

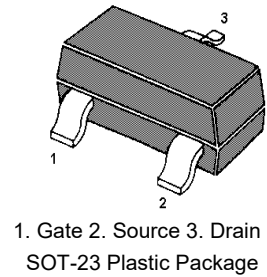
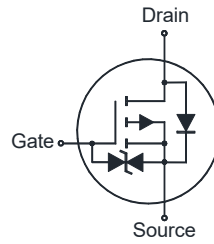
MMFTP2035AK

P-Channel Enhancement Mode MOSFET

Features

- Extremely low threshold voltage
- Built-in G-S Protection Diode
- Typical ESD Protection HBM Class 1C

Classification	Voltage Range(V)
0A	< 125
0B	125 to < 250
1A	250 to < 500
1B	500 to < 1000
1C	1000 to < 2000
2	2000 to < 4000
3A	4000 to < 8000
3B	≥ 8000



Applications

- Portable appliances
- High speed switch
- Battery management
- Low power DC to DC Converter

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}	± 10	V
Continuous Drain Current	$-I_D$	4.9	A
Peak Drain Current, Pulsed ¹⁾	$-I_{DM}$	24	A
Power Dissipation	P_D	0.81 ²⁾ 1.2 ³⁾	W
Operating Junction Temperature Range	T_j	- 55 to + 150	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	- 55 to + 150	$^\circ\text{C}$

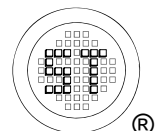
Thermal Characteristics

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Ambient	$R_{\theta JA}$	154 ²⁾ 104 ³⁾	$^\circ\text{C/W}$

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

²⁾ Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout, $t \leq 10 \text{ S}$.

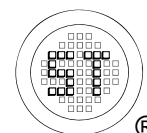
³⁾ Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate in still air, $t \leq 10 \text{ S}$.



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

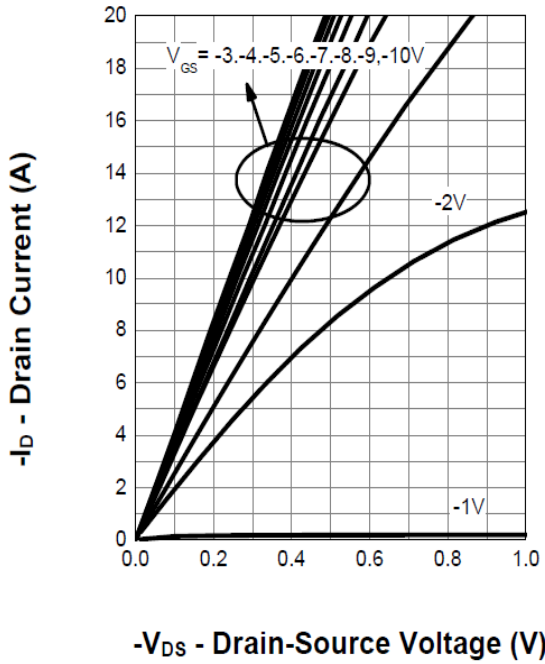
Parameter	Symbol	Min.	Typ.	Max.	Unit
STATIC PARAMETERS					
Drain-Source Breakdown Voltage at $-I_D = 250 \mu\text{A}$	$-V_{(BR)DSS}$	20	-	-	V
Zero Gate Voltage Drain Current at $-V_{DS} = 20 \text{ V}$	$-I_{DSS}$	-	-	1	μA
Gate-Source Leakage at $V_{GS} = \pm 8 \text{ V}$	I_{GSS}	-	-	± 10	μA
Gate-Source Threshold Voltage at $V_{DS} = V_{GS}$, $-I_D = 250 \mu\text{A}$	$-V_{GS(th)}$	0.4	-	1	V
Drain-Source On-State Resistance at $-V_{GS} = 4.5 \text{ V}$, $-I_D = 4 \text{ A}$ at $-V_{GS} = 2.5 \text{ V}$, $-I_D = 4 \text{ A}$ at $-V_{GS} = 1.8 \text{ V}$, $-I_D = 2 \text{ A}$	$R_{DS(on)}$	-	-	35 45 62	$\text{m}\Omega$
DYNAMIC PARAMETERS					
Forward Transconductance at $-V_{DS} = 5 \text{ V}$, $-I_D = 4 \text{ A}$	g_{fs}	-	14	-	S
Input Capacitance at $-V_{DS} = 10 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$	C_{iss}	-	816	-	pF
Output Capacitance at $-V_{DS} = 10 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$	C_{oss}	-	213	-	pF
Reverse Transfer Capacitance at $-V_{DS} = 10 \text{ V}$, $V_{GS} = 0 \text{ V}$, $f = 1 \text{ MHz}$	C_{rss}	-	83	-	pF
Total Gate Charge at $-V_{DS} = 10 \text{ V}$, $-I_D = 3 \text{ A}$, $-V_{GS} = 4.5 \text{ V}$ at $-V_{DS} = 10 \text{ V}$, $-I_D = 3 \text{ A}$, $-V_{GS} = 2.5 \text{ V}$	Q_g	-	12.5 7.2	-	nC
Gate to Source Charge at $-V_{DS} = 10 \text{ V}$, $-I_D = 3 \text{ A}$, $-V_{GS} = 4.5 \text{ V}$	Q_{gs}	-	1.6	-	nC
Gate to Drain Charge at $-V_{DS} = 10 \text{ V}$, $-I_D = 3 \text{ A}$, $-V_{GS} = 4.5 \text{ V}$	Q_{gd}	-	2.8	-	nC
Turn-On Delay Time at $-V_{DS} = 10 \text{ V}$, $-V_{GS} = 4.5 \text{ V}$, $-I_D = 3 \text{ A}$, $R_G = 4.5 \Omega$	$t_{d(on)}$	-	86	-	nS
Turn-On Rise Time at $-V_{DS} = 10 \text{ V}$, $-V_{GS} = 4.5 \text{ V}$, $-I_D = 3 \text{ A}$, $R_G = 4.5 \Omega$	t_r	-	51	-	nS
Turn-Off Delay Time at $-V_{DS} = 10 \text{ V}$, $-V_{GS} = 4.5 \text{ V}$, $-I_D = 3 \text{ A}$, $R_G = 4.5 \Omega$	$t_{d(off)}$	-	185	-	nS
Turn-Off Fall Time at $-V_{DS} = 10 \text{ V}$, $-V_{GS} = 4.5 \text{ V}$, $-I_D = 3 \text{ A}$, $R_G = 4.5 \Omega$	t_f	-	1050	-	nS
Body-Diode PARAMETERS					
Drain-Source Diode Forward Voltage at $-I_S = 1 \text{ A}$	$-V_{SD}$	-	-	1	V
Body-Diode Continuous Current	$-I_S$	-	-	4.9	A
Body Diode Reverse Recovery Time at $-I_S = 3 \text{ A}$, $di/dt = 100 \text{ A} / \mu\text{s}$	t_{rr}	-	0.9	-	μs
Body Diode Reverse Recovery Charge at $-I_S = 3 \text{ A}$, $di/dt = 100 \text{ A} / \mu\text{s}$	Q_{rr}	-	6.3	-	μC



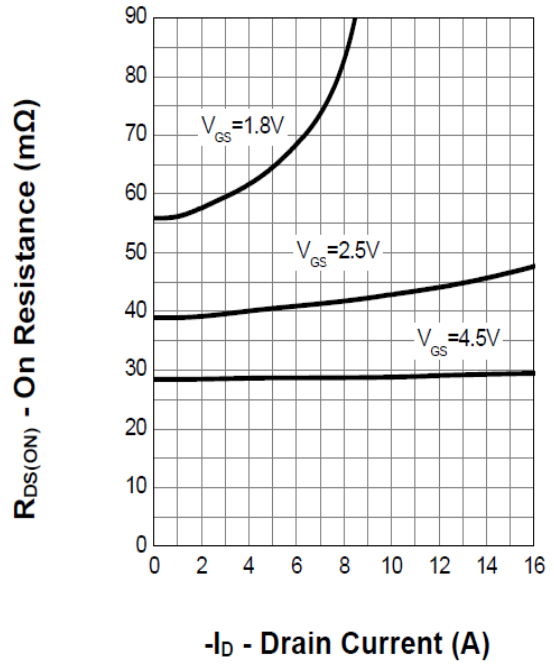
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Electrical Characteristics Curves

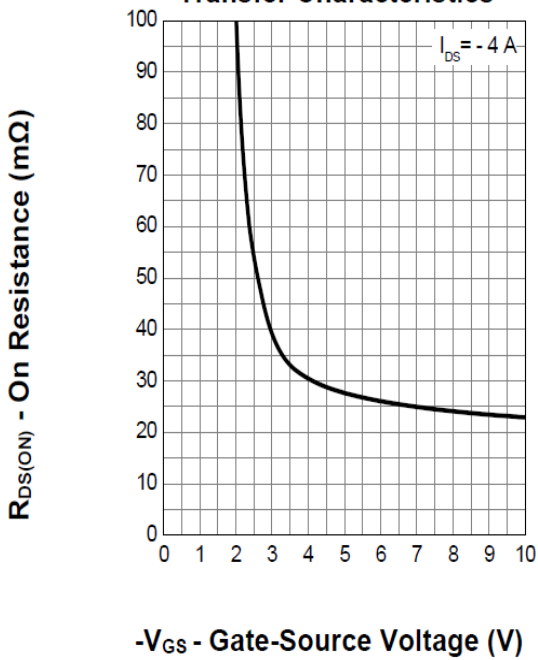
Output Characteristics



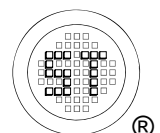
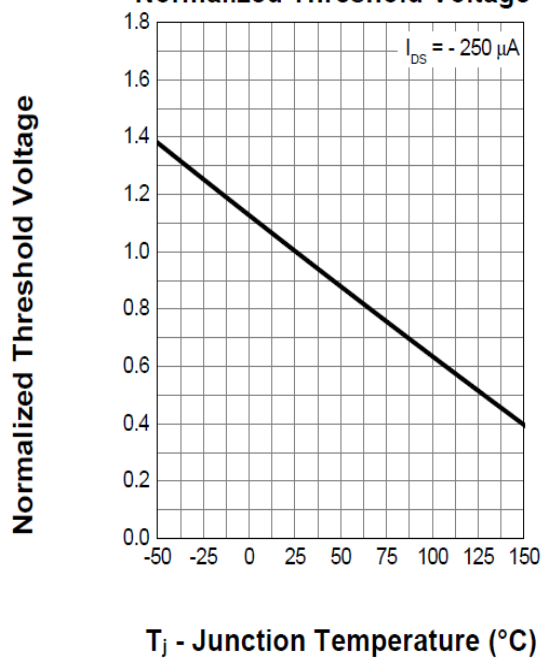
Drain-Source On Resistance



Transfer Characteristics

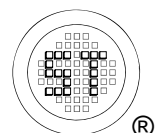
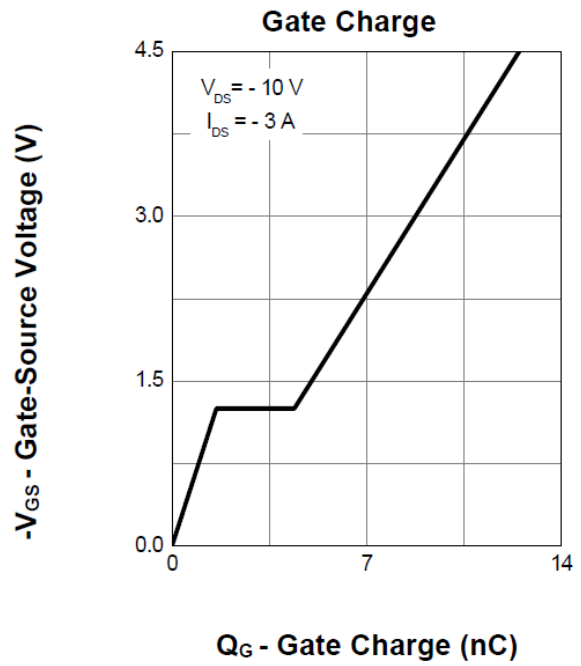
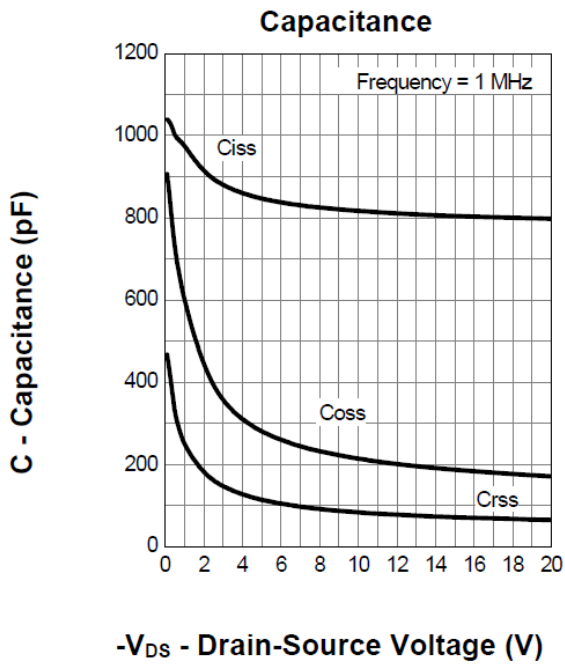
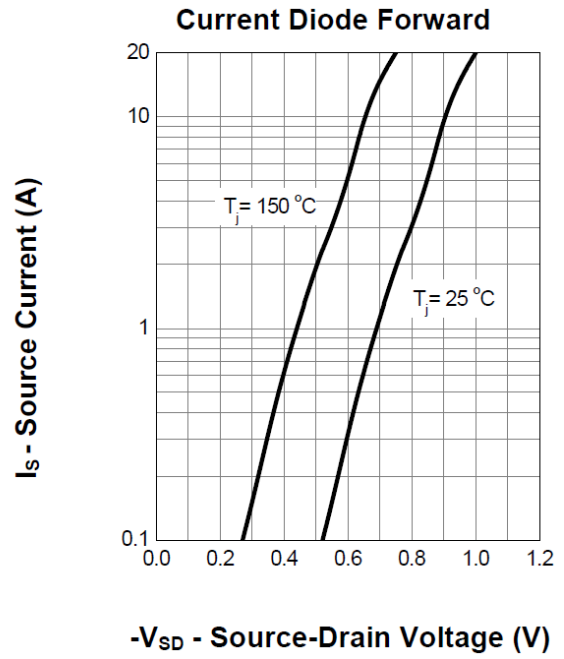
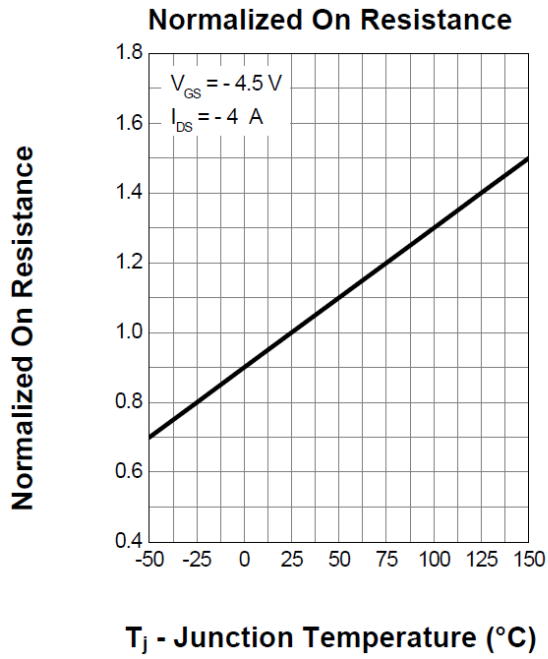


Normalized Threshold Voltage



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Electrical Characteristics Curves



Test Circuits

Fig.1-1 Switching times test circuit

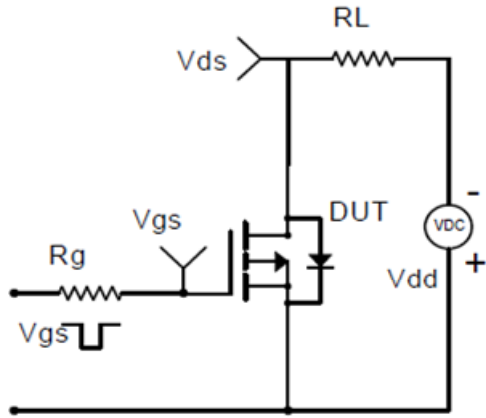


Fig.1-2 Switching Waveform

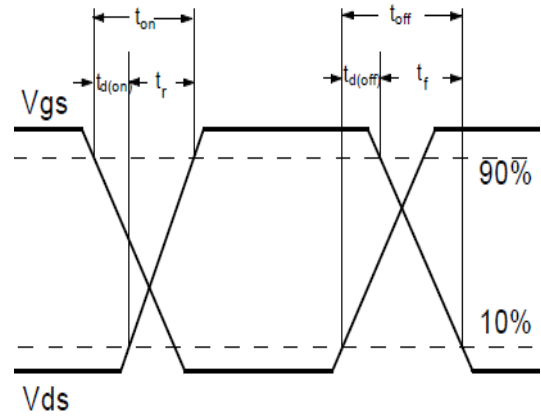


Fig.2-1 Gate charge test circuit

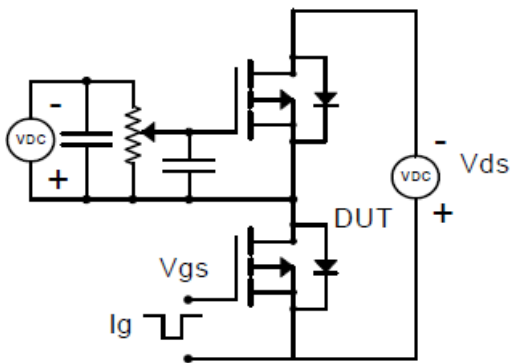
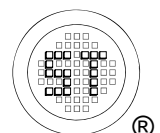
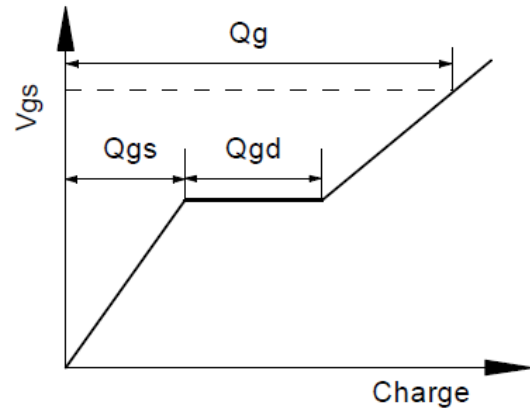


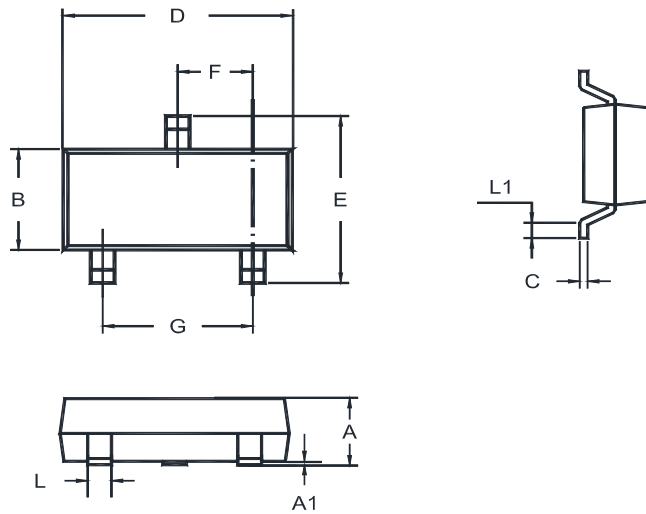
Fig.2-2 Gate charge waveform



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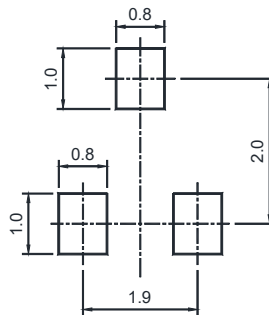
Package Outline (Dimensions in mm)

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

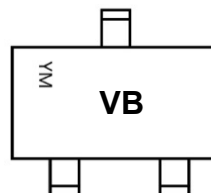


Packing information

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

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



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