MT4409

P-Channel MOSFET
-30V, -13A, 12mΩ

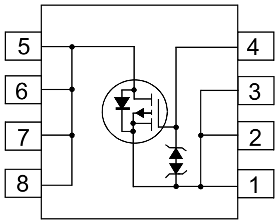
MT Semiconductor®

http://www.mtsemi.com

General Description

This N-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.

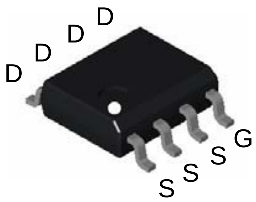
Simplified Schematic



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

$R_{θJA}$	Thermal Resistance , Junction to Ambient (Note 1a)	50	°C/W
$R_{θJC}$	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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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)

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$V_{GS(th)}$	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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
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)

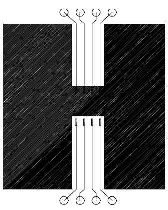
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = -15V, I_D = -1A V_{GS} = -10V, R_{GS} = 6Ω		13	24	ns
t_r	Rise Time			15	27	ns
$t_{d(off)}$	Turn-Off Delay Time			210	336	ns
t_f	Fall Time			92	148	ns
Q_g	Total Gate Charge	V_{DS} = -15V, V_{GS} = -10V, I_D = -13A		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

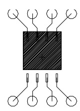
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0V, I_S = -2.1A		-0.7	-1.2	V
t_{rr}	Reverse Recovery Time	I_F = -13A, di/dt = 100A/μs			40	ns
Q_{rr}	Reverse Recovery Charge	I_F = -13A, di/dt = 100A/μs			-31	nC

Notes:

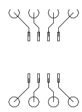
1: $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



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

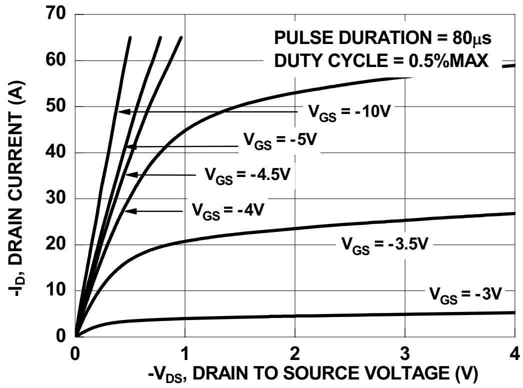


Figure 1. On Region Characteristics

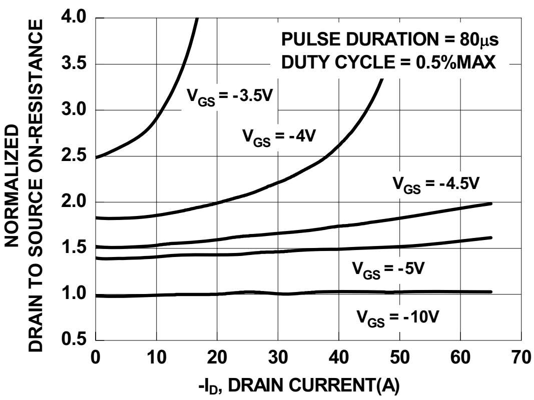


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

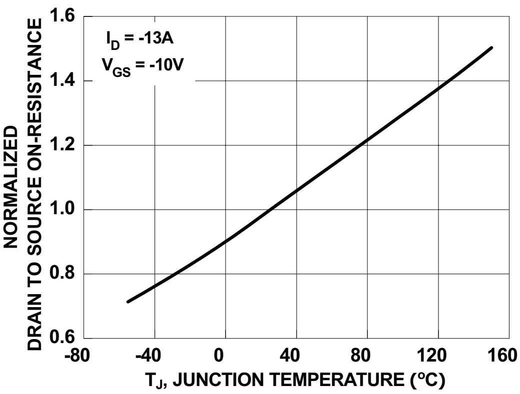


Figure 3. Normalized On Resistance vs Junction Temperature

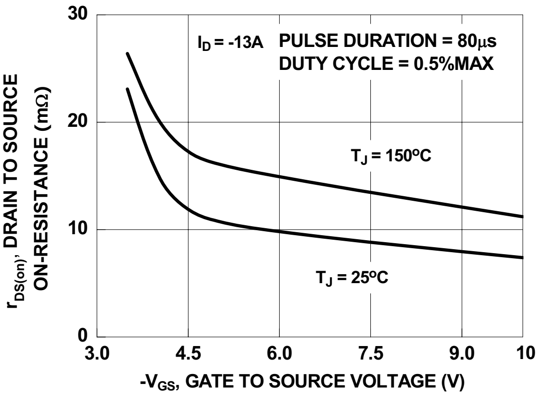


Figure 4. On-Resistance vs Gate to Source Voltage

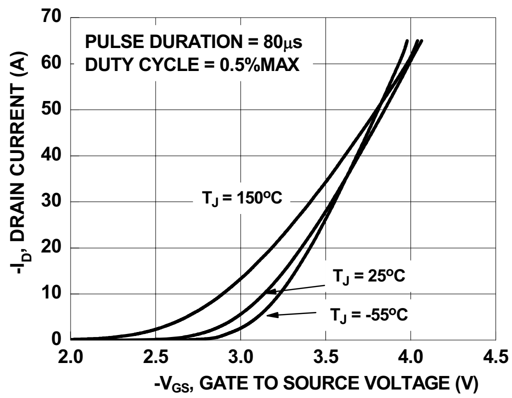


Figure 5. Transfer Characteristics

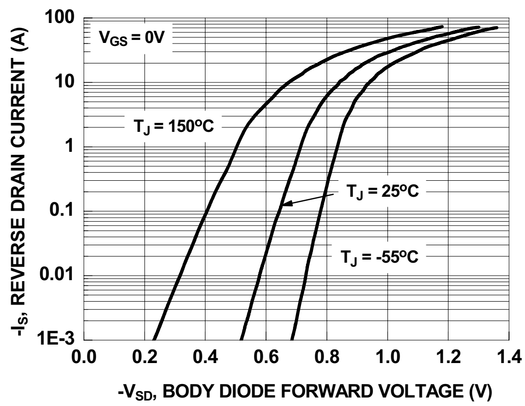


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25°C unless otherwise noted

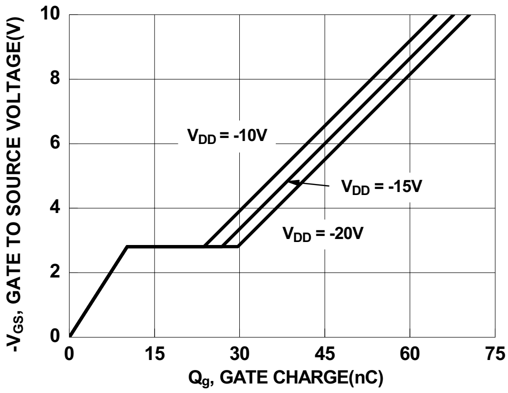


Figure 7. Gate Charge Characteristics

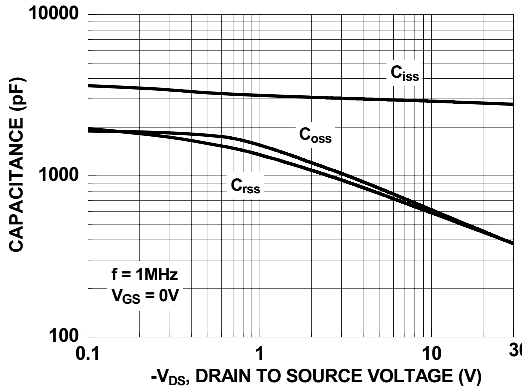


Figure 8. Capacitance vs Drain to Source Voltage

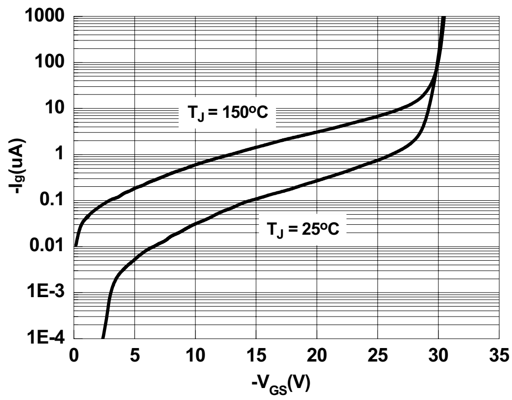


Figure 9. I_g vs V_{GS}

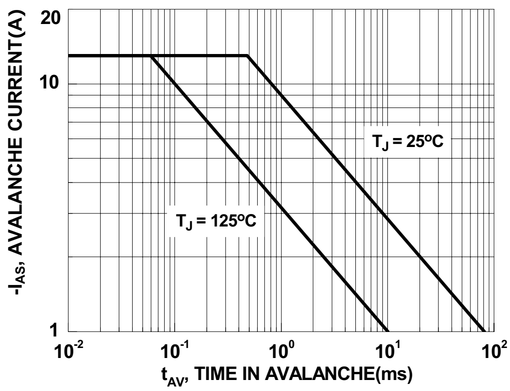


Figure 10. Unclamped Inductive Switching Capability

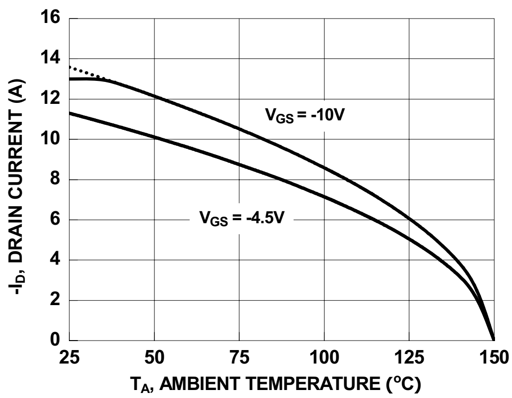


Figure 11. Maximum Continuous Drain Current vs Ambient Temperature

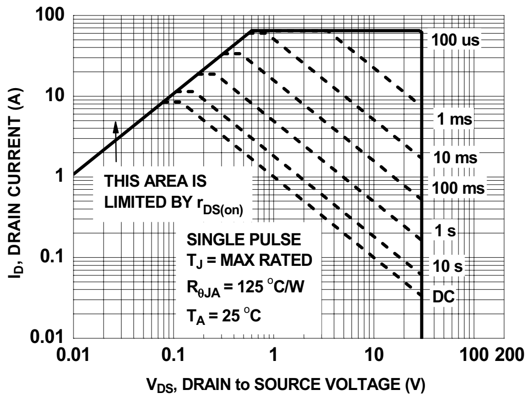


Figure 12. Forward Bias Safe Operating Area

Typical Characteristics T_J = 25°C unless otherwise noted

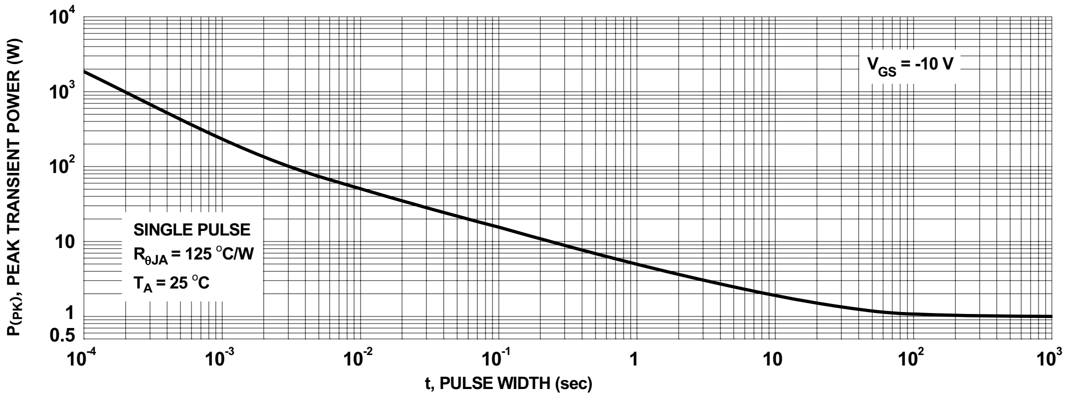


Figure 13. Single Pulse Maximum Power Dissipation

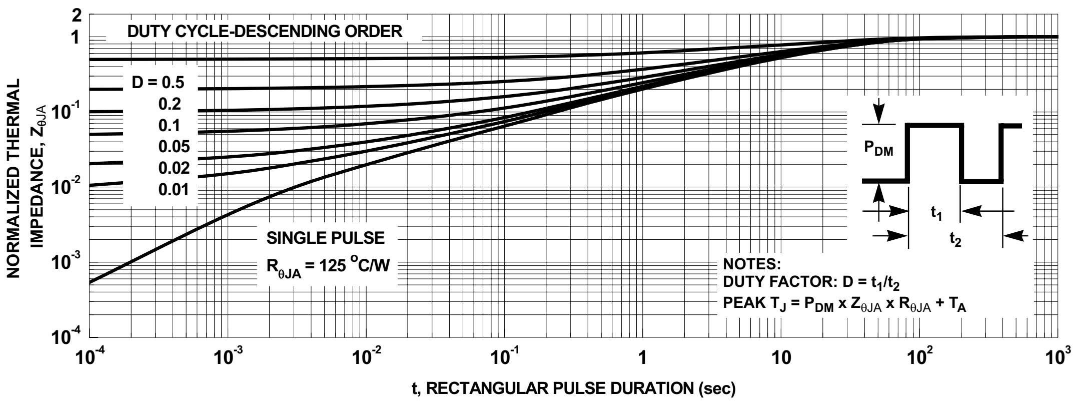


Figure 14. Junction-to-Ambient Transient Thermal Response Curve

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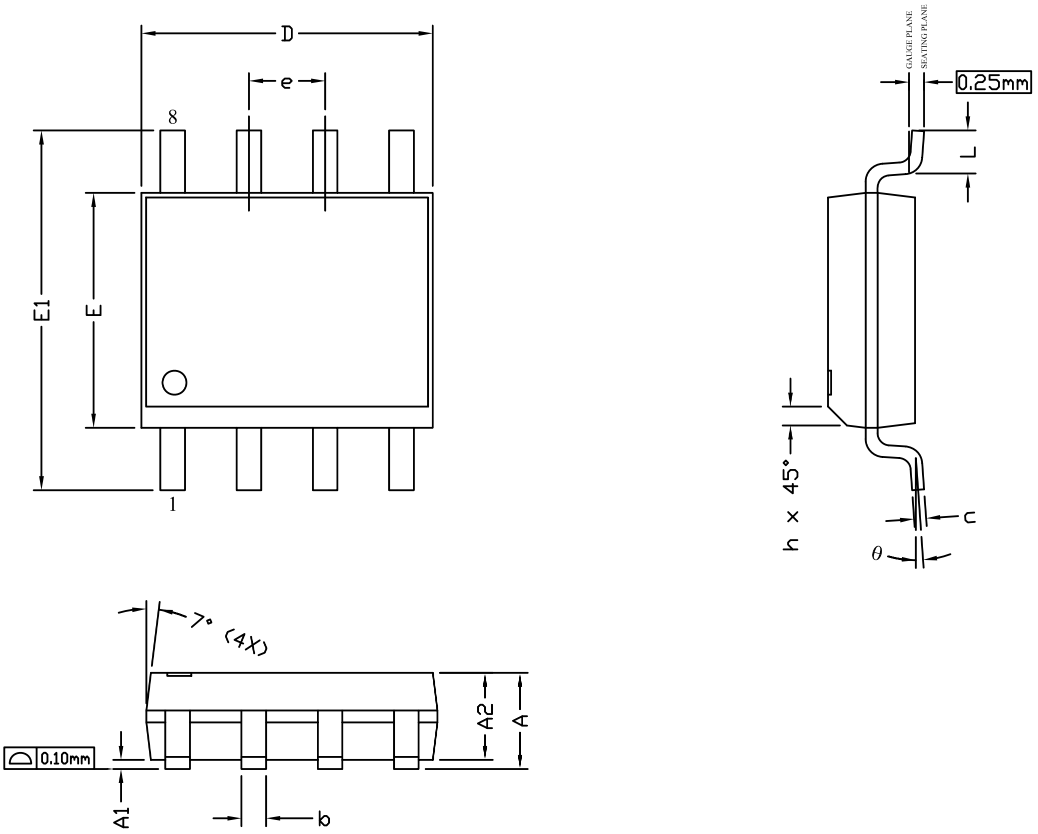
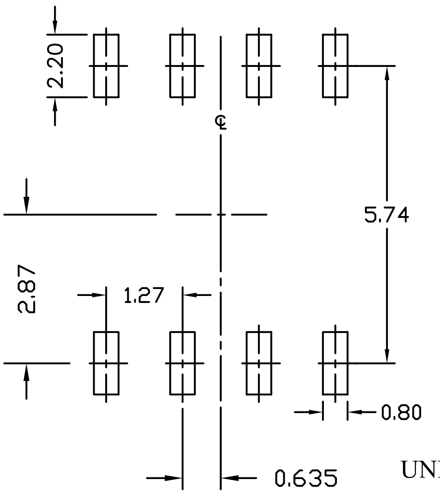
S08 PACKAGE OUTLINE



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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