ULS-2064H THROUGH ULS-2077H
1.25 A QUAD DARLINGTON SWITCHES
MIL-STD-883 Compliant

FEATURES

- TTL, DTL, PMOS, or CMOS Compatible Units
- Transient-Protected Outputs
- Hermetically Sealed Packages
- High-Reliability Screening to MIL-STD-883, Class B

INTENDED FOR MILITARY, aerospace, and related applications, ULS-2064H through ULS-2077H quad Darlington switches interface between low-level logic and a variety of peripheral power loads such as relays, solenoids, dc and stepping motors, multiplexed LED and incandescent displays, heaters, and similar loads of up to 400 watts (1.25 A per output, 80 V, 12.5% duty cycle, +50°C). The devices are specified with a minimum output breakdown of 50 volts (35 volts sustaining at 100 mA) or 80 volts (50 volts sustaining), and a saturated output current specification of 1.25 A.

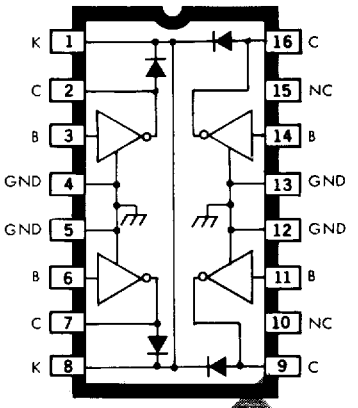
The ULS-2064/65/68/69H switches are designed for use with TTL, DTL, Schottky TTL, and 5 V CMOS logic. The ULS-2066/67/70/77H are intended for use with 6 V to 15 V CMOS and PMOS logic. These devices include integral transient-suppression diodes for use with inductive loads.

Types ULS-2068H and ULS-2069H incorporate a pre-driver stage operating from a low-current, 5 V supply. The pre-driver for the ULS-2070H and ULS-2071H operates from a low-current, 12 V supply. The input drive requirements for these devices are reduced while still allowing the outputs to switch currents up to 1.5 A.

The ULS-2074H through ULS-2077H switches are intended for use in emitter-follower applications. These circuits are identical with the ULS-2064H through ULS-2067H except for the uncommitted emitters and the omission of the suppression diodes.

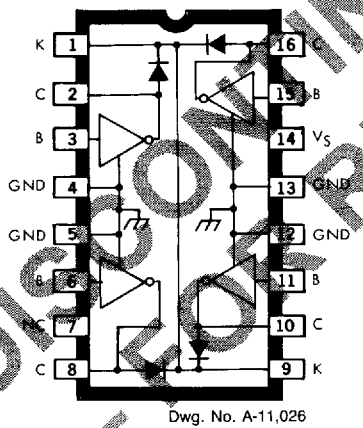
Reverse-bias burn-in and 100% high-reliability screening are standard for all side-brazed hermetic

Continued next page



Dwg. No. A-11,025

ULS-2064H—ULS-2067H



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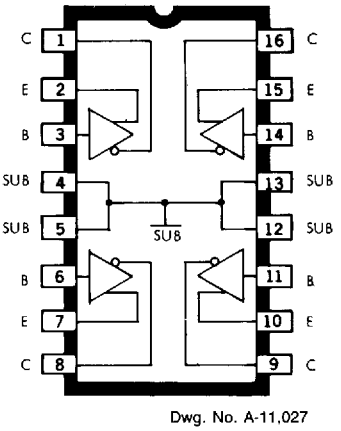
ULS-2068H—ULS-2071H



Dwg. No. A-11,027

ULS-2074H—ULS-2077H

ULS-2064H THROUGH ULS-2077H
1.25 A QUAD DARLINGTON SWITCHES

ENGINEERING BULLETIN
29305.1A

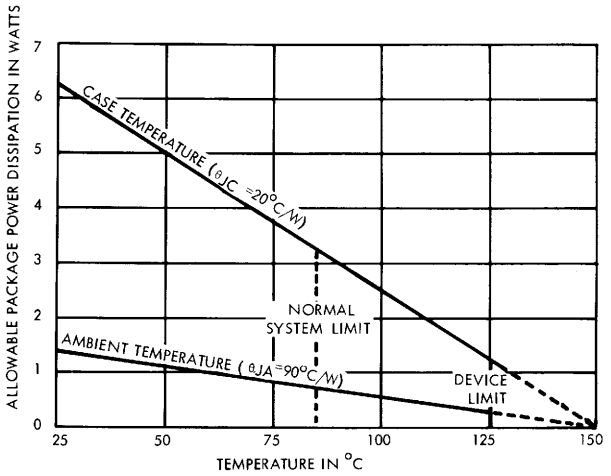
integrated circuits from Sprague Electric Company. Those devices previously manufactured as the ULS-2064H through ULS-2077H are now screened to the additional requirements of MIL-STD-883, Class B, and are so marked.

These quad Darlington switches are supplied in 16-pin glass/metal side-brazed hermetic packages. On special order, economical ceramic/glass cer-DIP hermetic packages can be specified by changing the part number suffix from 'H' to 'R'. Both package styles conform to the dimensional requirements of MIL-M-38510 and are rated for operation over the military temperature range of −55°C to +125°C.

ABSOLUTE MAXIMUM RATINGS
at 25°C Free-Air Temperature for any one driver (unless otherwise noted)

Output Voltage, V_{CEX} ..... See Below
Output Sustaining Voltage, $V_{CE(SUS)}$ ..... See Below
Output Current, I_{OUT} (Note 1) ..... 1.5 A
Input Voltage, V_{IN} (Note 2) ..... See Below
Input Current, I_B (Note 3) ..... 25 mA
Supply Voltage, V_S (ULS-2068/69H) ..... 10 V
(ULS-2070/71H) ..... 20 V
Total Package Power Dissipation ..... See Graph
Power Dissipation, P_D/Output ..... 2.2 W
Operating Ambient Temperature Range, T_A . −55°C to +125°C
Storage Temperature Range, T_S ..... −65°C to +150°C

ALLOWABLE PACKAGE POWER DISSIPATION AS A FUNCTION OF TEMPERATURE



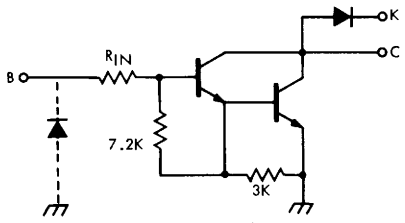
Dwg. No. A-10,198A

Type Number	V_{CEX} (Max.)	$V_{CE(SUS)}$ (Min.)	V_{IN} (Max.)	Application
ULS-2064H	50 V	35 V	15 V	TTL, DTL, Schottky TTL,
ULS-2065H	80 V	50 V	15 V	and 5 V CMOS
ULS-2066H	50 V	35 V	30 V	6 to 15 V CMOS
ULS-2067H	80 V	50 V	30 V	and PMOS
ULS-2068H	50 V	35 V	15 V	TTL, DTL, Schottky TTL,
ULS-2069H	80 V	50 V	15 V	and 5 V CMOS
ULS-2070H	50 V	35 V	30 V	6 to 15 V CMOS
ULS-2071H	80 V	50 V	30 V	and PMOS
ULS-2074H	50 V	35 V	30 V	General-Purpose
ULS-2075H	80 V	50 V	60 V	
ULS-2076H	50 V	35 V	30 V	6 to 15 V CMOS
ULS-2077H	80 V	50 V	60 V	and PMOS

Notes:
1. Allowable combinations of output current, number of outputs conducting, and duty cycle are shown on following pages.
2. Input voltage is with reference to the substrate (no connection to any other pins) for the ULS-2074/75/76/77H, reference is ground for all other types.
3. Input current may be limited by maximum allowable input voltage.

ULS-2064H THROUGH ULS-2067H

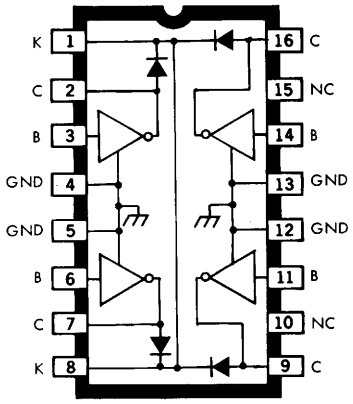
PARTIAL SCHEMATIC



Dwg. No. A-10,353

ULS-2064H
ULS-2065H $R_{IN} = 350\ \Omega$

ULS-2066H
ULS-2067H $R_{IN} = 3\ k\Omega$



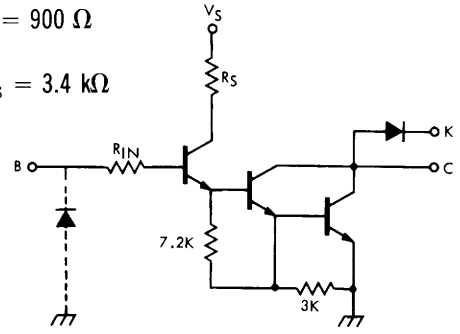
Dwg. No. A-11,025

ULS-2068H THROUGH ULS-2071H

PARTIAL SCHEMATIC

ULS-2068H
ULS-2069H $R_{IN} = 2.5\ k\Omega$, $R_S = 900\ \Omega$

ULS-2070H
ULS-2071H $R_{IN} = 11.6\ k\Omega$, $R_S = 3.4\ k\Omega$



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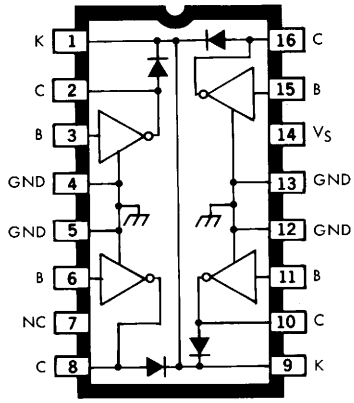
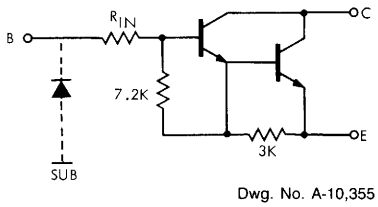


Dwg. No. A-11,026

ULS-2074H THROUGH ULS-2077H

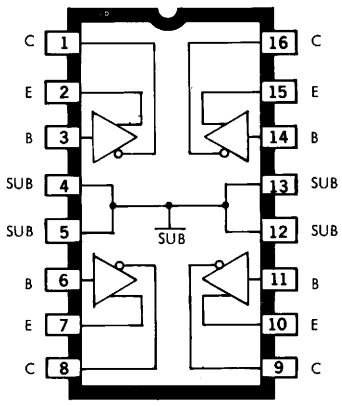
PARTIAL SCHEMATIC



Dwg. No. A-10,355

ULS-2074H
ULS-2075H $R_{IN} = 350\ \Omega$

ULS-2076H
ULS-2077H $R_{IN} = 3\ k\Omega$



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ULS-2064H THROUGH ULS-2067H

ELECTRICAL CHARACTERISTICS over operating temperature range (unless otherwise noted)

Characteristic	Symbol	Applicable Devices	Test Conditions			Limits		
			Temp.	Electrical Conditions	Fig.	Min.	Max.	Units
Output Leakage Current	I_{CEX}	ULS-2064/66H		V_{CE} = 50 V	1	—	500	µA
		ULS-2065/67H		V_{CE} = 80 V	1	—	500	µA
Output Sustaining Voltage	$V_{CE(SUS)}$	ULS-2064/66H		I_C = 100 mA, V_{IN} = 0.4 V	2	35	—	V
		ULS-2065/67H		I_C = 100 mA, V_{IN} = 0.4 V	2	50	—	V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	All	−55°C	I_C = 500 mA, I_B = 1.1 mA	3	—	1.35	V
				I_C = 750 mA, I_B = 1.7 mA	3	—	1.55	V
				I_C = 1.0 A, I_B = 2.25 mA	3	—	1.75	V
				I_C = 1.25 A, I_B = 3.75 mA	3	—	1.95	V
			+25°C	I_C = 500 mA, I_B = 625 µA	3	—	1.20	V
				I_C = 750 mA, I_B = 935 µA	3	—	1.35	V
				I_C = 1.0 A, I_B = 1.25 mA	3	—	1.55	V
				I_C = 1.25 A, I_B = 2.0 mA	3	—	1.75	V
			+125°C	I_C = 500 mA, I_B = 625 µA	3	—	1.35	V
				I_C = 750 mA, I_B = 935 µA	3	—	1.55	V
				I_C = 1.0 A, I_B = 1.25 mA	3	—	1.75	V
				I_C = 1.25 A, I_B = 2.0 mA	3	—	1.95	V
Input Current	$I_{IN(ON)}$	ULS-2064/65H		V_{IN} = 2.4 V	4	—	4.3	mA
				V_{IN} = 3.75 V	4	—	9.6	mA
		ULS-2066/67H		V_{IN} = 5.0 V	4	—	1.8	mA
				V_{IN} = 12 V	4	—	5.2	mA
Input Voltage	$V_{IN(ON)}$	ULS-2064/65H	−55°C	V_{CE} = 2.0 V, I_C = 1.0 A	5	—	3.1	V
			+25°C	V_{CE} = 2.0 V, I_C = 1.0 A	5	—	2.0	V
		ULS-2066/67H	−55°C	V_{CE} = 2.0 V, I_C = 1.0 A	5	—	11.5	V
			+25°C	V_{CE} = 2.0 V, I_C = 1.0 A	5	—	6.5	V
Turn-On Delay	t_{pHL}	All	+25°C		9	—	1.0	µs
Turn-Off Delay	t_{pLH}	All	+25°C		9	—	1.5	µs
Clamp Diode Leakage Current	I_R	ULS-2064/66H		V_R = 50 V	6	—	100	µA
		ULS-2065/67H		V_R = 80 V	6	—	100	µA
Clamp Diode Forward Voltage	V_F	All		I_F = 1.25 A	7	—	2.1	V

ULS-2068H THROUGH ULS-2071H

ELECTRICAL CHARACTERISTICS over operating temperature range, V_S = 5.0 V (ULS-2068/69H) or V_S = 12 V (ULS-2070/71H), (unless otherwise noted)

Characteristic	Symbol	Applicable Devices	Test Conditions			Limits		
			Temp.	Electrical Conditions	Fig.	Min.	Max.	Units
Output Leakage Current	I_{CEX}	ULS-2068/70H		V_{CE} = 50 V	1	—	500	µA
		ULS-2069/71H		V_{CE} = 80 V	1	—	500	µA
Output Sustaining Voltage	$V_{CE(SUS)}$	ULS-2068/70H		I_C = 100 mA, V_{IN} = 0.4 V	2	35	—	V
		ULS-2069/71H		I_C = 100 mA, V_{IN} = 0.4 V	2	50	—	V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	ULS-2068/69H	−55°C	I_C = 500 mA, V_{IN} = 3.2 V	3	—	1.35	V
				I_C = 750 mA, V_{IN} = 3.2 V	3	—	1.55	V
				I_C = 1.0 A, V_{IN} = 3.2 V	3	—	1.75	V
				I_C = 1.25 A, I_{IN} = 3.2 V	3	—	1.95	V
			+25°C	I_C = 500 mA, V_{IN} = 2.9 V	3	—	1.20	V
				I_C = 750 mA, V_{IN} = 2.9 V	3	—	1.35	V
				I_C = 1.0 A, V_{IN} = 2.9 V	3	—	1.55	V
				I_C = 1.25 A, V_{IN} = 2.9 V	3	—	1.75	V
			+125°C	I_C = 500 mA, V_{IN} = 2.8 V	3	—	1.35	V
				I_C = 750 mA, V_{IN} = 2.8 V	3	—	1.55	V
				I_C = 1.0 A, V_{IN} = 2.8 V	3	—	1.75	V
				I_C = 1.25 A, V_{IN} = 2.8 V	3	—	1.95	V
		ULS-2070/71H	−55°C	I_C = 500 mA, V_{IN} = 5.5 V	3	—	1.35	V
				I_C = 750 mA, V_{IN} = 5.5 V	3	—	1.55	V
				I_C = 1.0 A, V_{IN} = 5.5 V	3	—	1.75	V
				I_C = 1.25 A, V_{IN} = 5.5 V	3	—	1.95	V
			+25°C	I_C = 500 mA, V_{IN} = 5.1 V	3	—	1.20	V
				I_C = 750 mA, V_{IN} = 5.1 V	3	—	1.35	V
				I_C = 1.0 A, V_{IN} = 5.1 V	3	—	1.55	V
				I_C = 1.25 A, V_{IN} = 5.1 V	3	—	1.75	V
			+125°C	I_C = 500 mA, V_{IN} = 5.0 V	3	—	1.35	V
				I_C = 750 mA, V_{IN} = 5.0 V	3	—	1.55	V
				I_C = 1.0 A, V_{IN} = 5.0 V	3	—	1.75	V
				I_C = 1.25 A, V_{IN} = 5.0 V	3	—	1.95	V
Input Current	$I_{IN(ON)}$	ULS-2068/69H	−55°C	V_{IN} = 3.2 V	4	—	600	µA
			+25°C	V_{IN} = 2.75 V	4	—	550	µA
			+125°C	V_{IN} = 2.75 V	4	—	850	µA
			+125°C	V_{IN} = 3.75 V	4	—	1400	µA
		ULS-2070/71H		V_{IN} = 5.0 V	4	—	400	µA
				V_{IN} = 12 V	4	—	1250	µA
Input Voltage	$V_{IN(ON)}$	ULS-2068/69H	−55°C	V_{CE} = 2.0 V, I_C = 1.0 A	5	—	3.2	V
			+25°C	V_{CE} = 2.0 V, I_C = 1.0 A	5	—	2.75	V
		ULS-2070/71H	−55°C	V_{CE} = 2.0 V, I_C = 1.0 A	5	—	5.0	V
			+25°C	V_{CE} = 2.0 V, I_C = 1.0 A	5	—	5.0	V
Supply Current	I_S	ULS-2068/69H		I_C = 500 mA, V_{IN} = 3.2 V	8	—	6.0	mA
		ULS-2070/71H		I_C = 500 mA, V_{IN} = 5.0 V	8	—	4.5	mA
Turn-On Delay	t_{pHL}	All	+25°C		9	—	1.0	µs
Turn-Off Delay	t_{pLH}	All	+25°C		9	—	1.5	µs
Clamp Diode Leakage Current	I_R	ULS-2068/70H		V_R = 50 V	6	—	100	µA
		ULS-2069/71H		V_R = 80 V	6	—	100	µA
Clamp Diode Forward Voltage	V_F	All		I_F = 1.25 A	7	—	2.1	V

ULS-2074H THROUGH ULS-2077H

ELECTRICAL CHARACTERISTICS over operating temperature range (unless otherwise noted)

Characteristic	Symbol	Applicable Devices	Test Conditions			Limits		
			Temp.	Electrical Conditions	Fig.	Min.	Max.	Units
Output Leakage Current	I_{CEX}	ULS-2074/76H		V_{CE} = 50 V	1	—	500	µA
		ULS-2075/77H		V_{CE} = 80 V	1	—	500	µA
Output Sustaining Voltage	$V_{CE(SUS)}$	ULS-2074/76H		I_C = 100 mA, V_{IN} = 0.4 V	2	35	—	V
		ULS-2075/77H		I_C = 100 mA, V_{IN} = 0.4 V	2	50	—	V
Collector-Emitter Saturation Voltage	$V_{CE(SAT)}$	All	−55°C	I_C = 500 mA, I_B = 1.1 mA	3	—	1.35	V
				I_C = 750 mA, I_B = 1.7 mA	3	—	1.55	V
				I_C = 1.0 A, I_B = 2.25 mA	3	—	1.75	V
				I_C = 1.25 A, I_B = 3.75 mA	3	—	1.95	V
			+25°C	I_C = 500 mA, I_B = 625 µA	3	—	1.20	V
				I_C = 750 mA, I_B = 935 µA	3	—	1.35	V
				I_C = 1.0 A, I_B = 1.25 mA	3	—	1.55	V
				I_C = 1.25 A, I_B = 2.0 mA	3	—	1.75	V
			+125°C	I_C = 500 mA, I_B = 625 µA	3	—	1.35	V
				I_C = 750 mA, I_B = 935 µA	3	—	1.55	V
				I_C = 1.0 A, I_B = 1.25 mA	3	—	1.75	V
				I_C = 1.25 A, I_B = 2.0 mA	3	—	1.95	V
Input Current	$I_{IN(ON)}$	ULS-2074/75H		V_{IN} = 2.4 V	4	—	4.3	mA
				V_{IN} = 3.75 V	4	—	9.6	mA
		ULS-2076/77H		V_{IN} = 5.0 V	4	—	1.8	mA
				V_{IN} = 12 V	4	—	5.2	mA
Input Voltage	$V_{IN(ON)}$	ULS-2074/75H	−55°C	V_{CE} = 2.0 V, I_C = 1.0 A	5	—	3.1	V
			+25°C	V_{CE} = 2.0 V, I_C = 1.0 A	5	—	2.0	V
		ULS-2076/77H	−55°C	V_{CE} = 2.0 V, I_C = 1.0 A	5	—	11.5	V
			+25°C	V_{CE} = 2.0 V, I_C = 1.0 A	5	—	6.5	V
Turn-On Delay	t_{pHL}	All	+25°C		9	—	1.0	µs
Turn-Off Delay	t_{pLH}	All	+25°C		9	—	1.5	µs

TEST FIGURES

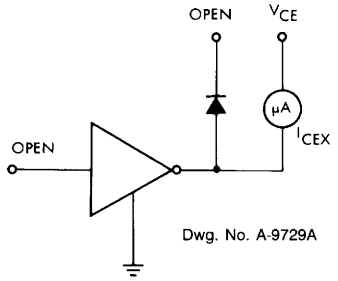


Figure 1

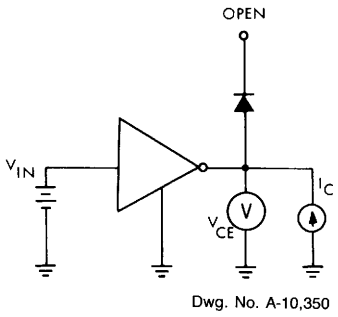


Figure 2

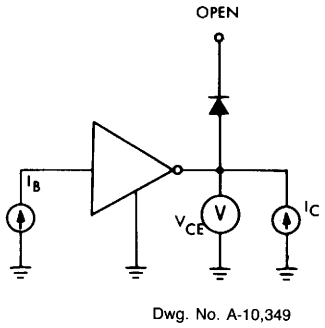


Figure 3

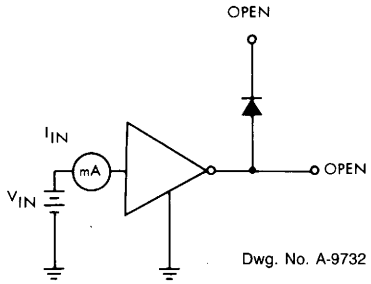


Figure 4

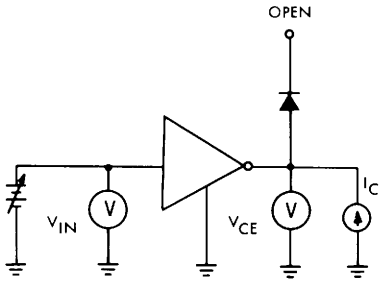


Figure 5

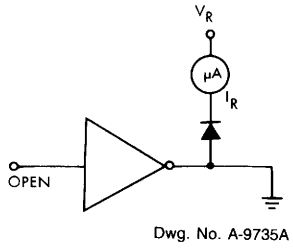


Figure 6

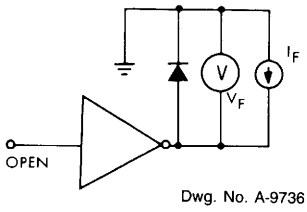


Figure 7

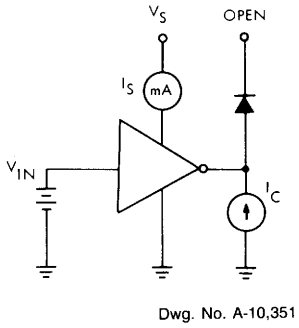
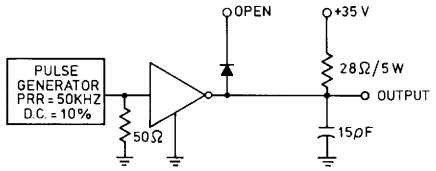


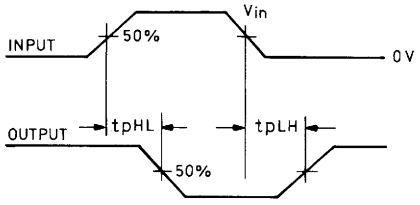
Figure 8

NOTE: Diodes not applicable to Types ULS-2074H through ULS-2077H.



Dwg. No. A-13,247

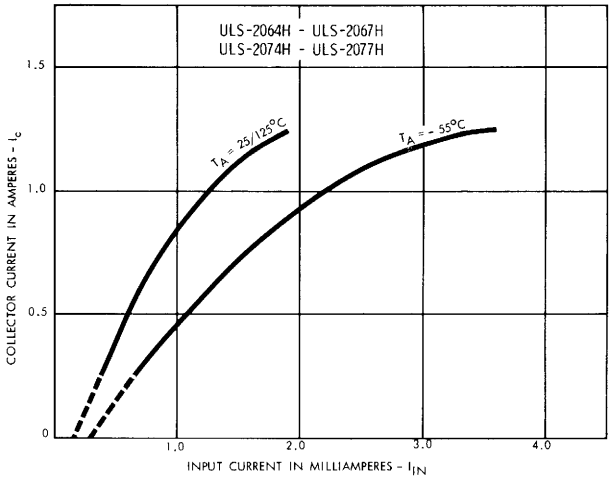
	V_{in}
ULS-2064/65/68/69/74/75H	2.4V
ULS-2066/67/70/71/76/77H	5.0V



Dwg. No. A-13,248

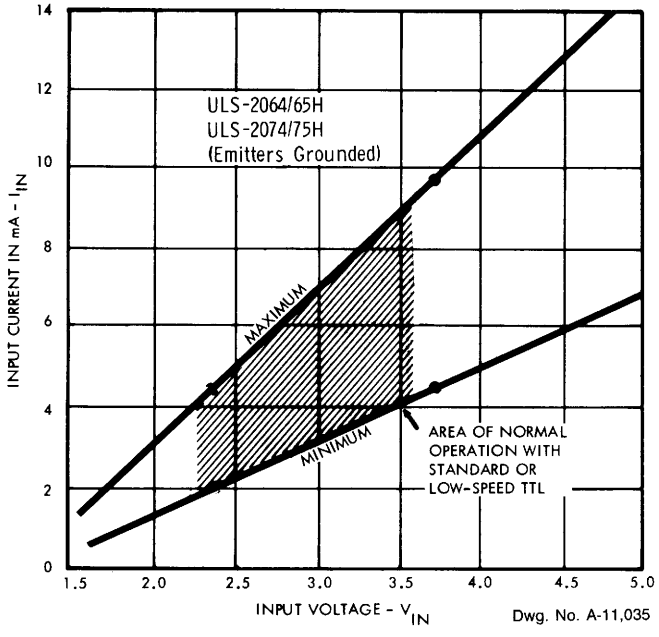
Figure 9

COLLECTOR CURRENT AS A FUNCTION OF INPUT CURRENT

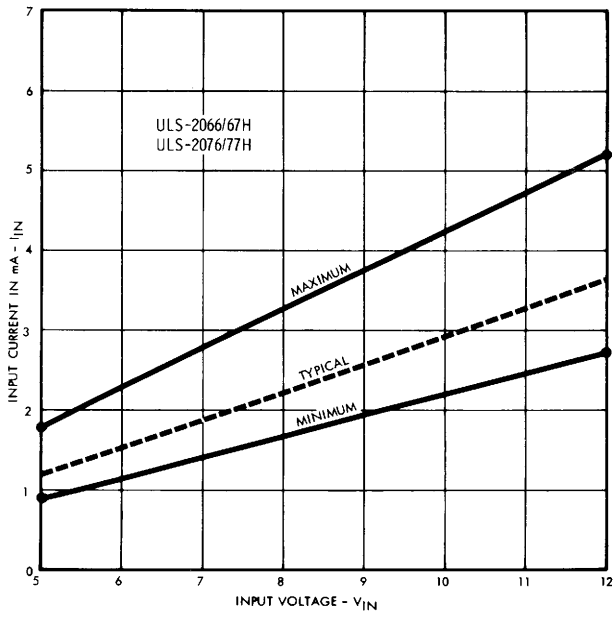


Dwg. No. A-11,030

INPUT CURRENT AS A FUNCTION OF INPUT VOLTAGE

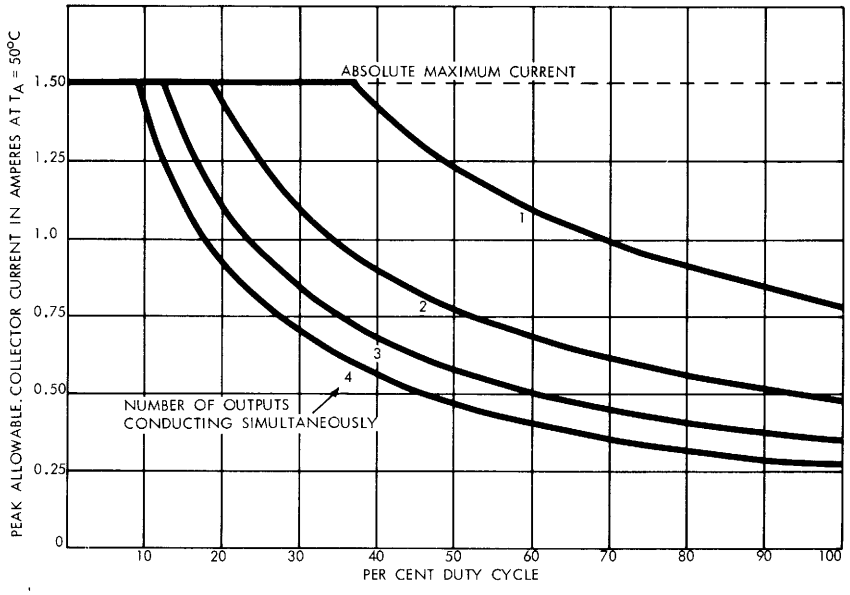


Dwg. No. A-11,035



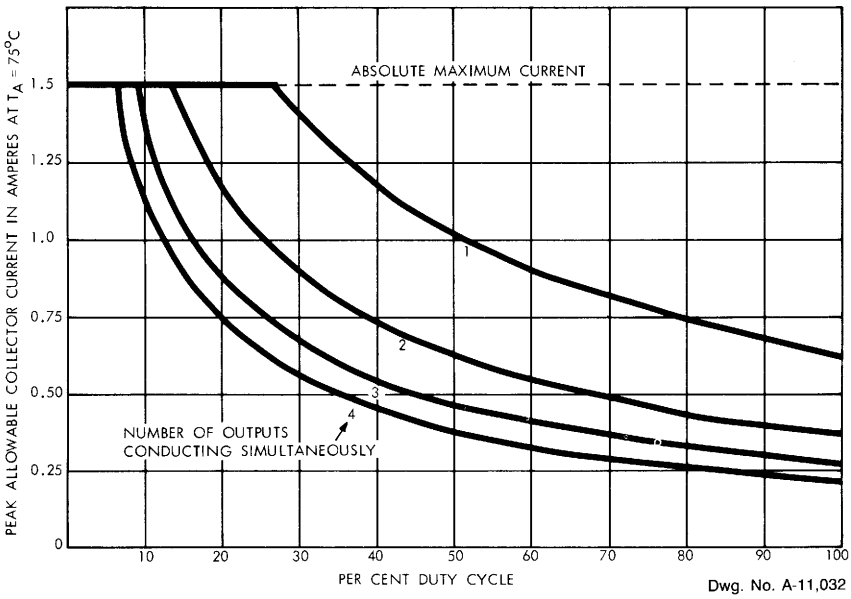
ALLOWABLE PEAK COLLECTOR CURRENT AS A FUNCTION OF DUTY CYCLE

AT T_A = +50°C



Dwg. No. A-11,031

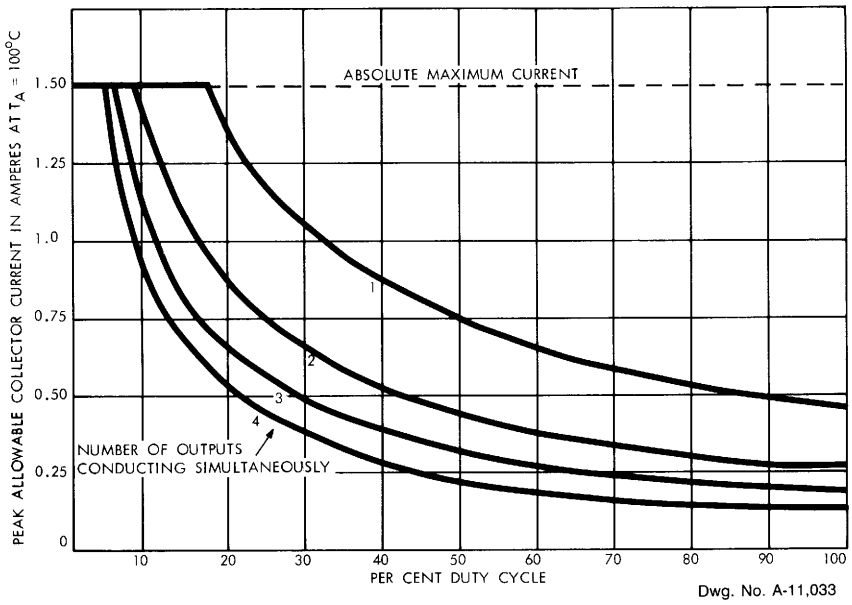
AT T_A = +75°C



Dwg. No. A-11,032

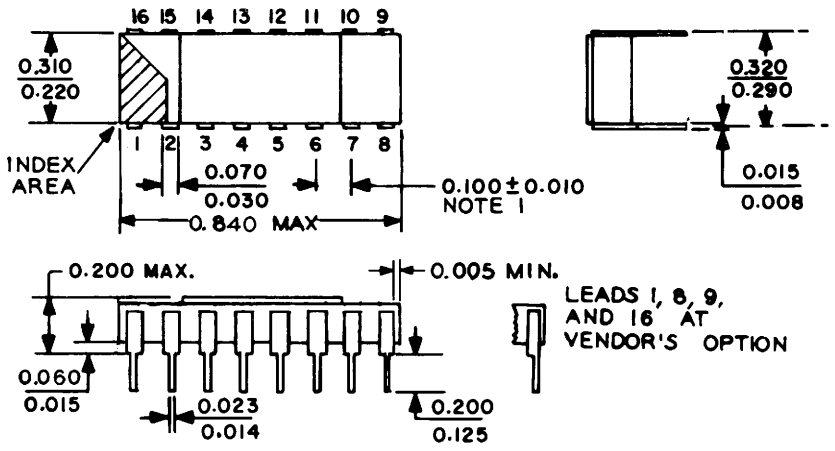
ALLOWABLE PEAK COLLECTOR CURRENT AS A FUNCTION OF DUTY CYCLE

AT T_A = +100°C



Dwg. No. A-11,033

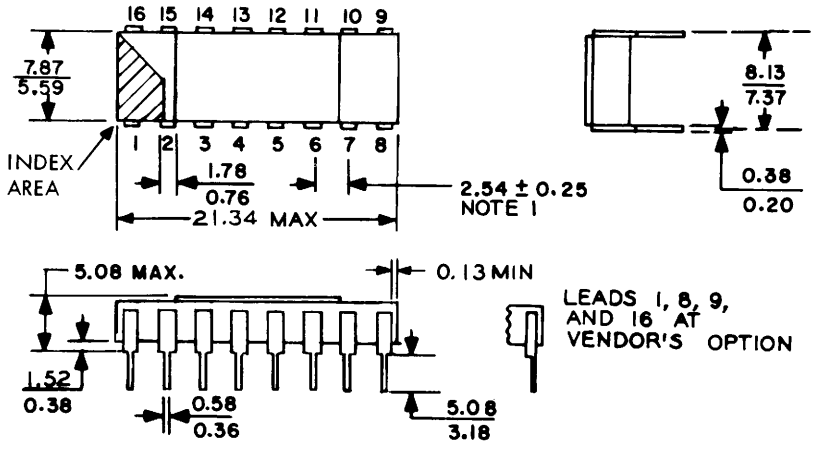
DIMENSIONS IN INCHES



Dwg. No. A-10,210C IN

DIMENSIONS IN MILLIMETERS

(Based on 1" = 25.4 mm)



Dwg. No. A-10,211B MM

This package conforms to military specification MIL-M-38510, case outline D-2, Configuration 3.

NOTES:

1. Lead spacing tolerances is non-cumulative.
2. Exact body and lead configuration at vendor's option within limits shown.
3. Lead gauge plane is 0.030" (0.76 mm), maximum below seating plane.

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