

FDZ2554P

Monolithic Common Drain P-Channel 2.5V Specified Power Trench® BGA MOSFET -20V, -6.5A, 28mΩ

Features

- Max $r_{DS(on)}$ = 28mΩ at $V_{GS} = -4.5V$, $I_D = -6.5A$
- Max $r_{DS(on)}$ = 45mΩ at $V_{GS} = -2.5V$, $I_D = -5A$
- Occupies only 0.10 cm² of PCB area: 1/3 the area of SO-8
- Ultra-thin package: less than 0.80 mm height when mounted to PCB
- Outstanding thermal transfer characteristics: significantly better than SO-8
- Ultra-low $Q_g \times r_{DS(on)}$ figure-of-merit
- High power and current handling capability
- RoHS Compliant



General Description

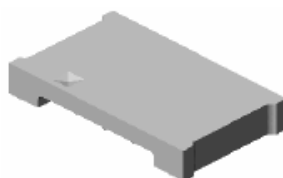
Combining Fairchild's advanced 2.5V specified PowerTrench process with state-of-the-art BGA packaging, the FDZ2554P minimizes both PCB space and $r_{DS(on)}$. This monolithic common drain BGA MOSFET embodies a breakthrough in packaging technology which enables the device to combine excellent thermal transfer characteristics, high current handling capability, ultra-low profile packaging, low gate charge, and low $r_{DS(on)}$.

Applications

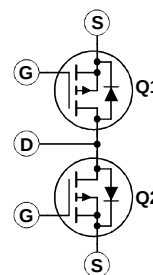
- Battery management
- Load Switch
- Battery protection



Bottom



Top



MOSFET Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Ratings	Units
V_{DS}	Drain to Source Voltage	-20	V
V_{GS}	Gate to Source Voltage	±12	V
I_D	Drain Current -Continuous (Note 1a)	-6.5	A
	-Pulsed	-20	
P_D	Power Dissipation (Steady State) (Note 1a)	2.1	W
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)	0.6	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	60	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1b)	108	
$R_{\theta JB}$	Thermal Resistance, Junction to Ball (Note 1)	6.3	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
2554P	FDZ2554P	BGA 2.5X4.0	7"	12 mm	3000 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
--------	-----------	-----------------	-----	-----	-----	-------

Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = -250\mu\text{A}$, $V_{GS} = 0\text{V}$	-20			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$, referenced to 25°C		-13		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = -16\text{V}$, $V_{GS} = 0\text{V}$			-1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 12\text{V}$, $V_{DS} = 0\text{V}$			± 100	nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = -250\mu\text{A}$	-0.6	-0.8	-1.5	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$, referenced to 25°C		3		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = -4.5\text{V}$, $I_D = -6.5\text{A}$		21	28	m Ω
		$V_{GS} = -2.5\text{V}$, $I_D = -5\text{A}$		36	45	
		$V_{GS} = -4.5\text{V}$, $I_D = -6.5\text{A}$, $T_J = 125^\circ\text{C}$		30	43	
g_{FS}	Forward Transconductance	$V_{DD} = -5\text{V}$, $I_D = -6.5\text{A}$		24		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = -10\text{V}$, $V_{GS} = 0\text{V}$, $f = 1\text{MHz}$		1430	1900	pF
C_{oss}	Output Capacitance			319	425	pF
C_{rss}	Reverse Transfer Capacitance			164	245	pF
R_g	Gate Resistance	$V_{GS} = 15\text{mV}$, $f = 1\text{MHz}$		9.2		Ω

Switching Characteristics

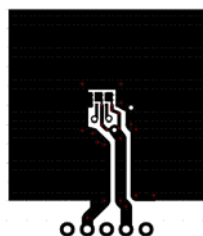
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -10\text{V}$, $I_D = -1\text{A}$, $V_{GS} = -4.5\text{V}$, $R_{GEN} = 6\Omega$		12	22	ns
t_r	Rise Time			9	18	ns
$t_{d(off)}$	Turn-Off Delay Time			62	100	ns
t_f	Fall Time			37	60	ns
Q_g	Total Gate Charge	$V_{GS} = -4.5\text{V}$, $V_{DD} = -10\text{V}$, $I_D = -6.5\text{A}$		14	20	nC
Q_{gs}	Gate to Source Charge			3		nC
Q_{gd}	Gate to Drain "Miller" Charge			4		nC

Drain-Source Diode Characteristics

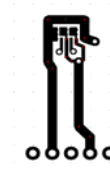
I _S	Maximum Continuous Drain-Source Diode Forward Current				-1.75	A
V _{SD}	Source to Drain Diode Forward Voltage	V _{GS} = 0V, I _S = -1.75A (Note 2)		-0.7	-1.2	V
t _{rr}	Reverse Recovery Time	I _F = -6.5A, di/dt = 100A/μs		25	40	ns
Q _{rr}	Reverse Recovery Charge			20	32	nC

NOTES:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in² oz. copper pad on a 1.5 x 1.5 in. board of FR-4 material. The thermal resistance from the junction to the circuit board side of the solder ball, $R_{\theta JB}$, is defined for reference. For $R_{\theta JC}$, the thermal reference point for the case is defined as the top surface of the copper chip carrier. $R_{\theta JC}$ and $R_{\theta JB}$ are guaranteed by design while $R_{\theta JA}$ is determined by the user's board design.



a. 60°C/W when mounted on a 1 in² pad of 2 oz copper.



b. 108°C/W when mounted on a minimum pad of 2 oz copper.

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

Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

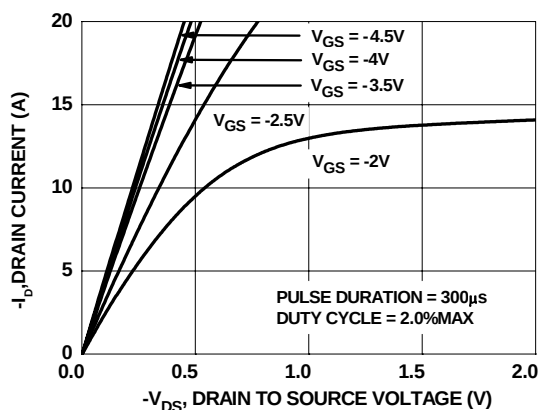


Figure 1. On-Region Characteristics

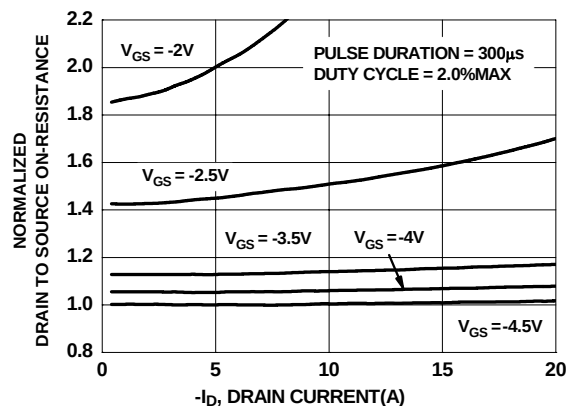


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

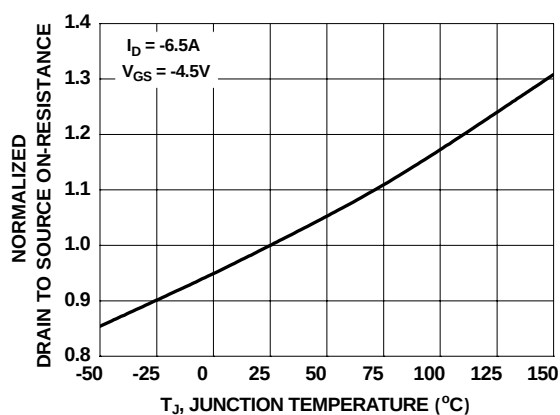


Figure 3. Normalized On-Resistance vs Junction Temperature

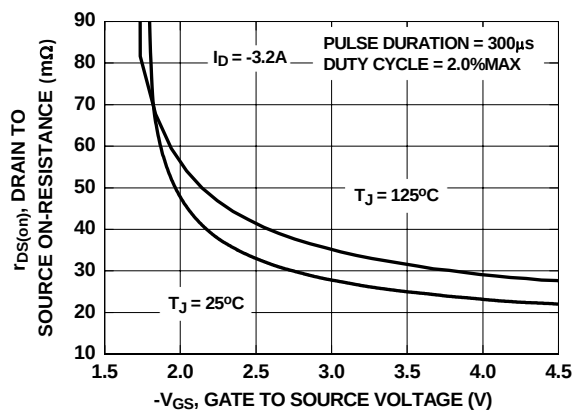


Figure 4. On-Resistance vs Gate to Source Voltage

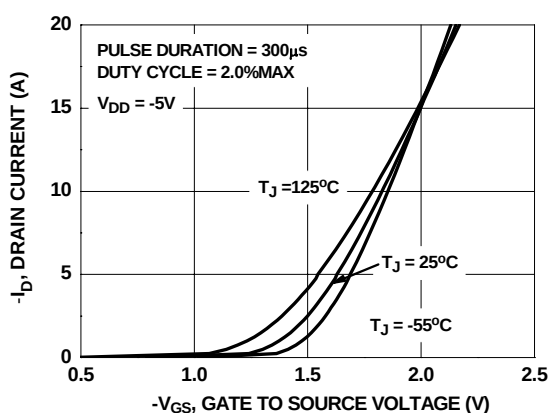


Figure 5. Transfer Characteristics

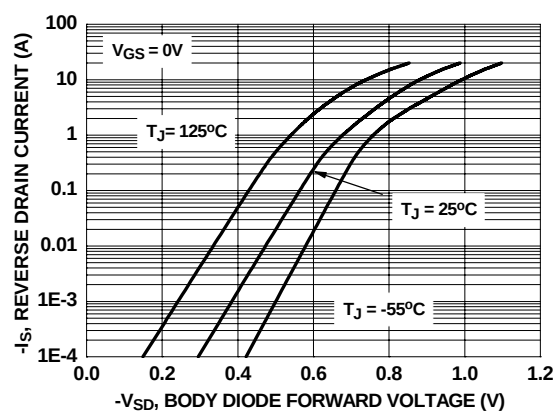


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

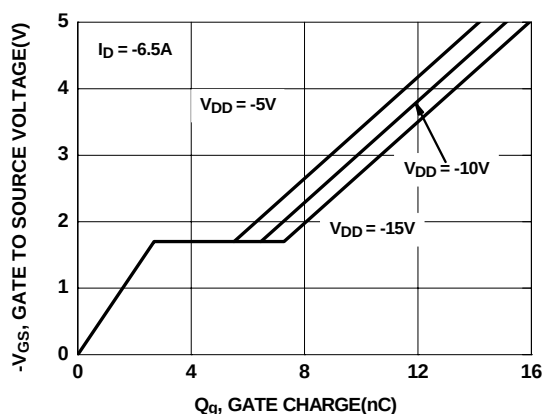


Figure 7. Gate Charge Characteristics

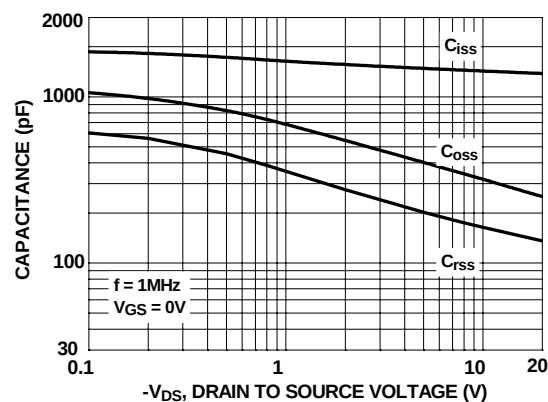


Figure 8. Capacitance vs Drain to Source Voltage

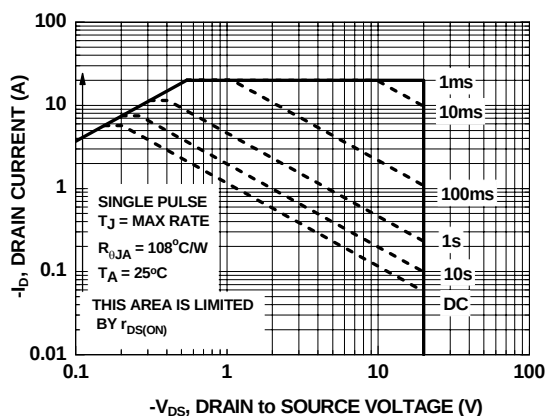


Figure 9. Forward Bias Safe Operating Area

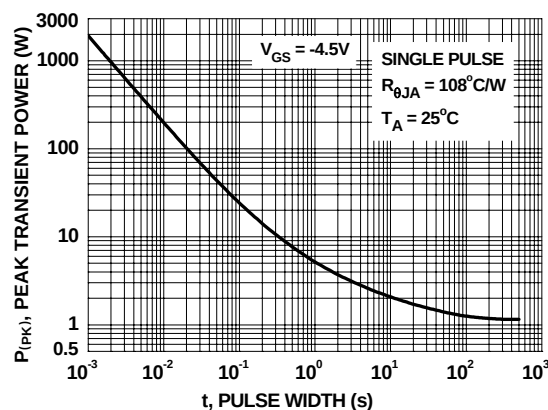


Figure 10. Single Pulse Maximum Power Dissipation

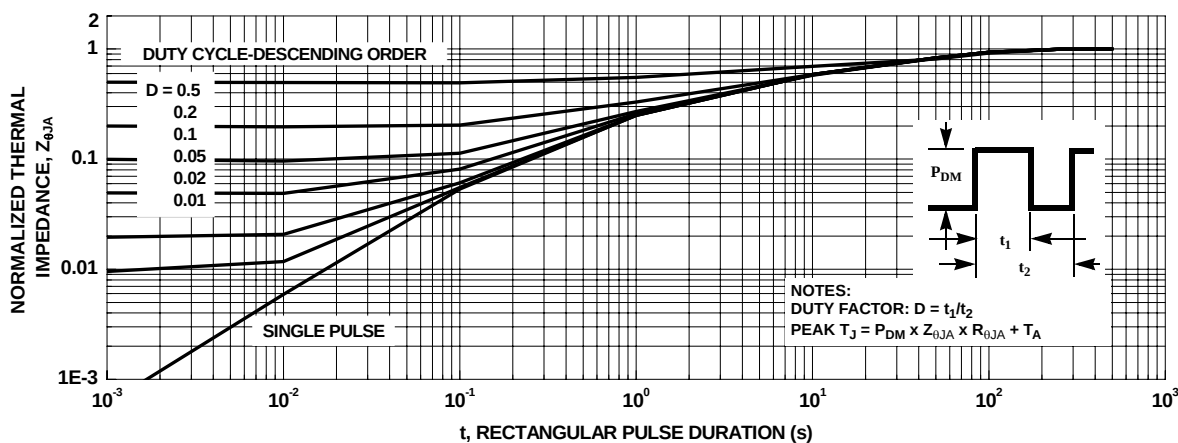
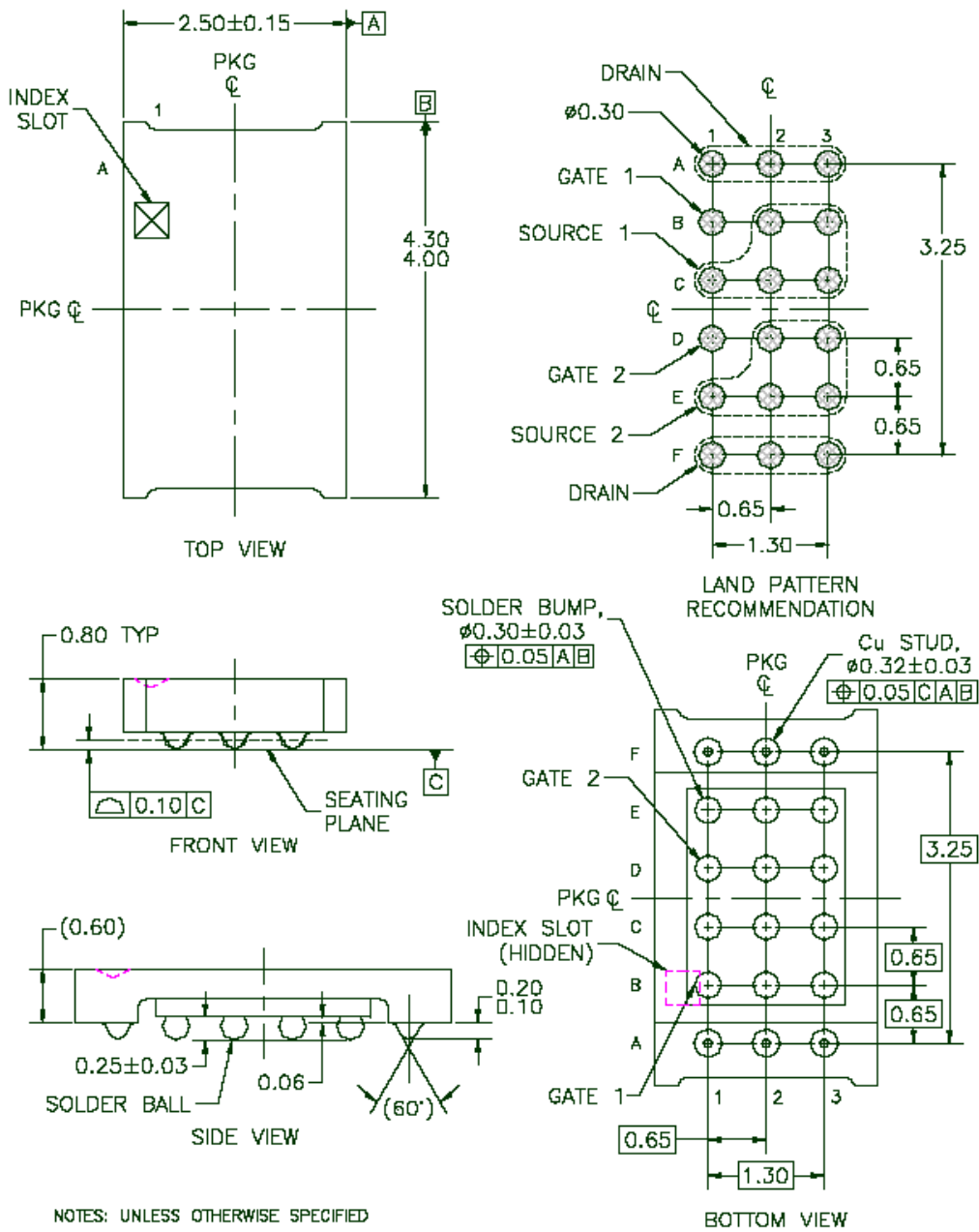


Figure 11. Transient Thermal Response Curve

Dimensional Outline and Pad Layout



NOTES: UNLESS OTHERWISE SPECIFIED

- A) ALL DIMENSIONS ARE IN MILLIMETERS.
- B) NO JEDEC REGISTRATION REFERENCE AS OF JULY 1999.
- C) BALL CONFIGURATION TABLE

TERMINAL	DESIGNATION
A1, A2, A3, F1, F2, F3	DRAIN
B1	GATE 1
B2, B3, C1, C2, C3	SOURCE 1
D1	GATE 2
D2, D3, E1, E2, E3	SOURCE 2



TRADEMARKS

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

ACE [®]	Green FPS [™] e-Series [™]	POWEREDGE [®]	SuperSOT [™] -8
Build it Now [™]	GOT [™]	Power-SPM [™]	SyncFET [™]
CorePLUS [™]	i-Lo [™]	PowerTrench [®]	The Power Franchise [®]
CROSSVOLT [™]	IntelliMAX [™]	Programmable Active Droop [™]	 [™]
CTL [™]	ISOPLANAR [™]	QFET [®]	TinyBoost [™]
Current Transfer Logic [™]	MegaBuck [™]	QS [™]	TinyBuck [™]
EcoSPARK [®]	MICROCOUPLER [™]	QT Optoelectronics [™]	TinyLogic [®]
FACT Quiet Series [™]	MicroFEET [™]	Quiet Series [™]	TINYOPTO [™]
FACT [®]	MicroPak [™]	RapidConfigure [™]	TinyPower [™]
FAST [®]	Motion-SPM [™]	SMART START [™]	TinyPWM [™]
FastvCore [™]	OPTOLOGIC [®]	SPM [®]	TinyWire [™]
FPS [™]	OPTOPLANAR [®]	STEALTH [™]	μSerDes [™]
FRFET [®]	PDP-SPM [™]	SuperFET [™]	UHC [®]
Global Power Resource SM	Power220 [®]	SuperSOT [™] -3	UniFET [™]
Green FPS [™]	Power247 [®]	SuperSOT [™] -6	VCX [™]

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 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. I29