MCP1406/07

6A High-Speed Power MOSFET Drivers

Features

- High Peak Output Current: 6.0A (typical)
- Low Shoot-Through/Cross-Conduction Current in Output Stage
- Wide Input Supply Voltage Operating Range:
  - 4.5V to 18V
- High Capacitive Load Drive Capability:
  - 2500 pF in 20 ns
  - 6800 pF in 40 ns
- Short Delay Times: 40 ns (typical)
- Matched Rise/Fall Times
- Low Supply Current:
  - With Logic '1' Input – 130 µA (typical)
  - With Logic '0' Input – 35 µA (typical)
- Latch-Up Protected: Will Withstand 1.5A Reverse Current
- Logic Input Will Withstand Negative Swing up to 5V
- Pin compatible with the TC4420/TC4429 devices
- Space-saving 8-Pin SOIC, PDIP and 8-Pin 6 x 5 mm DFN Packages

Applications

- Switch Mode Power Supplies
- Pulse Transformer Drive
- Line Drivers
- Motor and Solenoid Drive

General Description

The MCP1406/07 devices are a family of buffers/MOSFET drivers that feature a single-output with 6A peak drive current capability, low shoot-through current, matched rise/fall times and propagation delay times. These devices are pin-compatible and are improved versions of the TC4420/TC4429 MOSFET drivers.

The MCP1406/07 MOSFET drivers can easily charge and discharge 2500 pF gate capacitance in under 20 ns, provide low enough impedances (in both the ON and OFF states) to ensure that intended state of the MOSFETs will not be affected, even by large transients. The input to the MCP1406/07 may be driven directly from either TTL or CMOS (3V to 18V).

These devices are highly latch-up resistant under any conditions that fall within their power and voltage ratings. They are not subject to damage when up to 5V of noise spiking (of either polarity) occurs on the ground pin. All terminals are fully protected against electrostatic discharge (ESD), up to 2.0 kV (HBM) and 400V (MM).

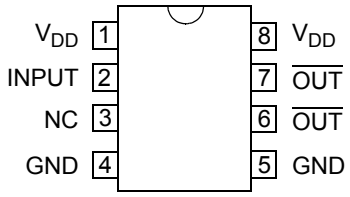
The MCP1406/07 single-output 6A MOSFET driver family is offered in both surface-mount and pin-through-hole packages with a -40°C to +125°C temperature rating, making it useful in any wide temperature range application.

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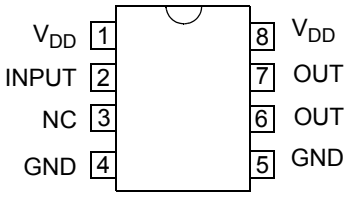
Package Types

8-Pin PDIP/SOIC

MCP1406

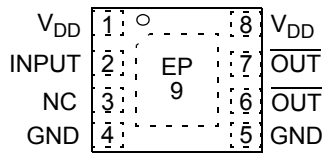


MCP1407

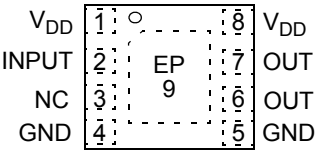


8-Pin 6x5 DFN-S(2)

MCP1406

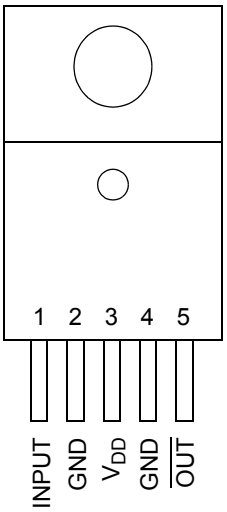


MCP1407



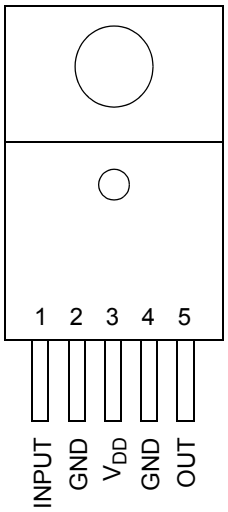
5-Pin TO-220

MCP1406



Tab is common to V_{DD}

MCP1407

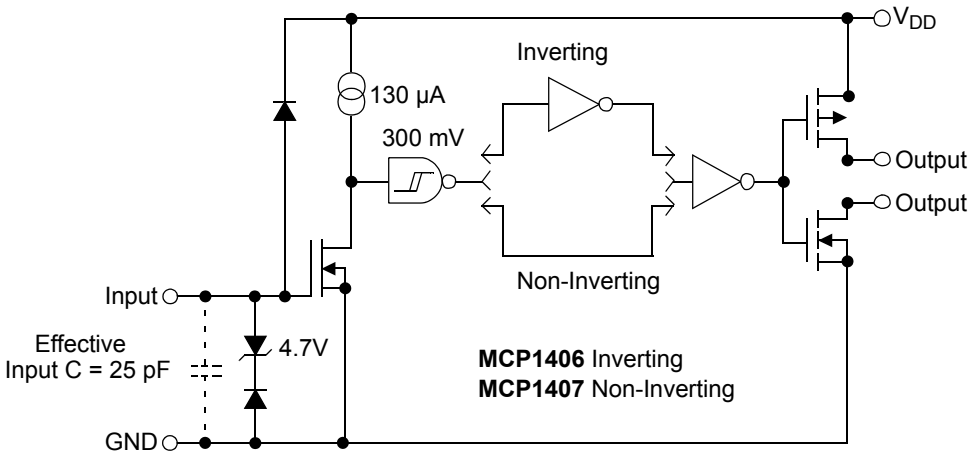


Note 1: Duplicate pins must both be connected for proper operation.

2: Exposed pad of the DFN package is electrically isolated; see Table 3-1.

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Functional Block Diagram(1)



Note 1: Unused inputs should be grounded.

1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

Supply Voltage .....+20V
Input Voltage .....(V_{DD} +0.3V) to (GND -5V)
Input Current (V_{IN} > V_{DD}) .....50 mA
Package Power Dissipation (TA <= +70°C)
- DFN-S 2.5W
- PDIP 1.2W
- SOIC 0.83W
- TO-220 .....3.9W

ESD Protection on all Pins .....2 kV (HBM), 400V (MM)

† **Notice:** Stresses above those listed under "Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability.

DC CHARACTERISTICS

Electrical Specifications: Unless otherwise indicated, T_A = +25°C, with 4.5V ≤ V_{DD} ≤ 18V.

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Input						
Logic '1', High Input Voltage	V_{IH}	2.4	1.8	—	V	
Logic '0', Low Input Voltage	V_{IL}	—	1.3	0.8	V	
Input Current	I_{IN}	–10	—	10	µA	0V ≤ V_{IN} ≤ V_{DD}
Input Voltage	V_{IN}	-5	—	V_{DD} + 0.3	V	
Output						
High Output Voltage	V_{OH}	V_{DD} – 0.025	—	—	V	DC Test
Low Output Voltage	V_{OL}	—	—	0.025	V	DC Test
Output Resistance, High	R_{OH}	—	2.1	2.8	Ω	I_{OUT} = 10 mA, V_{DD} = 18V
Output Resistance, Low	R_{OL}	—	1.5	2.5	Ω	I_{OUT} = 10 mA, V_{DD} = 18V
Peak Output Current	I_{PK}	—	6	—	A	V_{DD} = 18V **(Note 1)**
Continuous Output Current	I_{DC}	1.3			A	**Note 1**, **Note 2**
Latch-Up Protection Withstand Reverse Current	I_{REV}	—	1.5	—	A	Duty cycle ≤ 2%, t ≤ 300 µs
Switching Time (Note 3)						
Rise Time	t_R	—	20	30	ns	**Figure 4-1**, **Figure 4-2** C_L = 2500 pF
Fall Time	t_F	—	20	30	ns	**Figure 4-1**, **Figure 4-2** C_L = 2500 pF
Delay Time	t_{D1}	—	40	55	ns	**Figure 4-1**, **Figure 4-2**
Delay Time	t_{D2}	—	40	55	ns	**Figure 4-1**, **Figure 4-2**
Power Supply						
Supply Voltage	V_{DD}	4.5	—	18.0	V	
Power Supply Current	I_S	—	130	250	µA	V_{IN} = 3V
	I_S	—	35	100	µA	V_{IN} = 0V

Note 1: Tested during characterization, not production tested.
2: Valid for AT (TO-220) and MF (DFN-S) packages only. T_A = +25°C
3: Switching times ensured by design.

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DC CHARACTERISTICS (OVER OPERATING TEMPERATURE RANGE)

Electrical Specifications: Unless otherwise indicated, operating temperature range with 4.5V ≤ V_{DD} ≤ 18V.						
Parameters	**Sym.**	**Min.**	**Typ.**	**Max.**	**Units**	**Conditions**
Input						
Logic '1', High Input Voltage	V_{IH}	2.4	—	—	V	
Logic '0', Low Input Voltage	V_{IL}	—	—	0.8	V	
Input Current	I_{IN}	-10	—	+10	µA	0V ≤ V_{IN} ≤ V_{DD}
Input Voltage	V_{IN}	-5	—	V_{DD}+0.3	V	
Output						
High Output Voltage	V_{OH}	V_{DD} – 0.025	—	—	V	DC TEST
Low Output Voltage	V_{OL}	—	—	0.025	V	DC TEST
Output Resistance, High	R_{OH}	—	3.0	5.0	Ω	I_{OUT} = 10 mA, V_{DD} = 18V
Output Resistance, Low	R_{OL}	—	2.3	5.0	Ω	I_{OUT} = 10 mA, V_{DD} = 18V
Switching Time (Note 1)						
Rise Time	t_R	—	25	40	ns	**Figure 4-1**, **Figure 4-2** C_L = 2500 pF
Fall Time	t_F	—	25	40	ns	**Figure 4-1**, **Figure 4-2** C_L = 2500 pF
Delay Time	t_{D1}	—	50	65	ns	**Figure 4-1**, **Figure 4-2**
Delay Time	t_{D2}	—	50	65	ns	**Figure 4-1**, **Figure 4-2**
Power Supply						
Supply Voltage	V_{DD}	4.5	—	18.0	V	
Power Supply Current	I_S	—	200	500	µA	V_{IN} = 3V
		—	50	150		V_{IN} = 0V

Note 1: Switching times ensured by design.

TEMPERATURE CHARACTERISTICS

Electrical Specifications: Unless otherwise noted, all parameters apply with 4.5V ≤ V_{DD} ≤ 18V.						
Parameters	**Sym.**	**Min.**	**Typ.**	**Max.**	**Units**	**Conditions**
Temperature Ranges						
Specified Temperature Range	T_A	-40	—	+125	°C	
Maximum Junction Temperature	T_J	—	—	+150	°C	
Storage Temperature Range	T_A	-65	—	+150	°C	
Package Thermal Resistances						
Junction-to-Ambient Thermal Resistance, 8-L 6x5 DFN	θ_{JA}	—	31.8	—	°C/W	**Note 1**
Junction-to-Ambient Thermal Resistance, 8-L PDIP	θ_{JA}	—	65.2	—	°C/W	**Note 1**
Junction-to-Ambient Thermal Resistance, 8-L SOIC	θ_{JA}	—	96.3	—	°C/W	**Note 1**
Junction-to-Ambient Thermal Resistance, 5-L TO-220	θ_{JA}	—	20.1	—	°C/W	**Note 1**
Junction-to-Case (Bottom) Thermal Resistance, 5-L TO-220	$\theta_{JC(BOT)}$		3.2	—	°C/W	**Note 2**
Junction-to-Top Characterization Parameter, 8-L 6x5 DFN	Ψ_{JT}		0.2	—	°C/W	**Note 1**
Junction-to-Top Characterization Parameter, 8-L PDIP	Ψ_{JT}		8.8	—	°C/W	**Note 1**
Junction-to-Top Characterization Parameter, 8-L SOIC	Ψ_{JT}		3.2	—	°C/W	**Note 1**
Junction-to-Top Characterization Parameter, 5-L TO-220	Ψ_{JT}		3.6	—	°C/W	**Note 1**
Junction-to-Board Characterization Parameter, 8-L 6x5 DFN	Ψ_{JB}		15.5	—	°C/W	**Note 1**
Junction-to-Board Characterization Parameter, 8-L PDIP	Ψ_{JB}		36.1	—	°C/W	**Note 1**
Junction-to-Board Characterization Parameter, 8-L SOIC	Ψ_{JB}		60.7	—	°C/W	**Note 1**
Junction-to-Board Characterization Parameter, 5-L TO-220	Ψ_{JB}		4.0	—	°C/W	**Note 1**

Note 1: Parameter is determined using a High 2S2P 4-layer board, as described in JESD 51-7, as well as in JESD 51-5, for packages with exposed pads.

2: Parameter is determined using a 1S0P 2-layer board with a cold plate attached to indicated location.

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2.0 TYPICAL PERFORMANCE CURVES

Note: The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

Note: Unless otherwise indicated, T_A = +25°C with 4.5V ≤ V_{DD} ≤18V.

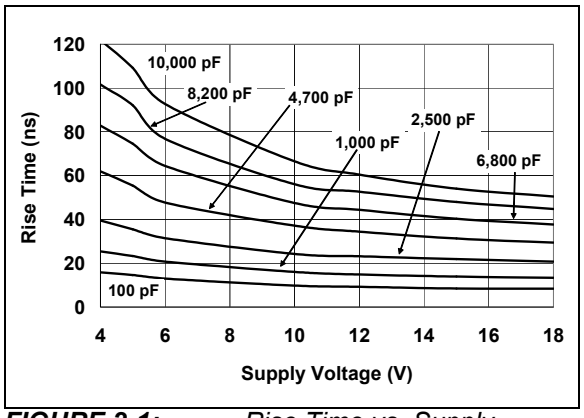


FIGURE 2-1: *Rise Time vs. Supply Voltage.*

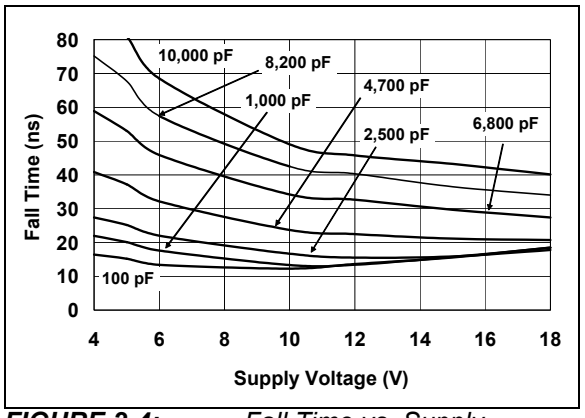


FIGURE 2-4: *Fall Time vs. Supply Voltage.*

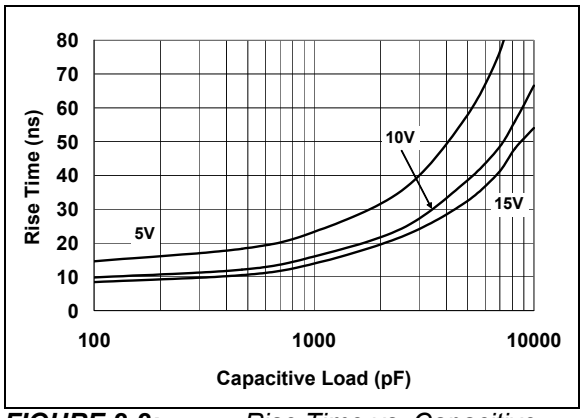


FIGURE 2-2: *Rise Time vs. Capacitive Load.*

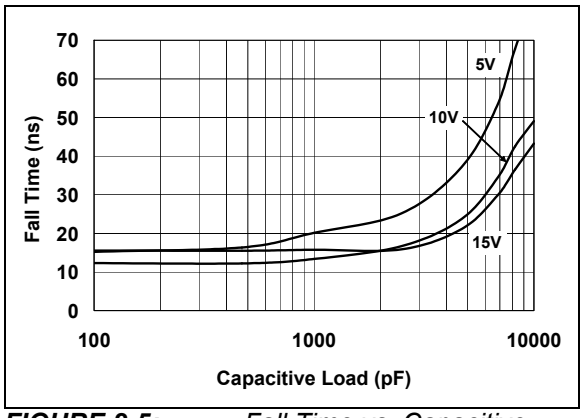


FIGURE 2-5: *Fall Time vs. Capacitive Load.*

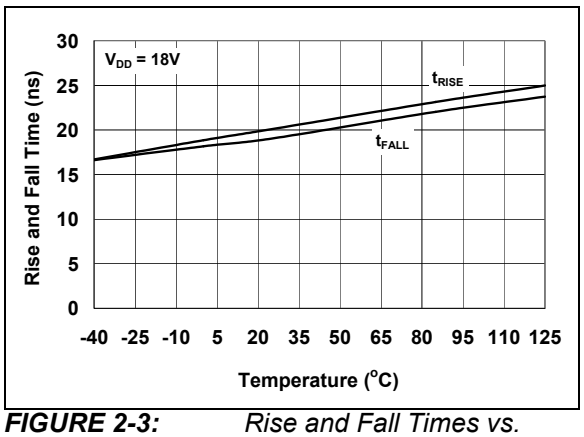


FIGURE 2-3: *Rise and Fall Times vs. Temperature.*

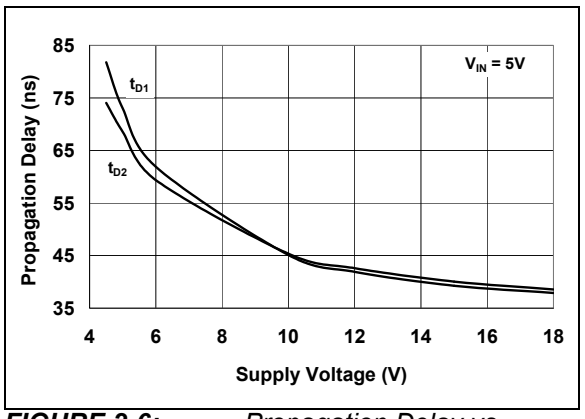


FIGURE 2-6: *Propagation Delay vs. Supply Voltage.*

Note: Unless otherwise indicated, T_A = +25°C with 4.5V ≤ V_{DD} ≤ 18V.

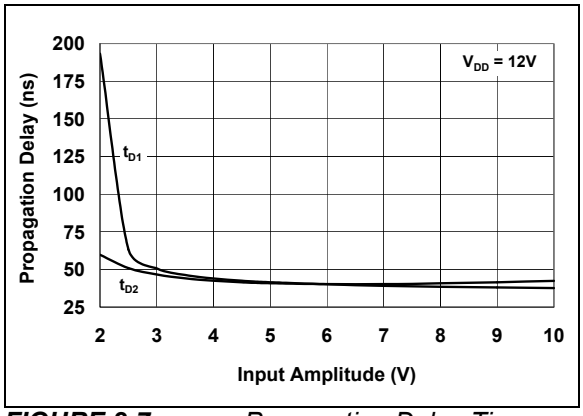


FIGURE 2-7: *Propagation Delay Time vs. Input Amplitude.*

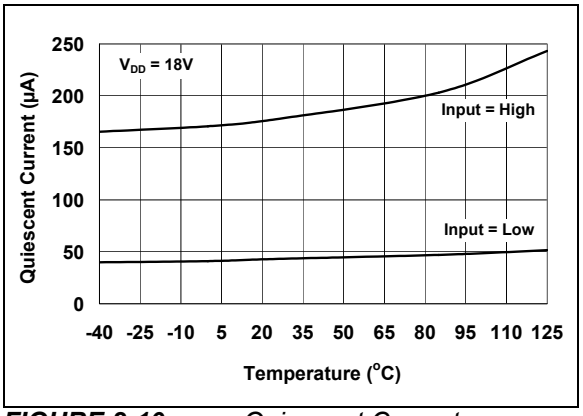


FIGURE 2-10: *Quiescent Current vs. Temperature.*

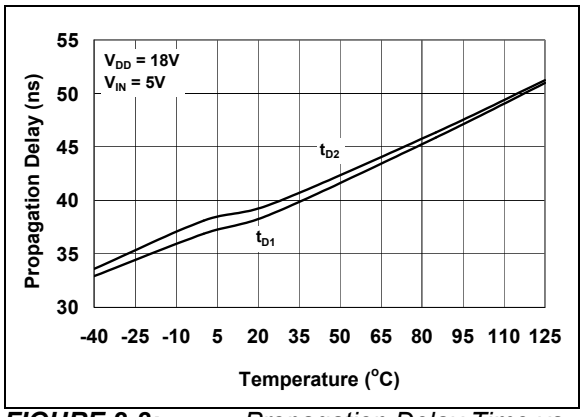


FIGURE 2-8: *Propagation Delay Time vs. Temperature.*

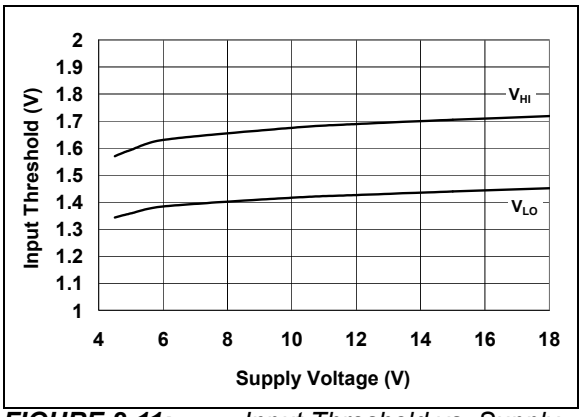


FIGURE 2-11: *Input Threshold vs. Supply Voltage.*

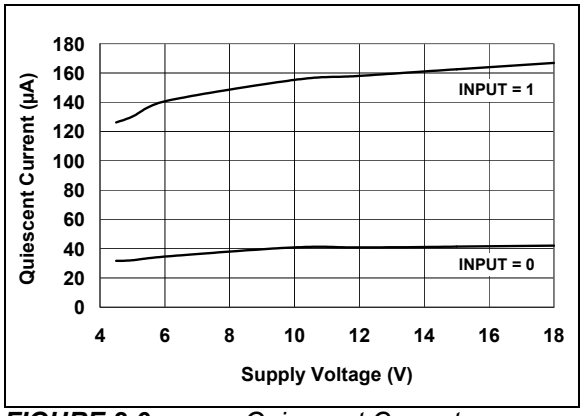


FIGURE 2-9: *Quiescent Current vs. Supply Voltage.*

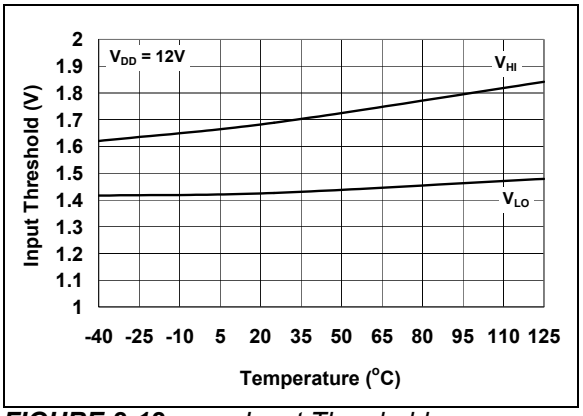


FIGURE 2-12: *Input Threshold vs. Temperature.*

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Note: Unless otherwise indicated, T_A = +25°C with 4.5V ≤ V_{DD} ≤ 18V.

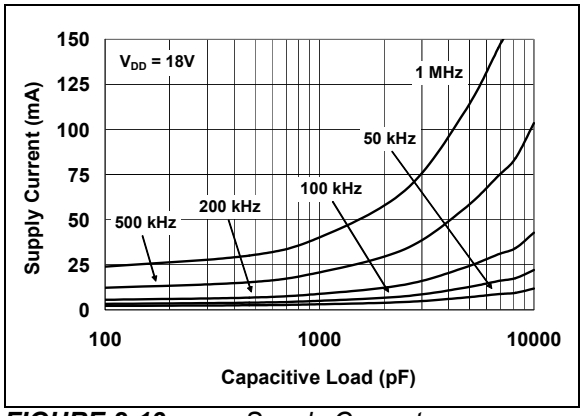


FIGURE 2-13: *Supply Current vs. Capacitive Load.*

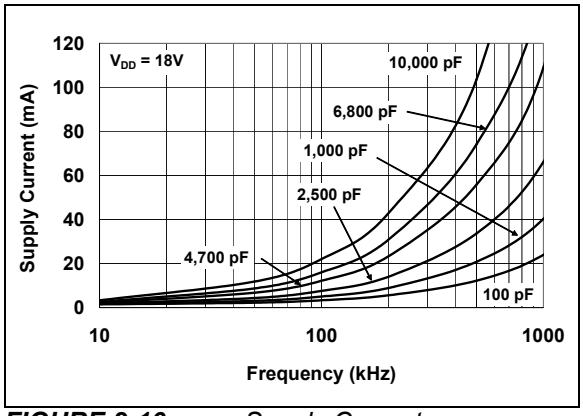


FIGURE 2-16: *Supply Current vs. Frequency.*

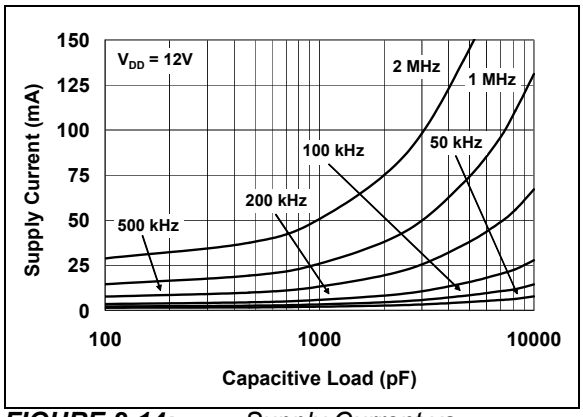


FIGURE 2-14: *Supply Current vs. Capacitive Load.*

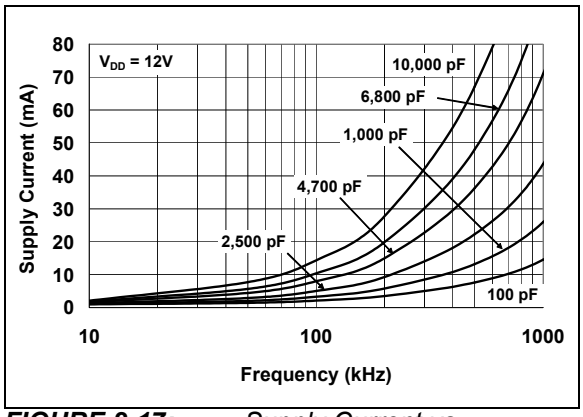


FIGURE 2-17: *Supply Current vs. Frequency.*

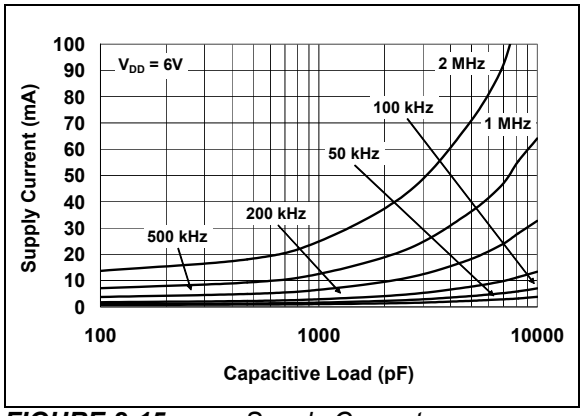


FIGURE 2-15: *Supply Current vs. Capacitive Load.*

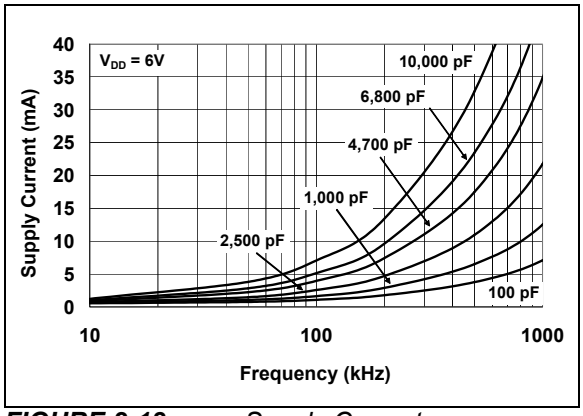


FIGURE 2-18: *Supply Current vs. Frequency.*

Note: Unless otherwise indicated, T_A = +25°C with 4.5V ≤ V_{DD} ≤ 18V.

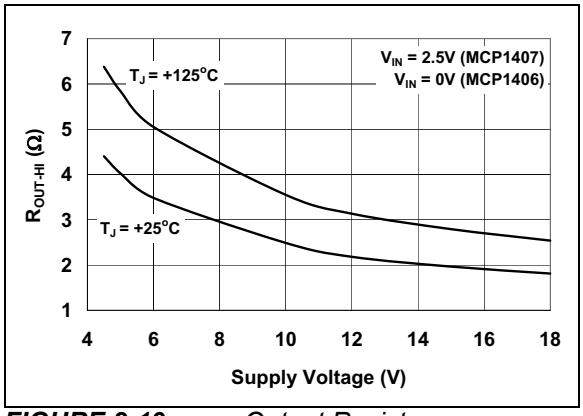


FIGURE 2-19: *Output Resistance (Output High) vs. Supply Voltage.*

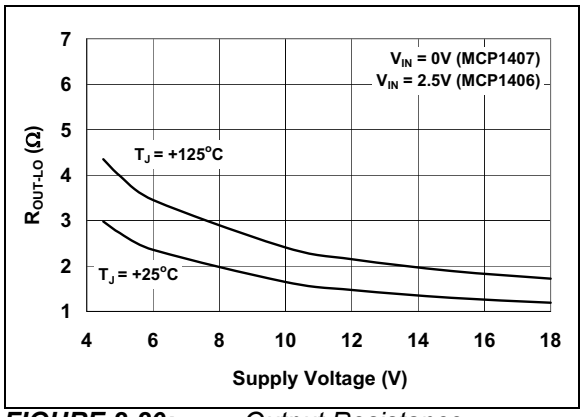


FIGURE 2-20: *Output Resistance (Output Low) vs. Supply Voltage.*

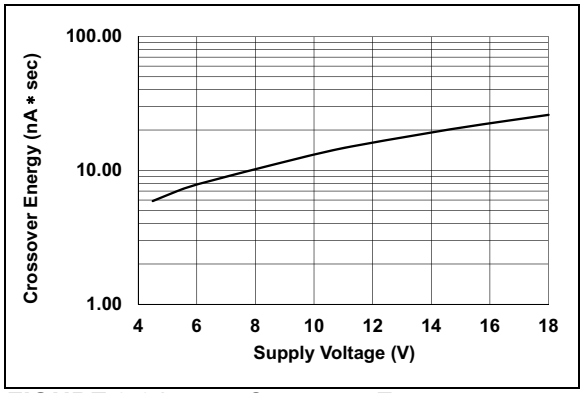


FIGURE 2-21: *Crossover Energy vs. Supply Voltage.*

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3.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in Table 3-1.

TABLE 3-1: PIN FUNCTION TABLE(1)

5-Pin TO-220	8-Pin 6x5 DFN	8-Pin PDIP, SOIC	Symbol	Description
—	1	1	V_{DD}	Supply Input
1	2	2	INPUT	Control Input
—	3	3	NC	No Connection
2	4	4	GND	Ground
4	5	5	GND	Ground
5	6	6	OUTPUT	CMOS Push-Pull Output
—	7	7	OUTPUT	CMOS Push-Pull Output
3	8	8	V_{DD}	Supply Input
—	9	—	EP	Exposed Metal Pad
TAB	—	—	V_{DD}	Metal Tab at V_{DD} Potential

Note 1: Duplicate pins must be connected for proper operation.

3.1 Supply Input (V_{DD})

V_{DD} is the bias supply input for the MOSFET driver and has a voltage range of 4.5V to 18V. This input must be decoupled to ground with local capacitors. The bypass capacitors provide a localized low-impedance path for the peak currents that are to be provided to the load.

3.2 Control Input (INPUT)

The MOSFET driver input is a high-impedance, TTL/CMOS-compatible input. The input also has hysteresis between the high and low input levels, allowing them to be driven from slow rising and falling signals, and to provide noise immunity.

3.3 Ground (GND)

Ground is the device return pin. The ground pin should have a low impedance connection to the bias supply source return. High peak currents will flow out the ground pin when the capacitive load is being discharged.

3.4 CMOS Push-Pull Output (OUTPUT)

The output is a CMOS push-pull output that is capable of sourcing peak currents of 6A (V_{DD} = 18V). The low output impedance ensures the gate of the external MOSFET will stay in the intended state even during large transients. The output pins also have reverse current latch-up ratings of 1.5A.

3.5 Exposed Metal Pad (6x5 DFN only)

The exposed metal pad of the DFN package is not internally connected to any potential. Therefore, this pad can be connected to a ground plane or other copper plane on a printed circuit board to aid in heat removal from the package.

3.6 TO-220 Metal Tab

The metal tab on the TO-220 package is at V_{DD} potential. This metal tab is not intended to be the V_{DD} connection to MCP1406/07. V_{DD} should be supplied using the Supply Input pin of the TO-220.

4.0 APPLICATION INFORMATION

4.1 General Information

MOSFET drivers are high-speed, high current devices which are intended to provide high peak currents to charge the gate capacitance of external MOSFETs or IGBTs. In high frequency switching power supplies, the PWM controller may not have the drive capability to directly drive the power MOSFET. A MOSFET driver like the MCP1406/07 family can be used to provide additional drive current capability.

4.2 MOSFET Driver Timing

The ability of a MOSFET driver to transition from a fully-OFF state to a fully-ON state are characterized by the drivers' rise time (t_R), fall time (t_F) and propagation delays (t_{D1} and t_{D2}). The MCP1406/07 family of devices is able to make this transition very quickly. Figure 4-1 and Figure 4-2 show the test circuits and timing waveforms used to verify the MCP1406/07 timing.

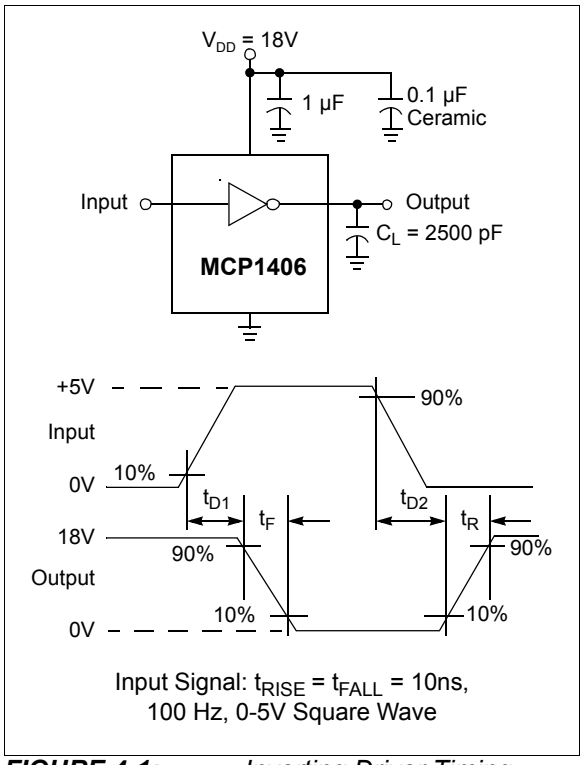


FIGURE 4-1: *Inverting Driver Timing Waveform.*

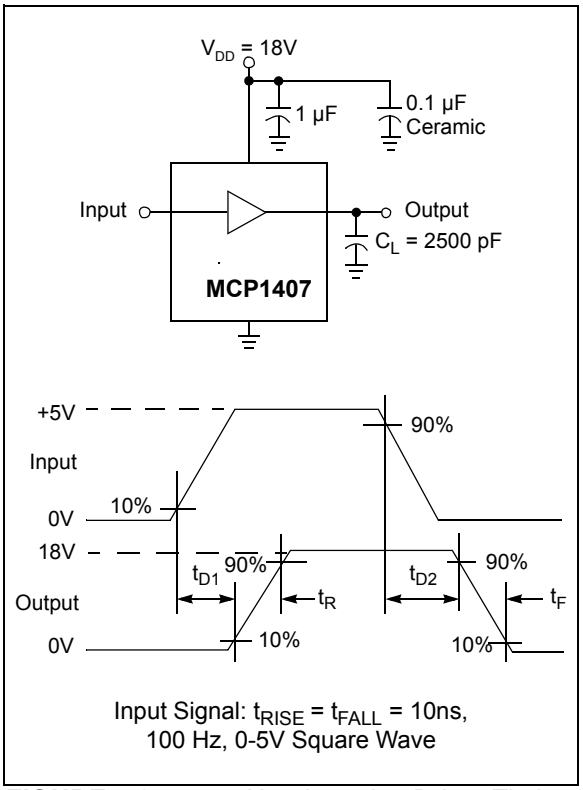


FIGURE 4-2: *Non-Inverting Driver Timing Waveform.*

4.3 Decoupling Capacitors

Careful layout and decoupling capacitors are highly recommended when using MOSFET drivers. Large currents are required to charge and discharge capacitive loads quickly. For example, 2.25A are needed to charge a 2500 pF load with 18V in 20 ns.

To operate the MOSFET driver over a wide frequency range with low supply impedance, a ceramic and a low ESR film capacitor are recommended to be placed in parallel between the driver V_{DD} and the GND. A 1.0 µF low ESR film capacitor and a 0.1 µF ceramic capacitor placed between pins 1, 8 and 4, 5 should be used. These capacitors should be placed close to the driver to minimize circuit board parasitics and provide a local source for the required current.

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4.4 PCB Layout Considerations

Proper PCB layout is important in a high current, fast switching circuit to provide proper device operation and robustness of design. PCB trace loop area and inductance should be minimized by the use of a ground plane or ground trace located under the MOSFET gate drive signals, separate analog and power grounds, and local driver decoupling.

The MCP1406/07 devices have two pins each for V_{DD}, OUTPUT and GND. Both pins must be used for proper operation. This also lowers path inductance which will, along with proper decoupling, help minimize ringing in the circuit.

Placing a ground plane beneath the MCP1406/07 will help as a radiated noise shield as well as providing some heat sinking for power dissipated within the device.

4.5 Power Dissipation

The total internal power dissipation in a MOSFET driver is the summation of three separate power dissipation elements, which can be calculated by using the following equation:

EQUATION 4-1:

$$P_T = P_L + P_Q + P_{CC}$$

Where:

P_T = Total power dissipation
P_L = Load power dissipation
P_Q = Quiescent power dissipation
P_{CC} = Operating power dissipation

4.5.1 CAPACITIVE LOAD DISSIPATION

The power dissipation caused by a capacitive load is a direct function of frequency, total capacitive load and supply voltage. The power lost in the MOSFET driver for a complete charging and discharging cycle of a MOSFET can be determined by means of this equation:

EQUATION 4-2:

$$P_L = f \times C_T \times V_{DD}^2$$

Where:

f = Switching frequency
C_T = Total load capacitance
V_{DD} = MOSFET driver supply voltage

4.5.2 QUIESCENT POWER DISSIPATION

The power dissipation associated with the quiescent current draw depends on the state of the input pin. The MCP1406/07 devices have a quiescent current draw when the input is high of 0.13 mA (typ) and 0.035 mA (typ) when the input is low. The quiescent power dissipation can be determined by using this equation:

EQUATION 4-3:

$$P_Q = (I_{QH} \times D + I_{QL} \times (1 - D)) \times V_{DD}$$

Where:

I_{QH} = Quiescent current in the high state
D = Duty cycle
I_{QL} = Quiescent current in the low state
V_{DD} = MOSFET driver supply voltage

4.5.3 OPERATING POWER DISSIPATION

The operating power dissipation occurs each time the MOSFET driver output transitions; this is because, for a very short period of time, both MOSFETs in the output stage are ON simultaneously. This cross-conduction current leads to a power dissipation, as described by the following equation:

EQUATION 4-4:

$$P_{CC} = CC \times f \times V_{DD}$$

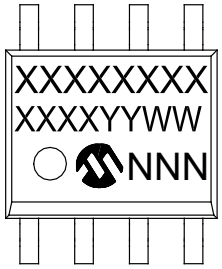
Where:

CC = Cross-conduction constant (A sec.)
f = Switching frequency
V_{DD} = MOSFET driver supply voltage

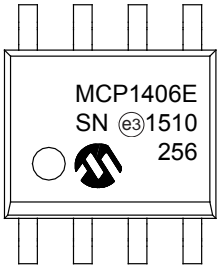
5.0 PACKAGING INFORMATION

5.1 Package Marking Information (Not to Scale)

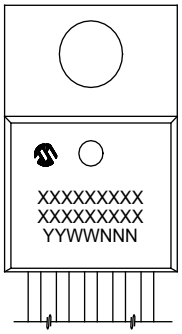
8-Lead SOIC (3.90 mm)



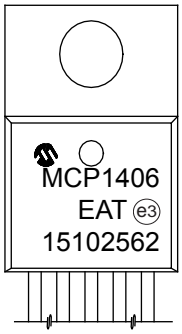
Example



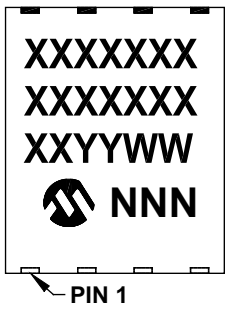
5-Lead TO-220



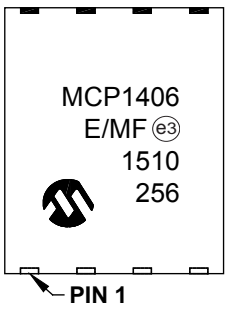
Example



8-Lead DFN-S (6x5x0.9 mm)



Example

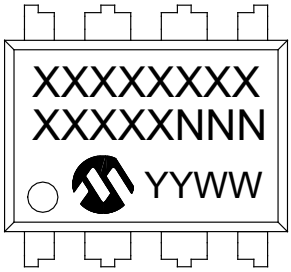


Legend:	XX...X	Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week '01')
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package.

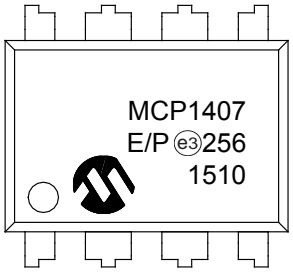
Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information.

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8-Lead PDIP (300 mil)



Example

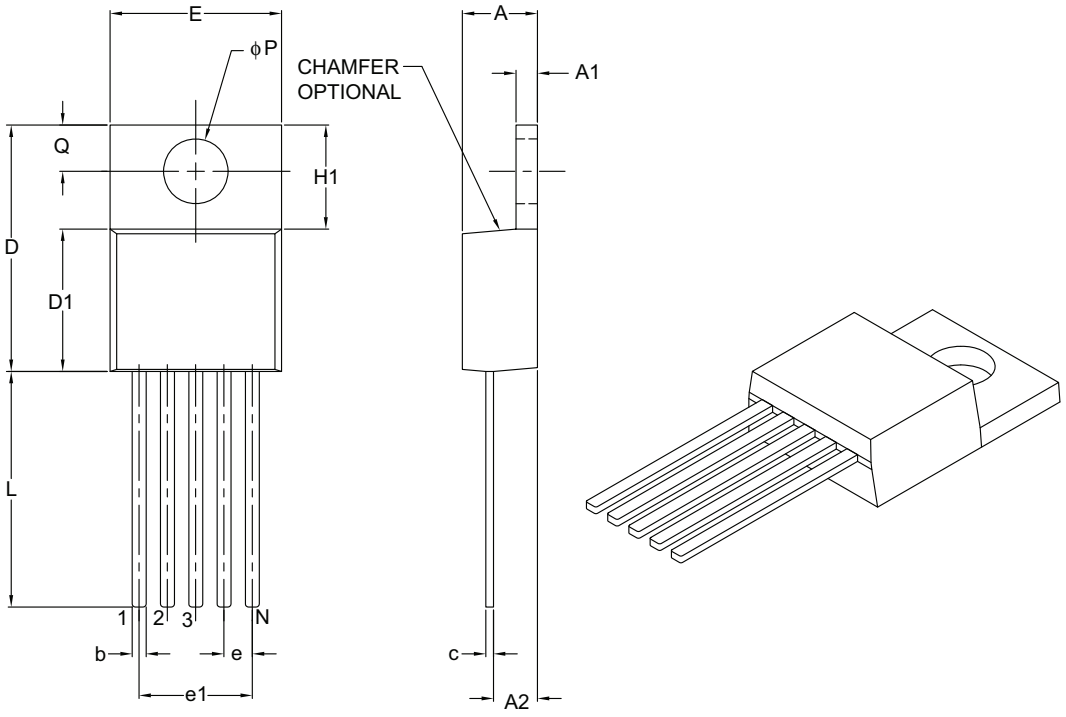


Legend:	XX...X	Customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week ‘01’)
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package.

Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information.

5-Lead Plastic Transistor Outline (AT) [TO-220]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		INCHES		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		5	
Pitch	e		.067 BSC	
Overall Pin Pitch	e1		.268 BSC	
Overall Height	A	.140	–	.190
Overall Width	E	.380	–	.420
Overall Length	D	.560	–	.650
Molded Package Length	D1	.330	–	.355
Tab Length	H1	.204	–	.293
Tab Thickness	A1	.020	–	.055
Mounting Hole Center	Q	.100	–	.120
Mounting Hole Diameter	ϕP	.139	–	.156
Lead Length	L	.482	–	.590
Base to Bottom of Lead	A2	.080	–	.115
Lead Thickness	c	.012	–	.025
Lead Width	b	.015	.027	.040

Notes:

1. Dimensions D and E do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .005" per side.
2. Dimensioning and tolerancing per ASME Y14.5M.

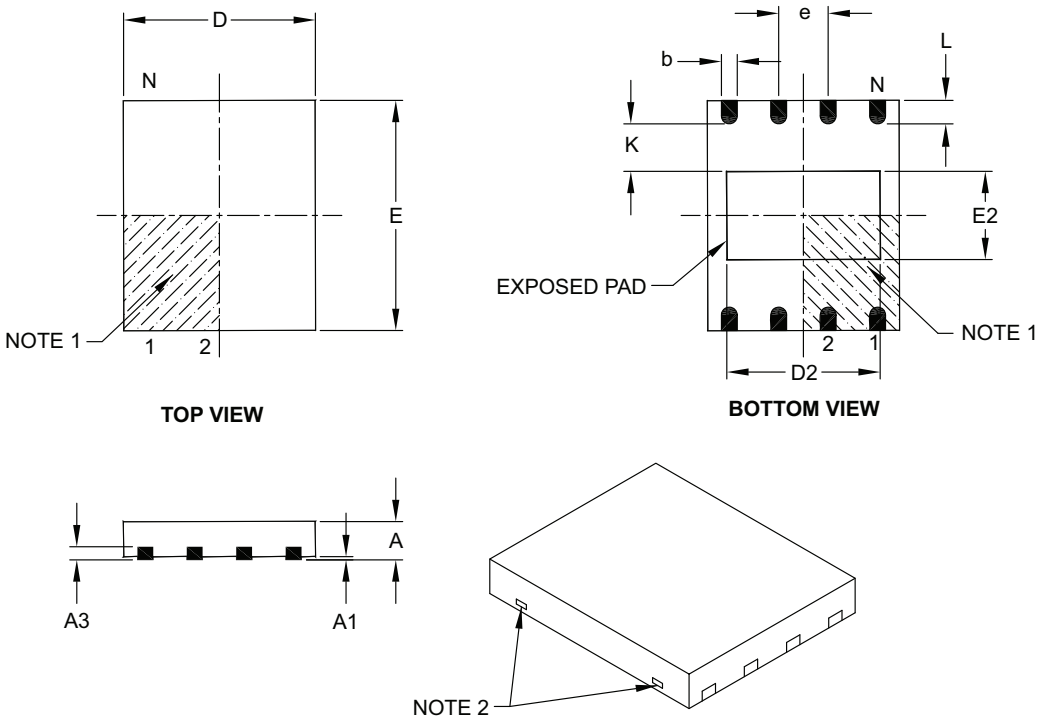
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-036B

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8-Lead Plastic Dual Flat, No Lead Package (MF) – 6x5 mm Body [DFN-S]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		1.27 BSC	
Overall Height	A	0.80	0.85	1.00
Standoff	A1	0.00	0.01	0.05
Contact Thickness	A3		0.20 REF	
Overall Length	D		5.00 BSC	
Overall Width	E		6.00 BSC	
Exposed Pad Length	D2	3.90	4.00	4.10
Exposed Pad Width	E2	2.20	2.30	2.40
Contact Width	b	0.35	0.40	0.48
Contact Length	L	0.50	0.60	0.75
Contact-to-Exposed Pad	K	0.20	–	–

Notes:

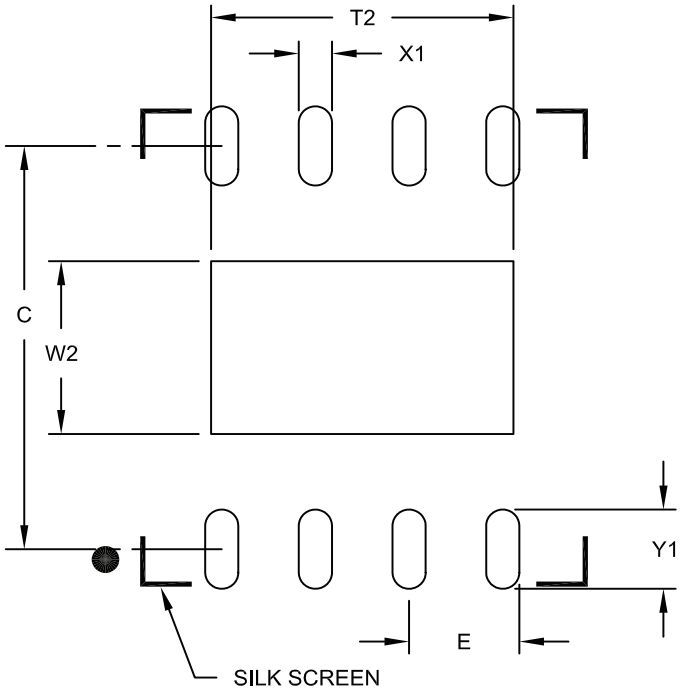
1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Package may have one or more exposed tie bars at ends.
3. Package is saw singulated.
4. Dimensioning and tolerancing per ASME Y14.5M.

BSC: Basic Dimension. Theoretically exact value shown without tolerances.
REF: Reference Dimension, usually without tolerance, for information purposes only.

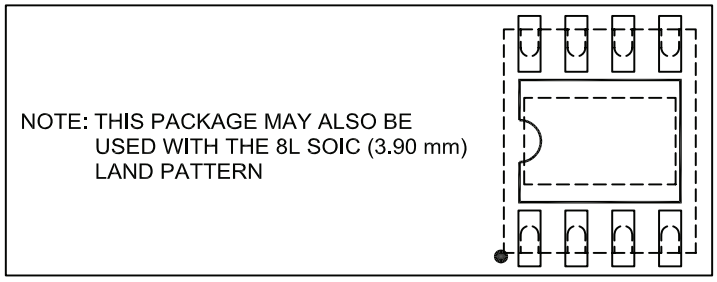
Microchip Technology Drawing C04-122B

8-Lead Plastic Dual Flat, No Lead Package (MF) - 6x5 mm Body [DFN-S]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E		1.27 BSC	
Optional Center Pad Width	W2			2.40
Optional Center Pad Length	T2			4.10
Contact Pad Spacing	C		5.60	
Contact Pad Width (X8)	X1			0.45
Contact Pad Length (X8)	Y1			1.10

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

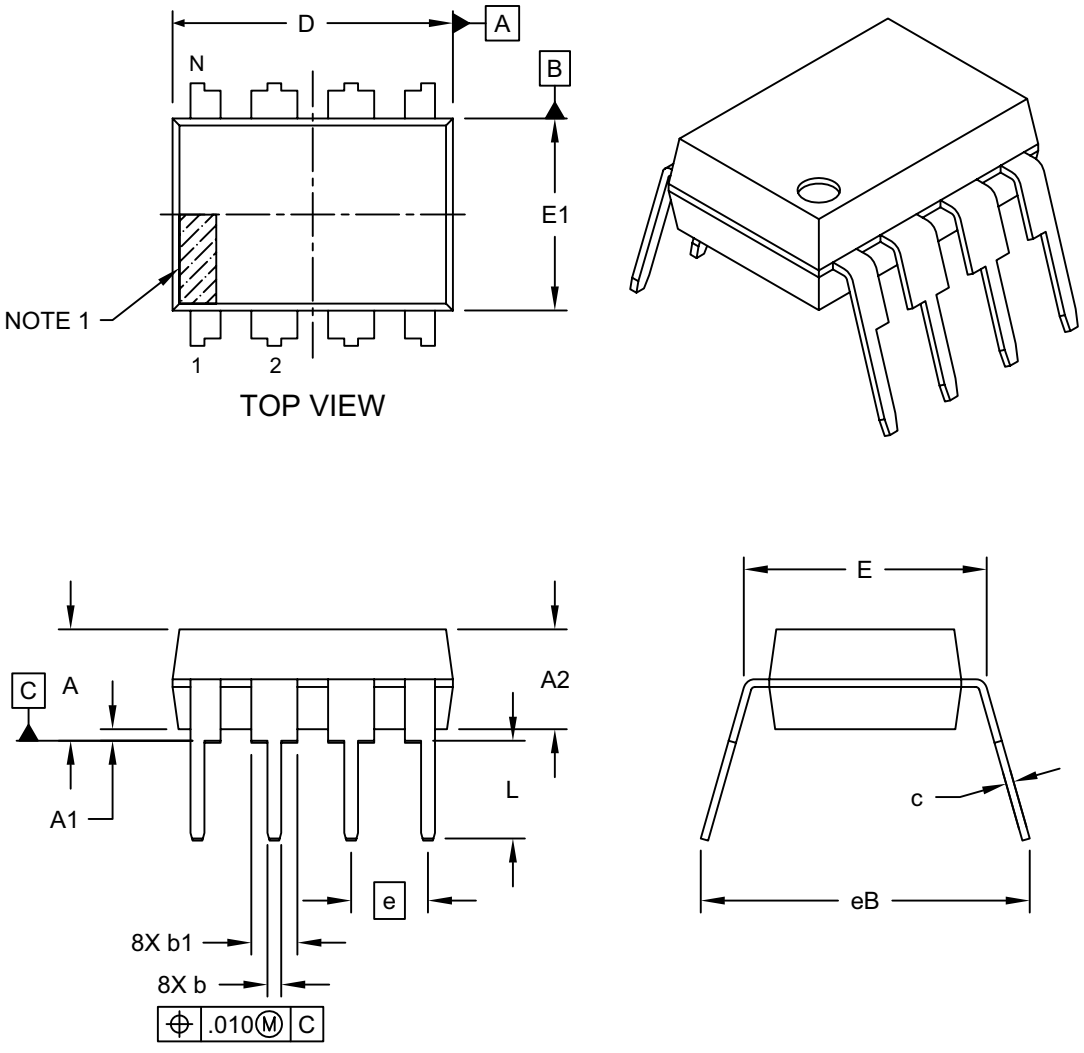
BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-2122A

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8-Lead Plastic Dual In-Line (P) - 300 mil Body [PDIP]

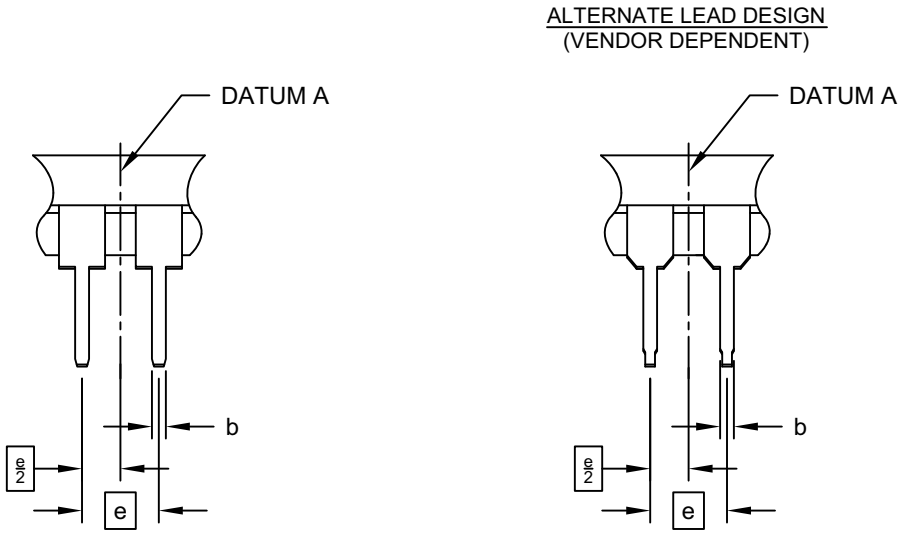
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Microchip Technology Drawing No. C04-018D Sheet 1 of 2

8-Lead Plastic Dual In-Line (P) - 300 mil Body [PDIP]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		INCHES		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		.100 BSC	
Top to Seating Plane	A	-	-	.210
Molded Package Thickness	A2	.115	.130	.195
Base to Seating Plane	A1	.015	-	-
Shoulder to Shoulder Width	E	.290	.310	.325
Molded Package Width	E1	.240	.250	.280
Overall Length	D	.348	.365	.400
Tip to Seating Plane	L	.115	.130	.150
Lead Thickness	c	.008	.010	.015
Upper Lead Width	b1	.040	.060	.070
Lower Lead Width	b	.014	.018	.022
Overall Row Spacing §	eB	-	-	.430

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. § Significant Characteristic
3. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" per side.
4. Dimensioning and tolerancing per ASME Y14.5M

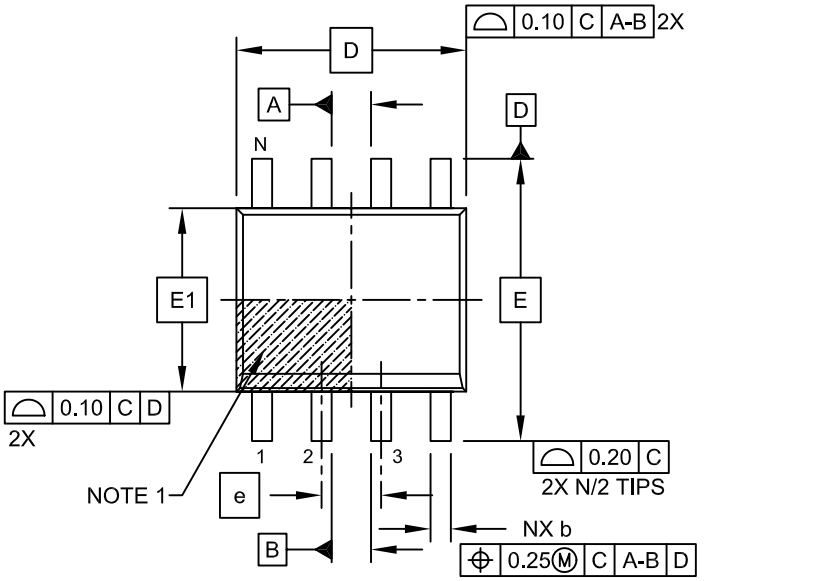
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-018D Sheet 2 of 2

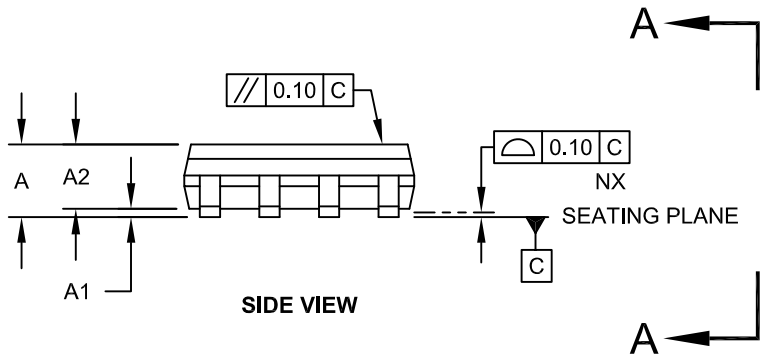
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8-Lead Plastic Small Outline (SN) - Narrow, 3.90 mm Body [SOIC]

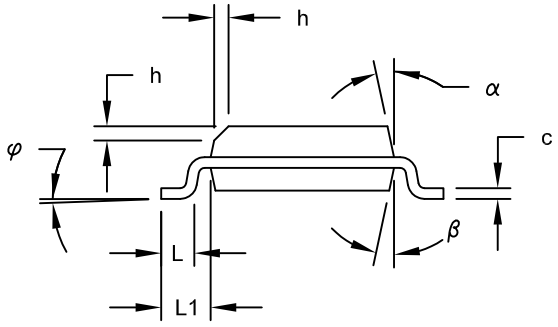
Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



TOP VIEW



SIDE VIEW

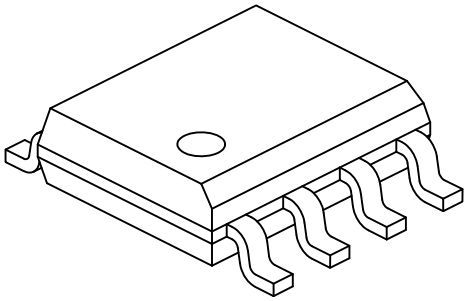


VIEW A-A

Microchip Technology Drawing No. C04-057C Sheet 1 of 2

8-Lead Plastic Small Outline (SN) - Narrow, 3.90 mm Body [SOIC]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Pins	N		8	
Pitch	e		1.27 BSC	
Overall Height	A	-	-	1.75
Molded Package Thickness	A2	1.25	-	-
Standoff §	A1	0.10	-	0.25
Overall Width	E		6.00 BSC	
Molded Package Width	E1		3.90 BSC	
Overall Length	D		4.90 BSC	
Chamfer (Optional)	h	0.25	-	0.50
Foot Length	L	0.40	-	1.27
Footprint	L1		1.04 REF	
Foot Angle	φ	0°	-	8°
Lead Thickness	c	0.17	-	0.25
Lead Width	b	0.31	-	0.51
Mold Draft Angle Top	α	5°	-	15°
Mold Draft Angle Bottom	β	5°	-	15°

Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. § Significant Characteristic
3. Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed 0.15mm per side.
4. Dimensioning and tolerancing per ASME Y14.5M

   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

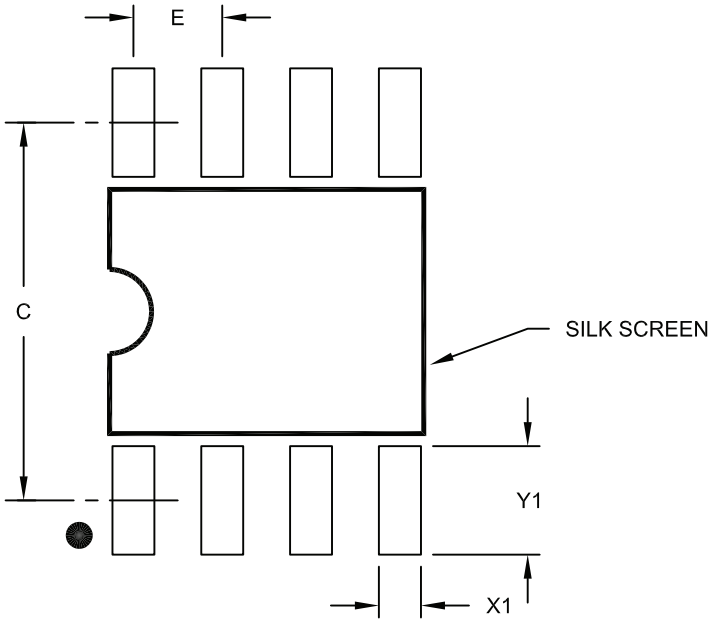
   REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing No. C04-057C Sheet 2 of 2

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8-Lead Plastic Small Outline (SN) – Narrow, 3.90 mm Body [SOIC]

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E		1.27 BSC	
Contact Pad Spacing	C		5.40	
Contact Pad Width (X8)	X1			0.60
Contact Pad Length (X8)	Y1			1.55

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing No. C04-2057A

NOTES:

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APPENDIX A: REVISION HISTORY

Revision C (April 2016)

The following is the list of modifications:

- Updated the Package Thermal Resistances section of Temperature Characteristics table with the latest information.
- Updated Figure 2-21 in **Section 2.0 "Typical Performance Curves"**.

Revision B (May 2012)

The following is the list of modifications:

Removed the information referring to the Electrostatic Discharge from the General Description section.

Revision A (December 2006)

Original release of this document.

NOTES:

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PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, refer to the factory or the listed sales office.

PART NO.	X	XX	XXX
Device	Temperature Range	Package	Tape & Reel

Device:	MCP1406:	6A High-Speed MOSFET Driver, Inverting
	MCP1406T:	6A High-Speed MOSFET Driver, Inverting, Tape and Reel
	MCP1407:	6A High-Speed MOSFET Driver, Non-Inverting
	MCP1407T:	6A High-Speed MOSFET Driver, Non-Inverting, Tape and Reel
Temperature Range:	E =	-40°C to +125°C
Package: *	AT =	Plastic Transistor Outline, 5-Lead (TO-220)
	MF =	Plastic Dual Flat - 6x5 mm Body, 8-Lead (DFN-S)
	P =	Plastic Dual In-Line - 300 mil Body, 8-Lead (PDIP)
	SN =	Plastic Small Outline - Narrow, 3.90 mm Body, 8-Lead (SOIC)

* All package offerings are Pb Free (Lead Free)

Examples:

a) MCP1406-E/MF: 6A High-Speed MOSFET Driver, Inverting, 8LD DFN Package

b) MCP1406-E/AT: 6A High-Speed MOSFET Driver, Inverting, 5LD TO-220 Package

c) MCP1406-E/SN: 6A High-Speed MOSFET Driver, Inverting, 8LD SOIC Package

d) MCP1406-E/P: 6A High-Speed MOSFET Driver, Inverting, 8LD PDIP Package

e) MCP1406T-E/MF: Tape and Reel, 6A High-Speed MOSFET Driver, Inverting, 8LD DFN Package

f) MCP1406T-E/SN: Tape and Reel, 6A High-Speed MOSFET Driver, Inverting, 8LD SOIC Package

a) MCP1407-E/MF: 6A High-Speed MOSFET Driver, Non-Inverting, 8LD DFN Package

b) MCP1407-E/AT: 6A High-Speed MOSFET Driver, Non-Inverting, 5LD TO-220 Package

c) MCP1407-E/SN: 6A High-Speed MOSFET Driver, Non-Inverting, 8LD SOIC Package

d) MCP1407-E/P: 6A High-Speed MOSFET Driver, Non-Inverting, 8LD PDIP Package

e) MCP1407T-E/MF: Tape and Reel, 6A High-Speed MOSFET Driver, Non-Inverting, 8LD DFN Package

f) MCP1407T-E/SN: Tape and Reel, 6A High-Speed MOSFET Driver, Non-Inverting, 8LD SOIC Package

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NOTES:

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- Microchip products meet the specification contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is one of the most secure families of its kind on the market today, when used in the intended manner and under normal conditions.
- There are dishonest and possibly illegal methods used to breach the code protection feature. All of these methods, to our knowledge, require using the Microchip products in a manner outside the operating specifications contained in Microchip's Data Sheets. Most likely, the person doing so is engaged in theft of intellectual property.
- Microchip is willing to work with the customer who is concerned about the integrity of their code.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of their code. Code protection does not mean that we are guaranteeing the product as "unbreakable."

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