



## SG6521 — PC Power Supply Supervisors

### Features

- Two 12V Sense Input Pins: VS12 and VS12B
- Over-Voltage Protection (OVP) for 3.3V, 5V, and two 12V
- Over-Current Protection (OCP) for 3.3V, 5V, and two 12V
- Under-Voltage Protection (UVP) for 3.3V, 5V, and two 12V
- Open-Drain Output for PGO and FPO Pins
- 300ms Power-Good Delay
- 2.8ms PSON Control to FPO Turn-off Delay
- 48ms PSON Control Delay
- No Lock-up During the Fast AC Power On/Off
- Wide Supply Voltage Range: 4V to 15V
- Over-Temperature Protection (OTP)
- Additional Protection Input (Pext)

### Applications

- Switch-Mode Power Supplies with Active PFC
- Servo System Power Supplies
- PC-ATX Power Supplies


### Description

The SG6521 is designed to provide the supply voltage, current supervisor, remote on/off (PSON), power good (PGO) indicator, and fault protection (FPO) functions for switching power systems.

For supervisory functions, it provides the over-voltage protection (OVP) for 3.3V, 5V, and two 12V; over-current protection (OCP) for 3.3V, 5V, and two 12V; under-voltage protection (UVP) for 3.3V, 5V, and two 12V. When 3.3V, 5V, or 12V voltage decreases to 2.3V, 3.5V, and 9V, respectively, the under-voltage protection function is enabled. FPO is set HIGH to turn off the PWM controller IC. The voltage difference across external current shunt is used for OCP functions. An external resistor can be used to adjust protection threshold. An additional protection input pin provides the flexibility for designing protection circuits.

The power supply is turned on after a 48ms delay when PSON signal is set from HIGH to LOW. To turn off the power supply, the PSON signal is set from LOW to HIGH with a delay of 48ms. The PGI circuitry provides a power-down warning signal for PGO. When PGI input is lower than the internal 1.25V reference voltage, PGO signal is pulled LOW.

### Ordering Information

Part Number	Operating Temperature Range	 Eco Status	Package	Packing Method
SG6521DZ	-40°C to +85°C	RoHS	16-pin Dual In-Line Package (DIP)	Rail
SG6521SZ	-40°C to +85°C	RoHS	16-pin Small Outline Package (SOP)	Tape & Reel

 For Fairchild's definition of "green" Eco Status, please visit: [http://www.fairchildsemi.com/company/green/rohs\\_green.html](http://www.fairchildsemi.com/company/green/rohs_green.html).

Application Diagram

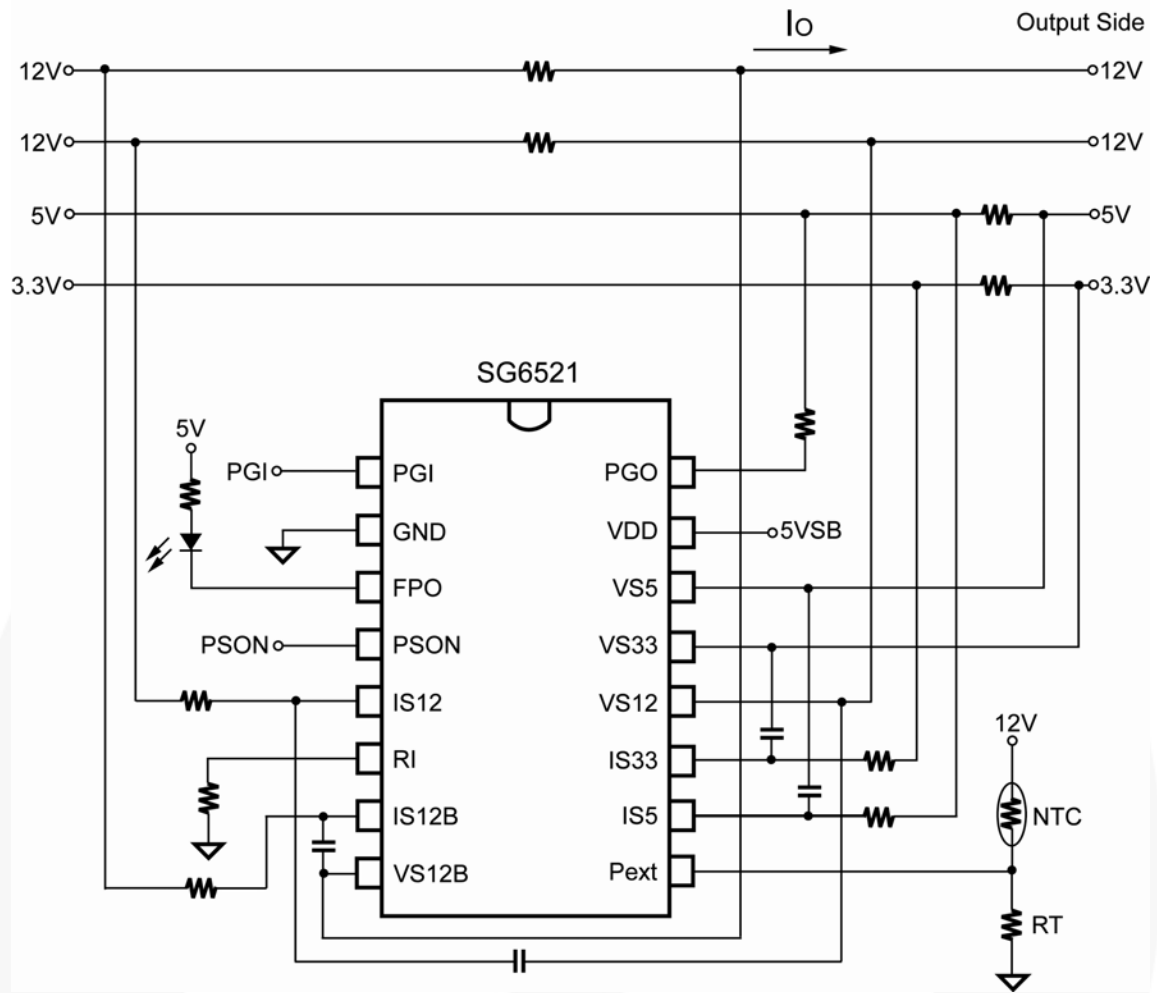


Figure 1. Typical Application

Block Diagram

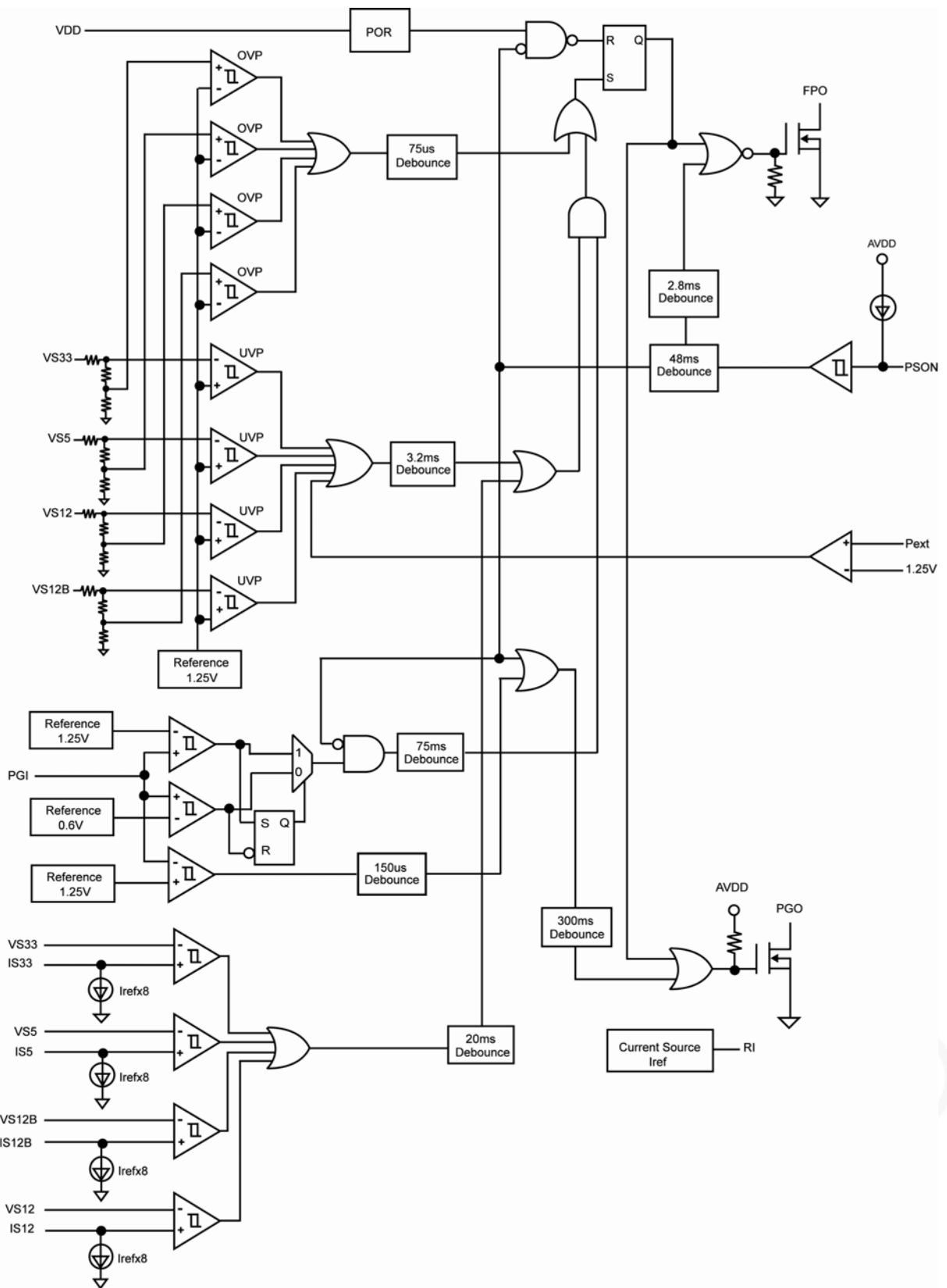


Figure 2. Function Block Diagram

## Pin Configuration

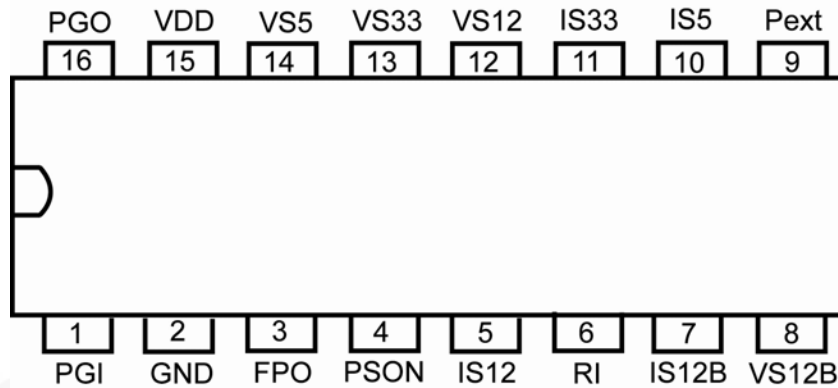


Figure 3. Pin Configuration(Top View)

## Pin Definitions

Pin #	Name	Description
1	PGI	<b>Power Good Input.</b> For ATX SMPS, it detects AC line voltage through the main transformer.
2	GND	<b>Ground.</b>
3	FPO	<b>Fault Protection Output.</b> Output signal to control the primary PWM IC through an opto-coupler. When FPO is low, the PWM IC is enabled.
4	PSON	<b>Remote On/Off Logic Input from CPU or Main Board.</b> The power supply is turned on/off after a 48ms delay.
5	IS12	<b>12V Over-Current Protection Sense Input.</b> For typical applications, this pin is connected to the positive end of a current shunt through one resistor. When the voltage on IS12 is higher than that of VS12 by 5mV, OCP is enabled.
6	RI	<b>Reference Setting.</b> One external resistor RI connected between the RI and GND pins determines a reference current, $I_{REF} = 1.25/R_I$ , for OCP programming.
7	IS12B	<b>12V Over-Current Protection Sense Input.</b> For typical application, this pin is connected to the positive end of a current shunt through one resistor. When the voltage on IS12 is higher than that of VS12 by 5mV, OCP is enabled.
8	VS12B	<b>Second 12V Over/Under-Voltage Control Sense Input.</b>
9	Pext	<b>External Protection Detects Input.</b>
10	IS5	<b>5V Over-Current Protection Sense Input.</b>
11	IS33	<b>3.3V Over-Current Protection Sense Input.</b>
12	VS12	<b>12V Over/Under-Voltage Control Sense Input.</b>
13	VS33	<b>3.3V Over/Under-Voltage Control Sense Input.</b>
14	VS5	<b>5V Over/Under-Voltage Control Sense Input.</b>
15	VDD	<b>Supply Voltage.</b> 4.2V ~ 15V. For ATX SMPS, it is connected to 5V-standby and 12V through diodes, respectively.
16	PGO	<b>Power-Good Logic Output.</b> 0 or 1 (open-drain). Power good=1 means that the power supply is good for operation. The power good delay is 300ms.

## 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 <sub>DD</sub>	DC Supply Voltage			16	V
V <sub>IN</sub>	Input Voltage	PS0N, PGI, VS5, IS5, VS33, IS33, Pext	-0.3	7.0	V
		VS12, VS12B, IS12, IS12B	-0.3	15.0	V
V <sub>OUT</sub>	Output Voltage	FPO, PGO	-0.3	8.0	V
T <sub>J</sub>	Operating Junction Temperature		-40	+125	°C
T <sub>STG</sub>	Storage Temperature Range		-55	+150	°C
T <sub>L</sub>	Lead Temperature (Soldering)			+260	°C
ESD	Electrostatic Discharge Capability	Human Body Model: JESD22-A114		3.0	KV
		Machine Model: JESD22-A115		200	V

## 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
T <sub>A</sub>	Operating Ambient Temperature	-40		+85	°C

## Electrical Characteristics

$V_{DD} = 5V$ , and  $T_A = 25^\circ C$  unless otherwise noted.

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
<b>V<sub>DD</sub> Section</b>						
$V_{DD}$	DC Supply Voltage		4.2		15.0	V
$I_{DD1}$	Supply Current	PSON = LOW		1.7	2.6	mA
$I_{DD2}$	Supply Current	PSON = HIGH		1.0	1.5	mA
$t_R$	Supply Voltage Rising Time		1			ms
$V_{ST}$	$V_{DD}$ Start Threshold Voltage				4.2	V
<b>Over-Voltage (OVP) and Over-Current (OCP) Protections</b>						
$V_{OVP}$	Over-Voltage Protection	VS33	3.7	3.9	4.1	V
		VS5	5.7	6.1	6.5	
		VS12, VS12B	13.2	13.8	14.4	
$I_{REF}$	Ratio of Current Sense Sink Current to Current Sense Setting Pin (RI) Source Current	$R_I = 18.5k\Omega \sim 75k\Omega$	7.6	8.0	8.4	
$V_{OFFSET}$	OCP Comparator Input Offset Voltage		-3		3	mV
$I_{LKG-FPO}$	Leakage Current (FPO)	FPO = 5V			5	$\mu A$
$V_{OL-FPO}$	Low-Level Output Voltage (FPO)	$I_{SINK} 20mA$			0.4	V
$t_{OVP}$	OVP Delay Time		33	75	110	$\mu s$
$t_{OCP}$	OCP Delay Time		12.5	20.0	27.5	ms
$V_{RI}$	RI Pin Voltage		0.98•Typ.	1.25	1.01•Typ.	V
$I_{RI}$	Output Current RI		12.5		62.5	$\mu A$
$t_{ST-OCP}$	Startup OCP / UVP Protection Time	0.6V < PGI < 1.25V; FPO = Low	49	75	114	ms
<b>Under-Voltage Protection and PGI, PGO</b>						
$V_{PG1\_1}$	Input Threshold Voltage	PGI 1	0.98•Typ.	1.25	1.02•Typ.	V
$V_{PG1\_2}$	Input Threshold Voltage	PGI 2	0.96•Typ.	0.60	1.03•Typ.	V
$V_{UVP}$	Under-Voltage Protection	VS33	2.1	2.3	2.5	V
		VS5	3.3	3.5	3.7	
		VS12, VS12B	8.5	9.0	9.5	
$t_{OND}$	Under-Voltage Turn-on Delay	PGI > 0.6V	49	75	114	ms
$t_{UVP}$	UVP Delay	PGI > 1.25V	2.4	3.2	4.0	ms
$I_{LKG-PGO}$	Leakage Current (PGO)	PGO = 5V			5	$\mu A$
$V_{OL-PGO}$	Low-Level Output Voltage (PGO)	$V_{DD} = 12V$ ; $I_{SINK} 10mA$			0.4	V
$t_{PG}$	Timing PG Delay		200	300	450	ms
$t_{ND1}$	Noise Deglitch Time		90	150	210	$\mu s$
<b>PSON Control</b>						
$I_{PSON}$	Input Pull-up Current	PSON = 0V		120		$\mu A$
$V_{IH}$	High-Level Input Voltage		2			V
$V_{IL}$	Low-Level Input Voltage				0.8	V
$t_{PSON}$	Timing PSON to On/Off	PSON LOW to FPO LOW	34	48	67	ms
		PSON HIGH to PGO LOW	34	48	67	
$t_{PSOFF}$	Timing PGO LOW to FPO HIGH		1.6	2.8	4.5	ms
<b>External Protection Detect Section</b>						
$V_{TH}$	Pext Threshold		1.20	1.25	1.30	V
$t_{Pext}$	Pext Delay Time		2.4	3.2	4.0	ms

## Functional Description

The SG6521 is designed to provide the supply voltage, current supervisor, remote on/off (PSON), power-good (PGO) indicator, and fault protection (FPO) functions for switching power systems.

For supervisory functions, it provides the over-voltage protection (OVP) for 3.3V, 5V, and two 12V; over-current protection (OCP) for 3.3V, 5V, and two 12V; under-voltage protection (UVP) for 3.3V, 5V, and two 12V. When 3.3V, 5V, or 12V voltage decreases to 2.3V, 3.5V, and 9V, respectively, the under-voltage protection function is enabled. FPO is set HIGH to turn off the PWM controller IC. The voltage difference across external current shunt is used for OCP functions. An external resistor can be used to adjust protection threshold. An additional protection input pin provides the flexibility for designing protection circuits.

The power supply is turned on after a 48ms delay when PSON signal is set from HIGH to LOW. To turn off the power supply, the PSON signal is set from LOW to HIGH with a delay of 48ms. The PGI circuitry provides a power-down warning signal for PGO. When PGI input is lower than the internal 1.25V reference voltage, PGO signal is pulled LOW.

The SG6521 provides over-current protection for the 3.3V, 5V, and two 12V rails. Whenever an OCP condition occurs at any of the voltage rails, PGO is LOW and FPO is open. The internal OCP comparators

have a very small offset voltage ( $\pm 3\text{mV}$ ). The sink currents of IS33, IS5, and IS12 are eight times the current at the RI pin. The current at the RI pin is  $V_{RI}/R_I$ .

Here is an example demonstrating how to set the over current protection. If  $I_1 \times R_1 > I_{RI} \times R_2$ , OCP is active. If  $R_1 = 5\text{m}\Omega$ ,  $R_I = 30\text{K}\Omega$ , and the OCP active level is 35A, then the  $R_2$  resistor is:

$$R_2 = \frac{I_1 \times R_1}{I_{RI} \times 8} = 525\Omega \quad (1)$$

where C is bypass noise, suggested value is between  $1\mu\text{F} \sim 2.2\mu\text{F}$

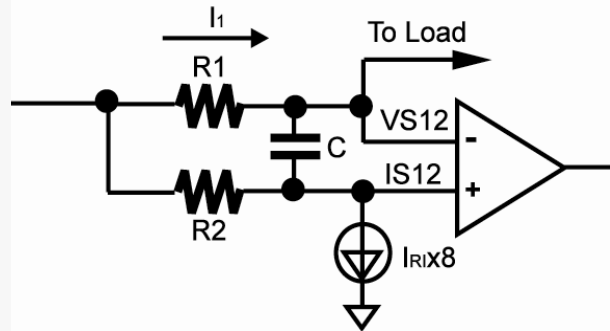


Figure 4. OCP Setup

Timing Chart

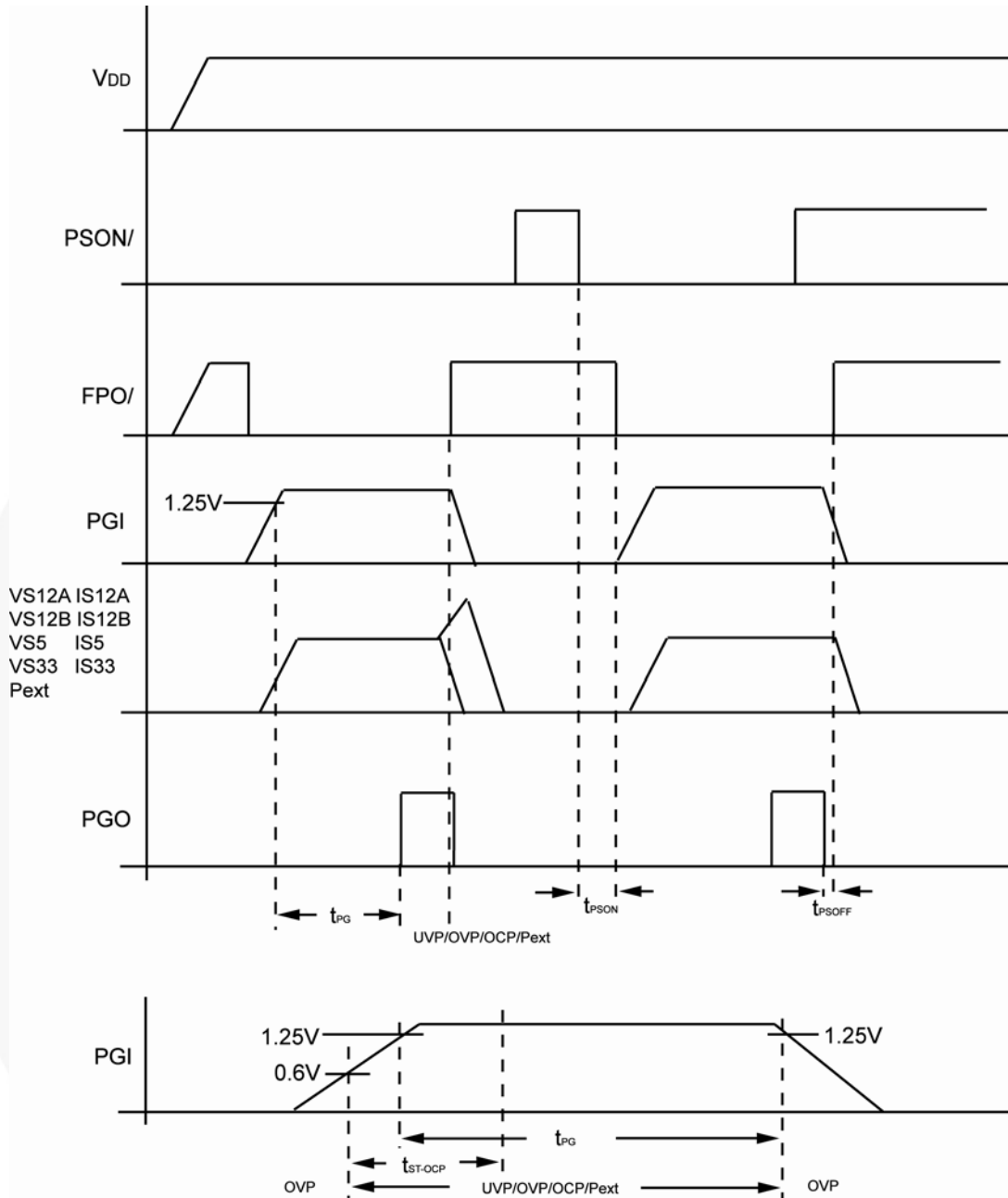


Figure 5. Timing Diagram



## Typical Performance Characteristics

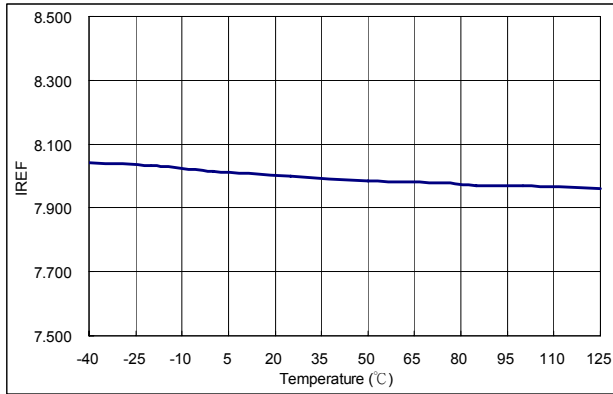


Figure 6. I<sub>REF</sub> vs. T<sub>A</sub>

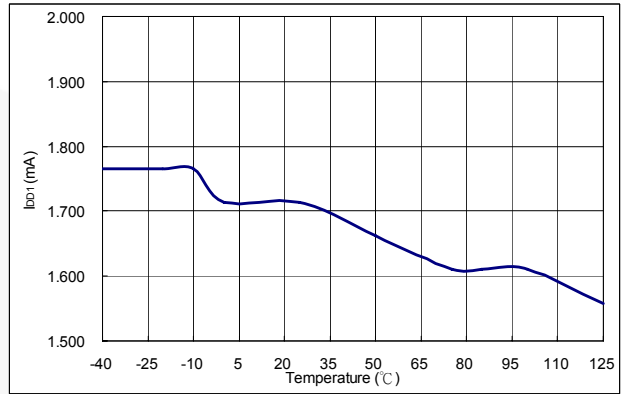


Figure 7. I<sub>D1</sub> vs. T<sub>A</sub>

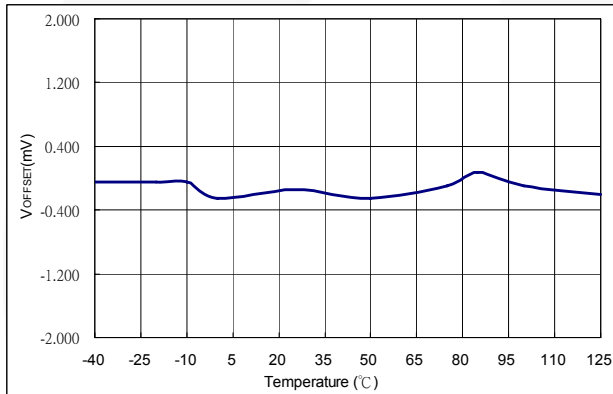


Figure 8. V<sub>OFFSET</sub> vs. T<sub>A</sub>

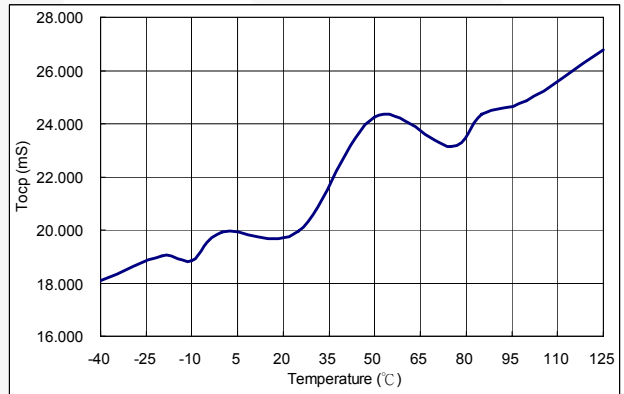


Figure 9. T<sub>OCP</sub> vs. T<sub>A</sub>

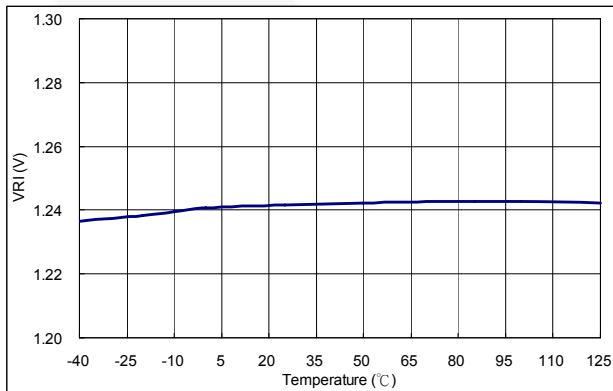


Figure 10. V<sub>RI</sub> vs. T<sub>A</sub>

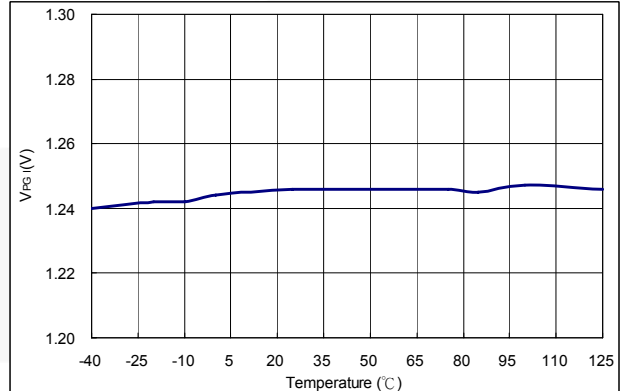
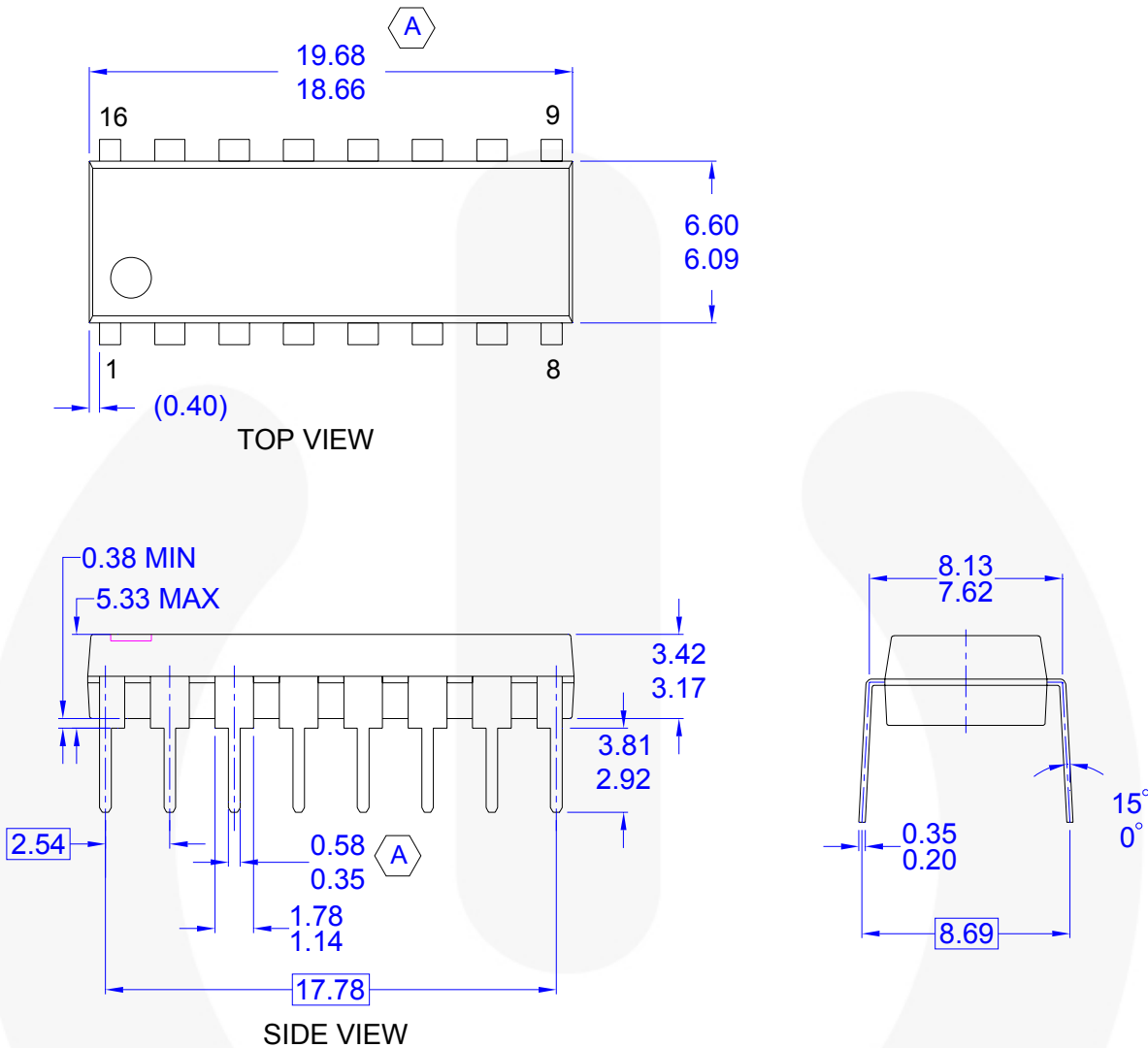


Figure 11. V<sub>PGI</sub> vs. T<sub>A</sub>

Physical Dimensions



NOTES: UNLESS OTHERWISE SPECIFIED

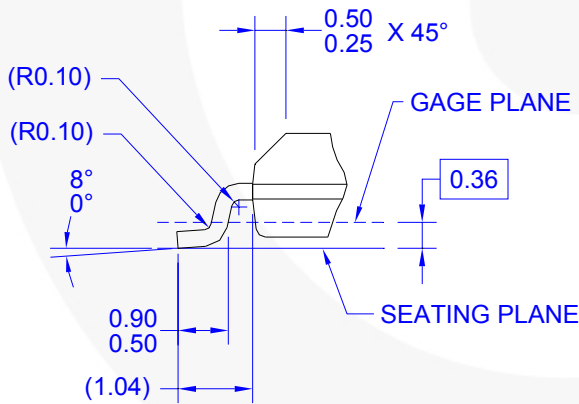
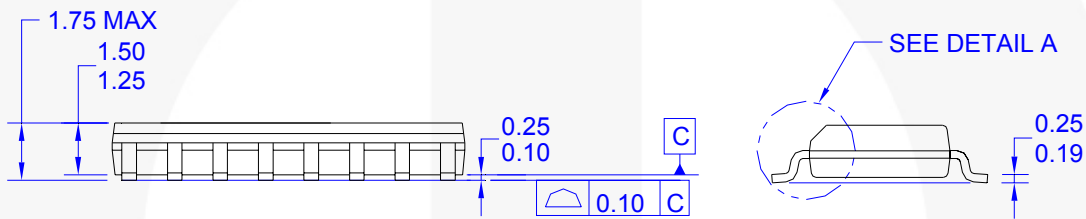
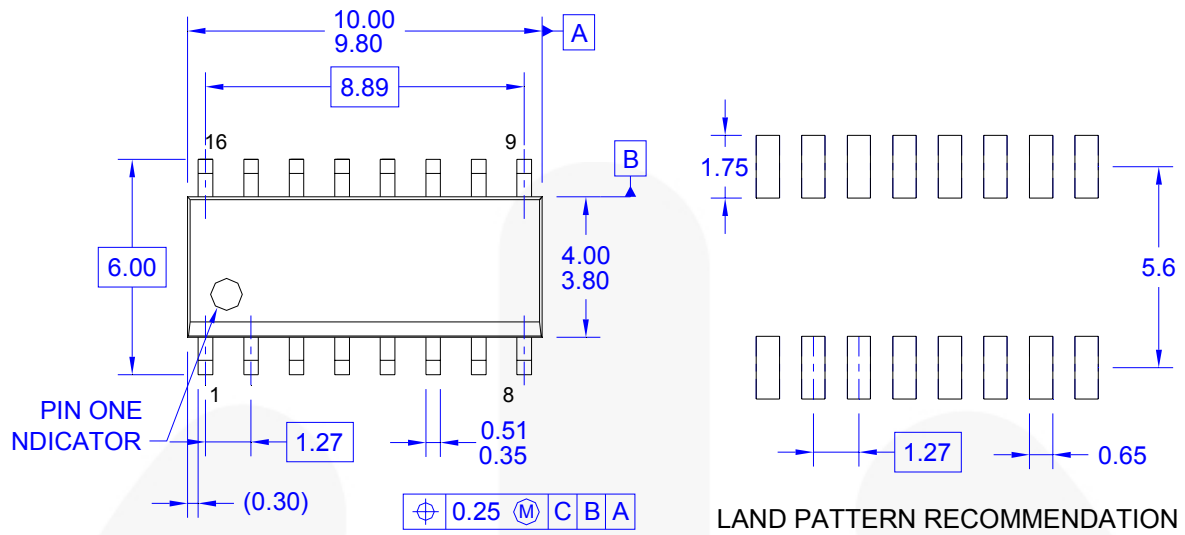
- A) THIS PACKAGE CONFORMS TO JEDEC MS-001 VARIATION BB
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLD FLASH, AND TIE BAR PROTRUSIONS
- D) CONFORMS TO ASME Y14.5M-1994
- E) DRAWING FILE NAME: N16REV1

Figure 12. 16-Lead, Dual In-line 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/>

Physical Dimensions (Continued)



NOTES: UNLESS OTHERWISE SPECIFIED

- A) THIS PACKAGE CONFORMS TO JEDEC MS-012, VARIATION AC, ISSUE C.
- 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) LANDPATTERN STANDARD: SOIC127P600X175-16AM
- F) DRAWING FILE NAME: M16AREV12.

DETAIL A  
SCALE: 2:1

Figure 13. 16-Lead, Small Outline Integrated Circuit (SOIC)

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.

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

\* 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.

**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](http://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. 136