Application Note

Handling Instructions for SCALE™-1 and SCALE™-2 Gate Drivers

Scope

This Application Note defines the requirements for handling the high-power SCALE™-1 and SCALE™-2 products (gate driver cores, plug-and-play gate drivers) from Power Integrations in terms of:

- Storage conditions
- Soldering instructions for gate driver core products
- Mechanical handling
- ESD handling
- Guideline for Return Material Analysis - RMA

The information given here applies to all customers, distributors and suppliers receiving high-power products from Power Integrations.

Content

Application Note

Storage Conditions

Power Integrations products mentioned in this Application Note must be stored and shipped according to the environmental conditions specified in Table 1.

Material	Measures	Ambient Atmosphere	Ambient Conditions [Temp. / RH]	Max. Storage Time [Months]
Non-dry pack*1	Original packaging	Air	25°C ± 10°C / 10% - 45%	36
Dry pack*2	Packed, evacuated, desiccant3, Humidity Indicator Card (HIC), sealed moisture barrier bag, ESD protection	Nitrogen	25°C ± 10°C / < 85%	>48

Table 1 Environmental conditions and lifetime during storage and transportation

*Legend: *1 - Low-pollution atmosphere and packaging*
**2 - Valid for single packed trays and stored in a nitrogen atmosphere*
**3 - Number of desiccant units to be calculated according to JEDEC Standard 033*

Products must be processed before the end of the maximum storage time.

Processing after the expiring date can increase the risk of non-processability or malfunction.

If the original packaging is damaged, opened and not stored in the ambient conditions specified in Table 1, the products must be processed within 168 hours.

Application Note

Soldering Instructions for Driver Core Products

Power Integrations gate driver cores can be soldered with the following techniques, which are defined for different process conditions.

Reflow Soldering

Reflow soldering of drivers is not permitted.

Wave Soldering

Parameter	Leaded	Lead-Free
Flux	25 weight % rosin, 75 weight % isopropanol	25 weight % rosin, 75 weight % isopropanol
Solder alloy	Sn63Pb37	Sn96.5Ag3.0Cu0.5
Flux amount	Depending on the PCB size and assembly complexity, the flux is determined to obtain maximum solder on the top side of the PCB with minimal flux residues on the bottom.	
Pot temperature	250°C	255°C
Preheating rate	3…4K/s[1]	
PCB top-side temperature	90…110°C[2]	
Dipping/dwelling time	3…5s	
Solder pot contact width	20mm	
Cooling-down rate	5K/s[1]	

Selective Soldering

Name	Leaded	Lead-Free
Flux	25 weight % rosin, 75 weight % isopropanol	25 weight % rosin, 75 weight % isopropanol
Solder alloy	Sn63Pb37	Sn96.5Ag3.0Cu0.5
Flux amount	The fluxing is determined as per the requirement of the board area and the solder joint size.	
Pot temperature	280…300°C	
PCB top-side temperature	100…125°C[2]	
Nozzle dragging rate	2…8mm/s[3]	
Point soldering time	3…5s[4]	

[1] …depending on the length of the wave soldering machine
[2] …depending on the thermal mass and components on the board when it reaches the solder pot
[3] …depending on the solder joint size
The solder nozzle should be selected depending on the surface area of the solder joint.
[4] …depending on the size of the solder joint

Application Note

Manual Soldering

Name	Leaded	Lead-Free
Solder iron temperature	320°C	340°C (SAC305)
Maximum solder time	3-4s	

It is recommended to use lead-free solder EF2210, SAC305 alloy. However, other solder types may also be used.

Mechanical Handling

The correct handling of mechanical gate drivers is based on two fundamental principles:

1) No excessive mechanical force must be applied to transformers.
2) No excessive mechanical force causing bending (reflected to IPC-T-650) must be applied to PCBs.

The root causes of possible driver failure mentioned above may appear during mounting and later during operation. If the carrier PCB on which the driver core is placed is large, there is a risk of driver PCB bending referred to the carrier PCB. These phenomena can be seen during vibrations tests where momentary displacement between driver core and carrier PCB can be observed. Therefore if significant vibrations are foreseeable, it is necessary to mechanically stabilize the driver.

Insertion of Gate Driver Cores into the Carrier PCB

It is recommended that no large steady-state or temporary mechanical force be applied to the transformers or terminals of the gate core drivers. Applying excessive mechanical force to the transformer bends the PCB and considerably stresses the transformer solder joints, leading to potential pre-damage. This increases the probability of cracks at the transformer solder points and other assembled SMD components, especially ceramic capacitors and resistors.

The transformer may be held by hand during removal or insertion from/into the packaging or assembly to carrier PCB, but the PCB should be free from bending.

Fig. 1 illustrates the correct removal and assembly of the driver core. If mechanical force applied to transformer causes PCB bending or excessive mechanical stress to the solder joints, the force must be shifted directly to the corresponding terminals of the driver PCB.

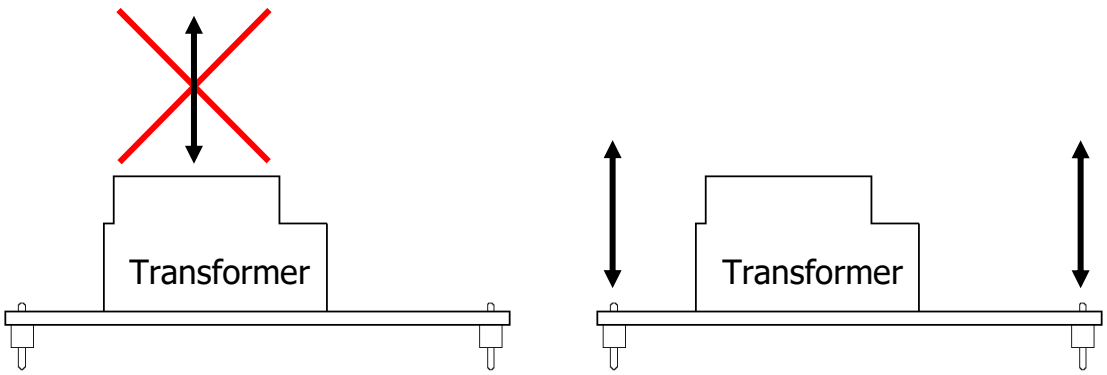

Fig. 1 Not recommended (left) and recommended (right) ways of handling Power Integrations gate driver cores during assembly (body plan of a driver)

Application Note

The IPC-T-650 standard gives general guidance for PCB handling and recommends that PCBs with surface mount components are not exposed to bending or twisting of more than 0.5% in relation to their length and width. Fig. 2 shows the gate driver core 2SC0435T as an example. It has dimensions (length and width) of 57.15mm by 51.56mm. The maximum permissible bending due to forces applied to the PCB would be 0.29mm and 0.26mm respectively.

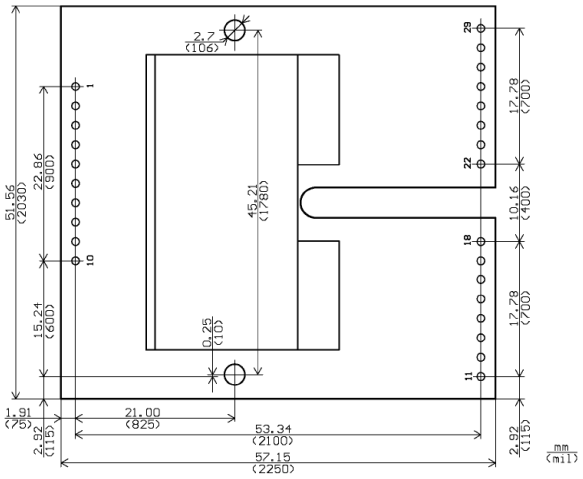

Fig. 2 Dimensions of a standard Power Integrations gate driver core

In case of Plug-and-Play drivers which are screw-fitted to a power module, it is important to adjust the height of the distance bolts properly. This will increase the driver's vibration withstand capability and avoid PCB bending. Fig. 3 illustrates the correct usage of the bolts.

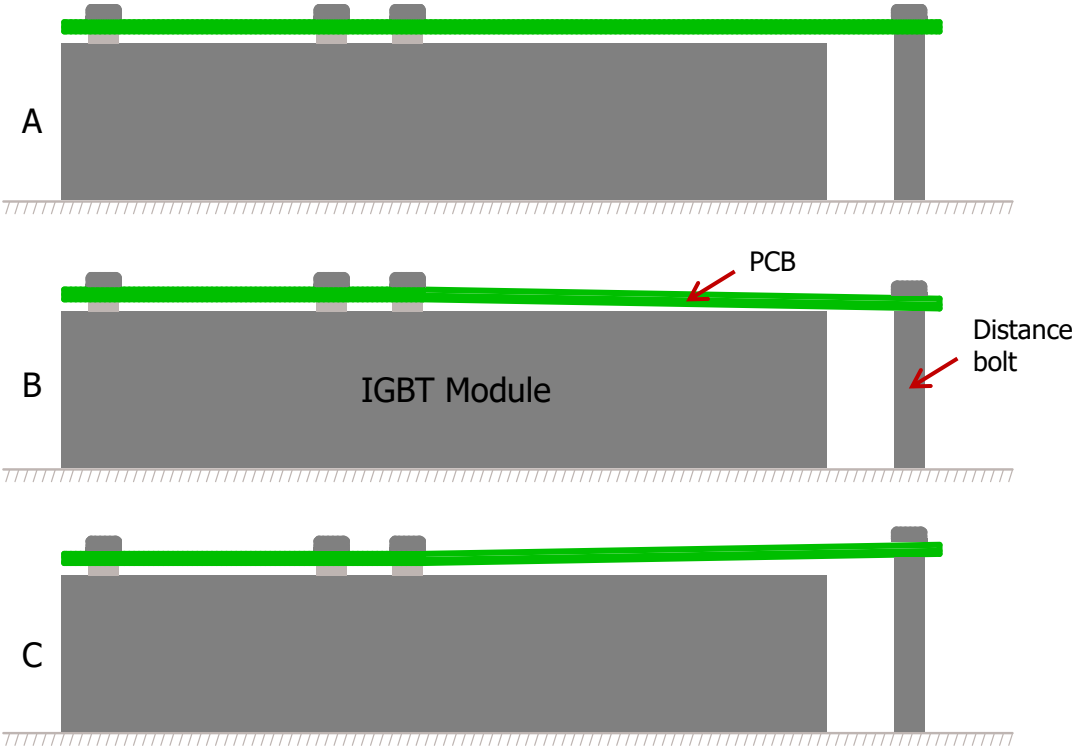

Fig. 3 Correct (A) and wrong (B and C) fixing of Power Integrations gate drivers

Application Note

ESD Handling

EPA (Electrostatic Protected Area)

In order to ensure a safe ESD environment in which the work on electronics components or subassemblies such as printed circuit boards is carried out, an ESD protected area or EPA must be set up and correctly used every time Power Integrations' high-power SCALE™-1 and SCALE™-2 products are handled or processed. An EPA or ESD PA (ESD Protected Area) is designed to minimize the generation and retention of ESD. It allows the level of failures during production and later in life to be kept to a minimum.

Guideline for Return Material Analysis - RMA

The following requirements are necessary to ensure proper RMA process handling:

- Acquire RMA number from the Power Integrations Customer Service Department before return.
- For each RMA case, a "Driver Failure Description Form DFDF" must be completed.
- In the customs documents, a goods value of 1 USD must be specified.
- Returned product must be packed properly and according to ESD rules.

Note that the RMA process is not applicable to:

- Prototypes (PRT) and Engineering (ENG) samples
- Products that were used or operated beyond specification
- Products arrived at customers with transportation damages
- Products which arrive at Power Integrations without "Driver Failure Description Form DFDF"
- Products without ESD-compliant packaging

Application Note

Legal Disclaimer

The statements, technical information and recommendations contained herein are believed to be accurate as of the date hereof. All parameters, numbers, values and other technical data included in the technical information were calculated and determined to our best knowledge in accordance with the relevant technical norms (if any). They may base on assumptions or operational conditions that do not necessarily apply in general. We exclude any representation or warranty, express or implied, in relation to the accuracy or completeness of the statements, technical information and recommendations contained herein. No responsibility is accepted for the accuracy or sufficiency of any of the statements, technical information, recommendations or opinions communicated and any liability for any direct, indirect or consequential loss or damage suffered by any person arising therefrom is expressly disclaimed.

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