FAIRCHILD SEMICONDUCTOR®

April 2003

FDC6432SH

12V P-Channel PowerTrench® MOSFET, 30V PowerTrench® SyncFET

General Description

This complementary P-Channel MOSFET with SyncFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers. It has been optimized for providing an extremely low $R_{DS(ON)}$ in a small package.

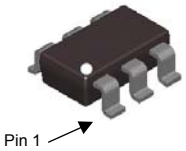
Applications

DC/DC converter

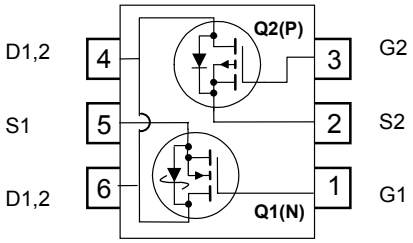
Power management

Features

- SyncFET 2.4 A, 30V
  $R_{DS(ON)}$ = 90 mΩ @ V_{GS} = 10 V
  $R_{DS(ON)}$ = 105 mΩ @ V_{GS} = 4.5 V
- P channel –2.5 A, –12V
  $R_{DS(ON)}$ = 90 mΩ @ V_{GS} = –4.5 V
  $R_{DS(ON)}$ = 125 mΩ @ V_{GS} = –2.5 V
  $R_{DS(ON)}$ = 220 mΩ @ V_{GS} = –1.8 V
- Fast switching speed.
- High performance trench technology for extremely low $R_{DS(ON)}$



SuperSOT™-6



Absolute Maximum Ratings

T_A=25°C unless otherwise noted

Symbol	Parameter		Ratings		Units
			Q1 (N)	Q2 (P)	
V_{DSS}	Drain-Source Voltage		30	–12	V
V_{GSS}	Gate-Source Voltage		±16	±8	V
I_D	Drain Current– Continuous	(Note 1a)	2.4	–2.5	A
	– Pulsed		7	–7	
P_D	Power Dissipation for Single Operation	(Note 1a)	1.3		W
		(Note 1b)	0.7		
T_J, T_{STG}	Operating and Storage Junction Temperature Range		–55 to +150		°C

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	(Note 1a)	100	°C/W
		(Note 1b)	175	
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	(Note 1)	60	

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
.432	FDC6432SH	7''	8mm	3000 units

Electrical Characteristics T_A = 25°C unless otherwise noted

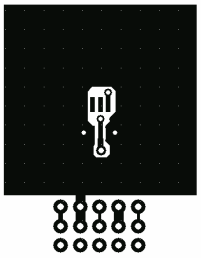
Symbol	Parameter	Test Conditions	Q	Min	Typ	Max	Units
Off Characteristics							
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 1 mA V_{GS} = 0 V, I_D = –250 µA	Q1 Q2	30 –12			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = 1 mA, Ref to 25°C I_D = –250 µA, Ref to 25°C	Q1 Q2		25 –10		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 24 V, V_{GS} = 0 V V_{DS} = –10 V, V_{GS} = 0 V	Q1 Q2			500 1	µA
I_{GSS}	Gate-Body Leakage	V_{GS} = ±16 V, V_{DS} = 0 V V_{GS} = ±8 V, V_{DS} = 0 V	Q1 Q2			±100 ±100	nA
On Characteristics							
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 1 mA V_{DS} = V_{GS}, I_D = –250 µA	Q1 Q2	1 –0.4	1.5 –0.7	3 –1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	I_D = 1 mA, Ref to 25°C I_D = –250 µA, Ref to 25°C	Q1 Q2		–7 3		mV/°C
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10V, I_D = 2.4A V_{GS} = 4.5V, I_D = 2.2A V_{GS}=10V,I_D=2.4A,T_J=125°C	Q1		75 85 100	90 105 140	mΩ
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = –4.5V, I_D = –2.5A V_{GS} = –2.5V, I_D = –2.0A V_{GS} = –1.8V, I_D = –1.6A V_{GS}=–4.5V,I_D=2.5A,T_J=125°C	Q2		75 97 154 86	90 125 220 120	mΩ
g_{FS}	Forward Transconductance	V_{DS} = 10 V, I_D = 1 mA V_{DS} = –5 V I_D = –2.5A	Q1 Q2		7 7		S
R_G	Gate Resistance	V_{GS} = 15 mV, f = 1.0 MHz	Q1 Q2		5 13		Ω
Dynamic Characteristics							
C_{iss}	Input Capacitance	For Q1: V_{DS}=15V, V_{GS}=0V, f=1MHz For Q2: V_{DS}= –6V, V_{GS}=0V, f=1MHz	Q1 Q2		270 514		pF
C_{oss}	Output Capacitance		Q1 Q2		50 234		pF
C_{rss}	Reverse Transfer Capacitance		Q1 Q2		20 167		pF
Switching Characteristics (Note 2)							
td(on)	Turn-on Delay Time	For Q1: V_{DS} = 15 V, I_D= 1 A, V_{GS} = 10 V, R_{GEN} = 6 Ω For Q2: V_{DS} = –10 V, I_D= –1 A, V_{GS} = –4.5 V, R_{GEN} = 6 Ω	Q1 Q2		5 13	10 23	ns
tr	Turn-on Rise Time		Q1 Q2		8 12	16 22	ns
td(off)	Turn-off Delay Time		Q1 Q2		18 22	32 35	ns
tf	Turn-off Fall Time		Q1 Q2		1.2 29	2.4 46	ns
Qg	Total Gate Charge	For Q1: V_{DS} = 15 V, I_D= 2.4 A, V_{GS} = 5 V For Q2: V_{DS} = –10 V, I_D= –2.5 A, V_{GS} = –4.5 V	Q1 Q2		2.5 5.7	3.5 8	nC
Qgs	Gate-Source Charge		Q1 Q2		0.7 1.2		nC
Qgd	Gate-Drain Charge		Q1 Q2		0.6 1.7		nC

Electrical Characteristics T_A = 25°C unless otherwise noted

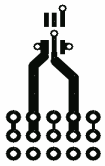
Symbol	Parameter	Test Conditions	Q	Min	Typ	Max	Units
Drain-Source Diode Characteristics							
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0 V, I_S = 0.7A, Note 2 V_{GS} = 0 V, I_S = –0.8A, Note 2	Q1 Q2		0.6 –0.7	700 1200	mV
t_{RR}	Reverse Recovery Time	For Q1: IF = 2.4A, dIF/dt = 300A/µs For Q2: IF = –2.5A, dIF/dt = 100A/µs	Q1 Q2		10 24		ns
I_{RM}	Maximum Reverse Recovery Current		Q1 Q2		0.8 –0.5		A
Q_{RR}	Reverse Recovery Charge		Q1 Q2		4 6		nC

Notes:

1. $R_{\theta JA}$ 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. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a) 100°C/W when mounted on a 1in^2 pad of 2 oz copper



b) 175°C/W when mounted on a minimum pad of 2 oz copper

Scale 1 : 1 on letter size paper

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

Typical Characteristics : Q1

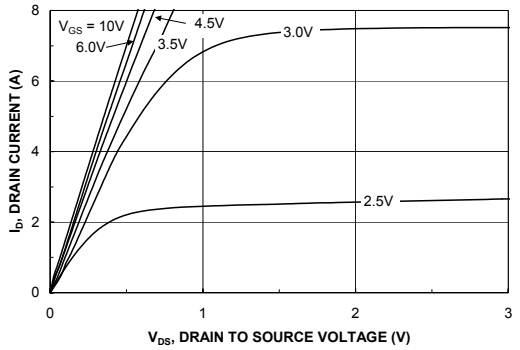


Figure 1. On-Region Characteristics.

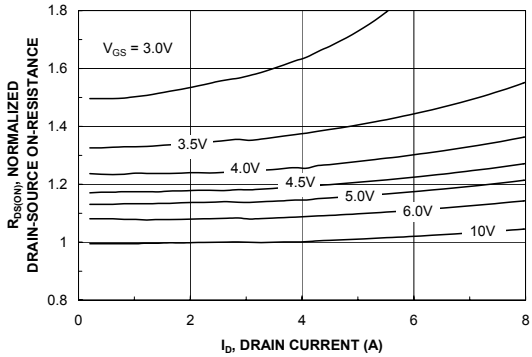


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

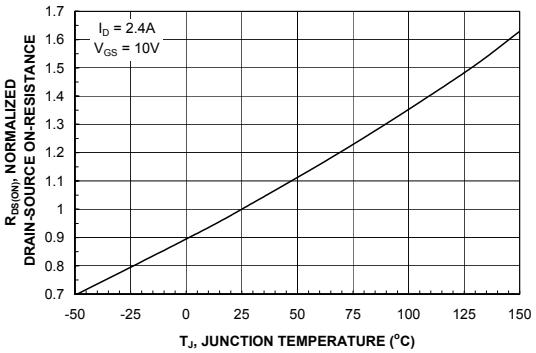


Figure 3. On-Resistance Variation with Temperature.

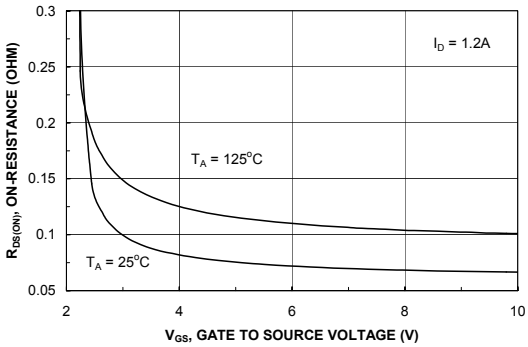


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

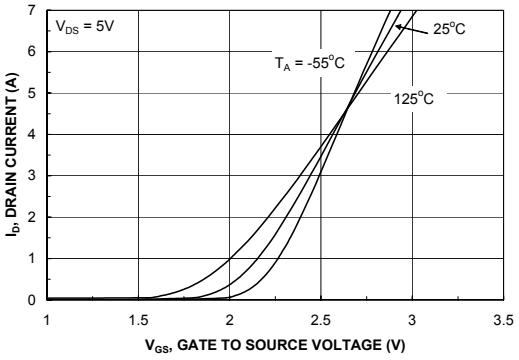


Figure 5. Transfer Characteristics.

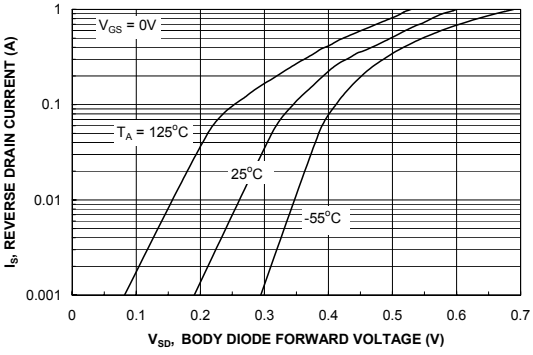


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics : Q1

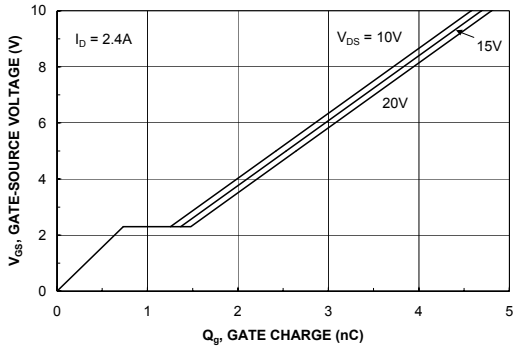


Figure 7. Gate Charge Characteristics.

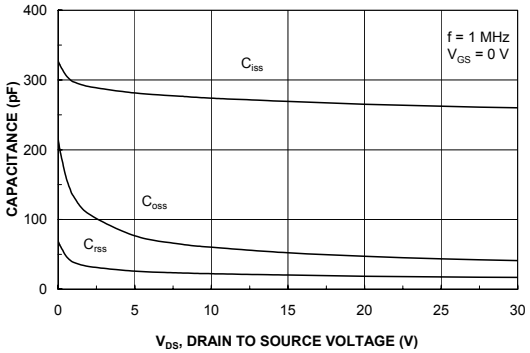


Figure 8. Capacitance Characteristics.

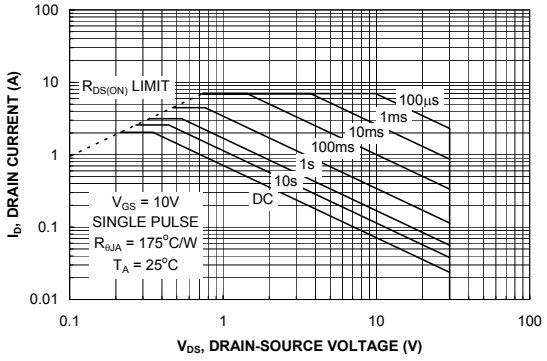


Figure 9. Maximum Safe Operating Area.

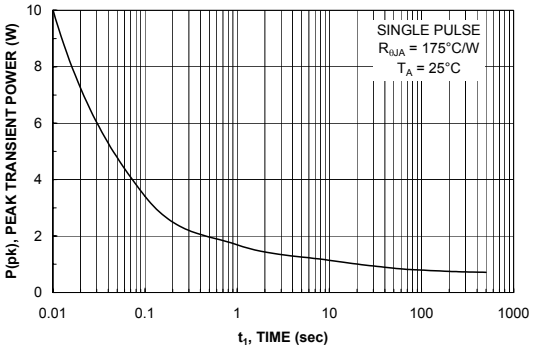


Figure 10. Single Pulse Maximum Power Dissipation.

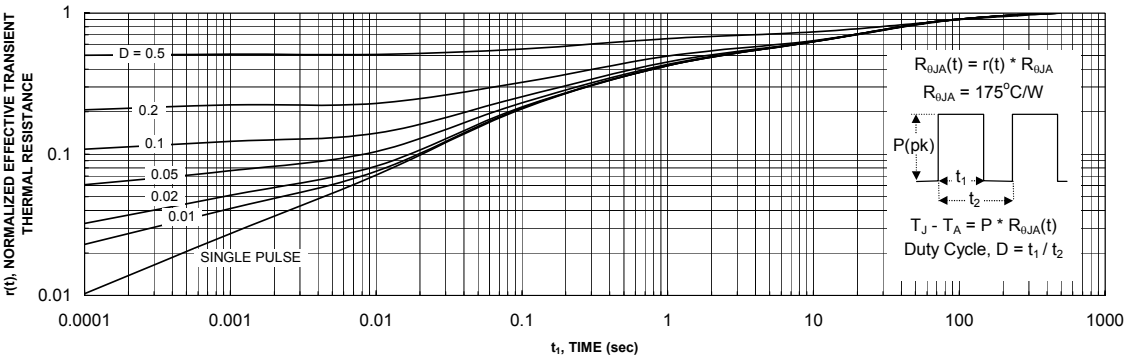


Figure 11. Transient Thermal Response Curve.

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

Typical Characteristics : Q2

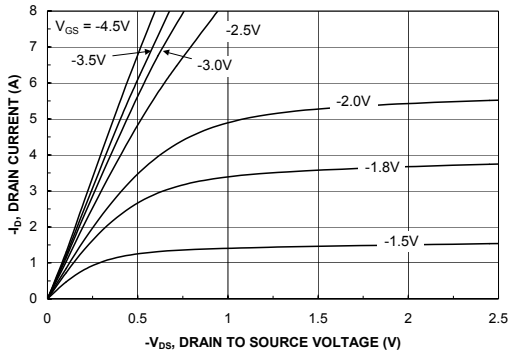


Figure 12. On-Region Characteristics.

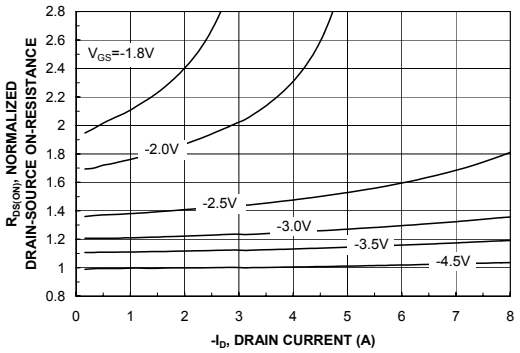


Figure 13. On-Resistance Variation with Drain Current and Gate Voltage.

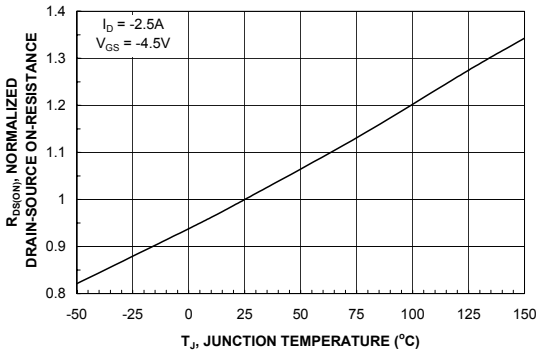


Figure 14. On-Resistance Variation with Temperature.

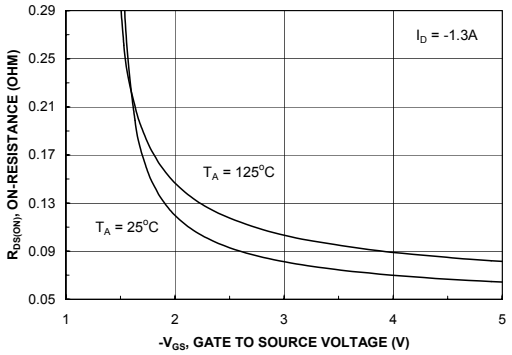


Figure 15. On-Resistance Variation with Gate-to-Source Voltage.

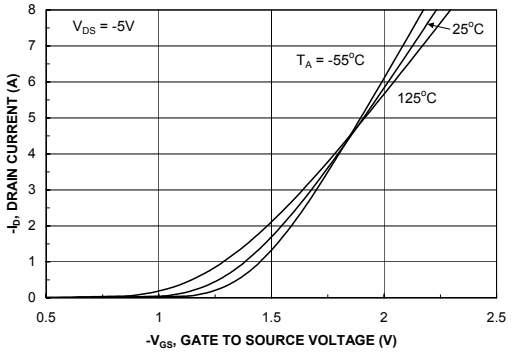


Figure 16. Transfer Characteristics.

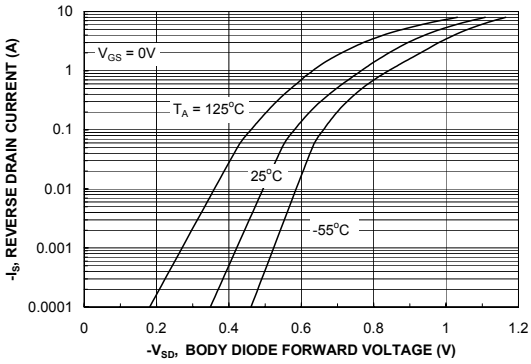


Figure 17. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics : Q2

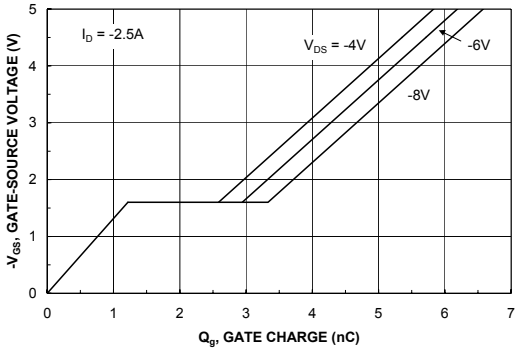


Figure 18. Gate Charge Characteristics.

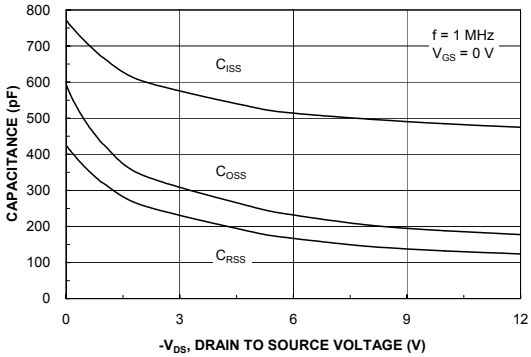


Figure 19. Capacitance Characteristics.

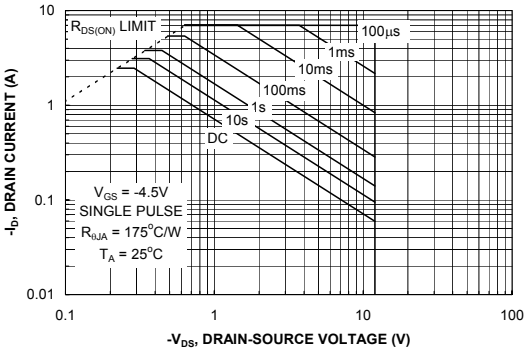


Figure 20. Maximum Safe Operating Area.

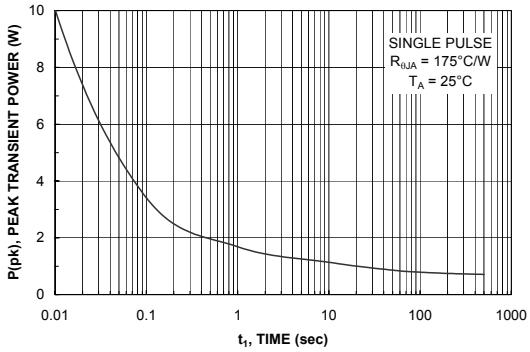


Figure 21. Single Pulse Maximum Power Dissipation.

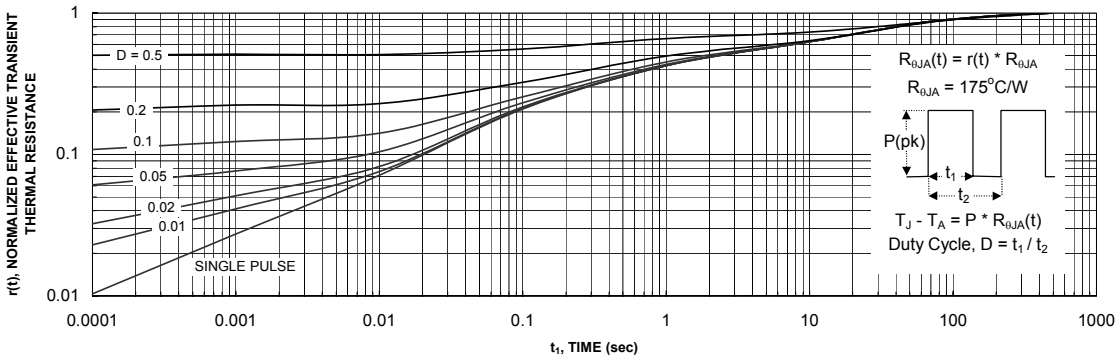


Figure 22. Transient Thermal Response Curve.

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

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2. 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.

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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 in order 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 in order to improve design.
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