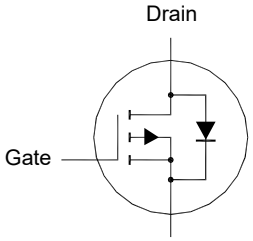
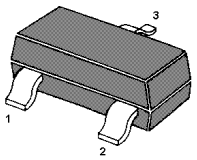
MMFTP6402

P-Channel Enhancement Mode MOSFET

Features

• Surface-mounted package





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

Applications

• Portable appliances

• Battery management

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

Parameter	Symbol	Value	Unit
Drain-Source Voltage	$-V_{DS}$	20	V
Gate-Source Voltage	V_{GS}	± 12	V
Drain Current	$-I_D$	3.7	A
Peak Drain Current, Pulsed [1)]	$-I_{DM}$	22	A
Total Power Dissipation [2)]	P_{tot}	1.3	W
Operating Junction and Storage Temperature Range	T_J,T_{stg}	- 55 to + 150	℃

Thermal Resistance Ratings

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Ambient [2)]	$R_{\theta JA}$	96	℃/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: 01/12/2023 Rev:03

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	$-BV_{DSS}$	20	-	-	V
Drain-Source Leakage Current at $-V_{DS}$ = 20 V	$-I_{DSS}$	-	-	1	µA
Gate Leakage Current at V_{GS} = ± 12 V	I_{GSS}	-	-	± 100	nA
Gate-Source Threshold Voltage at V_{DS} = V_{GS}, $-I_D$ = 250 µA	$-V_{GS(th)}$	0.4	-	1.2	V
Drain-Source On-State Resistance at $-V_{GS}$ = 4.5 V, $-I_D$ = 3.7 A at $-V_{GS}$ = 2.5 V, $-I_D$ = 3.1 A	$R_{DS(on)}$	- -	- -	65 135	mΩ
DYNAMIC PARAMETERS					
Forward Transconductance at $-V_{DS}$ = 5 V, $-I_D$ = 3.7 A	g_{fs}	-	12.4	-	S
Gate resistance at V_{DS} = 0 V, V_{GS} = 0 V, f = 1 MHz	R_g	-	4.7	-	Ω
Input Capacitance at $-V_{DS}$ = 10 V, V_{GS} = 0 V, f = 1 MHz	C_{iss}	-	535	-	pF
Output Capacitance at $-V_{DS}$ = 10 V, V_{GS} = 0 V, f = 1 MHz	C_{oss}	-	91	-	pF
Reverse Transfer Capacitance at $-V_{DS}$ = 10 V, V_{GS} = 0 V, f = 1 MHz	C_{rss}	-	64	-	pF
Total Gate Charge at $-V_{GS}$ = 4.5 V, $-V_{DS}$ = 10 V, $-I_D$ = 3.7 A at $-V_{GS}$ = 2.5 V, $-V_{DS}$ = 10 V, $-I_D$ = 3.7 A	Q_g	- -	5.7 3.3	- -	nC
Gate to Source Charge at $-V_{GS}$ = 4.5 V, $-V_{DS}$ = 10 V, $-I_D$ = 3.7 A	Q_{gs}	-	1.7	-	nC
Gate to Drain Charge at $-V_{GS}$ = 4.5 V, $-V_{DS}$ = 10 V, $-I_D$ = 3.7 A	Q_{gd}	-	1.6	-	nC
Turn-On Delay Time at $-V_{DD}$ = 10 V, $-V_{GS}$ = 10 V, $-I_D$ = 3.7 A, R_g = 3.3 Ω	$t_{d(on)}$	-	7	-	ns
Turn-On Rise Time at $-V_{DD}$ = 10 V, $-V_{GS}$ = 10 V, $-I_D$ = 3.7 A, R_g = 3.3 Ω	t_r	-	42	-	ns
Turn-Off Delay Time at $-V_{DD}$ = 10 V, $-V_{GS}$ = 10 V, $-I_D$ = 3.7 A, R_g = 3.3 Ω	$t_{d(off)}$	-	10	-	ns
Turn-Off Fall Time at $-V_{DD}$ = 10 V, $-V_{GS}$ = 10 V, $-I_D$ = 3.7 A, R_g = 3.3 Ω	t_f	-	7	-	ns
Body-Diode PARAMETERS					
Body Diode Voltage at $-I_S$ = 1 A, V_{GS}= 0 V	$-V_{SD}$	-	-	1.2	V
Body-Diode Continuous Current	$-I_S$	-	-	3.7	A
Body Diode Reverse Recovery Time at $-I_S$ = 3.7 A, di/dt = 100 A / µs	t_{rr}	-	5.6	-	ns
Body Diode Reverse Recovery Charge at $-I_S$ = 3.7 A, di/dt = 100 A / µs	Q_{rr}	-	0.6	-	nC

Electrical Characteristics Curves

Fig. 1 Typical Output Characteristics

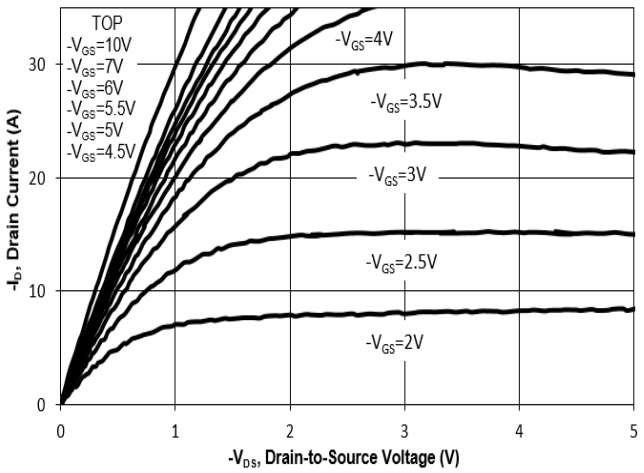


Fig. 2 Typical Transfer Characteristics

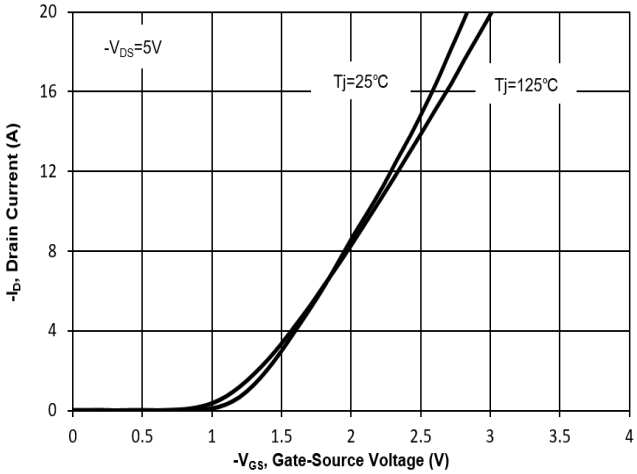


Fig. 3 On-Resistance vs. Drain Current

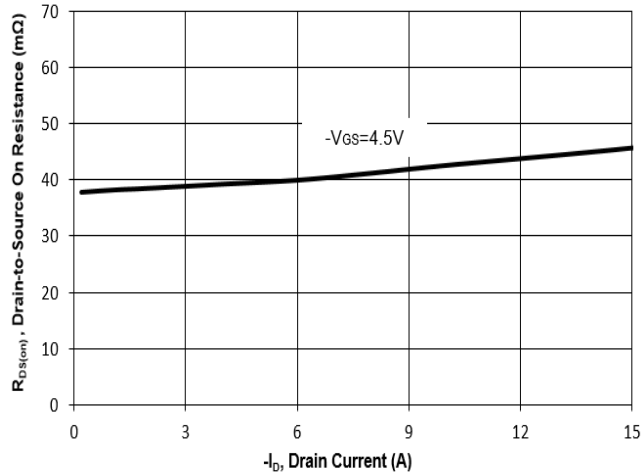


Fig. 4 On-Resistance vs. Gate-Source Voltage

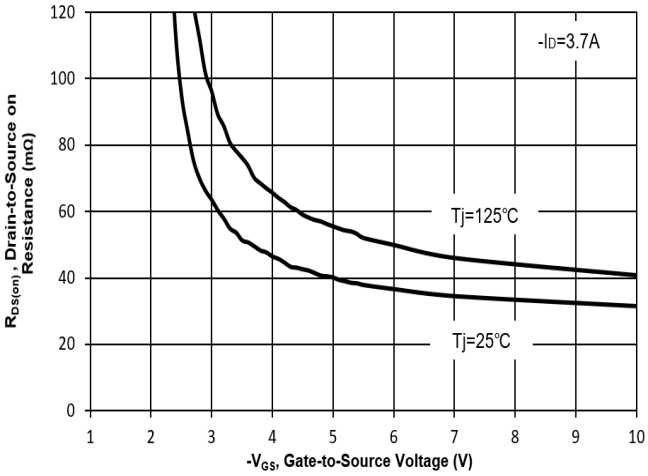


Fig. 5 On-Resistance vs.T_j

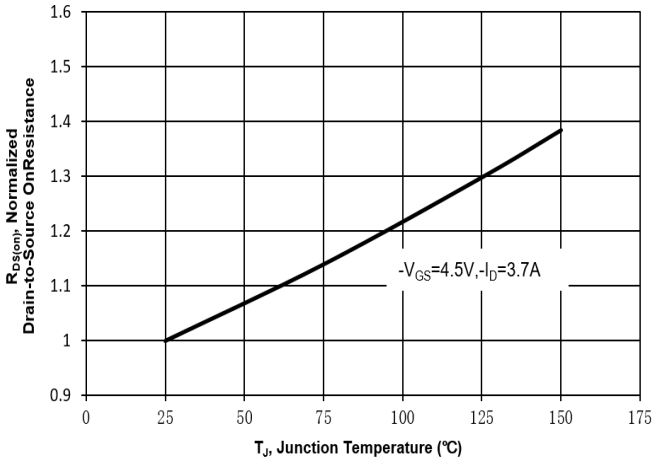
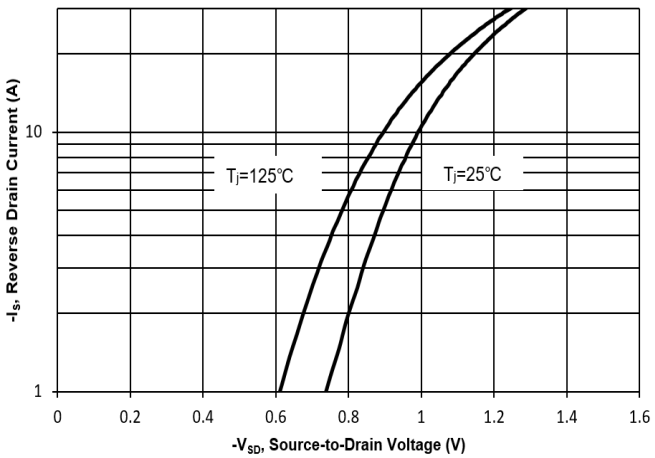


Fig. 6 Typical Body-Diode Forward Characteristics



Electrical Characteristics Curves

Fig. 7 Typical Junction Capacitance

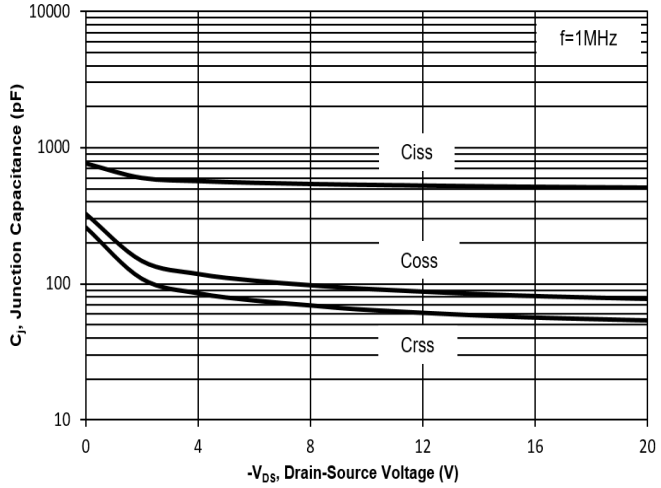


Fig. 8 Drain-Source Leakage Current vs. T_j

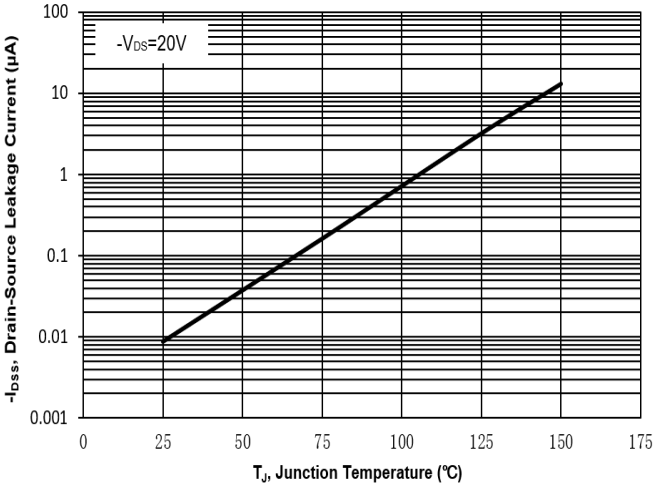


Fig. 9 $V_{(BR)DSS}$ vs. Junction Temperature

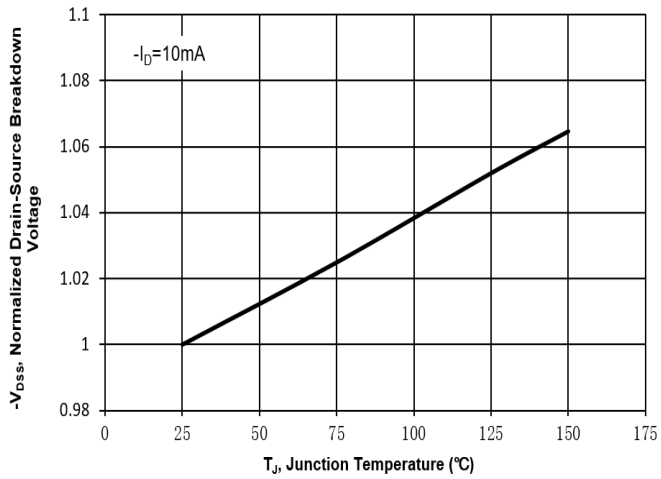


Fig. 10 Gate Threshold Variation vs. T_j

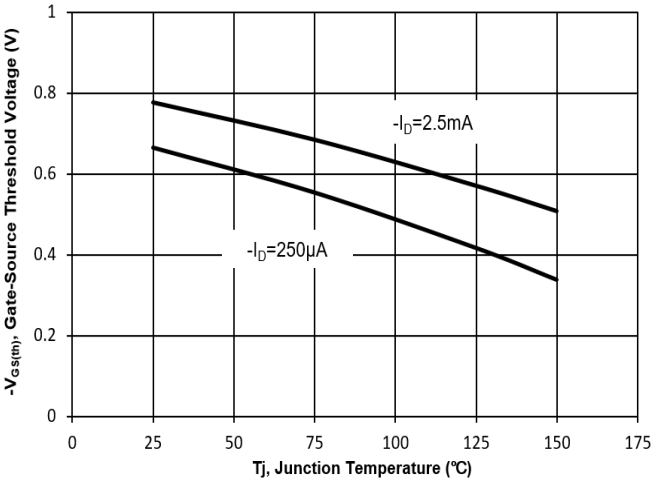
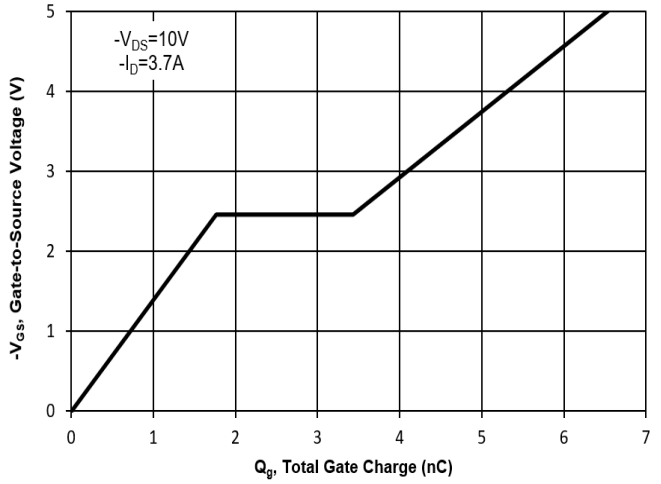


Fig. 11 Gate Charge



Test Circuits

Fig.1-1 Switching times test circuit

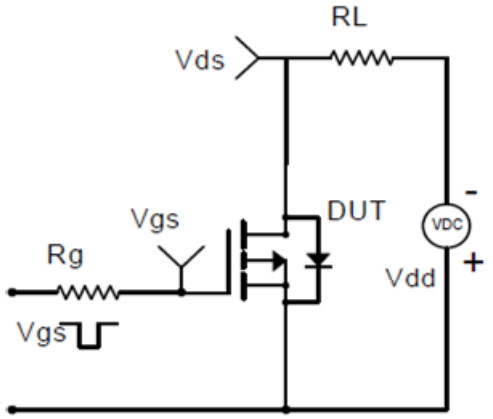


Fig.1-2 Switching Waveform

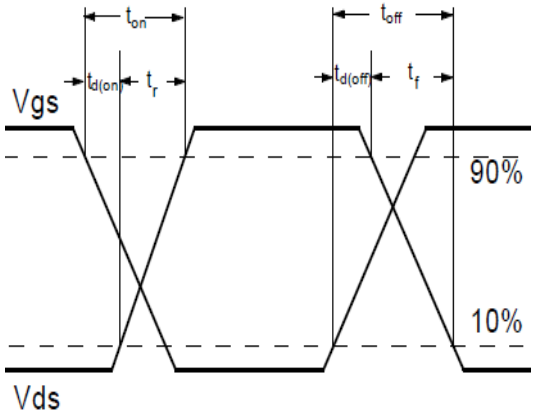


Fig.2-1 Gate charge test circuit

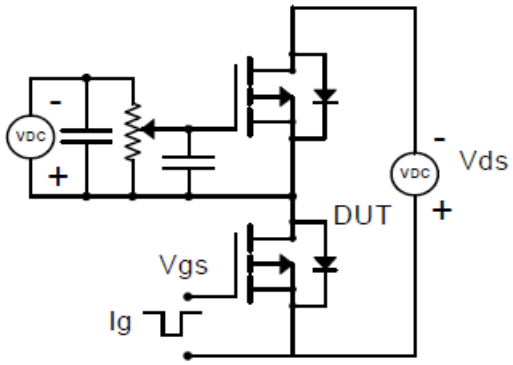
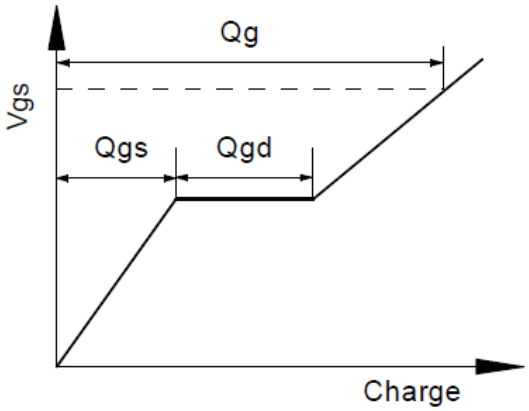
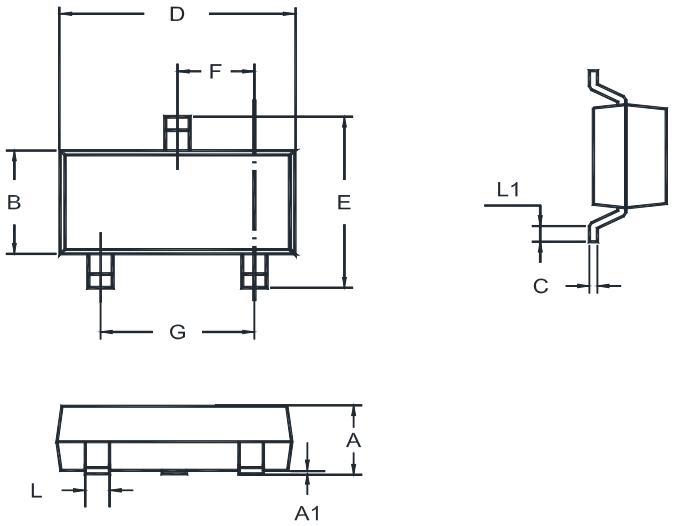


Fig.2-2 Gate charge waveform

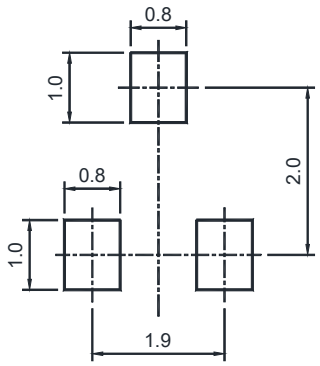


Package Outline (Dimensions in mm) SOT-23



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

" WS " = Part No.

" YM " = Date Code Marking

" Y " = Year

" M " = Month

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