

MMFTN2302

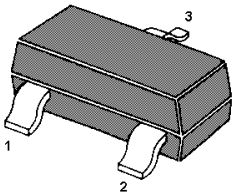
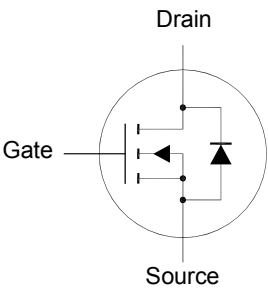
N-Channel Enhancement Mode MOSFET

Features

- Surface-mounted package
- Extremely low threshold voltage
- Advanced trench cell design

Applications

- Portable appliances



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

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

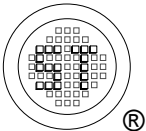
Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	20	V
Drain-Gate Voltage	V_{GS}	± 8	V
Drain Current - Continuous	I_{D}	3.5	A
Drain Current - Pulsed ¹⁾	I_{DM}	12	A
Total Power Dissipation ²⁾ ($t \leq 10 \text{ s}$)	P_{tot}	0.9	W
Operating Junction and Storage Temperature Range	$T_{\text{j}}, T_{\text{stg}}$	- 55 to + 150	$^{\circ}\text{C}$

Thermal Characteristics

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Ambient ²⁾	$R_{\theta\text{JA}}$	139	$^{\circ}\text{C/W}$

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

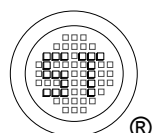
²⁾ Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate in still air.



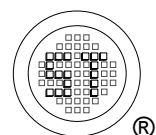
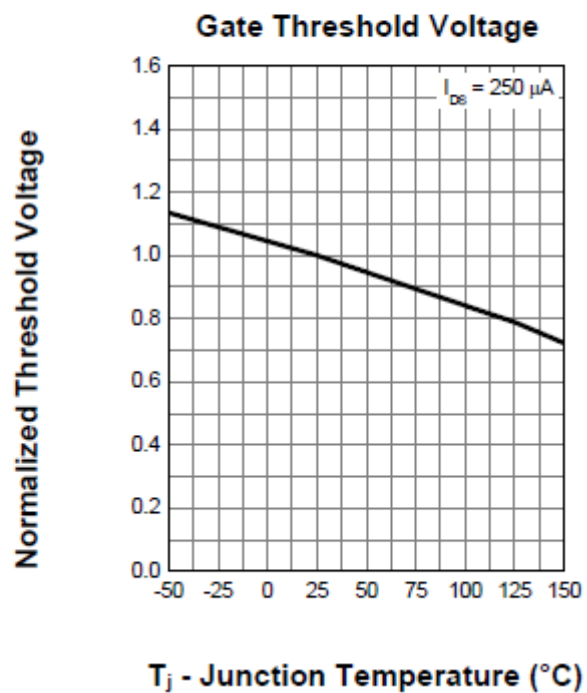
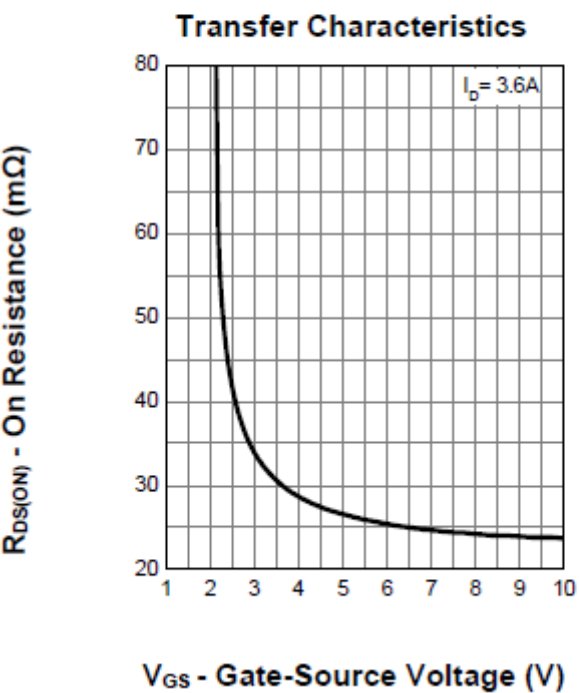
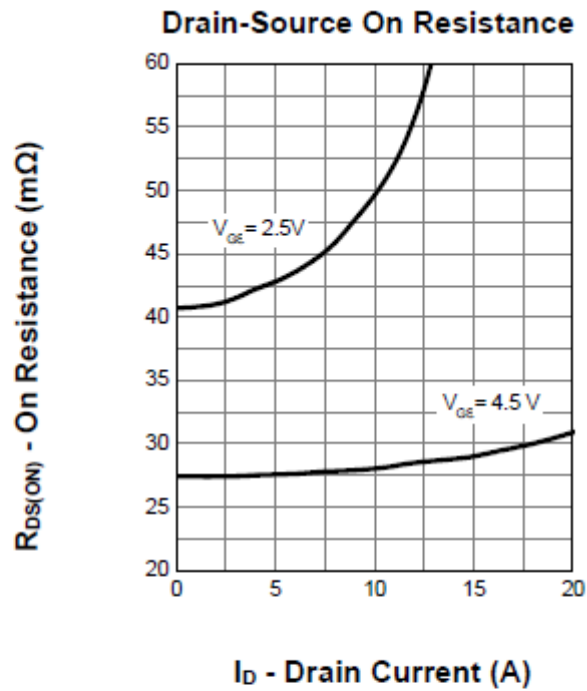
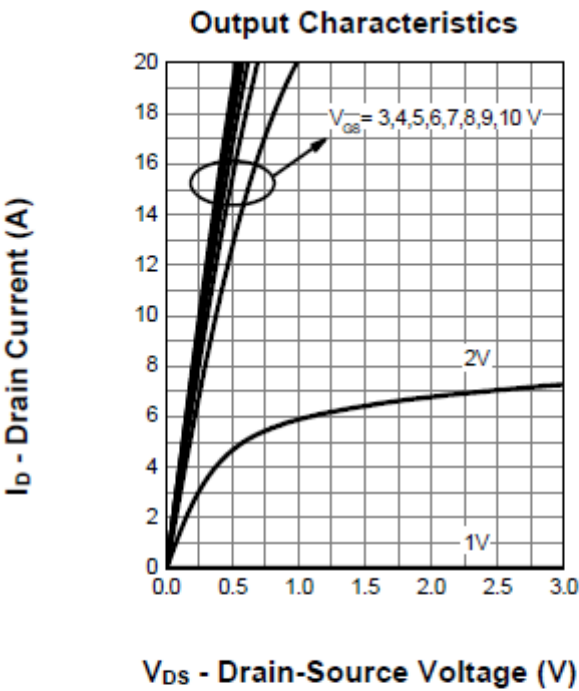
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Characteristics at $T_a = 25^\circ\text{C}$ unless otherwise specified

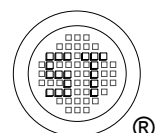
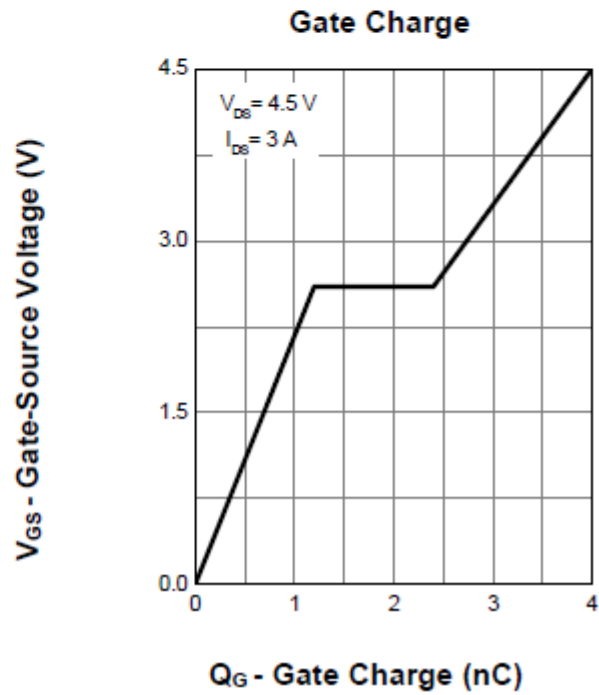
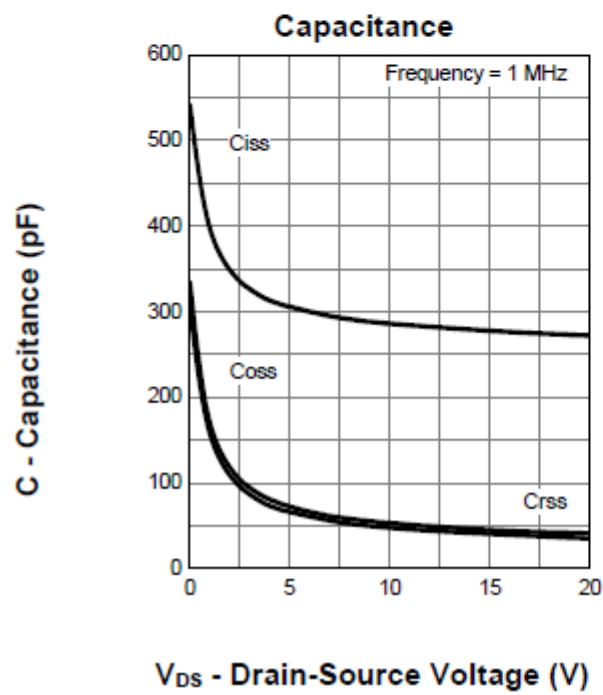
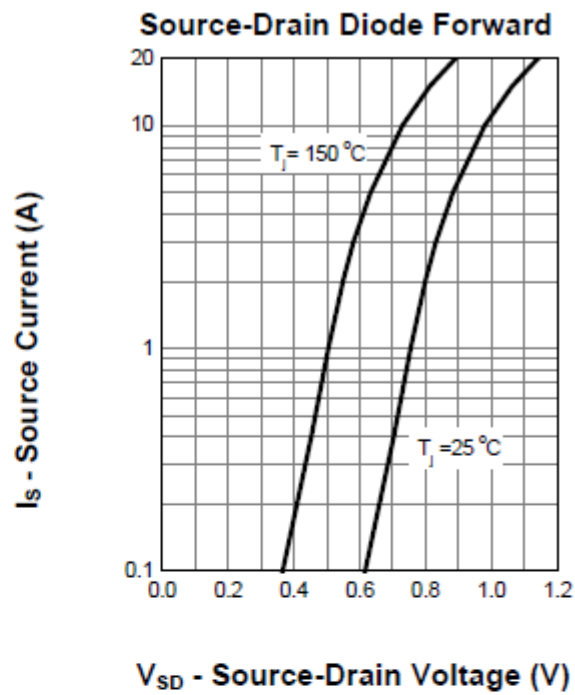
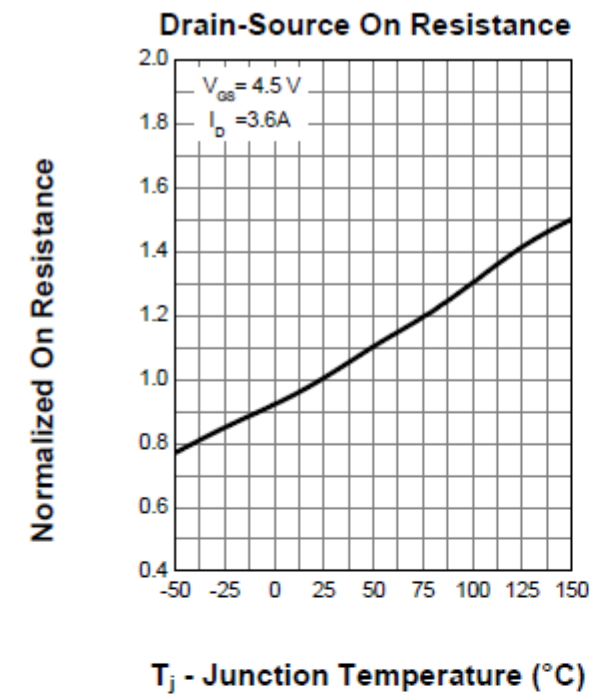
Parameter	Symbol	Min.	Typ.	Max.	Unit
STATIC PARAMETERS					
Drain-Source Breakdown Voltage at $I_D = 250\ \mu\text{A}$	$V_{(BR)DSS}$	20	-	-	V
Drain-Source Leakage Current at $V_{DS} = 20\ \text{V}$	I_{DSS}	-	-	1	μA
Gate-Source Leakage Current at $V_{GS} = \pm 8\ \text{V}$	I_{GSS}	-	-	± 100	nA
Gate-Source Threshold Voltage at $V_{GS} = V_{DS}$, $I_D = 250\ \mu\text{A}$	$V_{GS(th)}$	0.65	-	1.2	V
Drain-Source On-State Resistance at $V_{GS} = 2.5\ \text{V}$, $I_D = 3.1\ \text{A}$ at $V_{GS} = 4.5\ \text{V}$, $I_D = 3.6\ \text{A}$	$R_{DS(on)}$	- -	- -	115 60	m Ω
DYNAMIC PARAMETERS					
Forward Transconductance at $V_{DS} = 5\ \text{V}$, $I_D = 3.6\ \text{A}$	g_{FS}	-	8	-	S
Input Capacitance at $V_{DS} = 10\ \text{V}$, $f = 1\ \text{MHz}$	C_{iss}	-	300	-	pF
Output Capacitance at $V_{DS} = 10\ \text{V}$, $f = 1\ \text{MHz}$	C_{oss}	-	52	-	pF
Reverse Transfer Capacitance at $V_{DS} = 10\ \text{V}$, $f = 1\ \text{MHz}$	C_{rss}	-	48	-	pF
Total Gate Charge at $V_{GS} = 4.5\ \text{V}$, $V_{DS} = 10\ \text{V}$, $I_D = 3\ \text{A}$	Q_g	-	4	-	nC
Gate Source Charge at $V_{GS} = 4.5\ \text{V}$, $V_{DS} = 10\ \text{V}$, $I_D = 3\ \text{A}$	Q_{gs}	-	1.2	-	nC
Gate Drain Charge at $V_{GS} = 4.5\ \text{V}$, $V_{DS} = 10\ \text{V}$, $I_D = 3\ \text{A}$	Q_{gd}	-	1.2	-	nC
Turn-On Delay Time at $V_{DD} = 10\ \text{V}$, $I_D = 3\ \text{A}$, $V_{GS} = 4.5\ \text{V}$, $R_G = 4.5\ \Omega$	$t_{d(on)}$	-	3.8	-	ns
Turn-On Rise Time at $V_{DD} = 10\ \text{V}$, $I_D = 3\ \text{A}$, $V_{GS} = 4.5\ \text{V}$, $R_G = 4.5\ \Omega$	t_r	-	30	-	ns
Turn-Off Delay Time at $V_{DD} = 10\ \text{V}$, $I_D = 3\ \text{A}$, $V_{GS} = 4.5\ \text{V}$, $R_G = 4.5\ \Omega$	$t_{d(off)}$	-	12	-	ns
Turn-Off Fall Time at $V_{DD} = 10\ \text{V}$, $I_D = 3\ \text{A}$, $V_{GS} = 4.5\ \text{V}$, $R_G = 4.5\ \Omega$	t_f	-	20	-	ns
Body-Diode PARAMETERS					
Drain-Source Diode Forward Voltage at $I_S = 3\ \text{A}$, $V_{GS} = 0\ \text{V}$	$-V_{SD}$	-	-	1.3	V
Body Diode Reverse Recovery Time at $I_S = 3\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	t_{rr}	-	9.8	-	nS
Body Diode Reverse Recovery Charge at $I_S = 3\ \text{A}$, $di/dt = 100\ \text{A} / \mu\text{s}$	Q_{rr}	-	2.1	-	nC



Electrical Characteristics Curves



Electrical Characteristics Curves



Test Circuits

Fig.1-1 Switching times test circuit

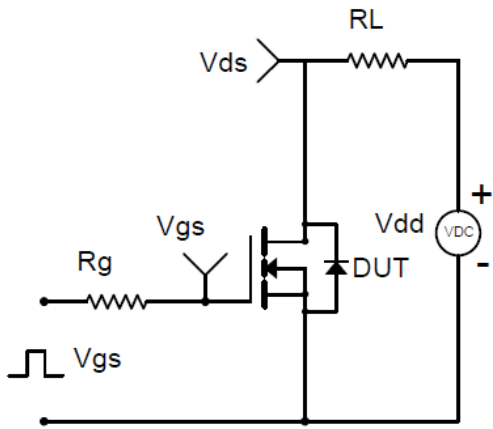


Fig.1-2 Switching Waveform

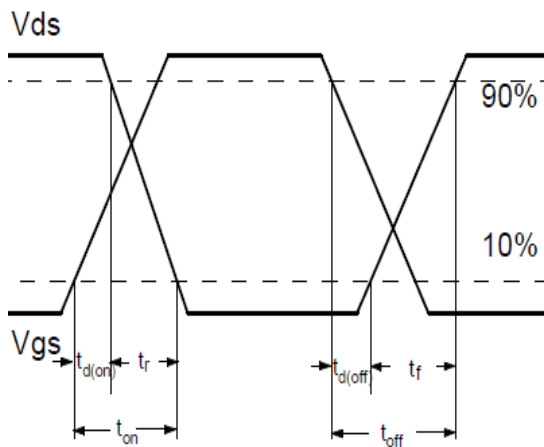


Fig.2-1 Gate charge test circuit

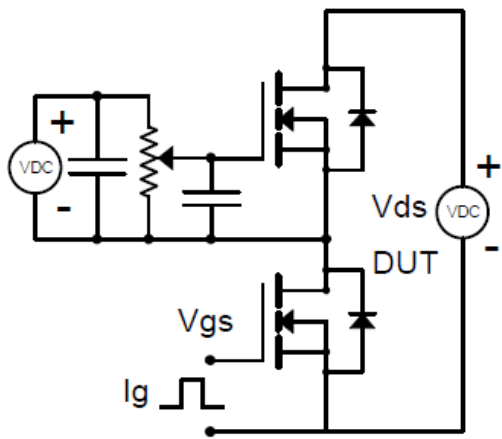
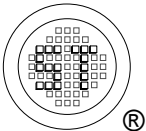
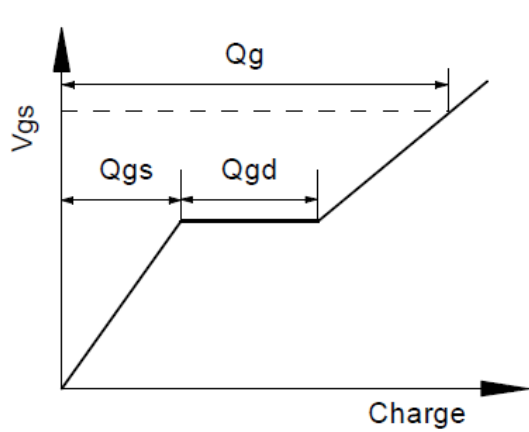


Fig.2-2 Gate charge waveform

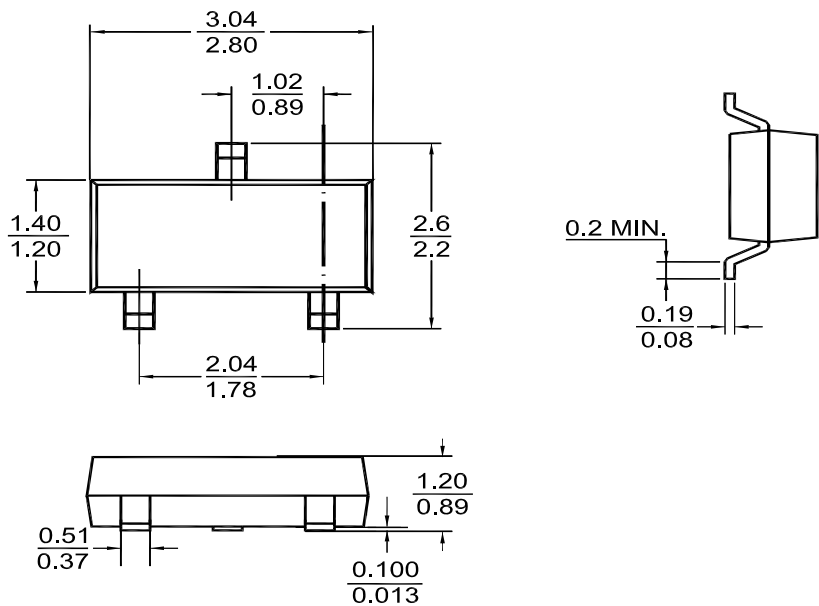


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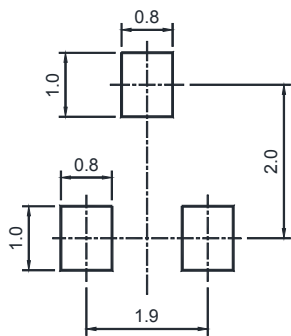
PACKAGE OUTLINE

Plastic surface mounted package (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

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

