

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.


This application note describes the following topics:

- “Handling J-Lead and QFP Devices” on page 1
- “Transferring Devices Between Tubes” on page 13
- “Transferring QFP, BGA, FBGA, and Lidless FBGA Devices Without Carriers Between Trays” on page 13
- “Dry Packing J-Lead, QFP, BGA, FBGA, and Lidless BGA Devices” on page 14
- “Shipping J-Lead, QFP, BGA, FBGA, and Lidless FBGA Devices in Boxes” on page 19


## 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 on QFP carriers, refer to the [QFP Carrier and Development Socket Datasheet](#).

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.

-  For more information about handling QFP or BGA devices without carriers, refer to “Trays for QFP, BGA, FBGA, and Lidless FBGA Devices without Carriers” on page 6 and “Straps for QFP, BGA, FBGA, and Lidless FBGA Devices without Carriers” on page 12.

## Tubes for J-Lead Devices and QFP Devices in Carriers

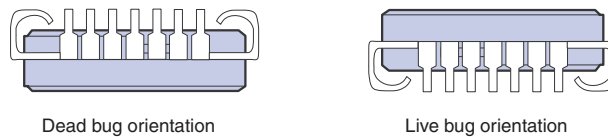
Altera-approved tubes protect J-Lead and QFP devices in carriers from electrostatic discharge (ESD) and during transportation and storage. Use clear tubes to inspect the top-side marking of the contents easily. The tube material must be antistatic (with “antistatic” printed on the tube), and stiff enough 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 [Figure 1](#))
- Ensure that the devices do not overlap inside the tube

[Figure 1](#) shows the difference between a “dead bug” and “live bug” orientation.

**Figure 1. Dead Bug Versus Live Bug Orientation**



[Figure 2](#) 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 [Table 1](#).

**Figure 2. Tube Dimensions for J-Lead Device Antistatic Shipping Tube**

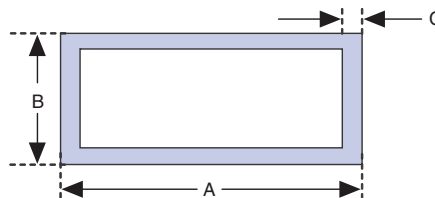


Table 1 lists the tube dimension as shown in Figure 2. Dimensions are shown in inches.

**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

Table 2 lists the part numbers for Altera-approved tubes for J-Lead devices.

**Table 2. Antistatic Tube Part Numbers for J-Lead Devices (Note 1)**

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

**Note to Table 2:**

(1) To order tubes, refer to Table 9.


Table 3 lists the part numbers for Altera-approved tubes for QFP devices in carriers.

**Table 3. Altera-Approved Tubes for QFP Devices in Carriers (Note 1)**

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

**Note to Table 3:**

(1) To order tubes, refer to Table 9.

 For more information about how to transfer device between tubes, refer to “Transferring Devices Between Tubes” on page 13.

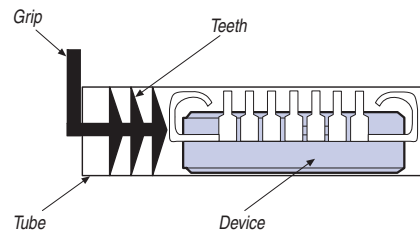
## Stoppers for J-Lead and QFP Devices in Carriers

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 [Figure 3](#)).
- To prevent devices from moving inside an incompletely filled tube, insert foam between the parts and stopper.

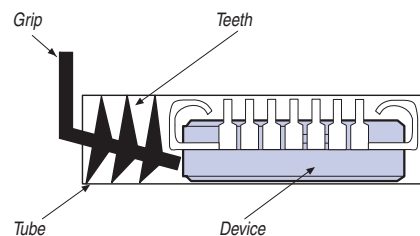
[Figure 3](#) shows how you can properly insert a stopper in a tube.

**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 [Figure 4](#).

**Figure 4. Proper Orientation of Special Stoppers**



[Table 4](#) lists the part numbers for Altera-approved black stoppers for J-Lead devices.

**Table 4. Black Stopper Part Numbers for J-Lead Devices (Note 1)**

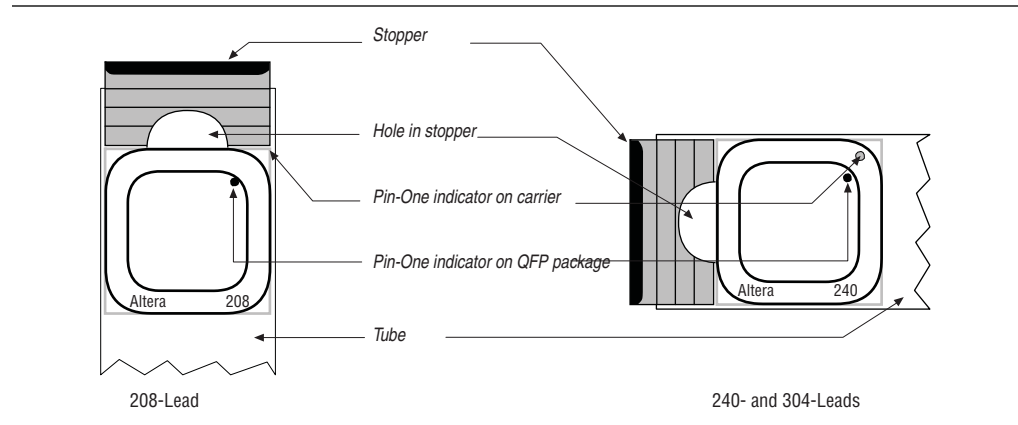
Pin Count	Manufacturer Part Number
20	K-VT0236-25
28	K-VT0236-12
44	KBR-044
68	KBR-068
84	KBR-084

**Note to Table 4:**

- (1) To order stoppers, refer to [Table 9](#).

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 [Figure 5](#)).

**Figure 5. Notched Stoppers for Tubes of RQFPs in Carriers**



[Table 5](#) 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 (1)**

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

**Note to [Table 5](#):**

(1) To order stoppers, refer to [Table 9](#).

## Foam for J-Lead Devices and QFP Devices in Carriers

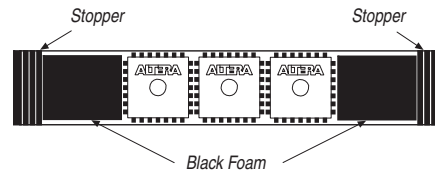
Foam provides extra cushioning and restricts movement inside the tube to prevent device pins from bending. To support the devices evenly, the foam must be nearly as wide as the tubes. You must not use foam in any full tube containing special stoppers, as shown in [Figure 4 on page 4](#). When you use the foam, place the foam at each end of the tube between the stoppers and devices, as shown in [Figure 6 on page 6](#).

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

Figure 6 shows the position of the stopper, foam and devices in a tube.

**Figure 6. Stoppers, Foam, and Devices in a Tube**



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

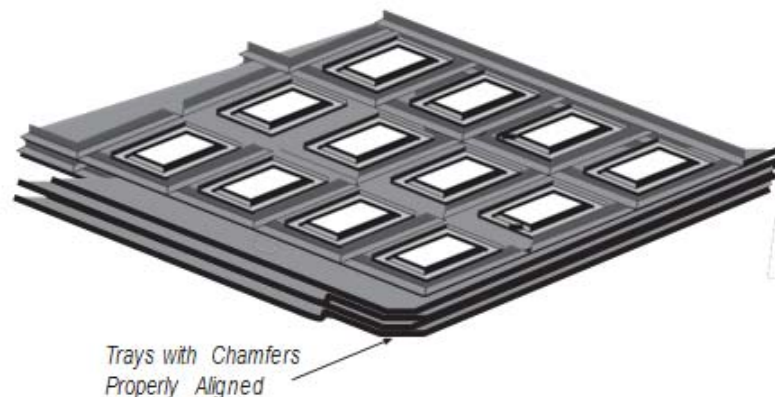
To hold QFP devices without carriers or BGA devices, use only altera-approved trays as shown in Table 6.

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 Figure 7.
- 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

Figure 7 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.

Table 6 lists the part number for Altera-approved, low-profile trays.

**Table 6. Altera-Approved Low-Profile Trays Part Number (Part 1 of 5) (Note 1)**

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 × 27	Plastic BGA	Daewon 125-2727-9XX (2)	A	E20-12211-00	40
		225	27 × 27	Ceramic BGA	R.H. Murphy # RHM-672	—	E20-03554-03	40
		256	27 × 27	—	Daewon 125-2727-9XX (2)	A	E20-12211-00	40
		356	35 × 35	FineLine BGA Package thickness of ~2.2mm	Daewon 125-3535-9XX (2)	E	E20-12214-00	24
		600	45 × 45	—	Daewon 12Y-4545-4XX (2)	A	E20-12216-00	12
		652	45 × 45	Wire Bond	Daewon 12Y-4545-4XX (2)	A	E20-12216-00	12
		652	45 × 45	Flip Chip	KOSTAT KS-880351	ORIG	E20-33170-00	12
		672	35 × 35	FineLine BGA Package thickness of ~2.2mm	Daewon 125-3535-9XX (2)	E	E20-12214-00	24
		672	35 × 35	Flip Chip BGA Package thickness >2.2mm	Daewon T0809050	A	E20-33149-00	24
		724	35 × 35	Flip Chip BGA Package thickness >2.2mm	Daewon T0809050	A	E20-33149-00	24
956	40 × 40	—	KOSTAT KS-886H	02	E20-33129-00	21		

**Table 6. Altera-Approved Low-Profile Trays Part Number (Part 2 of 5) (Note 1)**

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	
FineLine BGA	F	100	11 × 11	—	Daewon 12F-1111-1XX (2)	A	E20-12205-00	176
		144	13 × 13	—	Daewon 1F3-1313-DXX (2)	A	E20-12206-00	160
		169	14 × 14	—	KOSTAT KS-88088	00	E20-15430	119
		256	17 × 17	—	Daewon 1F1-1717-AXX (2)	A	E20-12207-00	90
		324	19 × 19	—	Daewon 12U-1919-GXX (2)	A	E20-12208-00	84
		400	21 × 21	—	KOSTAT KS-880104	ORIG	E20-08843-03	60
		484	23 × 23	FineLine BGA Package thickness of ~ 2.5mm	Daewon 12Y-2323-9XX (2)	A	E20-12209-00	60
		484	23 × 23	Flip Chip BGA Package thickness of ~ 3.5mm	Daewon 12V-2323-419	A	E20-12210-00	60
		484	23 × 23	OMPAC PFBGA (Conventional and Pin Gate)	Daewon T0812012	B	E20-33269-00	60
		572	25 × 25	—	Daewon 14Y-2525-119	A	E20-33190-00	44
		672	27 × 27	Flip Chip BGA Package thickness > 2.2mm	Daewon 12V-2727-319	B	E20-12212-00	40
		672	27 × 27	FineLine BGA Package thickness < /=2.2mm and OMPAC PFBGA (Conventional and Pin Gate)	Daewon 125-2727-9XX (2)	A	E20-12211-00	40
		780	29 × 29	Flip Chip	KOSTAT KS-88085	ORIG	E20-07373-03	36
		780	29 × 29	OMPAC (Wirebond PBGA) and Lidless Flip Chip (3)	Daewon 1F1-2929-CXX	B	E20-33029-00	36
		896	31 × 31	OMPAC PFBGA (Conventional and Pin Gate)	KOSTAT KS-880120	01	E20-11290-00	27
		1020	33 × 33	—	Daewon 12Y-3333-4XX (2)	A	E20-12213-00	24
		1152	35 × 35	Flip Chip BGA Package thickness >2.2mm	Daewon T0809050	A	E20-33149-00	24
		1152	35 × 35	Lidless Flip Chip (3)	Daewon 125-3535-9XX (2)	E	E20-12214-00	24
		1508	40 × 40	—	KOSTAT KS-886H	02	E20-33129-00	21
		1517	40 × 40	—	KOSTAT KS-886H	02	E20-33129-00	21
1760	42.5 × 42.5	—	KOSTAT KS-880350	ORIG	E20-33169-00	12		
1932	45 × 45	—	KOSTAT KS-880351	ORIG	E20-33170-00	12		



**Table 6. Altera-Approved Low-Profile Trays Part Number (Part 3 of 5) (Note 1)**

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	
Hybrid BGA (HBGA)	H	484	27 × 27	Flip Chip BGA Package thickness > 2.2mm	Daewon 12V-2727-319	B	E20-12212-00	40
		780	33 × 33	—	Daewon 12Y-3333-4XX (2)	A	E20-12213-00	24
		1152	40 × 40	—	KOSTAT KS-886H	02	E20-33129-00	21
		1152	42.5 × 42.5	—	KOSTAT KS-880350	ORIG	E20-33169-00	12
		1517	42.5 × 42.5	—	KOSTAT KS-880350	ORIG	E20-33169-00	12
Micro BGA (MBGA)	M	64	4.5 × 4.5	—	Daewon 14C-4545-D19	A	E20-33289-00	490
		68	5 × 5	—	KOSTAT KS-880203	00	E20-33230-00	640
		100	6 × 6	—	KOSTAT KS-88090	00	E20-33007-00	429
		144	7 × 7	—	Daewon 12U-0707-9XX (2)	A	E20-12204-01	416
		164	8 × 8	Lidless Flip Chip (3)	Daewon 1F3-0808-119	A	E20-33229-00	348
		256	11 × 11	—	Daewon 12F-1111-1XX (2)	A	E20-12205-00	176
		1019	17 × 17	—	Daewon 1F1-1717-AXX (2)	A	E20-12207-00	90
Quad Flat No-Lead (QFN)	N	148	11 × 11	—	Kostat KS-870324	A	E20-33249-00	176
Ultra FineLine BGA (UBGA)	U	49	7 × 7	—	Daewon 12U-0707-9XX (2)	A	E20-12204-01	416
		88	8 × 11	—	Shinon SL-BG081115TJ-1	ORIG	E20-09743-03	210
		169	11 × 11	—	Daewon 12F-1111-1XX (2)	A	E20-12205-00	176
		256	14 × 14	—	Kostat KS-88088	00	E20-15430	119
		358	17 × 17	Lidless Flip Chip (3)	Daewon 1F1-1717-AXX (2)	A	E20-12207-00	90
		484	19 × 19	—	Daewon 12U-1919-GXX (2)	A	E20-12208-00	84

**Table 6. Altera-Approved Low-Profile Trays Part Number (Part 4 of 5) (Note 1)**

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	
Thin Quad Flat Pack (TQFP)/ Plastic Enhanced Quad Flat Pack (EQFP)	T/E	32 (TQFP only)	7 × 7	—	KS-86015	00	E20-07179-03	250
		44	10 × 10	—	KS-8607	02	E20-07193-03	160
		64 (EQFP only)	7 × 7	—	KS-86015	00	E20-07179-03	250
		100	14 × 14	—	KS-8605	00	E20-07194-03	90
		144	20 × 20	—	KS-8303	03	E20-07195-03	60
PQFP	Q	44	10 × 10	—	Daewon 121-1010-3XX (2)	A	AE20-12227-00	96
		100	14 × 20	—	Kostat KS-8212	03	E20-05239-03	66
		100	14 × 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 × 28	—	Kostat KS-8201	10	E20-05240-03	24
		208	28 × 28	—	Kostat KS-8201	10	E20-05240-03	24
		240	32 × 32	—	Kostat KS-8205	06	E20-05241-03	24
RQFP	R	208	28 × 28	—	Kostat KS-8201	10	E20-05240-03	24
		240	32 × 32	—	Kostat KS-8205	06	E20-05241-03	24
		304	40 × 40	—	Peak ND-4040-3.8-0206 (1)	ORIG	E20-03552-03	12

**Table 6. Altera-Approved Low-Profile Trays Part Number (Part 5 of 5) (Note 1)**

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	
PGA	G	68	11 × 11	—	R.H. Murphy # RHM-605	—	E20-04266-03	21
		84	11x × 1	—	R.H. Murphy # RHM-605	—	E20-04266-03	21
		100	13 × 13	—	R.H. Murphy # RHM-605	—	E20-04266-03	21
		160	15 × 15	—	R.H. Murphy # RHM-605	—	E20-04266-03	21
		192	17 × 17	—	R.H. Murphy # RHM-601	—	E20-04217-03	10
		232	17 × 17	—	R.H. Murphy # RHM-601	—	E20-04217-03	10
		280	19 × 19	—	R.H. Murphy # RHM-601	—	E20-04217-03	10
		403	19 × 19	Ceramic lid	R.H. Murphy # RHM-620	—	E20-03556-03	10
		403	19 × 19	Gold lid	R.H. Murphy # RHM-750	—	E20-03563-03	8
		503	22 × 22	—	R.H. Murphy # RHM-750	—	E20-03563-03	8
599	24 × 24	—	R.H. Murphy # RHM-750	—	E20-03563-03	8		

**Notes to Table 6:**

- (1) This can either be an eight for 180° bakeable trays, six for 150° bakeable trays, or 13 for 140° bakeable trays.
- (2) “XX” represents Daewon temperature category. Must be 19 for 150° for bakeable trays.
- (3) These packages have lidless package tray offering.

## 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


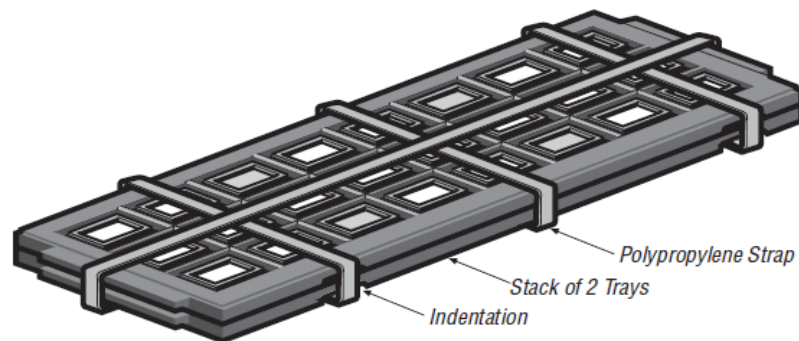
 Do not use rubber bands, masking tape, string, or other similar material in place of velcro or polypropylene straps.

Figure 8 shows the proper way to secure polypropylene straps on a stack of trays.

**Figure 8. Properly Secured Polypropylene Straps on a Stack of Trays**



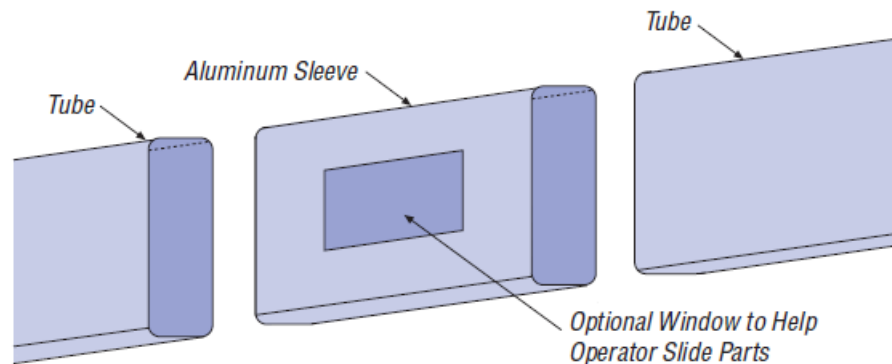
## Transferring Devices Between Tubes

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 (refer to [Figure 9](#)). 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.

[Figure 9](#) 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:

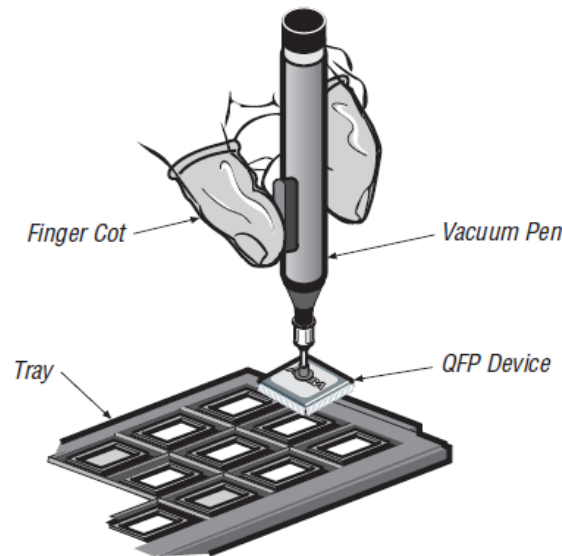
- Work in an ESD-protected environment.
- Use ground straps and finger cots.
- Use only vacuum pens to transfer QFP or BGA devices manually. Vacuum pens must be able to maintain their vacuum for at least four seconds (refer to [Figure 10](#)).
- Transfer devices right-side-up over a table, then release 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, as listed in [Table 6](#).

Figure 10 shows how you can transfer a QFP device with a vacuum pen.

**Figure 10. Transferring a QFP Device with a Vacuum Pen**



## 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.

Table 7 lists the contents of a typical package.

**Table 7. Dry Pack Contents**

Item	Specification
Moisture-barrier bag	MIL-B-81705C, Type 1 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

Table 8 lists the available dry pack sizes. Altera uses heavy-duty, 6" × 24", 6" × 30", and 10" × 30" bags for dry-packing tubes. Bags for trays by Altera are 10" × 20".

**Table 8. Dry Pack Sizes (Part 1 of 3) (Note 1), (2), (3), (4), (5), (6), (7), (8)**

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
B724	24	Tray	1	24	3	72
B956	21	Tray	1	21	N/A (9)	—
D08	50	Tube	1	50	N/A (9)	—
D20	20	Tube	10	200	N/A (9)	—
D24	15	Tube	8	120	48	720
D28	13	Tube	5	65	45	585
D40	10	Tube	5	50	40	400
E144	60	Tray	1	60	6	360
F100	176	Tray	1	176	6	1,056
F144	160	Tray	1	160	6	960
F256	90	Tray	1	90	6	540
F324	84	Tray	1	84	3	252
F400	60	Tray	1	60	4	240
F484	60	Tray	1	60	4	240
F572	44	Tray	1	44	4	176
F672	40	Tray	1	40	4	160
F672/F35	24	Tray	1	24	3	72
FC672	40	Tray	1	40	4	160
F780	36	Tray	1	36	4	144
F896	27	Tray	1	27	3	81
F1020/F33	24	Tray	1	24	3	72
F1152/F35	24	Tray	1	24	3	72
F1508/F40	21	Tray	1	21	N/A (9)	—
F1517/F40	21	Tray	1	21	N/A (9)	—
F1760/F43	12	Tray	1	12	4	48
F1932/F45	12	Tray	1	12	4	48
G100	21	Tray	1	21	N/A (9)	—
G160	21	Tray	1	21	N/A (9)	—
G192	10	Tray	1	10	N/A (9)	—



Table 8. Dry Pack Sizes (Part 2 of 3) (Note 1), (2), (3), (4), (5), (6), (7), (8)

Package and Lead	Quantity/ Primary Container	Type of Container	Minimum Container	Quantity	Maximum Container	Quantity
G232	10	Tray	1	10	N/A (9)	—
G280	10	Tray	1	10	N/A (9)	—
G403	10	Tray	1	10	N/A (9)	—
G503	10	Tray (10)	1/8	1	N/A (9)	—
G599	8	Tray (10)	1/8	1	N/A (9)	—
G655	8	Tray (10)	1/8	1	N/A (9)	—
G68	21	Tray	1	21	N/A (9)	—
G84	21	Tray	1	21	N/A (9)	—
H484	40	Tray	1	40	4	160
H780	24	Tray	1	24	4	72
H1152/H40	21	Tray	1	21	N/A (9)	—
H1152 (42.5)	21	Tray	1	12	4	48
H1517	12	Tray	1	12	4	48
J28	36	Tube	1	36	9	324
J44	26	Tube	N/A (9)	N/A (9)	N/A (9)	N/A (9)
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 (9)	—	24	1176
L28	39	Tube	4	156	24	936
L28DP	39	Tube	N/A (9)	—	24	936
L44	26	Tube (10)	5	130	30	780
L44DP	26	Tube (10)	5	130	30	780
L68	18	Tube (10)	3	54	24	432
L84	15	Tube (10)	1	15	15	225
M68	640	Tray	1	640	3	1920
M100	429	Tray	1	429	3	1287
M144	416	Tray	1	416	3	1248
M164	348	Tray	1	348	3	1044
M256	176	Tray	1	176	6	1056
M1019	90	Tray	1	90	6	540
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
Q100C	23	Carrier	1	23	20	460

**Table 8. Dry Pack Sizes (Part 3 of 3) (Note 1), (2), (3), (4), (5), (6), (7), (8)**

Package and Lead	Quantity/ Primary Container	Type of Container	Minimum Container	Quantity	Maximum Container	Quantity
Q132	36	Tray	1	36	6	216
Q160	24	Tray	1	24	6	144
Q160C	14	Carrier	1	14	10	140
Q208	24	Tray	1	24	6	144
Q208C	14	Carrier	1	14	10	140
Q240	24	Tray	1	24	4	96
Q44	96	Tray	1	96	6	576
R144	60	Tray	1	60	4	240
R208	24	Tray	1	24	4	96
R208C	14	Carrier	1	14	10	140
R240	24	Tray	1	24	4	96
R240C	12	Carrier	1	12	10	120
R304	12	Tray	1	12	4	48
R304C	10	Carrier	1	10	10	100
S08	100	Tube	N/A (9)	—	20	2000
S16	49	Tube	N/A (9)	—	25	1225
S20	38	Tube	1	38	9	342
S24	31	Tube	1	31	9	279
S28	27	Tube	1	27	9	243
T100	90	Tray	1	90	6	540
T144	60	Tray	1	60	6	360
T32	250	Tray	1	250	6	1500
T44	160	Tray	1	160	6	960
U49	416	Tray	1	416	3	1248
U88	210	Tray	1	210	3	630
U169	176	Tray	1	176	6	1056
U256	119	Tray	1	119	6	714
U358	90	Tray	1	90	6	540
U484	84	Tray	1	84	3	252

**Notes to Table 8:**

- (1) The tray quantities do not include one cover tray.
- (2) For the dry-packed devices in Tube 2, foam sheets are used at the bottom of the tube box.
- (3) To optimize the material and space usage, the box and foam sizes are “recommended only”.
- (4) If bubble wrap is used inside the moisture bag, follow the “2-foot bubble” recommendation. This is applicable only for all dry-packed devices.
- (5) J44 = 100% Pack 2.
- (6) L20DP, L28DP, S08/16, TR = 100% Pack 3
- (7) No Pack 3 for all PGAs
- (8) Pack 1 and Pack 2 are in jewelry boxes.
- (9) “N/A” means Pack 1, Pack 2, and/or Pack 3 are not recommended at this time.
- (10) All L68 and L84 packages are drypacked.

## 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

Table 9 lists Altera-approved packing media and suppliers.

**Table 9. Altera-Approved Packing Media and Suppliers**

Material	Suppliers
Tubes and stoppers	Altera
Trays (QFPs and BGAs)	Kostat Telephone: (408)-845-9110
	Daewon Telephone: (408)-213-6200
Trays (PGAs)	R.H Murphy
ESD velcro straps	Com-Kyl Telephone: (408)-734-9660
0.5"-wide, polypropylene, heat-sealed straps (E30-04766)	South Bay Packaging Telephone: (408) 998-1131
Tray-strapping machines (using polypropylene, heat-sealed straps) or other dry-packing equipment	Kent Landsberg Telephone: (408) 436-8010 StraPack (Sivaron Model S-699, D-52, and AQ-7)
Foam packaging (foam filler)	Pacific Southwest Container Telephone: (800) 772-0444
Bubble wraps, trays, or dry-packing supplies	Ecotech Telephone: (408) 988-2050
Vacuum pens	Virtual Industries Telephone: (800) 530-8377

## Document Revision History

Table 10 lists the revision history for this document.

**Table 10. Document Revision History**

Date	Version	Changes
Januray 2011	5.0	<ul style="list-style-type: none"><li>■ Updated to include lidless FBGA in this document.</li><li>■ Updated <a href="#">Table 6</a>, <a href="#">Table 8</a>, and <a href="#">Table 9</a>.</li><li>■ Minor text edits.</li></ul>