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# Data Sheet

# September 2013

# N-Channel Logic Level Power MOSFET 60V, 11A, 107 mΩ

These N-Channel enhancement-mode power MOSFETs are manufactured using the latest manufacturing process technology. This process, which uses feature sizes approaching those of LSI circuits, gives optimum utilization of silicon, resulting in outstanding performance. They were designed for use in applications such as switching regulators, switching converters, motor drivers and relay drivers. These transistors can be operated directly from integrated circuits.

Formerly developmental type TA49158.

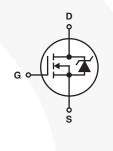
# **Ordering Information**

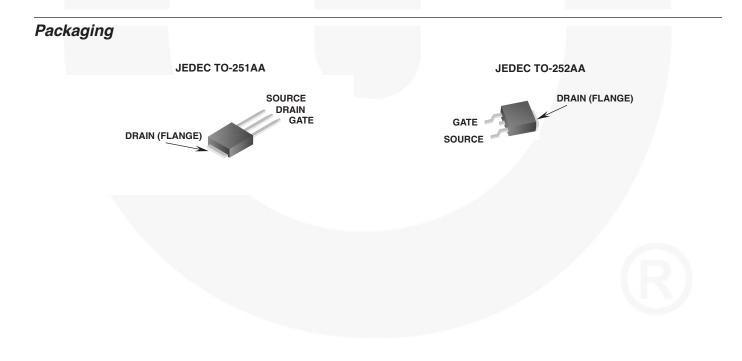
PART NUMBER	PACKAGE	BRAND
RFD3055LE	TO-251AA	F3055L
RFD3055LESM9A	TO-252AA	F3055L

# Features

- 11A, 60V
- r<sub>DS(ON)</sub> = 0.107Ω
- Temperature Compensating PSPICE<sup>®</sup> Model
- Peak Current vs Pulse Width Curve
- UIS Rating Curve
- Related Literature
  - TB334 "Guidelines for Soldering Surface Mount Components to PC Boards"

# Symbol





# Absolute Maximum Ratings $T_C = 25^{\circ}C$ , Unless Otherwise Specified

	RFD3055LE, RFD3055LESM9A	UNITS
Drain to Source Voltage (Note 1)VDSS	60	V
Drain to Gate Voltage ( $R_{GS} = 20k\Omega$ ) (Note 1)	60	v
Gate to Source Voltage	±16	V
Continuous Drain Current	11	А
Pulsed Drain Current (Note 3)	Refer to Peak Current Curve	
Single Pulse Avalanche RatingE <sub>AS</sub>	Refer to UIS Curve	
Power DissipationPD	38	W
Derate Above 25 <sup>o</sup> C	0.25	W/ <sup>o</sup> C
Operating and Storage Temperature	-55 to 175	°C
Maximum Temperature for Soldering		
Leads at 0.063in (1.6mm) from Case for 10s	300	°C
Package Body for 10s, See Techbrief 334	260	°C

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

#### NOTE:

1.  $T_J = 25^{\circ}C$  to  $150^{\circ}C$ .

### **Electrical Specifications** T<sub>C</sub> = 25°C, Unless Otherwise Specified

PARAMETER	SYMBOL	TEST CO	ONDITIONS	MIN	TYP	MAX	UNITS
Drain to Source Breakdown Voltage	BV <sub>DSS</sub>	$I_{D} = 250 \mu A, V_{GS} = 0 V$		60	-	-	V
Gate Threshold Voltage	V <sub>GS(TH)</sub>	$V_{GS} = V_{DS}, I_D = 250 \mu A$		1	-	3	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	$I_{DSS} = 55V, V_{GS} = 0V$ $V_{DS} = 50V, V_{GS} = 0V, T_{C} = 150^{\circ}C$		-	-	1	μA
				-	-	250	μA
Gate to Source Leakage Current	I <sub>GSS</sub>	$V_{GS} = \pm 16V$		-	-	±100	nA
Drain to Source On Resistance (Note 2)	r <sub>DS(ON)</sub>	I <sub>D</sub> = 8A, V <sub>GS</sub> = 5V (Fig	gure 11)	-	-	0.107	Ω
Turn-On Time	ton	$V_{DD} \approx 30V, I_D = 8A,$ $V_{GS} = 4.5V, R_{GS} = 32\Omega$ (Figures 10, 18, 19)		-	-	170	ns
Turn-On Delay Time	t <sub>d(ON)</sub>			-	8	-	ns
Rise Time	t <sub>r</sub>			-	105	-	ns
Turn-Off Delay Time	td(OFF)			-	22	-	ns
Fall Time	t <sub>f</sub>			-	39	-	ns
Turn-Off Time	tOFF			-	-	92	ns
Total Gate Charge	Q <sub>g(TOT)</sub>	$V_{GS} = 0V$ to 10V	$V_{DD} = 30V, I_D = 8A,$	-	9.4	11.3	nC
Gate Charge at 5V	Q <sub>g(5)</sub>	$V_{GS} = 0V$ to 5V	│ I <sub>g(REF)</sub> = 1.0mA │ (Figures 20, 21)	-	5.2	6.2	nC
Threshold Gate Charge	Q <sub>g(TH)</sub>	$V_{GS} = 0V \text{ to } 1V$		-	0.36	0.43	nC
Input Capacitance	C <sub>ISS</sub>	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1MHz	-	350	-	pF	
Output Capacitance	C <sub>OSS</sub>	(Figure 14)		-	105	-	pF
Reverse Transfer Capacitance	C <sub>RSS</sub>			-	23	-	pF
Thermal Resistance Junction to Case	R <sub>θJC</sub>			-	-	3.94	°C/W
Thermal Resistance Junction to Ambient	R <sub>0JA</sub>	TO-220AB		-	-	62	°C/W
		TO-251AA, TO-252AA	١	-	-	100	°C/W

# Source to Drain Diode Specifications

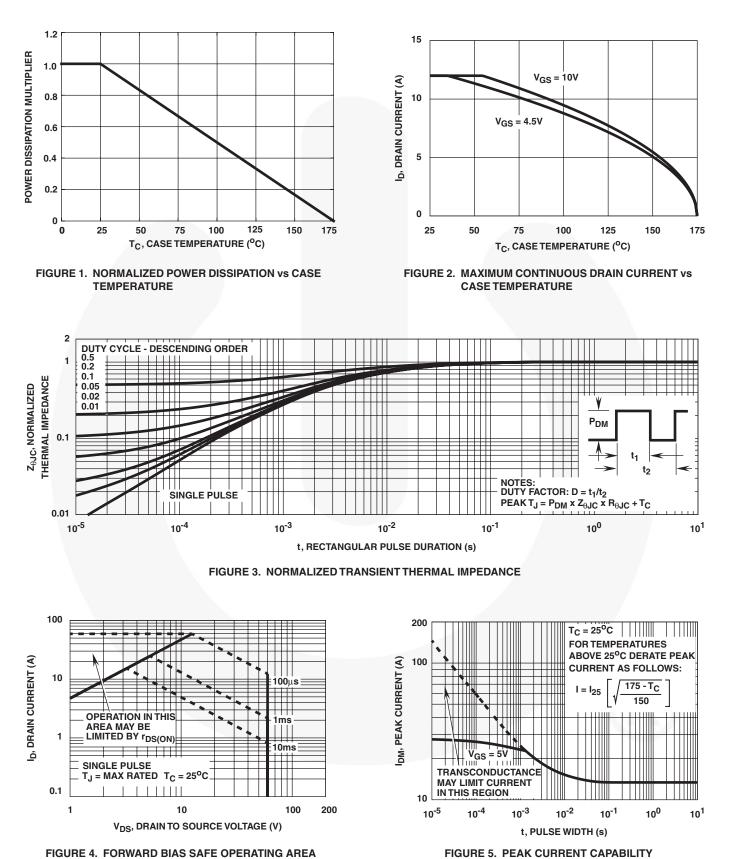
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	ТҮР	MAX	UNITS
Source to Drain Diode Voltage	V <sub>SD</sub>	I <sub>SD</sub> = 8A		-	1.25	V
Diode Reverse Recovery Time	t <sub>rr</sub>	$I_{SD} = 8A$ , $dI_{SD}/dt = 100A/\mu s$		-	66	ns

NOTES:

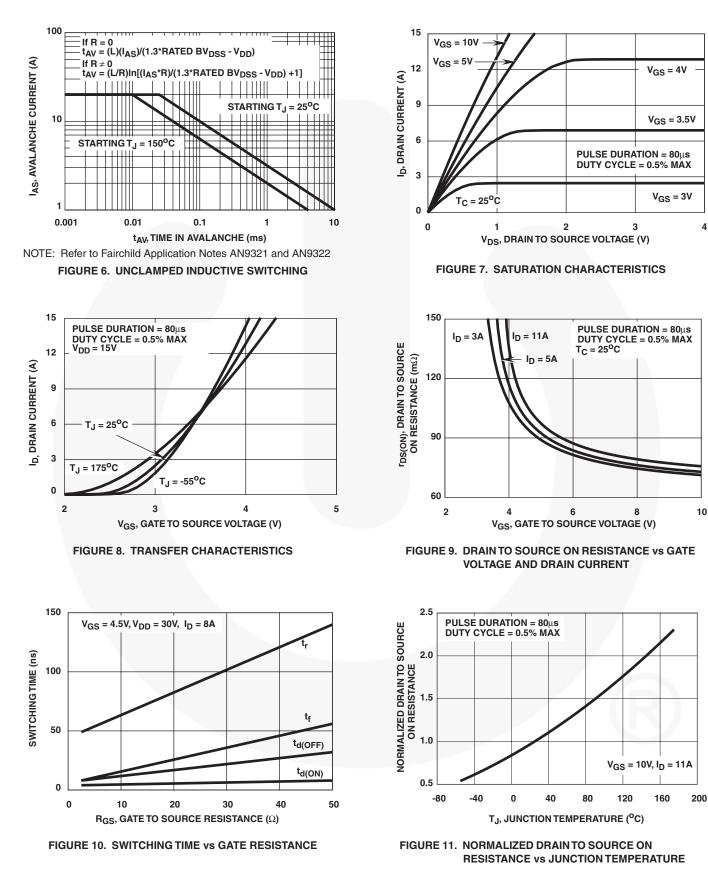
2. Pulse Test: Pulse Width  $\leq$  300ms, Duty Cycle  $\leq$  2%.

3. Repetitive Rating: Pulse Width limited by max junction temperature. See Transient Thermal Impedance Curve (Figure 3) and Peak Current Capability Curve (Figure 5).

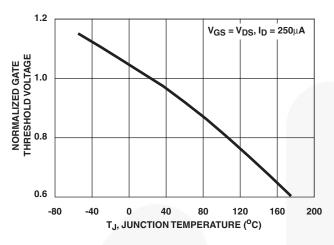
# Typical Performance Curves Unless Otherwise Specified



# Typical Performance Curves Unless Otherwise Specified (Continued)



# Typical Performance Curves Unless Otherwise Specified (Continued)





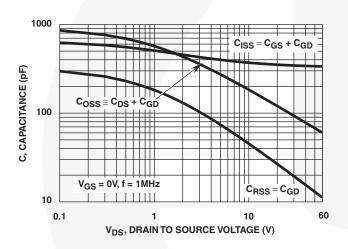


FIGURE 14. CAPACITANCE vs DRAIN TO SOURCE VOLTAGE

Test Circuits and Waveforms

VARY tP TO OBTAIN

REQUIRED PEAK IAS

VGS

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٥v

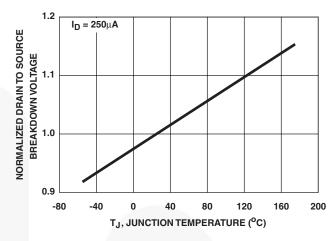


FIGURE 13. NORMALIZED DRAIN TO SOURCE BREAKDOWN VOLTAGE vs JUNCTION TEMPERATURE

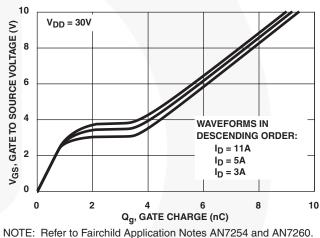
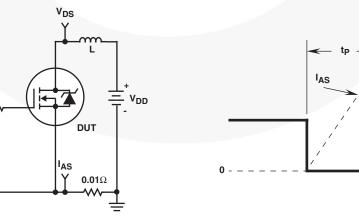


FIGURE 15. NORMALIZED SWITCHING WAVEFORMS FOR CONSTANT GATE CURRENT

**BV**<sub>DSS</sub>



### FIGURE 16. UNCLAMPED ENERGY TEST CIRCUIT

R<sub>G</sub>

0-----

### FIGURE 17. UNCLAMPED ENERGY WAVEFORMS

V<sub>DS</sub>

V<sub>DD</sub>

# Test Circuits and Waveforms (Continued)

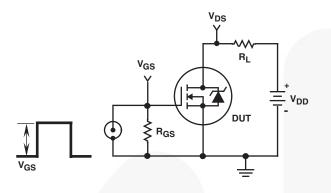


FIGURE 18. SWITCHING TEST CIRCUIT

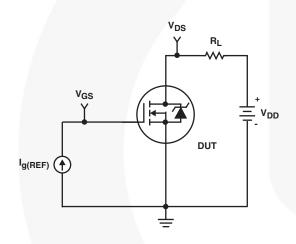


FIGURE 20. GATE CHARGE TEST CIRCUIT

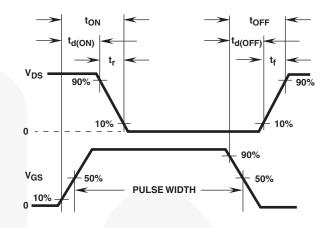
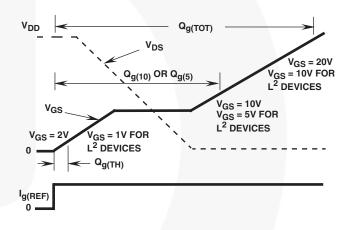


FIGURE 19. RESISTIVE SWITCHING WAVEFORMS

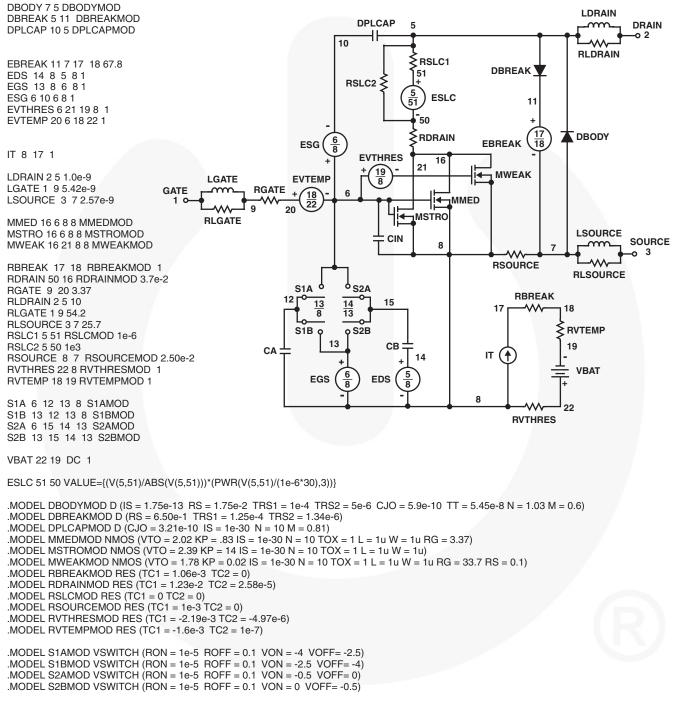


# FIGURE 21. GATE CHARGE WAVEFORMS

# **PSPICE Electrical Model**

.SUBCKT RFD3055LE 2 1 3 ; rev 1/30/95

CA 12 8 3.9e-9 CB 15 14 4.9e-9 CIN 6 8 3.25e-10



.ENDS

For further discussion of the PSPICE model, consult **A New PSPICE Sub-Circuit for the Power MOSFET Featuring Global Temperature Options**; IEEE Power Electronics Specialist Conference Records, 1991, written by William J. Hepp and C. Frank Wheatley.



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