INTEGRATED POWER SEMICONDUCTORS, LTD.

Darlington Transistor Arrays

T-43-25

Description

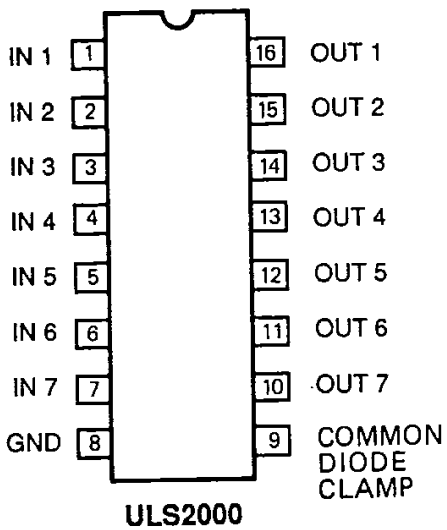
These power driver arrays are an arrangement of either seven (2000 series) or eight (2800 series) darlington transistors with independent inputs and outputs. They are designed to provide high voltage, medium current interface between low voltage control logic and peripheral loads. The range of inputs available allow specific compatibility with all popular logic families (PMOS, CMOS, TTL, Shottky TTL). Different maximum output current / output voltage combinations allow the customer to select the device closest to the exact needs of the application. Each darlington is configured as an open collector output with internal flyback diode to protect against potentially destructive transient voltages caused by inductive loads.

Features

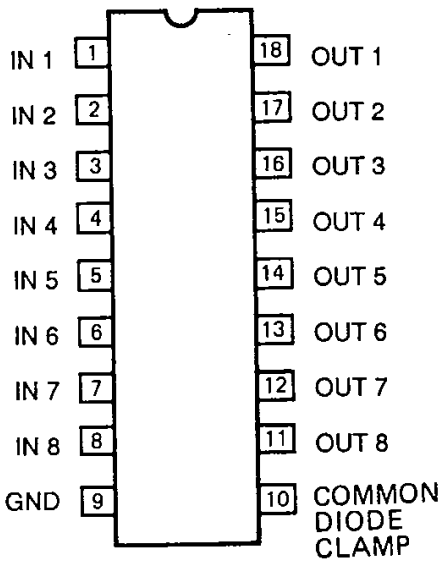
- 7 or 8 darlington power drives in single package
- 50V or 95V breakdown voltage ratings
- 500mA or 600mA output current capability per driver
- Low saturation voltage
- 5 input options to allow correct interface with all popular logic families
- Internal clamp diodes for driving inductive loads
- Improved cross-talk noise suppression
- Hermetically sealed package
- Operating temperature range; -55°C to +125°C

Connections

(Top View)



ULS2000



ULS2800

J and L Packages

Absolute Maximum Ratings (T_A = 25°C)

Output Voltage, V_{CE}
- ULS2000, 2010, 2800, 2810 Series — 50V
- ULS2020, 2820 Series — 95V

Input Voltage, V_{IN}
- ULS2002, 2003, 2004, 2802, 2803, 2804 — 30V
- ULS2005, 2805 — 15V

Continuous Collector Current, I_C
- ULS2000, 2020, 2800, 2820 Series — 500mA
- ULS2010, 2810 Series — 600mA

Ground Pin Current, I_{GND} — 3.0A

Continuous Base Current, I_B — 25mA

Power Dissipation, P_D
- (Single Darlington Drive) — 1.0W
- (Total Package Power Dissipation is Specified on Graphs of Collector Current Versus Duty Cycle)

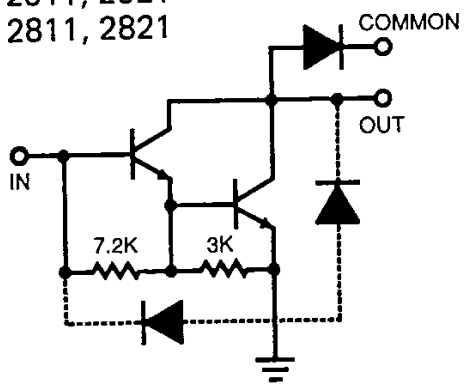
Operating Temp. Range, T_A — -55°C to +125°C

Storage Temp. Range, T_S — -65°C to +150°C

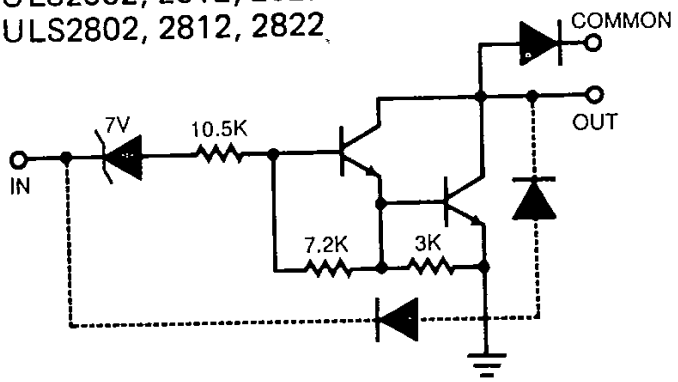
Absolute maximum ratings are those values beyond which the safety of the device cannot be guaranteed. They are not meant to imply that the device should be operated at these limits. The electrical characteristics provide conditions for actual device operation.

Schematic Diagrams (Single Darlington Shown)

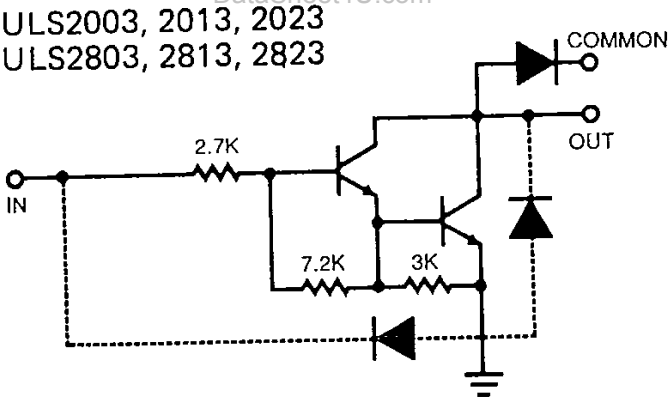
ULS2001, 2011, 2021
ULS2801, 2811, 2821



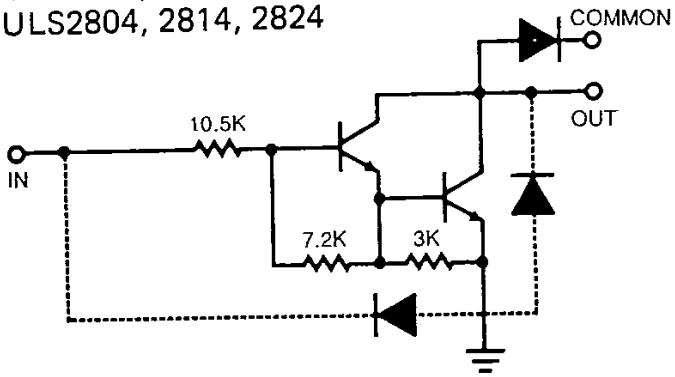
ULS2002, 2012, 2022
ULS2802, 2812, 2822



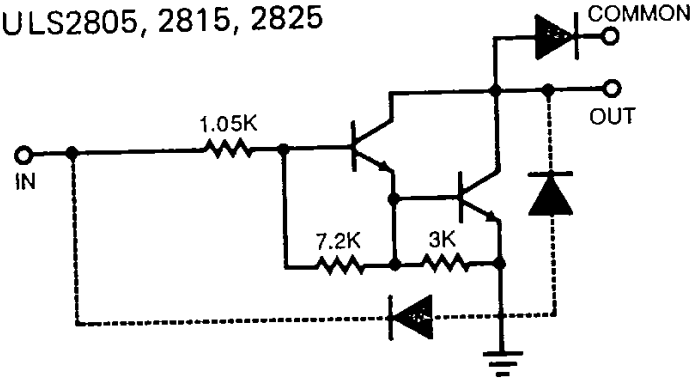
ULS2003, 2013, 2023
ULS2803, 2813, 2823



ULS2004, 2014, 2024
ULS2804, 2814, 2824



ULS2005, 2015, 2025
ULS2805, 2815, 2825



Electrical Characteristics

Characteristic	Conditions	Device	Temp	ULS2000/ULS2800 Min	Typ	Max	Units
Output Leakage Current, I_{CEX}	V_{CE} = 50V	All	•			100	µA
	V_{CE} = 50V, V_{IN} = 6V	2002, 2802	•			500	µA
	V_{CE} = 50V, V_{IN} = 1V	2004, 2804	•			500	µA
Collector-Emitter Saturation Voltage, $V_{CE(SAT)}$	I_C = 350mA, I_B = 850µA	All	-55°C		1.6	1.8	V
	I_C = 200mA, I_B = 550µA		-55°C		1.3	1.5	V
	I_C = 100mA, I_B = 350µA		-55°C		1.1	1.3	V
	I_C = 350mA, I_B = 500µA				1.25	1.6	V
	I_C = 200mA, I_B = 350µA				1.1	1.3	V
	I_C = 100mA, I_B = 250µA				0.9	1.1	V
	I_C = 350mA, I_B = 500µA		+125°C		1.6	1.8	V
	I_C = 200mA, I_B = 350µA		+125°C		1.3	1.5	V
	I_C = 100mA, I_B = 250µA		+125°C		1.1	1.3	V
Input Current, IIN (ON)	V_{IN} = 17V	2002, 2802	•	480	850	1300	µA
	V_{IN} = 3.85V	2003, 2803	•	650	930	1350	µA
	V_{IN} = 5V	2004, 2804	•	240	350	500	µA
	V_{IN} = 12V		•	650	1000	1450	µA
	V_{IN} = 3V	2005, 2805	•	1180	1500	2400	µA
Input Current, $I_{IN(OFF)}$	I_C = 500µA	All	+125°C	25	50		µA
Input Voltage, V_{IN} (ON)	V_{CE} = 2V, I_C = 300mA	2002, 2802	-55°C			18	V
	V_{CE} = 2V, I_C = 300mA		+125°C			13	V
	V_{CE} = 2V, I_C = 200mA	2003, 2803	-55°C			3.3	V
	V_{CE} = 2V, I_C = 250mA		-55°C			3.6	V
	V_{CE} = 2V, I_C = 300mA		-55°C			3.9	V
	V_{CE} = 2V, I_C = 200mA		+125°C			2.4	V
	V_{CE} = 2V, I_C = 250mA		+125°C			2.7	V
	V_{CE} = 2V, I_C = 300mA		+125°C			3.0	V
	V_{CE} = 2V, I_C = 125mA	2004, 2804	-55°C			6.0	V
	V_{CE} = 2V, I_C = 200mA		-55°C			8.0	V
	V_{CE} = 2V, I_C = 275mA		-55°C			10	V
	V_{CE} = 2V, I_C = 350mA		-55°C			12	V
	V_{CE} = 2V, I_C = 125mA		+125°C			5.0	V
	V_{CE} = 2V, I_C = 200mA		+125°C			6.0	V
	V_{CE} = 2V, I_C = 275mA		+125°C			7.0	V
	V_{CE} = 2V, I_C = 350mA		+125°C			8.0	V
	V_{CE} = 2V, I_C = 350mA	2005, 2805	-55°C			3.0	V
	V_{CE} = 2V, I_C = 350mA		+125°C			2.4	V
DC Forward Current Transfer Ratio, h_{FE}	V_{CE} = 2V, I_C = 350mA	2001, 2801	-55°C	500			
	V_{CE} = 2V, I_C = 350mA			1000			
Input Capacitance, C_{IN}		All			15	25	pF
Turn-on Delay, t_{PLH}	0.5 E_{IN} to 0.5 E_{OUT}	All			250	1000	ns
Turn-off Delay, t_{PHL}	0.5 E_{IN} to 0.5 E_{OUT}	All			250	1000	ns
Clamp Diode Leakage Current, I_R	V_R = 50V	All	•			50	µA
Clamp Diode Forward Voltage, V_F	I_F = 350mA	All	•		1.7	2.0	V

The • denotes the specifications which apply over the full operating temperature range, all others apply at T_A = 25°C unless otherwise specified.

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Electrical Characteristics Continued

Characteristic	Conditions	Device	Temp	ULS2010/ULS2810 Min	Typ	Max	Units
Output Leakage Current, I_{CEX}	V_{CE} = 50V	All	•			100	µA
	V_{CE} = 50V, V_{IN} = 6V	2012, 2812	•			500	µA
	V_{CE} = 50V, V_{IN} = 1V	2014, 2814	•			500	µA
Collector-Emitter Saturation Voltage, $V_{CE(SAT)}$	I_C = 500mA, I_B = 1100µA	All	-55°C		1.8	2.1	V
	I_C = 350mA, I_B = 850µA		-55°C		1.6	1.8	V
	I_C = 200mA, I_B = 550µA		-55°C		1.3	1.5	V
	I_C = 500mA, I_B = 600µA				1.7	1.9	V
	I_C = 350mA, I_B = 500µA				1.25	1.6	V
	I_C = 200mA, I_B = 350µA				1.1	1.3	V
	I_C = 500mA, I_B = 600µA		+125°C		1.8	2.1	V
	I_C = 350mA, I_B = 500µA		+125°C		1.6	1.8	V
	I_C = 200mA, I_B = 350µA		+125°C		1.3	1.5	V
Input Current, $I_{IN\ (ON)}$	V_{IN} = 17V	2012, 2812	•	480	850	1300	µA
	V_{IN} = 3.85V	2013, 2813	•	650	930	1350	µA
	V_{IN} = 5V	2014, 2814	•	240	350	500	µA
	V_{IN} = 12V		•	650	1000	1450	µA
	V_{IN} = 3V	2015, 2815	•	1180	1500	2400	µA
Input Current, $I_{IN(OFF)}$	I_C = 500µA	All	+125°C	25	50		µA
Input Voltage, $V_{IN\ (ON)}$	V_{CE} = 2V, I_C = 500mA	2012, 2812	-55°C			23.5	V
	V_{CE} = 2V, I_C = 500mA		+125°C			17	V
	V_{CE} = 2V, I_C = 250mA	2013, 2813	-55°C			3.6	V
	V_{CE} = 2V, I_C = 300mA		-55°C			3.9	V
	V_{CE} = 2V, I_C = 500mA		-55°C			6.0	V
	V_{CE} = 2V, I_C = 250mA		+125°C			2.7	V
	V_{CE} = 2V, I_C = 300mA		+125°C			3.0	V
	V_{CE} = 2V, I_C = 500mA		+125°C			3.5	V
	V_{CE} = 2V, I_C = 275mA	2014, 2814	-55°C			10	V
	V_{CE} = 2V, I_C = 350mA		-55°C			12	V
	V_{CE} = 2V, I_C = 500mA		-55°C			17	V
	V_{CE} = 2V, I_C = 275mA		+125°C			7.0	V
	V_{CE} = 2V, I_C = 350mA		+125°C			8.0	V
	V_{CE} = 2V, I_C = 500mA		+125°C			9.5	V
	V_{CE} = 2V, I_C = 350mA	2015, 2815	-55°C			3.0	V
	V_{CE} = 2V, I_C = 500mA		-55°C			3.5	V
	V_{CE} = 2V, I_C = 350mA		+125°C			2.4	V
	V_{CE} = 2V, I_C = 500mA		+125°C			2.6	V
DC Forward Current Transfer Ratio, h_{FE}	V_{CE} = 2V, I_C = 500mA	2011, 2811	-55°C	450			
	V_{CE} = 2V, I_C = 500mA			900			
Input Capacitance, C_{IN}		All			15	25	pF
Turn-on Delay, t_{PLH}	0.5 E_{IN} to 0.5 E_{OUT}	All			250	1000	ns
Turn-off Delay, t_{PHL}	0.5 E_{IN} to 0.5 E_{OUT}	All			250	1000	ns
Clamp Diode Leakage Current, I_R	V_R = 50V	All	•			50	µA
Clamp Diode Forward Voltage, V_F	I_F = 350mA	All	•		1.7	2.0	V
	I_F = 500mA		•			2.5	V

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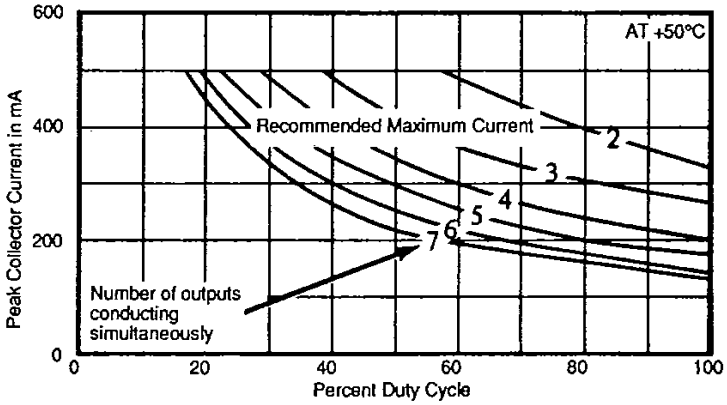
Electrical Characteristics Continued

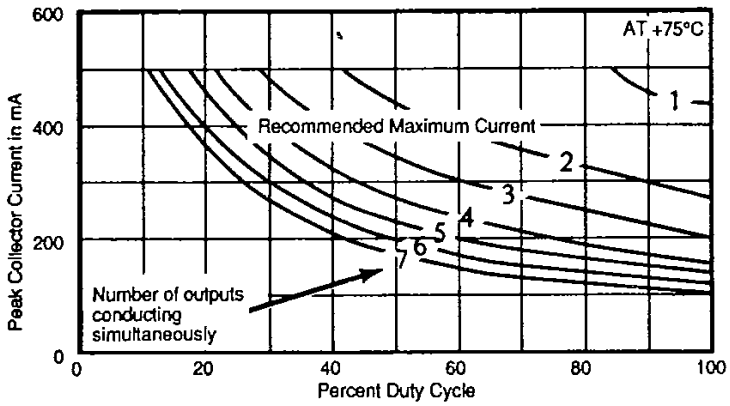
Characteristic	Conditions	Device	Temp	ULS2020/ULS2820 Min	Typ	Max	Units
Output Leakage Current, I_{CEX}	V_{CE} = 95V	All	•			100	µA
	V_{CE} = 95V, V_{IN} = 6V	2022, 2822	•			500	µA
	V_{CE} = 95V, V_{IN} = 1V	2024, 2824	•			500	µA
Collector-Emitter Saturation Voltage, $V_{CE(SAT)}$	I_C = 350mA, I_B = 850µA	All	-55°C		1.6	1.8	V
	I_C = 200mA, I_B = 550µA		-55°C		1.3	1.5	V
	I_C = 100mA, I_B = 350µA		-55°C		1.1	1.3	V
	I_C = 350mA, I_B = 500µA				1.25	1.6	V
	I_C = 200mA, I_B = 350µA				1.1	1.3	V
	I_C = 100mA, I_B = 250µA				0.9	1.1	V
	I_C = 350mA, I_B = 500µA		+125°C		1.6	1.8	V
	I_C = 200mA, I_B = 350µA		+125°C		1.3	1.5	V
	I_C = 100mA, I_B = 250µA		+125°C		1.1	1.3	V
Input Current, I_{IN} (ON)	V_{IN} = 17V	2022, 2822	•	480	850	1300	µA
	V_{IN} = 3.85V	2023, 2823	•	650	930	1350	µA
	V_{IN} = 5V	2024, 2824	•	240	350	500	µA
	V_{IN} = 12V		•	650	1000	1450	µA
	V_{IN} = 3V	2025, 2825	•	1180	1500	2400	µA
Input Current, $I_{IN(OFF)}$	I_C = 500µA	All	+125°C	25	50		µA
Input Voltage, V_{IN} (ON)	V_{CE} = 2V, I_C = 300mA	2022, 2822	-55°C			18	V
	V_{CE} = 2V, I_C = 300mA		+125°C			13	V
	V_{CE} = 2V, I_C = 200mA	2023, 2823	-55°C			3.3	V
	V_{CE} = 2V, I_C = 250mA		-55°C			3.6	V
	V_{CE} = 2V, I_C = 300mA		-55°C			3.9	V
	V_{CE} = 2V, I_C = 200mA		+125°C			2.4	V
	V_{CE} = 2V, I_C = 250mA		+125°C			2.7	V
	V_{CE} = 2V, I_C = 300mA		+125°C			3.0	V
	V_{CE} = 2V, I_C = 125mA	2024, 2824	-55°C			6.0	V
	V_{CE} = 2V, I_C = 200mA		-55°C			8.0	V
	V_{CE} = 2V, I_C = 275mA		-55°C			10	V
	V_{CE} = 2V, I_C = 350mA		-55°C			12	V
	V_{CE} = 2V, I_C = 125mA		+125°C			5.0	V
	V_{CE} = 2V, I_C = 200mA		+125°C			6.0	V
	V_{CE} = 2V, I_C = 275mA		+125°C			7.0	V
	V_{CE} = 2V, I_C = 350mA		+125°C			8.0	V
	V_{CE} = 2V, I_C = 350mA	2025, 2825	-55°C			3.0	V
	V_{CE} = 2V, I_C = 350mA		+125°C			2.4	V
DC Forward Current Transfer Ratio, h_{FE}	V_{CE} = 2V, I_C = 350mA	2021, 2821	-55°C	500			
	V_{CE} = 2V, I_C = 350mA			1000			
Input Capacitance, C_{IN}		All			15	25	pF
Turn-on Delay, t_{PLH}	0.5 E_{IN} to 0.5 E_{OUT}	All			250	1000	ns
Turn-off Delay, t_{PHL}	0.5 E_{IN} to 0.5 E_{OUT}	All			250	1000	ns
Clamp Diode Leakage Current, I_R	V_R = 95V	All	•			50	µA
Clamp Diode Forward Voltage, V_F	I_F = 350mA	All	•		1.7	2.0	V

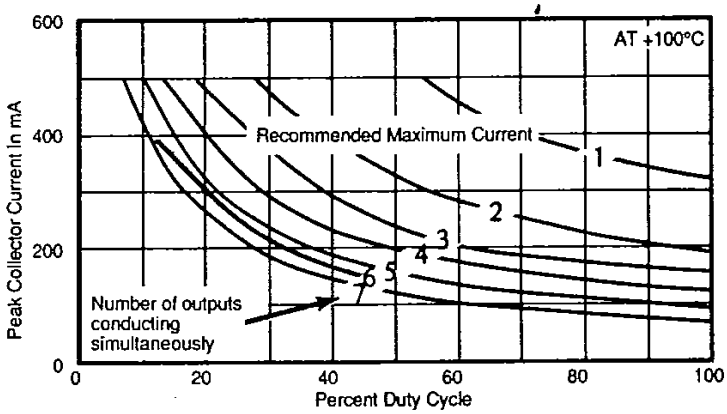
The • denotes the specifications which apply over the full operating temperature range, all others apply at T_A = 25°C unless otherwise specified.

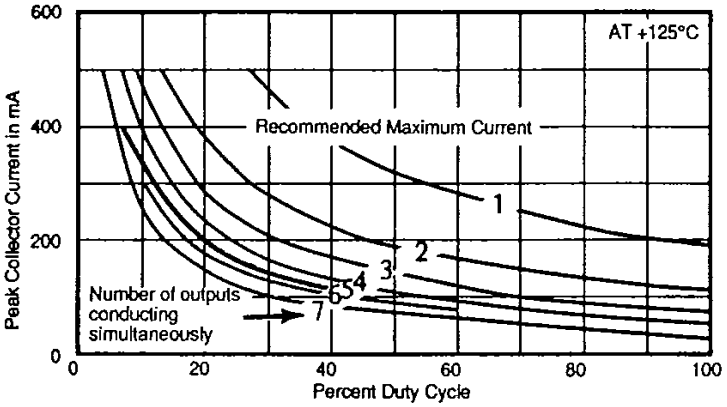
Operating Conditions

ULS2000L — Peak Collector Current as a Function of Duty Cycle (See Note)

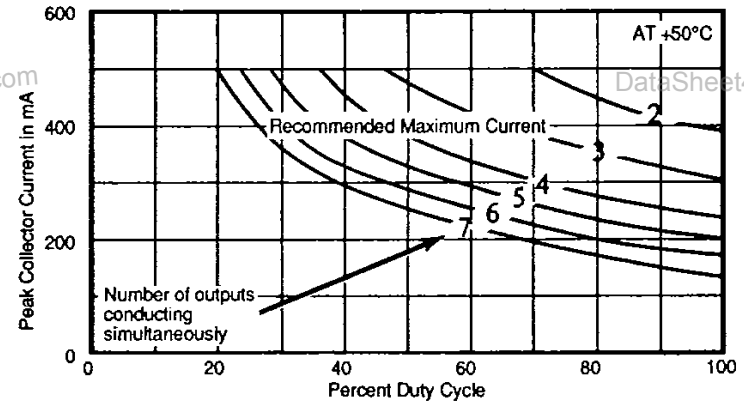


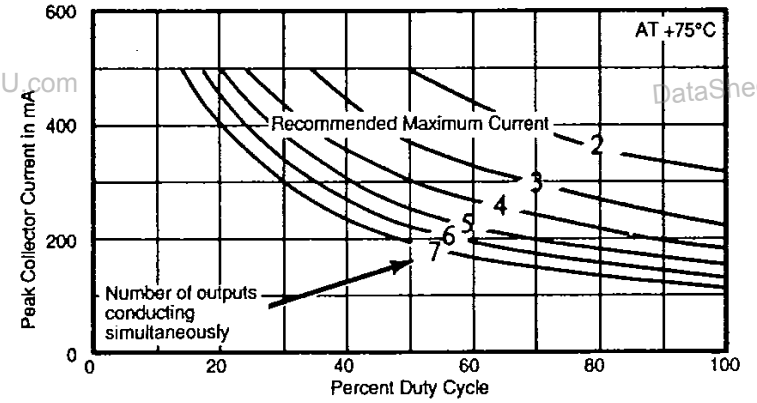




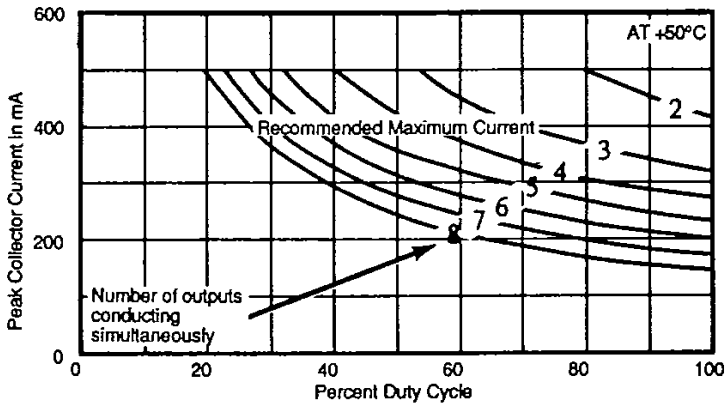


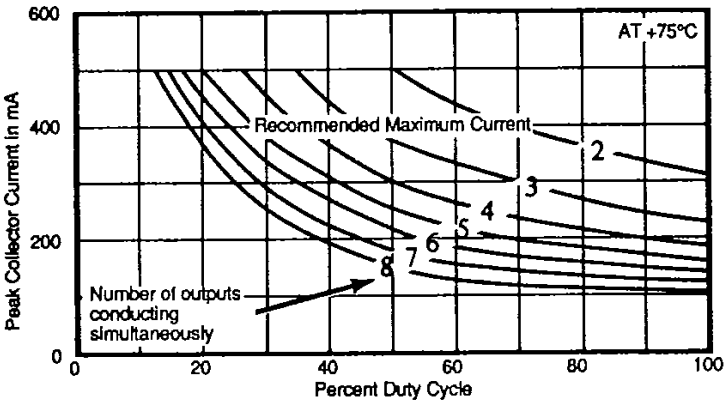
ULS2000J — Peak Collector Current as a Function of Duty Cycle (See Note)





ULS2800J — Peak Collector Current as a Function of Duty Cycle (See Note)





Note: The recommended maximum currents apply to the 2000, 2800, 2020, and 2820 series.

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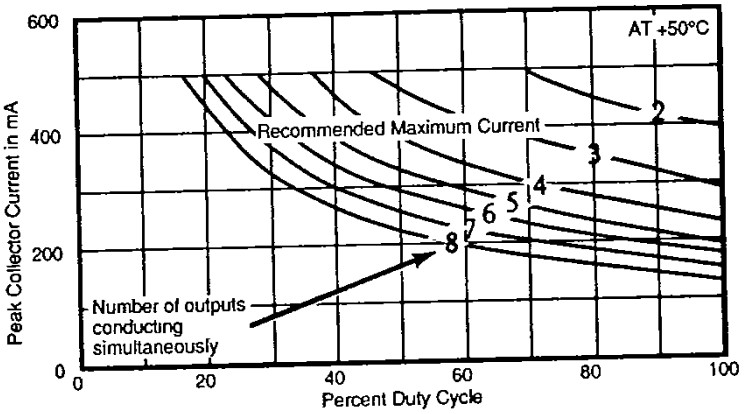
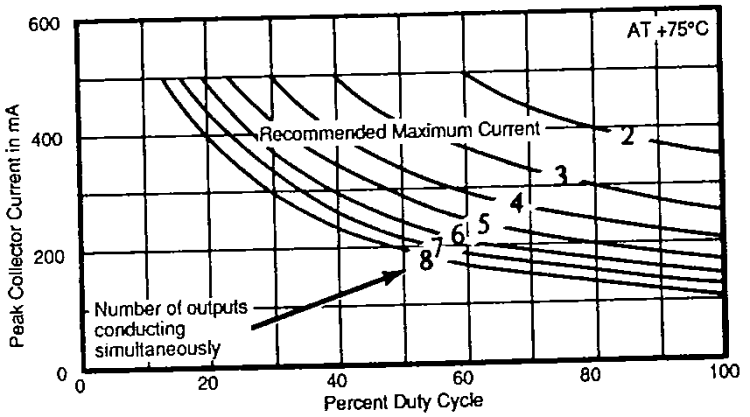
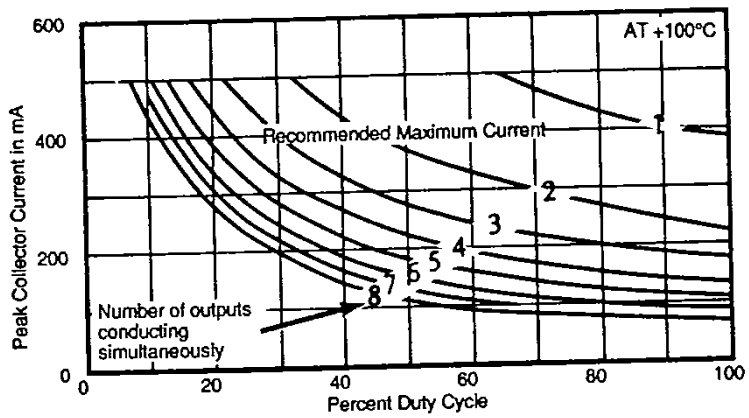
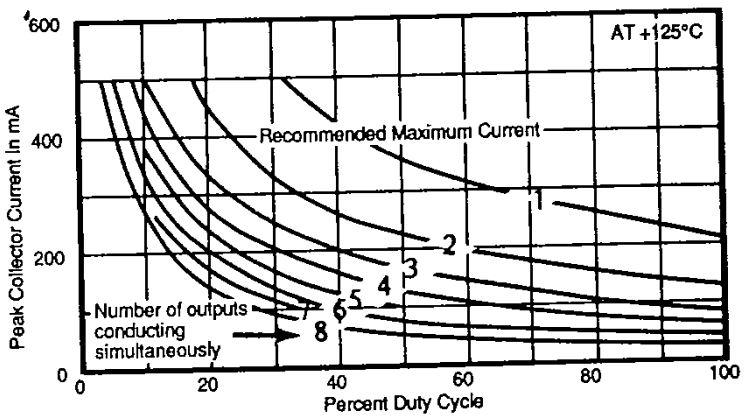
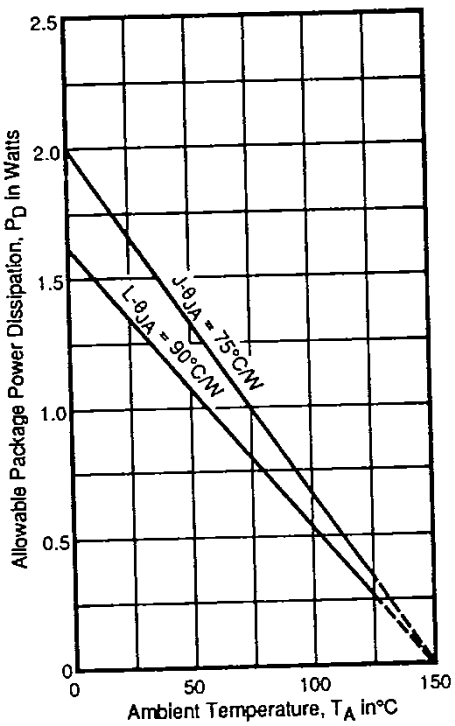
ULS2800L — Peak Collector Current as a Function of Duty Cycle (See Note)



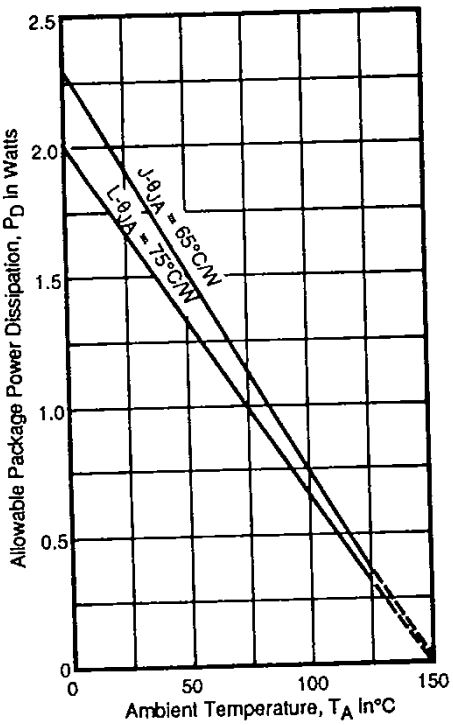








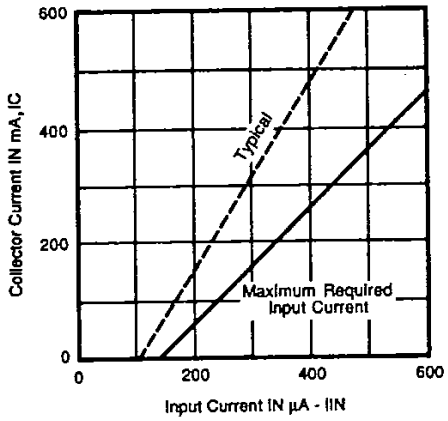
Allowable Package Power Dissipation
ULS-2000J and ULS-2000L



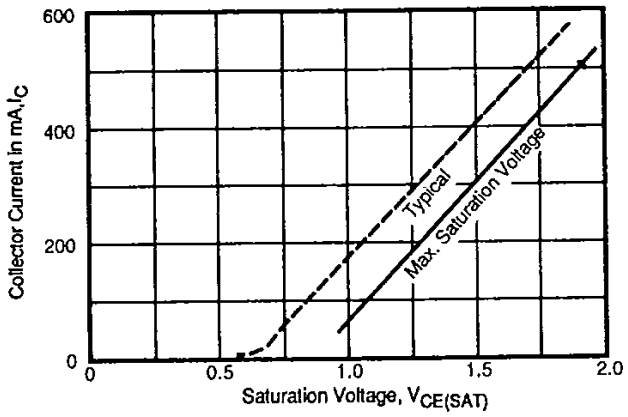
Allowable Package Power Dissipation
ULS-2800J and ULS-2800L

Note: The recommended maximum currents apply to 2000, 2800, 2020, and 2820 series.

Saturation Voltage Characteristics



Collector Current as a Function of Input Current



Collector Current as a Function of Saturation Voltage

Order Information

Input Conditions	Maximum Output Conditions					
	7 Segment Drive			8 Segment Drive		
	V_{CE} = 50V I_C = 500mA	V_{CE} = 50V I_C = 600mA	V_{CE} = 95V I_C = 500mA	V_{CE} = 50V I_C = 500mA	V_{CE} = 50V I_C = 600mA	V_{CE} = 95V I_C = 500mA
General Purpose CMOS, PMOS	ULS2001J ULS2001L	ULS2011J ULS2011L	ULS2021J ULS2021L	ULS2801J ULS2801L	ULS2811J ULS2811L	ULS2821J ULS2821L
14 - 25V PMOS	ULS2002J ULS2002L	ULS2012J ULS2012L	ULS2022J ULS2022L	ULS2802J ULS2802L	ULS2812J ULS2812L	ULS2822J ULS2822L
5V TTL, CMOS	ULS2003J ULS2003L	ULS2013J ULS2013L	ULS2023J ULS2023L	ULS2803J ULS2803L	ULS2813J ULS2813L	ULS2823J ULS2823L
6 - 15V CMOS, PMOS	ULS2004J ULS2004L	ULS2014J ULS2014L	ULS2024J ULS2024L	ULS2804J ULS2804L	ULS2814J ULS2814L	ULS2824J ULS2824L
High Output TTL	ULS2005J ULS2005L	ULS2015J ULS2015L	ULS2025J ULS2025L	ULS2805J ULS2805L	ULS2815J ULS2815L	ULS2825J ULS2825L

Note: J — 16 or 18 pin Cerdip
L — 16 or 18 pin side braised ceramic

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