

# International IOR Rectifier

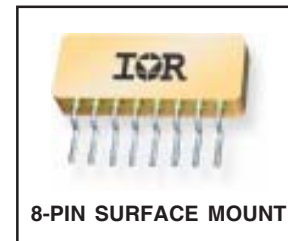
PD - 95876

## Radiation Hardended, Solid-State Relay with Buffered Inputs

## RDHA710SE10A2QK Dual 100V, 10A

### Product Summary ⑤

| Part Number     | Breakdown Voltage | Current | tr / tf    | Logic Drive Voltage |
|-----------------|-------------------|---------|------------|---------------------|
| RDHA710SE10A2QK | 100V              | 10A     | Controlled | 5.0V                |



### Description

The RDHA710SE10A2QK is a radiation hardened dual solid-state relay in a hermetic package. It is configured as a dual, single-pole-single-throw (SPST) normally open relay with common input supply. This device is characterized for 100 krad(Si) total ionizing dose. The input and output MOSFETs utilize International Rectifier's R5 technology. The RDHA710SE10A2QK is optically coupled and actuated by standard logic inputs.

### Features:

- Total Dose Capability to 100krad(Si)
- Optically Coupled
- 1000V<sub>DC</sub> Input to Output Isolation
- Buffered Input Stage
- 5.0V Compatible Logic Level Input
- Controlled Switching Times
- Hermetically Sealed Package

### Absolute Maximum Ratings per Channel @ T<sub>j</sub>=25°C (unless otherwise specified)

| Parameter                             | Symbol            | Value       | Units |
|---------------------------------------|-------------------|-------------|-------|
| Output Supply Voltage ⑤               | V <sub>S</sub>    | 100         | V     |
| Output Current ④ ⑤                    | I <sub>O</sub>    | 20          | A     |
| Input Buffer Voltage - (pins 4 & 6) ③ | V <sub>IN</sub>   | ±10         | V     |
| Input Buffer Current                  | I <sub>IN</sub>   | ±10         | mA    |
| Input Supply Voltage (pin 5) ⑦        | V <sub>DD</sub>   | 10          | V     |
| Input Supply Current ⑦                | I <sub>DD</sub>   | 25          | mA    |
| Power Dissipation ④⑤                  | P <sub>DISS</sub> | 60          | W     |
| Operating Temperature Range           | T <sub>J</sub>    | -55 to +125 | °C    |
| Storage Temperature Range             | T <sub>S</sub>    | -65 to +150 |       |
| Lead Temperature                      | T <sub>L</sub>    | 300         |       |

For notes, please refer to page 3

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## Pre-Irradiation

Electrical Characteristics per Channel @  $-55^{\circ}\text{C} \leq T_C \leq +125^{\circ}\text{C}$  (Unless Otherwise Specified)

| Parameter                                    | Group A Subgroups | Test Conditions   | Symbol       | Min. | Typ.  | Max.  | Units                |
|--|-------------------|---|--------------|------|-------|-------|----------------------|
| Output On-Resistance                         | 1                 | $V_{IN} = 5.0\text{V}$  | $R_{DS(ON)}$ | --   | 0.070 | 0.100 | $\Omega$             |
|  | 2                 | $V_{DD} = 5.0\text{V}, I_O = 10\text{A}$  |              | --   | 0.115 | 0.145 |                      |
| Input Buffer Threshold Voltage <sup>①③</sup> |                   | $V_{DD} = 5.0\text{V}, I_O = 10\text{A}$  | $V_{IN(TH)}$ | 4.5  | --    | --    | V                    |
| Output Leakage Current                       | 1                 | $V_{IN} = 0.8\text{V}, V_S = 100\text{V}$   | $I_O$        | --   | --    | 25    | $\mu\text{A}$        |
|  | 2                 | $V_{IN} = 0.8\text{V}, V_S = 80\text{V}$  |              | --   | --    | 250   |                      |
| Input Supply Current <sup>①</sup>            |                   | $V_{DD} = 5.0\text{V}, I_O = 10\text{A}$  | $I_{DD}$     | --   | 10    | 15    | mA                   |
|  |                   | $V_{DD} = 10\text{V}, I_O = 10\text{A}$ <sup>②</sup>  |              | --   | --    | 25    |                      |
| Input Buffer Current                         | 1                 | $V_{IN} = 5.0\text{V}$  | $I_{IN}$     | --   | --    | 1.0   | $\mu\text{A}$        |
|  | 2,3               |   |              | --   | --    | 3.0   |                      |
| Input-to-Output Leakage Current              | 1                 | $V_{I-O} = 1.0\text{KVdc}, \text{dwell} = 5.0\text{s}$  | $I_{I-O}$    | --   | --    | 1.0   |                      |
| Turn-On Delay <sup>⑥</sup>                   | 1,2,3             | $V_{IN} = 5.0\text{V}, V_{DD} = 5.0\text{V}, V_S = 30\text{V}$<br>$RC = 7.0\Omega/100\mu\text{F}, PW = 50\text{ms}$ | $t_{on}$     | --   | 6.5   | 25    | ms                   |
| Turn-Off Delay <sup>⑥</sup>                  | 1,2,3             | $V_{IN} = 0.8\text{V}, V_{DD} = 5.0\text{V}, V_S = 30\text{V}$<br>$RC = 7.0\Omega/100\mu\text{F}, PW = 50\text{ms}$ | $t_{off}$    | --   | 26    | 50    |                      |
| Rise Time <sup>②,⑥</sup>                     | 1,2,3             | $V_{IN} = 5.0\text{V}, V_{DD} = 5.0\text{V}, V_S = 30\text{V}$<br>$RC = 7.0\Omega/100\mu\text{F}, PW = 50\text{ms}$ | $t_r$        | --   | 1.3   | 5.5   |                      |
| Fall Time <sup>②,⑥</sup>                     | 1,2,3             | $V_{IN} = 0.8\text{V}, V_{DD} = 5.0\text{V}, V_S = 30\text{V}$<br>$RC = 7.0\Omega/100\mu\text{F}, PW = 50\text{ms}$ | $t_f$        | --   | 6.0   | 10    |                      |
| Output Capacitance <sup>①</sup>              |                   | $V_{IN} = 0.8\text{V}, f = 1.0\text{MHz}, V_S = 25\text{V}$<br>$T_C = 25^{\circ}\text{C}$                           | $C_{OSS}$    | --   | 365   | --    |                      |
| Thermal Resistance <sup>①</sup>              |                   | $V_{IN} = 5.0\text{V}, V_{DD} = 5.0\text{V}$ <sup>①,④</sup>   | $R_{THJC}$   | --   | --    | 1.7   | $^{\circ}\text{C/W}$ |
| MTBF (Per Channel)                           |                   | MIL-HDBK-217F, SF@ $T_C = 25^{\circ}\text{C}$   |              | 6.0  | --    | --    | MHrs                 |

For notes, please refer to page 3

Post Total Dose Irradiation ⑧,⑨,⑩

Electrical Characteristics per Channel @ 25°C (Unless Otherwise Specified)

| Parameter              | Group A Subgroups | Test Conditions   | Symbol       | Min. | Typ.  | Max.  | Units    |
|------------------------|-------------------|---|--------------|------|-------|-------|----------|
| Output On-Resistance   | 1                 | $V_{IN} = 5.0V, V_{DD} = 5.0V, I_O = 10A$   | $R_{DS(ON)}$ | --   | 0.070 | 0.100 | $\Omega$ |
| Output Leakage Current | 1                 | $V_{IN} = 0.8V, V_S = 100V$   | $I_O$        | --   | --    | 25    | $\mu A$  |
| Input Buffer Current   | 1                 | $V_{IN} = 5.0V$   | $I_{IN}$     | --   | --    | 1.0   |          |
| Turn-On Delay⑥         | 1                 | $V_{IN} = 5.0V, V_{DD} = 5.0V, V_S = 30V$<br>$RC = 7.0\Omega/100\mu F, PW = 50ms$ | $t_{on}$     | --   | 6.5   | 25    | ms       |
| Turn-Off Delay⑥        | 1                 | $V_{IN} = 0.8V, V_{DD} = 5.0V, V_S = 30V$<br>$RC = 7.0\Omega/100\mu F, PW = 50ms$ | $t_{off}$    | --   | 26    | 50    |          |
| Rise Time②⑥            | 1                 | $V_{IN} = 5.0V, V_{DD} = 5.0V, V_S = 30V$<br>$RC = 7.0\Omega/100\mu F, PW = 50ms$ | $t_r$        | --   | 1.3   | 5.5   |          |
| Fall Time②⑥            | 1                 | $V_{IN} = 0.8V, V_{DD} = 5.0V, V_S = 30V$<br>$RC = 7.0\Omega/100\mu F, PW = 50ms$ | $t_f$        | --   | 6.0   | 10    |          |

Notes for Maximum Ratings and Electrical Characteristic Tables

- ① Specification is guaranteed by design
- ② Rise and fall times are controlled internally
- ③ Inputs protected for  $V_{IN} < 1.0V$  and  $V_{IN} > 7.5V$
- ④ Optically coupled Solid State Relays (SSRs) have relatively slow turn on and turn off times. Care must be taken to insure that transient currents do not cause violation of SOA. If transient conditions are present, IR recommends a complete simulation to be performed by the end user to insure compliance with SOA requirements as specified in the IRHNJ57130 data sheet
- ⑤ While the SSR design meets the design requirements specified in MIL-PRF-38534, the end user is responsible for product derating, as required for the application
- ⑥ Reference Figures 3 & 4 for Switching Test Circuits and Wave Form
- ⑦ Input Supply voltage shall not exceed 5.25V @  $T_c \geq 70^\circ C$
- ⑧ Total Dose Irradiation with Input Bias. 10mA  $I_{DD}$  applied and  $V_{DS} = 0$  during Irradiation
- ⑨ Total Dose Irradiation with Output Bias. 80 Volts  $V_{DS}$  applied and  $I_{DD} = 0$  during Irradiation
- ⑩ International Rectifier does not currently have a DSCC certified Radiation Hardness Assurance Program

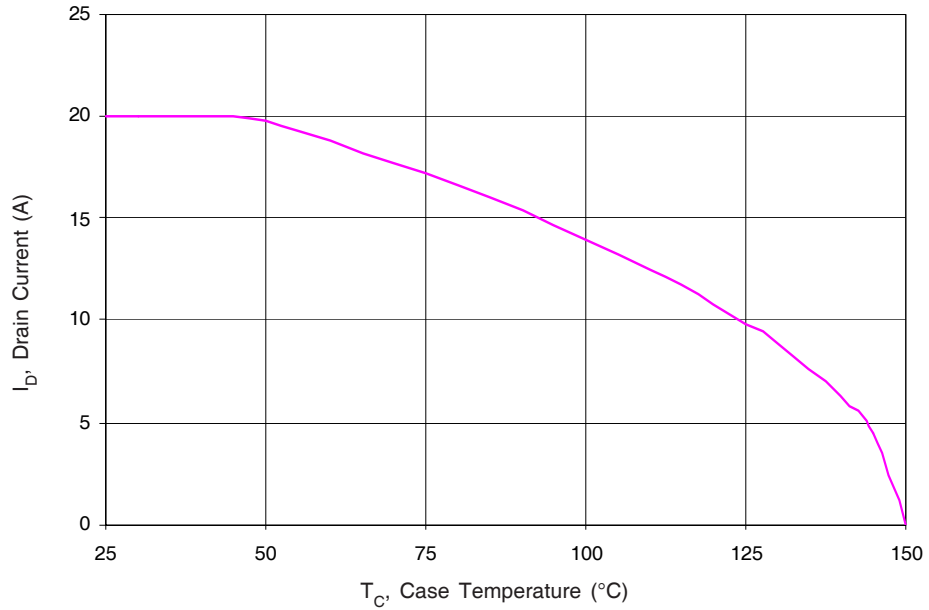


Fig 1: Maximum Drain Current Vs Case Temperature

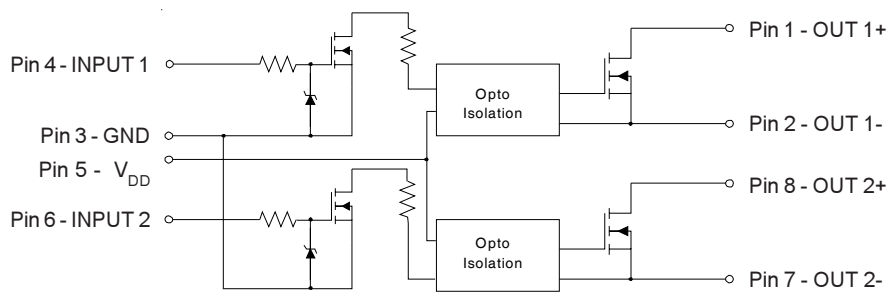
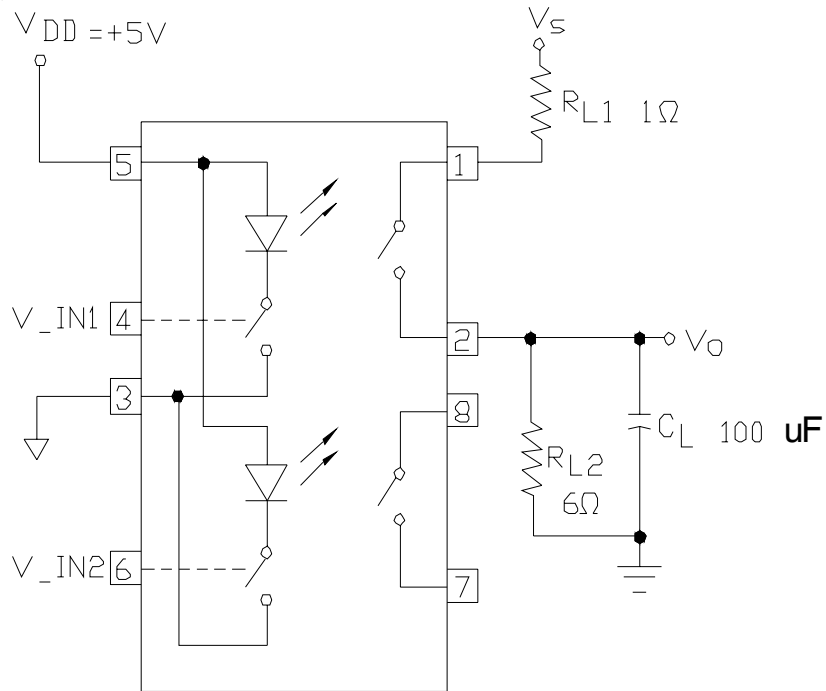


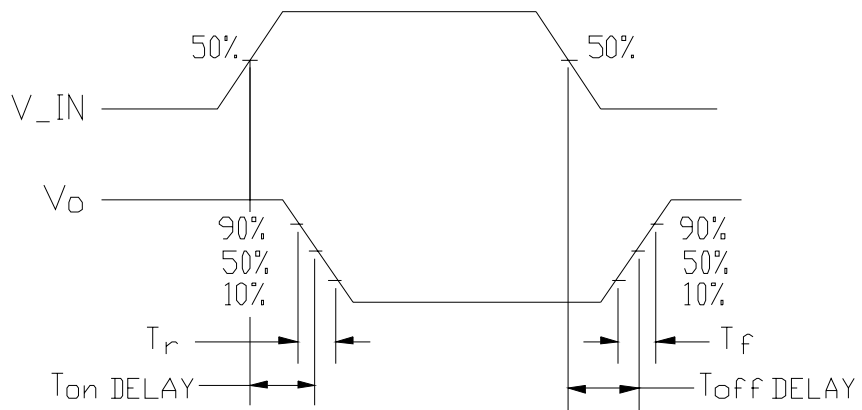
Fig 2: Typical Application

**Radiation Performance**

International Rectifier Radiation Hardened MOSFETs are tested to verify their hardness capability. The hardness assurance program at IR uses a Cobalt-60 (<sup>60</sup>Co) Source and heavy ion irradiation. Both pre- and post- irradiation performance are tested and specified using the same drive circuitry and test conditions to provide a direct comparison.

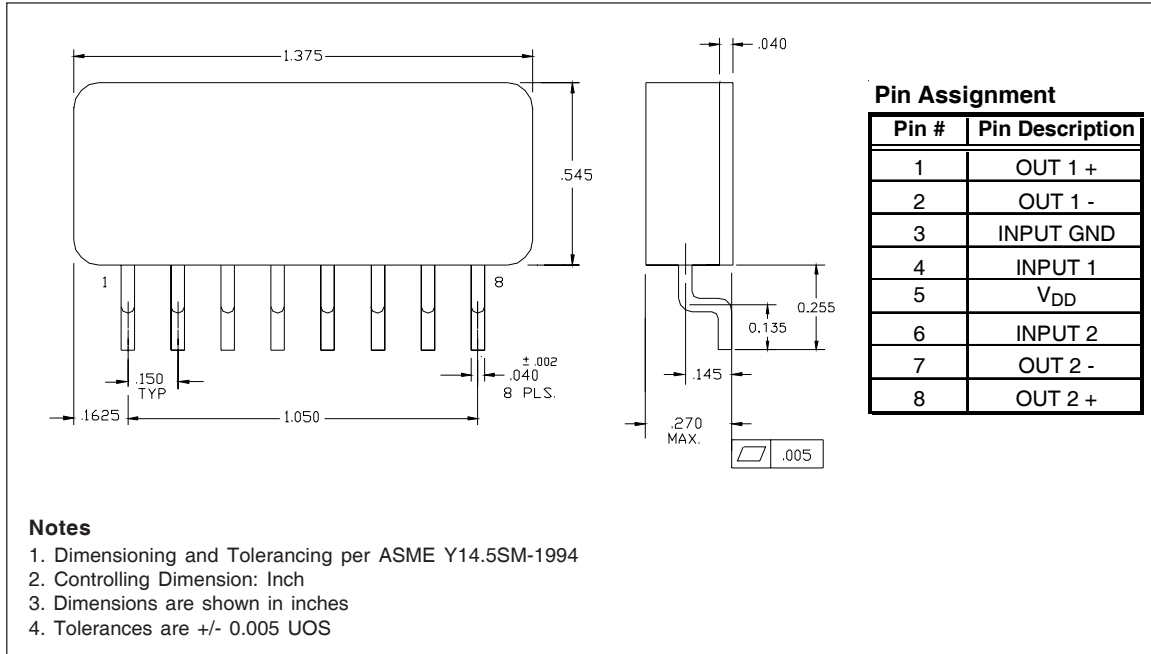


**Fig 3: Switching Test Circuit (Only one channel shown)**



**Fig 4: Switching Test Waveform**

**Case Outline and Dimensions — 8-Pin Surface Mount Package**



**Part Numbering Nomenclature**

