

4825898 INTEGRATED POWER

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SEMICONDUCTORS, LTD.

1.5 Amp Quad Darlington Arrays

T-43-25

Description

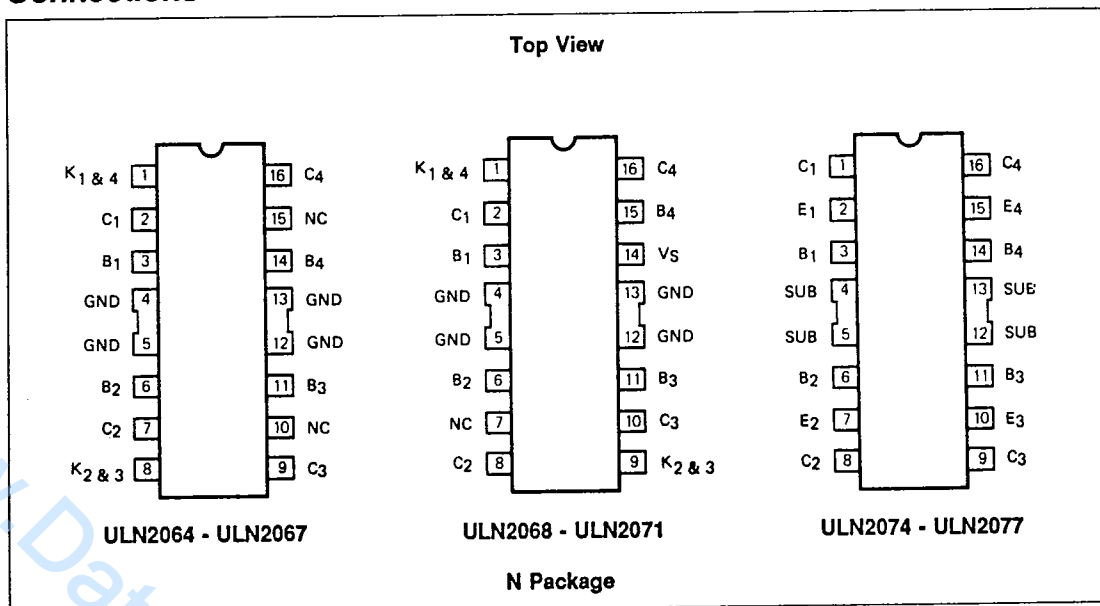
These high-voltage, high-current darlington arrays are monolithic bipolar devices especially designed for interfacing low-level control logic and peripheral loads such as relays, solenoids, DC and stepping motors, multiplexed LED and incandescent displays, and heaters. The logic inputs are designed to be compatible with TTL, DTL, LSTTL, CMOS and NMOS logic families. Several of the arrays include internal clamp diodes for driving inductive loads, and breakdown voltage ratings to 80 volts are available.

Features

- Four power drivers per package
- 1.5 amp collector currents
- 80 and 50 volt BV_{CEX} ratings
- Internal clamp diodes for inductive loads
- Compatibility with all popular logic families
- Low internal parasitics

Section 4 - Power Drivers
ULN2064 through ULN2077

Connections



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Absolute Maximum Ratings

Input Voltage (Note 2)	See Selection Guide	Power Dissipation at $T_A = +25^\circ\text{C}$	2.77W
Input Current (Note 3)	25mA	Thermal Resistance: junction to ambient	45°C/W
Supply Voltage		Operating Junction Temperature	+150°C
ULN2068/2069	10V	Operating Ambient Temperature	
ULN2070/2071	20V	Range	-20°C to +85°C
Output Voltage	See Selection Guide	Storage Temperature Range	-55°C to +150°C
Output Current (Note 1)	1.75A	Lead Temperature (Soldering, 10 sec.)	+300°C
Output Sustaining Voltage	See Selection Guide		

Absolute maximum ratings are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the device should be operated at these limits. The electrical characteristics provide conditions for actual device operation.

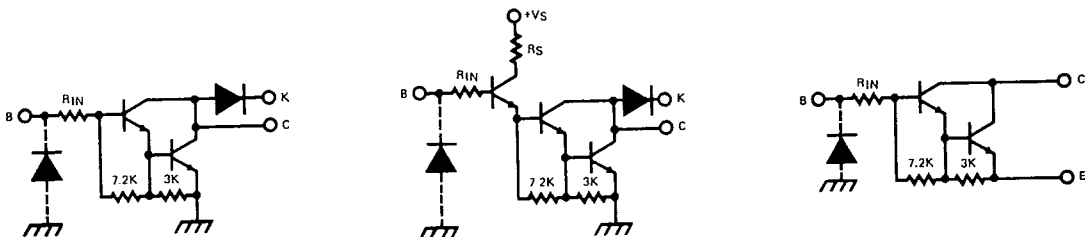
Note 1: Allowable combinations of output current, number of outputs conducting, and duty cycle are shown on the following pages.

Note 2: Input voltage is referenced to the substrate (no connection to other pins) for type ULN2074/75/76/77; reference is ground for all other types.

Note 3: Input current may be limited by maximum allowable input voltages.

Schematic Diagrams (Single Darlington Shown)

Section 4 - Power Drivers
ULN2064 through ULN2077



ULN2064/2065: $R_{IN} = 350\Omega$
 ULN2066/2067: $R_{IN} = 3K\Omega$

ULN2068/2069: $R_{IN} = 2.5K\Omega$, $R_S = 900\Omega$
 ULN2070/2071: $R_{IN} = 11.6K\Omega$, $R_S = 3.4K\Omega$

ULN2074/2075: $R_{IN} = 350\Omega$
 ULN2076/2077: $R_{IN} = 3K\Omega$

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Electrical Characteristics

(Unless otherwise indicated, electrical characteristics apply for $T_A = 25^\circ\text{C}$ only)

Parameter	Conditions	Device	ULN2064/2067		Units
			Min	Max	
Output Leakage Current, I_{CEX}	$V_{CE} = 50\text{V}$	2064/66		100	μA
	$V_{CE} = 50\text{V}, T_A = 70^\circ\text{C}$			500	μA
	$V_{CE} = 80\text{V}$	2065/67		100	μA
	$V_{CE} = 80\text{V}, T_A = 70^\circ\text{C}$			500	μA
Output Sustaining Voltage, $V_{CE(SUS)}$	$I_C = 100\text{mA}, V_{IN} = 0.4\text{V}$	2064/66	35		V
	$I_C = 100\text{mA}, V_{IN} = 0.4\text{V}$	2065/67	50		V
Collector-Emitter Saturation Voltage, $V_{CE(SAT)}$	$I_C = 500\text{mA}, I_B = 625\mu\text{A}$	All		1.1	V
	$I_C = 750\text{mA}, I_B = 935\mu\text{A}$			1.2	V
	$I_C = 1.0\text{A}, I_B = 1.25\text{mA}$			1.3	V
	$I_C = 1.25\text{A}, I_B = 2.0\text{mA}$			1.4	V
	$I_C = 1.5\text{A}, I_B = 2.25\text{mA}$	2065/67		1.5	V
Input Current, $I_{IN(ON)}$	$V_{IN} = 2.4\text{V}$	2064/65	1.4	4.3	mA
	$V_{IN} = 3.75\text{V}$		3.3	9.6	mA
	$V_{IN} = 5.0\text{V}$	2066/67	0.6	1.8	mA
	$V_{IN} = 12\text{V}$		1.7	5.2	mA
Input Voltage, $V_{IN(ON)}$	$V_{CE} = 2.0\text{V}, I_C = 1.0\text{A}$	2064/65		2.0	V
	$V_{CE} = 2.0\text{V}, I_C = 1.25\text{A}$	2064		2.5	V
	$V_{CE} = 2.0\text{V}, I_C = 1.5\text{A}$	2065		2.5	V
	$V_{CE} = 2.0\text{V}, I_C = 1.0\text{A}$	2066/67		6.5	V
	$V_{CE} = 2.0\text{V}, I_C = 1.25\text{A}$	2066		10	V
	$V_{CE} = 2.0\text{V}, I_C = 1.5\text{A}$	2067		10	V
Turn-on Delay, t_{PLH}	$0.5 E_{IN}$ to $0.5 E_{OUT}$	All		1.0	μS
Turn-off Delay, t_{PHL}	$0.5 E_{IN}$ to $0.5 E_{OUT}$	All		1.5	μS
Clamp Diode Leakage Current, I_R	$V_R = 50\text{V}$	2064/66		50	μA
	$V_R = 50\text{V}, T_A = 70^\circ\text{C}$			100	μA
	$V_R = 80\text{V}$	2065/67		50	μA
	$V_R = 80\text{V}, T_A = 70^\circ\text{C}$			100	μA
Clamp Diode Forward Voltage, V_F	$I_F = 1.0\text{A}$	All		1.75	V
	$I_F = 1.5\text{A}$			2.0	V

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ULN2064 through ULN2077



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Electrical Characteristics, Continued

(Unless otherwise indicated, electrical characteristics apply for $T_A = 25^\circ\text{C}$ only)

Parameter	Conditions	Device	ULN2068/2071		Units
			Min	Max	
Output Leakage Current, I_{CEX}	$V_{CE} = 50\text{V}$	2068/70		100	μA
	$V_{CE} = 50\text{V}, T_A = 70^\circ\text{C}$			500	μA
	$V_{CE} = 80\text{V}$	2069/71		100	μA
	$V_{CE} = 80\text{V}, T_A = 70^\circ\text{C}$			500	μA
Output Sustaining Voltage, $V_{CE}(\text{SUS})$	$I_C = 100\text{mA}, V_{IN} = 0.4\text{V}$	2068/70	35		V
	$I_C = 100\text{mA}, V_{IN} = 0.4\text{V}$	2069/71	50		V
Collector-Emitter Saturation Voltage, $V_{CE}(\text{SAT})$	$I_C = 500\text{mA}, V_{IN} = 2.75\text{V}$	2068/69		1.1	V
	$I_C = 750\text{mA}, V_{IN} = 2.75\text{V}$			1.2	V
	$I_C = 1.0\text{A}, V_{IN} = 2.75\text{V}$			1.3	V
	$I_C = 1.25\text{A}, V_{IN} = 2.75\text{V}$			1.4	V
	$I_C = 1.5\text{A}, V_{IN} = 2.75\text{V}$	2069		1.5	V
	$I_C = 500\text{mA}, V_{IN} = 5.0\text{V}$	2070/71		1.1	V
	$I_C = 750\text{mA}, V_{IN} = 5.0\text{V}$			1.2	V
	$I_C = 1.0\text{A}, V_{IN} = 5.0\text{V}$			1.3	V
	$I_C = 1.25\text{A}, V_{IN} = 5.0\text{V}$			1.4	V
	$I_C = 1.5\text{A}, V_{IN} = 5.0\text{V}$	2071		1.5	V
Input Current, $I_{IN}(\text{ON})$	$V_{IN} = 2.75\text{V}$	2068/69		550	μA
	$V_{IN} = 3.75\text{V}$			1000	μA
	$V_{IN} = 5.0\text{V}$	2070/71		400	μA
	$V_{IN} = 12\text{V}$			1250	μA
Input Voltage, $V_{IN}(\text{ON})$	$V_{CE} = 2.0\text{V}, I_C = 1.25\text{A}$	2068		2.75	V
	$V_{CE} = 2.0\text{V}, I_C = 1.5\text{A}$	2069		2.75	V
	$V_{CE} = 2.0\text{V}, I_C = 1.25\text{A}$	2070		5.0	V
	$V_{CE} = 2.0\text{V}, I_C = 1.5\text{A}$	2071		5.0	V
Supply Current, I_S	$I_C = 500\text{mA}, V_{IN} = 2.75\text{V}$	2068/69		6.0	mA
	$I_C = 500\text{mA}, V_{IN} = 5.0\text{V}$	2070/71		4.5	mA
Turn-on Delay, t_{PLH}	$0.5 E_{IN}$ to $0.5 E_{OUT}$	All		1.0	μS
Turn-off Delay, t_{PHL}	$0.5 E_{IN}$ to $0.5 E_{OUT}$	All		1.5	μS
Clamp Diode Leakage Current, I_R	$V_R = 50\text{V}$	2068/70		50	μA
	$V_R = 50\text{V}, T_A = 70^\circ\text{C}$			100	μA
	$V_R = 80\text{V}$	2069/71		50	μA
	$V_R = 80\text{V}, T_A = 70^\circ\text{C}$			100	μA
Clamp Diode Forward Voltage, V_F	$I_F = 1.0\text{A}$	All		1.75	V
	$I_F = 1.5\text{A}$			2.0	V

Section 4 - Power Drivers
ULN2064 through ULN2077



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Electrical Characteristics, continued

(Unless otherwise indicated, electrical characteristics apply for $T_A = 25^\circ\text{C}$ only)

Parameter	Conditions	Devices	ULN2074/2077		Units
			Min	Max	
Output Leakage Current, I_{CEX}	$V_{CE} = 50\text{V}$	2074/76		100	μA
	$V_{CE} = 50\text{V}, T_A = 70^\circ\text{C}$			500	μA
	$V_{CE} = 80\text{V}$	2075/77		100	μA
	$V_{CE} = 80\text{V}, T_A = 70^\circ\text{C}$			500	μA
Output Sustaining Voltage, $V_{CE}(\text{SUS})$	$I_C = 100\text{mA}, V_{IN} = 0.4\text{V}$	2074/76	35		V
	$I_C = 100\text{mA}, V_{IN} = 0.4\text{V}$	2075/77	50		V
Collector-Emitter Saturation Voltage, $V_{CE}(\text{SAT})$	$I_C = 500\text{mA}, I_B = 625\mu\text{A}$	All		1.1	V
	$I_C = 750\text{mA}, I_B = 935\mu\text{A}$			1.2	V
	$I_C = 1.0\text{A}, I_B = 1.25\text{mA}$			1.3	V
	$I_C = 1.25\text{A}, I_B = 2.0\text{mA}$			1.4	V
	$I_C = 1.5\text{A}, I_B = 2.25\text{mA}$	2075/77		1.5	V
Input Current, $I_{IN}(\text{ON})$	$V_{IN} = 2.4\text{V}$	2074/75	1.4	4.3	mA
	$V_{IN} = 3.75\text{V}$		3.3	9.6	mA
	$V_{IN} = 5.0\text{V}$	2076/77	0.6	1.8	mA
	$V_{IN} = 12\text{V}$		1.7	5.2	mA
Input Voltage, $V_{IN}(\text{ON})$	$V_{CE} = 2.0\text{V}, I_C = 1.0\text{A}$	2074/75		2.0	V
	$V_{CE} = 2.0\text{V}, I_C = 1.25\text{A}$	2074		2.5	V
	$V_{CE} = 2.0\text{V}, I_C = 1.5\text{A}$	2075		2.5	V
	$V_{CE} = 2.0\text{V}, I_C = 1.0\text{A}$	2076/77		6.5	V
	$V_{CE} = 2.0\text{V}, I_C = 1.25\text{A}$	2076		10	V
	$V_{CE} = 2.0\text{V}, I_C = 1.5\text{A}$	2077		10	V
Turn-on Delay, t_{PLH}	$0.5 E_{IN}$ to $0.5 E_{OUT}$	All		1.0	μS
Turn-off Delay, t_{PHL}	$0.5 E_{IN}$ to $0.5 E_{OUT}$	All		1.5	μS

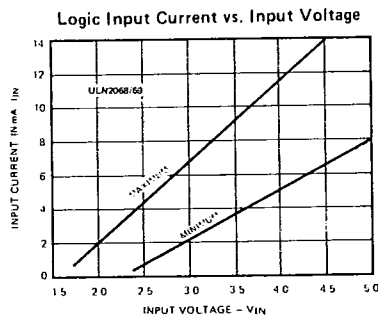
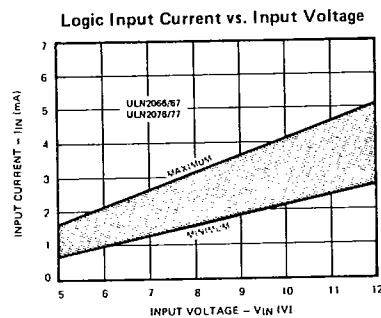
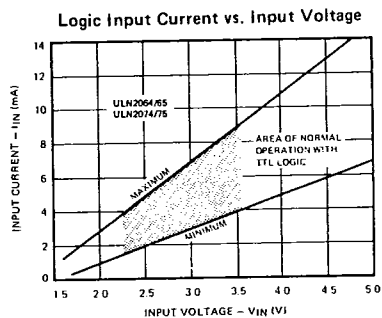
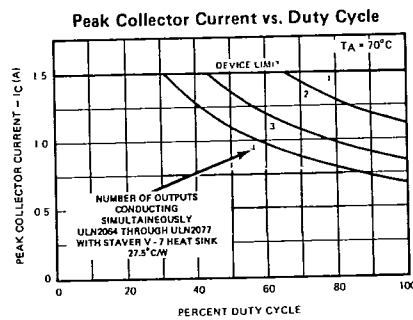
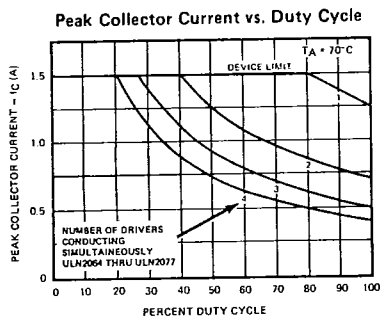
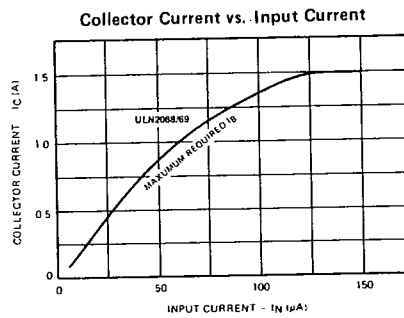
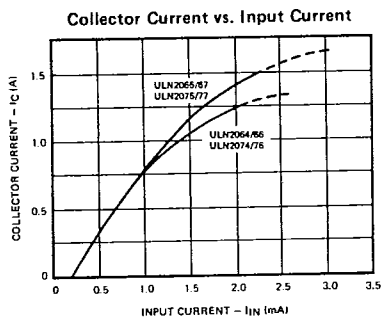
Section 4 - Power Drivers
ULN2064 through ULN2077



Typical Performance Characteristics

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Section 4 - Power Drivers
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Order Information

Input Conditions	V _{IN}	V _{CE} = 50V	V _{CE} = 80
	MAX	I _C = 1.5A	I _C = 1.5A
TTL, DTL, Schottky TTL, 5V CMOS and NMOS	15V	ULN2064N	ULN2065N
6 to 15V CMOS and PMOS	30V	ULN2066N	ULN2067N
TTL, DTL, Schottky TTL, 5V CMOS and NMOS	15V	ULN2068N	ULN2069N
6 to 15V CMOS and PMOS	30V	ULN2070N	ULN2071N
General Purpose	30V	ULN2074N	—
General Purpose	60V	—	ULN2075N
6 to 15V CMOS and PMOS	30V	ULN2076N	—
6 to 15V CMOS and PMOS	60V	—	ULN2077N

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Integrated Power Semiconductors, Ltd.

2727 Walsh Avenue, Suite 201, Santa Clara, CA 95051 • Telephone: 408-727-2772 • Telex: 350073 (IPS SNTA) • FAX: 408-988-6185
 8 Quaker Drive, West Warwick, RI 02893 • Telephone: 401-821-4260 • Telex: 332948 (IPS RI) • FAX: 401-823-7260
 2081 Business Center Drive, Suite 140, Irvine, CA 92715 • Telephone: 714-752-0188 • FAX: 714-752-5019
 789 Turnpike Street, North Andover, MA 01845 • Telephone: 617-683-9042 • FAX: 617-975-0193