

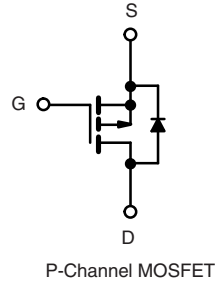
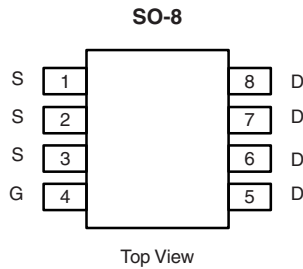
## Automotive P-Channel 40 V (D-S) 175 °C MOSFET

PRODUCT SUMMARY	
V <sub>DS</sub> (V)	- 40
R <sub>DS(on)</sub> (Ω) at V <sub>GS</sub> = - 10 V	0.014
R <sub>DS(on)</sub> (Ω) at V <sub>GS</sub> = - 4.5 V	0.023
I <sub>D</sub> (A)	- 17.3
Configuration	Single

### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET® Power MOSFET
- AEC-Q101 Qualified
- 100 % R<sub>G</sub> and UIS Tested
- Compliant to RoHS Directive 2002/95/EC

AUTOMOTIVE GRADE


**RoHS**  
 COMPLIANT  
 HALOGEN  
**FREE**


ORDERING INFORMATION	
Package	SO-8
Lead (Pb)-free and Halogen-free	SQ4401EY-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>	- 40	V
Gate-Source Voltage	V <sub>GS</sub>	± 20	
Continuous Drain Current <sup>a</sup>	I <sub>D</sub>	T <sub>C</sub> = 25 °C	- 17.3
		T <sub>C</sub> = 125 °C	- 10
Continuous Source Current (Diode Conduction) <sup>a</sup>	I <sub>S</sub>	- 6.5	A
Pulsed Drain Current <sup>b</sup>	I <sub>DM</sub>	- 69	
Single Pulse Avalanche Current	I <sub>AS</sub>	- 30	
Single Pulse Avalanche Energy			
Maximum Power Dissipation <sup>b</sup>	P <sub>D</sub>	T <sub>C</sub> = 25 °C	7.14
		T <sub>C</sub> = 125 °C	2.4
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>	85	°C/W
Junction-to-Foot (Drain)	R <sub>thJF</sub>	21	

### Notes

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



SPECIFICATIONS ( $T_C = 25\text{ }^\circ\text{C}$ , unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
<b>Static</b>							
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0, I_D = -250\text{ }\mu\text{A}$		-40	-	-	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	$I_{DSS}$	$V_{GS} = 0\text{ V}$	$V_{DS} = -40\text{ V}$	-	-	-1.0	$\mu\text{A}$
		$V_{GS} = 0\text{ V}$	$V_{DS} = -40\text{ V}, T_J = 125\text{ }^\circ\text{C}$	-	-	-50	
		$V_{GS} = 0\text{ V}$	$V_{DS} = -40\text{ V}, T_J = 175\text{ }^\circ\text{C}$	-	-	-150	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{GS} = -10\text{ V}$	$V_{DS} \geq -5\text{ V}$	-30	-	-	A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -10\text{ V}$	$I_D = -10.5\text{ A}$	-	0.011	0.014	$\Omega$
		$V_{GS} = -10\text{ V}$	$I_D = -10.5\text{ A}, T_J = 125\text{ }^\circ\text{C}$	-	-	0.020	
		$V_{GS} = -10\text{ V}$	$I_D = -10.5\text{ A}, T_J = 175\text{ }^\circ\text{C}$	-	-	0.024	
		$V_{GS} = -4.5\text{ V}$	$I_D = -8.7\text{ A}$	-	0.017	0.023	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -15\text{ V}, I_D = -10.5\text{ A}$		-	30	-	S
<b>Dynamic<sup>b</sup></b>							
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}$	$V_{DS} = -20\text{ V}, f = 1\text{ MHz}$	-	3400	4250	$\text{pF}$
Output Capacitance	$C_{oss}$			-	440	550	
Reverse Transfer Capacitance	$C_{riss}$			-	350	436	
Total Gate Charge <sup>c</sup>	$Q_g$	$V_{GS} = -10\text{ V}$	$V_{DS} = -20\text{ V}, I_D = -10.5\text{ A}$	-	74	115	$\text{nC}$
Gate-Source Charge <sup>c</sup>	$Q_{gs}$			-	11	-	
Gate-Drain Charge <sup>c</sup>	$Q_{gd}$			-	16	-	
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		1.16	-	3.21	$\Omega$
Turn-On Delay Time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = -15\text{ V}, R_L = 15\text{ }\Omega$ $I_D \cong -1\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 6\text{ }\Omega$		-	58	85	$\text{ns}$
Rise Time <sup>c</sup>	$t_r$			-	76	105	
Turn-Off Delay Time <sup>c</sup>	$t_{d(off)}$			-	67	85	
Fall Time <sup>c</sup>	$t_f$			-	44	55	
<b>Source-Drain Diode Ratings and Characteristics<sup>b</sup></b>							
Pulsed Current <sup>a</sup>	$I_{SM}$			-	-	-69	A
Forward Voltage	$V_{SD}$	$I_F = -2.7\text{ A}, V_{GS} = 0$		-	-0.8	-1.1	V

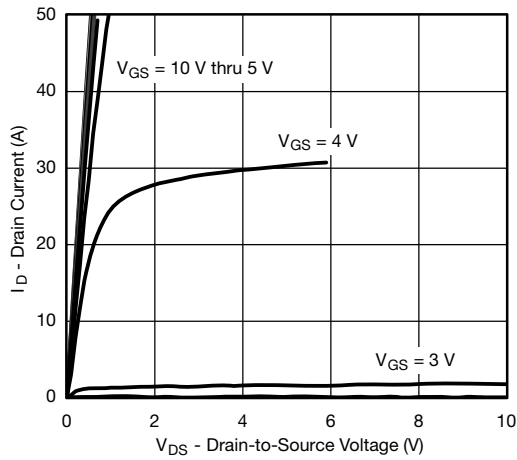
**Notes**

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

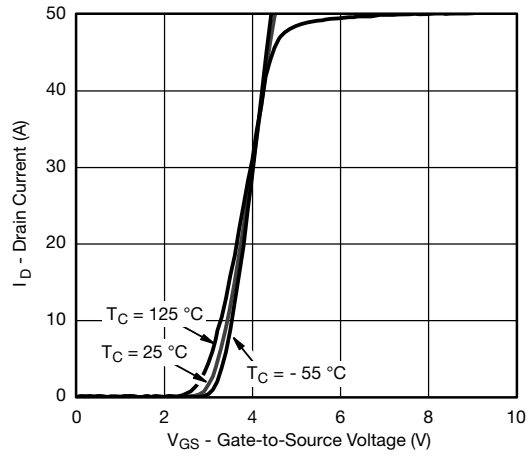
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



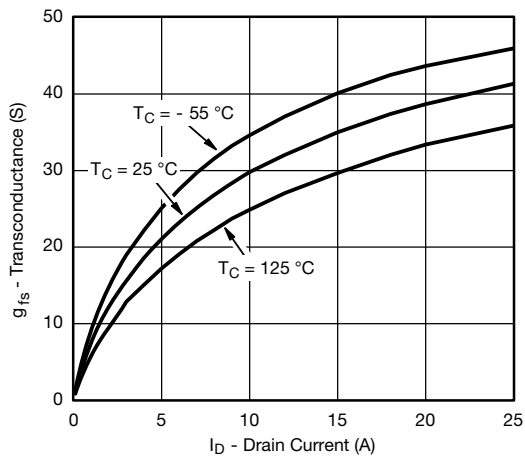
TYPICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C, unless otherwise noted)



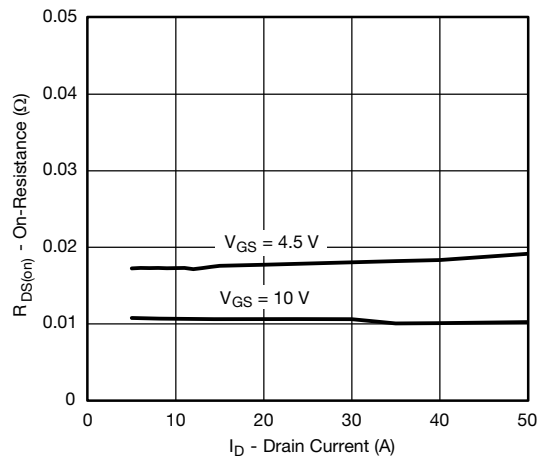
Output Characteristics



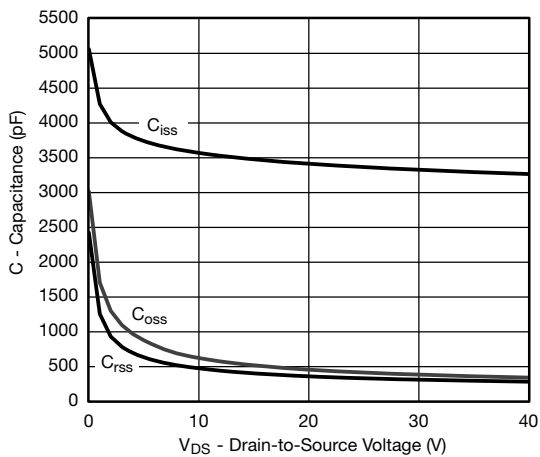
Transfer Characteristics



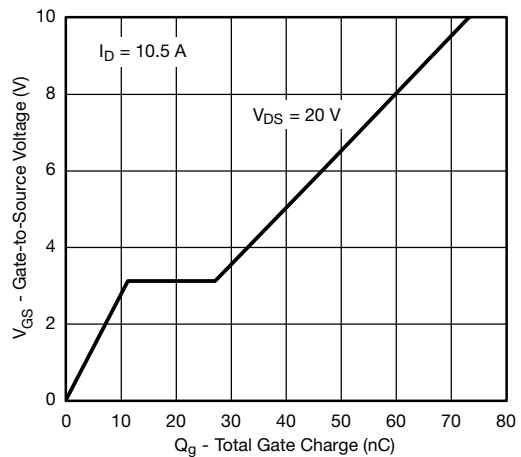
Transconductance



On-Resistance vs. Drain Current



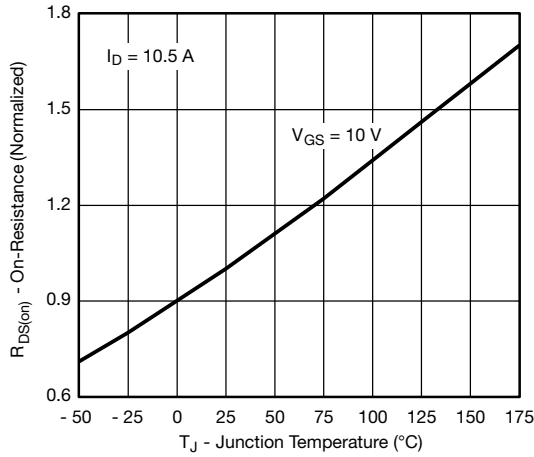
Capacitance



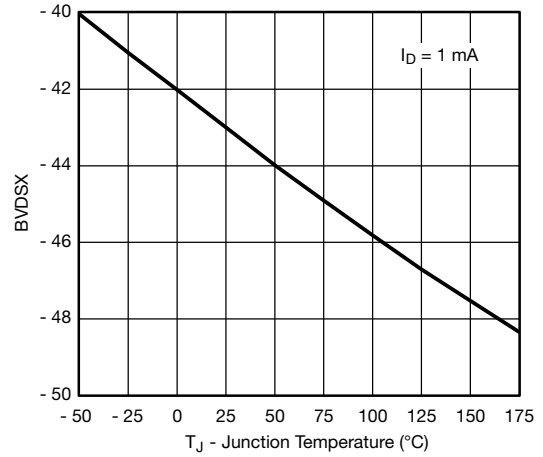
Gate Charge



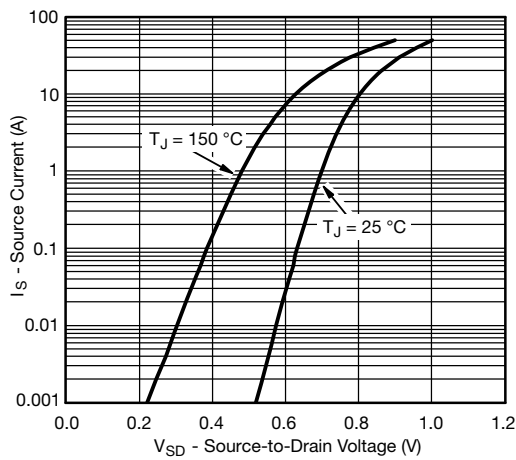
**TYPICAL CHARACTERISTICS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)



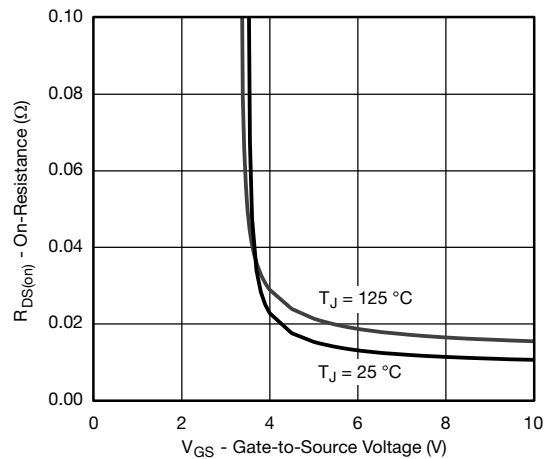
**On-Resistance vs. Junction Temperature**



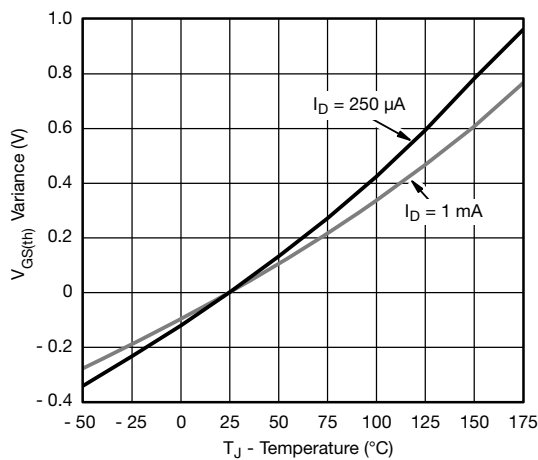
**Breakdown Voltage vs. Junction Temperature**



**Source Drain Diode Forward Voltage**



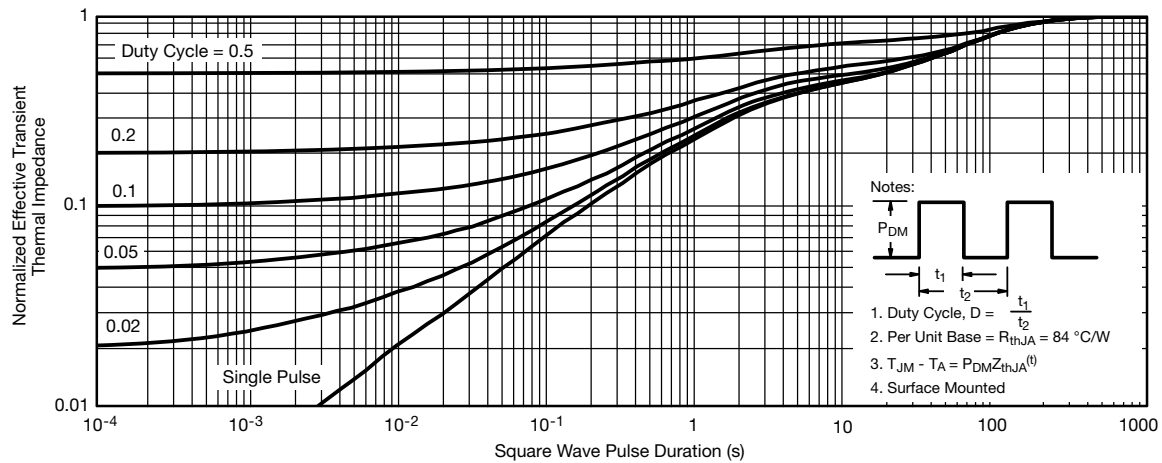
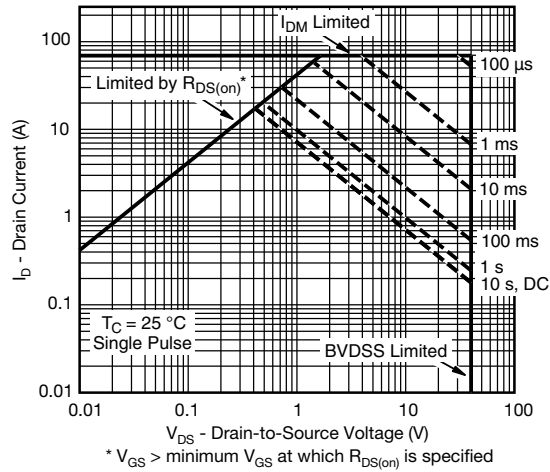
**On-Resistance vs. Gate-to-Source Voltage**



**Threshold Voltage**

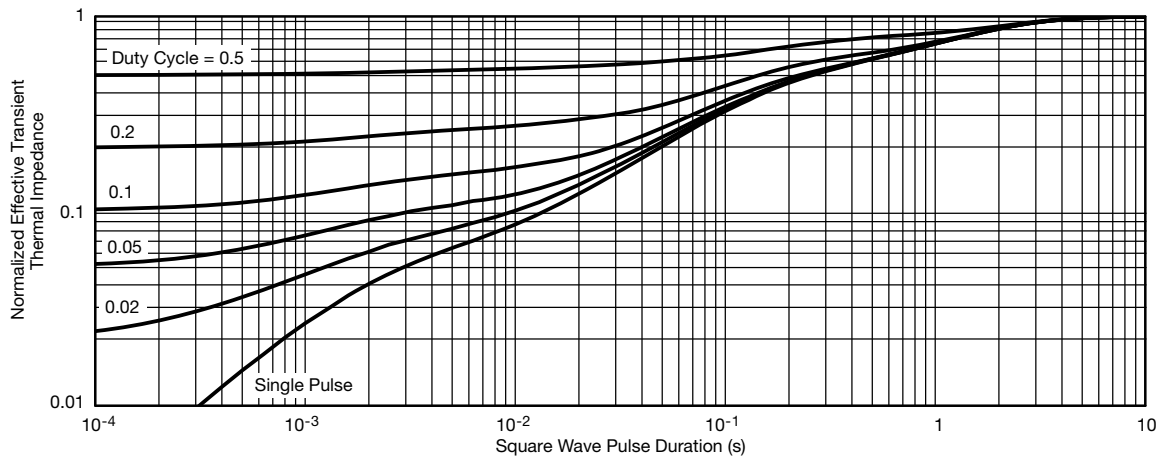


**THERMAL RATINGS** ( $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise noted)





**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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