

MDD3139KM

20V P-Channel Enhancement Mode MOSFET

1. Description

This P-Channel MOSFET is produced using MDD Semiconductor's advanced Trench process 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

- Typ $R_{DS(on)}$ = 300 m Ω at $V_{GS} = -4.5$ V, $I_D = -0.5$ A
- Improved dv/dt capability
- Fast switching
- 2kV HBM ESD capability

3. Application

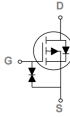
- Synchronous Rectification for Notebook / Server / Telecom PSU
- Motor Drives and Uninterruptible Power Supplies
- Battery Protection

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	-20	V
Gate-Source Voltage	V_{GS}	± 12	V
Continuous Drain Current (Note 1)	I_D	-600	mA
Pulsed Drain Current (Note 2)	I_{DM}	-2400	mA
Power Dissipation ($T_c = 25^\circ\text{C}$)	P_D	450	mW
Thermal Resistance, steady-state	$R_{\theta JA}$	280	$^\circ\text{C/W}$
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.

5. Pinning information

Pin	Symbol	Description	Simplified outline	Equivalent Circuit	Marking	Package
1	G	Gate			KD	SOT-723
2	S	Source				
3	D	Drain				

6. $T_A=25^{\circ}\text{C}$ unless otherwise specified

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=-250\mu A$	-20	—	—	V
I_{GSS}	Gate-Source Leakage Current	$V_{GS}=\pm 10V$	—	—	± 10	μA
I_{DSS}	Drain-Source Leakage Current	$V_{DS}=-20V, V_{GS}=0V$	—	—	-1	μA
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=-250\mu A$	-0.4	-0.7	-1.1	V
$R_{DS(ON)}$	Drain-Source On-State Resistance	$V_{GS}=-4.5V, I_D=-0.5A$	—	300	450	m Ω
		$V_{GS}=-2.5V, I_D=-0.4A$	—	450	650	m Ω

7. Dynamic Electrical Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{GS}=0V$ $V_{DS}=-10V$ $f=1.0MHz$	—	40	—	pF
C_{oss}	Output Capacitance		—	15	—	pF
C_{rss}	Reverse Transfer Capacitance		—	6.5	—	pF
Q_g	Total Gate Charge	$V_{GS}=-4.5V$ $V_{DS}=-10V$ $I_D=-0.2A$	—	1	—	nC
Q_{gs}	Gate Source Charge		—	0.28	—	nC
Q_{gd}	Gate Drain Charge		—	0.18	—	nC

8. Switching Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$t_{d(on)}$	Turn on Delay Time	$V_{GS}=-4.5V$ $V_{DD}=-10V$ $I_D=-0.2A$ $R_G=10\Omega$	—	8	—	ns
t_r	Turn on Rise Time		—	5.2	—	ns
$t_{d(off)}$	Turn Off Delay Time		—	30	—	ns
t_f	Turn Off Fall Time		—	18	—	ns

9. Source Drain Diode Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
V_{SD}	Drain-Source Diode Forward Voltage	$I_S=-0.2A, V_{GS}=0V$	—	-0.8	-1.2	V
I_S	Continuous Source Current	$V_G=V_D=0V$ Force Current	—	—	-600	mA

10. Electrical Characteristics Diagrams

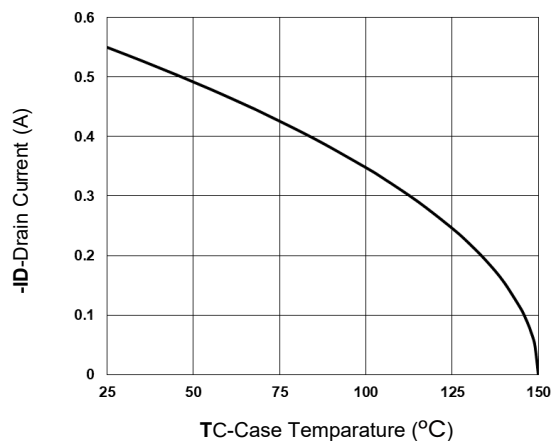


Figure 1. Continuous Drain Current vs. Tc

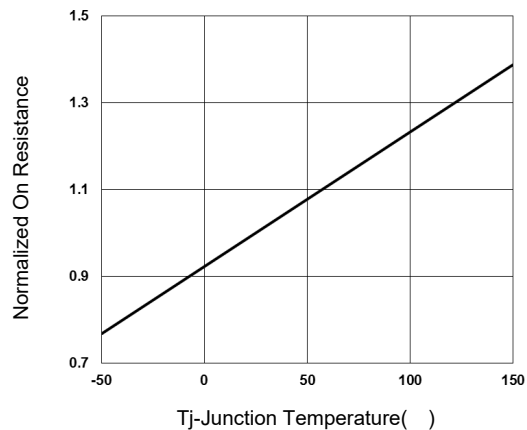


Figure 2. Normalized RDSon vs. Tj

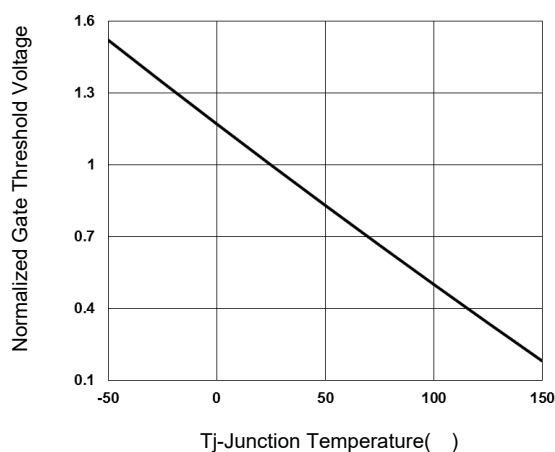


Figure 3. Normalized Vth vs. Tj

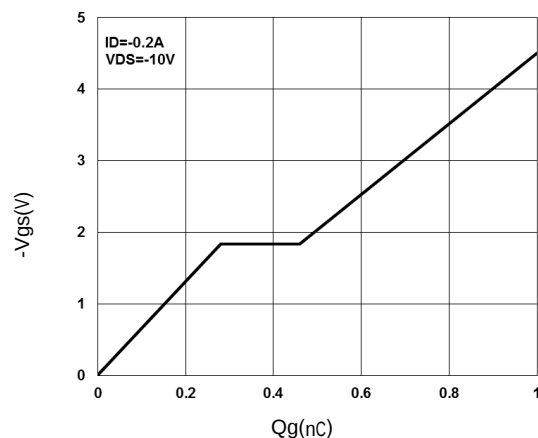


Figure 4. Gate Charge Characteristics

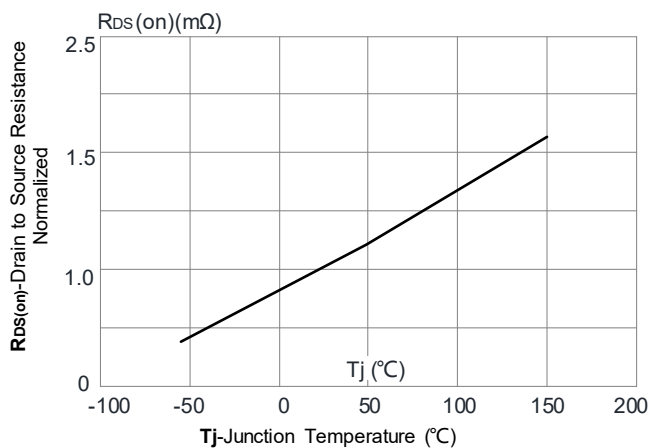


Figure 5. Normalized on Resistance vs. Junction Temperature

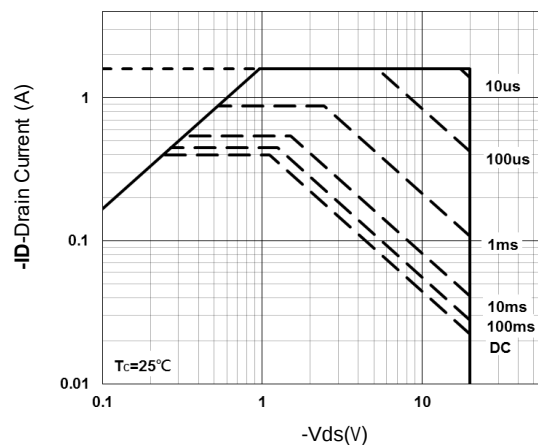


Figure 6. Forward characteristic of body diode

11. Test Circuits And Waveforms

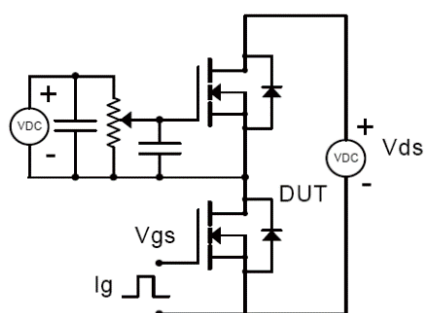


Figure 1. Gate charge test circuit & waveform

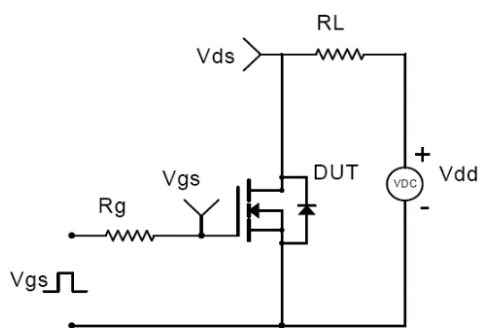
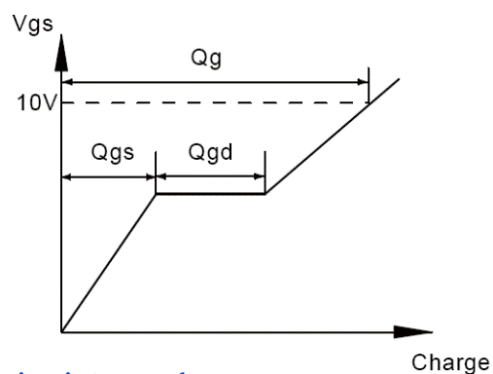
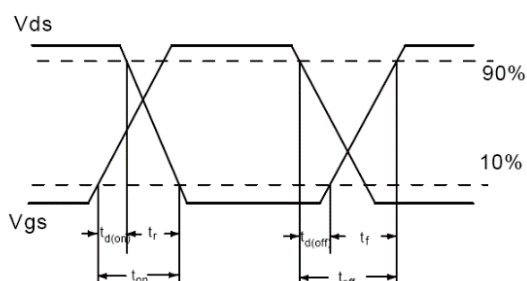
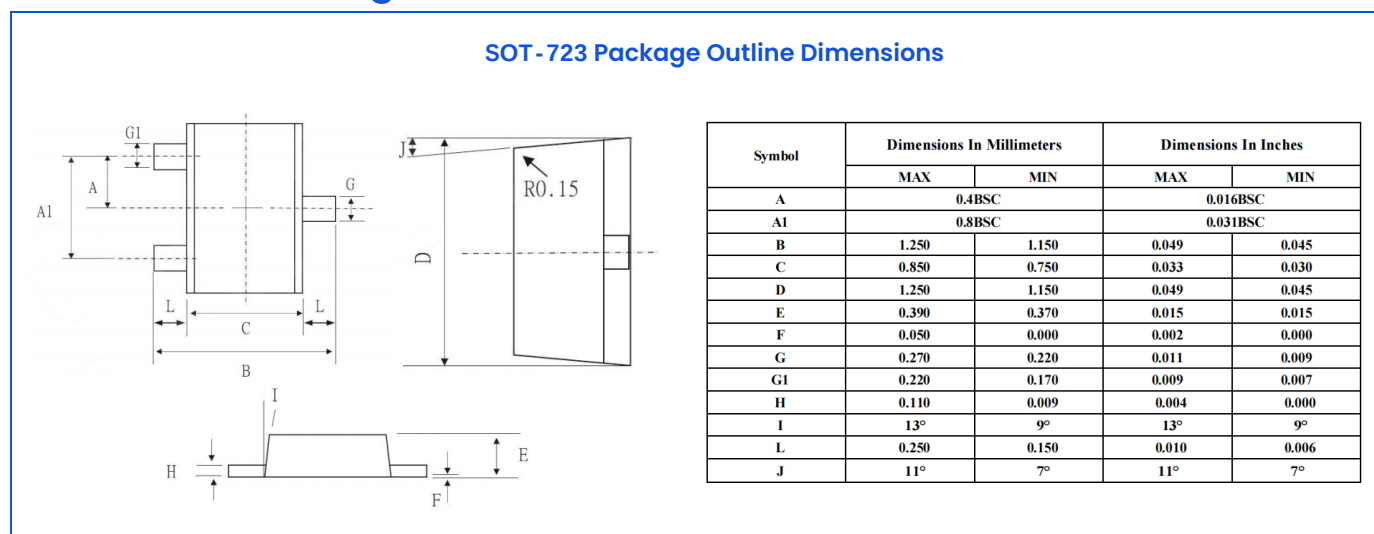


Figure 2. Switching time test circuit & waveforms



12. Outline Drawing



13. Important Notice and Disclaimer

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