Order this document by MC1411/D

MOTOROLA

MC1411
MC1412
MC1413,B
MC1416,B

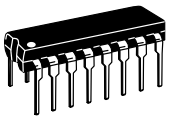
PERIPHERAL DRIVER ARRAYS

SEMICONDUCTOR TECHNICAL DATA

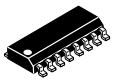
High Voltage, High Current Darlington Transistor Arrays

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 V PMOS Logic. The MC1413,B with a 2.7 kΩ series input resistor is well suited for systems utilizing a 5.0 V TTL or CMOS Logic. The MC1416,B uses a series 10.5 kΩ resistor and is useful in 8.0 to 18 V MOS systems.



P SUFFIX
PLASTIC PACKAGE
CASE 648



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

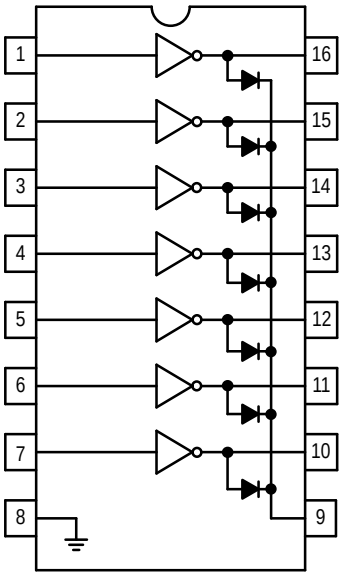
MAXIMUM RATINGS (T_A = 25°C and rating apply to any one device in the package, unless otherwise noted.)

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	Operating Temperature Range
MC1411P (ULN2001A) MC1412P (ULN2002A) MC1413P (ULN2003A) MC1416P (ULN2004A)	 MC1413D MC1416D	T_A = – 20° to + 85°C
MC1413BP MC1416BP	MC1413BD MC1416BD	T_A = – 40° to + 85°C

PIN CONNECTIONS



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		–	–	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		–	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		–	–	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	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 T_A = + 85°C	I_R	– –	– –	50 100	μA
Clamp Diode Forward Voltage (I_F = 350 mA)		V_F	–	1.5	2.0	V

TYPICAL PERFORMANCE CURVES – T_A = 25°C

Figure 1. Output Current versus Input Voltage

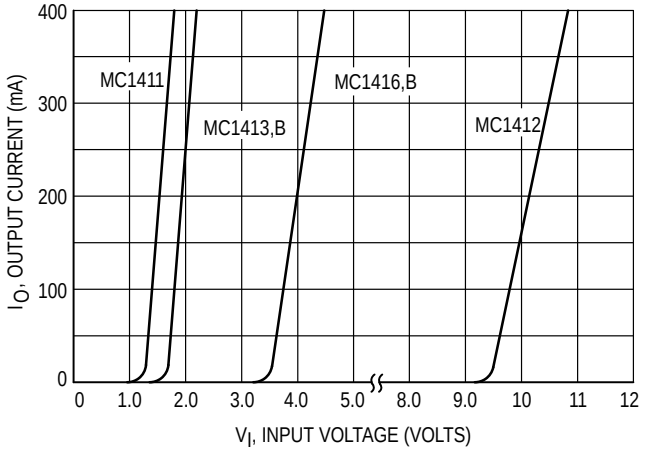
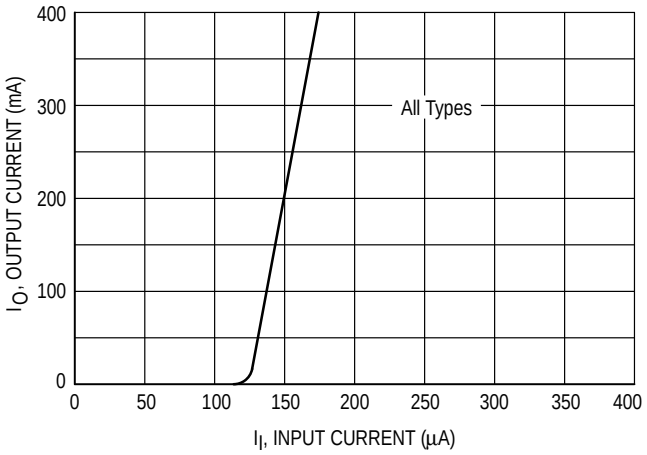


Figure 2. Output Current versus Input Current



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

Figure 3. Typical Output Characteristics

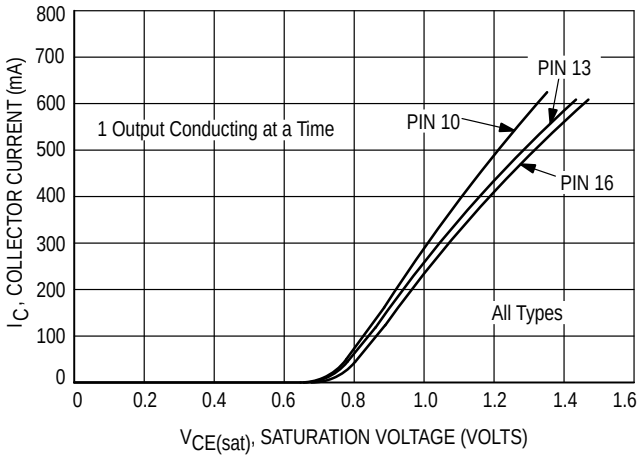


Figure 4. Input Characteristics – MC1412

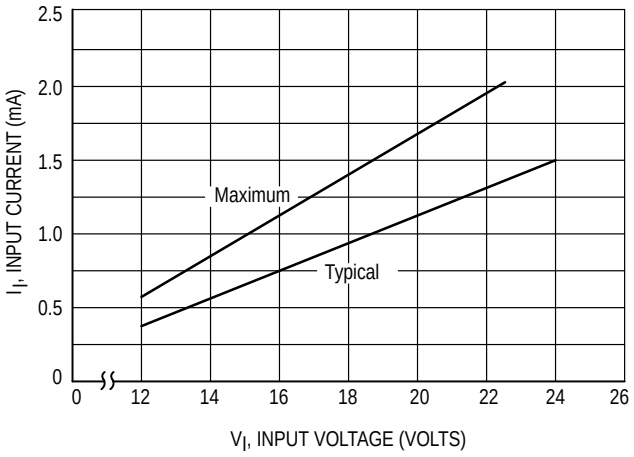


Figure 5. Input Characteristics – MC1413,B

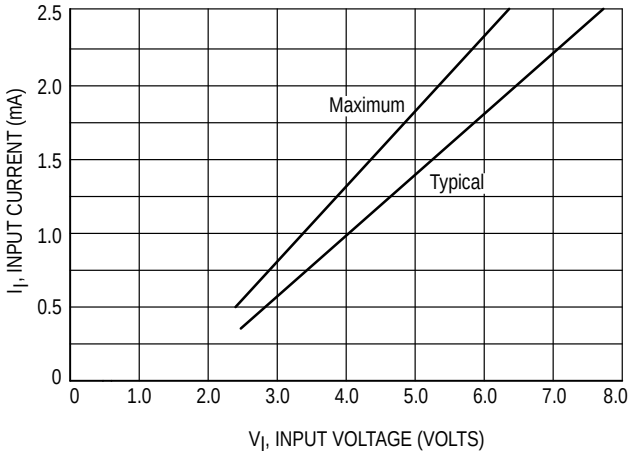


Figure 6. Input Characteristics – MC1416,B

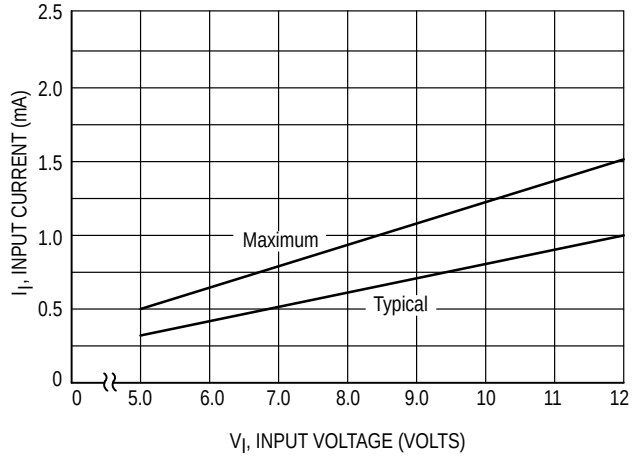
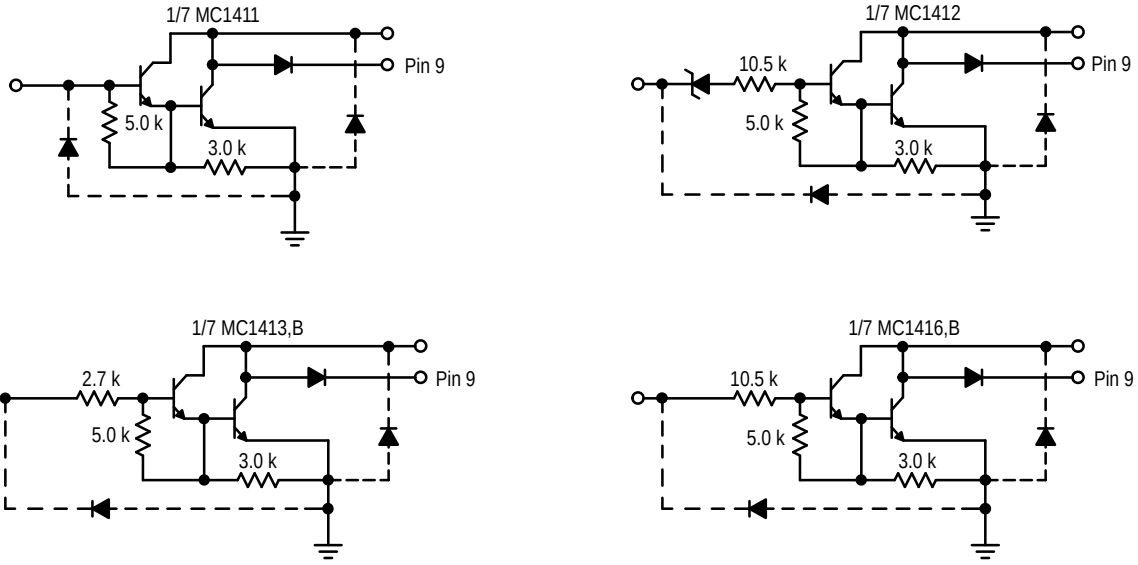


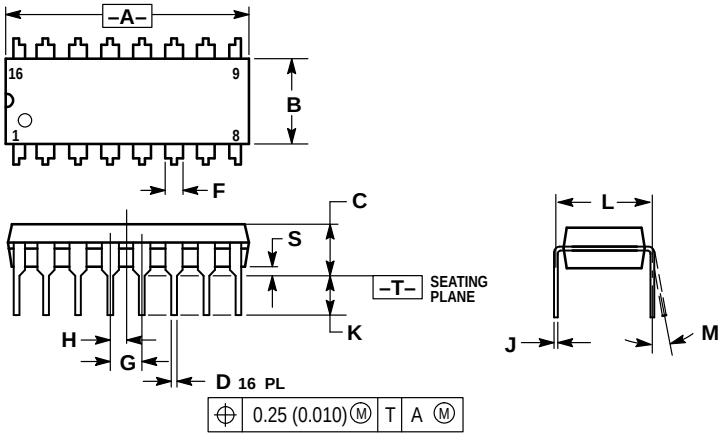
Figure 7. Maximum Collector Current versus Duty Cycle (and Number of Drivers in Use)

Representative Schematic Diagrams



OUTLINE DIMENSIONS

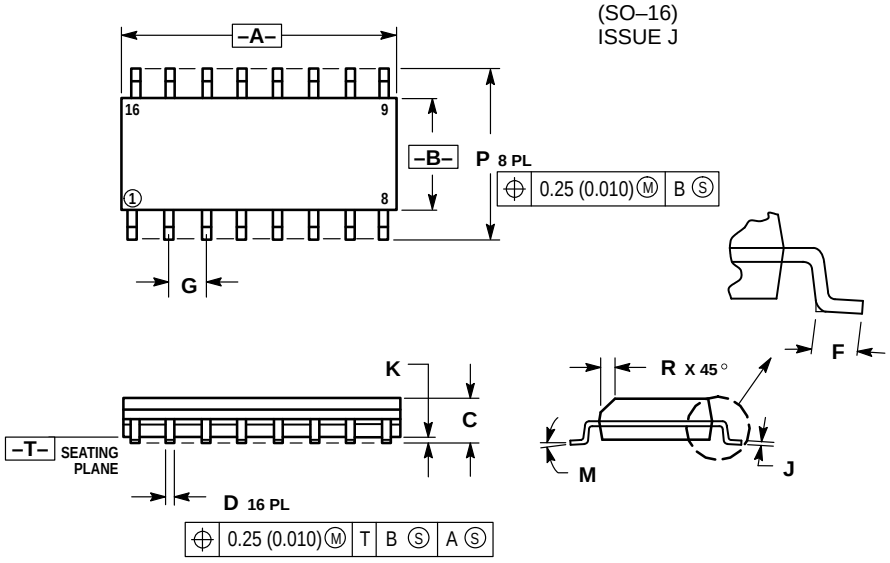
P SUFFIX
PLASTIC PACKAGE
CASE 648–08
ISSUE R



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0 °	10 °	0 °	10 °
S	0.020	0.040	0.51	1.01

D SUFFIX
PLASTIC PACKAGE
CASE 751B–05
(SO–16)
ISSUE J



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	9.80	10.00	0.386	0.393
B	3.80	4.00	0.150	0.157
C	1.35	1.75	0.054	0.068
D	0.35	0.49	0.014	0.019
F	0.40	1.25	0.016	0.049
G	1.27 BSC		0.050 BSC	
J	0.19	0.25	0.008	0.009
K	0.10	0.25	0.004	0.009
M	0 °	7 °	0 °	7 °
P	5.80	6.20	0.229	0.244
R	0.25	0.50	0.010	0.019

How to reach us:
USA / EUROPE: Motorola Literature Distribution;
P.O. Box 20912; Phoenix, Arizona 85036. 1–800–441–2447

MFAX: RMFAX0@email.sps.mot.com – TOUCHTONE (602) 244–6609
INTERNET: http://Design–NET.com

JAPAN: Nippon Motorola Ltd.; Tatsumi–SPD–JLDC, Toshikatsu Otsuki,
6F Seibu–Butsuryu–Center, 3–14–2 Tatsumi Koto–Ku, Tokyo 135, Japan. 03–3521–8315

HONG KONG: Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852–26629298