



## NC7SZ04 TinyLogic® UHS Inverter

### Features

- Ultra-High Speed:  $t_{PD}$  2.4ns (Typical) into 50pF at 5V  $V_{CC}$
- High Output Drive:  $\pm 24mA$  at 3V  $V_{CC}$
- Broad  $V_{CC}$  Operating Range: 1.65V to 5.5V
- Matches Performance of LCX when Operated at 3.3V  $V_{CC}$
- Power Down High Impedance Inputs/Outputs
- Over-Voltage Tolerance Inputs Facilitate 5V to 3V Translation
- Proprietary Noise/EMI Reduction Circuitry
- Ultra-Small MicroPak™ Packages
- Space-Saving SOT23 and SC70 Packages

### Description

The NC7SZ04 is a single inverter from Fairchild's Ultra-High Speed (UHS) series of TinyLogic®. The device is fabricated with advanced CMOS technology to achieve ultra-high speed with high output drive while maintaining low static power dissipation over a broad  $V_{CC}$  operating range. The device is specified to operate over the 1.65V to 5.5V  $V_{CC}$  operating range. The inputs and output are high-impedance when  $V_{CC}$  is 0V. Inputs tolerate voltages up to 6V, independent of  $V_{CC}$  operating voltage.

### Related Resources

- [MS-503 — Family Characteristics TinyLogic® HS/HST and UHS Series](#)

### Ordering Information

Part Number	Top Mark	Package	Packing Method
NC7SZ04M5X	7Z04	5-Lead SOT23, JEDEC MO-178 1.6mm	3000 Units on Tape & Reel
NC7SZ04P5X	Z04	5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3000 Units on Tape & Reel
NC7SZ04L6X	CC	6-Lead MicroPak™, 1.00mm Wide	5000 Units on Tape & Reel
NC7SZ04FHX	CC	6-Lead, MicroPak2™, 1x1mm Body, .35mm Pitch	5000 Units on Tape & Reel

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## Connection Diagrams

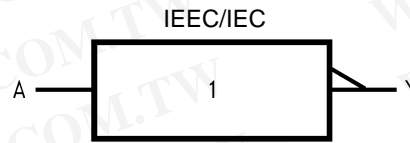


Figure 1. Logic Symbol

## Pin Configurations

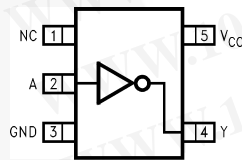


Figure 2. SC70 and SOT23 (Top View)

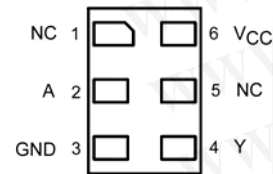


Figure 3. MicroPak™ (Top Through View)

## Pin Definitions

Pin # SC70 / SOT23	Pin # MicroPak™	Name	Description
1	1,5	NC	No Connect
2	2	A	Input
3	3	GND	Ground
4	4	Y	Output
5	6	V <sub>CC</sub>	Supply Voltage

## Function Table

Y = /A

Inputs	Output
A	Y
L	H
H	L

H = HIGH Logic Level

L = LOW Logic Level

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## 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	Min.	Max.	Unit
$V_{CC}$	Supply Voltage	-0.5	6.0	V
$V_{IN}$	DC Input Voltage	-0.5	6.0	V
$V_{OUT}$	DC Output Voltage	-0.5	6.0	V
$I_{IK}$	DC Input Diode Current	$V_{IN} < -0.5V$		-50
		$V_{IN} > 6.0V$		+20
$I_{OK}$	DC Output Diode Current	$V_{OUT} < -0.5V$		-50
		$V_{OUT} > 6V, V_{CC}=GND$		+20
$I_{OUT}$	DC Output Current		±50	mA
$I_{CC}$ or $I_{GND}$	DC $V_{CC}$ or Ground Current		±50	mA
$T_{STG}$	Storage Temperature Range	-65	+150	°C
$T_J$	Junction Temperature Under Bias		+150	°C
$T_L$	Junction Lead Temperature (Soldering, 10 Seconds)		+260	°C
$P_D$	Power Dissipation at +85°C	SOT-23		200
		SC70-5		150
		MicroPak™-6		130
		MicroPak2™-6		120
ESD	Human Body Model, JEDEC:JESD22-A114		4000	V
	Charge Device Model, JEDEC:JESD22-C101		2000	

## 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	Conditions	Min.	Max.	Unit
$V_{CC}$	Supply Voltage Operating		1.65	5.50	V
	Supply Voltage Data Retention		1.5	5.5	
$V_{IN}$	Input Voltage		0	5.5	V
$V_{OUT}$	Output Voltage		0	$V_{CC}$	V
$T_A$	Operating Temperature		-40	+85	°C
$t_r, t_f$	Input Rise and Fall Times	$V_{CC}$ at 1.8V, 2.5V ±0.2V	0	20	ns/V
		$V_{CC}$ at 3.3V ± 0.3V	0	10	
		$V_{CC}$ at 5.0V ± 0.5V	0	5	
$\theta_{JA}$	Thermal Resistance	SOT-23		300	°C/W
		SC70-5		425	
		MicroPak™-6		500	
		MicroPak2™-6		560	

### Note:

- Unused inputs must be held HIGH or LOW. They may not float.

### DC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub>	Conditions	T <sub>A</sub> =25°C			T <sub>A</sub> =-40 to 85°C		Units
				Min.	Typ.	Max.	Min.	Max.	
V <sub>IH</sub>	HIGH Level Input Voltage	1.65 to 1.95		0.75V <sub>CC</sub>			0.75V <sub>CC</sub>		V
		2.30 to 5.50		0.70V <sub>CC</sub>			0.70V <sub>CC</sub>		
V <sub>IL</sub>	LOW Level Input Voltage	1.65 to 1.95				0.25V <sub>CC</sub>	0.25V <sub>CC</sub>	V	
		2.30 to 5.50				0.30V <sub>CC</sub>	0.30V <sub>CC</sub>		
V <sub>OH</sub>	HIGH Level Output Voltage	1.65	V <sub>IN</sub> =V <sub>IL</sub> , I <sub>OH</sub> =-100μA	1.55	1.65			V	
		1.80		1.70	1.80	1.70			
		2.30		2.20	2.30	2.20			
		3.00		2.90	3.00	2.90			
		4.50		4.40	4.50	4.40			
		1.65	I <sub>OH</sub> =-4mA	1.29	1.52	1.29			
		2.30		I <sub>OH</sub> =-8mA	1.90	2.15	1.90		
		3.00		I <sub>OH</sub> =-16mA	2.40	2.80	2.40		
		3.00		I <sub>OH</sub> =-24mA	2.30	2.68	2.30		
		4.50		I <sub>OH</sub> =-32mA	3.80	4.20	3.80		
V <sub>OL</sub>	LOW Level Output Voltage	1.65	V <sub>IN</sub> =V <sub>IH</sub> , I <sub>OL</sub> =100μA		0.00	0.10	0.10	V	
		1.80			0.00	0.10	0.10		
		2.30			0.00	0.10	0.10		
		3.00			0.00	0.10	0.10		
		4.50			0.00	0.10	0.10		
		1.65	I <sub>OL</sub> =4mA	0.80	0.24	0.24			
		2.30		I <sub>OL</sub> =8mA	0.10	0.30	0.30		
		3.00		I <sub>OL</sub> =16mA	0.15	0.40	0.40		
		3.00		I <sub>OL</sub> =24mA	0.22	0.55	0.55		
		4.50		I <sub>OL</sub> =32mA	0.22	0.55	0.55		
I <sub>IN</sub>	Input Leakage Current	0 to 5.5	0 ≤ V <sub>IN</sub> ≤ 5.5V			±1	±10	μA	
I <sub>OFF</sub>	Power Off Leakage Current	0	V <sub>IN</sub> or V <sub>OUT</sub> =5.5V			1	10	μA	
I <sub>CC</sub>	Quiescent Supply Current	1.65 to 5.50	V <sub>IN</sub> =5.5V, GND			2.0	20	μA	

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## AC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub>	Conditions	T <sub>A</sub> =25°C			T <sub>A</sub> =-40 to 85°C		Units	Figure
				Min.	Typ.	Max.	Min.	Max.		
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay	1.65	C <sub>L</sub> =15pF, R <sub>L</sub> =1MΩ	2.0	5.3	11.4	2.0	12.0	ns	Figure 4 Figure 5
		1.80		2.0	4.4	9.5	2.0	10.0		
		2.50 ± 0.20		0.8	2.9	6.5	0.8	7.0		
		3.30 ± 0.30		0.5	2.1	4.5	0.5	4.7		
		5.00 ± 0.50		0.5	1.8	3.9	0.5	4.1		
		3.30 ± 0.30		C <sub>L</sub> =50pF, R <sub>L</sub> =500Ω	1.5	2.9	5.0	1.5		
5.00 ± 0.50	0.8	2.4	4.3		0.8	4.5				
C <sub>IN</sub>	Input Capacitance	0.00			4				pF	
C <sub>PD</sub>	Power Dissipation Capacitance <sup>(2)</sup>	3.30			20				pF	Figure 6
		5.00			26					

**Note:**

2. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression: I<sub>CCD</sub>=(C<sub>PD</sub>)(V<sub>CC</sub>)(f<sub>IN</sub>)+(I<sub>CC</sub>static).

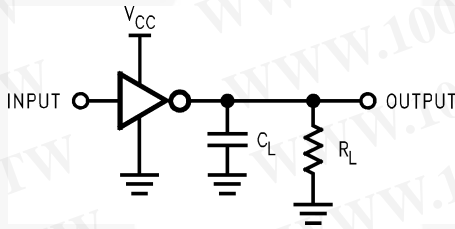


Figure 4. AC Test Circuit

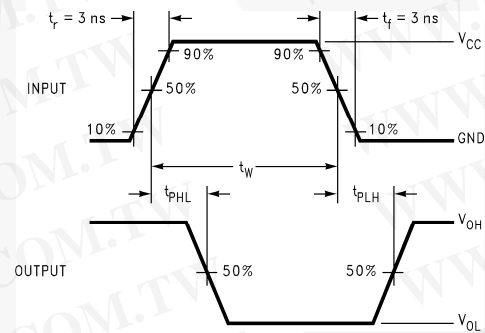
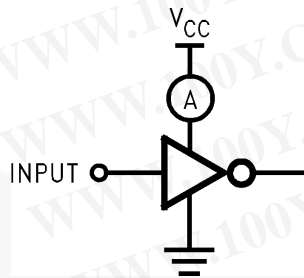


Figure 5. AC Waveforms



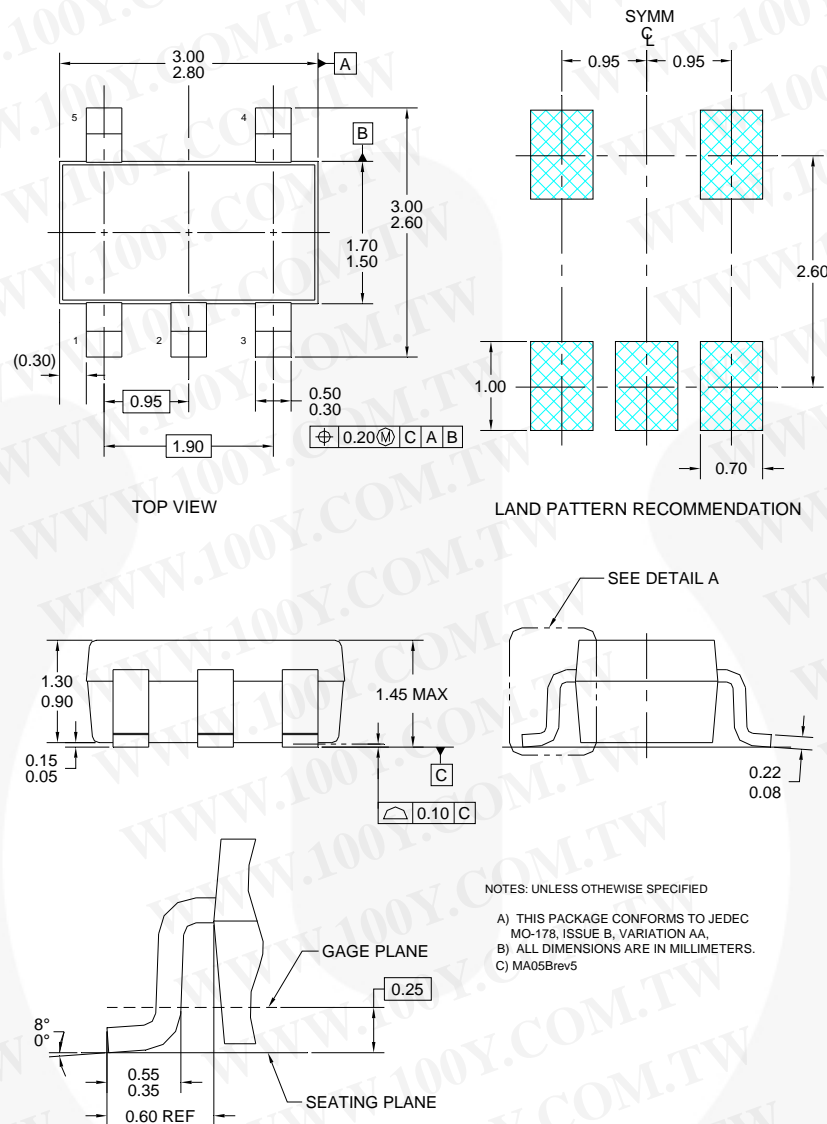
**Note:**

3. Input=AC Waveform; t<sub>r</sub>=t<sub>f</sub>=1.8ns; PRR=10MHz; Duty Cycle=50%.

Figure 6. I<sub>CCD</sub> Test Circuit

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## Physical Dimensions



**Figure 7. 5-Lead SOT23, JEDEC MO-178 1.6mm**

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.

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### Tape and Reel Specification

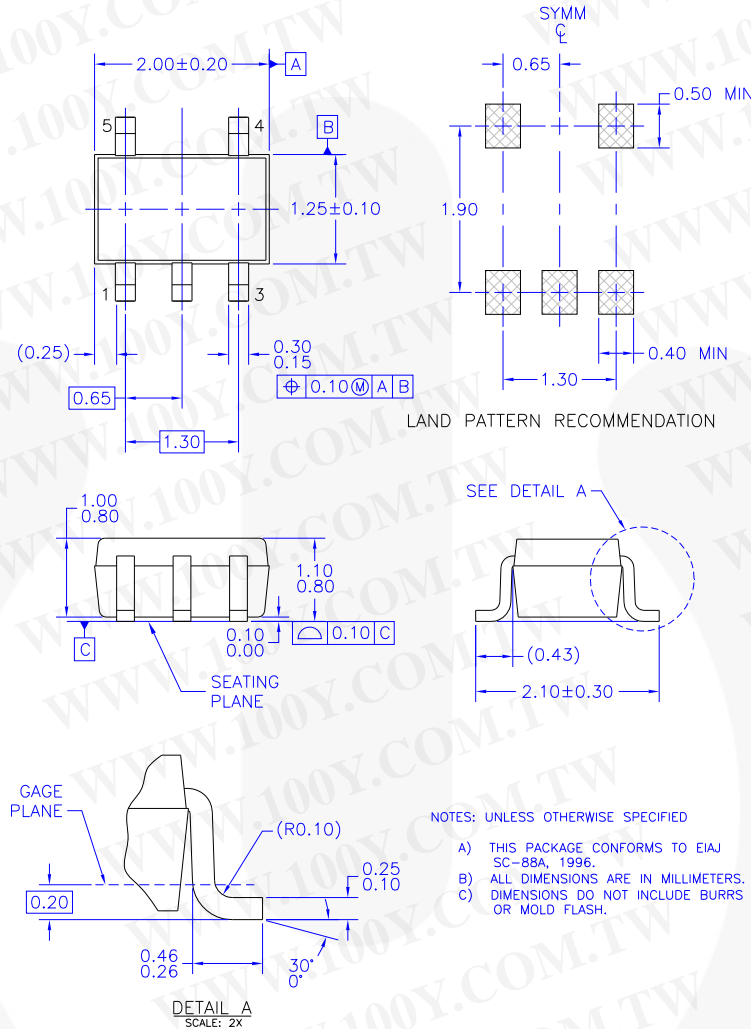
Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:  
[http://www.fairchildsemi.com/packaging/SOT23-5L\\_tr.pdf](http://www.fairchildsemi.com/packaging/SOT23-5L_tr.pdf).

Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
M5X	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

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**Physical Dimensions**



MAA05AREV5

**Figure 8. 5-Lead, SC70, EIAJ SC-88a, 1.25mm Wide**

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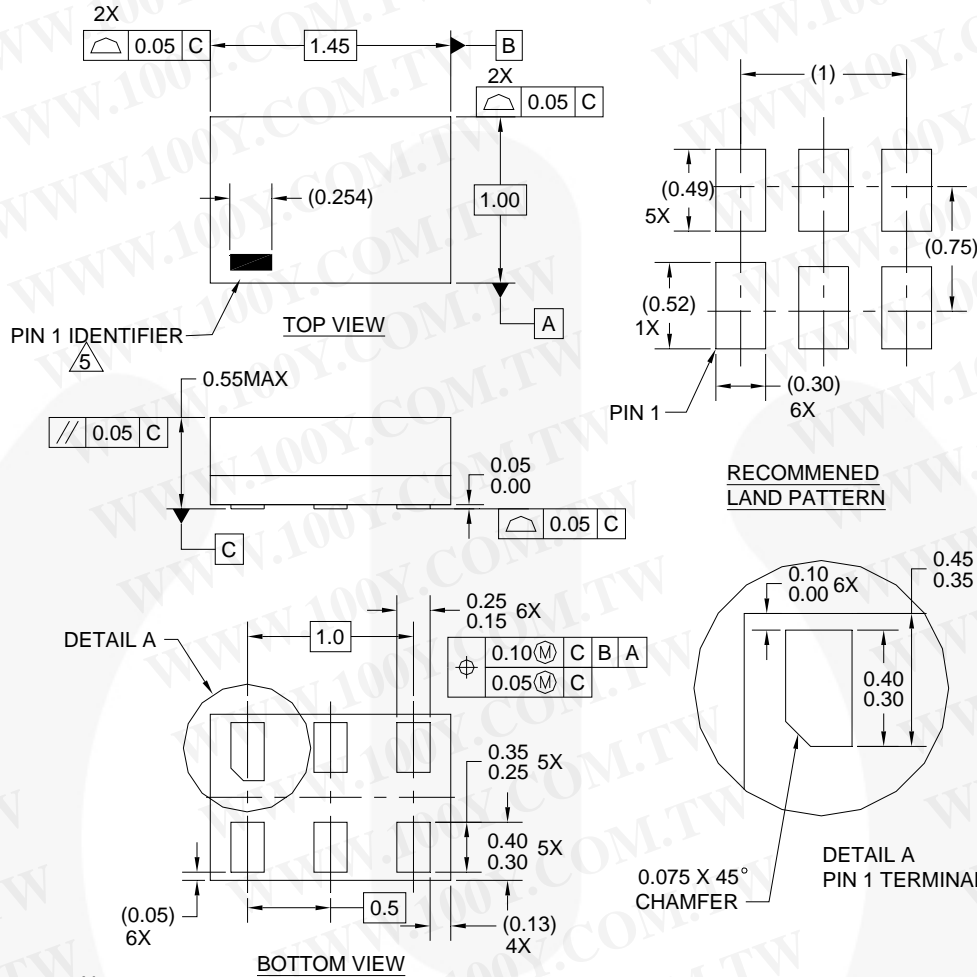
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**Tape and Reel Specification**

Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications:  
[http://www.fairchildsemi.com/products/analog/pdf/sc70-5\\_tr.pdf](http://www.fairchildsemi.com/products/analog/pdf/sc70-5_tr.pdf).

Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
P5X	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

### Physical Dimensions



**Notes:**

1. CONFORMS TO JEDEC STANDARD M0-252 VARIATION UAAD
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-1994
4. FILENAME AND REVISION: MAC06AREV4
5. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY OTHER LINE IN THE MARK CODE LAYOUT.

**Figure 9. 6-Lead, MicroPak™, 1.0mm Wide**

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### Tape and Reel Specification

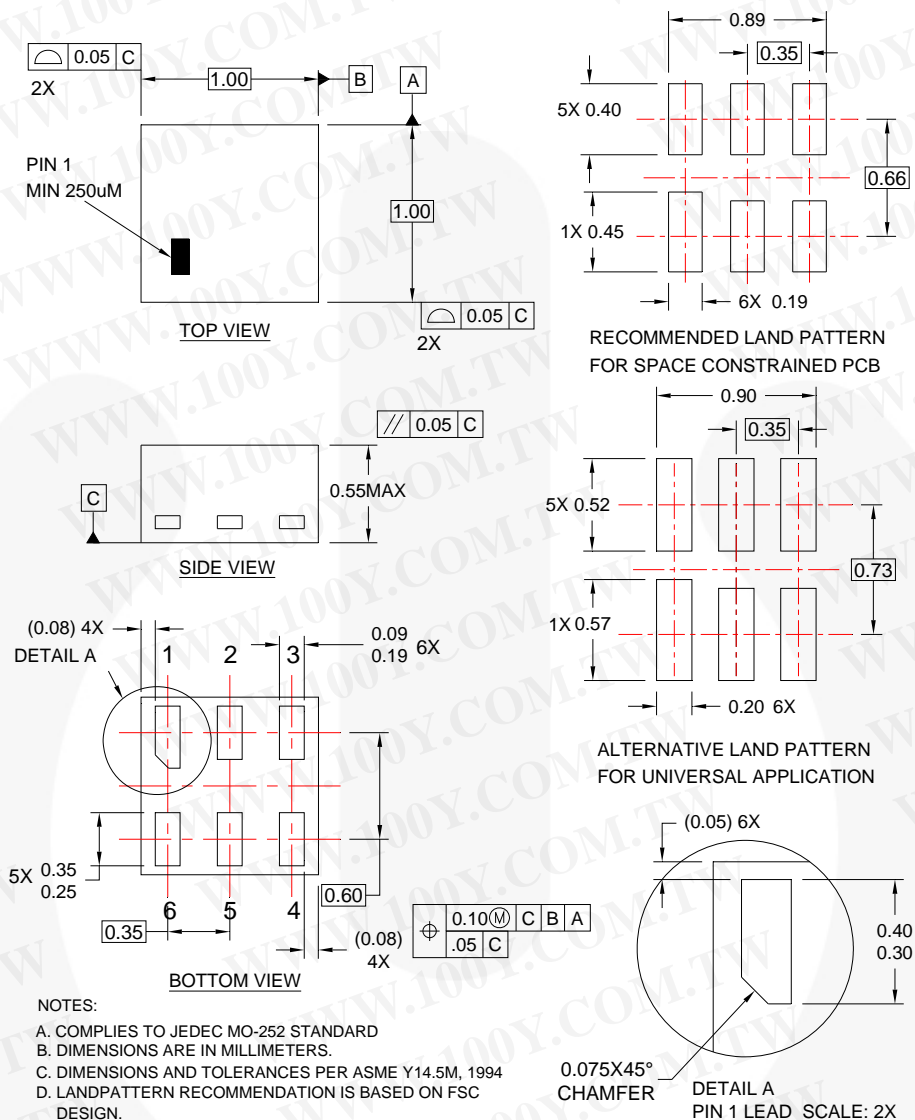
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[http://www.fairchildsemi.com/products/logic/pdf/micropak\\_tr.pdf](http://www.fairchildsemi.com/products/logic/pdf/micropak_tr.pdf).

Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
L6X	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed

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### Physical Dimensions



- NOTES:
- A. COMPLIES TO JEDEC MO-252 STANDARD
  - B. DIMENSIONS ARE IN MILLIMETERS.
  - C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994
  - D. LANDPATTERN RECOMMENDATION IS BASED ON FSC DESIGN.
  - E. DRAWING FILENAME AND REVISION: MGF06AREV3

**Figure 10. 6-Lead, MicroPak2™, 1x1mm Body, .35mm Pitch**

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[http://www.fairchildsemi.com/packaging/MicroPAK2\\_6L\\_tr.pdf](http://www.fairchildsemi.com/packaging/MicroPAK2_6L_tr.pdf).






Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status
FHX	Leader (Start End)	125 (Typical)	Empty	Sealed
	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed



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| CorePLUS™   | Green FPST™ e-Series™  | QFET™   | TinyBuck™   |
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| CTL™  | IntelliMAX™            | RapidConfigure™   | TINYOPTO™   |
| Current Transfer Logic™   | ISOPLANAR™             |  | TinyPower™  |
| DEUXPEED®   | MegaBuck™              | Saving our world, 1mW/WkWh at a time™   | TinyPWM™  |
| Dual Cool™  | MICROCOUPLER™          | SignalWise™   | TinyWire™   |
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| EfficientMax™   | MicroPak™              | SMART START™  | TRUECURRENT®*   |
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| Fairchild Semiconductor®  | Motion-SPM™            | SuperSOT™-3   | Ultra FRFET™  |
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| FAST®   | OPTOLOGIC®             | SupreMOS®   | VisualMax™  |
| FastvCore™  | OPTOPLANAR®            | SyncFET™  | XST™  |
| FETBench™   |                        | Sync-Lock™  |   |
| FlashWriter®*   |                        |  |   |
| FPST™   | PDP SPM™               |   |   |

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Advance Information	Formative / In Design	Datasheet contains the design specifications for product development. Specifications may change in any manner without notice.
Preliminary	First Production	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	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	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.

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