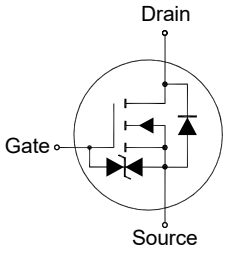
MMFTN138K

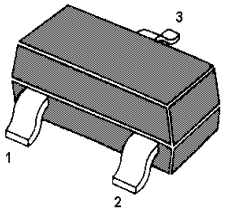
N-Channel Enhancement Mode MOSFET

Features

- Advanced trench cell design
- High speed switch
- Built-in G-S Protection Diode
- Typical ESD Protection HBM Class 1C

Classification	Voltage Range(V)
0A	< 125
0B	125 to < 250
1A	250 to < 500
1B	500 to < 1000
1C	1000 to < 2000
2	2000 to < 4000
3A	4000 to < 8000
3B	≥ 8000





1. Gate 2. Source 3. Drain
SOT-23 Plastic Package

Applications

- Portable appliances
- Load switch appliances

Absolute Maximum Ratings (at T_a = 25℃ unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	60	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current	I_D	360	mA
Peak Drain Current, Pulsed (tp < 10 μs)	I_{DM}	1.2	A
Power Dissipation	P_D	350 [1)] 420 [2)]	mW
Operating Junction Temperature Range	T_j	- 55 to + 150	℃
Storage Temperature Range	T_{stg}	- 55 to + 150	℃

Thermal Characteristics

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Ambient	$R_{\theta JA}$	357 [1)] 300 [2)]	℃/W

[1)] Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad.

[2)] Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate.

Dated: 30/06/2023 Rev:04

Characteristics at T_a = 25℃ unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Unit
STATIC PARAMETERS					
Drain-Source Breakdown Voltage at I_D = 250 µA	$V_{(BR)DSS}$	60	-	-	V
Drain-Source Leakage Current at V_{DS} = 60 V	I_{DSS}	-	-	1	µA
Gate-Source Leakage Current at V_{GS} = ± 20 V at V_{GS} = ± 10 V	I_{GSS}	- -	- -	10 1	µA
Gate-Source Threshold Voltage at V_{GS} = V_{DS}, I_D = 250 µA	V_{GSth}	0.48	-	1.6	V
Drain-Source On-State Resistance at V_{GS} = 10 V, I_D = 350 mA at V_{GS} = 4.5 V, I_D = 200 mA at V_{GS} = 2.5 V, I_D = 10 mA	$R_{DS(ON)}$	- - -	- - -	1.6 2.2 6.5	Ω
DYNAMIC PARAMETERS					
Forward Transconductance at V_{DS} = 5 V, I_D = 400 mA	g_{FS}	-	755	-	mS
Gate resistance at V_{DS} = 0 V, V_{GS} = 0 V, f = 1 MHz	R_g	-	38	-	Ω
Input Capacitance at V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	C_{iss}	-	51.3	-	pF
Output Capacitance at V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	C_{oss}	-	11.6	-	pF
Reverse Transfer Capacitance at V_{DS} = 10 V, V_{GS} = 0 V, f = 1 MHz	C_{rss}	-	8.2	-	pF
Gate charge total at V_{DS} = 30 V, I_D = 1 A, V_{GS} = 10 V at V_{DS} = 30 V, I_D = 1 A, V_{GS} = 4.5 V	Q_g	- -	1.3 0.85	- -	nC
Gate to Source Charge at V_{DS} = 30 V, I_D = 1 A, V_{GS} = 10 V	Q_{gs}	-	0.45	-	nC
Gate to Drain Charge at V_{DS} = 30 V, I_D = 1 A, V_{GS} = 10 V	Q_{gd}	-	0.3	-	nC
Turn-On Delay Time at V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 1 A, R_G = 51 Ω	$t_{d(on)}$	-	13.4	-	ns
Turn-On Rise Time at V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 1 A, R_G = 51 Ω	t_r	-	13.3	-	ns
Turn-Off Delay Time at V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 1 A, R_G = 51 Ω	$t_{d(off)}$	-	7.8	-	ns
Turn-Off Fall Time at V_{DS} = 10 V, V_{GS} = 4.5 V, I_D = 1 A, R_G = 51 Ω	t_f	-	4.6	-	ns
Body-Diode PARAMETERS					
Drain-Source Diode Forward Voltage at I_S = 300 mA	V_{SD}	0.47	-	1.2	V
Body-Diode Continuous Current	I_S	-	-	360	mA
Body Diode Reverse Recovery Time at I_S = 1 A, di/dt = 100 A / µs	t_{rr}	-	9.2	-	ns
Body Diode Reverse Recovery Charge at I_S = 1 A, di/dt = 100 A / µs	Q_{rr}	-	3.7	-	nC

Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

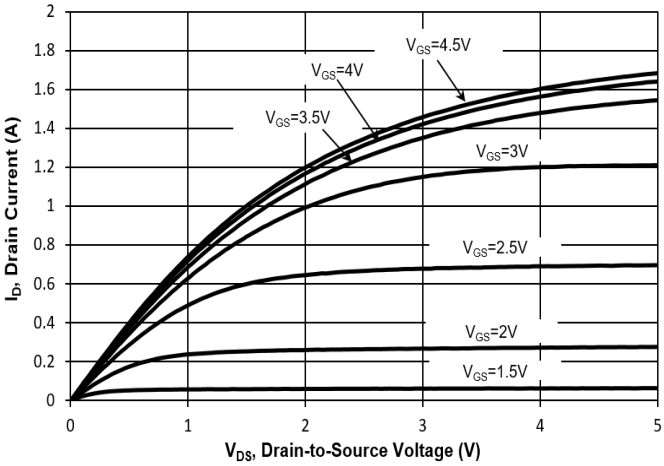


Fig. 2 Typical Transfer Characteristics

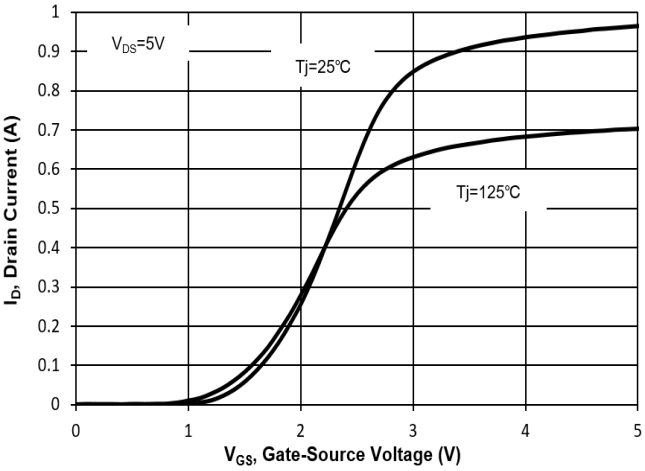


Fig. 3 On-Resistance vs. Drain Current

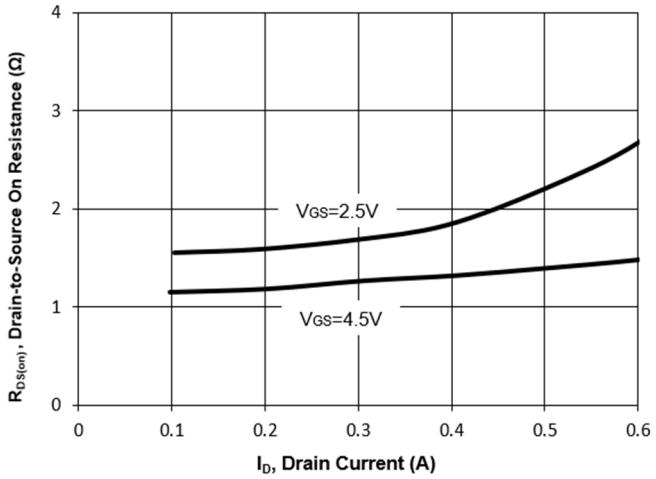


Fig. 4 On-Resistance vs. Gate-Source Voltage

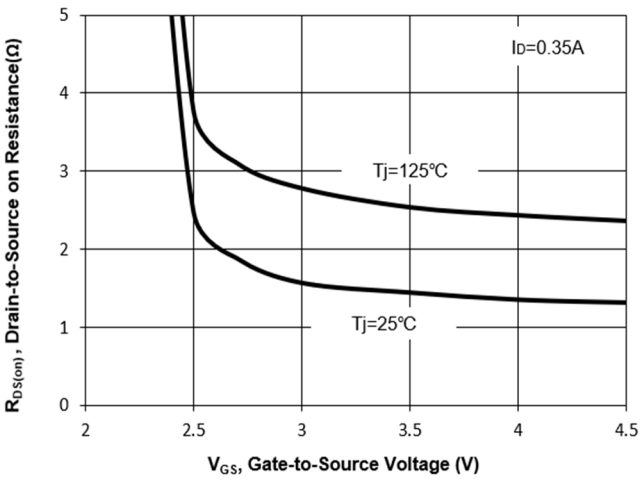


Fig. 5 On-Resistance vs.T_j

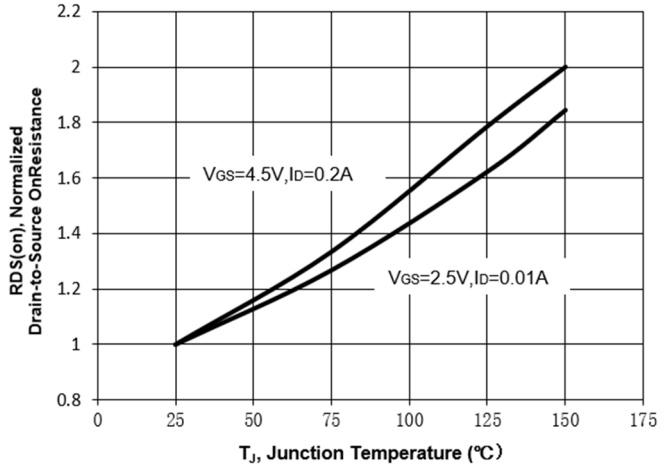
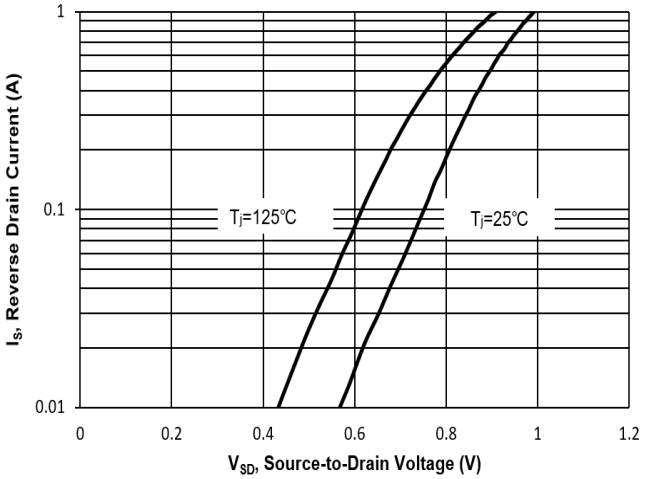


Fig. 6 Typical Body-Diode Forward Characteristics



Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

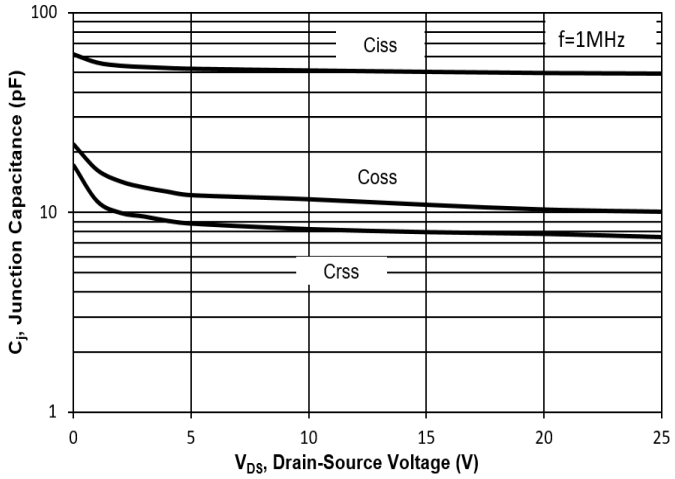


Fig. 8 Gate Charge

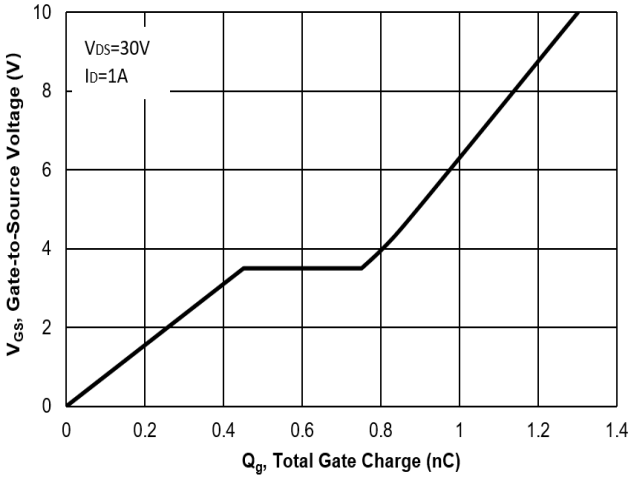


Fig. 9 $V_{(BR)DSS}$ vs. Junction Temperature

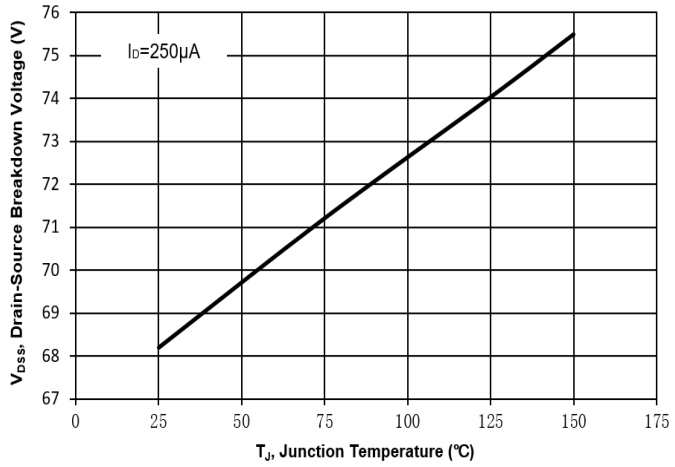
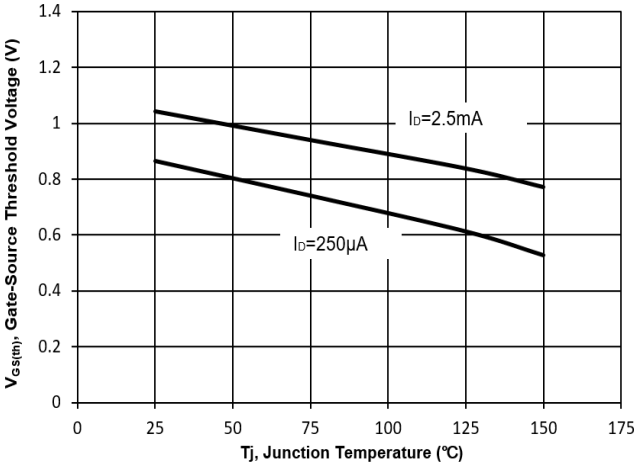


Fig. 10 Gate Threshold Variation vs. T_j



Test Circuits

Fig.1-1 Switching times test circuit

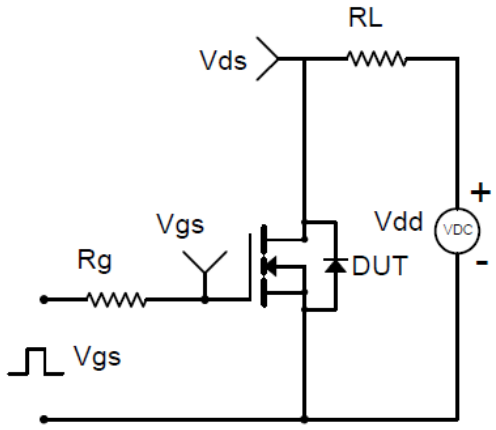


Fig.1-2 Switching Waveform

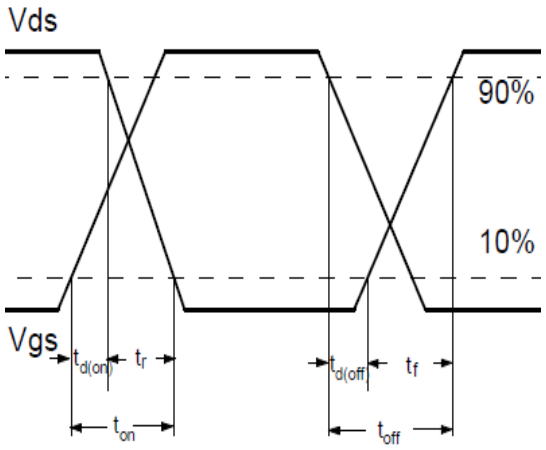


Fig.2-1 Gate charge test circuit

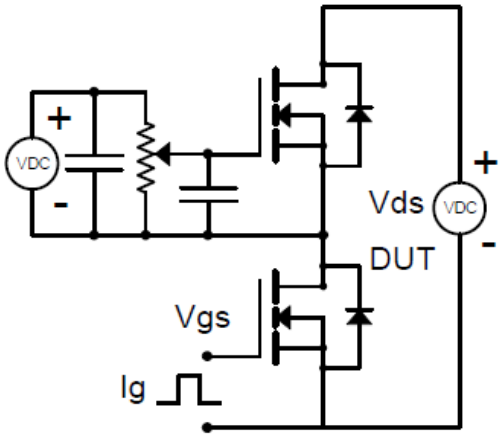
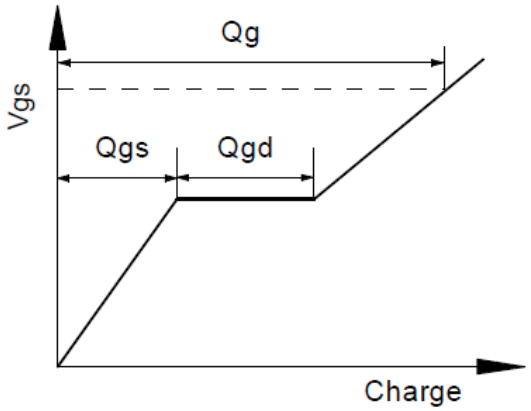
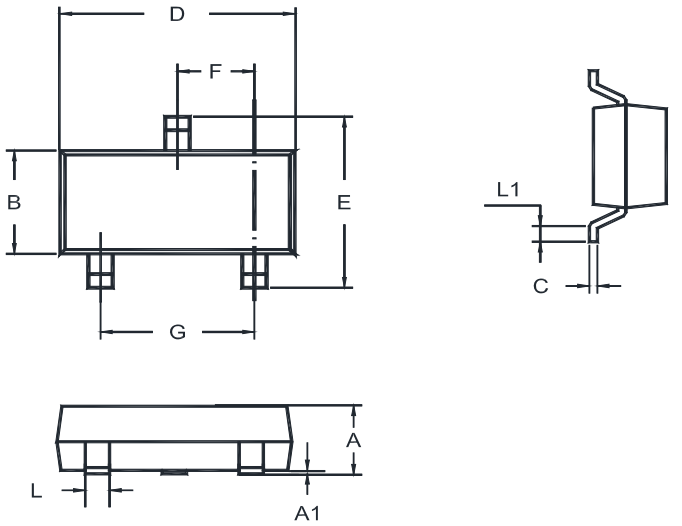


Fig.2-2 Gate charge waveform



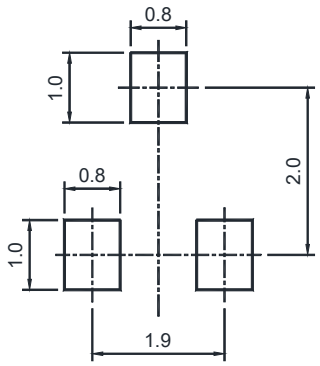
MMFTN138K

Package Outline (Dimensions in mm) SOT-23



Unit	A	A1	B	C	D	E	F	G	L	L1
mm	1.20 0.89	0.100 0.013	1.40 1.20	0.19 0.08	3.04 2.80	2.6 2.2	1.02 0.89	2.04 1.78	0.51 0.37	0.2 MIN

Recommended Soldering Footprint



Packing information

Package	Tape Width (mm)	Pitch		Reel Size		Per Reel Packing Quantity
		mm	inch	mm	inch	
SOT-23	8	4 ± 0.1	0.157 ± 0.004	178	7	3,000

Marking information

" VD " = Part No.

" YM " = Date Code Marking

" Y " = Year

" M " = Month

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