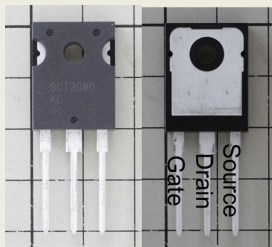
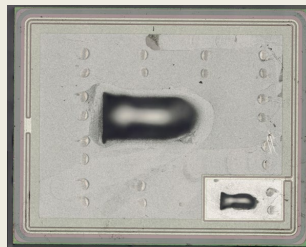


### RHOM SCT3080HLHR AUTOMOTIVE CERTIFIED 1200V SiC MOSFET SHORT CIRCUIT ROBUSTNESS ANALYSIS REPORT

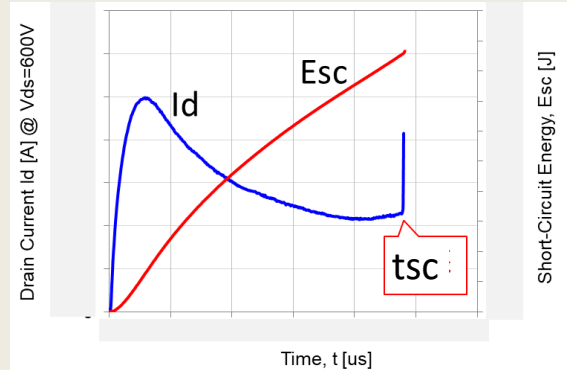
**February 2020.** The short-circuit (SC) capability of power transistors, especially SiC power MOSFETs, is one of the most critical reliability-related specifications. Compared to Si-based IGBTs, the size of the SiC transistor is smaller. This leads to significant reduction in SC endurance time ( $t_{sc}$ ).



Package



Die image



Drain current waveform and short-circuit energy (Esc)

This is the first published short-circuit robustness analysis report that examines the correlation between short circuit robustness and the physical structure of the SCT3080HLHR device. This device is compliant to the AEC Q101 automotive standard.

#### The report includes:

- Identification of the mechanisms limiting short-circuit capability, measurement, physical analysis results, and extraction of the critical temperature ( $T_{j(crit)}$ ) at the onset of failure.
- Comparison of short-circuit robustness with other makers' 1200V SiC MOSFETs. Examination of the differences in semiconductor structure, process, and their effect on short circuit robustness.
- Comparison of the electrical characteristics (off-leakage current and temperature dependence) and identification of differences and limitations.

#### Use value of the evaluation results in this report

- The minimum response time of the short-circuit protection circuit can be estimated.
- The internal device temperature can be estimated by performing electrothermal SPICE simulation using measured short-circuit drain current waveform and endurance time ( $t_{sc, f}$ ).

**Report price: \$6,500**

Contact LTEC Corporation for the current price as it decreases over time

19G-0019-1

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## Excerpts from the report

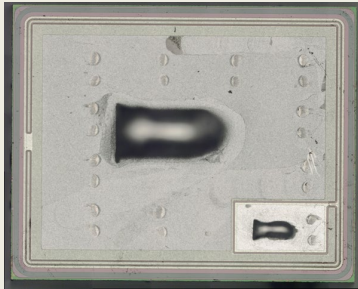


Fig.2: Die

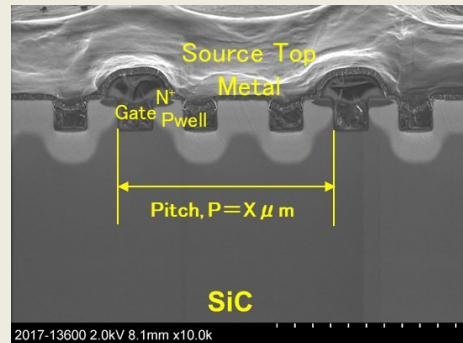


Fig.4: Cross-sectional image of SiC transistor

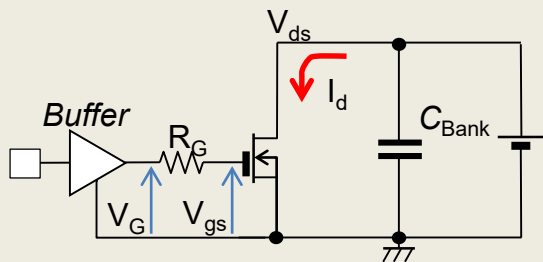


Table 2: Evaluation conditions

#	V <sub>ds</sub> [V]	V <sub>gs</sub> [V]	Purpose
1	600	18	Basic SC characteristics
2	600	18	Reproducibility check
3	400	18	Drain voltage effect
4	800	18	"
5	600	15	Gate-Source voltage effect
6	600	20	"
7	600	24	"

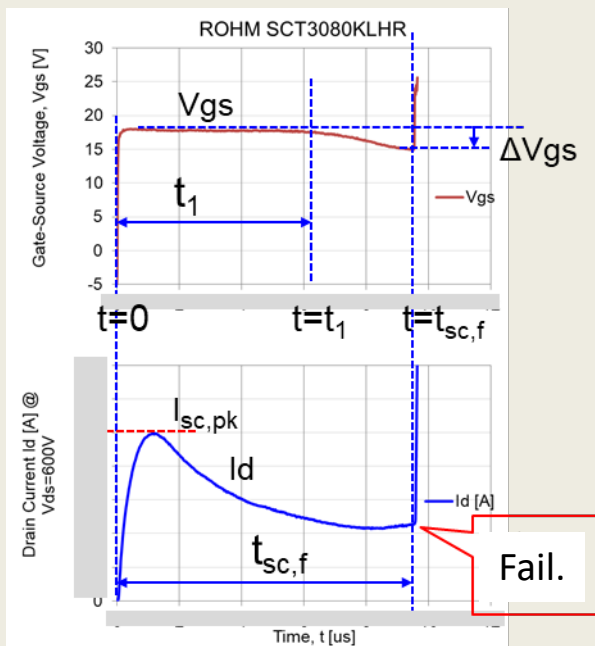


Fig.17: Measured gate-source voltage and drain current waveforms during SC event.

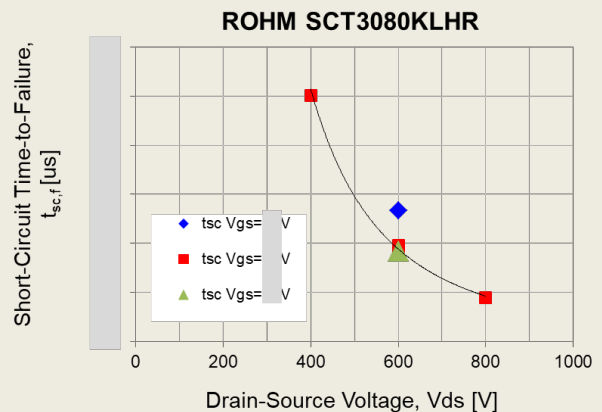
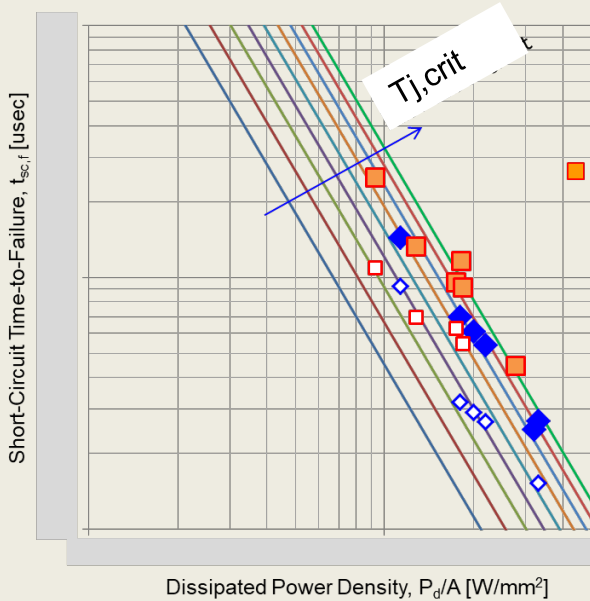
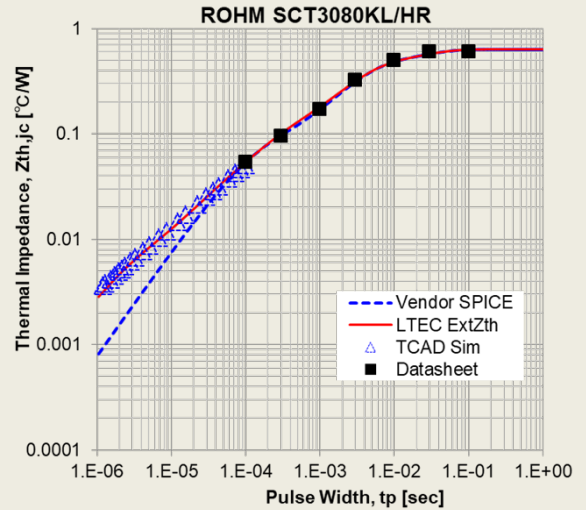


Fig.18: Measured dependence of the SC time to failure  $t_{sc,f}$  vs the drain voltage  $V_{ds}$ .

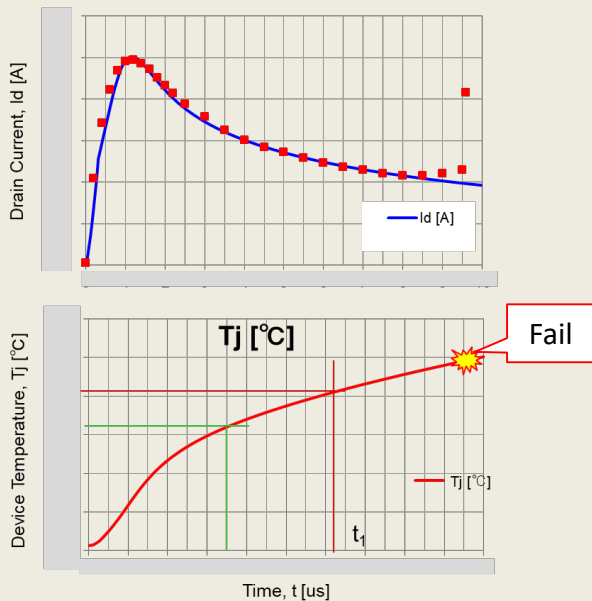
## Excerpts from the report (cont.)



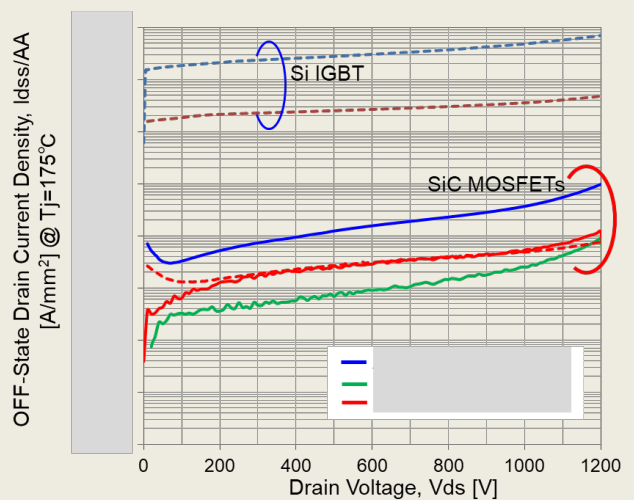
**Fig.28:** Measured short circuit durable time ( $t_{sc,r}$ ) vs. Power dissipation density  $P_d/A = (V_{ds} \times I_d)/A$ .



**Fig.29:** SCT3080KLHR Thermal impedance plot  
 ■: Data from the datasheet,  
 Blue dash line): Calculated using the SPICE model provided by manufacturer, and  
 △ Calculated using the analysis result by LTEC  
 Red line: LTEC synthesized SPICE model



**Fig.30:** Extracted transistor temperature rise using short circuit transient SPICE model



**Fig.33:** Measured off-state drain current (@  $V_{gs} = 0V$ )