

## MSH40N70D

### N-Channel 40-V (D-S) MOSFET

#### Description

The device is using trench DMOS technology. This advanced technology has been especially tailored to minimize  $R_{DS(ON)}$ , provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency fast switching applications.

The device meets the RoHS and Green Product requirement, 100% EAS guaranteed with full function reliability approved.

#### Features

- $R_{DS(ON)} = 7.2m\Omega @ V_{GS} = 10V$
- Fast switching
- Improve dv/dt Capability
- 100% EAS Guaranteed
- Green Device Available

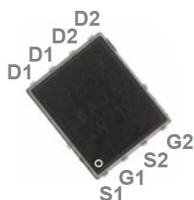
#### Typical Applications

- MB / VGA / Vcore
- POL Applications
- SMPS 2<sup>nd</sup> SR

Package type : PDFN 5X6 Dual

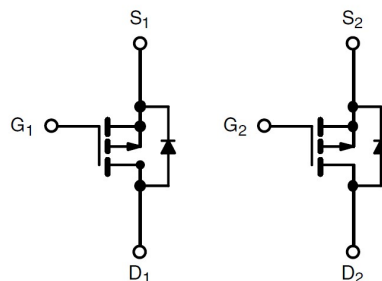
#### Packing & Order Information

3,000/Reel

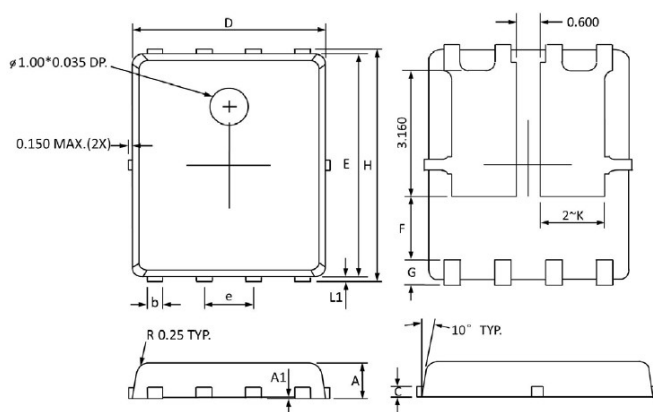


RoHS Compliant

#### Graphic Symbol

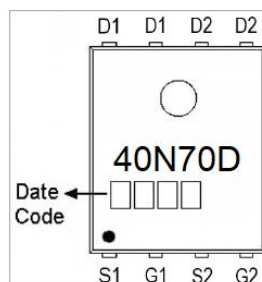


#### Package Dimension



REF.	Millimeter			REF.	Millimeter		
	Min.	Nom.	Max.		Min.	Nom.	Max.
A	0.90	1.00	1.10	E	5.70	-	5.90
A1	0.00	-	0.05	e	-	1.27	-
b	0.33	-	0.51	H	5.90	-	6.20
c	0.20	-	0.30	G	0.50	-	0.70
D	4.80	-	5.00	L1	0.06	-	0.20
F	1.6 Ref.			K	-	1.60	-

#### Marking



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#### MAXIMUM RATINGS AND ELECTRICAL CHARACTERISTICS

##### Absolute Maximum Ratings

Symbol	Parameter	Value	Units
$V_{DS}$	Drain-Source Voltage	40	V
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$I_D$	Continuous Drain Current <sup>1</sup> ( $T_C=25^\circ\text{C}$ )	70	A
	Continuous Drain Current <sup>1</sup> ( $T_C=100^\circ\text{C}$ )	44	A
$I_{DM}$	Pulsed Drain Current <sup>1,2</sup>	280	A
$I_{AS}$	Single Pulse Avalanche Current, $L=0.1\text{mH}^3$	39	A
$E_{AS}$	Single Pulse Avalanche Energy, $L=0.1\text{mH}^3$	76	mJ
$P_D$	Power Dissipation <sup>4</sup> ( $T_C=25^\circ\text{C}$ )	83	W
	Power Dissipation <sup>4</sup> ( $T_A=25^\circ\text{C}$ )	2	W
$T_J/T_{STG}$	Operating Junction and Storage Temperature	-55 to +150	$^\circ\text{C}$

##### Thermal Resistance Ratings

Symbol	Parameter	Maximum	Units
$R_{\theta JA}$	Maximum Junction-to-Ambient <sup>1</sup>	62.5	$^\circ\text{C/W}$
$R_{\theta JC}$	Maximum Junction-to-Case <sup>1</sup>	1.5	$^\circ\text{C/W}$

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

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$ , $I_D=250\mu\text{A}$	1.2	1.6	2.5	V
$BV_{DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0\text{V}$ , $I_D=250\mu\text{A}$	40	-	-	V
$g_{fs}$	Forward Transconductance	$V_{DS}=10\text{V}$ , $I_D=3\text{A}$	-	16	-	S
$I_{GSS}$	Gate-Source Leakage Current	$V_{DS}=0\text{V}$ , $V_{GS}=\pm 20\text{V}$	-	-	$\pm 100$	nA
$I_{DSS}$	Drain-Source Leakage Current	$V_{DS}=40\text{V}$ , $V_{GS}=0\text{V}$ , $T_J=25^\circ\text{C}$	-	-	1	$\mu\text{A}$
		$V_{DS}=32\text{V}$ , $V_{GS}=0\text{V}$ , $T_J=125^\circ\text{C}$	-	-	10	
$R_{DS(on)}$	Static Drain-Source On-Resistance <sup>2</sup>	$V_{GS}=10\text{V}$ , $I_D=20\text{A}$	-	6.1	7.2	m $\Omega$
		$V_{GS}=4.5\text{V}$ , $I_D=10\text{A}$	-	7.5	9.3	
$E_{AS}$	Single Pulse Avalanche Energy <sup>5</sup>	$V_{DD}=25\text{V}$ , $L=0.1\text{mH}$ , $I_{AS}=20\text{A}$	20	-	-	mJ
$V_{SD}$	Diode Forward Voltage <sup>2</sup>	$I_S=20\text{A}$ , $V_{GS}=0\text{V}$ , $T_J=25^\circ\text{C}$	-	-	1.2	V
$I_S$	Continuous Source Current <sup>1,6</sup>	$V_G=V_D=0\text{V}$ , Force Current	-	-	70	A
$I_{SM}$	Pulsed Source Current <sup>2,6</sup>		-	-	140	

##### Notes

1. The data tested by surface mounted on a 1 inch<sup>2</sup> FR-4 board with 2OZ copper.
2. The data tested by pulsed, pulse width  $\leq 300\mu\text{s}$ , duty cycle  $\leq 2\%$ .
3. The EAS data shows maximum rating. The test condition is  $V_{DD}=25\text{V}$ ,  $V_{GS}=10\text{V}$ ,  $L=0.1\text{mH}$ ,  $I_{AS}=39\text{A}$ .
4. The power dissipation is limited by  $150^\circ\text{C}$  junction temperature.
5. The Min. value is 100% EAS tested guarantee.
6. The data is theoretically the same as  $I_D$  and  $I_{DM}$ , in real applications, should be limited by total power dissipation.

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Dynamic						
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$Q_g$	Total Gate Charge <sup>2</sup>	$V_{DS}=20V$ $I_D=10A$ $V_{GS}=4.5V$	--	16.2	--	nC
$Q_{gs}$	Gate-Source Charge		--	3.85	--	
$Q_{gd}$	Gate-Drain Charge		--	6.05	--	
$t_{d(on)}$	Turn-On Delay Time <sup>2</sup>	$V_{DS}=15V$ $I_D=1A$ $V_{GS}=10V$ $R_G=6\Omega$	--	13.6	--	ns
$t_r$	Rise Time		--	2.5	--	
$t_{d(off)}$	Turn-Off Delay Time		--	68	--	
$t_f$	Fall Time		--	5	--	
$C_{ISS}$	Input Capacitance	$V_{DS}=25V$ $V_{GS}=0V$ $f=1.0MHz$	--	1540	--	pF
$C_{OSS}$	Output Capacitance		--	171	--	
$C_{RSS}$	Reverse Transfer Capacitance		--	115	--	
$R_g$	Gate Resistance	$V_{GS}=V_{DS}=0V, f=1.0MHz$	--	1.4	--	$\Omega$

## MSH40N70D

### N-Channel 40-V (D-S) MOSFET

- Typical Electrical Characteristics

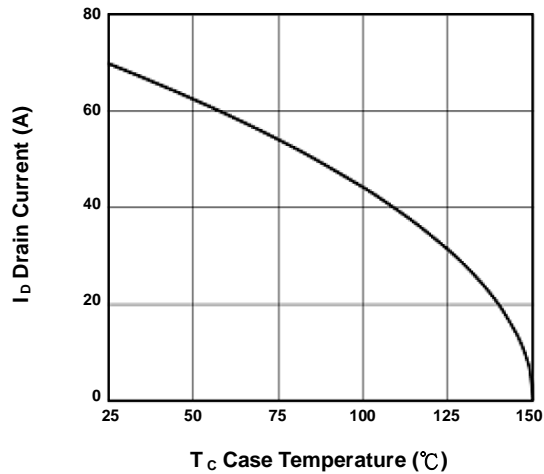


FIG.1-Drain Current vs.  $T_c$

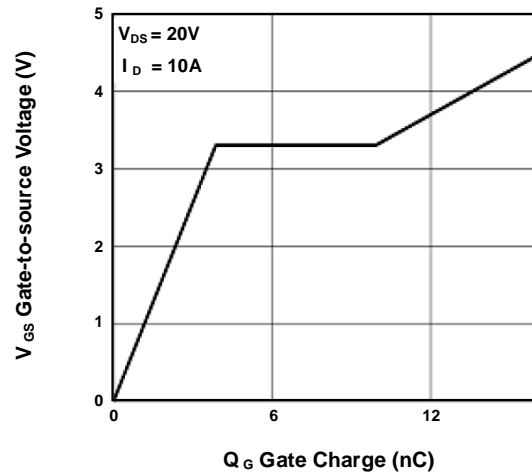


FIG.2-Gate Charge Characteristics

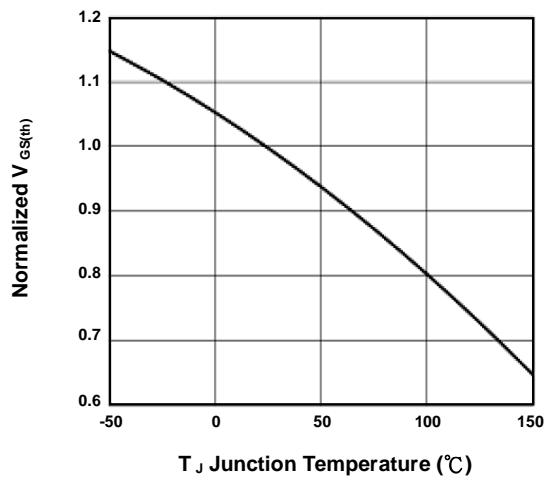


FIG.3-Normalized  $V_{GS(th)}$  vs.  $T_J$

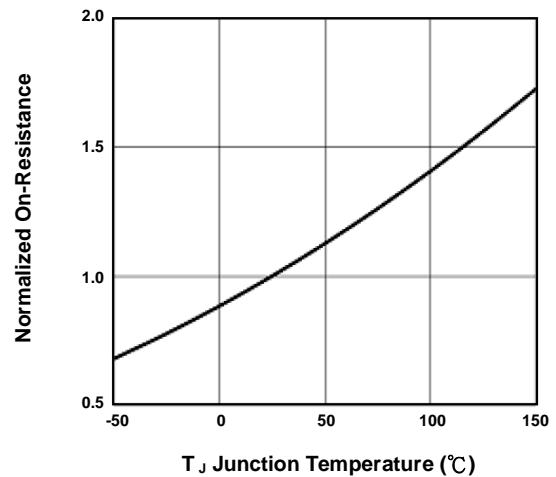


FIG.4-Normalized  $R_{DS(on)}$  vs.  $T_J$

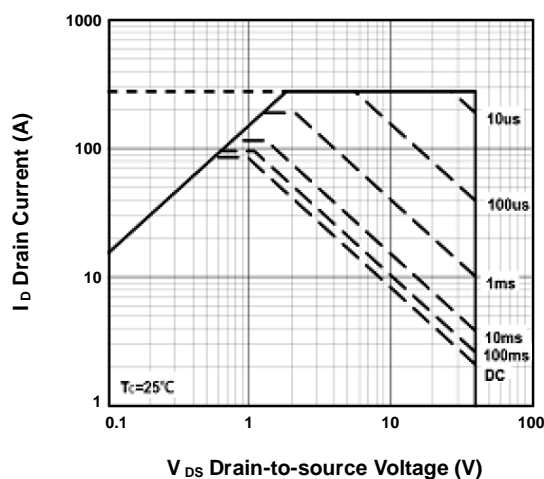


FIG.5-Safe Operating Area

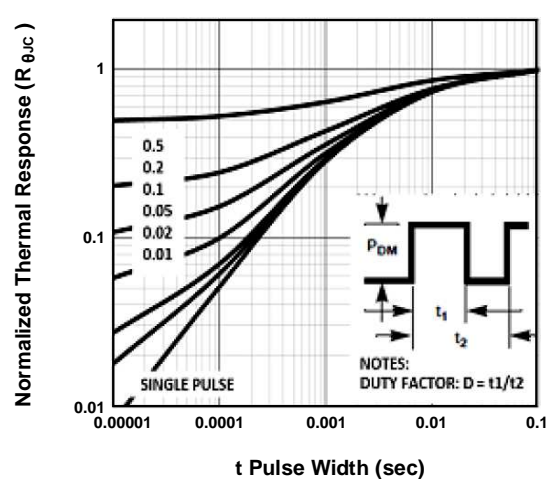
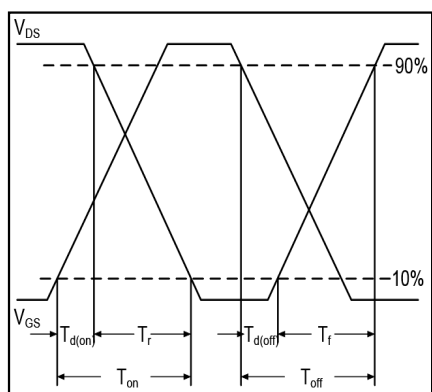


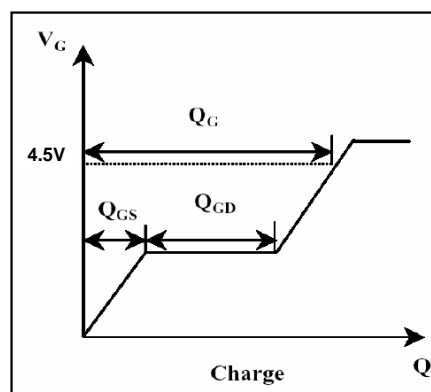
FIG.6-Transient Thermal Impedance

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**FIG.7-Switching Time Waveform**



**FIG.8-Gate Charge Waveform**

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