

MDD3139KT

-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

- P-Channel Switch with Low $R_{DS(on)}$
- Operated at Low Logic Level Gate Drive
- Load/Power Switching
- Interfacing, Logic Switching
- Easy to parallel
- Interfacing, Switching

3. Application

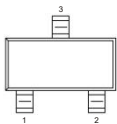
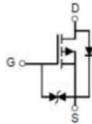
- Battery Management for Ultra Small Portable Electronics

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(note1)	I_D	-0.66	A
Pulsed Drain Current ($t_p=10\mu s$)	I_{DM}	-1.2	A
Power Dissipation (note1)	P_D	150	mW
Junction Temperature	T_J	150	$^{\circ}\text{C}$
Storage Temperature	T_{stg}	-50~+150	$^{\circ}\text{C}$
Thermal Resistance From Junction to Ambient(note1)	$R_{\theta JA}$	833	$^{\circ}\text{C/W}$

- 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-523
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(note2)	$V_{DS}=V_{GS}, I_D=-250\mu A$	-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	$V_{DS}=-20V, V_{GS}=0V$	—	—	-1.0	μA
$R_{DS(ON)}$	Drain-Source On-Resistance(note2)	$V_{GS}=-4.5V, I_D=-1A$	—	450	520	m Ω
		$V_{GS}=-2.5V, I_C=-0.8A$	—	570	700	m Ω
		$V_{GS}=-1.8V, I_C=-0.5A$	—	950	—	m Ω
g_{FS}	Forward trans conductance(note2)	$V_{DS}=-10V, I_D=-540mA$	—	1.2	—	S
V_{SD}	Diode forward voltage	$V_{GS}=0V, I_S=0.5A$	—	—	-1.2	V

7. Dynamic Electrical Characteristics(note4)

Symbol	Parameter	Condition	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	$V_{GS}=0V$	—	113	170	pF
C_{oss}	Output Capacitance	$V_{DS}=-16V$	—	15	25	pF
C_{rss}	Reverse Transfer Capacitance	$f=1.0MHz$	—	9	15	pF

8. Switching Characteristics(note4)

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$t_{d(on)}$	Turn on Delay Time	$V_{GS}=-4.5V$ $V_{DS}=-10V$ $I_D=-200mA$ $R_{GEN}=10\Omega$	—	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

Notes: 1.Surface mounted on FR4 board using the minimum recommended pad size
 2.Pulse Test: Pulse Width=300us, Duty Cycle=2%.
 3.Switching characteristics are independent of operating junction temperatures
 4.Guaranteed by design, not subject to producing

9. Electrical Characteristics Diagrams

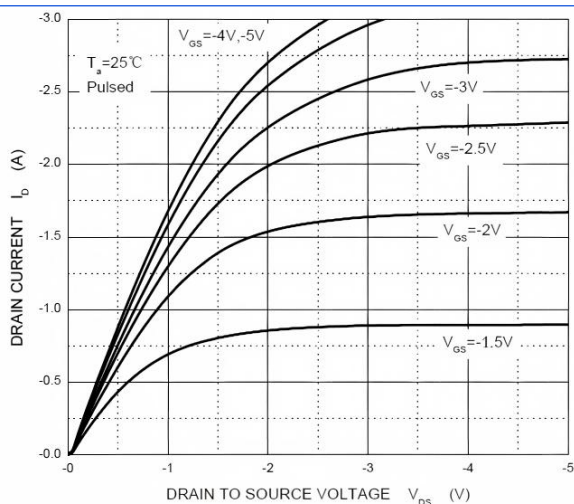


Figure 1. Output Characteristics

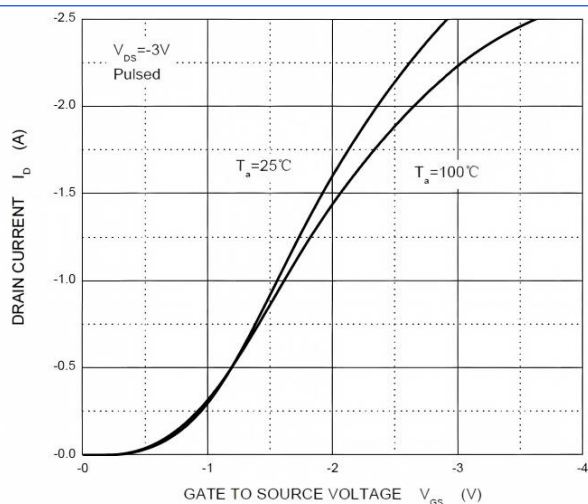


Figure 2. Transfer Characteristics

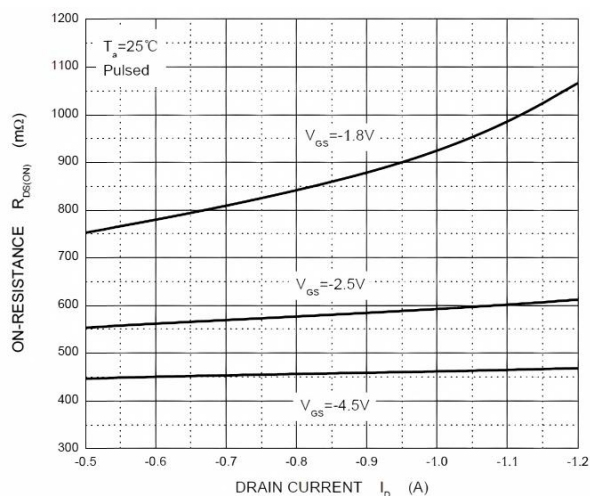


Figure 3. On-resistance vs. Drain Current

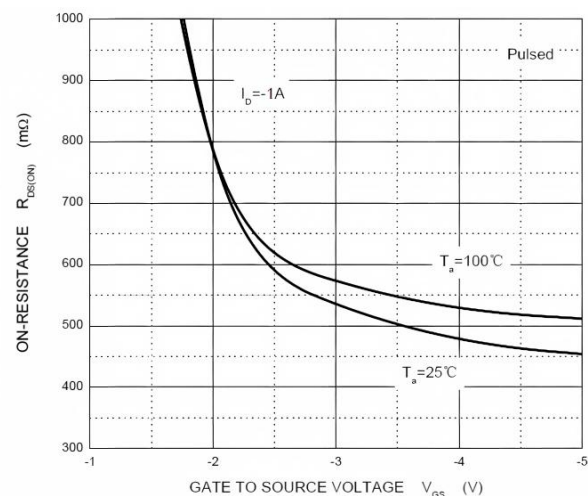


Figure 4. On-resistance vs. V_{GS}

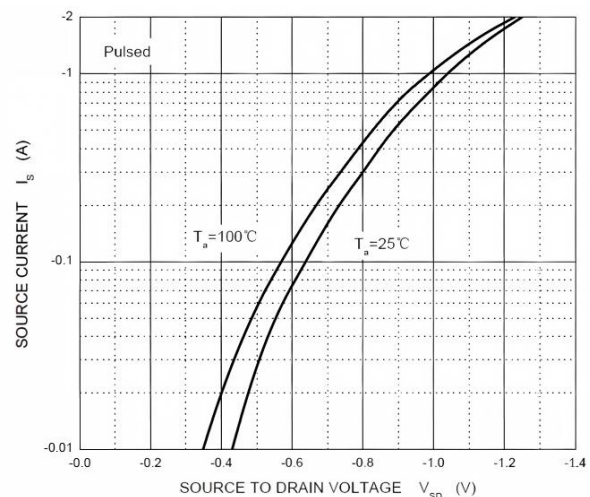


Figure 5. Body Diode Characteristics

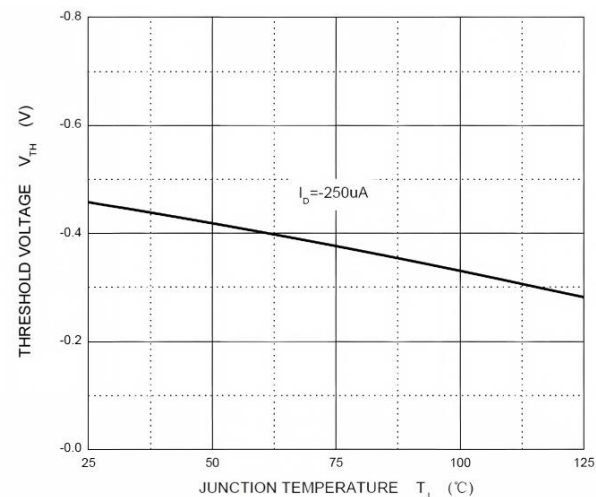
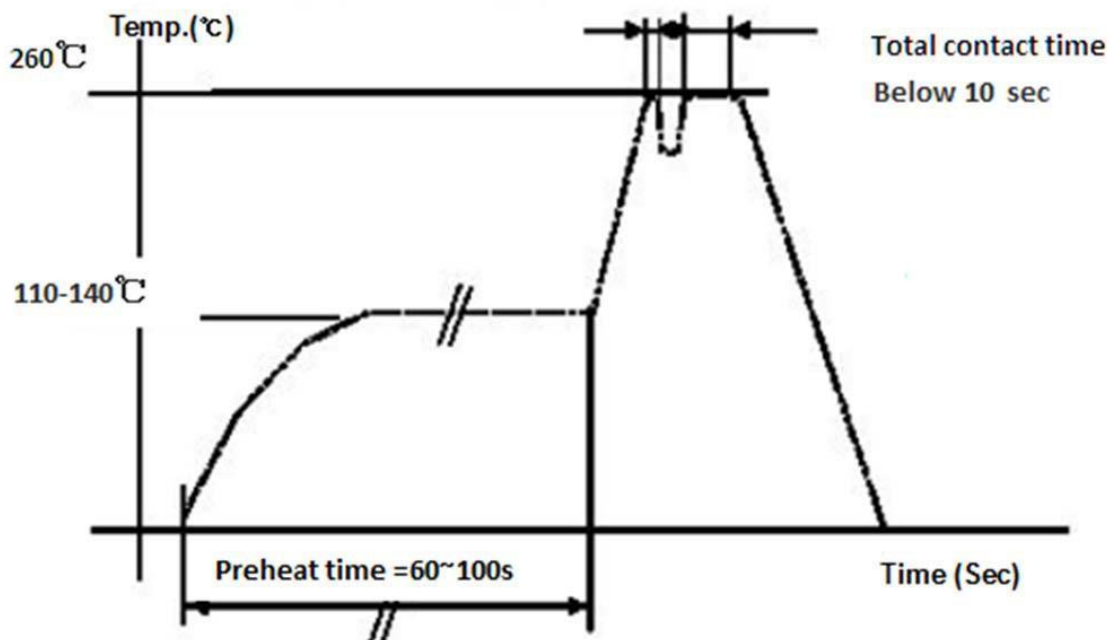


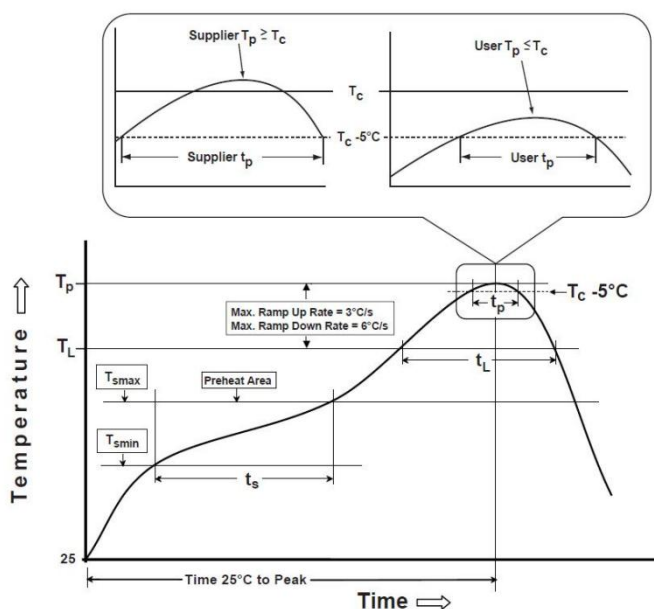
Figure 6. Threshold Voltage

10. Recommended Soldering Profile for Rectifier Diodes (PbFree)

a)Wave Soldering Profile



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

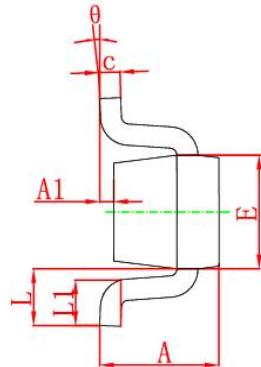
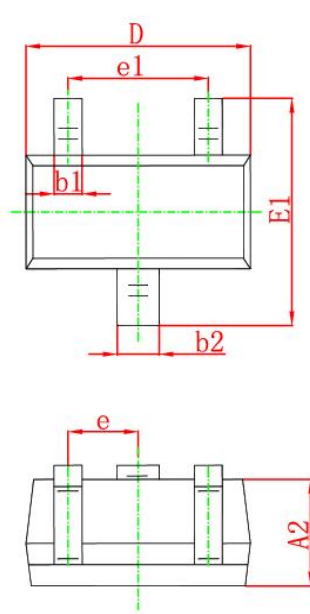


Preheat/Soak Temperature Min (T _{min}) Temperature Max (T _{max}) Time (ts) from (T _{min} to T _{max})	50 °C 200 °C 60-120 seconds
Melting Point of Solder (Sn Ag Cu)	217°C
Ramp-up Rate to 217°C (Melting Point of Solder)	3°C/sec
Time at Temp. > 217°C (Melting Point of Solder)	60–150 Sec
Peak Temperature	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.

11. Package Mechanical Data



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700	0.900	0.028	0.035
A1	0.000	0.100	0.000	0.004
A2	0.700	0.800	0.028	0.031
b1	0.150	0.250	0.006	0.010
b2	0.250	0.350	0.010	0.014
c	0.100	0.200	0.004	0.008
D	1.500	1.700	0.059	0.067
E	0.700	0.900	0.028	0.035
E1	1.450	1.750	0.057	0.069
e	0.500 TYP.		0.020 TYP.	
e1	0.900	1.100	0.035	0.043
L	0.400 REF.		0.016 REF.	
L1	0.260	0.460	0.010	0.018
θ	0°	8°	0°	8°

12. Important Notice and Disclaimer

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