

• Product Summary

Part #	V _{DS}	R _{DS(on)} .typ (@V _{GS} =10V)	R _{DS(on)} .typ (@V _{GS} =4.5V)	I _D
EFM2304	30V	32mΩ	40mΩ	4A

• Features

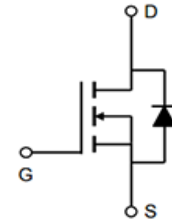
- Low R_{DS(on)} @V_{GS}=10V
- 4.5V Logic Level Control
- N Channel SOT23 Package
- Pb-Free, RoHS Compliant

• Application

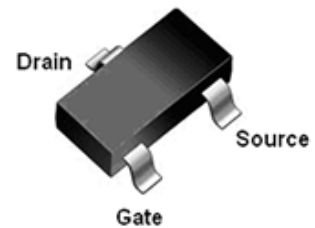
- DC-to-DC converters
- Power management
- Low-side load switch
- Switching circuits
- High-speed line driver

• Ordering Information:

Part NO.	EFM2304
Marking	S4
Packing Information	REEL TAPE
Basic ordering unit (pcs)	3000



N-Channel MOSFET



SOT-23



• Absolute Maximum Ratings (T_C=25°C)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V _{DS}	30	V
Gate-Source Voltage	V _{GS}	±20	V
Drain Current-Continuous	I _D	4	A
Drain Current-Pulsed ^(Note 1)	I _{DM}	18	A
Maximum Power Dissipation	P _D	1.5	W
Operating Junction and Storage Temperature Range	T _J , T _{STG}	-55 To 150	°C

• Thermal Characteristic

Thermal Resistance, Junction-to-Ambient ^(Note 2)	R _{θJA}	100	°C/W
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• Static Electrical Characteristics @ T_J = 25°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	30	--	--	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =30V V _{GS} =0V	--	--	1	μA
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	1.0	1.5	2.5	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =10V I _D =4A	--	32	42	mΩ
		V _{GS} =4.5V I _D =3A	--	40	55	mΩ
Dynamic Characteristics ^(Note4)						
Input Capacitance	C _{ISS}	V _{DS} =15V V _{GS} =0V F=1.0MHz	--	357	--	PF
Output Capacitance	C _{OSS}		--	52	--	PF
Reverse Transfer Capacitance	C _{RSS}		--	45	--	PF
Gate Resistance	R _g	F=1.0MHz	--	9	--	Ω
Switching Characteristics ^(Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =15V I _D =4A V _{GS} =10V R _G =3.3Ω,	--	7	--	nS
Turn-on Rise Time	t _r		--	18	--	nS
Turn-Off Delay Time	t _{d(off)}		--	25	--	nS
Turn-Off Fall Time	t _f		--	11	--	nS
Total Gate Charge	Q _g	V _{DS} =15V I _D =4A V _{GS} =10V	--	6.7	--	nC
Gate-Source Charge	Q _{gs}		--	3.4	--	nC
Gate-Drain Charge	Q _{gd}		--	1.5	--	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage ^(Note 3)	V _{SD}	V _{GS} =0V I _S =4A	--	0.79	1.2	V
Diode Forward Current ^(Note 2)	I _S		--	--	1.8	A

Notes:

- ① Pulse width limited by maximum allowable junction temperature
 ② Pulse test ; Pulse width≤300μs, duty cycle≤2%.

• Typical Characteristics

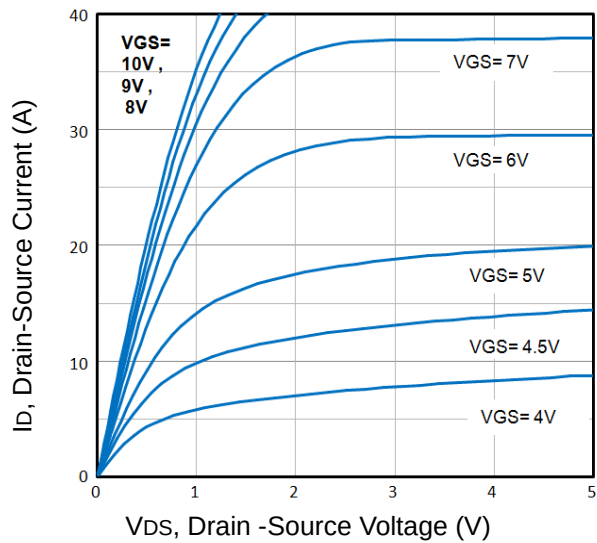


Fig1. Typical Output Characteristics

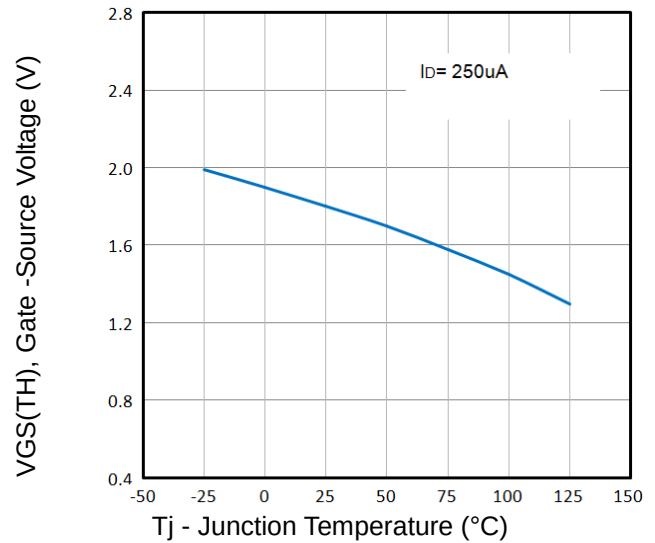


Fig2. Normalized Threshold Voltage Vs. Temperature

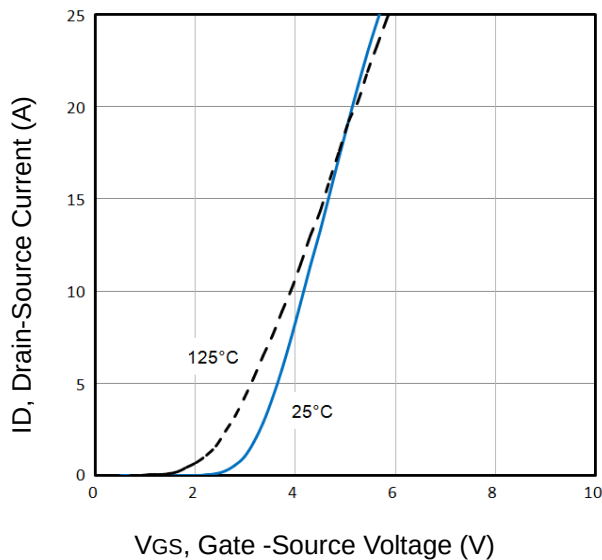


Fig3. Typical Transfer Characteristics

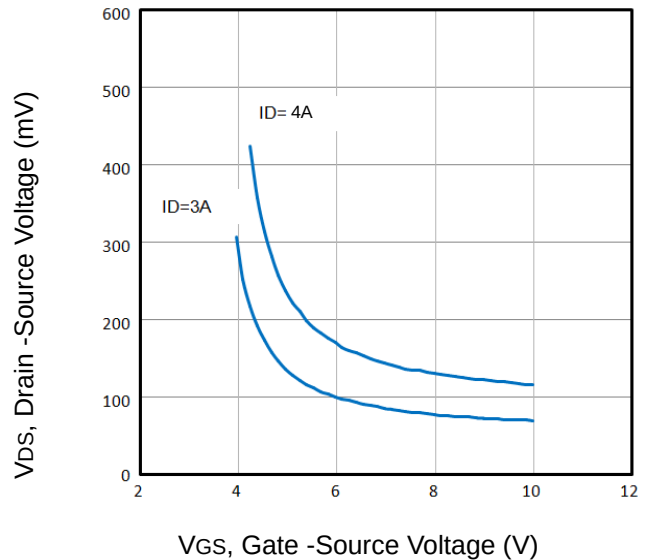


Fig4. Drain-Source Voltage vs Gate-Source Voltage

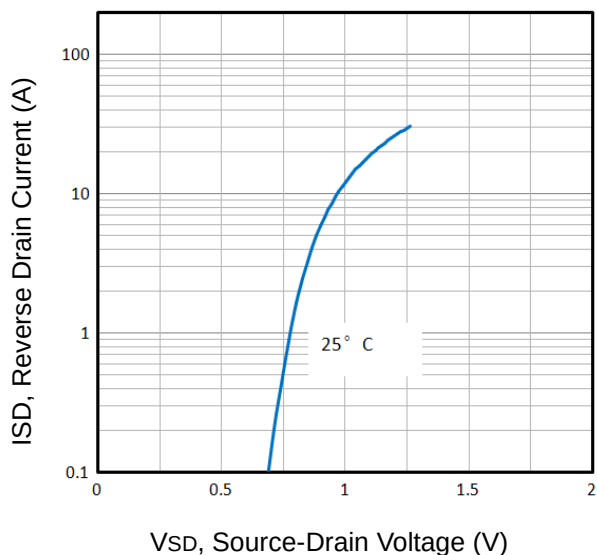


Fig5. Typical Source-Drain Diode Forward Voltage

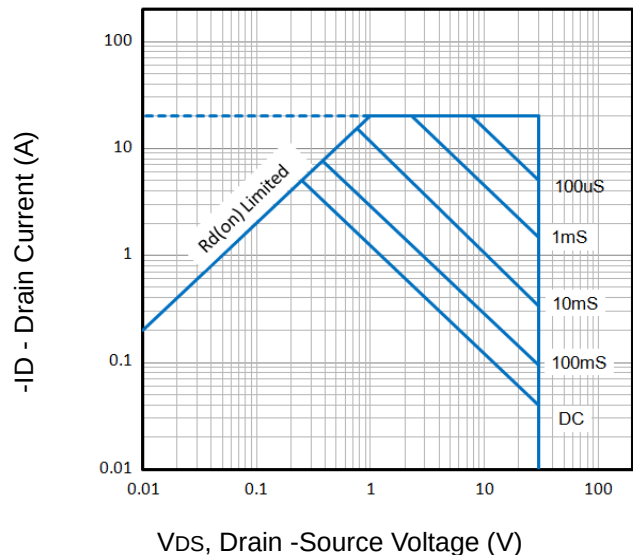


Fig6. Maximum Safe Operating Area

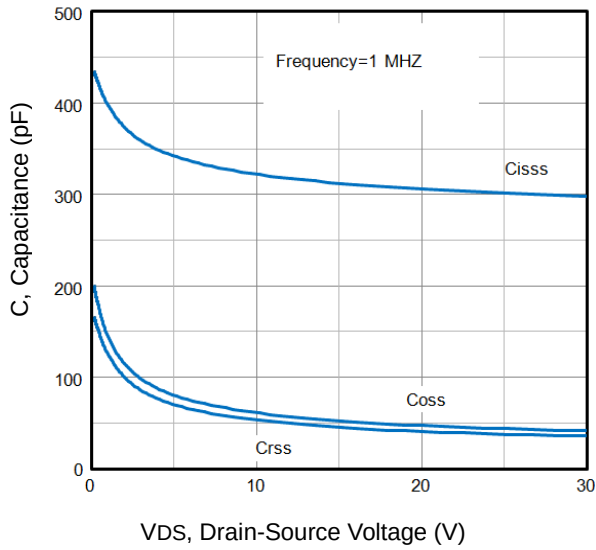


Fig7. Typical Capacitance Vs. Drain-Source Voltage

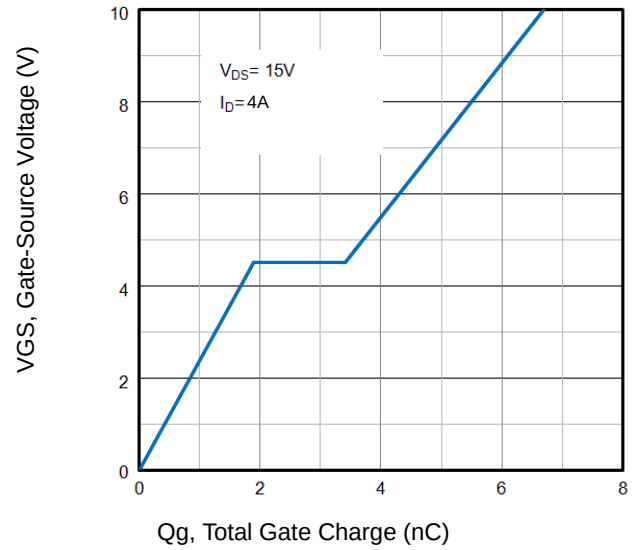


Fig8. Typical Gate Charge Vs. Gate-Source Voltage

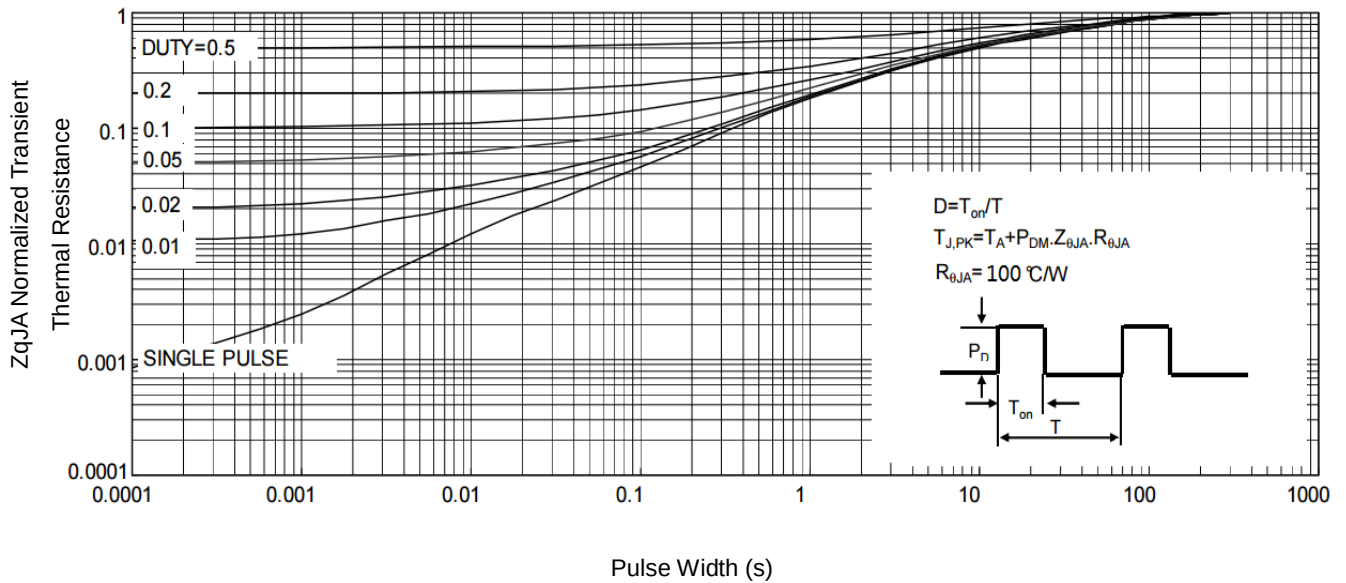


Fig9. Normalized Maximum Transient Thermal Impedance

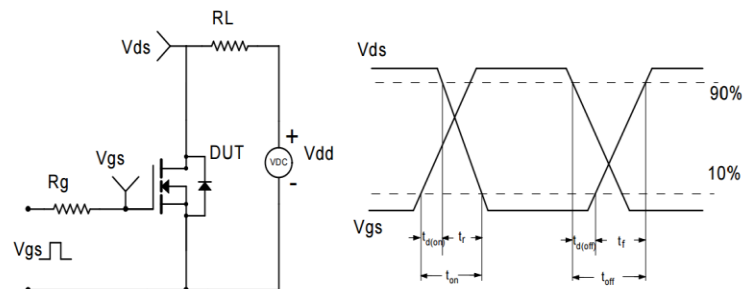
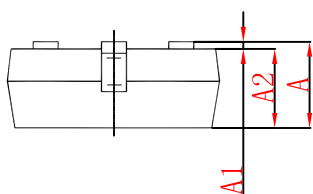
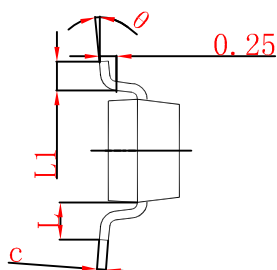
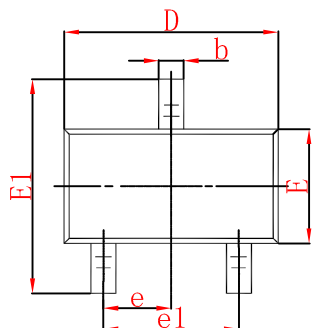
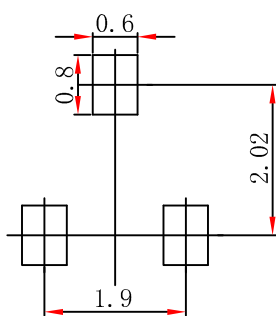


Fig10. Switching Time Test Circuit and waveforms

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.