

• Product Summary

Part #	V _{DS}	R _{DS(on)} .typ (@V _{GS} =10V)	R _{DS(on)} .typ (@V _{GS} =4.5V)	I _D
EFM2304A	30V	32mΩ	40mΩ	4A

• Features

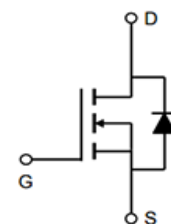
- Low R_{DS(on)} @V_{GS}=10V
- 4.5V Logic Level Control
- N Channel SOT23-3L Package
- Pb-Free, RoHS Compliant

• Application

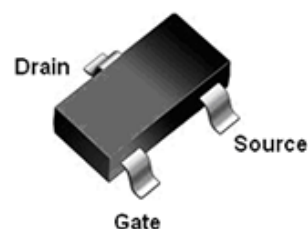
- DC-to-DC converters
- Power management
- Low-side load switch
- Switching circuits
- High-speed line driver

• Ordering Information:

Part NO.	EFM2304A
Marking	L4***
Packing Information	REEL TAPE
Basic ordering unit (pcs)	3000



N-Channel MOSFET



SOT23-3L



• 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 @ $T_J = 25^{\circ}\text{C}$ (unless otherwise stated)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V$ $I_D=250\mu A$	30	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=30V$ $V_{GS}=0V$	--	--	1	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 20V$ $V_{DS}=0V$	--	--	± 100	nA
On Characteristics ^(Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}$ $I_D=250\mu A$	1.0	1.5	2.5	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=10V$ $I_D=4A$	--	32	42	m Ω
		$V_{GS}=4.5V$ $I_D=3A$	--	40	55	m Ω
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	$t_{d(on)}$	$V_{DD}=15V$ $I_D=4A$ $V_{GS}=10V$ $R_G=3.3\Omega$,	--	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 $\leq 300\mu s$, duty cycle $\leq 2\%$.

• Typical Characteristics

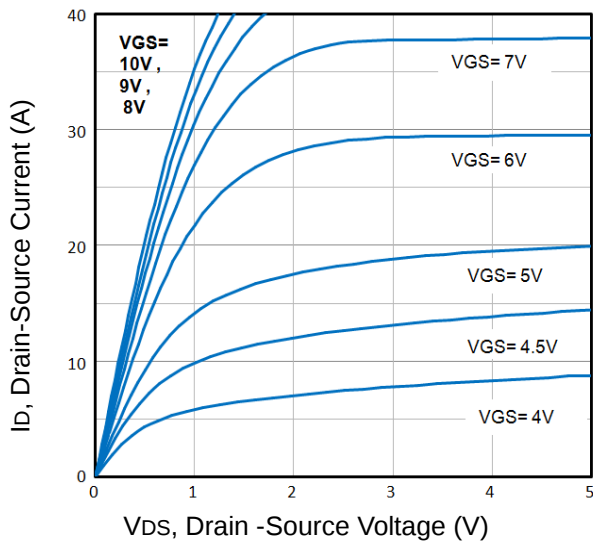


Fig1. Typical Output Characteristics

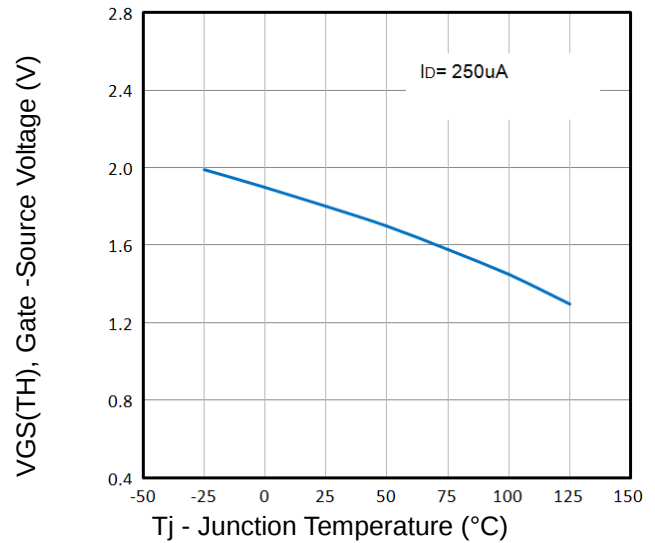


Fig2. Normalized Threshold Voltage Vs. Temperature

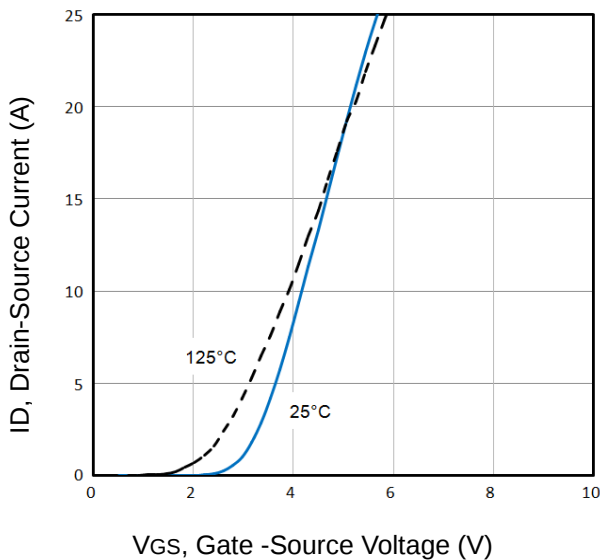


Fig3. Typical Transfer Characteristics

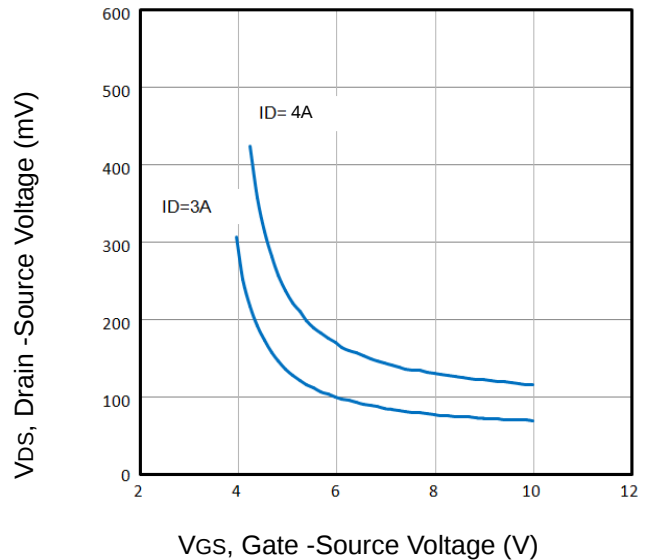


Fig4. Drain-Source Voltage vs Gate-Source Voltage

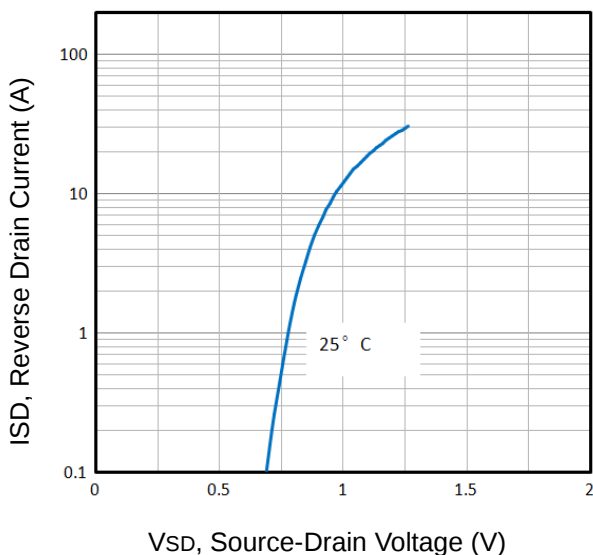


Fig5. Typical Source-Drain Diode Forward Voltage

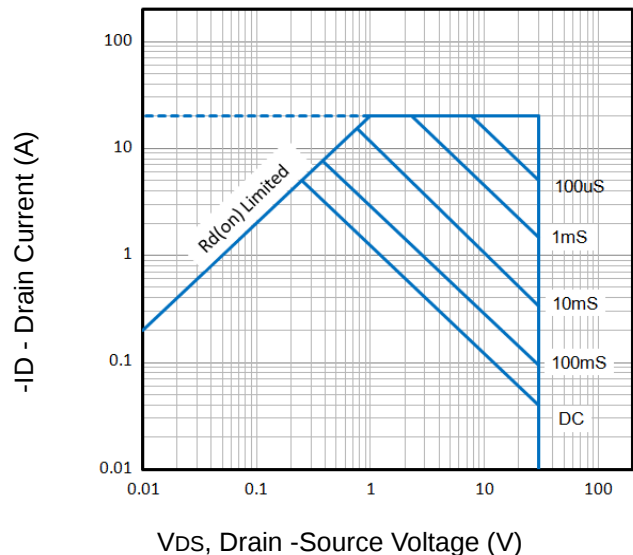


Fig6. Maximum Safe Operating Area

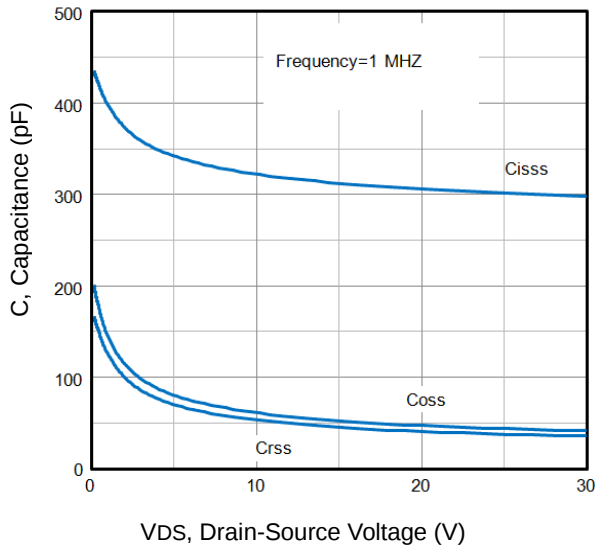


Fig7. Typical Capacitance Vs. Drain-Source Voltage

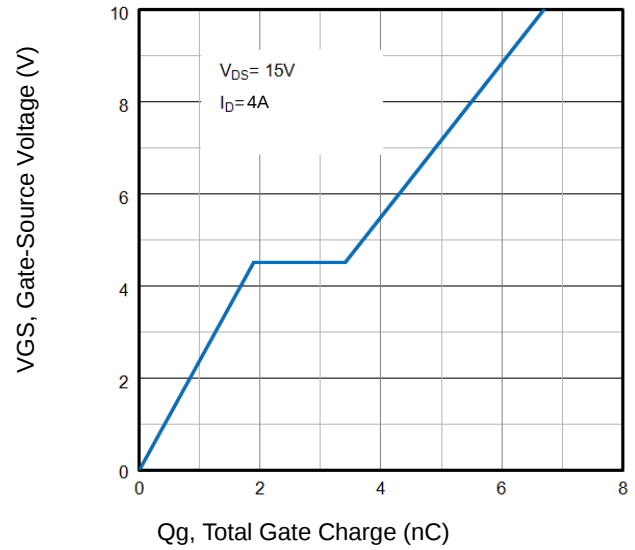


Fig8. Typical Gate Charge Vs. Gate-Source Voltage

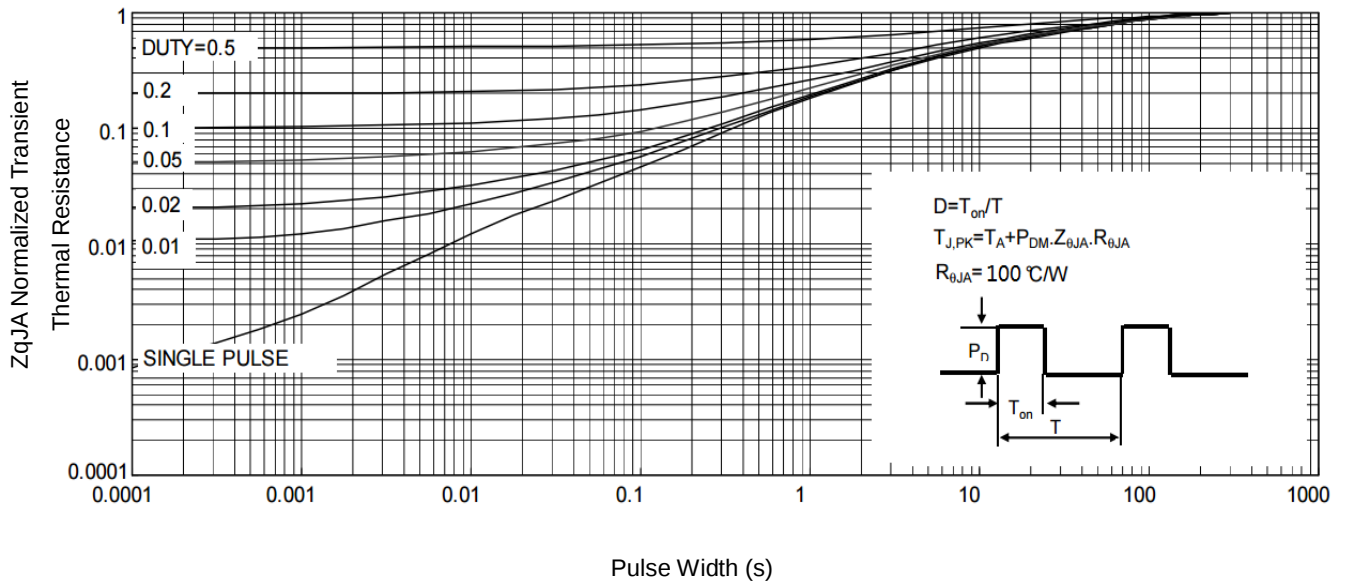


Fig9. Normalized Maximum Transient Thermal Impedance

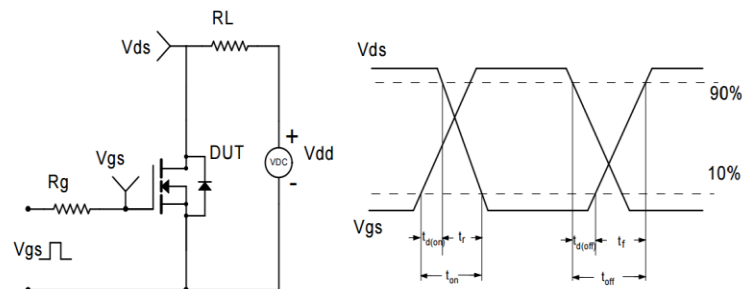
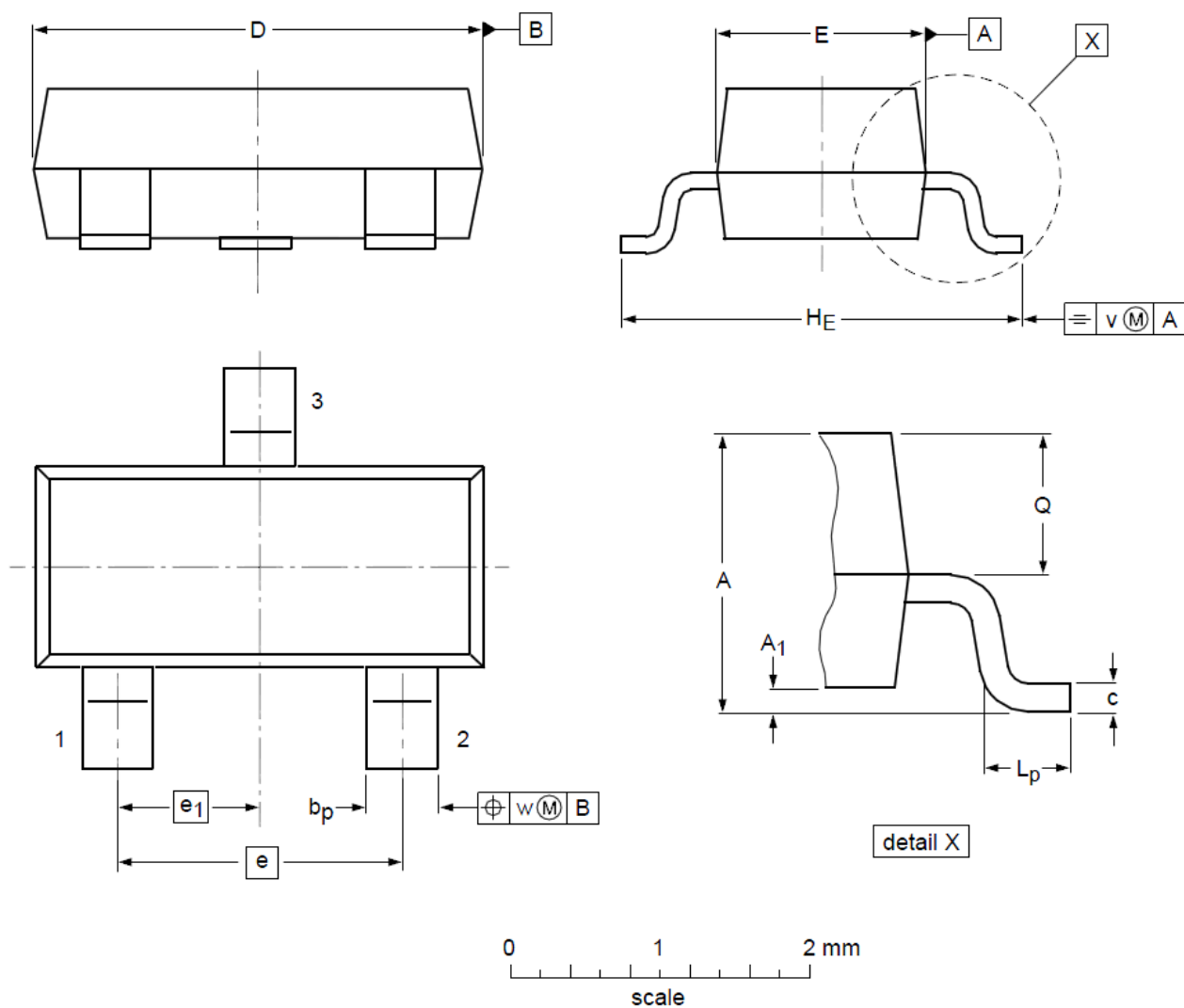


Fig10. Switching Time Test Circuit and waveforms

SOT23-3L Package Outline Dimensions



DIMENSIONS (unit : mm)

Symbol	Min	Typ	Max	Symbol	Min	Typ	Max
A	1.00	1.17	1.30	A₁	0.01	0.05	0.10
b_p	0.35	0.39	0.50	c	0.10	0.20	0.26
D	2.70	2.90	3.10	E	1.30	1.58	1.70
e	--	1.90	--	e₁	--	0.95	--
H_E	2.50	2.78	3.00	L_p	0.20	0.32	0.60
Q	0.23	0.27	0.33	v	--	0.20	--
w	--	0.20	--				