MT4409

P-Channel MOSFET
-30V, -13A, 12mΩ

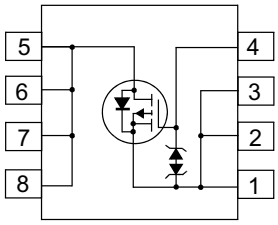
MT Semiconductor®

http://www.mtsemi.com

General Description

This P-channel MOSFET is produced using MOS-TECH Semiconductor's advanced PowerTrench process that has been especially tailored to minimize the on-state resistance This device is well suited for Power Management and Load switching applications common in Notebook computers and Portable Battery Packs.

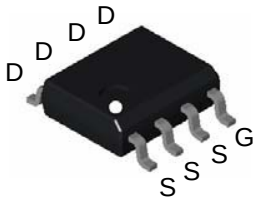
Simplified Schematic



Features

- $R_{DS(on)}$ = 12mΩ (Max.)@ V_{GS} = -10V, I_D = -13A
- $R_{DS(on)}$ = 16mΩ (Max.)@ V_{GS} = -4.5V, I_D = -11A
- Extended V_{GS} range (-25V) for battery applications
- HBM ESD protection level of 3kV typical (note 3)
- High performance trench technology for extremely low $R_{DS(ON)}$
- High power and current handling capability
- RoHS compliant

MARKING DIAGRAM & PIN ASSIGNMENT



SO-8

Absolute Maximum Ratings (T_A = 25℃ unless otherwise noted)

Symbol	Parameter		Ratings	Units
V_{DS}	Drain to Source Voltage		-30	V
V_{GS}	Gate to Source Voltage		±25	V
I_D	Drain Current -Continuous	(Note 1a)	-13	A
	-Pulsed		-65	
P_D	Power Dissipation for Single Operation	(Note 1a)	2.5	W
		(Note 1b)	1.2	
		(Note 1c)	1.0	
T_J, T_{STG}	Operating and Storage Temperature		-55 to +150	°C

Thermal Characteristics

$R_{\theta JA}$	Thermal Resistance , Junction to Ambient (Note 1a)	50	°C/W
$R_{\theta JC}$	Thermal Resistance , Junction to Case (Note 1)	25	°C/W

Package Marking and Ordering Information

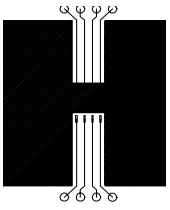
Device Marking	Device	Reel Size	Tape Width	Quantity
MT4409	MT4409	13”	12mm	2500 units

Electrical Characteristics T_J = 25°C unless otherwise noted

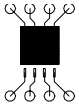
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
Off Characteristics						
B_{VDSS}	Drain to Source Breakdown Voltage	I_D = -250μA, V_{GS} = 0V	-30			V
$\frac{\Delta B_{VDSS}}{\Delta T_J}$	Breakdown Voltage Temperature Coefficient	I_D = -250μA, referenced to 25°C		-20		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS} = -24V, V_{GS}=0V			-1	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±25V, V_{DS}=0V			±10	μA
On Characteristics (Note 2)						
$V_{GS(th)}$	Gate to Source Threshold Voltage	V_{GS} = V_{DS}, I_D = -250μA	-1	-1.9	-3	V
$\frac{\Delta V_{GS(th)}}{\Delta T_J}$	Gate to Source Threshold Voltage Temperature Coefficient	I_D = -250μA, referenced to 25°C		6.5		mV/°C
$r_{DS(on)}$	Drain to Source On Resistance	V_{GS} = -10V, I_D = -13A		12	13	mΩ
		V_{GS} = -4.5V, I_D = -11A		16	17	
		V_{GS} = -10V, I_D = -13A, T_J = 125°C		15	18	
g_{FS}	Forward Transconductance	V_{DS} = -5V, I_D = -13A		55		S
Dynamic Characteristics						
C_{iss}	Input Capacitance	V_{DS} = -15V, V_{GS} = 0V, f = 1MHz		2890	3845	pF
C_{oss}	Output Capacitance			500	665	pF
C_{rss}	Reverse Transfer Capacitance			495	745	pF
Switching Characteristics (Note 2)						
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = -15V, I_D = -1A, V_{GS} = -10V, R_{GS} = 6Ω		13	24	ns
t_r	Rise Time			15	27	ns
$t_{d(off)}$	Turn-Off Delay Time			210	336	ns
t_f	Fall Time			92	148	ns
Q_g	Total Gate Charge	V_{DS} = -15V, V_{GS} = -10V, I_D = -13A		68	96	nC
Q_g	Total Gate Charge	V_{DS} = -15V, V_{GS} = -5V, I_D = -13A		38	54	nC
Q_{gs}	Gate to Source Gate Charge			10		nC
Q_{gd}	Gate to Drain Charge			17		nC
Drain-Source Diode Characteristic						
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0V, I_S = -2.1A		-0.7	-1.2	V
t_{rr}	Reverse Recovery Time	I_F = -13A, di/dt = 100A/μs			40	ns
Q_{rr}	Reverse Recovery Charge	I_F = -13A, di/dt = 100A/μs			-31	nC

Notes:

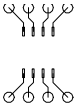
1: $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a) 50°C/W when mounted on a 1 in^2 pad of 2 oz copper



b)105°C/W when mounted on a .04 in^2 pad of 2 oz copper



c) 125°C/W when mounted on a minimun pad

Scale 1 : 1 on letter size paper

2: Pulse Test:Pulse Width <300μs, Duty Cycle <2.0%

3: The diode connected between the gate and source serves only as protection against ESD. No gate overvoltage rating is implied.

Typical Characteristics T_J = 25°C unless otherwise noted

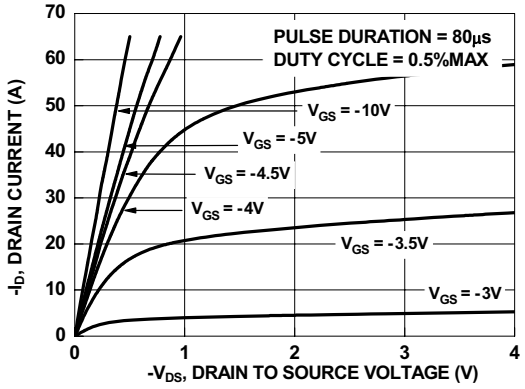


Figure 1. On Region Characteristics

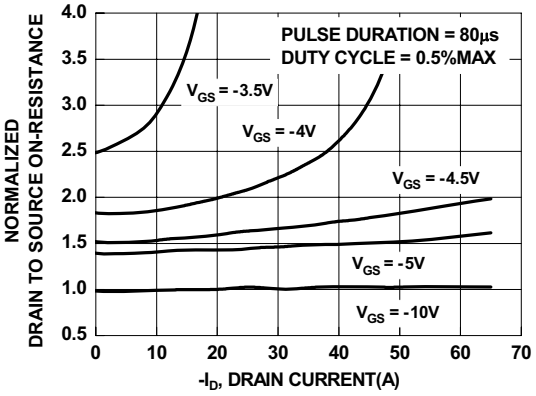


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

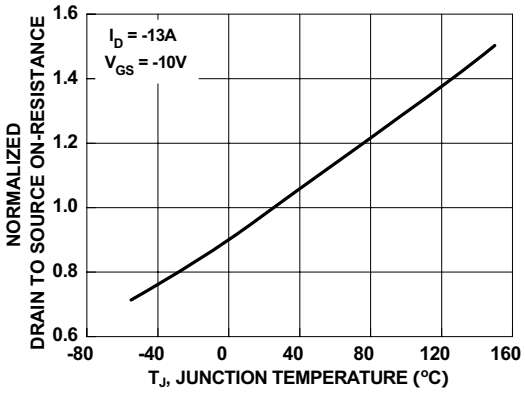


Figure 3. Normalized On Resistance vs Junction Temperature

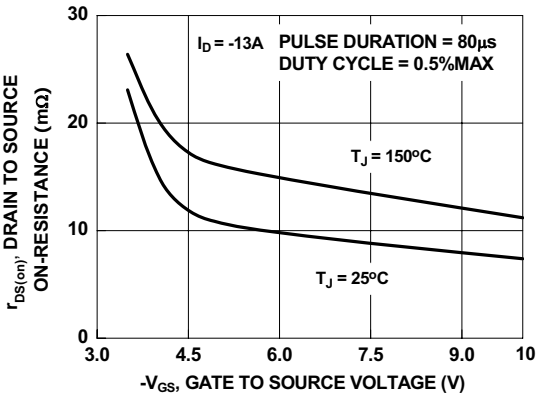


Figure 4. On-Resistance vs Gate to Source Voltage

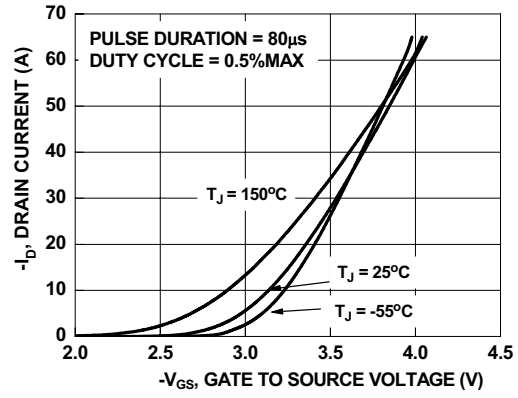


Figure 5. Transfer Characteristics

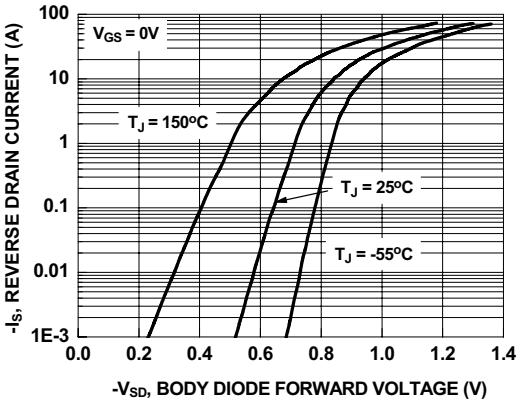


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25°C unless otherwise noted

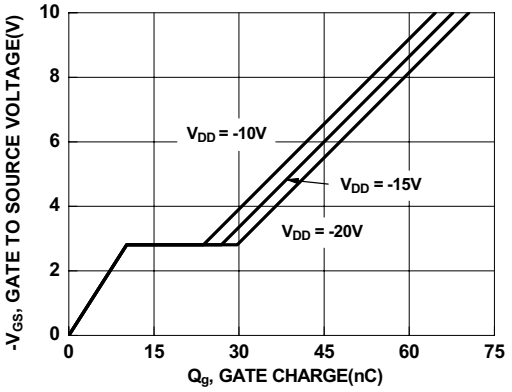


Figure 7. Gate Charge Characteristics

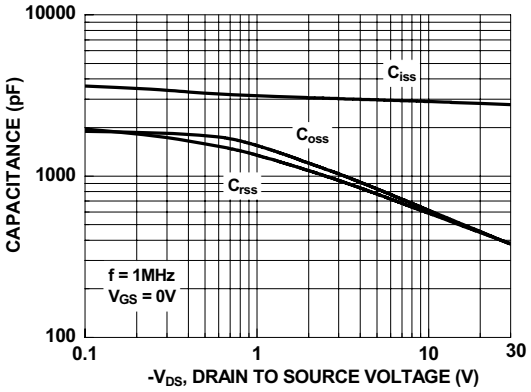


Figure 8. Capacitance vs Drain to Source Voltage

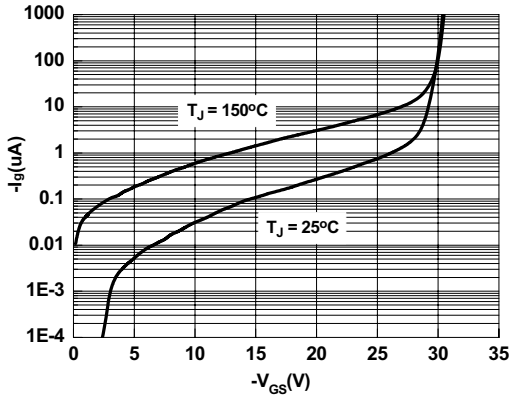


Figure 9. I_g vs V_{GS}

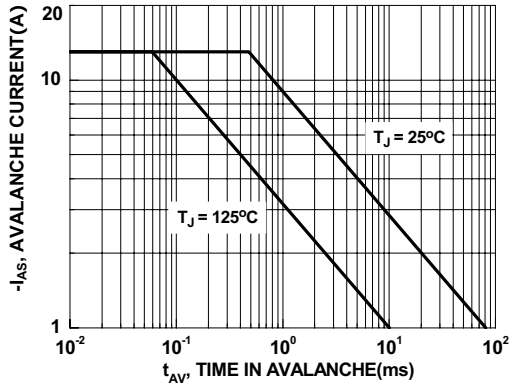


Figure 10. Unclamped Inductive Switching Capability

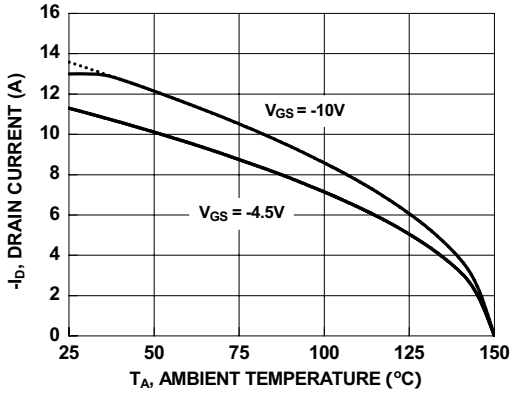


Figure 11. Maximum Continuous Drain Current vs Ambient Temperature

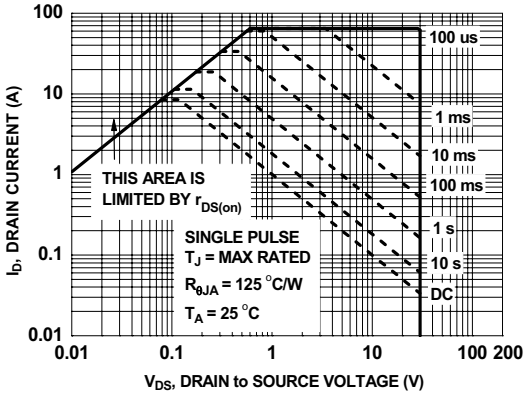


Figure 12. Forward Bias Safe Operating Area

Typical Characteristics T_J = 25°C unless otherwise noted

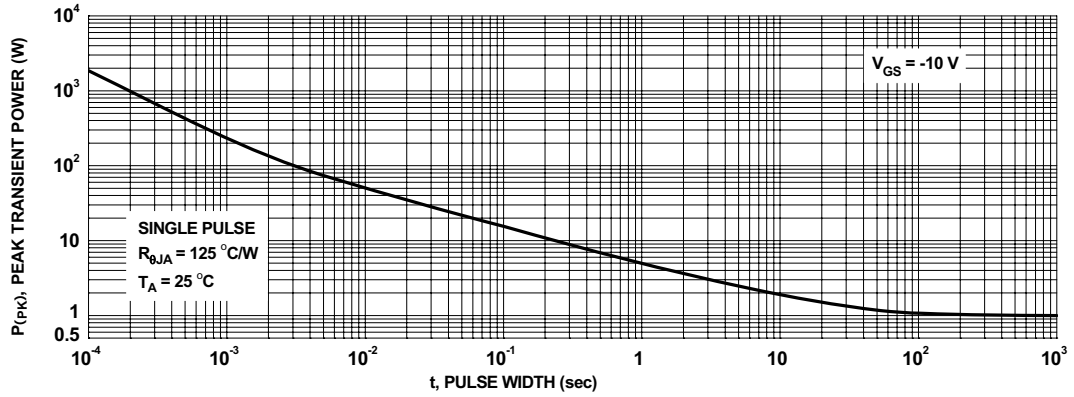


Figure 13. Single Pulse Maximum Power Dissipation

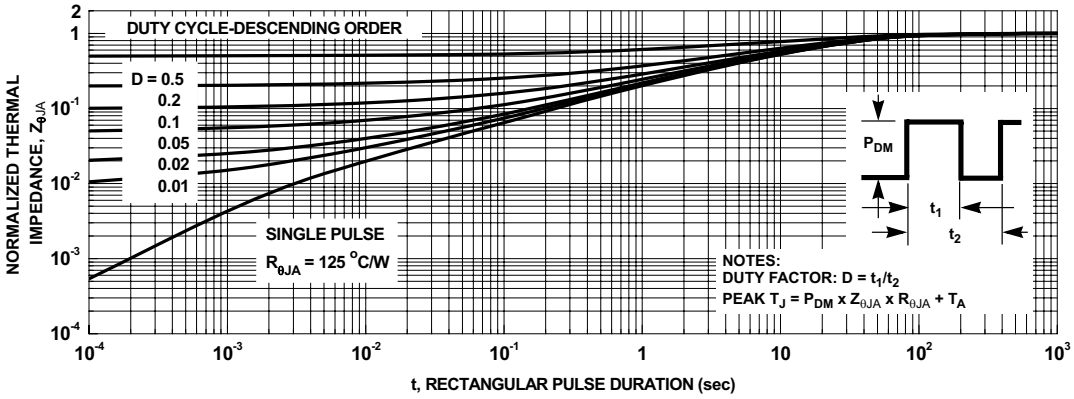
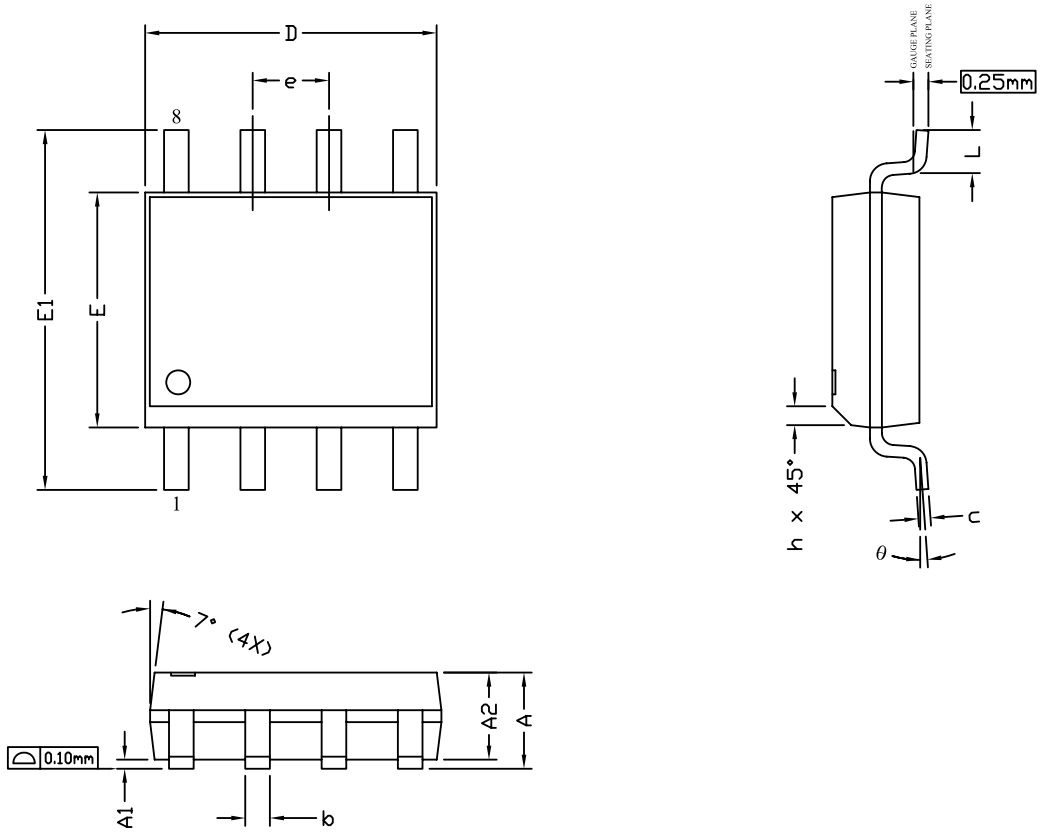


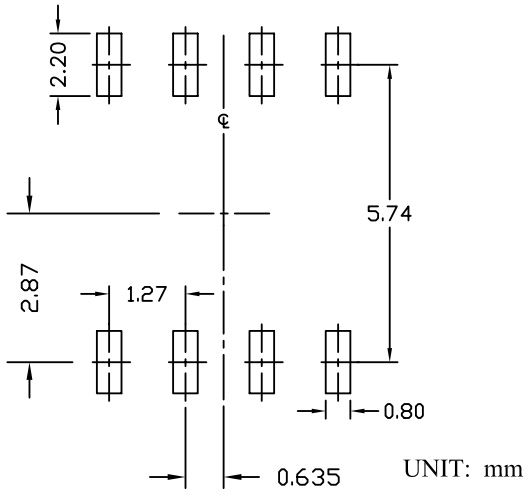
Figure 14. Junction-to-Ambient Transient Thermal Response Curve

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SO8 PACKAGE OUTLINE



RECOMMENDED LAND PATTERN



UNIT: mm

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	1.35	1.65	1.75	0.053	0.065	0.069
A1	0.10	–––	0.25	0.004	–––	0.010
A2	1.25	1.50	1.65	0.049	0.059	0.065
b	0.31	–––	0.51	0.012	–––	0.020
c	0.17	–––	0.25	0.007	–––	0.010
D	4.80	4.90	5.00	0.189	0.193	0.197
E	3.80	3.90	4.00	0.150	0.154	0.157
e	1.27 BSC			0.050 BSC		
E1	5.80	6.00	6.20	0.228	0.236	0.244
h	0.25	–––	0.50	0.010	–––	0.020
L	0.40	–––	1.27	0.016	–––	0.050
θ	0°	–––	8°	0°	–––	8°

NOTE
1. ALL DIMENSIONS ARE IN MILLMETERS.
2. DIMENSIONS ARE INCLUSIVE OF PLATING.
3. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.
   MOLD FLASH AT THE NON-LEAD SIDES SHOULD BE LESS THAN 6 MILS EACH.
4. DIMENSION L IS MEASURED IN GAUGE PLANE.
5. CONTROLLING DIMENSION IS MILLIMETER.
   CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

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Keep safety first in your circuit designs!

1. MOS-TECH Semiconductor Corp. puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage.
   Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.