

## 8-Bit Serial Input Constant-Current Latched LED Driver

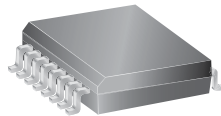
### Features and Benefits

- Up to 90 mA constant-current outputs
- Undervoltage lockout
- Low-power CMOS logic and latches
- High data-input rate
- Pin-compatible with TB62705CP

### Packages



16-pin DIP  
(A package)



16-pin SOICW  
(LW package)

Not to scale

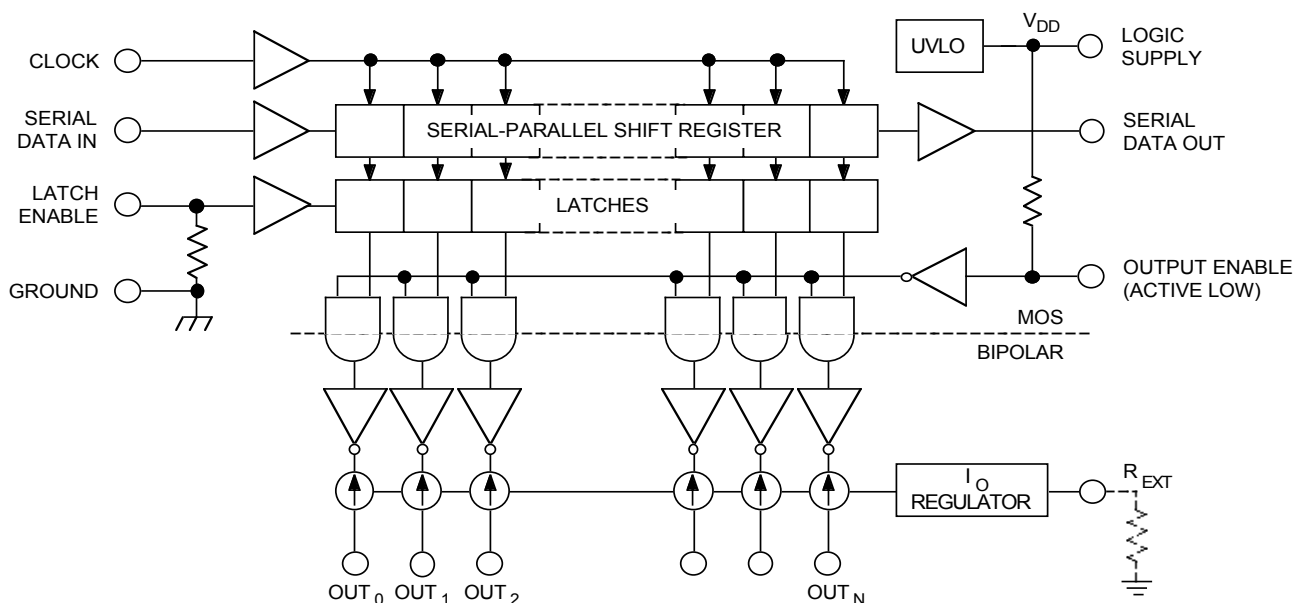
### Description

The A6275 is specifically designed for LED display applications. Each BiCMOS device includes an 8-bit CMOS shift register, accompanying data latches, and eight NPN constant-current sink drivers.

The CMOS shift register and latches allow direct interfacing with microprocessor-based systems. With a 5 V logic supply, typical serial data-input rates are up to 20 MHz. The LED drive current is determined by the user selection of a single resistor. A CMOS serial data output permits cascade connections in applications requiring additional drive lines. For inter-digit blanking, all output drivers can be disabled with an ENABLE input high. A similar 150 mA output device is available as the A6277; a similar 16-bit device is available as the A6276.

Two package styles are provided: a through-hole DIP (suffix A) and a surface-mount SOICW (suffix LW). Under normal applications, copper leadframes and low logic-power dissipation allow these devices to sink maximum rated current through all outputs continuously over the operating temperature range (90 mA, 0.9 V drop, 85°C). Both packages are lead (Pb) free, with 100% matte tin leadframe plating.

### Functional Block Diagram



Dwg. FP-013-3

# A6275

## Serial-Input Constant-Current Latched LED Driver with Open LED Detection and Dot Correction

### Selection Guide

Part Number	Package	Packing	Ambient Temperature (°C)
A6275EA-T	16-pin DIP	25 per tube	-40 to 85
A6275ELW-T	16-pin SOICW	47 per tube	
A6275ELWTR-T	16-pin SOICW	1000 per reel	
A6275SLW-T	16-pin SOICW	47 per tube	-20 to 85
A6275SLWTR-T	16-pin SOICW	1000 per reel	

### Absolute Maximum Ratings\*

Characteristic	Symbol	Notes	Rating	Units
Supply Voltage	$V_{DD}$		7.0	V
Input Voltage Range	$V_I$		-0.4 to $V_{DD} + 0.4$	V
Output Voltage Range	$V_O$		-0.5 to $V_{DD} + 17$	V
Output Current	$I_O$		90	mA
Ground Current	$I_{GND}$		750	mA
Operating Ambient Temperature	$T_A$	Range E	-40 to 85	°C
		Range S	-20 to 85	°C
Maximum Junction Temperature	$T_{J(max)}$		150	°C
Storage Temperature	$T_{stg}$		-55 to 150	°C

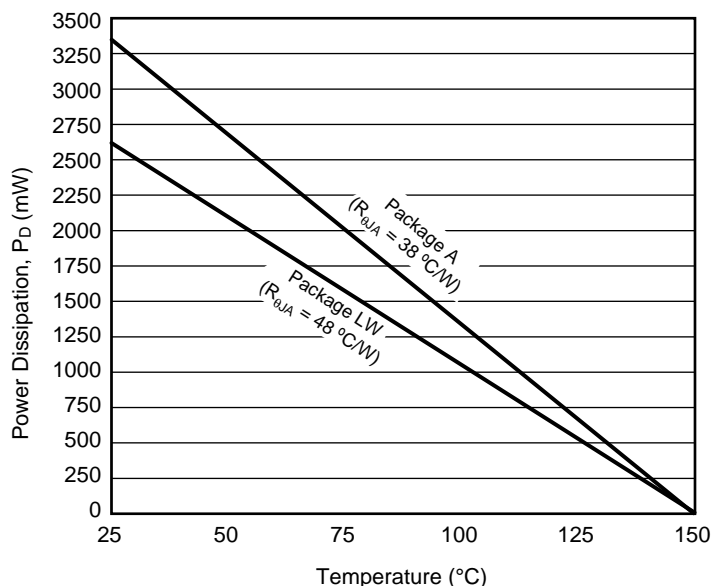
\*These CMOS devices have input static protection (Class 2) but are still susceptible to damage if exposed to extremely high static electrical charges.

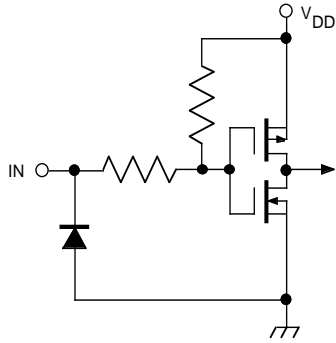
**Thermal Characteristics** may require derating at maximum conditions, see application information

Characteristic	Symbol	Test Conditions*	Value	Units
Package Thermal Resistance	$R_{\theta JA}$	Package A, 4-layer PCB based on JEDEC standard	38	°C/W
		Package LW, 4-layer PCB based on JEDEC standard	48	°C/W

\*Additional thermal information available on the Allegro website.

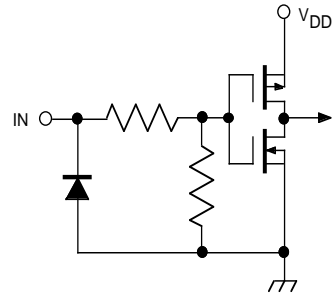
**Power Dissipation versus Ambient Temperature**





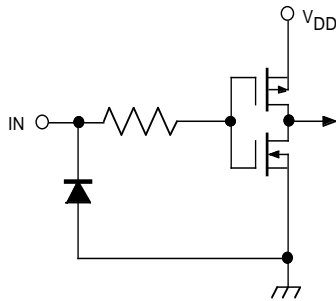
Dwg. EP-010-11

OUTPUT ENABLE (active low)



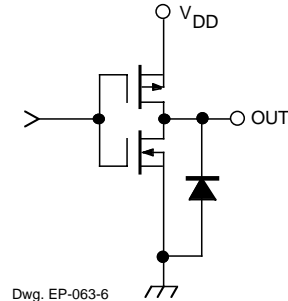
Dwg. EP-010-12

LATCH ENABLE



Dwg. EP-010-13

CLOCK and SERIAL DATA IN



Dwg. EP-063-6

SERIAL DATA OUT

**TRUTH TABLE**

Serial Data Input	Clock Input	Shift Register Contents						Serial Data Output	Latch Enable Input	Latch Contents						Output Enable Input	Output Contents					
		$I_1$	$I_2$	$I_3$	...	$I_{N-1}$	$I_N$			$l_1$	$l_2$	$l_3$	...	$l_{N-1}$	$l_N$		$l_1$	$l_2$	$l_3$	...	$l_{N-1}$	$l_N$
H		H	$R_1$	$R_2$	...	$R_{N-2}$	$R_{N-1}$	$R_{N-1}$														
L		L	$R_1$	$R_2$	...	$R_{N-2}$	$R_{N-1}$	$R_{N-1}$														
X		$R_1$	$R_2$	$R_3$	...	$R_{N-1}$	$R_N$	$R_N$														
		X	X	X	...	X	X	X	L	$R_1$	$R_2$	$R_3$	...	$R_{N-1}$	$R_N$							
		$P_1$	$P_2$	$P_3$	...	$P_{N-1}$	$P_N$	$P_N$	H	$P_1$	$P_2$	$P_3$	...	$P_{N-1}$	$P_N$	L						
					...					X	X	X	...	X	X	H	H	H	...	H	H	

L = Low Logic (Voltage) Level    H = High Logic (Voltage) Level    X = Irrelevant    P = Present State    R = Previous State

**ELECTRICAL CHARACTERISTICS at  $T_A = +25^\circ\text{C}$ ,  $V_{DD} = 5\text{ V}$  (unless otherwise noted).**

Characteristic	Symbol	Test Conditions	Limits			
			Min.	Typ.	Max.	Unit
Supply Voltage Range	$V_{DD}$	Operating	4.5	5.0	5.5	V
Undervoltage Lockout	$V_{DD(UV)}$	$V_{DD} = 0 \rightarrow 5\text{ V}$	3.4	–	4.0	V
Output Current (any single output)	$I_O$	$V_{CE} = 0.7\text{ V}$ , $R_{EXT} = 250\ \Omega$	64.2	75.5	86.8	mA
		$V_{CE} = 0.7\text{ V}$ , $R_{EXT} = 470\ \Omega$	34.1	40.0	45.9	mA
Output Current Matching (difference between any two outputs at same $V_{CE}$ )	$\Delta I_O$	$0.4\text{ V} \leq V_{CE(A)} = V_{CE(B)} \leq 0.7\text{ V}$ : $R_{EXT} = 250\ \Omega$	–	$\pm 1.5$	$\pm 6.0$	%
		$R_{EXT} = 470\ \Omega$	–	$\pm 1.5$	$\pm 6.0$	%
Output Leakage Current	$I_{CEX}$	$V_{OH} = 15\text{ V}$	–	1.0	5.0	$\mu\text{A}$
Logic Input Voltage	$V_{IH}$		$0.7V_{DD}$	–	$V_{DD}$	V
	$V_{IL}$		GND	–	$0.3V_{DD}$	V
SERIAL DATA OUT Voltage	$V_{OL}$	$I_{OL} = 500\ \mu\text{A}$	–	–	0.4	V
	$V_{OH}$	$I_{OH} = -500\ \mu\text{A}$	4.6	–	–	V
Input Resistance	$R_I$	ENABLE Input, Pull Up	150	300	600	k $\Omega$
		LATCH Input, Pull Down	100	200	400	k $\Omega$
Supply Current	$I_{DD(OFF)}$	$R_{EXT} = \text{open}$ , $V_{OE} = 5\text{ V}$	–	0.8	1.4	mA
		$R_{EXT} = 470\ \Omega$ , $V_{OE} = 5\text{ V}$	3.5	6.0	8.0	mA
		$R_{EXT} = 250\ \Omega$ , $V_{OE} = 5\text{ V}$	6.5	11	15	mA
	$I_{DD(ON)}$	$R_{EXT} = 470\ \Omega$ , $V_{OE} = 0\text{ V}$	5.0	10	14	mA
		$R_{EXT} = 250\ \Omega$ , $V_{OE} = 0\text{ V}$	8.0	16	24	mA

Typical Data is at  $V_{DD} = 5\text{ V}$  and is for design information only.

**SWITCHING CHARACTERISTICS** at  $T_A = 25^\circ\text{C}$ ,  $V_{DD} = V_{IH} = 5\text{ V}$ ,  $V_{CE} = 0.4\text{ V}$ ,  $V_{IL} = 0\text{ V}$ ,  
 $R_{EXT} = 470\ \Omega$ ,  $I_O = 40\text{ mA}$ ,  $V_L = 3\text{ V}$ ,  $R_L = 65\ \Omega$ ,  $C_L = 10.5\text{ pF}$ .

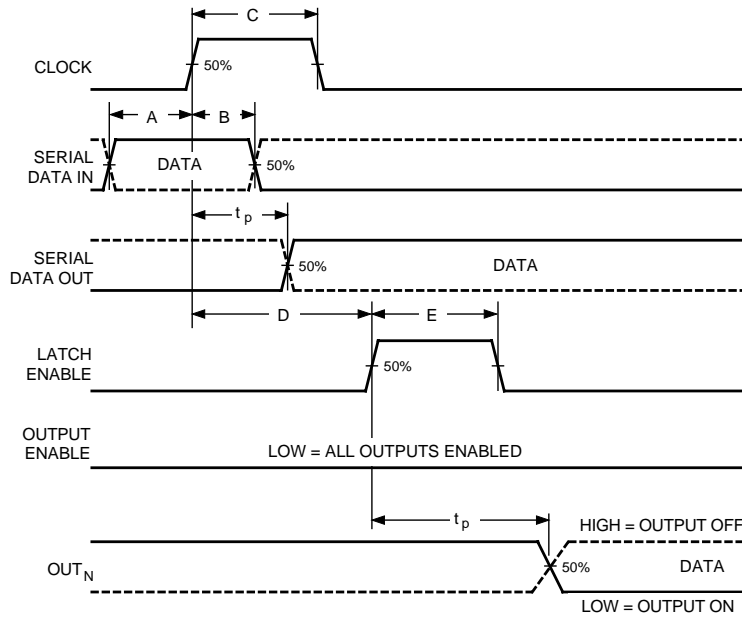
Characteristic	Symbol	Test Conditions	Limits			
			Min.	Typ.	Max.	Unit
Propagation Delay Time	$t_{pHL}$	CLOCK-OUT <sub>n</sub>	–	350	1000	ns
		LATCH-OUT <sub>n</sub>	–	350	1000	ns
		ENABLE-OUT <sub>n</sub>	–	350	1000	ns
		CLOCK-SERIAL DATA OUT	–	40	–	ns
Propagation Delay Time	$t_{pLH}$	CLOCK-OUT <sub>n</sub>	–	300	1000	ns
		LATCH-OUT <sub>n</sub>	–	300	1000	ns
		ENABLE-OUT <sub>n</sub>	–	300	1000	ns
		CLOCK-SERIAL DATA OUT	–	40	–	ns
Output Fall Time	$t_f$	90% to 10% voltage	150	350	1000	ns
Output Rise Time	$t_r$	10% to 90% voltage	150	300	600	ns

### RECOMMENDED OPERATING CONDITIONS

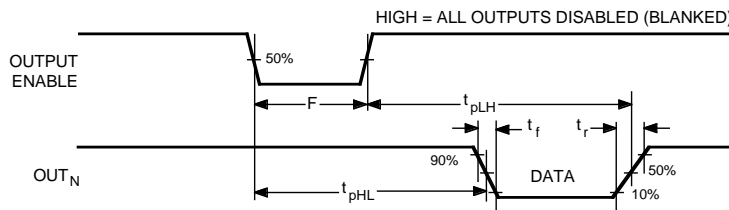
Characteristic	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply Voltage	$V_{DD}$		4.5	5.0	5.5	V
Output Voltage	$V_O$		–	1.0	4.0	V
Output Current	$I_O$	Continuous, any one output	–	–	90	mA
	$I_{OH}$	SERIAL DATA OUT	–	–	-1.0	mA
	$I_{OL}$	SERIAL DATA OUT	–	–	1.0	mA
Logic Input Voltage	$V_{IH}$		$0.7V_{DD}$	–	$V_{DD} + 0.3$	V
	$V_{IL}$		-0.3	–	$0.3V_{DD}$	V
Clock Frequency	$f_{CK}$	Cascade operation	–	–	10	MHz

**TIMING REQUIREMENTS and SPECIFICATIONS**

(Logic Levels are  $V_{DD}$  and Ground)



Dwg. WP-029-1



Dwg. WP-030-1A

- A.** Data Active Time Before Clock Pulse (Data Set-Up Time),  $t_{su(D)}$  ..... **50 ns**
- B.** Data Active Time After Clock Pulse (Data Hold Time),  $t_{h(D)}$  ..... **20 ns**
- C.** Clock Pulse Width,  $t_{w(CK)}$  ..... **50 ns**
- D.** Time Between Clock Activation and Latch Enable,  $t_{su(L)}$  ..... **100 ns**
- E.** Latch Enable Pulse Width,  $t_{w(L)}$  ..... **100 ns**
- F.** Output Enable Pulse Width,  $t_{w(OE)}$  ..... **4.5  $\mu$ s**

NOTE: Timing is representative of a 10 MHz clock. Significantly higher speeds are attainable.  
Max. Clock Transition Time,  $t_r$  or  $t_f$  ..... **10  $\mu$ s**

Serial data present at the input is transferred to the shift register on the logic 0-to-logic 1 transition of the CLOCK input pulse. On succeeding CLOCK pulses, the registers shift data information towards the SERIAL DATA OUTPUT. The serial data must appear at the input prior to the rising edge of the CLOCK input waveform.

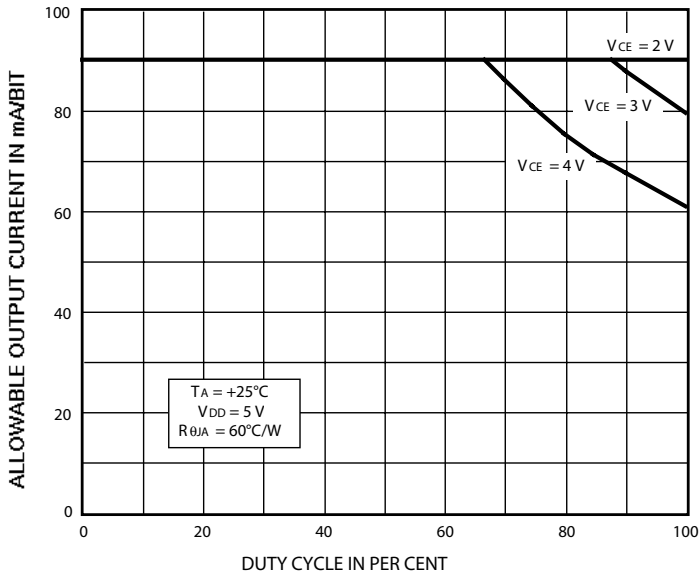
Information present at any register is transferred to the respective latch when the LATCH ENABLE is high (serial-to-parallel conversion). The latches continue to accept new data as

long as the LATCH ENABLE is held high. Applications where the latches are bypassed (LATCH ENABLE tied high) will require that the OUTPUT ENABLE input be high during serial data entry.

When the OUTPUT ENABLE input is high, the output sink drivers are disabled (OFF). The information stored in the latches is not affected by the OUTPUT ENABLE input. With the OUTPUT ENABLE input low, the outputs are controlled by the state of their respective latches.

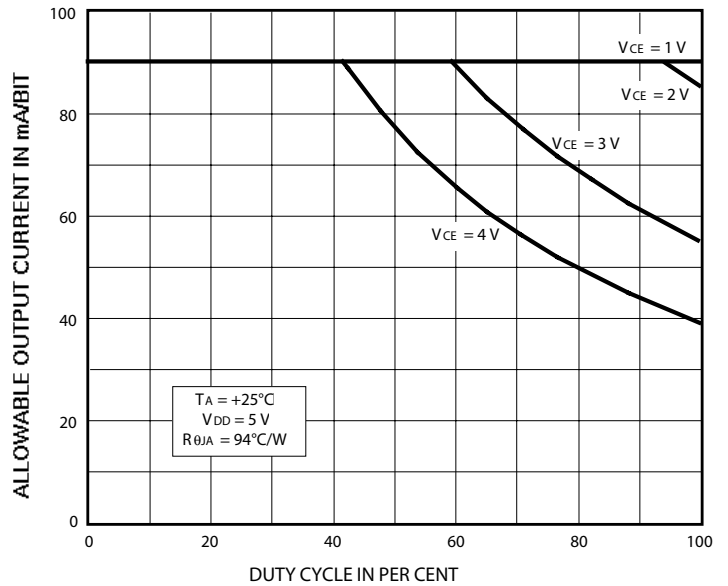
### ALLOWABLE OUTPUT CURRENT AS A FUNCTION OF DUTY CYCLE

#### A Package

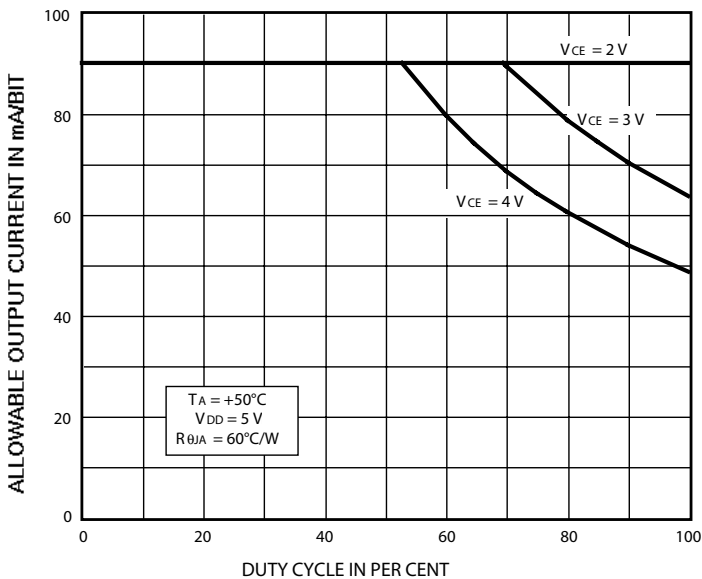


Dwg. GP-062-5

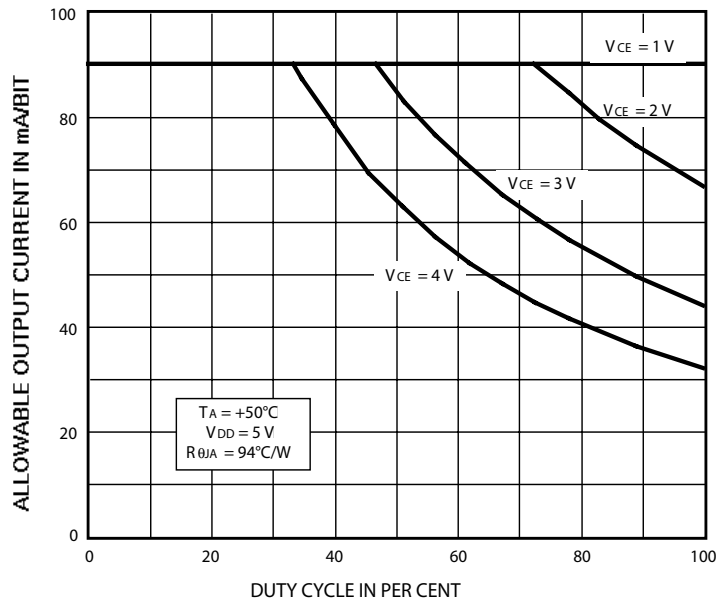
#### LW Package



Dwg. GP-062-4A



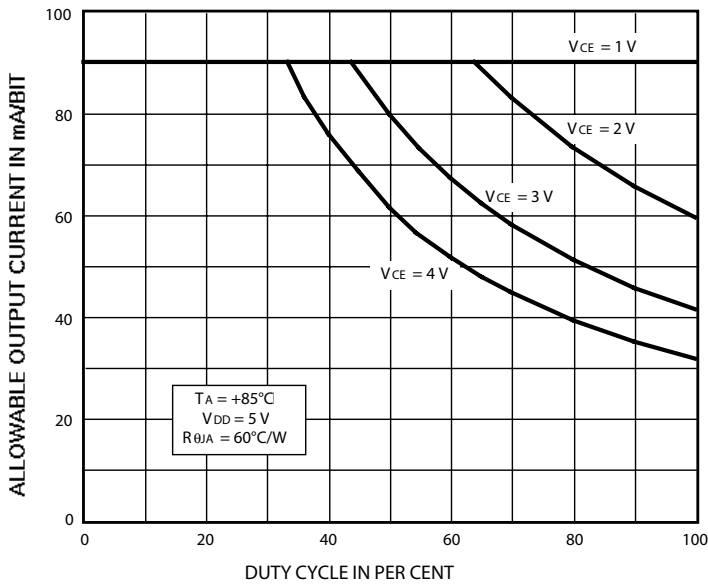
Dwg. GP-062-3



Dwg. GP-062-2A

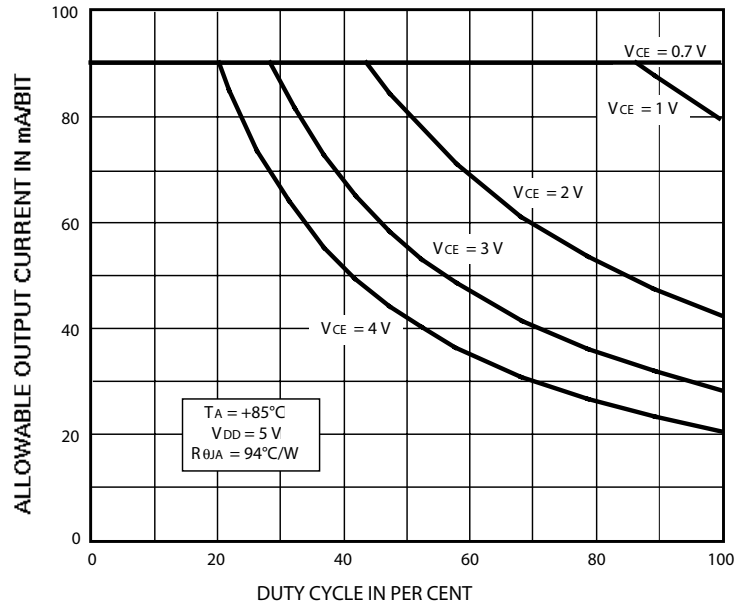
**ALLOWABLE OUTPUT CURRENT AS A FUNCTION OF DUTY CYCLE (cont.)**

**A Package**



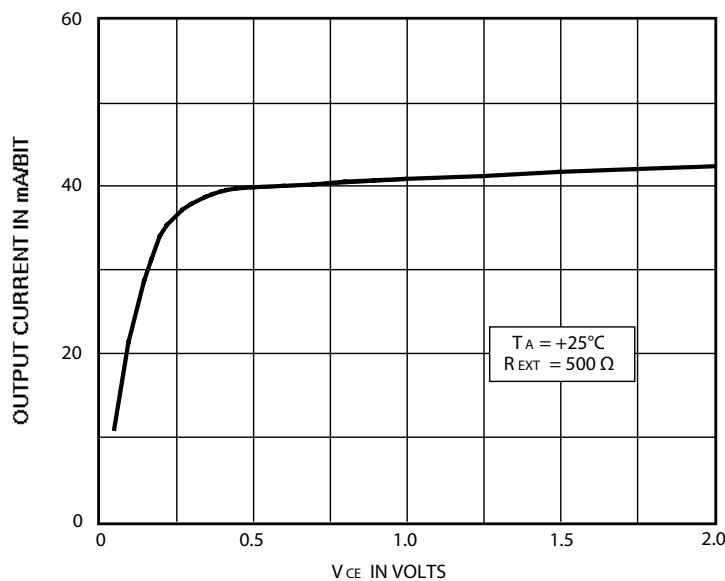
Dwg. GP-062-1

**LW Package**



Dwg. GP-062A

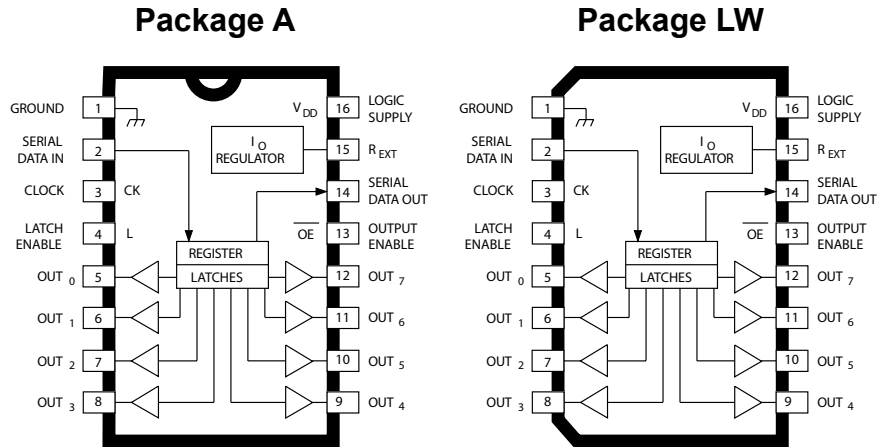
**TYPICAL CHARACTERISTICS**



Dwg. GP-063



**Pin-out Diagrams**

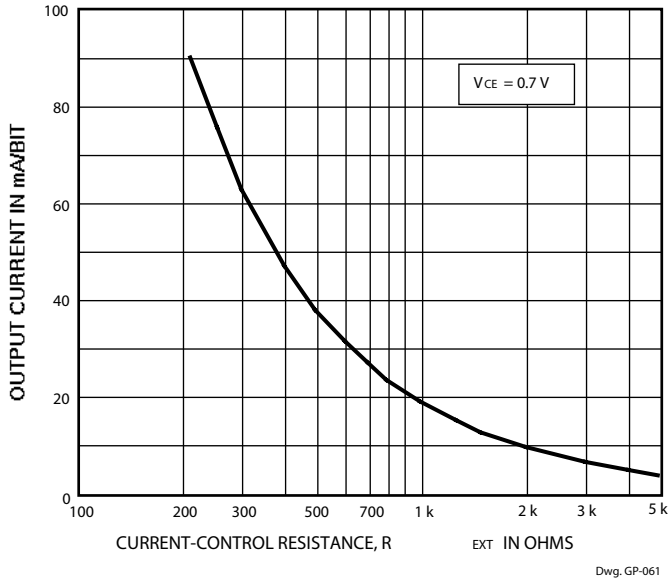


**TERMINAL DESCRIPTION**

Terminal No.	Terminal Name	Function
1	GND	Reference terminal for control logic.
2	SERIAL DATA IN	Serial-data input to the shift-register.
3	CLOCK	Clock input terminal for data shift on rising edge.
4	LATCH ENABLE	Data strobe input terminal; serial data is latched with high-level input.
5-12	OUT <sub>0-7</sub>	The eight current-sinking output terminals.
13	OUTPUT ENABLE	When (active) low, the output drivers are enabled; when high, all output drivers are turned OFF (blanked).
14	SERIAL DATA OUT	CMOS serial-data output to the following shift-register.
15	R <sub>EXT</sub>	An external resistor at this terminal establishes the output current for all sink drivers.
16	SUPPLY	(V <sub>DD</sub> ) The logic supply voltage (typically 5 V).

## Applications Information

The load current per bit ( $I_O$ ) is set by the external resistor ( $R_{EXT}$ ) as shown in the figure below.



**Package Power Dissipation ( $P_D$ ).** The maximum allowable package power dissipation is determined as

$$P_D(\text{max}) = (150 - T_A) / R_{\theta JA}$$

The actual package power dissipation is

$$P_D(\text{act}) = dc(V_{CE} \times I_O \times 8) + (V_{DD} \times I_{DD})$$

When the load supply voltage is greater than 3 V to 5 V, considering the package power dissipating limits of these devices, or if  $P_D(\text{act}) > P_D(\text{max})$ , an external voltage reducer ( $V_{DROP}$ ) should be used.

**Load Supply Voltage ( $V_{LED}$ ).** These devices are designed to operate with driver voltage drops ( $V_{CE}$ ) of 0.4 V to 0.7 V with LED forward voltages ( $V_F$ ) of 1.2 V to 4.0 V. If higher voltages are dropped across the driver, package power dissipation will be increased significantly. To minimize package power dissipation, it is recommended to use the lowest possible load supply voltage or to set any series dropping voltage ( $V_{DROP}$ ) as

$$V_{DROP} = V_{LED} - V_F - V_{CE}$$

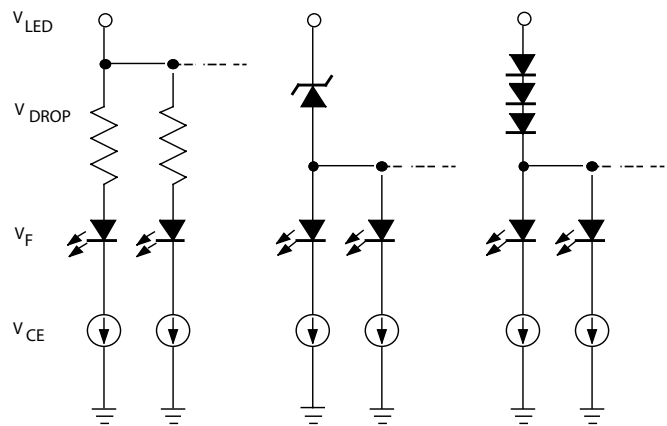
with  $V_{DROP} = I_o \times R_{DROP}$  for a single driver, or a Zener diode ( $V_Z$ ), or a series string of diodes (approximately

0.7 V per diode) for a group of drivers. If the available voltage source will cause unacceptable dissipation and series resistors or diode(s) are undesirable, a regulator such as the Sanken Series SAI or Series SI can be used to provide supply voltages as low as 3.3 V.

For reference, typical LED forward voltages are:

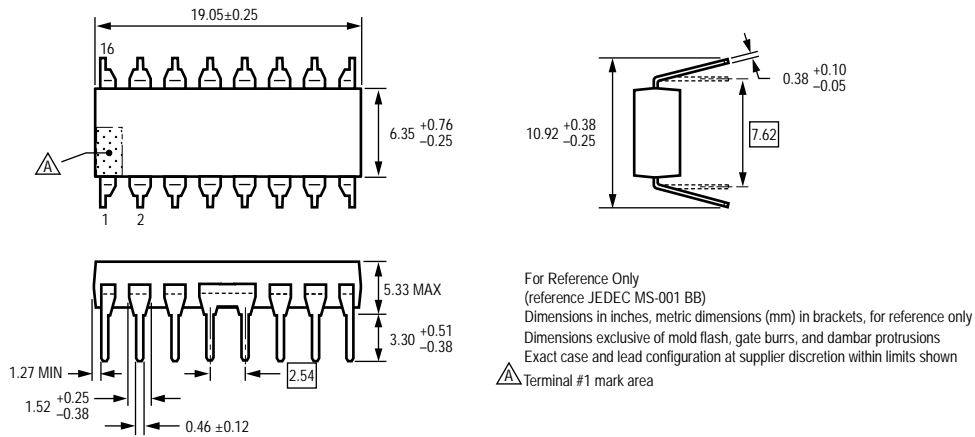
White	3.5 – 4.0 V
Blue	3.0 – 4.0 V
Green	1.8 – 2.2 V
Yellow	2.0 – 2.1 V
Amber	1.9 – 2.65 V
Red	1.6 – 2.25 V
Infrared	1.2 – 1.5 V

**Pattern Layout.** This device has a common logic-ground and power-ground terminal. If ground pattern layout contains large common-mode resistance, and the voltage between the system ground and the LATCH ENABLE or CLOCK terminals exceeds 2.5 V (because of switching noise), these devices may not operate correctly.

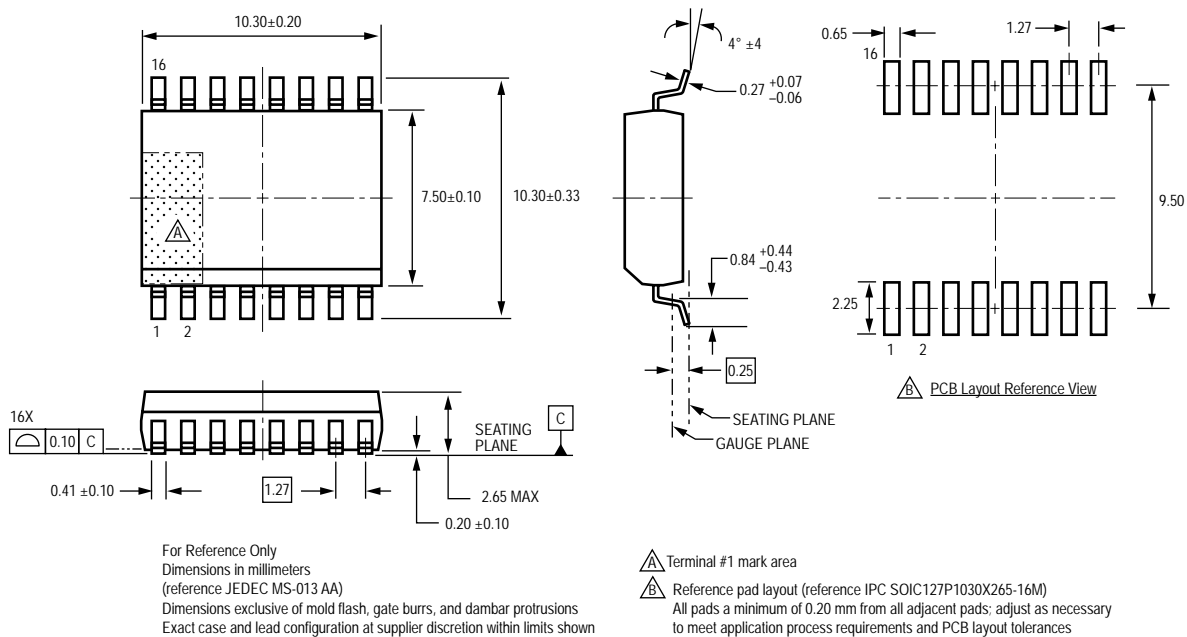


Dwg. EP-064

## Package A 16-Pin DIP



## Package LW 16-Pin SOICW



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