High-Voltage, High-Current Darlington Transistor Arrays

GENERAL DESCRIPTION

The XR-2011/2012/2013/2014 are high-voltage, high-current Darlington transistor arrays consisting of seven silicon NPN Darlington pairs on a common monolithic substrate. All units feature open collector outputs and integral protection diodes for driving inductive loads. Peak inrush currents of up to 750 mA are allowed, which makes the arrays ideal for driving tungsten filament lamps. The outputs may be paralleled to achieve higher load current capability although each driver has a maximum continuous collector current rating of 600 mA. The arrays are directly price competitive with discrete transistor alternatives.

FEATURES

Peak Inrush Current Capability of 750 mA
Internal Protection Diodes for Driving Inductive Loads
Excellent Noise Immunity
Direct Compatibility with Most Logic Families
Opposing Pin Configuration Eases Circuit Board Layout

APPLICATIONS

Relay Drive
High Current Logic Driver

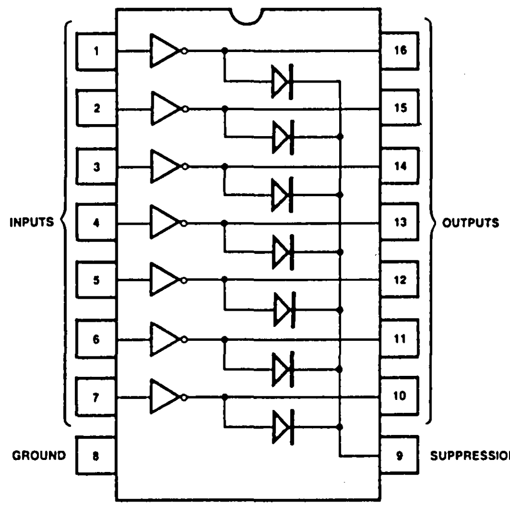
ABSOLUTE MAXIMUM RATINGS $T_A = 25°C$

Output Voltage, V_{CE}	50V
Input Voltage, V_{IN}	30V
Continuous Collector Current, I_C (Each Driver)	600 mA
Continuous Base Current, I_B (Each Driver)	25 mA
Power Dissipation, P_D (Each Driver)	1.0 W
(Total Package)	See graph
Derate Above 25°C	16.67 mW/°C
Storage Temperature Range	−55°C to +150°C

ORDERING INFORMATION

Part Number	Package Type	Operating Temperature
XR-2011 CN	Ceramic	0°C to +70°C
XR-2012 CN	Ceramic	0°C to +70°C
XR-2013 CN	Ceramic	0°C to +70°C
XR-2014 CN	Ceramic	0°C to +70°C

FUNCTIONAL BLOCK DIAGRAM



SYSTEM DESCRIPTION

The XR-2011 device is a general purpose array to be used with bipolar digital logic (with external current limiting), or with CMOS or PMOS directly. Output pins opposite input pins facilitates circuit board layout.

The XR-2012 was specifically designed to interface with 14 to 25 volt PMOS devices. The input current is limited to a safe value by a Zener diode and resistor in series.

A 2.7 kΩ series base resistor to each Darlington pair in the XR-2013 permits operation directly with CMOS or TTL operating with a 5 volt supply. Interface requirements beyond the scope of standard logic buffers are easily handled by the XR-2013.

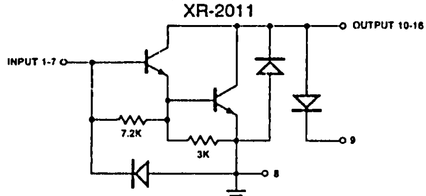
The XR-2014 requires less input current than the XR-2013 and the input voltage is less than that required by the XR-2012. The XR-2014 has a 10.5 kΩ series input resistor, permitting operation directly from PMOS or CMOS outputs using supply voltages of 6 to 15 volts.

ELECTRICAL CHARACTERISTICS (T_A 25°C unless otherwise noted)

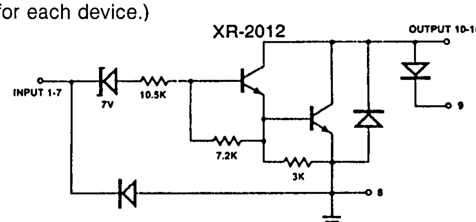
SYMBOL	PARAMETERS	LIMITS MIN	TYP	MAX	UNITS	CONDITIONS
I_{CEX}	Output Leakage Current XR-2012 XR-2014			100 500 500	μA μA μA	V_{CE} = 50 V, T_A = 70°C V_{CE} = 50 V, T_A = 70°C, V_{IN} = 6V V_{CE} = 50 V, T_A = 70°C, V_{IN} = 1V
V_{CE}	Collector-Emitter Saturation Voltage		1.7 1.3 1.1	1.9 1.6 1.3	V V V	I_C = 500mA, I_B = 600μA I_C = 350mA, I_B = 500μA I_C = 200mA, I_B = 350μA
I_{IN}	Input Current (on) XR-2012 XR-2013 XR-2014		0.82 0.93 0.35 1.0	1.25 1.35 0.5 1.45	mA mA mA mA	V_{IN} = 17V V_{IN} = 3.85V V_{IN} = 5V V_{IN} = 12V
I_{IN}	Input Current (off)	50	65		μA	I_C = 500μA, T_A = 70°C
V_{IN}	Input Voltage XR-2012 XR-2013 XR-2014			17 2.7 3.0 3.5 7.0 8.0 9.5	V V V V V V V	V_{CE} = 2 V, I_C = 500mA V_{CE} = 2 V, I_C = 250mA V_{CE} = 2 V, I_C = 300mA V_{CE} = 2 V, I_C = 500mA V_{CE} = 2 V, I_C = 275mA V_{CE} = 2 V, I_C = 350mA V_{CE} = 2 V, I_C = 500mA
h_{FE}	D-C Forward Current Transfer Ratio XR-2011	1000				V_{CE} = 2 V, I_C = 350mA
C_{IN}	Input Capacitance		15	30	pF	
I_R	Clamp Diode Leakage Current			50	μA	VR = 50V
V_F	Clamp Diode Forward Voltage		2.1	2.5	V	I_F = 500mA
t_{PLH}	Turn-On Delay		0.25	1.0	μS	0.5 E_{IN} to 0.5 E_{OUT}
t_{PHL}	Turn-Off Delay		0.25	1.0	μS	0.5 E_{IN} to 0.5 E_{OUT}

SCHEMATIC DIAGRAMS (One of 7 Identical Drivers is shown for each device.)

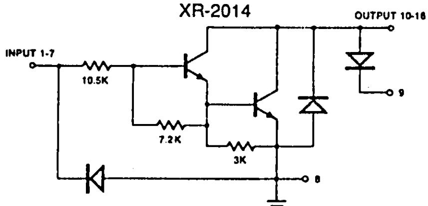
XR-2011



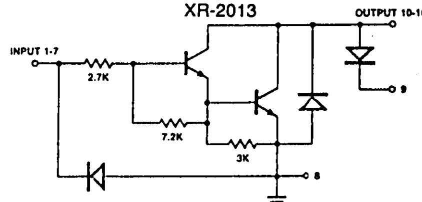
XR-2012



XR-2014



XR-2013



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CHARACTERISTIC CURVES

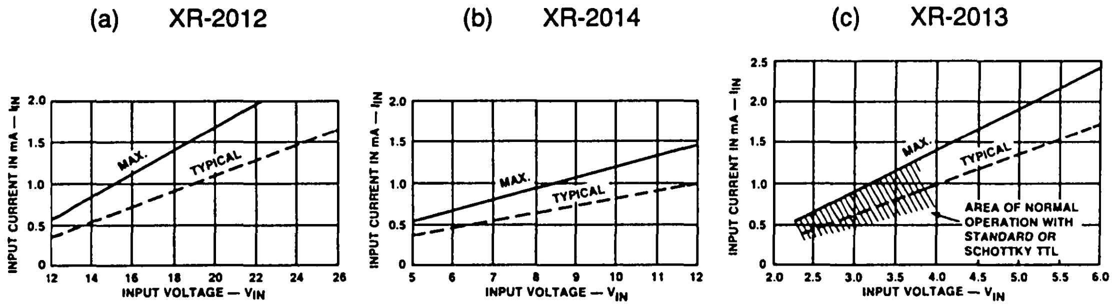

Figure 1. Input Current as a Function of Input Voltages

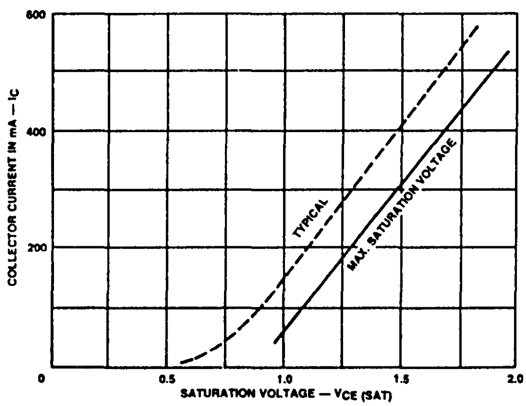

Figure 2. Collector Current as a Function of Saturation Voltage

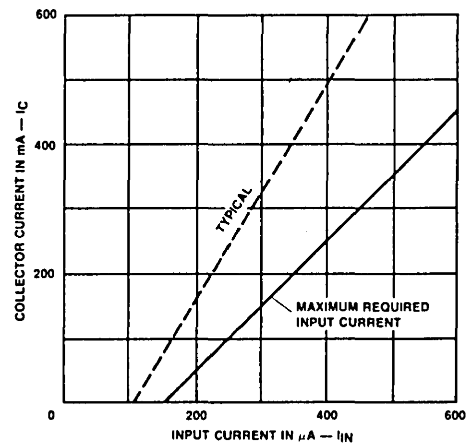

Figure 3. Collector Current as a Function of Input Current

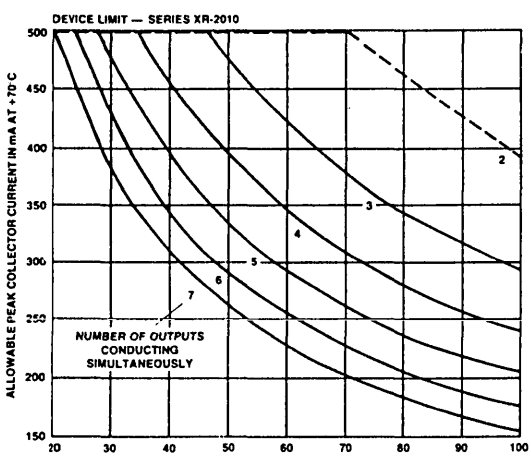

Figure 4. Peak Collector Current as a Function of Duty Cycle and Number of Outputs

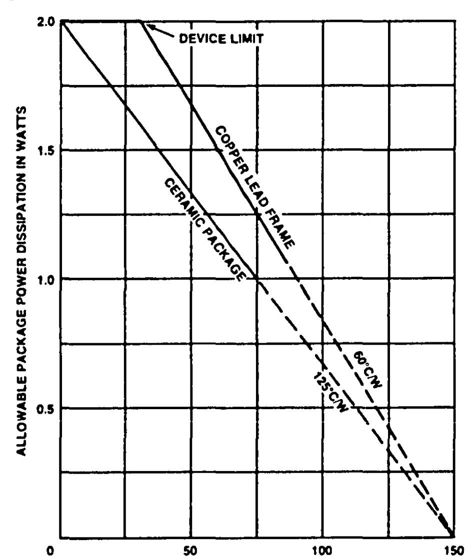

Figure 5. Allowable Average Power Dissipation as a Function of Ambient Temperature

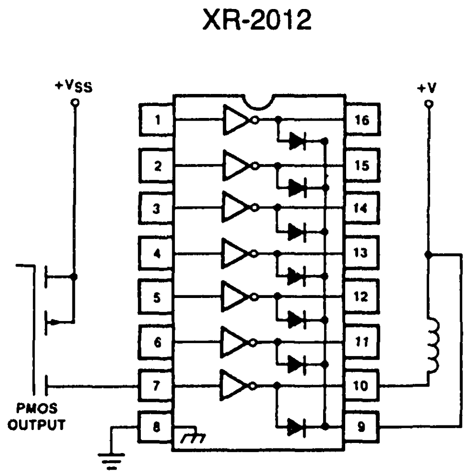

Figure 6. PMOS to Load

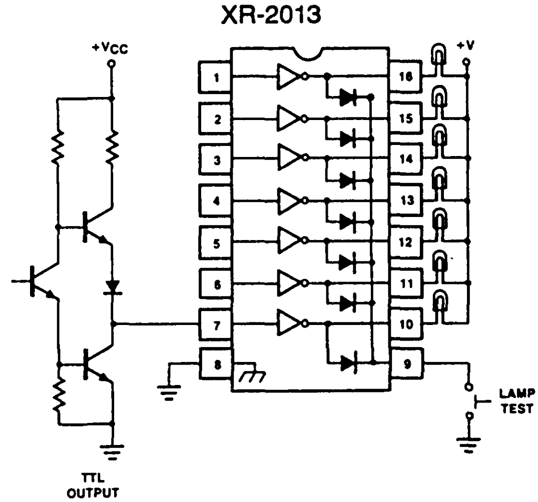

Figure 7. TTL to Load

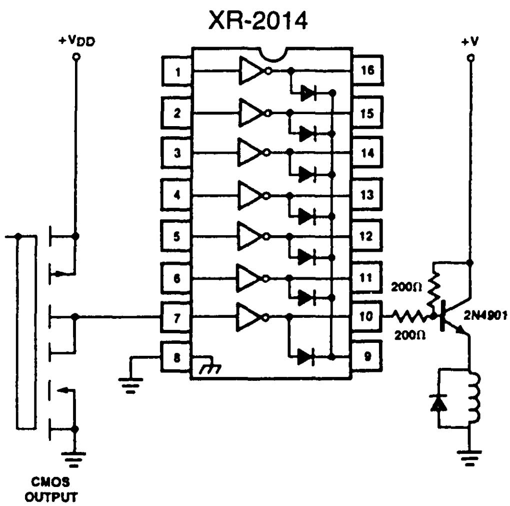

Figure 8. Buffer for Higher Current Loads

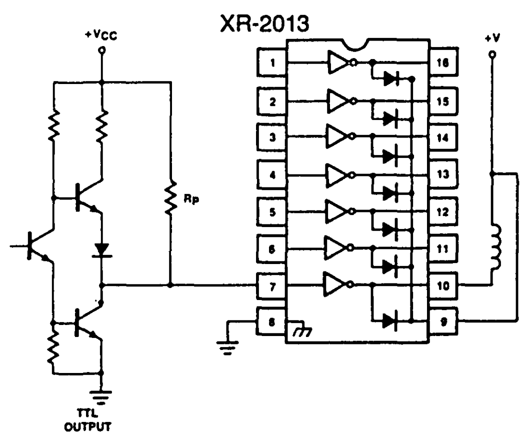

Figure 9. Use of Pull-up Resistors to Increase Drive Current