Integrated Circuits

ULN2801A/LW THROUGH ULN2825A/LW

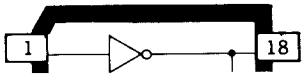
Data Sheet 29304.3B

IECQ MFG. APPROVAL

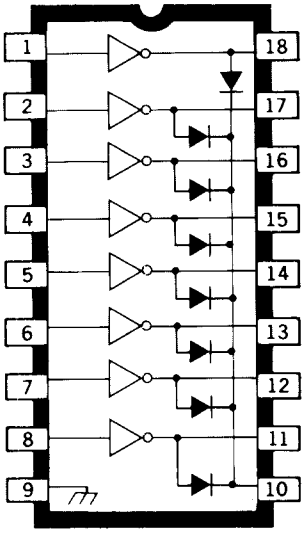
DESC LINE CERTIFICATION

HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAYS

ULN2800LW



ULN2800A



Dwg. No. A-10, 322A

ABSOLUTE MAXIMUM RATINGS

Output Voltage, V_{CE}
- (ULN280X*, ULN281XA) . . . . . **50 V**
- (ULN282X*) . . . . . **95 V**

Input Voltage, V_{IN}
- (ULN28X2, X3, X4*) . . . . . **30 V**
- (ULN28X5*) . . . . . **15 V**

Continuous Output Current, I_C
- (ULN280X*, ULN282X*) . . . . . **500 mA**
- (ULN281XA) . . . . . **600 mA**

Continuous Input Current, I_{IN} . . . . . **25 mA**

Power Dissipation, P_D
- (one Darlington pair) . . . . . **1.0 W**
- (total package) . . . . . **See Graph**

Operating Temperature
- Range, T_A . . . . . **–20°C to +85°C**

Storage Temperature
- Range, T_S . . . . . **–55°C to +150°C**

Note that the Series ULN2800A (dual in-line package) and Series ULN2800LW (small outline IC package) are electrically identical and share a common pin number assignment.

Featuring continuous load current ratings to 600 mA for each of the eight drivers, the Series ULN2800A/LW high-voltage, high-current Darlington arrays are ideally suited for interfacing between low-level logic circuitry and multiple peripheral power loads. Typical power loads totaling over 300 W (400 mA x 8, 95 V) can be controlled at an appropriate duty cycle depending on ambient temperature and number of drivers turned ON simultaneously. Typical loads include relays, solenoids, stepping motors, multiplexed LED and incandescent displays, and heaters. All devices feature open collector outputs with integral clamp diodes.

The Series ULN28x1A/LW devices are general-purpose arrays which may be used with external input current limiting, or with most PMOS or CMOS logic directly.

The Series ULN28x2A/LW is intended for use with 14 to 25 V PMOS logic. Each input has a series Zener diode and current limiting resistor. The Zener diode also provides excellent noise immunity for these devices.

The Series ULN28x3A/LW has series input resistors selected for operation directly with 5 V TTL or CMOS. These devices will handle numerous interface needs — particularly those beyond the capabilities of standard logic buffers.

The Series ULN28x4A/LW features series input resistors for operation directly from 6 to 15 V CMOS or PMOS logic outputs.

The Series ULN28x5A/LW is designed for use with standard and Schottky TTL where higher output currents are required and loading of the logic output is not a concern. These devices will sink a minimum of 350 mA when driven from a TTL "totem pole" logic output.

The Series ULN280xA/LW is the standard Darlington array. The outputs are capabile of sinking 500 mA and will withstand at least 50 V in the OFF state. Outputs may be paralleled for higher load current capability. The Series ULN281xA devices are similar except that they will sink 600 mA. The Series ULN282xA/LW will withstand 95 V in the OFF state.

These Darlington arrays are furnished in 18-pin dual in-line plastic packages (suffix A) and 18-lead surface-mountable wide-body SOICs (suffix LW). All devices are pinned with outputs opposite inputs to facilitate ease of circuit board layout.

FEATURES

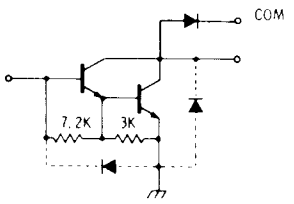
- TTL, DTL, PMOS, or CMOS Compatible Inputs
- Output Current to 600 mA
- Output Voltage to 95V
- Transient-Protected Outputs
- Dual In-Line Plastic Package or Small-Outline IC Package

x = digit to identify specific device. Characteristic shown applies to family of devices with remaining digits as shown.

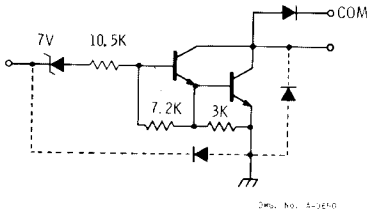
ULN2801A/LW through ULN2825A/LW
HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAYS

PARTIAL SCHEMATICS

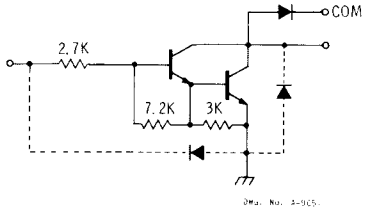
ULN28X1* (Each Driver)



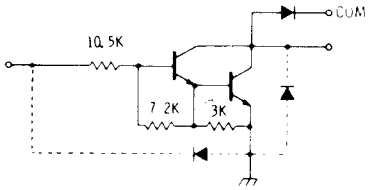
ULN28X2* (Each Driver)



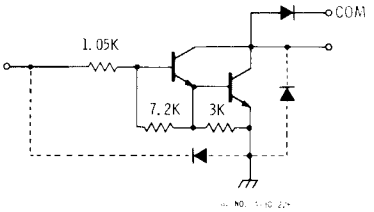
ULN28X3* (Each Driver)



ULN28X4* (Each Driver)



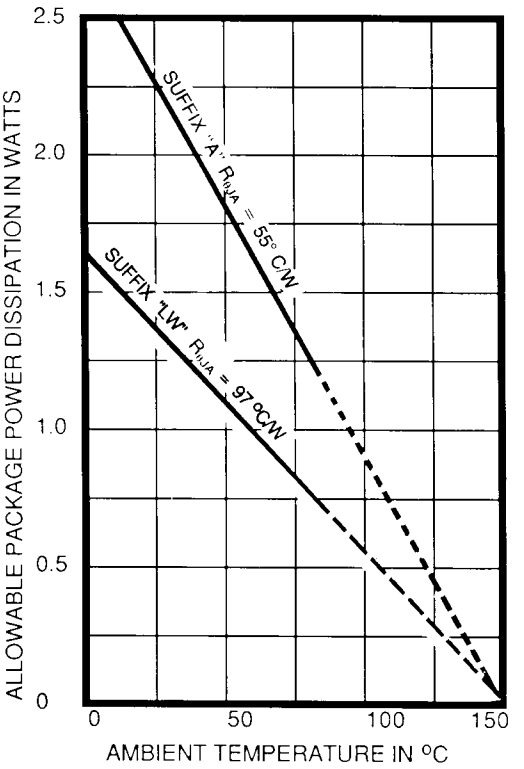
ULN28X5* (Each Driver)



Device Number Designation

$V_{CE(MAX)}$	50V	50V	95V
$I_{C(MAX)}$	500 mA	600 mA	500 mA
Logic	Part Number		
General Purpose PMOS, CMOS	ULN2801*	ULN2811A	ULN2821*
14-25 V PMOS	ULN2802*	ULN2812A	ULN2822*
5 V TTL, CMOS	ULN2803*	ULN2813A	ULN2823*
6-15 V CMOS, PMOS	ULN2804*	ULN2814A	ULN2824*
High-Output TTL	ULN2805*	ULN2815A	ULN2825*

ALLOWABLE AVERAGE PACKAGE POWER DISSIPATION



*Complete part number includes a final letter to indicate package (A = DIP, LW = Wide-Body SOIC)

X = Digit to identify specific device. Specification shown applies to family of devices with remaining digits as shown.

SPRAGUE
115 Northeast Cutoff, Box 15036
Worcester, Massachusetts 01615-0036 (508) 853-5000

TEST FIGURES

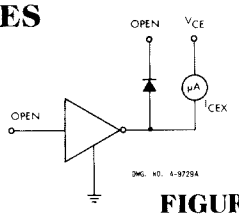


FIGURE 1A

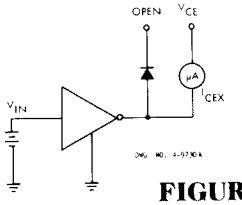


FIGURE 1B

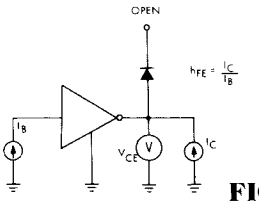


FIGURE 2

SERIES ULN2800A/LW
ELECTRICAL CHARACTERISTICS AT 25°C (unless otherwise noted)

Characteristic	Symbol	Test Fig.	Applicable Devices	Test Conditions	Limits Min.	Typ.	Max.	Units
Output Leakage Current	I_{CEX}	1A	All	V_{CE} = 50 V, T_A = 25°C	—	—	50	µA
				V_{CE} = 50 V, T_A = 70°C	—	—	100	µA
		1B	ULN2802*	V_{CE} = 50 V, T_A = 70°C, V_{IN} = 6.0 V	—	—	500	µA
			ULN2804*	V_{CE} = 50 V, T_A = 70°C, V_{IN} = 1.0 V	—	—	500	µA
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	2	All	I_C = 100 mA, I_B = 250 µA	—	0.9	1.1	V
				I_C = 200 mA, I_B = 350 µA	—	1.1	1.3	V
				I_C = 350 mA, I_B = 500 µA	—	1.3	1.6	V
Input Current	$I_{IN(ON)}$	3	ULN2802*	V_{IN} = 17 V	—	0.82	1.25	mA
			ULN2803*	V_{IN} = 3.85 V	—	0.93	1.35	mA
			ULN2804*	V_{IN} = 5.0 V	—	0.35	0.5	mA
				V_{IN} = 12 V	—	1.0	1.45	mA
			ULN2805*	V_{IN} = 3.0 V	—	1.5	2.4	mA
	$I_{IN(OFF)}$	4	All	I_C = 500 µA, T_A = 70° C	50	65	—	µA
Input Voltage	$V_{IN(ON)}$	5	ULN2802*	V_{CE} = 2.0 V, I_C = 300 mA	—	—	13	V
			ULN2803*	V_{CE} = 2.0 V, I_C = 200 mA	—	—	2.4	V
				V_{CE} = 2.0 V, I_C = 250 mA	—	—	2.7	V
				V_{CE} = 2.0 V, I_C = 300 mA	—	—	3.0	V
			ULN2804*	V_{CE} = 2.0 V, I_C = 125 mA	—	—	5.0	V
				V_{CE} = 2.0 V, I_C = 200 mA	—	—	6.0	V
				V_{CE} = 2.0 V, I_C = 275 mA	—	—	7.0	V
				V_{CE} = 2.0 V, I_C = 350 mA	—	—	8.0	V
			ULN2805*	V_{CE} = 2.0 V, I_C = 350 mA	—	—	2.4	V
D-C Forward Current Transfer Ratio	h_{FE}	2	ULN2801*	V_{CE} = 2.0 V, I_C = 350 mA	1000	—	—	
Input Capacitance	C_{IN}	—	All		—	15	25	pF
Turn-On Delay	t_{ON}	8	All	0.5 E_{in} to 0.5 E_{out}	—	0.25	1.0	µs
Turn-Off Delay	t_{OFF}	8	All	0.5 E_{in} to 0.5 E_{out}	—	0.25	1.0	µs
Clamp Diode Leakage Current	I_R	6	All	V_R = 50 V, T_A = 25° C	—	—	50	µA
				V_R = 50 V, T_A = 70° C	—	—	100	µA
Clamp Diode Forward Voltage	V_F	7	All	I_F = 350 mA	—	1.7	2.0	V

*Complete part number includes suffix to identify package style: A = DIP, LW = Wide-Body SOIC.

TEST FIGURES

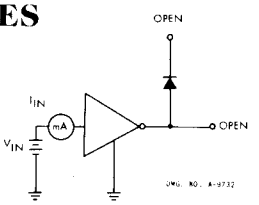


FIGURE 3

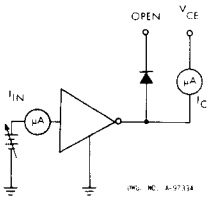


FIGURE 4

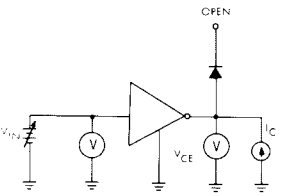


FIGURE 5

SERIES ULN2810A
ELECTRICAL CHARACTERISTICS AT 25°C (unless otherwise noted)

Characteristic	Symbol	Test Fig.	Applicable Devices	Test Conditions	Limits Min.	Typ.	Max.	Units
Output Leakage Current	I_{CEX}	1A	All	V_{CE} = 50 V, T_A = 25°C	—	—	50	μA
				V_{CE} = 50 V, T_A = 70°C	—	—	100	μA
		1B	ULN2812A	V_{CE} = 50 V, T_A = 70°C, V_{IN} = 6.0 V	—	—	500	μA
			ULN2814A	V_{CE} = 50 V, T_A = 70°C, V_{IN} = 1.0 V	—	—	500	μA
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	2	All	I_C = 200 mA, I_B = 350 μA	—	1.1	1.3	V
				I_C = 350 mA, I_B = 500 μA	—	1.3	1.6	V
				I_C = 500 mA, I_B = 600 μA	—	1.7	1.9	V
Input Current	$I_{IN(ON)}$	3	ULN2812A	V_{IN} = 17 V	—	0.82	1.25	mA
			ULN2813A	V_{IN} = 3.85 V	—	0.93	1.35	mA
			ULN2814A	V_{IN} = 5.0 V	—	0.35	0.5	mA
				V_{IN} = 12 V	—	1.0	1.45	mA
			ULN2815A	V_{IN} = 3.0 V	—	1.5	2.4	mA
	$I_{IN(OFF)}$	4	All	I_C = 500 μA, T_A = 70° C	50	65	—	μA
Input Voltage	$V_{IN(ON)}$	5	ULN2812A	V_{CE} = 2.0 V, I_C = 500 mA	—	—	17	V
			ULN2813A	V_{CE} = 2.0 V, I_C = 250 mA	—	—	2.7	V
				V_{CE} = 2.0 V, I_C = 300 mA	—	—	3.0	V
				V_{CE} = 2.0 V, I_C = 500 mA	—	—	3.5	V
			ULN2814A	V_{CE} = 2.0 V, I_C = 275 mA	—	—	7.0	V
				V_{CE} = 2.0 V, I_C = 350 mA	—	—	8.0	V
				V_{CE} = 2.0 V, I_C = 500 mA	—	—	9.5	V
			ULN2815A	V_{CE} = 2.0 V, I_C = 500 mA	—	—	2.6	V
D-C Forward Current Transfer Ratio	h_{FE}	2	ULN2811A	V_{CE} = 2.0 V, I_C = 350 mA	1000	—	—	
				V_{CE} = 2.0 V, I_C = 500 mA	900	—	—	
Input Capacitance	C_{IN}	—	All		—	15	25	pF
Turn-On Delay	t_{ON}	8	All	0.5 E_{in} to 0.5 E_{out}	—	0.25	1.0	μs
Turn-Off Delay	t_{OFF}	8	All	0.5 E_{in} to 0.5 E_{out}	—	0.25	1.0	μs
Clamp Diode Leakage Current	I_R	6	All	V_R = 50 V, T_A = 25° C	—	—	50	μA
				V_R = 50 V, T_A = 70° C	—	—	100	μA
Clamp Diode Forward Voltage	V_F	7	All	I_F = 350 mA	—	1.7	2.0	V
				I_F = 500 mA	—	2.1	2.5	V

TEST FIGURES

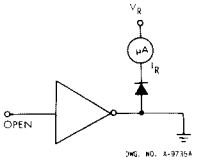


FIGURE 6

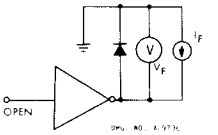
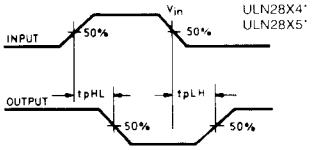
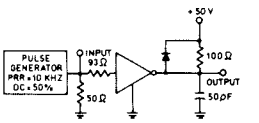


FIGURE 7

FIGURE 8



	V_{in}
ULN28X1*	3.5V
ULN28X2*	13V
ULN28X3*	3.5V
ULN28X4*	12V
ULN28X5*	3.5V



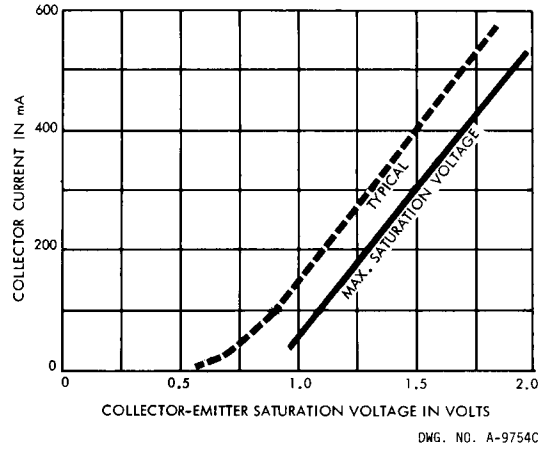
Complete part number includes a final letter to indicate package.
X Digit to identify specific device. Specification shown applies to family of devices with remaining digits as shown.

SERIES ULN2820A/LW
ELECTRICAL CHARACTERISTICS AT 25°C (unless otherwise noted)

Characteristic	Symbol	Test Fig.	Applicable Devices	Test Conditions	Limits Min.	Typ.	Max.	Units
Output Leakage Current	I_{CEX}	1A	All	V_{CE} = 95 V, T_A = 25°C	—	—	50	μA
				V_{CE} = 95 V, T_A = 70°C	—	—	100	μA
		1B	ULN2822*	V_{CE} = 95 V, T_A = 70°C, V_{IN} = 6.0 V	—	—	500	μA
			ULN2824*	V_{CE} = 95 V, T_A = 70°C, V_{IN} = 1.0 V	—	—	500	μA
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	2	All	I_C = 100 mA, I_B = 250 μA	—	0.9	1.1	V
				I_C = 200 mA, I_B = 350 μA	—	1.1	1.3	V
				I_C = 350 mA, I_B = 500 μA	—	1.3	1.6	V
Input Current	$I_{IN(ON)}$	3	ULN2822*	V_{IN} = 17 V	—	0.82	1.25	mA
			ULN2823*	V_{IN} = 3.85 V	—	0.93	1.35	mA
			ULN2824*	V_{IN} = 5.0 V	—	0.35	0.5	mA
				V_{IN} = 12 V	—	1.0	1.45	mA
			ULN2825*	V_{IN} = 3.0 V	—	1.5	2.4	mA
	$I_{IN(OFF)}$	4	All	I_C = 500 μA, T_A = 70° C	50	65	—	μA
Input Voltage	$V_{IN(ON)}$	5	ULN2822*	V_{CE} = 2.0 V, I_C = 300 mA	—	—	13	V
			ULN2823*	V_{CE} = 2.0 V, I_C = 200 mA	—	—	2.4	V
				V_{CE} = 2.0 V, I_C = 250 mA	—	—	2.7	V
				V_{CE} = 2.0 V, I_C = 300 mA	—	—	3.0	V
			ULN2824*	V_{CE} = 2.0 V, I_C = 125 mA	—	—	5.0	V
				V_{CE} = 2.0 V, I_C = 200 mA	—	—	6.0	V
				V_{CE} = 2.0 V, I_C = 275 mA	—	—	7.0	V
				V_{CE} = 2.0 V, I_C = 350 mA	—	—	8.0	V
			ULN2825*	V_{CE} = 2.0 V, I_C = 350 mA	—	—	2.4	V
D-C Forward Current Transfer Ratio	h_{FE}	2	ULN2821*	V_{CE} = 2.0 V, I_C = 350 mA	1000	—	—	
Input Capacitance	C_{IN}	—	All		—	15	25	pF
Turn-On Delay	t_{ON}	8	All	0.5 E_{in} to 0.5 E_{out}	—	0.25	1.0	μs
Turn-Off Delay	t_{OFF}	8	All	0.5 E_{in} to 0.5 E_{out}	—	0.25	1.0	μs
Clamp Diode Leakage Current	I_R	6	All	V_R = 95 V, T_A = 25° C	—	—	50	μA
				V_R = 95 V, T_A = 70° C	—	—	100	μA
Clamp Diode Forward Voltage	V_F	7	All	I_F = 350 mA	—	1.7	2.0	V

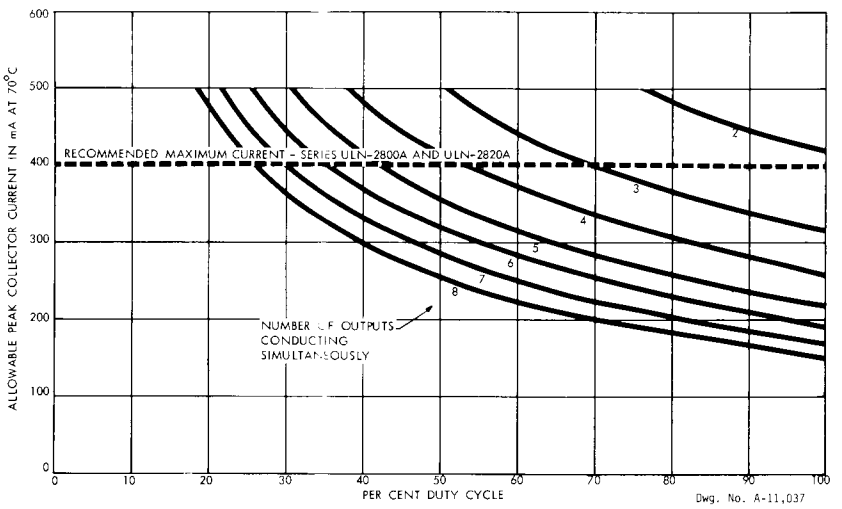
*Complete part number includes suffix to identify package style: A = DIP, LW = Wide-Body SOIC.

COLLECTOR CURRENT AS A FUNCTION OF SATURATION VOLTAGE



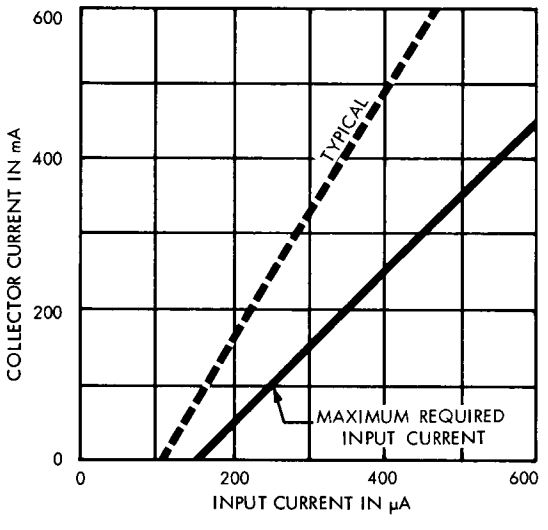
DWG. NO. A-9754C

PEAK COLLECTOR CURRENT AS A FUNCTION OF DUTY CYCLE (Dual In-line Packaged Devices)

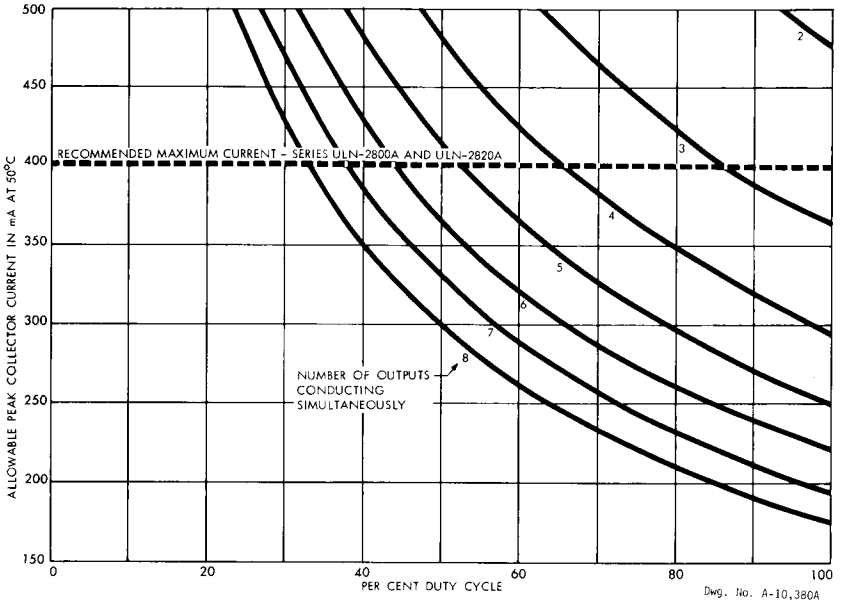


Dwg. No. A-11,037

COLLECTOR CURRENT AS A FUNCTION OF INPUT CURRENT



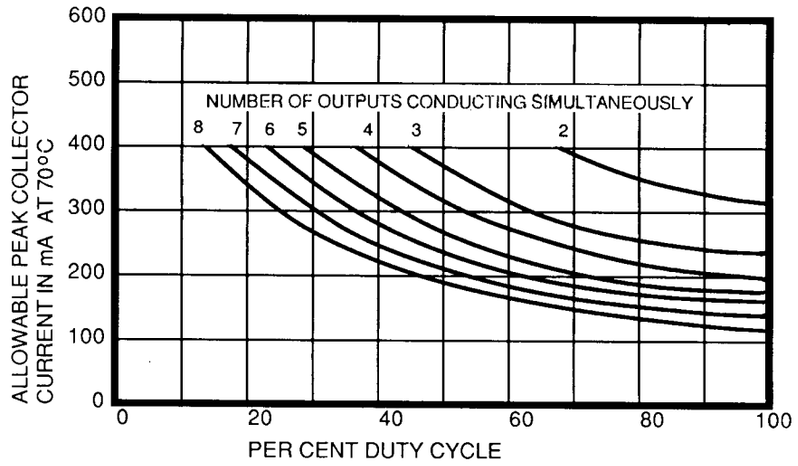
DWG. NO. A-10,872B

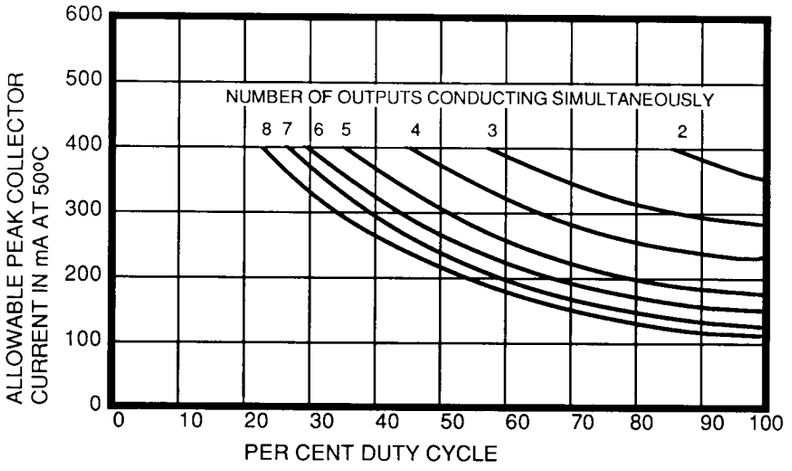


Dwg. No. A-10,380A

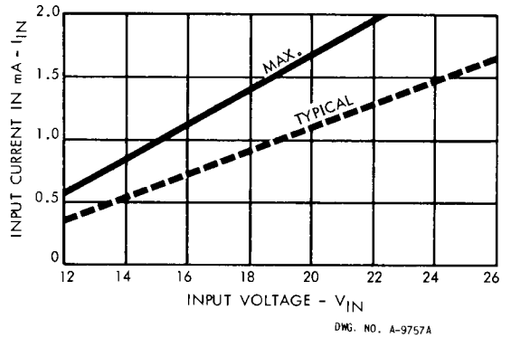
SPRAGUE
115 Northeast Cutoff, Box 15036
Worcester, Massachusetts 01615-0036 (508) 853-5000

PEAK COLLECTOR CURRENT AS A FUNCTION OF DUTY CYCLE (Small Outline Packaged Devices)

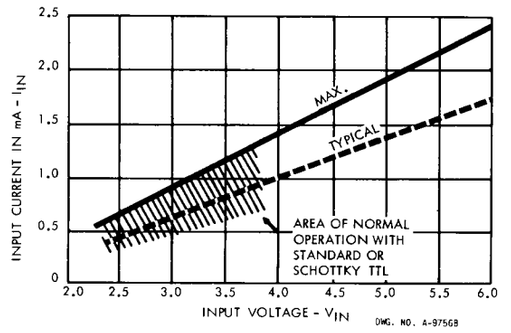




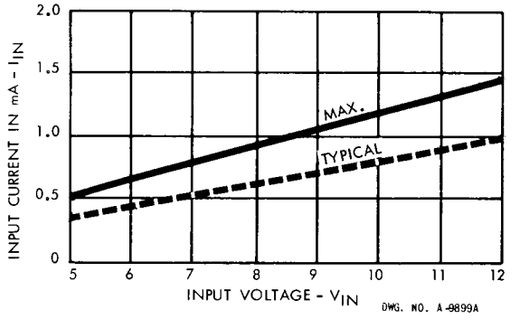
INPUT CURRENT AS A FUNCTION OF INPUT VOLTAGE



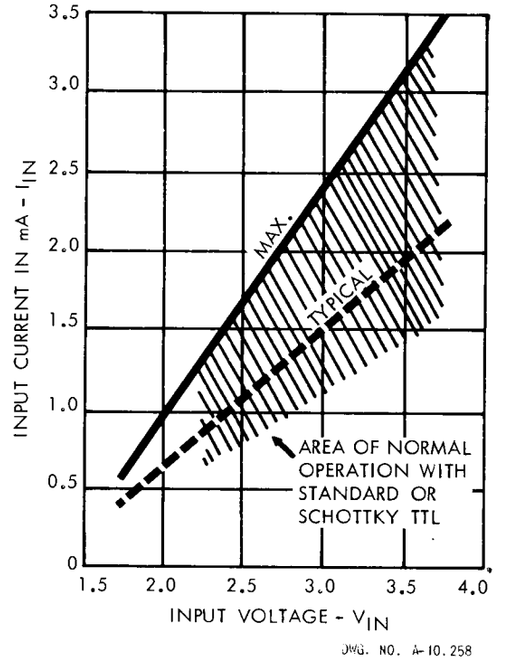
SERIES ULN2802A/LW



SERIES ULN2803A/LW



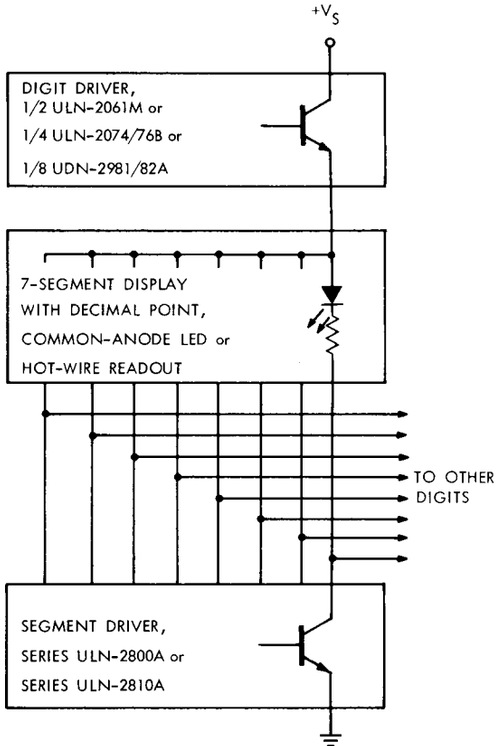
SERIES ULN2804A/LW



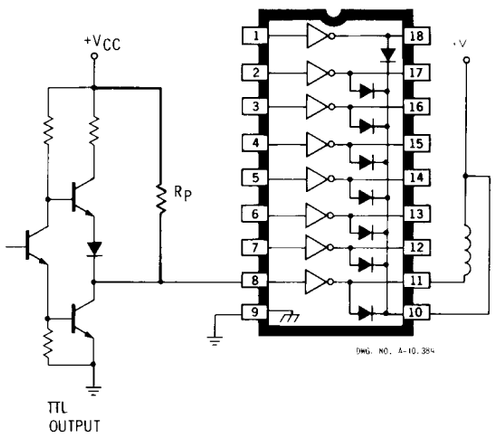
SERIES ULN2805A/LW

ULN2801A/LW through ULN2825A/LW
HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAYS

TYPICAL DISPLAY INTERFACE

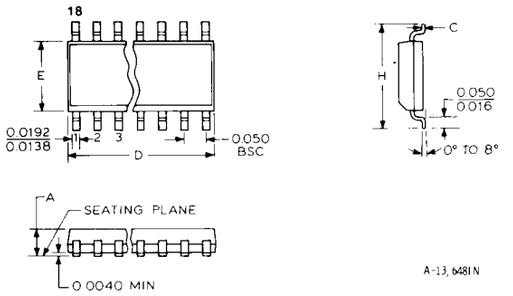


ULN2813A



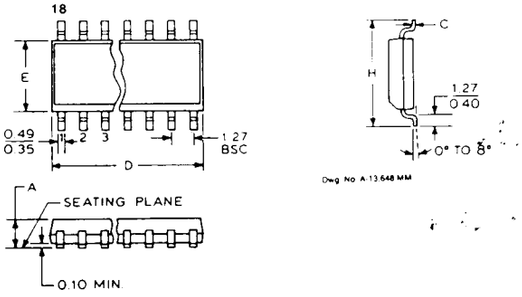
PLASTIC SOIC

DIMENSIONS IN INCHES
(BASED ON 1 mm = 0.03937″)



A	Seated Height	0.0926/0.1043
C	Lead Thickness	0.0091/0.0125
D	Body Length	0.4469/0.4625
E	Body Width	0.2914/0.2992
H	Overall Width	0.394/0.419

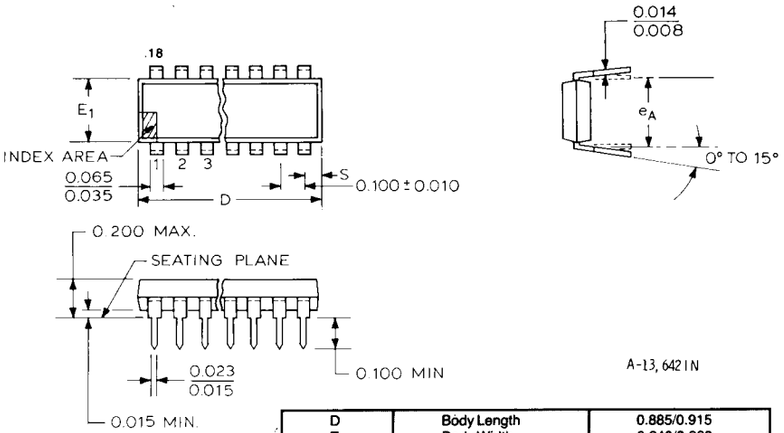
DIMENSIONS IN MILLIMETERS



A	Seated Height	2.35/2.65
C	Lead Thickness	0.23/0.32
D	Body Length	11.35/11.75
E	Body Width	7.40/7.60
H	Overall Width	10.0/10.65

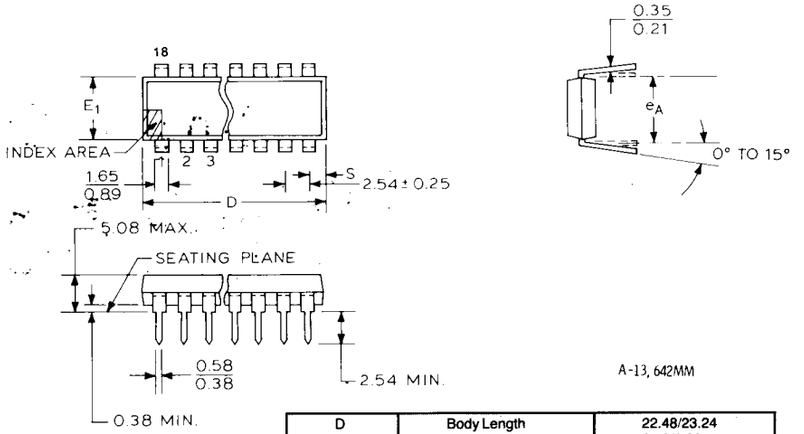
PLASTIC DIP

DIMENSIONS IN INCHES



D	Body Length	0.885/0.915
E_1	Body Width	0.240/0.260
e_A	Row Spacing	0.300 BSC
S	Lead CL to End	0.050 REF

DIMENSIONS IN MILLIMETERS
(BASED ON 1″ = 25.40 mm)



D	Body Length	22.48/23.24
E_1	Body Width	6.10/6.60
e_A	Row Spacing	7.62 BSC
S	Lead CL to End	1.27 REF

In the construction of the components described, the full intent of the specification will be met. The Sprague Electric Company, however, reserves the right to make, from time to time, such departures from the detail specifications as may be required to permit improvements in the design of its products. Components made under military approvals will be in accordance with the approval requirements.

The information included herein is believed to be accurate and reliable. However, the Sprague Electric Company assumes no responsibility for its use; nor for any infringements of patents or other rights of third parties which may result from its use.

A. Dimensions shown as ___ / ___ are Min./Max.
B. Lead thickness is measured at seating plane or below.
C. Lead spacing tolerance is non-cumulative.
D. Exact body and lead configuration at vendor's option within limits shown.
E. Lead gauge plane is 0.030″ (7.62 mm) max. below seating plane.

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