

# F1S70N03-VB Datasheet N-Channel 30-V (D-S) MOSFET

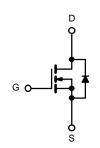
PRODUCT SUMMARY						
V <sub>DS</sub> (V)	$V_{DS}(V)$ $R_{DS(on)}(\Omega)$		Q <sub>g</sub> (Typ)			
30	$0.0024$ at $V_{GS} = 10 \text{ V}$	98	82 nC			
30	0.0027 at V <sub>GS</sub> = 4.5 V	98	02 110			

#### **FEATURES**

- Trench Power MOSFET
- 100 % R<sub>g</sub> and UIS Tested
- Compliant to RoHS Directive 2011/65/EU







N-Channel MOSFET

## **APPLICATIONS**

- OR-ing
- Server
- DC/DC

Parameter		Symbol	Limit	Unit	
Drain-Source Voltage		V <sub>DS</sub>	30		
Gate-Source Voltage	V <sub>GS</sub>	± 20	V		
	T <sub>C</sub> = 25 °C		98 <sup>a, e</sup>	A	
Continuous Drain Current (T <sub>.I</sub> = 175 °C)	T <sub>C</sub> = 70 °C		98 <sup>e</sup>		
Continuous Diain Current (1 j = 173 °C)	T <sub>A</sub> = 25 °C	I <sub>D</sub>	28.8 <sup>b, c</sup>		
	T <sub>A</sub> = 70 °C		27 <sup>b, c</sup>		
Pulsed Drain Current	I <sub>DM</sub>	300			
Avalanche Current Pulse	1 04 mll	I <sub>AS</sub>	36		
Single Pulse Avalanche Energy L = 0.1 mH		E <sub>AS</sub>	64.8	V	
Continuous Source-Drain Diode Current	T <sub>C</sub> = 25 °C	1	90 <sup>a, e</sup>	Δ.	
Continuous Source-Drain Diode Current	T <sub>A</sub> = 25 °C	I <sub>S</sub>	3.13 <sup>b, c</sup>	A	
	T <sub>C</sub> = 25 °C		250 <sup>a</sup>	w	
Mayimum Payar Dissination	T <sub>C</sub> = 70 °C	D	175		
Maximum Power Dissipation	T <sub>A</sub> = 25 °C	P <sub>D</sub>	3.75 <sup>b, c</sup>		
	T <sub>A</sub> = 70 °C		2.63 <sup>b, c</sup>		
Operating Junction and Storage Temperature R	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 175	°C		

THERMAL RESISTANCE RATINGS							
Parameter		Symbol	Тур.	Max.	Unit		
Maximum Junction-to-Ambient <sup>b, d</sup>	t ≤ 10 sec	R <sub>thJA</sub>	32	40	°C/W		
Maximum Junction-to-Case	Steady State	R <sub>thJC</sub>	0.5	0.6	]		

#### Notes:

- a. Based on T<sub>C</sub> = 25 °C.
  b. Surface mounted on 1" x 1" FR4 board.

- b. Striate informed on 1 X 1 114 board.
  c. t = 10 sec.
  d. Maximum under steady state conditions is 90 °C/W.
  e. Calculated based on maximum junction temperature. Package limitation current is 90 A.



Parameter	Symbol	Test Conditions	Min.	Тур.	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	$\Delta V_{DS}/T_{J}$	I <sub>D</sub> = 250 μA		35		mV/°C
V <sub>GS(th)</sub> Temperature Coefficient	$\Delta V_{GS(th)}/T_{J}$	ι <sub>D</sub> = 230 μΑ		- 7.5		
Gate-Source Threshold Voltage	V <sub>GS(th)</sub>	$V_{DS} = V_{GS}, I_D = 250 \mu A$	1.5		2.5	V
Gate-Source Leakage	I <sub>GSS</sub>	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$			± 100	nA
7 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	1.	$V_{DS} = 30 \text{ V}, V_{GS} = 0 \text{ V}$			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>	$V_{DS} \ge 5 \text{ V}, V_{GS} = 10 \text{ V}$	90			Α
		V <sub>GS</sub> = 10 V, I <sub>D</sub> = 28.8 A		0.0024		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> = 27 A		0.0027		
Forward Transconductance <sup>a</sup>	9 <sub>fs</sub>	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 28.8 A		160		S
Dynamic <sup>b</sup>			L			
Input Capacitance	C <sub>iss</sub>			12065		
Output Capacitance	C <sub>oss</sub>	$V_{DS} = 15 \text{ V}, V_{GS} = 0 \text{ V}, f = 1 \text{ MHz}$		1725		pF
Reverse Transfer Capacitance	C <sub>rss</sub>			970		
	Qg	V <sub>DS</sub> = 15 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 28.8 A		171	257	nC
Total Gate Charge				81.5	123	
Gate-Source Charge	Q <sub>gs</sub>	$V_{DS} = 15 \text{ V}, V_{GS} = 4.5 \text{ V}, I_{D} = 28.8 \text{ A}$		34		
Gate-Drain Charge	Q <sub>gd</sub>			29		
Gate Resistance	R <sub>g</sub>	f = 1 MHz		1.4	2.1	Ω
Turn-On Delay Time	t <sub>d(on)</sub>			18	27	
Rise Time	t <sub>r</sub>	$V_{DD} = 15 \text{ V}, R_{I} = 0.625 \Omega$		11	17	
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D \cong 24 \text{ A}, V_{GEN} = 10 \text{ V}, R_g = 1 \Omega$		70	105	
Fall Time	t <sub>f</sub>			10	15	
Turn-On Delay Time	t <sub>d(on)</sub>			55	83	ns ns
Rise Time	t <sub>r</sub>	$V_{DD} = 15 \text{ V}, R_1 = 0.67 \Omega$		180	270	
Turn-Off Delay Time	t <sub>d(off)</sub>	$I_D \cong 22.5 \text{ A}, V_{GEN} = 4.5 \text{ V}, R_g = 1 \Omega$		55	83	
Fall Time	t <sub>f</sub>	Ş		12	18	
Drain-Source Body Diode Characteristic	T T					l
Continuous Source-Drain Diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C			90	_
Pulse Diode Forward Current <sup>a</sup>	I <sub>SM</sub>				90	A
Body Diode Voltage	V <sub>SD</sub>	I <sub>S</sub> = 22 A		0.8	1.2	V
Body Diode Reverse Recovery Time	t <sub>rr</sub>			52	78	ns
Body Diode Reverse Recovery Charge	Q <sub>rr</sub>			70.2	105	nC
Reverse Recovery Fall Time	t <sub>a</sub>	I <sub>F</sub> = 20 A, di/dt = 100 A/μs, T <sub>J</sub> = 25 °C		27		ns
Reverse Recovery Rise Time	t <sub>b</sub>			25		

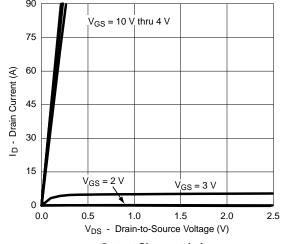
#### Notes:

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

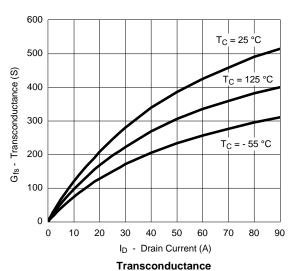
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



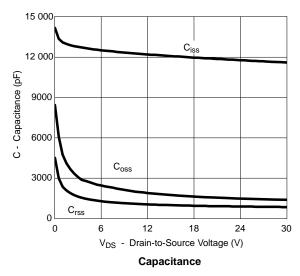
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

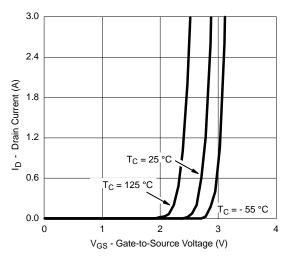


#### **Output Characteristics**

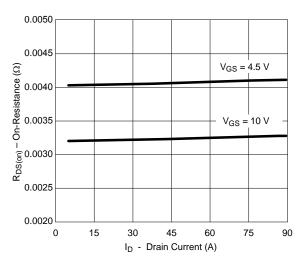


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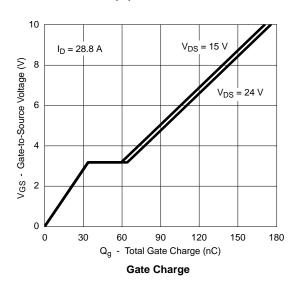




Transfer Characteristics

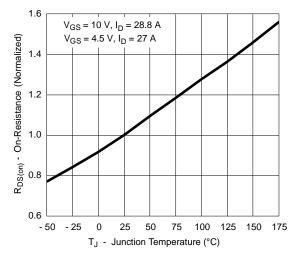


R<sub>DS(on)</sub> vs. Drain Current

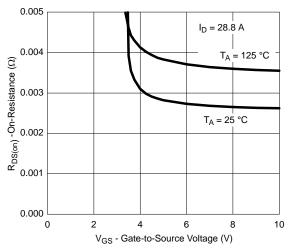




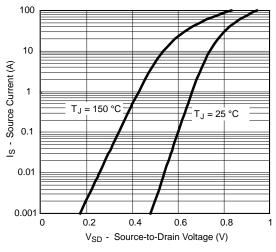
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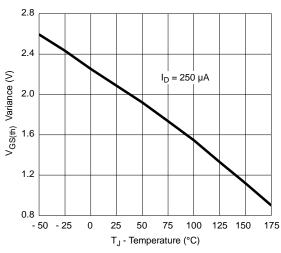
On-Resistance vs. Junction Temperature



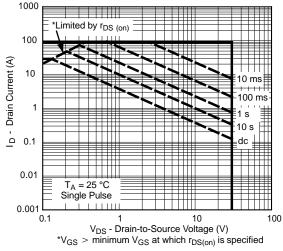
 $\rm R_{\rm DS(on)}$  vs.  $\rm V_{\rm GS}$  vs. Temperature



Forward Diode Voltage vs. Temperature



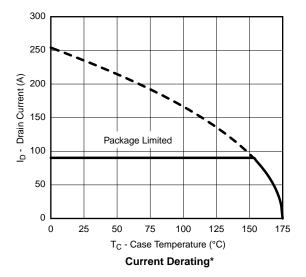
Threshold Voltage



Safe Operating Area, Junction-to-Ambient

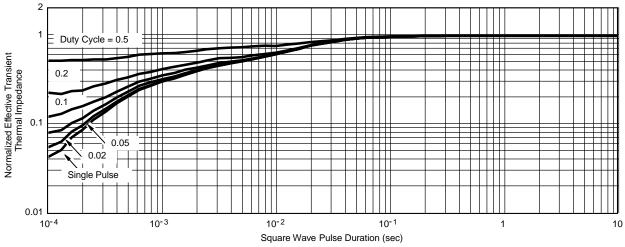


### TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)





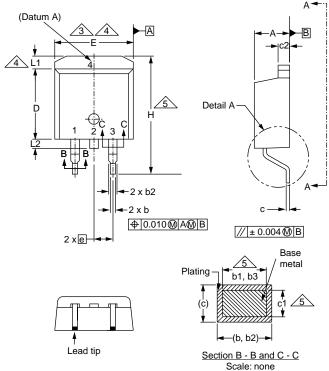
\*The power dissipation  $P_D$  is based on  $T_{J(max)}$  = 175 °C, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit.

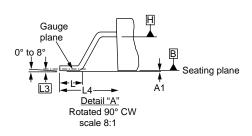


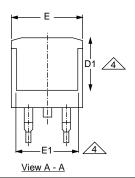
Normalized Thermal Transient Impedance, Junction-to-Case



#### **TO-263AB (HIGH VOLTAGE)**







				Scale.
	MILLIMETERS			HES
DIM.	MIN.	MAX.	MIN.	MAX.
А	4.06	4.83	0.160	0.190
A1	0.00	0.25	0.000	0.010
b	0.51	0.99	0.020	0.039
b1	0.51	0.89	0.020	0.035
b2	1.14	1.78	0.045	0.070
b3	1.14	1.73	0.045	0.068
С	0.38	0.74	0.015	0.029
c1	0.38	0.58	0.015	0.023
c2	1.14	1.65	0.045	0.065

9.65

0.330

0.380

DIM.         MIN.         MAX.         MIN.         MAX.           D1         6.86         -         0.270         -           E         9.65         10.67         0.380         0.420           E1         6.22         -         0.245         -           e         2.54 BSC         0.100 BSC           H         14.61         15.88         0.575         0.625           L         1.78         2.79         0.070         0.110           L1         -         1.65         -         0.066           L2         -         1.78         -         0.070           L3         0.25 BSC         0.010 BSC		MILLIMETERS IN		HES	
E       9.65       10.67       0.380       0.420         E1       6.22       -       0.245       -         e       2.54 BSC       0.100 BSC         H       14.61       15.88       0.575       0.625         L       1.78       2.79       0.070       0.110         L1       -       1.65       -       0.066         L2       -       1.78       -       0.070	DIM.	MIN.	MAX.	MIN.	MAX.
E1         6.22         -         0.245         -           e         2.54 BSC         0.100 BSC           H         14.61         15.88         0.575         0.625           L         1.78         2.79         0.070         0.110           L1         -         1.65         -         0.066           L2         -         1.78         -         0.070	D1	6.86	-	0.270	-
e     2.54 BSC     0.100 BSC       H     14.61     15.88     0.575     0.625       L     1.78     2.79     0.070     0.110       L1     -     1.65     -     0.066       L2     -     1.78     -     0.070	E	9.65	10.67	0.380	0.420
H     14.61     15.88     0.575     0.625       L     1.78     2.79     0.070     0.110       L1     -     1.65     -     0.066       L2     -     1.78     -     0.070	E1	6.22	-	0.245	-
L 1.78 2.79 0.070 0.110  L1 - 1.65 - 0.066  L2 - 1.78 - 0.070	е	2.54 BSC		0.100 BSC	
L1 - 1.65 - 0.066 L2 - 1.78 - 0.070	Н	14.61	15.88	0.575	0.625
L2 - 1.78 - 0.070	L	1.78	2.79	0.070	0.110
	L1	-	1.65	-	0.066
L3 0.25 BSC 0.010 BSC	L2	-	1.78	-	0.070
	L3	0.25 BSC		0.010	BSC
L4         4.78         5.28         0.188         0.208	L4	4.78	5.28	0.188	0.208

8.38 ECN: S-82110-Rev. A, 15-Sep-08

DWG: 5970

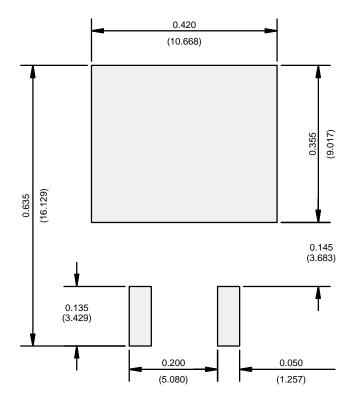
D

#### **Notes**

- 1. Dimensioning and tolerancing per ASME Y14.5M-1994.
- 2. Dimensions are shown in millimeters (inches).
- 3. Dimension D and E do not include mold flash. Mold flash shall not exceed 0.127 mm (0.005") per side. These dimensions are measured at the outmost extremes of the plastic body at datum A.
- 4. Thermal PAD contour optional within dimension E, L1, D1 and E1.
- 5. Dimension b1 and c1 apply to base metal only.
- 6. Datum A and B to be determined at datum plane H.
- 7. Outline conforms to JEDEC outline to TO-263AB.



# RECOMMENDED MINIMUM PADS FOR D<sup>2</sup>PAK: 3-Lead



Recommended Minimum Pads Dimensions in Inches/(mm)



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