

FEATURES:

- 32-Bit Direct Memory Access Controller
- RAD-PAK[®] Radiation Hardened Against Natural Space Radiation
- Total Dose Hardness >100 krad (Si)
- Single Event Performance contact factory
- Package:
 - 164 Pin RAD-PAK[®] Quad Flat Pack
- High Performance 32-Bit DMA Controller
 - 40 Mbytes/sec Maximum Data Transfer Rate at 20 MHz
 - 8 Independently Programmable Channels
- 20 Source Interrupt Controller
 - Individually Programmable Interrupt Vectors
 - 15 External, 5 Internal Interrupts
- Four 16-Sit Programmable Interval Timers
- Programmable Wait State Generator
 - 0 to 15 Wait States Pipelined
 - 1 to 16 Wait States Non-Pipelined
- DRAM Refresh Controller
- Processor Shutdown Detect and Reset Control
 - Software/Hardware Reset

DESCRIPTION:

Space Electronics 82380RP (RP for RAD-PAK[®]) DMA Controller features a minimum 100 kilorad (Si) total dose tolerance. Using Space Electronics radiation hardened RAD-PAK[®] packaging technology, the 82380RP is a multi-function support peripheral that integrates system functions necessary in an 386 processor environment. System support peripherals integrated into the 82380RP provide Interrupt Control, Timers, Wait State generation, DRAM Refresh Control, and System Reset logic. The 82380RP DMA Controller can transfer data between devices of different data path widths using a single channel. Each channel has a temporary data storage register for handling nonaligned data without the need for external alignment logic. Capable of surviving space environments, the 82380RP is ideal for satellite, spacecraft, and space probe missions. The 82380RP has a total dose survivability of greater than 100 krad (Si), based on a GEO type orbit (actual TID tolerance depends upon orbit and mission duration.) Space Electronics RAD-PAK[®] incorporates radiation shielding in the microcircuit package. It eliminates box shielding while providing lifetime in orbit. This product is available in Class B and Class S packaging and screening.

TABLE 1. 82380RP ABSOLUTE MAXIMUM RATINGS

PARAMETERS	MIN	MAX	UNIT
Storage Temperature	-65	+150	°C
Supply Voltage with Respect to VSS	-0.5	+6.5	V
Voltage on any other Pin	-0.5 to VCC	+0.5	V

TABLE 2. 82380RP RECOMMENDED OPERATING CONDITIONS

PARAMETER	SYMBOL	MIN	MAX	UNIT
Case Temperature (Instant On)	TC	-55	+125	°C
Digital Supply Voltage	VCC	4.75	5.25	V

TABLE 3. 82380RP DC ELECTRICAL CHARACTERISTICS

PARAMETER	TEST CONDITION	SYMBOL	MIN	MAX	UNIT
Input Low Voltage		VIL	-0.3	0.8	V
Input High Voltage		VIH	2.0	VCC+0.3	V
CLK2 Input Low Voltage		VILC	-0.3	0.8	V
CLK2 Input High Voltage		VIHC	2.0	VCC+0.3	V
Output Low Voltage IOL = 4 mA: A2-A31, D0-D31 IOL = 5 mA: All Others		VOL	--	0.45 0.45	V
Output High Voltage IOH = 1 mA: A2-A31, D0-D31 IOH = -0.9 mA: All Others		VOH	2.4 2.4		V
Input Leakage Current for all inputs except: IRO11-IRO23, TOUT2/IRO3, EOP, DREQ4/IRO9	0V < VIN < VCC	ILI		±15	mA
Inputs Leakage Current for pins: IRO11-IRO23, TOUT2/IRO3, EOP, DREQ4/IRO9	0V < VIN < VCC ¹	ILI1	10	-300	mA
Output Leakage Current	0 < VIN < VCC	ILO		±15	mA
Supply Current	CLK2 = 32 MHz ²	ICC		375	mA
Capacitance (Input/IO)	fc = 1 MHz	CI		12	pF
CLK2 Capacitance	fc = 1 MHz	CCLK		20	pF

1. These pins have internal pullups on them.
2. ICC is specified with inputs driven to CMOS levels. ICC may be higher if driven to TTL levels.

TABLE 4. 82380RP AC ELECTRICAL CHARACTERISTICS

PARAMETER	TEST CONDITION	SYMBOL	MIN	MAX	UNIT
Operating Frequency 82380RP-16 82380RP-20	Half CLK2 Frequency		4 4	16 20	MHz
CLK2 Period 82380RP-16 82380RP-20		t1	31 25	125 125	ns
CLK2 High Time 82380RP-16 82380RP-20	at 2.0V	t2a	9 8		ns
CLK2 High Time 82380RP-16 82380RP-20	at (VCC - 0.8) V	t2b	5 5		ns
CLK2 Low Time 82380RP-16 82380RP-20	at 2.0V	t3a	9 8		ns
CLK2 Low Time 82380RP-16 82380RP-20	at 0.8V	t3b	7 6		ns
CLK2 Fall Time 82380RP-16 82380RP-20	(VCC - 0.8) V to 0.8V	t4		8 8	ns
CLK2 Rise Time 82380RP-16 82380RP-20	0.8V to (VCC - 0.8) V	t5		8 8	ns
A (2-31), BE (0-3), EDACK (0-2)	CL = 120 pF	t6	4 4	36 30	ns
Valid Delay 82380RP-16 82380RP-20					
Float Delay 82380RP-16 82380RP-20					
A (2-31), BE (0-3)		t8	6 4		ns
Setup Time 82380RP-16 82380RP-20					
Hold Time 82380RP-16 82380RP-20					
		t9	6 4		

TABLE 4. 82380RP AC ELECTRICAL CHARACTERISTICS

PARAMETER	TEST CONDITION	SYMBOL	MIN	MAX	UNIT
W/R, M/IO, D/C,	CL = 75 pF	t14	6 6	33 28	ns
Valid Delay 82380RP-16 82380RP-20					
Float Delay 82380RP-16 82380RP-20					
Setup Time 82380RP-16 82380RP-20					
Hold Time 82380RP-16 82380RP-20					
ADS	CL = 75 pF	t10	6 6	33 28	ns
Valid Delay 82380RP-16 82380RP-20					
Float Delay 82380RP-16 82380RP-20					
Setup Time 82380RP-16 82380RP-20					
Hold Time 82380RP-16 82380RP-20					
Slave Mode - D (0-31) Read Valid		t18	3 4	46 46	ns
Delay 82380RP-16 82380RP-20					
Float Delay 82380RP-16 82380RP-20					
Slave Mode - D (0-31) Write		t20	31 29		ns
Setup Time 82380RP-16 82380RP-20					
Hold Time 82380RP-16 82380RP-20					
		t19	6 6	35 29	
		t21	26 26		

TABLE 4. 82380RP AC ELECTRICAL CHARACTERISTICS

PARAMETER	TEST CONDITION	SYMBOL	MIN	MAX	UNIT
Master Mode - D (0-31) Write					
Valid Delay 82380RP-16 82380RP-20		t22	4 4	48 38	ns
Float Delay 82380RP-16 82380RP-20		t23	4 4	35 27	
Master Mode - D (0-31) Read					
Setup Time 82380RP-16 82380RP-20		t24	11 11		ns
Hold Time 82380RP-16 82380RP-20		t25	6 6		
READY					
Setup Time 82380RP-16 82380RP-20		t26	21 12		ns
Hold Time 82380RP-16 82380RP-20		t27	4 4		
WSC (0-1)					
Setup Time 82380RP-16 82380RP-20		t28	6 6		ns
Hold Time 82380RP-16 82380RP-20		t29	21 21		
RESET					ns
Setup Time 82380RP-16 82380RP-20		t31	13 12		
Hold Time 82380RP-16 82380RP-20		t30	4 4		
READYO Valid Delay 82380RP-16 82380RP-20	CL = 25 pF	t32	4 4	31 28	ns
CPU Reset From CLK2 82380RP-16 82380RP-20	CL = 50 pF	t33	2 2	18 16	ns

TABLE 4. 82380RP AC ELECTRICAL CHARACTERISTICS

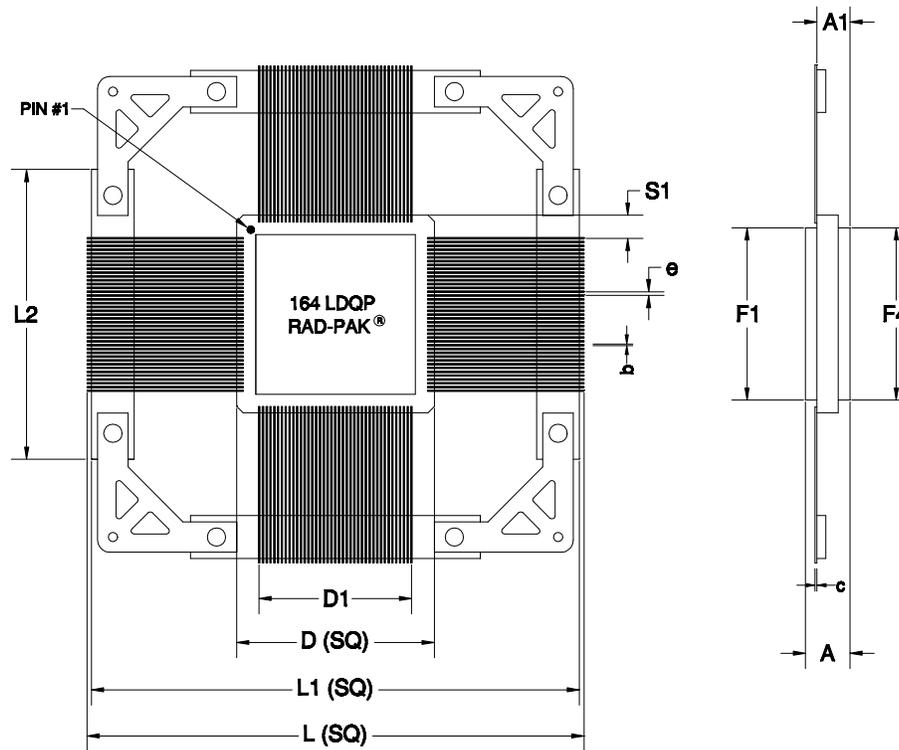
PARAMETER	TEST CONDITION	SYMBOL	MIN	MAX	UNIT
HOLD Valid Delay 82380RP-16 82380RP-20	CL = 100 pF	t34	5 5	33 30	ns
HLDA					
Setup Time 82380RP-16 82380RP-20		t35	21 17		ns
Hold Time 82380RP-16 82380RP-20		t36	6 6		
EOP Setup Time 82380RP-16 82380RP-20	Synch. EOP	t37a	21 17		ns
EOP Hold Time 82380RP-16 82380RP-20		t38a	4 4		ns
EOP Setup Time 82380RP-16 82380RP-20	Asynch. EOP	t37b	11 11		ns
EOP Hold Time 82380RP-16 82380RP-20		t38b	11 11		ns
EOP Valid Delay 82380RP-16 82380RP-20	CL = 100 pF	t39	5 5	38 30	ns
EOP Float Delay 82380RP-16 82380RP-20	CL = 100 pF	t40	5 5	40 32	ns
DREQ					
Setup Time 82380RP-16 82380RP-20	Synchronous DREQ	t41a	21 19		ns
Hold Time 82380RP-16 82380RP-20		t42a	4 4		
DREQ					
Setup Time 82380RP-16 82380RP-20	Asynchronous DREQ	t41b	11 11		ns
Hold Time 82380RP-16 82380RP-20		t42b	11 11		

TABLE 4. 82380RP AC ELECTRICAL CHARACTERISTICS

PARAMETER	TEST CONDITION	SYMBOL	MIN	MAX	UNIT
INT Valid Delay 82380RP-16 82380RP-20	From IRQ Input CL = 75 pF	t43	-- 15	500 500	ns
NA					
Setup Time 82380RP-16 82380RP-20		t44	11 10		ns
Hold Time 82380RP-16 82380RP-20		t45	15 15		ns
CLKIN Frequency 82380RP-16 82380RP-20		t46	0 0	10 10	MHz
CLKIN High Time 82380RP-16 82380RP-20	At 2.0V	t47	30 30		ns
CLKIN Low Time 82380RP-16 82380RP-20	At 0.8V	t48	50 50		ns
CLKIN Rise Time 82380RP-16 82380RP-20	0.8V to VCC - 0.8V	t49		10 10	ns
CLKIN Fall Time 82380RP-16 82380RP-20	VCC - 0.8V to 0.8V	t50		10 10	ns
TOUT1/REF Valid 82380RP-16 82380RP-20	From CLK2, CL = 25 pF	t51	4 4	36 30	ns
TOUT1/REF Valid 82380RP-16 82380RP-20	From CLKIN	t52	3 3	93 93	ns
TOUT2 Valid Delay 82380RP-16 82380RP-20	From CLKIN (Falling Edge Only)	t53	3 3	93 93	ns
TOUT2 Float Delay 82380RP-16 82380RP-20	From CLKIN	t54	3 3	40 40	ns
TOUT3 Valid Delay 82380RP-16 82380RP-20	From CLKIN	t55	3 3	93 93	ns

TABLE 5. 82380RP PIN CONFIGURATION

PIN	SIGNAL	PIN	SIGNAL	PIN	SIGNAL	PIN	SIGNAL
1	A4	42	D23	83	D24	124	$\overline{\text{IRQ19}}$
2	Vcc	43	D15	84	D16	125	$\overline{\text{IRQ20}}$
3	Vss	44	D7	85	D8	126	$\overline{\text{IRQ21}}$
4	A5	45	D30	86	D0	127	$\overline{\text{IRQ22}}$
5	A6	46	Vss	87	Vss	128	$\overline{\text{IRQ23}}$
6	A7	47	Vcc	88	Vcc	129	Vcc
7	A8	48	D22	89	READY0	130	Vss
8	A9	49	D14	90	TOUT1/REF	131	DREQ0
9	Vcc	50	D6	91	HOLD	132	DREQ1
10	Vss	51	Vss	92	M/IO	133	DREQ2
11	A10	52	Vcc	93	Vss	134	DREQ3
12	A11	53	D29	94	Vcc	135	DREQ4/ $\overline{\text{IRQ9}}$
13	A12	54	D21	95	NC	136	DREQ5
14	A13	55	D13	96	NC	137	NA
15	Vcc	56	D5	97	W/R	138	DREQ6
16	Vss	57	D28	98	D/C	139	DREQ7
17	A14	58	D20	99	TOUT3	140	Vcc
18	A15	59	D12	100	TOUT2/ $\overline{\text{IRQ3}}$	141	Vss
19	A16	60	Vcc	101	CPURST	142	NC
20	A17	61	Vss	102	NC	143	NC
21	NC	62	NC	103	Vcc	144	NC
22	NC	63	NC	104	Vss	145	NC
23	Vcc	64	Vcc	105	Vcc	146	HLDA
24	A18	65	D4	106	NC	147	INT
25	A19	66	D27	107	Vss	148	NC
26	A20	67	D19	108	Vcc	149	NC
27	A21	68	D11	109	READY	150	EDACU0
28	A22	69	D3	110	RESET	151	EDACU1
29	Vss	70	D26	111	WSC0	152	EDACU2
30	Vcc	71	D18	112	WSC1	153	Vcc
31	A23	72	D10	113	Vss	154	Vss
32	A24	73	D2	114	CLKIN	155	EOP
33	A25	74	Vss	115	Vcc	156	ADS
34	A26	75	Vcc	116	IRQ11	157	BE0
35	A27	76	D25	117	IRQ12	158	BE1
36	A28	77	D17	118	IRQ13	159	BE2
37	A29	78	D9	119	IRQ14	160	BE3
38	A30	79	Vss	120	IRQ15	161	Vcc
39	A31	80	CLK2	121	IRQ16	162	Vss
40	NC	81	Vss	122	IRQ17	163	A2
41	A31	82	D1	123	IRQ18	164	A3



164-PIN RAD-PAK® QUAD-FLAT PACKAGE

SYMBOL	DIMENSION		
	MIN	NOM	MAX
A	0.118	0.132	0.146
b	0.007	0.008	0.013
c	0.004	0.006	0.009
D	1.138	1.150	1.167
D1	1.000 BSC		
e	0.025 BSC		
S1	0.013	0.071	--
F1	0.890	0.895	0.900
F4	0.880	0.890	0.899
L	2.500	2.520	2.540
L1	2.485	2.500	2.505
L2	1.690	1.700	1.710
A1	0.078	0.090	0.102
N	164		

Q164-01

Note: All dimensions in inches.