3.3V CMOS 1-TO-10 CLOCK DRIVER

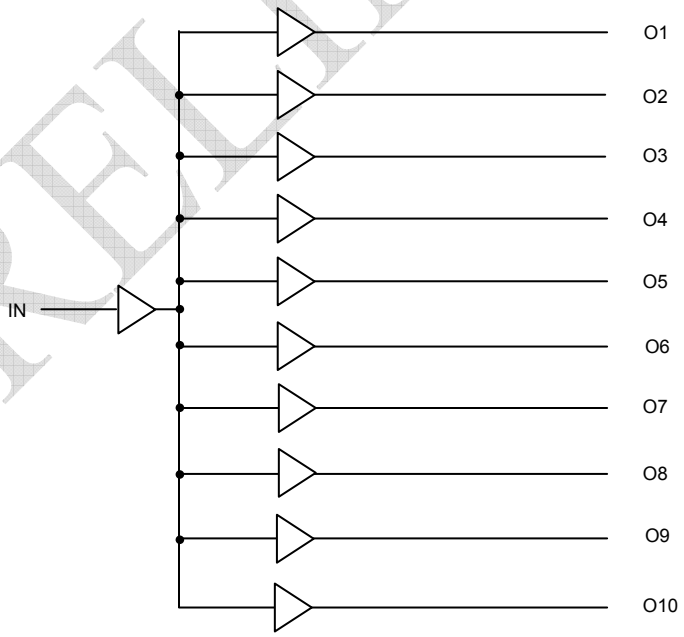
Features

- 0.5 MICRON CMOS Technology
- Guaranteed low skew < 350pS (max.)
- Very low duty cycle distortion < 350pS (max.)
- High speed: propagation delay < 3nS (max.)
- Very low CMOS power levels
- TTL compatible inputs and outputs
- 1:10 fanout
- Maximum output rise and fall time < 1.5nS (max.)
- Low input capacitance: 4.5pF typical
- Operates with 3.3V ± 0.3V Supply
- Inputs can be driven from 3.3V or 5V components
- Available in SSOP, SOIC, and QSOP Packages

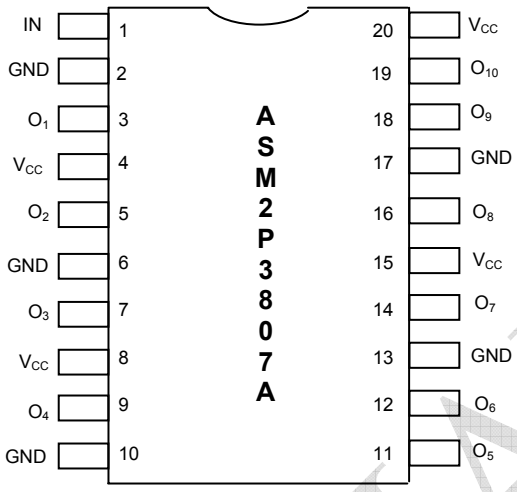
Product Description

The ASM2P3807A 3.3V clock driver is built using advanced dual metal CMOS technology. This low skew clock driver offers 1:10 fanout. The large fanout from a single input reduces loading on the preceding driver and provides an efficient clock distribution network. The ASM2P3807A offers low capacitance inputs with hysteresis for improved noise margins. Multiple power and grounds reduce noise. Typical applications are clock and signal distribution.

Block Diagram



Pin Configuration



SOIC / SSOP/ QSOP Packages
TOP VIEW

Pin Description

Pin#	Pin Names	Description
1	I N	Clock Inputs
3,5,7,9,11,12,14,16,18,19	O 1-O10	Clock Outputs
2,6,10,13,17	GND	Ground
4,8,15,20	Vcc	Power

Absolute Maximum Ratings

Symbol	Description	Max	Unit
V_{TERM}[1]	Terminal Voltage with Respect to GND	-0.5 to +4.6	V
V_{TERM}[2]	Terminal Voltage with Respect to GND	-0.5 to +7	V
V_{TERM}[3]	Terminal Voltage with Respect to GND	-0.5 to V_{CC}+0.5	V
T_{STG}	Storage Temperature	-65 to +150	° C
I_{OUT}	DC Output Current	-60 to +60	mA

Note: These are stress ratings only and are not implied for functional use. Exposure to absolute maximum ratings for prolonged periods of time may affect device reliability.

NOTES:
1. V_{CC} terminals.
2. Input terminals.
3. Outputs and I/O terminals.

Capacitance (T_A = +25°C, f = 1.0MHz)

Symbol	Parameter[1]	Conditions	Typ	Max	Unit
C_{IN}	Input Capacitance	V_{IN}= 0V	4.5	6	pF
C_{OUT}	Output Capacitance	V_{OUT} = 0V	5.5	8	pF
Note:1. This parameter is measured at characterization but not tested.					

Power Supply Characteristics

Symbol	Parameter	Test Conditions[1]		Min	Typ[2]	Max	Unit
ΔI_{CC}	Quiescent Power Supply Current TTL Inputs HIGH	V_{CC}= Max. V_{IN} = V_{CC} –0.6V[3]			10	30	µA
I_{CCD}	Dynamic Power Supply Current[4]	V_{CC}= Max. Input toggling 50% Duty Cycle Outputs Open	V_{IN} = V_{CC} V_{IN} = GND		0.31	0.45	mA/ MHz
I_C	Total Power Supply Current[6]	V_{CC}= Max. Input toggling 50% Duty Cycle Outputs Open fi = 50MHz	V_{IN} = V_{CC} V_{IN} = GND		15.5	22.8[5]	mA

NOTES:
1. For conditions shown as Max. or Min., use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at V_{CC} = 3.3V, +25°C ambient.
3. Per TTL driven input (V_{IN} = V_{CC} -0.6V); all other inputs at V_{CC} or GND.
4. This parameter is not directly testable, but is derived for use in Total Power Supply calculations.
5. Values for these conditions are examples of the IC formula. These limits are guaranteed but not tested.
6. I_C = IQUIESCENT + IINPUTS + IDYNAMIC
   I_C = I_{CC} + ΔI_{CC} DHNT + I_{CCD} (fi)
   I_{CC} = Quiescent Current (I_{CCL}, I_{CCH} and I_{CCZ})
   ΔI_{CC} = Power Supply Current for a TTL High Input (V_{IN} = V_{CC} -0.6V)
   D_H = Duty Cycle for TTL Inputs High
   N_T = Number of TTL Inputs at D_H
   I_{CCD} = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)
   fi = Input Frequency
   All currents are in milliamps and all frequencies are in megahertz.

DC Electrical Characteristics over Operating Range

Following Conditions Apply Unless Otherwise Specified
Commercial: T_A = 0°C to +70°C, Industrial: TA = -40°C to +85°C, V_{CC} = 3.3V ± 0.3V

Symbol	Parameter	Test Conditions[1]		Min	Typ	Max	Unit
V_{IH}	Input HIGH Level (Input pins)	Guaranteed Logic HIGH Level		2		5.5	V
	Input HIGH Level (I/O pins)			2		V_{CC}+ 0.5	
V_{IL}	Input LOW Level (Input and I/O pins)	Guaranteed Logic LOW Level		-0.5		0.8	V
I_{IH}	Input HIGH Current (Input pins)	V_{CC}= Max	V_I = 5.5V			±1	
	Input HIGH Current (I/O pins)		V_I = V_{CC}			±1	µA
I_{IL}	Input LOW Current (Input pins)	V_{CC}= Max	V_I = GND			±1	
	Input LOW Current (I/O pins)		V_I = GND			±1	
I_{OZH}	High Impedence Output Current	V_{CC}= Max	V_O = V_{CC}			±1	µA
I_{OZL}	(3-State Output Pins)		V_O = GND			±1	
V_{IK}	Clamp Diode Voltage	V_{CC}= Min., I_{IN} = –18mA			-0.7	-1.2	V
I_{ODH}	Output HIGH Current	V_{CC}= 3.3V, V_{IN} = V_{IH} or V_{IL}, V_O = 1.5V[3]		-36	-60	-110	mA
I_{ODL}	Output LOW Current	V_{CC}= 3.3V, V_{IN} = V_{IH} or V_{IL}, V_O = 1.5V[3]		50	90	200	mA
V_{OH}	Output HIGH Voltage	V_{CC}= Min.	I_{OH}= –0.1mA	V_{CC}-0.2			V
		V_{IN} = V_{IH} or V_{IL}	I_{OH}= –8mA	2.4[5]	3		
V_{OL}	Output LOW Voltage	V_{CC}= Min	I_{OL}= 0.1mA			0.2	
		V_{IN} = V_{IH} or V_{IL}	I_{OL}= 16mA		0.2	0.4	V
			I_{OL}= 24mA		0.3	0.5	
I_{OFF}	Input Power Off Leakage	V_{CC}= 0V, V_{IN} = 4.5V				±1	µA
I_{OS}	Short Circuit Current[4]	V_{CC}= Max., V_O = GND[3]		-60	-135	-240	mA
V_H	Input Hysteresis	-			150		mV
I_{CCL} I_{CCH} I_{CCZ}	Quiescent Power Supply Current	V_{CC}= Max. V_{IN} = GND or V_{CC}			0.1	10	µA

NOTES:
1. For conditions shown as Max or Min, use appropriate value specified under Electrical Characteristics for the applicable device type.
2. Typical values are at Vcc = 3.3V, +25°C ambient.
3. Not more than one output should be shorted at one time. Duration of the test should not exceed one second.
4. This parameter is guaranteed but not tested.
5. V_{OH} = Vcc - 0.6V at rated current.

Switching Characteristics Over Operating Range – Commercial[3,4]

Symbol	Parameter	Conditions[1]	ASM2P3807A		Unit
			Min[2]	Max	
t_{PLH}	Propagation Delay	50Ω to $V_{CC}/2$ C_L= 10pF (See figure 1) or 10Ω AC termination, C_L= 50pF (See figure 2) f≤ 100MHz Outputs connected in groups of two	1.5	3	nS
t_{PHL}					
t_R	Output Rise Time			1.5	nS
t_F	Output Fall Time			1.5	nS
$t_{SK(O)}$	Output skew: skew between outputs of same package (same transition)			0.35	nS
$t_{SK(P)}$	Pulse skew: skew between opposite transitions of same output ($\|t_{PHL} - t_{PLH}\|$)			0.35	nS
$t_{SK(T)}$	Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade			0.65	nS

Symbol	Parameter	Conditions[1]	ASM2P3807A		Unit
			Min[2]	Max	
t_{PLH} / t_{PHL}	Propagation Delay	C_L= 30pF f≤ 67MHz (See figure 3)	1.5	4	nS
t_R	Output Rise Time			1.5	nS
t_F	Output Fall Time			1.5	nS
$t_{SK(O)}$	Output skew: skew between outputs of same package (same transition)			0.45	nS
$t_{SK(P)}$	Pulse skew: skew between opposite transitions of same output ($\|t_{PHL} - t_{PLH}\|$)			0.45	nS
$t_{SK(T)}$	Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade			0.75	nS

Symbol	Parameter	Conditions[1]	ASM2P3807A		Unit
			Min[2]	Max	
t_{PLH} / t_{PHL}	Propagation Delay	C_L= 50pF f≤ 40MHz (See figure 4)	1.5	4.3	nS
t_R	Output Rise Time			1.5	nS
t_F	Output Fall Time			1.5	nS
$t_{SK(O)}$	Output skew: skew between outputs of same package (same transition)			0.35	nS
$t_{SK(P)}$	Pulse skew: skew between opposite transitions of same output ($\|t_{PHL} - t_{PLH}\|$)			0.35	nS
$t_{SK(T)}$	Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade			0.75	nS

NOTES:1. See test circuits and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. t_{PLH}, t_{PHL}, $t_{SK(t)}$ are production tested. All other parameters guaranteed but not production tested.
4. Propagation delay range indicated by Min. and Max. limit is due to V_{CC}, operating temperature and process parameters. These propagation delays limits do not imply skew.

Switching Characteristics Over Operating Range - Industrial[3,4]

Symbol	Parameter	Conditions[1]	ASM2P3807A		Unit
			Min[2]	Max	
t_{PLH} / t_{PHL}	Propagation Delay	50Ω to $V_{CC}/2$, C_L= 10pF (See figure 1) or 50Ω AC termination, C_L= 10pF (See figure 2) f≤ 100MHz Outputs connected in groups of two	1.5	3	nS
t_R	Output Rise Time			1.5	nS
t_F	Output Fall Time			1.5	nS
$t_{SK(O)}$	Output skew: skew between outputs of same package (same transition)			0.45	nS
$t_{SK(P)}$	Pulse skew: skew between opposite transitions of same output ($\|t_{PHL} - t_{PLH}\|$)			0.45	nS
$t_{SK(T)}$	Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade			0.65	nS

Symbol	Parameter	Conditions[1]	ASM2P3807A		Unit
			Min[2]	Max	
t_{PLH} / t_{PHL}	Propagation Delay	C_L= 30pF f≤ 67MHz (See figure 3)	1.5	4	nS
t_R	Output Rise Time			1.5	nS
t_F	Output Fall Time			1.5	nS
$t_{SK(O)}$	Output skew: skew between outputs of same package (same transition)			0.45	nS
$t_{SK(P)}$	Pulse skew: skew between opposite transitions of same output ($\|t_{PHL} - t_{PLH}\|$)			0.45	nS
$t_{SK(T)}$	Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade			0.75	nS

Symbol	Parameter	Conditions[1]	ASM2P3807A		Unit
			Min[2]	Max	
t_{PLH}	Propagation Delay	C_L= 50pF f≤ 40MHz (See figure 4)	1.5	4.3	nS
t_{PHL}					
t_R	Output Rise Time			1.5	nS
t_F	Output Fall Time			1.5	nS
$t_{SK(O)}$	Output skew: skew between outputs of same package (same transition)			0.45	nS
$t_{SK(P)}$	Pulse skew: skew between opposite transitions of same output ($\|t_{PHL} - t_{PLH}\|$)			0.45	nS
$t_{SK(T)}$	Package skew: skew between outputs of different packages at same power supply voltage, temperature, package type and speed grade			0.75	nS

NOTES:1. See test circuits and waveforms.
2. Minimum limits are guaranteed but not tested on Propagation Delays.
3. t_{PLH}, t_{PHL}, $t_{SK(t)}$ are production tested. All other parameters guaranteed but not production tested.
4. Propagation delay range indicated by Min and Max limit is due to V_{CC}, operating temperature and process parameters. These propagation delay limits do not imply skew.

Test Circuits

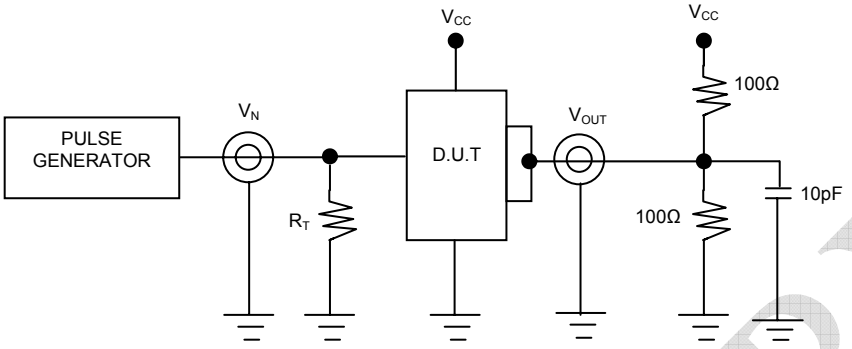


Figure 1. Zo = 50Ω to V_{CC}/2, C_L = 10pF

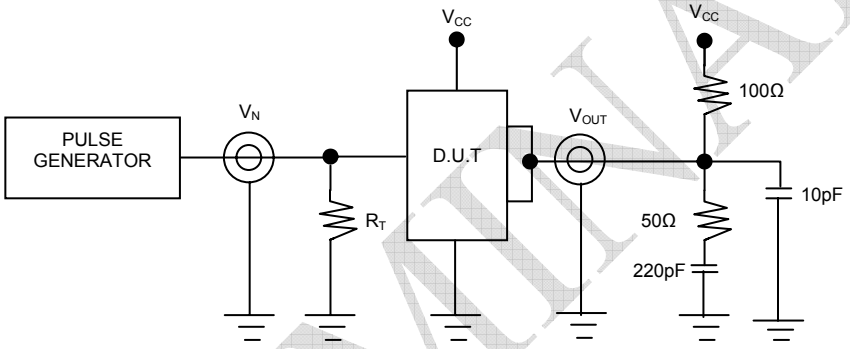


Figure 2. Zo = 50Ω AC Termination, C_L = 10pF

The capacitor value for ac termination is determined by the operating frequency. For very low frequencies a higher capacitor value should be selected.

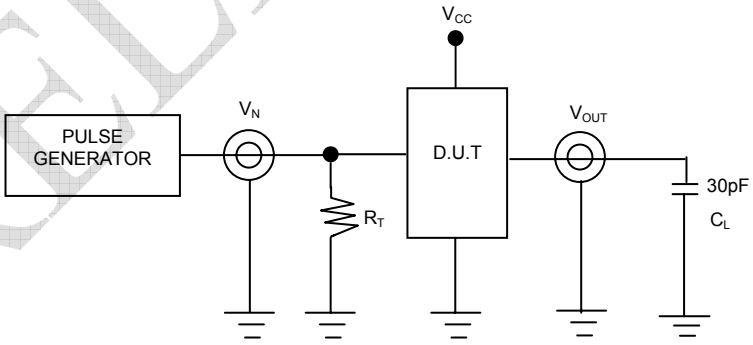


Figure 3. C_L = 30pF Circuit

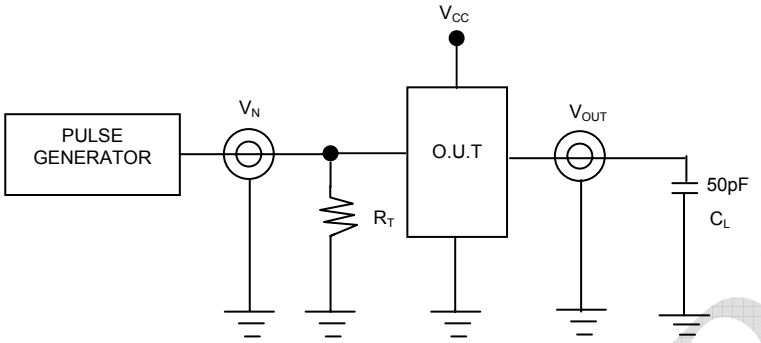


Figure 3. C_L = 50pF Circuit

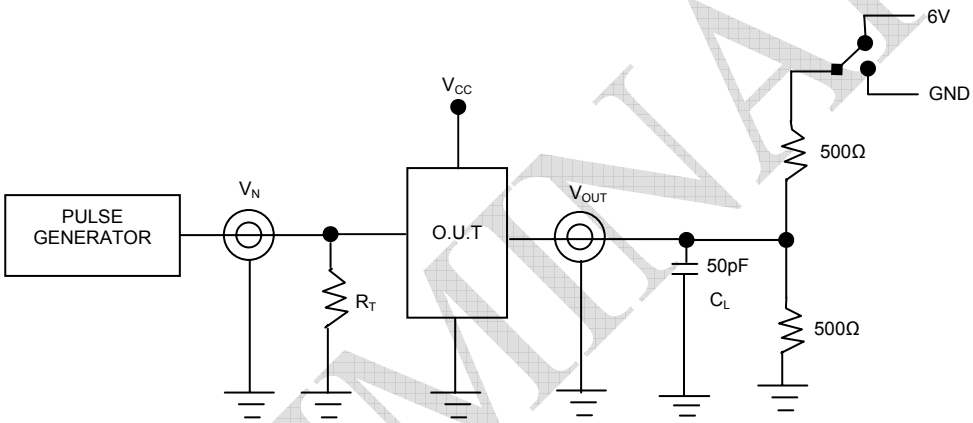


Figure 5. Enable and Disable Time Circuit

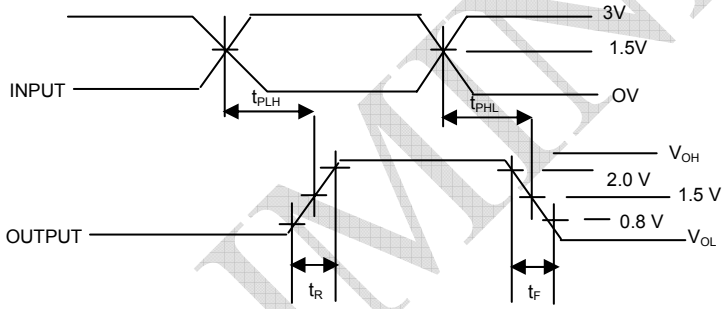
Enable and Disable Time

Switch Position

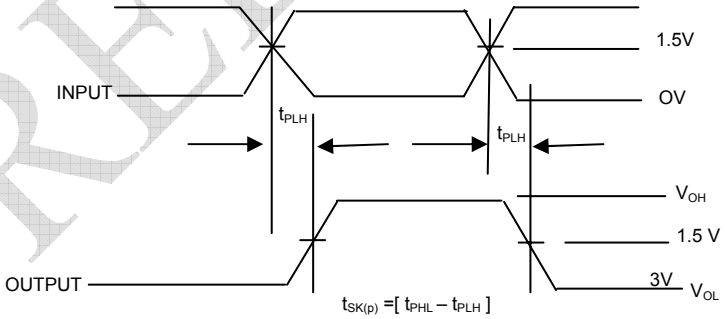
Test	Switch
Disable LOW Enable LOW	6V
Disable HIGH Enable HIGH	GND

DEFINITIONS:
C_L = Load capacitance: includes jig and probe capacitance.
R_T = Termination resistance: should be equal to Z_{OUT} of the Pulse Generator.

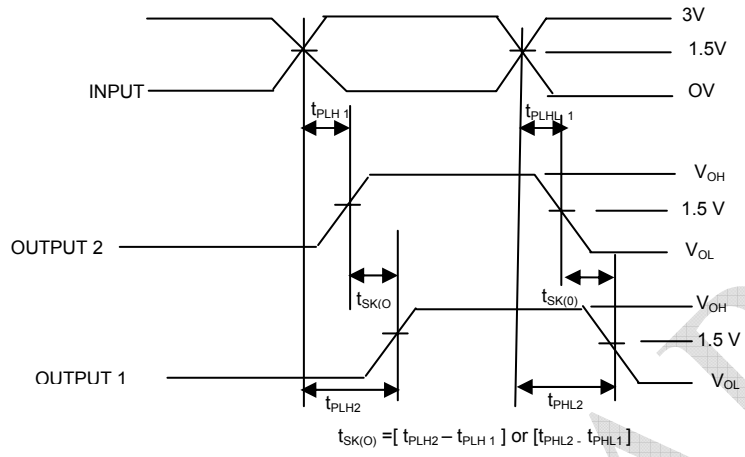
Test Waveforms



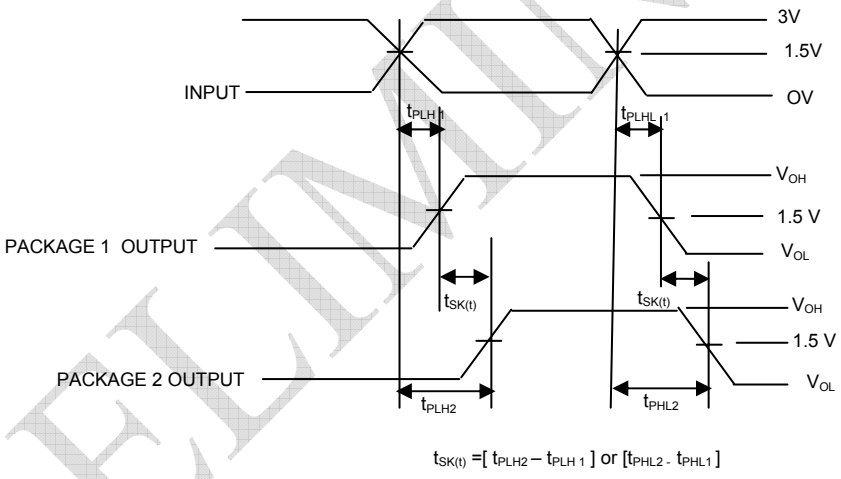
Package Delay



Pulse Skew - $t_{SK(P)}$

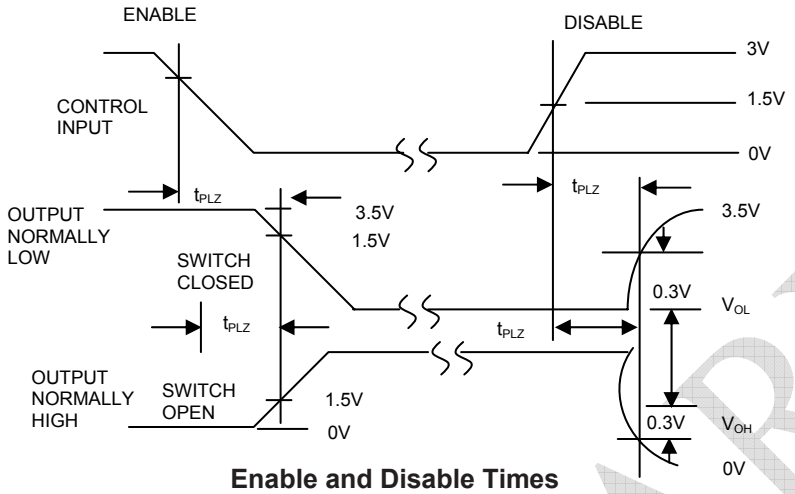


Output Skew - $t_{SK(O)}$



Package Skew - $t_{SK(T)}$

Package 1 and Package 2 are same device type and speed grade

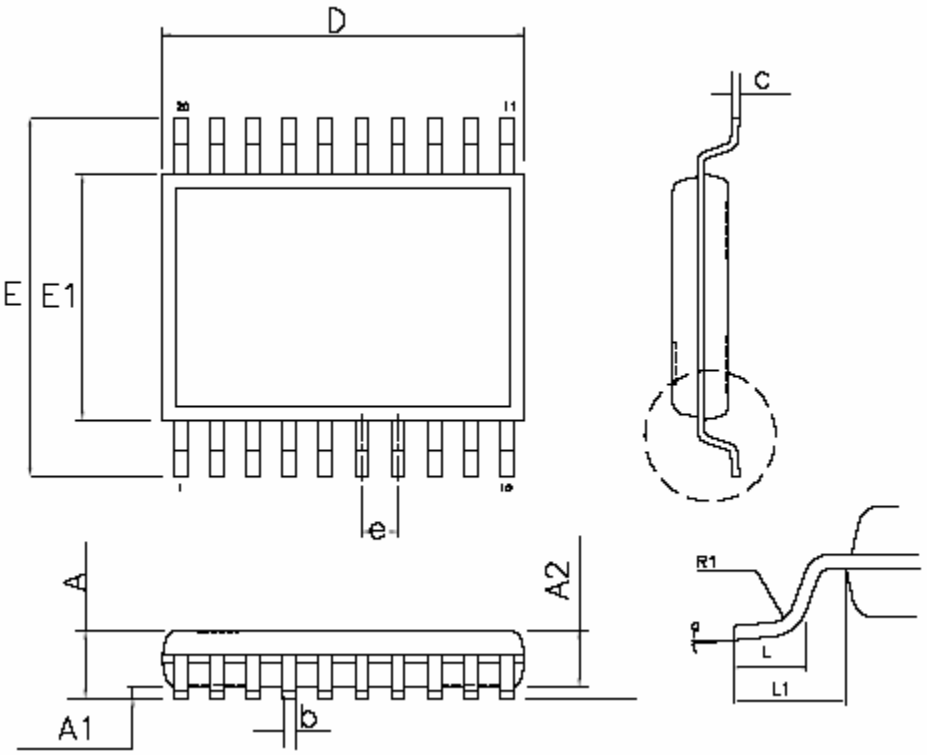


Enable and Disable Times

NOTES: 1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH
2. Pulse Generator for All Pulses: f ≤1.0MHz; t_F ≤2.5nS; t_R ≤2.5nS

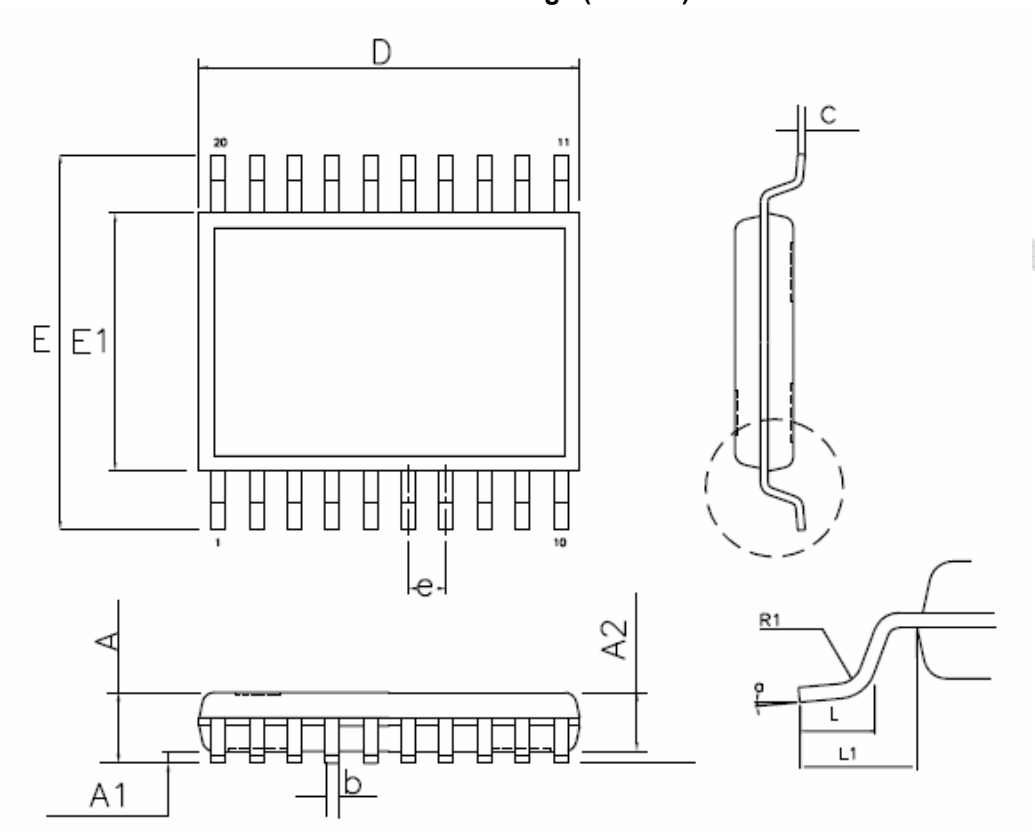
Package Information

20-lead SSOP (150 mil)



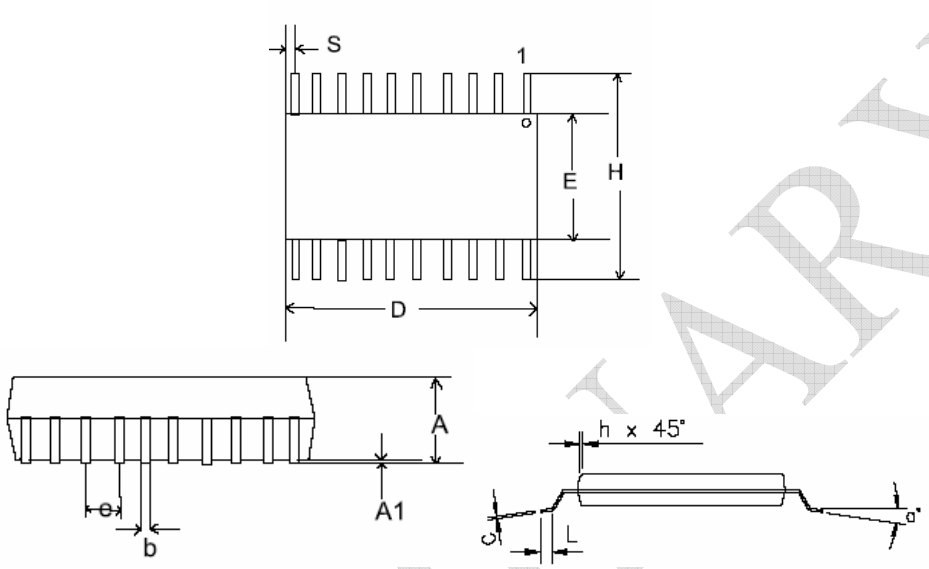
Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	0.053	0.069	1.346	1.753
A1	0.004	0.010	0.102	0.254
A2	….	0.059	….	1.499
D	0.337	0.344	8.560	8.738
c	0.007	0.011	0.178	0.274
E	0.228	0.244	5.791	6.198
E1	0.150	0.157	3.810	3.988
L	0.016	0.035	0.406	0.890
L1	0.010 BASIC		0.254 BASIC	
b	0.008	0.014	0.203	0.356
R1	0.003	….	0.08	…..
a	0°	8°	0°	8°
e	0.025 BASIC		0.635 BASIC	

20L SOIC Package (300 mil)



Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	0.093	0.104	2.35	2.65
A1	0.004	0.012	0.10	0.30
A2	0.088	0.094	2.25	2.40
D	0.496	0.512	12.60	13.00
L	0.016	0.050	0.40	1.27
E1	0.291	0.299	7.40	7.60
R1	0.003	….	0.08	…..
b	0.013	0.022	0.33	0.56
c	0.009	0.015	0.23	0.38
E	0.394	0.419	10.00	10.65
e	0.050 BSC		1.27 BSC	
a	0°	8°	0°	8°

20-lead QSOP Package



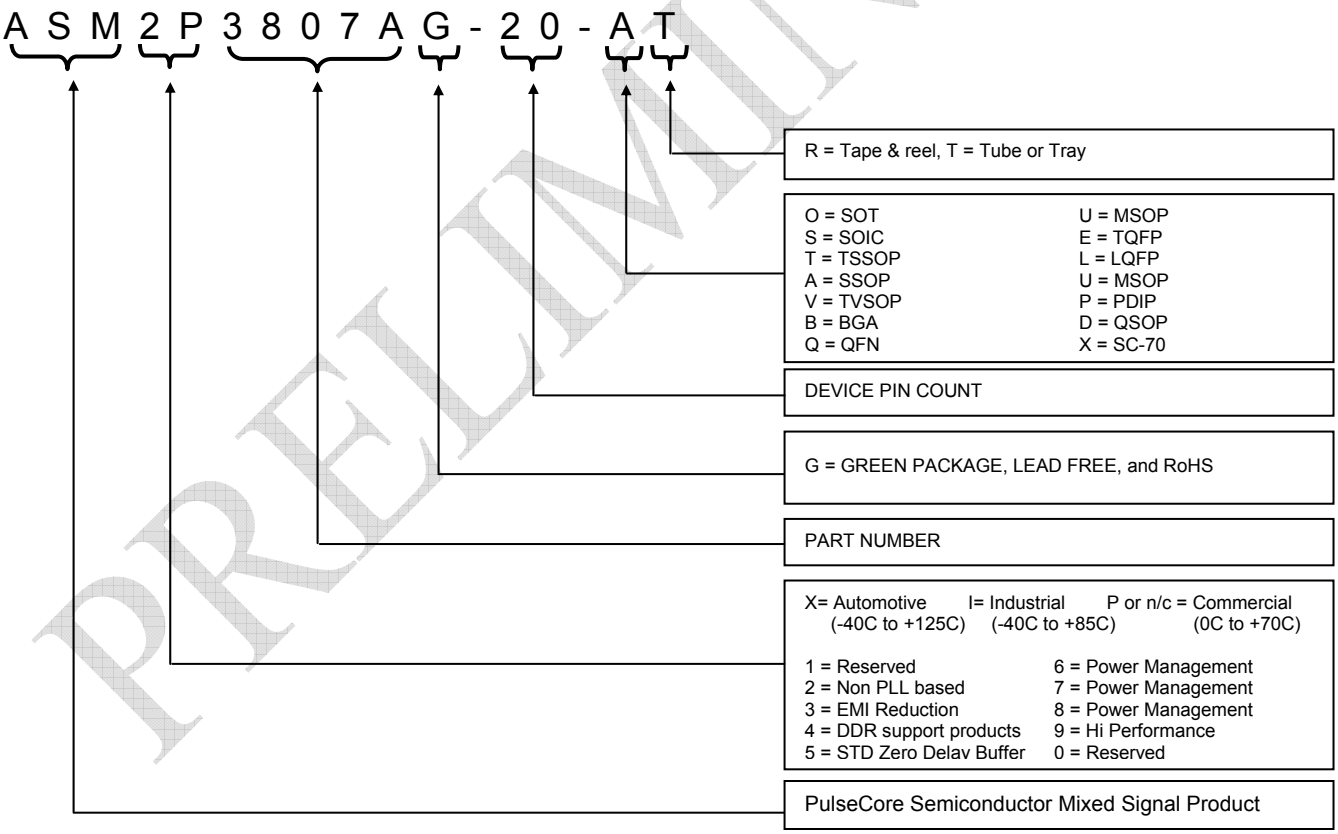
Symbol	Dimensions			
	Inches		Millimeters	
	Min	Max	Min	Max
A	0.060	0.068	1.52	1.73
A1	0.004	0.008	0.10	0.20
b	0.009	0.012	0.23	0.30
c	0.007	0.010	0.18	0.25
D	0.337	0.344	8.56	8.74
E	0.150	0.157	3.81	3.99
e	0.025 BSC		0.64 BSC	
H	0.230	0.244	5.84	6.20
h	0.010	0.016	0.25	0.41
L	0.014	0.030	0.35	0.75
S	0.056	0.060	1.42	1.52
a	0°	8°	0°	8°

rev 0.3

Ordering Information

Part Number	Marking	Package Type	Temperature
ASM2P3807AG-20-AR	2P3807AG	20-Pin SSOP, TAPE & REEL, Green	Commercial
ASM2P3807AG-20-AT	2P3807AG	20-Pin SSOP, TUBE, Green	Commercial
ASM2P3807AG-20-DR	2P3807AG	20-Pin QSOP, TAPE & REEL, Green	Commercial
ASM2P3807AG-20-DT	2P3807AG	20-Pin QSOP, TUBE, Green	Commercial
ASM2P3807AG-20-SR	2P3807AG	20-Pin SOIC, TAPE & REEL, Green	Commercial
ASM2P3807AG-20-ST	2P3807AG	20-Pin SOIC, TUBE, Green	Commercial
ASM2I3807AG-20-AR	2I3807AG	20-Pin SSOP, TAPE & REEL, Green	Industrial
ASM2I3807AG-20-AT	2I3807AG	20-Pin SSOP, TUBE, Green	Industrial
ASM2I3807AG-20-DR	2I3807AG	20-Pin QSOP, TAPE & REEL, Green	Industrial
ASM2I3807AG-20-DT	2I3807AG	20-Pin QSOP, TUBE, Green	Industrial
ASM2I3807AG-20-SR	2I3807AG	20-Pin SOIC, TAPE & REEL, Green	Industrial
ASM2I3807AG-20-ST	2I3807AG	20-Pin SOIC, TUBE, Green	Industrial

Device Ordering Information



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Preliminary Information
Part Number: ASM2P3807A
Document Version: v0.3

Note: This product utilizes US Patent # 6,646,463 Impedance Emulator Patent issued to PulseCore Semiconductor, dated 11-11-2003