



# AMDU040N014VRH

Single N-channel Trench MOSFET 40V 1.4mΩ 194A

## FEATURES

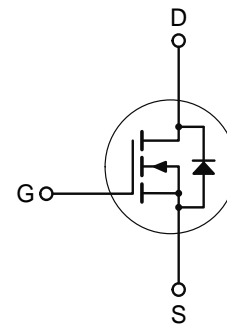
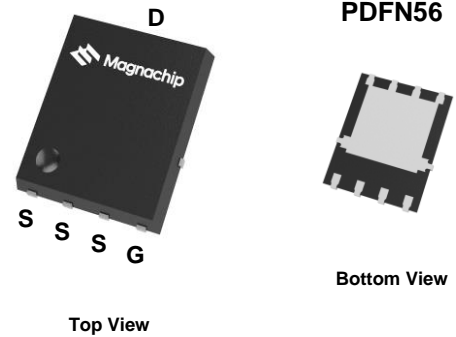
- Trench power MOSFET technology
- N-channel, normal level
- Enhanced avalanche ruggedness
- 100% Avalanche tested
- Maximum 175°C junction temperature
- AEC-Q101 qualified

## APPLICATIONS

- DC/DC and AC/DC converters
- Brushed and BLDC motor drive systems

## KEY PERFORMANCE PARAMETERS

$V_{DS}$	40	V
$R_{DS(on), typ.}$	0.0011	$\Omega$
$I_D$	194	A
$Q_G$	71	nC
Junction temperature <sub>, max</sub>	175	°C



## ORDERING INFORMATION

Type / Ordering Code	Package	Marking	Packing	RoHS Status
AMDU040N014VRH	PDFN56	040N014	Tape & Reel	Halogen Free

<http://www.magnachip.com/>

**ABSOLUTE MAXIMUM RATINGS**, at  $T_C = 25^\circ\text{C}$ , unless otherwise specified

PARAMETER		SYMBOL	RATING	UNIT
Drain-source Voltage		$V_{DS}$	40	V
Gate-source Voltage		$V_{GS}$	$\pm 20$	V
Drain current	$T_C=25^\circ\text{C}$	$I_D$	194	A
	$T_C=100^\circ\text{C}$		137	A
<sup>1)</sup> Pulsed drain current	$T_C=25^\circ\text{C}$	$I_{DM}$	776	A
Total power dissipation	$T_C=25^\circ\text{C}$	$P_{tot}$	100	W
	$T_C=100^\circ\text{C}$		50	W
<sup>2)</sup> Avalanche energy, single pulse		$E_{AS}$	288	mJ
Operating and storage temperature		$T_j, T_{stg}$	- 55 ~ 175	$^\circ\text{C}$

**THERMAL CHARACTERISTICS**

PARAMETER		SYMBOL	RATING	UNIT
Thermal resistance, junction - case		$R_{\theta JC}$	1.5	K/W
<sup>3)</sup> Thermal resistance, junction - ambient		$R_{\theta JA}$	50	K/W

ELECTRICAL CHARACTERISTICS (T<sub>J</sub> = 25°C)

## STATIC CHARACTERISTICS

PARAMETER	Symbol	Min.	Typ.	Max.	Unit	Conditions / Note
Drain-source breakdown voltage	V <sub>(BR)DSS</sub>	40	-	-	V	V <sub>GS</sub> =0 V, I <sub>D</sub> =250 μA
Gate threshold voltage	V <sub>GS(th)</sub>	2.35	3.10	3.85	V	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250 μA
Zero gate voltage drain current	I <sub>DSS</sub>	-	-	1	μA	V <sub>DS</sub> =40 V, V <sub>GS</sub> =0 V, T <sub>J</sub> =25°C
Gate-source leakage current	I <sub>GSS</sub>	-	-	± 100	nA	V <sub>GS</sub> =±20 V, V <sub>DS</sub> =0 V
Drain-source on-state resistance	R <sub>DS(on)</sub>	-	1.1	1.4	mΩ	V <sub>GS</sub> =10 V, I <sub>D</sub> =50 A
		-	1.2	1.7	mΩ	V <sub>GS</sub> =8V, I <sub>D</sub> =50 A
<sup>4)</sup> Gate resistance	R <sub>G</sub>	-	3.5	-	Ω	f=1MHz
<sup>4)</sup> Transconductance	g <sub>fs</sub>	-	130	-	S	V <sub>DS</sub> =10 V, I <sub>D</sub> =50 A

<sup>4)</sup> DYNAMIC CHARACTERISTICS

PARAMETER	Symbol	Min.	Typ.	Max.	Unit	Conditions / Note
Input capacitance	C <sub>iss</sub>	-	5,613	-	pF	V <sub>GS</sub> =0 V, V <sub>DS</sub> =20 V, f=1 MHz
Output capacitance	C <sub>oss</sub>	-	1,594	-	pF	V <sub>GS</sub> =0 V, V <sub>DS</sub> =20 V, f=1 MHz
Reverse transfer capacitance	C <sub>rss</sub>	-	105	-	pF	V <sub>GS</sub> =0 V, V <sub>DS</sub> =20 V, f=1 MHz
Turn-on delay time	t <sub>d(on)</sub>	-	27	-	ns	V <sub>DD</sub> =20 V, V <sub>GS</sub> =10 V, I <sub>D</sub> =50 A, R <sub>G,ext</sub> =3Ω
Rise time	t <sub>r</sub>	-	13	-	ns	V <sub>DD</sub> =20 V, V <sub>GS</sub> =10 V, I <sub>D</sub> =50 A, R <sub>G,ext</sub> =3Ω
Turn-off delay time	t <sub>d(off)</sub>	-	66	-	ns	V <sub>DD</sub> =20 V, V <sub>GS</sub> =10 V, I <sub>D</sub> =50 A, R <sub>G,ext</sub> =3Ω
Fall time	t <sub>f</sub>	-	26	-	ns	V <sub>DD</sub> =20 V, V <sub>GS</sub> =10 V, I <sub>D</sub> =50 A, R <sub>G,ext</sub> =3Ω

<sup>4)</sup> GATE CHARGE CHARACTERISTICS

PARAMETER	Symbol	Min.	Typ.	Max.	Unit	Conditions / Note
Gate to source charge	Q <sub>gs</sub>	-	26	-	nC	V <sub>DD</sub> =20 V, I <sub>D</sub> =50 A, V <sub>GS</sub> =0 to 10 V
Gate charge at threshold	Q <sub>gs(th)</sub>	-	16	-	nC	V <sub>DD</sub> =20 V, I <sub>D</sub> =50 A, V <sub>GS</sub> =0 to 10 V
Gate to drain charge	Q <sub>gd</sub>	-	11	-	nC	V <sub>DD</sub> =20 V, I <sub>D</sub> =50 A, V <sub>GS</sub> =0 to 10 V
Switching charge	Q <sub>sw</sub>	-	22	-	nC	V <sub>DD</sub> =20 V, I <sub>D</sub> =50 A, V <sub>GS</sub> =0 to 10 V
Gate charge total	Q <sub>g</sub>	-	71	-	nC	V <sub>DD</sub> =20 V, I <sub>D</sub> =50 A, V <sub>GS</sub> =0 to 10 V
Gate plateau voltage	V <sub>plateau</sub>	-	5.3	-	V	V <sub>DD</sub> =20 V, I <sub>D</sub> =50 A, V <sub>GS</sub> =0 to 10 V

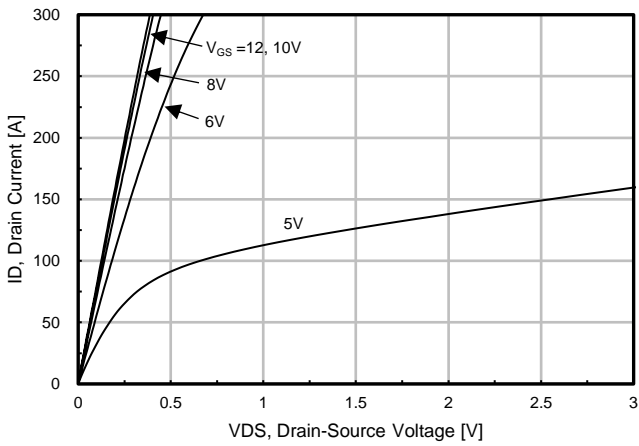
## SOURCE-DRAIN DIODE

PARAMETER	Symbol	Min.	Typ.	Max.	Unit	Conditions / Note
<sup>4)</sup> Diode continuous forward current	I <sub>S</sub>	-	-	194	A	-
<sup>4)</sup> Diode pulse current	I <sub>S,pulse</sub>	-	-	776	A	pulsed; t <sub>p</sub> ≤ 10 μs
Diode forward voltage	V <sub>SD</sub>	-	0.86	1.2	V	V <sub>GS</sub> =0 V, I <sub>F</sub> =50 A
<sup>4)</sup> Reverse recovery time	t <sub>rr</sub>	-	106	-	ns	I <sub>F</sub> =50 A, d <sub>I</sub> /dt=100 A/μs
<sup>4)</sup> Reverse recovery charge	Q <sub>rr</sub>	-	224	-	nC	I <sub>F</sub> =50 A, d <sub>I</sub> /dt=100 A/μs

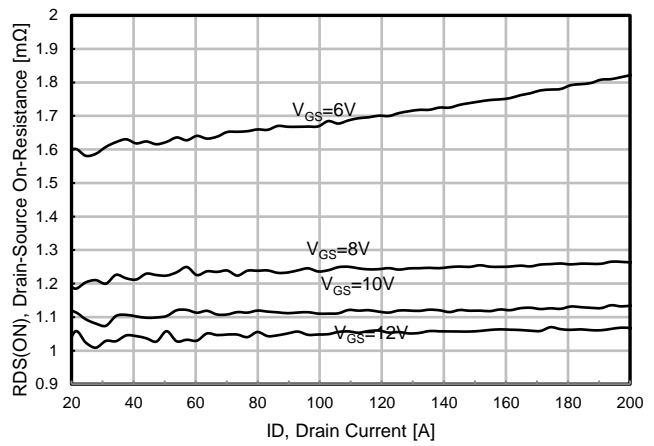
## Notes

- Pulse width limited by T<sub>Jmax</sub>
- Starting T<sub>J</sub>=25°C, L=1mH, I<sub>AS</sub>=24A, V<sub>DD</sub>=36V, V<sub>GS</sub>=10V
- Surface mounted FR-4 board by JEDEC (jesd51-7)
- The parameter is not subject to production testing - guaranteed by design.

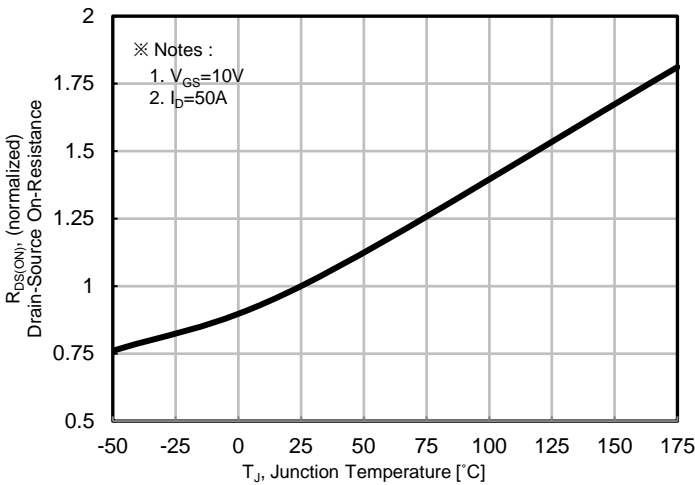
**Electrical Characteristics Diagrams (25 °C, unless otherwise noted)**



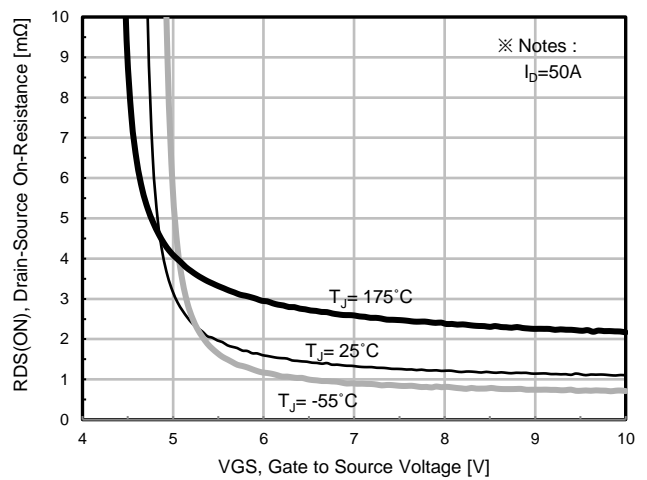
**Fig. 1. Output Characteristics**



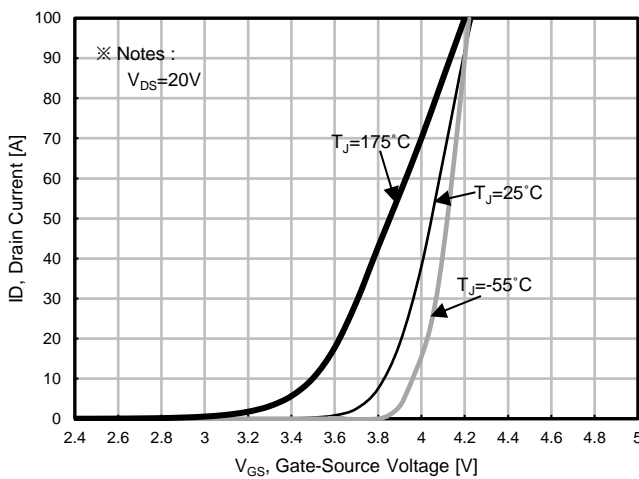
**Fig. 2. Static On-Resistance Variation**



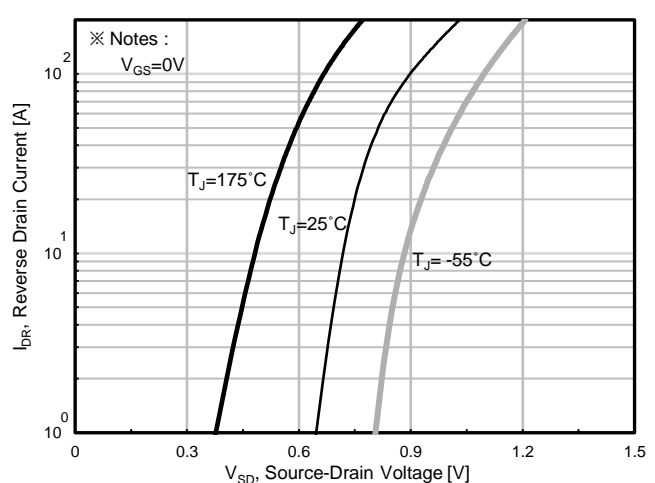
**Fig. 3. On-Resistance vs. Junction Temperature**



**Fig. 4. On-Resistance vs. Gate to source Voltage**



**Fig. 5. Transfer Characteristics**



**Fig. 6. Body Diode Forward Voltage Variation with Source Current and Temperature**

Electrical Characteristics Diagrams (25 °C, unless otherwise noted)

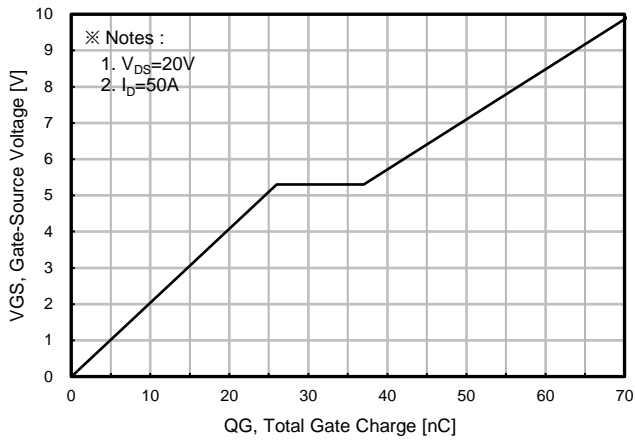


Fig. 7. Gate Charge

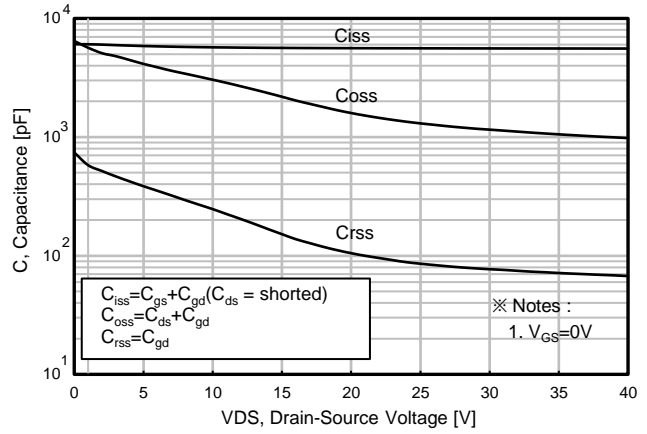


Fig. 8. Capacitance

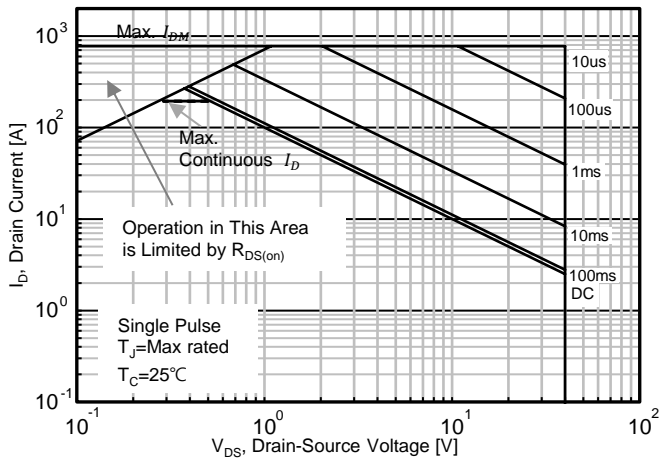


Fig. 9. Safe Operating Area, Junction-to-Ambient

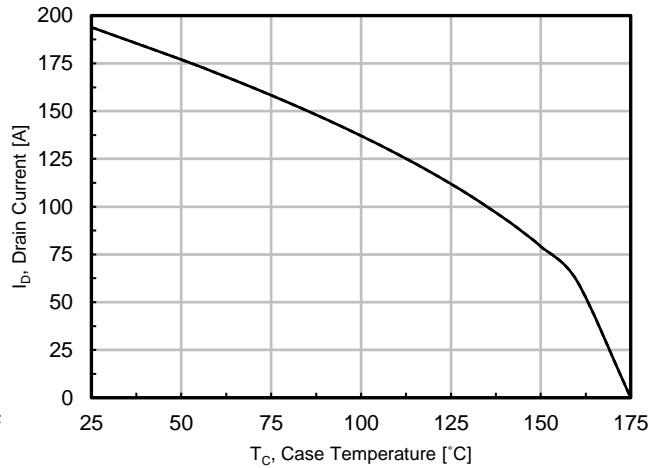


Fig. 10. Maximum Drain vs. Case Temperature

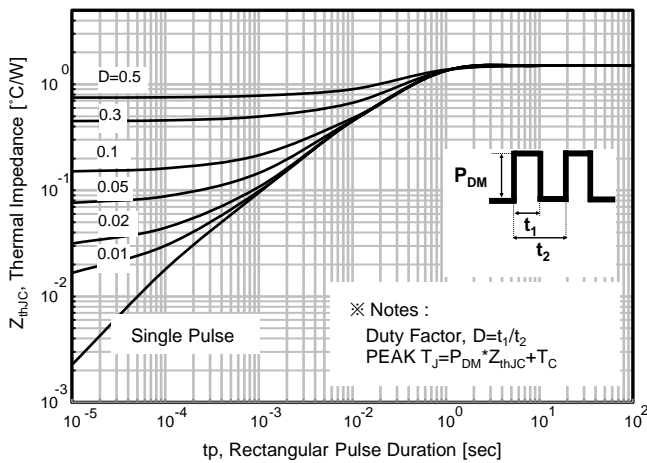


Fig. 11. Transient Thermal Impedance

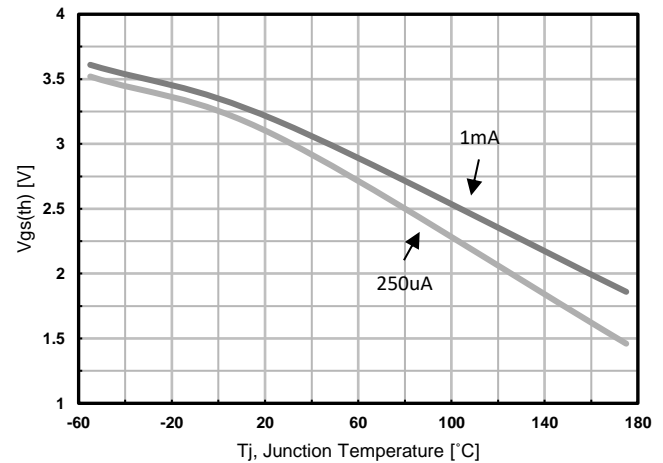
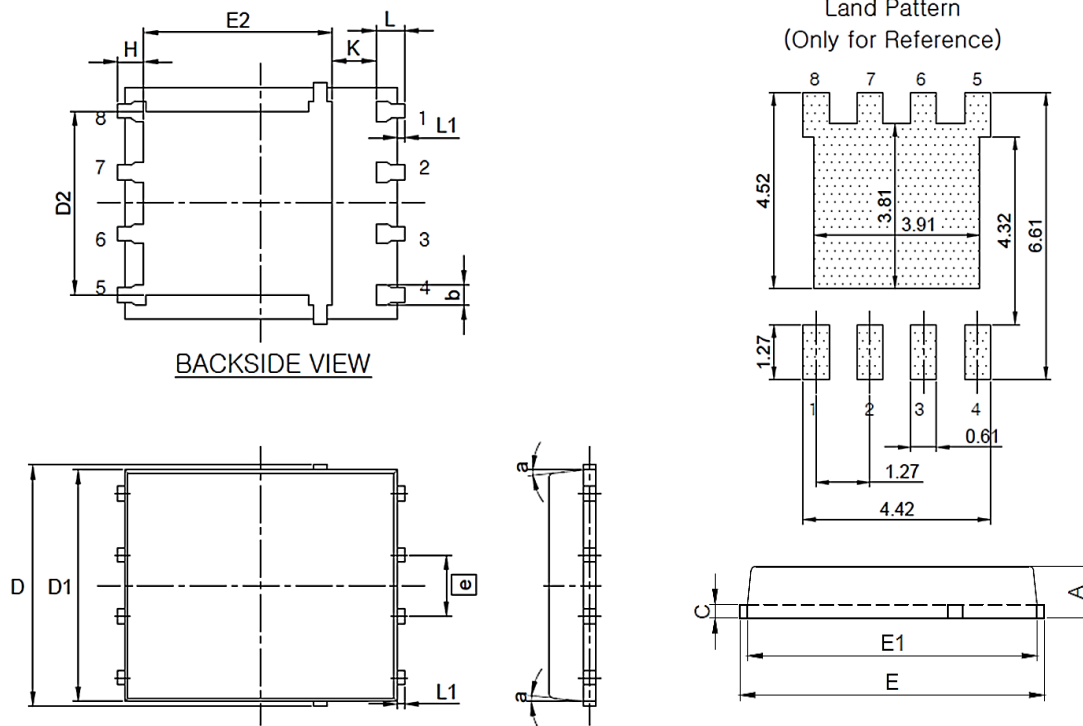


Fig. 12. G-S threshold Voltage vs. Junction Temperature

# Package information

PDFN56




Symbol	Dimension (mm)		
	Min.	Norm.	Max.
A	0.90	-	1.10
B	0.33	-	0.51
C	0.20	-	0.34
D	4.50	-	5.30
D1	4.50	-	5.10
D2	3.61	-	4.22
E	5.90	-	6.30
E1	5.50	-	6.10
E2	3.38	-	4.30
e	1.27 BSC		
H	0.41	-	0.71
K	0.20	-	-
L	0.51	-	0.71
L1	0.06	-	0.20
a	0°	-	12°

## Notes

Package body size, length and width do not include mold flash, protrusions and gate burrs.

**DISCLAIMER :**

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