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National Semiconductor

Display Controllers/Drivers

T-51-15

DS8654 8-Output Display Driver (LED, VF, Thermal Printer) DS8656 Diode Matrix

General Description

DS8654 is an 8-digit driver with emitter/follower outputs. It can source up to 50 mA at a low impedance, and operates with a constant internal drive current over a wide range of power supply—from 4.5V to 33V. The DS8654 can be used to drive electrical or mechanical, multiplexed or unmultiplexed display systems. It can be used as a segment driver for common cathode displays with external current limiting resistors or can drive incandescent or fluorescent displays directly, both digits (anodes) and segments (grids). It will be necessary to run the device at a lower duty cycle, to keep the maximum package dc power dissipation less than 600 mW while operating all 8 outputs at high supply voltage and large source current. The inputs are MOS compatible and eliminate the need for level shifting since inputs are referenced to the most negative supply of system.

System Description

The DS8654 and DS8656 are specifically designed to operate a thermal printing head for calculator or other uses. In this application the same segment in each digit is selected at the same time, reducing the overall time for a complete print cycle. The DS8654 is an 8-digit driver. With a 15-digit print head, two of the DS8654 are required.

The DS8656 diode arrays are used to prevent "sneak" currents in the resistive print head. In a 15-digit print head with one alphanumeric digit there are 119 resistor segments requiring 119 diodes. For ease of assembly, the DS8656 is configured in four groups of three common cathode diodes in each group. In the system, ten parts of DS8656 are required.

The whole system is designed to operate from a +19V supply for the print head and an 8-cell nickel-cadmium battery supplying −8V to −11.6V for the rest of the electronics. The 8-segment drive transistors require LV_{CER}'s of 33V min, β of > 100 at I_C = 500 mA, and $V_{SAT} \leq 1.0V$ at 800 mA with 15 mA drive.

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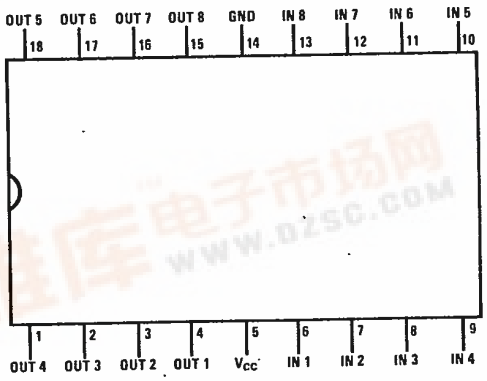
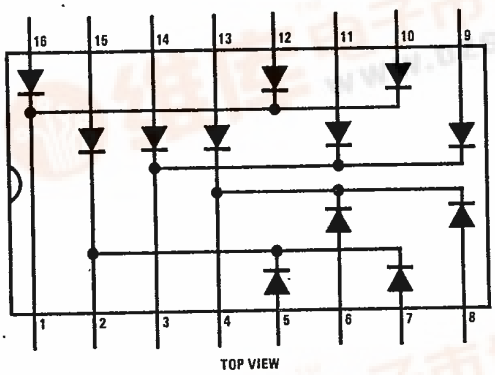
Connection Diagrams

Dual-In-Line Package



Order Number DS8654N
See NS Package N18A

Dual-In-Line Package



Order Number DS8656N
See NS Package N16A

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Absolute Maximum Ratings DS8654 (Note 1)

Supply Voltage	36V
Input Voltage	36V
Output Voltage	V_{CC} − 36V
Storage Temperature Range	−65°C to +150°C
Maximum Power Dissipation at 25°C	
Molded Package (DS8654)*	1563 mW
Molded Package (DS8656)†	1280 mW
Lead Temperature (Soldering, 10 seconds)	300°C

*Derate molded package 12.5 mW/°C above 25°C.
†Derate molded package 10.24 mW/°C above 25°C.

Operating Conditions DS8654

	MIN	MAX	UNITS
Supply Voltage (V_{CC})	4.5	33	V
Temperature (T_A)	0	+70	°C

T-52-13-05

Electrical Characteristics DS8654 (Notes 2 and 3)

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
I_{IH}	Logical "1" Input Current	V_{CC} = Max, V_{IN} = 6.5V		390	500	μA
I_{IL}	Logical "0" Input Current	V_{CC} = Max, V_{IN} = 0.4V		13	40	μA
I_{OFF}	"Off" State Leakage Current	V_{OUT} = V_{CC} − 33V		0.01	−100	μA
V_{ON}	"On" State Output Voltage	V_{CC} = Max, I_{IN} = 500μA, I_{OH} = −50 mA		V_{CC}−1.8	V_{CC}−2.5	V
$I_{CC(OFF)}$	Supply Current	V_{CC} = Max, V_{IN} = V_{OUT} = Gnd		0.01	1.0	mA
$I_{CC(ON)}$	Supply Current (All Outputs "ON")	V_{CC} = Max, V_{IN} = 6.5V, I_{OUT} = 0 mA		7.5	10	mA

Note 1: "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

Note 2: Unless otherwise specified min/max limits apply across the 0°C to +70°C range for the DS8654. All typicals are given for V_{CC} = 30V and T_A = 25°C.

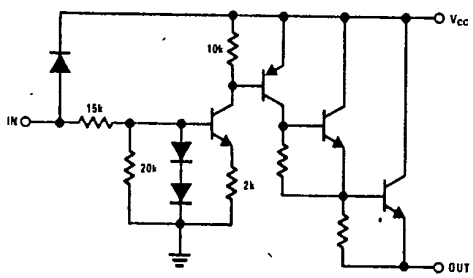
Note 3: All currents into device pins shown as positive, out of device pins as negative, all voltages referenced to ground unless otherwise noted. All values shown as max or min on absolute value basis.

Electrical Characteristics DS8656 (T_A = 0°C to +70°C)

PARAMETER		CONDITIONS	MIN	TYP	MAX	UNITS
V_R	Peak Inverse Voltage	I_R = 0.1 mA	35			V
V_F	Forward Voltage	I_F = 50 mA			1.5	V
t_r	Reverse Recov. Time	I_F = 50 mA to I_R = 0.1 mA at V_R = 30V			1.0	μs

Schematic Diagram

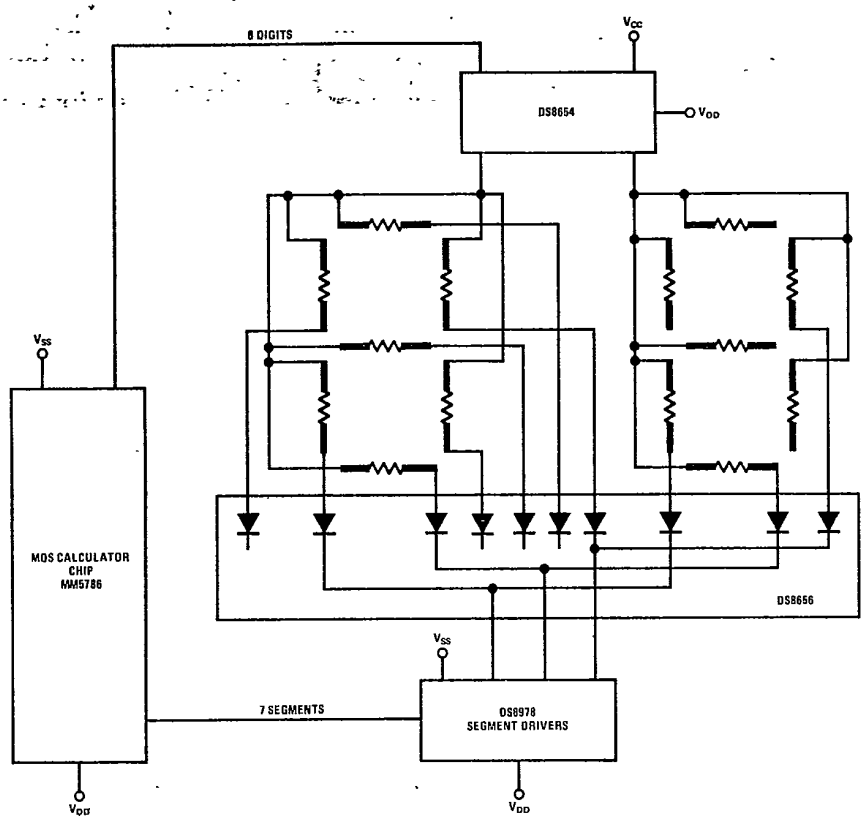
DS8654



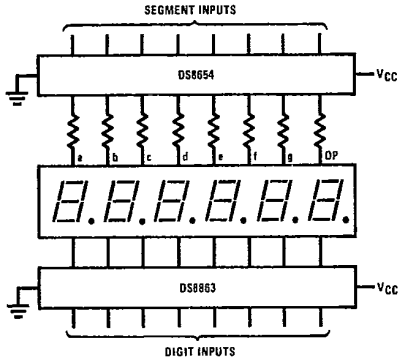
Typical Applications

T-51-15

Thermal Printer



LED Display—0 mA to 50 mA Peak Segment Current



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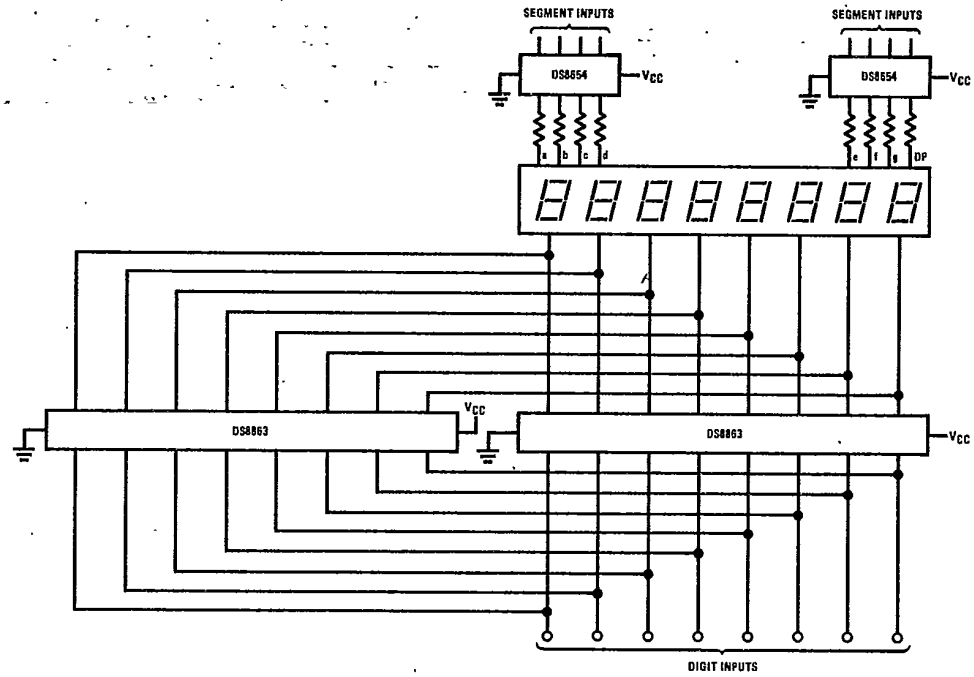
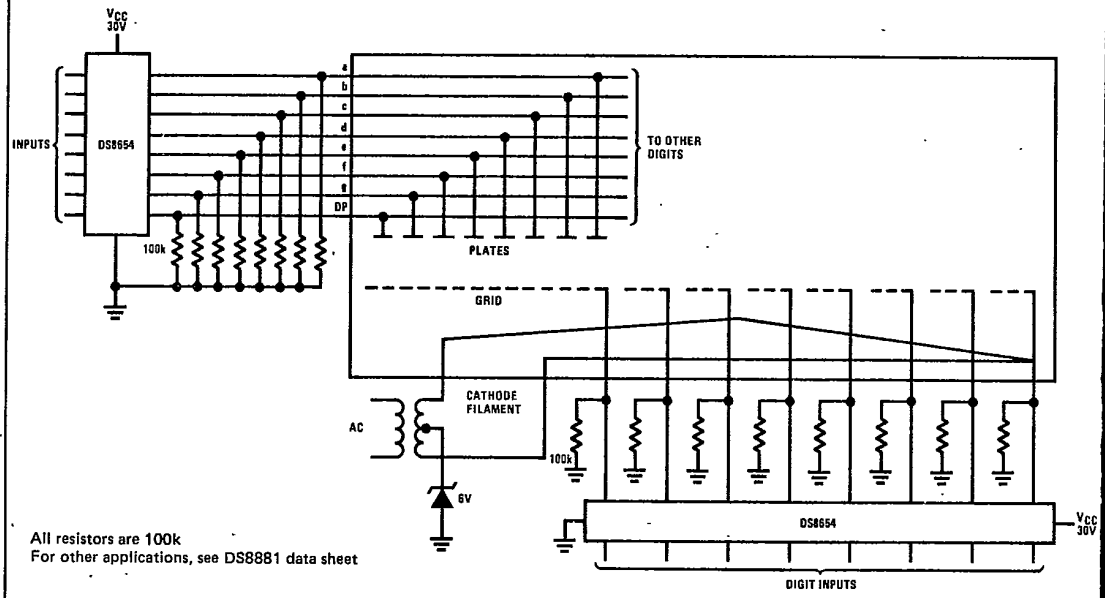
Typical Applications (Continued)

LED Display—50 mA to 100 mA Peak Segment Current



VF Display



All resistors are 100k
For other applications, see DS8881 data sheet

Physical Dimensions

A

T-90-20

PACKAGES

Dual-In-Line Packages

(N) Devices ordered with "N" suffix are supplied in plastic molded dual-in-line packages. Molding material is a highly reliable compound suitable for military as well as commercial temperature range applications. Lead material is copper or alloy 42 with a hot solder dipped surface to allow ease of solderability.

(J) Devices ordered with the "J" suffix are supplied in a CERDIP package (ceramic lid and base sealed with high temperature vitreous glass). Lead material is solder dipped alloy 42.

(D) Devices ordered with the "D" suffix are supplied in side brazed, multi-layer, ceramic dual-in-line packages. The leads are Kovar or alloy 42 and either tin-plated, gold-plated, or solder-plated.

(Q) Devices ordered with the "Q" suffix are supplied in either a "D" or "J" package, but with a UV window.

Metal Can Packages

(H) Devices ordered with the "H" suffix are supplied in a metal can package. The cap is nickel finish and the leads are gold-plated Kovar. Gold free construction using epoxy D/A is also available, with a tin-plated finish.

Flat Packages

(F) Devices ordered with the "F" suffix are supplied in a multi-layer, ceramic bottom brazed flat package. The lid is plated alloy 42, and leads are gold-plated, tin-plated, or solder-plated alloy 42 or Kovar.

(W) Devices ordered with the "W" suffix are supplied in a low-temperature ceramic flat package.