

RELIABILITY REPORT
FOR
MAX17149ETE+T
PLASTIC ENCAPSULATED DEVICES

May 11, 2012

MAXIM INTEGRATED PRODUCTS

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Conclusion

The MAX17149ETE+T successfully meets the quality and reliability standards required of all Maxim products. In addition, Maxim's continuous reliability monitoring program ensures that all outgoing product will continue to meet Maxim's quality and reliability standards.

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I. Device Description

A. General

The MAX17129/MAX17149 are high-efficiency drivers for white LEDs. They are designed for small- to medium-sized LCDs that employ an array of LEDs as the light source. An internal switch step-up controller with Quick- PWM(tm) drives the LED array, which can be configured for up to 6 strings in parallel and either 11 LEDs (MAX17129) or 6 LEDs in series (MAX17149) per string. Each string is terminated with a ballast that achieves $\pm 2\%$ current-regulation accuracy, ensuring even LED brightness and provides an adjustable 10mA to 45mA full-scale LED current. The devices have a wide input voltage range of 6V to 26V. The MAX17129 integrates an LDO to simplify applications that have a single high-voltage supply. The devices also feature a low-input-voltage mode for applications that have a 3V to 5.5V supply voltage. The devices support both PWM and hybrid dimming mode. In PWM dimming mode, the external PWM signal directly controls the brightness of LEDs. The dimming frequency ranges from 100Hz to 25kHz with 400ns minimum on-time. In hybrid dimming mode, the LED current amplitude can be adjusted to 25% of full-scale LED current to improve system efficiency when brightness is low. The devices have multiple features to protect the controller from fault conditions. Separate voltage-feedback loops limit the output voltage to safe operation. The open and short-LED detection shuts down the faulty string while keeping other strings operating normally. The devices feature cycle-by-cycle current limit on the internal switch to provide consistent operation and soft-start capability. If the devices are in current-limit condition, the step-up converter is latched off after an internal timer expires. A thermal-shutdown circuit provides another level of protection and prevents ICs from damage. The ICs' step-up controller features an internal 0.25 (typ), 48V (max) power MOSFET with lossless current sense and accurate cycle-by-cycle current limit. The Quick-PWM control architecture provides fast load-transient response without requiring an external loop compensation component, simplifies the external circuitry, and saves board area. The Quick-PWM control scheme has constant off-time and adjustable pseudo-fixed frequency, which enables a wide variety of applications that can trade off component size for operating frequency. Low feedback voltage at each LED string (275mV typ at 20mA LED current) helps reduce power loss and improve efficiency. The ICs are available in a 16-pin, thin QFN package with 0.5mm lead spacing. The package is 3mm x 3mm with a maximum thickness of 0.8mm for ultra-thin LCD panel design.

II. Manufacturing Information

A. Description/Function:	Low-Cost, 6-String WLED Drivers with Quick-PWM Step-Up Converters
B. Process:	S18
C. Number of Device Transistors:	57470
D. Fabrication Location:	USA
E. Assembly Location:	China, Taiwan and Thailand
F. Date of Initial Production:	December 22, 2010

III. Packaging Information

A. Package Type:	16-pin TQFN 3x3
B. Lead Frame:	Copper
C. Lead Finish:	100% matte Tin
D. Die Attach:	Conductive
E. Bondwire:	Au (1.3 mil dia.)
F. Mold Material:	Epoxy with silica filler
G. Assembly Diagram:	#05-9000-4328
H. Flammability Rating:	Class UL94-V0
I. Classification of Moisture Sensitivity per JEDEC standard J-STD-020-C	Level 1
J. Single Layer Theta Ja:	68°C/W
K. Single Layer Theta Jc:	10°C/W
L. Multi Layer Theta Ja:	48°C/W
M. Multi Layer Theta Jc:	10°C/W

IV. Die Information

A. Dimensions:	70.87 X 70.87 mils
B. Passivation:	Si ₃ N ₄ /SiO ₂ (Silicon nitride/ Silicon dioxide)
C. Interconnect:	Al/0.5%Cu with Ti/TiN Barrier
D. Backside Metallization:	None
E. Minimum Metal Width:	Metal1 = 0.23 / Metal2-3 = 0.28 / Metal 4 = 2.6 microns (as drawn)
F. Minimum Metal Spacing:	Metal1 = 0.23 / Metal2-3 = 0.28 / Metal 4 = 3.0 microns (as drawn)
G. Bondpad Dimensions:	
H. Isolation Dielectric:	SiO ₂
I. Die Separation Method:	Wafer Saw

V. Quality Assurance Information

- A. Quality Assurance Contacts: Richard Aburano (Manager, Reliability Engineering)
Don Lipps (Manager, Reliability Engineering)
Bryan Preeshl (Vice President of QA)
- B. Outgoing Inspection Level: 0.1% for all electrical parameters guaranteed by the Datasheet.
0.1% For all Visual Defects.
- C. Observed Outgoing Defect Rate: < 50 ppm
- D. Sampling Plan: Mil-Std-105D

VI. Reliability Evaluation

A. Accelerated Life Test

The results of the 100C biased (static) life test are shown in Table 1. Using these results, the Failure Rate (λ) is calculated as follows:

$$\lambda = \frac{1}{\text{MTTF}} = \frac{1.83}{192 \times 516 \times 144 \times 2} \quad (\text{Chi square value for MTTF upper limit})$$

(where 516 = Temperature Acceleration factor assuming an activation energy of 0.8eV)

$$\lambda = 64.2 \times 10^{-9}$$

$$\lambda = 64.2 \text{ F.I.T. (60\% confidence level @ 25}^\circ\text{C)}$$

The following failure rate represents data collected from Maxim's reliability monitor program. Maxim performs quarterly life test monitors on its processes. This data is published in the Reliability Report found at <http://www.maxim-ic.com/qa/reliability/monitor>. Cumulative monitor data for the S18 Process results in a FIT Rate of 0.06 @ 25C and 1.04 @ 55C (0.8 eV, 60% UCL)

B. E.S.D. and Latch-Up Testing (lot SC4ZIQ001H, D/C 1105)

The PF64 die type has been found to have all pins able to withstand a HBM transient pulse of +/- 2500V per JEDEC JESD22-A114. Latch-Up testing has shown that this device withstands a current of +/- 250mA and overvoltage per JEDEC JESD78.

Table 1
Reliability Evaluation Test Results

MAX17149ETE+T

TEST ITEM	TEST CONDITION	FAILURE IDENTIFICATION	SAMPLE SIZE	NUMBER OF FAILURES	COMMENTS
Static Life Test (Note 1)	Ta = 100C	DC Parameters	48	0	SC4ZI0014D, D/C 1050
	Biased	& functionality	48	0	SC4ZIQ001G, D/C 1051
	Time = 192 hrs.		48	0	SC4ZIQ001H, D/C 1051

Note 1: Life Test Data may represent plastic DIP qualification lots.