

## N-Channel Reduced $Q_g$ , Fast Switching MOSFET

PRODUCT SUMMARY		
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A)
20	0.0028 at $V_{GS} = 10$ V	25
	0.0040 at $V_{GS} = 4.5$ V	22

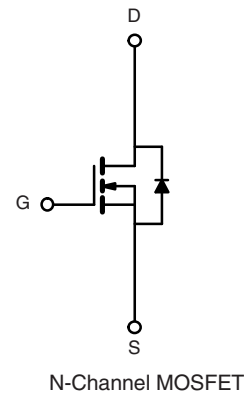
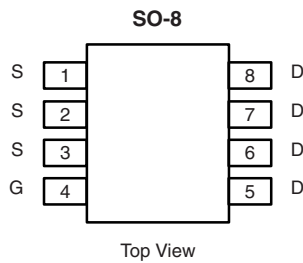
### FEATURES

- Halogen-free According to IEC 61249-2-21 Definition
- Extremely Low  $Q_{gd}$  for Switching Losses
- Ultra-Low On-Resistance
- 100 %  $R_g$  and UIS Tested
- Compliant to RoHS Directive 2002/95/EC



### APPLICATIONS

- Synchronous Rectifier in Low Power DC/DC Converters
- POL
- OR-ing



**Ordering Information:** Si4398DY-T1-E3 (Lead (Pb)-free)  
Si4398DY-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)					
Parameter	Symbol	10 s	Steady State	Unit	
Drain-Source Voltage	$V_{DS}$	20		V	
Gate-Source Voltage	$V_{GS}$	$\pm 20$			
Continuous Drain Current ( $T_J = 150$ °C) <sup>a</sup>	$I_D$	$T_A = 25$ °C	25	19	A
		$T_A = 70$ °C	20	13	
Pulsed Drain Current (10 $\mu$ s Pulse Width)	$I_{DM}$	70			
Continuous Source Current (Diode Conduction) <sup>a</sup>	$I_S$	2.9	1.3		
Avalanche Current	$I_{AS}$	40		mJ	
Single Pulse Avalanche Energy		$E_{AS}$	80		
Maximum Power Dissipation <sup>a</sup>	$P_D$	$T_A = 25$ °C	3.5	1.6	W
		$T_A = 70$ °C	2.2	1.0	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150		°C	

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

Notes:

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

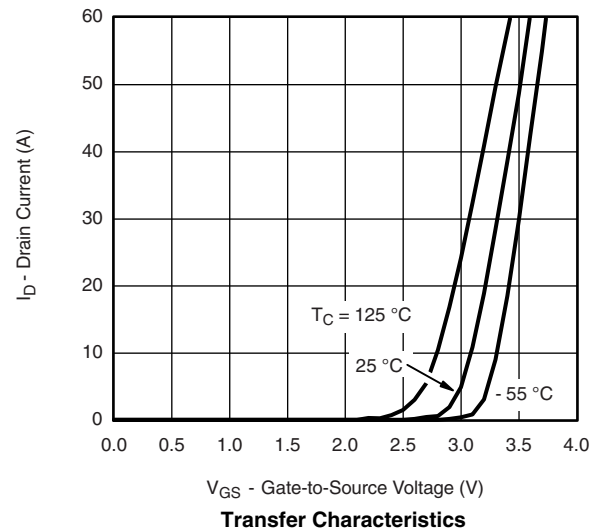
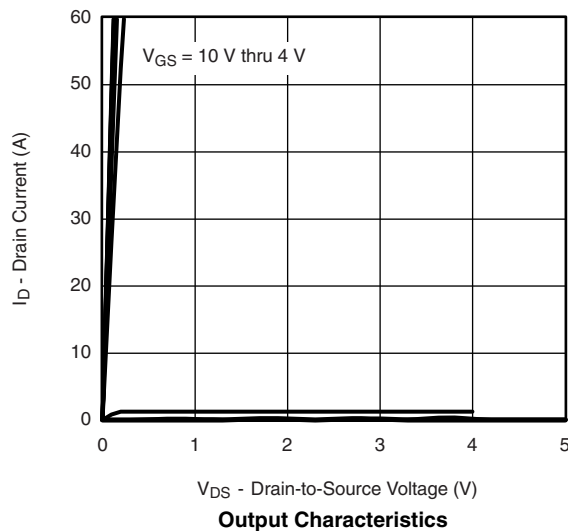
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.0		3.0	V
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 12\text{ V}$			$\pm 100$	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>	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	50			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 25\text{ A}$		0.0023	0.0028	$\Omega$
		$V_{GS} = 4.5\text{ V}, I_D = 22\text{ A}$		0.0033	0.0040	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = 10\text{ V}, I_D = 15\text{ A}$		95		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	$C_{iss}$	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		5620		$\mu\text{F}$
Output Capacitance	$C_{oss}$			1340		
Reverse Transfer Capacitance	$C_{rss}$			540		
Total Gate Charge	$Q_g$	$V_{DS} = 10\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 20\text{ A}$		34	50	$\text{nC}$
Gate-Source Charge	$Q_{gs}$			17.5		
Gate-Drain Charge	$Q_{gd}$			7.5		
Gate Resistance	$R_g$		0.7	1.4	2.1	$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 10\text{ V}, R_L = 10\text{ }\Omega$ $I_D \cong 1\text{ A}, V_{GEN} = 4.5\text{ V}, R_g = 6\text{ }\Omega$		23	35	ns
Rise Time	$t_r$			15	23	
Turn-Off Delay Time	$t_{d(off)}$			80	120	
Fall Time	$t_f$			23	35	
Source-Drain Reverse Recovery Time	$t_{rr}$	$I_F = 2.9\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		50	80	

Notes:

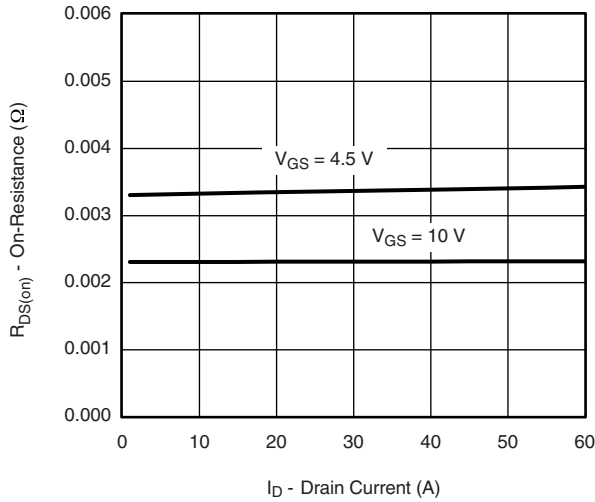
- Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Guaranteed by design, not subject to production testing.

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.

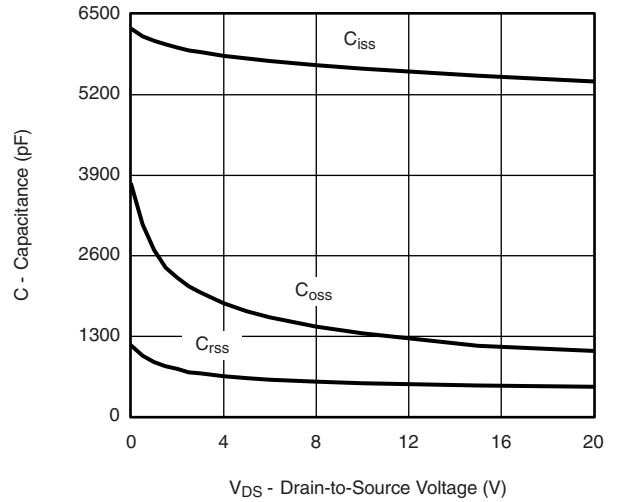
### TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



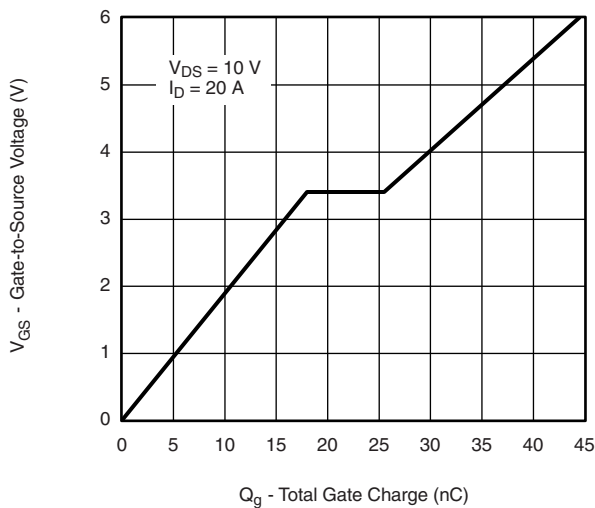
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



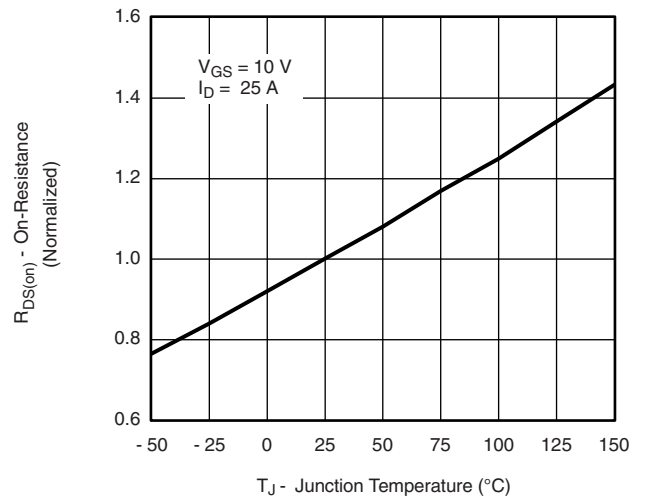
**On-Resistance vs. Drain Current**



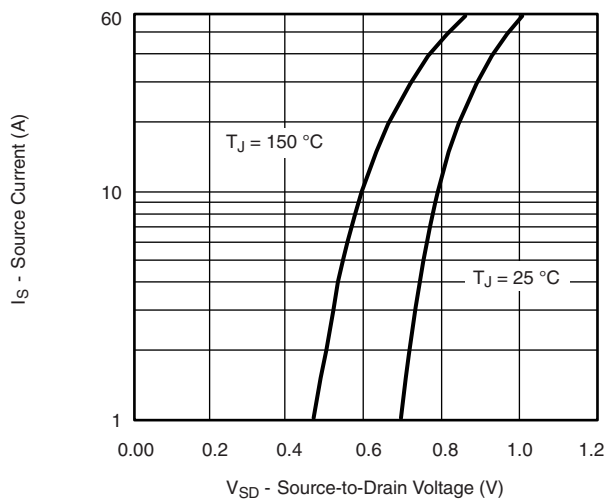
**Capacitance**



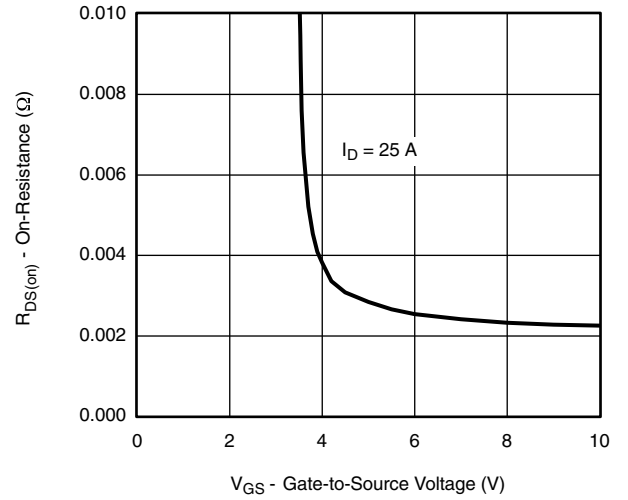
**Gate Charge**



**On-Resistance vs. Junction Temperature**

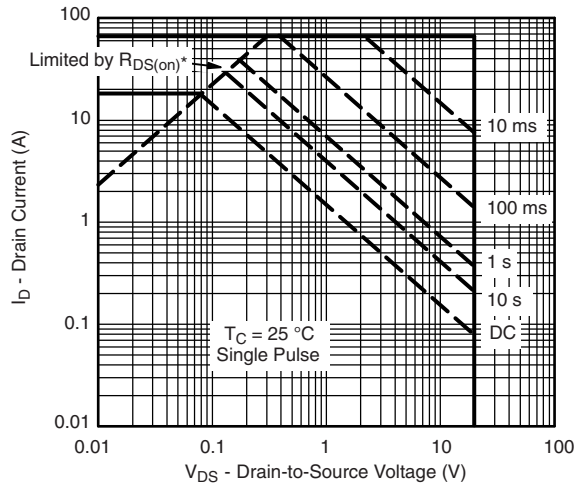
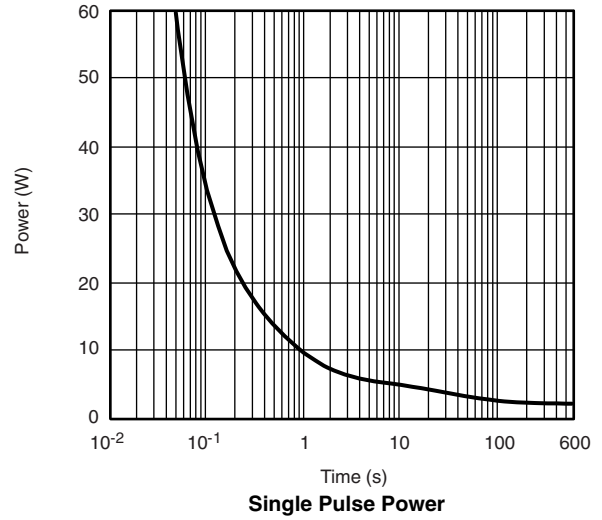
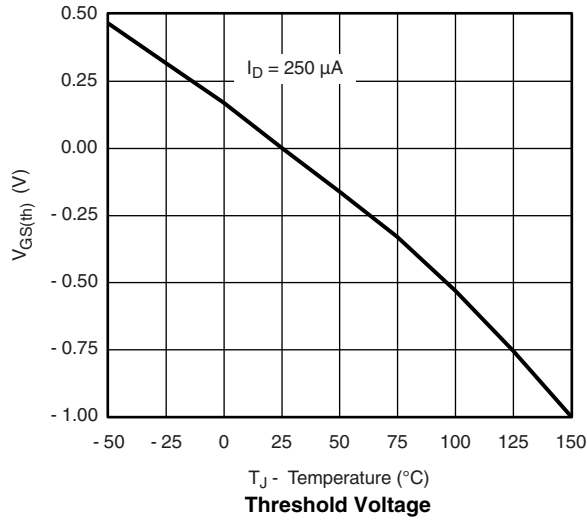


**Source-Drain Diode Forward Voltage**

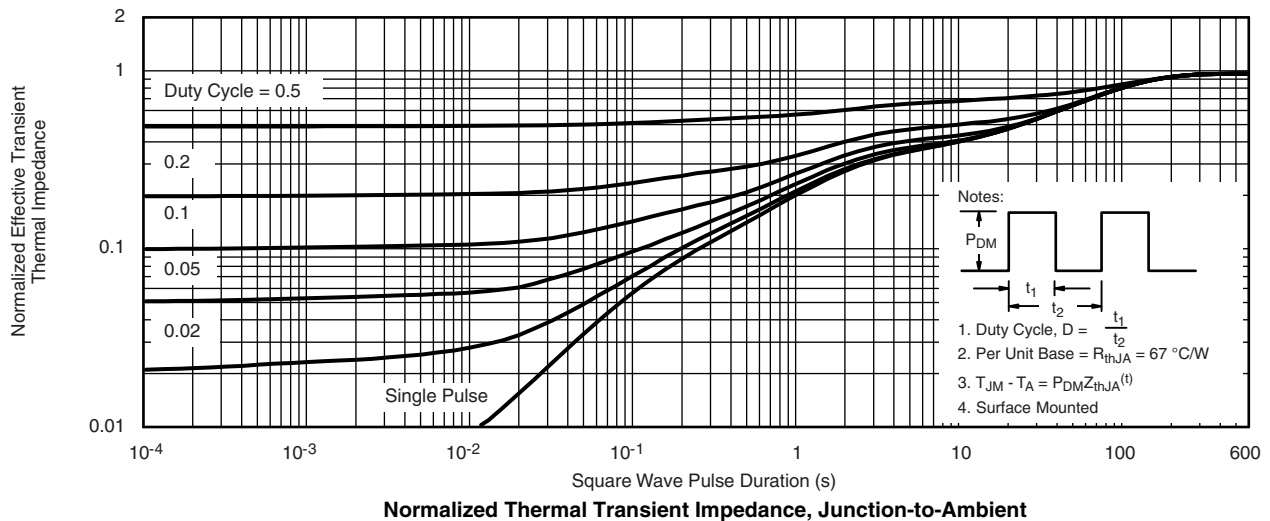


**On-Resistance vs. Gate-to-Source Voltage**

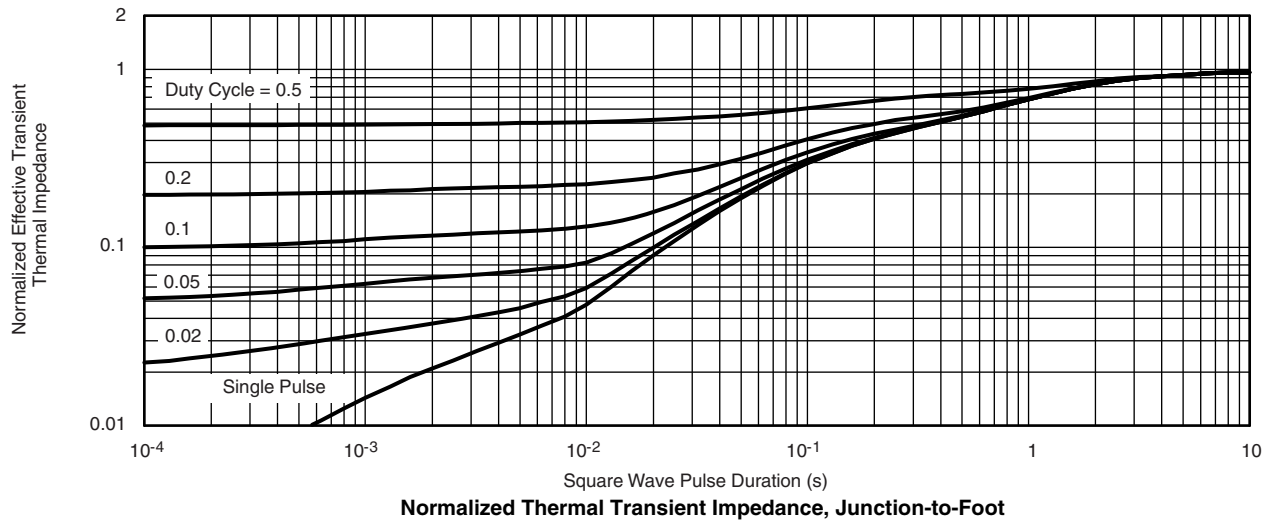
## TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified  
**Safe Operating Area, Junction-to-Case**



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



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