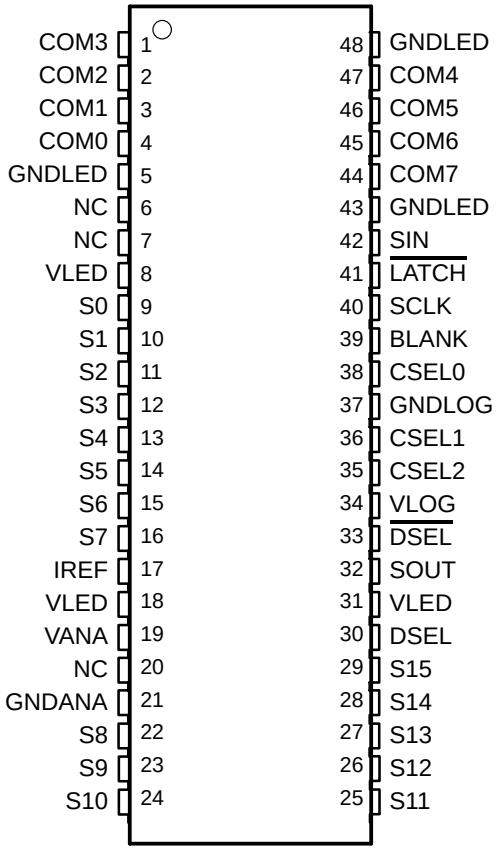
- **Drive Capability:**
  - **Segment . . . 30 mA × 16 Bits**
  - **Common . . . 640 mA**
- **Constant Current Output . . . 3 mA to 30 mA (Current Value Setting for All Channels Using External Resistor)**
- **Constant Current Accuracy ±6% (Maximum Error Between Bits)**
- **Data Input: Clock Synchronized Serial Input**
- **LED Type Applied Cathode Common**
- **Logic Power Supply Voltage 4.5 V to 5.5 V**
- **LED Power Supply Voltage 4.5 V to 5.5 V**
- **Operating Frequency . . . 10 MHz**
- **Operating Free-Air Temperature Range –20°C to 85°C**
- **48-Pin SSOL Package**

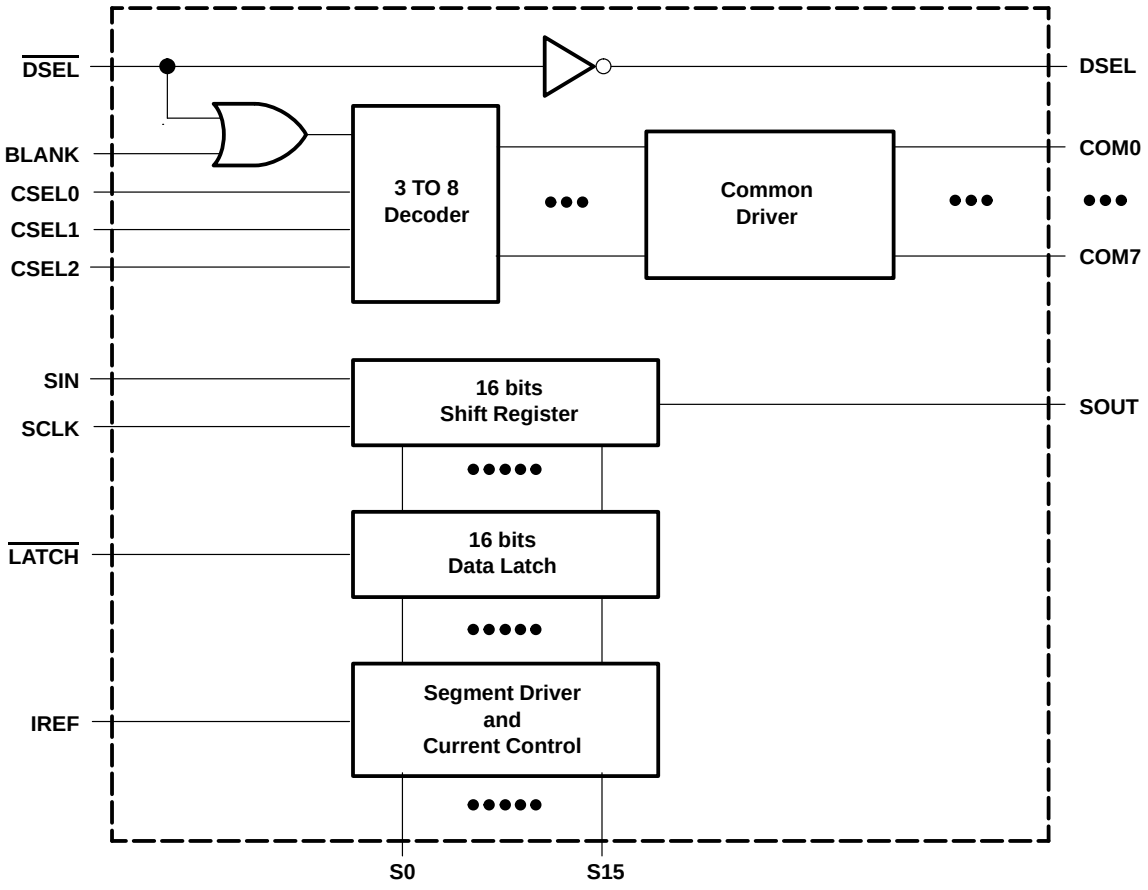
DL PACKAGE
(TOP VIEW)



description

The TLC5920 is an LED driver incorporating a 16-channel shift register, data latch, and constant current circuitry with current value control and 8-channel common driver into a single chip. The constant output current is capable of 30 mA for 16 bits simultaneously, and the current value can be set by one external register. This device also includes a 16-bit segment driver and 8-bit common driver; therefore, the monocolor LED array with 16 × 8 dots can be driven by only one TLC5920, and a two-color LED array with 16 x 16 dots can be driven by two TLC5920s.

functional block diagram



Terminal Functions

TERMINAL NAME	TERMINAL NO.	I/O	DESCRIPTION
BLANK	39	I	Blank(light off). By turning all the output for the common driver off, the LED is turned off. When BLANK is high, the LED is turned off.
COM0 – COM7	4, 3, 2, 1, 47, 46, 45, 44	O	LED common driver output
CSEL0 – 2	38, 36, 35	I	Common driver select. One terminal out of COM0 through COM7 is selected. **2 1 0 Common Driver** L L L 0 L L H 1 L H L 2 L H H 3 H L L 4 H L H 5 H H L 6 H H H 7
$\overline{\text{DSEL}}$	33	I	Display select. When $\overline{\text{DSEL}}$ is high, the LED is turned off. Note that, when BLANK is high, the LED is turned off with no regard to the $\overline{\text{DSEL}}$ input.
DSEL	30	O	Display select output. The inverted data of $\overline{\text{DSEL}}$ is clocked out.
GNDANA	21		Analog ground
GNDLED	5, 43, 48		LED driver ground
GNDLOG	37		Logic ground
IREF	17	I	Constant current control setting. The LED current is set to the desired value by connecting an external resistor between IREF and GND.
$\overline{\text{LATCH}}$	41	I	Latch. When $\overline{\text{LATCH}}$ is high, data on the shift register goes through latch. When $\overline{\text{LATCH}}$ is low, data is latched.
SIN	42	I	Serial input for display
SOUT	32	O	Serial output for display
SCLK	40	I	Synchronous clock input for serial data transfer. The input data of SIN is synchronized to the rising edge of SCLK, and transferred to SOUT.
S0 – S15	9, 10, 11, 12, 13, 14, 15, 16, 22, 23, 24, 25, 26, 27, 28, 29	O	LED segment driver output
VANA	19		Analog power supply voltage
VLOG	34		Logic power supply voltage
VLED	8, 18, 31		LED driver power supply voltage

absolute maximum ratings† (see Note 1)

Logic supply voltage, $V_{(LOG)}$ . . . – 0.3 V to 7 V
LED supply voltage, $V_{(LED)}$ . . . – 0.3 V to 7 V
Analog supply voltage, $V_{(ANA)}$ . . . – 0.3 V to 7 V
Output current, $I_{OH(S)}$ . . . – 32 mA
Output current, $I_{OL(C)}$ . . . 650 mA
Input voltage range, V_I . . . – 0.3 V to $V_{(LOG)}$ + 0.3 V
Output voltage range, V_O . . . – 0.3 V to $V_{(LOG)}$ + 0.3 V
Continuous total power dissipation . . . 1500 mW
Thermal resistance . . . 83°C/W
Operating free-air temperature range (see Note 2), T_A . . . – 20 to 85°C
Storage temperature range, T_{stg} . . . –40°C to 125°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. All voltage values are with respect to GND terminal.
2. $T_J \le 150°C$ (refer to appendix thermal condition).

recommended operating conditions

dc characteristics (see Note 3)

PARAMETER	TEST CONDITIONS	MIN	NOM	MAX	UNIT
Logic supply voltage, $V_{(LOG)}$		4.5	5	5.5	V
LED supply voltage, $V_{(LED)}$		4.5	5	5.5	V
Analog power supply, $V_{(ANA)}$		4.5	5	5.5	V
Voltage between GND and $V_{(DEF)}$, $G_{(DEF)}$	$G_{(DEF)} = GND_{(LOG)} – GND_{(LED)}$	–0.3	0	0.3	V
High-level input voltage, V_{IH}		2.0		$V_{(LOG)}$	V
Low-level input voltage, V_{IL}		$GND_{(LOG)}$		0.8	V
High-level output current, I_{OH}	$V_{(LOG)}$ = 4.5V, SOUT, DSEL			–1	mA
High-level output current, $I_{OH(S)}$	S0 to S15			–30	
Low-level output current, I_{OL}	$V_{(LOG)}$ = 4.5V, SOUT, DSEL			1.6	mA
Low-level output current, $I_{OL(C)}$	DUTY = 1/16, COM0 to COM7			640	
Operating free-air temperature range, T_A (see Note 2)		–20		85	°C

NOTES: 2 $T_J \le 150°C$ (refer to appendix thermal condition).
3. V_{ANA} must be same as V_{LED}.

ac characteristics (T_A = –20°C to 85°C)

PARAMETER		TEST CONDITIONS	MIN	NOM	MAX	UNIT
$f_{(SCLK)}$	Shift clock frequency				10	MHz
$t_{w(H)}/t_{w(l)}$	SCLK pulse duration (high- or low-level)		40			ns
t_r/t_f	Rise/fall time				100	ns
t_{su}	Setup time	SIN – SCLK	10			ns
		SCLK – $\overline{LATCH}$	10			
t_h	Hold time	$\overline{LATCH}$ – SCLK	10			ns
		SIN – SCLK	10			

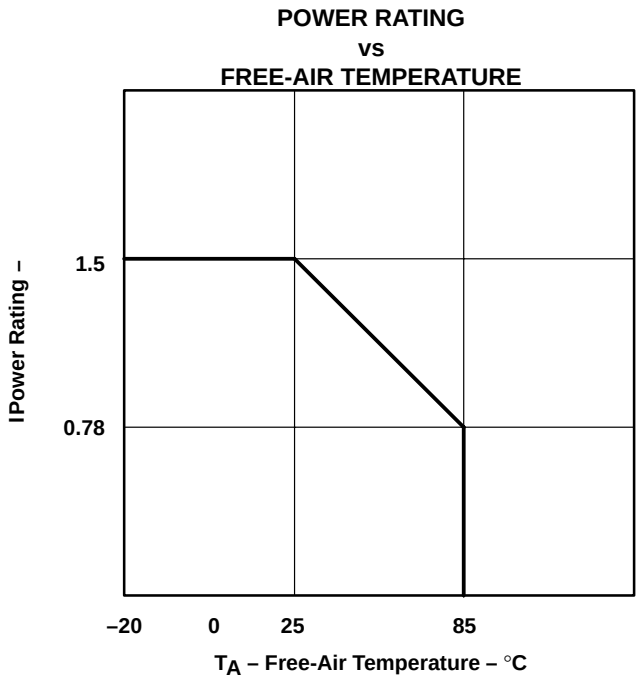
electrical characteristics (unless otherwise noted), MIN/MAX: $V_{(LOG)} = V_{(ANA)} = V_{(LED)} = 4.5$ V to 5.5 V, $T_A = -20°C$ to $85°C$ TYP: $V_{(LOG)} = V_{(ANA)} = V_{(LED)} = 5$ V, $T_A = 25°C$

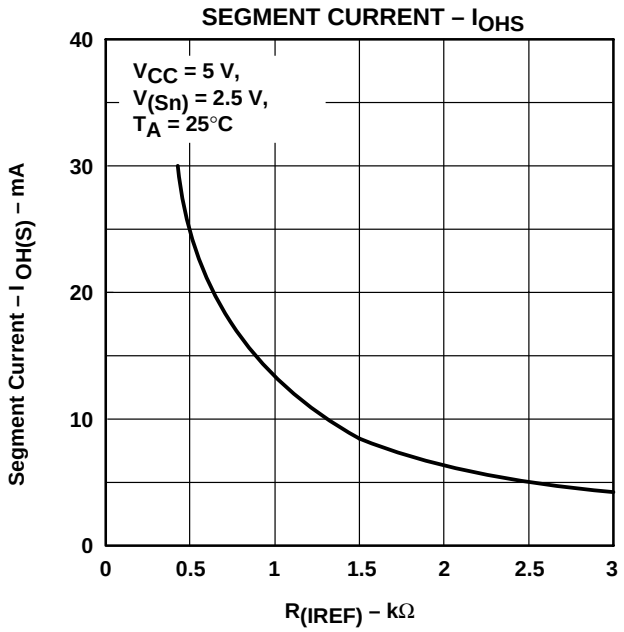
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{OH}	High-level output voltage	$I_{OH} = -1$ mA, SOUT, DSEL	3.6			V
V_{OL}	Low-level output voltage	$I_{OL} = 1.6$ mA, SOUT, DSEL			0.6	V
		$I_{OL} = 640$ mA, COM0 to COM7		0.6	0.9	
I_I	Input current	$V_I = V_{(LOG)}$ or $GND_{(LOG)}$			±1	µA
$I_{(LOG)}$	Supply current	Data transfer, SCLK = 10 MHz			0.1	mA
$I_{(LED)}$		LED is turned off		0.8	1.6	
$I_{(ANA)}$		LED is turned off		0.8	1.6	
$I_{OH(S03)}$	Segment current	$V_{(Sn)} = 2.5$ V, $R_{(IREF)} = 4200\ \Omega$	−2.1	−3	−3.9	mA
$I_{OH(S10)}$		$V_{(Sn)} = 2.5$ V, $R_{(IREF)} = 1260\ \Omega$	−8.5	−10	−11.5	
$I_{OH(S20)}$		$V_{(Sn)} = 2.5$ V, $R_{(IREF)} = 630\ \Omega$	−17	−20	−23	
$I_{OH(S30)}$		$V_{(Sn)} = 2.5$ V, $R_{(IREF)} = 420\ \Omega$	−25.5	−30	−34.5	
$\Delta I_{OH(S)}$	Segment current error between bits	$V_{(LED)} = 5$ V, $R_{(IREF)} = 630\ \Omega$, $V_{(Sn)} = 2.5$ V		±3%	±6%	
V_{REF}	Voltage reference		1.2	1.26	1.3	V

switching characteristics, $C_L = 15$ pF

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_r	Rise time	SOUT			40	ns
		DSEL			40	
		COMn			80	
		Sn			80	
t_f	Fall time	SOUT			40	ns
		DSEL			40	
		COMn			40	
		Sn			40	
t_d	Propagation delay time	$\overline{\text{LATCH}}$ – Sn			40	ns
		SCLK – Sn			40	
		SCLK – SOUT			40	
		$\overline{\text{DSEL}}$ – DSEL			40	
$t_{(DLH)}$	Propagation delay time	CSELn – COMn			120	ns
		$\overline{\text{DSEL}}$ – COMn			120	
		BLANK – COMn			120	
$t_{(DHL)}$	Propagation delay time	CSELn – COMn			40	ns
		$\overline{\text{DSEL}}$ – COMn			40	
		BLANK – COMn			40	

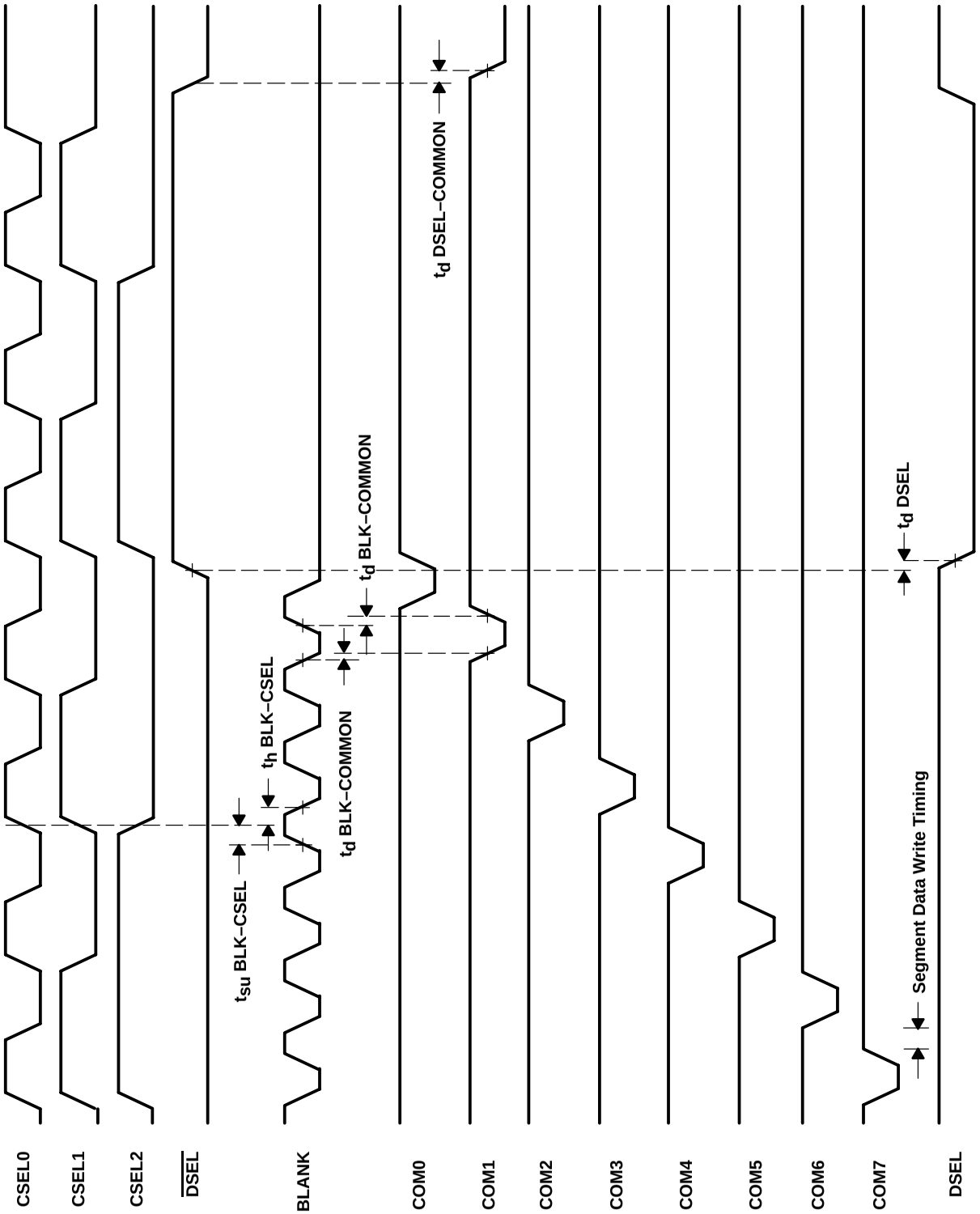
PARAMETER MEASUREMENT INFORMATION



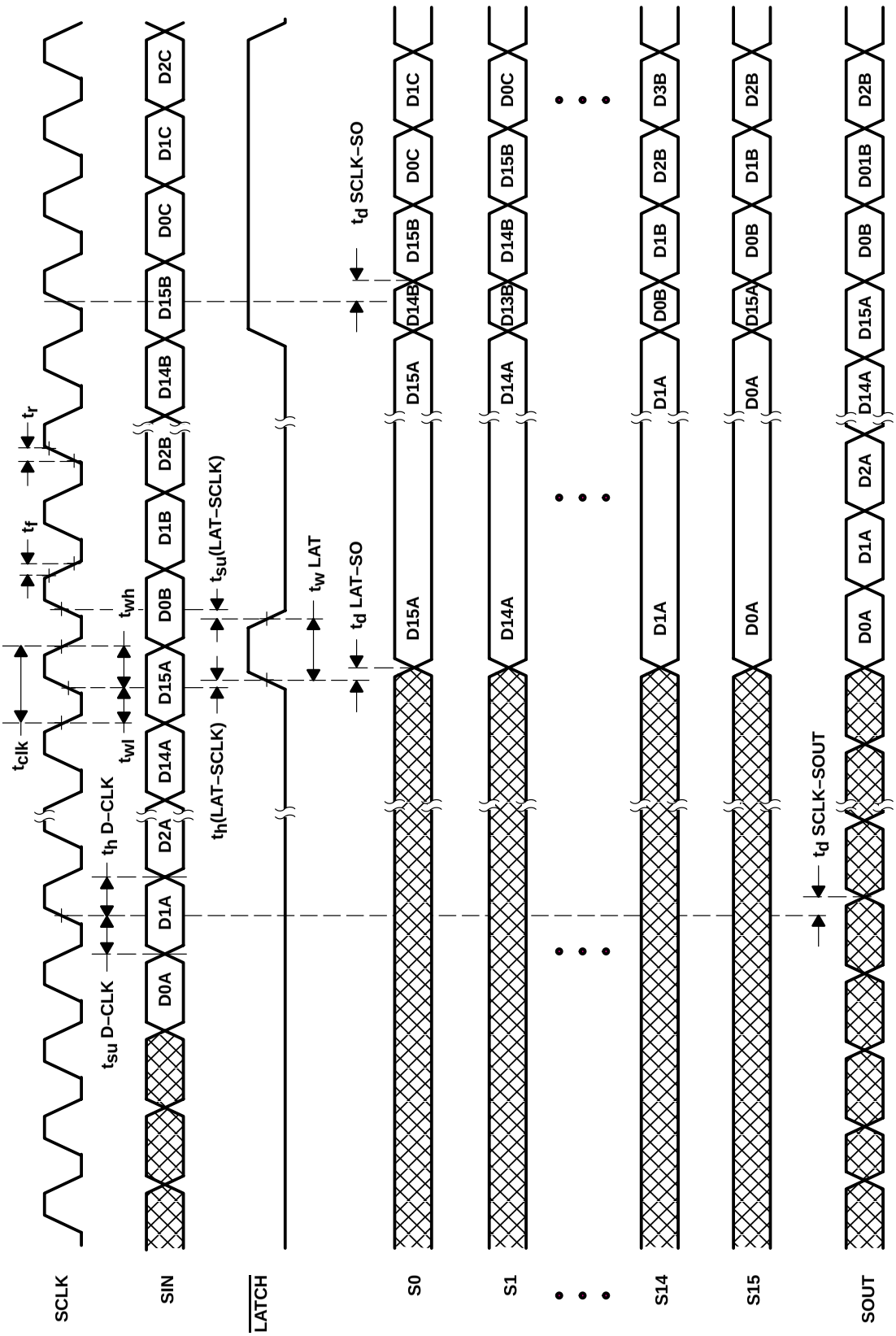


$$I_{OH(S)} = \frac{V_{REF}}{R_{(IREF)}} \times 10$$

timing diagram (common driver)



timing diagram (segment driver)



APPLICATION INFORMATION

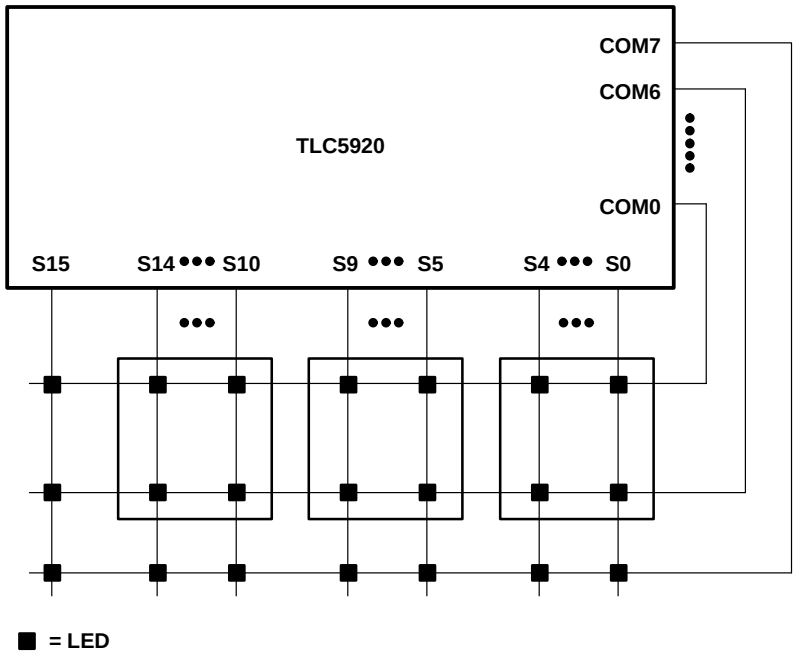
example 1

The other remaining terminals used for dot matrix LED drive can be utilized for LED lamp drive and other displays.

LEDs driven by TLC5920

cathode common type

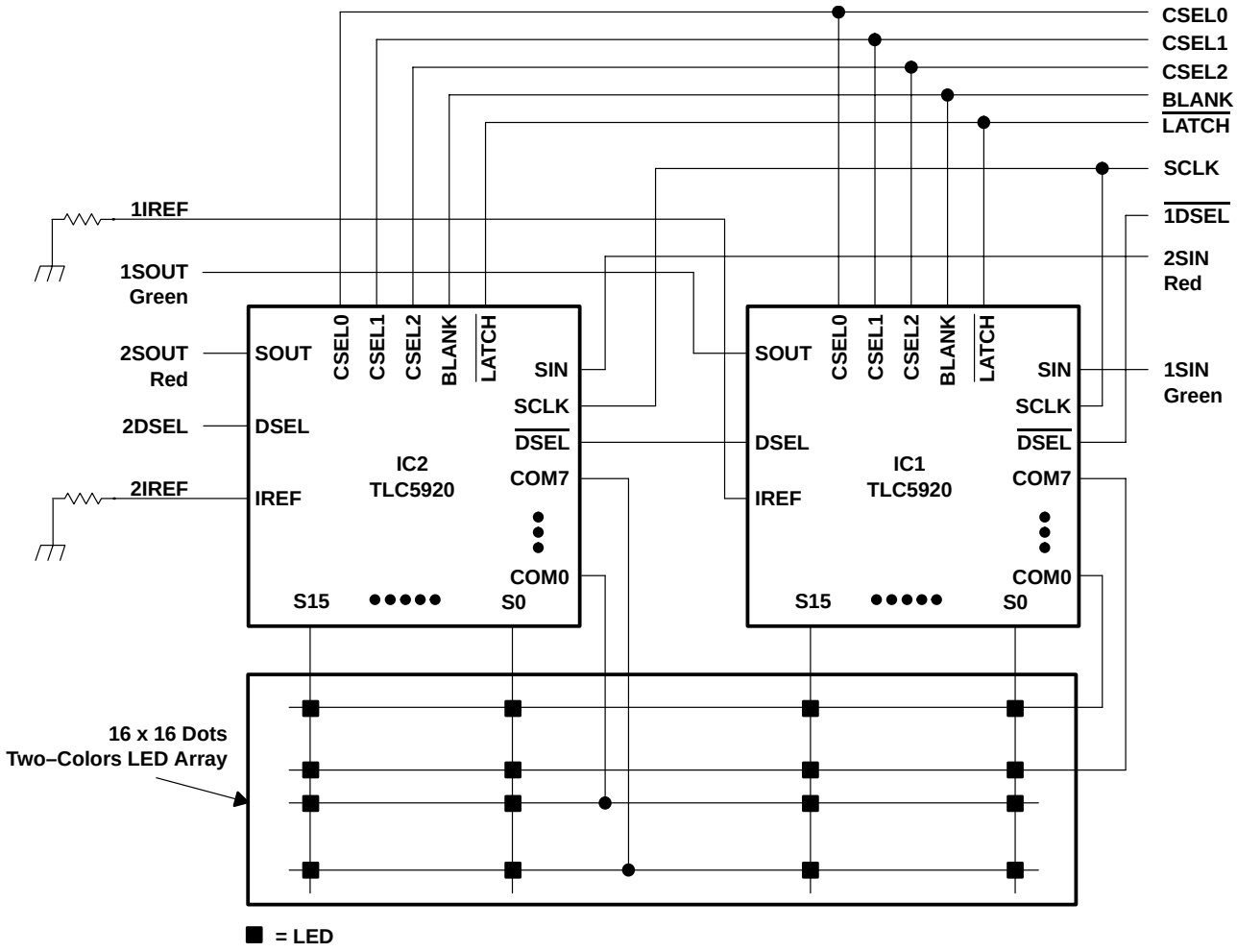
LED			TLC5920 QUANTITY	DUTY	DRIVE CURRENT (mA)
TYPE	NO. OF COLOR	QUANTITY			
LAMP	Mono	16	1	Static	30
	Two	8	1	Static	30
7 SEGMENT	Mono	16	1	1/8	30
	Two	8	1	1/8	30
5 x 7	Mono	3	1	1/8	30
	Two	1	1	1/8	30
8 x 8	Mono	2	1	1/8	30
	Two	1	1	1/8	30
16 x 16	Mono	2	2	1/16	20
	Two	1	2	1/16	20
	Three	1	3	1/16	13
24 x 24	Mono	2	3	1/24	13
	Two	1	3	1/24	13



APPLICATION INFORMATION

example 2

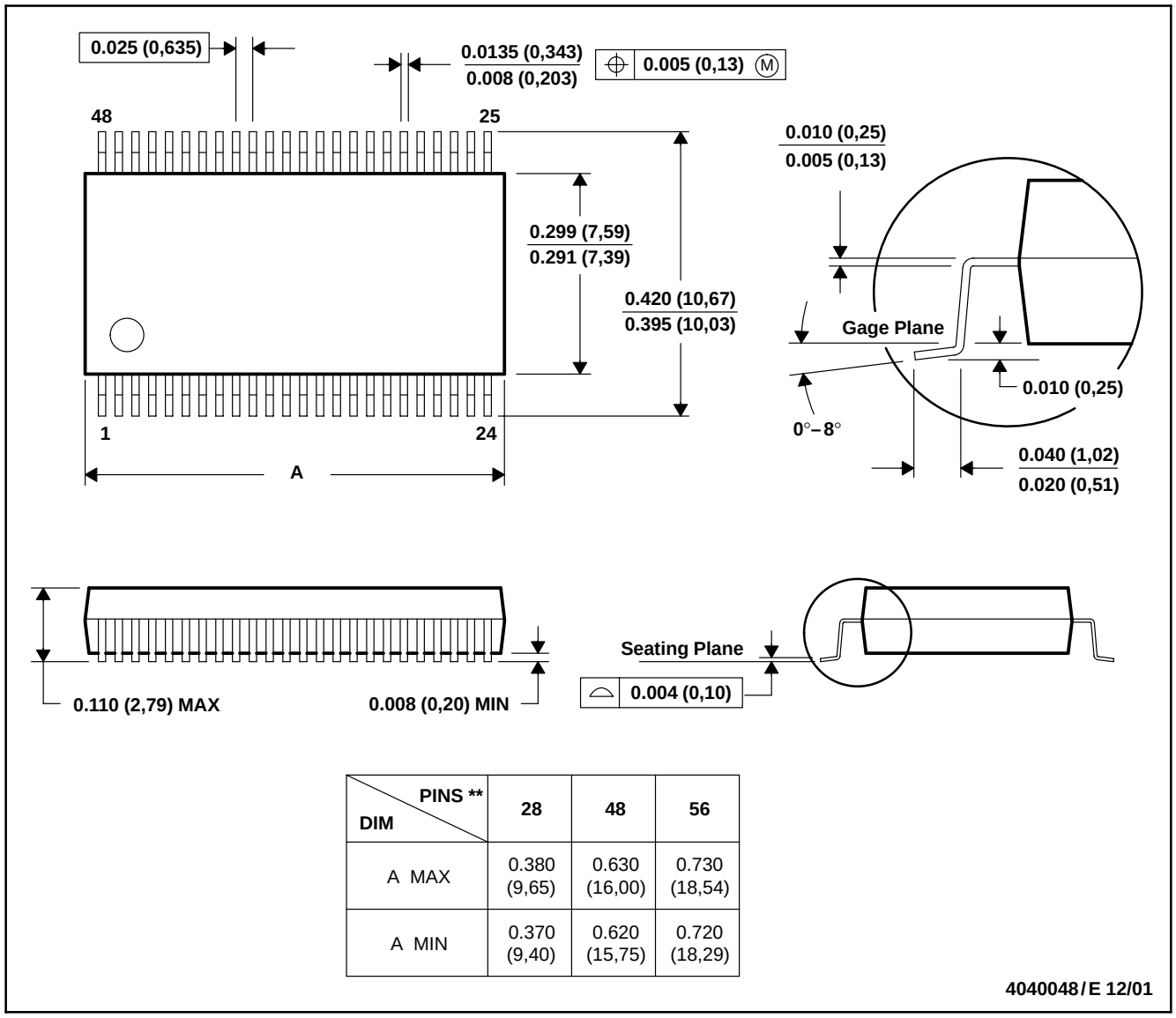
Using two TLC5920s, an LED with two colors and 16 x 16 dots can be driven. The number of LED arrays can also be increased by making a cascade connection in the application circuit.



MECHANICAL DATA

DL (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

48 PINS SHOWN



DIM \ PINS **	28	48	56
A MAX	0.380 (9,65)	0.630 (16,00)	0.730 (18,54)
A MIN	0.370 (9,40)	0.620 (15,75)	0.720 (18,29)

4040048/E 12/01

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MO-118

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
TLC5920DL	ACTIVE	SSOP	DL	48	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLC5920DLG4	ACTIVE	SSOP	DL	48	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLC5920DLR	ACTIVE	SSOP	DL	48	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
TLC5920DLRG4	ACTIVE	SSOP	DL	48	1000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR

(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) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

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

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