



Is Now Part of



ON Semiconductor®

To learn more about ON Semiconductor, please visit our website at
www.onsemi.com

Please note: As part of the Fairchild Semiconductor integration, some of the Fairchild orderable part numbers will need to change in order to meet ON Semiconductor's system requirements. Since the ON Semiconductor product management systems do not have the ability to manage part nomenclature that utilizes an underscore (_), the underscore (_) in the Fairchild part numbers will be changed to a dash (-). This document may contain device numbers with an underscore (_). Please check the ON Semiconductor website to verify the updated device numbers. The most current and up-to-date ordering information can be found at www.onsemi.com. Please email any questions regarding the system integration to Fairchild_questions@onsemi.com.

ON Semiconductor and the ON Semiconductor logo are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

FMS6410B

Dual-Channel Video Drivers with Integrated Filters and Composite Video Summer

Features

- 7.1MHz fifth-order Y,C filters with composite summer
- 50dB stopband attenuation at 27MHz on Y, C, and CV outputs
- Better than 0.1dB flatness to 4.5MHz on Y, C, and CV outputs
- No external frequency selection components or clocks
- < 5ns group delay on Y, C, and CV outputs
- AC-coupled inputs
- AC- or DC-coupled outputs
- Capable of PAL frequency selection components or clocks
- 0.3% differential gain with 0.2° differential phase on Y, C, and CV channels
- Integrated DC restore circuitry with low tilt
- Lead-free SOIC-8 package

Applications

- Cable and satellite set-top boxes
- DVD players
- Personal Video Recorders (PVR)
- Video On Demand (VOD)

Description

The FMS6410B is a dual Y/C fifth-order Butterworth low-pass video filter optimized for minimum overshoot and flat group delay. The device also contains a summing circuit to generate filtered composite video. In a typical application, the Y and C input signals from DACs are AC coupled into the filters. Both channels have DC restore circuitry to clamp the DC input levels during video sync. The Y and C channels use separate feedback clamps. The clamp pulse is derived from the Y channel.

All outputs are capable of driving $2V_{pp}$, AC or DC coupled, into either a single or dual video load. A single video load consists of a series 75Ω impedance matching resistor connected to a terminated 75Ω line. This presents a total of 150Ω of loading to the part. A dual load is two of these in parallel, which presents a total of 75Ω to the part. The gain of the Y, C, and CV signals is 6dB with $1V_{pp}$ input levels. All video channels are clamped during sync to establish the appropriate output voltage reference levels.

Block Diagrams

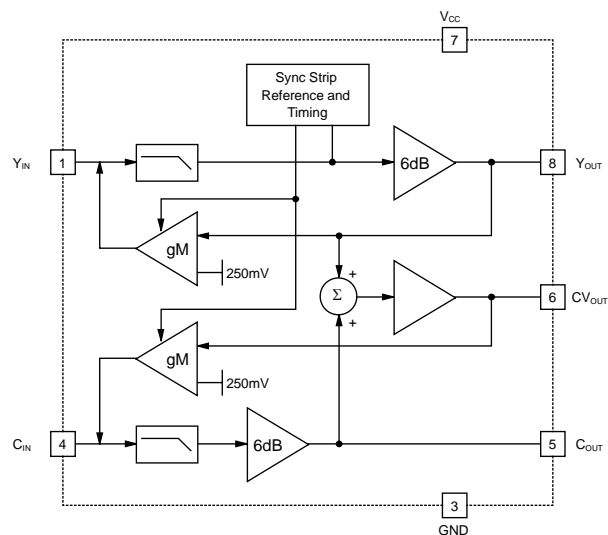


Figure 1. Block Diagram

Ordering Information

Part Number	Package	Operating Temperature Range	Pb-Free	Container	Pack Qty.
FMS6410BCS	SOIC-8	0°C to 70°C	Yes	Rail	95
FMS6410BCSX	SOIC-8	0°C to 70°C	Yes	Reel	2500

Pin Configuration

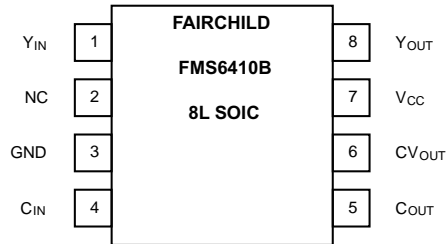


Figure 2. Pin Configuration

Pin Assignments

Pin#	Pin	Type	Description
1	Y _{IN}	Input	Luminance (luma) input: This pin is typically connected to the luma or composite video output pin from the external video encoder.
2	NC		No connect.
3	GND	Input	Must be tied to ground.
4	C _{IN}	Input	Chrominance (chroma) Input: This pin is typically connected to the chroma output pin from the external video encoder.
5	C _{OUT}	Output	Filtered chrominance video output from the C _{IN} channel.
6	CV _{OUT}	Output	Composite video output: This pin is the sum of Y _{OUT} and C _{OUT} .
7	V _{CC}	Input	+5V supply.
8	Y _{OUT}	Output	Filtered luminance output from the Y _{IN} channel.

Typical Application Diagram

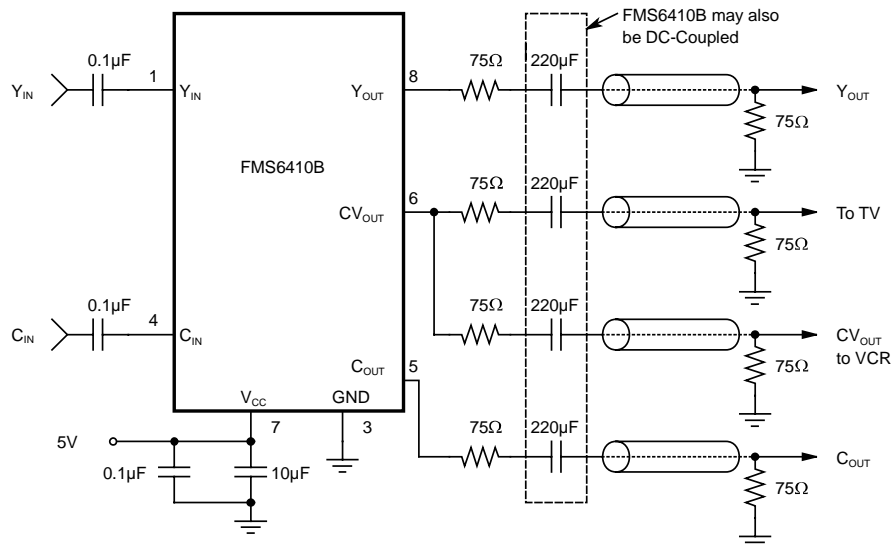


Figure 3. AC- or DC-Coupled Application Diagram

Absolute Maximum Ratings

The "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The "Recommended Operating Conditions" table defines the conditions for actual device operation.

Parameter	Min.	Max.	Unit
DC Supply Voltage	-0.3	6.0	V
Analog and Digital I/O	-0.3	$V_{CC} + 0.3$	V
Output Current Any One Channel, Do Not Exceed		40	mA

Reliability Information

Symbol	Parameter	Min.	Typ.	Max.	Unit
T_J	Junction Temperature			150	°C
T_{STG}	Storage Temperature Range	-65		150	°C
T_L	Lead Temperature (Soldering, 10s)			300	°C
Θ_{JA}	Thermal Resistance, JEDEC Standard Multi-Layer Test Boards, Still Air		115		°C/W

Recommended Operating Conditions

Symbol	Parameter	Min.	Typ.	Max.	Unit
T_A	Operating Temperature Range	0		70	°C
V_{CC}	Supply Voltage Range	4.75	5.00	5.25	V

DC Electrical Characteristics

$T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$, $V_{IN} = 1V_{pp}$; all inputs are AC coupled with $0.1\mu\text{F}$; all outputs are AC coupled with $220\mu\text{F}$ into 150Ω loads; referenced to 400kHz ; unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{CC}	Supply Current ⁽¹⁾	No Load		50	60	mA
V_{IN}	Input Voltage Maximum			1.4		V_{pp}
PSRR	Power Supply Rejection Ratio	All Channels, DC		60		dB

Notes:

- 100% tested at 25°C .

AC Electrical Characteristics

$T_A = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$, $V_{IN} = 1V_{pp}$; all inputs are AC coupled with $0.1\mu\text{F}$; all outputs are AC coupled with $220\mu\text{F}$ into 150Ω loads; referenced to 400kHz ; unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
AV	Channel Gain ⁽¹⁾	All Channels	5.75	6.00	6.25	dB
C_{sync}	C_{OUT} Output Level (during sync) ⁽¹⁾	Sync Present on Y_{IN} (after 6dB gain)		1.0	1.3	V
Y_{sync}	Y_{OUT} Output Level (during sync) ⁽¹⁾	Sync Present on Y_{IN} (after 6dB gain)		0.35	0.50	V
CV_{sync}	CV_{OUT} Output Level (during sync) ⁽¹⁾	Sync Present on Y_{IN} (after 6dB gain)		0.35	0.50	V
t_{CLAMP}	Clamp Response Time	Y Channel, Settled to within 10mV		10		ms
f_{FLAT}	Gain Flatness to 4.5MHz	All Channels		0		dB
f_C	-3dB Bandwidth ⁽¹⁾	All Channels	6.7	7.1		MHz
f_{SB}	Stopband Attenuation ⁽¹⁾	All Channels at 27MHz	42	50		dB
dG	Differential Gain	All Channels		0.3		%
dP	Differential Phase	All Channels		0.2		deg
THD	Output Distortion	$V_{OUT} = 1.4V_{pp}$, 3.58MHz		0.3		%
X_{TALK}	Crosstalk	at 3.58MHz		-50		dB
SNR	Signal-to-Noise Ratio	All Channels, NTC-7 weighting, 4.2MHz LP, 100kHz HP		82		dB
t_{pd}	Propagation Delay	All Channels		115		ns
GD	Group Delay Deviation	All Channels at 3.58MHz		4		ns
t_{SKEW}	Skew Between Y_{OUT} and C_{OUT}	at 1MHz		0		ns
t_{CLGCV}	Chroma-Luma Gain CV_{OUT} ⁽¹⁾	$f = 3.58\text{MHz}$ (Ref. to Y_{IN} at 400kHz)	96	100	104	%
t_{CLDCV}	Chroma-Luma Delay CV_{OUT}	$f = 3.58\text{MHz}$ (Ref. to Y_{IN} at 400kHz)		4		ns

Notes:

- 100% tested at 25°C .

Applications Information

Functional Description

This product is a two-channel, monolithic, continuous-time, video filter designed for reconstructing the luminance and chrominance signals from an S-Video D/A source. Composite video output is generated by summing the Y and C outputs. The chip is designed to have AC-coupled inputs and work with either AC- or DC-coupled outputs.

The reconstruction filters provide a fifth-order Butterworth response with group delay equalization. This provides a maximally flat response in terms of delay and amplitude. Each of the three outputs is capable of driving $2V_{pp}$ into a 75Ω load.

All channels are clamped during the sync interval to set the appropriate minimum output DC level. With this operation, the effective input time constant is greatly reduced, which allows use of small, low-cost coupling capacitors. The net effect is that the input settles to 10mV in 10ms for any DC shifts present in the input video signal.

In most applications, the input coupling capacitors are $0.1\mu\text{F}$. The Y and C inputs typically sink $1\mu\text{A}$ of current during active video, which normally tilts a horizontal line by 2mV at the Y output. During sync, the clamp restores this leakage current by sourcing an average of $20\mu\text{A}$ over the clamp interval. Any change in the coupling capacitor values affect the amount of tilt per line. Any reduction in tilt comes with an increase in settling time.

Luminance (Y) I/O

The typical luma input is driven by either a low-impedance source of $1V_{pp}$ or the output of a 75Ω terminated line driven by the output of a current DAC. In either case, the input must be capacitively coupled to allow the sync-detect and DC-restore circuitry to operate properly.

All outputs are capable of driving $2V_{pp}$, AC or DC coupled, into either a single or dual video load. A single video load consists of a series 75Ω impedance matching resistor connected to a terminated 75Ω line, presenting a total of 150Ω of loading to the part. A dual load is two of these in parallel, which presents a total of 75Ω to the part. The gain of the Y, C, and CV signals is 6dB with $1V_{pp}$ input levels.

Chrominance (C) I/O

The chrominance input can be driven in the same manner as the luminance input, but is typically only a $0.7V_{pp}$ signal.

Since the chrominance signal doesn't contain any DC content, the output signal can be AC coupled using a capacitor as small as $0.1\mu\text{F}$ if DC coupling is not desired.

Composite Video (CV) Output

The composite video output driver is same as the other outputs.

Layout Considerations

General layout and supply bypassing play major roles in high-frequency performance and thermal characteristics. Fairchild offers a demonstration board, FMS6410BDEMO, to guide layout and aid device testing and characterization. The FMS6410BDEMO is a four-layer board with a full power and ground plane. For optimum results, follow the steps below as a basis for high-frequency layout:

- Include $10\mu\text{F}$ and $0.1\mu\text{F}$ ceramic bypass capacitors.
- Place the $10\mu\text{F}$ capacitor within 0.75 inches of the power pin.
- Place the $0.1\mu\text{F}$ capacitor within 0.1 inches of the power pin.
- If using DC-coupled outputs, use a large ground plane to help dissipate heat.
- Minimize all trace lengths to reduce series inductances.

Output Interface

To obtain the highest quality output signal, place the series termination resistor as close to the device output pin as possible. This greatly reduces the parasitic capacitance and inductance effect on the output of the driver. Place the series termination resistor less than 0.1 inches from the device pin, as shown in Figure 4.



Figure 4. 75Ω Series Resistor 0.1 Inches from Pin

Figure 5 is the schematic representation of a video filter/driver used in a system as the output driver to a media device. In this case, the composite video signal is terminated by the media device and the S-video output terminations are open. It is very critical to have the series termination resistors close to the output pins of the device to minimize the effects of parasitic capacitance on the filter output driver which may show up as noise on the CV output.

Applications Information (Continued)

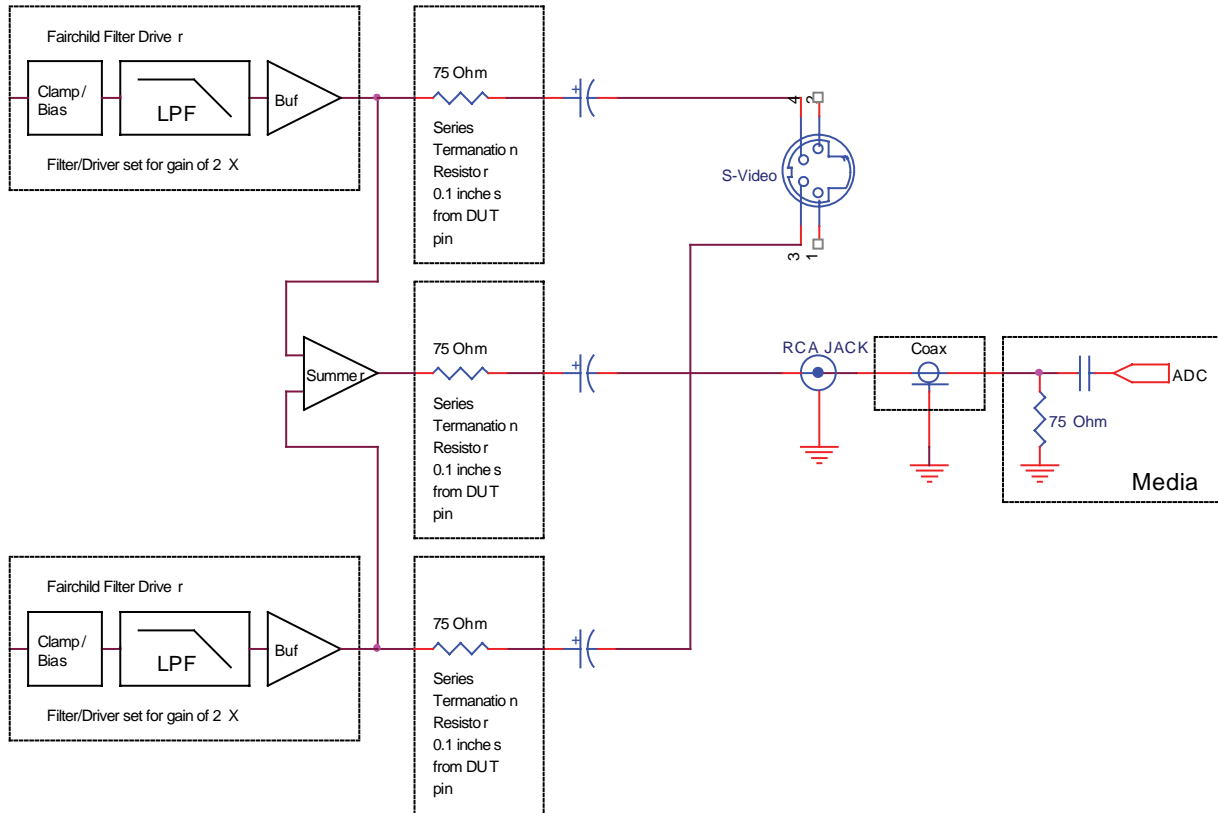


Figure 5. Schematic Representation of a Video Filter / Driver

Physical Dimensions

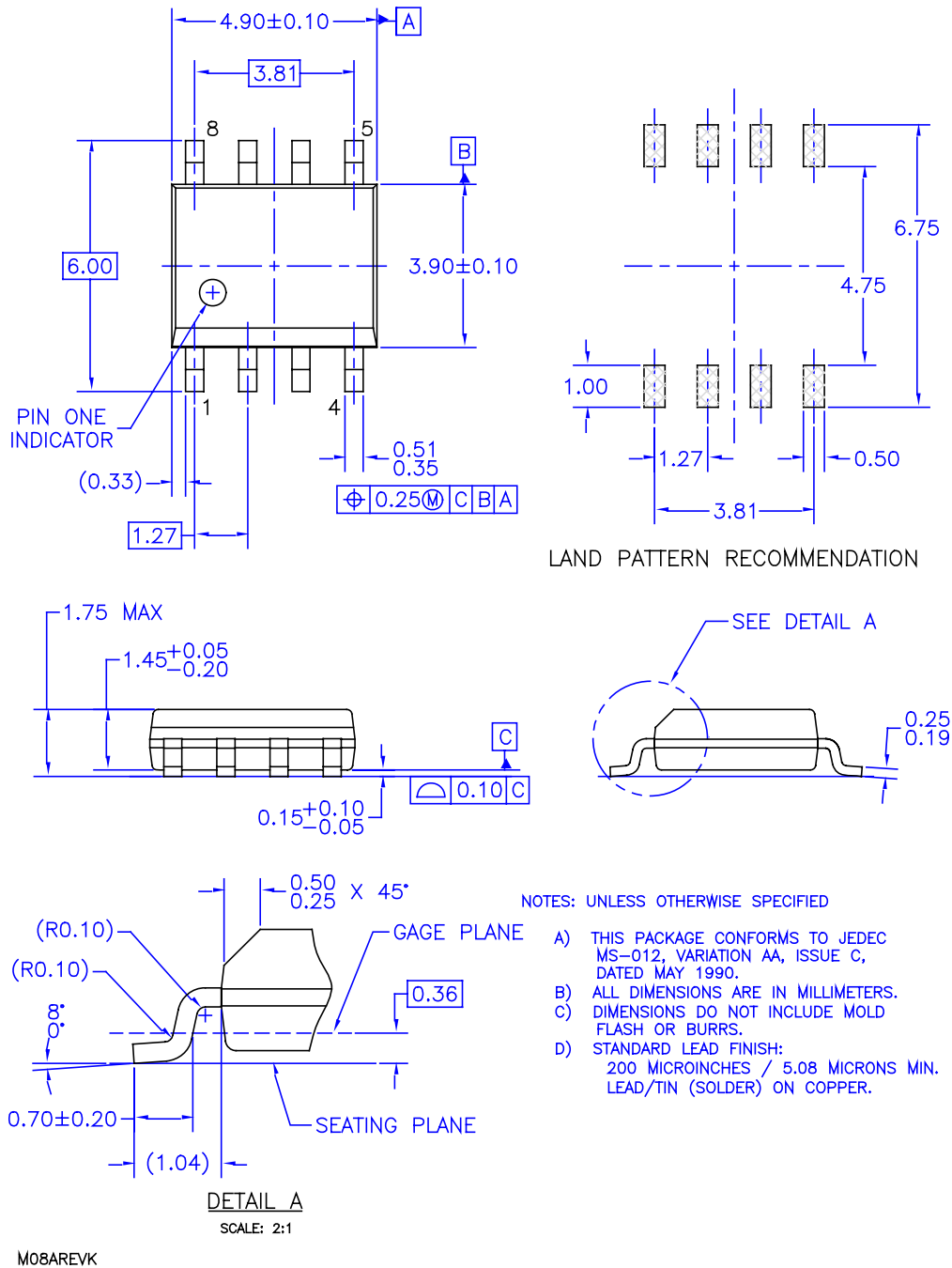


Figure 6. 8-Lead Small Outline Integrated Circuit (SOIC) Package

TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

ACE ^x ™	FACT Quiet Series™	OCX™	SILENT SWITCHER®	UniFET™
ActiveArray™	GlobalOptoisolator™	OCXPro™	SMART START™	UltraFET®
Bottomless™	GTO™	OPTOLOGIC®	SPM™	VCX™
Build it Now™	HiSeC™	OPTOPLANAR™	Stealth™	Wire™
CoolFET™	I ² C™	PACMAN™	SuperFET™	
CROSSVOLT™	i-Lo™	POP™	SuperSOT™_3	
DOME™	ImpliedDisconnect™	Power247™	SuperSOT™_6	
EcoSPARK™	IntelliMAX™	PowerEdge™	SuperSOT™_8	
E ² C MOS™	ISOPLANAR™	PowerSaver™	SyncFET™	
EnSigna™	LittleFET™	PowerTrench®	TCM™	
FACT™	MICROCOUPLER™	QFET®	TinyBoost™	
FAST®	MicroFET™	QS™	TinyBuck™	
FAST _r ™	MicroPak™	QT Optoelectronics™	TinyPWM™	
FPS™	MICROWIRE™	Quiet Series™	TinyPower™	
FRFET™	MSX™	RapidConfigure™	TinyLogic®	
	MSXPro™	RapidConnect™	TINYOPTO™	
Across the board. Around the world.™		μSerDes™	TruTranslation™	
The Power Franchise®		ScalarPump™	UHC™	
Programmable Active Droop™				

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:

- 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, or (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 significant injury to the user.
- A critical component is 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, and 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 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. I20

ON Semiconductor and  are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of ON Semiconductor's product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. Buyer is responsible for its products and applications using ON Semiconductor products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by ON Semiconductor. "Typical" parameters which may be provided in ON Semiconductor data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. ON Semiconductor does not convey any license under its patent rights nor the rights of others. ON Semiconductor products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use ON Semiconductor products for any such unintended or unauthorized application, Buyer shall indemnify and hold ON Semiconductor and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that ON Semiconductor was negligent regarding the design or manufacture of the part. ON Semiconductor is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
19521 E. 32nd Pkwy, Aurora, Colorado 80011 USA
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

N. American Technical Support: 800-282-9855 Toll Free
USA/Canada
Europe, Middle East and Africa Technical Support:
Phone: 421 33 790 2910
Japan Customer Focus Center
Phone: 81-3-5817-1050

ON Semiconductor Website: www.onsemi.com
Order Literature: <http://www.onsemi.com/orderlit>
For additional information, please contact your local
Sales Representative