

# MJ N-Channel Enhancement Mode Power MOSFET

## Description

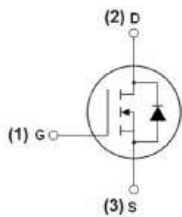
The MJ40H20AD uses advanced trench technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. It can be used in a wide variety of applications.

## General Features

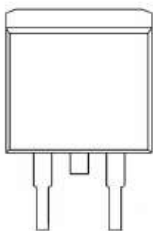
- ◆  $V_{DS} = 40V, I_D = 200A$   
 $R_{DS(ON)} < 2.6m\Omega @ V_{GS} = 10V$  (Typ: 2.0m $\Omega$ )
- ◆ Special process technology for high ESD capability
- ◆ High density cell design for ultra low  $R_{dson}$
- ◆ Fully characterized avalanche voltage and current
- ◆ Good stability and uniformity with high  $E_{AS}$
- ◆ Excellent package for good heat dissipation

## Application

- ◆ Power switching application
- ◆ Hard switched and High frequency circuits
- ◆ Uninterruptible power supply



Schematic diagram



Marking and pin assignment



TO-263-2L top view

100% UIS TESTED! 100%  $\Delta V_{ds}$  TESTED!

## Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
MJ40H20AD	MJ40H20AD	TO-263-2L	-	-	-

## Absolute Maximum Ratings (T<sub>c</sub> = 25 °C unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	40	V
Gate-Source Voltage	$V_{GS}$	±20	V
Drain Current-Continuous	$I_D$	200	A
Drain Current-Continuous(T <sub>c</sub> = 100°C)	$I_{D(100^{\circ}C)}$	140	A
Pulsed Drain Current	$I_{DM}$	790	A
Maximum Power Dissipation	$P_D$	285	W
Derating factor		1.9	W/°C
Single pulse avalanche energy <sup>(Note 5)</sup>	$E_{AS}$	2500	mJ
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 175	°C

## Thermal Characteristic

Thermal Resistance, Junction-to-Case <sup>(Note 2)</sup>	$R_{\theta JC}$	0.53	°C/W
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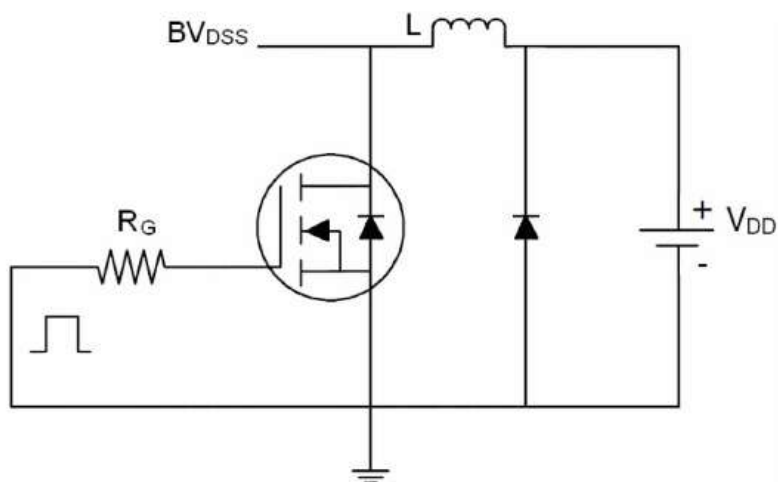
Electrical Characteristics (T<sub>c</sub> =25°C unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V I <sub>D</sub> =250μA	40	-	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =40V,V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>DS</sub> =±20V,V <sub>GS</sub> =0V	-	-	±100	nA
On Characteristics <sup>(Note 3)</sup>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> ,I <sub>D</sub> =250μA	2	3	4	V
Drain-Source On-State Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> =10V, I <sub>D</sub> =40A	-	2.0	2.6	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V,I <sub>D</sub> =40A	60	-	-	S
Dynamic Characteristics <sup>(Note 4)</sup>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =25V,V <sub>GS</sub> =0V F=1.0MHz	-	7182	-	PF
Output Capacitance	C <sub>oss</sub>		-	1355	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	1244	-	PF
Switching Characteristics <sup>(Note 4)</sup>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =20V,V <sub>GS</sub> =10V R <sub>GEN</sub> =2.5Ω	-	21	-	nS
Turn-on Rise Time	t <sub>r</sub>		-	37	-	nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	75	-	nS
Turn-Off Fall Time	t <sub>f</sub>		-	40	-	nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =20V,I <sub>D</sub> =20A V <sub>GS</sub> =10V	-	130	-	nC
Gate-Source Charge	Q <sub>gs</sub>		-	36	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	56	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage <sup>(Note 3)</sup>	V <sub>SD</sub>	V <sub>GS</sub> =0V,I <sub>S</sub> =20A	-	-	1.2	V
Diode Forward Current <sup>(Note 2)</sup>	I <sub>S</sub>		-	-	200	A
Reverse Recovery Time	t <sub>rr</sub>	T <sub>J</sub> =25°C, I <sub>F</sub> =20A di/dt=500A/μs <sup>(Note 3)</sup>	-	50	-	nS
Reverse Recovery Charge	Q <sub>rr</sub>		-	61	-	nC
Forward Turn-On Time	t <sub>on</sub>	Intrinsic turn-on time is negligible(turn-on is dominated by LS+LD)				

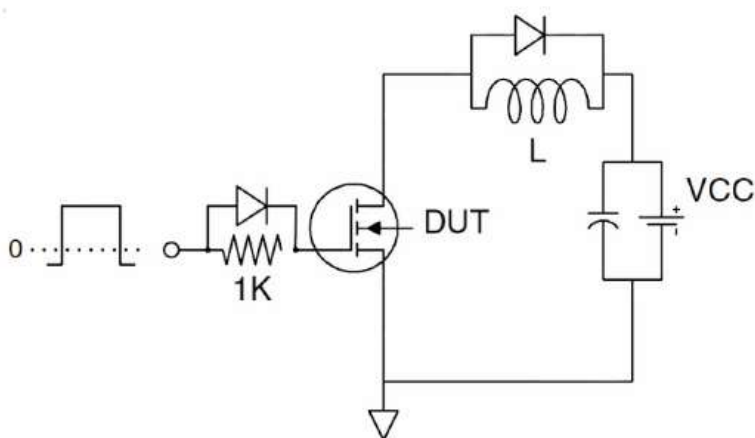
## Notes:

- ① Repetitive Rating: Pulse width limited by maximum junction temperature.
- ② Surface Mounted on FR4 Board, t ≤ 10 sec.
- ③ Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
- ④ Guaranteed by design, not subject to production
- ⑤ EAS condition: T<sub>J</sub>=25°C,V<sub>DD</sub>=20V,V<sub>G</sub>=10V,L=0.5mH,R<sub>g</sub>=25Ω

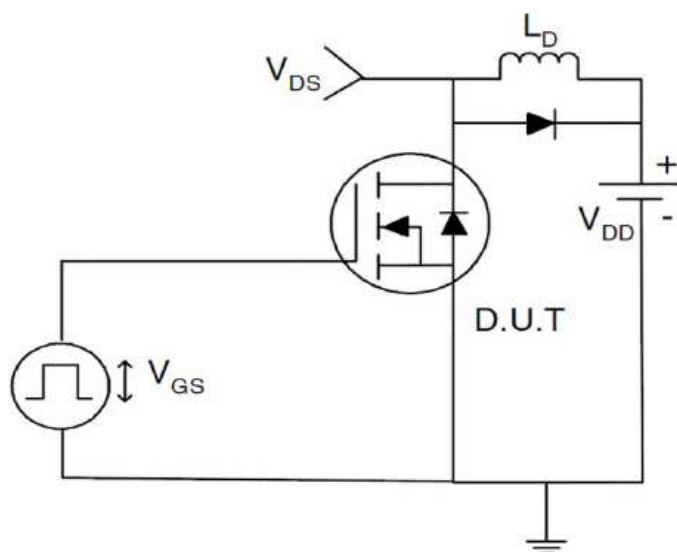
## Test circuit



EAS test Circuit

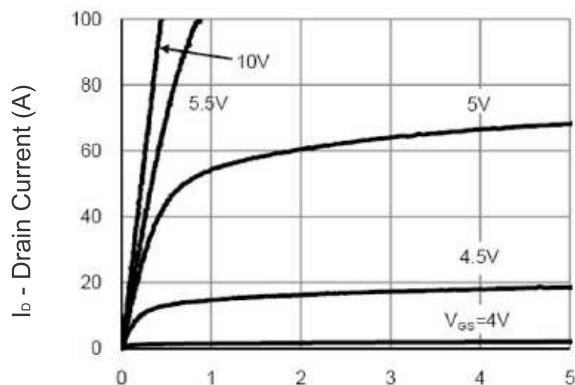


Gate charge test Circuit

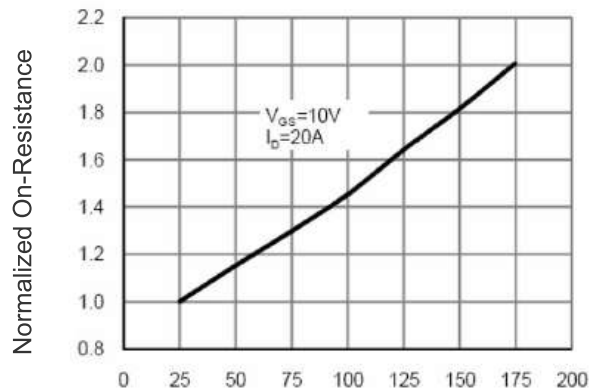


Switch Time Test Circuit

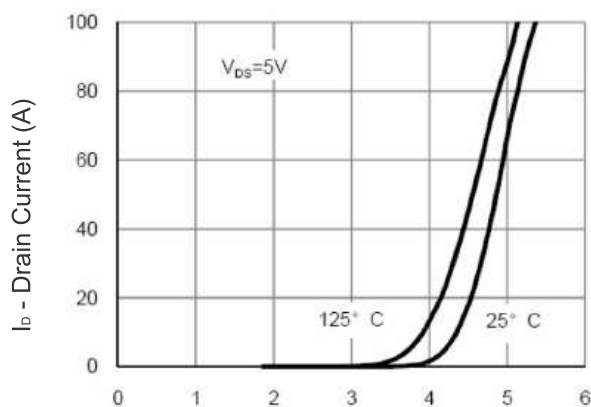
## Typical Electrical and Thermal Characteristics (Curves)



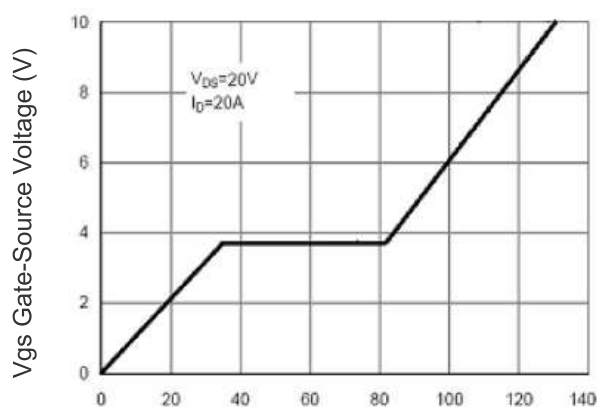
V<sub>ds</sub> Drain-Source Voltage (V)  
Figure 1 Output Characteristics



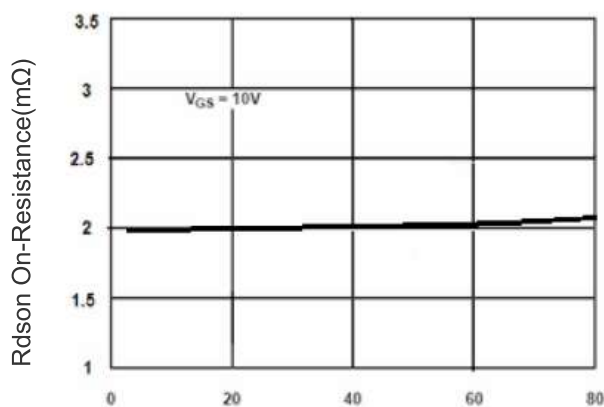
T<sub>J</sub> -Junction Temperature(°C)  
Figure 4 Rdson-Junction Temperature



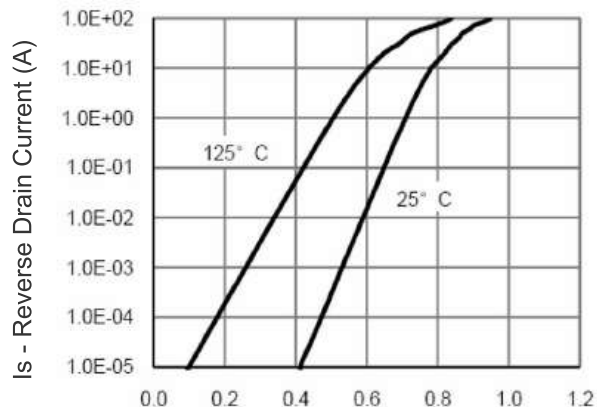
V<sub>gs</sub> Gate-Source Voltage (V)  
Figure 2 Transfer Characteristics



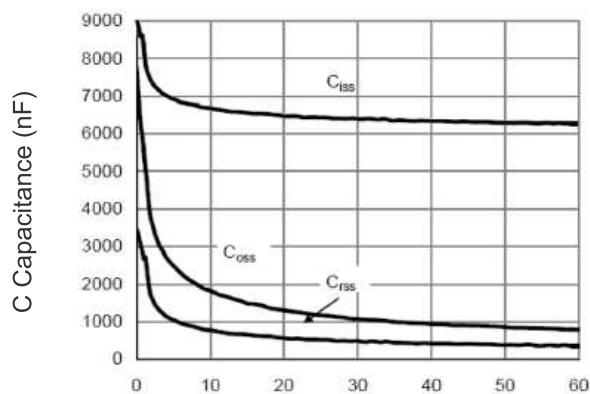
Q<sub>g</sub> Gate Charge (nC)  
Figure 5 Gate Charge



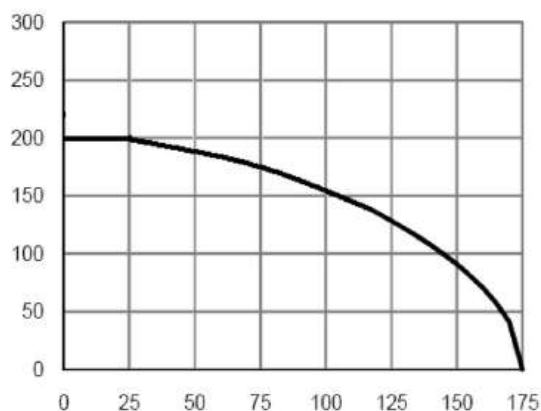
I<sub>D</sub> - Drain Current (A)  
Figure 3 Rdson- Drain Current



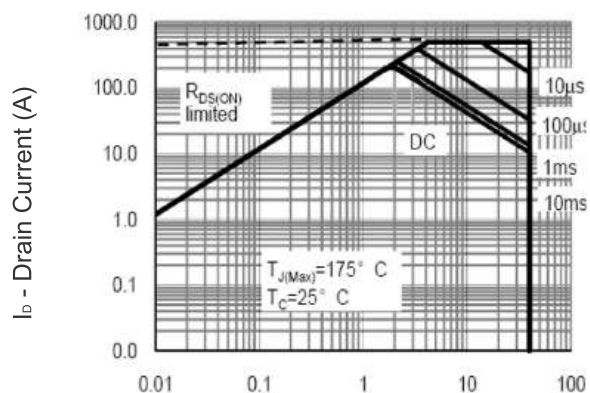
V<sub>sd</sub> Source-Drain Voltage (V)  
Figure 6 Source- Drain Diode Forward



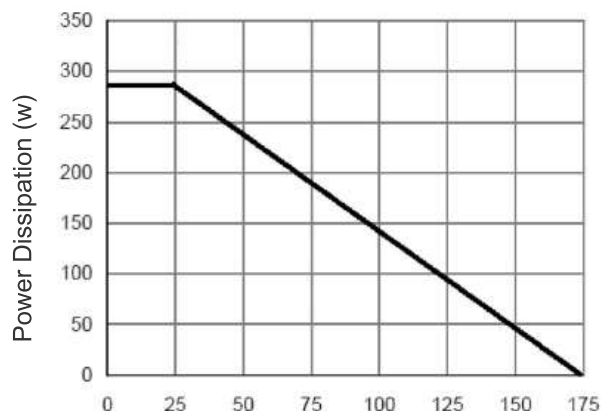
Vds Drain-Source Voltage (V)  
Figure 7 Capacitance vs Vds



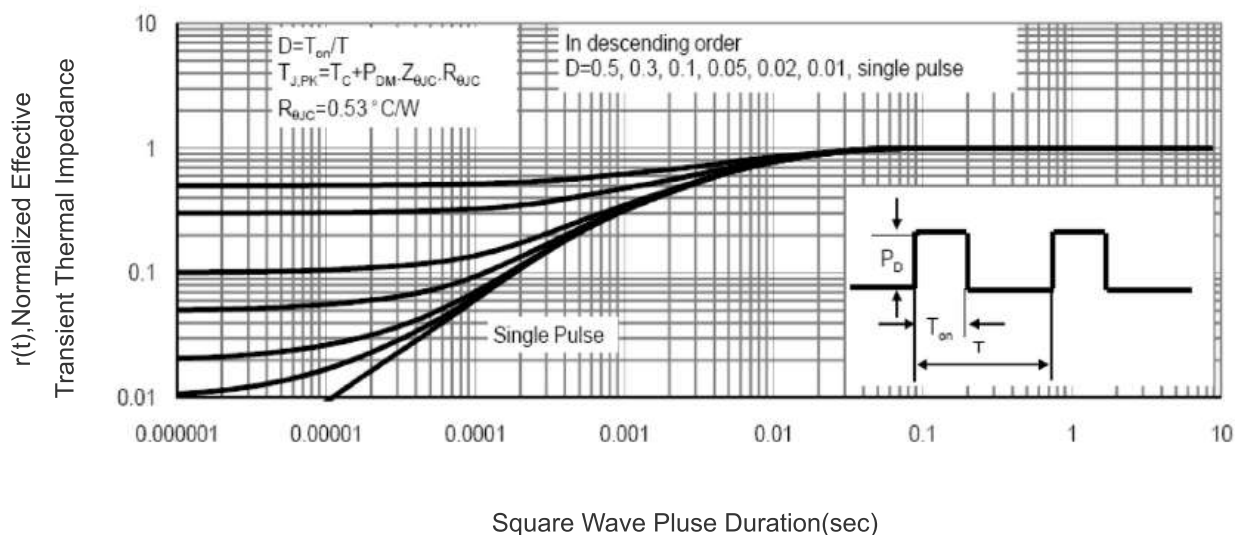
Tj -Junction Temperature(°C)  
Figure 9 Current De-rating



Vds Drain-Source Voltage (V)  
Figure 8 Safe Operation Area

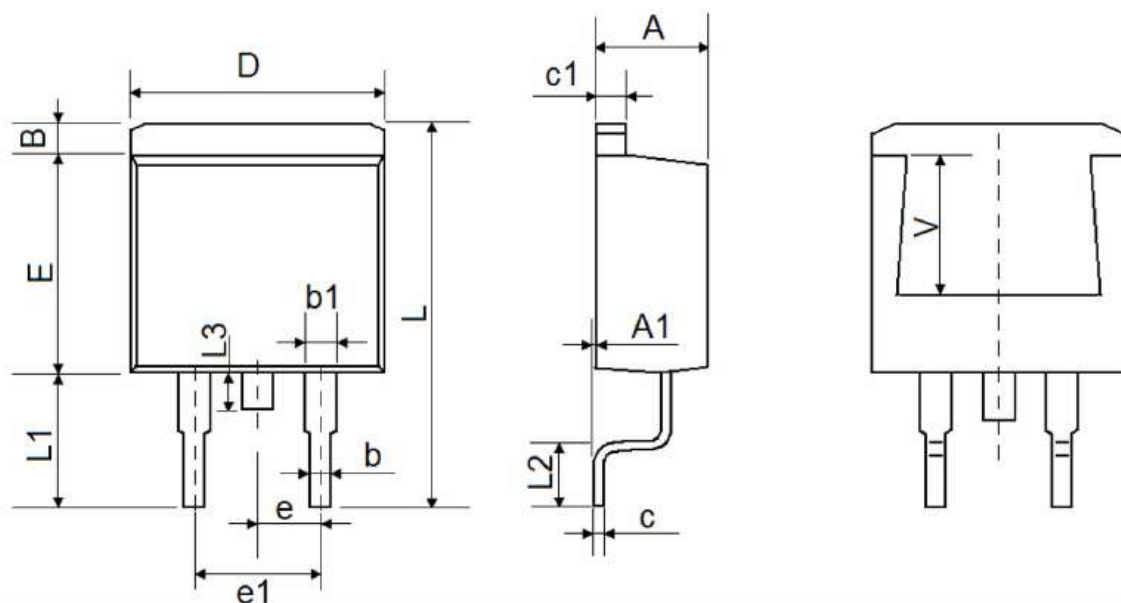


Tj -Junction Temperature(°C)  
Figure 10 Power De-rating



Square Wave Pluse Duration(sec)  
Figure 11 Normalized Maximum Transient Thermal Impedance

## TO-263-2L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	4.470	4.670	0.176	0.184
A1	0.000	0.150	0.000	0.006
B	1.170	1.370	0.046	0.054
b	0.710	0.910	0.028	0.036
b1	1.170	1.370	0.046	0.054
c	0.310	0.530	0.012	0.021
c1	1.170	1.370	0.046	0.054
D	10.010	10.310	0.394	0.406
E	8.500	8.900	0.335	0.350
e	2.540 TYP.		0.100 TYP.	
e1	4.980	5.180	0.196	0.204
L	15.050	15.450	0.593	0.608
L1	5.080	5.480	0.200	0.216
L2	2.340	2.740	0.092	0.108
L3	1.300	1.700	0.051	0.067
V	5.600 REF		0.220 REF	



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