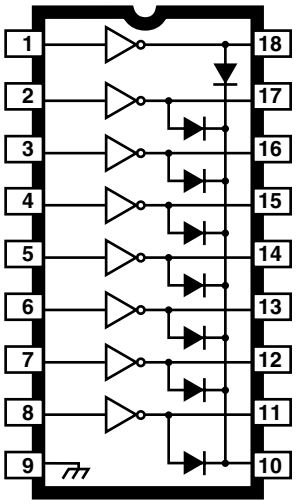
2803 THRU 2824

Data Sheet 29304.3E

HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAYS



Dwg. No. A-10,322A

Note that the ULx28xxA series (dual in-line package) and ULx28xxLW series (small-outline IC package) are electrically identical and share a common terminal number assignment.

ABSOLUTE MAXIMUM RATINGS

Output Voltage, V_{CE}
- (x2803x and x2804x) ..... **50 V**
- (x2823x and x2824x) ..... **95 V**

Input Voltage, V_{IN} ..... **30 V**

Continuous Output Current, I_C .... **500 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
- Prefix 'ULN' ..... **-20°C to + 85°C**
- Prefix 'ULQ' ..... **-40°C to +85°C**

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

Featuring continuous load current ratings to 500 mA for each of the drivers, the Series ULN28xxA/LW and ULQ28xxA/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 260 W (350 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, magnetic print hammers, multiplexed LED and incandescent displays, and heaters. All devices feature open-collector outputs with integral clamp diodes.

The ULx2803A, ULx2803LW, ULx2823A, and ULN2823LW have 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 ULx2804A, ULx2804LW, ULx2824A, and ULN2824LW have series input resistors for operation directly from 6 V to 15 V CMOS or PMOS logic outputs.

The ULx2803A/LW and ULx2804A/LW are the standard Darlington arrays. The outputs are capable 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 ULx2823A/LW and ULx2824A/LW will withstand 95 V in the off state.

These Darlington arrays are furnished in 18-pin dual in-line plastic packages (suffix 'A') or 18-lead small-outline plastic packages (suffix 'LW'). All devices are pinned with outputs opposite inputs to facilitate ease of circuit board layout. Prefix 'ULN' devices are rated for operation over the temperature range of -20°C to +85°C; prefix 'ULQ' devices are rated for operation to -40°C.

FEATURES

- TTL, DTL, PMOS, or CMOS Compatible Inputs
- Output Current to 500 mA
- Output Voltage to 95 V
- Transient-Protected Outputs
- Dual In-Line Package or Wide-Body Small-Outline Package

x = Character to identify specific device. Characteristic shown applies to family of devices with remaining digits as shown. See matrix on next page.

2803 THRU 2824
HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAYS

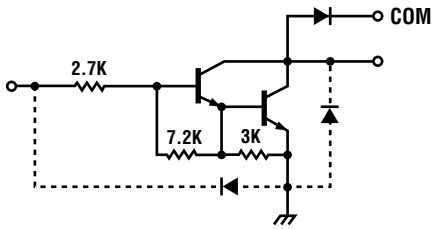
DEVICE PART NUMBER DESIGNATION

$V_{CE(MAX)}$	50 V	95 V
$I_{C(MAX)}$	500 mA	500 mA
Logic	**Part Number**	
5V TTL, CMOS	ULN2803A* ULN2803LW*	ULN2823A* ULN2823LW
6-15 V CMOS, PMOS	ULN2804A* ULN2804LW*	ULN2824A* ULN2824LW

*Also available for operation between -40°C and +85°C. To order, change prefix from 'ULN' to 'ULQ'.

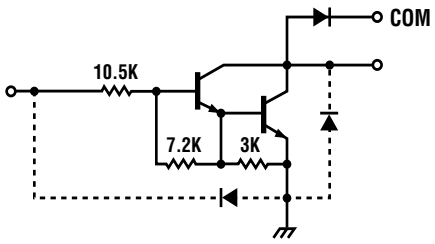
PARTIAL SCHEMATICS

ULx28x3A/LW (Each Driver)

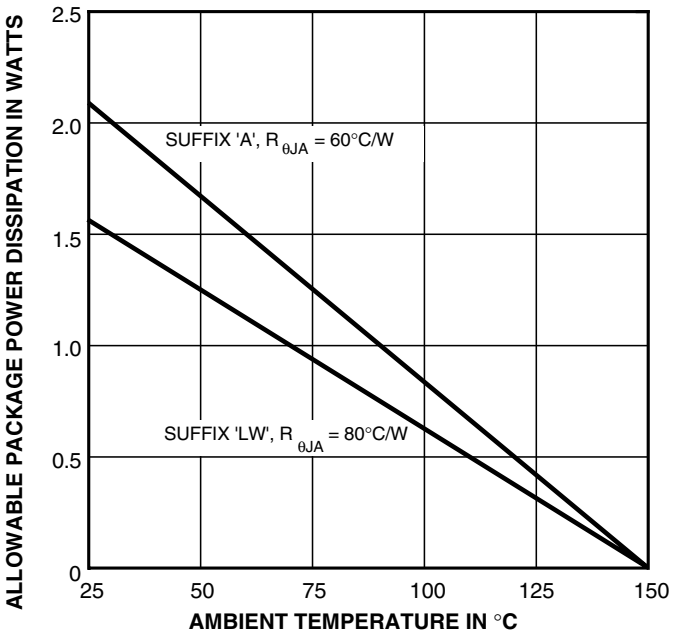


Dwg. No. A-9651

ULx28x4A/LW (Each Driver)



Dwg. No. A-9898A



Dwg. GP-018B

x = Character to identify specific device. Specification shown applies to family of devices with remaining digits as shown. See matrix above.

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Types ULx2803A, ULx2803LW, ULx2804A, and ULx2804LW 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	—	< 1	50	µA
				V_{CE} = 50 V, T_A = 70°C	—	< 1	100	µA
		1B	ULx2804x	V_{CE} = 50 V, T_A = 70°C, V_{IN} = 1.0 V	—	< 5	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	ULx2803x	V_{IN} = 3.85 V	—	0.93	1.35	mA
			ULx2804x	V_{IN} = 5.0 V	—	0.35	0.5	mA
				V_{IN} = 12 V	—	1.0	1.45	mA
	$I_{IN(OFF)}$	4	All	I_C = 500 µA, T_A = 70°C	50	65	—	µA
Input Voltage	$V_{IN(ON)}$	5	ULx2803x	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
			ULx2804x	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
Input Capacitance	C_{IN}	—	All		—	15	25	pF
Turn-On Delay	t_{PLH}	8	All	0.5 E_{IN} to 0.5 E_{OUT}	—	0.25	1.0	µs
Turn-Off Delay	t_{PHL}	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 prefix to operating temperature range: ULN = -20°C to +85°C, ULQ = -40°C to +85°C and a suffix to identify package style: A = DIP, LW = SOIC.

Types ULx2823A, ULN2823LW, ULx2824A, and ULN2824LW ELECTRICAL CHARACTERISTICS at +25°C (unless otherwise noted).

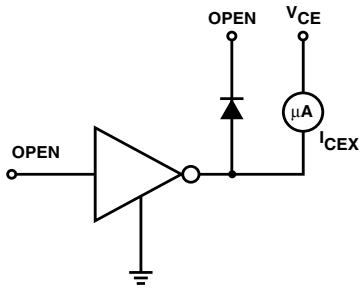
Characteristic	Symbol	Test Fig.	Applicable Devices	Test Conditions	Limits			
					Min.	Typ.	Max.	Units
Output Leakage Current	I_{CEX}	1A	All	V_{CE} = 95 V, T_A = 25°C	—	< 1	50	µA
				V_{CE} = 95 V, T_A = 70°C	—	< 1	100	µA
		1B	ULx2824x	V_{CE} = 95 V, T_A = 70°C, V_{IN} = 1.0 V	—	< 5	500	µA
Collector-Emitter 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	ULx2823x	V_{IN} = 3.85 V	—	0.93	1.35	mA
			ULx2824x	V_{IN} = 5.0 V	—	0.35	0.5	mA
				V_{IN} = 12 V	—	1.0	1.45	mA
	$I_{IN(OFF)}$	4	All	I_C = 500 µA, T_A = 70°C	50	65	—	µA
Input Voltage	$V_{IN(ON)}$	5	ULx2823x	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
			ULx2824x	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
Input Capacitance	C_{IN}	—	All		—	15	25	pF
Turn-On Delay	t_{PLH}	8	All	0.5 E_{IN} to 0.5 E_{OUT}	—	0.25	1.0	µs
Turn-Off Delay	t_{PHL}	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 prefix to operating temperature range: ULN = -20°C to +85°C, ULQ = -40°C to +85°C and a suffix to identify package style: A = DIP, LW = SOIC. Note that the ULQ2823LW and ULQ2824LW are not presently available.

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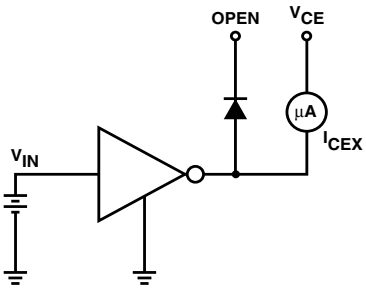
TEST FIGURES

FIGURE 1A



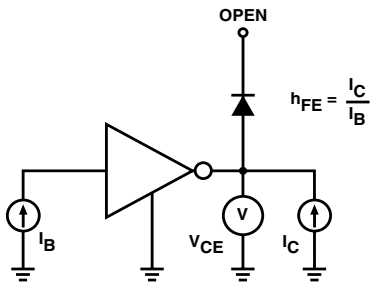
Dwg. No. A-9729A

FIGURE 1B



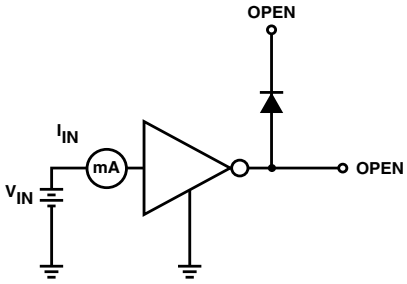
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FIGURE 2



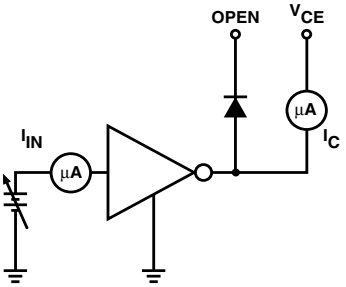
Dwg. No. A-9731A

FIGURE 3



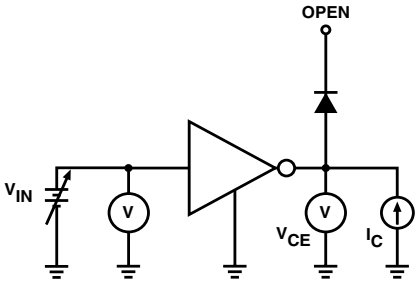
Dwg. No. A-9732A

FIGURE 4



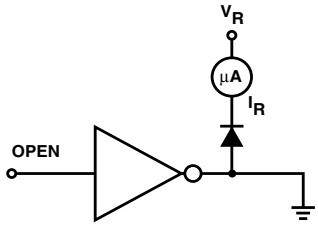
Dwg. No. A-9733A

FIGURE 5



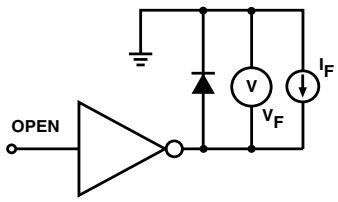
Dwg. No. A-9734A

FIGURE 6



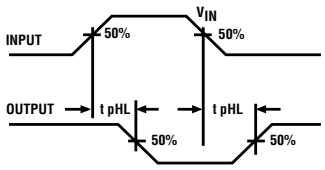
Dwg. No. A-9735A

FIGURE 7

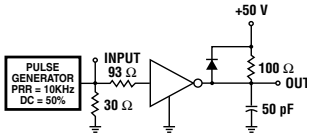


Dwg. No. A-9736A

FIGURE 8

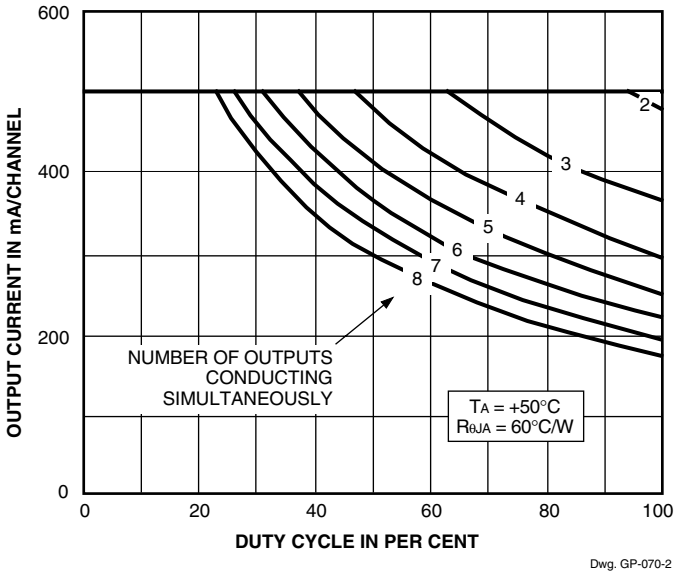


	V_{in}
ULx28x3x	3.5 V
ULx28x4x	12 V



ALLOWABLE COLLECTOR CURRENT AS A FUNCTION OF DUTY CYCLE

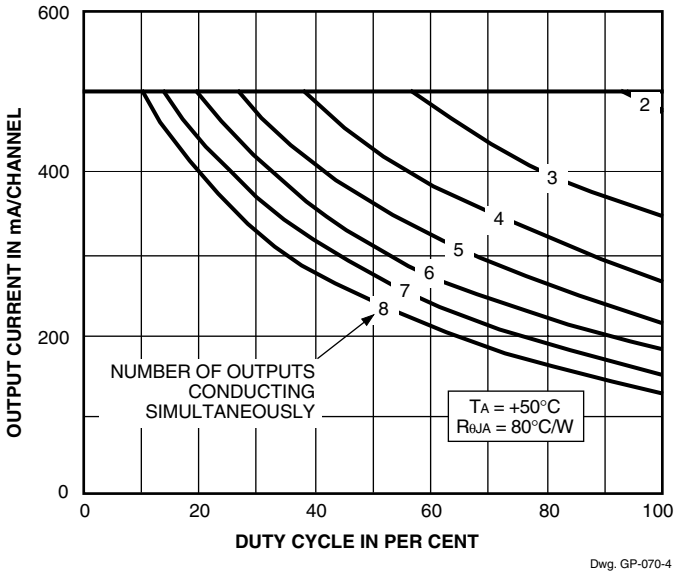
ULx28xxA



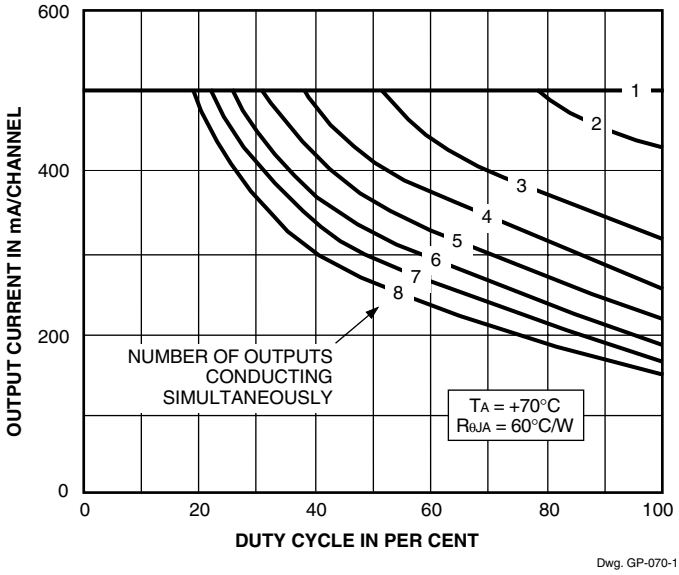
Dwg. GP-070-2

ALLOWABLE COLLECTOR CURRENT AS A FUNCTION OF DUTY CYCLE

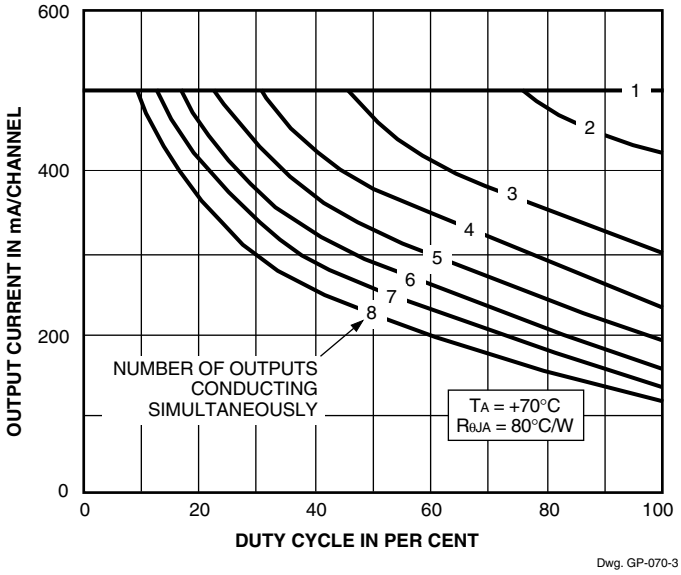
ULx28xxLW



Dwg. GP-070-4



Dwg. GP-070-1



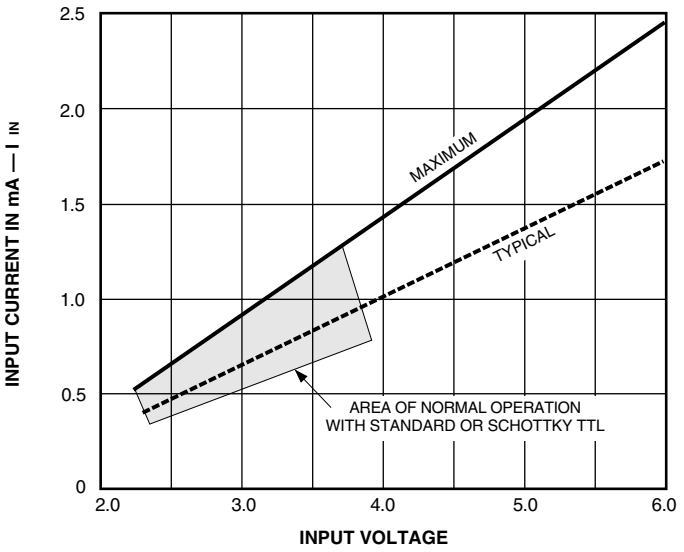
Dwg. GP-070-3

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

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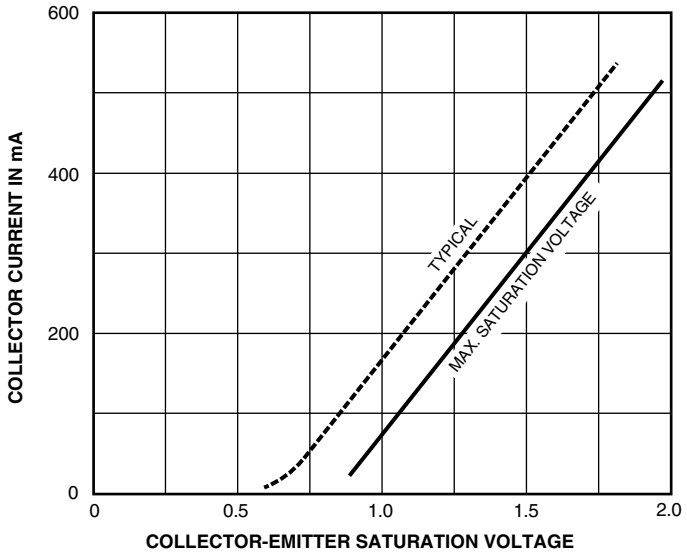
INPUT CURRENT AS A FUNCTION OF INPUT VOLTAGE

ULx28x3x



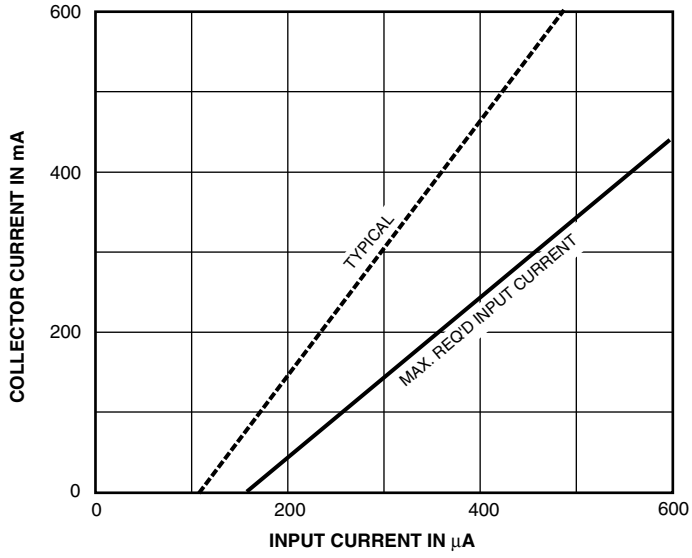
Dwg. GP-069

SATURATION VOLTAGE AS A FUNCTION OF COLLECTOR CURRENT



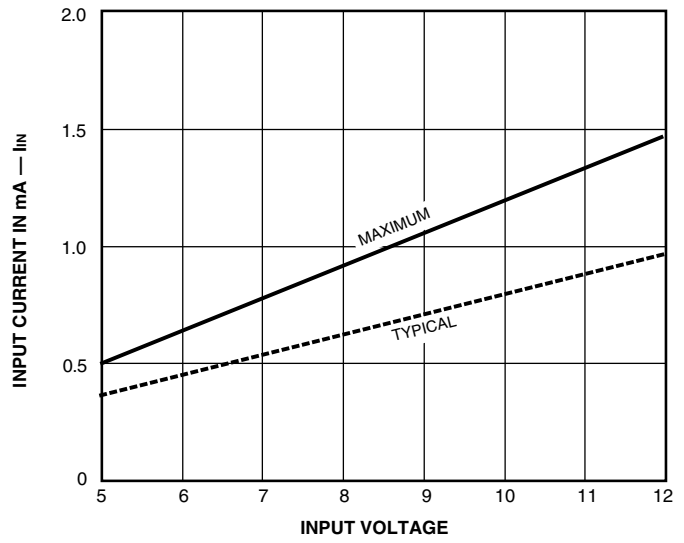
Dwg. GP-067

COLLECTOR CURRENT AS A FUNCTION OF INPUT CURRENT



Dwg. GP-068

ULx28x4x



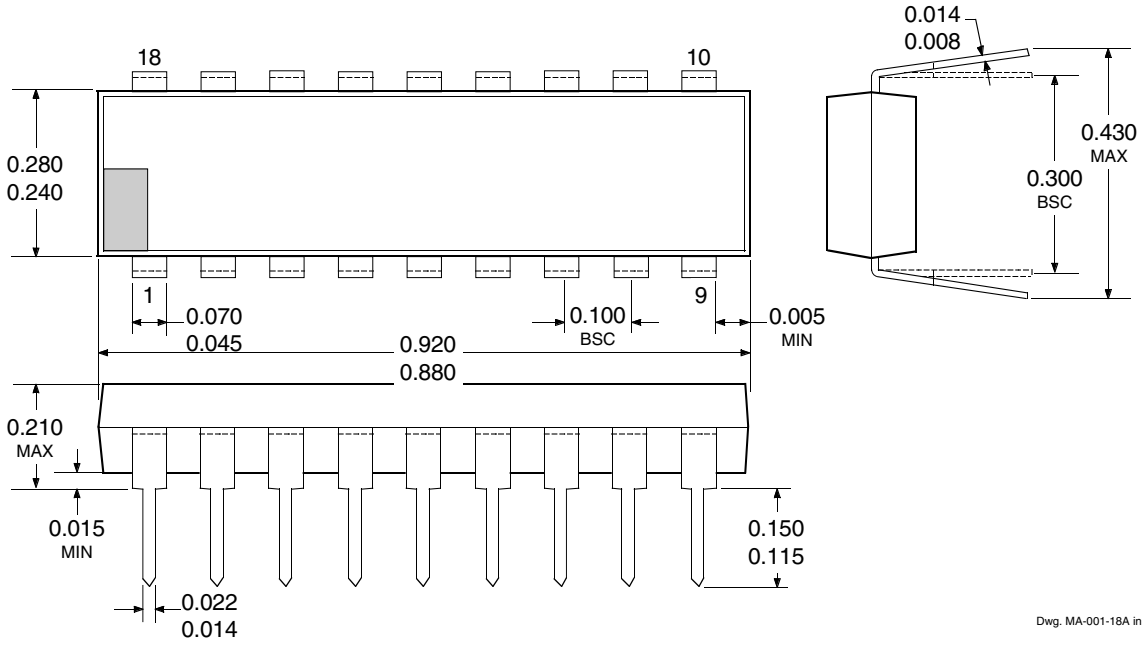
Dwg. GP-069-1

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

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HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAYS

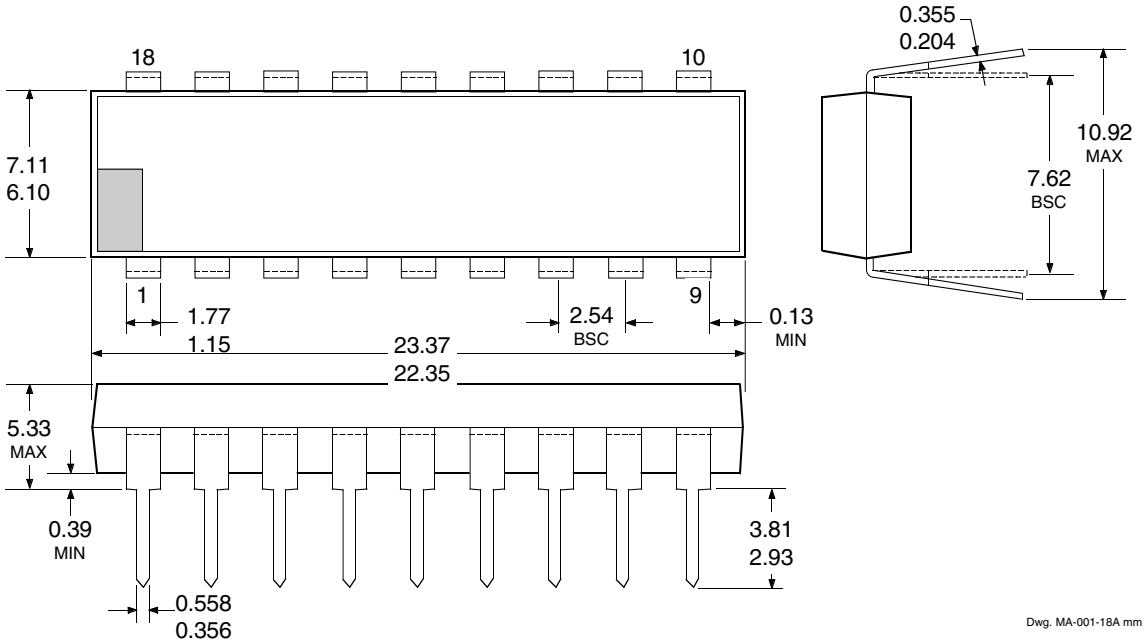
PACKAGE DESIGNATOR "A" DIMENSIONS

Dimensions in Inches
(controlling dimensions)



Dwg. MA-001-18A in

Dimensions in Millimeters
(for reference only)



Dwg. MA-001-18A mm

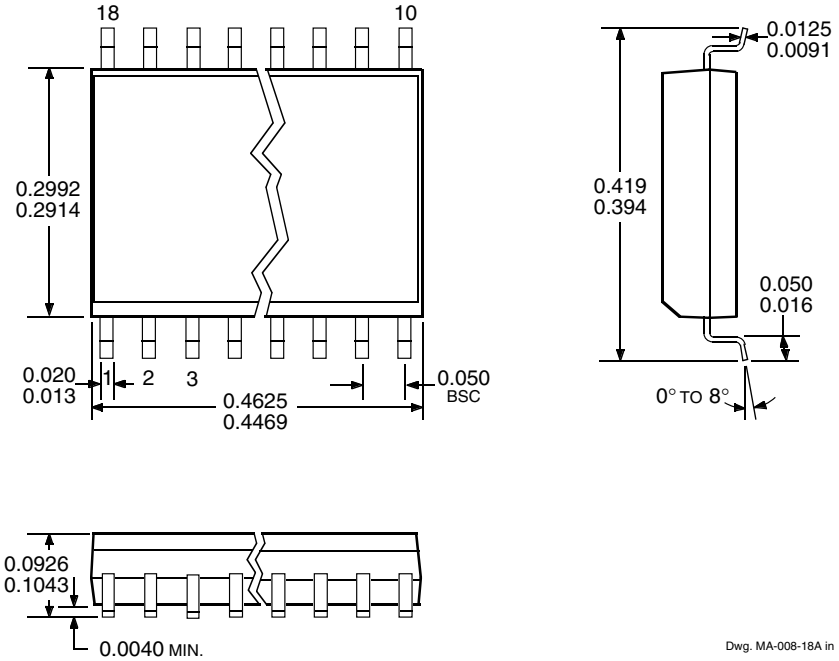
NOTES: 1. Exact body and lead configuration at vendor's option within limits shown.
2. Lead spacing tolerance is non-cumulative.
3. Lead thickness is measured at seating plane or below.

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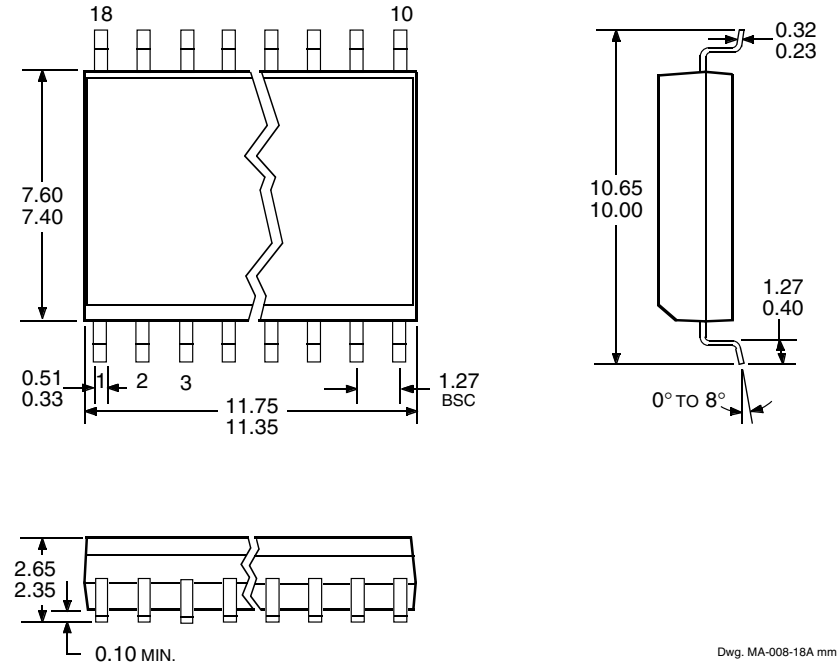
PACKAGE DESIGNATOR "LW" DIMENSIONS

Dimensions in Inches
(for reference only)



Dwg. MA-008-18A in

Dimensions in Millimeters
(controlling dimensions)



Dwg. MA-008-18A mm

NOTES: 1. Exact body and lead configuration at vendor's option within limits shown.
2. Lead spacing tolerance is non-cumulative.

2803 THRU 2824
HIGH-VOLTAGE, HIGH-CURRENT DARLINGTON ARRAYS

The products described here are manufactured under one or more U.S. patents or U.S. patents pending.

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