

## N-Channel 20-V (D-S) MOSFET

PRODUCT SUMMARY		
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A)
20	0.0027 at V <sub>GS</sub> = 4.5 V	25
	0.0042 at V <sub>GS</sub> = 2.5 V	22

### FEATURES

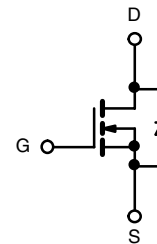
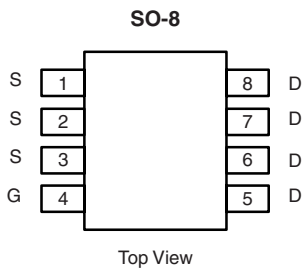
- Halogen-free According to IEC 61249-2-21 Available
- Ultra Low On-Resistance Using High Density TrenchFET<sup>®</sup> Gen II Power MOSFET Technology
- Q<sub>g</sub> Optimized
- 100 % R<sub>g</sub> Tested



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

### APPLICATIONS

- Synchronous Rectification
- Point-Of-Load



N-Channel MOSFET

**Ordering Information:** Si4378DY-T1-E3 (Lead (Pb)-free)  
Si4378DY-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS T <sub>A</sub> = 25 °C, unless otherwise noted					
Parameter	Symbol	10 s	Steady State	Unit	
Drain-Source Voltage	V <sub>DS</sub>	20		V	
Gate-Source Voltage	V <sub>GS</sub>	± 12			
Continuous Drain Current (T <sub>J</sub> = 150 °C) <sup>a</sup>	I <sub>D</sub>	T <sub>A</sub> = 25 °C	25	19	A
		T <sub>A</sub> = 70 °C	20	13	
Pulsed Drain Current (10 μs Pulse Width)	I <sub>DM</sub>	70			
Continuous Source Current (Diode Conduction) <sup>a</sup>	I <sub>S</sub>	2.9	1.3		
Avalanche Current	L = 0.1 mH	I <sub>AS</sub>	40		
Maximum Power Dissipation <sup>a</sup>	P <sub>D</sub>	T <sub>A</sub> = 25 °C	3.5	1.6	W
		T <sub>A</sub> = 70 °C	2.2	1	
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150		°C	

THERMAL RESISTANCE RATINGS					
Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>a</sup>	t ≤ 10 s	R <sub>thJA</sub>	29	35	°C/W
	Steady State		67	80	
Maximum Junction-to-Foot (Drain)	Steady State	R <sub>thJF</sub>	13	16	

Notes:

a. Surface Mounted on 1" x 1" FR4 board.

<b>SPECIFICATIONS</b> $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	0.6		1.8	V
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			5	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 4.5\text{ V}$	30			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 4.5\text{ V}, I_D = 25\text{ A}$		0.0022	0.0027	$\Omega$
		$V_{GS} = 2.5\text{ V}, I_D = 22\text{ A}$		0.0034	0.0042	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 10\text{ V}, I_D = 25\text{ A}$		150		S
Diode Forward Voltage <sup>a</sup>	$V_{SD}$	$I_S = 2.9\text{ A}, V_{GS} = 0\text{ V}$		0.72	1.1	V
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		8500		$\mu\text{F}$
Output Capacitance	$C_{oss}$			1250		
Reverse Transfer Capacitance	$C_{rss}$			650		
Total Gate Charge	$Q_g$	$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 25\text{ A}$		55		$\text{nC}$
Gate-Source Charge	$Q_{gs}$			16		
Gate-Drain Charge	$Q_{gd}$			10		
Gate Resistance	$R_g$		0.8	1.3	2.0	$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}, R_L = 10\text{ }\Omega$ $I_D \cong 1\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 6\text{ }\Omega$		85	130	$\text{ns}$
Rise Time	$t_r$			65	100	
Turn-Off Delay Time	$t_{d(off)}$			140	210	
Fall Time	$t_f$			50	80	
Source-Drain Reverse Recovery Time	$t_{rr}$		$I_F = 2.9\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		50	

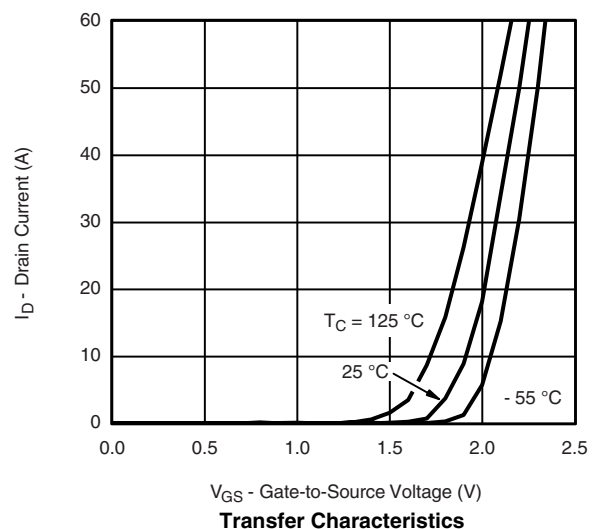
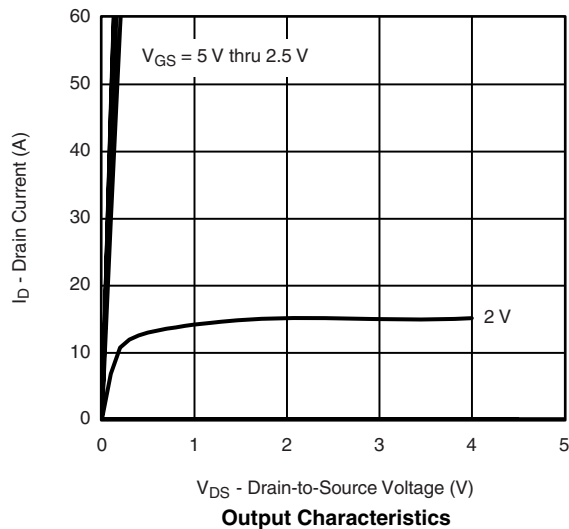
Notes:

a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .

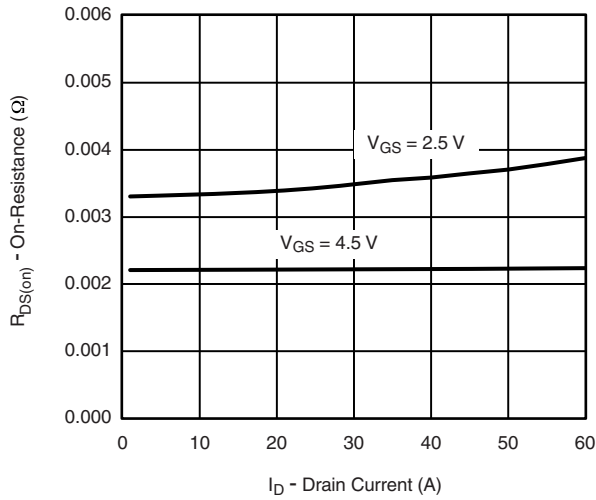
b. Guaranteed by design, not subject to production testing.

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.

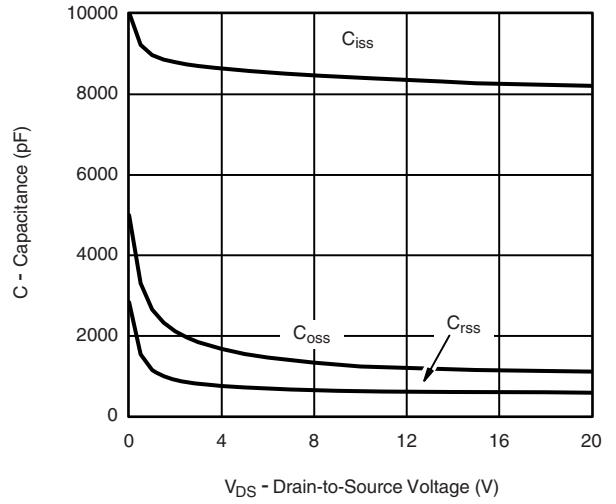
## TYPICAL CHARACTERISTICS $25\text{ }^\circ\text{C}$ , unless otherwise noted



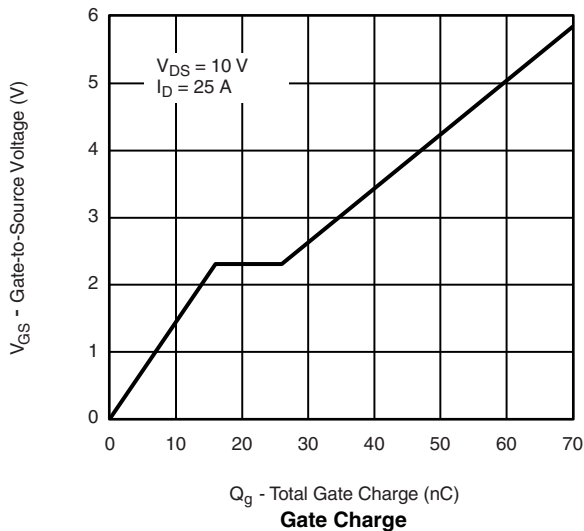
**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



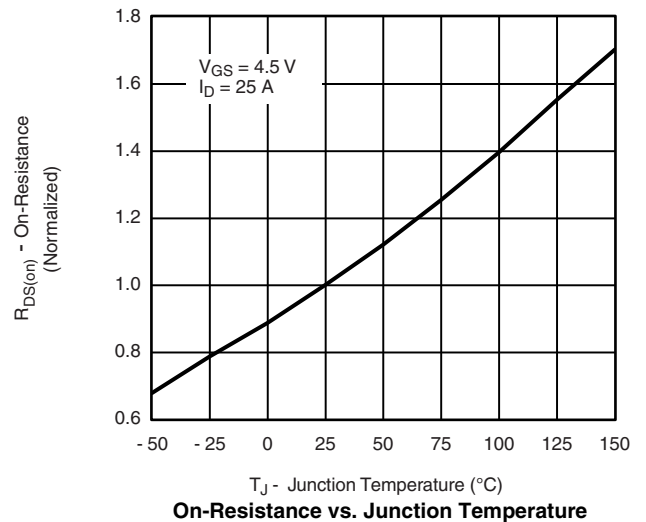
**On-Resistance vs. Drain Current**



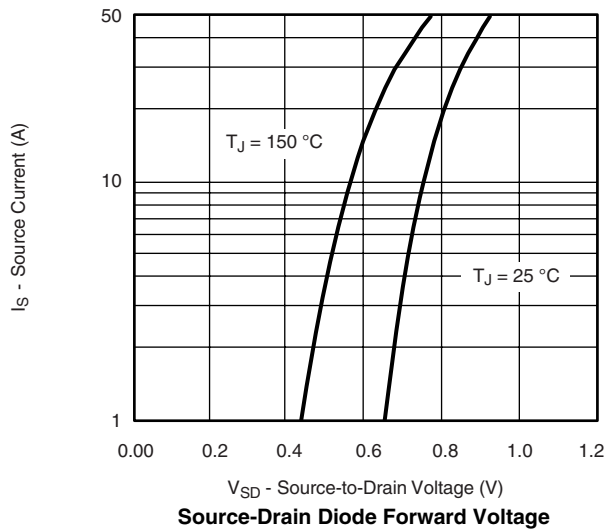
**Capacitance**



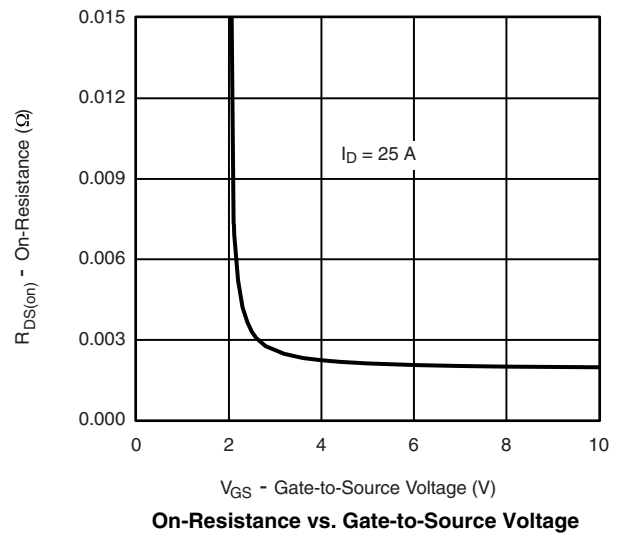
**Gate Charge**



**On-Resistance vs. Junction Temperature**

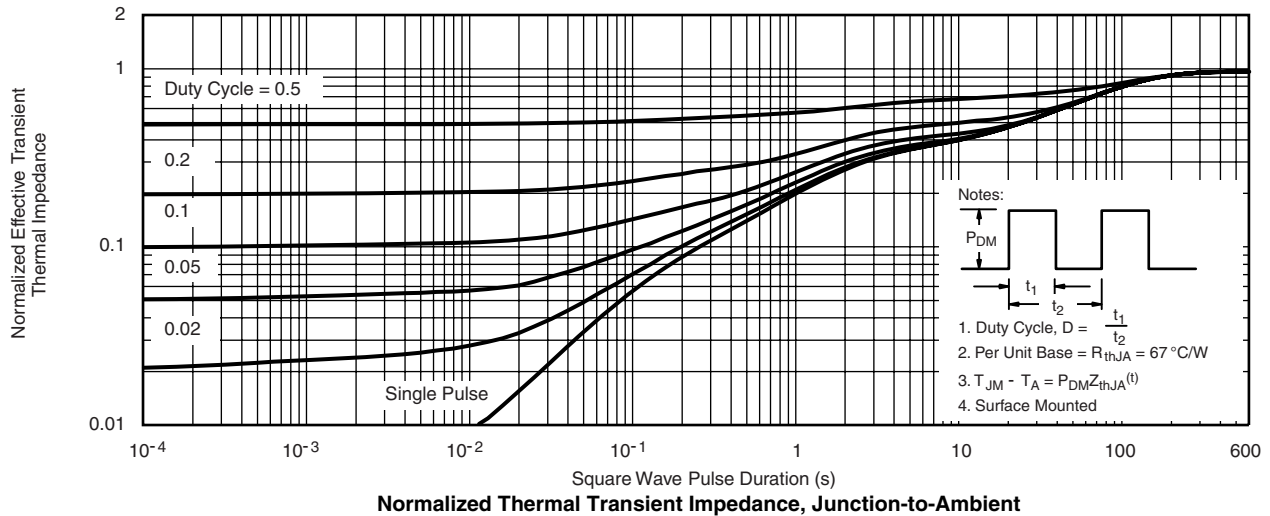
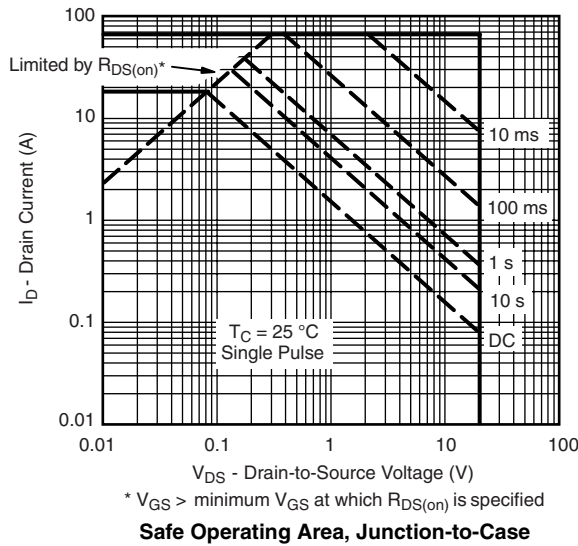
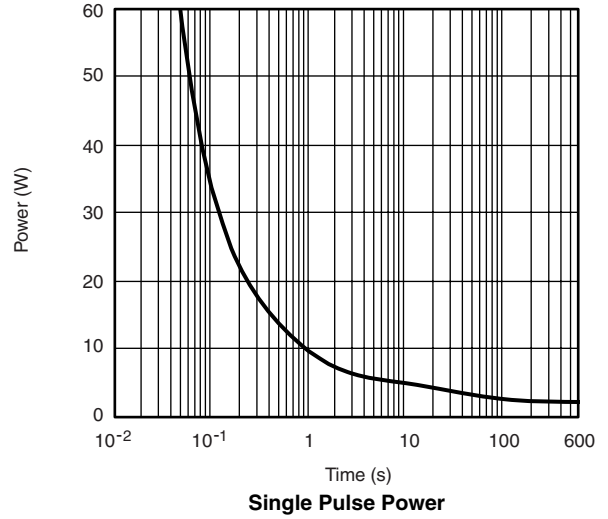
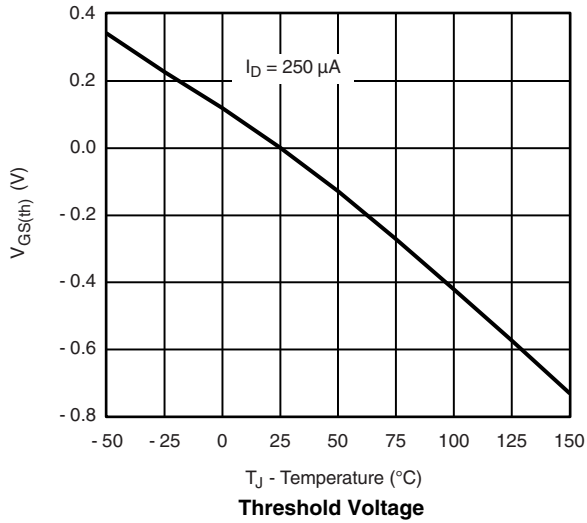


**Source-Drain Diode Forward Voltage**



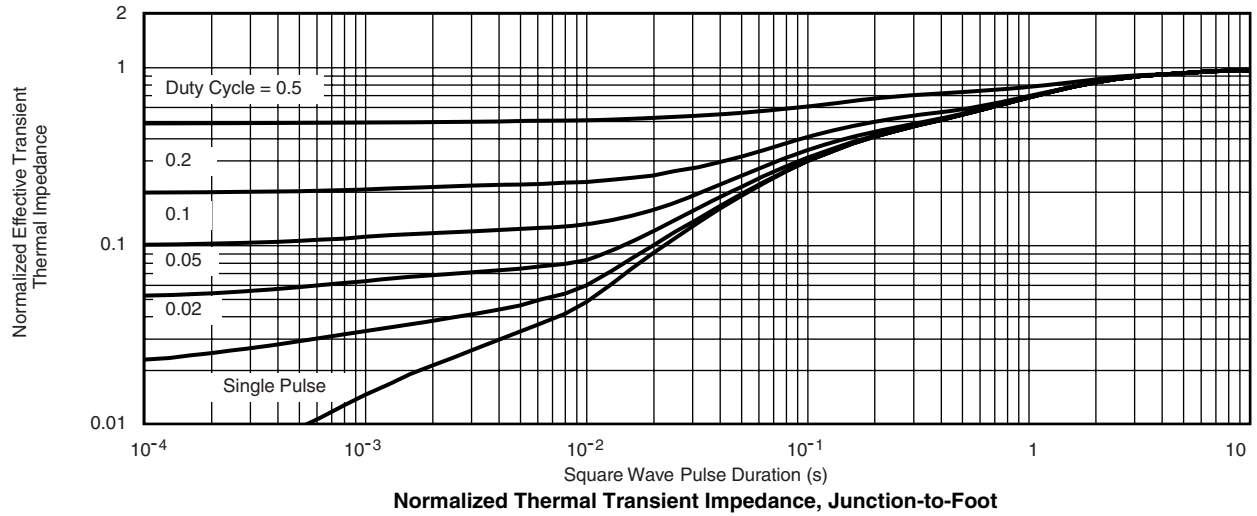
**On-Resistance vs. Gate-to-Source Voltage**

**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted





**TYPICAL CHARACTERISTICS** 25 °C, unless otherwise noted



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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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