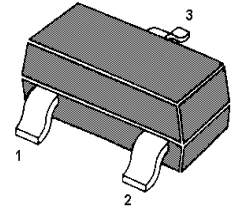
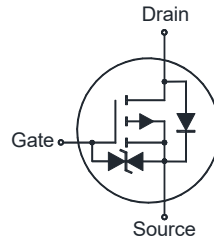


# MMFTP2333K-AH

## P-Channel Enhancement Mode MOSFET

### Features

- AEC-Q101 Qualified
- Extremely low threshold voltage
- Halogen and Antimony Free(HAF), RoHS compliant
- Typical ESD Protection HBM Class 1C



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

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)

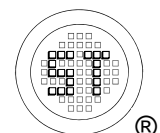
Parameter	Symbol	Value	Unit
Drain-Source Voltage	$-V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 10$	V
Continuous Drain Current	$-I_D$	4	A
Peak Drain Current, Pulsed <sup>1)</sup>	$-I_{DM}$	30	A
Total Power Dissipation	$P_{tot}$	1 <sup>2)</sup> 0.8	W
Operating Junction Temperature Range	$T_j$	- 55 to + 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 <sup>2)</sup>	$R_{\theta JA}$	125	$^\circ\text{C}/\text{W}$

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

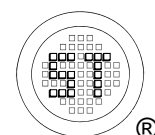
<sup>2)</sup> Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate in still air,  $t \leq 10 \text{ s}$ .



# MMFTP2333K-AH

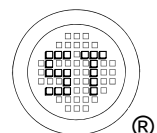
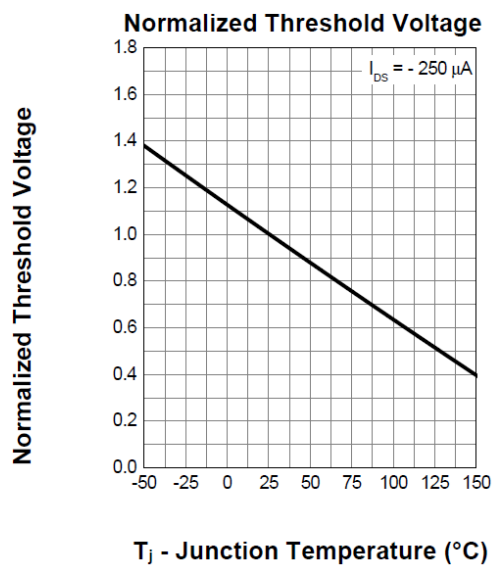
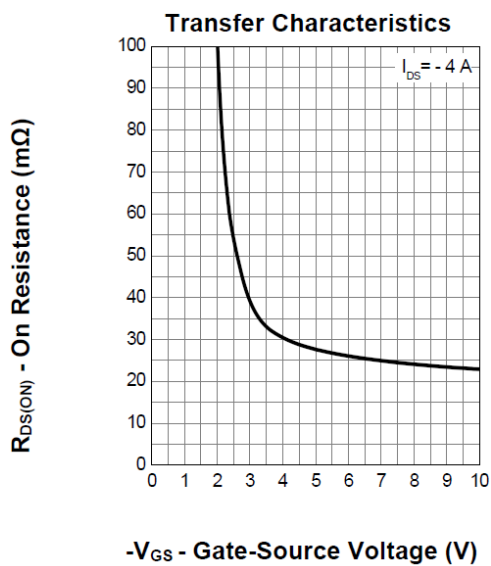
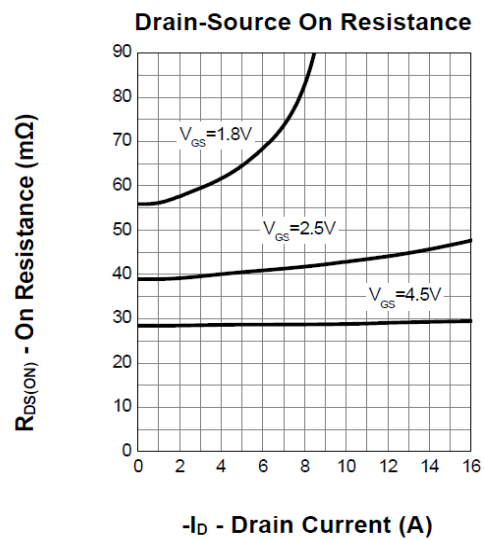
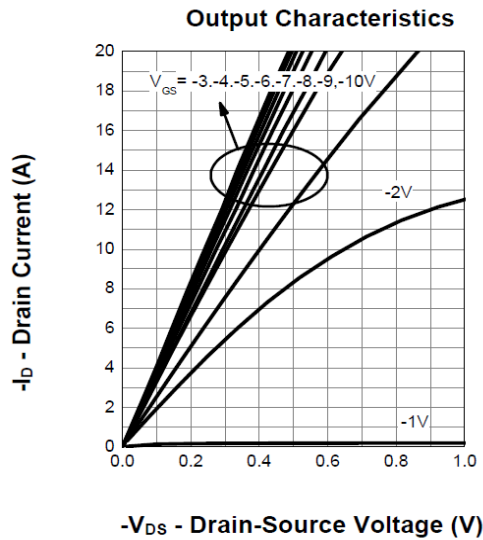
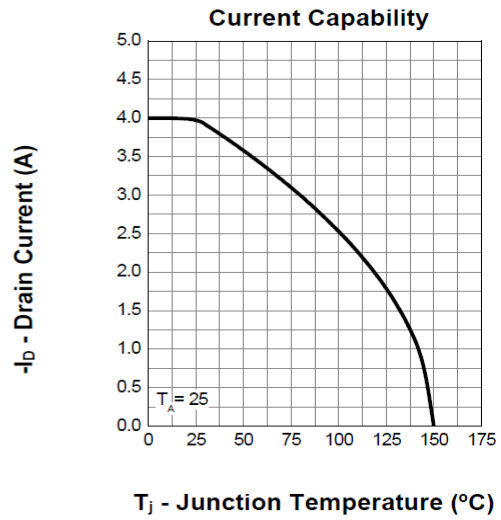
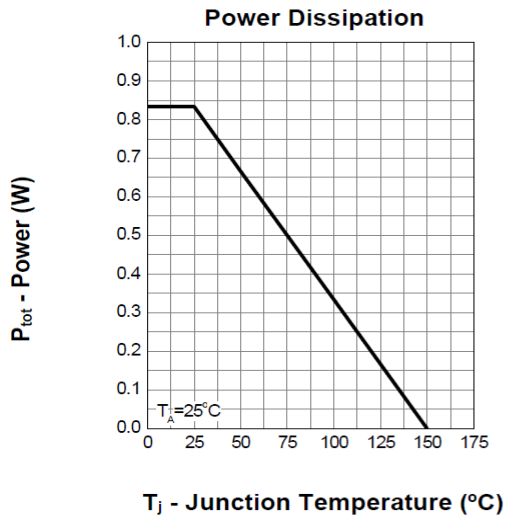
Characteristics at  $T_a = 25^\circ\text{C}$  unless otherwise specified

Parameter	Symbol	Min.	Typ.	Max.	Unit
<b>STATIC PARAMETERS</b>					
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 $V_{DS} = V_{GS}$ , $-I_D = 250 \mu\text{A}$	$-V_{GS(th)}$	0.4	-	1	V
Drain-Source On-State Resistance at $-V_{GS} = 4.5 \text{ V}$ , $-I_D = 4 \text{ A}$ at $-V_{GS} = 2.5 \text{ V}$ , $-I_D = 3 \text{ A}$ at $-V_{GS} = 1.8 \text{ V}$ , $-I_D = 2 \text{ A}$	$R_{DS(on)}$	- - -	- - -	35 45 62	$\text{m}\Omega$
<b>DYNAMIC PARAMETERS</b>					
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	-	$\text{pF}$
Output Capacitance at $-V_{DS} = 10 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{oss}$	-	213	-	$\text{pF}$
Reverse Transfer Capacitance at $-V_{DS} = 10 \text{ V}$ , $V_{GS} = 0 \text{ V}$ , $f = 1 \text{ MHz}$	$C_{rss}$	-	83	-	$\text{pF}$
Total Gate Charge at $-V_{GS} = 4.5 \text{ V}$ , $-V_{DS} = 10 \text{ V}$ , $-I_D = 3 \text{ A}$	$Q_g$	-	12.5	-	$\text{nC}$
Gate to Source Charge at $-V_{GS} = 4.5 \text{ V}$ , $-V_{DS} = 10 \text{ V}$ , $-I_D = 3 \text{ A}$	$Q_{gs}$	-	1.6	-	$\text{nC}$
Gate to Drain Charge at $-V_{GS} = 4.5 \text{ V}$ , $-V_{DS} = 10 \text{ V}$ , $-I_D = 3 \text{ A}$	$Q_{gd}$	-	2.8	-	$\text{nC}$
Turn-On Delay Time at $-V_{DD} = 10 \text{ V}$ , $-I_D = 3 \text{ A}$ , $-V_{GS} = 4.5 \text{ V}$ , $R_G = 4.7 \Omega$	$t_{d(on)}$	-	86	-	$\text{nS}$
Turn-On Rise Time at $-V_{DD} = 10 \text{ V}$ , $-I_D = 3 \text{ A}$ , $-V_{GS} = 4.5 \text{ V}$ , $R_G = 4.7 \Omega$	$t_r$	-	51	-	$\text{nS}$
Turn-Off Delay Time at $-V_{DD} = 10 \text{ V}$ , $-I_D = 3 \text{ A}$ , $-V_{GS} = 4.5 \text{ V}$ , $R_G = 4.7 \Omega$	$t_{d(off)}$	-	185	-	$\text{nS}$
Turn-Off Fall Time at $-V_{DD} = 10 \text{ V}$ , $-I_D = 3 \text{ A}$ , $-V_{GS} = 4.5 \text{ V}$ , $R_G = 4.7 \Omega$	$t_f$	-	1050	-	$\text{nS}$
<b>Body-Diode PARAMETERS</b>					
Drain-Source Diode Forward Voltage at $-I_S = 1 \text{ A}$	$-V_{SD}$	-	-	1.2	V



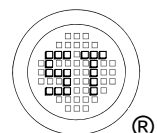
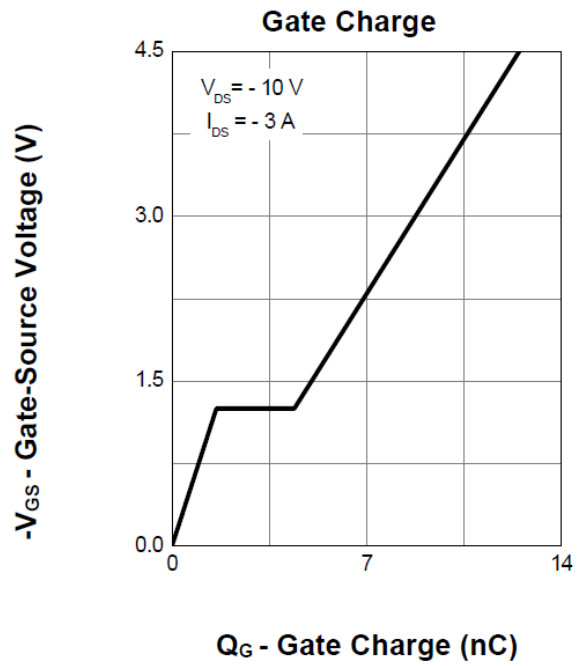
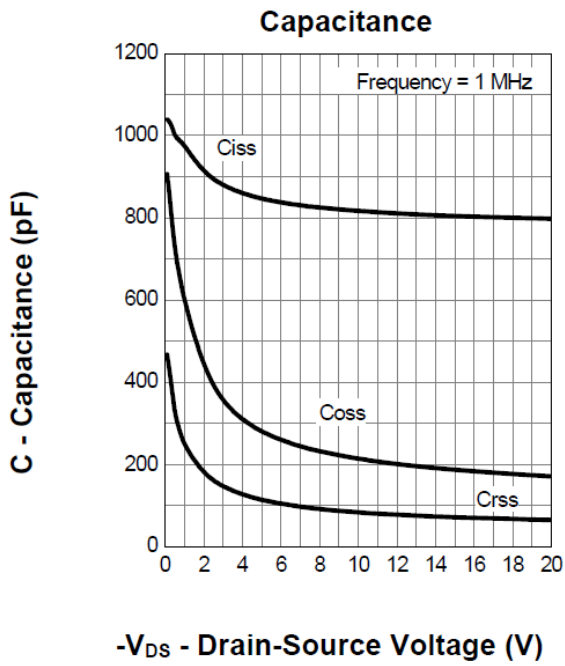
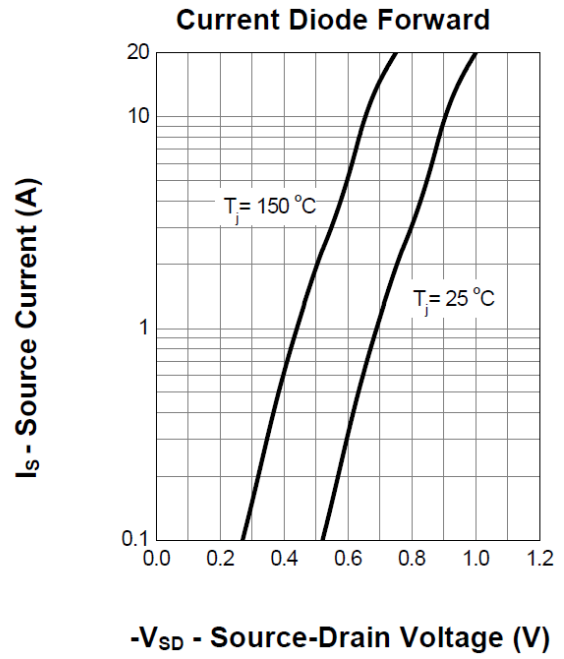
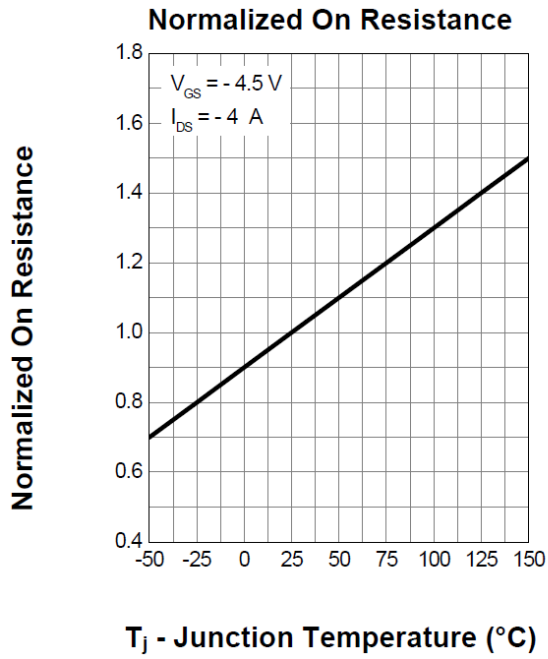
# MMFTP2333K-AH

## Electrical Characteristics Curves



# MMFTP2333K-AH

## Electrical Characteristics Curves



## Test Circuits

Fig.1-1 Switching times test circuit

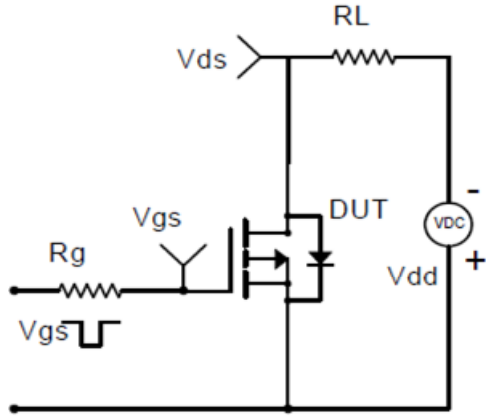


Fig.1-2 Switching Waveform

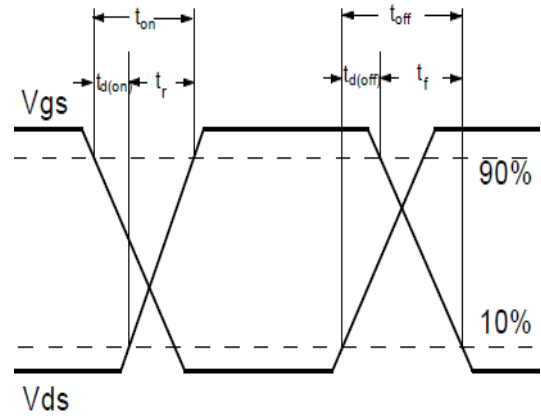


Fig.2-1 Gate charge test circuit

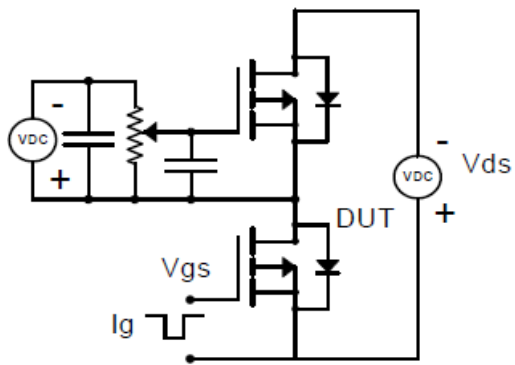
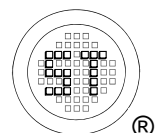
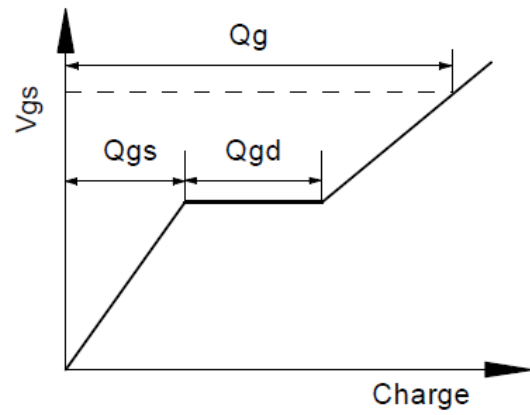


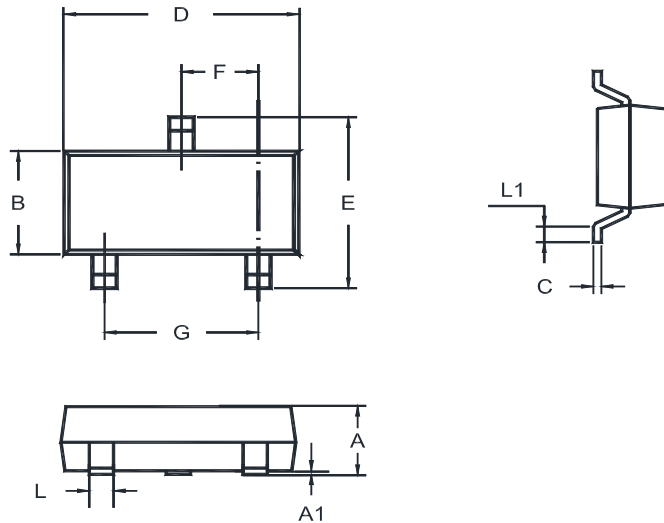
Fig.2-2 Gate charge waveform



# MMFTP2333K-AH

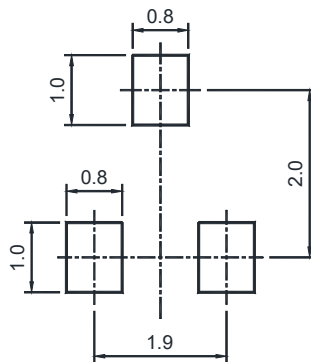
## Package Outline (Dimensions in mm)

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.

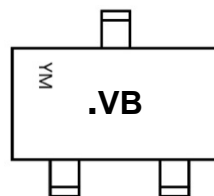
" • " = HAF (Halogen and Antimony Free)

" YM " = Date Code Marking

" Y " = Year

" M " = Month

Font type: Arial



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