recovered Charge	$T_C = 125^\circ\text{C}$	-	275	-	nC
t_{rr}	Reverse Recovery Time	$I_F = 15\text{ A},$	-	52	-	ns
S	Softness Factor (t_b/t_a)	$di_F/dt = 800\text{ A}/\mu\text{s},$	-	1.36	-	
I_{rr}	Maximum Reverse Recovery Current	$V_R = 390\text{ V},$	-	13.5	-	A
Q_{rr}	Reverse Recovered Charge	$T_C = 125^\circ\text{C}$	-	390	-	nC
di_M/dt	Maximum di/dt during t_b		-	800	-	$\text{A}/\mu\text{s}$

Thermal Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$R_{\theta JC}$	Thermal Resistance Junction to Case		-	-	4.1	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient	TO-247	-	-	70	$^\circ\text{C}/\text{W}$

Typical Performance Curves

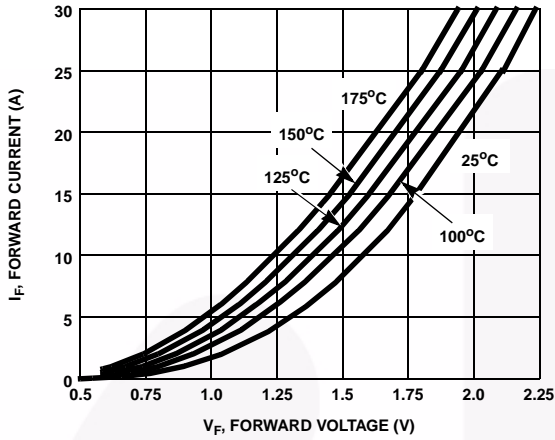


Figure 1. Forward Current vs Forward Voltage

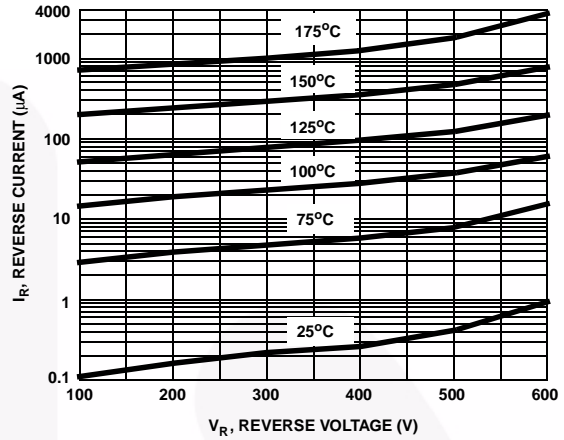


Figure 2. Reverse Current vs Reverse Voltage

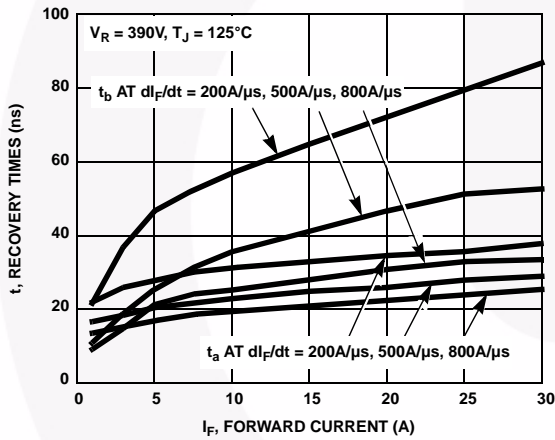


Figure 3. t_a and t_b Curves vs Forward Current

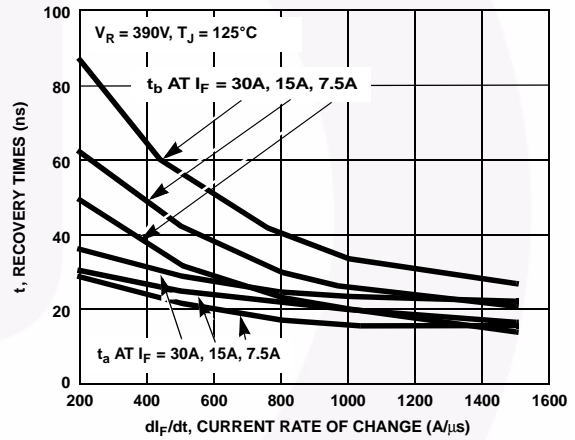


Figure 4. t_a and t_b Curves vs di_F/dt

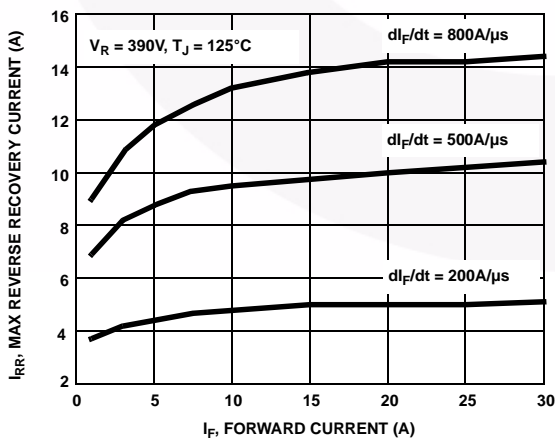


Figure 5. Maximum Reverse Recovery Current vs Forward Current

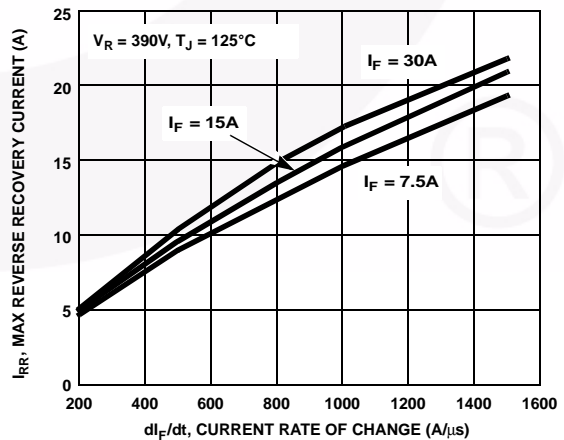


Figure 6. Maximum Reverse Recovery Current vs di_F/dt

Typical Performance Curves (Continued)

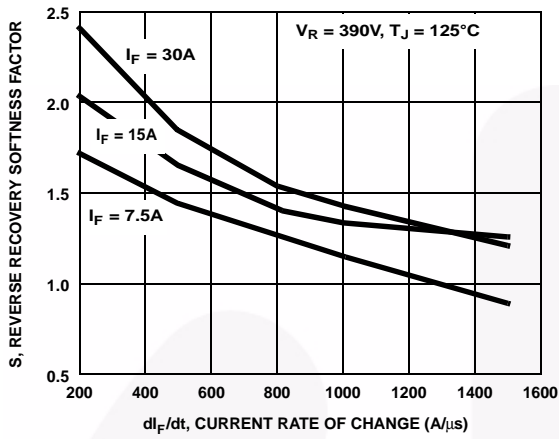


Figure 7. Reverse Recovery Softness Factor vs di_F/dt

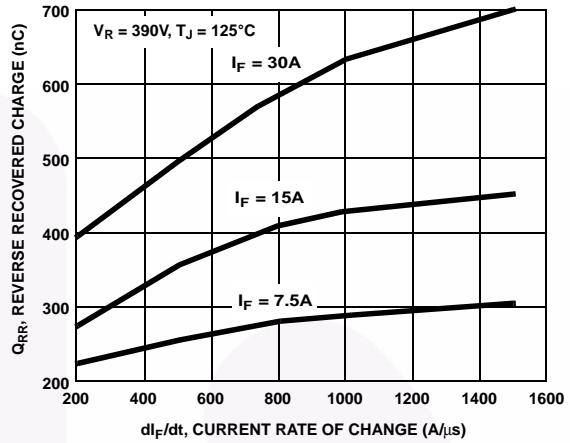


Figure 8. Reverse Recovered Charge vs di_F/dt

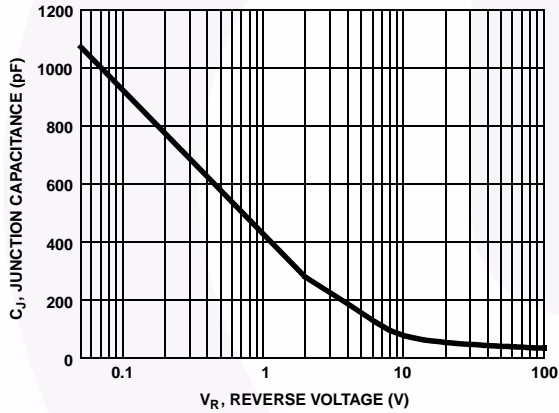


Figure 9. Junction Capacitance vs Reverse Voltage

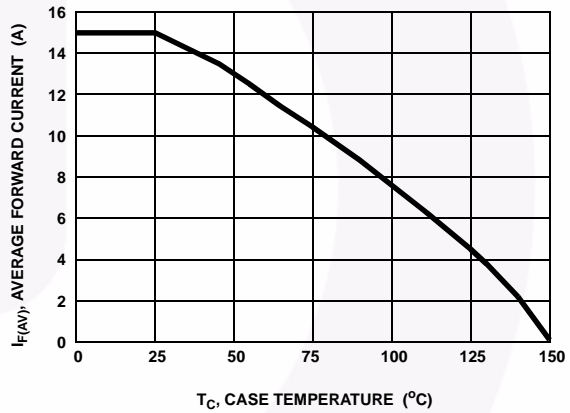


Figure 10. DC Current Derating Curve

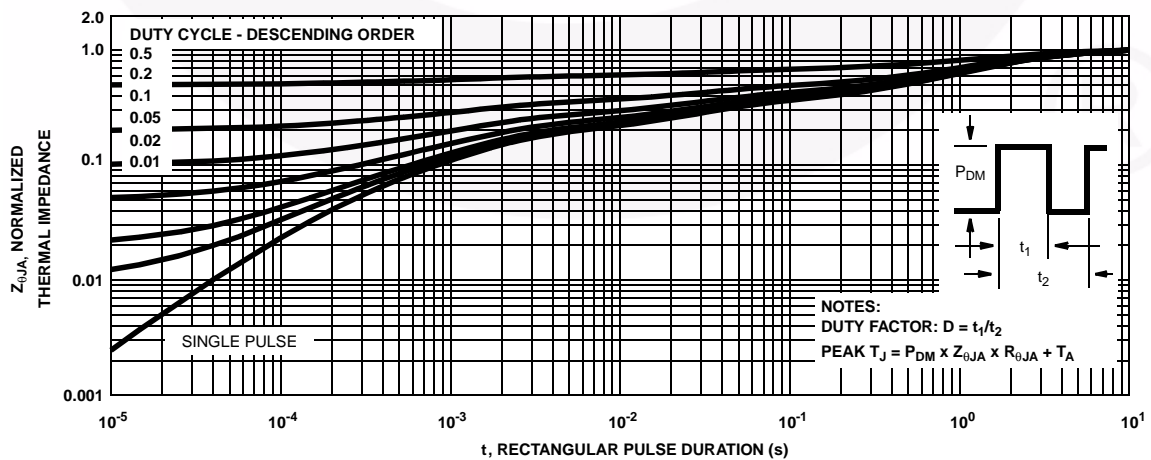


Figure 11. Normalized Maximum Transient Thermal Impedance

Test Circuit and Waveforms

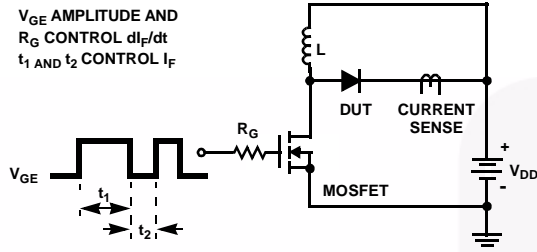


Figure 12. t_{rr} Test Circuit

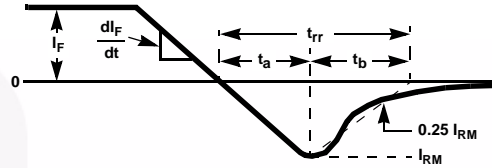


Figure 13. t_{rr} Waveforms and Definitions

$I = 1A$
 $L = 40mH$
 $R < 0.1\Omega$
 $V_{DD} = 50V$
 $E_{AVL} = 1/2LI^2 [V_{R(AVL)} / (V_{R(AVL)} - V_{DD})]$
 $Q_1 = IGBT (BV_{CES} > DUT V_{R(AVL)})$

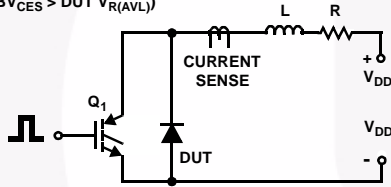


Figure 14. Avalanche Energy Test Circuit

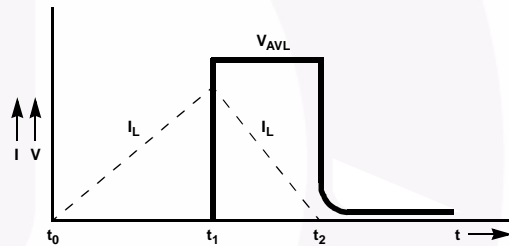
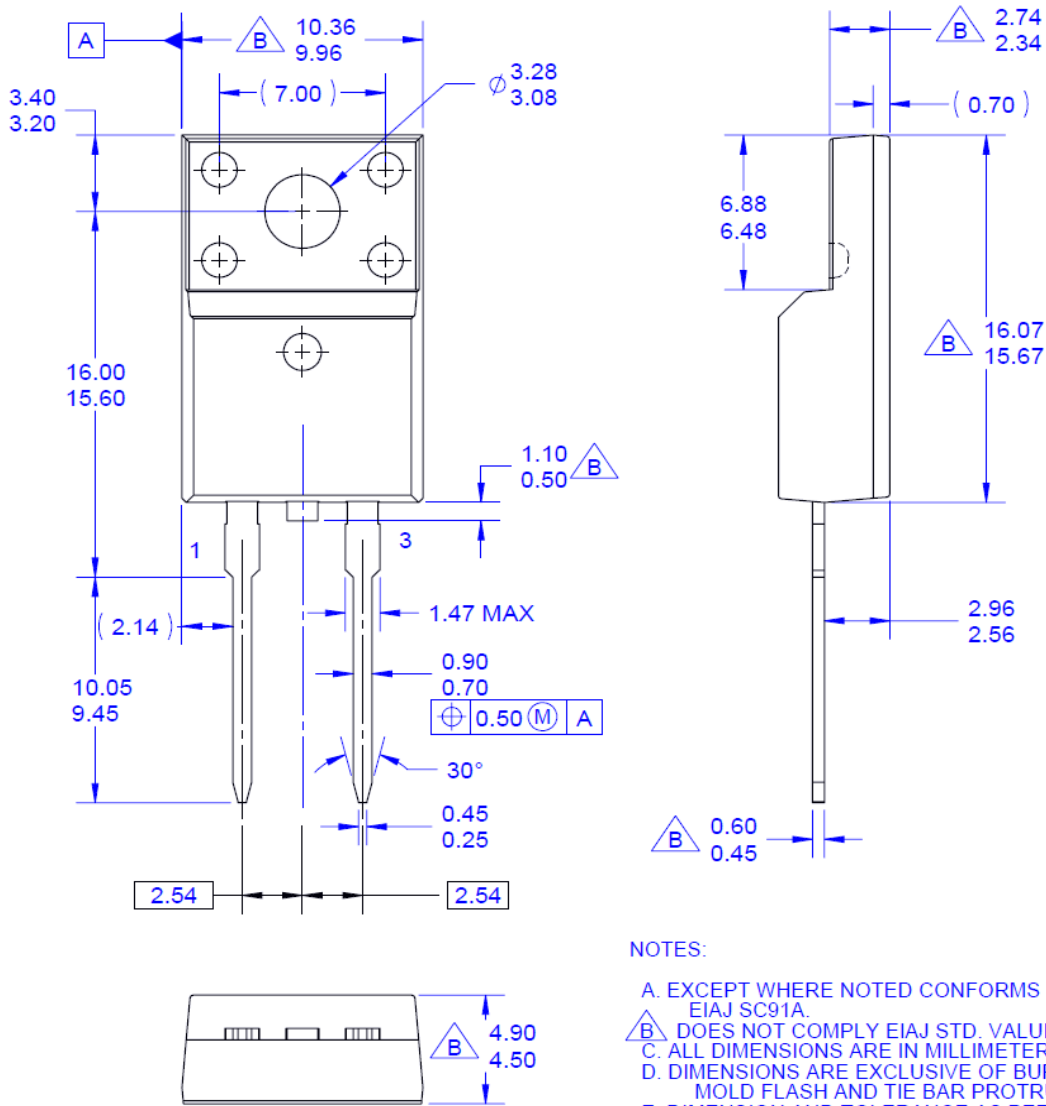


Figure 15. Avalanche Current and Voltage Waveforms

Mechanical Dimensions



NOTES:

- A. EXCEPT WHERE NOTED CONFORMS TO EIAJ SC91A.
- B. DOES NOT COMPLY EIAJ STD. VALUE.
- C. ALL DIMENSIONS ARE IN MILLIMETERS.
- D. DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH AND TIE BAR PROTRUSIONS.
- E. DIMENSION AND TOLERANCE AS PER ASME Y14.5-1994.
- F. DRAWING FILE NAME: TO220C02REV2

Figure 16. TO-220F 2L - 2LD; TO220; MOLDED; FULL PACK

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Телефон: 8 (812) 309 58 32 (многоканальный)

Факс: 8 (812) 320-02-42

Электронная почта: org@eplast1.ru

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, дом 2, корпус 4, литера А.