FMOS2309AF

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-1.6A -60V P-Channel Enhancement Mode Power MOSFET

Features

- $-V_{DS}$=60V, $-I_D$=1.6A.
- $R_{DS(on)}$≤ 190 mΩ @$-V_{GS}$=10V, $-I_D$=2A.
- $R_{DS(on)}$≤ 240 mΩ @$-V_{GS}$=4.5V,$-I_D$=1.5A.
- Advanced trench technology .
- Excellent on-resistance .
- Lead-free parts meet RoHS requirements.
- Suffix "-H" indicates Halogen-free part, ex.FMOS2309AF-H.

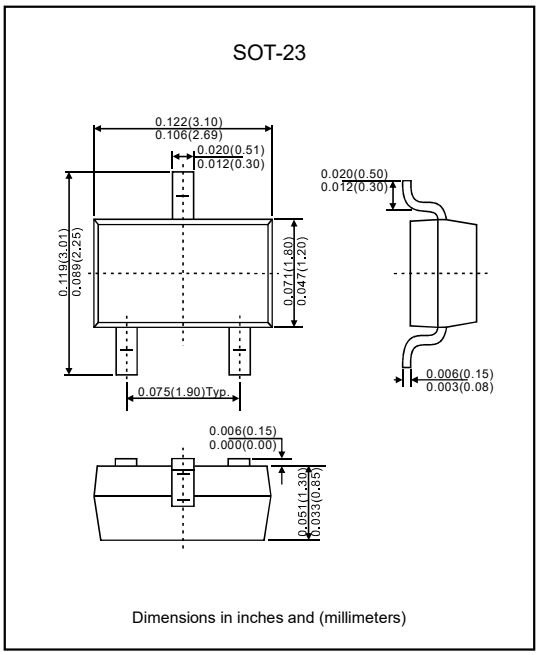
Applications

- PWM applications.
- Load switch.
- Power management.

Mechanical data

- Epoxy:UL94-V0 rated flame retardant.
- Case : Molded plastic, SOT-23.

Package outline



Maximum Ratings (At T_A=25°C Unless otherwise noted)

Parameter	Symbol	Rating	Unit
Drain source voltage	$-V_{DS}$	60	V
Gate source voltage	V_{GS}	±20	V
Drain current continuous	$-I_D$	1.6	A
Pulsed drain current	$-I_{DM}$	8	A
Power dissipation	P_D	0.35	W
Thermal resistance, junction to ambient	$R_{\theta JA}$	357	°C/W
Operating junction temperature	T_J	+150	°C
Storage temperature range	T_{STG}	-55 to +150	°C

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Electrical characteristics (At T_A=25°C unless otherwise specified)

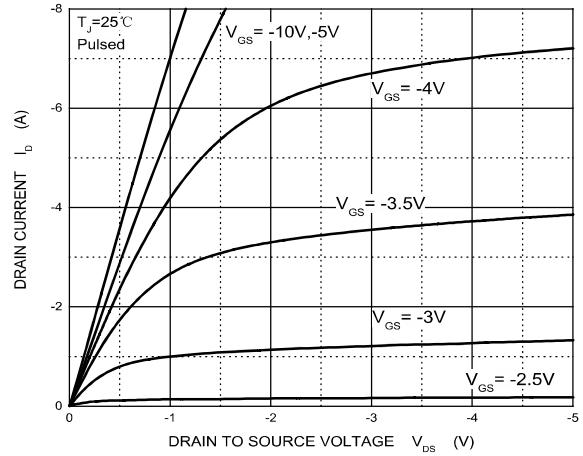
Parameter	Symbol	Conditions	Min.	Typ	Max	Unit
Static parameters						
Drain-source breakdown voltage	$-BV_{DSS}$	$-I_D$=250μA, V_{GS}=0V	60			V
Drain-source leakage current	$-I_{DSS}$	$-V_{DS}$=60V , V_{GS}=0V			1	μA
		$-V_{DS}$=60V , V_{GS}=0V, T_J=125°C			1	mA
Gate-source leakage current	I_{GSS}	V_{GS}=±20V, V_{DS}=0V			±100	nA
On characteristics						
Gate threshold voltage	$-V_{GS(TH)}$	V_{DS}=V_{GS}, $-I_D$=250μA	1	1.9	2.5	V
Static drain-source on-state resistance (note 2)	$R_{DS(ON)}$	$-V_{GS}$=10V, $-I_D$=2A		130	190	mΩ
		$-V_{GS}$=4.5V, $-I_D$=1.5A		180	240	
Forward transconductance	g_{FS}	V_{DS}=-10V, $-I_D$=2A		3.1		S
Dynamic parameters (note 3)						
Input capacitance	C_{iss}	V_{GS}=0V, $-V_{DS}$=30V, f=1.0MHz		380		pF
Out capacitance	C_{oss}			32		
Reverse transfer capacitance	C_{rss}			6		
Gate resistance	R_g	V_{DS}=0V, V_{GS}=0V, f=1.0MHz		17		Ω
Switching parameters (note 3)						
Total gate charge	Q_g	$-V_{GS}$=10V, $-V_{DS}$=30V, $-I_D$=1.5A		12		nC
Gate to source charge	Q_{gs}			2.5		
Gate to drain charge	Q_{gd}			3.9		
Turn-on delay time	$t_{d(on)}$	$-V_{DD}$=30V, $-V_{GS}$=10V, R_G=3Ω, $-I_D$=1.5A		45		ns
Rise time	t_r			38		
Turn-off delay time	$t_{d(off)}$			18		
Fall time	t_f			15		
Source-drain diode ratings and characteristics						
Drain-source diode forward voltage (Note2)	$-V_{SD}$	$-I_S$=1A, V_{GS}=0V		0.81	1	V
Maximum continuous drain-source diode forward current	$-I_S$				1.6	A
Maximum pulsed drain-source diode forward current (Note1)	$-I_{SM}$				8	A

Note: 1. Repetitive rating: pulse width limited by maximum junction temperature.
2. Pulse test: Pulse width ≤ 300μs, duty cycle ≤ 2%.
3. Guaranteed by design, not subject to production testing.

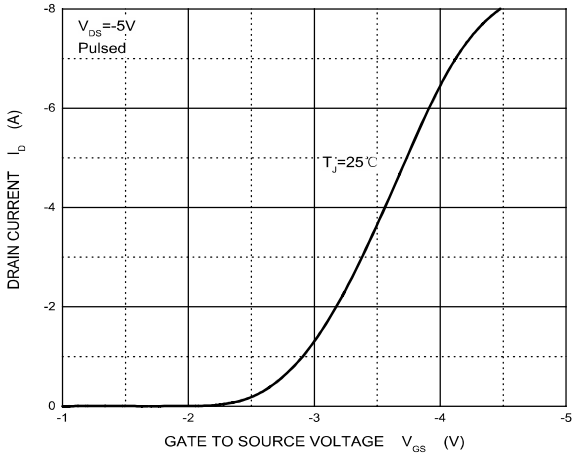
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Rating and characteristic curves

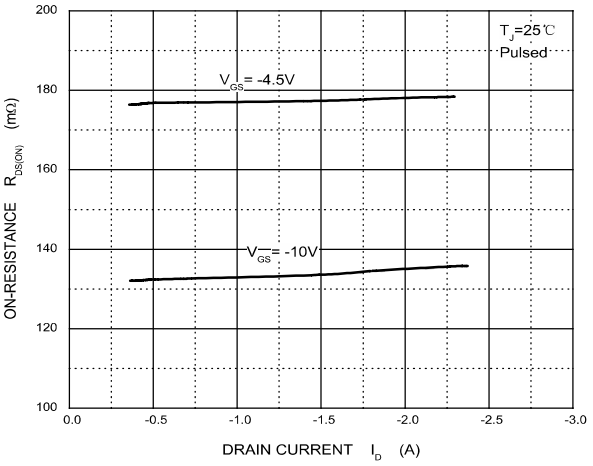
Output Characteristics



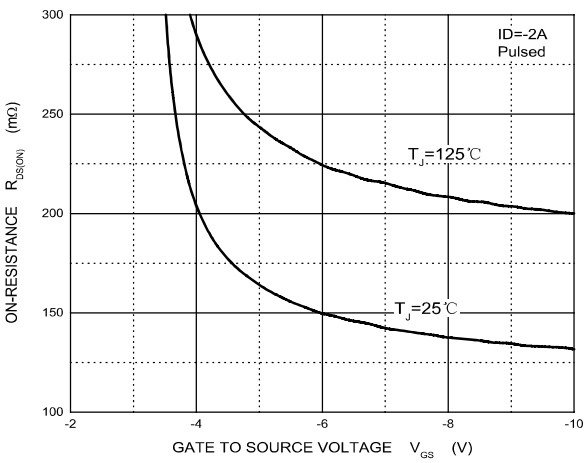
Transfer Characteristics



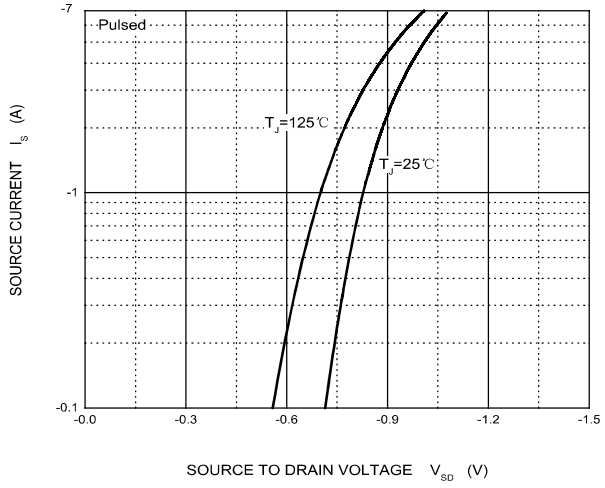
$R_{DS(ON)}$ —— I_D



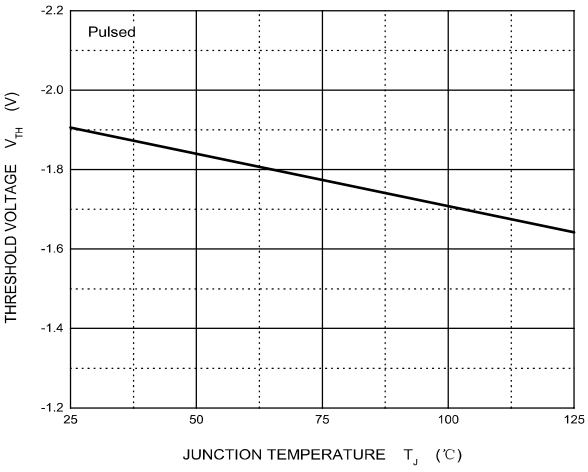
$R_{DS(ON)}$—— V_{GS}



I_S —— V_{SD}

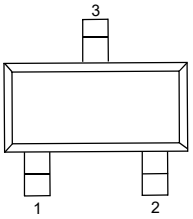
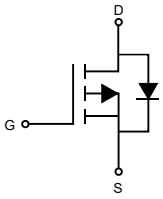


Threshold Voltage



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Pinning information

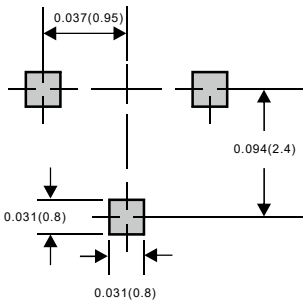
Pin	Simplified outline	Symbol
Pin1 Gate Pin2 Source Pin3 Drain		

Marking

Type Number	Marking code
FMOS2309AF	S09

Suggested solder pad layout

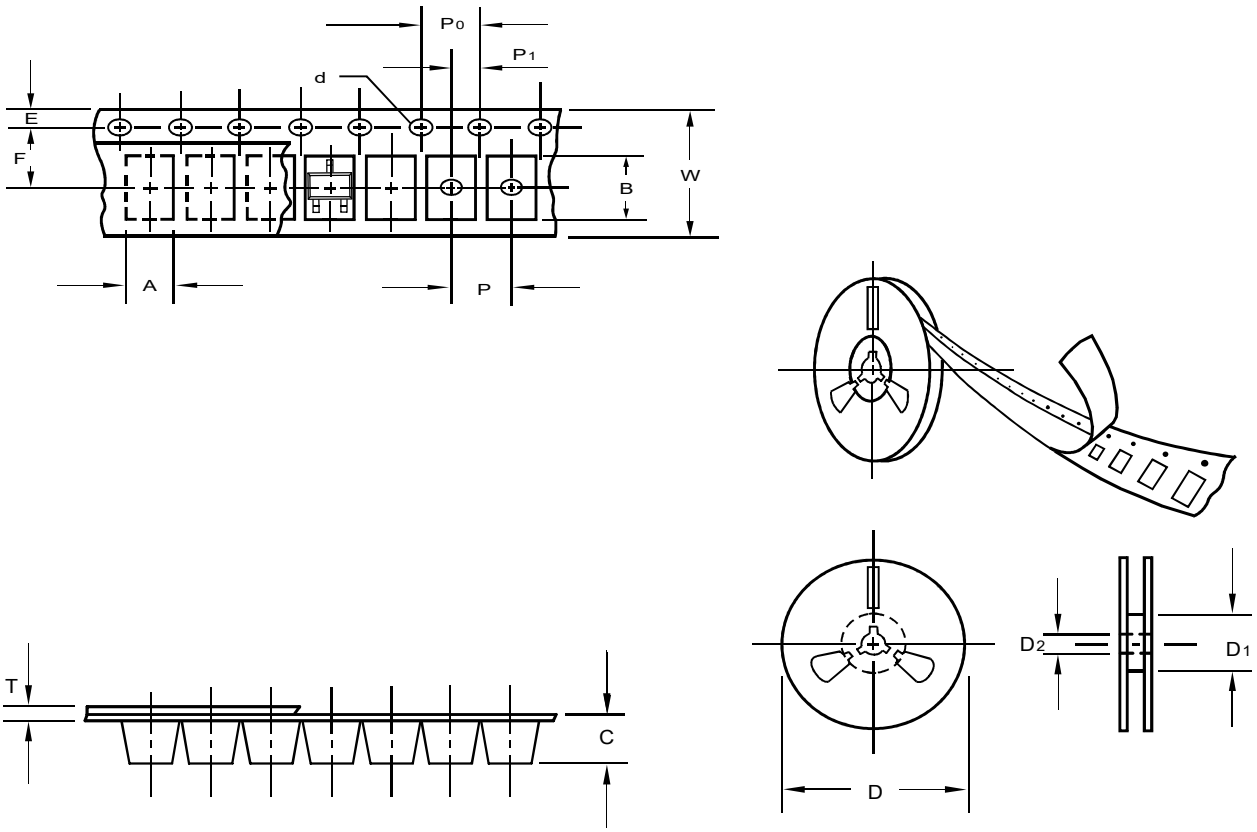
SOT-23



Dimensions in inches and (millimeters)

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Packing information



unit:mm

Item	Symbol	Tolerance	SOT-23
Carrier width	A	1.0	3.15
Carrier length	B	1.0	2.77
Carrier depth	C	1.0	1.22
Sprocket hole	d	0.1	1.50
13" Reel outside diameter	D	2.0	-
13" Reel inner diameter	D_1	min	-
7" Reel outside diameter	D	2.0	178.00
7" Reel inner diameter	D_1	min	54.4
Feed hole diameter	D_2	0.5	13.00
Sprocket hole position	E	0.1	1.75
Punch hole position	F	0.1	3.50
Punch hole pitch	P	0.1	4.00
Sprocket hole pitch	P_0	0.1	4.00
Embossment center	P_1	0.1	2.00
Overall tape thickness	T	0.1	0.20
Tape width	W	0.3	8.00

Note:Devices are packed in accor dance with EIA standar RS-481-A and specifications listed above.

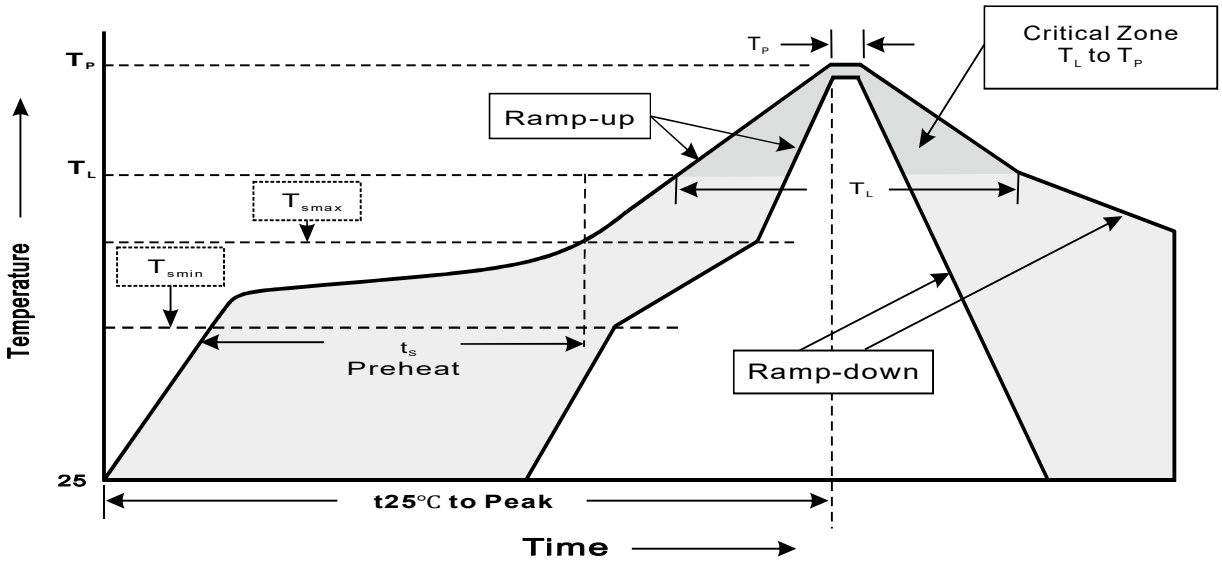
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Reel packing

PACKAGE	REEL SIZE	REEL (pcs)	COMPONENT SPACING (m/m)	BOX (pcs)	INNER BOX (m/m)	REEL DIA, (m/m)	CARTON SIZE (m/m)	CARTON (pcs)
SOT-23	7"	3,000	4.0	30,000	183*123*183	178	382*257*387	240,000

Suggested thermal profiles for soldering processes

1.Storage environment: Temperature=5℃~40℃ Humidity=55%±25%
2.Reflow soldering of surface-mount devices



3.Reflow soldering

Profile feature	Soldering Condition
Average ramp-up rate (T_L to T_P)	< 3℃/sec
Prehaeat -Temperature Min (T_{smin}) -Temperature Max (T_{smax}) -Time (min to max) (t_S)	 150℃ 200℃ 60 ~120sec
T_{smax} to T_L -Ramp-up rate	< 3℃/sec
Time maintained above: -Temperature (T_L) -Time(T_L)	 217℃ 60 ~ 260 sec
Peak Temperature(T_P)	255℃ -0/+5℃
Time within 5℃ of actual peak Temperature(T_P)	10 ~ 30sec
Ramp-down rate	< 6℃/sec
Time 25℃ to peak temperature	< 6 minutes