

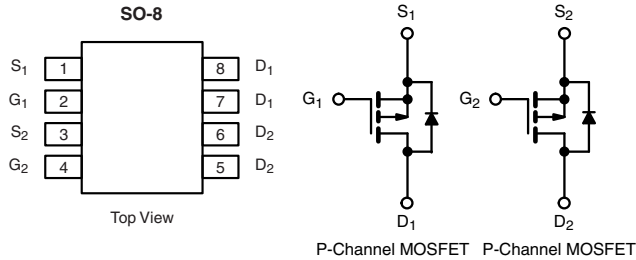


# Automotive Dual P-Channel 60 V (D-S) 175 °C MOSFET

PRODUCT SUMMARY	
V <sub>DS</sub> (V)	- 60
R <sub>DS(on)</sub> (Ω) at V <sub>GS</sub> = - 10 V	0.085
R <sub>DS(on)</sub> (Ω) at V <sub>GS</sub> = - 4.5 V	0.115
I <sub>D</sub> (A) per leg	- 4.4
Configuration	Dual

## FEATURES

- TrenchFET® Power MOSFET
- AEC-Q101 Qualified
- 100 % R<sub>g</sub> and UIS Tested
- Material categorization:  
For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



ORDERING INFORMATION	
Package	SO-8
Lead (Pb)-free and Halogen-free	SQ4961EY-T1-GE3

ABSOLUTE MAXIMUM RATINGS (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	
Continuous Drain Current	I <sub>D</sub>	T <sub>C</sub> = 25 °C	- 4.4
		T <sub>C</sub> = 125 °C	- 2.5
Continuous Source Current (Diode Conduction)	I <sub>S</sub>	- 3	A
Pulsed Drain Current <sup>a</sup>	I <sub>DM</sub>	- 18	
Single Pulse Avalanche Current	I <sub>AS</sub>	- 20	
Single Pulse Avalanche Energy	E <sub>AS</sub>	20	mJ
Maximum Power Dissipation <sup>a</sup>	P <sub>D</sub>	T <sub>C</sub> = 25 °C	3.3
		T <sub>C</sub> = 125 °C	1.1
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	R <sub>thJA</sub>	105	°C/W
Junction-to-Foot (Drain)	R <sub>thJF</sub>	45	

### Notes

- Pulse test; pulse width ≤ 300 μs, duty cycle ≤ 2 %.
- When mounted on 1" square PCB (FR-4 material).



<b>SPECIFICATIONS</b> ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	-60	-	-	V
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	-1.5	-2.0	-2.5	
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$	-	-	$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{GS} = 0\text{ V}, V_{DS} = -60\text{ V}$	-	-	-1	$\mu\text{A}$
		$V_{GS} = 0\text{ V}, V_{DS} = -60\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	-	-50	
		$V_{GS} = 0\text{ V}, V_{DS} = -60\text{ V}, T_J = 175\text{ }^\circ\text{C}$	-	-	-150	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{GS} = -10\text{ V}, V_{DS} \leq -5\text{ V}$	-12	-	-	A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -3.5\text{ A}$	-	0.070	0.085	$\Omega$
		$V_{GS} = -10\text{ V}, I_D = -3.5\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	-	0.142	
		$V_{GS} = -10\text{ V}, I_D = -3.5\text{ A}, T_J = 175\text{ }^\circ\text{C}$	-	-	0.176	
		$V_{GS} = -4.5\text{ V}, I_D = -2.5\text{ A}$	-	0.095	0.115	
Forward Transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = -15\text{ V}, I_D = -3.5\text{ A}$	-	9	-	S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = -30\text{ V}, f = 1\text{ MHz}$	-	912	1140	$\mu\text{F}$
Output Capacitance	$C_{oss}$		-	100	125	
Reverse Transfer Capacitance	$C_{rss}$		-	60	75	
Total Gate Charge <sup>c</sup>	$Q_g$	$V_{GS} = -10\text{ V}, V_{DS} = -30\text{ V}, I_D = -4.3\text{ A}$	-	26.5	40	nC
Gate-Source Charge <sup>c</sup>	$Q_{gs}$		-	3.8	-	
Gate-Drain Charge <sup>c</sup>	$Q_{gd}$		-	5.8	-	
Gate Resistance	$R_g$	$f = 1\text{ MHz}$	3	-	16	$\Omega$
Turn-On Delay Time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = -30\text{ V}, R_L = 8.8\text{ }\Omega, I_D \cong -3.4\text{ A}, V_{GEN} = -10\text{ V}, R_g = 1\text{ }\Omega$	-	11	17	ns
Rise Time <sup>c</sup>	$t_r$		-	13	20	
Turn-Off Delay Time <sup>c</sup>	$t_{d(off)}$		-	36	54	
Fall Time <sup>c</sup>	$t_f$		-	8	12	
<b>Source-Drain Diode Ratings and Characteristics<sup>b</sup></b>						
Pulsed Current <sup>a</sup>	$I_{SM}$		-	-	-18	A
Forward Voltage	$V_{SD}$	$I_F = -3\text{ A}, V_{GS} = 0\text{ V}$	-	-0.84	-1.2	V

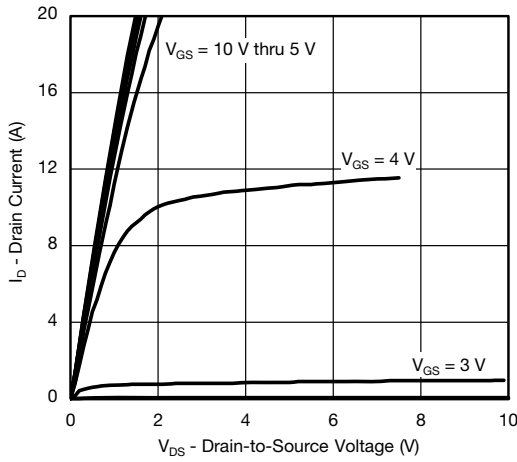
**Notes**

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

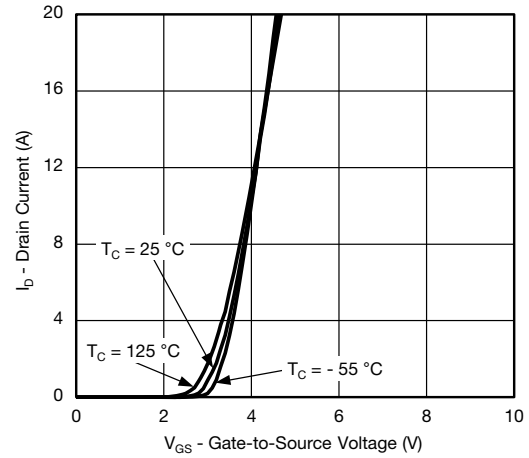
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



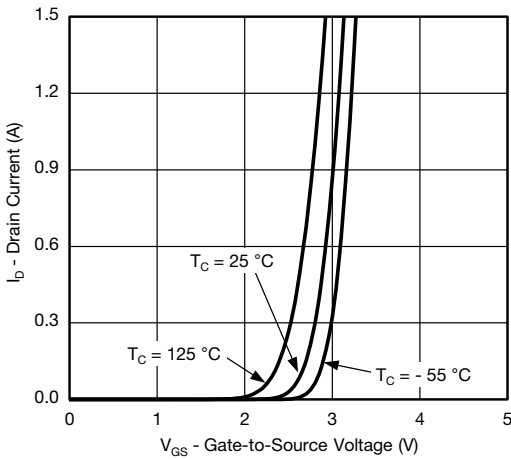
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C, unless otherwise noted)



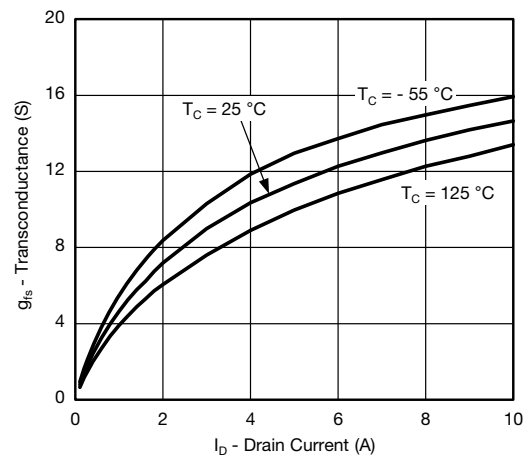
Output Characteristics



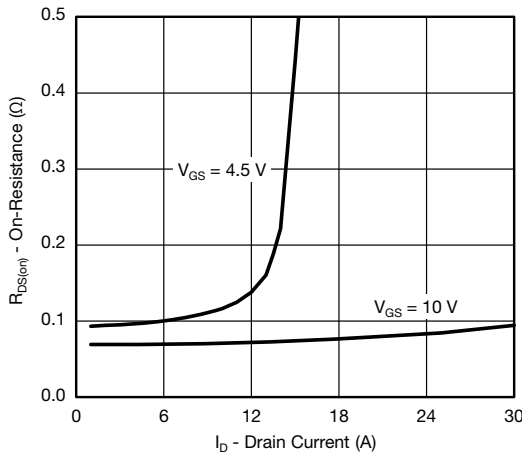
Transfer Characteristics



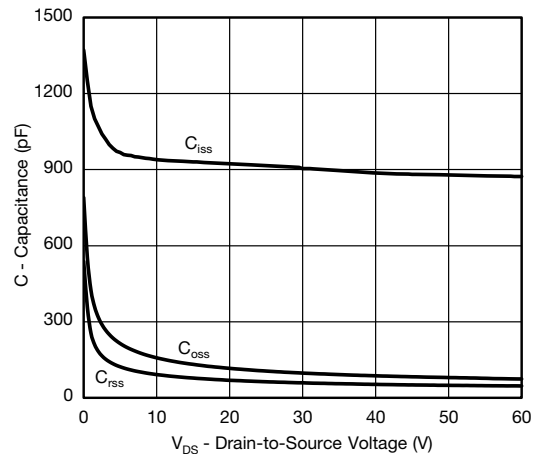
Transfer Characteristics



Transconductance



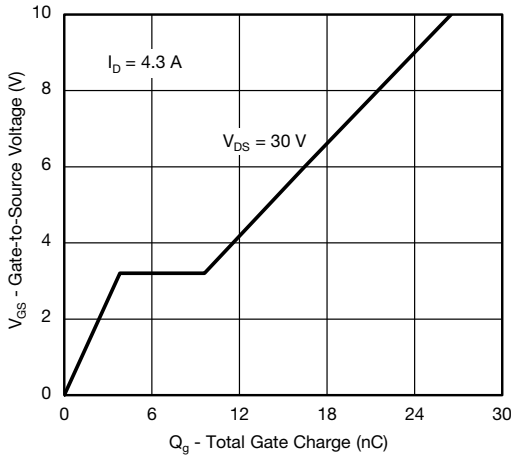
On-Resistance vs. Drain Current



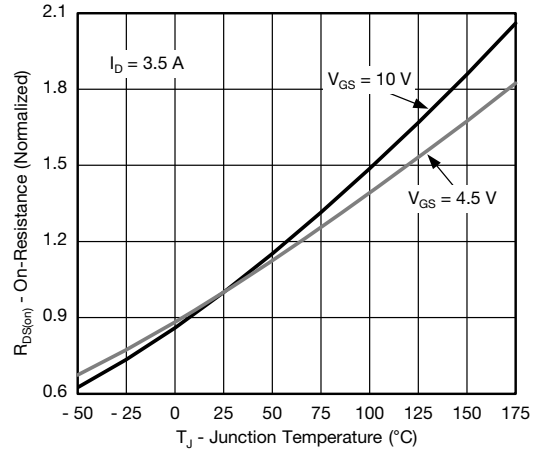
Capacitance



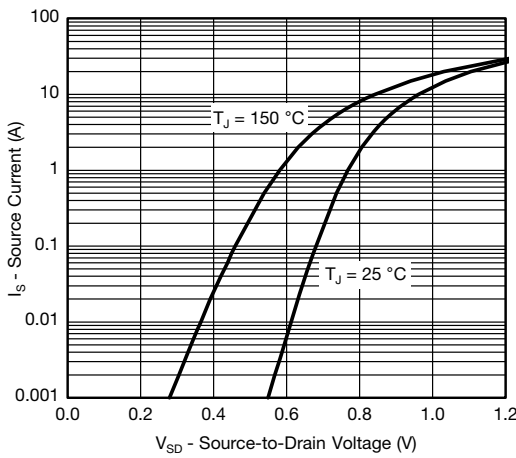
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C, unless otherwise noted)



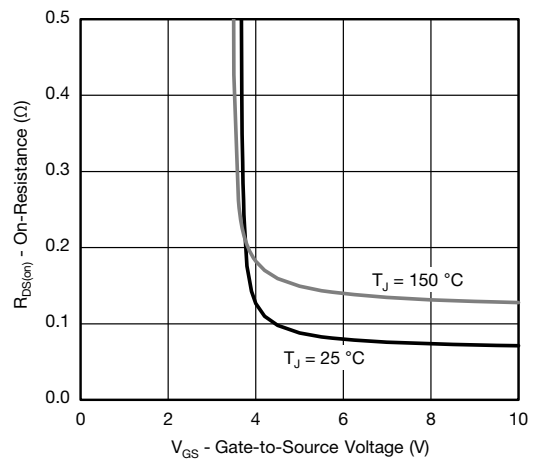
Gate Charge



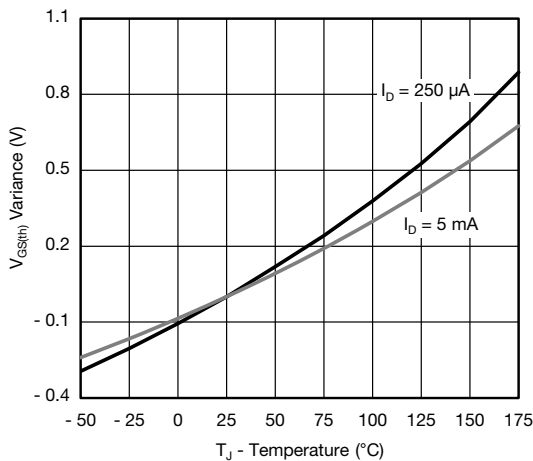
On-Resistance vs. Junction Temperature



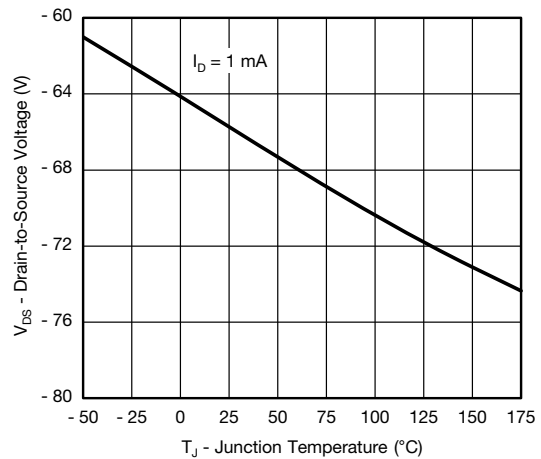
Source Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage



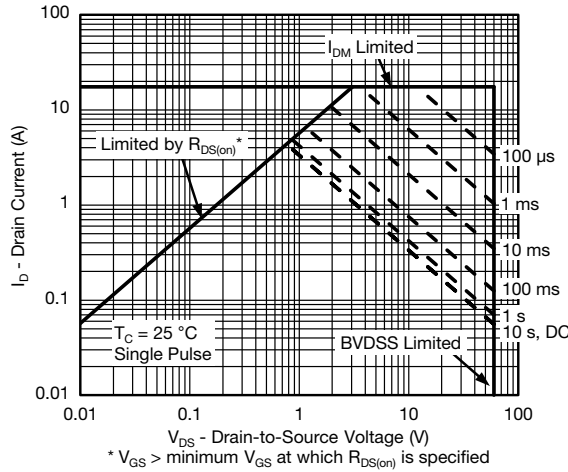
Threshold Voltage



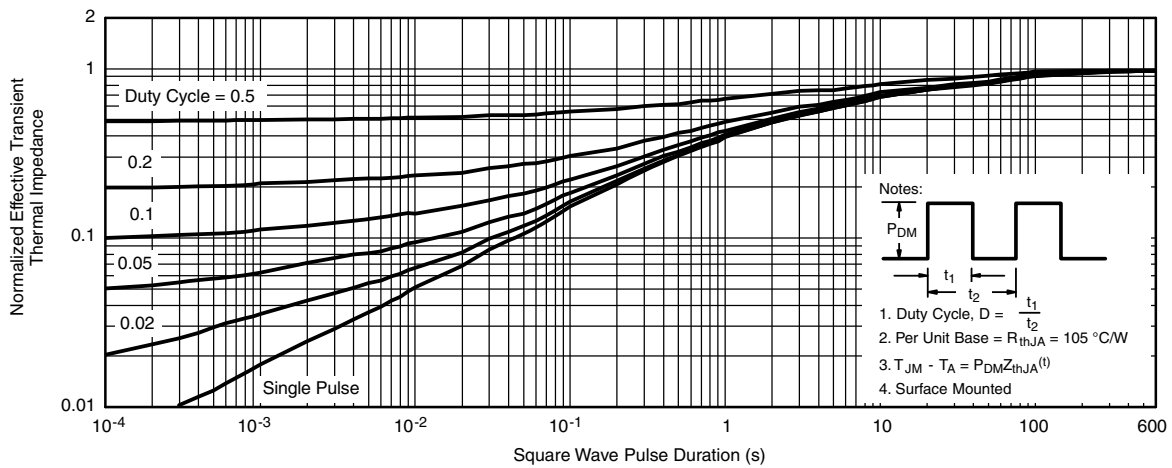
Drain Source Breakdown vs. Junction Temperature



**THERMAL RATINGS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



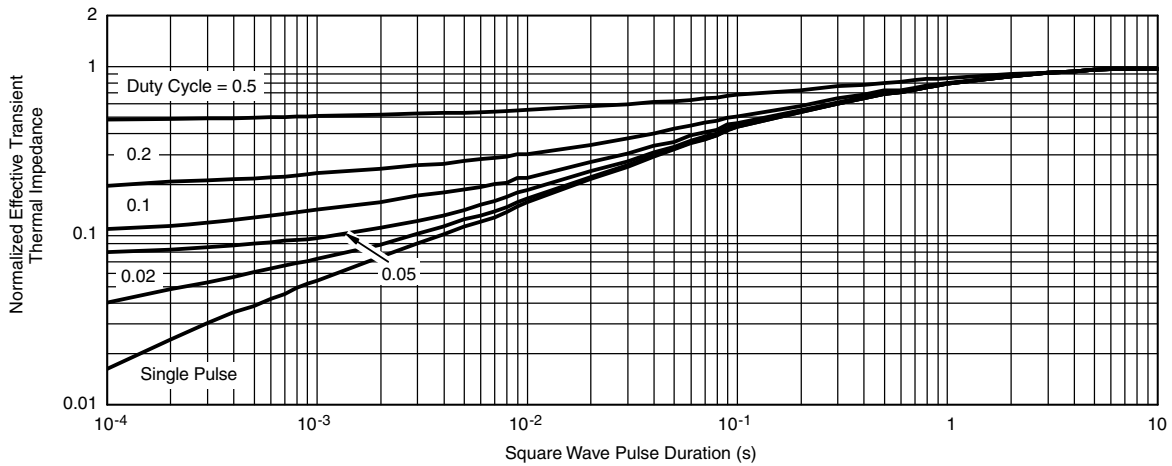
**Safe Operating Area**



**Normalized Thermal Transient Impedance, Junction-to-Ambient**



**THERMAL RATINGS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



**Normalized Thermal Transient Impedance, Junction-to-Foot**

**Note**

- The characteristics shown in the two graphs
  - Normalized Transient Thermal Impedance Junction-to-Ambient (25 °C)
  - Normalized Transient Thermal Impedance Junction-to-Foot (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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## SOIC (NARROW): 8-LEAD

JEDEC Part Number: MS-012



DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A <sub>1</sub>	0.10	0.20	0.004	0.008
B	0.35	0.51	0.014	0.020
C	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
e	1.27 BSC		0.050 BSC	
H	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
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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