

ISL9R460P2, ISL9R460S2, ISL9R460S3S

4A, 600V Stealth™ Diode

General Description

The ISL9R460P2, ISL9R460S2 and ISL9R460S3S are Stealth™ diodes 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

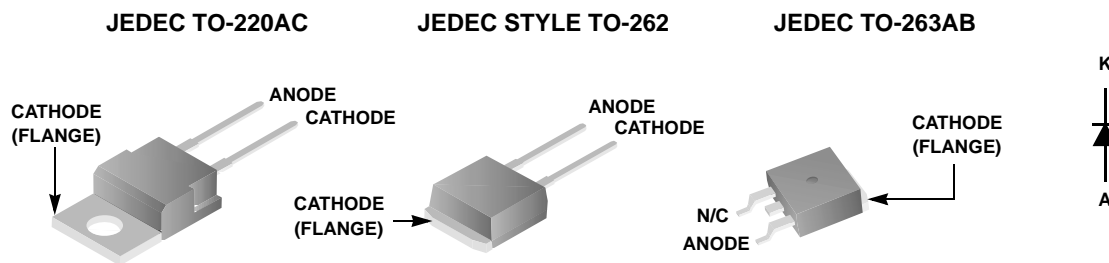
- Soft Recovery $t_b / t_a > 3$
- Fast Recovery $t_{rr} < 20\text{ns}$
- Operating Temperature 175°C
- Reverse Voltage 600V
- Avalanche Energy Rated

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 ($T_C = 155^\circ\text{C}$) | 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 | 58 | W |
| E_{AVL} | Avalanche Energy (0.5A, 80mH) | 10 | mJ |
| T_J, T_{STG} | Operating and Storage Temperature Range | -55 to 175 | °C |
| T_L | Maximum Temperature for Soldering | | |
| T_{PKG} | Leads at 0.063in (1.6mm) from Case for 10s Package Body for 10s, See Techbrief TB334 | 300 260 | °C °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 |
|----------------|--------------|----------|------------|----------|
| R460P2 | ISL9R460P2 | TO-220AC | N/A | 50 |
| R460S2 | ISL9R460S2 | TO-262 | N/A | 50 |
| R460S3S | ISL9R460S3S | TO-263AB | N/A | 50 |
| R460S3S | ISL9R460S3ST | TO-263AB | 24mm | 800 |

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

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Units |
|--------|-----------|-----------------|-----|-----|-----|-------|
|--------|-----------|-----------------|-----|-----|-----|-------|

Off State Characteristics

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

On State Characteristics

| | | | | | | | |
|-------|-------------------------------|-------------------|---------------------------|---|-----|-----|---|
| V_F | Instantaneous Forward Voltage | $I_F = 4\text{A}$ | $T_C = 25^\circ\text{C}$ | - | 2.0 | 2.4 | V |
| | | | $T_C = 125^\circ\text{C}$ | - | 1.6 | 2.0 | V |

Dynamic Characteristics

| | | | | | | |
|-------|----------------------|-------------------------------------|---|----|---|-------------|
| C_J | Junction Capacitance | $V_R = 10\text{V}, I_F = 0\text{A}$ | - | 19 | - | pF |
|-------|----------------------|-------------------------------------|---|----|---|-------------|

Switching Characteristics

| | | | | | | |
|-----------|----------------------------------|--|---|-----|----|------------------------|
| 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 |
| | | $I_F = 4\text{A}, dI_F/dt = 100\text{A}/\mu\text{s}, V_R = 30\text{V}$ | - | 19 | 22 | ns |
| t_{rr} | Reverse Recovery Time | $I_F = 4\text{A},$ | - | 17 | - | ns |
| I_{RRM} | Maximum Reverse Recovery Current | $dI_F/dt = 200\text{A}/\mu\text{s},$ | - | 2.6 | - | A |
| Q_{RR} | Reverse Recovery Charge | $V_R = 390\text{V}, T_C = 25^\circ\text{C}$ | - | 22 | - | nC |
| t_{rr} | Reverse Recovery Time | $I_F = 4\text{A},$ | - | 77 | - | ns |
| S | Softness Factor (t_b/t_a) | $dI_F/dt = 200\text{A}/\mu\text{s},$ | - | 4.2 | - | |
| I_{RRM} | Maximum Reverse Recovery Current | $V_R = 390\text{V},$ | - | 2.8 | - | A |
| Q_{RR} | Reverse Recovery Charge | $T_C = 125^\circ\text{C}$ | - | 100 | - | nC |
| t_{rr} | Reverse Recovery Time | $I_F = 4\text{A},$ | - | 54 | - | ns |
| S | Softness Factor (t_b/t_a) | $dI_F/dt = 400\text{A}/\mu\text{s},$ | - | 3.5 | - | |
| I_{RRM} | Maximum Reverse Recovery Current | $V_R = 390\text{V},$ | - | 4.3 | - | A |
| Q_{RR} | Reverse Recovery Charge | $T_C = 125^\circ\text{C}$ | - | 110 | - | nC |
| dI_M/dt | Maximum dI/dt during t_b | | - | 500 | - | $\text{A}/\mu\text{s}$ |

Thermal Characteristics

| | | | | | | |
|-----------------|--|--------|---|---|-----|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance Junction to Case | | - | - | 2.6 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance Junction to Ambient | TO-220 | - | - | 62 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance Junction to Ambient | TO-262 | - | - | 62 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance Junction to Ambient | TO-263 | | | 62 | $^\circ\text{C}/\text{W}$ |

Typical Performance Curves

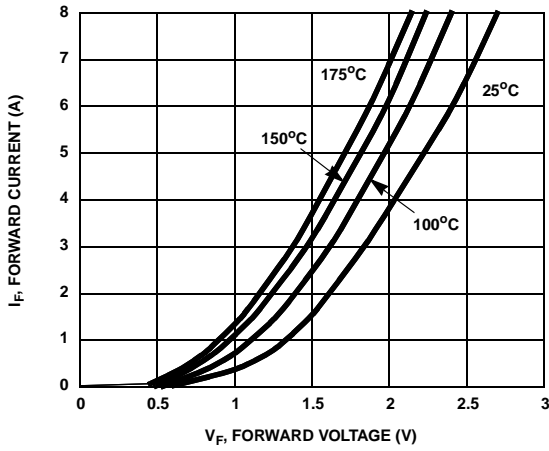


Figure 1. Forward Current vs Forward Voltage

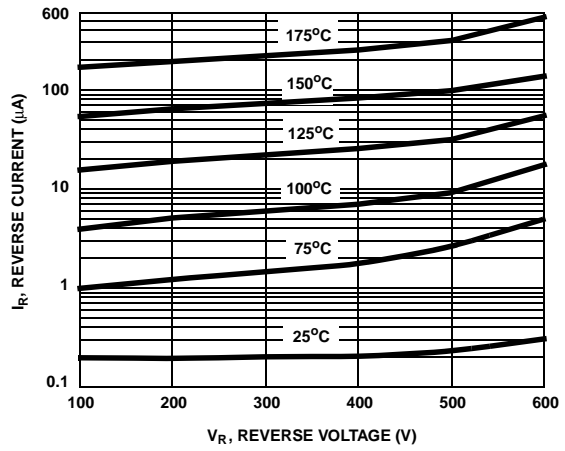


Figure 2. Reverse Current vs Reverse Voltage

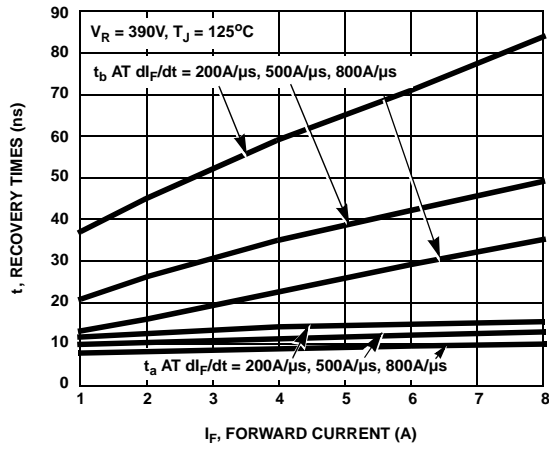


Figure 3. t_a and t_b Curves vs Forward Current

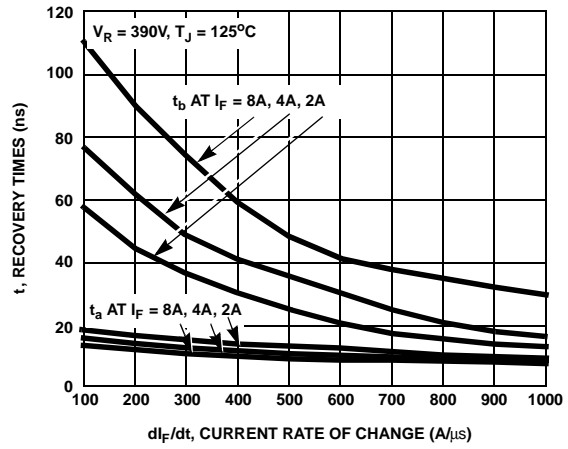


Figure 4. t_a and t_b Curves vs di_F/dt

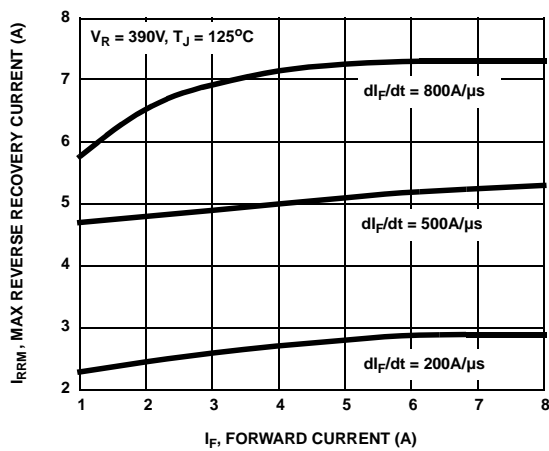


Figure 5. Maximum Reverse Recovery Current vs Forward Current

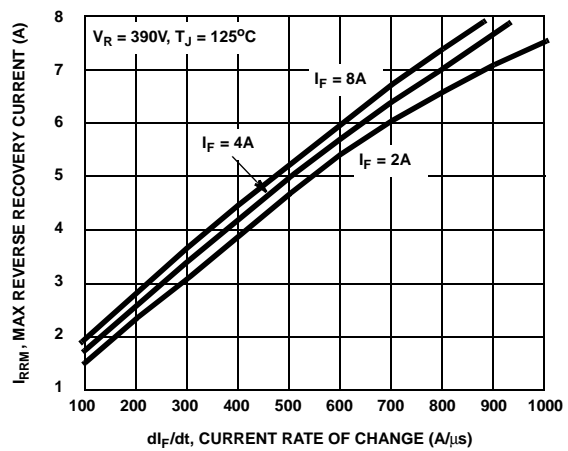


Figure 6. Maximum Reverse Recovery Current vs di_F/dt

Typical Performance Curves (Continued)

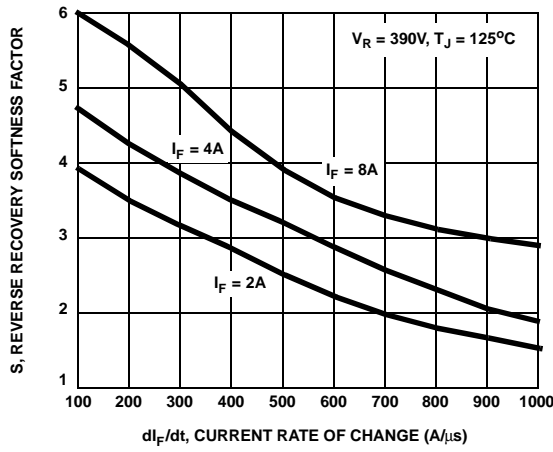


Figure 7. Reverse Recovery Softness Factor vs di_F/dt

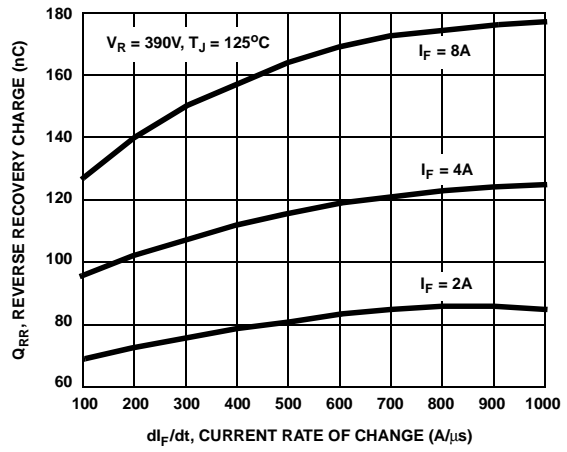


Figure 8. Reverse Recovery Charge vs di_F/dt

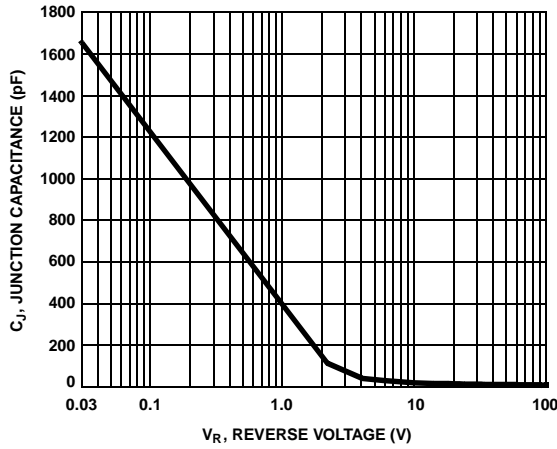


Figure 9. Junction Capacitance vs Reverse Voltage

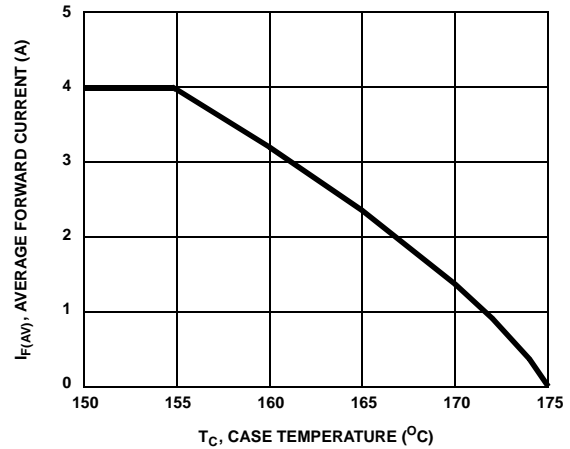


Figure 10. DC Current Derating Curve

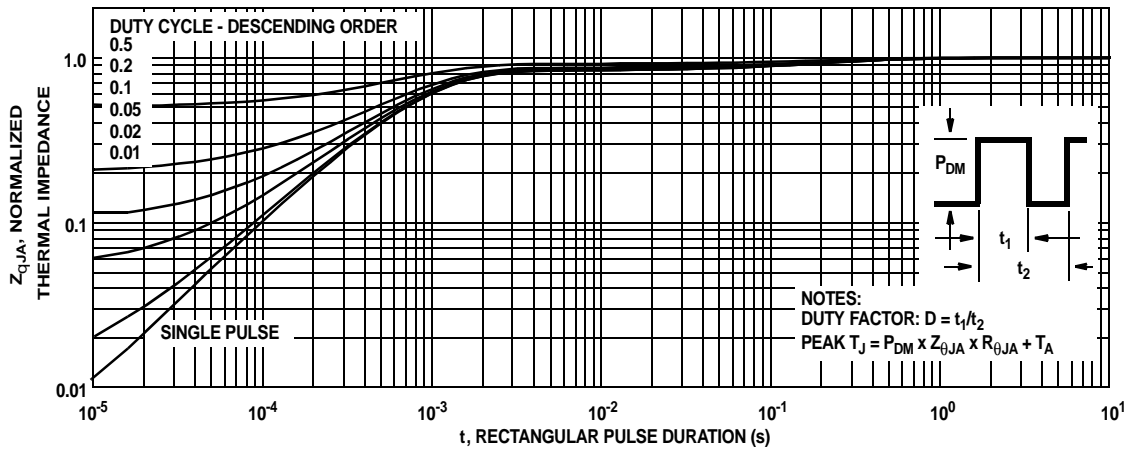


Figure 11. Normalized Maximum Transient Thermal Impedance

Test Circuit and Waveforms

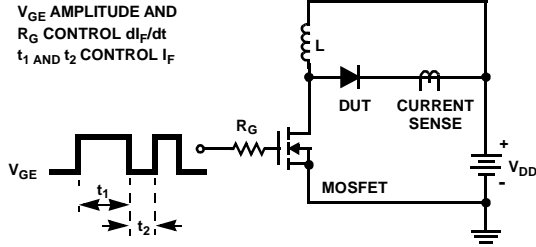


Figure 12. I_{trr} Test Circuit

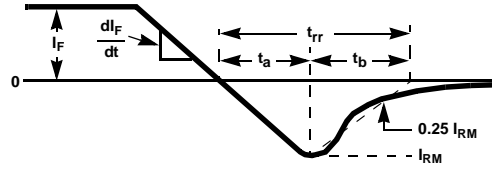


Figure 13. t_{rr} Waveforms and Definitions

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

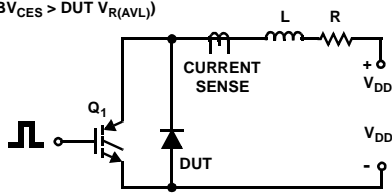


Figure 14. Avalanche Energy Test Circuit

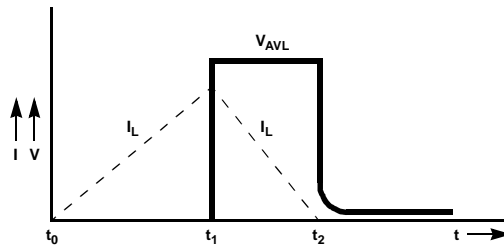


Figure 15. Avalanche Current and Voltage Waveforms

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| CoolFET™ | FASTr™ | MicroFET™ | PowerTrench® | SuperSOT™-6 |
| CROSSVOLT™ | FRFET™ | MicroPak™ | QFET® | SuperSOT™-8 |
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