24-CHANNEL, 12-BIT PWM LED DRIVER WITH 7-BIT DOT CORRECTION AND 3-GROUP, 8-BIT GLOBAL BRIGHTNESS CONTROL

FEATURES

- 24-Channel Constant-Current Sink Output
- Current Capability
- Selectable Grayscale (GS) Control With PWM: 12-Bit (4096 Step), 10-Bit (1024 Step), 8-Bit (256 Step)
- Three Independent Grayscale Clocks for Three Color Groups
- Dot Correction (DC): 7-Bit (128 Step)
- Global Brightness Control (BC) for Each Color Group: 8-Bit (256 Step)
- Auto Display Repeat Function
- Independent Data Port for GS, BC and DC Data
- Communication Path Between Each Data Port
- LED Power-Supply Voltage
- V_{CC} = 3.0 V to 5.5 V
- Constant-Current Accuracy:
  - Channel-to-Channel
  - Device-to-Device
- CMOS Logic Level I/O
- Data Transfer Rate
- Grayscale Control Clock
- Continuous Base LED Open Detection (LOD)
- Continuous Base LED Short Detection (LSD)
- Thermal Shutdown (TSD) With Auto Restart
- Grouped Delay to Prevent Inrush Current

APPLICATIONS

- Full-Color LED Displays
- LED Signboards

DESCRIPTION

The TLC5951 is a 24-channel, constant-current sink driver. Each channel has an individually-adjustable, 4096-step, pulse width modulation (PWM) grayscale (GS) brightness control and 128 step constant-current dot correction (DC). The dot correction adjusts brightness deviation between channels and other LED drivers. The output channels are grouped into three groups of eight channels. Each channel group has a 256-step global brightness control (BC) function and an individual grayscale clock input.

GS, DC, and BC data are accessible via a serial interface port. DC and BC can be programmed via a dedicated serial interface port.

The TLC5951 has three error detection circuits for LED open detection (LOD), LED short detection (LSD), and thermal error flag (TEF). LOD detects a broken or disconnected LED while LSD detects a shorted LED. TEF indicates an over-temperature condition.

ORDERING INFORMATION(1)

PRODUCT	PACKAGE DESIGNATOR	PACKAGE	ORDERABLE PART NUMBER	PACKAGE QUANTITY
TLC5951	TD	Bare die in waffle pack(2)	TLC5951TDA2	10
			TLC5951TDA3	96

(1) For the most current package and ordering information, see the Package Option Addendum at the end of this document, or see the TI web site at www.ti.com.

(2) Processing is per the Texas Instruments commercial production baseline and is in compliance with the Texas Instruments Quality Control System in effect at the time of manufacture. Electrical screening consists of DC parametric and functional testing at room temperature only. Unless otherwise specified by Texas Instruments AC performance and performance over temperature is not warranted. Visual Inspection is performed in accordance with MIL-STD-883 Test Method 2010 Condition B at 75X minimum.

This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

BARE DIE INFORMATION

DIE THICKNESS	BACKSIDE FINISH	BACKSIDE POTENTIAL	BOND PAD METALLIZATION COMPOSITION	BOND PAD THICKNESS
11 mils.	Silicon with backgrind	Floating	TiW-AlCu (0.5%)	900 nm

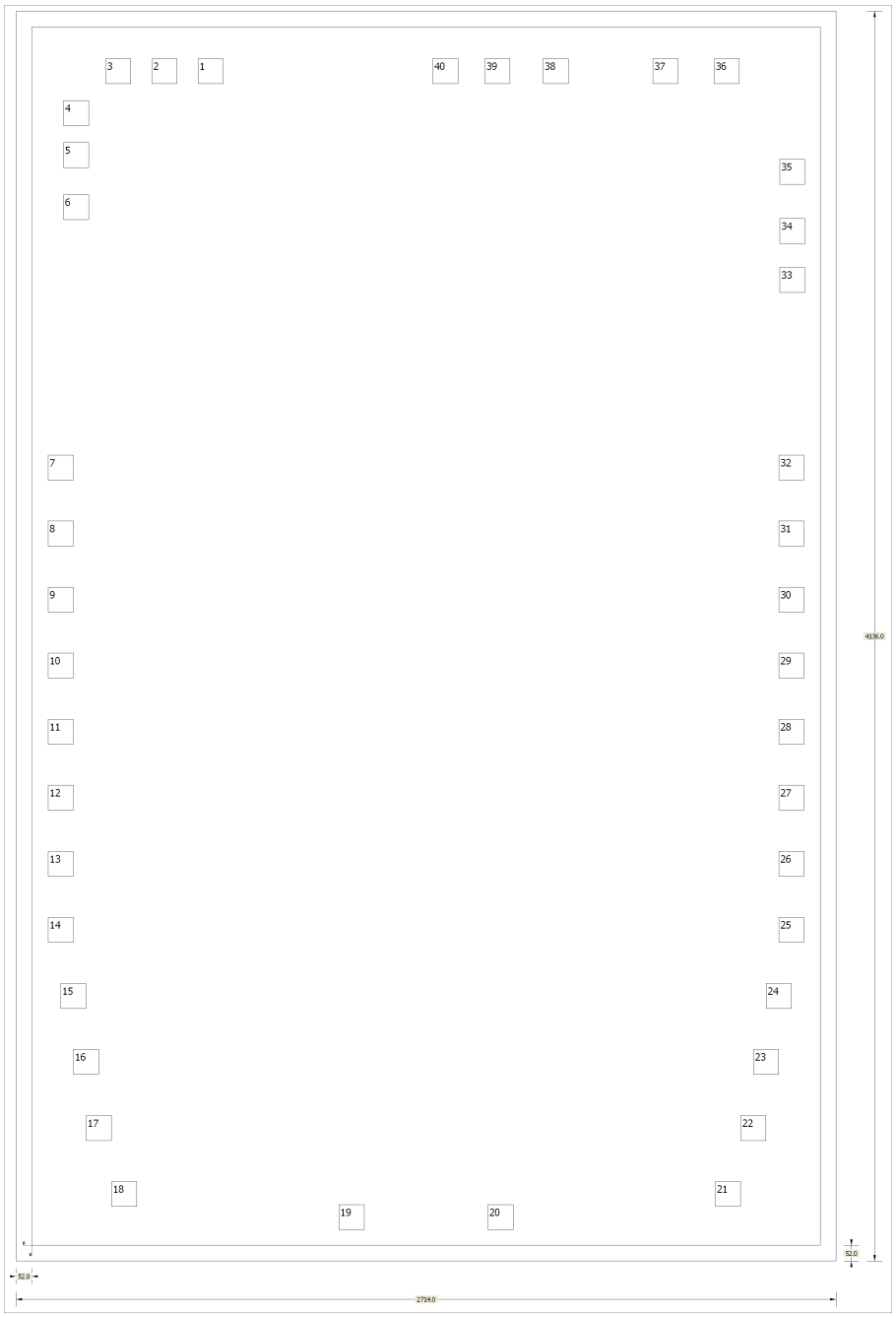

Table 1. Bond Pad Coordinates in Microns(1)

DESCRIPTION	PAD NUMBER	X MIN	Y MIN	X MAX	Y MAX
GSSIN	1	550.35	3842.64	634.41	3926.7
GSSCK	2	396.99	3842.64	481.05	3926.7
GSLAT	3	243.63	3842.64	327.69	3926.7
GSCKG	4	105.3	3704.31	189.36	3788.37
GSCKR	5	105.3	3565.17	189.36	3649.23
GSCKB	6	105.3	3392.55	189.36	3476.61
OUTG0	7	54	2531.43	138.06	2615.49
OUTR0	8	54	2312.91	138.06	2396.97
OUTB0	9	54	2094.39	138.06	2178.45
OUTG1	10	54	1875.87	138.06	1959.93
OUTR1	11	54	1657.35	138.06	1741.41
OUTB1	12	54	1438.83	138.06	1522.89
OUTG2	13	54	1220.31	138.06	1304.37
OUTR2	14	54	1001.79	138.06	1085.85
OUTB2	15	96.03	783.27	180.09	867.33
OUTG3	16	138.06	564.75	222.12	648.81
OUTR3	17	180.09	346.23	264.15	430.29
OUTB3	18	264.15	127.71	348.21	211.77
GSSOUT	19	1016.46	51.3	1100.52	135.36
DCSOUT	20	1509.48	51.3	1593.54	135.36
OUTB4	21	2261.79	127.71	2345.85	211.77
OUTR4	22	2345.85	346.23	2429.91	430.29
OUTG4	23	2387.88	564.75	2471.94	648.81
OUTB5	24	2429.91	783.27	2513.97	867.33
OUTR5	25	2471.94	1001.79	2556	1085.85
OUTG5	26	2471.94	1220.31	2556	1304.37
OUTB6	27	2471.94	1438.83	2556	1522.89
OUTR6	28	2471.94	1657.35	2556	1741.41
OUTG6	29	2471.94	1875.87	2556	1959.93
OUTB7	30	2471.94	2094.39	2556	2178.45
OUTR7	31	2471.94	2312.91	2556	2396.97
OUTG7	32	2471.94	2531.43	2556	2615.49
GND	33	2474.64	3152.43	2558.7	3236.49
GND	34	2474.64	3314.34	2558.7	3398.4
GND	35	2474.64	3510	2558.7	3594.06
IREF	36	2258.37	3842.64	2342.43	3926.7
VCC	37	2055.42	3842.64	2139.48	3926.7
XBLNK	38	1692	3842.64	1776.06	3926.7
DCSCK	39	1499.31	3842.64	1583.37	3926.7
DCSIN	40	1326.69	3842.64	1410.75	3926.7

(1) Substrate V_{DD}.

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
TLC5951TDA2	ACTIVE			0	10	RoHS & Green	Call TI	N / A for Pkg Type			Samples
TLC5951TDA3	ACTIVE			0	96	RoHS & Green	Call TI	N / A for Pkg Type			Samples

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".
RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.
Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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