Vishay Siliconix

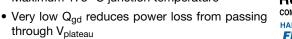
# N-Channel 60 V (D-S) MOSFET



PRODUCT SUMMARY	
V <sub>DS</sub> (V)	60
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 10 \text{ V}$	0.00173
$R_{DS(on)}$ max. ( $\Omega$ ) at $V_{GS} = 4.5 \text{ V}$	0.0023
Q <sub>g</sub> typ. (nC)	192
I <sub>D</sub> (A)	150 <sup>d</sup>
Configuration	Single

### **FEATURES**

- TrenchFET® Gen IV power MOSFET
- Maximum 175 °C junction temperature

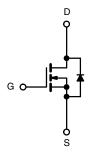




- 100 % R<sub>a</sub> and UIS tested
- Material categorization: for definitions of compliance please see <a href="https://www.vishay.com/doc?99912">www.vishay.com/doc?99912</a>

### **APPLICATIONS**

- Power supply
  - Secondary synchronous rectification
- DC/DC converter
- Power tools
- · Motor drive switch
- DC/AC inverter
- · Battery management
- OR-ing / e-fuse



N-Channel MOSFET

ORDERING INFORMATION	
Package	TO-220
Lead (Pb)-free and halogen-free	SUP50010EL-GE3

<b>ABSOLUTE MAXIMUM RATINGS</b> (T <sub>C</sub> = 25 °C, unless otherwise noted)					
PARAMETER	SYMBOL	LIMIT	UNIT		
Drain-source voltage		V <sub>DS</sub>	60	V	
Gate-source voltage		V <sub>GS</sub>	± 20	V	
Continuous drain current (T <sub>J</sub> = 150 °C)	T <sub>C</sub> = 25 °C		150 <sup>d</sup>		
	T <sub>C</sub> = 70 °C	I <sub>D</sub>	150 <sup>d</sup>	A	
Pulsed drain current (t = 100 μs)		I <sub>DM</sub>	500		
Avalanche current		I <sub>AS</sub>	60		
Single avalanche energy <sup>a</sup>	ngle avalanche energy <sup>a</sup> L = 0.1 mH		180	mJ	
Maximum power dissipation <sup>a</sup>	T <sub>C</sub> = 25 °C	Ъ	375 b	W	
	T <sub>C</sub> = 125 °C	P <sub>D</sub>	125 <sup>b</sup>	vv	
Operating junction and storage temperature range		T <sub>J</sub> , T <sub>stg</sub>	-55 to +175	°C	

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	LIMIT	UNIT	
Junction-to-ambient (PCB mount) <sup>c</sup>	R <sub>thJA</sub>	40	°C/W	
Junction-to-case (drain)	R <sub>thJC</sub>	0.4		

# Notes

- a. Duty cycle ≤ 1 %
- b. See SOA curve for voltage derating
- c. When mounted on 1" square PCB (FR4 material)
- d. Package limited

# Vishay Siliconix

PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-source breakdown voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 1 mA	60	-	-	V
Gate threshold voltage	V <sub>GS(th)</sub>	$V_{DS} = V_{GS}, I_D = 250 \mu A$	1	-	2.5	
Gate-body leakage	I <sub>GSS</sub>	$V_{DS} = 0 \text{ V}, V_{GS} = \pm 20 \text{ V}$	-	-	± 250	nA
Zero gate voltage drain current		V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V	-	-	1	
	I <sub>DSS</sub>	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 125 °C	-	-	150	μA
		V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 175 °C	-	-	5	mA
Dusing assumes are state unsintered 2	_	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 30 A	-	0.00138	0.00173	Ω
Drain-source on-state resistance a	R <sub>DS(on)</sub>	$V_{GS} = 4.5 \text{ V}, I_D = 20 \text{ A}$	-	0.00165	0.0023	
Forward transconductance <sup>a</sup>	9fs	V <sub>DS</sub> = 15 V, I <sub>D</sub> = 30 A	-	140	-	S
Dynamic <sup>b</sup>	•					
Input capacitance	C <sub>iss</sub>		-	13 646	-	pF
Output capacitance	Coss	$V_{GS} = 0 \text{ V}, V_{DS} = 30 \text{ V}, f = 1 \text{ MHz}$	-	2474	-	
Reverse transfer capacitance	C <sub>rss</sub>		-	82	-	
Total gate charge <sup>c</sup>	Qg		-	192	288	nC
Gate-source charge <sup>c</sup>	Q <sub>gs</sub>	$V_{DS} = 30 \text{ V}, V_{GS} = 10 \text{ V}, I_D = 30 \text{ A}$	-	32	-	
Gate-drain charge c	$Q_{gd}$		-	17.5	-	
Output charge	Q <sub>oss</sub>	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V	-	156	235	
Gate resistance	Rg	f = 1 MHz	0.4	0.9	1.6	Ω
Turn-on delay time <sup>c</sup>	t <sub>d(on)</sub>	$V_{DD} = 30 \text{ V}, \text{ R}_{L} = 3 \Omega$ $I_{D} \cong 10 \text{ A}, V_{GEN} = 10 \text{ V}, \text{ R}_{g} = 1 \Omega$	-	19	38	
Rise time <sup>c</sup>	t <sub>r</sub>		-	11	22	
Turn-off delay time <sup>c</sup>	t <sub>d(off)</sub>		-	68	130	ns
Fall time <sup>c</sup>	t <sub>f</sub>		-	14	28	
Drain-Source Body Diode Ratings	and Characte	ristics <sup>b</sup> (T <sub>C</sub> = 25 °C)	•			
Pulsed current (t = 100 μs)	I <sub>SM</sub>		-	-	250	А
Forward voltage <sup>a</sup>	V <sub>SD</sub>	I <sub>F</sub> = 10 A, V <sub>GS</sub> = 0 V	-	0.74	1.5	V
Reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 34 A, di/dt = 100 A/μs	-	81	160	ns
Peak reverse recovery charge	I <sub>RM(REC)</sub>		-	3.5	7.0	Α
Reverse recovery charge	Q <sub>rr</sub>		-	0.16	0.32	μC
Reverse recovery fall time	ta		-	48	-	ns
Reverse recovery rise time	t <sub>b</sub>		-	32	-	115

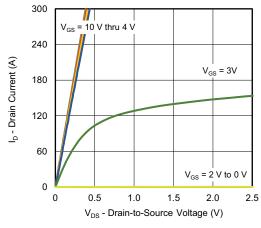
### **Notes**

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

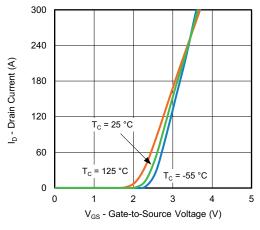
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



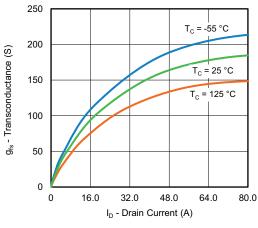
# **TYPICAL CHARACTERISTICS** (T<sub>A</sub> = 25 °C, unless otherwise noted)



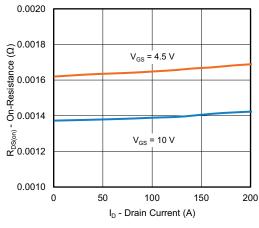
## **Output Characteristics**



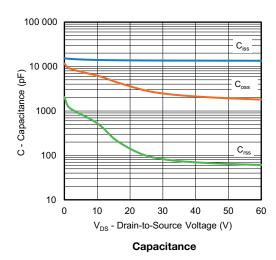
**Transfer Characteristics** 

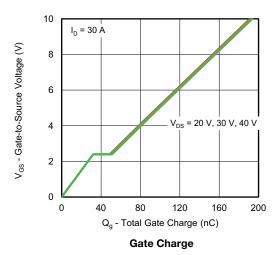


Transconductance



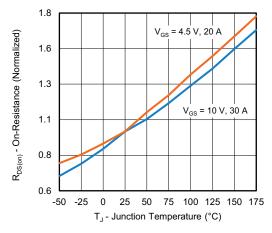
On-Resistance vs. Drain Current



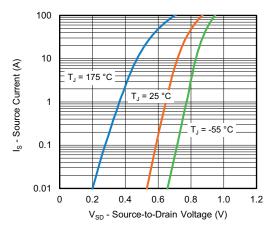




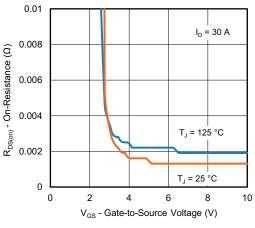
# **TYPICAL CHARACTERISTICS** (T<sub>A</sub> = 25 °C, unless otherwise noted)



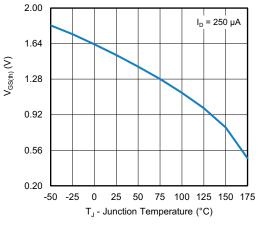
On-Resistance vs. Junction Temperature



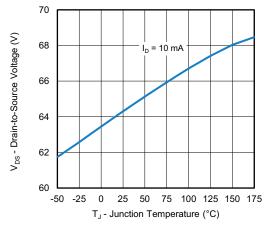
**Source Drain Diode Forward Voltage** 



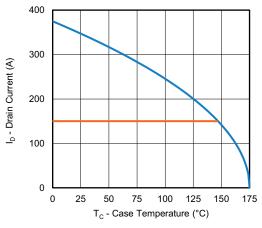
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



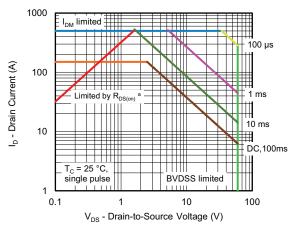
Drain Source Breakdown vs. Junction Temperature



**Current De-rating** 



# **THERMAL RATINGS** ( $T_A = 25$ °C, unless otherwise noted)



### Safe Operating Area

# 10 150 °C - 25 °C - 25

100

t - Time (s)

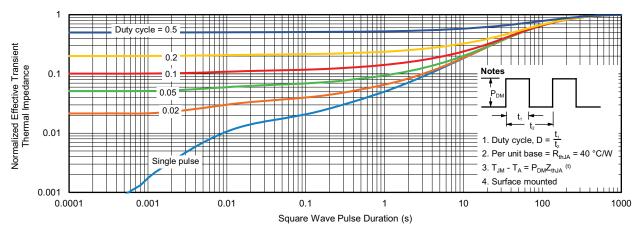
Avalanche Current vs. Time

### Note

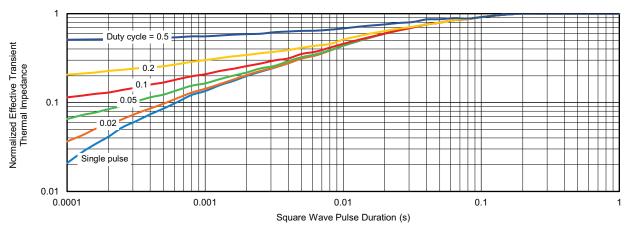
a.  $V_{GS} > minimum \ V_{GS}$  at which  $R_{DS(on)}$  is specified



# THERMAL RATINGS (T<sub>A</sub> = 25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Case

### Note

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction to Ambient (25 °C)
  - Normalized Transient Thermal Impedance Junction to Case (25 °C) are given for general guidelines only to enable the user to get a "ball park" indication of part capabilities. The data are extracted from single pulse transient thermal impedance characteristics which are developed from empirical measurements. The latter is valid for the part mounted on printed circuit board FR4, size 1" x 1" x 0.062", double sided with 2 oz. copper, 100 % on both sides. The part capabilities can widely vary depending on actual application parameters and operating conditions

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