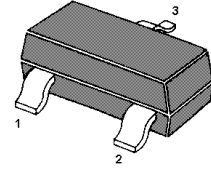
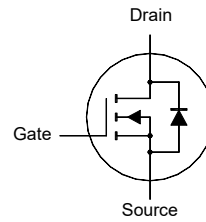


MMBT7002A-HAF

N-Channel Enhancement Mode MOSFET

Features

- Surface-mounted package
- Halogen and Antimony Free(HAF),
RoHS compliant



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

Applications

- Portable appliances
- Battery management

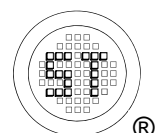
Absolute Maximum Ratings (at $T_a = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	60	V
Drain-Gate Voltage	V_{DG}	60	V
Gate Source Voltage	V_{GSS}	± 40	V
Drain Current - Continuous	I_D	280	mA
Peak Drain Current	I_{DM}	1.5	A
	$t_p \leq 10 \mu\text{s}$		
Total Power Dissipation ¹⁾	P_{tot}	350	mW
Operating Junction and Storage Temperature Range	T_J, T_{stg}	- 65 to + 150	$^\circ\text{C}$

Thermal Characteristics

Parameter	Symbol	Max.	Unit
Thermal Resistance - Junction to Ambient ¹⁾	$R_{\theta JA}$	357	$^\circ\text{C}/\text{W}$

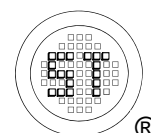
¹⁾ Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad.



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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 $I_D = 10\ \mu\text{A}$	BV_{DSS}	60	-	-	V
Zero Gate Voltage Drain Current at $V_{DS} = 60\ \text{V}$	I_{DSS}	-	-	1	μA
Gate Source Leakage Current at $V_{GS} = \pm 20\ \text{V}$	I_{GSS}	-	-	± 100	nA
Gate Source Threshold Voltage at $V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$	$V_{GS(th)}$	1	-	2.5	V
On-State Drain Current at $V_{GS} = 10\ \text{V}$, $V_{DS} = 10\ \text{V}$	$I_{D(ON)}$	500	-	-	mA
Drain-Source On-Voltage at $V_{GS} = 10\ \text{V}$, $I_D = 500\ \text{mA}$ at $V_{GS} = 5\ \text{V}$, $I_D = 50\ \text{mA}$	$V_{DS(ON)}$	-	-	1.5 0.15	V V
Static Drain Source On Resistance at $V_{GS} = 10\ \text{V}$, $I_D = 500\ \text{mA}$ at $V_{GS} = 5\ \text{V}$, $I_D = 50\ \text{mA}$	$R_{DS(ON)}$	-	-	3 3	Ω
DYNAMIC PARAMETERS					
Forward Transconductance at $V_{DS} = 10\ \text{V}$, $I_D = 200\ \text{mA}$	g_{FS}	-	235	-	mS
Input Capacitance at $V_{DS} = 25\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	C_{iss}	-	22.5	50	pF
Output Capacitance at $V_{DS} = 25\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	C_{oss}	-	9	25	pF
Reverse Transfer Capacitance at $V_{DS} = 25\ \text{V}$, $V_{GS} = 0\ \text{V}$, $f = 1\ \text{MHz}$	C_{rss}	-	7.5	10	pF
Total Gate Charge at $V_{DS} = 30\ \text{V}$, $I_D = 0.4\ \text{A}$, $V_{GS} = 10\ \text{V}$	Q_g	-	1.08	-	nC
Gate Source Charge at $V_{DS} = 30\ \text{V}$, $I_D = 0.4\ \text{A}$, $V_{GS} = 10\ \text{V}$	Q_{gs}	-	0.28	-	nC
Gate Drain Charge at $V_{DS} = 30\ \text{V}$, $I_D = 0.4\ \text{A}$, $V_{GS} = 10\ \text{V}$	Q_{gd}	-	0.09	-	nC
Turn-On Delay Time at $V_{DD} = 30\ \text{V}$, $I_D = 0.4\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_G = 4.5\ \Omega$	$t_{d(on)}$	-	2.7	-	ns
Turn-On Rise Time at $V_{DD} = 30\ \text{V}$, $I_D = 0.4\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_G = 4.5\ \Omega$	t_r	-	17	-	ns
Turn-Off Delay Time at $V_{DD} = 30\ \text{V}$, $I_D = 0.4\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_G = 4.5\ \Omega$	$t_{d(off)}$	-	8.5	-	ns
Turn-Off Fall Time at $V_{DD} = 30\ \text{V}$, $I_D = 0.4\ \text{A}$, $V_{GS} = 10\ \text{V}$, $R_G = 4.5\ \Omega$	t_f	-	28	-	ns
Body-Diode PARAMETERS					
Drain-Source Diode Forward Voltage at $V_{GS} = 0\ \text{V}$, $I_S = 0.4\ \text{A}$	V_{SD}	-	-	1.2	V
Body Diodes Continuous Current	I_S	-	-	280	mA



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Electrical Characteristics Curves

Fig. 1 Output Characteristics

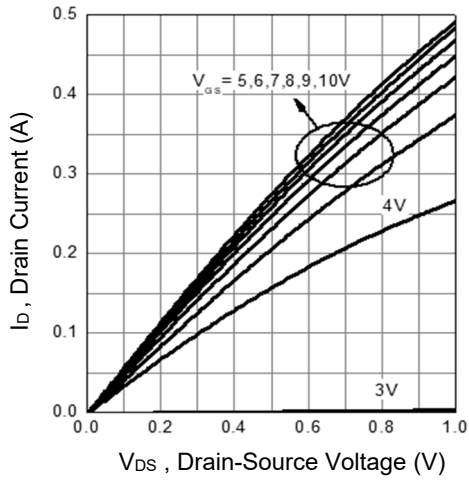


Fig. 2 Transfer Characteristics

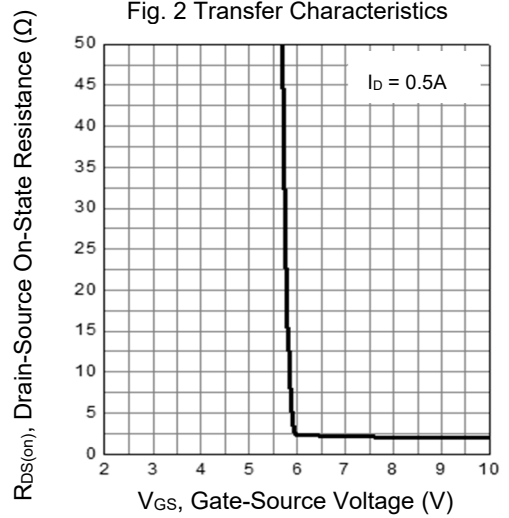


Fig. 3 on-Resistance vs. Drain Current

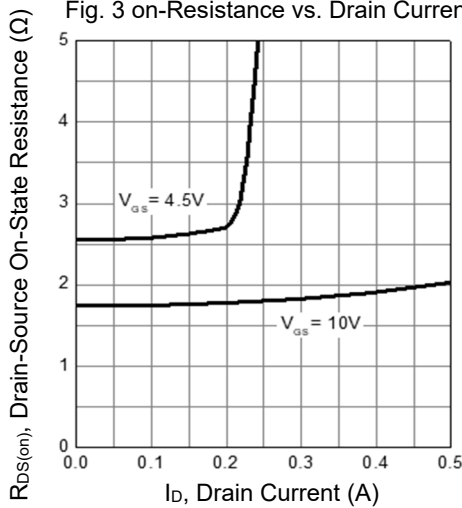


Fig. 4 Body Diode Forward Characteristics

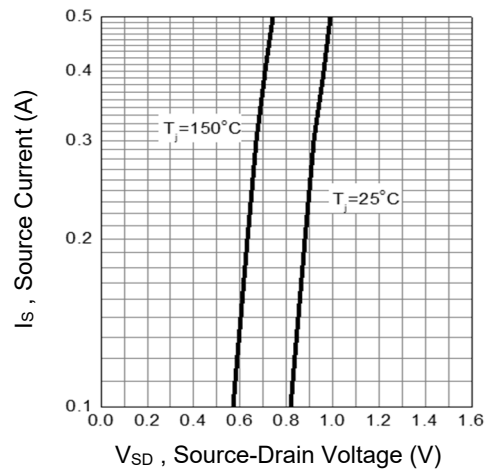


Fig. 5 $R_{DS(on)}$ vs. T_J

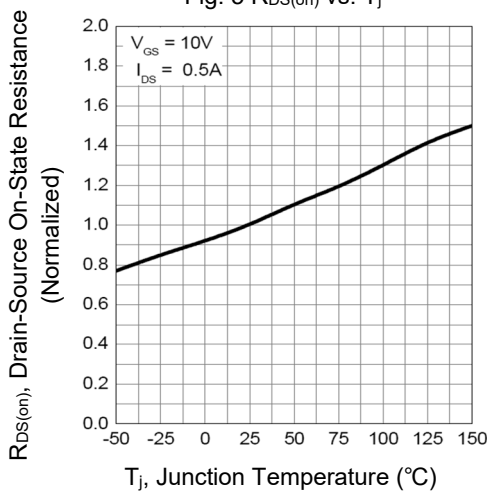
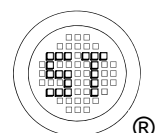
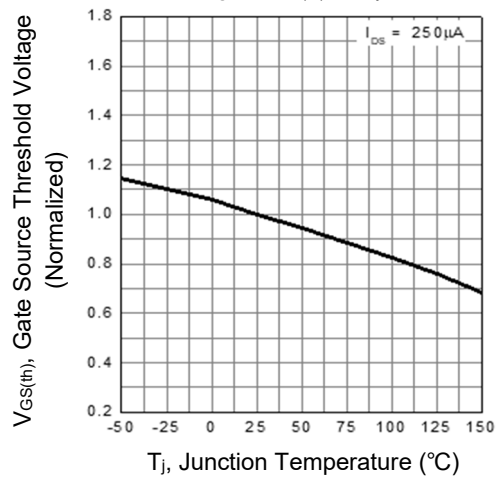


Fig. 6 $V_{GS(th)}$ vs T_J



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Electrical Characteristics Curves

Fig. 7 Capacitance

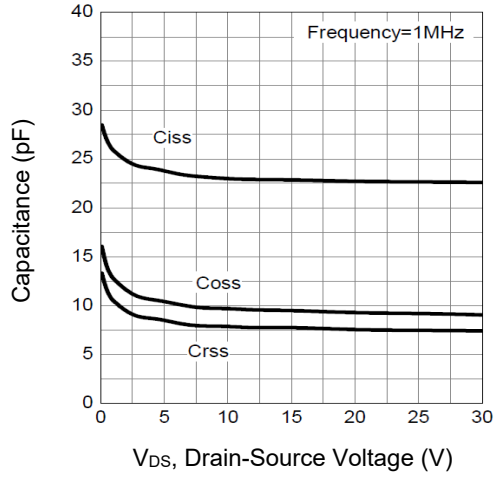
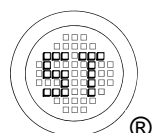
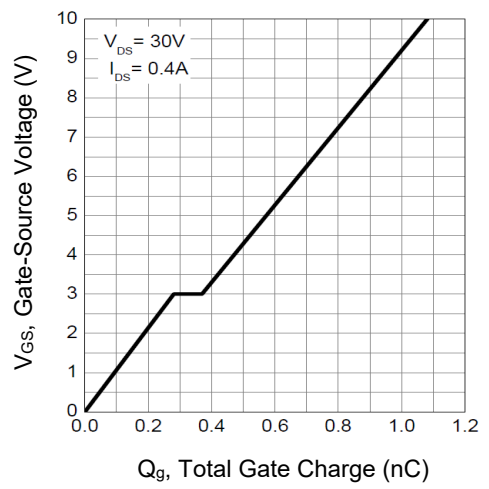


Fig. 8 Gate Charge



Test Circuits

Fig.1-1 Switching times test circuit

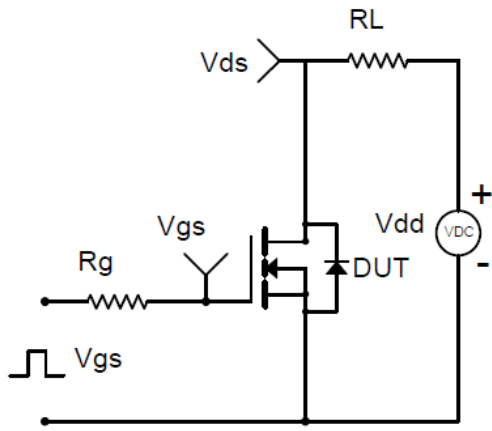


Fig.1-2 Switching Waveform

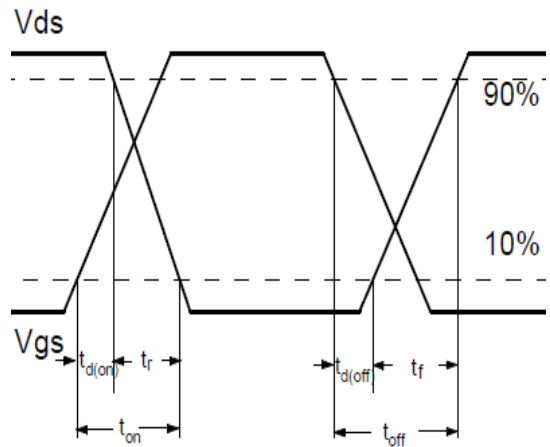


Fig.2-1 Gate charge test circuit

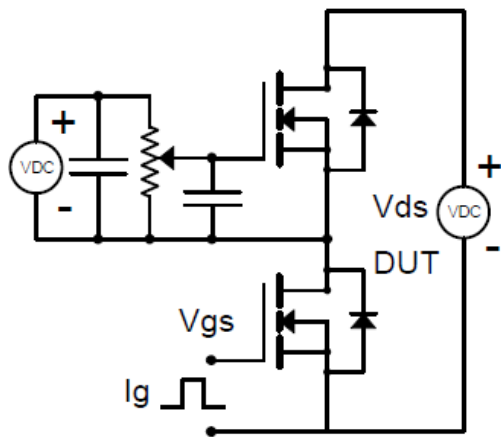
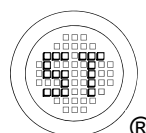
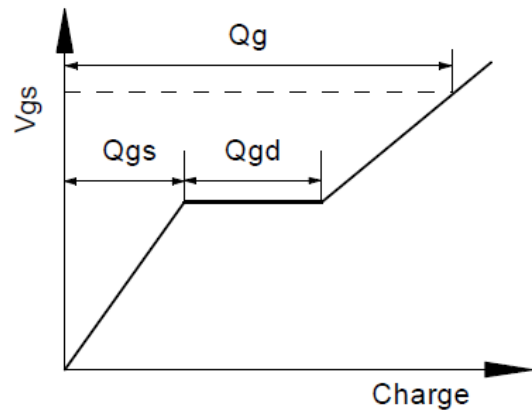


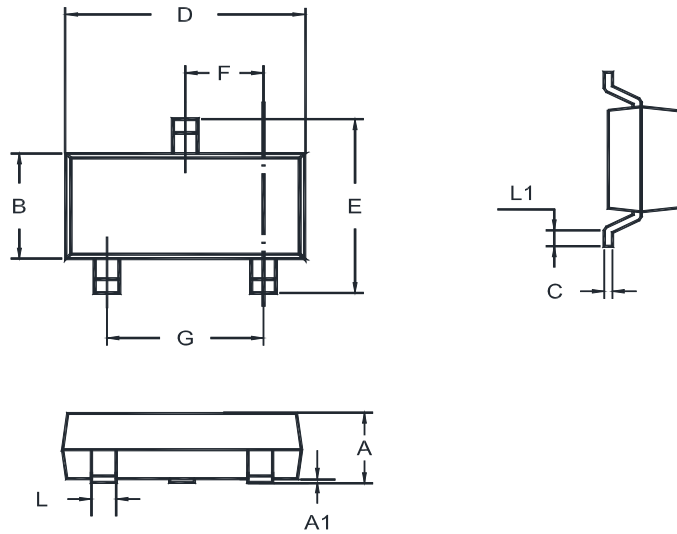
Fig.2-2 Gate charge waveform



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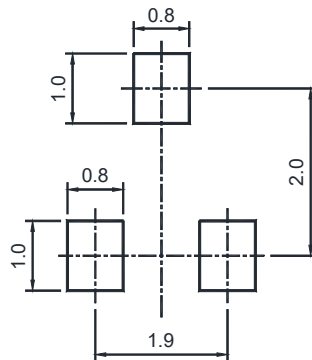
Package Outline (Dimensions in mm)

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

- " S72 " = Part No.
 - " • " = HAF (Halogen and Antimony Free)
 - " YM " = Date Code Marking
 - " Y " = Year
 - " M " = Month
- Font type: Arial

