

MDD3139KW

-20V P-Channel Enhancement Mode MOSFET

1. Description

This -20V P-channel MOSFET is based on MDD's unique device design to achieve low $R_{DS(on)}$ and fast switching and good ESD rating performance.

2. Features

- Lead free product is acquired
- Surface mount package
- Moisture Sensitivity Level 3

3. Application

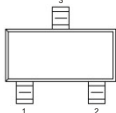
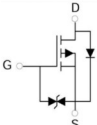
- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories
- Battery Operated Systems
- Power Supply Converter Circuits
- Load/Power Switching Cell Phones, Pagers

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	I_D	-0.66	A
Pulsed Drain Current(note1)	I_{DM}	-2.64	A
Power Dissipation(note2)	P_D	200	mW
Thermal Resistance From Junction to Ambient	$R_{\theta JA}$	625	$^{\circ}\text{C/W}$
Storage Temperature	T_{stg}	-50~+150	$^{\circ}\text{C}$
Junction Temperature	T_J	150	$^{\circ}\text{C}$

- Stresses exceeding Maximum Ratings may damage the device.
- Maximum Ratings are stress ratings only.
- Functional operation above the Recommended Operating Conditions is not implied.
- Extended exposure to stresses above the recommended Operating Conditions may affect device reliability

5. Pinning information

Pin	Symbol	Description	Simplified outline	Equivalent Circuit	Marking	Package
1	G	Gate			39K	SOT-323
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
$V_{GS(TH)}$	Gate Threshold Voltage(note3)	$V_{DS}=V_{GS}, I_D=-250\mu A$	-0.35	—	-1.1	V
I_{GSS}	Gate-body Leakage	$V_{DS}=0V, V_{GS}=\pm 10V$	—	—	± 20	μA
I_{DSS}	Zero Gate Voltage Drain current	$V_{DS}=-20V, V_{GS}=0V$	—	—	-1	μA
$R_{DS(ON)}$	Drain-Source On-Resistance(note3)	$V_{GS}=-4.5V, I_D=-1A$	—	430	520	m Ω
		$V_{GS}=-2.5V, I_C=-0.8A$	—	624	700	m Ω
		$V_{GS}=-1.8V, I_C=-0.5A$	—	950	—	m Ω
gfs	Forward trans conductance	$V_{DS}=-10V, I_D=-0.54A$	0.8	—	—	S

7. Dynamic Electrical Characteristics(note4)

Symbol	Parameter	Condition	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{GS}=0V$	—	—	170	pF
C_{oss}	Output Capacitance	$V_{DS}=-16V$	—	—	25	pF
C_{rss}	Reverse Transfer Capacitance	$f=1.0MHz$	—	—	15	pF

8. Switching Characteristics(note4)

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$t_{d(on)}$	Turn on Delay Time	$V_{GS}=-4.5V$ $V_{DD}=-10V$ $I_D=-0.2A$ $R_{GEN}=10\Omega$	—	9	—	nS
t_r	Turn on Rise Time		—	5.8	—	nS
$t_{d(off)}$	Turn Off Delay Time		—	32.7	—	nS
t_f	Turn Off Fall Time		—	20.3	—	nS

9. Drain-Source Diode Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
V_{SD}	Diode forward voltage(note3)	$V_{GS}=0V, I_S=-0.5A$	—	—	1.2	V

Notes: 1.Repetitive Rating: Pulse width limited by maximum junction temperature

2.This test is performed with on heat sink at $T_A=25^{\circ}\text{C}$

3.Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 0.5\%$

4.These parameters have no way to verify

10. Electrical Characteristics Diagrams

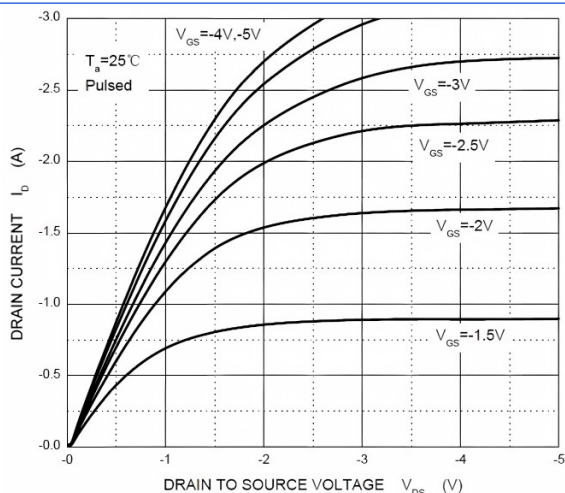


Figure 1. Output Characteristics

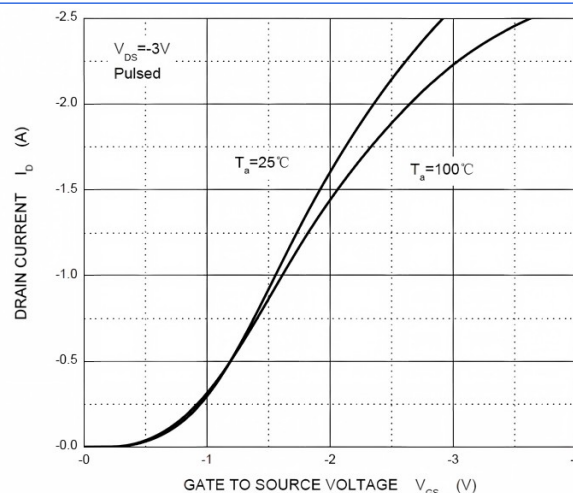


Figure 2. Transfer Characteristics

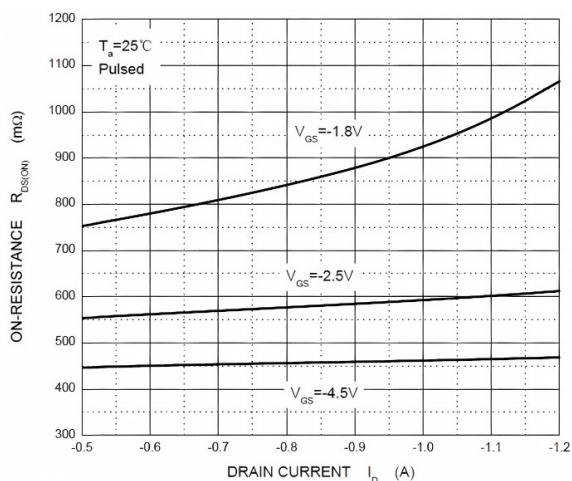


Figure 3. $R_{DS(on)}$ VS Drain Current

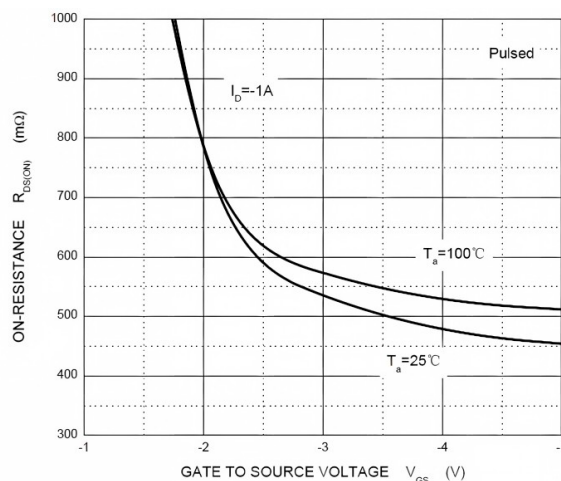


Figure 4. $R_{DS(on)}$ VS V_{GS}

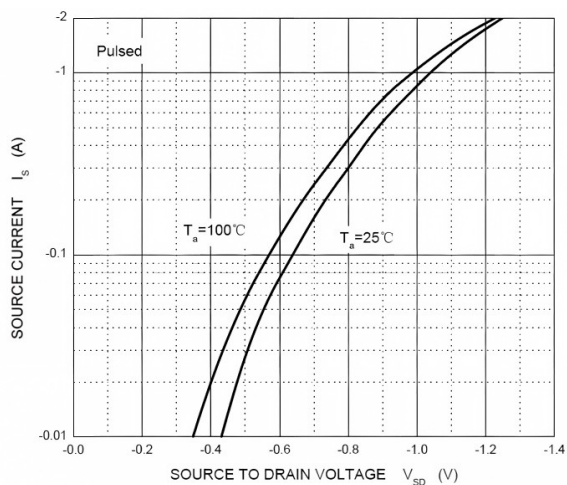


Figure 5. Source-Drain Diode Forward Characteristics

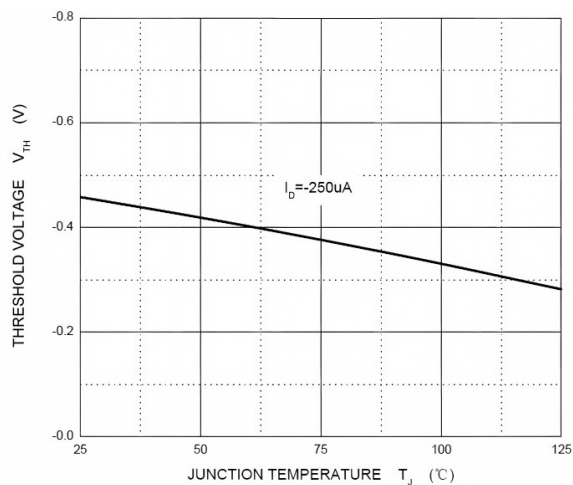
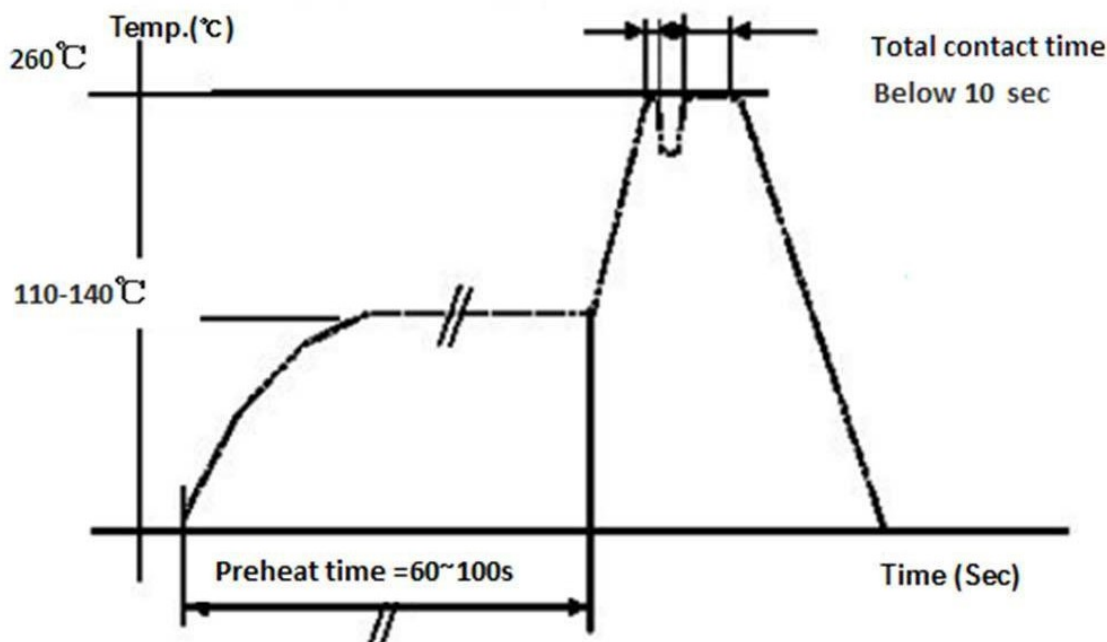


Figure 6. Threshold Voltage vs. Junction Temperature

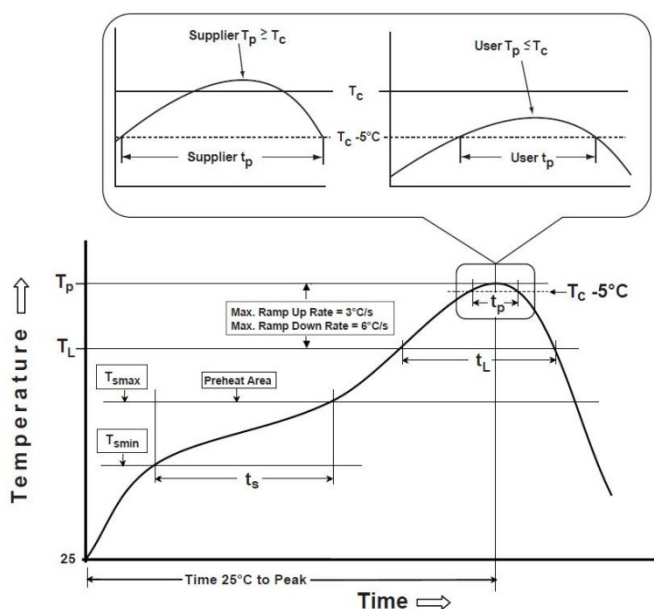
-20V P-Channel Enhancement Mode MOSFET

11. Recommended Soldering Profile for Rectifier Diodes (PbFree)

a)Wave Soldering Profile



b)Reflow Soldering Profile(PbFreeApplication),refer to IPC/JEDEC J-STD-020



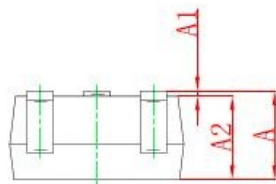
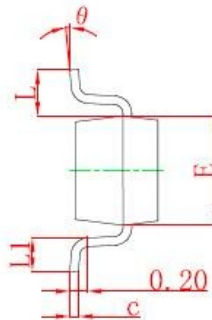
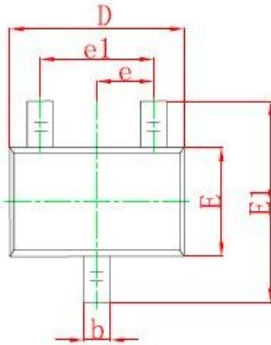
Preheat/Soak Temperature Min (T _{sm}) Temperature Max (T _{sm} max) Time (ts) from (T _{sm} to T _{sm} max)	50 °C 200 °C 60-120 seconds
Melting Point of Solder (Sn Ag Cu)	217°C
Ramp-up Rate to 217°C (Melting Point of Solder)	3°C/sec
Time at Temp.>217°C (Melting Point of Solder)	60–150 Sec
Peak Temperature	255±5°C
Time within 5°C below Peak Temp.	20–40 Sec
Cooling Rate	6°C/sec (max)
Time from 25°C to Peak Temp.	8min (max)

c)Manual Soldering

When using an electric soldering iron for manual soldering, it is recommended that the temperature does not exceed 300°C and the soldering time is less than 10 seconds.

12. Package Mechanical Data

SOT-323 Package Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.200	0.400	0.008	0.016
c	0.080	0.150	0.003	0.006
D	2.000	2.200	0.079	0.087
E	1.150	1.350	0.045	0.053
E1	2.150	2.450	0.085	0.096
e	0.650 TYP		0.026 TYP	
e1	1.200	1.400	0.047	0.055
L	0.525 REF		0.021 REF	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

13. Important Notice and Disclaimer

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