

**Radiation Hardended, Octal,
 Buffered and Non-Buffered,
 Solid State Relays**

**RDHA701FP10A8CK
 RDHA701FP10A8QK
 Octal, 100V, 1.5A**

Product Summary

| Part Number | Voltage | Current | tr / tf | Buffer |
|-----------------|---------|---------|------------|--------|
| RDHA701FP10A8CK | 100V | 1.5A | Fast | None |
| RDHA701FP10A8QK | 100V | 1.5A | Controlled | 5.0V |



Description

The RDHA701FP10A8CK, RDHA701FP10A8QK are a family of radiation hardened, octal, single-pole, normally open, buffered and non-buffered solid state relays. These devices are actuated by an input voltage or current, depending on model, and have been characterized for 100 krad(Si) total dose. These parts are useful for applications requiring a compact, hermetic device.

Features:

- Total Dose Capability to 100krad(Si)
- Optically Coupled
- Buffered Input Stage (RDHA701FP10A8QK)
- Input Current Actuated (RDHA701FP10A8CK)
- 1000V_{DC} Input to Output Isolation
- Hermetically Sealed Package

Absolute Maximum Ratings per Channel @ T_J=25°C (unless otherwise specified)

| Parameter | Symbol | Value | Units |
|---|--------------------|-------------|-------|
| Output Maximum Voltage ^① | V _S | 100 | V |
| Output Current ^{④ ⑤} | I _O | 1.5 | A |
| Input Buffer Voltage - RDHA701FP10A8QK | V _{IN} | ±10 | V |
| Input Buffer Current - RDHA701FP10A8QK | I _{IN} | ±10 | mA |
| Input Supply Voltage (Optocoupler) - RDHA701FP10A8QK ^② | V _{DD} | 10 | V |
| Input Supply Current - RDHA701FP10A8CK / RDHA701FP10A8QK | I _{DD} | 30 | mA |
| Peak Input Supply Current (t ≤ 1.0ms) - RDHA701FP10A8CK | I _{DD pk} | 100 | |
| Power Dissipation | P _{DISS} | 5.5 | W |
| Operating Temperature Range | T _J | -55 to +125 | °C |
| Storage Temperature Range | T _S | -65 to +150 | |
| Lead Temperature | T _L | 300 | |

For notes, please refer to page 4

RDHA701FP10A8CK

General 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 |
|-----------------------------------|-------------------|---|------------|------|------|------|----------------------|
| Input Supply Current ^① | | $I_O = 1.0\text{A}$ | I_{DD} | -- | 10 | 25 | mA |
| Input Voltage Drop | 1 | $I_{IN} = 10\text{mA}$ | V_L | 1.2 | -- | 1.6 | V |
| | 2 | | | 1.4 | -- | 2.2 | |
| | 3 | | | 1.0 | -- | 1.4 | |
| Input-to-Output Leakage Current | 1 | $V_{I-O} = 1.0\text{KVdc}$, dwell = 5.0s | I_{I-O} | -- | -- | 1.0 | μA |
| Output Capacitance ^① | | $V_{IN} = 0.8\text{V}$, $f = 1.0\text{MHz}$, $V_S = 25\text{V}$ $T_C = 25^{\circ}\text{C}$ | C_{OSS} | -- | 145 | -- | pF |
| Thermal Resistance ^① | | $I_{DD} = 10\text{mA}$ ^① | R_{THJC} | -- | -- | 18 | $^{\circ}\text{C/W}$ |
| MTBF (Per Channel) | | MIL-HDBK-217F, SF@ $T_C = 25^{\circ}\text{C}$ | | 48 | -- | -- | MHrs |

RDHA701FP10A8QK

General 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 |
|---|-------------------|---|--------------|------|------|------|----------------------|
| Input Buffer Threshold Voltage ^{①,③} | | | $V_{IN(TH)}$ | 4.5 | -- | -- | V |
| Input Supply Current ^① | | $V_{DD} = 5.0\text{V}$, $I_O = 1.0\text{A}$ | I_{DD} | -- | 10 | 15 | mA |
| | | $V_{DD} = 10\text{V}$, $I_O = 1.0\text{A}$ ^② | | -- | -- | 25 | |
| Input-to-Output Leakage Current | 1 | $V_{I-O} = 1.0\text{KVdc}$, dwell = 5.0s | I_{I-O} | -- | -- | 1.0 | μA |
| Output Capacitance ^① | | $V_{IN} = 0.8\text{V}$, $f = 1.0\text{MHz}$, $V_S = 25\text{V}$ $T_C = 25^{\circ}\text{C}$ | C_{OSS} | -- | 145 | -- | pF |
| Thermal Resistance ^① | | $V_{IN} = 5.0\text{V}$, $V_{DD} = 5.0\text{V}$ ^{①,④} | R_{THJC} | -- | -- | 18 | $^{\circ}\text{C/W}$ |
| MTBF (Per Channel) | | MIL-HDBK-217F, SF@ $T_C = 25^{\circ}\text{C}$ | | 24.6 | -- | -- | MHrs |

For notes, please refer to page 5

**Pre-Irradiation
RDHA701FP10A8CK**

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 | $I_{DD} = 10\text{mA}, I_O = 1.0\text{A}$ | $R_{DS(ON)}$ | -- | 0.24 | 0.35 | Ω |
| | 2 | | | -- | 0.45 | 0.75 | |
| Output Leakage Current | 1 | $V_{IN} = 0.8\text{V}, V_S = 100\text{V}$ | I_O | -- | -- | 10 | μA |
| | 2 | $V_{IN} = 0.8\text{V}, V_S = 80\text{V}$ | | -- | -- | 25 | |
| Turn-On Delay [Ⓞ] | 1,2,3 | $I_{DD} = 10\text{mA}, V_S = 28\text{V}, D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}, PW = 50\text{ms}$ | t_{on} | -- | 0.6 | 2.5 | ms |
| Turn-Off Delay [Ⓞ] | 1,2,3 | $V_S = 28\text{V}, D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}, PW = 50\text{ms}$ | t_{off} | -- | 3.5 | 7.0 | |
| Rise Time ^{Ⓞ,Ⓢ} | 1,2,3 | $I_{DD} = 10\text{mA}, V_S = 28\text{V}, D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}, PW = 50\text{ms}$ | t_r | -- | 0.5 | 2.0 | |
| Fall Time ^{Ⓞ,Ⓢ} | 1,2,3 | $V_S = 28\text{V}, D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}, PW = 50\text{ms}$ | t_f | -- | 7.2 | 9.5 | |

**Pre-Irradiation
RDHA701FP10A8QK**

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 | $I_{DD} = 10\text{mA}, I_O = 1.0\text{A}$ | $R_{DS(ON)}$ | -- | 0.24 | 0.35 | Ω |
| | 2 | | | -- | 0.45 | 0.75 | |
| Output Leakage Current | 1 | $V_{IN} = 0.8\text{V}, V_S = 100\text{V}$ | I_O | -- | -- | 10 | μA |
| | 2 | $V_{IN} = 0.8\text{V}, V_S = 80\text{V}$ | | -- | -- | 25 | |
| Input Buffer Current | 1 | $V_{IN} = 5.0\text{V}$ | I_{IN} | -- | -- | 1.0 | μA |
| | 2,3 | | | -- | -- | 3.0 | |
| Turn-On Delay [Ⓞ] | 1,2,3 | $I_{DD} = 10\text{mA}, V_S = 28\text{V}, D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}, PW = 50\text{ms}$ | t_{on} | -- | 4.5 | 15 | ms |
| Turn-Off Delay [Ⓞ] | 1,2,3 | $V_S = 28\text{V}, D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}, PW = 50\text{ms}$ | t_{off} | -- | 35 | 60 | |
| Rise Time ^{Ⓞ,Ⓢ} | 1,2,3 | $I_{DD} = 10\text{mA}, V_+ = 28\text{V}, D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}, PW = 50\text{ms}$ | t_r | -- | 1.1 | 3.0 | |
| Fall Time ^{Ⓞ,Ⓢ} | 1,2,3 | $V_S = 28\text{V}, D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}, PW = 50\text{ms}$ | t_f | -- | 11 | 15 | |

For notes, please refer to page 5

Post Total Dose Irradiation ⑧,⑨,⑩

RDHA701FP10A8CK

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

| Parameter | Group A Subgroups | Test Conditions | Symbol | Min. | Typ. | Max. | Units |
|-----------------------------|-------------------|--|--------------|------|------|------|---------------|
| Output On-Resistance | 1 | $I_{DD} = 10\text{mA}$, $I_O = 1.0\text{A}$ | $R_{DS(ON)}$ | -- | 0.24 | 0.35 | Ω |
| Output Leakage Current | 1 | $V_{IN} = 0.8\text{V}$, $V_S = 100\text{V}$ | I_O | -- | -- | 10 | μA |
| Turn-On Delay ^⑥ | 1 | $I_{DD} = 10\text{mA}$, $V_S = 28\text{V}$, $D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}$, $PW = 50\text{ms}$ | t_{on} | -- | 0.6 | 2.5 | ms |
| Turn-Off Delay ^⑥ | 1 | $V_S = 28\text{V}$, $D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}$, $PW = 50\text{ms}$ | t_{off} | -- | 3.5 | 7.0 | |
| Rise Time ^{②,⑥} | 1 | $I_{DD} = 10\text{mA}$, $V_S = 28\text{V}$, $D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}$, $PW = 50\text{ms}$ | t_r | -- | 0.5 | 2.0 | |
| Fall Time ^{②,⑥} | 1 | $V_S = 28\text{V}$, $D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}$, $PW = 50\text{ms}$ | t_f | -- | 7.2 | 9.5 | |

Post Total Dose Irradiation ⑧,⑨,⑩

RDHA701FP10A8QK

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

| Parameter | Group A Subgroups | Test Conditions | Symbol | Min. | Typ. | Max. | Units |
|-----------------------------|-------------------|--|--------------|------|------|------|---------------|
| Output On-Resistance | 1 | $I_{DD} = 10\text{mA}$, $I_O = 1.0\text{A}$ | $R_{DS(ON)}$ | -- | 0.24 | 0.35 | Ω |
| Output Leakage Current | 1 | $V_{IN} = 0.8\text{V}$, $V_S = 100\text{V}$ | I_O | -- | -- | 10 | μA |
| Input Buffer Current | 1 | $V_{IN} = 5.0\text{V}$ | I_{IN} | -- | -- | 1.0 | |
| Turn-On Delay ^⑥ | 1 | $I_{DD} = 10\text{mA}$, $V_S = 28\text{V}$, $D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}$, $PW = 50\text{ms}$ | t_{on} | -- | 4.5 | 15 | ms |
| Turn-Off Delay ^⑥ | 1 | $V_S = 28\text{V}$, $D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}$, $PW = 50\text{ms}$ | t_{off} | -- | 35 | 60 | |
| Rise Time ^{②,⑥} | 1 | $I_{DD} = 10\text{mA}$, $V_S = 28\text{V}$, $D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}$, $PW = 50\text{ms}$ | t_r | -- | 1.1 | 3.0 | |
| Fall Time ^{②,⑥} | 1 | $V_S = 28\text{V}$, $D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}$, $PW = 50\text{ms}$ | t_f | -- | 11 | 15 | |

For notes, please refer to page 5

Notes for Maximum Ratings, General 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 a violation of SOA. If transient conditions are present, IR recommends a complete simulation to be performed by the end user to ensure compliance with SOA requirements as specified in the IRHQ57110 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 applicable for the application
- ⑥ Reference Figures 2, 3 & 4 for Switching Test Circuits and Wave Form
- ⑦ Input Supply voltage for RDHA701FP10A8QK 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

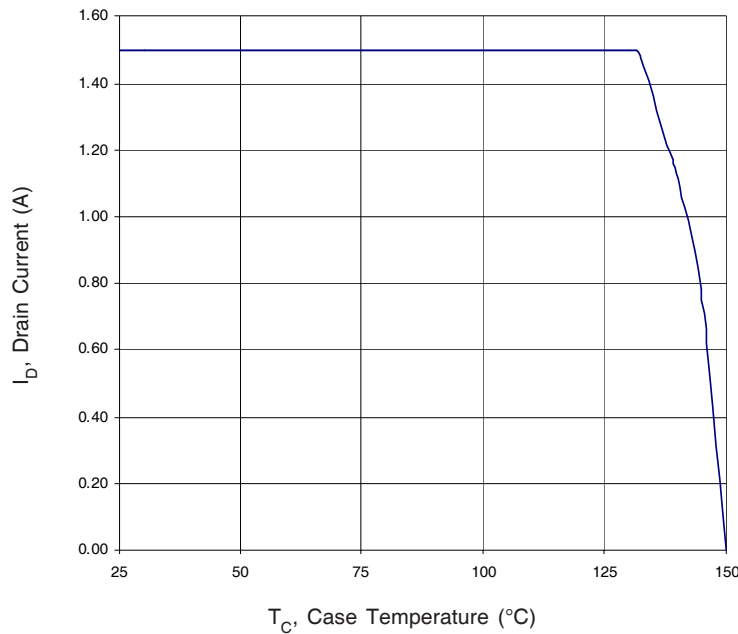
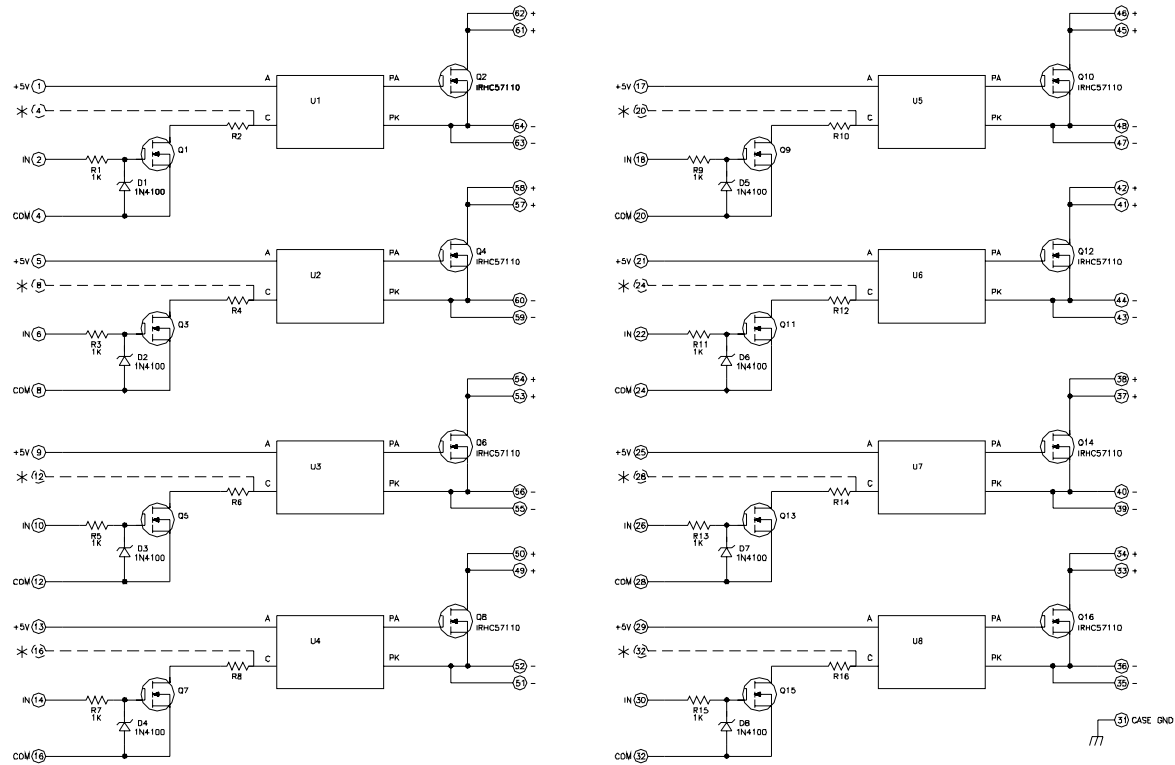


Fig 1: Maximum Drain Current Vs Case Temperature

RDHA701FP10A8CK, RDHA701FP10A8QK

Schematic



Notes

1. Buffered Input stages on RDHA701FP10A8QK only
2. Input Current Actuation (*) on RDHA701FP10A8CK only

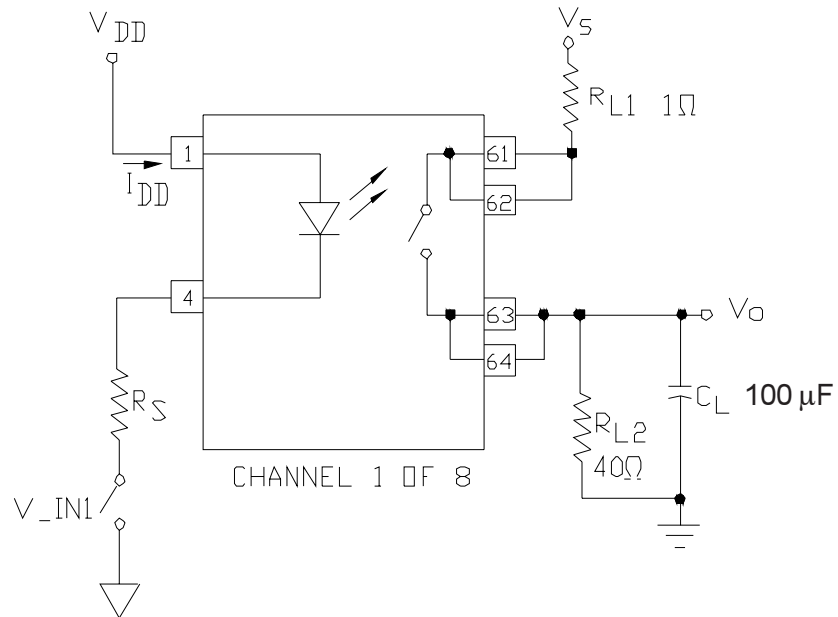


Fig 2: Switching Test Circuit for RDHA701FP10A8CK only

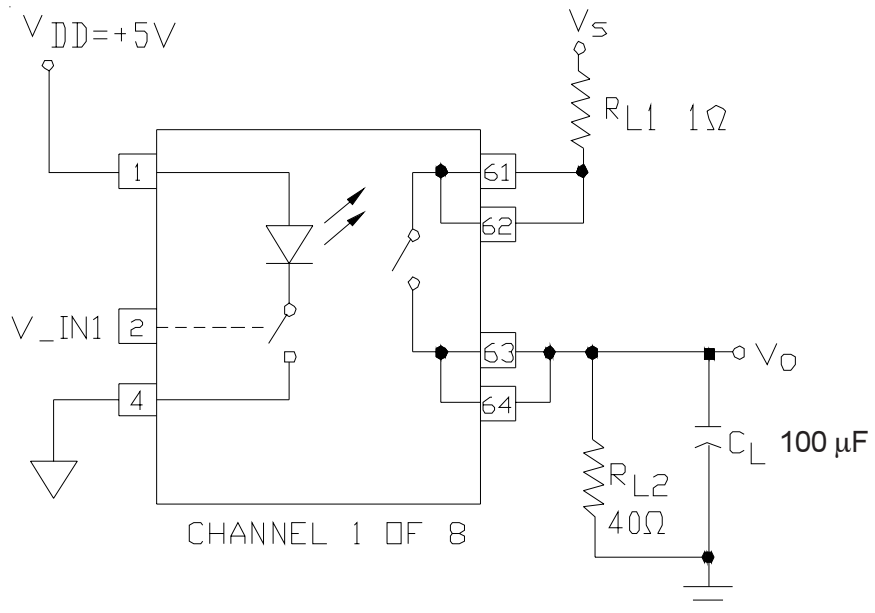


Fig 3: Switching Test Circuit for RDHA701FP10A8QK only

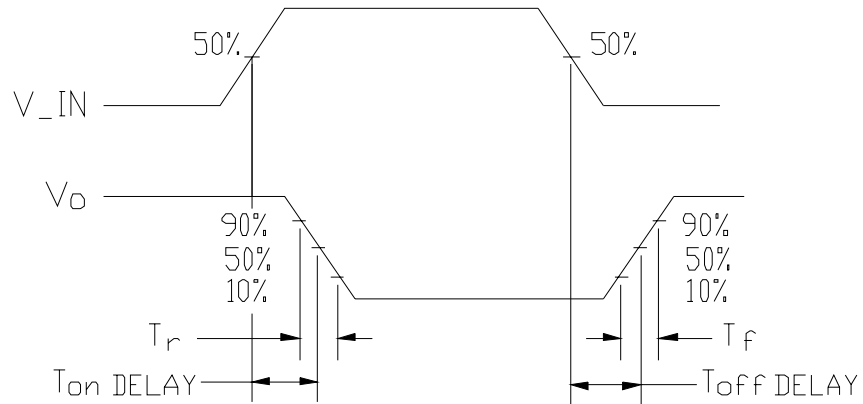


Fig 4: Switching Test Waveform

Radiation Performance

International Rectifier Radiation Hardened SSRs are tested to verify their hardness capability. The hardness assurance program at IR uses a Cobalt-60 (^{60}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.

Pin Designation - RDHA701FP10A8CK

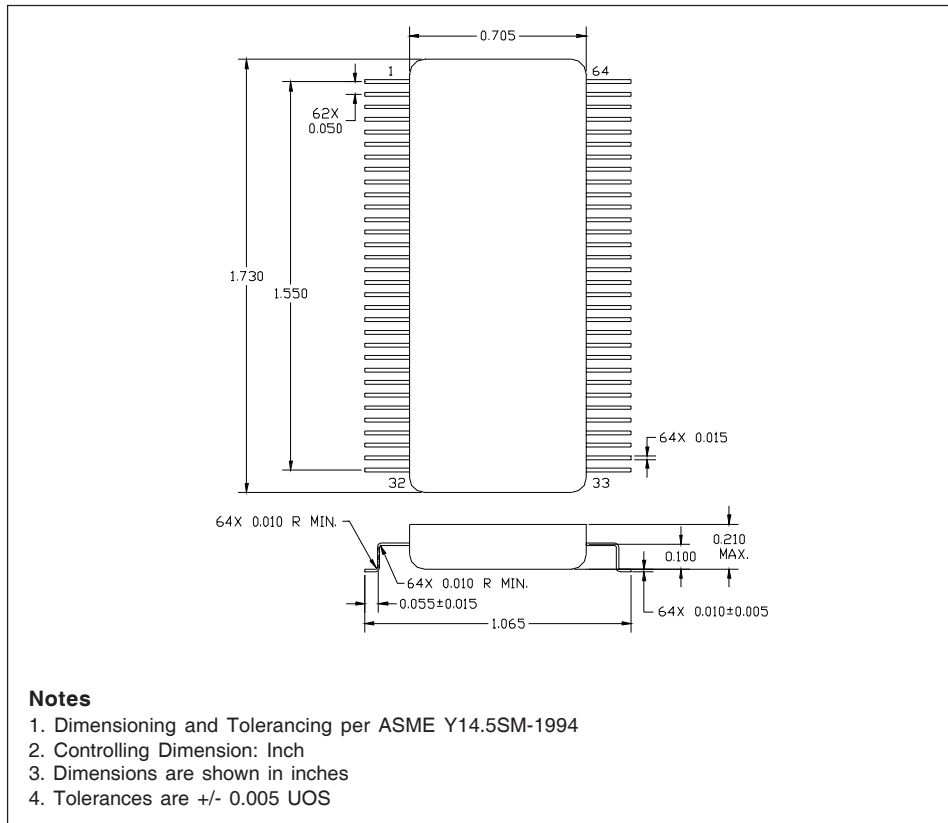
| Pin No. | Designation | Pin No. | Designation | Pin No. | Designation | Pin No. | Designation |
|---------|---------------|---------|--------------------------|---------|-------------|---------|-------------|
| 1 | Current IN 1 | 17 | Current IN 5 | 33 | Drain 8 | 49 | Drain 4 |
| 2 | N/C | 18 | N/C | 34 | Drain 8 | 50 | Drain 4 |
| 3 | N/C | 19 | N/C | 35 | Source 8 | 51 | Source 4 |
| 4 | Current OUT 1 | 20 | Current OUT 5 | 36 | Source 8 | 52 | Source 4 |
| 5 | Current IN 2 | 21 | Current IN 6 | 37 | Drain 7 | 53 | Drain 3 |
| 6 | N/C | 22 | N/C | 38 | Drain 7 | 54 | Drain 3 |
| 7 | N/C | 23 | N/C | 39 | Source 7 | 55 | Source 3 |
| 8 | Current OUT 2 | 24 | Current OUT 6 | 40 | Source 7 | 56 | Source 3 |
| 9 | Current IN 3 | 25 | Current IN 7 | 41 | Drain 6 | 57 | Drain 2 |
| 10 | N/C | 26 | N/C | 42 | Drain 6 | 58 | Drain 2 |
| 11 | N/C | 27 | N/C | 43 | Source 6 | 59 | Source 2 |
| 12 | Current OUT 3 | 28 | Current OUT 7 | 44 | Source 6 | 60 | Source 2 |
| 13 | Current IN 4 | 29 | Current IN 8 | 45 | Drain 5 | 61 | Drain 1 |
| 14 | N/C | 30 | N/C | 46 | Drain 5 | 62 | Drain 1 |
| 15 | N/C | 31 | Case ground [Ⓞ] | 47 | Source 5 | 63 | Source 1 |
| 16 | Current OUT 4 | 32 | Current OUT 8 | 48 | Source 5 | 64 | Source 1 |

Pin Designation - RDHA701FP10A8QK

| Pin No. | Designation | Pin No. | Designation | Pin No. | Designation | Pin No. | Designation |
|---------|-------------|---------|--------------------------|---------|-------------|---------|-------------|
| 1 | +5V 1 | 17 | + 5V 5 | 33 | Drain 8 | 49 | Drain 4 |
| 2 | IN 1 | 18 | IN 5 | 34 | Drain 8 | 50 | Drain 4 |
| 3 | N/C | 19 | N/C | 35 | Source 8 | 51 | Source 4 |
| 4 | 5V RTN 1 | 20 | 5V RTN 5 | 36 | Source 8 | 52 | Source 4 |
| 5 | +5V 2 | 21 | + 5V 6 | 37 | Drain 7 | 53 | Drain 3 |
| 6 | IN 2 | 22 | IN 6 | 38 | Drain 7 | 54 | Drain 3 |
| 7 | N/C | 23 | N/C | 39 | Source 7 | 55 | Source 3 |
| 8 | 5V RTN 2 | 24 | 5V RTN 6 | 40 | Source 7 | 56 | Source 3 |
| 9 | + 5V 3 | 25 | + 5V 7 | 41 | Drain 6 | 57 | Drain 2 |
| 10 | IN 3 | 26 | IN 7 | 42 | Drain 6 | 58 | Drain 2 |
| 11 | N/C | 27 | N/C | 43 | Source 6 | 59 | Source 2 |
| 12 | 5V RTN 3 | 28 | 5V RTN 7 | 44 | Source 6 | 60 | Source 2 |
| 13 | + 5V 4 | 29 | + 5V 8 | 45 | Drain 5 | 61 | Drain 1 |
| 14 | IN 4 | 30 | IN 8 | 46 | Drain 5 | 62 | Drain 1 |
| 15 | N/C | 31 | Case ground [Ⓞ] | 47 | Source 5 | 63 | Source 1 |
| 16 | 5V RTN 4 | 32 | 5V RTN 8 | 48 | Source 5 | 64 | Source 1 |

Ⓞ Case ground is for EMI shielding purposes only. It does not have to be connected for proper relay operation

Case Outline and Dimensions — 64 Pin Flat Pak Package



Notes

1. Dimensioning and Tolerancing per ASME Y14.5SM-1994
2. Controlling Dimension: Inch
3. Dimensions are shown in inches
4. Tolerances are +/- 0.005 UOS

Part Numbering Nomenclature

