FAIRCHILD SEMICONDUCTOR®

FDA59N30

300V N-Channel MOSFET

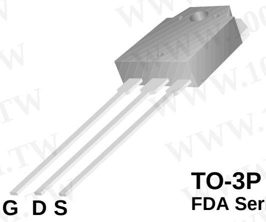
Features

- 59A, 300V, $R_{DS(on)}$ = 0.056Ω @V_{GS} = 10 V
- Low gate charge (typical 77 nC)
- Low C_{rss} (typical 80 pF)
- Fast switching
- 100% avalanche tested
- Improved dv/dt capability

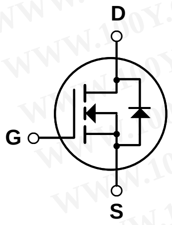
Description

These N-Channel enhancement mode power field effect transistors are produced using Fairchild's proprietary, planar stripe, DMOS technology.

This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficient switched mode power supplies and active power factor correction.



TO-3P
FDA Series



Absolute Maximum Ratings

Symbol	Parameter			FDA59N30	Unit
V_{DSS}	Drain-Source Voltage			300	V
I_D	Drain Current	- Continuous (T_C = 25°C) - Continuous (T_C = 100°C)		59 35	A A
I_{DM}	Drain Current	- Pulsed	(Note 1)	236	A
V_{GSS}	Gate-Source voltage			±30	V
E_{AS}	Single Pulsed Avalanche Energy		(Note 2)	1734	mJ
I_{AR}	Avalanche Current		(Note 1)	59	A
E_{AR}	Repetitive Avalanche Energy		(Note 1)	50	mJ
dv/dt	Peak Diode Recovery dv/dt		(Note 3)	4.5	V/ns
P_D	Power Dissipation	(T_C = 25°C) - Derate above 25°C		500 4	W W/°C
T_J, T_{STG}	Operating and Storage Temperature Range			-55 to +150	°C
T_L	Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds			300	°C

Thermal Characteristics

Symbol	Parameter	Min.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	--	0.25	°C/W
$R_{\theta CS}$	Thermal Resistance, Case-to-Sink	0.24	--	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	--	40	°C/W

Package Marking and Ordering Information

Device Marking	Device	Package	Reel Size	Tape Width	Quantity
FDA59N30	FDA59N30	TO-3P	-	-	30

Electrical Characteristics $T_C = 25°C$ unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max	Units
Off Characteristics						
BV_{DSS}	Drain-Source Breakdown Voltage	V_{GS} = 0V, I_D = 250μA	300	--	--	V
$\Delta BV_{DSS} / \Delta T_J$	Breakdown Voltage Temperature Coefficient	I_D = 250μA, Referenced to 25°C	--	0.3	--	V/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = 300V, V_{GS} = 0V V_{DS} = 240V, T_C = 125°C	-- --	-- --	1 10	μA μA
I_{GSSF}	Gate-Body Leakage Current, Forward	V_{GS} = 30V, V_{DS} = 0V	--	--	100	nA
I_{GSSR}	Gate-Body Leakage Current, Reverse	V_{GS} = -30V, V_{DS} = 0V	--	--	-100	nA
On Characteristics						
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 250μA	3.0	--	5.0	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS} = 10V, I_D = 29.5A	--	0.047	0.056	Ω
g_{FS}	Forward Transconductance	V_{DS} = 40V, I_D = 29.5A (Note 4)	--	52	--	S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz	--	3590	4670	pF
C_{oss}	Output Capacitance		--	710	920	pF
C_{rss}	Reverse Transfer Capacitance		--	80	120	pF
Switching Characteristics						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 150V, I_D = 59A R_G = 25Ω (Note 4, 5)	--	140	290	ns
t_r	Turn-On Rise Time		--	575	1160	ns
$t_{d(off)}$	Turn-Off Delay Time		--	120	250	ns
t_f	Turn-Off Fall Time		--	200	410	ns
Q_g	Total Gate Charge	V_{DS} = 240V, I_D = 59A V_{GS} = 10V (Note 4, 5)	--	77	100	nC
Q_{gs}	Gate-Source Charge		--	22	--	nC
Q_{gd}	Gate-Drain Charge		--	40	--	nC
Drain-Source Diode Characteristics and Maximum Ratings						
I_S	Maximum Continuous Drain-Source Diode Forward Current		--	--	59	A
I_{SM}	Maximum Pulsed Drain-Source Diode Forward Current		--	--	236	A
V_{SD}	Drain-Source Diode Forward Voltage	V_{GS} = 0V, I_S = 59A	--	--	1.4	V
t_{rr}	Reverse Recovery Time	V_{GS} = 0V, I_S = 59A dI_F/dt =100A/μs (Note 4)	--	246	--	ns
Q_{rr}	Reverse Recovery Charge		--	6.9	--	μC

NOTES:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. L = 0.83mH, I_{AS} = 59A, V_{DD} = 50V, R_G = 25Ω, Starting T_J = 25°C
3. $I_{SD} \leq 59A$, $di/dt \leq 200A/\mu s$, $V_{DD} \leq BV_{DSS}$, Starting T_J = 25°C
4. Pulse Test: Pulse width ≤ 300μs, Duty Cycle ≤ 2%
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

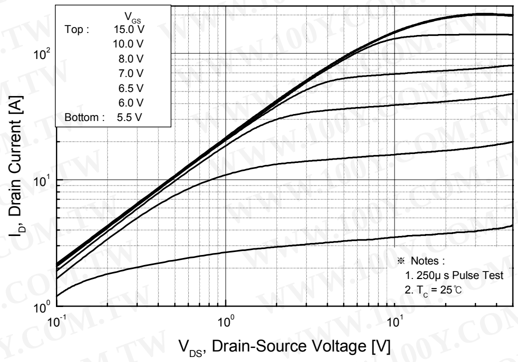


Figure 2. Transfer Characteristics

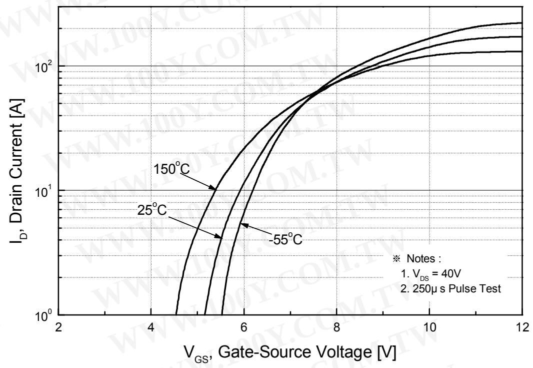


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

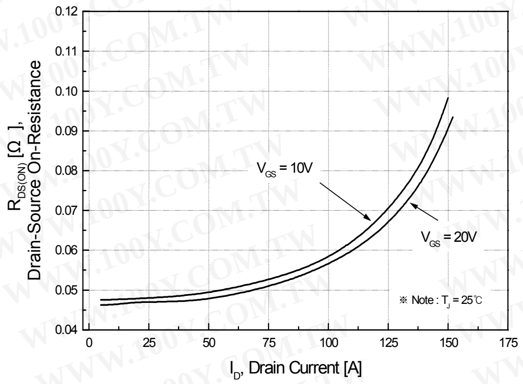


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperatue

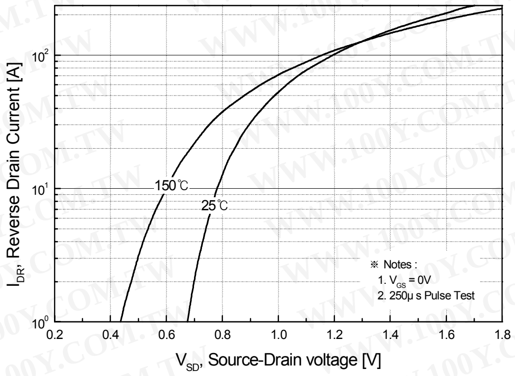


Figure 5. Capacitance Characteristics

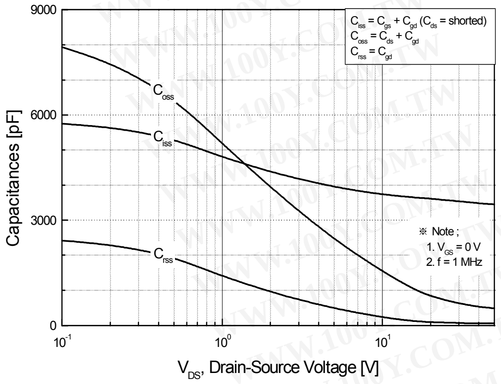
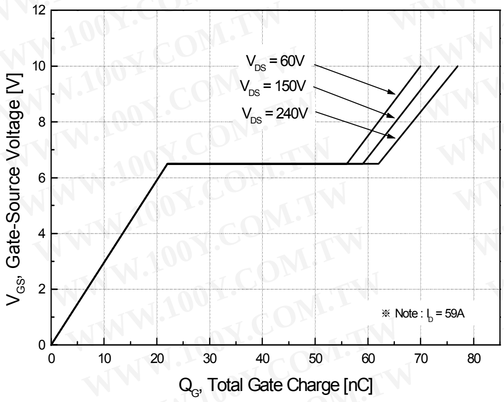


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

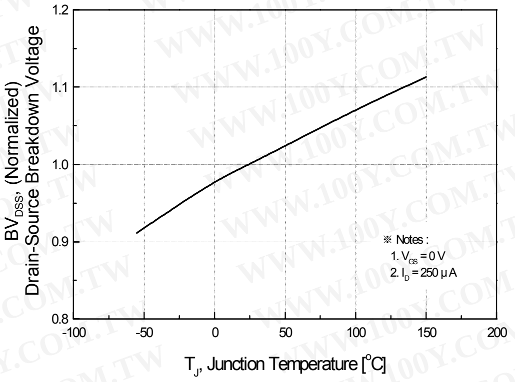


Figure 8. On-Resistance Variation vs. Temperature

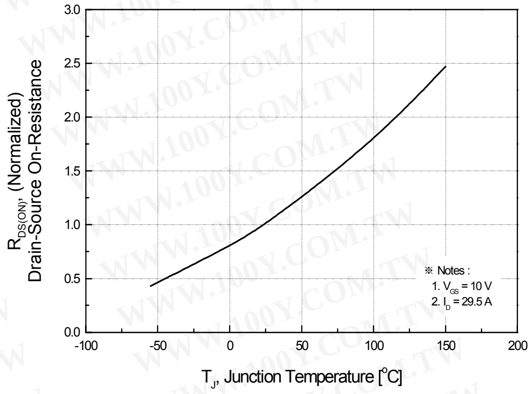


Figure 9. Maximum Safe Operating Area

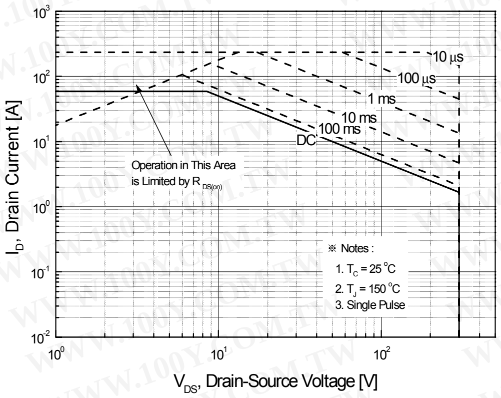


Figure 10. Maximum Drain Current vs. Case Temperature

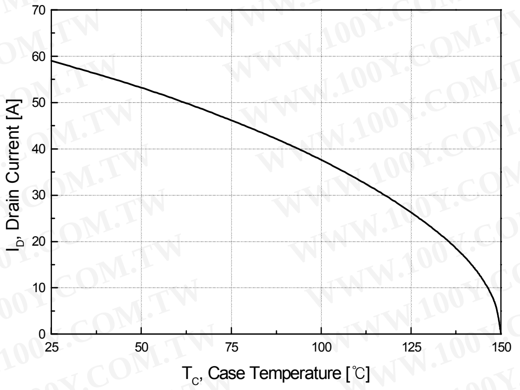
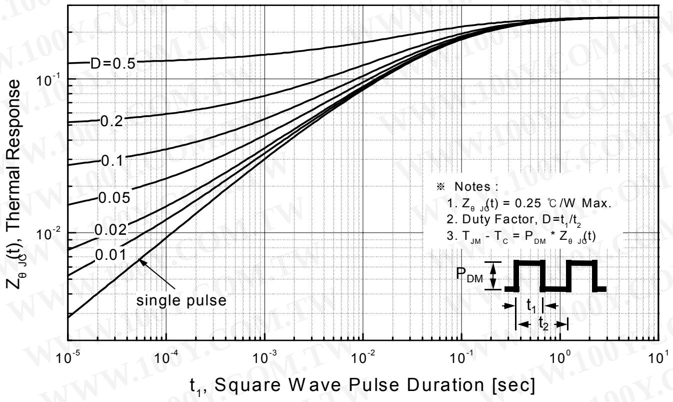
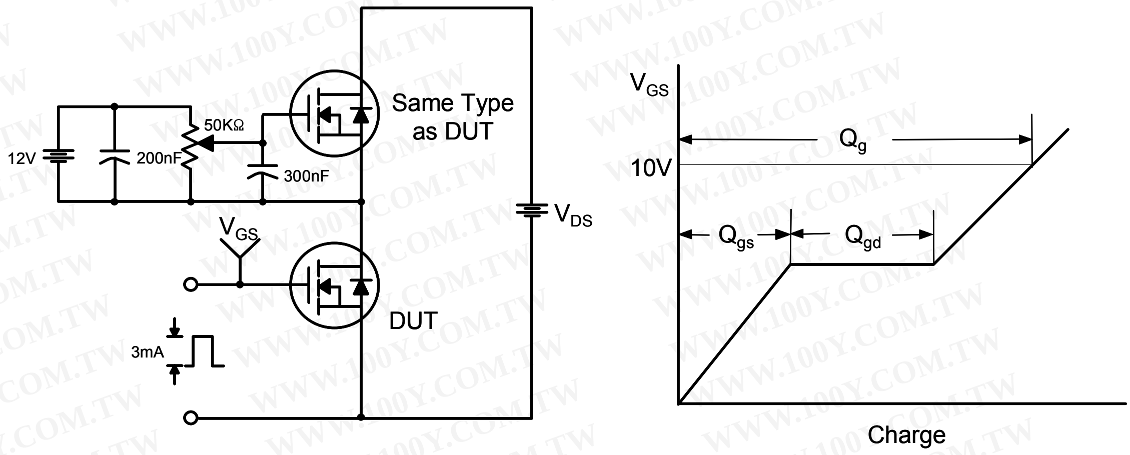


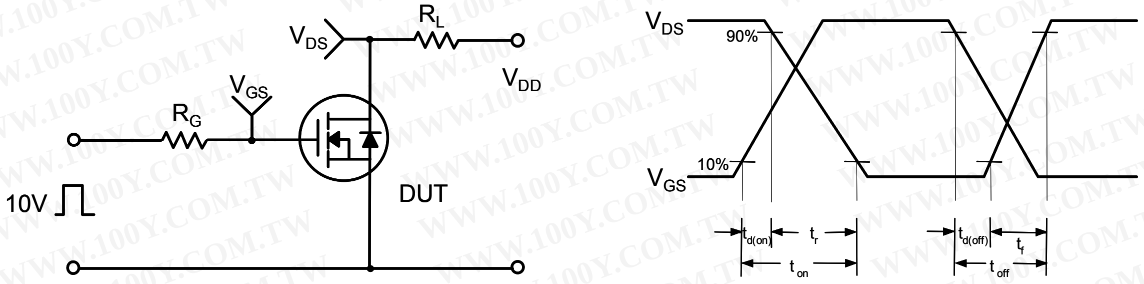
Figure 11. Transient Thermal Response Curve



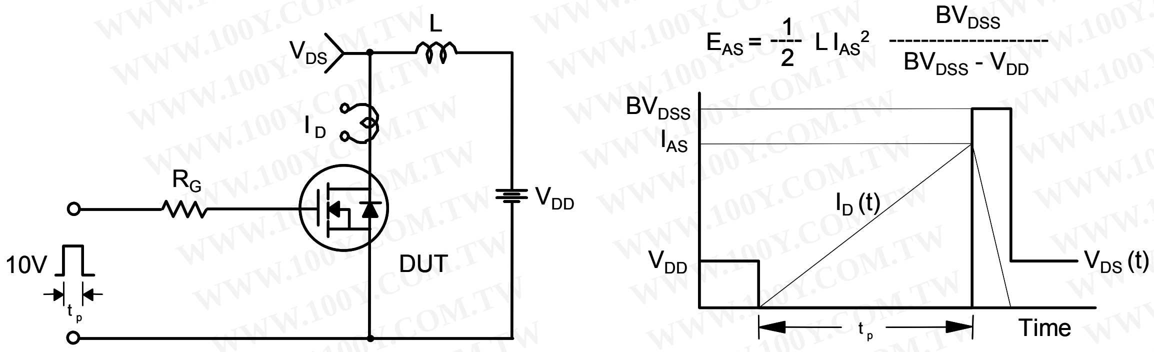
Gate Charge Test Circuit & Waveform



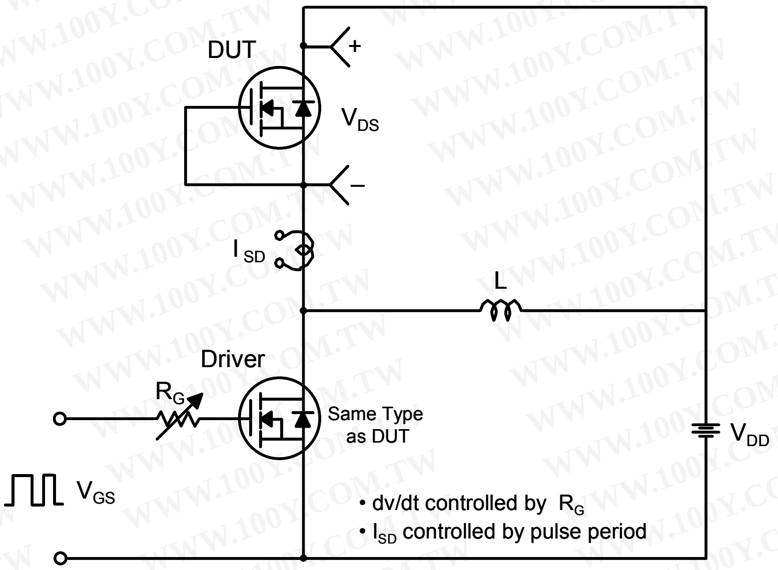
Resistive Switching Test Circuit & Waveforms



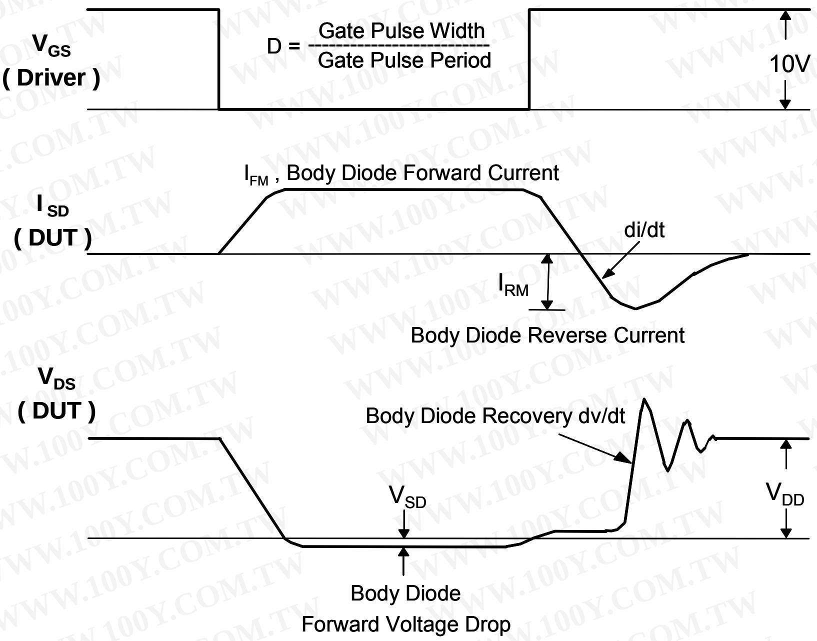
Unclamped Inductive Switching Test Circuit & Waveforms



Peak Diode Recovery dv/dt Test Circuit & Waveforms

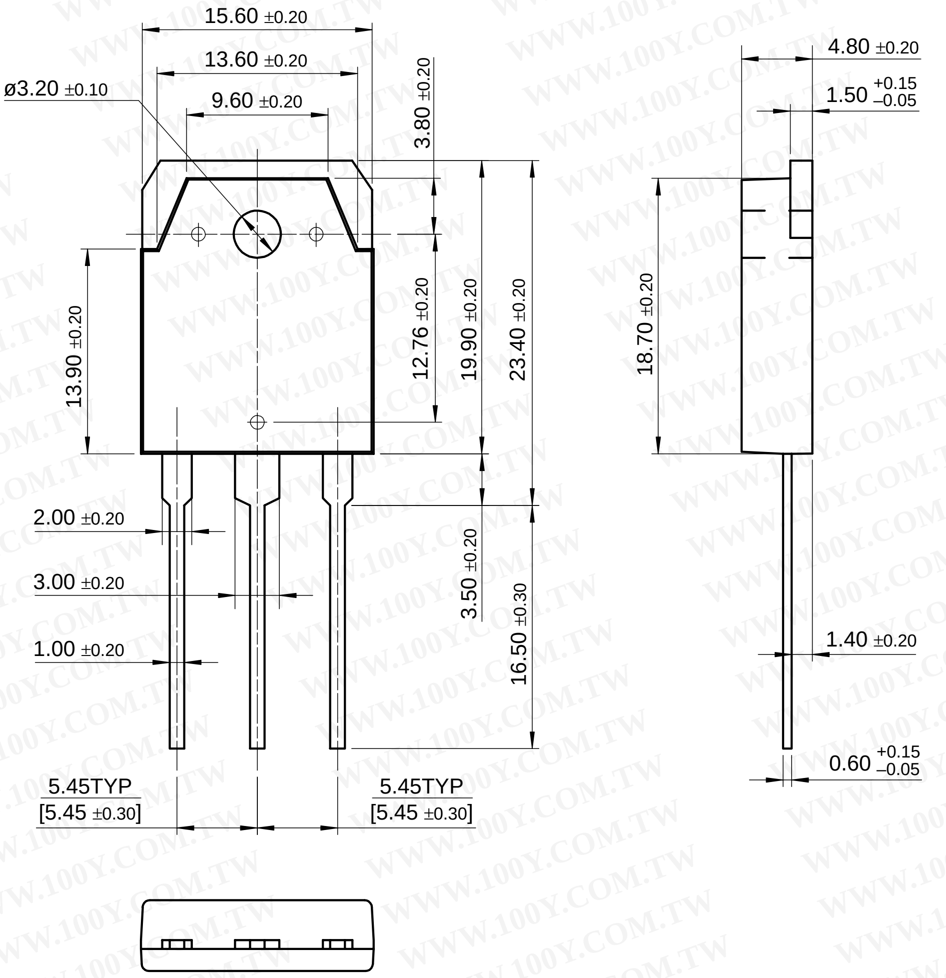


- dv/dt controlled by R_G
- I_{SD} controlled by pulse period



Mechanical Dimensions (Continued)

TO-3P



Dimensions in Millimeters