

Material Declaration Data for Altera's Lead-Free Devices (8 DIP – 88 UBGA)

Package Type	8 PDIP	8 SOIC	16 SOIC	20 PLCC	32 TQFP	44 PLCC	44 PQFP	44 TQFP	49 UBGA	84 PLCC	88 UBGA
Pitch	2.5 mm	1.27 mm	1.27 mm	1.27 mm	0.8 mm	1.27 mm	0.8 mm	0.8 mm	0.8 mm	1.27 mm	0.8 mm
Technology	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond
Weight (g)	0.5	0.08	0.4	0.8	0.2	2.3	0.5	0.3	0.1	6.8	0.2
Termination or Ball Finish	Matte Tin(over Cu)	NiPdAu	NiPdAu	Matte Tin(over Cu)	Matte Tin(over Cu)	Matte Tin(over Cu)	Matte Tin(over Cu)	Matte Tin(over Cu)	SnAgCu	Matte Tin(over Cu)	SnAgCu
JESD 97 marking	e3	e4	e4	e3	e3	e3	e3	e3	e1	e3	e1
Whisker mitigation Technique	Anneal ⁵	N/A	N/A	Anneal ⁵	Anneal ⁵	Anneal ⁵	Anneal ⁵	Anneal ⁵	N/A	Anneal ⁵	N/A
Plating thickness	12 um	Ni: 1um, Pd: 0.05um, Au: 0.006um	Ni: 1um, Pd: 0.05um, Au: 0.006um	12 um	12 um	12 um	12 um	12 um	N/A	12 um	N/A
ROHS Compliant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ROHS technology exemption	None	None	None	None	None	None	None	None	None	None	None
Peak Reflow Temperature (IPC/JEDEC J-STD-020C) ⁶	250°C	260°C	260°C	250°C	260°C	245°C	260°C	260°C	260°C	245°C	260°C
Is this Pb-free version backward compatible Surface Mount (SM) or Through Hole (TH)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No
JIG A Substances ¹	Lead (Pb) Content	0	0	0	0	0	0	0	0	0	0
	Mercury Content	0	0	0	0	0	0	0	0	0	0
	Cadmium Content	0	0	0	0	0	0	0	0	0	0
	Hexavalent Chromium Content	0	0	0	0	0	0	0	0	0	0
	PBB Content	0	0	0	0	0	0	0	0	0	0
	PBDE Content	0	0	0	0	0	0	0	0	0	0
Other JIG A Substances	0	0	0	0	0	0	0	0	0	0	
JIG B Substances ²	Antimony	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera
	Arsenic	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm
	Brominated flame retardants other than PBBs and PBDEs	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera
	Other JIG B substances	0	0	0	0	0	0	0	0	0	0

¹JIG A substances : Asbestos, Azocolourants and Azodyes, Cadmium, Hexavalent Chromium, Lead, Mercury, Ozone Depleting Substances, PBB, PBDE, PCB, PCN, Radioactive Substances, Chlorinated Paraffins, TBT and TPT, TBTO

²JIG B substances: Antimony, Arsenic, Beryllium, Bismuth, Brominated Flame Retardant other PBB or PBDE, Nickel on external application, Phthalates, Selenium, PVC

³Solder bumps in Flip Chip BGA packages contain lead (Pb) in high melting temperature type solder (> 85% Pb). This type of lead application is exempted by ROHS

⁴The following part numbers have MIR/MCR TQFP packages with 245°C peak temperature: EP20K100ETC144-1N, EP20K100ETC144-2N, EP20K160ETC144-3N, EP20K30ETC144-3N,

⁵Annealing: 1 hr at 150°C within 24 hours post plating process

⁶Time within 5° of peak Temperature: 20 to 40 sec

⁷Lead in high melting temperature type solders (> 85% Pb in flip chip bump)

Material Declaration Data for Altera's Lead-Free Devices (100 FBGA - 240 RQFP)

Package Type	100 FBGA	100 PQFP-Option 1	100 TQFP	144 FBGA	144 TQFP	160 PQFP	169 UBGA	208 PQFP	208 RQFP	240 PQFP	240 RQFP
Pitch	1.0 mm	0.65 mm	0.50 mm	1.0 mm	0.50 mm	0.65 mm	0.8 mm	0.50 mm	0.50 mm	0.50 mm	0.50 mm
Technology	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond
Weight (g)	1.6	1.6	0.5	1.7	1.3	5.4	0.4	5.7	10.8	7.0	15.1
Termination or Ball Finish	SnAgCu	Matte Tin(over Cu)	Matte Tin(over Cu)	SnAgCu	Matte Tin(over Cu)	Matte Tin(over Cu)	SnAgCu	Matte Tin(over Cu)	Matte Tin(over Cu)	Matte Tin(over Cu)	Matte Tin(over Cu)
JESD 97 marking	e1	e3	e3	e1	e3	e3	e1	e3	e3	e3	e3
Whisker mitigation Technique	N/A	Anneal ⁵	Anneal ⁵	N/A	Anneal ⁵	Anneal ⁵	N/A	Anneal ⁵	Anneal ⁵	Anneal ⁵	Anneal ⁵
Plating thickness	N/A	12 um	12 um	N/A	12 um	12 um	N/A	12 um	12 um	12 um	12 um
ROHS Compliant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ROHS technology exemption	None	None	None	None	None	None	None	None	None	None	None
Peak Reflow Temperature (IPC/JEDEC J-ST-020C) ⁶	260°C	245°C	260°C	260°C	260°C ⁴	245°C	260°C	245°C	245°C	245°C	245°C
Is this Pb-free version backward compatible with conventional tin-lead soldering?	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	Yes	Yes
Surface Mount (SM) or Through Hole (TH)	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM
JIG A Substances ¹	Lead (Pb) Content	0	0	0	0	0	0	0	0	0	0
	Mercury Content	0	0	0	0	0	0	0	0	0	0
	Cadmium Content	0	0	0	0	0	0	0	0	0	0
	Hexavalent Chromium Content	0	0	0	0	0	0	0	0	0	0
	PBB Content	0	0	0	0	0	0	0	0	0	0
	PBDE Content	0	0	0	0	0	0	0	0	0	0
	Other JIG A Substances	0	0	0	0	0	0	0	0	0	0
JIG B Substances ²	Antimony	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera
	Arsenic	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm
	Brominated flame retardants other than PBBs and PBDEs	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera
	Other JIG B substances	0	0	0	0	0	0	0	0	0	0

¹JIG A substances : Asbestos, Azocolourants and Azodyes, Cadmium, Hexavalent Chromium, Lead, Mercury, Ozone Depleting Substances, PBB, PBDE, PCB, PCN, Radioactive Substances, Chlorinated Paraffins, TBT and TPT, TBTO

²JIG B substances: Antimony, Arsenic, Beryllium, Bismuth, Brominated Flame Retardant other PBB or PBDE, Nickel on external application, Phthalates, Selenium, PVC

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⁴The following part numbers have MIR/MCR TQFP packages with 245°C peak temperature: EP20K100ETC144-1N, EP20K100ETC144-2N, EP20K160ETC144-3N, EP20K30ETC144-3N.

⁵Annealing: 1 hr at 150°C within 24 hours post plating process

⁶Time within 5° of peak Temperature: 20 to 40 sec

⁷Lead in high melting temperature type solders (> 85% Pb in flip chip bump)

Material Declaration Data for Altera's Lead-Free Devices (256 FBGA – 484 UBGA)

Package Type	256 FBGA - Option 1	256 FBGA - Option 2	256 BGA - Option 1	256 BGA - Option 2	324 FBGA	356 BGA	400 FBGA	484 FBGA - Option 1	484 FBGA - Option 2	484 FBGA - Option 3	484 HBGA	484 UBGA	600 BGA
Pitch	1.0 mm	1.0 mm	1.27 mm	1.27 mm	1.0 mm	1.27 mm	1.0 mm	1.0 mm	1.0 mm	1.0 mm	1.0 mm	0.8 mm	1.27 mm
Technology	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Wire Bond	Flip Chip	Wire Bond	Wire Bond	Flip Chip	Wire Bond	Wire Bond
Weight (g)	1.9	1.9	4.3	2.1	2.0	7.0	2.2	5.8	2.4	2.3	7.7	1.8	12.0
Termination or Ball Finish	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu
JESD 97 marking	e1	e1	e1	e1	e1	e1	e1	e1	e1	e1	e1	e1	e1
Whisker mitigation Technique	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Plating thickness	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ROHS Compliant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ROHS technology exemption	None	None	None	None	None	None	None	Yes ⁷	None	None	Yes ⁷	None	None
Peak Reflow Temperature (IPC/JEDEC J-STD-020C) ⁶	250°C	260°C	260°C	250°C	260°C	245°C	260°C	245°C	260°C	250°C	245°C	250°C	245°C
Is this Pb-free version backward compatible with conventional tin-lead soldering?	No	No	No	No	No	No	No	No	No	No	No	No	No
Surface Mount (SM) or Through Hole (TH)	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM
JIG A Substances ¹	Lead (Pb) Content	0	0	0	0	0	0	0	0	0	0	0	0
	Mercury Content	0	0	0	0	0	0	0	0	0	0	0	0
	Cadmium Content	0	0	0	0	0	0	0	0	0	0	0	0
	Hexavalent Chromium Content	0	0	0	0	0	0	0	0	0	0	0	0
	PBB Content	0	0	0	0	0	0	0	0	0	0	0	0
	PBDE Content	0	0	0	0	0	0	0	0	0	0	0	0
Other JIG A Substances	0	0	0	0	0	0	0	0	0	0	0	0	
JIG B Substances ²	Antimony	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera
	Arsenic	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm
	Brominated flame retardants other than PBBs and PBDEs	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera
	Other JIG B substances	0	0	0	0	0	0	0	0	0	0	0	0

¹JIG A substances : Asbestos, Azocolourants and Azodyes, Cadmium, Hexavalent Chromium, Lead, Mercury, Ozone Depleting Substances, PBB, PBDE, PCB, PCN, Radioactive Substances, Chlorinated Paraffins, TBT and TPT, TBTO

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⁴The following part numbers have MIR/MCR TQFP packages with 245°C peak temperature: EP20K100ETC144-1N, EP20K100ETC144-2N, EP20K160ETC144-3N, EP20K30ETC144-3N,

⁵Annealing: 1 hr at 150°C within 24 hours post plating process

⁶Time within 5° of peak Temperature: 20 to 40 sec

⁷Lead in high melting temperature type solders (> 85% Pb in flip chip bump)

Material Declaration Data for Altera's Lead-Free Devices (600 BGA – 1508 FBGA)

Package Type	652 BGA - Option 1	652 BGA - Option 2	652 BGA - Option 3	672 BGA	672 FBGA - Option 1	672 FBGA - Option 2	672 FBGA - Option 3	724 BGA	780 FBGA	896 FBGA	956 BGA	1020 FBGA	1152 FBGA	1508 FBGA
Pitch	1.27 mm	1.27 mm	1.27 mm	1.27 mm	1.0 mm	1.0 mm	1.0 mm	1.27 mm	1.0 mm	1.0 mm	1.27 mm	1.0 mm	1.0 mm	1.0 mm
Technology	Flip Chip	Wire Bond	Wire Bond	Wire Bond	Flip Chip	Wire Bond	Wire Bond	Flip Chip	Flip Chip	Wire Bond	Flip Chip	Flip Chip	Flip Chip	Flip Chip
Weight (g)	16.1	9.6	14.9	5.2	7.7	3.0	3.3	12.4	8.9	4.2	14.6	11.5	12.0	14.6
Termination or Ball Finish	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu	SnAgCu
JESD 97 marking	e1	e1	e1	e1	e1	e1	e1	e1	e1	e1	e1	e1	e1	e1
Whisker mitigation Technique	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Plating thickness	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
ROHS Compliant	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ROHS technology exemption	Yes ⁷	None	None	None	Yes ⁷	None	None	Yes ⁷	Yes ⁷	None	Yes ⁷	Yes ⁷	Yes ⁷	Yes ⁷
Peak Reflow Temperature (IPC/JEDEC J-STD-020C) ⁶	245°C	245°C	245°C	245°C	245°C	260°C	260°C	245°C	245°C	250°C	245°C	245°C	245°C	245°C
Is this Pb-free version backward compatible with conventional tin-lead soldering?	No	No	No	No	No	No	No	No	No	No	No	No	No	No
Surface Mount (SM) or Through Hole (TH)	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM	SM
JIG A Substances ¹	Lead (Pb) Content	0 ⁻³	0	0	0	0 ⁻³	0	0	0 ⁻³	0 ⁻³	0	0 ⁻³	0 ⁻³	0 ⁻³
	Mercury Content	0	0	0	0	0	0	0	0	0	0	0	0	0
	Cadmium Content	0	0	0	0	0	0	0	0	0	0	0	0	0
	Hexavalent Chromium Content	0	0	0	0	0	0	0	0	0	0	0	0	0
	PBB Content	0	0	0	0	0	0	0	0	0	0	0	0	0
	PBDE Content	0	0	0	0	0	0	0	0	0	0	0	0	0
	Other JIG A Substances	0	0	0	0	0	0	0	0	0	0	0	0	0
JIG B Substances ²	Antimony	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera
	Arsenic	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm	~3 ppm
	Brominated flame retardants other than PBBs and PBDEs	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera	Contact Altera
	Other JIG B substances	0	0	0	0	0	0	0	0	0	0	0	0	0

¹JIG A substances : Asbestos, Azocolourants and Azodyes, Cadmium, Hexavalent Chromium, Lead, Mercury, Ozone Depleting Substances, PBB, PBDE, PCB, PCN, Radioactive Substances, Chlorinated Paraffins, TBT and TPT, TBTO

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