



175°C P-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

BV _{DSS}	R _{DS(ON)} MAX	I _D Τ _C = +25°C
-40V	15mΩ @ $V_{GS} = -10V$	-55A
	$23m\Omega @ V_{GS} = -4.5V$	-50A

Description

This MOSFET is designed to minimize the on-state resistance (R_{DS(ON)}) and yet maintain superior switching performance, making it ideal for high-efficiency power management applications.

Applications

- Reverse Polarity Protection
- Motor Control
- Power Management

Features and Benefits

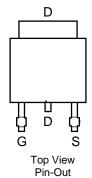
- Rated to +175°C Ideal for High Ambient Temperature Environments
- 100% Unclamped Inductive Switch (UIS) Test in Production
- Low On-Resistance
- · Fast Switching Speed
- Lead-Free Finish; RoHS Compliant (Notes 1 & 2)
- Halogen and Antimony Free. "Green" Device (Note 3)
- · Qualified to AEC-Q101 Standards for High Reliability
- An Automotive-Compliant Part is Available Under Separate Datasheet (DMPH4013SK3Q)

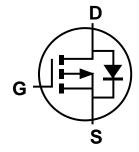
Mechanical Data

- Case: TO252 (DPAK)
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram
- Terminals: Finish Matte Tin Finish Annealed over Copper Leadframe. Solderable per MIL-STD-202, Method 208 (3)
- Weight: 0.33 grams (Approximate)



Top View





Equivalent Circuit

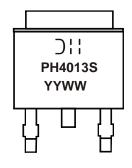
Ordering Information (Note 4)

-			
	Part Number	Case	Packaging
	DMPH4013SK3-13	TO252 (DPAK)	2,500/Tape & Reel

Notes:

- 1. EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant. All applicable RoHS exemptions applied.
- 2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
- 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
- 4. For packaging details, go to our website at https://www.diodes.com/design/support/packaging/diodes-packaging/

Marking Information



DII = Manufacturer's Marking
PH4013S = Product Type Marking Code YYWW = Date Code Marking YY = Year (ex: 18 = 2018)
WW = Week (01 to 53)



Maximum Ratings (@ T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit		
Drain-Source Voltage	V_{DSS}	-40	V		
Gate-Source Voltage			V _{GSS}	±20	V
Continuous Drain Current (Note 6) V _{GS} = -10V	I _D	-55 -40	А		
Pulsed Drain Current (10μs Pulse, Duty Cycle = 1%)	I _{DM}	-120	Α		
Maximum Body Diode Forward Current (Note 6)			Is	-3.6	Α
Pulsed Drain Current (10μs Pulse, Duty Cycle = 1%)			I _{SM}	-120	Α
Avalanche Current, L = 0.1mH (Note 7)			I _{AS}	-40	Α
Avalanche Energy, L = 0.1mH (Note 7)			Eas	69	mJ

Thermal Characteristics (@ $T_A = +25$ °C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit	
Total Power Dissipation (Note 5)		P_D	2.1	W
Thermal Resistance, Junction to Ambient (Note 5)	Steady state	$R_{ heta JA}$	71	°C/W
Total Power Dissipation (Note 6)		P_{D}	3.7	W
Thermal Resistance, Junction to Ambient (Note 6)	Steady state	$R_{ heta JA}$	41	°C/W
Thermal Resistance, Junction to Case		$R_{ heta JC}$	1.7	C/VV
Operating and Storage Temperature Range		$T_{J,}T_{STG}$	-55 to +175	°C

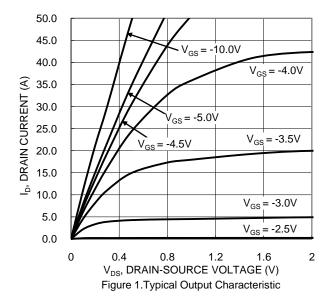
Electrical Characteristics (@ T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Тур	Max	Unit	Test Condition	
OFF CHARACTERISTICS (Note 8)							
Drain-Source Breakdown Voltage	BV _{DSS}	-40		_	V	$V_{GS} = 0V, I_D = -250\mu A$	
Zero Gate Voltage Drain Current	I _{DSS}			-1	μΑ	$V_{DS} = -40V, V_{GS} = 0V$	
Gate-Source Leakage	IGSS	_	_	±100	nA	$V_{GS} = \pm 20V, V_{DS} = 0V$	
ON CHARACTERISTICS (Note 8)							
Gate Threshold Voltage	V _{GS(TH)}	-1.0		-3.0	V	$V_{DS} = V_{GS}, I_{D} = -250 \mu A$	
Static Drain-Source On-Resistance		_	10	15	0	$V_{GS} = -10V, I_D = -10A$	
Static Drain-Source On-Resistance	R _{DS(ON)}		15	23	mΩ	$V_{GS} = -4.5V, I_D = -8A$	
Diode Forward Voltage	V_{SD}		-0.7	-1.2	V	$V_{GS} = 0V, I_{S} = -1A$	
DYNAMIC CHARACTERISTICS (Note 9)							
Input Capacitance	Ciss	_	4004			$V_{DS} = -20V$, $V_{GS} = 0V$ f = 1MHz	
Output Capacitance	Coss		309	_	pF		
Reverse Transfer Capacitance	Crss	_	229	_			
Gate Resistance	R_g		3.5	_	Ω	$V_{DS} = 0V$, $V_{GS} = 0V$, $f = 1MHz$	
Total Gate Charge (V _{GS} = -4.5V)	Q_g	_	31				
Total Gate Charge (V _{GS} = -10V)	Q_g		67		nC	V _{DS} = -20V. I _D = -10A	
Gate-Source Charge	Q_{gs}		13.2	_	liC	V _{DS} = -20V, I _D = -10A	
Gate-Drain Charge	Q_{gd}	_	11				
Turn-On Delay Time	t _{D(ON)}	_	9.9	_			
Turn-On Rise Time	t _R	_	32	_	no	$V_{GS} = -10V, V_{DD} = -20V,$	
Turn-Off Delay Time	t _{D(OFF)}	_	46	_	ns	$R_G = 3\Omega$, $I_D = -10A$	
Turn-Off Fall Time	t _F	_	53				
Reverse Recovery Time	t _{RR}	_	19.5	_	ns	$I_F = -10A$, $di/dt = -100A/\mu s$	
Reverse Recovery Charge	Q_{RR}	_	11.6	_	nC	$I_F = -10A$, $di/dt = -100A/\mu s$	

Notes

- 5. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
- 6. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.
- 7. I_{AS} and E_{AS} ratings are based on low frequency and duty cycles to keep T_J = +25°C.
- 8. Short duration pulse test used to minimize self-heating effect.
- 9. Guaranteed by design. Not subject to product testing.





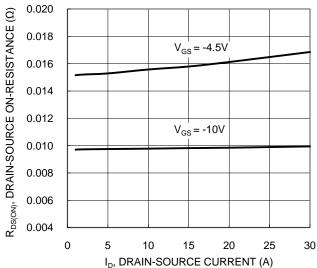


Figure 3. Typical On-Resistance vs. Drain Current and Gate Voltage

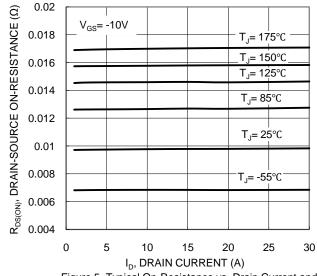


Figure 5. Typical On-Resistance vs. Drain Current and Temperature

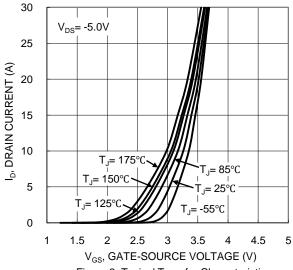
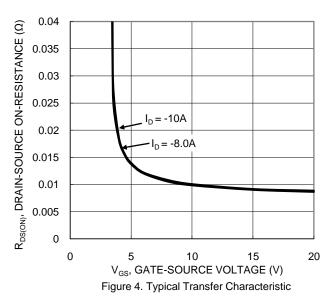


Figure 2. Typical Transfer Characteristic



1.8

UNDUSTION

1.6

VGS = -10V, ID = -10A

VGS = -4.5V, ID = -8.0A

VGS = -4.5V, ID = -8.0A

1.6

-50 -25 0 25 50 75 100 125 150 175

TJ, JUNCTION TEMPERATURE (°C)

Figure 6. On-Resistance Variation with Temperature





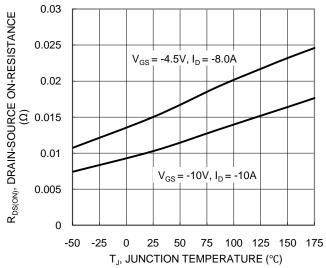


Figure 7. On-Resistance Variation with Temperature

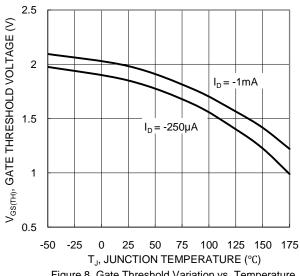
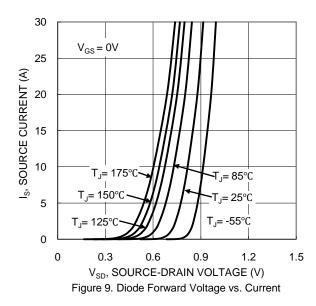
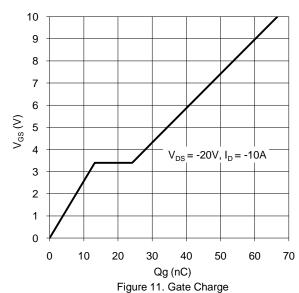
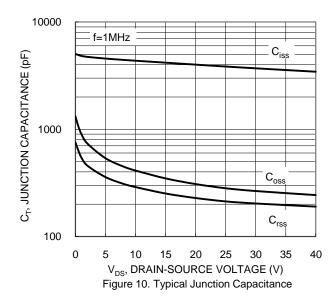
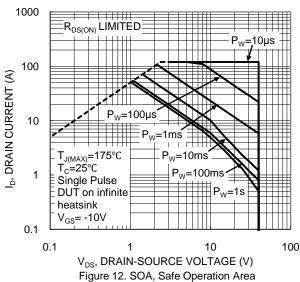


Figure 8. Gate Threshold Variation vs. Temperature











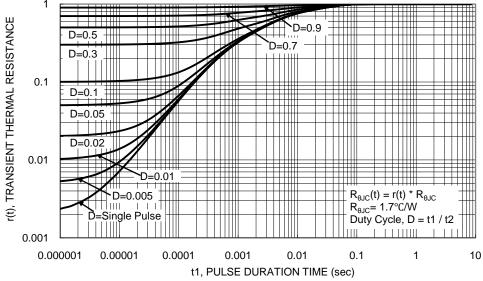


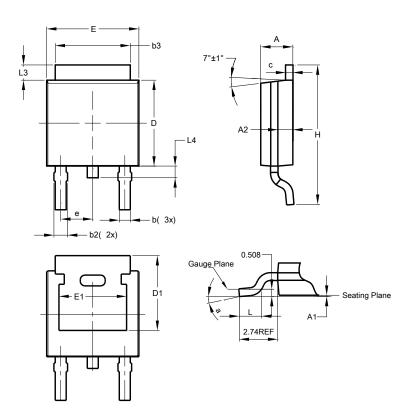
Figure 13. Transient Thermal Resistance



Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

TO252 (DPAK)

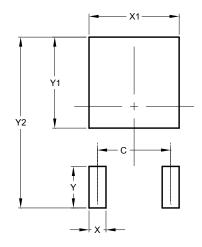


TO252 (DPAK)					
Dim	Min	Max	Тур		
Α	2.19	2.39	2.29		
A1	0.00	0.13	0.08		
A2	0.97	1.17	1.07		
b	0.64	0.88	0.783		
b2	0.76	1.14	0.95		
b3	5.21	5.46	5.33		
O	0.45	0.58	0.531		
D	6.00	6.20	6.10		
D1	5.21	-	-		
е	-	-	2.286		
Е	6.45	6.70	6.58		
E1	4.32	-	-		
Н	9.40	10.41	9.91		
L	1.40	1.78	1.59		
L3	0.88	1.27	1.08		
L4	0.64	1.02	0.83		
а	0°	10°	-		
All Dimensions in mm					

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

TO252 (DPAK)



Dimensions	Value (in mm)		
С	4.572		
Х	1.060		
X1	5.632		
Υ	2.600		
Y1	5.700		
Y2	10.700		



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