

FGA50N60LS

General Description

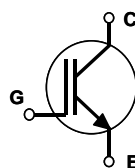
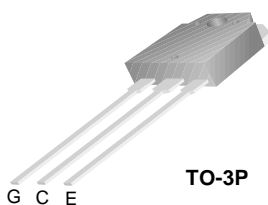
Fairchild's LS series product of Insulated Gate Bipolar Transistors (IGBTs) provides low conduction and switching losses as well as short circuit ruggedness. The LS series is especially designed for applications in medium frequencies such as switched reluctance motor controls, AC & DC motor controls, general inverters etc.

Features

- Short circuit rated 10 μ s @ $T_C = 100^\circ\text{C}$, $V_{GE} = 15\text{V}$
- Low saturation voltage : $V_{CE(sat)} = 1.6\text{V}$ @ $I_C = 50\text{A}$
- High input impedance
- Optimized for medium operating frequencies (1~5kHz)

Applications

Switched Reluctance Motor Controls , AC & DC motor controls, general purpose inverters, Robotics, and Servo controls



Absolute Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Description	FGA50N60LS	Units
V_{CES}	Collector-Emitter Voltage	600	V
V_{GES}	Gate-Emitter Voltage	± 20	V
I_C	Collector Current @ $T_C = 25^\circ\text{C}$	100	A
	Collector Current @ $T_C = 100^\circ\text{C}$	50	A
$I_{CM(1)}$	Pulsed Collector Current	150	A
T_{SC}	Short Circuit Withstand Time @ $T_C = 100^\circ\text{C}$	10	μs
P_D	Maximum Power Dissipation @ $T_C = 25^\circ\text{C}$	240	W
	Maximum Power Dissipation @ $T_C = 100^\circ\text{C}$	96	W
T_J	Operating Junction Temperature	-55 to +150	$^\circ\text{C}$
T_{stg}	Storage Temperature Range	-55 to +150	$^\circ\text{C}$
T_L	Maximum Lead Temp. for soldering Purposes, 1/8" from case for 5 seconds	300	$^\circ\text{C}$

Notes :

(1) Repetitive rating : Pulse width limited by max. junction temperature

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Units
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.52	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	$^\circ\text{C}/\text{W}$

Electrical Characteristics of the IGBT $T_C = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
Off Characteristics						
BV_{CES}	Collector-Emitter Breakdown Voltage	$V_{GE} = 0V, I_C = 250\mu A$	600	--	--	V
$\frac{\Delta BV_{CES}}{\Delta T_J}$	Temperature Coefficient of Breakdown Voltage	$V_{GE} = 0V, I_C = 1mA$	--	0.6	--	$V/^\circ C$
I_{CES}	Collector Cut-Off Current	$V_{CE} = V_{CES}, V_{GE} = 0V$	--	--	250	μA
I_{GES}	G-E Leakage Current	$V_{GE} = V_{GES}, V_{CE} = 0V$	--	--	± 100	nA
On Characteristics						
$V_{GE(th)}$	G-E Threshold Voltage	$I_C = 50mA, V_{CE} = V_{GE}$	3.5	5.5	7.5	V
$V_{CE(sat)}$	Collector to Emitter Saturation Voltage	$I_C = 50A, V_{GE} = 15V$	--	1.6	1.8	V
		$I_C = 80A, V_{GE} = 15V$	--	1.96	--	V
Dynamic Characteristics						
C_{ies}	Input Capacitance	$V_{CE} = 30V, V_{GE} = 0V,$ $f = 1MHz$	--	2660	--	pF
C_{oes}	Output Capacitance		--	250	--	pF
C_{res}	Reverse Transfer Capacitance		--	78	--	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300V, I_C = 50A,$ $R_G = 5.9\Omega, V_{GE} = 15V,$ Inductive Load, $T_C = 25^\circ C$	--	54	--	ns
t_r	Rise Time		--	96	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	146	220	ns
t_f	Fall Time		--	326	600	ns
E_{on}	Turn-On Switching Loss		--	1.1	--	mJ
E_{off}	Turn-Off Switching Loss		--	3.2	--	mJ
E_{ts}	Total Switching Loss	--	4.3	6.0	mJ	
$t_{d(on)}$	Turn-On Delay Time	$V_{CC} = 300V, I_C = 50A,$ $R_G = 5.9\Omega, V_{GE} = 15V,$ Inductive Load, $T_C = 125^\circ C$	--	56	--	ns
t_r	Rise Time		--	87	--	ns
$t_{d(off)}$	Turn-Off Delay Time		--	134	215	ns
t_f	Fall Time		--	575	880	ns
E_{on}	Turn-On Switching Loss		--	1.2	--	mJ
E_{off}	Turn-Off Switching Loss		--	5.0	--	mJ
E_{ts}	Total Switching Loss	--	6.2	8.7	mJ	
T_{sc}	Short Circuit Withstand Time	$V_{CC} = 300V, V_{GE} = 15V$ @ $T_C = 100^\circ C$	10	--	--	μs
Q_g	Total Gate Charge	$V_{CE} = 300V, I_C = 50A,$ $V_{GE} = 15V$	--	167	240	nC
Q_{ge}	Gate-Emitter Charge		--	27	35	nC
Q_{gc}	Gate-Collector Charge		--	68	100	nC
L_e	Internal Emitter Inductance	Measured 5mm from PKG	--	14	--	nH

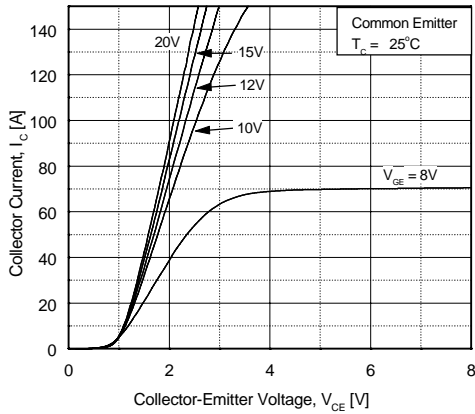


Fig 1. Typical Output Characteristics

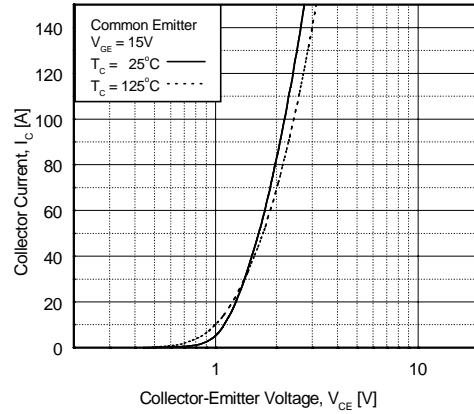


Fig 2. Typical Saturation Voltage Characteristics

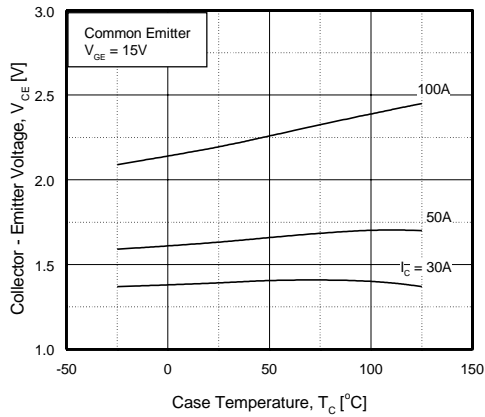


Fig 3. Saturation Voltage vs. Case Temperature at Variant Current Level

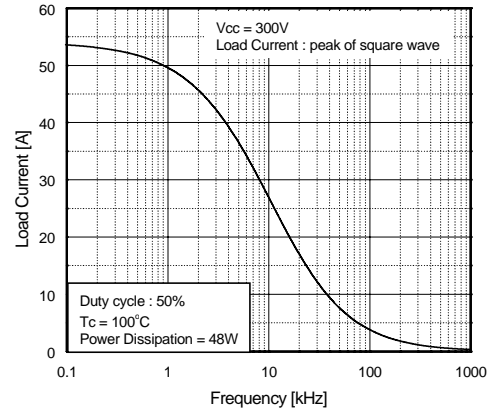


Fig 4. Load Current vs. Frequency

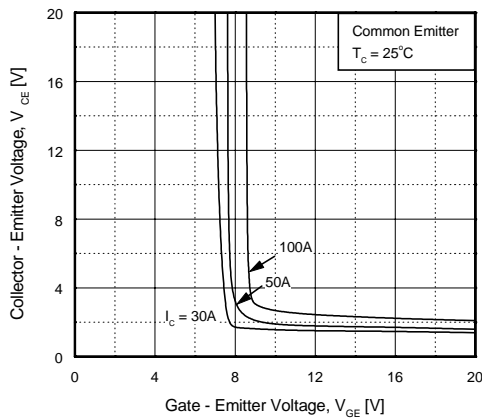


Fig 5. Saturation Voltage vs. V_{GE}

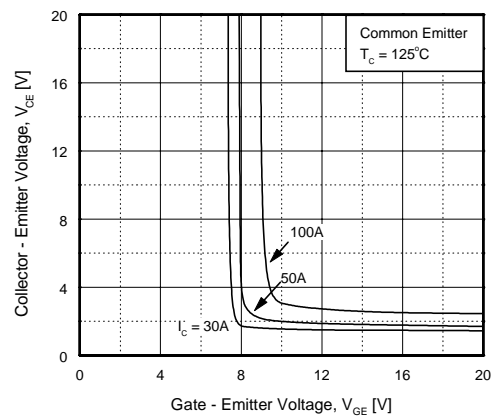


Fig 6. Saturation Voltage vs. V_{GE}

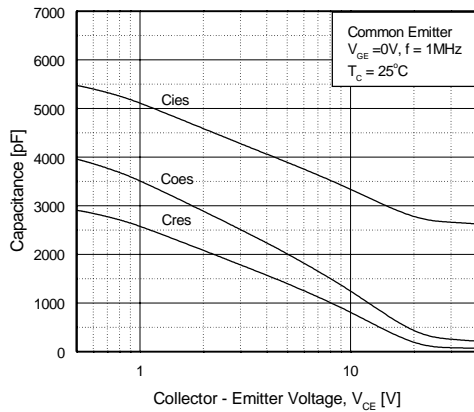


Fig 7. Capacitance Characteristics

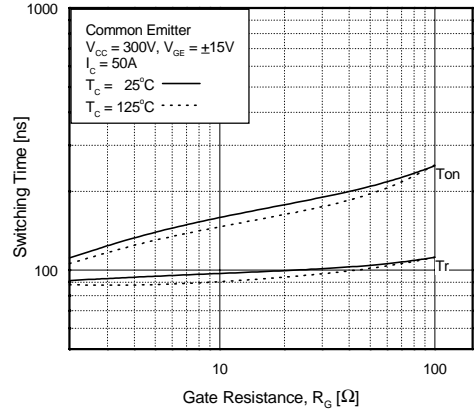


Fig 8. Turn-On Characteristics vs. Gate Resistance

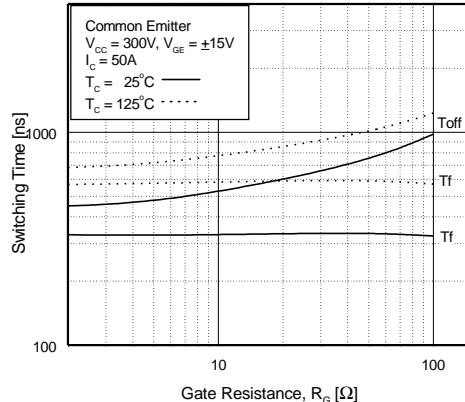


Fig 9. Turn-Off Characteristics vs. Gate Resistance

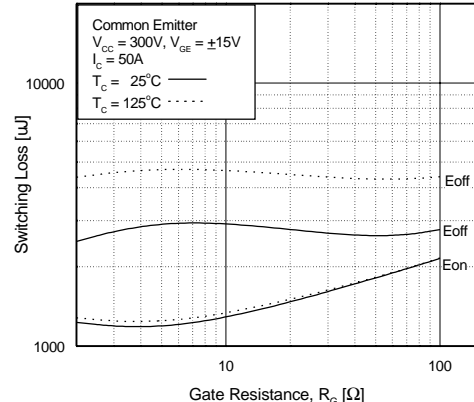


Fig 10. Switching Loss vs. Gate Resistance

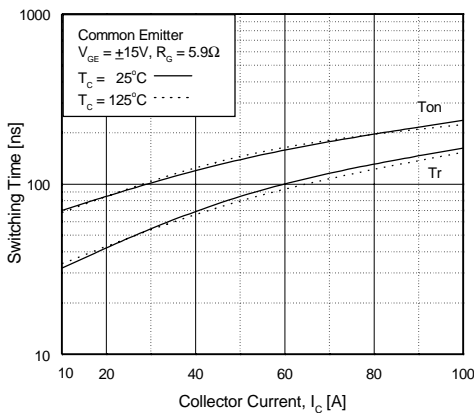


Fig 11. Turn-On Characteristics vs. Collector Current

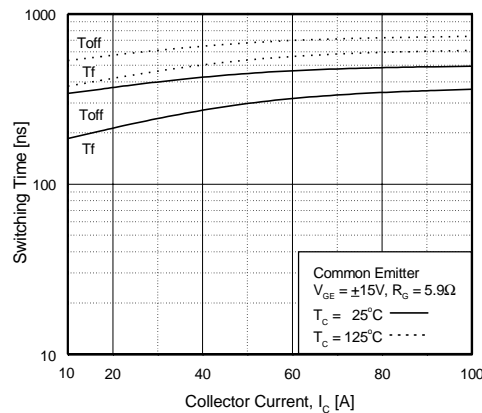


Fig 12. Turn-Off Characteristics vs. Collector Current

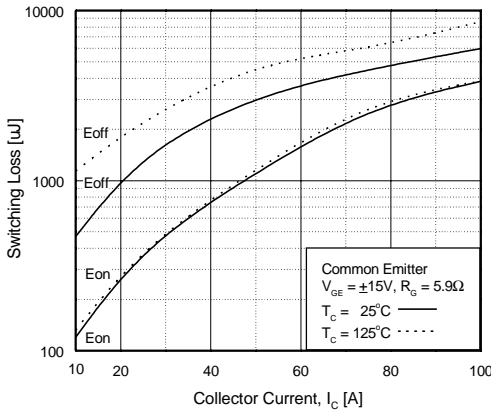


Fig 13. Switching Loss vs. Collector Current

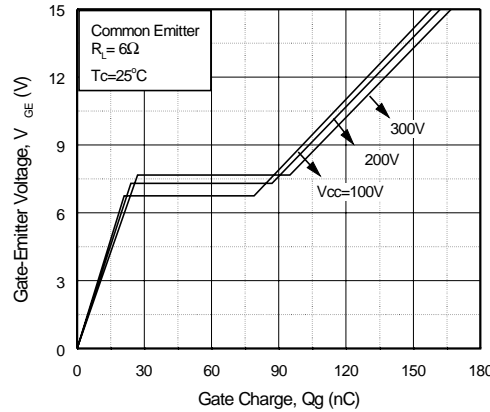


Fig 14. Gate Charge Characteristics

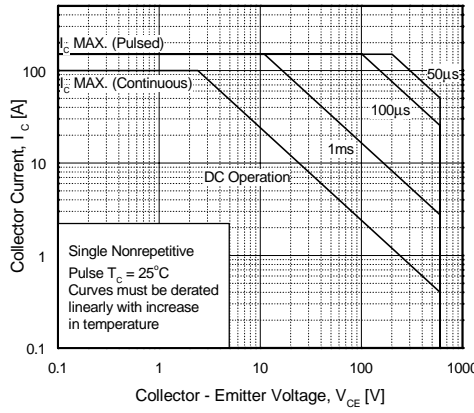


Fig 15. SOA Characteristics

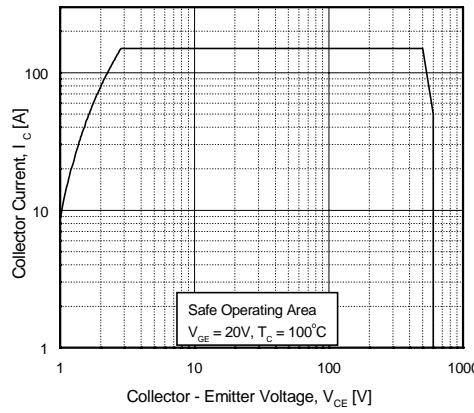


Fig 16. Turn-Off SOA

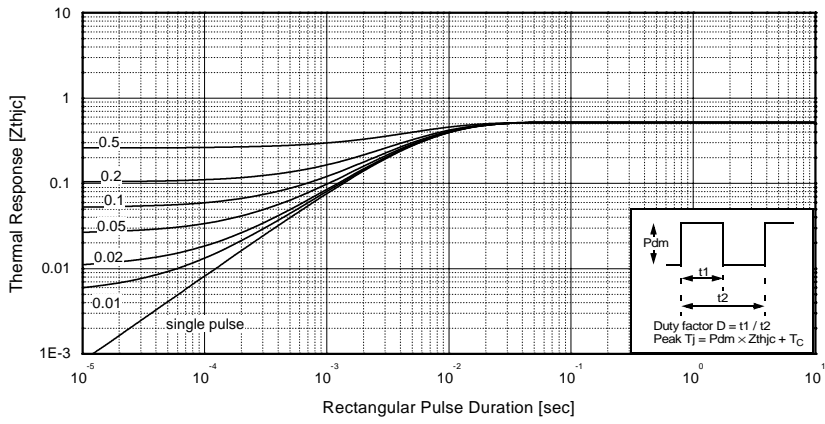
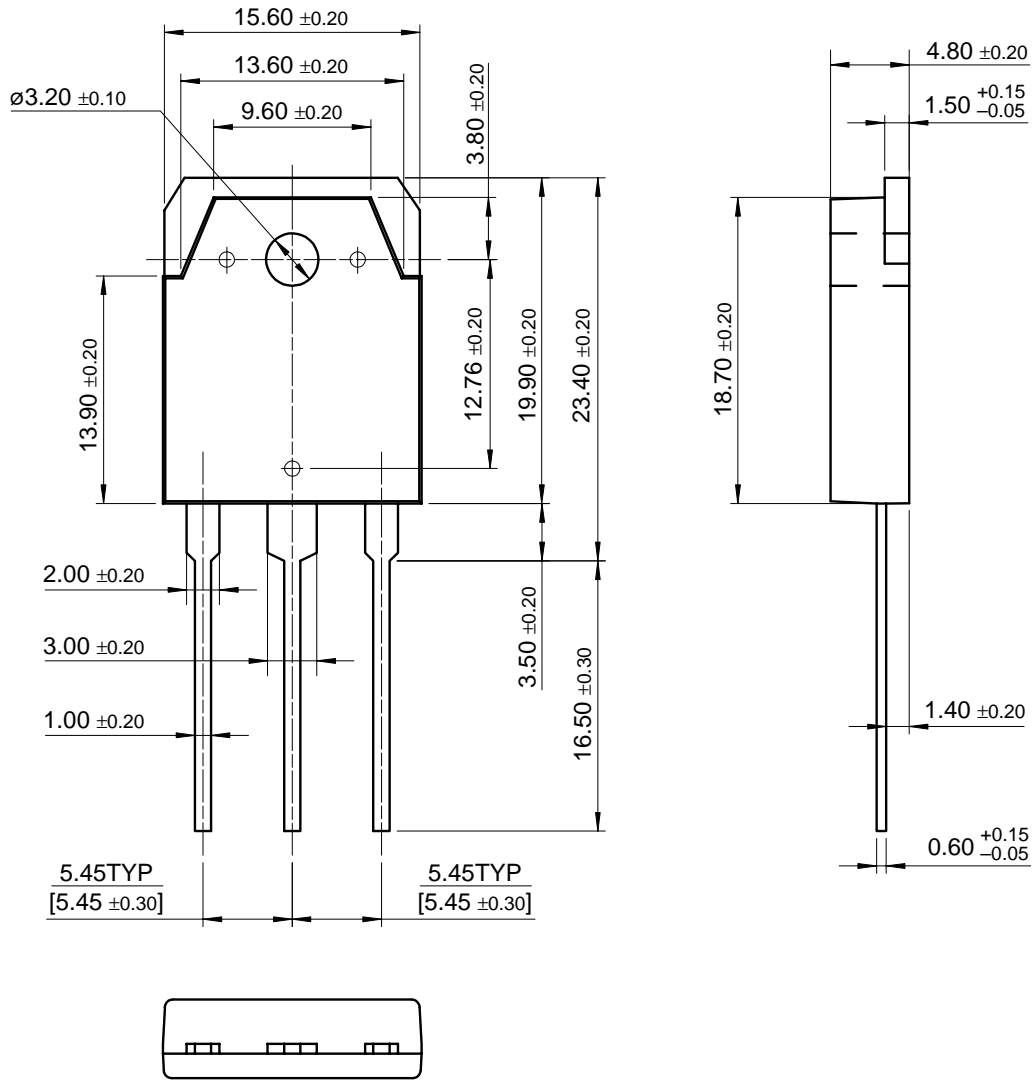


Fig 17. Transient Thermal Impedance of IGBT

Package Dimension

TO-3P



Dimensions in Millimeters

FGA50N60LS

TRADEMARKS

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

ACE ^x TM	FACT Quiet Series TM	LittleFET TM	Power247 TM	SuperSOT TM -6
ActiveArray TM	FAST [®]	MICROCOUPLER TM	PowerTrench [®]	SuperSOT TM -8
Bottomless TM	FAST ^r TM	MicroFET TM	QFET [®]	SyncFET TM
CoolFET TM	FRFET TM	MicroPak TM	QS TM	TinyLogic [®]
CROSSVOLT TM	GlobalOptoisolator TM	MICROWIRE TM	QT Optoelectronics TM	TINYOPTO TM
DOMET TM	GTO TM	MSX TM	Quiet Series TM	TruTranslation TM
EcoSPARK TM	HiSeC TM	MSXPro TM	RapidConfigure TM	UHC TM
E ² CMOS TM	I ² C TM	OCX TM	RapidConnect TM	UltraFET [®]
EnSigna TM	ImpliedDisconnect TM	OCXPro TM	SILENT SWITCHER [®]	VCX TM
FACT TM	ISOPLANAR TM	OPTOLOGIC [®]	SMART START TM	
Across the board. Around the world. TM		OPTOPLANAR TM	SPM TM	
The Power Franchise TM		PACMAN TM	Stealth TM	
Programmable Active Droop TM		POP TM	SuperSOT TM -3	

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.

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, or (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 significant injury to the user.
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.

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, 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.
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.