

FDMC86570L

N-Channel Shielded Gate PowerTrench® MOSFET

60 V, 56 A, 4.3 mΩ

Features

- Shielded Gate MOSFET Technology
- Max $r_{DS(on)}$ = 4.3 mΩ at $V_{GS} = 10$ V, $I_D = 18$ A
- Max $r_{DS(on)}$ = 6.5 mΩ at $V_{GS} = 4.5$ V, $I_D = 15$ A
- High performance technology for extremely low $r_{DS(on)}$
- Termination is Lead-free
- RoHS Compliant

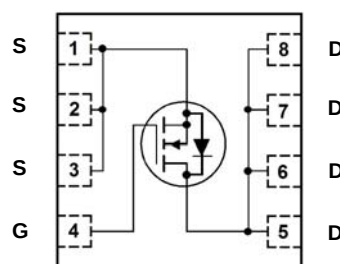
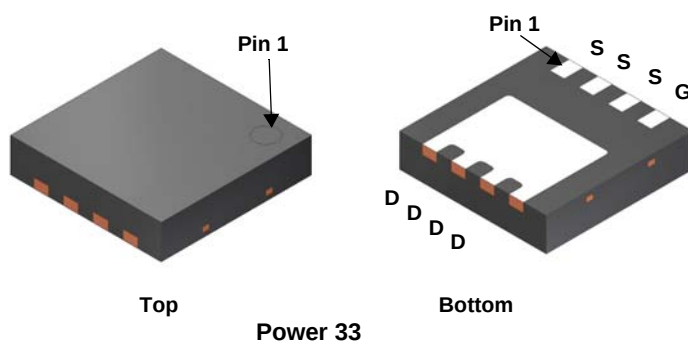


General Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that incorporates Shielded Gate technology. This process has been optimized for the on-state resistance and yet maintain superior switching performance.

Application

- DC-DC Conversion



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

Symbol	Parameter	Ratings	Units
V_{DS}	Drain to Source Voltage	60	V
V_{GS}	Gate to Source Voltage	± 20	V
I_D	Drain Current -Continuous $T_C = 25^\circ\text{C}$	56	A
	-Continuous $T_A = 25^\circ\text{C}$ (Note 1a)	18	
	-Pulsed (Note 4)	200	
E_{AS}	Single Pulse Avalanche Energy (Note 3)	253	mJ
P_D	Power Dissipation $T_C = 25^\circ\text{C}$	54	W
	Power Dissipation $T_A = 25^\circ\text{C}$ (Note 1a)	2.3	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case (Note 1)	2.3	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	53	

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDMC86570L	FDMC86570L	Power33	13 "	12 mm	3000 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0\ \text{V}$	60			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\ \mu\text{A}$, referenced to 25°C		30		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 48\ \text{V}$, $V_{GS} = 0\ \text{V}$			1	μA
I_{GSS}	Gate to Source Leakage Current	$V_{GS} = \pm 20\ \text{V}$, $V_{DS} = 0\ \text{V}$			± 100	nA

On Characteristics

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}$, $I_D = 250\ \mu\text{A}$	1.0	1.8	3.0	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		-7		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 10\ \text{V}$, $I_D = 18\ \text{A}$		3.1	4.3	m Ω
		$V_{GS} = 4.5\ \text{V}$, $I_D = 15\ \text{A}$		4.7	6.5	
		$V_{GS} = 10\ \text{V}$, $I_D = 18\ \text{A}$, $T_J = 125^\circ\text{C}$		5.0	6.9	
g_{FS}	Forward Transconductance	$V_{DD} = 5\ \text{V}$, $I_D = 18\ \text{A}$		75		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 30\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$		4790	6705	pF
C_{oss}	Output Capacitance			821	1150	pF
C_{rss}	Reverse Transfer Capacitance			19	30	pF
R_g	Gate Resistance		0.1	0.9	2.7	Ω

Switching Characteristics

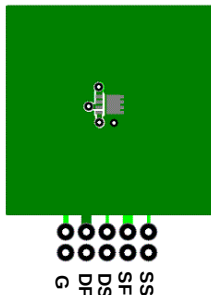
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 30\ \text{V}$, $I_D = 18\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_{GEN} = 6\ \Omega$		19	34	ns
t_r	Rise Time			6.2	12	ns
$t_{d(off)}$	Turn-Off Delay Time			38	61	ns
t_f	Fall Time			3.9	10	ns
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $10\ \text{V}$	$V_{DD} = 30\ \text{V}$, $I_D = 18\ \text{A}$	63	88	nC
$Q_{g(TOT)}$	Total Gate Charge	$V_{GS} = 0\ \text{V}$ to $4.5\ \text{V}$		29	41	nC
Q_{gs}	Gate to Source Charge			14		nC
Q_{gd}	Gate to Drain "Miller" Charge			6.3		nC

Drain-Source Diode Characteristics

V_{SD}	Source to Drain Diode Forward Voltage	$V_{GS} = 0\ \text{V}$, $I_S = 18\ \text{A}$ (Note 2)		0.8	1.3	V
		$V_{GS} = 0\ \text{V}$, $I_S = 1.9\ \text{A}$ (Note 2)		0.7	1.2	V
t_{rr}	Reverse Recovery Time	$I_F = 18\ \text{A}$, $di/dt = 100\ \text{A}/\mu\text{s}$		43	69	ns
Q_{rr}	Reverse Recovery Charge			26	42	nC

Notes:

1. $R_{\theta JA}$ is determined with the device mounted on a 1 in² pad 2 oz copper pad on a 1.5 x 1.5 in. board of FR-4 material. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a. $53^\circ\text{C}/\text{W}$ when mounted on a 1 in² pad of 2 oz copper



b. $125^\circ\text{C}/\text{W}$ when mounted on a minimum pad of 2 oz copper

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

3. E_{AS} of 253 mJ is based on starting $T_J = 25^\circ\text{C}$, $L = 3\ \text{mH}$, $I_{AS} = 13\ \text{A}$, $V_{DD} = 60\ \text{V}$, $V_{GS} = 10\ \text{V}$. 100% test at $L = 0.1\ \text{mH}$, $I_{AS} = 43\ \text{A}$.

4. Pulsed I_d limited by junction temperature, $t_d \leq 100\ \mu\text{s}$, please refer to SOA curve for more details.

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

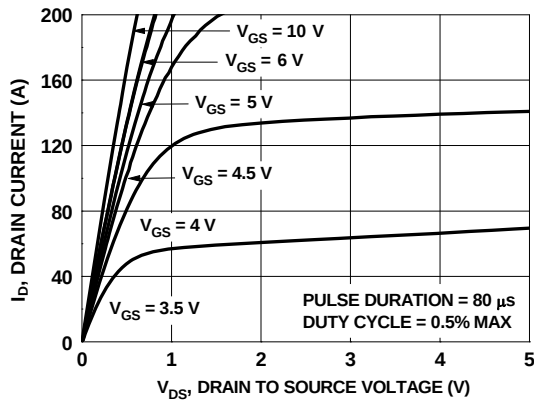


Figure 1. On-Region Characteristics

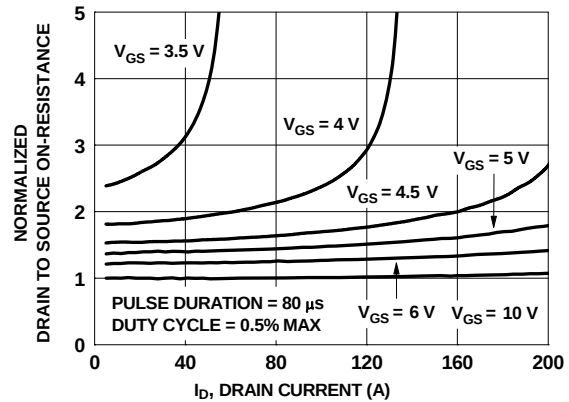


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

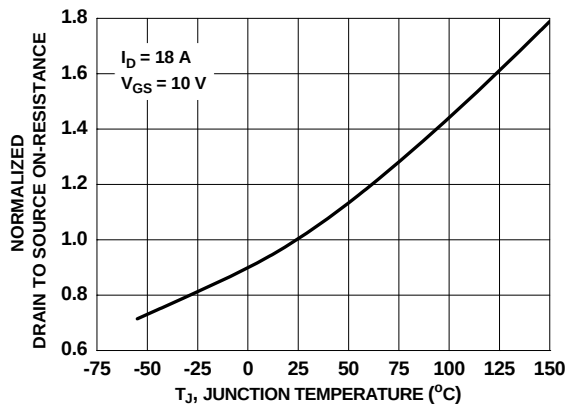


Figure 3. Normalized On-Resistance vs Junction Temperature

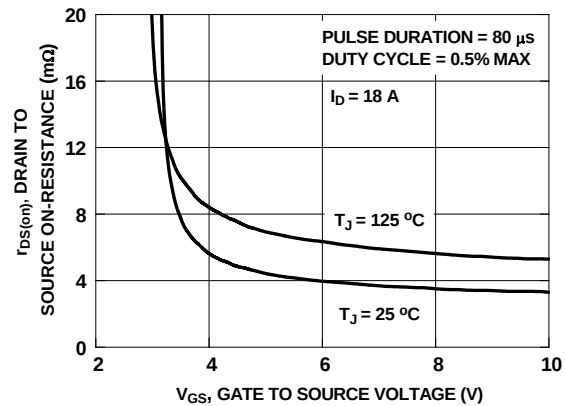


Figure 4. On-Resistance vs Gate to Source Voltage

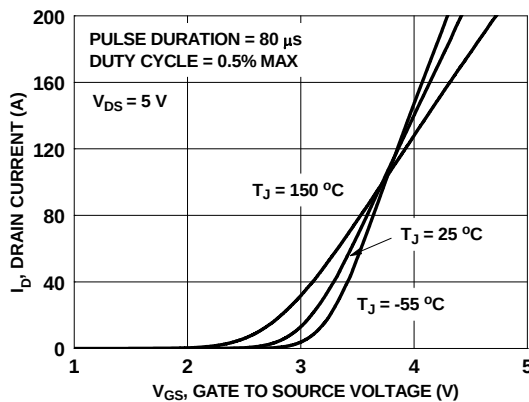


Figure 5. Transfer Characteristics

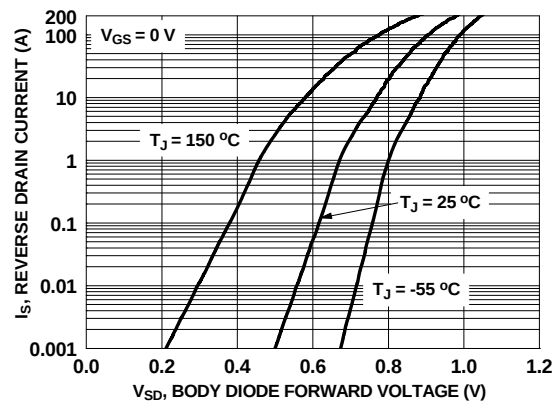


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

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

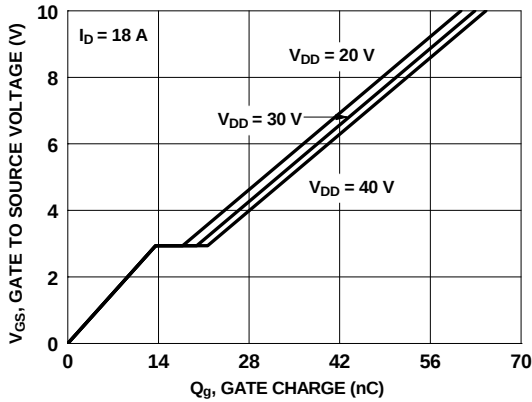


Figure 7. Gate Charge Characteristics

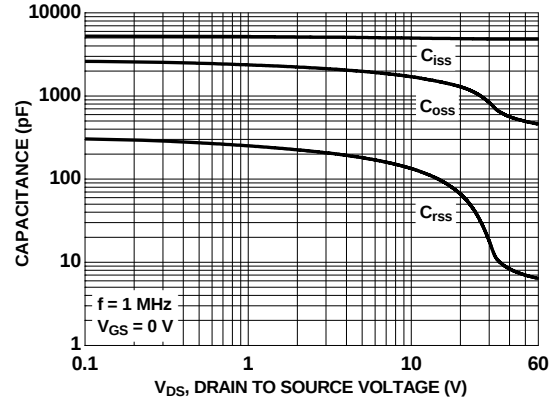


Figure 8. Capacitance vs Drain to Source Voltage

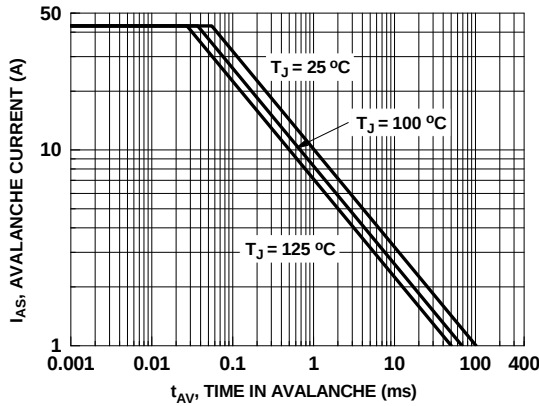


Figure 9. Unclamped Inductive Switching Capability

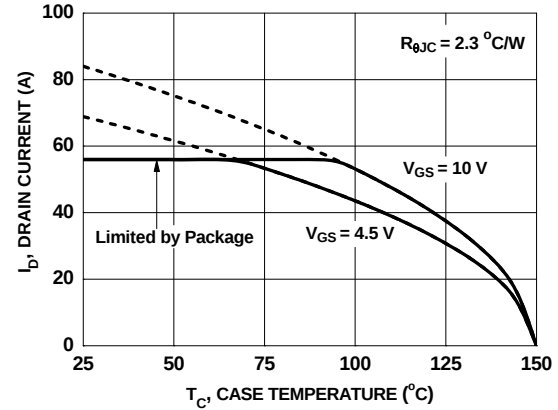


Figure 10. Maximum Continuous Drain Current vs Case Temperature

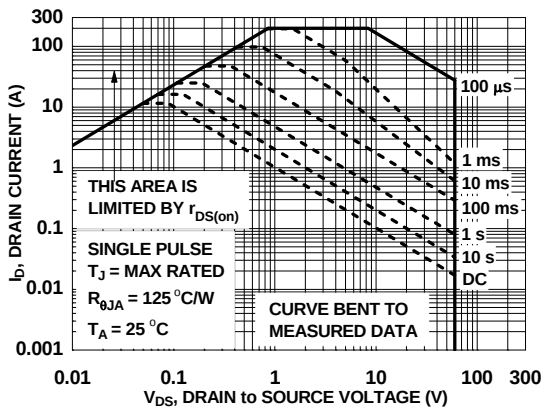


Figure 11. Forward Bias Safe Operating Area

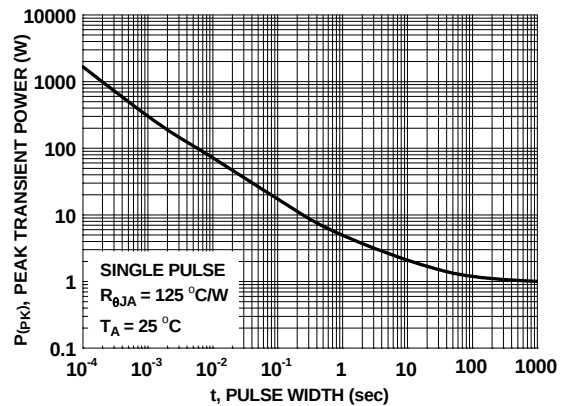
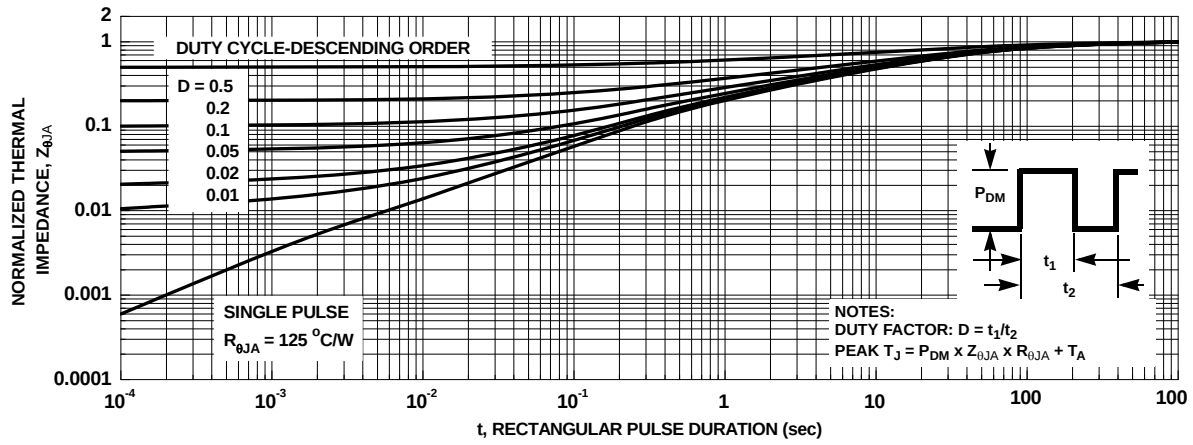
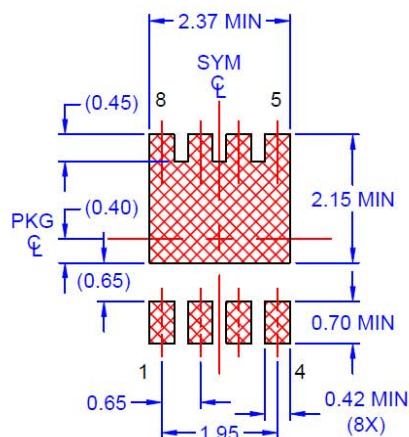
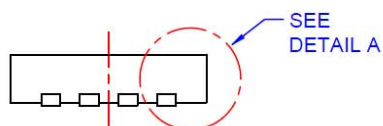
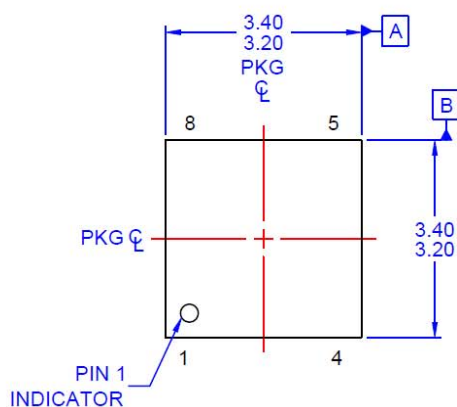


Figure 12. Single Pulse Maximum Power Dissipation

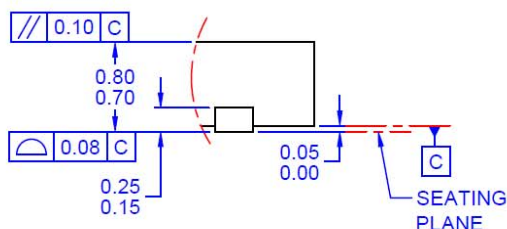
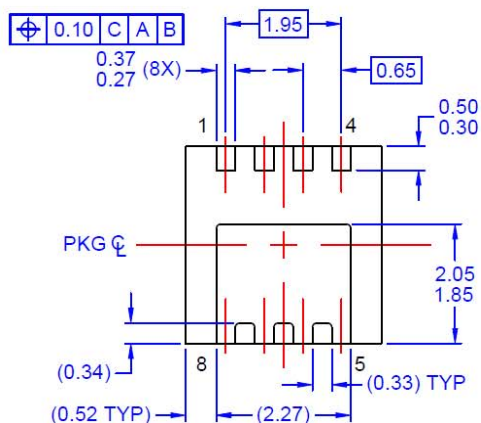
Typical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted



Dimensional Outline and Pad Layout



LAND PATTERN
RECOMMENDATION



DETAIL A
SCALE: 2X

NOTES: UNLESS OTHERWISE SPECIFIED

- A) PACKAGE STANDARD REFERENCE: JEDEC MO-240, ISSUE A, VAR. BA, DATED OCTOBER 2002.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.
- C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
- D) DIMENSIONING AND TOLERANCING PER ASME Y14.5M-1994.
- E) DRAWING FILE NAME:

2Cool™
 AccuPower™
 AX-CAP®
 BitSiC™
 Build it Now™
 CorePLUS™
 CorePOWER™
 CROSSVOLT™
 CTL™
 Current Transfer Logic™
 DEUXPEED®
 Dual Cool™
 EcoSPARK®
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 and Better™
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 MicroPak2™
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PowerTrench[®]
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Programmable Active Droop[™]
QFET[®]
QS[™]
Quiet Series[™]
RapidConfigure[™]
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Saving our world, 1mW/W/kW at a time[™]
SignalWise[™]
SmartMax[™]
SMART Series[™]
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SPM[®]
STEALTH[™]
SuperFET[®]
SuperSOT^{™-3}
SuperSOT^{™-6}
SuperSOT^{™-8}
SupreMOS[®]
SvncFET[™]



Sync-Lock™
E SYSTEM®*
 GENERAL
 TinyBoost™
 TinyBuck™
 TinyCalc™
 TinyLogic®
 TINYOPTO™
 TinyPower™
 TinyPWM™
 TinyWire™
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 SerDes®
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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.