

# MMFTN2302A

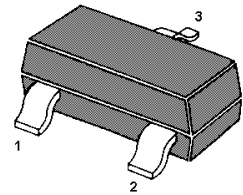
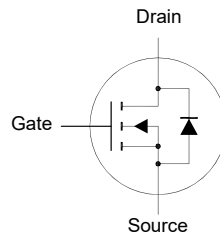
## N-Channel Enhancement Mode MOSFET

### Features

- Advanced trench cell design
- Extremely low threshold voltage

### Applications

- Portable appliances
- Battery management



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

### Absolute Maximum Ratings(at $T_a = 25^\circ\text{C}$ unless otherwise specified)

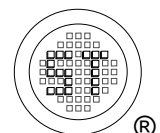
Parameter	Symbol	Value	Unit
Drain-Source Voltage	$V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 8$	V
Drain Current	$I_D$	2.8	A
Peak Drain Current <sup>1)</sup>	$I_{DM}$	10	A
Power Dissipation <sup>2)</sup>	$P_D$	1.25	W
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to + 150	$^\circ\text{C}$

### Thermal Characteristics

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Ambient <sup>2)</sup> $t \leq 10$ s Steady State	$R_{\theta JA}$	77 100	$^\circ\text{C/W}$

<sup>1)</sup> Pulse Test: Pulse Width  $\leq 100 \mu\text{s}$ , Duty Cycle  $\leq 2\%$ , Repetitive rating, pulse width limited by junction temperature  $T_{J(MAX)}=150^\circ\text{C}$ .

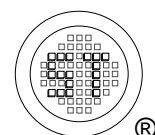
<sup>2)</sup> Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate.



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Characteristics at  $T_a = 25^\circ\text{C}$  unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Unit
<b>STATIC PARAMETERS</b>					
Drain-Source Breakdown Voltage at $I_D = 250 \mu\text{A}$	$BV_{DSS}$	20	-	-	V
Drain-Source Leakage Current at $V_{DS} = 20 \text{ V}$	$I_{DSS}$	-	-	1	$\mu\text{A}$
Gate Leakage Current at $V_{GS} = \pm 8 \text{ V}$	$I_{GSS}$	-	-	$\pm 100$	nA
Gate-Source Threshold Voltage at $V_{DS} = V_{GS}$ , $I_D = 250 \mu\text{A}$	$V_{GS(th)}$	0.5	-	1.2	V
Drain-Source On-State Resistance at $V_{GS} = 4.5 \text{ V}$ , $I_D = 2.8 \text{ A}$ at $V_{GS} = 2.5 \text{ V}$ , $I_D = 2.5 \text{ A}$	$R_{DS(on)}$	-	-	85 115	m $\Omega$
<b>DYNAMIC PARAMETERS</b>					
Forward Transconductance at $V_{DS} = 5 \text{ V}$ , $I_D = 2.8 \text{ A}$	$g_{fs}$	-	8	-	S
Gate Resistance at $V_{DS} = 0 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$	$R_g$	-	2.2	-	$\Omega$
Input Capacitance at $V_{GS} = 0 \text{ V}$ , $V_{DS} = 10 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{iss}$	-	348	-	pF
Output Capacitance at $V_{GS} = 0 \text{ V}$ , $V_{DS} = 10 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{oss}$	-	59	-	pF
Reverse Transfer Capacitance at $V_{GS} = 0 \text{ V}$ , $V_{DS} = 10 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{rss}$	-	35	-	pF
Total Gate Charge at $V_{DS} = 10 \text{ V}$ , $I_D = 2.8 \text{ A}$ , $V_{GS} = 4.5 \text{ V}$ at $V_{DS} = 10 \text{ V}$ , $I_D = 2.8 \text{ A}$ , $V_{GS} = 2.5 \text{ V}$	$Q_g$	-	3.9 2.2	-	nC
Gate-Source Charge at $V_{DS} = 10 \text{ V}$ , $I_D = 2.8 \text{ A}$ , $V_{GS} = 4.5 \text{ V}$	$Q_{gs}$	-	0.8	-	nC
Gate-Drain Charge at $V_{DS} = 10 \text{ V}$ , $I_D = 2.8 \text{ A}$ , $V_{GS} = 4.5 \text{ V}$	$Q_{gd}$	-	1	-	nC
Turn-On Delay Time at $V_{DD} = 10 \text{ V}$ , $V_{GS} = 4.5 \text{ V}$ , $I_D = 2.8 \text{ A}$ , $R_G = 3.3 \Omega$	$t_{d(on)}$	-	10	-	nS
Turn-On Rise Time at $V_{DD} = 10 \text{ V}$ , $V_{GS} = 4.5 \text{ V}$ , $I_D = 2.8 \text{ A}$ , $R_G = 3.3 \Omega$	$t_r$	-	30	-	nS
Turn-Off Delay Time at $V_{DD} = 10 \text{ V}$ , $V_{GS} = 4.5 \text{ V}$ , $I_D = 2.8 \text{ A}$ , $R_G = 3.3 \Omega$	$t_{d(off)}$	-	10	-	nS
Turn-Off Fall Time at $V_{DD} = 10 \text{ V}$ , $V_{GS} = 4.5 \text{ V}$ , $I_D = 2.8 \text{ A}$ , $R_G = 3.3 \Omega$	$t_f$	-	4	-	nS
<b>Body-Diode PARAMETERS</b>					
Diode Forward Voltage at $I_S = 1 \text{ A}$ , $V_{GS} = 0 \text{ V}$	$V_{SD}$	-	-	1.2	V
Body-Diode Continuous Current	$I_S$	-	-	2.8	A
Body Diode Reverse Recovery Time at $I_S = 2.8 \text{ A}$ , $di/dt = 100 \text{ A} / \mu\text{s}$	$t_{rr}$	-	6	-	ns
Body Diode Reverse Recovery Charge at $I_S = 2.8 \text{ A}$ , $di/dt = 100 \text{ A} / \mu\text{s}$	$Q_{rr}$	-	1.5	-	nC



## Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

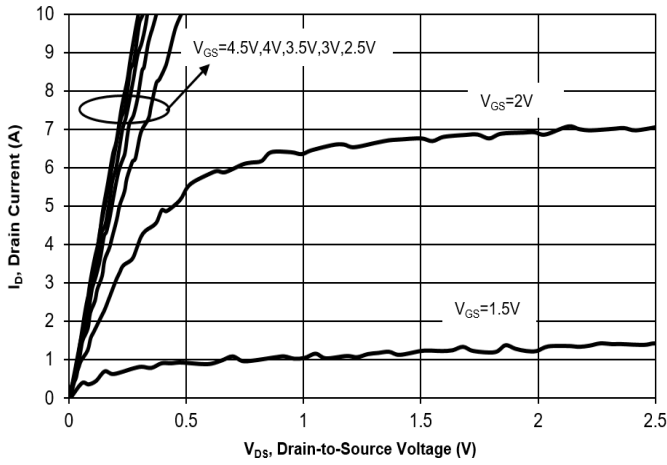


Fig. 2 Typical Transfer Characteristics

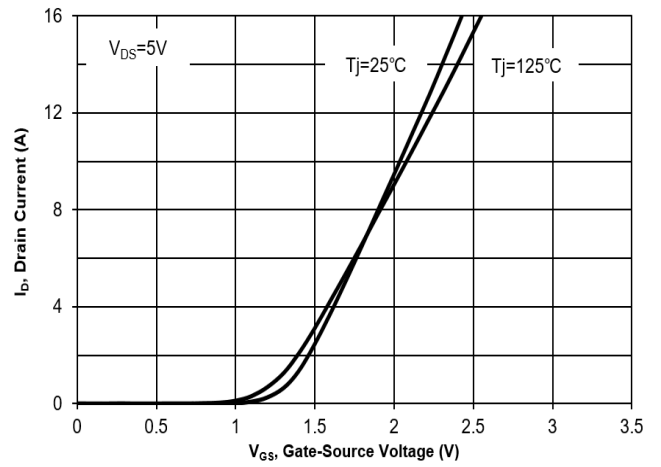


Fig. 3 On-Resistance vs. Drain Current

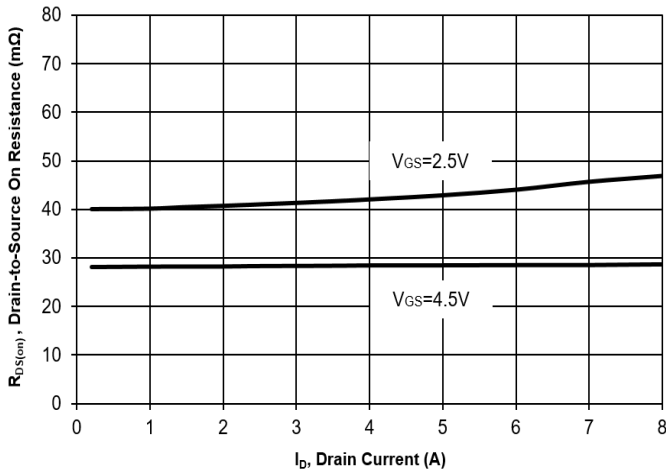


Fig. 4 On-Resistance vs. Gate-Source Voltage

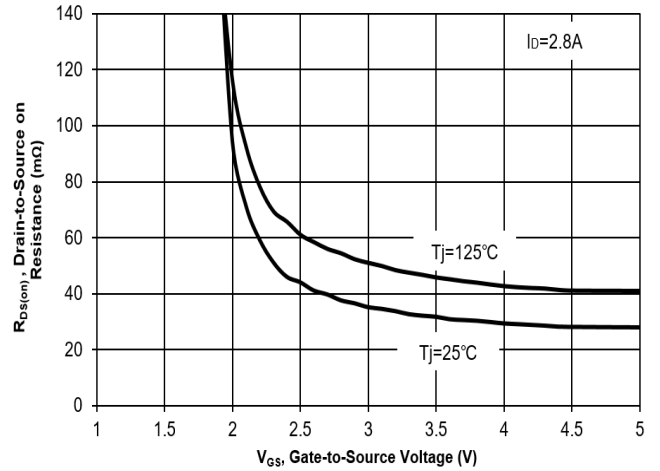


Fig. 5 On-Resistance vs.  $T_J$

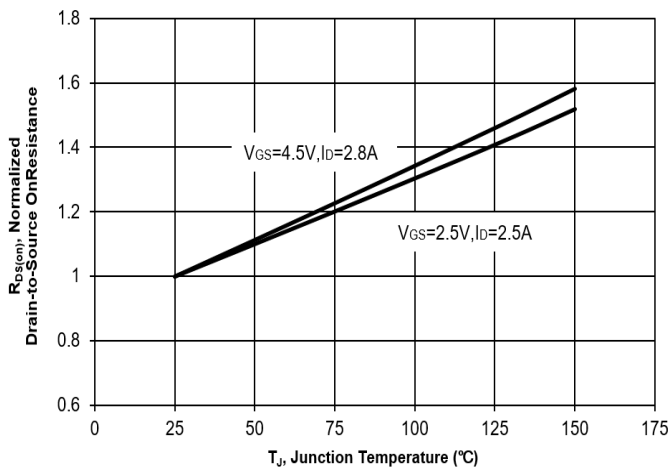
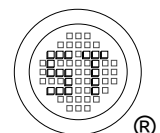
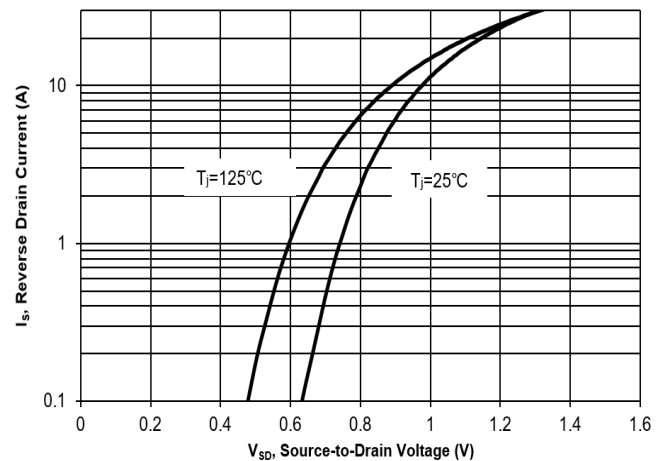


Fig. 6 Typical Body-Diode Forward Characteristics



# MMFTN2302A

## Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

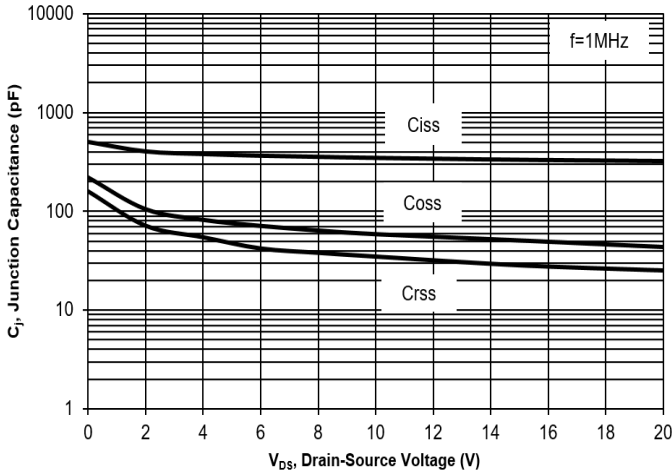


Fig. 8 Drain-Source Leakage Current vs.  $T_j$

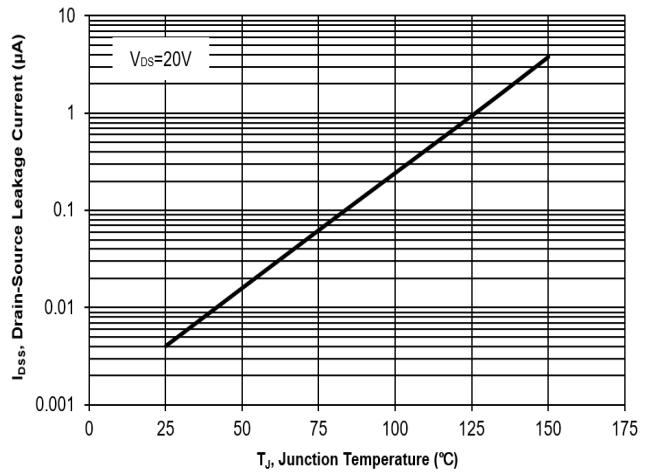


Fig. 9  $V_{(BR)DSS}$  vs. Junction Temperature

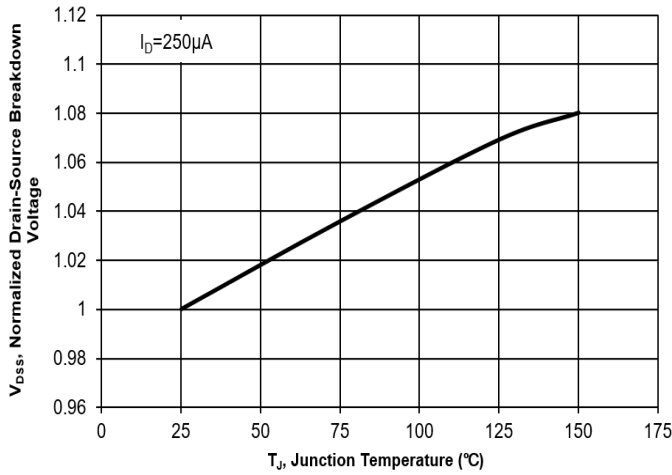


Fig. 10 Gate Threshold Variation vs.  $T_j$

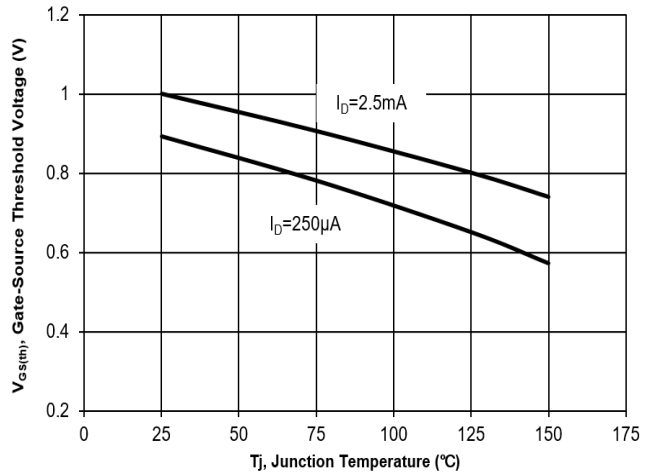
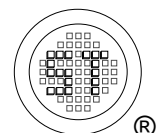
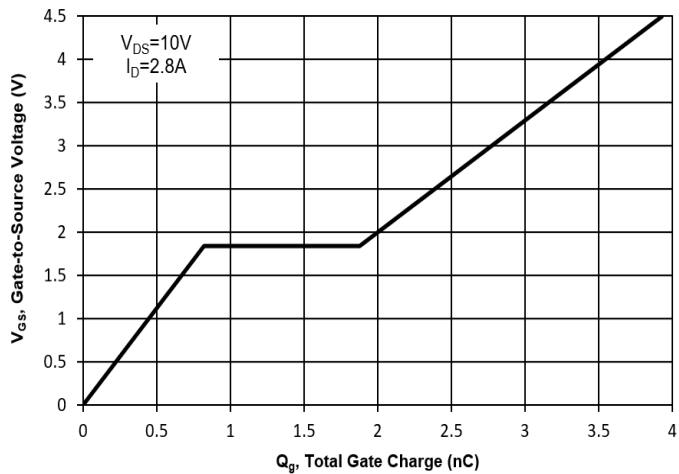


Fig. 11 Gate Charge



## Test Circuits

Fig.1-1 Switching times test circuit

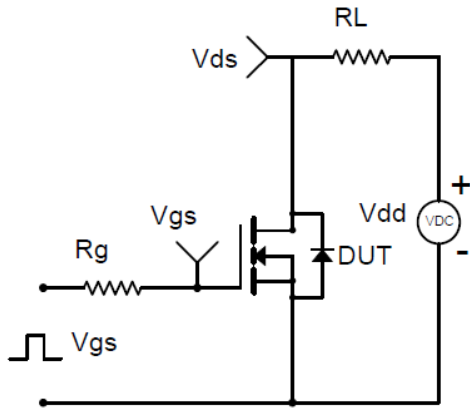


Fig.1-2 Switching Waveform

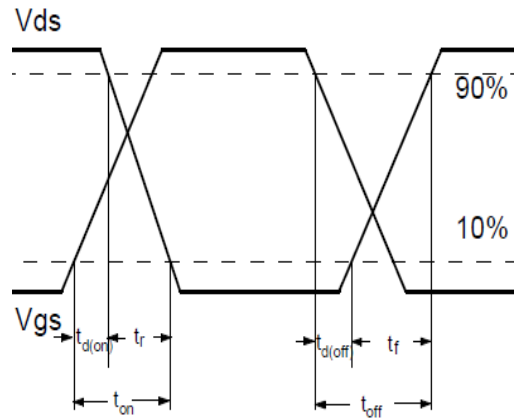


Fig.2-1 Gate charge test circuit

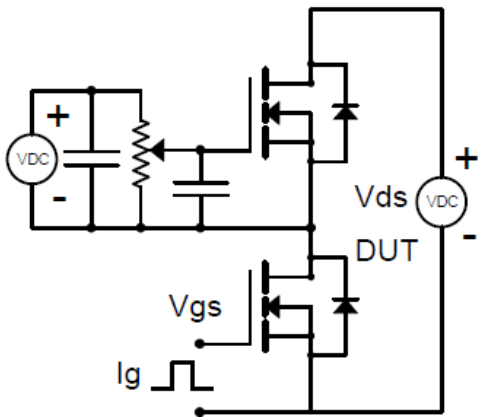
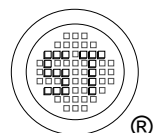
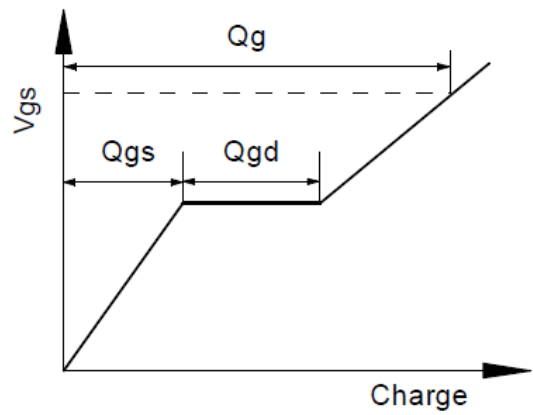


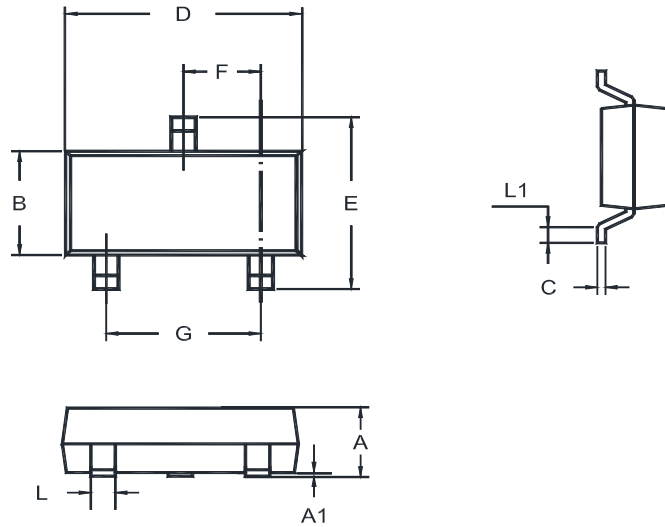
Fig.2-2 Gate charge waveform



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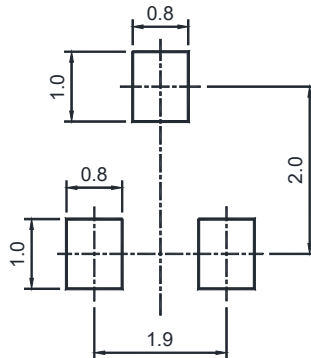
## Package Outline (Dimensions in mm)

SOT-23



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

- " M22 " = Part No.
  - " YM " = Date Code Marking
  - " Y " = Year
  - " M " = Month
- Font type: Arial

