

**RADIATION HARDENED, OCTAL
BUFFERED and NON-BUFFERED
SOLID STATE RELAY**

100V, 1.3A

Product Summary

Part Number	Voltage	Current	tr / tf	Buffer
RDHA701FP10A8CK	100V	1.3A	Fast	None
RDHA701FP10A8QK	100V	1.3A	Controlled	5.0V



Description

The RDHA701FP10A8CK and RDHA701FP10A8QK are part of the International Rectifier HiRel family of products. They 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 100kRads(Si) total dose. These parts are useful for applications requiring a compact hermetic device.

Features

- Total Dose Capability to 100kRads(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 ⑤	V _S	100	V
Output Current ④ ⑤	I _O	1.3	A
Input Buffer Voltage - RDHA701FP10A8QK	V _{IN}	±10	v
Input Buffer Current - RDHA701FP10A8QK	I _{IN}	±10	mA
Input Supply Voltage (Optocoupler) - RDHA701FP10A8QK ⑦	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 Junction Range	T _J	-55 to +125	°C
Storage Temperature Range	T _{STG}	-65 to +150	
Lead Temperature	T _L	300	

For Notes, refer to the page 5.

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			1.0	—	1.4	
	3			1.4	—	2.2	
Input-to-Output Leakage Current	1	$V_{I-O} = 1.0\text{kV}_{DC}$, 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		$I_{DD} = 10\text{mA}$	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 ①③			$V_{IN(TH)}$	4.5	—	—	V
Input Supply Current ①		$V_{DD} = 5.0\text{V}$, $I_O = 1.0\text{A}$	I_{DD}	—	10	15	mA
		$V_{DD} = 10\text{V}$, $I_O = 1.0\text{A}$ ⑦		—	—	25	
Input-to-Output Leakage Current	1	$V_{I-O} = 1.0\text{kV}_{DC}$, 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, refer to the page 5

Pre-Radiation

RDHA701FP10A8CK

Electrical Characteristics per Channel @ -55°C ≤ T_C ≤ +125°C (Unless Otherwise Specified)

Parameter	Group A Subgroups	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Output On-Resistance	1	I _{DD} = 10mA, I _O = 1.0A	R _{DS(ON)}	—	0.24	0.35	Ω
	2			—	0.45	0.75	
Output Leakage Current	1	V _{IN} = 0.8V, V _S = 100V	I _O	—	—	10	μA
	2	V _{IN} = 0.8V, V _S = 80V		—	—	25	
Turn-On Delay ⑥	9, 10, 11	I _{DD} = 10mA, V _S = 28V, D = 2.0% RC = 41Ω/100μF, PW = 50ms	t _{on}	—	0.6	2.5	ms
Turn-Off Delay ⑥	9, 10, 11	V _S = 28V, D = 2.0% RC = 41Ω/100μF, PW = 50ms	t _{off}	—	3.5	7.0	
Rise Time ②⑥	9, 10, 11	I _{DD} = 10mA, V _S = 28V, D = 2.0% RC = 41Ω/100μF, PW = 50ms	t _r	—	0.5	2.0	
Fall Time ②⑥	9, 10, 11	V _S = 28V, D = 2.0% RC = 41Ω/100μF, PW = 50ms	t _f	—	7.2	9.5	

Pre-Radiation

RDHA701FP10A8QK

Electrical Characteristics per Channel @ -55°C ≤ T_C ≤ +125°C (Unless Otherwise Specified)

Parameter	Group A Subgroups	Test Conditions	Symbol	Min.	Typ.	Max.	Units
Output On-Resistance	1	I _{DD} = 10mA, I _O = 1.0A	R _{DS(ON)}	—	0.24	0.35	Ω
	2			—	0.45	0.75	
Output Leakage Current	1	V _{IN} = 0.8V, V _S = 100V	I _O	—	—	10	μA
	2	V _{IN} = 0.8V, V _S = 80V		—	—	25	
Input Buffer Current	1	V _{IN} = 5.0V	I _{IN}	—	—	1.0	μA
	2, 3			—	—	3.0	
Turn-On Delay ⑥	9, 10, 11	I _{DD} = 10mA, V _S = 28V, D = 2.0% RC = 41Ω/100μF, PW = 50ms	t _{on}	—	4.5	15	ms
Turn-Off Delay ⑥	9, 10, 11	V _S = 28V, D = 2.0% RC = 41Ω/100μF, PW = 50ms	t _{off}	—	35	60	
Rise Time ②⑥	9, 10, 11	I _{DD} = 10mA, V _S = 28V, D = 2.0% RC = 41Ω/100μF, PW = 50ms	t _r	—	1.1	3.0	
Fall Time ②⑥	9, 10, 11	V _S = 28V, D = 2.0% RC = 41Ω/100μF, PW = 50ms	t _f	—	11	15	

For Notes, refer to the 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	9	$I_{DD} = 10\text{mA}$, $V_S = 28\text{V}$, $D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}$, $PW = 50\text{ms}$	t_{on}	—	0.6	2.5	ms
Turn-Off Delay ⑥	9	$V_S = 28\text{V}$, $D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}$, $PW = 50\text{ms}$	t_{off}	—	3.5	7.0	
Rise Time ②⑥	9	$I_{DD} = 10\text{mA}$, $V_S = 28\text{V}$, $D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}$, $PW = 50\text{ms}$	t_r	—	0.5	2.0	
Fall Time ②⑥	9	$V_S = 28\text{V}$, $D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}$, $PW = 50\text{ms}$	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	9	$I_{DD} = 10\text{mA}$, $V_S = 28\text{V}$, $D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}$, $PW = 50\text{ms}$	t_{on}	—	4.5	15	ms
Turn-Off Delay ⑥	9	$V_S = 28\text{V}$, $D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}$, $PW = 50\text{ms}$	t_{off}	—	35	60	
Rise Time ②⑥	9	$I_{DD} = 10\text{mA}$, $V_S = 28\text{V}$, $D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}$, $PW = 50\text{ms}$	t_r	—	1.1	3.0	
Fall Time ②⑥	9	$V_S = 28\text{V}$, $D = 2.0\%$ $RC = 41\Omega/100\mu\text{F}$, $PW = 50\text{ms}$	t_f	—	11	15	

For Notes, refer to the page 5.

Notes for Maximum Ratings, General and Electrical Characteristics Tables:

- ① Specification is guaranteed by design.
- ② Rise and fall time are controlled internally.
- ③ Inputs protected by $V_{IN} < 1.0V$ 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 ensure that transient currents do not cause a violation of SOA. If transient conditions are present, IR HiRel recommends a complete simulation to be performed by the end user to ensure compliance with SOA requirements as specified in the IRHQ57110 datasheet.
- 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 Fig. 2, 3 and 4 for Switching Test Circuits and Wave Forms.
- 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 IR HiRel does not currently have a DLA Certified Radiation Hardness Assurance Program.

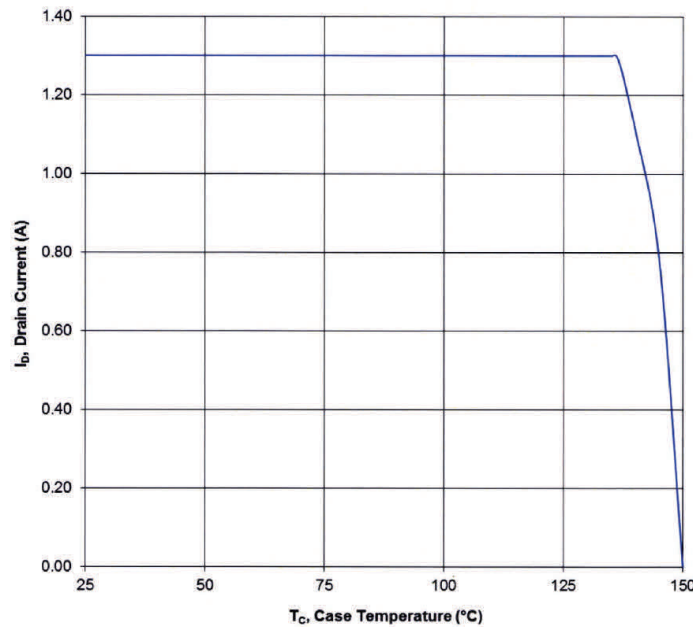
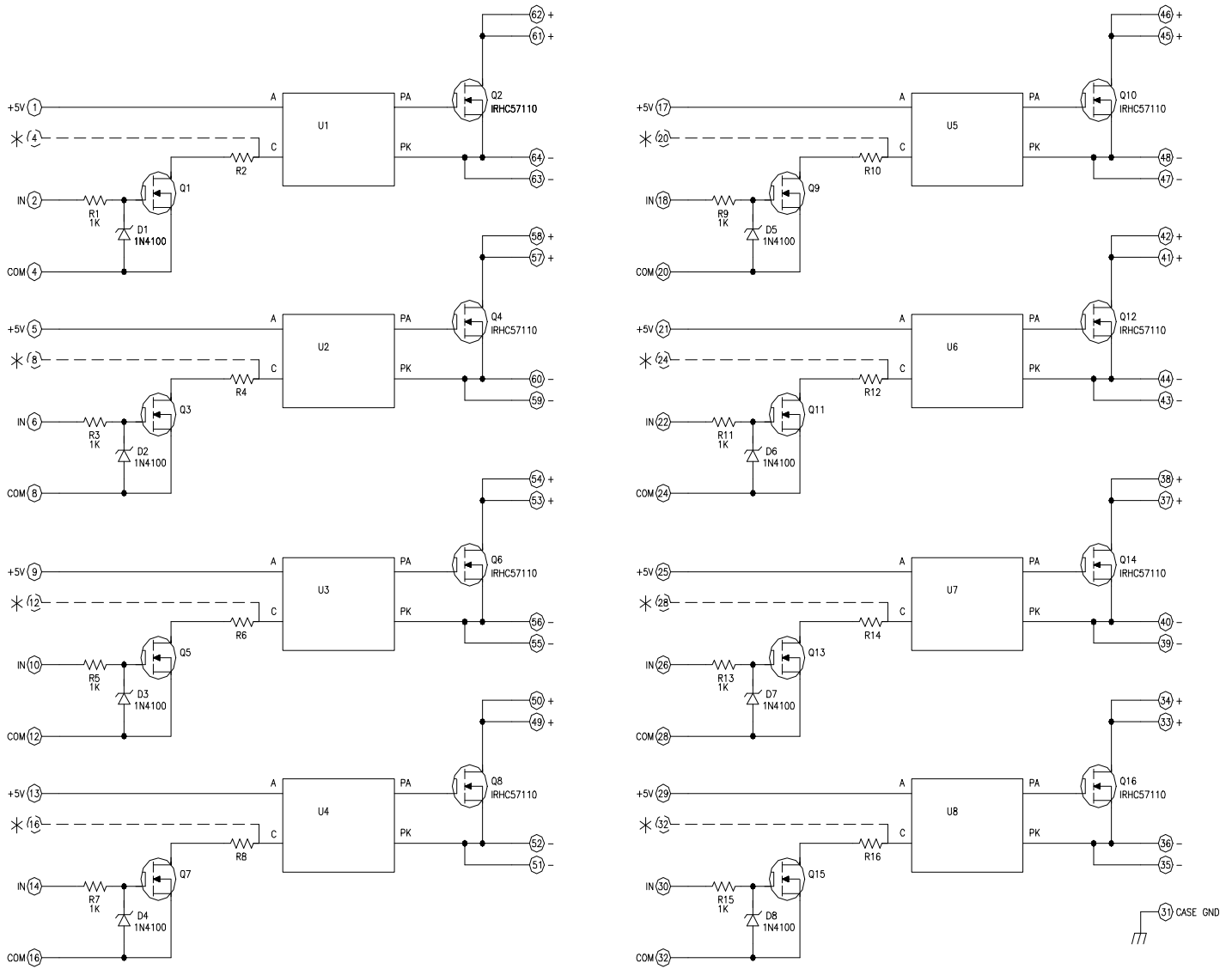


Fig 1. Maximum Drain Current Vs Case Temperature

Radiation Performance:

IR HiRel Radiation Hardened SSRs are tested to verify their hardness capability. The hardness assurance program at IR HiRel uses a Cobalt-60(⁶⁰Co) 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.

Schematic Diagram



Notes:

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

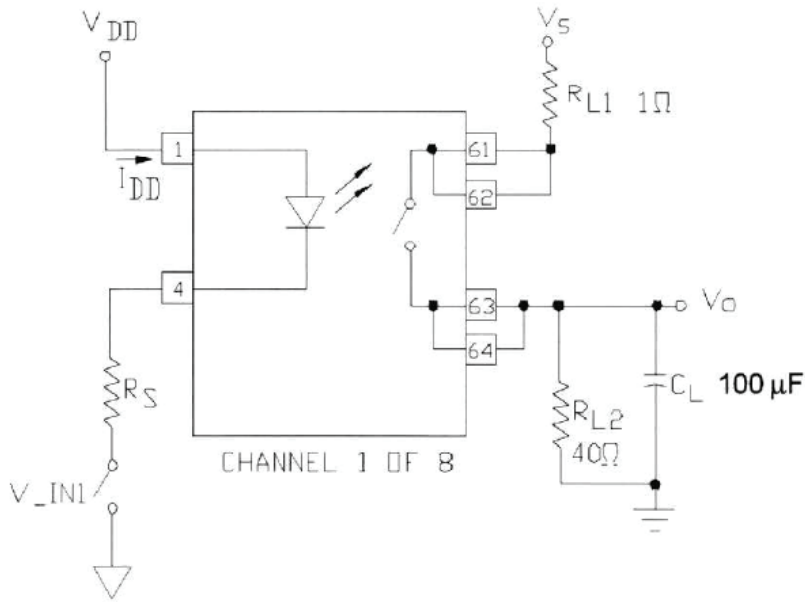


Fig 2. Switching Test Circuit for RDHA701FP10A8CK only

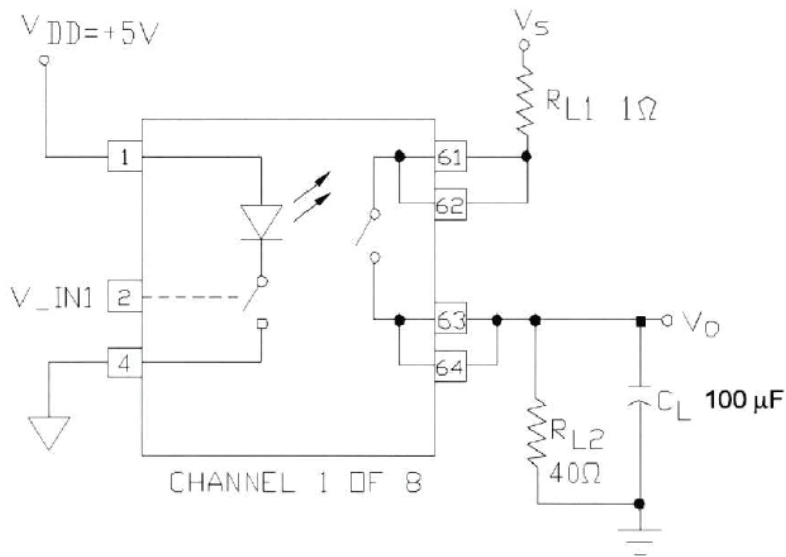


Fig 3. Switching Test Circuit for RDHA701FP10A8QK only

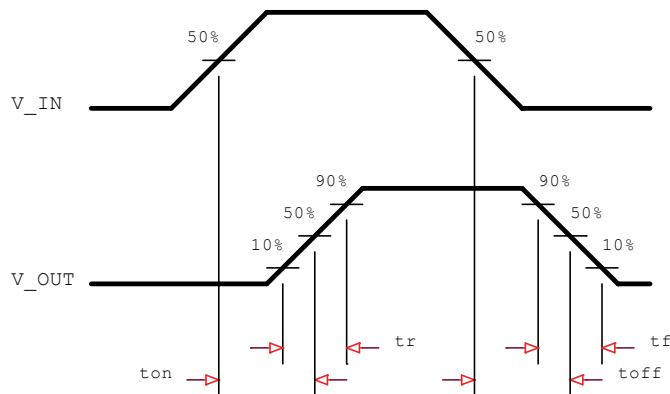


Fig 4. Switching Test Waveforms

Pin Designation - RDHA701FP10A8CK

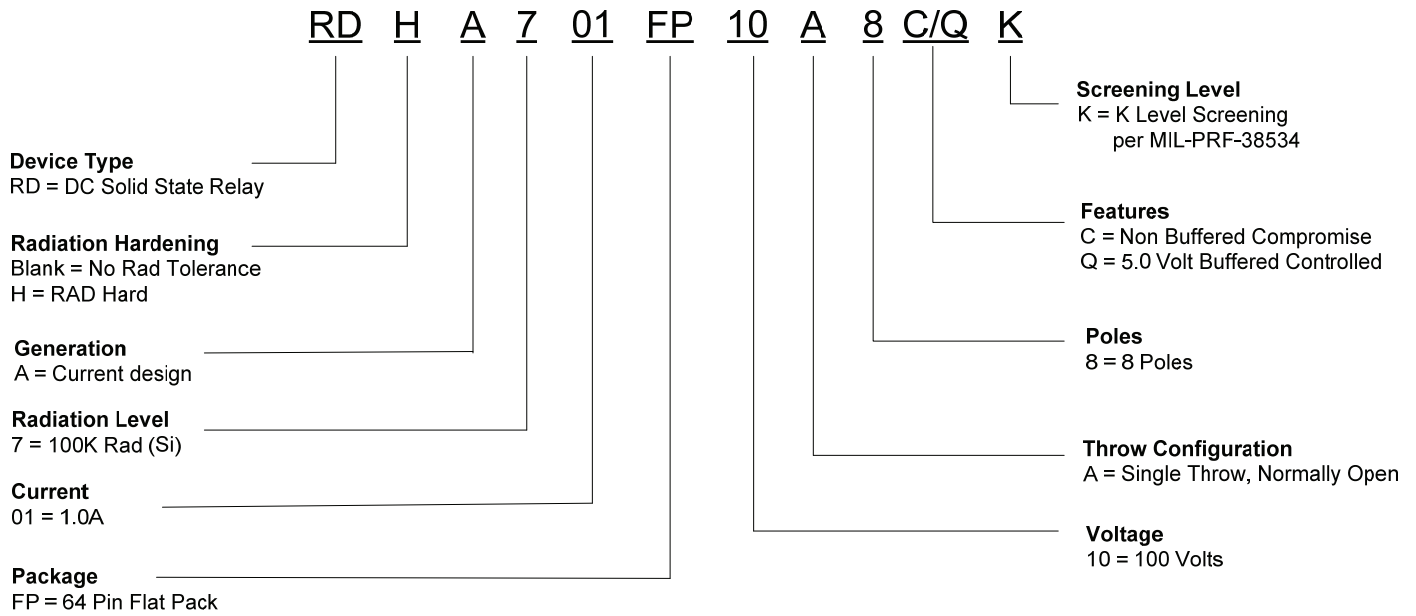
Pin No.	Designation	Pin No.	Designation	No.	Designation	No.	Designation
1	Current IN 1	17	Current IN 5	33	Drain 8	49	Drain 4
2	N/C	18	N/C	34	Drain 8	50	Drain 4
3	N/C	19	N/C	35	Source 8	51	Source 4
4	Current OUT 1	20	Current OUT 5	36	Source 8	52	Source 4
5	Current IN 2	21	Current IN 6	37	Drain 7	53	Drain 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 ①	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	No.	Designation	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 ①	47	Source 5	63	Source 1
16	5V RTN 4	32	5V RTN 8	48	Source 5	64	Source 1

① Case ground is for EMI shielding purposes only. It does not have to be connected for proper relay operation.

Part Numbering Nomenclature



IMPORTANT NOTICE

The information given in this document shall be in no event regarded as guarantee of conditions or characteristic. The data contained herein is a characterization of the component based on internal standards and is intended to demonstrate and provide guidance for typical part performance. It will require further evaluation, qualification and analysis to determine suitability in the application environment to confirm compliance to your system requirements.

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