

KA7500C

SMPS Controller

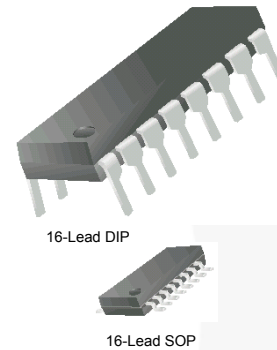
Features

- Internal Regulator Provides a Stable 5V Reference Supply Trimmed to ±1% Accuracy
- Uncommitted Output TR for 200mA Sink or Source Current
- Output Control for Push-Pull or Single-Ended Operation
- Variable Duty Cycle by Dead-Time Control (Pin 4) Complete PWM Control Circuit
- On-Chip Oscillator with Master or Slave Operation
- Internal Circuit Prohibits Double Pulse at Either Output

Description

The KA7500C is used for the control circuit of the pulse-width modulation switching regulator. The KA7500C consists of 5V reference voltage circuit, two error amplifiers, flip flop, an output control circuit, a PWM comparator, a dead-time comparator, and an oscillator.

This device can be operated in the switching frequency of 1kHz to 300kHz. The precision of voltage reference (V_{REF}) is improved up to ±1% with trimming. This provides a better output voltage regulation. The operating temperature range is -25°C ~ +85°C.



Ordering Information

Part Number	Operating Temperature Range	Eco Status	Package	Packing Method
KA7500C	-25 to +85°C	RoHS	16-Lead Dual Inline Package (DIP)	Tube
KA7500CD			16-Lead Small Outline Package (SOP)	Tube
KA7500CDTF				Tape and Reel

For Fairchild's definition of Eco Status, please visit: http://www.fairchildsemi.com/company/green/rohs_green.html.

Block Diagram

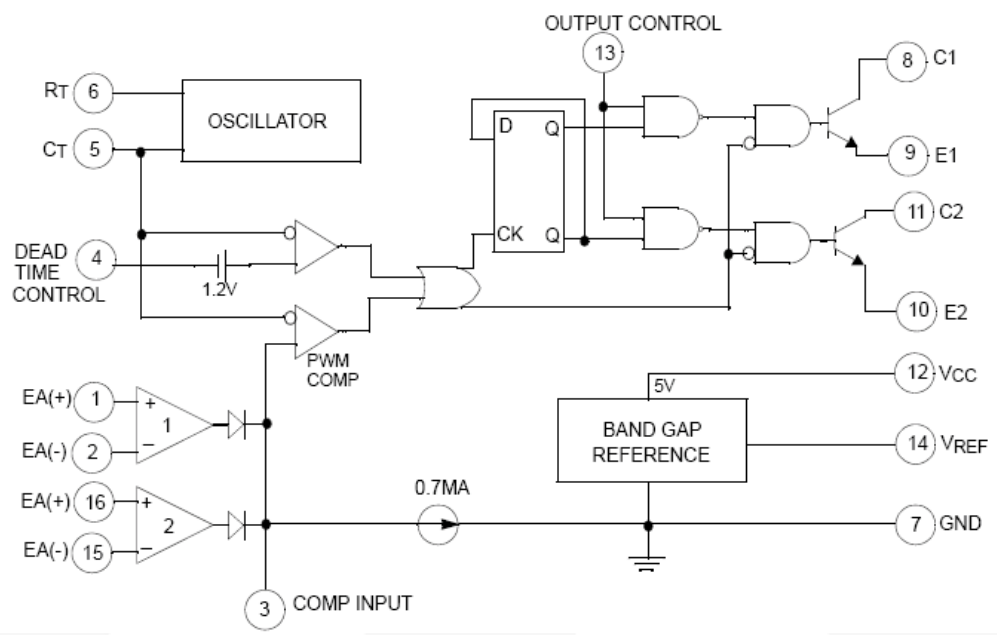


Figure 1. Block Diagram

Typical Application

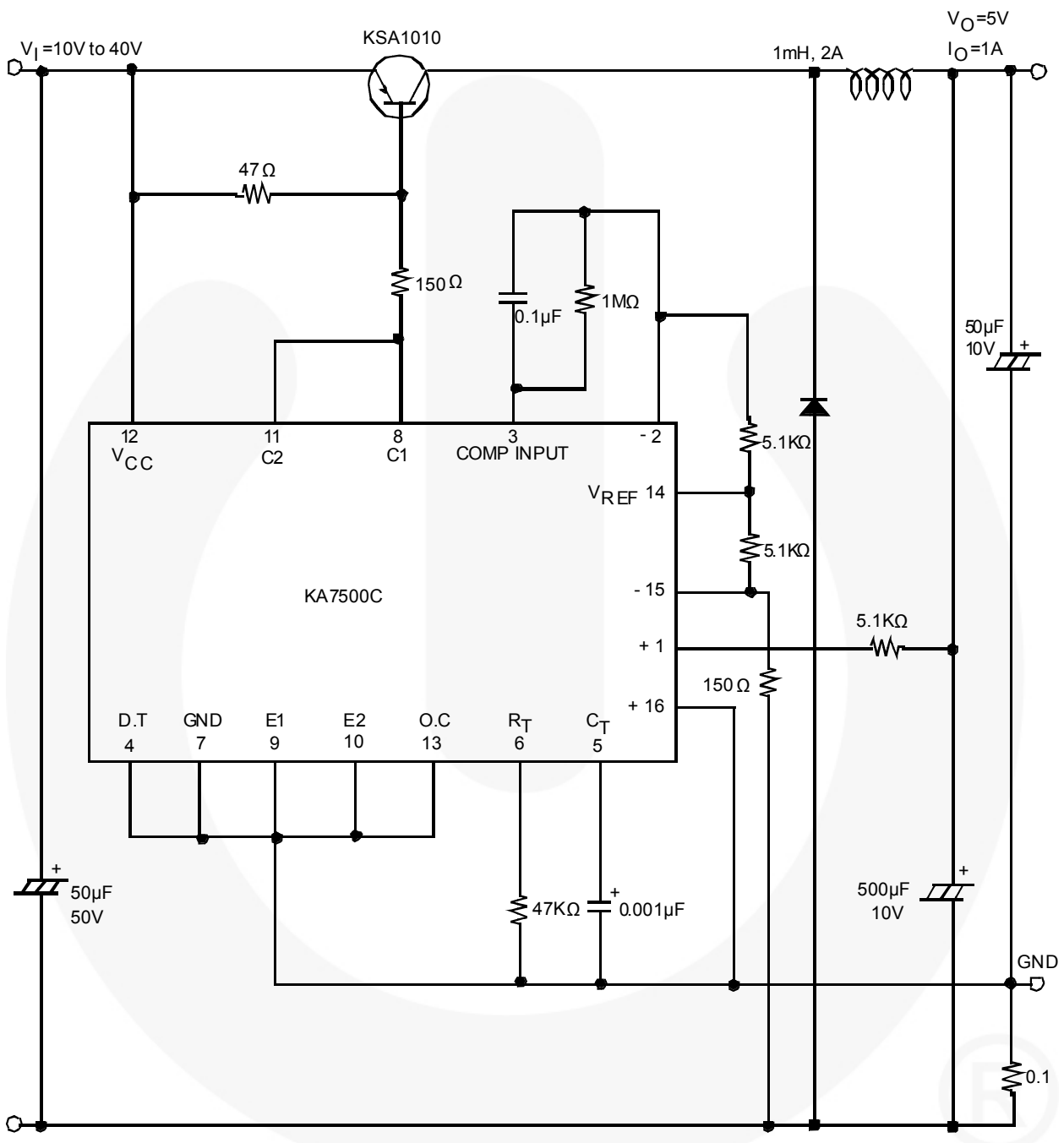


Figure 2. Pulse-Width Modulated Step-Down Converter

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		42	V
V_C	Collector Supply Voltage		42	V
I_O	Output Current		250	mA
V_{IN}	Amplifier Input Voltage		$V_{CC} + 0.3$	V
P_D	Power Dissipation	KA7500C	1	W
		KA7500CD	0.9	
T_{OPR}	Operation Temperature Range	-25	+85	°C
T_{STG}	Storage Temperature Rang	-65	+150	°C
T_J	Junction Temperature		+125	°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	Min.	Typ.	Max.	Unit
V_{CC}	Power Supply Voltage	7	15	40	V
V_{C1}, V_{C2}	Collector Supply Voltage		30	40	V
I_{C1}, I_{C2}	Collector Output Current (Each Transition)			200	mA
V_{IN}	Amplifier Input Voltage	0.3		$V_{CC} - 2.0$	V
I_{FB}	Current Into Feedback Terminal			0.3	mA
I_{REF}	Reference Output Terminal			10	mA
R_T	Timing Resistor	1.8	30.0	500.0	K Ω
C_T	Timing Capacitor	0.0047	0.0010	10.0000	μ A
f_{OSC}	Oscillator Frequency	1	40	200	kHz
V_{IN_PWM}	PWM Input Voltage (Pins 3, 4, and 13)	0.3		5.3	V

Electrical Characteristics

$V_{CC} = 20V$, $f = 10kHz$, $T_A = -25^{\circ}C$ to $+85^{\circ}C$, unless otherwise specified.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
Reference Section						
V_{REF}	Reference Output Voltage	$I_{REF}=1mA$, $T_A=25^{\circ}C^{(1)}$	4.95	5.00	5.05	V
		$I_{REF}=1mA$	4.90	5.00	5.10	
R_{LINE}	Line Regulation	$V_{CC}=7V$ to $40V$		2	25	mV
R_{LOAD}	Load Regulation	$I_{REF}=1mA$ to $10mA$		1	15	mV
I_{SC}	Short-Circuit Output Current	$V_{REF}=0V$	10	35	50	mA
Oscillation Frequency						
f_{OSC}	Oscillation Frequency	$C_T=0.001\mu F$, $R_T=30K\Omega$		40.0		kHz
		$C_T=0.01\mu F$, $R_T=12K\Omega$, $T_A=25^{\circ}C$	9.2	10.0	10.8	
		$C_T=0.01\mu F$, $R_T=12K\Omega$, $T_A=T_{LOW}$ to T_{HIGH}	9.0		12.0	
$\Delta f/\Delta t$	Frequency Change with Temperature	$C_T=0.01\mu F$, $R_T=12K\Omega$			2	%
Dead-Time Control Section						
I_{BIAS}	Input Bias Current	$V_{CC}=15V$, $0V \leq V_4 \leq 5.25V$		-2	-10	μA
$D_{(MAX)}$	Maximum Duty Cycle	$V_{CC}=15V$, $V_4=0V$, OC Pin= V_{REF}	45			%
V_{ITH}	Input Threshold Voltage	Zero Duty Cycle		3.0	3.3	V
		Maximum Duty Cycle	0			
Error Amplifier Section						
V_{IO}	Input Offset Voltage	$V_3=2.5V$		2	10	mV
I_{IO}	Input Offset Current	$V_3=2.5V$		25	250	mA
I_{BIAS}	Input Bias Current	$V_3=2.5V$		0.2	1.0	μA
V_{CIM}	Common Mode Input Voltage	$7V \leq V_{CC} \leq 40V$	-0.3		V_{CC}	V
G_{VO}	Open-Loop Voltage Gain	$0.5V \leq V_3 \leq 3.5V$	70	95		dB
B_W	Unit-Gain Bandwidth			650		kHz
PWM Comparator Section						
V_{ITH}	Input Threshold Voltage	Zero Duty Cycle		4.0	4.5	V
I_{SINK}	Input Sink Current	$V_3=0.7V$	-0.3	-0.7		mA
Output Section						
$V_{CE(SAT)}$	Output Saturation Voltage Common Emitter	$V_E=0V$, $I_C=200mA$		1.0	1.3	V
$V_{CC(SAT)}$	Emitter-Follower	$V_C=15V$, $I_E=-200mA$		1.5	2.5	
$I_{C(OFF)}$	Collector Off-State Current	$V_{CC}=40V$, $V_{CE}=40V$		2	100	μA
$I_{E(OFF)}$	Emitter Off-State Current	$V_{CC}=V_C=40V$, $V_E=40V$			-100	
Total Device						
I_{CC}	Supply Current	Pin6= V_{REF} , $V_{CC}=15V$		6	10	mA
Output Switching Characteristics						
t_R	Rise Time, Common Emitter, Common Collector			100	200	ns
t_F	Fall Time, Common Emitter, Common Collector			25	100	

Note:

- This is guaranteed where the marking code of the package surface is over 027.

Physical Dimensions

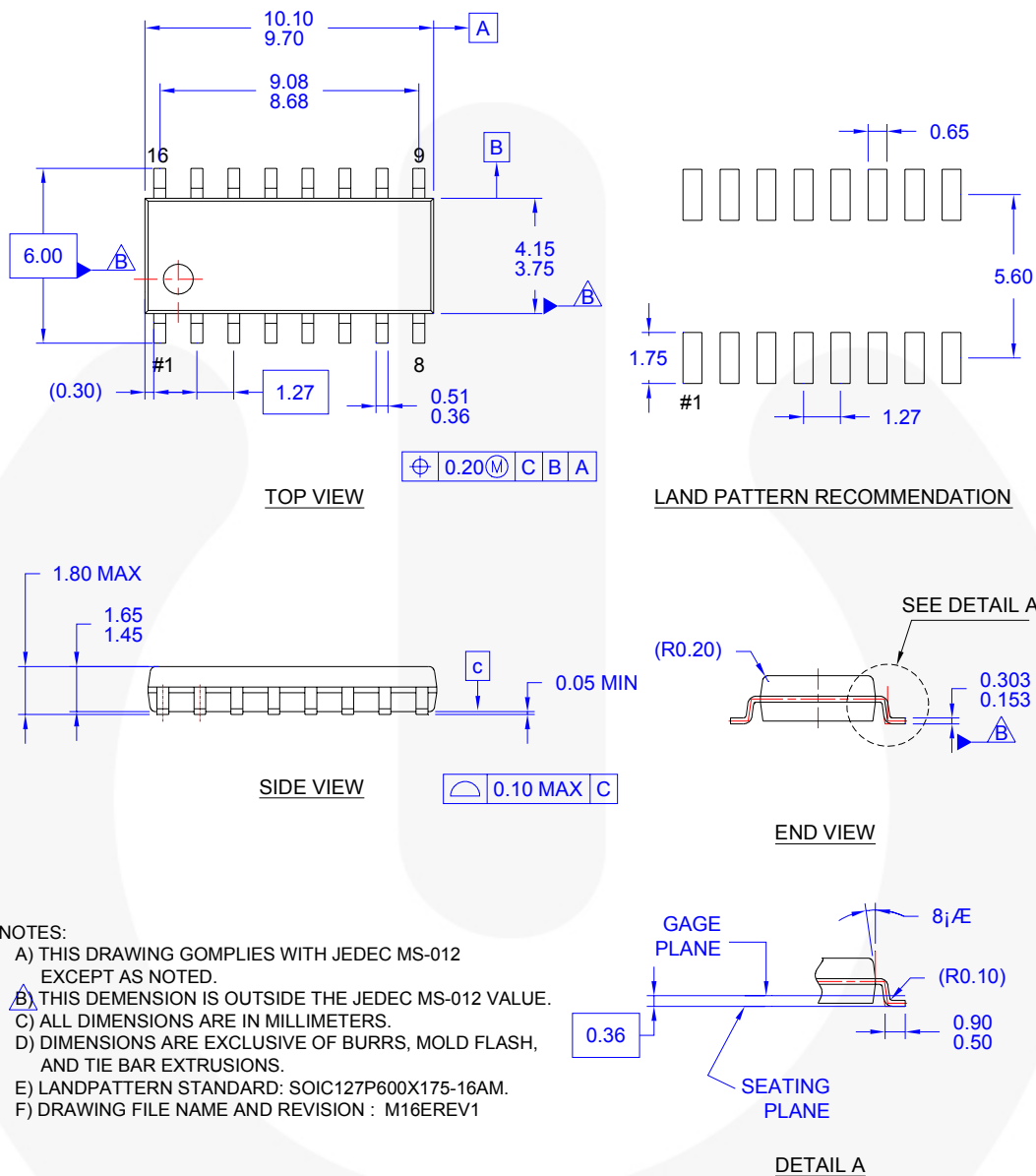
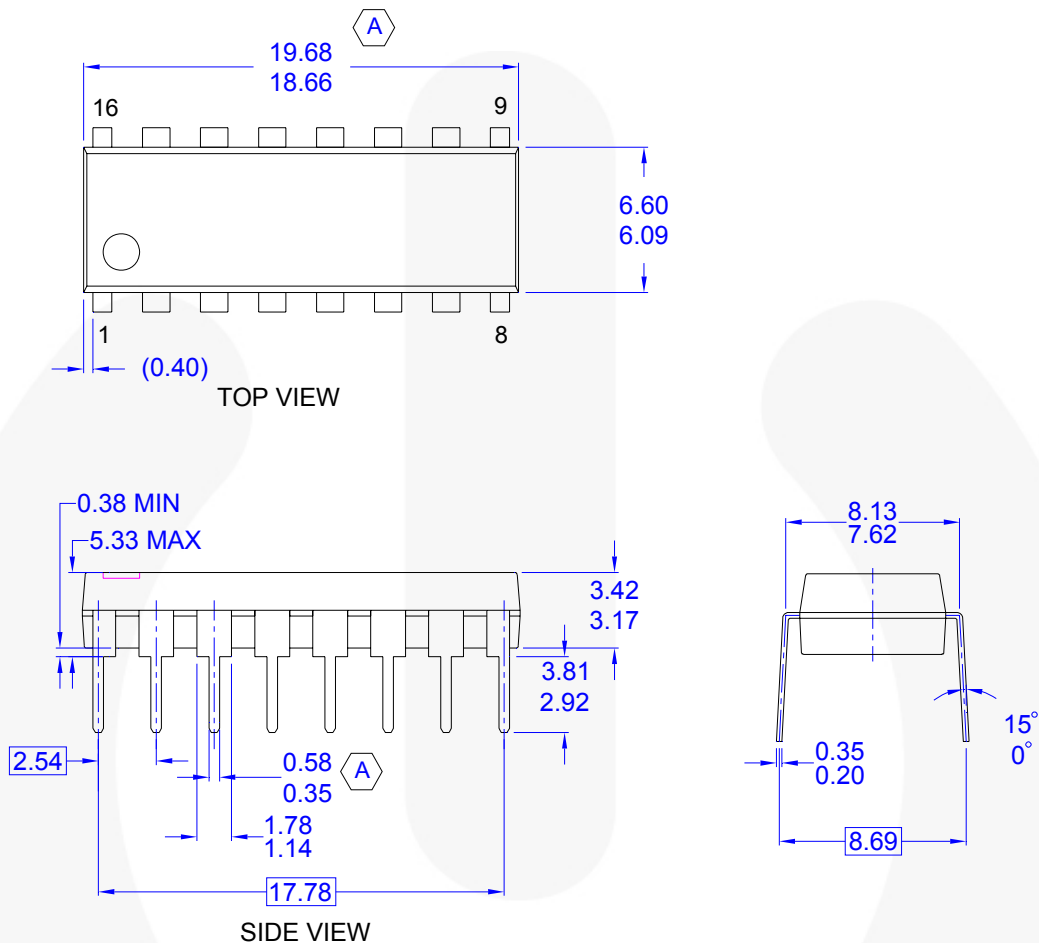


Figure 3. 16-Lead Small Outline Package (SOP)

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



NOTES: UNLESS OTHERWISE SPECIFIED

- A) THIS PACKAGE CONFORMS TO JEDEC MS-001 VARIATION BB
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR PROTRUSIONS
- D) CONFORMS TO ASME Y14.5M-1994
- E) DRAWING FILE NAME: N16EREV1

Figure 4. 16-Lead Dual Inline Package (DIP)







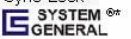
Package drawings are provided as a service to customers considering Fairchild components. Drawings may change in any manner without notice. Please note the revision and/or date on the drawing and contact a Fairchild Semiconductor representative to verify or obtain the most recent revision. Package specifications 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.

Auto-SPM™	F-PFST™	PowerTrench®	The Power Franchise®
Build it Now™	FRFET®	PowerXS™	
CorePLUS™	Global Power Resource™	Programmable Active Droop™	TinyBoost™
CorePOWER™	Green FPS™	QFET®	TinyBuck™
CROSSVOLT™	Green FPS™ e-Series™	QST™	TinyLogic®
CTL™	Gmax™	Quiet Series™	TINYOPTO™
Current Transfer Logic™	GTO™	RapidConfigure™	TinyPower™
EcoSPARK®	IntelliMAX™		TinyPWM™
EfficientMax™	ISOPLANAR™	Saving our world, 1mW/W/kW at a time™	TinyWire™
EZSWITCH™	MegaBuck™	SmartMax™	TriFault Detect™
	MICROCOUPLER™	SMART START™	TRUECURRENT™
	MicroFET™	SPM®	µSerDes™
Fairchild®	MicroPak™	STEALTH™	
Fairchild Semiconductor®	MillerDrive™	SuperFET™	UHC®
FACT Quiet Series™	MotionMax™	SuperSOT™-3	Ultra FRFET™
FACT®	Motion-SPM™	SuperSOT™-6	UniFET™
FAST®	OPTOLOGIC®	SuperSOT™-8	VCX™
FastvCore™	OPTOPLANAR®	SupreMOS™	VisualMax™
FETBench™		SyncFET™	XST™
FlashWriter®	PDP SPM™	Sync-Lock™	
FPS™	Power-SPM™		

* 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.

ANTI-COUNTERFEITING POLICY

Fairchild Semiconductor Corporation's Anti-Counterfeiting Policy. Fairchild's Anti-Counterfeiting Policy is also stated on our external website, www.fairchildsemi.com, under Sales Support.

Counterfeiting of semiconductor parts is a growing problem in the industry. All manufacturers of semiconductor products are experiencing counterfeiting of their parts. Customers who inadvertently purchase counterfeit parts experience many problems such as loss of brand reputation, substandard performance, failed applications, and increased cost of production and manufacturing delays. Fairchild is taking strong measures to protect ourselves and our customers from the proliferation of counterfeit parts. Fairchild strongly encourages customers to purchase Fairchild parts either directly from Fairchild or from Authorized Fairchild Distributors who are listed by country on our web page cited above. Products customers buy either from Fairchild directly or from Authorized Fairchild Distributors are genuine parts, have full traceability, meet Fairchild's quality standards for handling and storage and provide access to Fairchild's full range of up-to-date technical and product information. Fairchild and our Authorized Distributors will stand behind all warranties and will appropriately address any warranty issues that may arise. Fairchild will not provide any warranty coverage or other assistance for parts bought from Unauthorized Sources. Fairchild is committed to combat this global problem and encourage our customers to do their part in stopping this practice by buying direct or from authorized distributors.

PRODUCT STATUS DEFINITIONS

Definition of Terms

Datasheet Identification	Product Status	Definition
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.

Rev. 140