

### FSS238-TL-E-VB Datasheet

# N-Channel 30-V (D-S) MOSFET

PRODUCT SUMMARY						
V <sub>DS</sub> (V)	$R_{DS(on)}$ ( $\Omega$ )	I <sub>D</sub> (A) <sup>a</sup>	Q <sub>g</sub> (Typ.)			
30	0.008 at V <sub>GS</sub> = 10 V	13	6.1 nC			
	0.011 at V <sub>GS</sub> = 4.5 V	11	0.1110			

**SO-8** 

Top View

D D

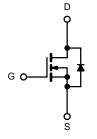
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#### **FEATURES**

- · Halogen-free
- Trench Power MOSFET
- Optimized for High-Side Synchronous Rectifier Operation
- 100 % R<sub>g</sub> Tested
- 100 % UIS Tested

#### **APPLICATIONS**

- Notebook CPU Core
  - High-Side Switch



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS	<b>S</b> T <sub>A</sub> = 25 °C, unles	s otherwise no	oted	
Parameter	Symbol	Limit	Unit	
Drain-Source Voltage	$V_{DS}$	30	V	
Gate-Source Voltage		$V_{GS}$	± 20	7 v
	T <sub>C</sub> = 25 °C		13	
Continuous Proin Current (T. – 150 °C)	T <sub>C</sub> = 70 °C	,	10	
Continuous Drain Current (T <sub>J</sub> = 150 °C)	T <sub>A</sub> = 25 °C	- I <sub>D</sub>	9 <sup>b, c</sup>	
	T <sub>A</sub> = 70 °C		7 <sup>b, c</sup>	
Pulsed Drain Current	I <sub>DM</sub>	45	A	
Continuous Course Desir Diede Current	T <sub>C</sub> = 25 °C	- I <sub>S</sub>	3.7	
Continuous Source-Drain Diode Current	T <sub>A</sub> = 25 °C		2.0 <sup>b, c</sup>	
Single Pulse Avalanche Current	L = 0.1 mH	I <sub>AS</sub>	20	
Avalanche Energy	L = 0.1 IIII	E <sub>AS</sub>	21	mJ
	T <sub>C</sub> = 25 °C		4.1	
Manianum Davian Disabation	T <sub>C</sub> = 70 °C	В	2.5	W
Maximum Power Dissipation	T <sub>A</sub> = 25 °C	P <sub>D</sub>	2,2 <sup>b, c</sup>	¬ vv
	T <sub>A</sub> = 70 °C		1.3 <sup>b, c</sup>	
Operating Junction and Storage Temperature Ra	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C	

THERMAL RESISTANCE RATINGS						
Parameter		Symbol	Typical	Maximum	Unit	
Maximum Junction-to-Ambient <sup>b, d</sup>	t ≤ 10 s	$R_{thJA}$	39	55	°C/W	
Maximum Junction-to-Foot (Drain)	Steady State	$R_{thJF}$	25	29	C/VV	

#### Notes:

- a. Base on  $T_C$  = 25 °C.
- b. Surface Mounted on 1" x 1" FR4 board.
- c. t = 10 s.
- d. Maximum under Steady State conditions is 85 °C/W.



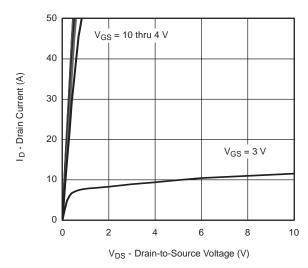
<b>SPECIFICATIONS</b> $T_J = 25  ^{\circ}\text{C}$ Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit	
Static				.,,,,			
Drain-Source Breakdown Voltage	V <sub>DS</sub>	$V_{GS} = 0 \text{ V}, I_{D} = 250 \mu\text{A}$	30			V	
V <sub>DS</sub> Temperature Coefficient	$\Delta V_{DS}/T_{J}$			26		mV/°C	
V <sub>GS(th)</sub> Temperature Coefficient	$\Delta V_{GS(th)}/T_J$	I <sub>D</sub> = 250 μA		- 6			
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	$V_{DS} = V_{GS}, I_{D} = 250 \mu\text{A}$	1.0		3.0	V	
Gate-Source Leakage	I <sub>GSS</sub>	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$			± 100	nA	
		V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V			1		
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 55 °C			10	μA	
On-State Drain Current <sup>a</sup>	I <sub>D(on)</sub>	$V_{DS} \ge 5 \text{ V}, V_{GS} = 10 \text{ V}$	20			Α	
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A		0.008		Ω	
Drain-Source On-State Resistance <sup>a</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 9 A		0.011			
Forward Transconductance <sup>a</sup>	9 <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 10 A		50		S	
Dynamic <sup>b</sup>				L		ı	
Input Capacitance	C <sub>iss</sub>			800			
Output Capacitance	C <sub>oss</sub>	$V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$		165		pF	
Reverse Transfer Capacitance	C <sub>rss</sub>			73			
Total Cata Charma	$Q_g$ $V_{DS} = 15 \text{ V}, V_{GS} = 10 \text{ V}, I_D$	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 10 A		15	23	nC	
Total Gate Charge				6.8	10.2		
Gate-Source Charge	$Q_{gs}$	$V_{DS} = 15 \text{ V}, V_{GS} = 5 \text{ V}, I_{D} = 10 \text{ A}$		2.5			
Gate-Drain Charge	$Q_{gd}$			2.3			
Gate Resistance	$R_g$	f = 1 MHz	0.36	1.8	3.6	Ω	
Turn-On Delay Time	t <sub>d(on)</sub>			16	23		
Rise Time	t <sub>r</sub>	$V_{DD}$ = 15 V, $R_L$ = 1.4 $\Omega$		12	16	]	
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D \cong 9 \text{ A}, V_{GEN} = 4.5 \text{ V}, R_g = 1 \Omega$		16	22		
Fall Time	t <sub>f</sub>			10	18	]	
Turn-On Delay Time	t <sub>d(on)</sub>			8	16	ns	
Rise Time	t <sub>r</sub>	$V_{DD}$ = 15 V, $R_L$ = 1.4 $\Omega$		10	20		
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D \cong 9 \text{ A}, V_{GEN} = 10 \text{ V}, R_g = 1 \Omega$		16	22		
Fall Time	t <sub>f</sub>			8	15		
Drain-Source Body Diode Characterist	ics						
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			10		
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>				50	A	
Body Diode Voltage	$V_{SD}$	I <sub>S</sub> = 9 A		0.8	1.2	V	
Body Diode Reverse Recovery Time	t <sub>rr</sub>			15	30	ns	
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>	I <sub>F</sub> = 9 A, dI/dt = 100 A/μs, T <sub>.I</sub> = 25 °C		6	12	nC	
Reverse Recovery Fall Time	t <sub>a</sub>	i <sub>F</sub> = θ A, αί/αι = 100 A/μs, 1 <sub>J</sub> = 25 °C		8		ns	
Reverse Recovery Rise Time	t <sub>b</sub>			7			

#### Notes:

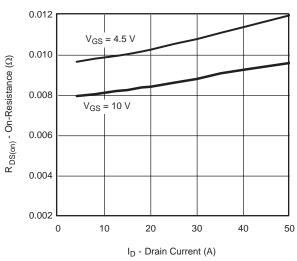
- a. Pulse test; pulse width  $\leq 300~\mu s,$  duty cycle  $\leq 2~\%.$
- b. Guaranteed by design, not subject to production testing.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

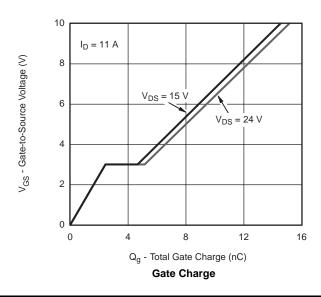




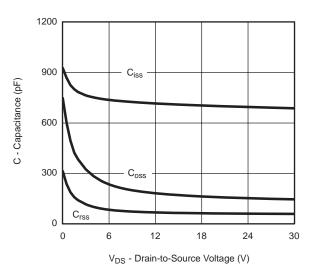
#### **Output Characteristics**



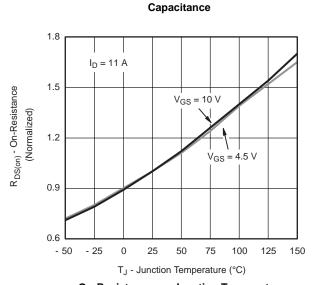
On-Resistance vs. Drain Current and Gate Voltage



V<sub>GS</sub> - Gate-to-Source Voltage (V) **Transfer Characteristics** 

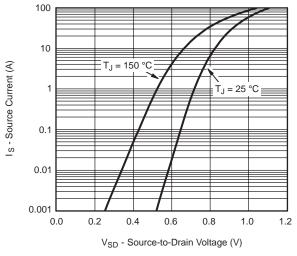


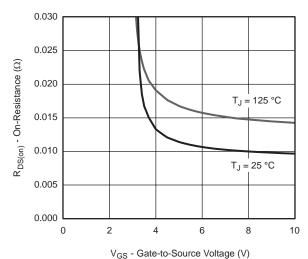
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On-Resistance vs. Junction Temperature

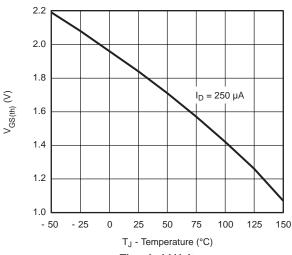


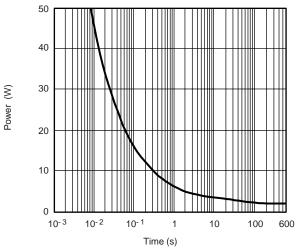




#### Source-Drain Diode Forward Voltage

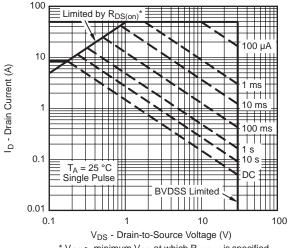






#### Threshold Voltage

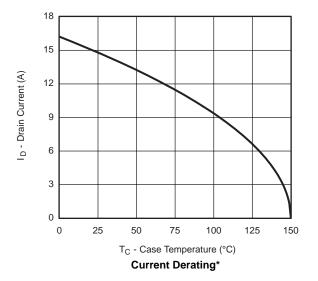
Single Pulse Power, Junction-to-Ambient

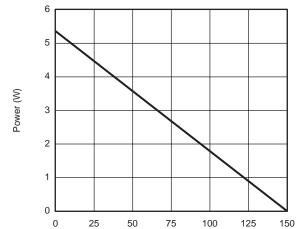


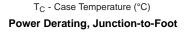
\*  $V_{\mbox{\footnotesize{GS}}} >$  minimum  $V_{\mbox{\footnotesize{GS}}}$  at which  $R_{\mbox{\footnotesize{DS(on)}}}$  is specified

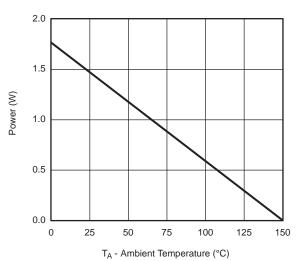
Safe Operating Area, Junction-to-Ambient







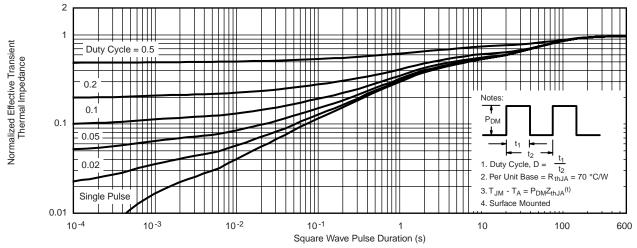




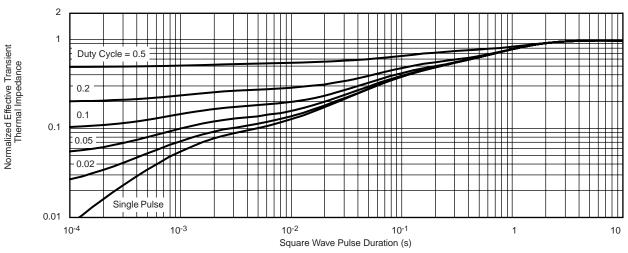
Power Derating, Junction-to-Ambient

<sup>\*</sup> The power dissipation  $P_D$  is based on  $T_{J(max)} = 150$  °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.





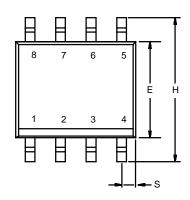
Normalized Thermal Transient Impedance, Junction-to-Ambient

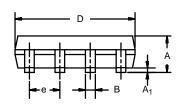


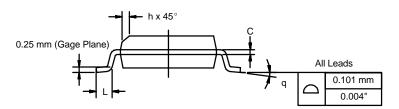
Normalized Thermal Transient Impedance, Junction-to-Foot



## SOIC (NARROW): 8-LEAD







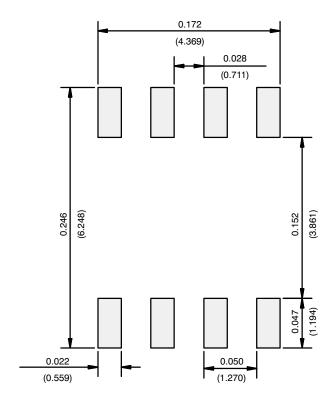
	MILLIM	IETERS	INC	HES	
DIM	Min	Max	Min	Max	
Α	1.35	1.75	0.053	0.069	
A <sub>1</sub>	0.10	0.20	0.004	0.008	
В	0.35	0.51	0.014	0.020	
С	0.19	0.25	0.0075	0.010	
D	4.80	5.00	0.189	0.196	
E	3.80	4.00	0.150	0.157	
е	1.27 BSC		0.050 BSC		
Н	5.80	6.20	0.228	0.244	
h	0.25	0.50	0.010	0.020	
L	0.50	0.93	0.020	0.037	
q	0°	8°	0°	8°	
S	0.44	0.64	0.018	0.026	
FCN: C-06527-Rev I 11-Sen-06					

ECN: C-06527-Rev. I, 11-Sep-06

DWG: 5498



#### **RECOMMENDED MINIMUM PADS FOR SO-8**



Recommended Minimum Pads Dimensions in Inches/(mm)



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