

Product Summary

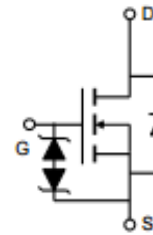
Part #	V_{DS}	$R_{DS(on).typ}$ (@ $V_{GS}=4.5V$)	$R_{DS(on).typ}$ (@ $V_{GS}=2.5V$)	I_D
EFM3416	20V	15m Ω	20m Ω	6.5A

Features

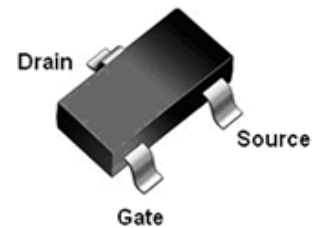
- Low $R_{DS(on)}$ @ $V_{GS}=4.5V$
- 2.5V Logic Level Control
- N Channel SOT23 Package
- Pb-Free, RoHS Compliant

Application

- Load Switch
- Battery switch
- DC/DC Converter
- BD portables



N-Channel MOSFET



SOT-23



Ordering Information:

Part NO.	EFM3416
Marking	3416
Packing Information	REEL TAPE
Basic ordering unit (pcs)	3000

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	20	V
Gate-Source Voltage	V_{GS}	± 12	V
Drain Current-Continuous	I_D	6.5	A
Drain Current-Pulsed ^(Note 1)	I_{DM}	26	A
Maximum Power Dissipation	P_D	1.56	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)	$R_{\theta JA}$	80	$^{\circ}C/W$
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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}	$V_{GS}=0V$ $I_D=250\mu A$	20	--	--	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=20V$ $V_{GS}=0V$	--	--	1	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 12V$ $V_{DS}=0V$	--	--	± 10	μA
On Characteristics ^(Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}$ $I_D=250\mu A$	0.4	0.7	1.0	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=4.5V$ $I_D=6.5A$	--	15	20	m Ω
		$V_{GS}=2.5V$ $I_D=5A$	--	20	25	m Ω
Dynamic Characteristics ^(Note4)						
Input Capacitance	C_{ISS}	$V_{DS}=10V$ $V_{GS}=0V$ $F=1.0MHz$	--	450	--	PF
Output Capacitance	C_{OSS}		--	108	--	PF
Reverse Transfer Capacitance	C_{RSS}		--	80	--	PF
Switching Characteristics ^(Note 4)						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=10V$ $I_D=1A$ $V_{GS}=4.5V$ $R_G=3.3\Omega$,	--	285	--	nS
Turn-on Rise Time	t_r		--	345	--	nS
Turn-Off Delay Time	$t_{d(off)}$		--	5.8	--	nS
Turn-Off Fall Time	t_f		--	4.2	--	nS
Total Gate Charge	Q_g	$V_{DS}=10V$ $I_D=6.5A$ $V_{GS}=4.5V$	--	8.3	--	nC
Gate-Source Charge	Q_{gs}		--	1.4	--	nC
Gate-Drain Charge	Q_{gd}		--	4.7	--	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage ^(Note 3)	V_{SD}	$V_{GS}=0V$ $I_S=6.5A$	--	0.79	1.2	V
Diode Forward Current ^(Note 2)	I_S		--	--	2	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

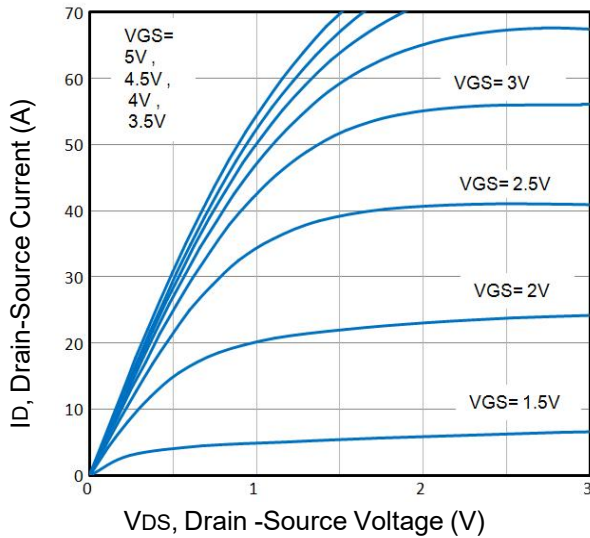


Fig1. Typical Output Characteristics

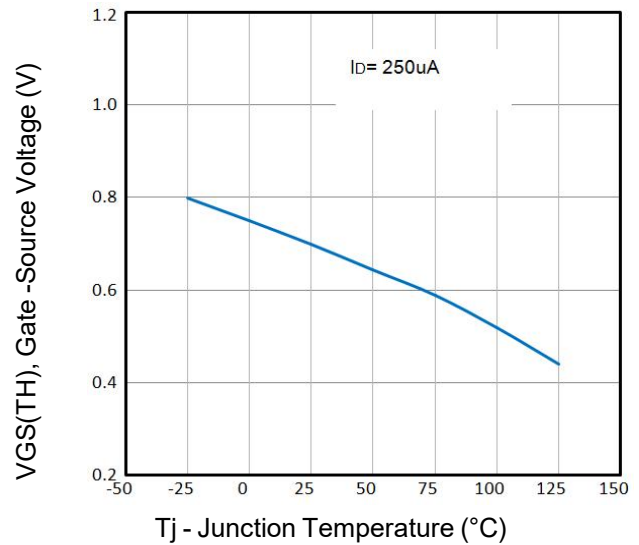


Fig2. VGS(TH) Voltage Vs. Temperature

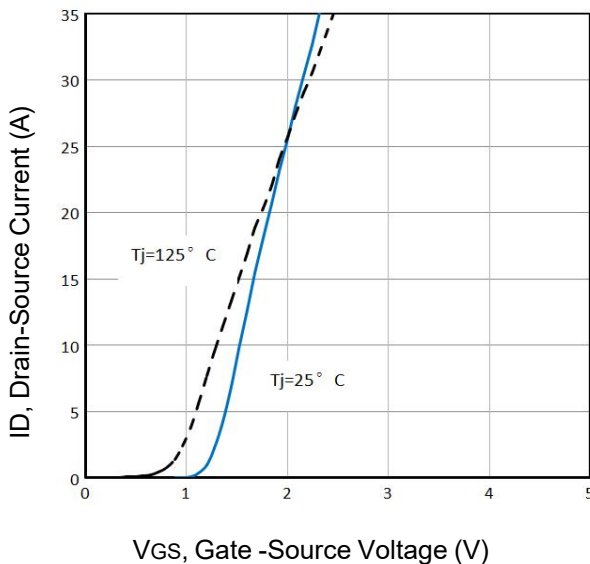


Fig3. Typical Transfer Characteristics

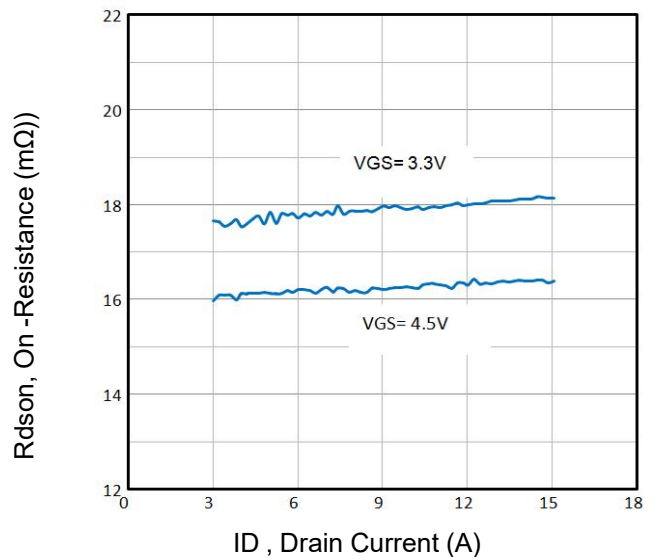


Fig4. On-Resistance vs. Drain Current and Gate

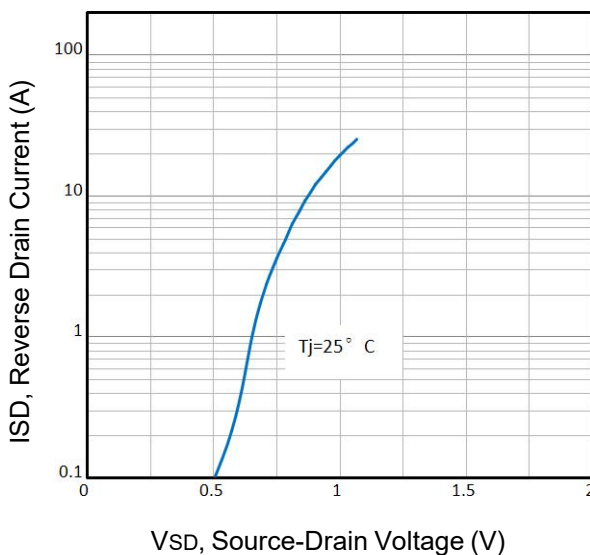


Fig5. Typical Source-Drain Diode Forward Voltage

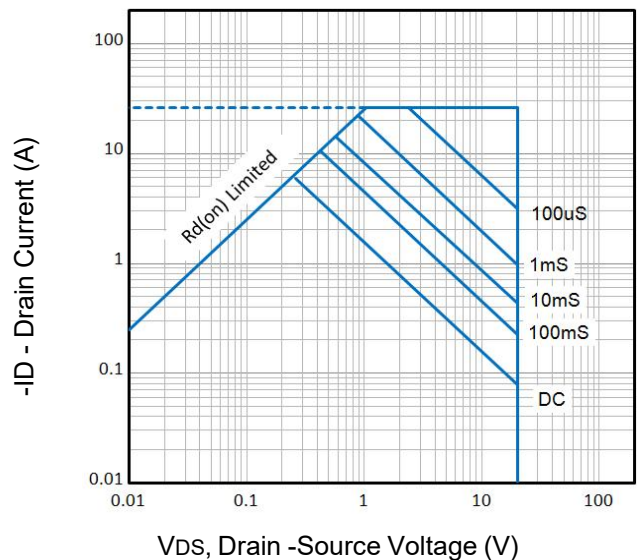


Fig6. Maximum Safe Operating Area

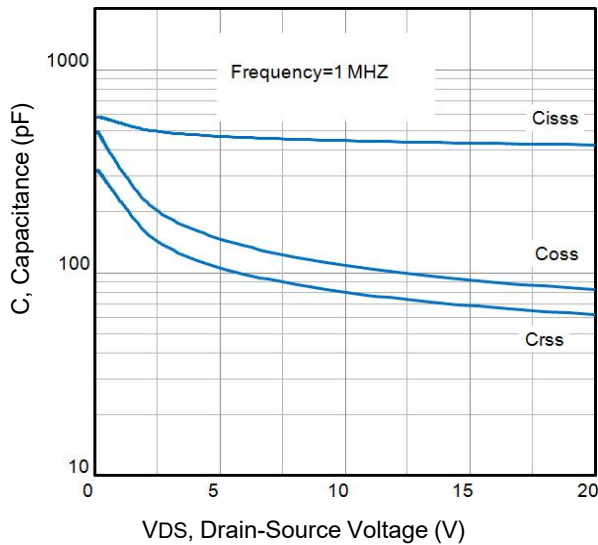


Fig7. Typical Capacitance Vs. Drain-Source Voltage

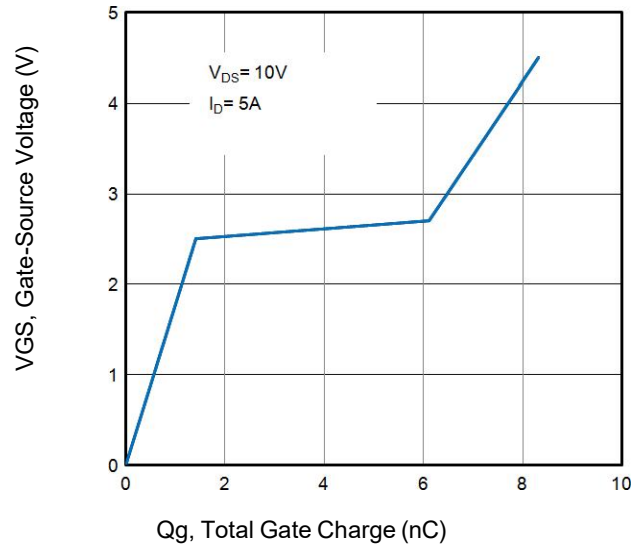


Fig8. Typical Gate Charge Vs. Gate-Source Voltage

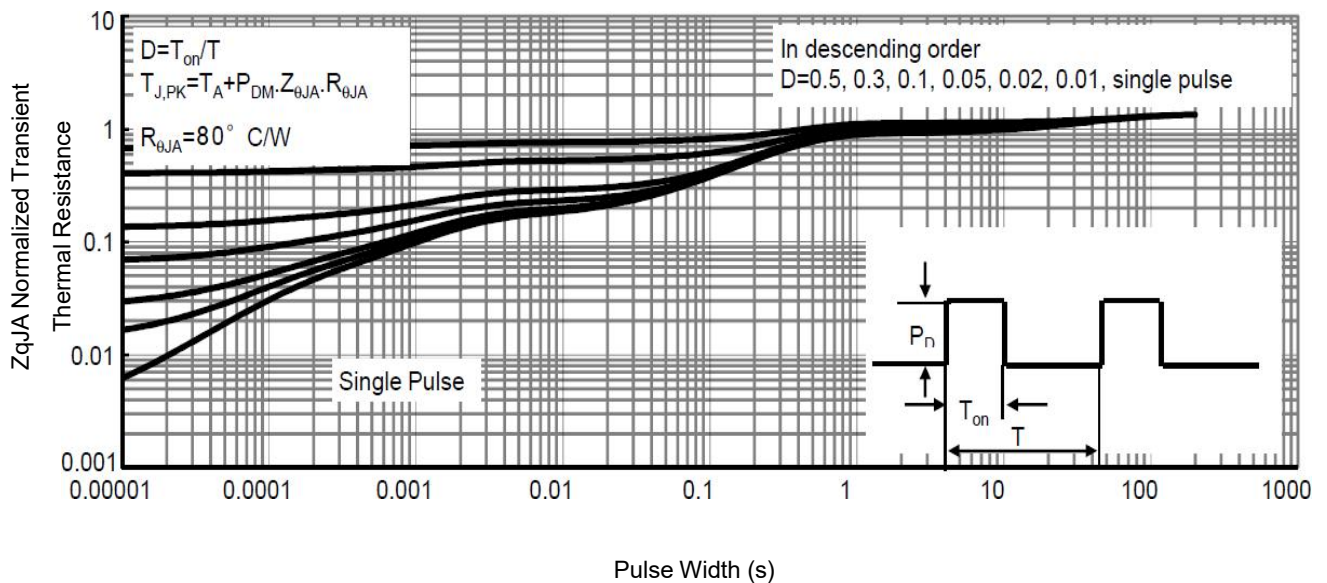


Fig9. Normalized Maximum Transient Thermal Impedance

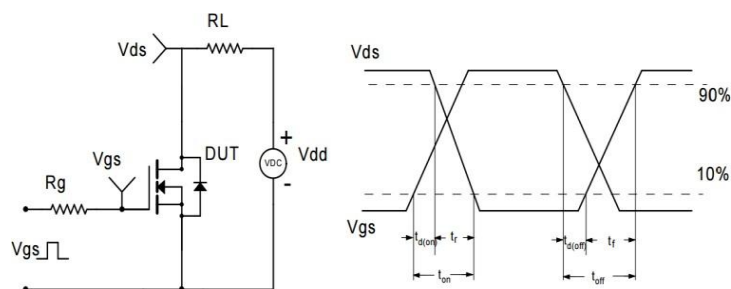
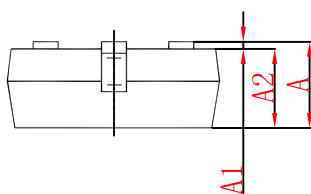
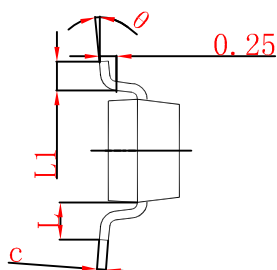
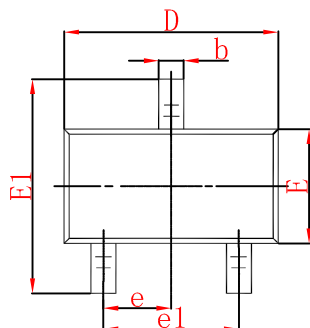
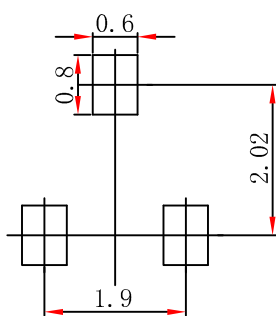


Fig10. Switching Time Test Circuit and waveforms

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.