



# AH (S)-P-Channel Power MOSFET

-30V, -13A, 1mΩ

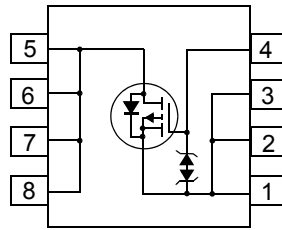
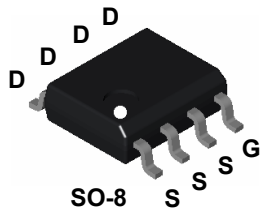
## General Description

This P-Channel MOSFET is produced using MOS-TECH Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance.

This device is well suited for Power Management and load switching applications common in Notebook Computers and Portable Battery Packs.

## Features

- Max  $r_{DS(on)}$  = 1mΩ at  $V_{GS} = -10V$ ,  $I_D = -13A$
- Max  $r_{DS(on)}$  = 11mΩ at  $V_{GS} = -4.5V$ ,  $I_D = -11A$
- Extended  $V_{GS}$  range (-25V) for battery applications
- HBM ESD protection level of 1kV typical (note 3)
- High performance trench technology for extremely low  $r_{DS(on)}$
- High power and current handling capability
- RoHS Compliant



## MOSFET Maximum Ratings $T_A = 25^\circ C$ unless otherwise noted

Symbol	Parameter	Rated Value	Units
$V_{DS}$	Drain to Source Voltage	-30	V
$V_{GS}$	Gate to Source Voltage	$\pm 25$	V
$I_D$	Drain Current -Continuous (Note 1a)	-13	A
	-Pulsed	-65	
$P_D$	Power Dissipation for Single Operation (Note 1a)	2.5	W
	(Note 1b)	1.2	
	(Note 1c)	1.0	
$T_J, T_{STG}$	Operating and Storage Temperature	-55 to +150	$^\circ C$

## Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance, Junction to Ambient (Note 1a)	50	$^\circ C/W$
$R_{\theta JC}$	Thermal Resistance, Junction to Case (Note 1)	25	$^\circ C/W$

## Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
AH (S) 1EJ	AH (S) 1EJ	3"	2mm	2500 units

## Electrical Characteristics $T_J = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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### Off Characteristics

$B_{VDSS}$	Drain to Source Breakdown Voltage	$I_D = -250\mu\text{A}, V_{GS} = 0\text{V}$	-30			V
$\frac{\Delta B_{VDSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$		-20		mV/ $^\circ\text{C}$
$I_{DSS}$	Zero Gate Voltage Drain Current	$V_{DS} = -24\text{V}, V_{GS} = 0\text{V}$			-1	$\mu\text{A}$
$I_{GSS}$	Gate to Source Leakage Current	$V_{GS} = \pm 25\text{V}, V_{DS} = 0\text{V}$			$\pm 10$	$\mu\text{A}$

### On Characteristics (Note 2)

$V_{GS(th)}$	Gate to Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = -250\mu\text{A}$	-1	-1.9	-3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	$I_D = -250\mu\text{A}$ , referenced to $25^\circ\text{C}$		6.5		mV/ $^\circ\text{C}$
$r_{DS(on)}$	Drain to Source On Resistance	$V_{GS} = -10\text{V}, I_D = -13\text{A}$		FG	F3	m $\Omega$
		$V_{GS} = -4.5\text{V}, I_D = -11\text{A}$		$\hat{A}\hat{I}$	$\hat{A}\hat{I}$	
		$V_{GS} = -10\text{V}, I_D = -13\text{A}$ , $T_J = 125^\circ\text{C}$		$\hat{A}\hat{I}$	$\hat{A}\hat{I}$	
$g_{FS}$	Forward Transconductance	$V_{DS} = -5\text{V}, I_D = -13\text{A}$		55		S

### Dynamic Characteristics

$C_{iss}$	Input Capacitance	$V_{DS} = -15\text{V}, V_{GS} = 0\text{V}$ , $f = 1\text{MHz}$		2890	3845	pF
$C_{oss}$	Output Capacitance			500	665	pF
$C_{rss}$	Reverse Transfer Capacitance			495	745	pF

### Switching Characteristics (Note 2)

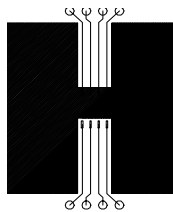
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = -15\text{V}, I_D = -1\text{A}$ $V_{GS} = -10\text{V}, R_{GS} = 6\Omega$		13	24	ns
$t_r$	Rise Time			15	27	ns
$t_{d(off)}$	Turn-Off Delay Time			210	336	ns
$t_f$	Fall Time			92	148	ns
$Q_g$	Total Gate Charge	$V_{DS} = -15\text{V}, V_{GS} = -10\text{V}$ , $I_D = -13\text{A}$		68	96	nC
$Q_g$	Total Gate Charge	$V_{DS} = -15\text{V}, V_{GS} = -5\text{V}$ , $I_D = -13\text{A}$		38	54	nC
$Q_{gs}$	Gate to Source Gate Charge			10		nC
$Q_{gd}$	Gate to Drain Charge			17		nC

### Drain-Source Diode Characteristic

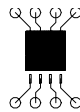
$V_{SD}$	Source to Drain Diode Forward Voltage	$V_{GS} = 0\text{V}, I_S = -2.1\text{A}$		-0.7	-1.2	V
$t_{rr}$	Reverse Recovery Time	$I_F = -13\text{A}, di/dt = 100\text{A}/\mu\text{s}$			40	ns
$Q_{rr}$	Reverse Recovery Charge	$I_F = -13\text{A}, di/dt = 100\text{A}/\mu\text{s}$			-31	nC

#### Notes:

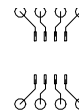
1:  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins.  $R_{\theta JC}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.



a)  $50^\circ\text{C}/\text{W}$  when mounted on a  $1\text{ in}^2$  pad of 2 oz copper



b)  $105^\circ\text{C}/\text{W}$  when mounted on a  $.04\text{ in}^2$  pad of 2 oz copper



c)  $125^\circ\text{C}/\text{W}$  when mounted on a minimum pad

Scale 1 : 1 on letter size paper

2: Pulse Test: Pulse Width  $< 300\mu\text{s}$ , Duty Cycle  $< 2.0\%$

3: The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted

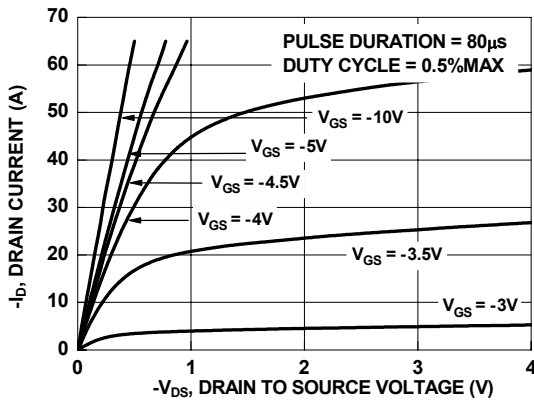


Figure 1. On Region Characteristics

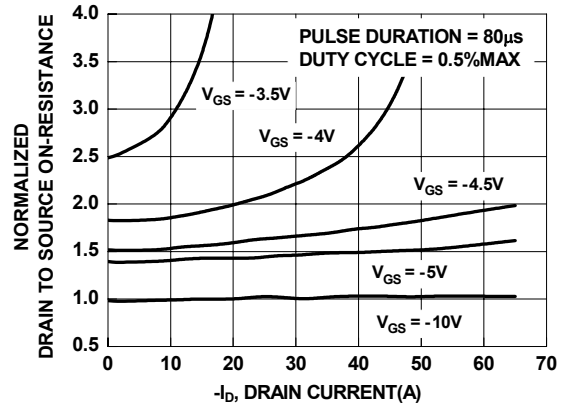


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

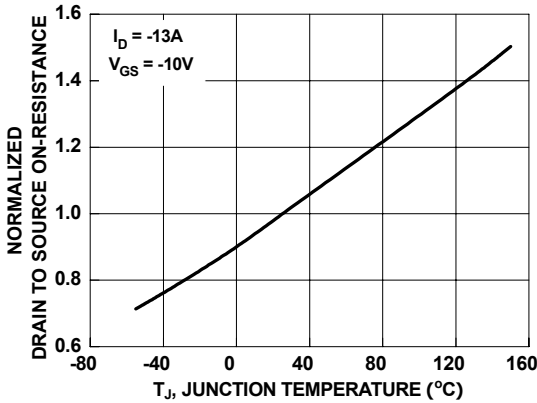


Figure 3. Normalized On Resistance vs Junction Temperature

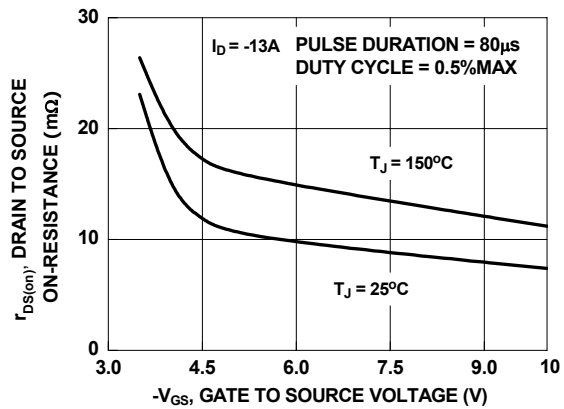


Figure 4. On-Resistance vs Gate to Source Voltage

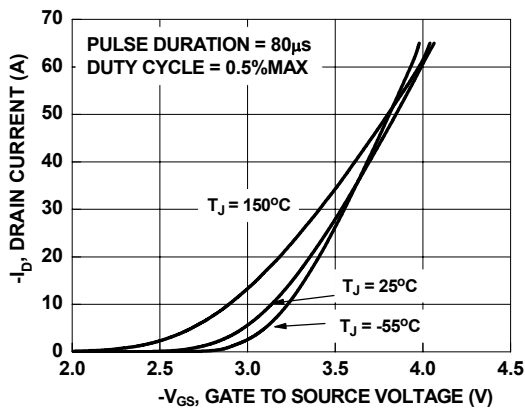


Figure 5. Transfer Characteristics

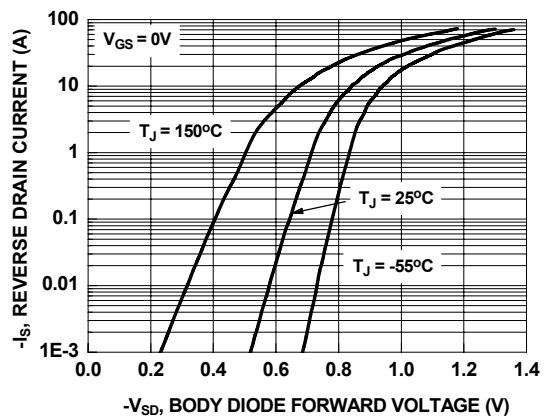


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted

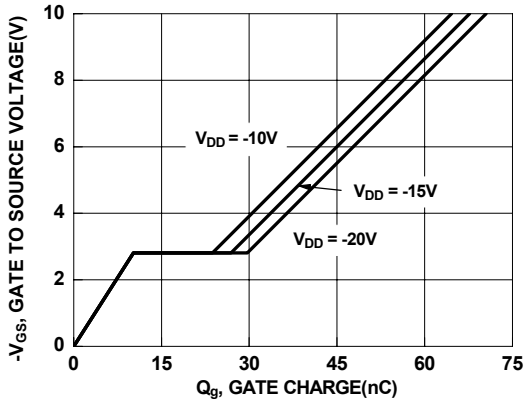


Figure 7. Gate Charge Characteristics

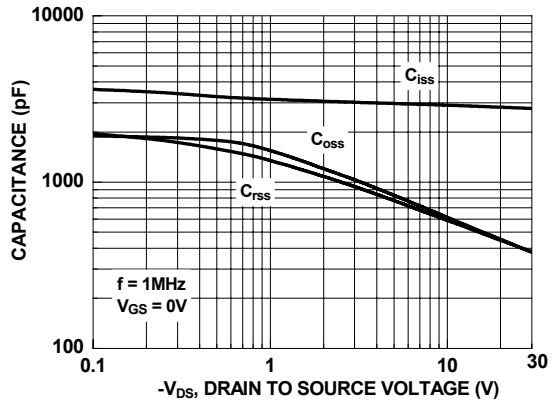


Figure 8. Capacitance vs Drain to Source Voltage

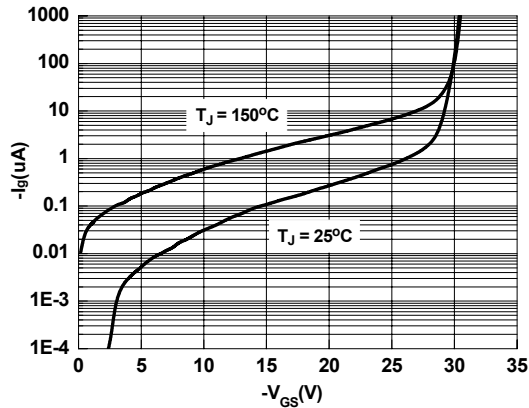


Figure 9.  $I_g$  vs  $V_{GS}$

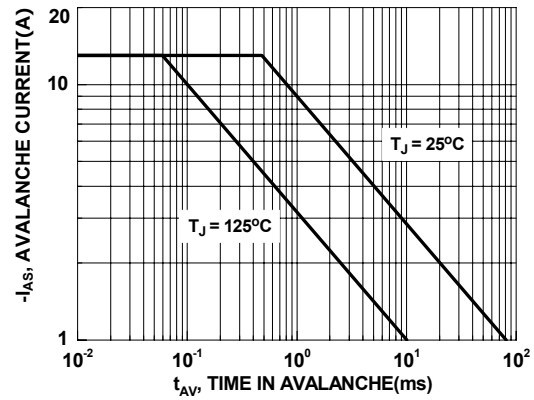


Figure 10. Unclamped Inductive Switching Capability

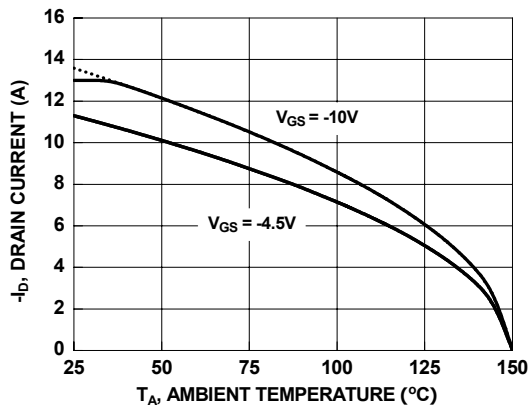


Figure 11. Maximum Continuous Drain Current vs Ambient Temperature

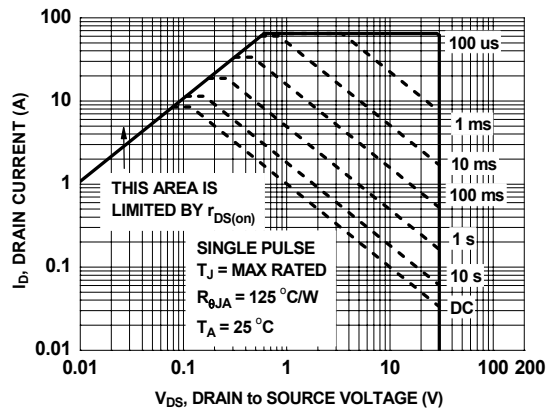


Figure 12. Forward Bias Safe Operating Area

**Typical Characteristics**  $T_J = 25^\circ\text{C}$  unless otherwise noted

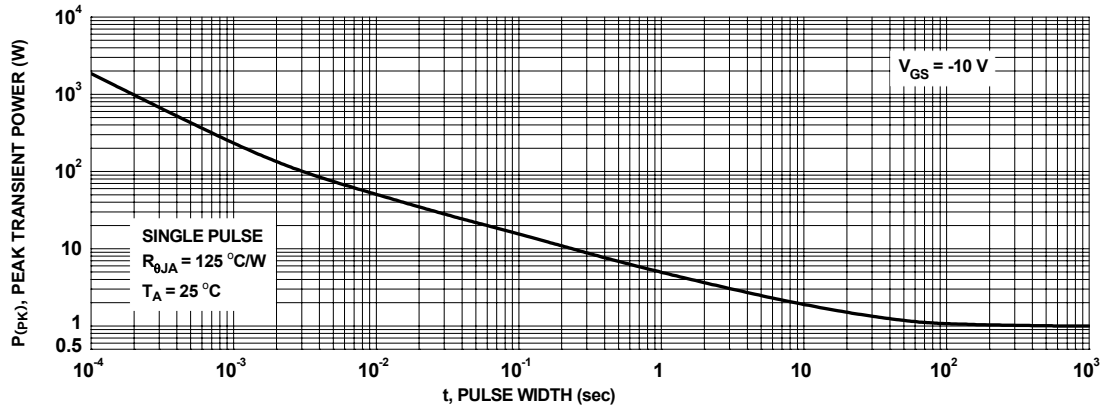


Figure 13. Single Pulse Maximum Power Dissipation

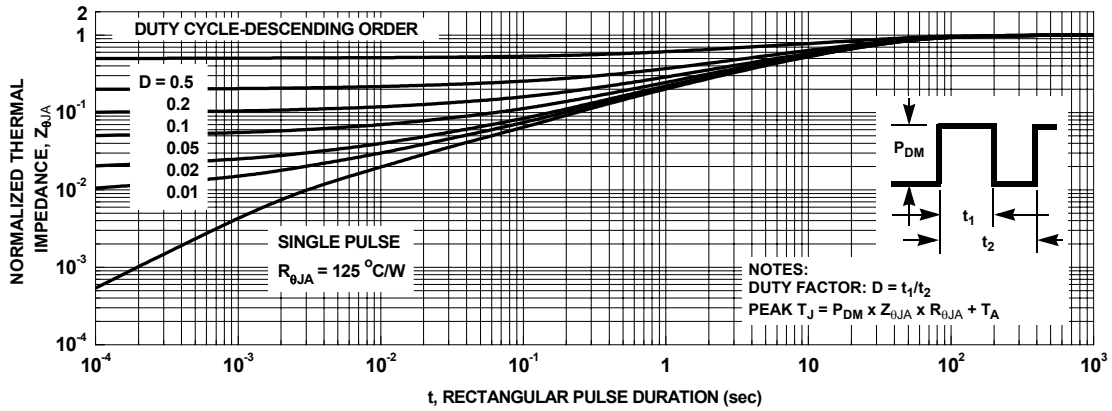


Figure 14. Junction-to-Ambient Transient Thermal Response Curve



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