

P-Channel Enhancement Mode Power MOSFET

Description

The TF4409 uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge and operation with gate voltages as low as 4.5V.

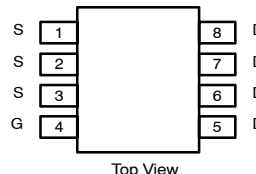
General Features

- $V_{DS} = -30V$
- $R_{DS(ON)} < 11.5m\Omega @ V_{GS} = -4.5V \quad I_D = -12.0A$
- $R_{DS(ON)} < 8.5m\Omega @ V_{GS} = -10V \quad I_D = -15.0A$
- High power and current handling capability
- Lead free product is acquired
- Surface mount package

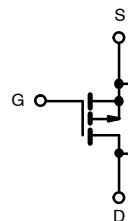
Application

- Battery Switch
- Load switch
- Power management

SOP-8



Equivalent Circuit



MARKING



Y :year code W :week code

Absolute Maximum Ratings ($T_A = 25^\circ C$, unless otherwise noted)

Symbol	Parameter	Ratings	Units
V_{DS}	Drain-Source Voltage	-30	V
V_{GS}	Gate-Source Voltage	± 20	V
I_D	Drain Current @ $T_A = 25^\circ C$	-15	A
I_{DM}	Drain Current (Pulsed) ^a	-60	A
I_{AR}	Avalanche Current	30	A
E_{AR}	Repetitive Avalanche Energy $L = 0.3mH$	135	mJ
P_D	Total Power Dissipation @ $T_A = 25^\circ C$	3.1	W
	Total Power Dissipation @ $T_A = 75^\circ C$	2.1	
I_S	Maximum Diode Forward Current	-2.1	A
T_J, T_{stg}	Operating Junction and Storage Temperature Range	-55 to +150	$^\circ C$
$R_{\theta JA}$	Thermal Resistance Junction to Ambient (PCB mounted) ^b	40	$^\circ C/W$

a: Repetitive Rating: Pulse width limited by the maximum junction temperature.

b: 1-in² 2oz Cu PCB board

SOP-8 Plastic-Encapsulate MOSFETS

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Electrical Characteristics (T_A=25°C, unless otherwise noted)

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
• Off Characteristics						
BV _{DSS}	Drain-Source Breakdown Voltage	V _{GS} =0V, I _D =-250uA	-30	-	-	V
I _{DSS}	Zero Gate Voltage Drain Current	V _{DS} =-24V, V _{GS} =0V	-	-	-1	uA
I _{GSS}	Gate-Body Leakage Current	V _{GS} =±25V, V _{DS} =0V	-	-	±100	nA
• On Characteristics ^c						
V _{GS(th)}	Gate Threshold Voltage	V _{DS} =V _{GS} , I _D =-250uA	-1.0	-1.5	-3.0	V
I _{DS(on)}	On State Drain Current	V _{DS} =-5V, V _{GS} =-10V	60	-	-	A
R _{DS(on)}	Drain-Source On-State Resistance	V _{GS} =-10V, I _D =-15A	-	8.5	10	mΩ
		V _{GS} =-4.5V, I _D =-12A	-	11.5	13	
g _{FS}	Forward Transconductance	V _{DS} =-10V, I _D =-5A	-	26	-	S
• Dynamic Characteristics ^d						
C _{iss}	Input Capacitance	V _{DS} =-15V, V _{GS} =0V, f=1MHz	-	2900	-	pF
C _{oss}	Output Capacitance		-	410	-	
C _{rss}	Reverse Transfer Capacitance		-	280	-	
R _g	Gate Resistance	V _{DS} =0V, V _{GS} =0V, f=1MHz	1	2	3	Ω
• Switching Characteristics ^d						
Q _g	Total Gate Charge	V _{DS} =-15V, I _D =-10A, V _{GS} =-10V	-	48	-	nC
Q _{gs}	Gate-Source Charge		-	12	-	
Q _{gd}	Gate-Drain Charge		-	14	-	
t _{d(on)}	Turn-on Delay Time	V _{DD} =-15V, I _D =-10A, V _{GS} =-10V, R _G =3Ω	-	15	-	nS
t _r	Turn-on Rise Time		-	11	-	
t _{d(off)}	Turn-off Delay Time		-	44	-	
t _f	Turn-off Fall Time		-	21	-	
t _{rr}	Reverse Recovery Time	I _{DS} =-12A, dI/ dt=100A/ uS	-	33	40	nS
Q _{rr}	Reverse Recovery Charge		-	23	-	nC
• Drain-Source Diode Characteristics						
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} =0V, I _S =-1A	-	-	-1	V
I _S	Drain-Source Diode Forward Current		-	-	-2.1	A

Note: Pulse Test: Pulse Width ≤300us, Duty Cycle≤2%

Typical Electrical and Thermal Characteristics

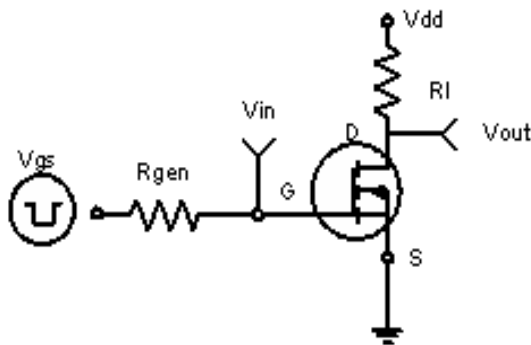


Figure 1 Switching Test Circuit

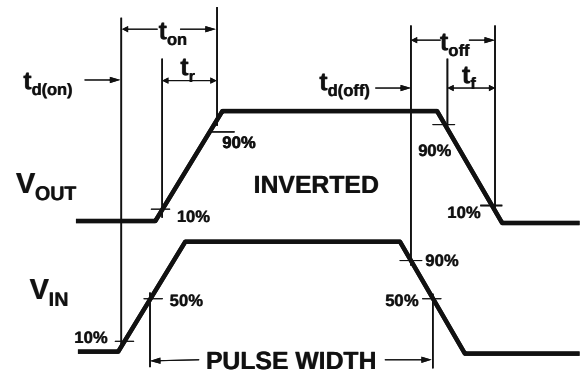


Figure 2 Switching Waveforms

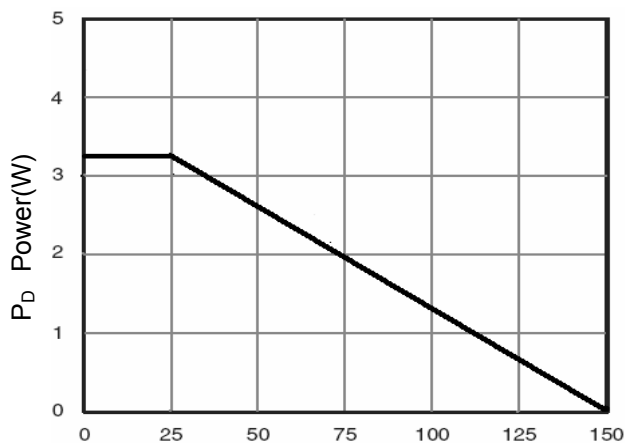


Figure 3 Power Dissipation

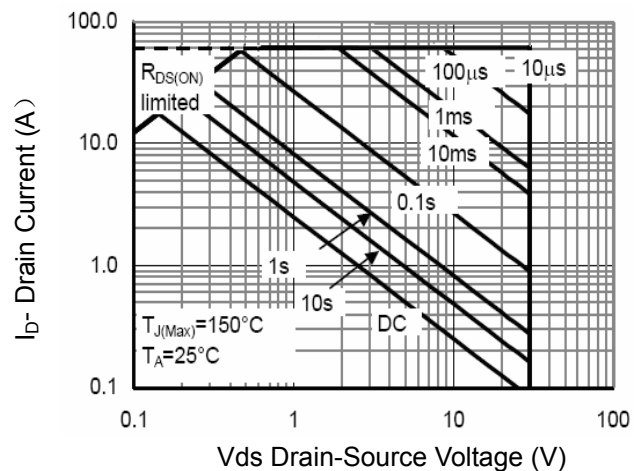


Figure 4 Safe Operation Area

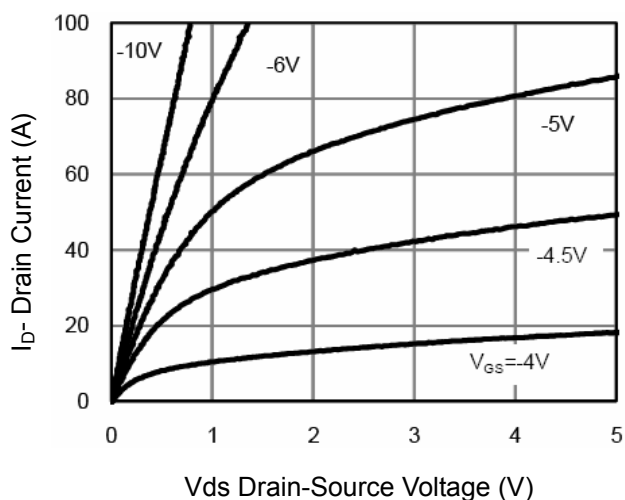


Figure 5 Output Characteristics

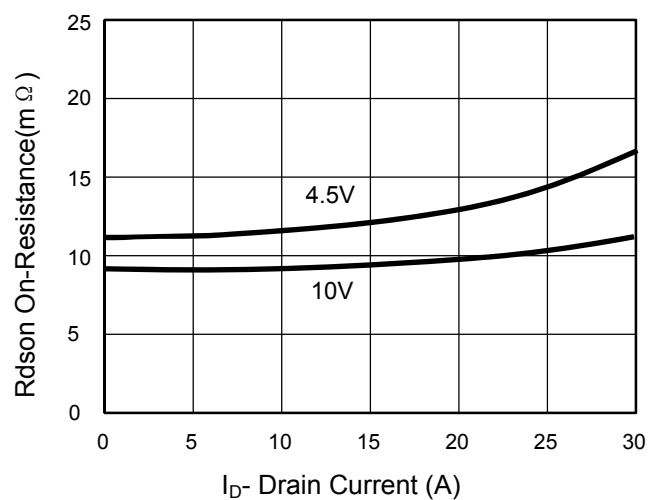


Figure 6 Drain-Source On-Resistance

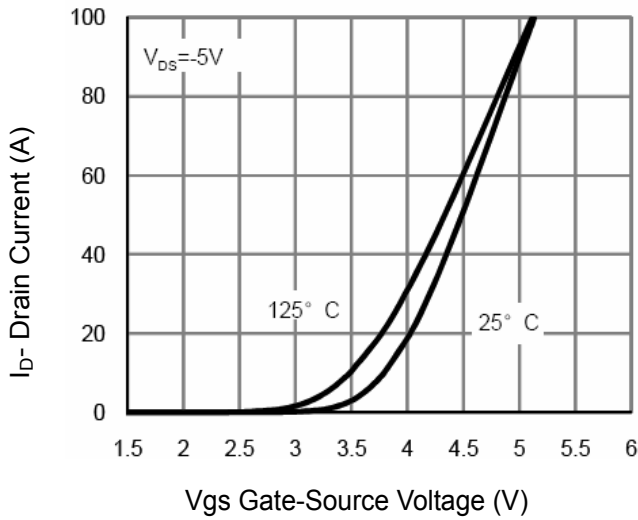


Figure 7 Transfer Characteristics

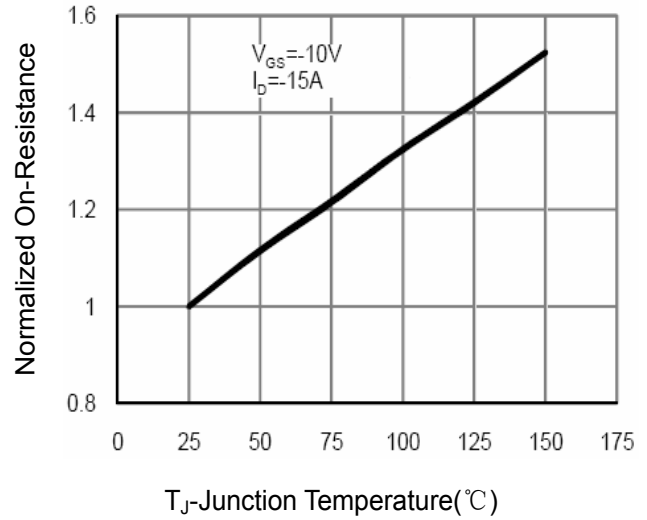


Figure 8 Drain-Source On-Resistance

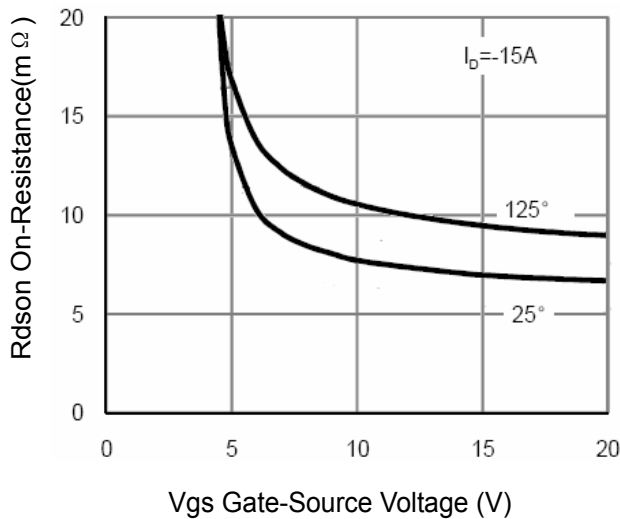


Figure 9 Rdson vs Vgs

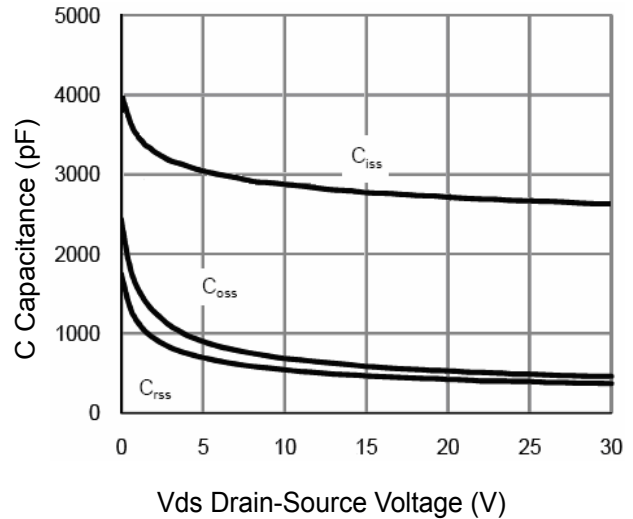


Figure 10 Capacitance vs Vds

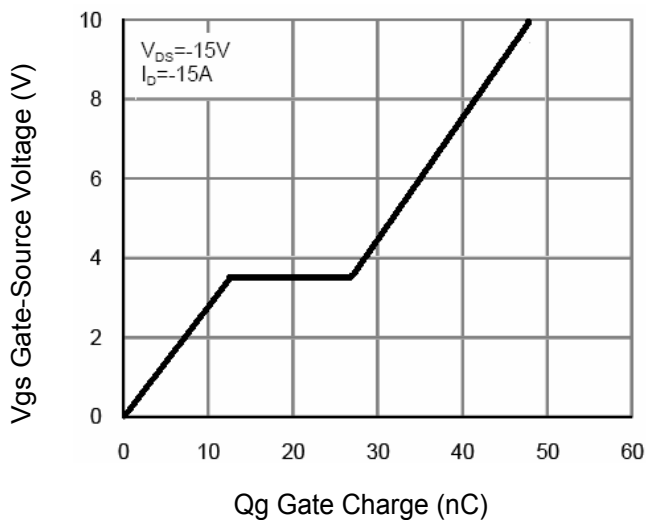


Figure 11 Gate Charge

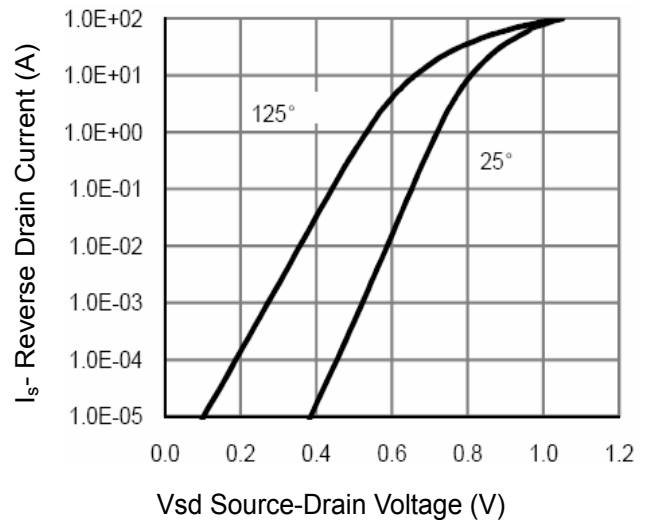


Figure 12 Source- Drain Diode Forward

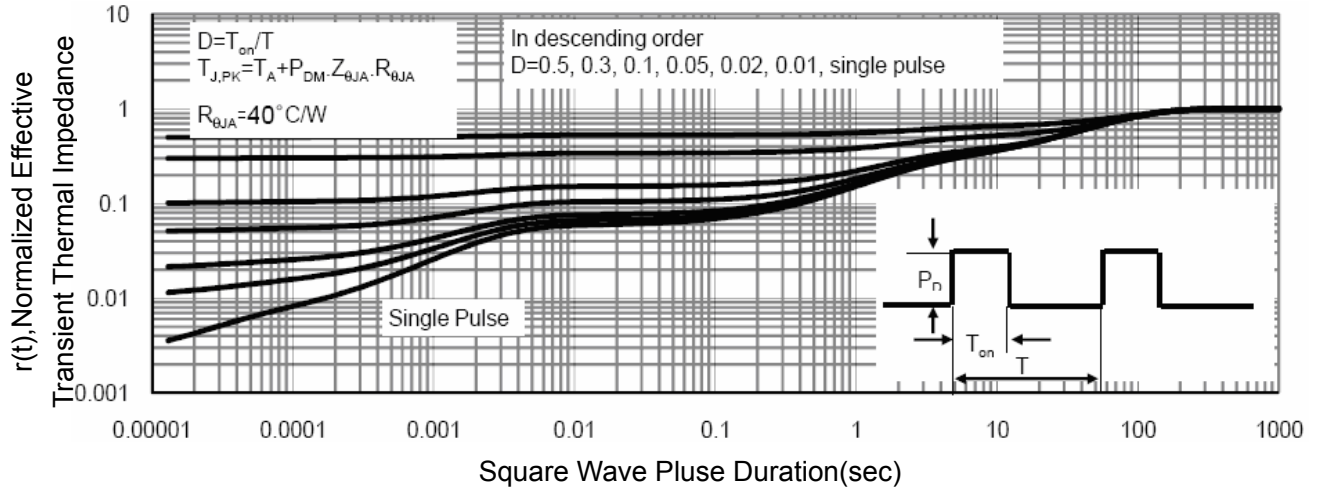
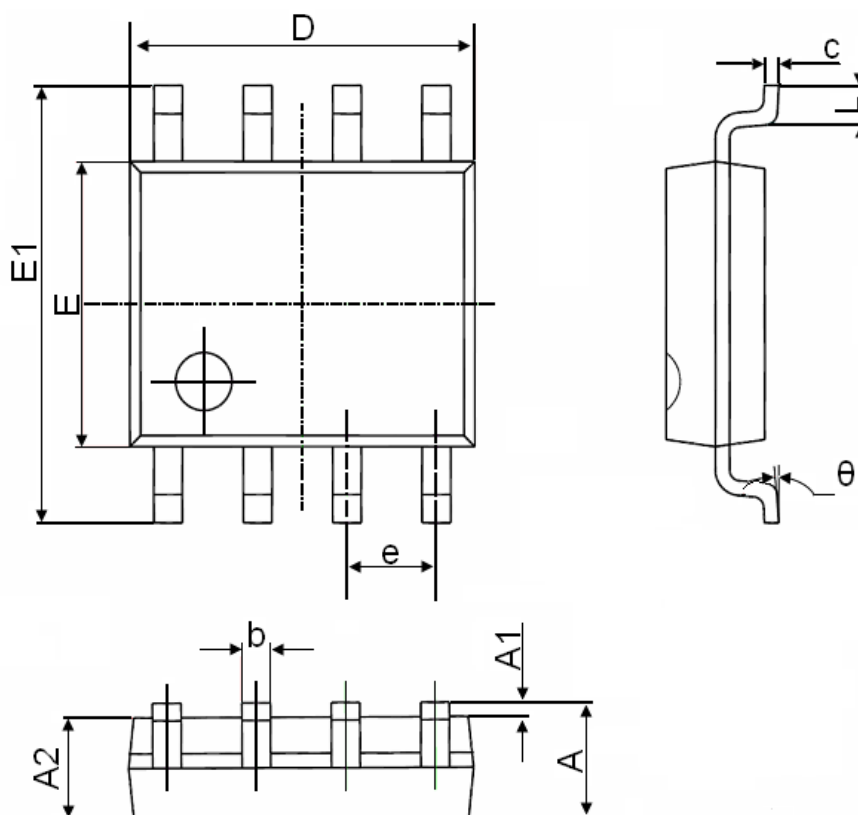


Figure 13 Normalized Maximum Transient Thermal Impedance

SOP-8 Plastic-Encapsulate MOSFETS

TF4409

SOP-8 Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.350	1.750	0.053	0.069
A1	0.100	0.250	0.004	0.010
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.006	0.010
D	4.700	5.100	0.185	0.200
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
e	1.270(BSC)		0.050(BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°