

Product Summary

Part #	V_{DS}	$R_{DS(on).typ}$ (@ $V_{GS}=4.5V$)	$R_{DS(on).typ}$ (@ $V_{GS}=2.5V$)	I_D
EFM2309	-60V	140m Ω	190m Ω	-2A

Features

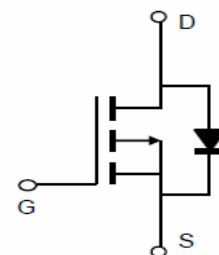
- Low $R_{DS(on)}$ @ $V_{GS}=-10V$
- -5V Logic Level Control
- P Channel SOT23 Package
- Pb-Free, RoHS Compliant

Application

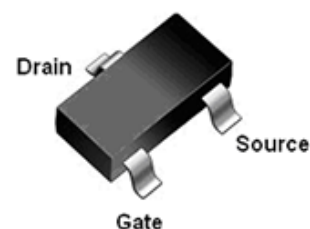
- High-side Load Switch
- Switching Circuits
- High Speed line Driver

Ordering Information:

Part NO.	EFM2309
Marking	N9***
Packing Information	REEL TAPE
Basic ordering unit (pcs)	3000



P-Channel MOSFET



SOT- 23



Absolute Maximum Ratings ($T_C=25^{\circ}C$)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	-60	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current-Continuous	I_D	-2	A
Drain Current-Pulsed ^(Note 1)	I_{DM}	-8	A
Maximum Power Dissipation	P_D	1	W
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	$^{\circ}C$

Thermal Characteristic

Thermal Resistance, Junction-to-Ambient ^(Note 2)	$R_{\theta JA}$	125	$^{\circ}C/W$
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• Static Electrical Characteristics @ $T_J = 25^\circ\text{C}$ (unless otherwise stated)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V I _D =250uA	-60	--	--	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =-60V V _{GS} =0V	--	--	-1	uA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V V _{DS} =0V	--	--	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} I _D =250uA	-1.4	-2.0	-2.6	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =-10V I _D =-2A	--	140	190	mΩ
		V _{GS} =-4.5V I _D =-1.5A	--	190	240	mΩ
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =-30V V _{GS} =0V F=1.0MHz	--	310	--	PF
Output Capacitance	C _{oss}		--	22	--	PF
Reverse Transfer Capacitance	C _{rss}		--	15	--	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =-30V I _D =-2A V _{GS} =-10V R _G =3.3Ω,	--	41	--	nS
Turn-on Rise Time	t _r		--	22	--	nS
Turn-Off Delay Time	t _{d(off)}		--	25	--	nS
Turn-Off Fall Time	t _f		--	32	--	nS
Total Gate Charge	Q _g	V _{DS} =-30V I _D =-2A V _{GS} =-10V	--	5.4	--	nC
Gate-Source Charge	Q _{gs}		--	1.1	--	nC
Gate-Drain Charge	Q _{gd}		--	1.6	--	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V I _S =-2A	--	-0.84	-1.2	V
Diode Forward Current (Note 2)	I _S		--	--	-1.4	A

Notes:

- ① Pulse width limited by maximum allowable junction temperature
 ② Pulse test ; Pulse width $\leq 300\mu s$, duty cycle $\leq 2\%$.

• Typical Characteristics

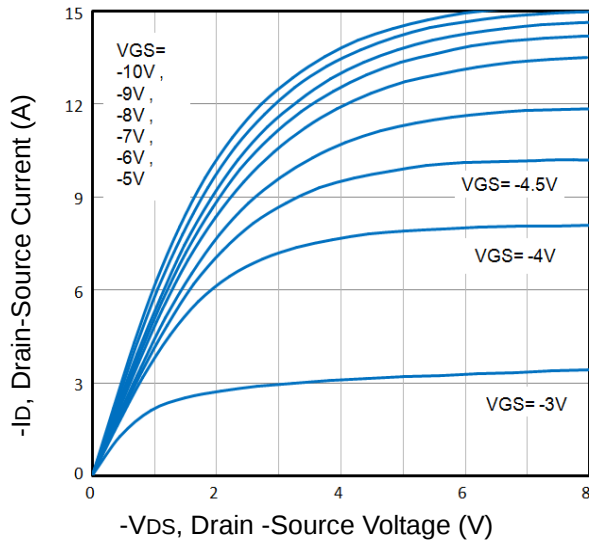


Fig1. Typical Output Characteristics

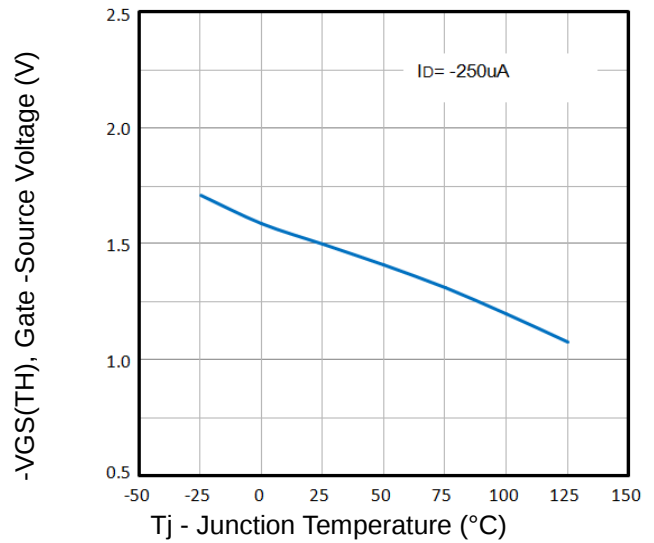


Fig2. Normalized Threshold Voltage Vs. Temperature

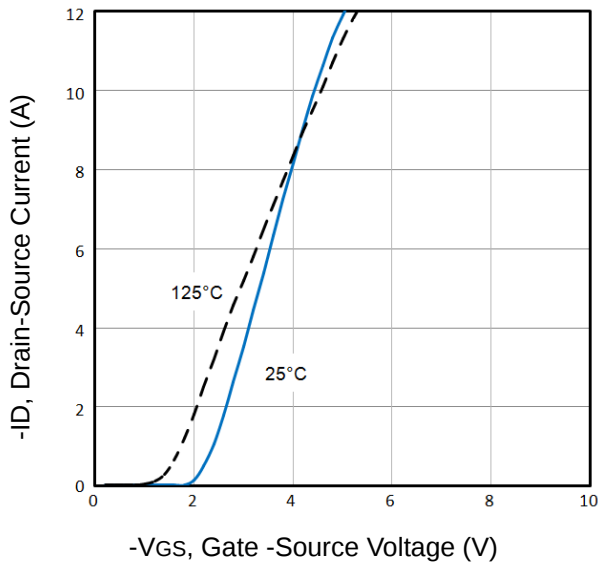


Fig3. Typical Transfer Characteristics

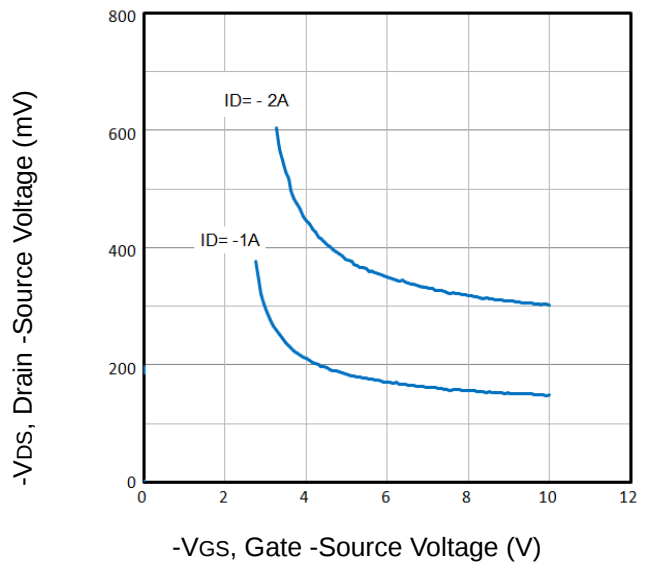


Fig4. Drain-Source Voltage vs Gate-Source Voltage

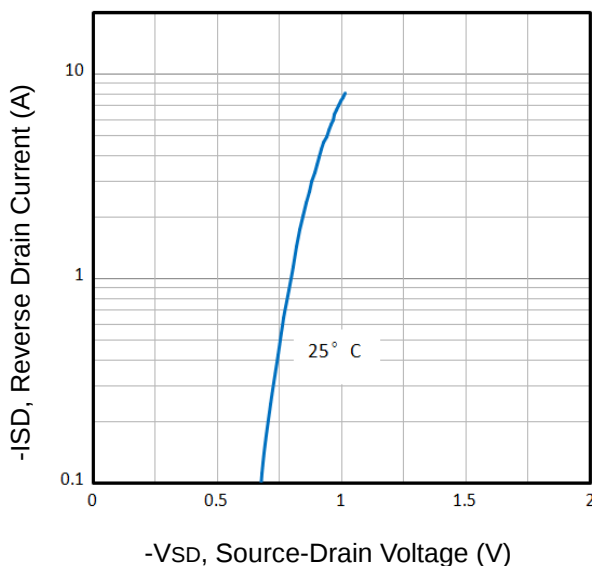


Fig5. Typical Source-Drain Diode Forward Voltage

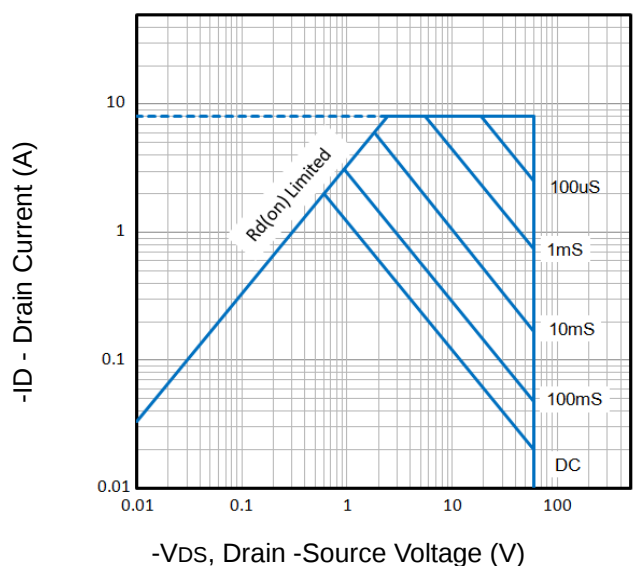


Fig6. Maximum Safe Operating Area

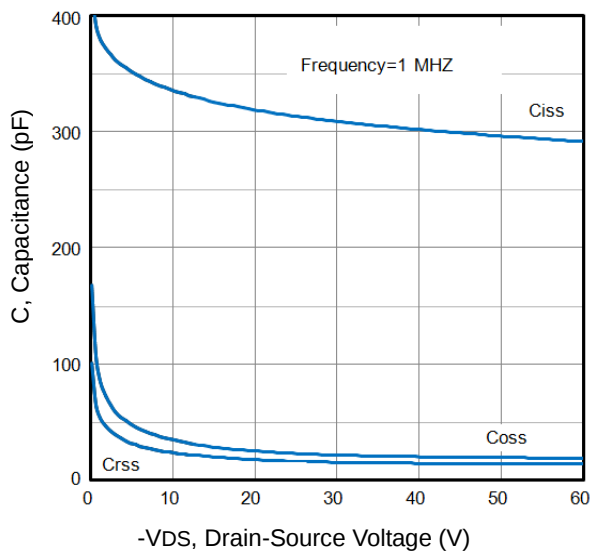


Fig7. Typical Capacitance Vs. Drain-Source Voltage

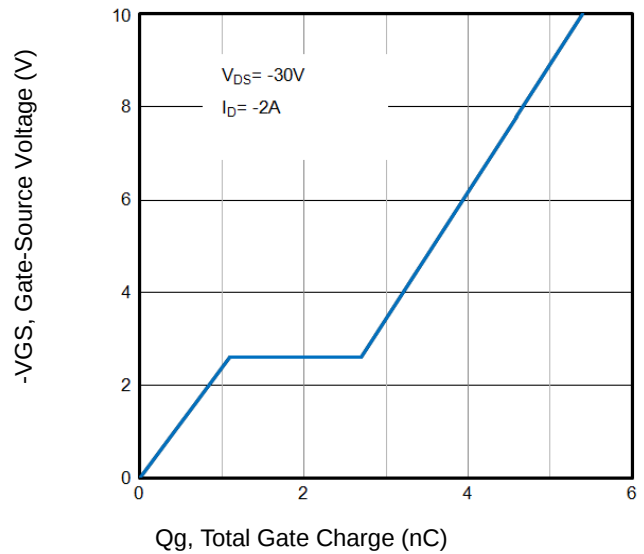


Fig8. Typical Gate Charge Vs. Gate-Source Voltage

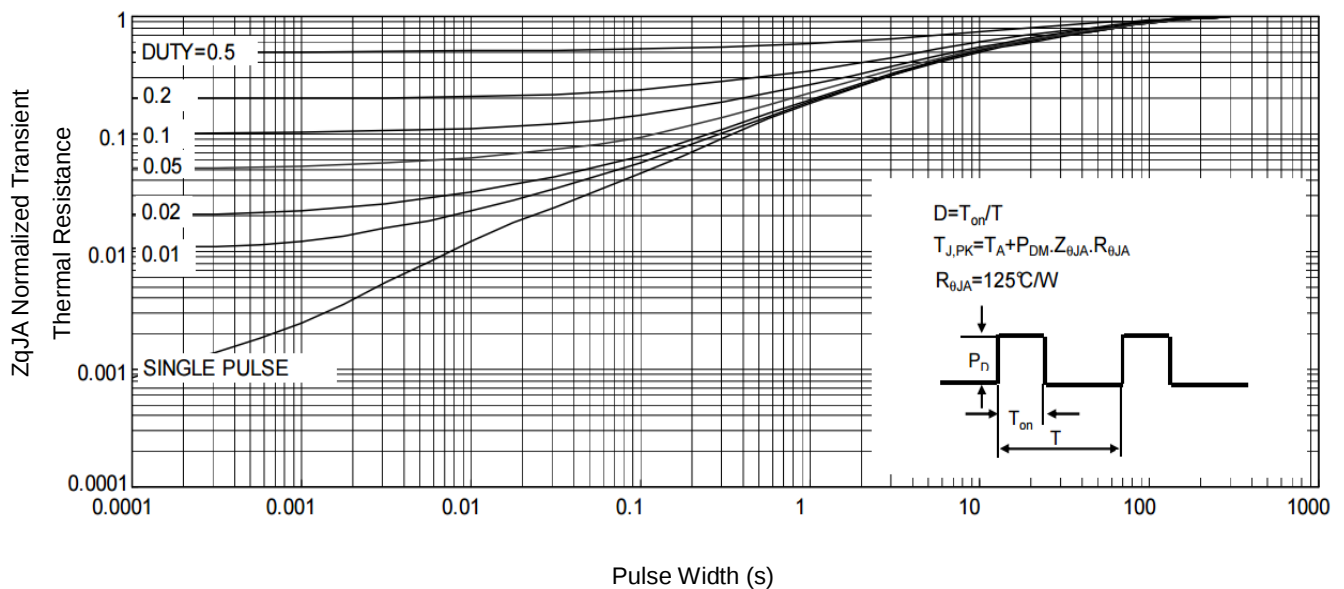


Fig9. Normalized Maximum Transient Thermal Impedance

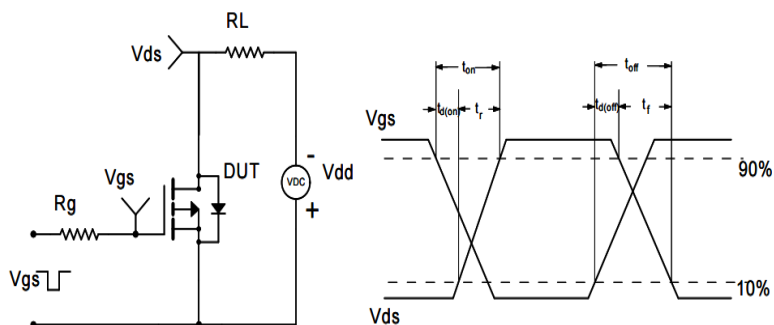
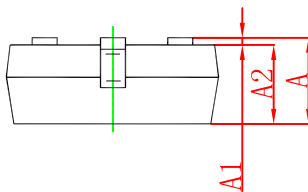
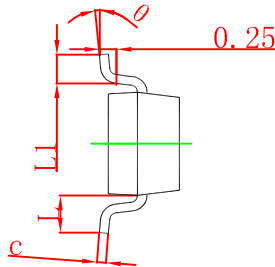
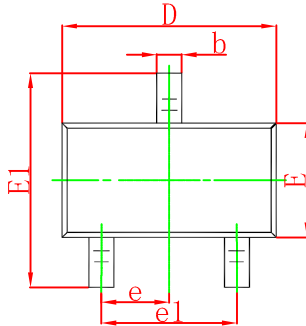
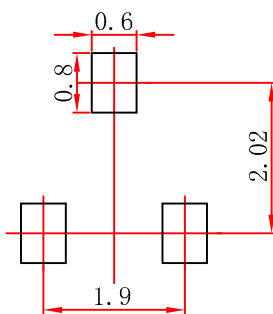


Fig10. Switching Time Test Circuit and waveforms

SOT-23 Package Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP		0.037 TYP	
e1	1.800	2.000	0.071	0.079
L	0.550 REF		0.022 REF	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°



Note:

1. Controlling dimension: in millimeters.
2. General tolerance: $\pm 0.05\text{mm}$.
3. The pad layout is for reference purposes only.