



February 2000
PRELIMINARY

FDS3690

100V N-Channel PowerTrench[®] MOSFET

General Description

This N-Channel MOSFET has been designed specifically to improve the overall efficiency of DC/DC converters using either synchronous or conventional switching PWM controllers.

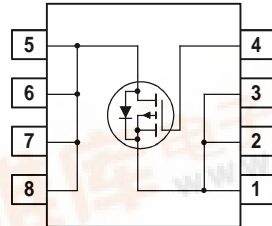
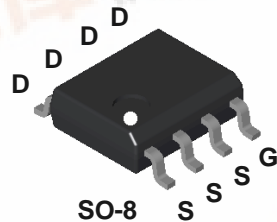
These MOSFETs feature faster switching and lower gate charge than other MOSFETs with comparable $R_{DS(ON)}$ specifications. The result is a MOSFET that is easy and safer to drive (even at very high frequencies), and DC/DC power supply designs with higher overall efficiency.

Applications

- DC/DC converter
- Motor Driver

Features

- 5 A, 100 V. $R_{DS(ON)} = 0.059 \Omega$ @ $V_{GS} = 10$ V
 $R_{DS(ON)} = 0.066 \Omega$ @ $V_{GS} = 6$ V
- Fast switching speed.
- Low gate charge
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability.



Absolute Maximum Ratings

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

Symbol	Parameter	Ratings	Units
V_{DSS}	Drain-Source Voltage	100	V
V_{GSS}	Gate-Source Voltage	± 20	V
I_D	Drain Current – Continuous (Note 1a)	5	A
	– Pulsed	40	
P_D	Power Dissipation for Single Operation (Note 1a) (Note 1b) (Note 1c)	2.5	W
		1.2	
		1.0	
T_J, T_{STG}	Operating and Storage Junction Temperature Range	-55 to +150	$^\circ\text{C}$

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1a)	50	$^\circ\text{C/W}$
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case (Note 1)	25	$^\circ\text{C/W}$

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape width	Quantity
FDS3690	FDS3690	13"	12mm	2500 units



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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics [JK3]						
BV_{DSS}	Drain–Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	100			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C		78		mV/ $^\circ\text{C}$
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 80\text{ V}, V_{GS} = 0\text{ V}$			25	μA
I_{GSSF}	Gate–Body Leakage, Forward	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			100	nA
I_{GSSR}	Gate–Body Leakage, Reverse	$V_{GS} = -20\text{ V}, V_{DS} = 0\text{ V}$			-100	nA

On Characteristics (Note 2)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2	2.4	4	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate Threshold Voltage Temperature Coefficient	$I_D = 250\text{ }\mu\text{A}$, Referenced to 25°C		-6.2		mV/ $^\circ\text{C}$
$R_{DS(on)}$	Static Drain–Source On–Resistance	$V_{GS} = 10\text{ V}, I_D = 5\text{ A}$ $V_{GS} = 10\text{ V}, I_D = 5\text{ A}, T_J = 125^\circ\text{C}$ $V_{GS} = 6\text{ V}, I_D = 4.4\text{ A}$		0.044 0.088 0.047	0.059 0.130 0.066	Ω
$I_{D(on)}$	On–State Drain Current	$V_{GS} = 10\text{ V}, V_{DS} = 5\text{ V}$	20			A
g_{FS}	Forward Transconductance	$V_{DS} = 5\text{ V}, I_D = 5\text{ A}$		20		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}, f = 1.0\text{ MHz}$		1514		pF
C_{oss}	Output Capacitance			82		pF
C_{rss}	Reverse Transfer Capacitance			44		pF

Switching Characteristics (Note 2)

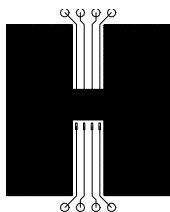
$t_{d(on)}$	Turn–On Delay Time	$V_{DD} = 50\text{ V}, V_{GS} = 10\text{ V}, I_D = 1\text{ A}, R_{GEN} = 6\text{ }\Omega$		11	20	ns
t_r	Turn–On Rise Time			6.5	15	ns
$t_{d(off)}$	Turn–Off Delay Time			29	60	ns
t_f	Turn–Off Fall Time			10	20	ns
Q_g	Total Gate Charge	$V_{DS} = 50\text{ V}, V_{GS} = 10\text{ V}, I_D = 5\text{ A}$		28	39	nC
Q_{gs}	Gate–Source Charge			6.2		nC
Q_{gd}	Gate–Drain Charge			5.4		nC

Drain–Source Diode Characteristics and Maximum Ratings

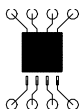
I _S	Maximum Continuous Drain–Source Diode Forward Current				2.1	A
V _{SD}	Drain–Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 2.1 A (Note 2)		0.73	1.2	V

Notes:

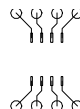
1. $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a) 50°/W when mounted on a 1 in² pad of 2 oz copper



b) 105°/W when mounted on a .04 in² pad of 2 oz copper



c) 125°/W when mounted on a minimum pad.

Scale 1 : 1 on letter size paper

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

Typical Characteristics

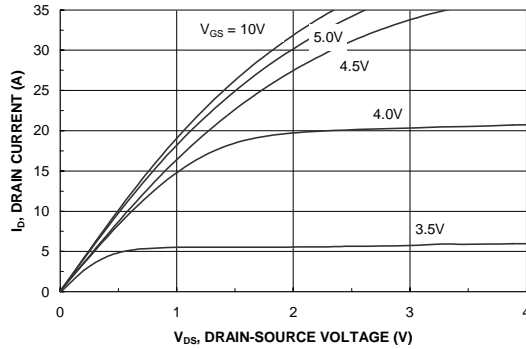


Figure 1. On-Region Characteristics.

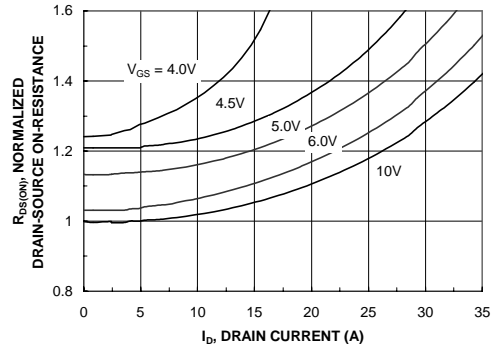


Figure 2. On-Resistance Variation with Drain Current and Gate Voltage.

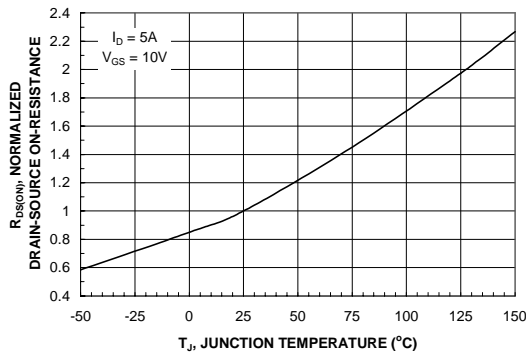


Figure 3. On-Resistance Variation with Temperature.

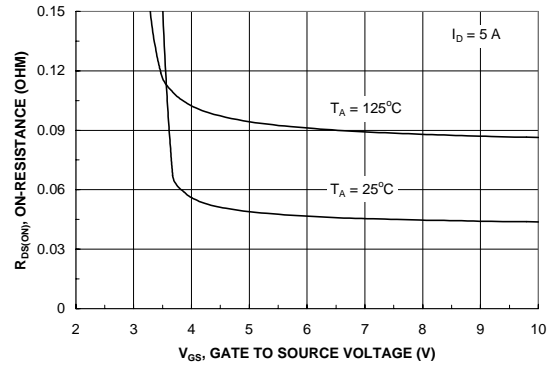


Figure 4. On-Resistance Variation with Gate-to-Source Voltage.

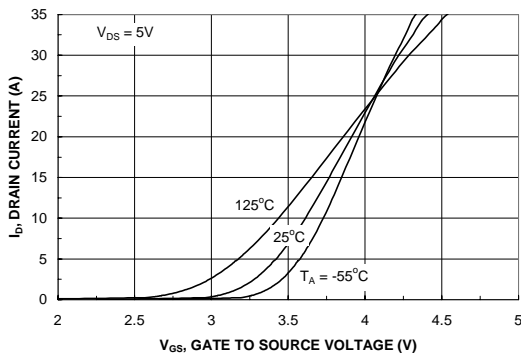


Figure 5. Transfer Characteristics.

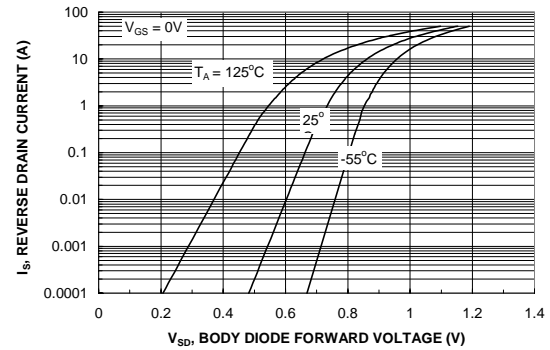


Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature.

Typical Characteristics

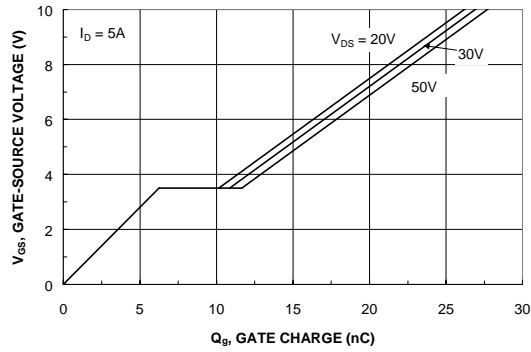


Figure 7. Gate Charge Characteristics.

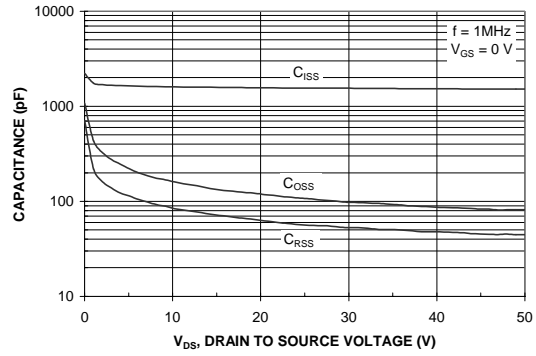


Figure 8. Capacitance Characteristics.

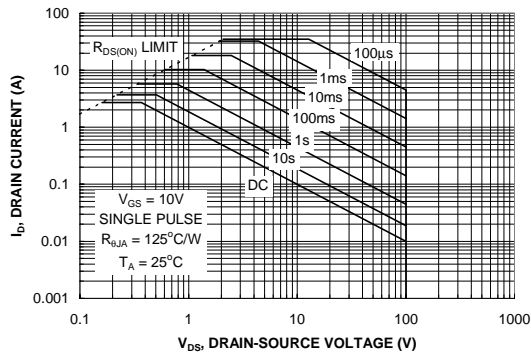


Figure 9. Maximum Safe Operating Area.

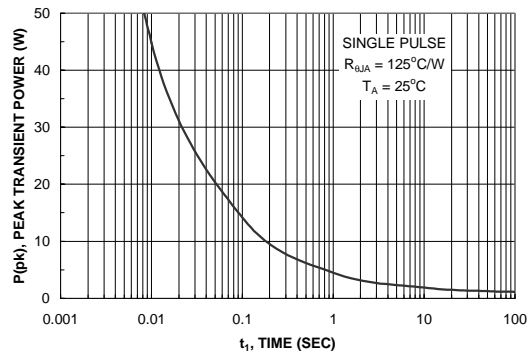


Figure 10. Single Pulse Maximum Power Dissipation.

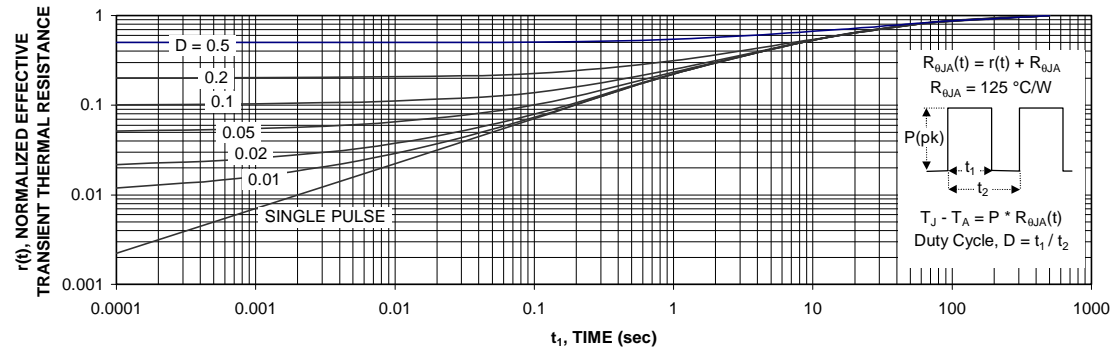


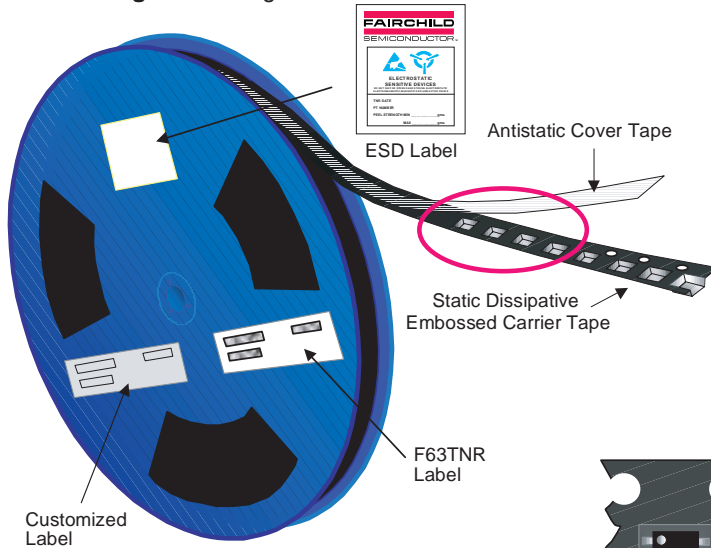
Figure 11. Transient Thermal Response Curve.

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

SO-8 Tape and Reel Data and Package Dimensions



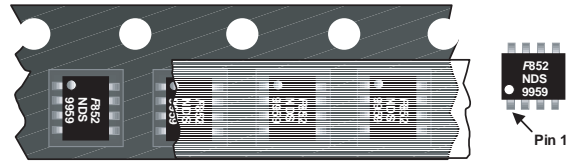
SOIC(8lds) Packaging Configuration: Figure 1.0



Packaging Description:

SOIC-8 parts are shipped in tape. The carrier tape is made from a dissipative (carbon filled) polycarbonate resin. The cover tape is a multilayer film (Heat Activated Adhesive in nature) primarily composed of polyester film, adhesive layer, sealant, and anti-static sprayed agent. These reeled parts in standard option are shipped with 2,500 units per 13" or 330cm diameter reel. The reels are dark blue in color and is made of polystyrene plastic (anti-static coated). Other option comes in 500 units per 7" or 177cm diameter reel. This and some other options are further described in the Packaging Information table.

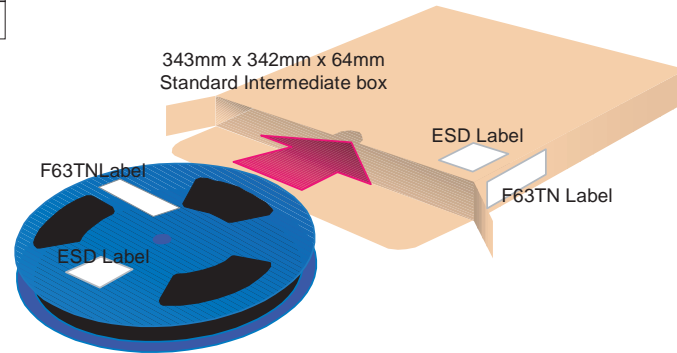
These full reels are individually barcode labeled and placed inside a standard intermediate box (illustrated in figure 1.0) made of recyclable corrugated brown paper. One box contains two reels maximum. And these boxes are placed inside a barcode labeled shipping box which comes in different sizes depending on the number of parts shipped.



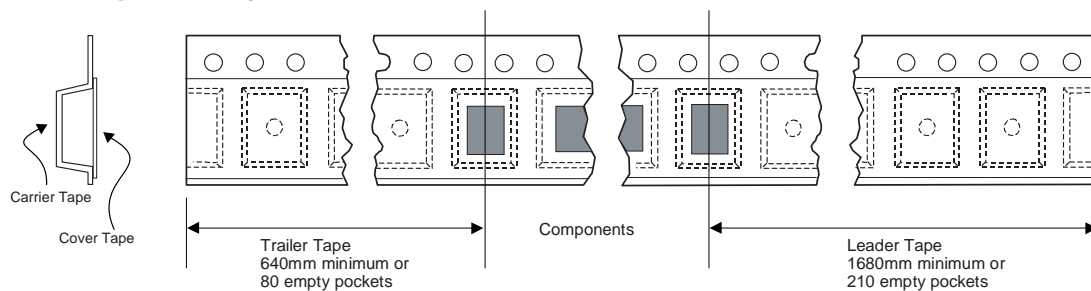
SOIC-8 Unit Orientation

SOIC (8lds) Packaging Information				
Packaging Option	Standard (no flow code)	L86Z	F011	D84Z
Packaging type	TNR	Rail/Tube	TNR	TNR
Qty per Reel/Tube/Bag	2,500	95	4,000	500
Reel Size	13" Dia	-	13" Dia	7" Dia
Box Dimension (mm)	343x64x343	530x130x83	343x64x343	184x187x47
Max qty per Box	5,000	30,000	8,000	1,000
Weight per unit (gm)	0.0774	0.0774	0.0774	0.0774
Weight per Reel (kg)	0.6060	-	0.9696	0.1182
Note/Comments				

F63TNR Label sample

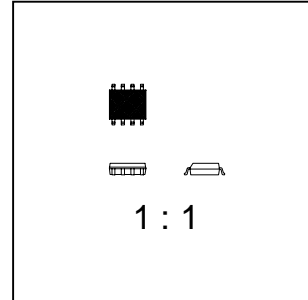
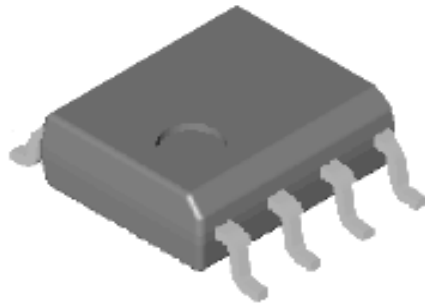


SOIC(8lds) Tape Leader and Trailer Configuration: Figure 2.0



SO-8 Tape and Reel Data and Package Dimensions, continued

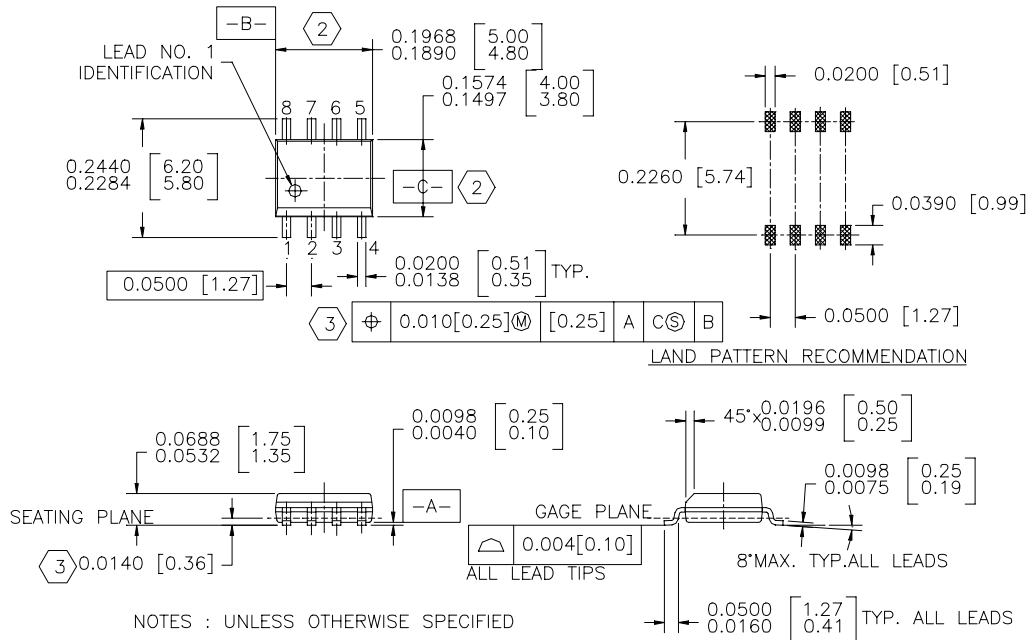
SOIC-8 (FS PKG Code S1)



Scale 1:1 on letter size paper

Dimensions shown below are in:
inches [millimeters]

Part Weight per unit (gram): 0.0774



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