

N-Channel 40-V (D-S) Fast Switching MOSFET

PRODUCT SUMMARY			
V _{DS} (V)	R _{DS(on)} (Ω)	I _D (A)	Q _g (Typ.)
40	0.0078 at V _{GS} = 10 V	16.4	15 nC
	0.010 at V _{GS} = 4.5 V	14.5	

FEATURES

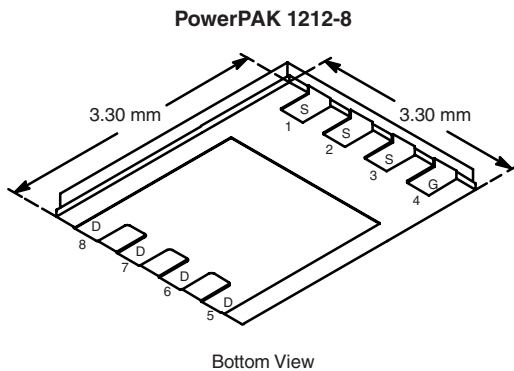
- Halogen-free Option Available
- TrenchFET[®] Power MOSFET
- New Low Thermal Resistance PowerPAK[®] Package with Low 1.07 mm Profile
- PWM Optimized
- 100 % R_g Tested



RoHS
COMPLIANT

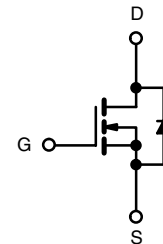
APPLICATIONS

- Synchronous Rectification
- Intermediate Switch
- Synchronous Buck



Bottom View

Ordering Information: Si7116DN-T1-E3 (Lead (Pb)-free)
Si7116DN-T1-GE3 (Lead (Pb)-free and Halogen-free)



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS T _A = 25 °C, unless otherwise noted				
Parameter	Symbol	10 s	Steady State	Unit
Drain-Source Voltage	V _{DS}	40		V
Gate-Source Voltage	V _{GS}	± 20		
Continuous Drain Current (T _J = 150 °C) ^a	I _D	T _A = 25 °C	16.4	10.5
		T _A = 70 °C	13.1	8.4
Pulsed Drain Current	I _{DM}	60		A
Continuous Source Current (Diode Conduction) ^a	I _S	3.2	1.3	
Avalanche Current	I _{AS}	15		
Avalanche Energy	E _{AS}	11		mJ
Maximum Power Dissipation ^a	P _D	T _A = 25 °C	3.8	1.5
		T _A = 70 °C	2.0	0.8
Operating Junction and Storage Temperature Range	T _J , T _{stg}	- 55 to 150		°C
Soldering Recommendations (Peak Temperature) ^{b, c}		260		

THERMAL RESISTANCE RATINGS					
Parameter	Symbol	Typical	Maximum	Unit	
Maximum Junction-to-Ambient ^a	R _{thJA}	t ≤ 10 s	24	33	°C/W
		Steady State	65	81	
Maximum Junction-to-Case (Drain)	R _{thJC}	1.9	2.4		

Notes:

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

b. See Solder Profile (<http://www.vishay.com/ppg?73257>). The PowerPAK 1212-8 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.

c. Rework Conditions: manual soldering with a soldering iron is not recommended for leadless components.

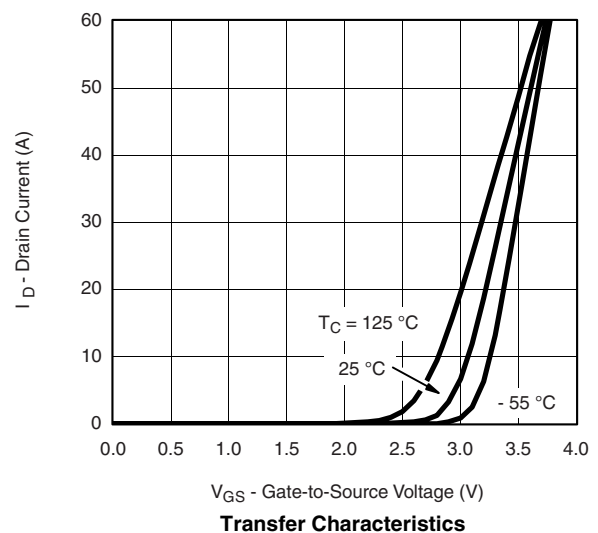
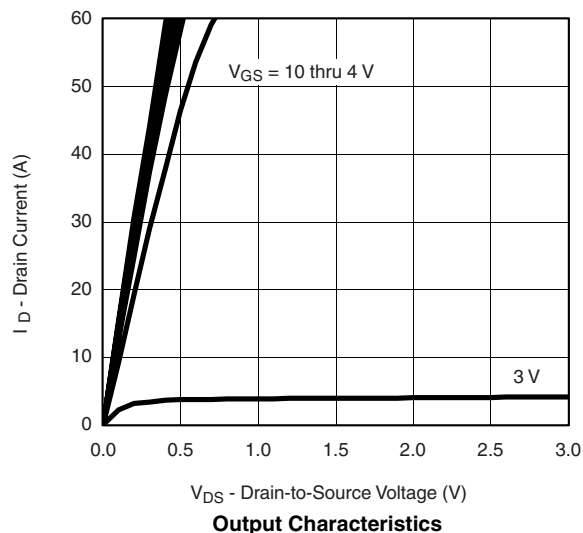
MOSFET SPECIFICATIONS $T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
Static						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1.5		2.5	V
Gate-Body Leakage	I_{GSS}	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$			1	μA
		$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}, T_J = 55\text{ }^\circ\text{C}$			5	
On-State Drain Current ^a	$I_{D(on)}$	$V_{DS} \geq 5\text{ V}, V_{GS} = 10\text{ V}$	40			A
Drain-Source On-State Resistance ^a	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 16.4\text{ A}$		0.0065	0.0078	Ω
		$V_{GS} = 4.5\text{ V}, I_D = 14.5\text{ A}$		0.0083	0.010	
Forward Transconductance ^a	g_{fs}	$V_{DS} = 15\text{ V}, I_D = 16.4\text{ A}$		68		S
Diode Forward Voltage ^a	V_{SD}	$I_S = 3.2\text{ A}, V_{GS} = 0\text{ V}$		0.8	1.2	V
Dynamic^b						
Total Gate Charge	Q_g	$V_{DS} = 20\text{ V}, V_{GS} = 4.5\text{ V}, I_D = 16.4\text{ A}$		15	23	nC
Gate-Source Charge	Q_{gs}			6.7		
Gate-Drain Charge	Q_{gd}			5.1		
Gate Resistance	R_g	$f = 1\text{ MHz}$	0.7	1.4	2.1	Ω
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 20\text{ V}, R_L = 20\text{ }\Omega$ $I_D \cong 1\text{ A}, V_{GEN} = 10\text{ V}, R_g = 6\text{ }\Omega$		10	15	ns
Rise Time	t_r			10	15	
Turn-Off Delay Time	$t_{d(off)}$			36	55	
Fall Time	t_f			10	15	
Source-Drain Reverse Recovery Time	t_{rr}	$I_F = 3.2\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		30	60	
Body Diode Reverse Recovery Charge	Q_{rr}	$I_F = 3.2\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		26	52	nc

Notes:

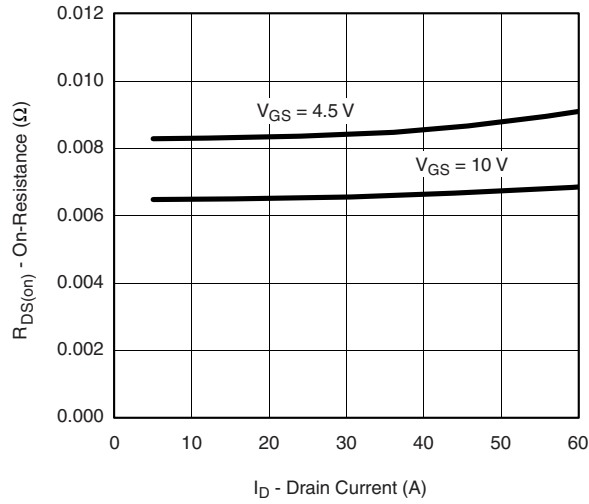
- a. Pulse test; pulse width $\leq 300\text{ }\mu\text{s}$, duty cycle $\leq 2\%$.
- b. Guaranteed by design, not subject to production testing.

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.

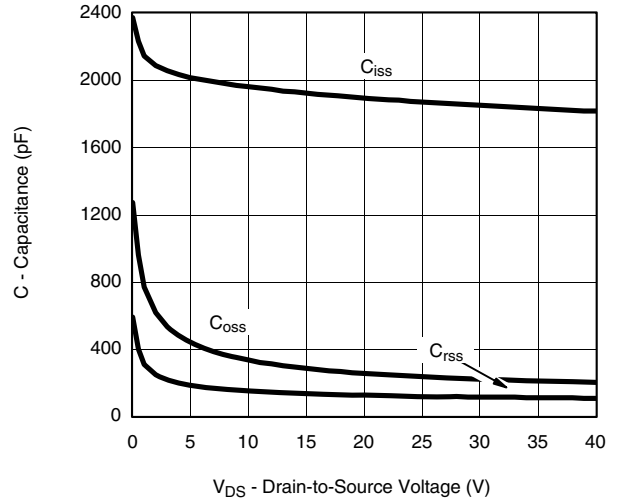
TYPICAL CHARACTERISTICS $25\text{ }^\circ\text{C}$, unless otherwise noted



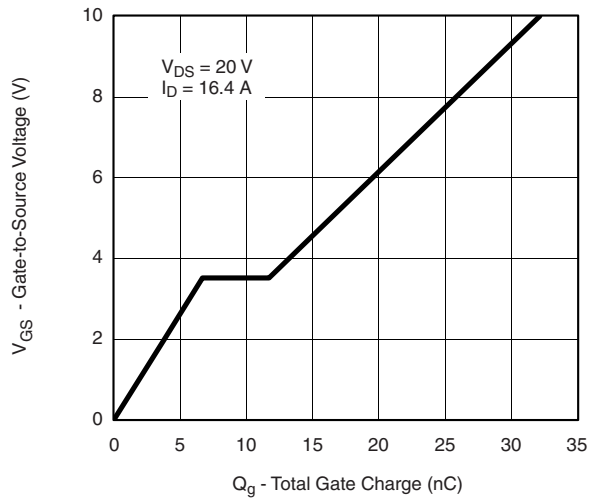
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



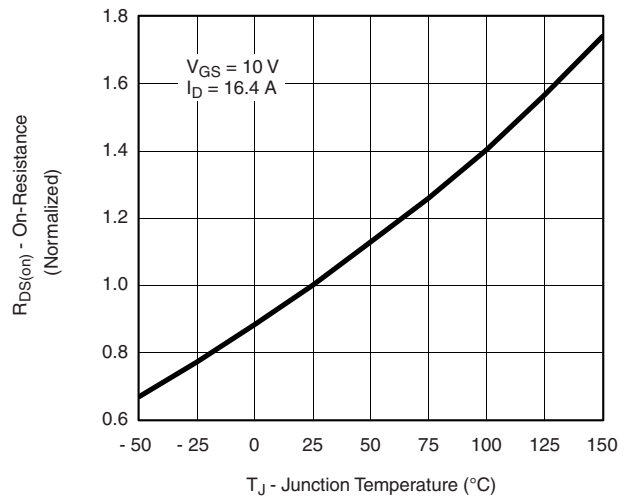
On-Resistance vs. Drain Current



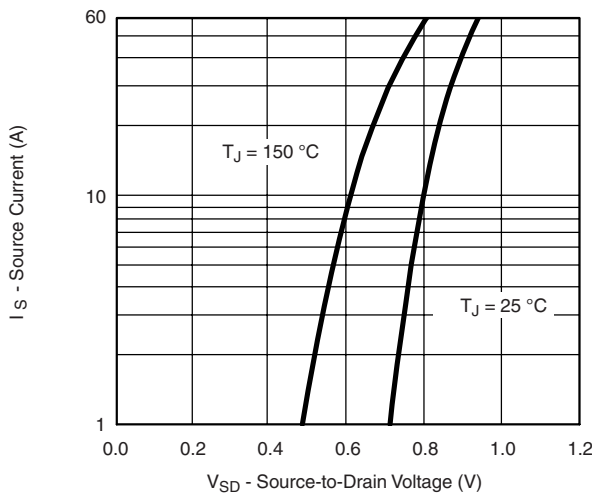
Capacitance



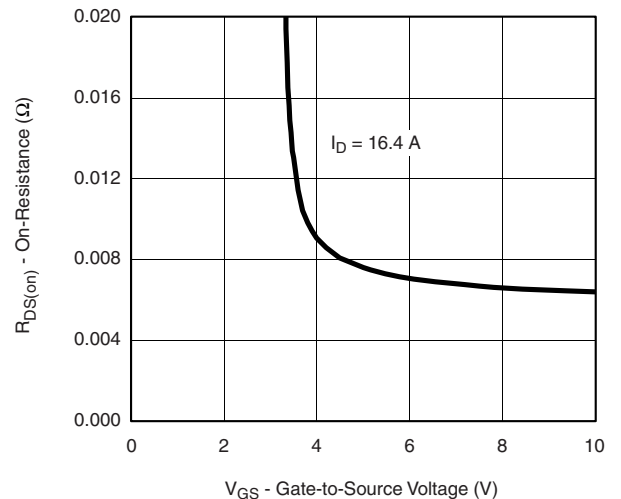
Gate Charge



On-Resistance vs. Junction Temperature

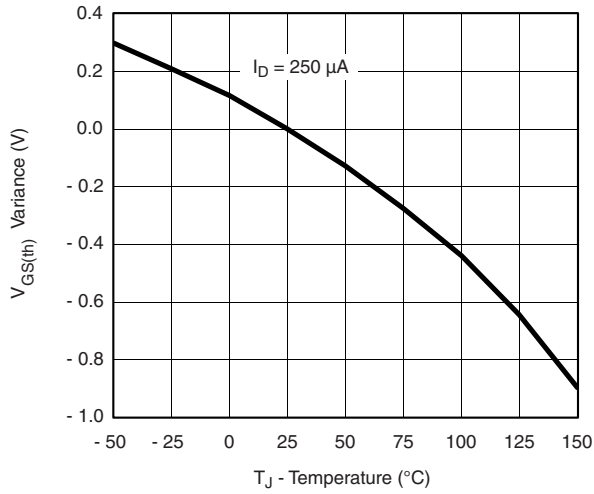


Source-Drain Diode Forward Voltage

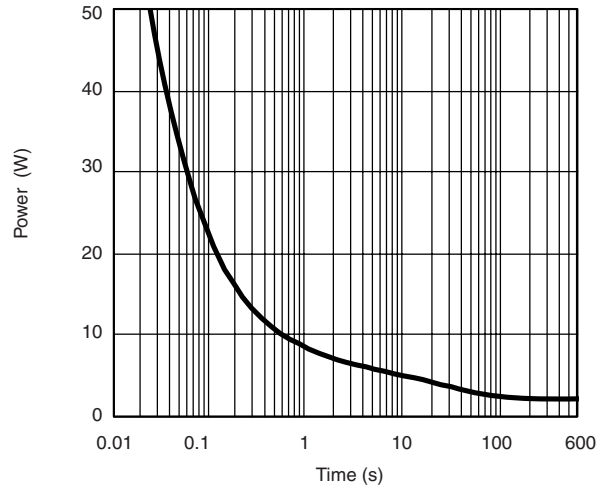


On-Resistance vs. Gate-to-Source Voltage

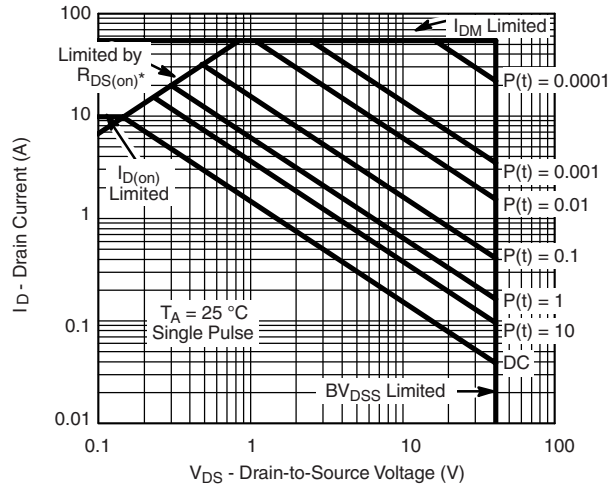
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



Threshold Voltage

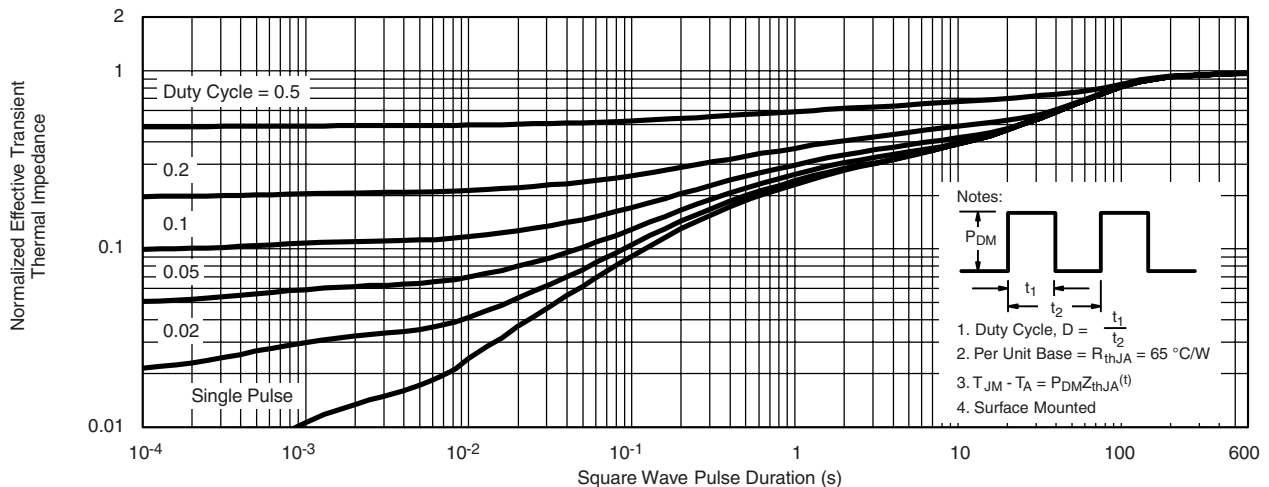


Single Pulse Power, Junction-to-Ambient



* $V_{GS} >$ minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area

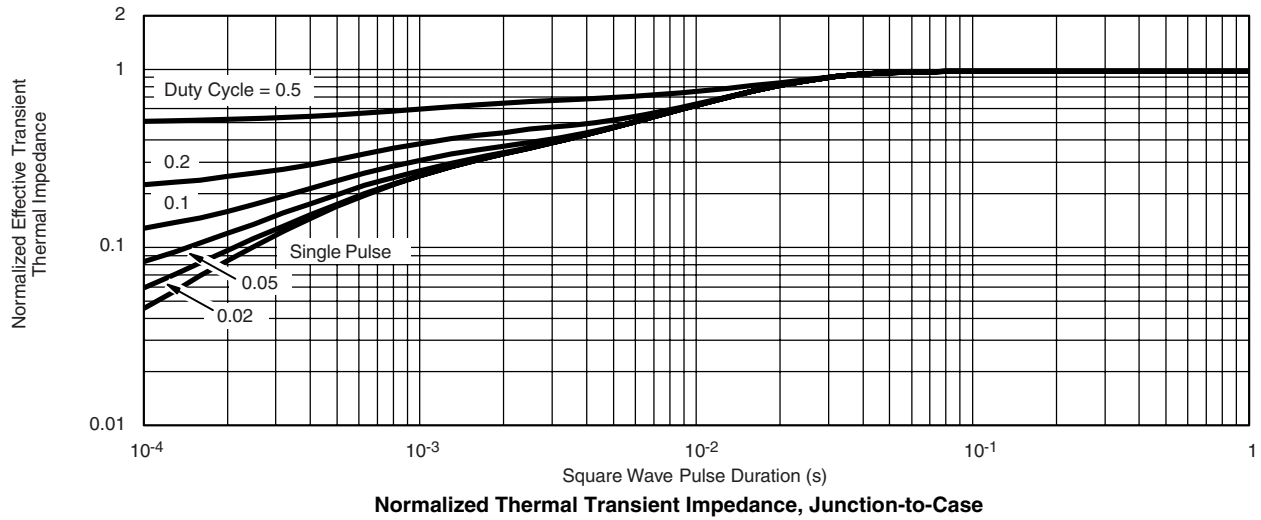


- Notes:
1. Duty Cycle, $D = \frac{t_1}{t_2}$
 2. Per Unit Base = $R_{thJA} = 65 \text{ }^\circ\text{C/W}$
 3. $T_{JM} - T_A = P_{DM} Z_{thJA}(t)$
 4. Surface Mounted

Normalized Thermal Transient Impedance, Junction-to-Ambient



TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



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