

Guidelines for Handling J-Lead, QFP, BGA, FBGA, and Lidless FBGA Devices

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This application note provides guidelines for handling J-Lead, Quad Flat Pack (QFP), and Ball-Grid Array (BGA, including FineLine BGA [FBGA] and lidless FBGA packaging) devices to preserve the quality of these devices during storage, shipment, and transfer and to ensure easier soldering.

Devices that use surface-mount J-Lead, QFP, BGA, FBGA, and lidless BGA are now common on boards because they provide density, size, and cost benefits. However, a few precautions are necessary to protect these devices from mechanical damage during transportation and storage.

Note: All lidless flip chip and wire bond packages are non-vented packages. All other flip chip packages are vented packages.

Handling J-Lead and QFP Devices

To protect device leads and ensure proper operation, you must handle J-Lead and QFP devices carefully when they are stored, shipped, and transferred. You must store and ship J-Lead devices in tubes sealed with stoppers. Add foam inside the tubes for cushioning if necessary.

You must ship QFP devices in carriers only inside tubes sealed with stoppers and with foam (if necessary). Carriers are static-dissipative, molded plastic shells that hold QFP devices in a secure frame to prevent mechanical damage to device leads. You can program and erase these QFP devices inside carriers and they can tolerate the 125°C baking required for dry packing. When handling QFP devices in carriers, do not touch the QFP device; only use fingers cots to touch the carrier.

If you are required to insert a QFP device into a carrier, contact Altera® Customer Marketing. For more information, refer to the QFP Carrier and Development Socket Datasheet as listed in the Related Information section.

You must store and ship QFP devices without carriers, QFP devices that have been extracted from carriers, and BGA devices only in trays sealed with straps. When extracting QFP devices from a carrier, use only Altera QFP extraction tools and inspect the orientation and lead integrity of the devices. You must extract the device and place them directly into trays.

Related Information

- [QFP Carrier and Development Socket Datasheet](#)
Provides more details on QFP carriers.
- [Trays for QFP, BGA, FBGA, and Lidless FBGA Devices without Carriers](#) on page 6
Provides more details about handling QFP or BGA devices without carriers.

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- [Straps for QFP, BGA, FBGA, and Lidless FBGA Devices without Carriers](#) on page 14
Provides more details about handling QFP or BGA devices without carriers.

Tubes for J-Lead Devices and QFP Devices in Carriers

Altera-approved tubes protect J-Lead and QFP devices in carriers from electrostatic discharge (ESD) and during transportation and storage. Use clear tubes to inspect the top-side marking of the contents easily. The tube material must be antistatic (with “antistatic” printed on the tube), and stiff enough to prevent the tubes from warping, cracking, or developing burrs during normal handling.

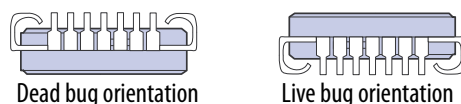
When transporting or storing devices in tubes, follow these guidelines:

- Keep tubes horizontal
- Keep devices in “dead bug” orientation (refer to the Dead Bug Versus Live Bug Orientation figure)
- Ensure that the devices do not overlap inside the tube

The following figure shows the difference between a “dead bug” and “live bug” orientation.

The following figure shows the tube dimensions required for each J-Lead device. The tubes must match the dimensions of the device. For the tube dimension, refer to the Tube Dimension for J-Lead Device Antistatic Shipping Tube table.

Figure 1: Dead Bug Versus Live Bug Orientation



The following table lists the tube dimension as shown in the Tube Dimensions for J-Lead Device Antistatic Shipping Tube figure.

Figure 2: Tube Dimensions for J-Lead Device Antistatic Shipping Tube

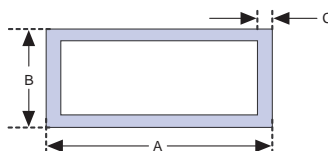


Table 1: Tube Dimension for J-Lead Device Antistatic Shipping Tube

Pin Count	A	B	C	Shipping Length
20	0.480	0.260	0.025	20.00
28	0.580	0.260	0.025	20.00
44	0.780	0.260	0.025	20.25
68	1.100	0.280	0.035	20.00
84	1.300	0.280	0.035	20.25

The following table lists the part numbers for Altera-approved tubes for J-Lead devices.

Table 2: Antistatic Tube Part Numbers for J-Lead Devices

For more information about how to order tubes, refer to the Altera-Approved Packing Media and Suppliers table as listed in the Related Information section.

Pin Count	Altera Reference Part Number	Tube Capacity (Devices)
20	E20-03708-00	49
28	E20-02078-00	39
44	E20-05952-00	26
68	E20-04431-00	18
84	E20-04740-00	15

The following table lists the part numbers for Altera-approved tubes for QFP devices in carriers.

Table 3: Altera-Approved Tubes for QFP Devices in Carriers

For more information about how to order tubes, refer to the Altera-Approved Packing Media and Suppliers table as listed in the Related Information section.

Pin Count	Package Dimensions (mm)	Tube Capacity (QFP Devices in Carriers)	Altera Reference Part Number
100	14 x 20	23	E20-02080-00
160	28 x 28	14	E20-04743-00
208	28 x 28	14	E20-04743-00
240	32 x 32	12	E20-04800-00
304	40 x 40	10	E20-04783-00

Related Information

- [Ordering Information](#) on page 24
- [Transferring Devices Between Tubes](#) on page 15

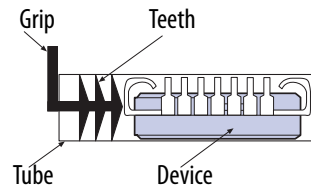
Stoppers for J-Lead and QFP Devices in Carriers

Stoppers seal tubes and protect J-Lead and QFP devices in carriers against mechanical damage and ESD. Altera uses black stoppers that match the tube dimensions. When inserting stoppers, follow these guidelines:

- Before transporting or storing devices, seat stoppers firmly into both ends of the tube.
- For easy removal, push stopper teeth fully inside the tube, with the grip extending outside. Do not insert the stopper completely inside the tube (refer to the Stopper Properly Inserted into a Tube figure).
- To prevent devices from moving inside an incompletely filled tube, insert foam between the parts and stopper.

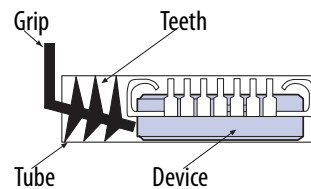
The following figure shows how you can properly insert a stopper in a tube.

Figure 3: Stopper Properly Inserted into a Tube



To reduce the risk of damaging leads, some special stoppers are designed to fit into a tube in only one way. It is important to insert these special stoppers correctly with the grip in the same direction as the leads, as shown in the following figure.

Figure 4: Proper Orientation of Special Stoppers



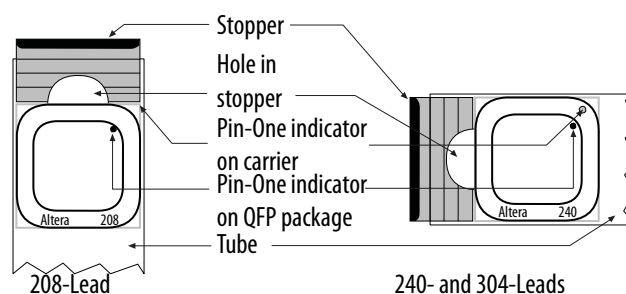
The following table lists the part numbers for Altera-approved black stoppers for J-Lead devices.

Table 4: Black Stopper Part Numbers for J-Lead Devices

For more information about how to order stoppers, refer to the Altera-Approved Packing Media and Suppliers table as listed in the Related Information section.

Pin Count	Manufacturer Part Number
20	K-VT0236-25
28	K-VT0236-12
44	KBR-044
68	KBR-068
84	KBR-084

To prevent damage to leads during shipping, tubes containing 208-, 240-, and 304-lead Power Quad Flat Pack (RQFP) packages in carriers must have modified stoppers. These modified stoppers are used just like other stopper although they have a notch cut out of them, refer to the following figure.

Figure 5: Notched Stoppers for Tubes of RQFPs in Carriers

The following table lists the part numbers for Altera-approved black stoppers for QFP devices in carriers.

Table 5: Black Stopper Part Numbers for QFP Devices in Carriers

For more information about how to order stoppers, refer to the Altera-Approved Packing Media and Suppliers table as listed in the Related Information section.

Pin Count	Altera Part Number
100	E20-04739-00
160	E20-04764-00
208	E20-04764-00
240	E20-04765-00
304	E20-04766-00

Related Information

[Ordering Information](#) on page 24

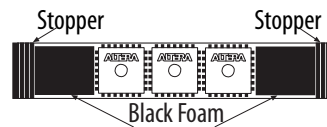
Foam for J-Lead Devices and QFP Devices in Carriers

Foam provides extra cushioning and restricts movement inside the tube to prevent device pins from bending. To support the devices evenly, the foam must be nearly as wide as the tubes. You must not use foam in any full tube containing special stoppers, as shown in the Proper Orientation of Special Stoppers figure. When you use the foam, place the foam at each end of the tube between the stoppers and devices, as shown in the following figure.

Foam must be antistatic, non-corrosive, and free of contaminants. Place foam in tubes containing the following:

- A gap inside the tube measuring 1/4 inch or greater (for both J-Lead and QFP devices in carriers)
- Plastic J-Lead Chip Carrier (PLCC) devices with 44 or more pins (full tubes containing PLCC devices with 28 or fewer pins generally do not require foam)
- Ceramic J-Lead Chip Carrier (JLCC) devices

The following figure shows the position of the stopper, foam, and devices in a tube.

Figure 6: Stoppers, Foam, and Devices in a Tube**Related Information**

[Stoppers for J-Lead and QFP Devices in Carriers](#) on page 3

Trays for QFP, BGA, FBGA, and Lidless FBGA Devices without Carriers

To hold QFP devices without carriers or BGA devices, use only altera-approved trays as listed in the Altera-Approved Low-Profile Trays Part Number table.

When stacking trays for transportation or storage, follow these guidelines:

- Seal stacks of trays with straps.
- Ensure that all trays are of the same revision. The revision is indicated by the letter following "Rev".
- Align all pin-one chamfers on the trays together, as shown in the Properly-Aligned Peak Trays figure.
- Align trays and ensure that they are seated properly before strapping them together.
- Stack RQFP trays no higher than five trays (for example, four trays containing devices and one cover tray).
- Stack Plastic Quad Flat Pack (PQFP) and BGA trays no higher than seven trays (for example, six trays containing devices and one cover tray).
- Shipping trays used for shipment of QFP and BGA (including FBGA, and lidless FBGA) packages must be low profile.
- Shipping trays used for shipment of Pin-Grid Array (PGA) packages must be high profile.

The following figure shows an example of a properly-aligned peak trays.

Figure 7: Properly-Aligned Peak Trays

All the full-size JEDEC trays used by Altera can withstand temperatures of at least 150°C, or you can also refer to the maximum rated temperature marked on each tray. These heat-resistant trays are not only more rigid, but they endure baking at 125°C, which is the recommended temperature for dehydrating moisture-sensitive devices.

The following table lists the part number for Altera-approved, low-profile trays.

Table 6: Altera-Approved Low-Profile Trays Part Number

This can either be an eight for 180°C bakeable trays, six for 150°C bakeable trays, or 13 for 140°C bakeable trays.

Package Type	Package Code	Lead Count	Body Size (mm)	Remark	Primary Supplier			Parts or Tray
					Vendor and Vendor Part Number	Tray Revision	Altera Part Number	
BGA	B	225	27 x 27	Plastic BGA	Daewon 125-2727-9XX ⁽¹⁾	A	E20-12211-00	40
		225	27 x 27	Ceramic BGA	R.H. Murphy # RHM-672	—	E20-03554-03	40
		256	27 x 27	—	Daewon 125-2727-9XX ⁽¹⁾	A	E20-12211-00	40
		356	35 x 35	FineLine BGA Package thickness of ~2.2mm	Daewon 125-3535-9XX ⁽¹⁾	E	E20-12214-00	24
		600	45 x 45	—	Daewon 12Y-4545-4XX ⁽¹⁾	A	E20-12216-00	12
		652	45 x 45	Wire Bond	Daewon 12Y-4545-4XX ⁽¹⁾	A	E20-12216-00	12
		652	45 x 45	Flip Chip	KOSTAT KS-880351	ORIG	E20-33170-00	12
		672	35 x 35	FineLine BGA Package thickness of ~2.2mm	Daewon 125-3535-9XX ⁽¹⁾	E	E20-12214-00	24
		672	35 x 35	Flip Chip BGA Package thickness > 2.2mm	Daewon T0809050	A	E20-33149-00	24

⁽¹⁾ "XX represents Daewon temperature category. Must be 19 for 150°C bakeable trays.

Package Type	Package Code	Lead Count	Body Size (mm)	Remark	Primary Supplier			Parts or Tray
					Vendor and Vendor Part Number	Tray Revision	Altera Part Number	
		724	35 x 35	Flip Chip BGA Package thickness > 2.2mm	Daewon T0809050	A	E20-33149-00	24
		956	40 x 40	—	KOSTAT KS-886H	02	E20-33129-00	21
FineLine BGA	F	100	11 x 11	—	Daewon 12F-1111-1XX ⁽¹⁾	A	E20-12205-00	176
		144	13 x 13	—	Daewon 1F3-1313-DXX ⁽¹⁾	A	E20-12206-00	160
		169	14 x 14	—	KOSTAT KS-88088	00	E20-15430	119
		256	17 x 17	—	Daewon 1F1-1717-AXX ⁽¹⁾	A	E20-12207-00	90
		324	19 x 19	—	Daewon 12U-1919-GXX ⁽¹⁾	A	E20-12208-00	84
		400	21 x 21	—	KOSTAT KS-880104	ORIG	E20-08843-03	60
		484	23 x 23	FineLine BGA Package thickness of ~2.5mm	Daewon 12Y-2323-9XX ⁽¹⁾	A	E20-12209-00	60
		484	23 x 23	Flip Chip BGA Package thickness of ~3.5mm	Daewon 12V-2323-419	A	E20-12210-00	60

Package Type	Package Code	Lead Count	Body Size (mm)	Remark	Primary Supplier			Parts or Tray
					Vendor and Vendor Part Number	Tray Revision	Altera Part Number	
		484	23 x 23	OMPAC PFBGA (Conventional and Pin Gate)	Daewon T0812012	B	E20-33269-00	60
		572	25 x 25	—	Daewon 14Y-2525-119	A	E20-33190-00	44
		672	27 x 27	Flip Chip BGA Package thickness > 2.2mm	Daewon 12V-2727-319	B	E20-12212-00	40
		672	27 x 27	FineLine BGA Package thickness < / = 2.2mm and OMPAC PFBGA (Conventional and Pin Gate)	Daewon 125-2727-9XX ⁽¹⁾	A	E20-12211-00	40
		780	29 x 29	Flip Chip	KOSTAT KS-88085	ORIG	E20-07373-03	36
		780	29 x 29	OMPAC (Wirebond PBGA) and Lidless Flip Chip ⁽²⁾	KOSTAT KS-880466	A	E20-33329-00	36
		780	29 x 29	FCmBGA Flip Chip	Daewon 1F1-2929-C19	B	E-20-33349-00	36

⁽²⁾ These packages have lidless package tray offering.

Package Type	Package Code	Lead Count	Body Size (mm)	Remark	Primary Supplier			Parts or Tray
					Vendor and Vendor Part Number	Tray Revision	Altera Part Number	
		896	31 x 31	OMPAC PFBGA (Conventional and Pin Gate)	KOSTAT KS-880120	01	E20-11290-00	27
		1020	33 x 33	—	Daewon 12Y-3333-4XX ⁽¹⁾	A	E20-12213-00	24
		1152	35 x 35	Flip Chip BGA Package thickness > 2.2mm	Daewon T0809050	A	E20-33149-00	24
		1152	35 x 35	Lidless Flip Chip ⁽²⁾	Daewon 125-3535-9XX ⁽¹⁾	E	E20-12214-00	24
		1508	40 x 40	—	KOSTAT KS-886H	02	E20-33129-00	21
		1510	40 x 40	Lidded Flip Chip	KOSTAT KS-886H	02	E20-33129-00	21
		1517	40 x 40	—	KOSTAT KS-886H	02	E20-33129-00	21
		1760	42.5 x 42.5	—	KOSTAT KS-880350	ORIG	E20-33169-00	12
		1932	45 x 45	—	KOSTAT KS-880351	ORIG	E20-33170-00	12
Hybrid BGA (HBGA)	H	484	27 x 27	Flip Chip BGA Package thickness > 2.2mm	Daewon 12V-2727-319	B	E20-12212-00	40
		780	33 x 33	—	Daewon 12Y-3333-4XX ⁽¹⁾	A	E20-12213-00	24
		1152	40 x 40	—	KOSTAT KS-886H	02	E20-33129-00	21

Package Type	Package Code	Lead Count	Body Size (mm)	Remark	Primary Supplier			Parts or Tray
					Vendor and Vendor Part Number	Tray Revision	Altera Part Number	
		1152	42.5 x 42.5	—	KOSTAT KS-880350	ORIG	E20-33169-00	12
		1517	42.5 x 42.5	—	KOSTAT KS-880350	ORIG	E20-33169-00	12
		1517	45 x 45	—	KOSTAT KS-880351	ORIG	E20-33170-00	12
		1760	45 x 45	—	KOSTAT KS-880351	ORIG	E20-33170-00	12
Micro BGA (MBGA)	M	64	4.5 x 4.5	—	Daewon 14C-4545-D19	A	E20-33289-00	490
		68	5 x 5	—	KOSTAT KS-880203	00	E20-33230-00	640
		100	6 x 6	—	KOSTAT KS-88090	00	E20-33007-00	429
		144	7 x 7	—	Daewon 12U-0707-9XX ⁽¹⁾	A	E20-12204-01	416
		153	8 x 8	—	Daewon 1F3-0808-119	A	E20-33229-00	348
		164	8 x 8	Lidless Flip Chip ⁽²⁾	Daewon 1F3-0808-119	A	E20-33229-00	348
		256	9 x 9	—	ePAK eTR0121-54 (eN BG0909 1.5 1026 54)	0	E20-33353-00	260
		256	11 x 11	—	Daewon 12F-1111-1XX ⁽¹⁾	A	E20-12205-00	176
		301	11 x 11	—	Daewon 12F-1111-1XX ⁽¹⁾	A	E20-12205-00	176
		383	13 x 13	—	KOSTAT KS-880432	00	E20-33355-00	119

Package Type	Package Code	Lead Count	Body Size (mm)	Remark	Primary Supplier			Parts or Tray
					Vendor and Vendor Part Number	Tray Revision	Altera Part Number	
		484	15 x 15	—	KOSTAT KS-870369	00	E20-33350-00	119
		1019	17 x 17	—	Daewon 1F1-1717-AXX ⁽¹⁾	A	E20-12207-00	90
Quad Flat No-Lead (QFN)	N	148	11 x 11	—	Kostat KS-870324	A	E20-33249-00	176
Ultra FineLine BGA (UBGA)	U	49	7 x 7	—	Daewon 12U-0707-9XX ⁽¹⁾	A	E20-12204-01	416
		88	8 x 11	—	Shinon SL-BG081115TJ-1	ORIG	E20-09743-03	210
		169	11 x 11	—	Daewon 12F-1111-1XX ⁽¹⁾	A	E20-12205-00	176
		256	14 x 14	—	Kostat KS-88088	00	E20-15430	119
		324	15 x 15	—	KOSTAT KS-870369	00	E20-33350-00	119
		358	17 x 17	Lidless Flip Chip ⁽²⁾	Daewon 1F1-1717-AXX ⁽¹⁾	A	E20-12207-00	90
		484	19 x 19	—	Daewon 12U-1919-GXX ⁽¹⁾	A	E20-12208-00	84
		672	23 x 23	OMPAC PFBGA (Conventional & Pin Gate)	Daewon T0812012	B	E20-33269-00	60
Thin Quad Flat Pack (TQFP)/ Plastic Enhanced	T/E	32 (TQFP only)	7 x 7	—	KS-86015	00	E20-07179-03	250
		44	10 x 10	—	KS-8607	02	E20-07193-03	160

Package Type	Package Code	Lead Count	Body Size (mm)	Remark	Primary Supplier			Parts or Tray
					Vendor and Vendor Part Number	Tray Revision	Altera Part Number	
Quad Flat Pack (EQFP)		64 (EQFP only)	7 x 7	—	KS-86015	00	E20-07179-03	250
		100	14 x 14	—	KS-8605	00	E20-07194-03	90
		144	20 x 20	—	KS-8303	03	E20-07195-03	60
PQFP	Q	44	10 x 10	—	Daewon 121-1010-3XX ⁽¹⁾	A	AE20-12227-00	96
		100	14 x 20	—	Kostat KS-8212	03	E20-05239-03	66
		100	14 x 20	PQFP parts assembled by Sharp-JAPAN must use Rev.6P	Peak ND-1420-2.7-0611- 6P	6P	E20-09907-00	66
		160	28 x 28	—	Kostat KS-8201	10	E20-05240-03	24
		208	28 x 28	—	Kostat KS-8201	10	E20-05240-03	24
		240	32 x 32	—	Kostat KS-8205	06	E20-05241-03	24
RQFP	R	208	28 x 28	—	Kostat KS-8201	10	E20-05240-03	24
		240	32 x 32	—	Kostat KS-8205	06	E20-05241-03	24
		304	40 x 40	—	Peak ND-4040-3.8-0206 ⁽³⁾	ORIG	E20-03552-03	12
PGA	G	68	11 x 11	—	R.H. Murphy # RHM-605	—	E20-04266-03	21
		84	11 x 11	—	R.H. Murphy # RHM-605	—	E20-04266-03	21

⁽³⁾ This can either be an eight for 180°C bakeable trays, six for 150°C bakeable trays, or 13 for 140°C bakeable trays.

Package Type	Package Code	Lead Count	Body Size (mm)	Remark	Primary Supplier			Parts or Tray
					Vendor and Vendor Part Number	Tray Revision	Altera Part Number	
		100	13 x 13	—	R.H. Murphy # RHM-605	—	E20-04266-03	21
		160	15 x 15	—	R.H. Murphy # RHM-605	—	E20-04266-03	21
		192	17 x 17	—	R.H. Murphy # RHM-601	—	E20-04217-03	10
		232	17 x 17	—	R.H. Murphy # RHM-601	—	E20-04217-03	10
		280	19 x 19	—	R.H. Murphy # RHM-601	—	E20-04217-03	10
		403	19 x 19	Ceramic lid	R.H. Murphy # RHM-620	—	E20-03556-03	10
		403	19 x 19	Gold lid	R.H. Murphy # RHM-750	—	E20-03563-03	8
		503	22 x 22	—	R.H. Murphy # RHM-750	—	E20-03563-03	8
		599	24 x 24	—	R.H. Murphy # RHM-750	—	E20-03563-03	8

Straps for QFP, BGA, FBGA, and Lidless FBGA Devices without Carriers

Straps secure trays and prevent devices from jostling during transportation and storage. To hold trays together during transportation, Altera recommends using at least 1/2-inch wide polypropylene straps that can withstand temperatures up to 130°C in case you are required to bake the devices before mounting. When storing devices, Altera recommends using either velcro or polypropylene straps.

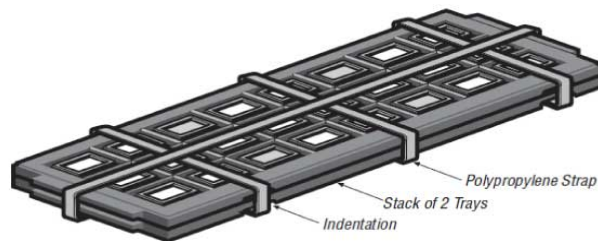
Velcro straps that are 20 inches in length are sufficiently long to bind stacks of two to seven trays for storage. When you strap trays together for shipping, follow these guidelines:

- Use only heat-sealed polypropylene straps. Although velcro straps can hold trays together during storage, they lack the strength required to hold trays during transportation.
- Set the tension on the strapping machine high enough to prevent straps from sliding off a stack of trays.
- Secure one polypropylene strap across the length of the tray.
- Remove straps with a knife to prevent jostling devices in the trays.

Note: Do not use rubber bands, masking tape, string, or other similar material in place of velcro or polypropylene straps.

The following figure shows the proper way to secure polypropylene straps on a stack of trays.

Figure 8: Properly Secured Polypropylene Straps on a Stack of Trays



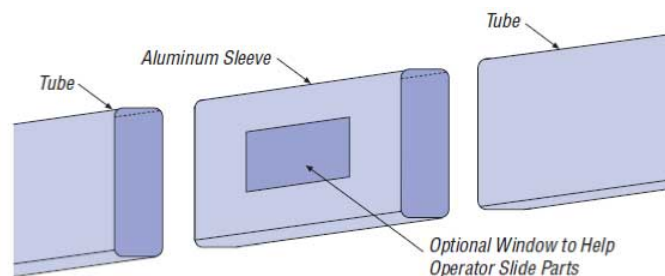
Transferring Devices Between Tubes

To prevent leads from bending on tube edges, follow these steps when transferring J-Lead devices and QFP devices in carriers from one tube to another:

1. Use a metal or plastic sleeve to line up tube ends. If you do not have a sleeve, carefully line up the tube ends.
2. Tilt the tubes so that the devices slide from one tube to the other. Do not shake or vibrate the tubes.

The following figure shows the sleeve for tube-to-tube transfer.

Figure 9: Sleeve for Tube-to-Tube Transfer



Transferring QFP, BGA, FBGA, and Lidless FBGA Devices Without Carriers Between Trays

Altera recommends using automated pick-and-place machines in an ESD-protected environment to transfer QFP or BGA devices between trays. If you are required to transfer these devices manually, follow these guidelines:

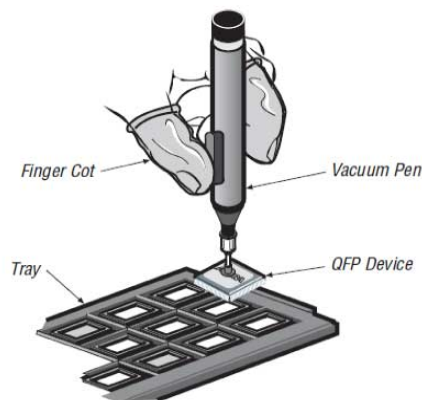
- Work in an ESD-protected environment.
- Use ground straps and finger cots.
- Use only vacuum pens to transfer QFP or BGA devices manually. Vacuum pens must be able to maintain their vacuum for at least four seconds.
- Transfer devices right-side-up over a table, then release the vacuum only after the device is oriented and seated in the tray properly.
- Do not allow QFP device leads to contact the tray.

For transferring lidless FBGA devices, follow these guidelines:

- Ensure that you use vacuum pens with soft rubber tips.
- Ensure that the vacuum pen does not touch the edge of the exposed die.
- Ensure that the vacuum tip covers the die area without losing any suction.
- Altera recommends that you use Altera-specified trays for lidless flip chip. For more information, refer to the Altera-Approved Low-Profile Trays Part Number table as listed in the Related Information section.

The following figure shows how you can transfer a QFP device with a vacuum pen.

Figure 10: Transferring a QFP Device with a Vacuum Pen



Related Information

[Trays for QFP, BGA, FBGA, and Lidless FBGA Devices without Carriers](#) on page 6

Dry Packing J-Lead, QFP, BGA, FBGA, and Lidless BGA Devices

Dry packing is a method of packing moisture-sensitive devices for shipment. Risk to moisture-sensitive devices can occur when the high-soldering temperatures of the reflow process suddenly heat any moisture absorbed by a plastic package. Although many of Altera devices are not sensitive to moisture, Altera adopted dry packing as a standard practice for moisture-sensitive devices to eliminate all risk of moisture. Additionally, Altera can dry-pack other devices upon request. During dry packing, devices are first baked to remove any existing moisture and then packed and vacuum-sealed in moisture-barrier bags.

The following table lists the contents of a typical package.

Table 7: Dry Pack Contents

Item	Specification
Moisture-barrier bag	MIL-B-81705C, Type I or equivalent
Desiccant	MIL-D-3464, Type II or equivalent
Humidity-indicator card	Compliant with MIL-I-8835A
Labels	ID label and caution label

To maintain a moisture-free environment, follow these guidelines after receiving dry-packed devices from Altera:

- Open bags as close to the seal as possible to leave enough of the bag for resealing.
- Reseal bags after opening to minimize exposure to moisture.
- Inspect all dry packs for potential leaks in the seals or bags. If a leak exists and the humidity-indicator card shows an unacceptable humidity level (for example, the 20% dot has started to turn pink), rebake the devices. If a leak exists but the humidity-indicator shows an acceptable humidity level (for example, the 20% dot is blue with no pink), reseal the devices in an undamaged bag.
- Check that the humidity-indicator card shows acceptable humidity after opening dry packs. If the card shows an unacceptable humidity level, rebake the devices.
- Store dry packs in condition less than 40°C and less than 90% relative humidity.

In addition, Altera lists the floor life on every dry-pack label. The floor life is the length of time you can expose a device to a factory environment (less than 30°C and less than 60% relative humidity) after you removed the device from the bag and before it is mounted. Parts that are not dry packed have an unlimited floor life but you must store at a proper environment (less than 30°C and less than 85% relative humidity). If the interval between opening a dry pack and mounting the devices onto a board exceeds the floor life of the device, rebake devices prior to mounting.

Distributors have an additional allotment of time beyond the labelled floor life. Six hours are available for products with a 24-hour floor life, and 24 hours are available for products with a 168-hour or one-year floor life. These time allotments allow for programming and repacking as required.

When dry-packing devices, follow these guidelines:

- When transferring parts to new dry pack bags, operators must remember to copy the floor life and expiration date accurately to the new dry-pack labels.
- Bake QFP or BGA devices in strapped heat-resistant trays at 125°C for at least 12 hours.
- Bake J-Lead devices in heat-resistant tubes at 125°C for at least 12 hours. If you lack heat-resistant tubes, bake J-Lead devices on a cookie sheet in a dead-bug orientation.
- Use heat-sealed bags that are resistant to punctures and abrasion.
- Use foam covers or bubble wrap around a stack of trays inside the moisture-barrier bag to avoid punctures.
- Seal bags with a vacuum-operated bag-sealing machine. Relax the vacuum enough to prevent the tube or tray from puncturing the bag.
- If the dry pack is open for longer than one hour, replace the desiccant and humidity indicator card.
- Use at least one unit of desiccant per dry pack.
- You must not use zip-lock and dry-pack bags for longer than one week.

Dry Pack Sizes

The following table lists the available dry pack sizes. Altera uses heavy-duty, 6" x 24", 6" x 30", and 10" x 30" bags for dry-packing tubes. Bags for trays by Altera are 10" x 20".

Table 8: Dry Pack Sizes

- The tray quantities do not include one cover tray.
- For the dry-packed devices in Tube 2, foam sheets are used at the bottom of the tube box.
- To optimize the material and space usage, the box and foam sizes are "recommended only".
- If bubble wrap is used inside the moisture bag, follow the "2-feet bubble" recommendation. This is applicable only for all dry-packed devices.
- J44 = 100% Pack 2.
- L20DP, L28DP, S08/16, TR = 100% Pack 3.
- No Pack 3 for all PGAs.
- Pack 1 and Pack 2 are in jewellery boxes.

Package and Lead	"Quantity/ Primary Container"	Type of Container	Minimum Container	Quantity	Maximum Container	Quantity
B225	40	TRAY	1	40	6	240
B256	40	TRAY	1	40	6	240
B356	24	TRAY	1	24	4	96
B600	12	TRAY	1	12	6	72
B652	12	TRAY	1	12	4	48
B672	24	TRAY	1	24	3	72
B724	24	TRAY	1	24	3	72
B956	21	TRAY	1	21	3	63

Package and Lead	"Quantity/ Primary Container"	Type of Container	Minimum Container	Quantity	Maximum Container	Quantity
D08	50	TUBE	1	50	N/A	N/A
D10	1000	REEL	N/A	N/A	1	1000
D12	1000	REEL	N/A	N/A	1	1000
D20	20	TUBE	10	200	N/A	N/A
D24	15	TUBE	8	120	48	720
D28	13	TUBE	5	65	45	585
D36	500	REEL	1	500	2	1000
D36TR	500	REEL	1	500	2	1000
D40	10	TUBE	5	50	40	400
E144	60	TRAY	1	60	6	360
E64	250	TRAY	1	250	6	1500
F100	176	TRAY	1	176	6	1056
F1020	24	TRAY	1	24	3	72
F1152	24	TRAY	1	24	3	72
F144	160	TRAY	1	160	6	960
F1508	21	TRAY	1	21	3	63
F1510	21	TRAY	1	21	3	63
F1517	21	TRAY	1	21	3	63
F169	119	TRAY	1	119	6	714
F1760	12	TRAY	1	12	4	48
F1932	12	TRAY	1	12	4	48
F1933	12	TRAY	1	12	4	48
F24	187	TRAY	1	187	5	935
F256	90	TRAY	1	90	6	540
F324	84	TRAY	1	84	3	252
F33	24	TRAY	1	24	3	72
F400	60	TRAY	1	60	4	240
F484	60	TRAY	1	60	4	240
F484FC	60	TRAY	1	60	4	240
F572	44	TRAY	1	44	4	176

Package and Lead	"Quantity/ Primary Container"	Type of Container	Minimum Container	Quantity	Maximum Container	Quantity
F672	40	TRAY	1	40	4	160
F672F35	24	TRAY	1	24	3	72
F672FC	40	TRAY	1	40	4	160
F780	36	TRAY	1	36	4	144
F780FC	36	TRAY	1	36	4	144
F896	27	TRAY	1	27	3	81
G100	21	TRAY	1	21	N/A	N/A
G160	21	TRAY	1	21	N/A	N/A
G192	10	TRAY	1	10	N/A	N/A
G232	10	TRAY	1	10	N/A	N/A
G280	10	TRAY	1	10	N/A	N/A
G403	10	TRAY	1	10	N/A	N/A
G503	10	JEWEL	1	10	N/A	N/A
G599	8	JEWEL	1	8	N/A	N/A
G655	8	JEWEL	1	8	N/A	N/A
G68	21	TRAY	1	21	N/A	N/A
G84	21	TRAY	1	21	N/A	N/A
H1152	21	TRAY	1	21	3	63
H1152H425	12	TRAY	1	12	4	48
H1517	12	TRAY	1	12	4	48
H1760	12	TRAY	1	12	4	48
H484	40	TRAY	1	40	4	160
H780	24	TRAY	1	24	3	72
J28	36	TUBE	1	36	9	324
J44	26	TUBE	N/A	N/A	N/A	N/A
J68	18	TUBE	1	18	10	180
J84	15	TUBE	1	15	10	150
L20	49	TUBE	4	196	24	1176
L20DP	49	TUBE	N/A	N/A	24	1176
L28	39	TUBE	4	156	24	936

Package and Lead	"Quantity/ Primary Container"	Type of Container	Minimum Container	Quantity	Maximum Container	Quantity
L28DP	39	TUBE	N/A	N/A	24	936
L44	26	TUBE	5	130	30	780
L44DP	26	TUBE	5	130	30	780
L44TR	500	REEL	N/A	N/A	1	500
L68	18	TUBE	3	54	24	432
L84	15	TUBE	1	15	15	225
L84TR	200	REEL	N/A	N/A	1	200
M100	429	TRAY	1	429	3	1287
M100TR	3000	REEL	N/A	N/A	1	3000
M1019TR	875	REEL	N/A	N/A	1	875
M144	416	TRAY	1	416	3	1248
M153	348	TRAY	1	348	3	1044
M164	348	TRAY	1	348	3	1044
M256	176	TRAY	1	176	6	1056
M256M99	260	TRAY	1	260	3	780
M301	176	TRAY	1	176	6	1056
M383	119	TRAY	1	119	6	714
M484	119	TRAY	1	119	6	714
M64	490	TRAY	1	490	3	1470
M68	640	TRAY	1	640	3	1920
N148	176	TRAY	1	176	6	1056
P08	50	TUBE	2	100	12	600
P20	18	TUBE	10	180	60	1080
P24	15	TUBE	8	120	48	720
P28	14	TUBE	8	112	48	672
P40	10	TUBE	5	50	40	400
Q100	66	TRAY	1	66	10	660
Q100SH	50	TRAY	1	50	10	500
Q100TR	1	REEL	N/A	N/A	1	1
Q132	36	TRAY	1	36	6	216

Package and Lead	"Quantity/ Primary Container"	Type of Container	Minimum Container	Quantity	Maximum Container	Quantity
Q16	1000	REEL	N/A	N/A	1	1000
Q160	24	TRAY	1	24	6	144
Q20	1000	REEL	N/A	N/A	1	1000
Q208	24	TRAY	1	24	6	144
Q24	500	REEL	1	500	2	1000
Q240	24	TRAY	1	24	4	96
Q28	500	REEL	N/A	N/A	1	500
Q30	500	REEL	N/A	N/A	1	500
Q36	1000	REEL	N/A	N/A	1	1000
Q38	500	REEL	N/A	N/A	1	500
Q40	1000	REEL	N/A	N/A	1	1000
Q44	96	TRAY	1	96	6	576
Q44TR	500	REEL	N/A	N/A	1	500
Q46	1000	REEL	N/A	N/A	1	1000
Q54	250	REEL	N/A	N/A	1	250
Q58	250	REEL	N/A	N/A	1	250
Q68	250	REEL	1	250	2	500
Q76	250	REEL	N/A	N/A	1	250
Q92	250	REEL	N/A	N/A	1	250
R144	60	TRAY	1	60	4	240
R208	24	TRAY	1	24	4	96
R240	24	TRAY	1	24	4	96
R304	12	TRAY	1	12	4	48
S08	100	TUBE	N/A	N/A	20	2000
S14	1000	REEL	N/A	N/A	1	1000
S16	49	TUBE	N/A	N/A	25	1225
S20	38	TUBE	1	38	9	342
S24	31	TUBE	1	31	9	279
S28	27	TUBE	1	27	9	243
S8	1000	REEL	N/A	N/A	1	1000

Package and Lead	"Quantity/ Primary Container"	Type of Container	Minimum Container	Quantity	Maximum Container	Quantity
T100	90	TRAY	1	90	6	540
T100TR	1000	REEL	N/A	N/A	1	1000
T14	1000	REEL	N/A	N/A	1	1000
T144	60	TRAY	1	60	6	360
T32	250	TRAY	1	250	6	1500
T44	160	TRAY	1	160	6	960
U14	1000	REEL	N/A	N/A	1	1000
U16	1000	REEL	N/A	N/A	1	1000
U169	176	TRAY	1	176	6	1056
U16TR	1000	REEL	N/A	N/A	1	1000
U256	119	TRAY	1	119	6	714
U324	119	TRAY	1	119	6	714
U358	90	TRAY	1	90	6	540
U484	84	TRAY	1	84	3	252
U49	416	TRAY	1	416	3	1248
U672	60	TRAY	1	60	4	240
U88PK	210	TRAY	1	210	3	630
U88SH	80	TRAY	1	80	6	480
V81	1000	REEL	N/A	N/A	1	1000
W100	66	TRAY	1	66	6	396
W208	24	TRAY	1	24	4	96

Shipping J-Lead, QFP, BGA, FBGA, and Lidless FBGA Devices in Boxes

When shipping trays or tubes of devices, only use boxes that have passed the ASTM D776 test for shipping containers. To protect against ESD, Altera recommends using boxes with an internal, conductive finish. You must add filler material to boxes to cushion the contents and prevent trays or tubes from shifting position during shipping. Boxes must contain enough filler material to prevent stoppers from falling out of tubes when jostled. Filler material must meet the following standards:

- Must be antistatic and non-corrosive
- Must not crumble, flake, powder, outgas, or shed
- Must not scratch or puncture the trays, tubes, or dry-pack bags

Ordering Information

The following table lists Altera-approved packing media and suppliers.

Material	Suppliers
Tubes and stoppers	Altera
Trays (QFPs and BGAs)	Kostat
	Daewon
Trays (PGAs)	R.H Murphy
ESD velcro straps	Com-Kyl
0.5"-wide, polypropylene, heat-sealed straps (E30-04766)	South Bay Packaging
Tray-strapping machines (using polypropylene, heat-sealed straps) or other dry-packing equipment	Kent Landsberg StraPack (Sivaron Model S-699, D-52, and AQ-7)
Foam packaging (foam filler)	Pacific Southwest Container
Bubble wraps, trays, or dry-packing supplies	Ecotech
Vacuum pens	Virtual Industries

Related Information

- [Altera](#)
- [Kostat](#)
- [Daewon](#)
- [R. H. Murphy](#)
- [Com-Kyl](#)
- [South Bay Packaging](#)
- [Kent Landsberg](#)
- [Pacific Southwest Container](#)
- [Ecotech](#)
- [Virtual Industries](#)

Document Revision History

The following table lists the revision history for this document.

Table 9: Document Revision History

Date	Version	Changes
June 2017	2017.06.28	Added a note to clarify that all lidless flip chip and wire bond packages are non-vented packages and all other flip chip packages are vented packages.
June 2015	2015.06.12	<ul style="list-style-type: none">Updated the Altera-Approved Low-Profile Trays Part Number table to include the following packages:<ul style="list-style-type: none">FBGA 780 FCmBGA Flip Chip (29 mm x 29 mm)FBGA 1510 Lidded Flip Chip (40 mm x 40 mm)HBGA 1517 (45 mm x 45 mm)HBGA 1760 (45 mm x 45 mm)MBGA 153 (8 mm x 8 mm)MBGA 256 (9 mm x 9 mm)MBGA 301 (11 mm x 11 mm)MBGA 383 (13 mm x 13 mm)MBGA 484 (15 mm x 15 mm)UBGA 324 (15 mm x 15 mm)UBGA 672 (23 mm x 23 mm)Updated the Dry Pack Sizes table.
January 2011	5.0	<ul style="list-style-type: none">Updated to include lidless FBGA in this document.Updated Table 6, Table 8, and Table 9.Minor text edits.