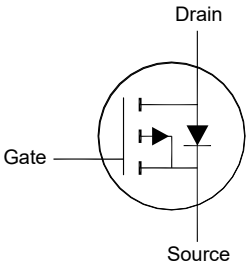
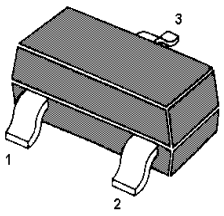
MMFTP3409-AH

P-Channel Enhancement Mode MOSFET





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

Features

- AEC-Q101 is Available
- Halogen and Antimony Free(HAF), RoHS complian

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$-V_{DS}$	30	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current	$-I_D$	2.6	A
Peak Drain Current, Pulsed [1]	$-I_{DM}$	20	A
Power Dissipation	P_D	1.4	W
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 55 to + 150	℃

Thermal Characteristics

Parameter		Symbol	Max.	Unit
Thermal Resistance - Junction to Ambient [2]	t ≤ 10 S Steady State	$R_{\theta JA}$	90 125	℃/W

[1] Pulse Test: Pulse Width ≤ 100 μs, Duty Cycle ≤ 2%, Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$ = 150°C

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

Dated: 03/08/2020 CL IMH4 Rev: 02

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	$-V_{(BR)DSS}$	30	-	-	V
Drain-Source On-State Current at $-V_{DS}$ = 24 V	$-I_{DSS}$	-	-	1	µA
Gate-Source Leakage Current at V_{GS} = ± 20 V	I_{GSS}	-	-	± 100	nA
Gate-Source Threshold Voltage at $-V_{DS}$ = V_{GS}, $-I_D$ = 250 µA	$-V_{GS(th)}$	1	-	2	V
Drain-Source On-State Resistance at $-V_{GS}$ = 10 V, $-I_D$ = 2.6 A at $-V_{GS}$ = 4.5 V, $-I_D$ = 2 A	$R_{DS(ON)}$	- -	- -	90 160	mΩ
DYNAMIC PARAMETERS					
Gate resistance at $-V_{DS}$ = 0 V, f = 1 MHz	Rg	-	21	-	Ω
Forward Transconductance at $-V_{DS}$ = 5 V,$-I_D$ = 2.5 A	gfs	3	-	-	S
Input Capacitance at $-V_{GS}$ = 0 V, $-V_{DS}$ = 30 V, f = 1 MHz	C_{iss}	-	441	-	pF
Output Capacitance at $-V_{GS}$ = 0 V, $-V_{DS}$ = 30 V, f = 1 MHz	C_{oss}	-	41	-	pF
Reverse Transfer Capacitance at $-V_{GS}$ = 0 V, $-V_{DS}$ = 30 V, f = 1 MHz	C_{rss}	-	35	-	pF
Total Gate Charge at $-V_{GS}$ = 10 V, $-V_{DS}$ = 15 V, $-I_D$ = 2.6 A at $-V_{GS}$ = 4.5 V, $-V_{DS}$ = 15 V, $-I_D$ = 2.6 A	Q_g	- -	9 4.5	- -	nC
Gate-Source Charge at $-V_{GS}$ = 10 V, $-V_{DS}$ = 15 V, $-I_D$ = 2.6 A	Q_{gs}	-	3	-	nC
Gate-Drain Charge at $-V_{GS}$ = 10 V, $-V_{DS}$ = 15 V, $-I_D$ = 2.6 A	Q_{gd}	-	1.2	-	nC
Turn-On Delay Time at $-V_{DS}$ = 15 V, $-V_{GS}$ = 10 V, R_G = 3.3 Ω, R_L = 5.8Ω	$t_{d(on)}$	-	7.5	-	ns
Turn-On Rise Time at $-V_{DS}$ = 15 V, $-V_{GS}$ = 10 V, R_G = 3.3 Ω, R_L = 5.8Ω	t_r	-	3.2	-	ns
Turn-Off Delay Time at $-V_{DS}$ = 15 V, $-V_{GS}$ = 10 V, R_G = 3.3 Ω, R_L = 5.8Ω	$t_{d(off)}$	-	17	-	ns
Turn-Off Fall Time at $-V_{DS}$ = 15 V, $-V_{GS}$ = 10 V, R_G = 3.3 Ω, R_L = 5.8Ω	t_f	-	6.8	-	ns
Body-Diode PARAMETERS					
Drain-Source Diode Forward Voltage at $-I_F$ = 1 A, $-V_{GS}$ = 0 V	$-V_{SD}$	-	-	1	V
Body Diode Reverse Recovery Time at $-I_F$ = 2.6 A , di/dt = 100 A / µs	t_{rr}	-	7	-	ns
Body Diode Reverse Recovery Charge at $-I_F$ = 2.6 A , di/dt = 100 A / µs	Q_{rr}	-	3	-	nC

Electrical Characteristics Curves

Fig. 1 Typical Output Characteristic

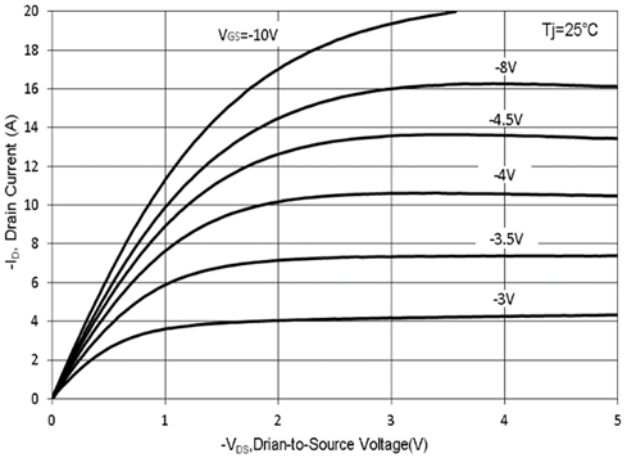


Fig. 2 Darin Current Vs Gate Voltage

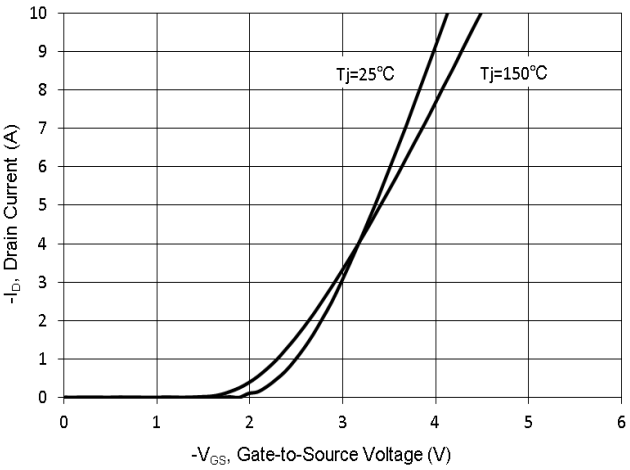


Fig. 3 On-Resistance Vs Gate Voltage

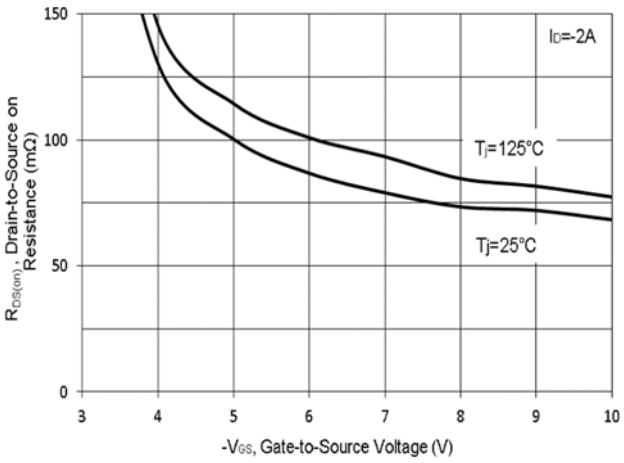


Fig. 4 On-Resistance Vs Tj

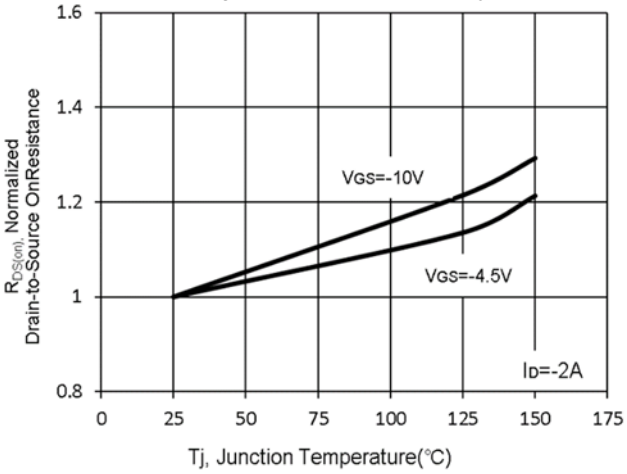


Fig. 5 On-Resistance Vs Drain Current

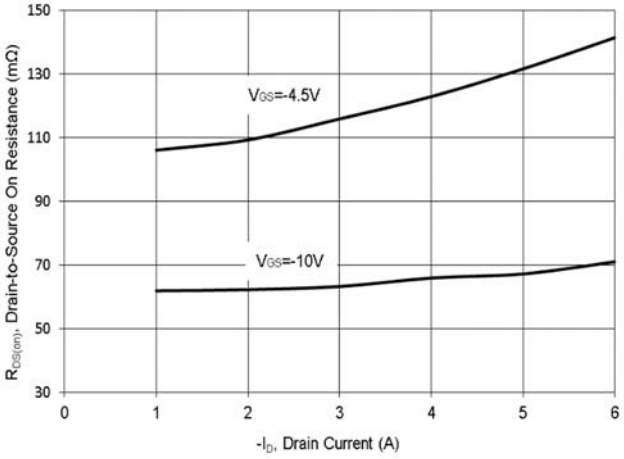
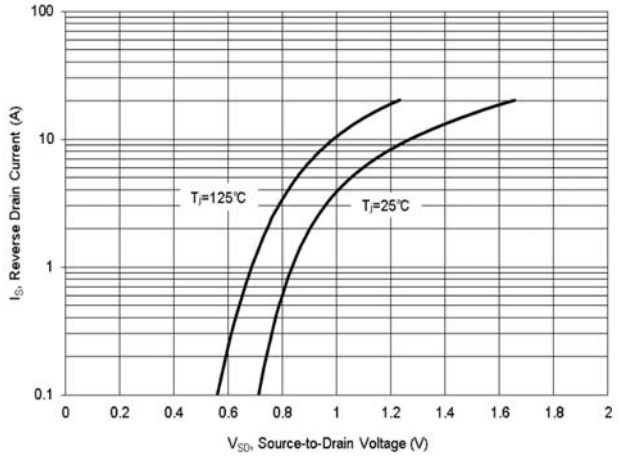


Fig. 6 Reverse Drain Current Vs Source-to-Drain Voltage



Electrical Characteristics Curves

Fig. 7 Drain-Source Leakage Current Vs Tj

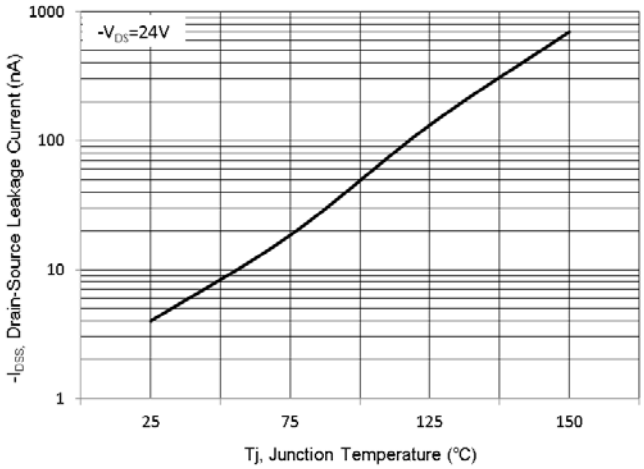


Fig. 8 Gate Charge

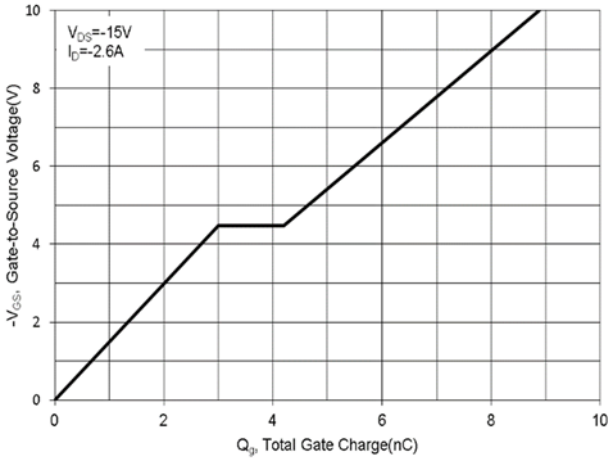


Fig. 9 Gate Threshold Variation Vs Tj

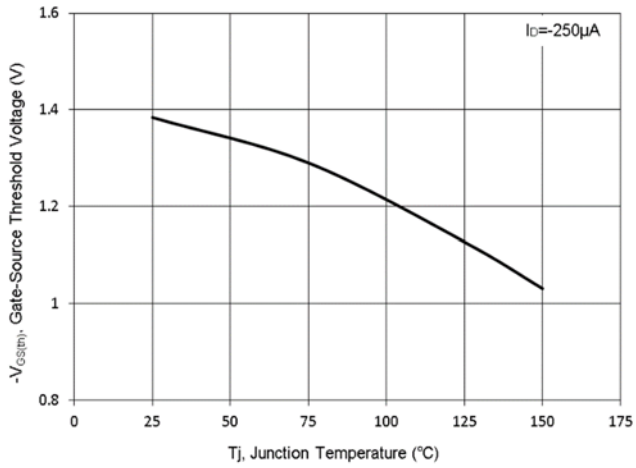


Fig. 10 $V_{(BR)DSS}$ Vs Junction Temperature

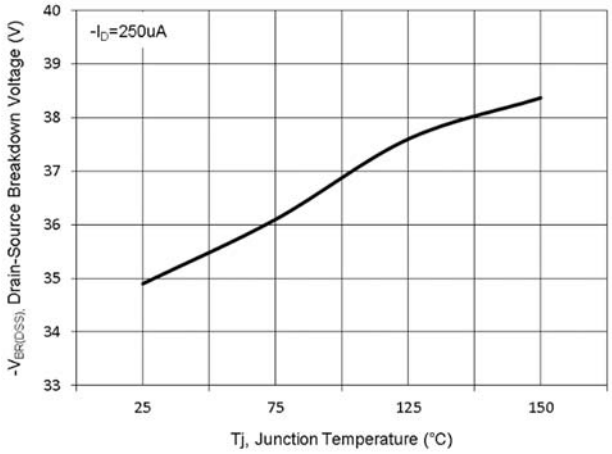


Fig. 11 Typical Junction Capacitance

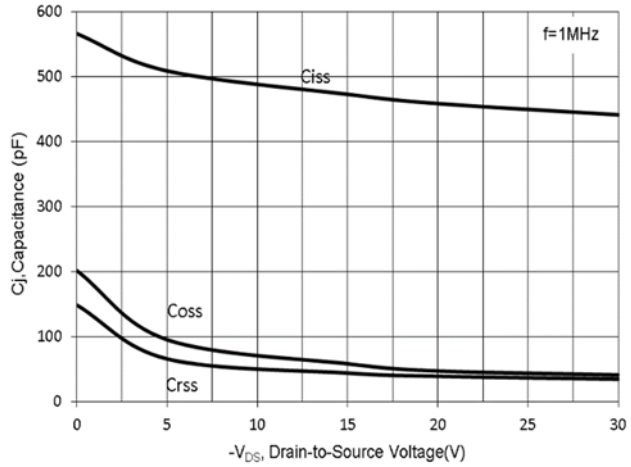
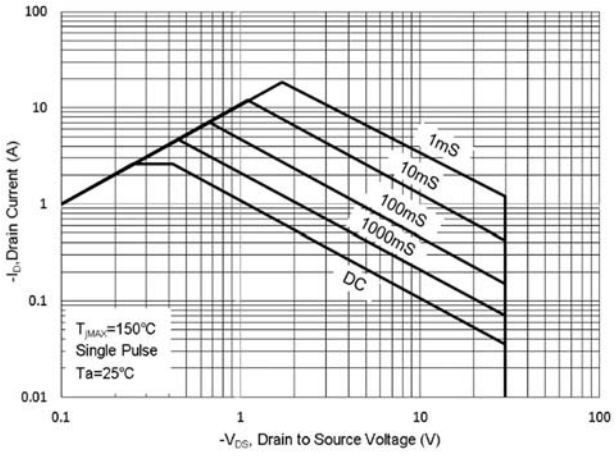


Fig. 12 SOA, Safe Operation Area



Test Circuits

Fig.1-1 Switching times test circuit

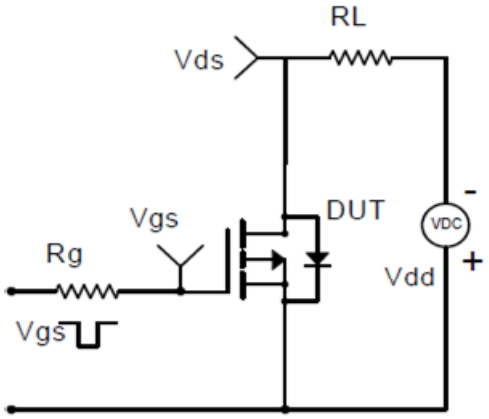


Fig.1-2 Switching Waveform

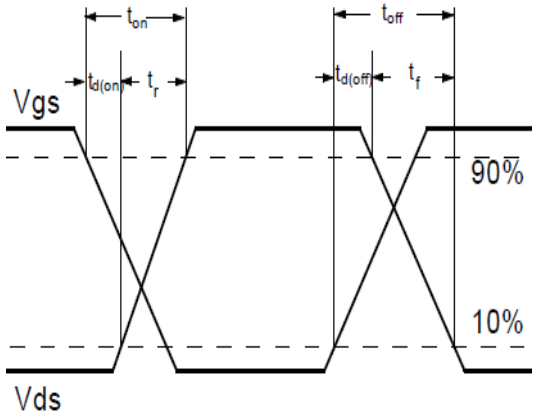


Fig.2-1 Gate charge test circuit

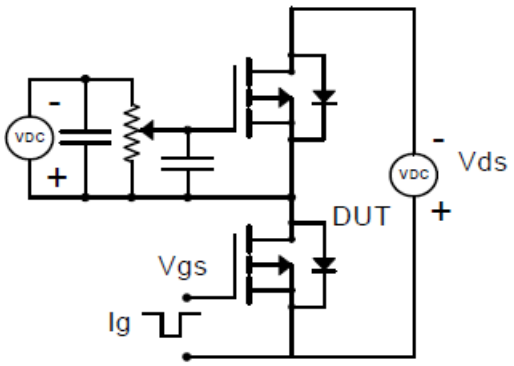
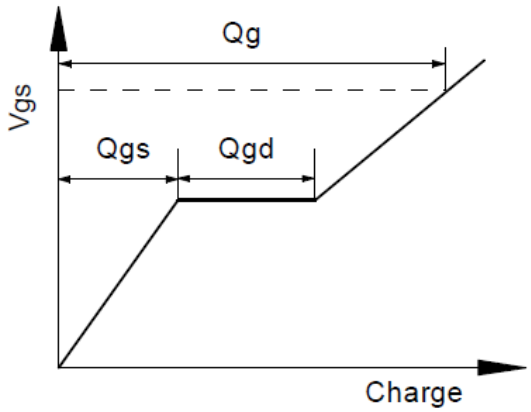
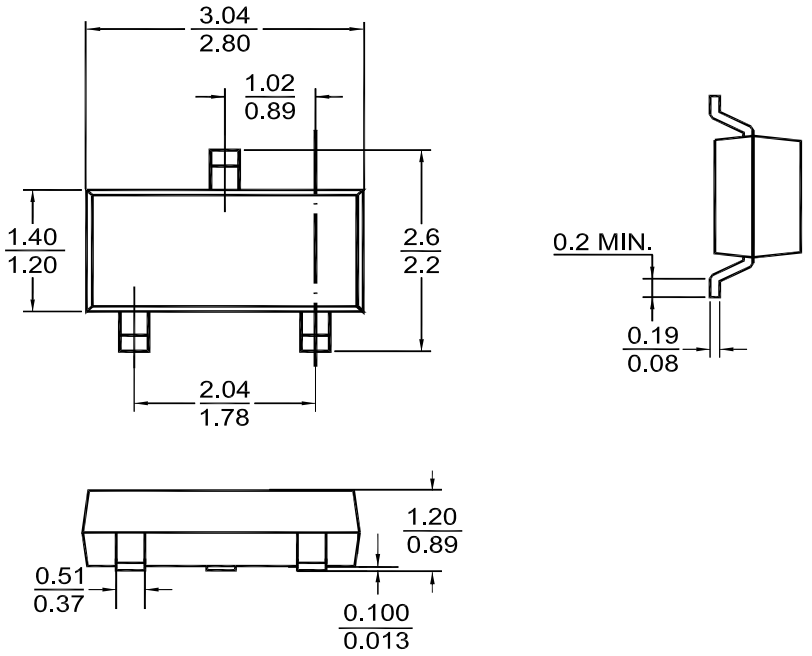


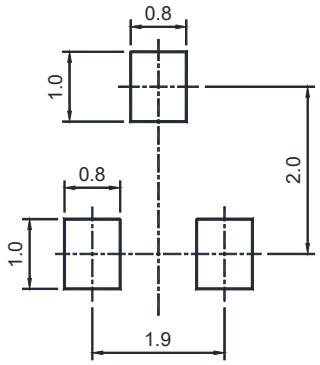
Fig.2-2 Gate charge waveform



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

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