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PACKAGE INFORMATION

5. THERMAL-RESISTANCE OF IC PACKAGE

This document is Chapter 5 of the package information document consisting of 8 chapters in total.

5. THERMAL-RESISTANCE OF IC PACKAGE

5.1 Thermal-resistance of IC Package

ICs have recently become more highly integrated and high speed. IC's power consumption tends to increase with this progress. On the other hand, the packages to mount IC chips become more smaller and thinner. In other words, the thermal-resistance of IC packages is generally greater and the heat dissipation for ICs has become more important than before.

Generally, the heat dissipating path for IC packages is regarded as the arrow mark in Figure 5.1.1.

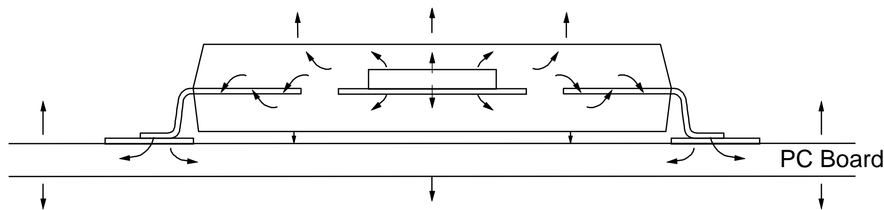

Figure 5.1.1 Heat Dissipating Path for IC Packages

Therefore, there are two paths as follows from Figure 5.1.1 as the heat dissipating paths from the IC chip to the atmosphere.

a) IC chip → Package → Atmosphere

b) IC chip → Package → Lead → PC board → Atmosphere

The amount of heat dissipated by the path b) depends on various factors such as the kind and size of IC packages and the size, wired length, wired width, wired density, layer number, layer configuration, thickness, materials, etc. of the PC boards and comes to approximately 5 to 50% of all the amount of heat, accordingly, the influence for ICs must be considered as the whole system.

(1) Thermal resistance θjc

The thermal resistance θjc is defined in the following equation (1).

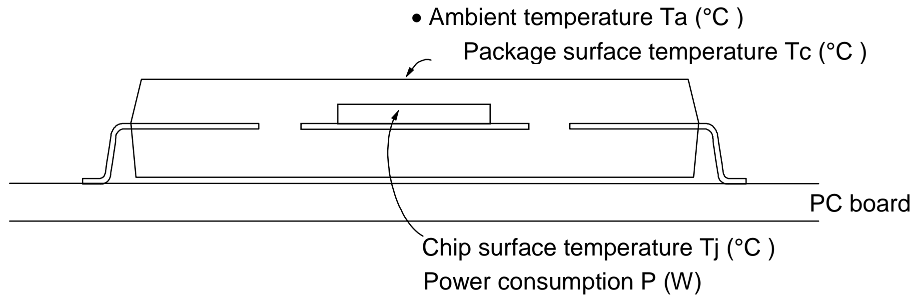

Figure 5.1.2

$$\theta jc = \frac{Tj - Tc}{P} \quad \text{.......} (1)$$

where Tj (°C) = chip surface temperature
Tc (°C) = package surface temperature
P (w) = power consumption

The thermal resistance θjc is decided by thermal conduction only in package constituent materials as shown in the Figure 5.1.2 and the equation (1).

(2) Thermal resistance θja

The thermal resistance θja is described by the following equation (2).

$$\theta ja = \frac{Tj - Ta}{P} \quad \text{.......} (2)$$

where Tj (°C) = chip surface temperature
Ta (°C) = package ambient temperature
P (w) = power consumption

Even if the same package is used, the thermal resistance θja depends on the following factors.

Chip size
Power consumption
Mounting conditions
Package ambient temperature
The velocity of wind ....Figure 5.1.3

Therefore, the thermal resistance value shown in the Figure 5.1.1, 5.1.2, and Lists of Thermal Resistance Values is measured by the constant measuring conditions as follows:

Chip size ....the most approximate size for the actual size
Power consumption..................................1 (W)
Package ambient temperature ....25°C (in static air)
Mounting..PC board size: 114.3 × 76.2 × 1.6 (SEMI G42-96 both-sided mounting board)

In addition, the thermal resistance θja also changes in the case of forced air cooling and Figure 5.1.3 shows the wind velocity depending rate.

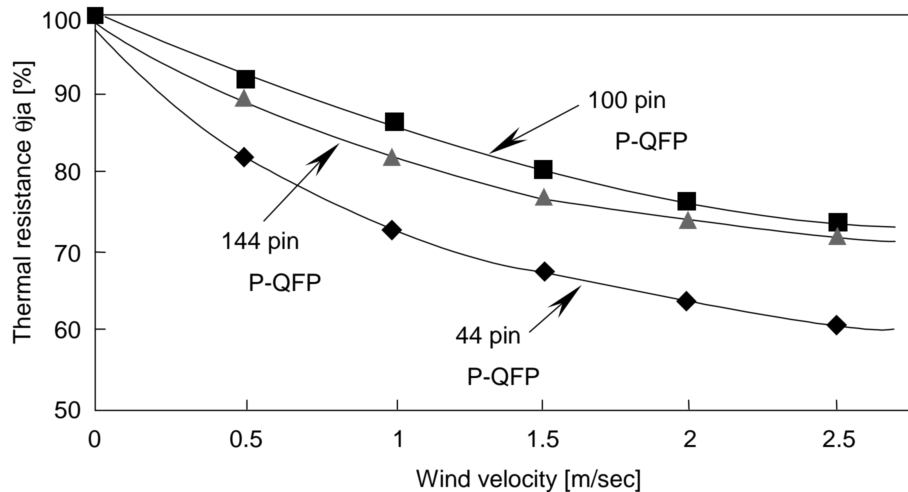

Figure 5.1.3 Wind Velocity Depending Rate of Thermal Resistance θja

5.2 Lists of Thermal Resistance Values

A maximum junction temperature (Tjmax) is given for an IC to prevent its malfunctioning and the deterioration of reliability. Such abnormalities may occur, however, if the surface temperature of an IC chip exceeds its maximum junction temperature.
Therefore, the thermal design of a system must be so made that the surface temperature of an IC chip will not exceed the maximum junction temperature. The maximum junction temperature depends on the type and design rules of the IC chip and the term of using it.
Moreover, it is more important for designers to take into account heat buildup when making a thermal design.

Data described in this chapter should be used as reference data.
It is recommended that a thermal design, that requires a stringent thermal specification, be determined after actual measurements.
The standard test methods for thermal resistance are shown below.

SEMI G38-96 [TEST METHOD FOR STILL-AND FORCED-AIR JUNCTION-TO-AMBIENT THERMAL RESISTANCE MEASUREMENTS OF INTEGRATED CIRCUIT PACKAGES]
SEMI G42-96 [SPECIFICATION FOR THERMAL TEST BOARD STANDARDIZATION FOR MEASURING JUNCTION-TO-AMBIENT THERMAL RESISTANCE OF SEMICONDUCTOR PACKAGES]
SEMI G43-87 [TEST METHOD FOR JUNCTION-TO-CASE THERMAL RESISTANCE MEASUREMENTS MOLDED PLASTIC PACKAGES]

Table 5.2.1 Thermal Resistance Values of Plastic Standard DIP

PKG code	Package outline size [mm]	Chip size [mm]	Lead frame material	θja [°C/W]				θjc [°C/W]
				At a wind velocity of 0m/sec	At a wind velocity of 0.5m/sec	At a wind velocity of 1.0m/sec	At a wind velocity of 2.0m/sec	
DIP8-P-300-2.54	6.40 × 8.70 × 3.65	3.1 × 3.1	42 Alloy	200	195	193	190	42
DIP14-P-300-2.54	6.40 × 19.10 × 3.45	3.1 × 3.1	42 Alloy	157	135	123	110	41
DIP16-P-300-2.54	6.40 × 19.10 × 3.45	3.1 × 3.1	42 Alloy	157	135	123	110	41
DIP18-P-300-2.54	6.40 × 22.60 × 3.50	3.1 × 3.1	42 Alloy	147	125	113	105	40
DIP20-P-300-2.54-W1	7.30 × 24.40 × 3.65	9.3 × 3.1	42 Alloy	124	100	93	85	20
DIP22-P-400-2.54	8.80 × 27.30 × 3.30	3.1 × 3.1	42 Alloy	128	110	103	95	40
DIP24-P-600-2.54	13.70 × 31.00 × 4.05	3.1 × 3.1	42 Alloy	114	95	93	85	44
DIP28-P-600-2.54	13.70 × 36.70 × 4.05	3.1 × 3.1	42 Alloy	109	90	85	80	44
DIP32-P-600-2.54	13.70 × 41.70 × 4.05	6.2 × 6.2	42 Alloy	86	70	65	60	19
DIP36-P-600-2.54	13.70 × 47.40 × 4.05	6.2 × 6.2	42 Alloy	81	68	65	55	19
DIP40-P-600-2.54	13.70 × 52.00 × 4.05	6.2 × 6.2	42 Alloy	76	63	57	50	19
DIP42-P-600-2.54	13.70 × 52.00 × 4.05	6.2 × 6.2	42 Alloy	76	63	57	50	19
DIP48-P-600-2.54	13.70 × 62.20 × 4.05	6.2 × 6.2	42 Alloy	72	58	53	45	19

Table 5.2.2 Thermal Resistance Values of Plastic Skinny DIP

PKG code	Package outline size [mm]	Chip size [mm]	Lead frame material	θja [°C/W]				θjc [°C/W]
				At a wind velocity of 0m/sec	At a wind velocity of 0.5m/sec	At a wind velocity of 1.0m/sec	At a wind velocity of 2.0m/sec	
DIP20-P-300-2.54-S1	6.40 × 26.90 × 3.45	3.1 × 3.1	42 Alloy	138	115	105	100	41
DIP22-P-300-2.54-S1	6.40 × 26.90 × 3.45	3.1 × 6.2	42 Alloy	135	110	100	95	25

Table 5.2.3 Thermal Resistance Values of Plastic Shrink DIP

PKG code	Package outline size [mm]	Chip size [mm]	Lead frame material	θja [°C/W]				θjc [°C/W]
				At a wind velocity of 0m/sec	At a wind velocity of 0.5m/sec	At a wind velocity of 1.0m/sec	At a wind velocity of 2.0m/sec	
SDIP30-P-400-1.78	8.80 × 27.30 × 3.30	6.2 × 6.2	42 Alloy	114	95	85	80	—
SDIP42-P-600-1.78	13.70 × 38.10 × 3.85	6.2 × 6.2	42 Alloy	86	70	65	60	18
SDIP64-P-750-1.78	17.00 × 57.60 × 4.00	9.3 × 9.3	Cu Alloy	48	38	35	26	8

Table 5.2.4 Thermal Resistance Values of Ceramic Standard DIP

PKG code	Package outline size [mm]	Chip size [mm]	θja [°C/W]				θjc [°C/W]
			At a wind velocity of 0m/sec	At a wind velocity of 0.5m/sec	At a wind velocity of 1.0m/sec	At a wind velocity of 2.0m/sec	
DIP14-C-300-2.54	7.49 × 20.60 × 2.80	3.1 × 3.1	90	80	65	55	—
DIP16-C-300-2.54	7.49 × 20.60 × 2.80	3.1 × 3.1	90	80	65	55	—
DIP18-C-300-2.54	7.49 × 23.20 × 2.80	3.1 × 3.1	90	75	65	55	—
DIP20-C-300-2.54	7.49 × 25.80 × 2.80	3.1 × 3.1	80	70	60	50	—
DIP22-C-400-2.54	9.40 × 27.75 × 2.80	3.1 × 3.1	68	62	50	45	—
DIP24-C-600-2.54	15.11 × 30.48 × 2.80	6.2 × 6.2	55	43	35	30	—
DIP28-C-600-2.54	15.11 × 35.96 × 2.80	6.2 × 6.2	51	43	35	25	—
DIP40-C-600-2.54	15.11 × 51.30 × 2.80	6.2 × 6.2	47	38	30	25	—
DIP42-C-600-2.54	15.11 × 53.60 × 2.80	6.2 × 6.2	47	33	25	20	—
DIP48-C-600-2.54	15.11 × 61.57 × 2.80	6.2 × 6.2	43	33	25	20	—

Table 5.2.5 Thermal Resistance Values of Plastic ZIP

PKG code	Package outline size [mm]	Chip size [mm]	Lead frame material	θja [°C/W]				θjc [°C/W]
				At a wind velocity of 0m/sec	At a wind velocity of 0.5m/sec	At a wind velocity of 1.0m/sec	At a wind velocity of 2.0m/sec	
ZIP20-P-400-1.27	8.50 × 25.50 × 2.80	3.1 × 9.3	42 Alloy	100	85	75	67	15
ZIP20-P-400-1.27-W1	9.00 × 25.50 × 2.80	3.1 × 9.3	42 Alloy	100	85	75	67	15
ZIP24-P-400-1.27	8.50 × 30.50 × 2.80	3.1 × 6.2	42 Alloy	114	100	90	82	22
ZIP28-P-400-1.27	8.50 × 36.00 × 2.80	3.1 × 6.2	42 Alloy	110	95	85	77	22
ZIP40-P-475-1.27	10.70 × 51.20 × 2.80	3.1 × 6.2	42 Alloy	95	80	75	67	22

Table 5.2.6 Thermal Resistance Values of Ceramic PGA

PKG code	Package outline size [mm]	Chip size [mm]	θja [°C/W]				θjc [°C/W]
			At a wind velocity of 0m/sec	At a wind velocity of 0.5m/sec	At a wind velocity of 1.0m/sec	At a wind velocity of 2.0m/sec	
PGA73-C-S11U-2.54	27.9 × 27.9 × 3.30	9.3 × 9.3	38	25	23	18	2
*1 HPGA73-C-S11D-2.54	27.9 × 27.9 × 3.30	6.2 × 6.2	31	24	18	14	—
PGA88-C-S13U-2.54	33.02 × 33.02 × 3.90	6.2 × 6.2	36	24	20	15	—
*2 HPGA88-C-S13D-2.54-W1	34.54 × 34.54 × 2.48	9.3 × 9.3	23	16	13	10	—
PGA133-C-S14U-2.54	35.56 × 35.56 × 3.30	9.3 × 9.3	32	24	20	20	—
PGA177-C-S15U-2.54	38.10 × 38.10 × 3.30	9.3 × 9.3	32	24	20	15	—
PGA209-C-S17U-2.54	44.70 × 44.70 × 3.50	12.4 × 12.4	24	18	15	13	2
PGA240-C-S17U-2.54	44.70 × 44.70 × 3.55	12.4 × 12.4	24	18	15	13	—
PGA257-C-S20U-2.54	50.80 × 50.80 × 4.10	12.4 × 12.4	25	17	15	13	2
PGA301-C-S20U-2.54	52.32 × 52.32 × 3.07	12.4 × 12.4	24	17	14	12	—
IPGA365-C-S33U-1.27	44.70 × 44.70 × 3.45	12.4 × 12.4	23	17	14	12	—
IPGA400-C-S33U-1.27	44.70 × 44.70 × 3.45	12.4 × 12.4	23	17	14	12	—

*1: Package with radiator fin

*2: Package with heat sink and radiator fin

Table 5.2.7 Thermal Resistance Values of Plastic SOP

PKG code	Package outline size [mm]	Chip size [mm]	Lead frame material	θja [°C/W]				θjc [°C/W]
				At a wind velocity of 0m/sec	At a wind velocity of 0.5m/sec	At a wind velocity of 1.0m/sec	At a wind velocity of 2.0m/sec	
SOP8-P-250-1.27-K	5.00 × 5.00 × 1.60	3.1 × 3.1	42 Alloy	208	194	184	176	22
SOP16-P-300-1.27-K	5.30 × 10.50 × 1.65	3.1 × 3.1	Cu Alloy	149	135	124	119	23
SSOP20-P-250-0.95-K	5.00 × 10.00 × 1.60	3.1 × 3.1	42 Alloy	183	162	143	138	22
SOP24-P-430-1.27-K	7.90 × 16.00 × 2.20	3.1 × 3.1	42 Alloy	136	122	110	105	32
SOP28-P-430-1.27-K	8.80 × 18.50 × 2.15	6.2 × 6.2	42 Alloy	106	90	78	72	12
SSOP30-P-56-0.65-K	5.60 × 9.70 × 1.50	6.2 × 6.2	42 Alloy	128	99	92	81	7
SSOP32-P-430-1.00-K	7.90 × 16.00 × 2.20	3.1 × 3.1	42 Alloy	128	108	97	86	26
SOP32-P-525-1.27-K	11.00 × 21.00 × 2.65	9.3 × 9.3	42 Alloy	76	63	60	53	7
SOP40-P-525-1.27-K	10.7 × 26.0 × 2.05	6.2 × 6.2	42 Alloy	94	81	74	72	11
SOP44-P-600-1.27-K	13.00 × 28.15 × 2.65	9.3 × 9.3	42 Alloy	68	54	51	43	7
SSOP60-P-700-0.65-BK	14.00 × 20.00 × 2.10	6.2 × 6.2	42 Alloy	90	77	74	67	11
SSOP64-P-525-0.80-K	10.7 × 26.0 × 2.05	6.2 × 6.2	42 Alloy	94	81	74	72	11
SSOP70-P-500-0.80-K	12.70 × 28.60 × 2.70	9.3 × 9.3	42 Alloy	68	59	51	43	6

Table 5.2.8 Thermal Resistance Values of Plastic TSOP

PKG code	Package outline size [mm]	Chip size [mm]	Lead frame material	θja [°C/W]				θjc [°C/W]
				At a wind velocity of 0m/sec	At a wind velocity of 0.5m/sec	At a wind velocity of 1.0m/sec	At a wind velocity of 2.0m/sec	
TSOP(1)32-P-814-0.50-1K	8.00 × 12.40 × 0.95	6.2 × 6.2	42 Alloy	133	113	98	86	5
TSOP(2)26-P-300-1.27-K	7.62 × 17.14 × 1.05	9.3 × 3.1	42 Alloy	112	95	84	76	6
TSOP(2)28-P-400-1.27-K	10.16 × 18.41 × 0.85	6.2 × 12.4	42 Alloy	88	69	62	48	2
TSOP(2)28-P-400-1.27-1K	10.16 × 18.41 × 1.0	6.2 × 12.4	42 Alloy	93	76	64	51	2
TSOP(2)32-P-400-1.27-K	10.16 × 20.95 × 1.0	6.2 × 12.4	42 Alloy	88	70	60	47	2
TSOP(2)44-P-400-0.80-K	10.16 × 18.41 × 0.95	6.2 × 12.4	42 Alloy	86	68	61	48	2
TSOP(2)44-P-400-0.50-K	10.16 × 11.50 × 1.00	6.2 × 6.2	42 Alloy	110	95	85	75	5
TSOP(2)48-P-550-0.80-K	13.97 × 19.68 × 0.95	6.2 × 12.4	42 Alloy	73	63	51	43	2
TSOP(2)50/44-P-400-0.80-K	10.16 × 20.95 × 0.95	6.2 × 12.4	42 Alloy	84	68	56	48	2
TSOP(2)50/44-P-400-0.80-1K	10.16 × 20.95 × 1.0	6.2 × 12.4	42 Alloy	71	60	50	38	2
TSOP(2)50-P-400-0.80-K	10.16 × 20.95 × 0.95	6.2 × 12.4	42 Alloy	82	68	56	48	2
TSOP(2)70-P-400-0.50-K	10.16 × 18.41 × 0.95	6.2 × 12.4	42 Alloy	73	59	50	38	2

Table 5.2.9 Thermal Resistance Values of Plastic QFP

PKG code	Package outline size [mm]	Chip size [mm]	Lead frame material	θja [°C/W]				θjc [°C/W]
				At a wind velocity of 0m/sec	At a wind velocity of 0.5m/sec	At a wind velocity of 1.0m/sec	At a wind velocity of 2.0m/sec	
QFP44-P-910-0.80-2K	9.5 × 10.5 × 1.85	6.2 × 6.2	42 Alloy	110	90	80	70	8
QFP56-P-910-0.65-2K	9.5 × 10.5 × 1.85	3.1 × 3.1	42 Alloy	150	130	120	113	25
QFP64-P-1420-1.00-BK	14.0 × 20.0 × 2.10	6.2 × 6.2	42 Alloy	94	82	75	67	11
QFP64-P-1414-0.80-BK	14.0 × 14.0 × 2.10	6.2 × 6.2	42 Alloy	102	85	80	75	12
QFP80-P-1420-0.80-BK	14.0 × 20.0 × 2.10	6.2 × 6.2	42 Alloy	85	78	73	65	12
QFP80-P-1414-0.65-K	14.0 × 14.0 × 2.10	6.2 × 6.2	42 Alloy	102	85	80	75	12
QFP100-P-1420-0.65-BK	14.0 × 20.0 × 2.10	6.2 × 6.2	42 Alloy	85	78	75	65	11
QFP128-P-1420-0.50-K	14.0 × 20.0 × 2.10	6.2 × 6.2	42 Alloy	85	78	73	65	11
QFP128-P-2828-0.80-DK	28.0 × 28.0 × 3.75	6.2 × 6.2	42 Alloy	68	60	56	48	16
QFP128-P-2828-0.80-BK	28.0 × 28.0 × 3.75	9.3 × 9.3	Cu Alloy	41	34	31	28	8
QFP160-P-2828-0.65-BK/BK4	28.0 × 28.0 × 3.75	6.2 × 6.2	42 Alloy	64	58	53	48	15
QFP160-P-2828-0.65-BK/BK4	28.0 × 28.0 × 3.75	9.3 × 9.3	42 Alloy	50	45	40	37	9
QFP208-P-2828-0.50-BK4	28.0 × 28.0 × 3.75	9.3 × 9.3	Cu Alloy	41	36	33	30	8
QFP208-P-2828-0.50-CK4	28.0 × 28.0 × 3.75	9.3 × 9.3	Cu Alloy	31	26	24	20	7
QFP240-P-3232-0.50-BK4	32.0 × 32.0 × 3.75	9.3 × 9.3	Cu Alloy	40	35	33	30	—
QFP272-P-3636-0.50-BK4	36.0 × 36.0 × 3.75	9.3 × 9.3	Cu Alloy	31	26	25	23	10
QFP304-P-4040-0.50-BK4	40.0 × 40.0 × 3.75	9.3 × 9.3	Cu Alloy	29	25	23	20	—

Table 5.2.10 Thermal Resistance Values of Plastic TQFP

PKG code	Package outline size [mm]	Chip size [mm]	Lead frame material	θja [°C/W]				θjc [°C/W]
				At a wind velocity of 0m/sec	At a wind velocity of 0.5m/sec	At a wind velocity of 1.0m/sec	At a wind velocity of 2.0m/sec	
TQFP44-P-1010-0.80-K	10.0 × 10.0 × 1.0	6.2 × 6.2	42 Alloy	120	101	93	79	5
TQFP48-P-0707-0.50-K	7.0 × 7.0 × 1.0	3.1 × 3.1	42 Alloy	156	139	128	106	13
TQFP64-P-1010-0.50-K	10.0 × 10.0 × 1.0	6.2 × 6.2	42 Alloy	116	101	88	75	5
TQFP80-P-1212-0.50-K	12.0 × 12.0 × 1.0	6.2 × 6.2	42 Alloy	108	93	84	70	5
TQFP100-P-1414-0.50-K	14.0 × 14.0 × 1.0	6.2 × 6.2	42 Alloy	96	85	75	66	4
TQFP100-P-1414-0.50-K	14.0 × 14.0 × 1.0	9.3 × 9.3	42 Alloy	80	68	57	48	3
TQFP120-P-1414-0.40-K	14.0 × 14.0 × 1.0	9.3 × 9.3	42 Alloy	83	71	61	50	—

Table 5.2.11 Thermal Resistance Values of Plastic LQFP

PKG code	Package outline size [mm]	Chip size [mm]	Lead frame material	θja [°C/W]				θjc [°C/W]
				At a wind velocity of 0m/sec	At a wind velocity of 0.5m/sec	At a wind velocity of 1.0m/sec	At a wind velocity of 2.0m/sec	
LQFP144-P-2020-0.50-K	20.0 × 20.0 × 1.4	9.3 × 9.3	42 Alloy	60	53	47	41	3
LQFP176-P-2424-0.50-BK	24.0 × 24.0 × 1.4	9.3 × 9.3	42 Alloy	57	50	45	40	3
LQFP208-P-2828-0.50-K	28.0 × 28.0 × 1.4	9.3 × 9.3	42 Alloy	55	50	45	40	3

Table 5.2.12 Thermal Resistance Values of Ceramic QFP

PKG code	Package outline size [mm]	Chip size [mm]	θja [°C/W]				θjc [°C/W]
			At a wind velocity of 0m/sec	At a wind velocity of 0.5m/sec	At a wind velocity of 1.0m/sec	At a wind velocity of 2.0m/sec	
*3 HQFP208-C-3939-0.65	39.0 × 39.0 × 2.00	12.4 × 12.4	20	14	12	10	—
*3 HQFP256-C-3636-0.50	36.0 × 36.0 × 1.80	12.4 × 12.4	20	14	12	10	—

*3: Package with heat sink and radiator fin

Table 5.2.13 Thermal Resistance Values of Plastic SOJ

PKG code	Package outline size [mm]	Chip size [mm]	Lead frame material	θja [°C/W]				θjc [°C/W]
				At a wind velocity of 0m/sec	At a wind velocity of 0.5m/sec	At a wind velocity of 1.0m/sec	At a wind velocity of 2.0m/sec	
SOJ26-P-300-1.27	7.62 × 17.15 × 2.75	9.3 × 3.1	42 Alloy	100	86	76	68	15
SOJ26-P-350-1.27	8.89 × 17.15 × 2.78	6.2 × 12.4	42 Alloy	74	63	53	44	7
SOJ28-P-400-1.27	10.16 × 18.41 × 2.78	6.2 × 12.4	42 Alloy	74	61	53	44	6
SOJ32-P-400-1.27	10.16 × 20.95 × 2.78	6.2 × 12.4	42 Alloy	70	54	48	39	8
SOJ40-P-400-1.27	10.16 × 26.03 × 2.96	6.2 × 6.2	42 Alloy	90	81	76	68	16
SOJ42-P-400-1.27	10.16 × 27.30 × 2.78	6.2 × 6.2	42 Alloy	90	81	76	68	14

Table 5.2.14 Thermal Resistance Values of Plastic QFJ

PKG code	Package outline size [mm]	Chip size [mm]	Lead frame material	θja [°C/W]				θjc [°C/W]
				At a wind velocity of 0m/sec	At a wind velocity of 0.5m/sec	At a wind velocity of 1.0m/sec	At a wind velocity of 2.0m/sec	
QFJ18-P-R290-1.27	7.24 × 12.45 × 2.65	6.2 × 3.1	42 Alloy	132	119	107	100	20
QFJ20-P-S350-1.27	8.97 × 8.97 × 3.60	3.1 × 3.1	Cu Alloy	88	77	70	60	41
QFJ22-P-R290-1.27	7.24 × 12.45 × 2.65	9.3 × 3.1	42 Alloy	119	105	87	80	15
QFJ28-P-S450-1.27	11.51 × 11.51 × 3.60	3.1 × 3.1	Cu Alloy	81	72	66	55	41
QFJ32-P-R450-1.27	11.43 × 13.97 × 2.65	3.1 × 3.1	42 Alloy	128	119	112	105	34
QFJ44-P-S650-1.27	16.59 × 16.59 × 3.60	9.3 × 9.3	Cu Alloy	64	60	54	50	9
QFJ68-P-S950-1.27	24.21 × 24.21 × 3.80	9.3 × 9.3	Cu Alloy	45	38	33	30	9
QFJ84-P-S115-1.27	29.29 × 29.29 × 3.80	9.3 × 9.3	Cu Alloy	42	33	30	27	9

Table 5.2.15 Thermal Resistance Values of BGA

PKG code	Package outline size [mm]	Chip size [mm]	θja [°–C/W]				θjc [°C/W]
			At a wind velocity of 0m/sec	At a wind velocity of 0.5m/sec	At a wind velocity of 1.0m/sec	At a wind velocity of 2.0m/sec	
P-TFLGA56-0808-0.8	8 × 8 × 0.91	3.1 × 3.1	145	120	112	98	—
P-LFBGA84-0909-0.8	9 × 9 × 0.91	6.2 × 6.2	105	85	75	65	—
P-LFBGA144-1111-0.8	11 × 11 × 0.91	0.2 × 6.2	95	77	70	60	—
P-LFBGA104-1313-0.8	13 × 13 × 0.96	6.2 × 6.2	105	93	81	70	—
P-LFBGA144-1313-0.8	13 × 13 × 0.96	6.2 × 6.2	103	91	80	70	8
P-LFBGA224-1515-0.8	15 × 15 × 0.96	9.3 × 9.3	75	60	52	45	—
P-BGA256-2727-1.27	27 × 27 × 1.53	9.3 × 9.3	47	41	36	30	6
P-BGA352-3535-1.27	35 × 35 × 1.73	9.3 × 9.3	45	39	35	30	5
P-BGA420-3535-1.27	35 × 35 × 1.27	12.4 × 12.4	40	35	31	27	—
P-BGA560-3535-1.0	35 × 35 × 1.68	12.4 × 12.4	29	23	19	15	1
M-BGA560-3535-1.00	35 × 35 × 1.20	12.4 × 12.4	26	21	16	13	—