

FPC Handling Guide & Limitation Of Use For Automotive Applications

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1. PURPOSE:

- 1.1. The purpose of this document is 1) to provide guidelines for handling Johnson Electric Flexible Printed Circuit (FPC), during assembly by an assembler, defined as any semiconductor manufacturer or any other electronic manufacturer who integrates FPC into its products ("Assembler"), in any assembly environment such in the light housing or in the vehicle, and 2) to set forth certain limitations when using any product integrating FPC as a component for the lifetime of a vehicle.

2. LIMIT OF RESPONSIBILITY

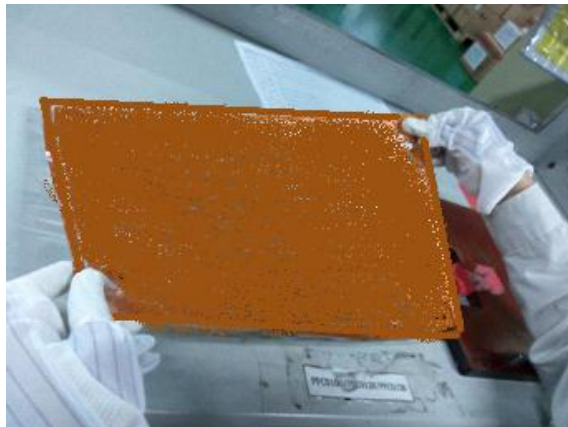
- 2.1. Assembler is responsible for the part design. Johnson Electric is responsible to make the part per Assembler's end customer specification. Any FPC defects related to the design are the responsibility of Assembler and/or its end customer.
- 2.2. Any defect associated with non-adherence to this product limitation shall void Johnson Electric product warranty and liability

3. GENERAL HANDLING INSTRUCTIONS:

- 3.1. At all times your FPC should be handled with care avoiding stretching, creasing, folding at a bend radius less than recommended in IPC 2223 (latest revision), or otherwise stressing (mechanically, electrically or environmentally) the part beyond its limits as specified in section 4.1 General Flex Characteristics
- 3.2. Wear clean lint free, talc free gloves at all times when handling the FPC, if gloves become dirty or contaminated with any foreign material DO NOT handle the FPC until gloves are replaced
- 3.3. In the event of receiving singulated FPC's handle circuits at each end, allowing the part to hang loosely between hands (see picture). At no time should you touch exposed copper pads



- 3.4. In the event of receiving FPC in panel form handle the panels from opposite corners allowing the part to hang loosely between hands (see picture). At no time should you touch exposed copper pads



- 3.5. At no point shall the FPC be allowed to come in contact with oils, greases, dust, dirt, chemicals or other foreign materials to which it was not designed. Exposed and/or coated or plated copper is particularly vulnerable to unintended foreign materials and environmental conditions and may result in any or all of the following defects during SMT processing or during product lifetime
- 3.5.1. Defective solder fillets due to poor wetting or non-wetting of solder paste to circuit pads during SMT reflow
 - 3.5.2. Pin holes / blow holes in solder fillets
 - 3.5.3. Insufficient adhesion of solder paste to circuit pads during SMT reflow
 - 3.5.4. Dry and / or embrittled solder joints causing premature failure of component connection to FPC
 - 3.5.5. Any other soldering defect as listed in IPC-A-610 Acceptability of Electronic Assemblies (current revision)

3.5.6. Reduction in surface and/or insulation resistance causing current leakage, corrosion and premature electrical breakdown

3.6. The PI (polyimide) materials from which the FPC is manufactured are hygroscopic and liable to absorb moisture in a humid environment. If moisture is not removed prior to SMT processing (see section 7. Pre SMT Conditioning) the absorbed moisture will turn to vapor during the elevated temperature of the solder reflow process causing delamination of the FPC coverlay or basefilm which will detrimentally affect electrical performance and product lifetime

3.7. Product should remain in sealed bags until ready to process through SMT assembly as specified in section 8.

4. PRODUCT DESCRIPTION:

4.1. General Flex Characteristics

4.1.1. IPC 6013 Qualification and Performance Specification for Flexible Printed Boards (latest revision) Type 1, Use A and Use C

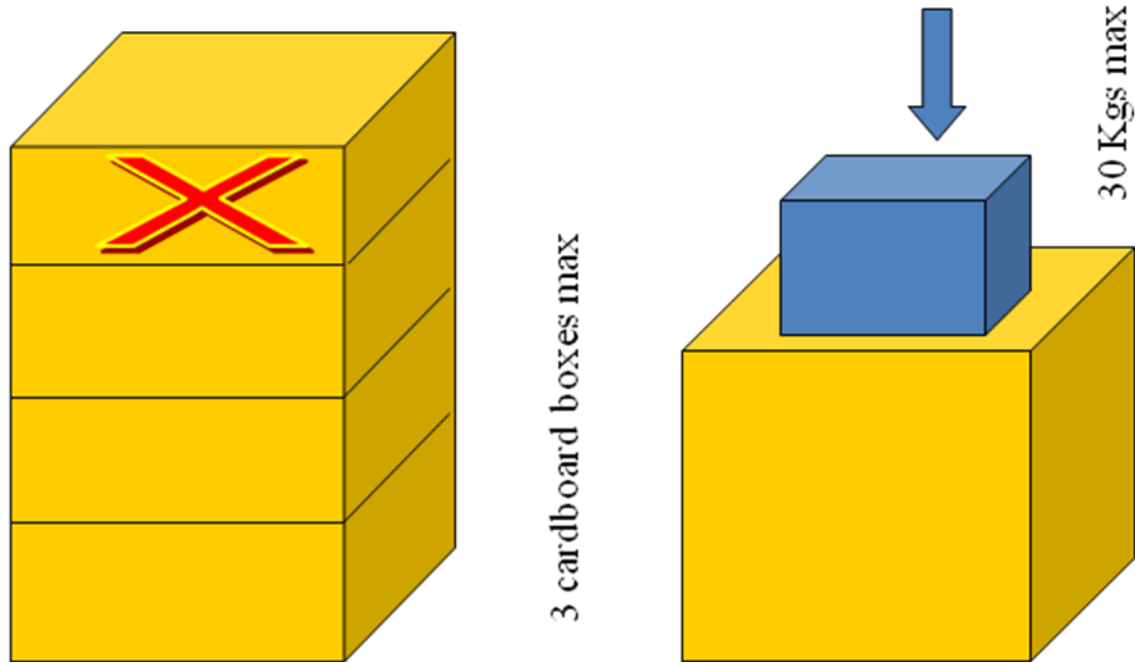
4.1.2. IPC 6011 Generic Performance Specification for Printed Boards (latest revision) Class 2

4.1.3. Operating temperature limit as listed on Parlex (JE) drawing

4.1.4. IPC 2223 Sectional Design Standard for Flexible Printed Boards (latest revision)


5. STORAGE CONDITIONS / UNPACKING:

5.1. Store boxes according to below instructions:

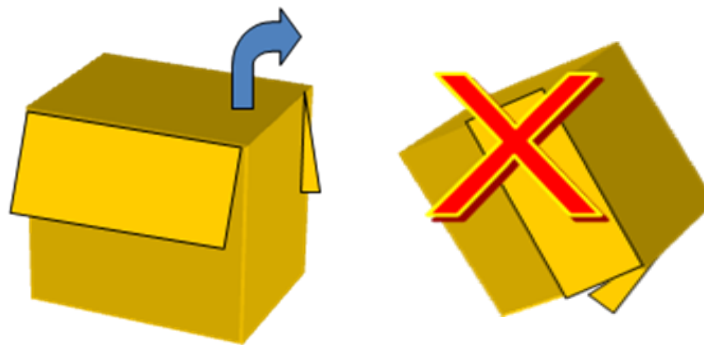


- 5.2. Boxes must be stored between 5 and 27 Deg C and < 50% Relative Humidity

- 5.3. Product Shelf Life is as indicated on box label (Shelf Life to:), see example below.

D2LC LED FPC Array			
GM PN:	AD 001288 Rev 002		
JE PN:	1632-PFC00*** Rev A		
Batch #:	08/16	Lot #:	9012552
Manu Date:	08/16	Qty:	250
Date Code(s):	092716		
Shelf Life to:	041517		

- 5.4. Avoid all risk of damage to FPC during unpacking, such as dropping, bending, creasing



- 5.5. Cardboard box shall be carefully opened and (bagged) packaging trays shall be placed on clean work surface



- 5.6. Trays should not be removed from sealed bags until ready for pre SMT conditioning
- 5.7. Parts shall be removed from packing trays with gloved hands, supporting FPC's from each end (as shown in 3. General Handling Instructions)



- 5.8. At no point shall the FPC be allowed to come in contact with oils, greases, dust, dirt, chemicals or other foreign materials to which it was not designed. Exposed and/or coated or plated copper is particularly vulnerable to unintended foreign materials and environmental conditions which may prevent reliable soldering of components during SMT processing and other defects (see section 3. General Handling Conditions)
- 5.9. Unless supplied pre-baked and dry bagged, circuits shall be pre-baked to remove excess moisture prior to SMT processing (see section 7. Pre SMT Conditioning)
- 5.10. Circuits must be SMT processed within 4 hours of Pre SMT Conditioning (or of opening bags if supplied pre-baked and dry bagged).
- 5.11. Circuits shall not be exposed to more than 2 Pre SMT Conditioning cycles.

6. INCOMING INSPECTION:

- 6.1. Incoming inspection should take place in a temperature / humidity controlled environment (16-27 deg C / <50% RH)
- 6.2. Check humidity labels to confirm that packaged circuits have not been exposed to maximum relative humidity > 40%. In case of above 40% contact Johnson Electric for further instructions to validate product integrity
- 6.3. Only open the amount of bags required to perform the necessary inspection, FPC's must be placed back in bags and resealed within 30 minutes
- 6.4. During inspection parts must be handled according to section 3, General Handling Instructions.
- 6.5. If deviations or non-conformances are found Johnson Electric must be notified and provided with a picture of the box label (see section 5.3) and FPC panel location #'s.

7. PRE SMT CONDITIONING

7.1. Before SMT assembly prebaking is required to remove moisture from PI (polyimide) film

7.2. Unpack the product



7.3. Place panel or circuits on suitable mesh shelves that allow air flow all around product. Never stack panels or circuits on the same shelf layer



7.4. Bake at 120 deg C, 60-80 mins in an air circulating oven with exhaust



- 7.5. In order to avoid post bake moisture ingress and to prevent any risk of out gassing and coverlay/basefilm delamination during the SMT process all parts must be processed within 4 hours of prebaking in an environment of $\leq 50\%$ relative humidity.

8. SMT ASSEMBLY:

- 8.1. Clean lint free, talc free gloves must be worn at all times when handling FPC's during the SMT assembly process
- 8.2. SMT carrier fixtures shall be defined by assembler to securely hold the FPC in place during SMT assembly without stretching or over-stressing the part
- 8.3. The FPC must lay flat with good planarity in the carrier fixture and the X-Y position must be repeatable
- 8.4. SMT process must adhere to IPC FA 251 Assembly Guidelines for Single Sided and Double Sided Flexible Printed Boards (latest revision) Class B Type 1 and (IPC) J-STD-001 Requirements for Soldered Electrical and Electronic Assemblies (latest revision)
- 8.5. FPC must not be allowed to exceed a temperature of greater than 265 deg C for 10 seconds during reflow, maximum of 2 cycles
- 8.6. Only 'no clean' type solder paste shall be used
- 8.7. No rework after SMT allowed

9. ELECTRICAL TEST:

- 9.1. Test conditions must be compatible with circuit design and not exceed circuit design limits

10. POST SMT PACKAGING:

- 10.1. After SMT assembly parts must be packaged in clean handling trays or totes that prevent damage to the FPC assembly
- 10.2. All surfaces to which the parts are exposed must be clean, free of oils, greases, dust, dirt, chemicals or other detrimental foreign materials which may cause electrical, mechanical or environmental defects
- 10.3. If parts will not be assembled immediately they must be stored in temperature / humidity range listed in section 5. Storage Conditions / Unpacking



- 10.4. If trays are stacked on shelves the trays must be designed in such a way as to not exert any force on the FPC's inside the trays

11. MODULE ASSEMBLY:

- 11.1. General handling instructions (section 3.) must be observed at all times during module assembly
- 11.2. No stage during the module assembly shall expose the FPC to conditions beyond those listed in section 4.1 General Flex Characteristics.
- 11.3. At no stage during the module assembly shall the FPC be allowed to come in contact with burrs or sharp edges (i.e. on fixtures or work surfaces)
- 11.4. At no time during Module Assembly shall the FPC be exposed to a bend radius less than recommended in IPC-2223 (latest revision)
- 11.5. Electrical Test conditions must not exceed circuit design limits

12. ASSEMBLY IN LIGHT HOUSING:

- 12.1. All automotive customers must be notified of FPC limitations noted in this document
- 12.2. Electrical protection shall be designed into the vehicle electronics to prevent over voltage or current surge to the FPC

13. IN VEHICLE LIMITATIONS:

- 13.1. At no time during the life of the FPC assembly shall the FPC become saturated in any liquids (water or other chemicals)
- 13.2. At no time during the life of the FPC assembly shall the FPC temperature exceed the limits specified in the Parlex (JE) drawing
- 13.3. Electrical protection shall be designed into the vehicle electronics to prevent over voltage or current surge to the FPC