MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MC1411,B
MC1412,B
MC1413,B
MC1416,B

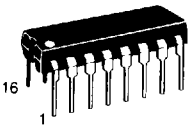
PERIPHERAL DRIVER ARRAYS

SILICON MONOLITHIC INTEGRATED CIRCUITS

HIGH VOLTAGE, HIGH CURRENT DARLINGTON TRANSISTOR ARRAYS

The seven NPN Darlington connected transistors in these arrays are well suited for driving lamps, relays, or printer hammers in a variety of industrial and consumer applications. Their high breakdown voltage and internal suppression diodes insure freedom from problems associated with inductive loads. Peak inrush currents to 600 mA permit them to drive incandescent lamps.

The MC1411,B device is a general purpose array for use with DTL, TTL, PMOS, or CMOS Logic. The MC1412,B contains a zener diode and resistor in series with the input to limit input current for use with 14 to 25 Volt PMOS Logic. The MC1413,B with a 2.7 kΩ series input resistor is well suited for systems utilizing a 5 Volt TTL or CMOS Logic. The MC1416,B uses a series 10.5 kΩ resistor and is useful in 8 to 18 Volt MOS systems.



P SUFFIX
PLASTIC PACKAGE
CASE 648

D SUFFIX
PLASTIC PACKAGE
CASE 751B
(SO-16)

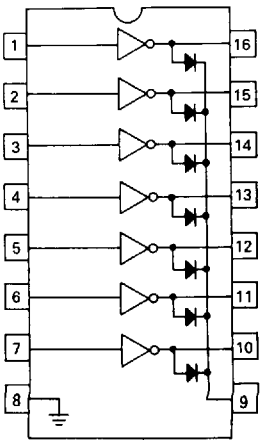
MAXIMUM RATINGS (T_A = 25°C and rating apply to any one device in the package unless otherwise noted.)

Rating	Symbol	Value	Unit
Output Voltage	V_O	50	V
Input Voltage (Except MC1411)	V_I	30	V
Collector Current — Continuous	I_C	500	mA
Base Current — Continuous	I_B	25	mA
Operating Ambient Temperature Range MC1411-16 MC1411B-16B	T_A	 −20 to +85 −40 to +85	°C
Storage Temperature Range	T_{stg}	−55 to +150	°C
Junction Temperature	T_J	150	°C
Thermal Resistance — Junction-to-Ambient Case 648, P Suffix Case 751B, D Suffix	θ_{JA}	 67 100	°C/W

ORDERING INFORMATION

Plastic DIP	SOIC	Ambient Temperature Range
MC1411P (ULN2001A) MC1412P (ULN2002A) MC1413P (ULN2003A) MC1416P (ULN2004A)	MC1411D MC1412D MC1413D MC1416D	−20° to +85°C
MC1411BP MC1412BP MC1413BP MC1416BP	MC1411BD MC1412BD MC1413BD MC1416BD	−40° to +85°C

PIN CONNECTIONS



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MC1411,B, MC1412,B, MC1413,B, MC1416,B

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
Output Leakage Current		I_{CEX}				μA
(V_O = 50 V, T_A = +85°C)	All Types		—	—	100	
(V_O = 50 V, T_A = +25°C)	All Types		—	—	50	
(V_O = 50 V, T_A = +85°C, V_I = 6.0 V)	MC1412,B		—	—	500	
(V_O = 50 V, T_A = +85°C, V_I = 1.0 V)	MC1416,B		—	—	500	
Collector-Emitter Saturation Voltage		$V_{CE(sat)}$				V
(I_C = 350 mA, I_B = 500 μA)	All Types		—	1.1	1.6	
(I_C = 200 mA, I_B = 350 μA)	All Types		—	0.95	1.3	
(I_C = 100 mA, I_B = 250 μA)	All Types		—	0.85	1.1	
Input Current — On Condition		$I_{I(on)}$				mA
(V_I = 17 V)	MC1412,B		—	0.85	1.3	
(V_I = 3.85 V)	MC1413,B		—	0.93	1.35	
(V_I = 5.0 V)	MC1416,B		—	0.35	0.5	
(V_I = 12 V)	MC1416,B		—	1.0	1.45	
Input Voltage — On Condition		$V_{I(on)}$				V
(V_{CE} = 2.0 V, I_C = 300 mA)	MC1412,B		—	—	13	
(V_{CE} = 2.0 V, I_C = 200 mA)	MC1413,B		—	—	2.4	
(V_{CE} = 2.0 V, I_C = 250 mA)	MC1413,B		—	—	2.7	
(V_{CE} = 2.0 V, I_C = 300 mA)	MC1413,B		—	—	3.0	
(V_{CE} = 2.0 V, I_C = 125 mA)	MC1416,B		—	—	5.0	
(V_{CE} = 2.0 V, I_C = 200 mA)	MC1416,B		—	—	6.0	
(V_{CE} = 2.0 V, I_C = 275 mA)	MC1416,B		—	—	7.0	
(V_{CE} = 2.0 V, I_C = 350 mA)	MC1416,B		—	—	8.0	
Input Current — Off Condition (I_C = 500 μA, T_A = +85°C)	All Types	$I_{I(off)}$	50	100	—	μA
DC Current Gain (V_{CE} = 2.0 V, I_C = 350 mA)	MC1411,B	h_{FE}	1000	—	—	—
Input Capacitance		C_I	—	15	30	pF
Turn-On Delay Time (50% E_I to 50% E_O)		t_{on}	—	0.25	1.0	μs
Turn-Off Delay Time (50% E_I to 50% E_O)		t_{off}	—	0.25	1.0	μs
Clamp Diode Leakage Current (V_R = 50 V)	T_A = +25°C	I_R	—	—	50	μA
	T_A = +85°C		—	—	100	
Clamp Diode Forward Voltage (I_F = 350 mA)		V_F	—	1.5	2.0	V

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TYPICAL PERFORMANCE CURVES — T_A = 25°C

FIGURE 1 — OUTPUT CURRENT versus INPUT VOLTAGE

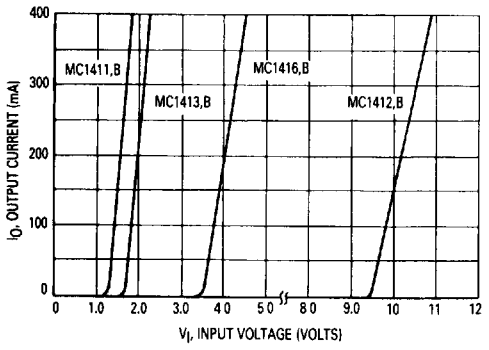
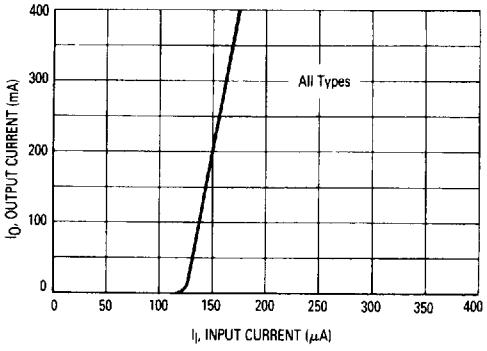


FIGURE 2 — OUTPUT CURRENT versus INPUT CURRENT



TYPICAL CHARACTERISTIC CURVES – T_A = 25°C (continued)

FIGURE 3 — TYPICAL OUTPUT CHARACTERISTICS

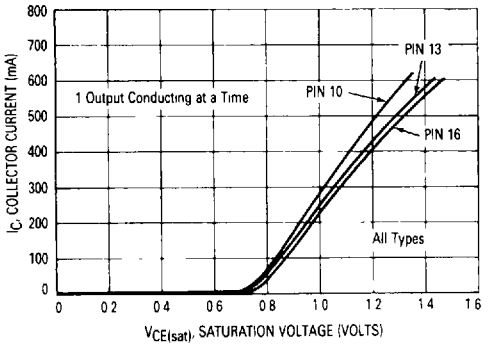


FIGURE 4 — INPUT CHARACTERISTICS — MC1412,B

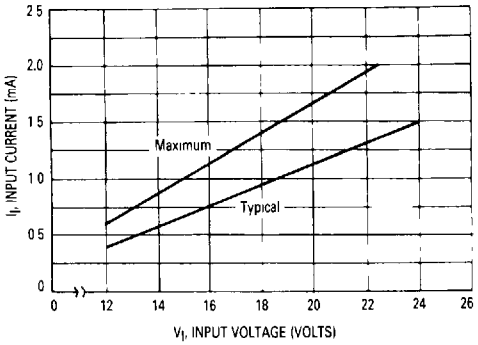


FIGURE 5 — INPUT CHARACTERISTICS — MC1413,B

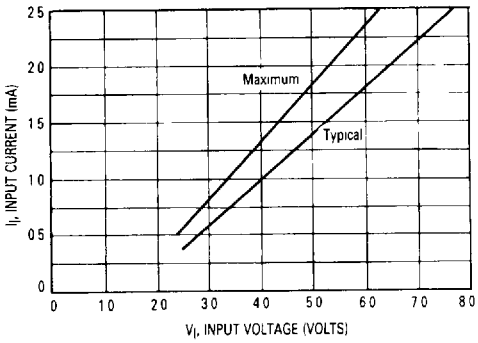


FIGURE 6 — INPUT CHARACTERISTICS — MC1416,B

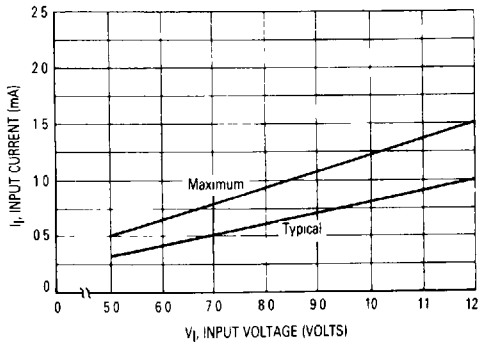


FIGURE 7 — MAXIMUM COLLECTOR CURRENT versus DUTY CYCLE (AND NUMBER OF DRIVERS IN USE)

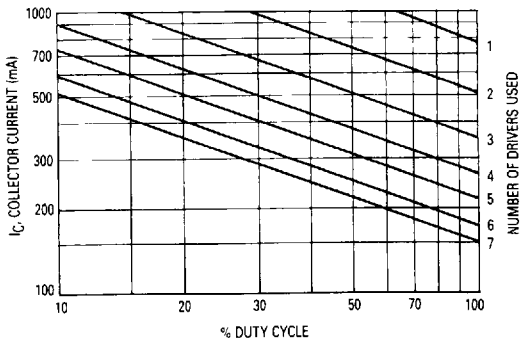


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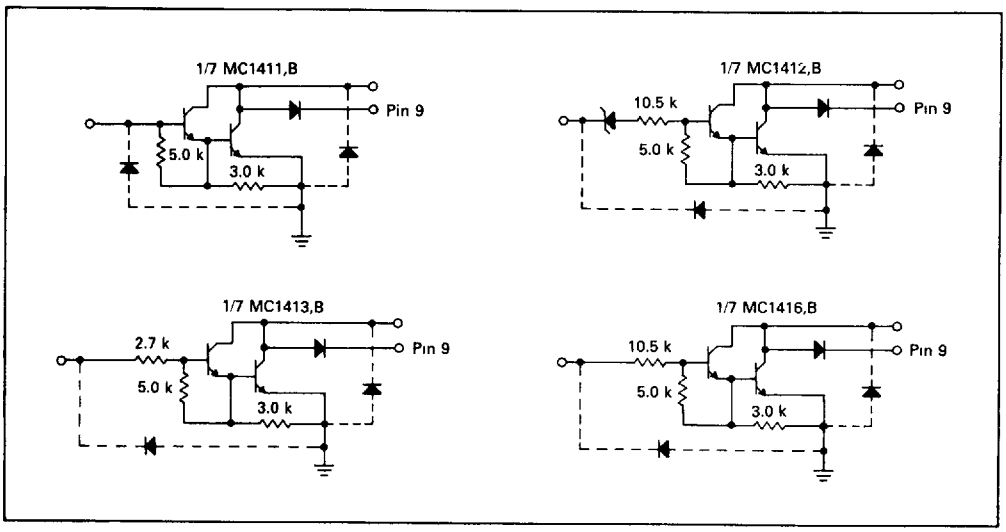
FIGURE 8 — REPRESENTATIVE CIRCUIT SCHEMATICS



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