A. ECAD Design Information

This appendix contains information that supports the development of the PCB ECAD model for this device. It is intended to be used by PCB designers.

A.1 Part Number Indexing

Orderable Part Number	Number of Pins	Package Type	Package Code/POD Number
R5F513T3ADFJ#10	32	LQFP	PLQP0032GB-A
R5F513T3ADFJ#50	32	LQFP	PLQP0032GB-A
R5F513T3ADNE#40	48	HWQFN	PWQN0048KE-A
R5F513T3ADNH#40	32	HWQFN	PWQN0032KE-A
R5F513T3AGFJ#50	32	LQFP	PLQP0032GB-A
R5F513T3AGNE#40	48	HWQFN	PWQN0048KE-A
R5F513T3AGNH#40	32	HWQFN	PWQN0032KE-A
R5F513T5ADFJ#50	32	LQFP	PLQP0032GB-A
R5F513T5ADNE#40	48	HWQFN	PWQN0048KE-A
R5F513T5ADNH#40	32	HWQFN	PWQN0032KE-A
R5F513T5AGFJ#50	32	LQFP	PLQP0032GB-A
R5F513T5AGNE#40	48	HWQFN	PWQN0048KE-A
R5F513T5AGNH#40	32	HWQFN	PWQN0032KE-A

A.2 Symbol Pin Information

A.2.1 48-HWQFN

Pin Number	Primary Pin Name	Primary Electrical Type	Alternate Pin Name(s)
1	VCL	Power	-
2	MD	Input	FINED
3	\RES	Input	-
4	XTAL	Output	P37
5	VSS	Power	-
6	EXTAL	Input	P36
7	VCC	Power	-
8	PE2	Input	POE10#/NMI/IRQ0
9	PD6	I/O	MTIOC0D/CTS1#/RTS1#/SS1#/IRQ5/ADST0
10	PD5	I/O	MTIOC0C/RXD1/SMISO1/SSCL1/IRQ3
11	PD4	I/O	MTIOC0B/SCK1/IRQ2
12	PD3	I/O	MTIOC0A/TXD1/SMOSI1/SSDA1
13	PB7	I/O	MTIOC3C/MTCLKD/RXD1/SMISO1/SSCL1/RXD5/SMISO5/SSCL5/IRQ5
14	PB6	I/O	MTIOC1B/MTIOC3A/TXD1/SMOSI1/SSDA1/TXD5/SMOSI5/SSDA5
15	PB5	I/O	ADTRG0#
16	PB4	I/O	POE8#/IRQ3
17	PB3	I/O	MTIOC0A/CACREF/SCK5/SCK12
18	PB2	I/O	MTIOC0B/MTCLKC/ADSM0/TXD5/SMOSI5/SSDA5/SDA0
19	PB1	I/O	MTIOC0C/MTIC5W/MTCLKA/RXD5/SMISO5/SSCL5/SCL0/IRQ2
20	PB0	I/O	MTIOC0D/MTIOC2A/MTCLKB/TXD12/TXDX12/SIOX12/SMOSI12/SSDA12
21	PA3	I/O	MTIOC1B/MTIOC2A/CTS12#/RTS12#/SS12#
22	PA2	I/O	MTIOC1A/MTIOC2B/CTS5#/RTS5#/SS5#/IRQ4
23	P94	I/O	MTIOC2B/MTIC5U/MTCLKA/RXD12/RXDX12/SMISO12/SSCL12/IRQ1
24	P93	I/O	MTIOC1A/MTIC5V/SCK5/SCK12/IRQ0/ADTRG0#
25	P76	I/O	MTIOC4D
26	P75	I/O	MTIOC4C
27	P74	I/O	MTIOC3D
28	P73	I/O	MTIOC4B
29	P72	I/O	MTIOC4A
30	P71	I/O	MTIOC3B
31	P70	I/O	POE0#/IRQ5

Pin Number	Primary Pin Name	Primary Electrical Type	Alternate Pin Name(s)
32	VCC	Power	-
33	VSS	Power	-
34	P24	I/O	MTIC5U/RXD5/SMISO5/SSCL5/IRQ3/COMP0
35	P23	I/O	MTIC5V/CACREF/TXD5/SMOSI5/SSDA5/IRQ4/COMP1
36	P22	I/O	MTIC5W/IRQ2/COMP2
37	P47	I/O	AN007/CMPC13
38	P46	I/O	AN006/CMPC03
39	P45	I/O	AN005/CMPC22
40	P44	I/O	AN004/CMPC12
41	P43	I/O	AN003/CMPC02
42	P42	I/O	AN002/CMPC20
43	P41	I/O	AN001/CMPC10
44	P40	I/O	AN000/CMPC00
45	AVCC0	Power	-
46	AVSS0	Power	-
47	P11	I/O	MTIOC3A/MTCLKA/POE8#/IRQ1/CVREFC0
48	P10	I/O	MTCLKB/IRQ0
49	EPAD	Power	-

A.2.2 32-LQFP

Pin Number	Primary Pin Name	Primary Electrical Type	Alternate Pin Name(s)
1	VCL	Power	-
2	MD	Input	FINED
3	\RES	Input	-
4	XTAL	Output	P37
5	VSS	Power	-
6	EXTAL	Input	P36
7	VCC	Power	-
8	PE2	Input	POE10#/NMI/IRQ0
9	PB7	I/O	MTIOC3C/MTCLKD/RXD1/SMISO1/SSCL1/RXD5/SMISO5/SSCL5/IRQ5
10	PB6	I/O	MTIOC1B/MTIOC3A/TXD1/SMOSI1/SSDA1/TXD5/SMOSI5/SSDA5
11	PB3	I/O	MTIOC0A/CACREF/SCK5/SCK12
12	PB2	I/O	MTIOC0B/MTCLKC/ADSM0/TXD5/SMOSI5/SSDA5/SDA0
13	PB1	I/O	MTIOC0C/MTIC5W/MTCLKA/RXD5/SMISO5/SSCL5/SCL0/IRQ2
14	PB0	I/O	MTIOC0D/MTIOC2A/MTCLKB/TXD12/TXDX12/SIOX12/SMOSI12/SSDA12
15	P94	I/O	MTIOC2B/MTIC5U/MTCLKA/RXD12/RXDX12/SMISO12/SSCL12/IRQ1
16	P93	I/O	MTIOC1A/MTIC5V/SCK5/SCK12/IRQ0/ADTRG0#
17	P76	I/O	MTIOC4D
18	P75	I/O	MTIOC4C
19	P74	I/O	MTIOC3D
20	P73	I/O	MTIOC4B
21	P72	I/O	MTIOC4A
22	P71	I/O	MTIOC3B
23	VCC	Power	-
24	VSS	Power	-
25	P44	I/O	AN004/CMPC12
26	P43	I/O	AN003/CMPC02
27	P42	I/O	AN002/CMPC20
28	P41	I/O	AN001/CMPC10
29	P40	I/O	AN000/CMPC00
30	AVCC0	Power	-
31	AVSS0	Power	-
32	P11	I/O	MTIOC3A/MTCLKA/POE8#/IRQ1/CVREFC0

A.2.3 32-HWQFN

Pin Number	Primary Pin Name	Primary Electrical Type	Alternate Pin Name(s)
1	VCL	Power	-

Pin Number	Primary Pin Name	Primary Electrical Type	Alternate Pin Name(s)
2	MD	Input	FINED
3	\RES	Input	-
4	XTAL	Output	P37
5	VSS	Power	-
6	EXTAL	Input	P36
7	VCC	Power	-
8	PE2	Input	POE10#/NMI/IRQ0
9	PB7	I/O	MTIOC3C/MTCLKD/RXD1/SMISO1/SSCL1/RXD5/SMISO5/SSCL5/IRQ5
10	PB6	I/O	MTIOC1B/MTIOC3A/TXD1/SMOSI1/SSDA1/TXD5/SMOSI5/SSDA5
11	PB3	I/O	MTIOC0A/CACREF/SCK5/SCK12
12	PB2	I/O	MTIOC0B/MTCLKC/ADSM0/TXD5/SMOSI5/SSDA5/SDA0
13	PB1	I/O	MTIOC0C/MTIC5W/MTCLKA/RXD5/SMISO5/SSCL5/SCL0/IRQ2
14	PB0	I/O	MTIOC0D/MTIOC2A/MTCLKB/TXD12/TXDX12/SIOX12/SMOSI12/SSDA12
15	P94	I/O	MTIOC2B/MTIC5U/MTCLKA/RXD12/RXDX12/SMISO12/SSCL12/IRQ1
16	P93	I/O	MTIOC1A/MTIC5V/SCK5/SCK12/IRQ0/ADTRG0#
17	P76	I/O	MTIOC4D
18	P75	I/O	MTIOC4C
19	P74	I/O	MTIOC3D
20	P73	I/O	MTIOC4B
21	P72	I/O	MTIOC4A
22	P71	I/O	MTIOC3B
23	VCC	Power	-
24	VSS	Power	-
25	P44	I/O	AN004/CMPC12
26	P43	I/O	AN003/CMPC02
27	P42	I/O	AN002/CMPC20
28	P41	I/O	AN001/CMPC10
29	P40	I/O	AN000/CMPC00
30	AVCC0	Power	-
31	AVSS0	Power	-
32	P11	I/O	MTIOC3A/MTCLKA/POE8#/IRQ1/CVREFC0
33	EPAD	Power	-

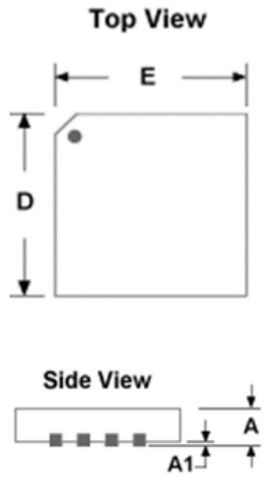
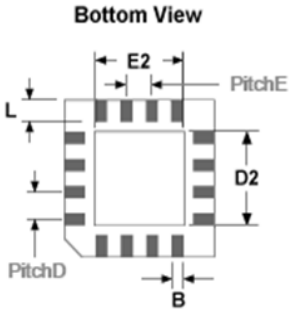
A.3 Symbol Parameters

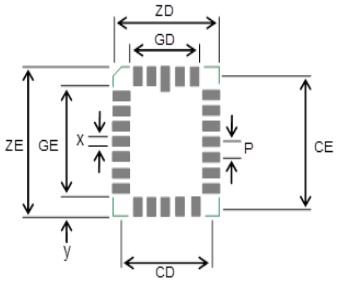
Orderable Part Number	Min Input Voltage	Max Input Voltage	Max Output Frequency	Min Operating Temperature	Max Operating Temperature	RAM Size	Memory Size	Interface	Number of ADC Channels	Number of I2C Channels	Number of SPI Channels	Number of UART Channels	Number of Timers/Counters
R5F513T3ADFJ#10	2.7 V	5.5 V	32 MHz	–40° C	+85 °C	12 KB	64 KB	SCI, I2C, SPI, UART	12-bit X 5-Ch	4	3	3	16-bit x 8-ch
R5F513T3ADFJ#50	2.7 V	5.5 V	32 MHz	–40° C	+85 °C	12 KB	64 KB	SCI, I2C, SPI, UART	12-bit X 5-Ch	4	3	3	16-bit x 8-ch
R5F513T3ADNE#40	2.7 V	5.5 V	32 MHz	–40° C	+85 °C	12 KB	64 KB	SCI, I2C, SPI, UART	12-bit X 8-Ch	4	3	3	16-bit x 8-ch
R5F513T3ADNH#40	2.7 V	5.5 V	32 MHz	–40° C	+85 °C	12 KB	64 KB	SCI, I2C, SPI, UART	12-bit X 5-Ch	4	3	3	16-bit x 8-ch
R5F513T3AGFJ#50	2.7 V	5.5 V	32 MHz	–40° C	+105 °C	12 KB	64 KB	SCI, I2C, SPI, UART	12-bit X 5-Ch	4	3	3	16-bit x 8-ch
R5F513T3AGNE#40	2.7 V	5.5 V	32 MHz	–40° C	+105 °C	12 KB	64 KB	SCI, I2C, SPI, UART	12-bit X 8-Ch	4	3	3	16-bit x 8-ch
R5F513T3AGNH#40	2.7 V	5.5 V	32 MHz	–40° C	+105 °C	12 KB	64 KB	SCI, I2C, SPI, UART	12-bit X 5-Ch	4	3	3	16-bit x 8-ch
R5F513T5ADFJ#50	2.7 V	5.5 V	32 MHz	–40° C	+85 °C	12 KB	128 KB	SCI, I2C, SPI, UART	12-bit X 5-Ch	4	3	3	16-bit x 8-ch
R5F513T5ADNE#40	2.7 V	5.5 V	32 MHz	–40° C	+85 °C	12 KB	128 KB	SCI, I2C, SPI, UART	12-bit X 8-Ch	4	3	3	16-bit x 8-ch
R5F513T5ADNH#40	2.7 V	5.5 V	32 MHz	–40° C	+85 °C	12 KB	128 KB	SCI, I2C, SPI, UART	12-bit X 5-Ch	4	3	3	16-bit x 8-ch
R5F513T5AGFJ#50	2.7 V	5.5 V	32 MHz	–40° C	+105 °C	12 KB	128 KB	SCI, I2C, SPI, UART	12-bit X 5-Ch	4	3	3	16-bit x 8-ch
R5F513T5AGNE#40	2.7 V	5.5 V	32 MHz	–40° C	+105 °C	12 KB	128 KB	SCI, I2C, SPI, UART	12-bit X 8-Ch	4	3	3	16-bit x 8-ch
R5F513T5AGNH#40	2.7 V	5.5 V	32 MHz	–40° C	+105 °C	12 KB	128 KB	SCI, I2C, SPI, UART	12-bit X 5-Ch	4	3	3	16-bit x 8-ch

A.4 **Footprint Design Information**

A.4.1 **48-QFN**

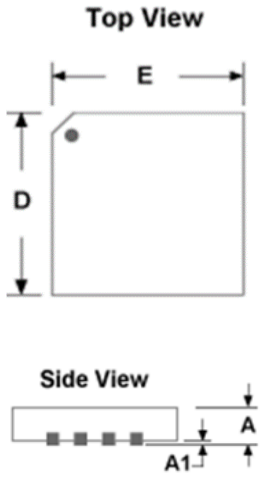
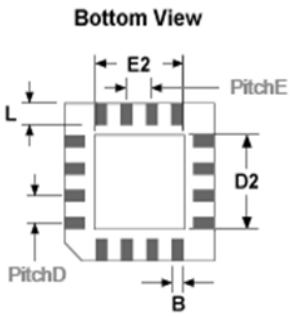
IPC Footprint Type	Package Code/ POD number	Number of Pins
QFN	PWQN0048KE-A	48

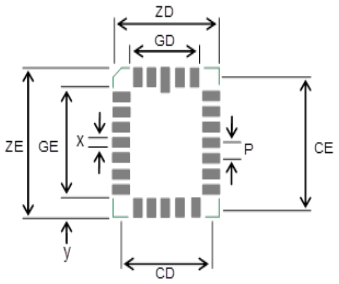
Description	Dimension	Value (mm)	Diagram
Minimum body span (vertical side)	Dmin	7	
Maximum body span (vertical side)	Dmax	7	
Minimum body span (horizontal side)	Emin	7	
Maximum body span (horizontal side)	Emax	7	
Minimum Lead Width	Bmin	0.2	
Maximum Lead Width	Bmax	0.3	
Minimum Lead Length	Lmin	0.3	
Maximum Lead Length	Lmax	0.5	
Maximum Height	Amax	0.8	
Minimum Standoff Height	A1min	0	
Minimum Lead Thickness	cmin	-	
Maximum Lead Thickness	cmax	-	
Number of pins (vertical side)	PinCountD	12	
Number of pins (horizontal side)	PinCountE	12	
Distance between the center of any two adjacent pins (vertical side)	PitchD	0.5	
Distance between the center of any two adjacent pins (horizontal side)	PitchE	0.5	
Location of pin 1; S2 = corner of D side, C1 = center of E side	Pin1	S2	
Minimum thermal pad size (vertical side)	D2min	5.5	
Maximum thermal pad size (vertical side)	D2max	5.6	
Minimum thermal pad size (horizontal side)	E2min	5.5	
Maximum thermal pad size (horizontal side)	E2max	5.6	

Recommended Land Pattern (NSMD Design)			
Description	**Dimension**	**Value (mm)**	**Diagram**
Distance between left pad toe to right pad toe (horizontal side)	ZE	-	
Distance between top pad toe to bottom pad toe (vertical side)	ZD	-	
Distance between left pad heel to right pad heel (horizontal side)	GE	-	
Distance between top pad heel to bottom pad heel (vertical side)	GD	-	
Pad Width	X	-	
Pad Length	Y	-	

A.4.2 **32-HWQFN**

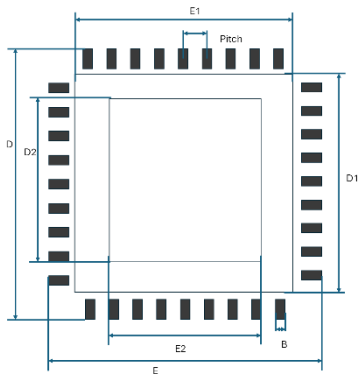
IPC Footprint Type	Package Code/ POD number	Number of Pins
QFN	PWQN0032KE-A	32

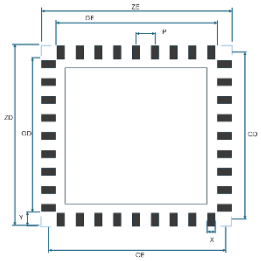
Description	Dimension	Value (mm)	Diagram
Minimum body span (vertical side)	Dmin	5	
Maximum body span (vertical side)	Dmax	5	
Minimum body span (horizontal side)	Emin	5	
Maximum body span (horizontal side)	Emax	5	
Minimum Lead Width	Bmin	0.18	
Maximum Lead Width	Bmax	0.3	
Minimum Lead Length	Lmin	0.35	
Maximum Lead Length	Lmax	0.45	
Maximum Height	Amax	0.8	
Minimum Standoff Height	A1min	0	
Minimum Lead Thickness	cmin	-	
Maximum Lead Thickness	cmax	-	
Number of pins (vertical side)	PinCountD	8	
Number of pins (horizontal side)	PinCountE	8	
Distance between the center of any two adjacent pins (vertical side)	PitchD	0.5	
Distance between the center of any two adjacent pins (horizontal side)	PitchE	0.5	
Location of pin 1; S2 = corner of D side, C1 = center of E side	Pin1	S2	
Minimum thermal pad size (vertical side)	D2min	3.15	
Maximum thermal pad size (vertical side)	D2max	3.25	
Minimum thermal pad size (horizontal side)	E2min	3.15	
Maximum thermal pad size (horizontal side)	E2max	3.25	

Recommended Land Pattern (NSMD Design)			
Description	**Dimension**	**Value (mm)**	**Diagram**
Distance between left pad toe to right pad toe (horizontal side)	ZE	-	
Distance between top pad toe to bottom pad toe (vertical side)	ZD	-	
Distance between left pad heel to right pad heel (horizontal side)	GE	-	
Distance between top pad heel to bottom pad heel (vertical side)	GD	-	
Pad Width	X	-	
Pad Length	Y	-	

A.4.3 **32-LQFP**

IPC Footprint Type	Package Code/ POD number	Number of Pins
QFP	PLQP0032GB-A	32

Description	Dimension	Value (mm)	Diagram
Minimum lead span (vertical side)	Dmin	8.8	
Maximum lead span (vertical side)	Dmax	9.2	
Minimum lead span (horizontal side)	Emin	8.8	
Maximum lead span (horizontal side)	Emax	9.2	
Minimum body span (vertical side)	D1min	6.9	
Maximum body span (vertical side)	D1max	7.1	
Minimum body span (horizontal side)	E1min	6.9	
Maximum body span (horizontal side)	E1max	7.1	
Minimum Lead Width	Bmin	0.32	
Maximum Lead Width	Bmax	0.42	
Minimum Lead Length	Lmin	0.3	
Maximum Lead Length	Lmax	0.7	
Maximum Height	Amax	1.7	
Minimum Standoff Height	A1min	0.01	
Minimum Lead Thickness	cmin	-	
Maximum Lead Thickness	cmax	-	
Number of pins (vertical side)	PinCountD	8	
Number of pins (horizontal side)	PinCountE	8	
Distance between the center of any two adjacent pins	Pitch	0.8	
Location of pin 1; S2 = corner of D side, C1 = center of E side	Pin1	S2	
Minimum thermal pad size (vertical side)	D2min	-	
Maximum thermal pad size (vertical side)	D2max	-	
Minimum thermal pad size (horizontal side)	E2min	-	
Maximum thermal pad size (horizontal side)	E2max	-	

Recommended Land Pattern (NSMD Design)			
Description	**Dimension**	**Value (mm)**	**Diagram**
Distance between left pad toe to right pad toe (horizontal side)	ZE	-	
Distance between top pad toe to bottom pad toe (vertical side)	ZD	-	
Distance between left pad heel to right pad heel (horizontal side)	GE	-	
Distance between top pad heel to bottom pad heel (vertical side)	GD	-	
Pad Width	X	-	
Pad Length	Y	-	