LTEC IP Service

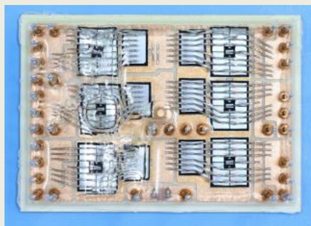
New Release

LTEC Corporation

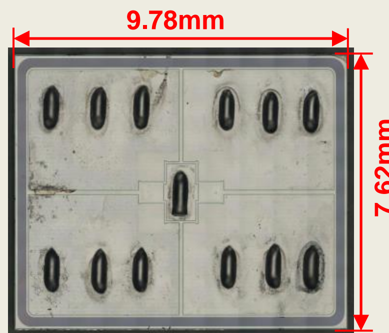
Your most experienced partner in IP protection

INFINEON EasyPACK™ 7th GEN. IGBT module STRUCTURE and PROCESS ANALYSIS REPORTS

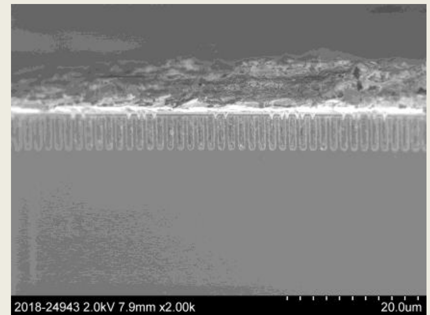
February 2020. LTEC Corporation released a detailed structure and process analysis reports of the S100R12W2T7_B11 7th Gen IGBT module.



Module



Die image



Cross section of the cell area

Product overview

The FS100R12W2T7_B11 is a 1200 V, 100A power module featuring a new high-density Micro Pattern Trench (MPT) design developed to reduce saturation voltage, Vce(sat) from 1.85V to 1.5V by (~19%) relative to 6th Generation device.

Summary of the analysis results

- The unit IGBT cell, formed by a set of seven trenches, and the electrical connection of these trenches is discussed.
- The effective process technology node is extracted from the trench pitch and contact opening. These are the minimum processing dimensions of the manufacturing process technology.
- The off-state collector leakage current of IGBT7 and IGBT6 transistors are measured. A significant difference in activation energy is confirmed.
- The breakdown voltages of the IGBT chip and the parallel-connected FWD are measured.

Note: The report price may change over time. For current price contact **info@ltecusa.com**.

18G-0017-1

LTEC Corporation US Representative Office
No.203 2880 Zanker Road San Jose, CA 95034
Phone: (408) 489-1994
www.ltecusa.com Contact: info@ltecusa.com

Table of Contents
Structure Analysis Report

	Page
Device summary	
Table 1, Executive Summary	3
Analysis results summary	4
Table 2. Device structure	9
Table 3. Material analysis	10
Table 4. Package structure	11
Module analysis	
Module overview	13
Die image	17
Module cross section	19
IGBT die analysis	
Plane view (optical microscope)	46
Plane view, Scanning Electron Microscope (SEM)	74
Cross-sectional structure analysis (SEM)	87
Electric characteristic	
IC-Vce	106
Collect current at of- mode	108
Brake down voltage at off-mode	109
Appendix	
EDX results	110
Additional analysis list	136

Table of Contents
Process Analysis Report

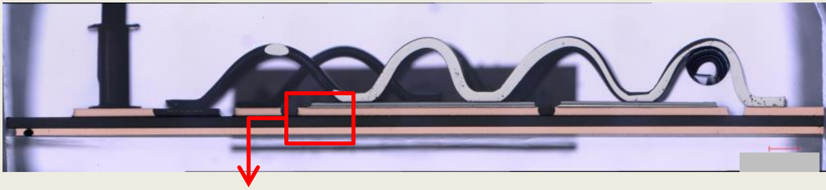
	Page
Analysis summary	3
Comparison summary (Infineon IGBT5, IGBT6 and IGBT7)	4
Module structure (overview)	6
Die overview	7
Device structure IGBT (Cell structure diagram & equivalent schematic)	8
Plain analysis	9
MPT IGBT structure	10
Analysis details	
Plan analysis (die edge)	14
Cross section (die edge)	15
Channel stopper (die edge)	17
Cross section (IGBT array)	20
Process flow (estimation)	
Si IGBT front-end estimated wafer process flow	24
Alignment tree	25
Si IGBT process sequence cross-sectional view	26
Layout	32
Electric characteristic	
IC-Vce characteristics	37
Off-state Collector current	39
Off-state Collector current activation energy (Ea)	42
Off-state breakdown voltage BVces	43
Off-state leakage current comparison (IGBT6 and IGBT7)	44
Appendix	
Reference papers list	45
Reference patents list	46

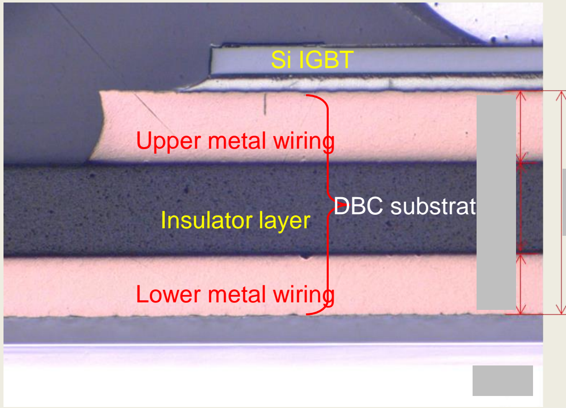
LTEC IP Service

LTEC Corporation US Representative Office
No.203 2880 Zanker Road San Jose, CA 95034

Phone: (408) 489-1994
www.ltecusa.com Contact: info@ltecusa.com

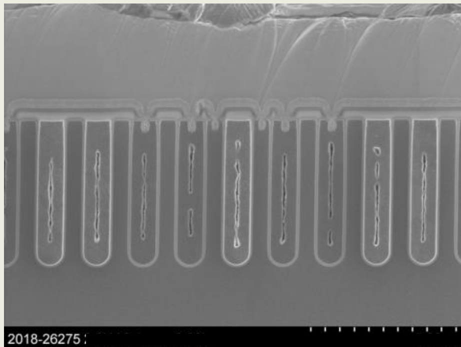
Excerpts from the Structure Analysis Report

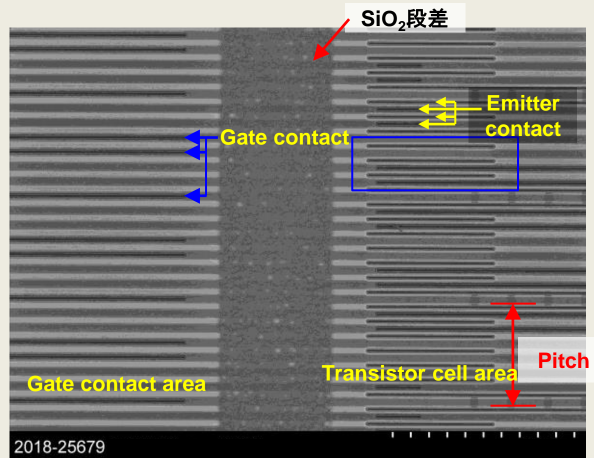




Module cross section

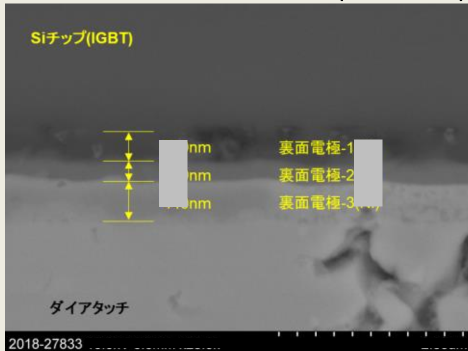
IGBT plane view



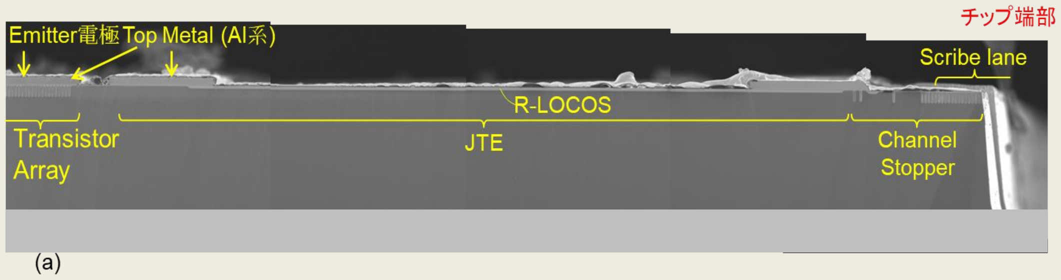


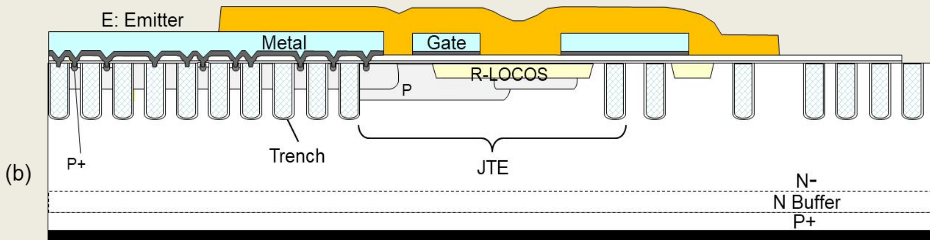
Plane SEM image (Gate area)

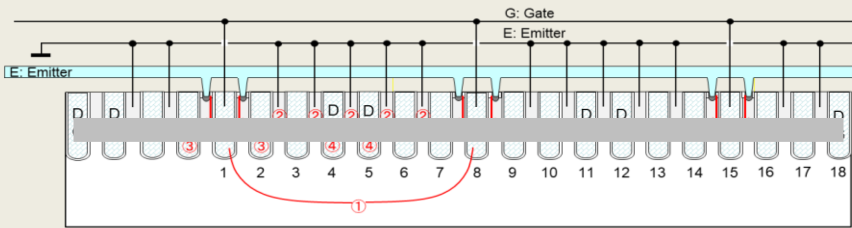
IGBT structure (Backside)



Excerpts from the Process Analysis Report







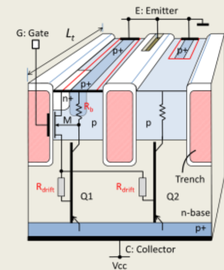
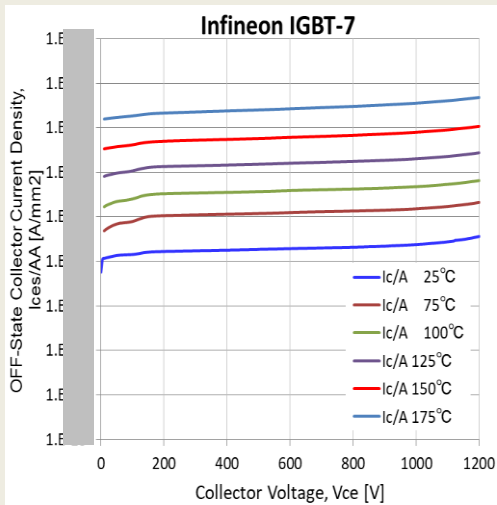
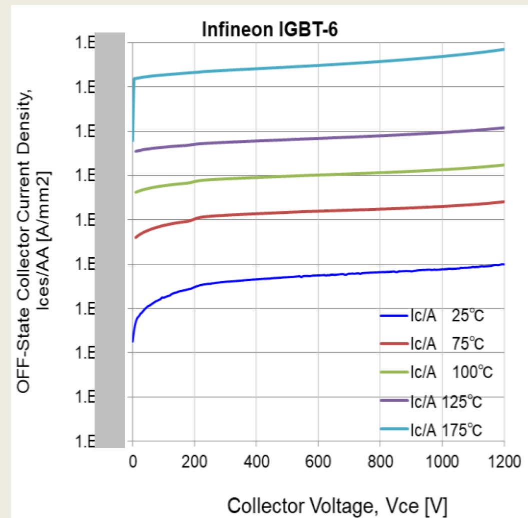


Fig.1-6-1 IGBT7 MPT cell array





Comparison of off-state collect current per cell area (IGBT7 & IGBT6)

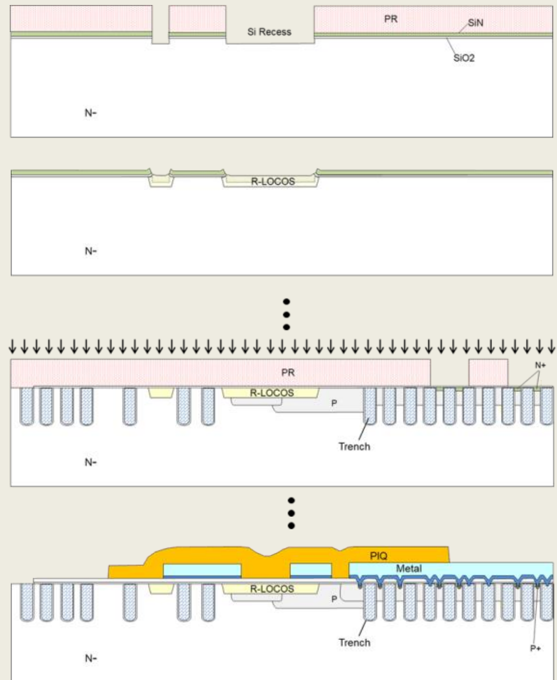
LTEC Corporation US Representative Office
No.203 2880 Zanker Road San Jose, CA 95034
Phone: (408) 489-1994
www.ltecusa.com Contact: info@ltecusa.com

Excerpts from the Structure Analysis Report (cont.)

Si IGBT front-end estimated wafer process flow

マスク	プロセス工程	コメント
	ウェーハ	Si FZ N-type 基板 N-(～50-60Ωcm)
	第1酸化	熱酸化
	CVD SiN	LOCOS stack
[1]	FOXフォト	FOX: Field Oxide フィールド素子分離絶縁膜
[illegible]	[illegible]	...ss LOCOS
[illegible]	[illegible]	...ension-1 (JT1) Mask
[illegible]	[illegible]	...ension-2 (JT1) Mask
[illegible]	[illegible]	...)
[illegible]	[illegible]	...um
[illegible]	[illegible]	...化エッチング，ゲートSiO2 ～
[illegible]	[illegible]	...s
	PECVDデポ	ILD形成

Si IGBT process sequence cross-sectional view



LTEC Corporation US Representative Office
No.203 2880 Zanker Road San Jose, CA 95034
Phone: (408) 489-1994
www.ltecusa.com Contact: info@ltecusa.com