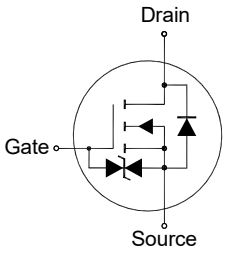
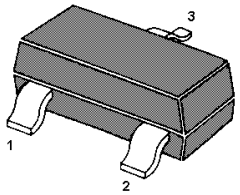
MMFTN138K-AH

N-Channel Enhancement Mode MOSFET





1. Gate 2. Source 3. Drain
TO-236 Plastic Package

Features

- AEC-Q101 Qualified
- Advanced trench cell design
- High speed switch
- Halogen and Antimony Free(HAF), RoHS compliant
- ESD protected
- 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

Applications

- Portable appliances
- Load switch appliances

Absolute Maximum Ratings (T_a = 25 °C unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	60	V
Gate-Source Voltage	V_{GSS}	± 20	V
Drain Current [1] at V_{GS} = 10 V, T_a = 25 °C at V_{GS} = 10 V, T_a = 100 °C	I_D	 360 230	mA
Peak Drain Current , Pulsed(tp < 10 μS)	I_{DM}	1.2	A
Total Power Dissipation	P_{tot}	350 [2] 420 [1]	mW
Thermal Resistance from Junction to Ambient	$R_{\theta JA}$	370 [2] 300 [1]	°C/W
Operating Junction Temperature	T_j	- 55 to + 150	°C
Storage Temperature Range	T_{stg}	- 55 to + 150	°C

[1] Device mounted on an FR4 PCB, single-sided copper, tin-plated, mounting pad for drain 1 cm^2.

[2] Device mounted on an FR4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

Dated: 21/01/2021 Rev: 01

Characteristics at T_a = 25 °C 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
Gate-Source Threshold Voltage at V_{GS} = V_{DS}, I_D = 250 µA	V_{GSth}	0.48	-	1.6	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
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, f = 1 MHz	C_{iss}	-	51.3	-	pF
Output Capacitance at V_{DS} = 10 V, f = 1 MHz	C_{oss}	-	11.6	-	pF
Reverse Transfer Capacitance at V_{DS} = 10 V, f = 1 MHz	C_{rss}	-	8.2	-	pF
Gate charge total at V_{DS} = 25 V, I_D = 1 A, V_{GS} = 10 V at V_{DS} = 25 V, I_D = 1 A, V_{GS} = 4.5 V	Q_g	- -	1.3 0.85	- -	nC
Gate to Source Gate Charge at V_{DS} = 25 V, I_D = 1 A, V_{GS} = 10 V	Q_{gs}	-	0.45	-	nC
Gate to Drain Charge at V_{DS} = 25 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 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 Characteristic

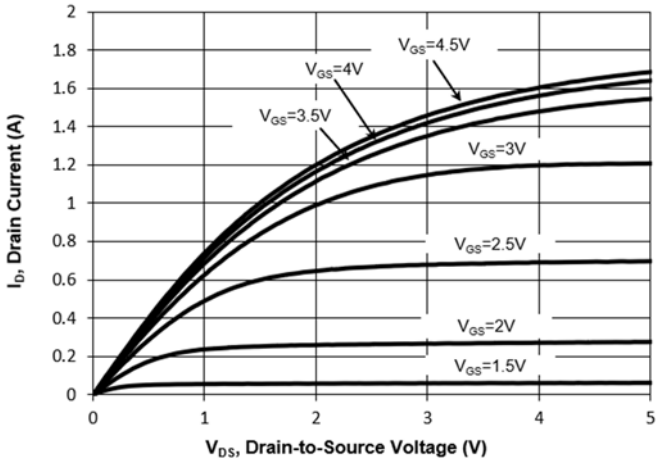


Fig. 2 Typical Transfer Characteristic

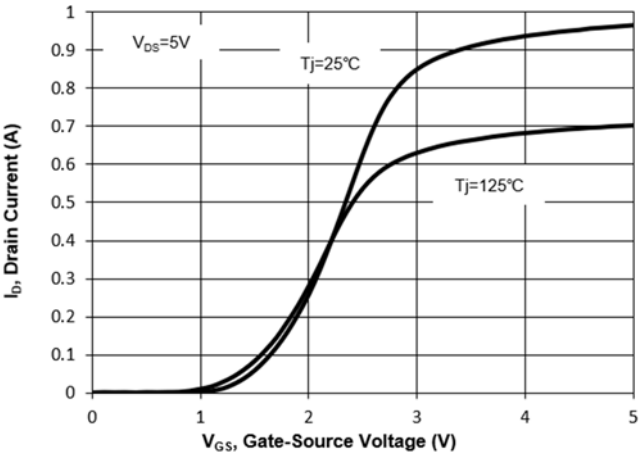


Fig. 3 on-Resistance vs Drain Current

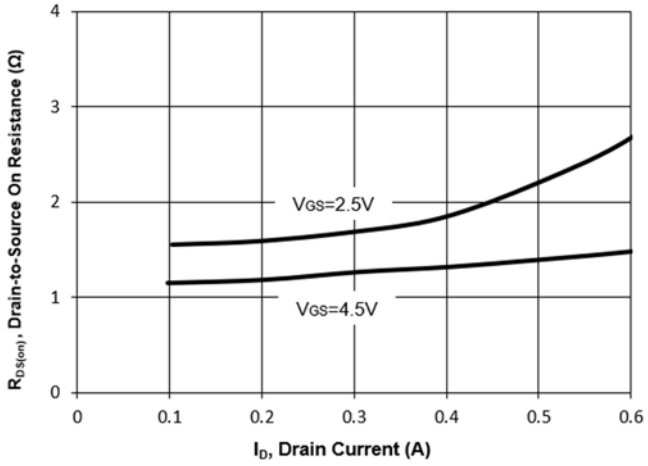


Fig. 4 on-Resistance vs. Gate Voltage

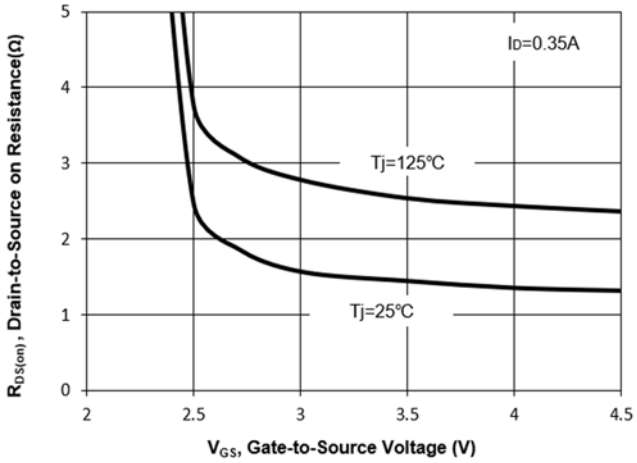


Fig. 5 on-Resistance vs.T_j

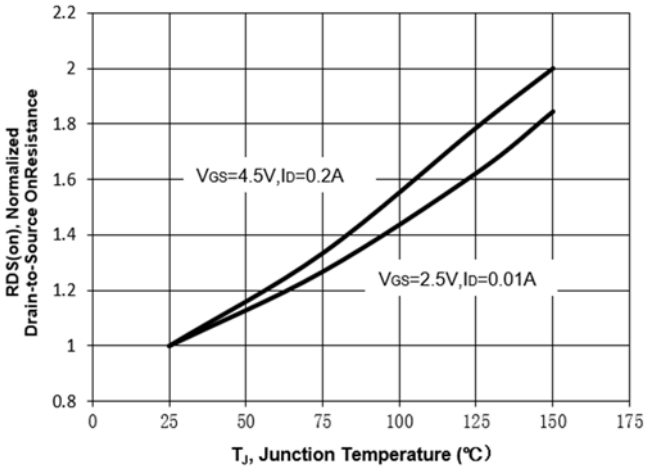
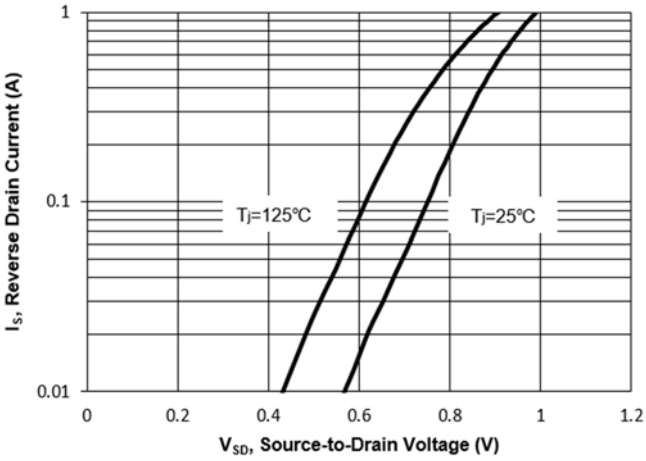


Fig. 6 Typical Forward Characteristic



Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

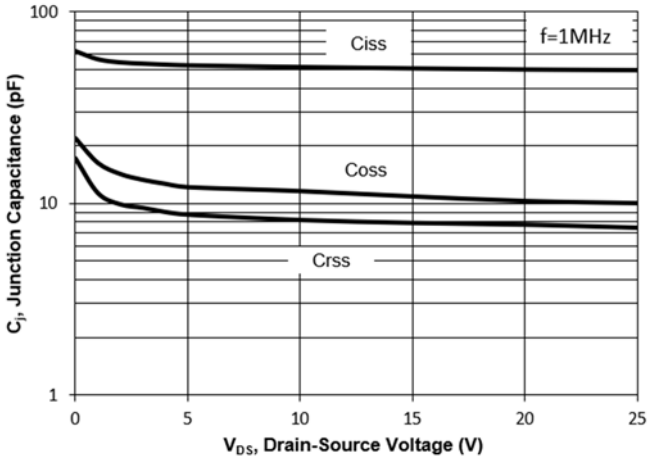


Fig. 8 $V_{(BR)DSS}$ vs. Junction Temperature

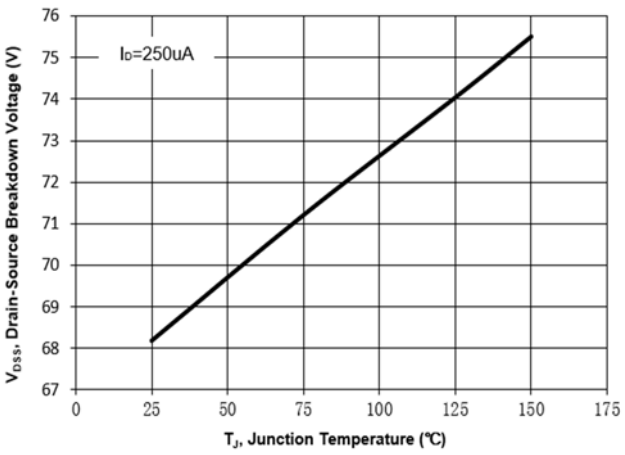


Fig. 9 Gate Threshold Variation vs. T_j

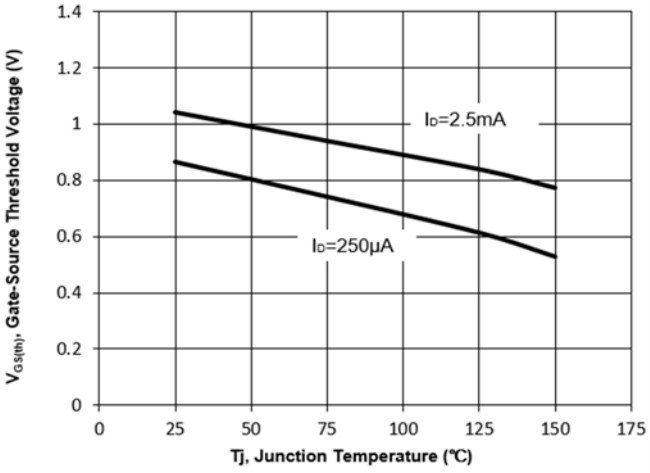
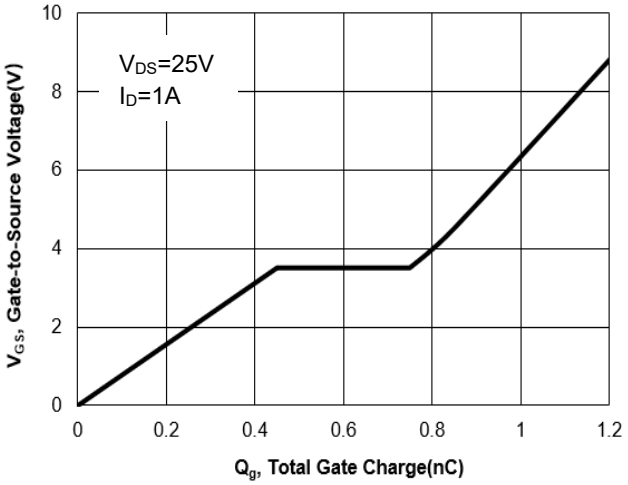


Fig. 10 Gate Charge



Test Circuits

Fig.1-1 Switching times test circuit

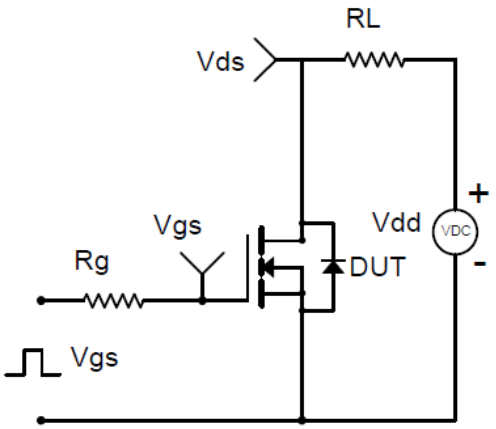


Fig.1-2 Switching Waveform

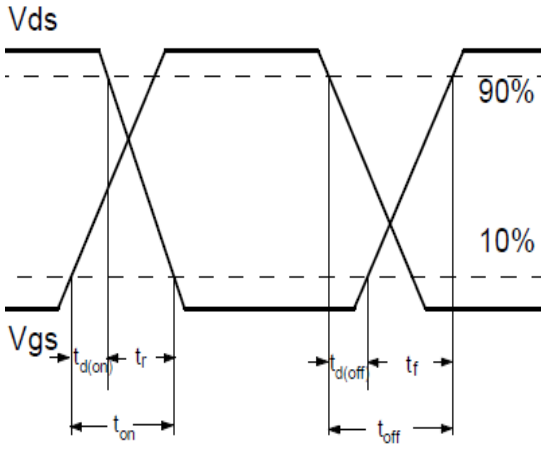


Fig.2-1 Gate charge test circuit

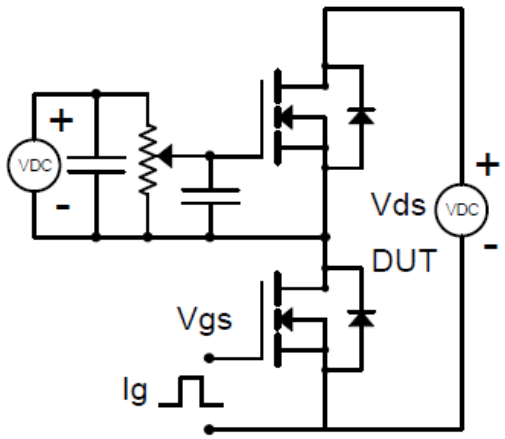
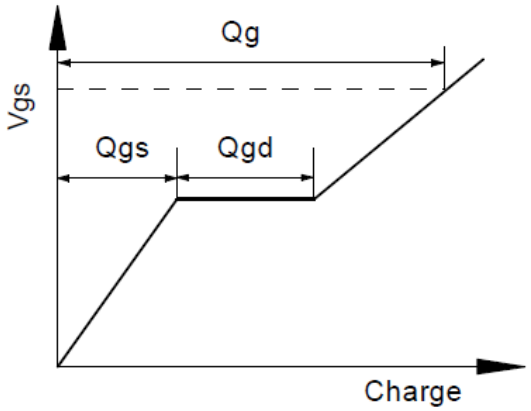
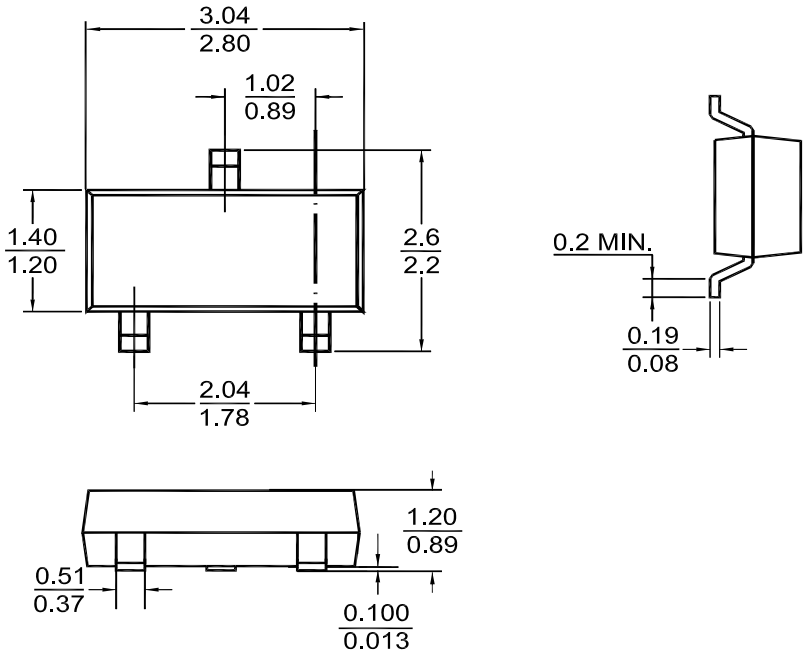


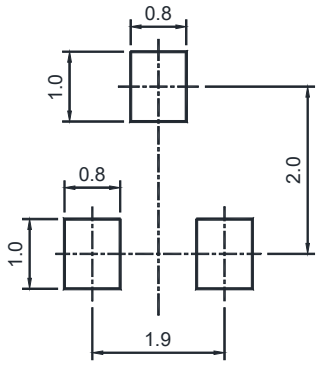
Fig.2-2 Gate charge waveform



Package Outline (Dimensions in mm) TO-236



Recommended Soldering Footprint



Packing information

Package	Tape Width (mm)	Pitch		Reel Size		Per Reel Packing Quantity
		mm	inch	mm	inch	
TO-236	8	4 ± 0.1	0.157 ± 0.004	178	7	3,000

Marking information

" VD " = Part No.
" • " = HAF (Halogen and Antimony Free)
" YM " = Date Code Marking
" Y " = Year
" M " = Month
Font type: Arial