

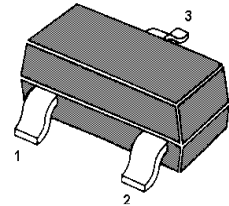
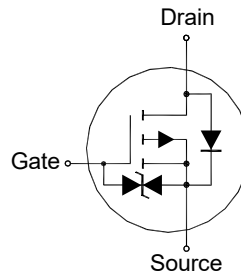
# MMFTP3419AK

## P-Channel Enhancement Mode MOSFET

### Features

- Surface-mounted package
- Advanced trench cell design
- Typical ESD Protection HBM Class 1B

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



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

### Applications

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

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

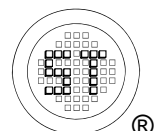
Parameter	Symbol	Value	Unit
Drain-Source Voltage	$-V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 12$	V
Continuous Drain Current	$-I_D$	4	A
Peak Drain Current, Pulsed <sup>1)</sup>	$-I_{DM}$	16	A
Power Dissipation $t \leq 10$ s	$P_D$	1.25	W
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to + 150	$^\circ\text{C}$

### Thermal Resistance Ratings

Parameter	Symbol	Max.	Unit
Thermal Resistance from Junction to Ambient <sup>2)</sup>	$R_{\theta JA}$	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  $T_{J(\text{MAX})}=150^\circ\text{C}$ .

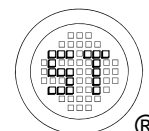
<sup>2)</sup> Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate in still air.



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

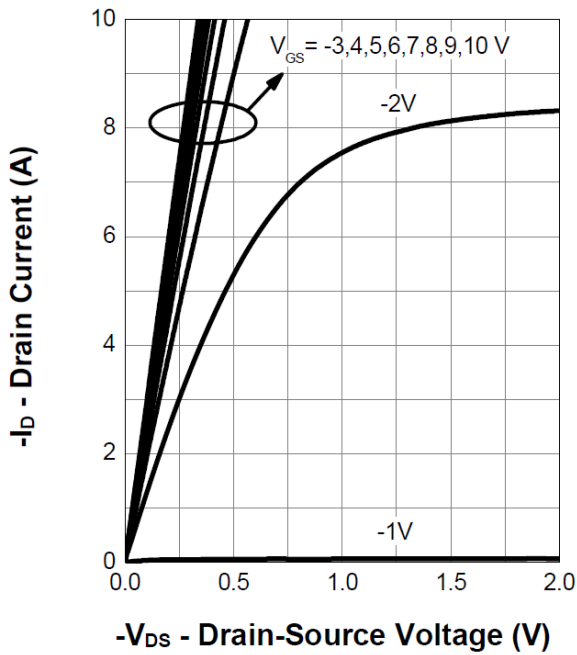
Parameter	Symbol	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage at $-I_D = 250 \mu\text{A}$	$-V_{(BR)DSS}$	20	-	-	V
Zero Gate Voltage Drain Current at $-V_{DS} = 20 \text{ V}$	$-I_{DSS}$	-	-	1	$\mu\text{A}$
Gate-Source Leakage at $V_{GS} = \pm 8 \text{ V}$	$I_{GSS}$	-	-	$\pm 10$	$\mu\text{A}$
Gate-Source 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 $-V_{GS} = 10 \text{ V}$ , $-I_D = 4 \text{ A}$ at $-V_{GS} = 4.5 \text{ V}$ , $-I_D = 3.3 \text{ A}$ at $-V_{GS} = 2.5 \text{ V}$ , $-I_D = 2 \text{ A}$ at $-V_{GS} = 1.8 \text{ V}$ , $-I_D = 0.5 \text{ A}$	$R_{DS(on)}$	-	-	60 70 96 180	$\text{m}\Omega$
<b>DYNAMIC PARAMETERS</b>					
Input Capacitance at $-V_{DS} = 10 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{iss}$	-	849	-	$\text{pF}$
Output Capacitance at $-V_{DS} = 10 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{oss}$	-	106	-	$\text{pF}$
Reverse Transfer Capacitance at $-V_{DS} = 10 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{rss}$	-	99	-	$\text{pF}$
Total Gate Charge at $-V_{GS} = 10 \text{ V}$ , $-V_{DS} = 10 \text{ V}$ , $-I_D = 3 \text{ A}$	$Q_g$	-	20	-	$\text{nC}$
Gate-Source Charge at $-V_{GS} = 10 \text{ V}$ , $-V_{DS} = 10 \text{ V}$ , $-I_D = 3 \text{ A}$	$Q_{gs}$	-	2.8	-	$\text{nC}$
Gate-Drain Charge at $-V_{GS} = 10 \text{ V}$ , $-V_{DS} = 10 \text{ V}$ , $-I_D = 3 \text{ A}$	$Q_{gd}$	-	2.1	-	$\text{nC}$
Turn-On Rise Time at $-V_{DS} = 10 \text{ V}$ , $-I_D = 3 \text{ A}$ , $-V_{GS} = 10 \text{ V}$ , $R_G = 3.9 \Omega$	$t_{d(on)}$	-	4.1	-	$\text{ns}$
Turn-On Rise Time at $-V_{DS} = 10 \text{ V}$ , $-I_D = 3 \text{ A}$ , $-V_{GS} = 10 \text{ V}$ , $R_G = 3.9 \Omega$	$t_r$	-	26	-	$\text{ns}$
Turn-Off Delay Time at $-V_{DS} = 10 \text{ V}$ , $-I_D = 3 \text{ A}$ , $-V_{GS} = 10 \text{ V}$ , $R_G = 3.9 \Omega$	$t_{d(off)}$	-	87	-	$\text{ns}$
Turn-Off Fall Time at $-V_{DS} = 10 \text{ V}$ , $-I_D = 3 \text{ A}$ , $-V_{GS} = 10 \text{ V}$ , $R_G = 3.9 \Omega$	$t_f$	-	44	-	$\text{ns}$
<b>Body-Diode PARAMETERS</b>					
Body Diode Voltage at $-I_S = 3 \text{ A}$ , $V_{GS} = 0 \text{ V}$	$-V_{SD}$	-	-	1.1	V
Body-Diode Continuous Current	$-I_S$	-	-	4	A
Body Diode Reverse Recovery Time at $-I_S = 3 \text{ A}$ , $di/dt = 100 \text{ A} / \mu\text{s}$	$t_{rr}$	-	29	-	$\text{ns}$
Body Diode Reverse Recovery Charge at $-I_S = 3 \text{ A}$ , $di/dt = 100 \text{ A} / \mu\text{s}$	$Q_{rr}$	-	8	-	$\text{nC}$



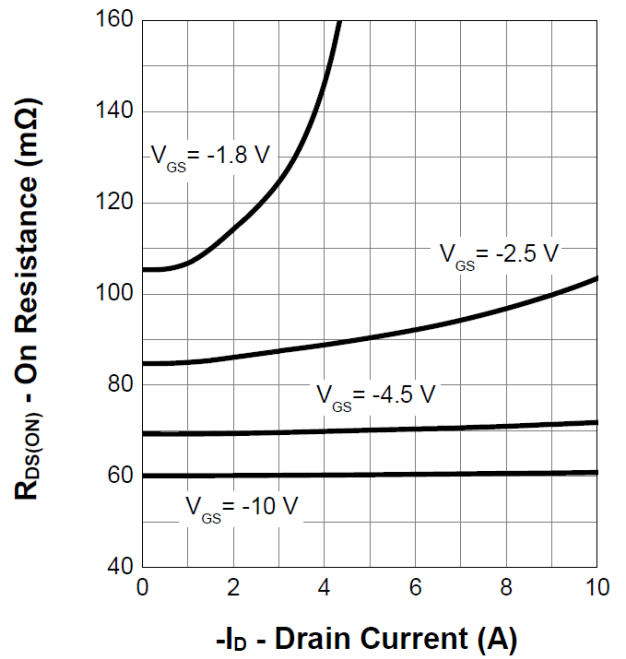
# MMFTP3419AK

## Electrical Characteristics Curves

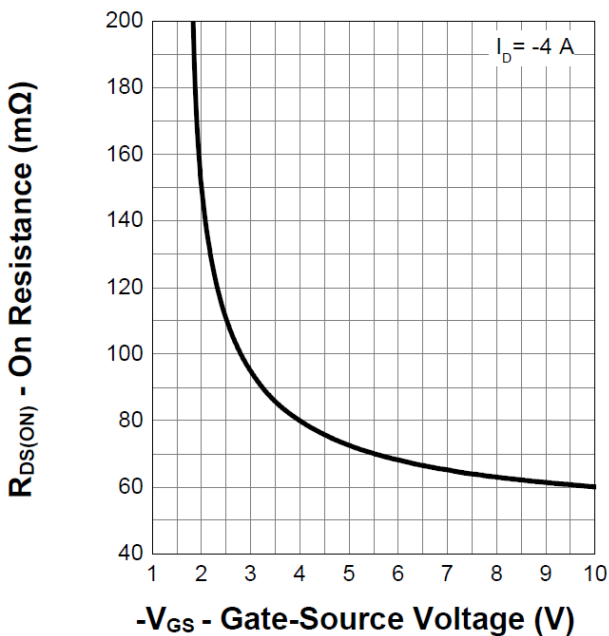
Output Characteristics



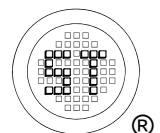
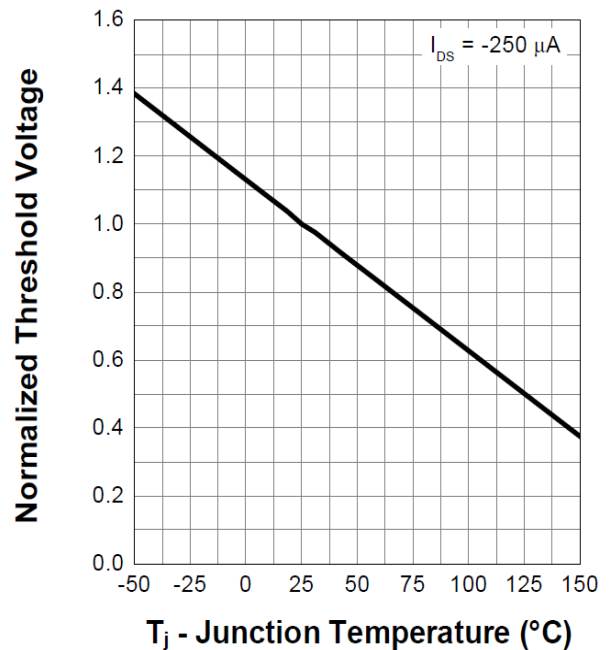
On Resistance



Transfer Characteristics



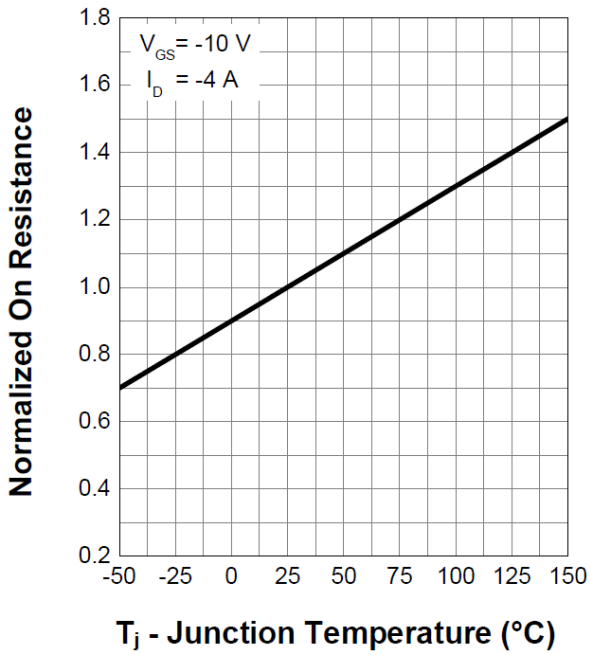
Normalized Threshold Voltage



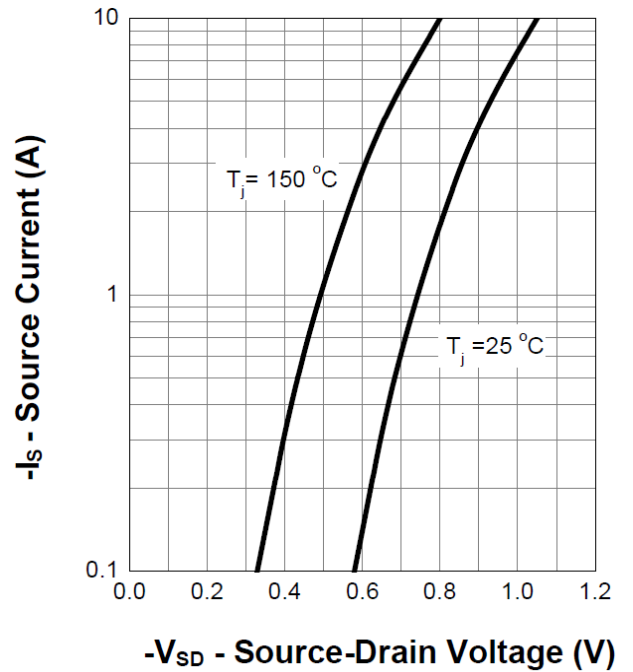
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## Electrical Characteristics Curves

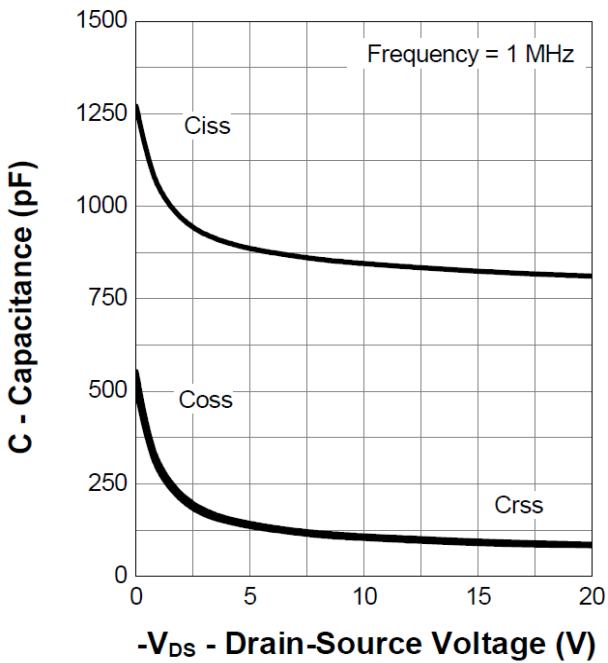
Normalized On Resistance



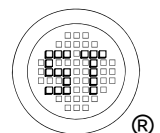
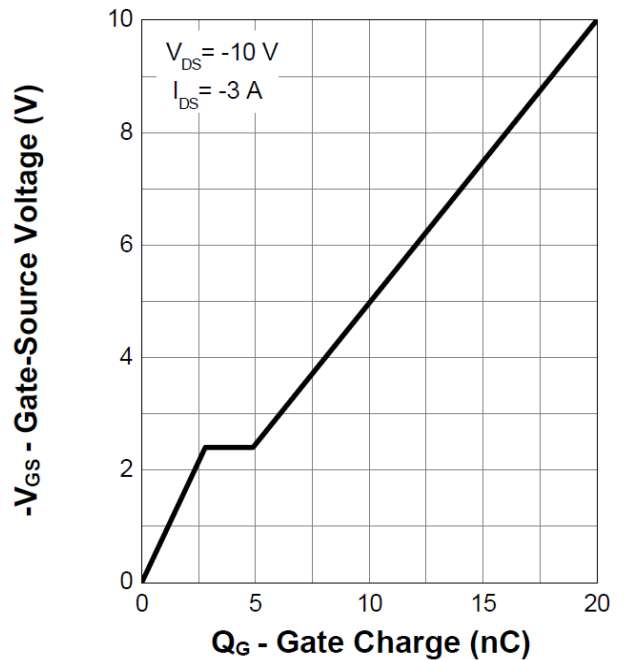
Diode Forward Current



Capacitance



Gate Charge



## Test Circuits

Fig.1-1 Switching times test circuit

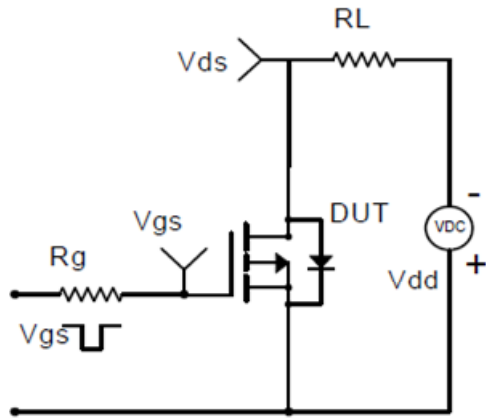


Fig.1-2 Switching Waveform

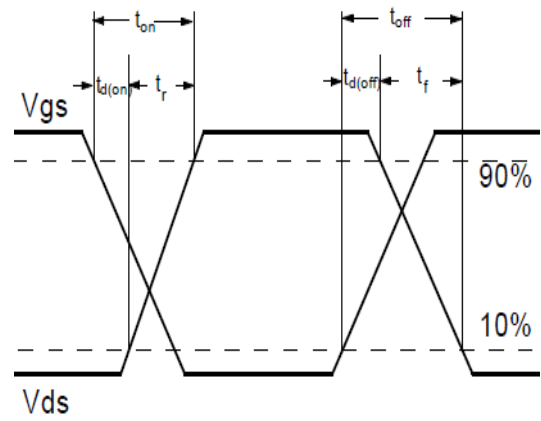


Fig.2-1 Gate charge test circuit

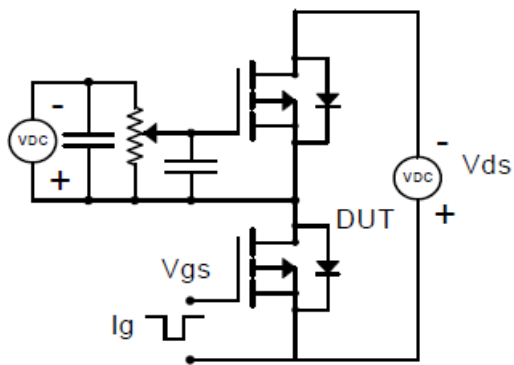
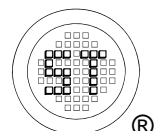
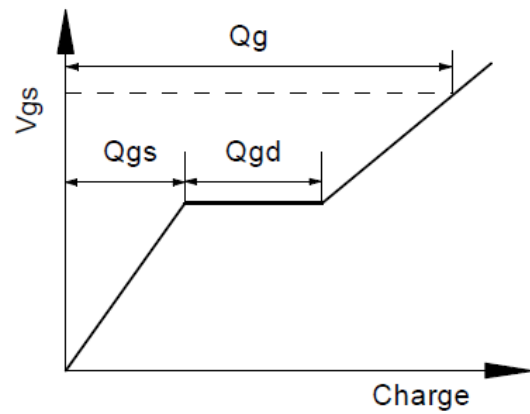


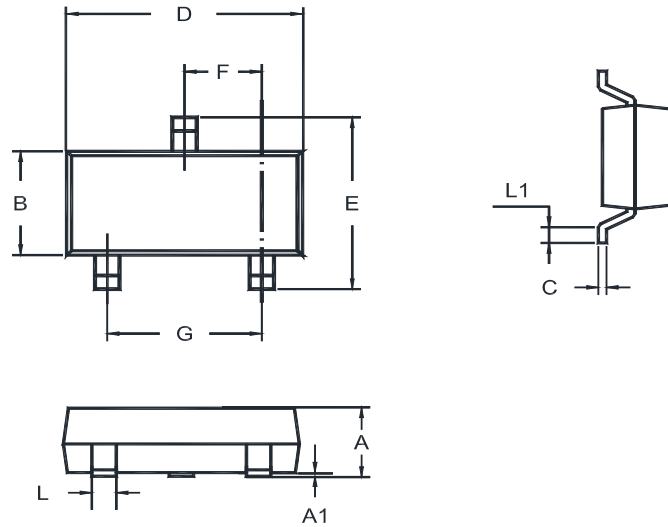
Fig.2-2 Gate charge waveform



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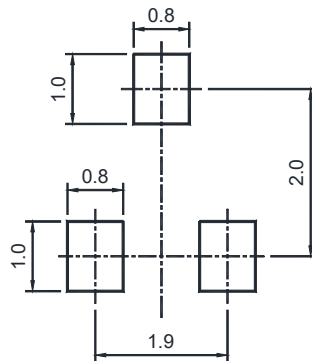
## Package Outline (Dimensions in mm)

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

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

