

FDD6676AS

30V N-Channel PowerTrench® SyncFET™

General Description

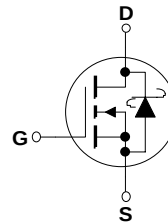
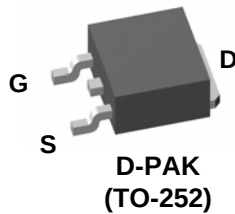
The FDD6676AS is designed to replace a single MOSFET and Schottky diode in synchronous DC:DC power supplies. This 30V MOSFET is designed to maximize power conversion efficiency, providing a low $R_{DS(ON)}$ and low gate charge. The FDD6676AS includes a patented combination of a MOSFET monolithically integrated with a Schottky diode using Fairchild's monolithic SyncFET technology.

Applications

- DC/DC converter
- Low side notebook

Features

- 90 A, 30 V $R_{DS(ON)} = 5.7 \text{ m}\Omega @ V_{GS} = 10 \text{ V}$
 $R_{DS(ON)} = 7.1 \text{ m}\Omega @ V_{GS} = 4.5 \text{ V}$
- Includes SyncFET schottky body diode
- Low gate charge (46nC typical)
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability
- RoHS Compliant



Absolute Maximum Ratings T_A=25°C unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain-Source Voltage	30	V
V_{GSS}	Gate-Source Voltage	± 20	V
I_D	Drain Current – Continuous (Note 3)	90	A
	– Pulsed (Note 1a)	100	
P_D	Power Dissipation for Single Operation (Note 1)	70	W
		3.1	
		1.3	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	1.8	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	40	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1b)	96	°C/W

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDD6676AS	FDD6676AS	13"	12mm	2500 units

Electrical Characteristics $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Drain-Source Avalanche Ratings (Note 2)						
W_{DSS}	Drain-Source Avalanche Energy	Single Pulse, $V_{DD} = 15\text{ V}$, $I_D = 16\text{ A}$		108	250	mJ
I_{AR}	Drain-Source Avalanche Current				16	A
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}$, $I_D = 1\text{ mA}$	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 10\text{ mA}$, Referenced to 25°C		31		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 24\text{ V}$, $V_{GS} = 0\text{ V}$			500	μA
		$V_{DS} = 24\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 125^\circ\text{C}$		11		mA
I_{GSS}	Gate-Body Leakage	$V_{GS} = \pm 20\text{ V}$, $V_{DS} = 0\text{ V}$			± 100	nA
On Characteristics (Note 2)						
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 1\text{ mA}$	1	1.5	3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 10\text{ mA}$, Referenced to 25°C		-3.6		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}$, $I_D = 16\text{ A}$		4.7	5.7	m Ω
		$V_{GS} = 4.5\text{ V}$, $I_D = 15\text{ A}$		5.8	7.1	
		$V_{GS} = 10\text{ V}$, $I_D = 16\text{ A}$, $T_J = 125^\circ\text{C}$		6.7	8.4	
g_{FS}	Forward Transconductance	$V_{DS} = 5\text{ V}$, $I_D = 16\text{ A}$		61		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	$V_{DS} = 15\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1.0\text{ MHz}$		2500		pF
C_{oss}	Output Capacitance			710		pF
C_{rss}	Reverse Transfer Capacitance			270		pF
R_G	Gate Resistance	$V_{GS} = 0\text{ V}$, $f = 1.0\text{ MHz}$		1.6		Ω
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{ V}$, $I_D = 1\text{ A}$, $V_{GS} = 10\text{ V}$, $R_{GEN} = 6\text{ }\Omega$		12	21	ns
t_r	Turn-On Rise Time			12	22	ns
$t_{d(off)}$	Turn-Off Delay Time			46	74	ns
t_f	Turn-Off Fall Time			28	44	ns
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 15\text{ V}$, $I_D = 1\text{ A}$, $V_{GS} = 4.5\text{ V}$, $R_{GEN} = 6\text{ }\Omega$		20	32	ns
t_r	Turn-On Rise Time			24	38	ns
$t_{d(off)}$	Turn-Off Delay Time			35	56	ns
t_f	Turn-Off Fall Time			27	43	ns
$Q_{g(TOT)}$	Total Gate Charge, $V_{GS} = 10\text{ V}$	$V_{DS} = 15\text{ V}$, $I_D = 16\text{ A}$		46	64	nC
Q_g	Total Gate Charge, $V_{GS} = 5\text{ V}$			25	35	nC
Q_{gs}	Gate-Source Charge			7		nC
Q_{gd}	Gate-Drain Charge			9		nC

Electrical Characteristics (continued)

T_A = 25°C unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Drain–Source Diode Characteristics and Maximum Ratings						
I _S	Maximum Continuous Drain–Source Diode Forward Current				3.5	A
V _{SD}	Drain–Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 3.5 A (Note 2)		0.4	0.7	V
t _{RR}	Diode Reverse Recovery Time	dI _F /dt = 300A/us, I _F = 16A		25		ns
I _{RM}	Maximum Recovery Current			1.9		A
Q _{RR}	Diode Reverse Recovery Charge			24		nC

Notes:

- R_{θJA} is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. R_{θJC} is guaranteed by design while R_{θCA} is determined by the user's board design.



a) R_{θJA} = 40°C/W when mounted on a 1in² pad of 2 oz copper



b) R_{θJA} = 96°C/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

- Pulse Test: Pulse Width < 300μs, Duty Cycle < 2.0%

- Maximum current is calculated as:
$$\sqrt{\frac{P_D}{R_{DS(ON)}}}$$

where P_D is maximum power dissipation at T_C = 25°C and R_{DS(on)} is at T_{J(max)} and V_{GS} = 10V. Package current limitation is 21A

Typical Characteristics

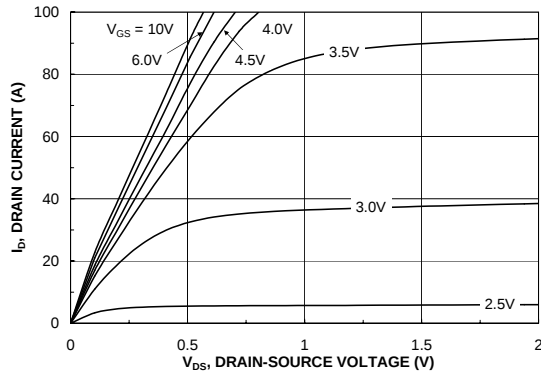


Figure 1. On-Region Characteristics

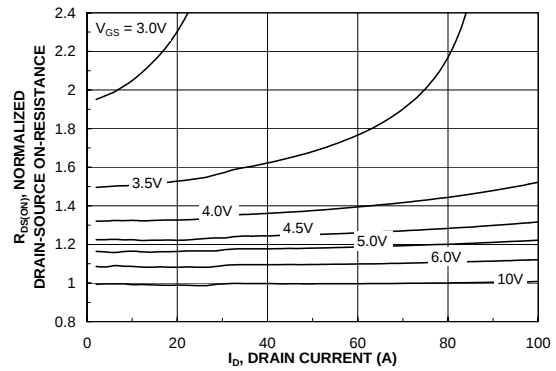


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage

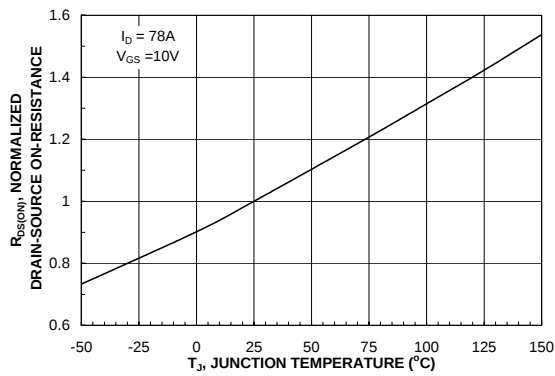


Figure 3. On-Resistance Variation with Temperature

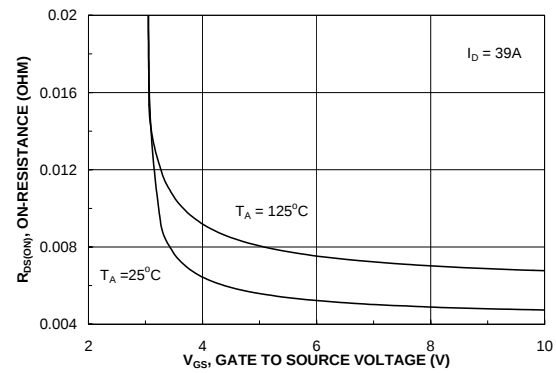


Figure 4. On-Resistance Variation with Gate-to-Source Voltage

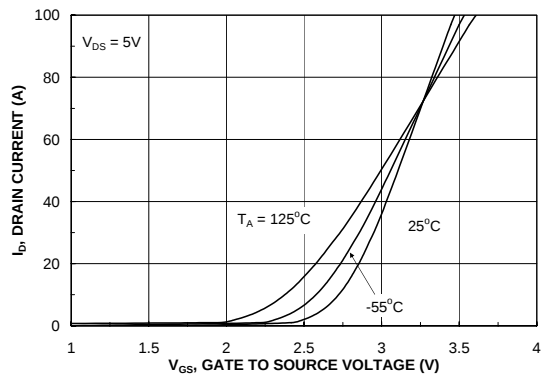


Figure 5. Transfer Characteristics

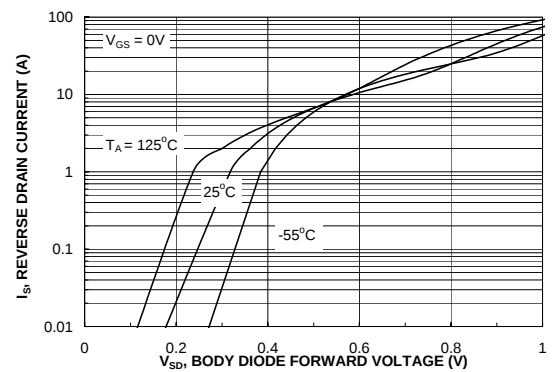


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature

Typical Characteristics

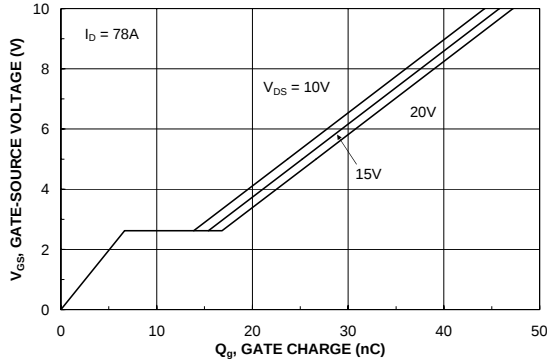


Figure 7. Gate Charge Characteristics

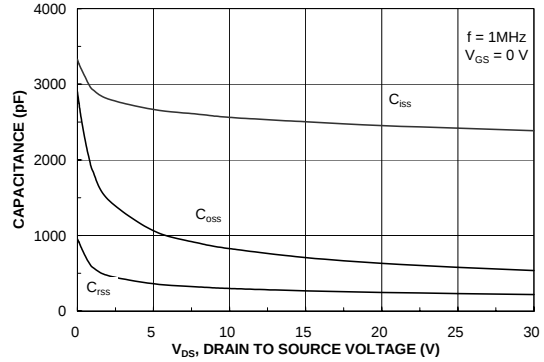


Figure 8. Capacitance Characteristics

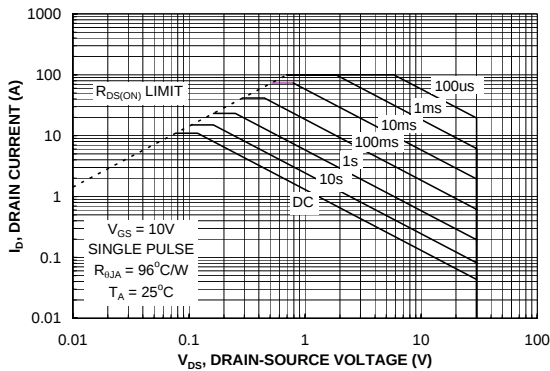


Figure 9. Maximum Safe Operating Area

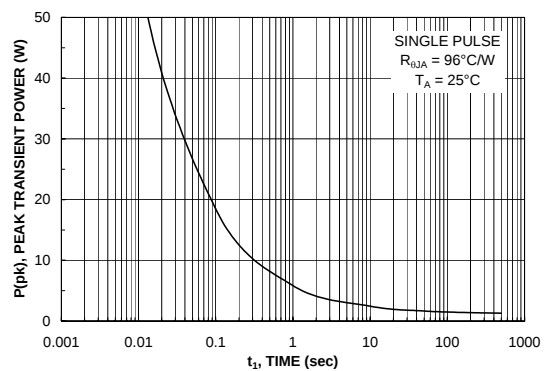


Figure 10. Single Pulse Maximum Power Dissipation

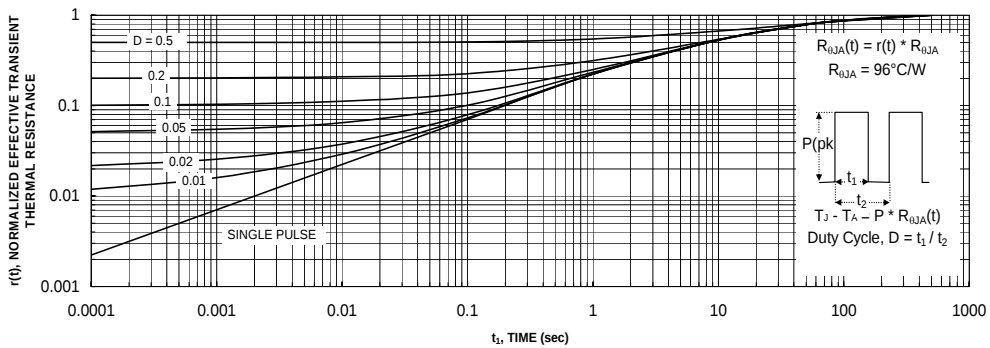


Figure 11. Transient Thermal Response Curve

Thermal characterization performed using the conditions described in Note 1b.
Transient thermal response will change depending on the circuit board design.

Typical Characteristics (continued)

SyncFET Schottky Body Diode Characteristics

Fairchild's SyncFET process embeds a Schottky diode in parallel with PowerTrench MOSFET. This diode exhibits similar characteristics to a discrete external Schottky diode in parallel with a MOSFET. Figure 12 shows the reverse recovery characteristic of the FDD6676AS.

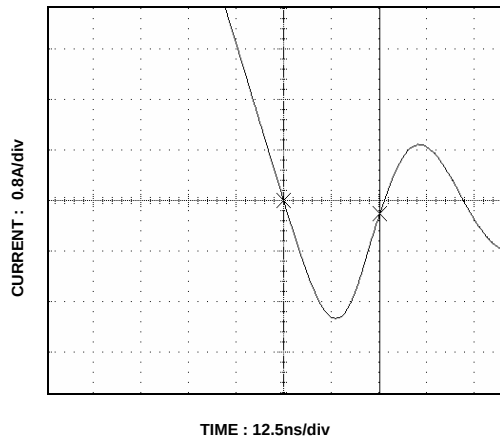


Figure 12. FDD6676AS SyncFET body diode reverse recovery characteristic.

For comparison purposes, Figure 13 shows the reverse recovery characteristics of the body diode of an equivalent size MOSFET produced without SyncFET (FDD6676A).

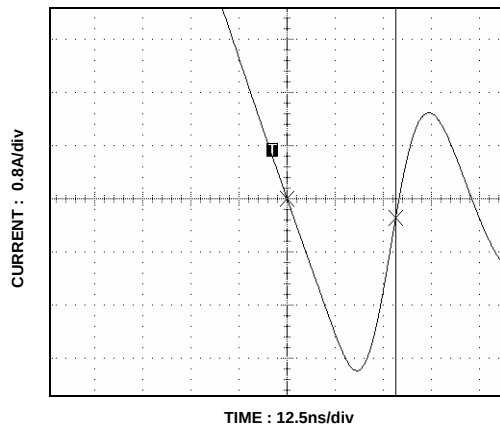


Figure 13. Non-SyncFET (FDD6676A) body diode reverse recovery characteristic.

Schottky barrier diodes exhibit significant leakage at high temperature and high reverse voltage. This will increase the power in the device.

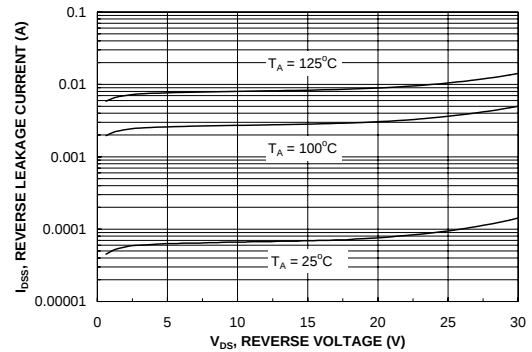


Figure 14. SyncFET body diode reverse leakage versus drain-source voltage and temperature.

Typical Characteristics

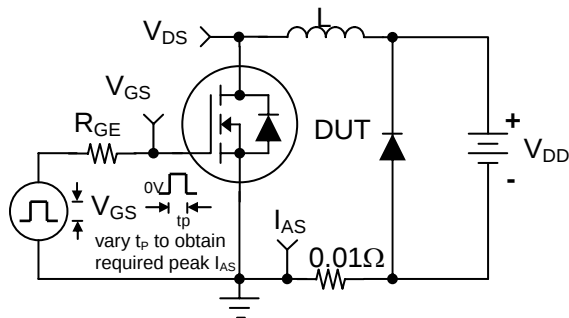


Figure 15. Unclamped Inductive Load Test Circuit

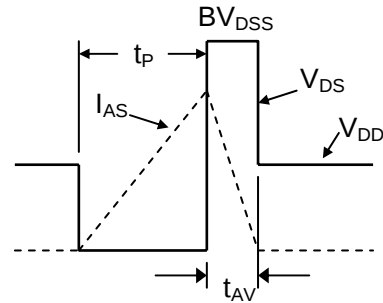


Figure 16. Unclamped Inductive Waveforms

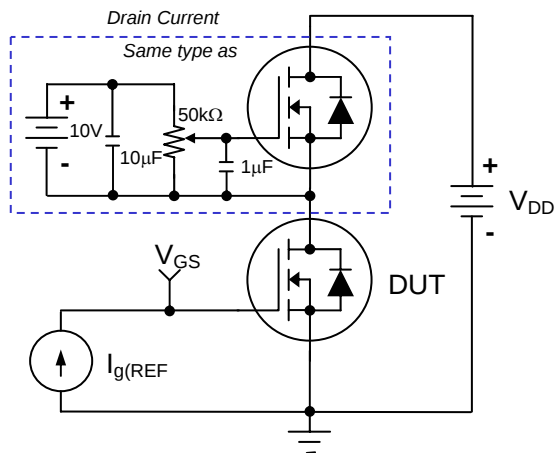


Figure 17. Gate Charge Test Circuit

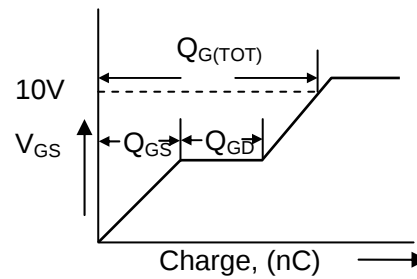


Figure 18. Gate Charge Waveform

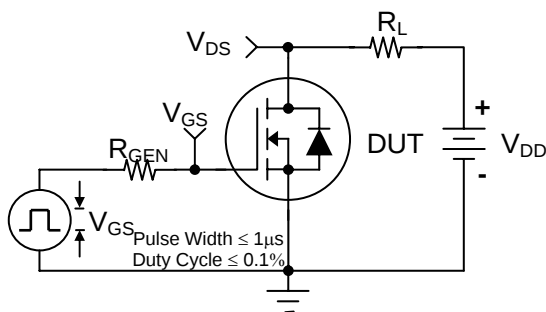


Figure 19. Switching Time Test Circuit

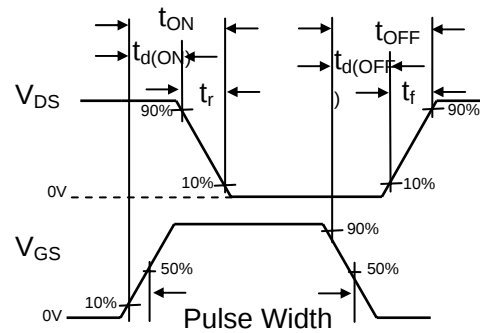


Figure 20. Switching Time Waveforms



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.

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

* 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 is discontinued by Fairchild Semiconductor. The datasheet is for reference information only.



ООО «НИОКРсистемс» - это оперативные поставки широкого спектра электронных компонентов отечественного и импортного производства напрямую от производителей и с крупнейших мировых складов. Реализуемая нашей компанией продукция насчитывает более полумиллиона наименований.

Благодаря этому наша компания предлагает к поставке практически не ограниченный ассортимент компонентов как оптовыми, мелкооптовыми партиями, так и в розницу.

Благодаря развитой сети поставщиков, помогаем в поиске и приобретении экзотичных или снятых с производства компонентов.

Наша компания это:

- Гарантия качества поставляемой продукции
- Широкий ассортимент
- Минимальные сроки поставок
- Техническая поддержка
- Подбор комплектации
- Индивидуальный подход
- Гибкое ценообразование
- Работаем по 275 ФЗ