

74AC374, 74ACT374

Octal D-Type Flip-Flop with 3-STATE Outputs

Features

- I_{CC} and I_{OZ} reduced by 50%
- Buffered positive edge-triggered clock
- 3-STATE outputs for bus-oriented applications
- Outputs source/sink 24mA
- See 273 for reset version
- See 377 for clock enable version
- See 373 for transparent latch version
- See 574 for broadside pinout version
- See 564 for broadside pinout version with inverted outputs
- ACT374 has TTL-compatible inputs

General Description

The AC/ACT374 is a high-speed, low-power octal D-type flip-flop featuring separate D-type inputs for each flip-flop and 3-STATE outputs for bus-oriented applications. A buffered Clock (CP) and Output Enable ($\overline{OE}$) are common to all flip-flops.

Ordering Information

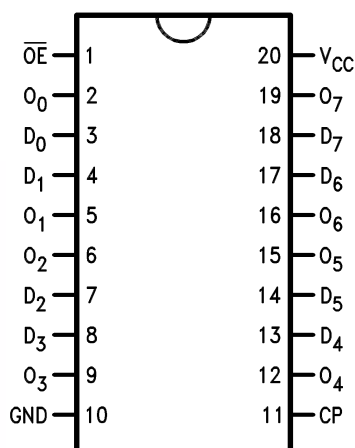
Order Number	Package Number	Package Description
74AC374SC	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
74AC374SJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74AC374MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74AC374PC	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide
74ACT374SC	M20B	20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide
74ACT374SJ	M20D	20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74ACT374MSA	MSA20	20-Lead Shrink Small Outline Package (SSOP), JEDEC MO-150, 5.3mm Wide
74ACT374MTC	MTC20	20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide
74ACT374PC	N20A	20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering number.



All packages are lead free per JEDEC: J-STD-020B standard.

Connection Diagram



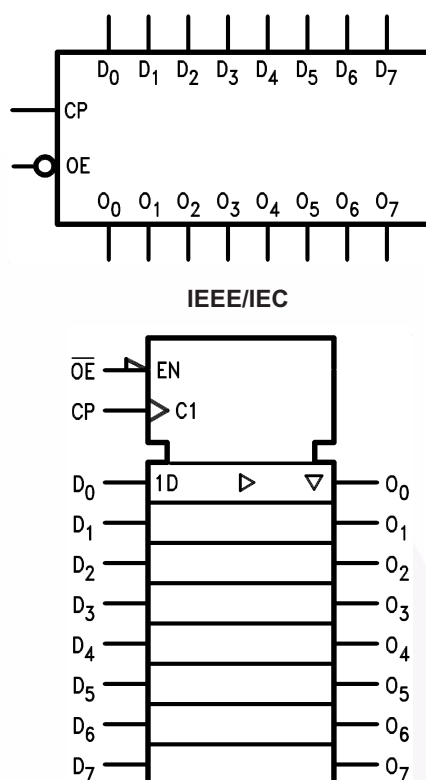
Pin Description

Pin Names	Description
D ₀ –D ₇	Data Inputs
CP	Clock Pulse Input
$\overline{OE}$	3-STATE Output Enable Input
O ₀ –O ₇	3-STATE Outputs

Functional Description

The AC/ACT374 consists of eight edge-triggered flip-flops with individual D-type inputs and 3-STATE true outputs. The buffered clock and buffered Output Enable are common to all flip-flops. The eight flip-flops will store the state of their individual D inputs that meet the setup and hold time requirements on the LOW-to-HIGH Clock (CP) transition. With the Output Enable ($\overline{OE}$) LOW, the contents of the eight flip-flops are available at the outputs. When the $\overline{OE}$ is HIGH, the outputs go to the high impedance state. Operation of the $\overline{OE}$ input does not affect the state of the flip-flops.

Logic Symbols



Truth Table

Inputs			Outputs
D _n	CP	$\overline{OE}$	O _n
H		L	H
L		L	L
X	X	H	Z

H = HIGH Voltage Level

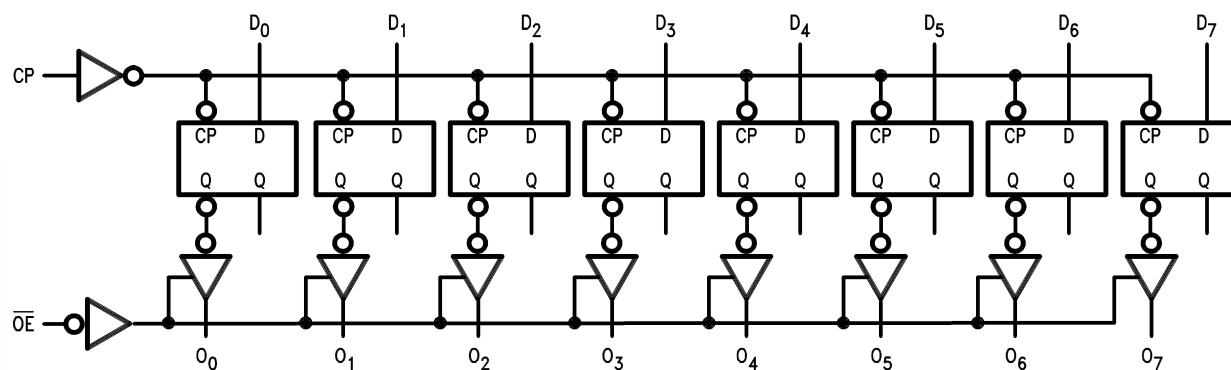
L = LOW Voltage Level

X = Immaterial

Z = High Impedance

= LOW-to-HIGH Transition

Logic Diagram



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Parameter	Rating
V_{CC}	Supply Voltage	−0.5V to +7.0V
I_{IK}	DC Input Diode Current $V_I = -0.5V$	−20mA
	$V_I = V_{CC} + 0.5$	+20mA
V_I	DC Input Voltage	−0.5V to $V_{CC} + 0.5V$
I_{OK}	DC Output Diode Current $V_O = -0.5V$	−20mA
	$V_O = V_{CC} + 0.5V$	+20mA
V_O	DC Output Voltage	−0.5V to $V_{CC} + 0.5V$
I_O	DC Output Source or Sink Current	±50mA
I_{CC} or I_{GND}	DC V_{CC} or Ground Current per Output Pin	±50mA
T_{STG}	Storage Temperature	−65°C to +150°C
T_J	Junction Temperature	140°C

Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to absolute maximum ratings.

Symbol	Parameter	Rating
V_{CC}	Supply Voltage AC	2.0V to 6.0V
	ACT	4.5V to 5.5V
V_I	Input Voltage	0V to V_{CC}
V_O	Output Voltage	0V to V_{CC}
T_A	Operating Temperature	−40°C to +85°C
$\Delta V / \Delta t$	Minimum Input Edge Rate, AC Devices: V_{IN} from 30% to 70% of V_{CC} , V_{CC} @ 3.3V, 4.5V, 5.5V	125mV/ns
$\Delta V / \Delta t$	Minimum Input Edge Rate, ACT Devices: V_{IN} from 0.8V to 2.0V, V_{CC} @ 4.5V, 5.5V	125mV/ns

DC Electrical Characteristics for AC

Symbol	Parameter	V _{CC} (V)	Conditions	T _A = +25°C		T _A = −40°C to +85°C		Units
				Typ.	Guaranteed Limits			
V _{IH}	Minimum HIGH Level Input Voltage	3.0	V _{OUT} = 0.1V or V _{CC} − 0.1V	1.5	2.1	2.1		V
		4.5		2.25	3.15	3.15		
		5.5		2.75	3.85	3.85		
V _{IL}	Maximum LOW Level Input Voltage	3.0	V _{OUT} = 0.1V or V _{CC} − 0.1V	1.5	0.9	0.9		V
		4.5		2.25	1.35	1.35		
		5.5		2.75	1.65	1.65		
V _{OH}	Minimum HIGH Level Output Voltage	3.0	I _{OUT} = −50μA	2.99	2.9	2.9		V
		4.5		4.49	4.4	4.4		
		5.5		5.49	5.4	5.4		
		3.0	V _{IN} = V _{IL} or V _{IH} , I _{OH} = −12mA		2.56	2.46		
		4.5	V _{IN} = V _{IL} or V _{IH} , I _{OH} = −24mA		3.86	3.76		
		5.5	V _{IN} = V _{IL} or V _{IH} , I _{OH} = −24mA ⁽¹⁾		4.86	4.76		
V _{OL}	Maximum LOW Level Output Voltage	3.0	I _{OUT} = 50μA	0.002	0.1	0.1		V
		4.5		0.001	0.1	0.1		
		5.5		0.001	0.1	0.1		
		3.0	V _{IN} = V _{IL} or V _{IH} , I _{OL} = 12mA		0.36	0.44		
		4.5	V _{IN} = V _{IL} or V _{IH} , I _{OL} = 24mA		0.36	0.44		
		5.5	V _{IN} = V _{IL} or V _{IH} , I _{OL} = 24mA ⁽¹⁾		0.36	0.44		
I _{IN} ⁽²⁾	Maximum Input Leakage Current	5.5	V _I = V _{CC} , GND		±0.1	±1.0		μA
I _{OZ}	Maximum 3-STATE Leakage Current	5.5	V _I (OE) = V _{IL} , V _{IH} ; V _I = V _{CC} , GND; V _O = V _{CC} , GND		±0.25	±2.5		μA
I _{OLD}	Minimum Dynamic Output Current ⁽³⁾	5.5	V _{OLD} = 1.65V Max.			75		mA
I _{OHD}		5.5	V _{OHD} = 3.85V Min.			−75		mA
I _{CC} ⁽²⁾	Maximum Quiescent Supply Current	5.5	V _{IN} = V _{CC} or GND		4.0	40.0		μA

Notes:

1. All outputs loaded; thresholds on input associated with output under test.
2. I_{IN} and I_{CC} @ 3.0V are guaranteed to be less than or equal to the respective limit @ 5.5V V_{CC} .
3. Maximum test duration 2.0ms, one output loaded at a time.

DC Electrical Characteristics for ACT

Symbol	Parameter	V _{CC} (V)	Conditions	T _A = +25°C		T _A = −40°C to +85°C		Units
				Typ.	Guaranteed Limits			
V _{IH}	Minimum HIGH Level Input Voltage	4.5	V _{OUT} = 0.1V or V _{CC} − 0.1V	1.5	2.0	2.0		V
		5.5		1.5	2.0	2.0		
V _{IL}	Maximum LOW Level Input Voltage	4.5	V _{OUT} = 0.1V or V _{CC} − 0.1V	1.5	0.8	0.8		V
		5.5		1.5	0.8	0.8		
V _{OH}	Minimum HIGH Level Output Voltage	4.5	I _{OUT} = −50μA	4.49	4.4	4.4		V
		5.5		5.49	5.4	5.4		
		4.5	V _{IN} = V _{IL} or V _{IH} , I _{OH} = −24mA		3.86	3.76		
		5.5	V _{IN} = V _{IL} or V _{IH} , I _{OH} = −24mA ⁽⁴⁾		4.86	4.76		
V _{OL}	Maximum LOW Level Output Voltage	4.5	I _{OUT} = 50μA	0.001	0.1	0.1		V
		5.5		0.001	0.1	0.1		
		4.5	V _{IN} = V _{IL} or V _{IH} , I _{OL} = 24mA		0.36	0.44		
		5.5	V _{IN} = V _{IL} or V _{IH} , I _{OL} = 24mA ⁽⁴⁾		0.36	0.44		
I _{IN}	Maximum Input Leakage Current	5.5	V _I = V _{CC} , GND		±0.1	±1.0		μA
I _{OZ}	Maximum 3-STATE Leakage Current	5.5	V _I = V _{IL} , V _{IH} ; V _O = V _{CC} , GND		±0.25	±2.5		μA
I _{CCT}	Maximum I _{CC} /Input	5.5	V _I = V _{CC} − 2.1V	0.6		1.5		mA
I _{OLD}	Minimum Dynamic Output Current ⁽⁵⁾	5.5	V _{OLD} = 1.65V Max.			75		mA
I _{OHD}		5.5	V _{OHD} = 3.85V Min.			−75		mA
I _{CC}	Maximum Quiescent Supply Current	5.5	V _{IN} = V _{CC} or GND		4.0	40.0		μA

Notes:

4. All outputs loaded; thresholds on input associated with output under test.
5. Maximum test duration 2.0ms, one output loaded at a time.

AC Electrical Characteristics for AC

Symbol	Parameter	V _{CC} (V) ⁽⁶⁾	T _A = +25°C, C _L = 50pF			T _A = -40°C to +85°C, C _L = 50pF		Units
			Min.	Typ.	Max.	Min.	Max.	
f _{MAX}	Maximum Clock Frequency	3.3	60	110		60		MHz
		5.0	100	155		100		
t _{PLH}	Propagation Delay, CP to O _n	3.3	3.0	11.0	13.5	1.5	15.5	ns
		5.0	2.5	8.0	9.5	1.5	10.5	
t _{PHL}	Propagation Delay, CP to O _n	3.3	2.5	10.0	12.5	2.0	14.0	ns
		5.0	2.0	7.0	9.0	1.5	10.0	
t _{PZH}	Output Enable Time	3.3	3.0	9.5	11.5	1.5	13.0	ns
		5.0	2.0	7.0	8.5	1.0	9.5	
t _{PZL}	Output Enable Time	3.3	2.5	9.0	11.5	1.5	13.0	ns
		5.0	2.0	6.5	8.5	1.0	9.5	
t _{PHZ}	Output Disable Time	3.3	3.0	10.5	12.5	2.0	14.5	ns
		5.0	2.0	8.0	11.0	2.0	12.5	
t _{PLZ}	Output Disable Time	3.3	2.0	8.0	11.5	1.0	12.5	ns
		5.0	1.5	6.5	8.5	1.0	10.0	

Note:

6. Voltage range 3.3 is 3.3V ± 0.3V. Voltage range 5.0 is 5.0V ± 0.5V.

AC Operating Requirements for AC

Symbol	Parameter	V _{CC} (V) ⁽⁷⁾	T _A = +25°C, C _L = 50pF		T _A = −40°C to +85°C, C _L = 50pF	Units
			Typ.	Guaranteed Minimum		
t _S	Setup Time, HIGH or LOW, D _n to CP	3.3	2.0	5.5	6.0	ns
		5.0	1.0	4.0	4.5	
t _H	Hold Time, HIGH or LOW, D _n to CP	3.3	−1.0	1.0	1.0	ns
		5.0	0	1.5	1.5	
t _W	CP Pulse Width, HIGH or LOW	3.3	4.0	5.5	6.0	ns
		5.0	2.5	4.0	4.5	

Note:

7. Voltage range 3.3 is 3.3V ± 0.3V. Voltage range 5.0 is 5.0V ± 0.5V.

AC Electrical Characteristics for ACT

Symbol	Parameter	V_{CC} (V) ⁽⁸⁾	$T_A = +25^\circ\text{C}$, $C_L = 50\text{pF}$			$T_A = -40^\circ\text{C to } +85^\circ\text{C}$, $C_L = 50\text{pF}$		Units
			Min.	Typ.	Max.	Min.	Max.	
f_{MAX}	Maximum Clock Frequency	5.0	100	160		90		MHz
t_{PLH}	Propagation Delay, CP to O_n	5.0	2.0	8.5	10.0	2.0	11.5	ns
t_{PHL}	Propagation Delay, CP to O_n	5.0	2.0	8.0	9.5	1.5	11.0	ns
t_{PZH}	Output Enable Time	5.0	2.0	8.0	9.5	1.5	10.5	ns
t_{PZL}	Output Enable Time	5.0	1.5	8.0	9.0	1.5	10.5	ns
t_{PHZ}	Output Disable Time	5.0	1.5	8.5	11.5	1.0	12.5	ns
t_{PLZ}	Output Disable Time	5.0	1.5	7.0	8.5	1.0	10.0	ns

Note:

8. Voltage range 5.0 is $5.0\text{V} \pm 0.5\text{V}$.

AC Operating Requirements for ACT

Symbol	Parameter	V _{CC} (V) ⁽⁹⁾	T _A = +25°C, C _L = 50pF		T _A = −40°C to +85°C, C _L = 50pF	Units
			Typ.	Guaranteed Minimum		
t _S	Setup Time, HIGH or LOW, D _n to CP	5.0	1.0	5.5	5.5	ns
t _H	Hold Time, HIGH or LOW, D _n to CP	5.0	0	1.5	1.5	ns
t _W	CP Pulse Width, HIGH or LOW	5.0	2.5	5.0	5.0	ns

Note:

9. Voltage range 5.0 is $5.0\text{V} \pm 0.5\text{V}$.

Capacitance

Symbol	Parameter	Conditions	Typ.	Units
C_{IN}	Input Capacitance	$V_{CC} = \text{OPEN}$	4.5	pF

Physical Dimensions

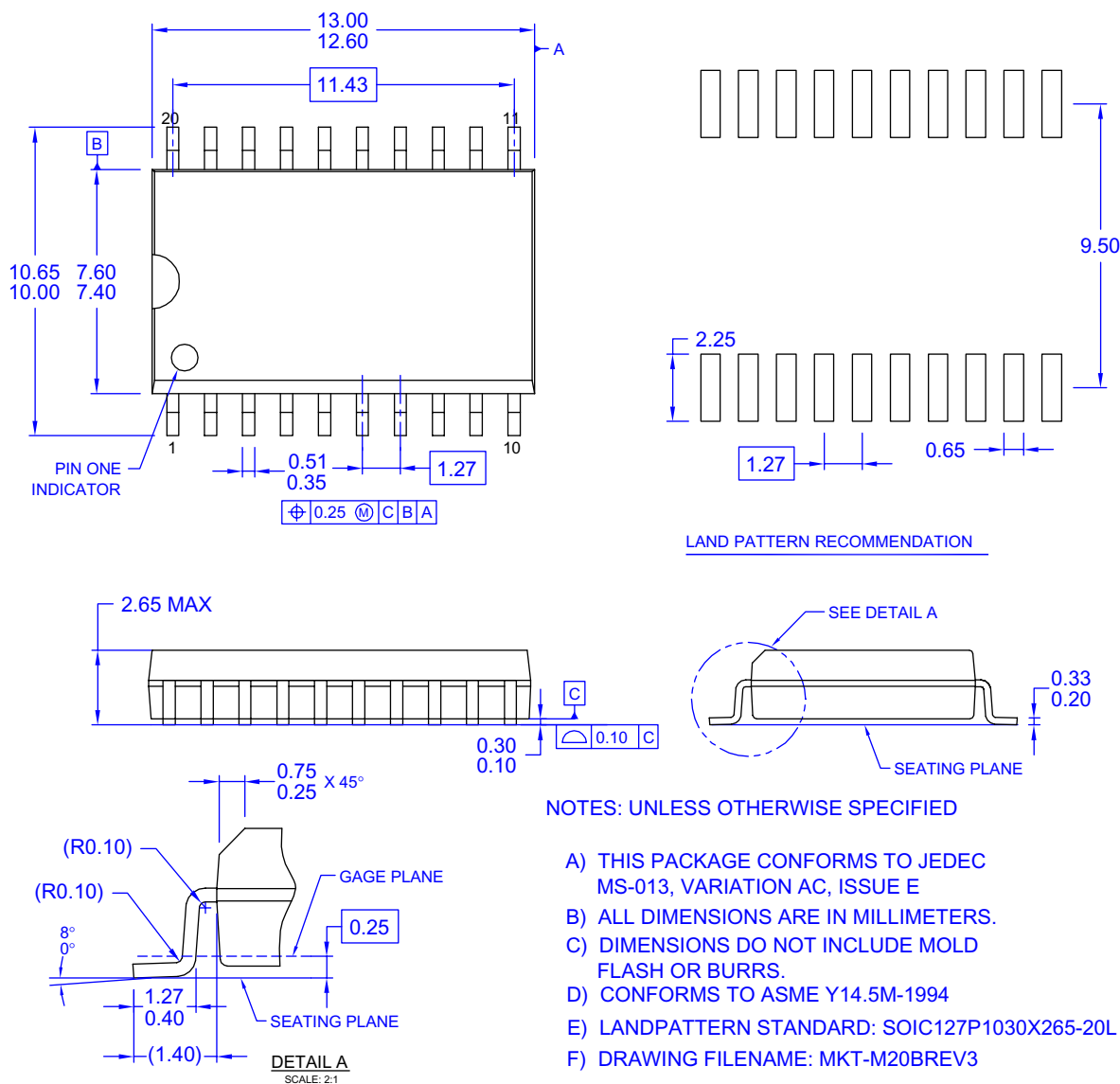


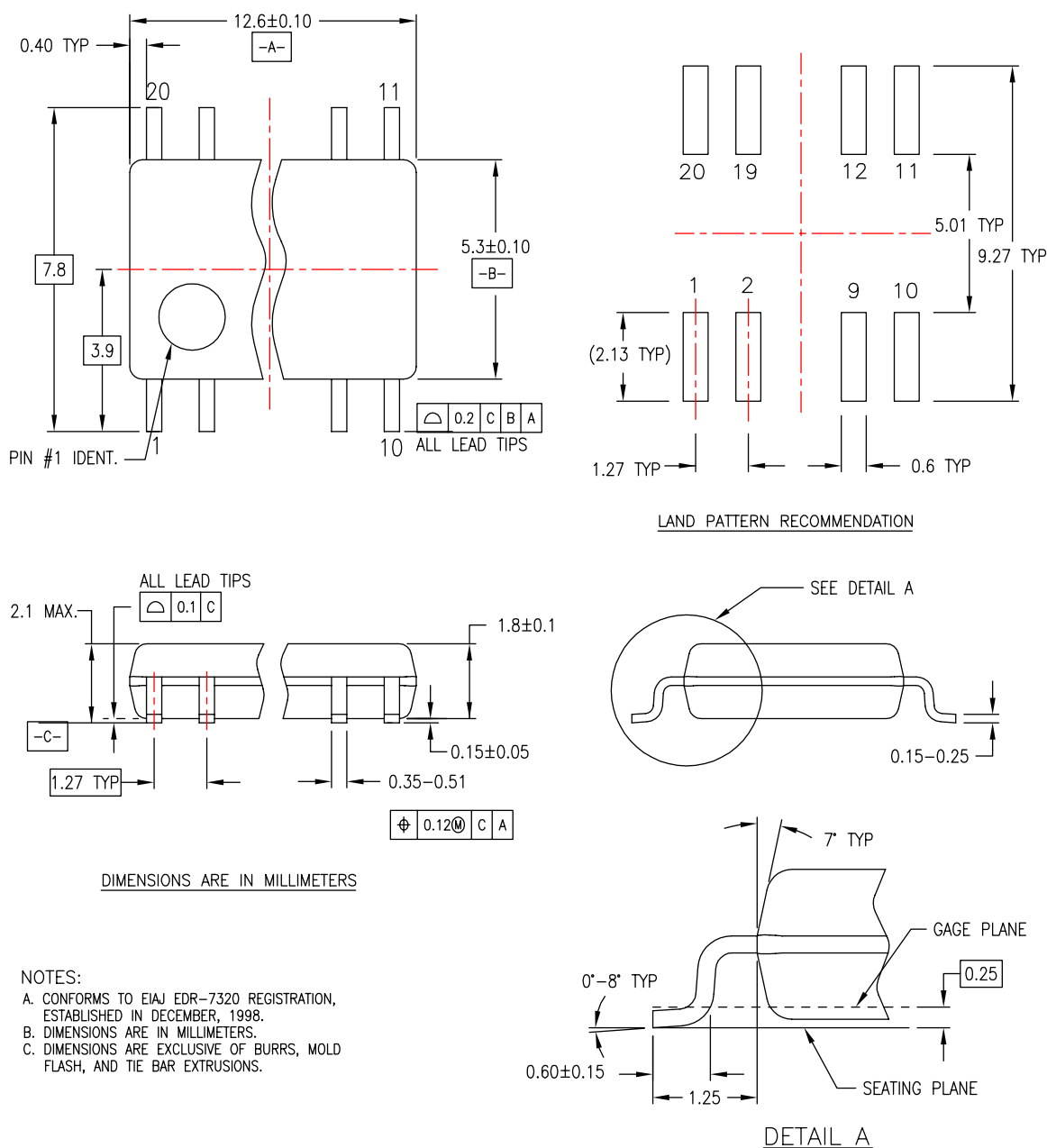
Figure 1. 20-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-013, 0.300" Wide

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

<http://www.fairchildsemi.com/packaging/>

Physical Dimensions (Continued)



M20DREVC

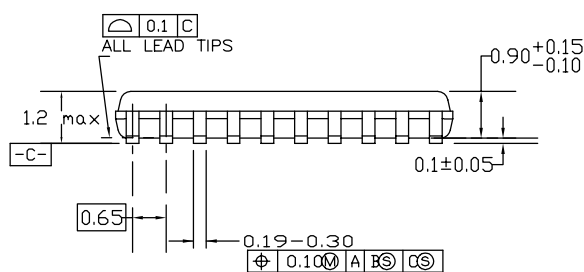
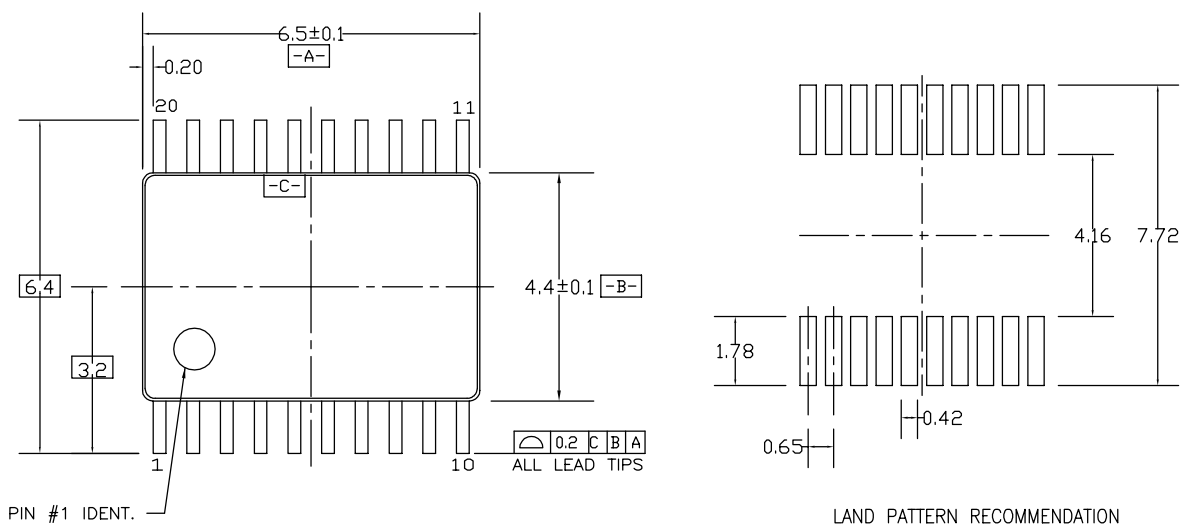
Figure 2. 20-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

<http://www.fairchildsemi.com/packaging/>

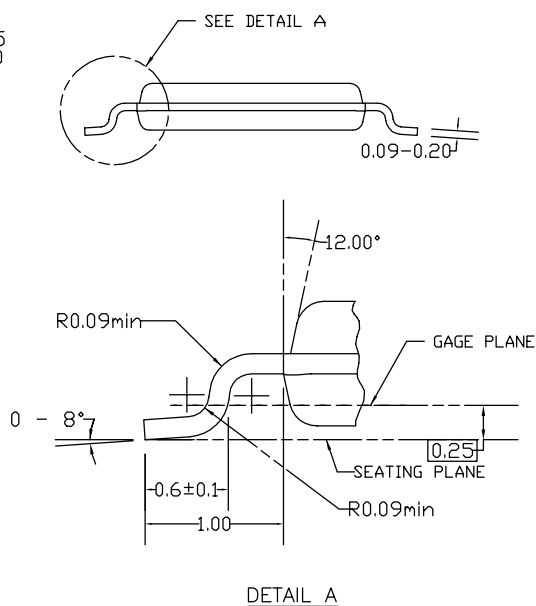
Physical Dimensions (Continued)



DIMENSIONS ARE IN MILLIMETERS

NOTES:

- CONFORMS TO JEDEC REGISTRATION MD-153, VARIATION AC, REF NOTE 6, DATE 7/93.
- DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLDS FLASH, AND TIE BAR EXTRUSIONS.
- DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.



MTC20REV D1

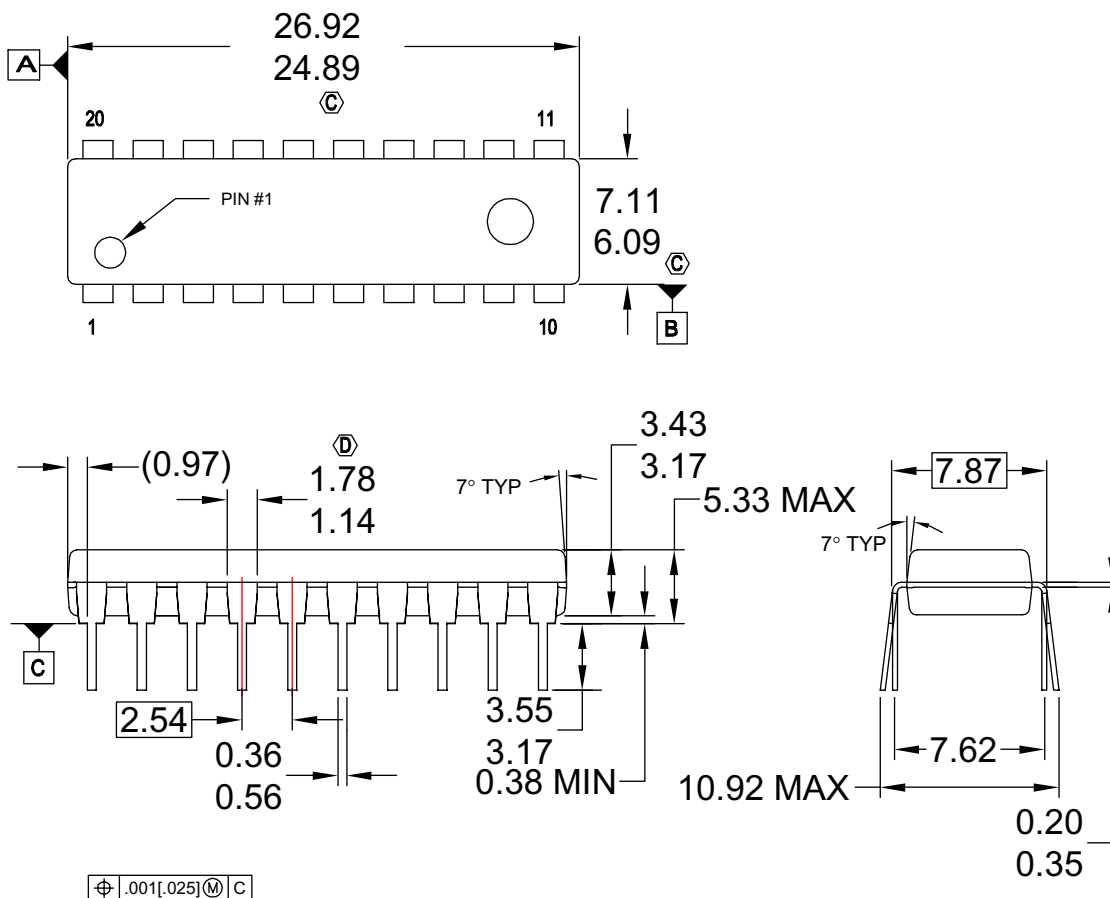
Figure 3. 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

<http://www.fairchildsemi.com/packaging/>

Physical Dimensions (Continued)



NOTES:

- A. CONFORMS TO JEDEC REGISTRATION MS-001, VARIATIONS AD.
- B. ALL DIMENSIONS ARE IN MILLIMETERS
- C. DOES NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.25MM.
- D. DOES NOT INCLUDE DAMBAR PROTRUSIONS. DAMBAR PROTRUSIONS SHALL NOT EXCEED 0.25MM.
- E. DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
- F. DRAWING FILE NAME: N20AREV8

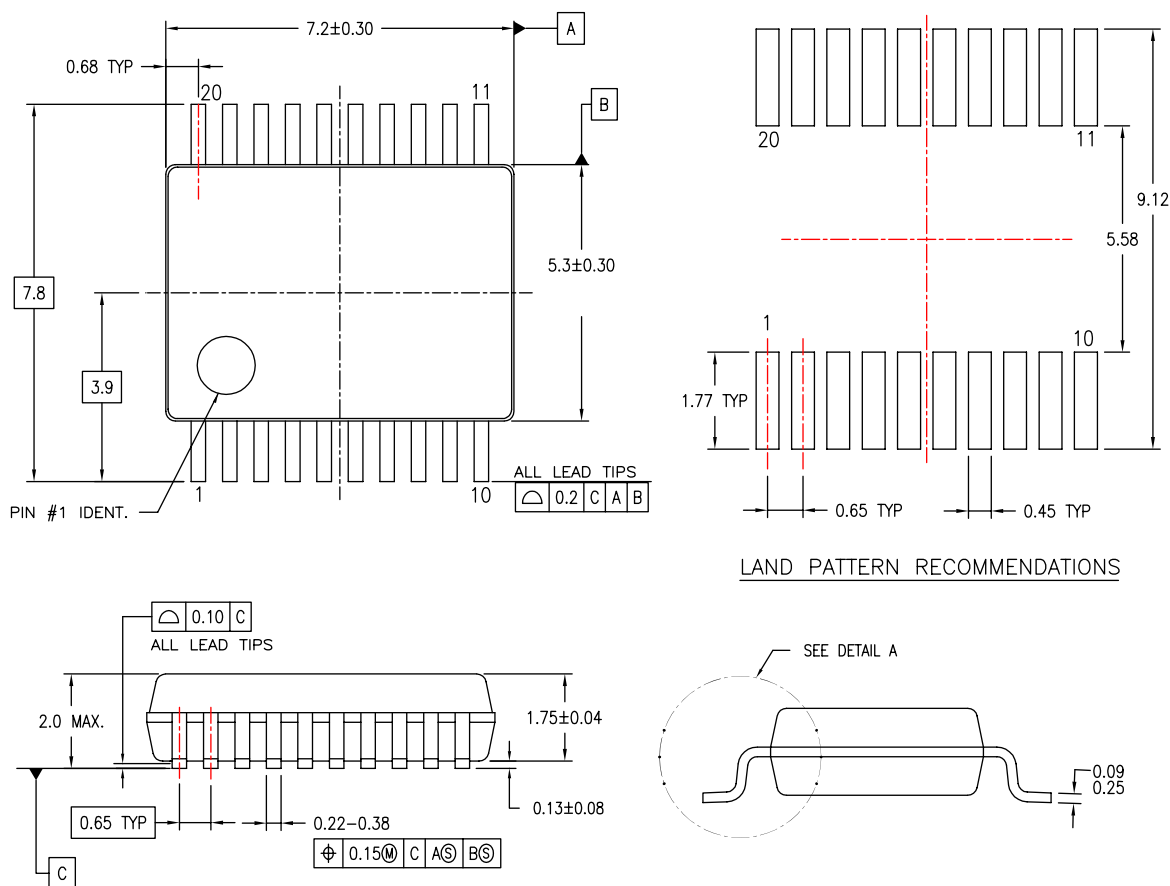
Figure 4. 20-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

<http://www.fairchildsemi.com/packaging/>

Physical Dimensions (Continued)



DIMENSIONS ARE IN MILLIMETERS

NOTES:

- CONFORMS TO JEDEC REGISTRATION MO-150, VARIATION AE, DATE 1/94.
- DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR EXTRUSIONS.
- DIMENSIONS AND TOLERANCES PER ASME Y14.5M - 1994.

MSA20REVB

Figure 5. 20-Lead Shrink Small Outline Package (SSOP), JEDEC MO-150, 5.3mm Wide

Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications do not expand the terms of Fairchild's worldwide terms and conditions, specifically the warranty therein, which covers Fairchild products.

Always visit Fairchild Semiconductor's online packaging area for the most recent package drawings:

<http://www.fairchildsemi.com/packaging/>



TRADEMARKS

The following includes registered and unregistered trademarks and service marks, owned by Fairchild Semiconductor and/or its global subsidiaries, and is not intended to be an exhaustive list of all such trademarks.

ACEx [®]	FPS [™]	PDP-SPM [™]	SyncFET [™]
Build it Now [™]	FRFET [®]	Power220 [®]	SYSTEM [®]
CorePLUS [™]	Global Power Resource SM	Power247 [®]	GENERAL
CROSSVOLT [™]	Green FPS [™]	POWEREDGE [®]	The Power Franchise [®]
CTL [™]	Green FPS [™] e-Series [™]	Power-SPM [™]	the power [™]
Current Transfer Logic [™]	GTO [™]	PowerTrench [®]	franchise
EcoSPARK [®]	i-Lo [™]	Programmable Active Droop [™]	TinyBoost [™]
EZSWITCH [™] *	IntelliMAX [™]	QFET [®]	TinyBuck [™]
 [™]	ISOPLANAR [™]	QS [™]	TinyLogic [®]
 [®]	MegaBuck [™]	QT Optoelectronics [™]	TINYOPTO [™]
Fairchild [®]	MICROCOUPLER [™]	Quiet Series [™]	TinyPower [™]
Fairchild Semiconductor [®]	MicroFET [™]	RapidConfigure [™]	TinyPWM [™]
FACT Quiet Series [™]	MicroPak [™]	SMART START [™]	TinyWire [™]
FACT [®]	MillerDrive [™]	SPM [®]	μSerDes [™]
FAST [®]	Motion-SPM [™]	STEALTH [™]	UHC [®]
FastvCore [™]	OPTOLOGIC [®]	SuperFET [™]	Ultra FRFET [™]
FlashWriter [®] *	OPTOPLANAR [®]	SuperSOT [™] -3	UniFET [™]
		SuperSOT [™] -6	VCX [™]
		SuperSOT [™] -8	

* EZSWITCH[™] and FlashWriter[®] are trademarks of System General Corporation, used under license by Fairchild Semiconductor.

DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury of the user.
2. A critical component in any component of a life support, device, or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
Advance Information	Formative or In Design	This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	This datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	This datasheet contains specifications on a product that has been discontinued by Fairchild Semiconductor. The datasheet is printed for reference information only.

Rev. I32