

MDD60N04D

40V N-Channel Enhancement Mode POWER MOSFET

1. Description

This N-Channel MOSFET is produced using MDD's advanced Power Trench technology. This process has been optimized to minimize on-state resistance and yet maintain superior switching performance with best in class soft body diode.

2. Features

- Max $R_{DS(on)}$ = 7m Ω at V_{GS} = 10 V, I_D = 30 A
- Extremely Low Reverse Recovery Charge, Q_g
- 100% UIS Tested
- 100% dVDS Tested

3. Application

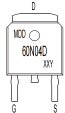
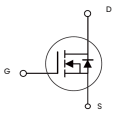
- Power Management in Telecom., Industrial Automation
- Motor Drives and Uninterruptible Power Supplies
- Current Switching in DC/DC&AC/DC(SR) Sub-systems
- Load Switch

4. Absolute Maximum Ratings ($T_A=25^{\circ}\text{C}$ unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	40	V
Gate-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current (Note 1)	I_D	60	A
Single Pulsed Avalanche Energy (Note 3)	E_{AS}	72	mJ
Thermal Resistance, steady-state	$R_{\theta JA}$	37	$^{\circ}\text{C}/\text{W}$
Power Dissipation	P_D	114	W
Junction Temperature	T_J	-55~+150	$^{\circ}\text{C}$
Storage Temperature	T_{stg}	-55~+150	$^{\circ}\text{C}$

Note: 1) Calculated continuous current based on maximum allowable junction temperature.
2) Repetitive rating, pulse width limited by max. junction temperature.
3) E_{AS} condition : $T_J=25^{\circ}\text{C}$, $V_{DD}=20\text{V}$, $V_{GS}=10\text{V}$, $L=0.5\text{mH}$, $R_g=25\Omega$, $I_{AS}=17\text{A}$.

5. Pinning information

Pin	Symbol	Description	Simplified outline	Equivalent Circuit	Marking	Package
1	G	Gate			MDD 60N04D XXY: Date code	TO-252
2	D	Drain				
3	S	Source				

6. T_A=25°C unless otherwise specified

Symbol	Parameter		Condition	Min	Typ	Max	Unit
V _{(BR)DSS}	Drain-Source Breakdown Voltage		V _{GS} =0V, I _D =250μA	40	—	—	V
I _{SS}	Gate-Source Leakage Current	Forward	V _{GS} =20V	—	—	100	nA
		Reverse	V _{GS} =-20V	—	—	-100	nA
I _{DSS}	Drain-Source Leakage Current		V _{DS} =40V, V _{GS} =0V	—	—	1	μA
V _{GS(TH)}	Gate Threshold Voltage		V _{DS} =V _{GS} , I _D =250μA	1.2	1.5	2.2	V
R _{DS(ON)}	Drain-Source On-State Resistance		V _{GS} =10V, I _D =30A	—	5.7	7	mΩ
			V _{GS} =4.5V, I _D =20A	—	7.1	12	mΩ

7. Dynamic Electrical Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
C _{iss}	Input Capacitance	V _{GS} =0V	—	2330	—	pF
C _{oss}	Output Capacitance	V _{DS} =20V	—	165	—	pF
C _{rss}	Reverse Transfer Capacitance	f=1MHz	—	155	—	pF
Q _g	Total Gate Charge	V _{GS} =0 to 10V	—	48	—	nC
Q _{gs}	Gate Source Charge	V _{DS} =20V	—	10	—	nC
Q _{gd}	Gate Drain Charge	I _D =20A	—	10	—	nC

8. Switching Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
t _{d(on)}	Turn on Delay Time	V _{GS} =10V V _{DD} =20V I _D =20A R _G =3Ω	—	10	—	ns
t _r	Turn on Rise Time		—	28	—	ns
t _{d(off)}	Turn Off Delay Time		—	40	—	ns
t _f	Turn Off Fall Time		—	7	—	ns

9. Source Drain Diode Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
V _{SD}	Drain-Source Diode Forward Voltage	I _S =30A, V _{GS} =0V	—	0.8	1.2	V
t _{rr}	Body Diode Reverse Recovery Time	I _F =20A	—	11	—	ns
Q _{rr}	Body Diode Reverse Recovery Charge	di/dt=100A/μs	—	5	—	nC

10. Test Circuits And Waveforms

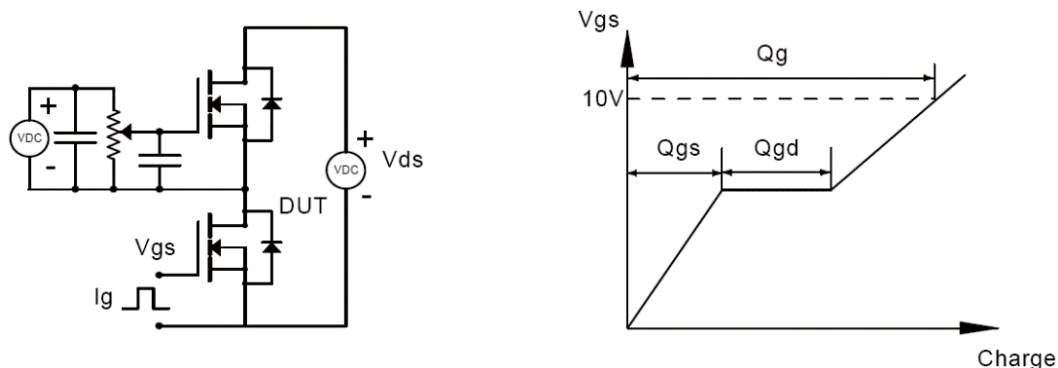


Figure 1. Gate charge test circuit & waveform

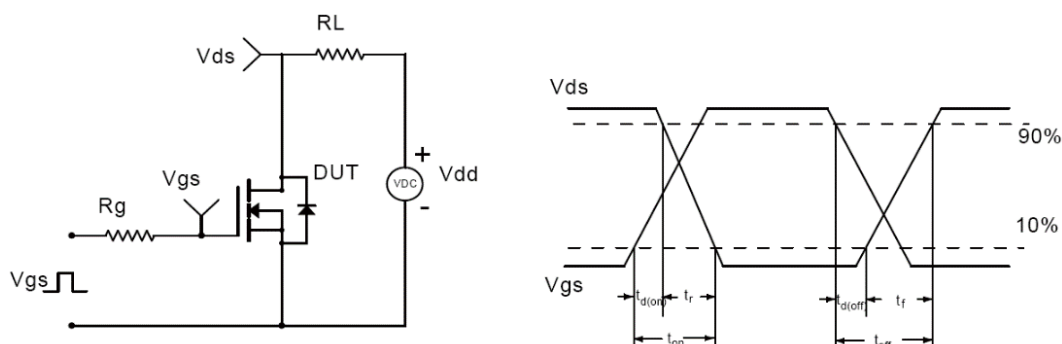


Figure 2. Switching time test circuit & waveforms

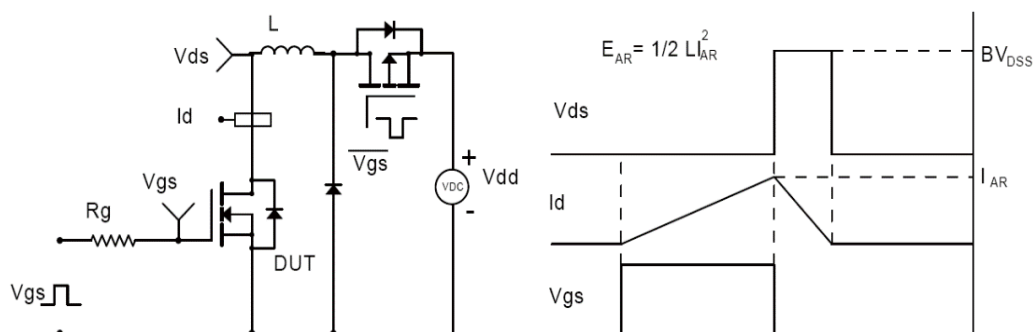


Figure 3. Unclamped inductive switching (UIS) test circuit & waveforms

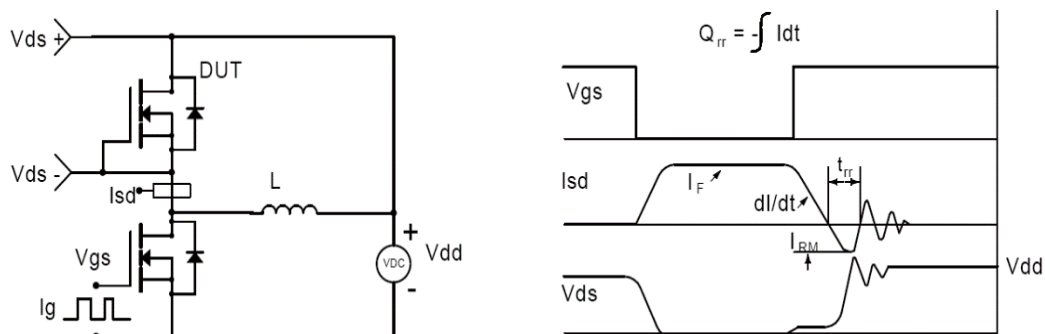


Figure 4. Diode reverse recovery test circuit & waveforms

11. Electrical Characteristics Diagrams

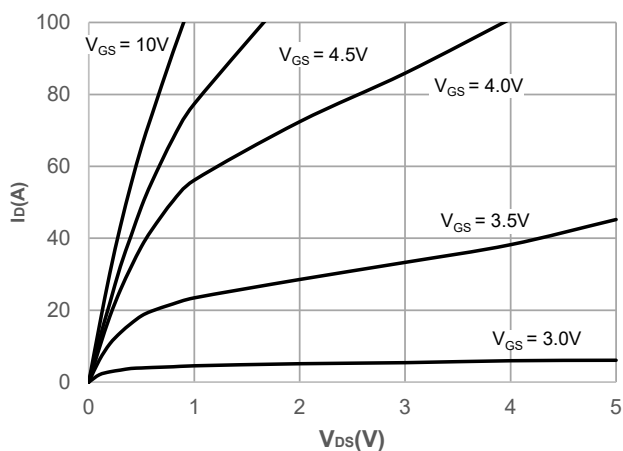


Figure 1. Typ. output characteristics

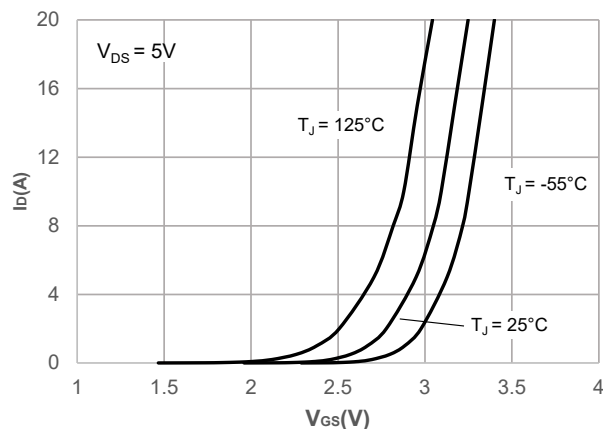


Figure 2. Typ. transfer characteristics

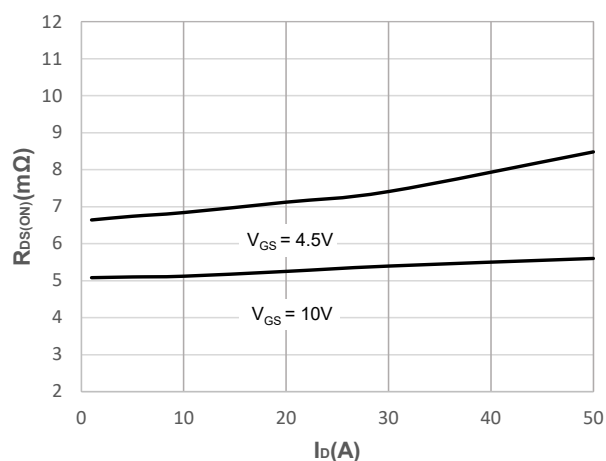


Figure 3. On-Resistance vs. Drain Current

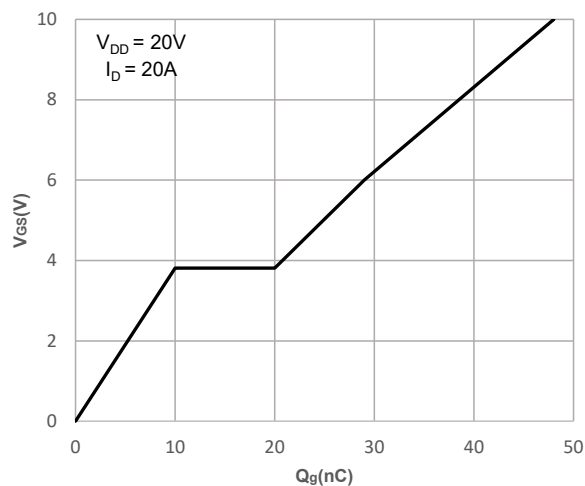


Figure 4. Gate Charge Characteristics

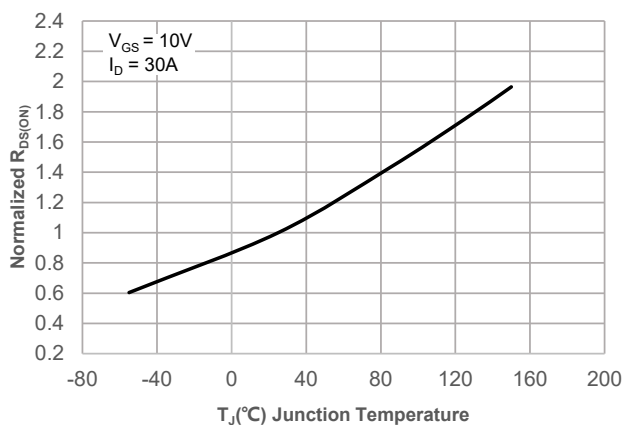


Figure 5. Normalized on Resistance vs. Junction Temperature

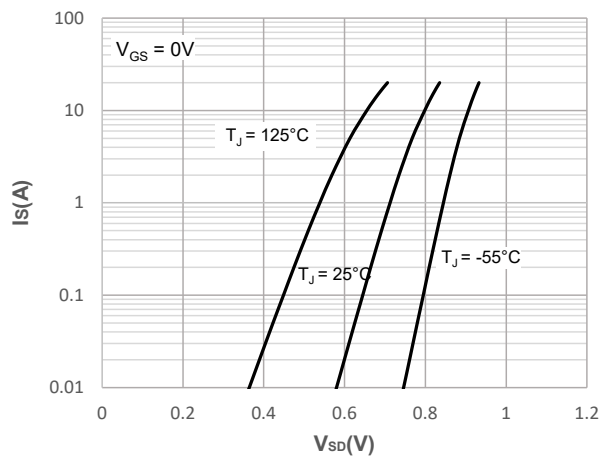
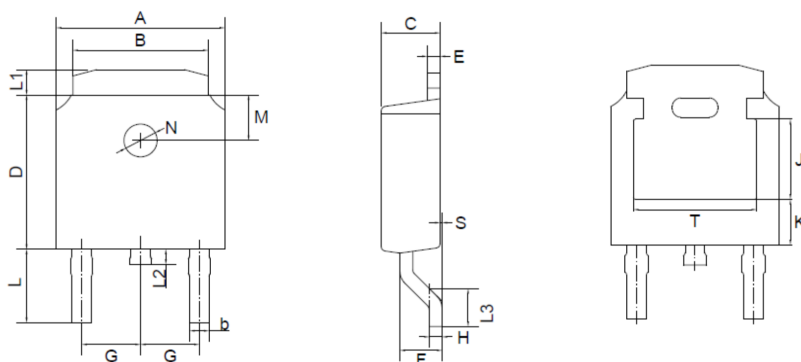


Figure 6. Forward characteristic of body diode

12. Outline Drawing

TO-252 Package Outline Dimensions



TO-252(D-PAK) mechanical data

UNIT		A	B	b	C	D	E	F	G	H	L	L1	L2	L3	S	M	N	J	K	T
mm	max	6.7	5.5	0.8	2.5	6.3	0.6	1.8	2.29	0.55	3.1	1.2	1.0	1.75	0.1	1.8	1.3	3.16	1.80	4.83
	min	6.3	5.1	0.3	2.1	5.9	0.4	1.3	TYPICAL	0.45	2.7	0.8	0.6	1.40	0.0	TYPICAL	TYPICAL	ref.	ref.	ref.
mil	max	264	217	31	98	248	24	71	90	22	122	47	39	69	4	71	51	124	71	190
	min	248	201	12	83	232	16	51	TYPICAL	18	106	31	24	55	0	TYPICAL	TYPICAL	ref.	ref.	ref.

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