

N-Channel 30 V (D-S) MOSFET



FEATURES

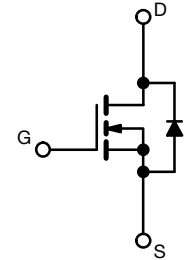
- TrenchFET® power MOSFET
- 100% R_g and UIS tested
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Notebook system power
- Low current DC/DC



N-Channel MOSFET

PRODUCT SUMMARY

V_{DS} (V)	30
$R_{DS(on)}$ max. (Ω) at $V_{GS} = 10$ V	0.021
$R_{DS(on)}$ max. (Ω) at $V_{GS} = 4.5$ V	0.033
Q_g typ. (nC)	3.7
I_D (A) ^a	12
Configuration	Single

ORDERING INFORMATION

Package	SO-8
Lead (Pb)-free and halogen-free	Si4178DY-T1-GE3

ABSOLUTE MAXIMUM RATINGS ($T_A = 25$ °C, unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT
Drain-source voltage	V_{DS}	30	V
Gate-source voltage	V_{GS}	± 25	
Continuous drain current ($T_J = 150$ °C)	I_D	$T_C = 25$ °C	12 ^a
		$T_C = 70$ °C	9.7 ^a
		$T_A = 25$ °C	8.3 ^{b, c}
		$T_A = 70$ °C	6.7 ^{b, c}
Pulsed drain current	I_{DM}	40	A
Continuous source-drain diode current	I_S	$T_C = 25$ °C	4.2
		$T_A = 25$ °C	2 ^{b, c}
Single pulse avalanche current	I_{AS}	10	
Single pulse avalanche energy	E_{AS}	5	mJ
Maximum power dissipation	P_D	$T_C = 25$ °C	5
		$T_C = 70$ °C	3.2
		$T_A = 25$ °C	2.4 ^{b, c}
		$T_A = 70$ °C	1.5 ^{b, c}
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 ^{b, d}	R_{thJA}	42	53	°C/W
Maximum junction-to-foot (drain)	R_{thJF}	19	25	

Notes

- Package limited
- Surface mounted on 1" x 1" FR4 board
- $t = 10$ s
- Maximum under steady state conditions is 85 °C/W



SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-source breakdown voltage	V_{DS}	$V_{GS} = 0\text{ V}$, $I_D = 250\text{ }\mu\text{A}$	30	-	-	V
V_{DS} temperature coefficient	$\Delta V_{DS}/T_J$	$I_D = 250\text{ }\mu\text{A}$	-	25	-	mV/ $^\circ\text{C}$
$V_{GS(th)}$ temperature coefficient	$\Delta V_{GS(th)}/T_J$		-	-6	-	
Gate-source threshold voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	1.4	-	2.8	V
Gate-source leakage	I_{GSS}	$V_{DS} = 0\text{ V}$, $V_{GS} = \pm 25\text{ V}$	-	-	± 100	nA
Zero gate voltage drain current	I_{DSS}	$V_{DS} = 30\text{ V}$, $V_{GS} = 0\text{ V}$	-	-	1	μA
		$V_{DS} = 30\text{ V}$, $V_{GS} = 0\text{ V}$, $T_J = 55\text{ }^\circ\text{C}$	-	-	10	
On-state drain current ^a	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}$, $V_{GS} = 10\text{ V}$	20	-	-	A
Drain-source on-state resistance ^a	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$, $I_D = 8.4\text{ A}$	-	0.017	0.021	Ω
		$V_{GS} = 4.5\text{ V}$, $I_D = 2\text{ A}$	-	0.027	0.033	
Forward transconductance ^a	g_{fs}	$V_{DS} = 15\text{ V}$, $I_D = 8.4\text{ A}$	-	22	-	S
Dynamic ^b						
Input capacitance	C_{iss}	$V_{DS} = 15\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$	-	405	-	pF
Output capacitance	C_{oss}		-	110	-	
Reverse transfer capacitance	C_{rss}		-	56	-	
Total gate charge	Q_g	$V_{DS} = 15\text{ V}$, $V_{GS} = 10\text{ V}$, $I_D = 8.4\text{ A}$	-	7.5	12	nC
		$V_{DS} = 15\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 8.4\text{ A}$	-	3.7	5.6	
Gate-source charge	Q_{gs}	$V_{DS} = 15\text{ V}$, $V_{GS} = 4.5\text{ V}$, $I_D = 8.4\text{ A}$	-	1.6	-	
Gate-drain charge	Q_{gd}		-	1.3	-	
Gate resistance	R_g	$f = 1\text{ MHz}$	0.5	2.6	5.2	Ω
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 15\text{ V}$, $R_L = 2.2\text{ }\Omega$ $I_D \cong 6.7\text{ A}$, $V_{GEN} = 4.5\text{ V}$, $R_g = 1\text{ }\Omega$	-	20	30	ns
Rise time	t_r		-	15	25	
Turn-off delay time	$t_{d(off)}$		-	11	20	
Fall time	t_f		-	10	15	
Turn-on delay time	$t_{d(on)}$	$V_{DD} = 15\text{ V}$, $R_L = 2.2\text{ }\Omega$ $I_D \cong 6.7\text{ A}$, $V_{GEN} = 10\text{ V}$, $R_g = 1\text{ }\Omega$	-	7	15	ns
Rise time	t_r		-	10	15	
Turn-off delay time	$t_{d(off)}$		-	12	20	
Fall time	t_f		-	10	15	
Drain-Source Body Diode Characteristics						
Continuous source-drain diode current	I_S	$T_C = 25\text{ }^\circ\text{C}$	-	-	4.2	A
Pulse diode forward current	I_{SM}		-	-	40	
Body diode voltage	V_{SD}	$I_S = 6.7\text{ A}$, $V_{GS} = 0\text{ V}$	-	0.85	1.2	V
Body diode reverse recovery time	t_{rr}	$I_F = 6.7\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$, $T_J = 25\text{ }^\circ\text{C}$	-	15	30	ns
Body diode reverse recovery charge	Q_{rr}		-	8	16	nC
Reverse recovery fall time	t_a		-	8.5	-	ns
Reverse recovery rise time	t_b		-	6.5	-	

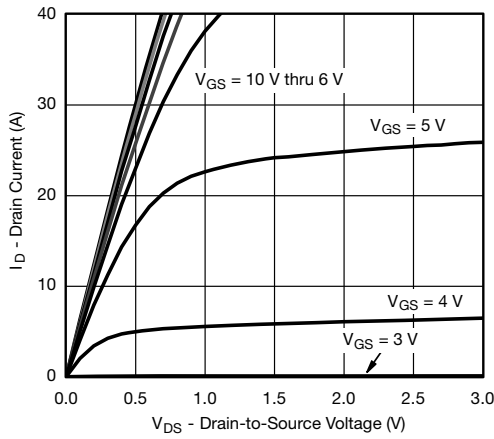
Notes

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

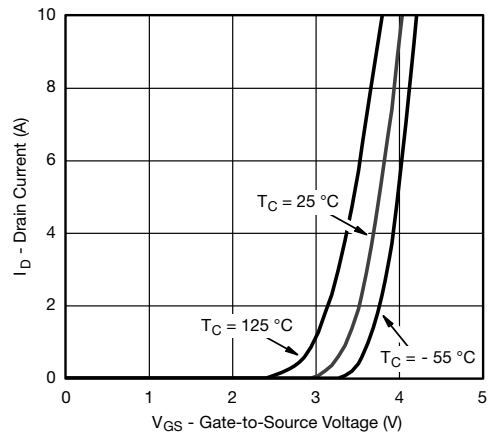
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



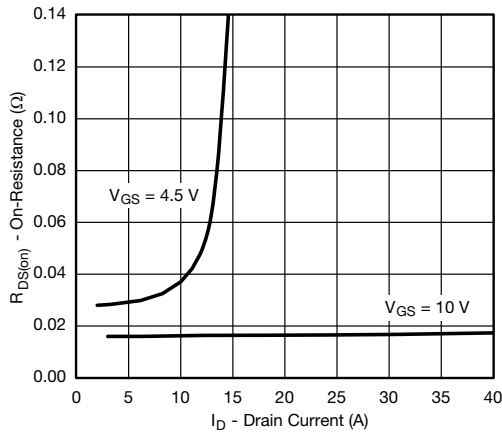
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



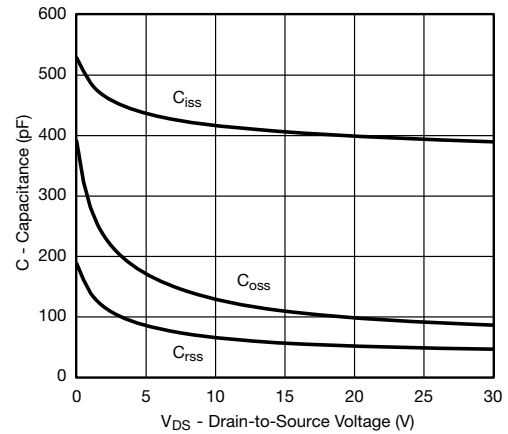
Output Characteristics



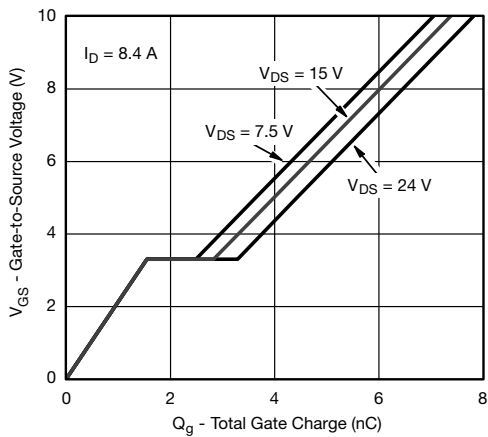
Transfer Characteristics



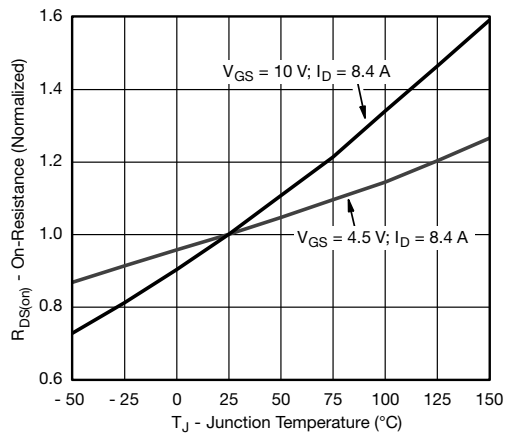
On-Resistance vs. Drain Current



Capacitance



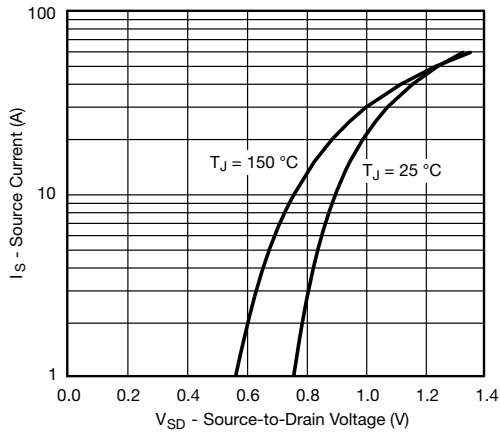
Gate Charge



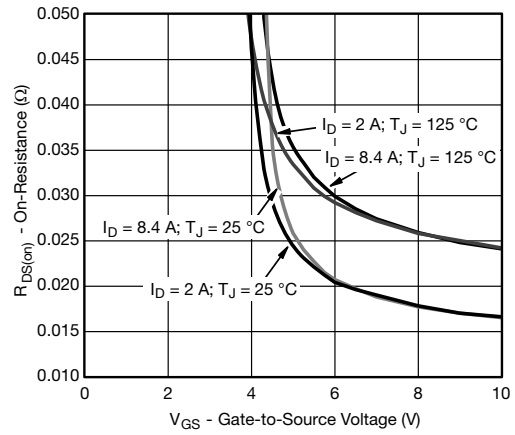
On-Resistance vs. Junction Temperature



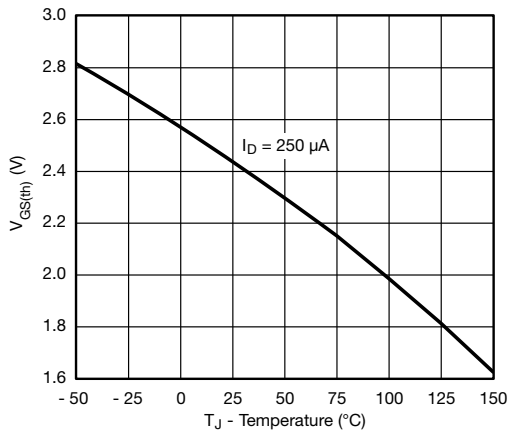
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



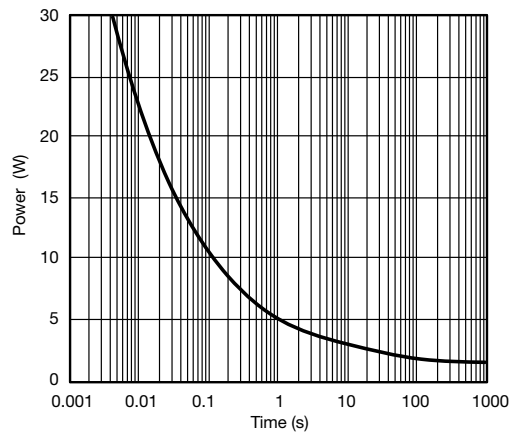
Source-Drain Diode Forward Voltage



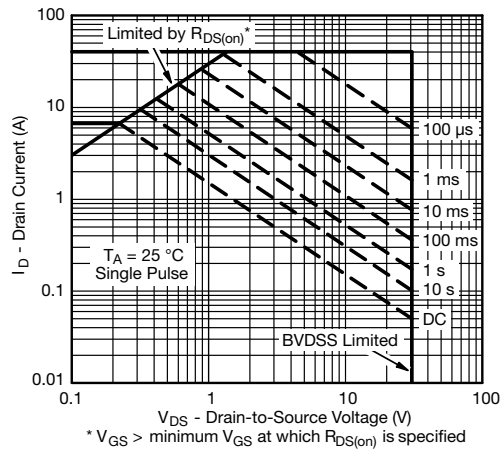
On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage



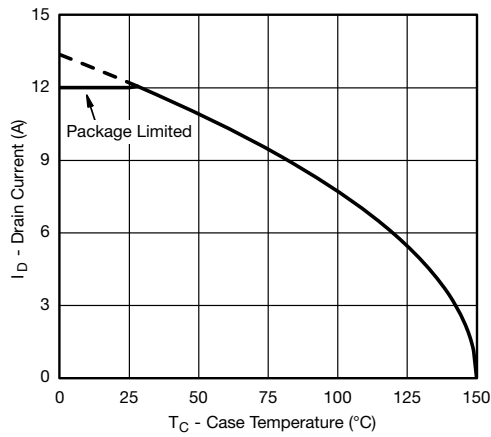
Single Pulse Power



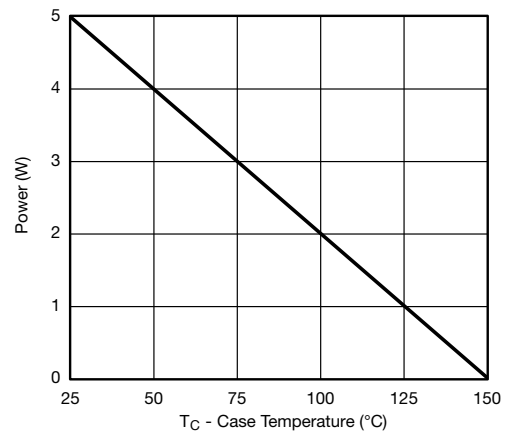
Safe Operating Area, Junction-to-Ambient



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Current Derating ^a



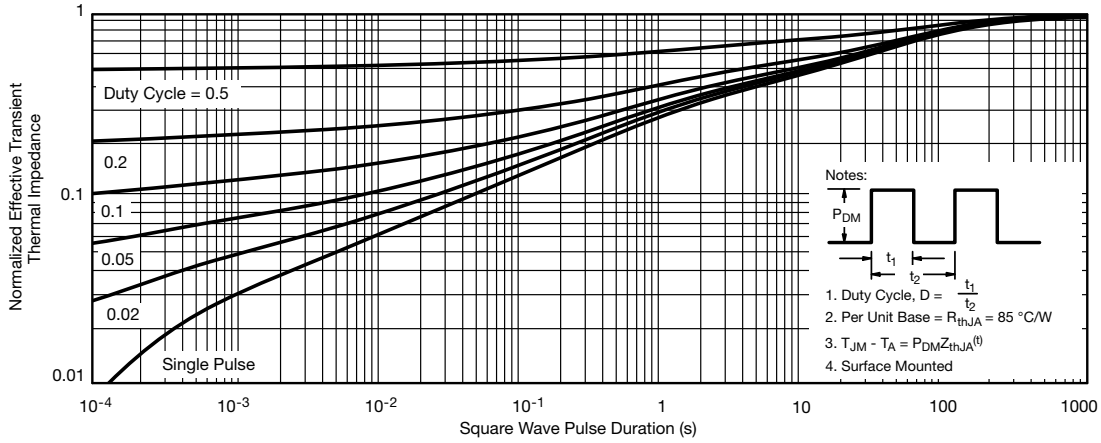
Power Derating

Note

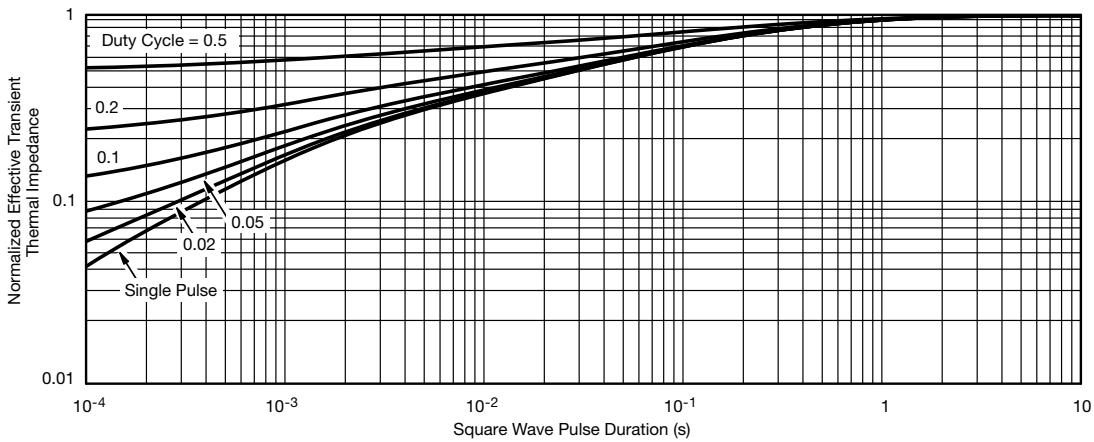
- a. The power dissipation P_D is based on $T_J \text{ max.} = 150 \text{ }^\circ\text{C}$, using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit



TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



Normalized Thermal Transient Impedance, Junction-to-Ambient



Normalized Thermal Transient Impedance, Junction-to-Foot

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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 ₁	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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