MT6680

N-Channel PowerTrench®MOSFET

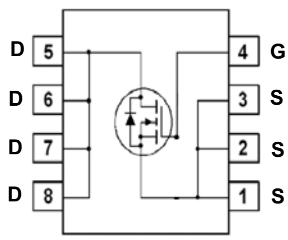
30V, 15A, 9mΩ

http://www.mtsemi.com

General Description

This N-Channel MOSFET is produced using Mos-tech Semiconductor's advanced Power mosfet 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.

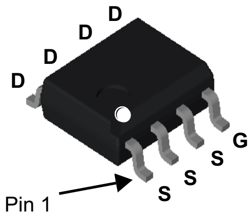
Simplified Schematic



Features

- Max $R_{DS(on)}$ = 9mΩ , V_{GS} = 10V, I_D = 15A
- Max $R_{DS(on)}$ = 12mΩ , V_{GS} = 4.5V, I_D = 12.6A
- 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		±20	V
I_D	Drain Current -Continuous	(Note 1a)	15	A
	-Pulsed		60	
E_{AS}	Single Pulse Avalanche Energy	(Note 4)	181	mJ
P_D	Power Dissipation	(Note 1a)	2.5	W
	Power Dissipation	(Note 1b)	1.0	
T_J, T_{STG}	Operating and Storage Junction Temperature Range		-55 to +150	°C

Thermal Characteristics

$R_{\theta JC}$	Thermal Resistance, Junction to Case	(Note 1)	25	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1a)	50	
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient	(Note 1b)	125	

Package Marking and Ordering Information

Device Marking	Device	Reel Size	Tape Width	Quantity
MT6680	MT6680	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
BV_{DSS}	Drain to Source Breakdown Voltage	I_D = 250μA, V_{GS} = 0V	30			V
$\frac{\Delta BV_{DSS}}{\Delta T_J}$	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			30	μA
I_{GSS}	Gate to Source Leakage Current	V_{GS} = ±20V, V_{DS} = 0V			±100	nA

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	1.8	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		mV/°C
$r_{DS(on)}$	Static Drain to Source On Resistance	V_{GS} = 10V, I_D = 15A		9	10	mΩ
		V_{GS} = 4.5V, I_D = 12.6A		12	13	
		V_{GS} = 10V, I_D = 15A T_J = 125°C		10	13	
g_{FS}	Forward Transconductance	V_{DS} = 5V, I_D = 15A		54		S

Dynamic Characteristics

Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
C_{iss}	Input Capacitance	V_{DS} = 15V, V_{GS} = 0V, f = 1MHz		1805	2400	pF
C_{oss}	Output Capacitance			335	445	pF
C_{rss}	Reverse Transfer Capacitance			200	300	pF
R_g	Gate Resistance	f = 1MHz		1.4		Ω

Switching Characteristics

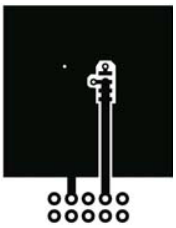
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
$t_{d(on)}$	Turn-On Delay Time	V_{DD} = 15V, I_D = 15A V_{GS} = 10V, R_{GEN} = 6Ω		11	22	ns
t_r	Rise Time			13	26	ns
$t_{d(off)}$	Turn-Off Delay Time			25	40	ns
t_f	Fall Time			7	14	ns
Q_g	Total Gate Charge	V_{GS} = 0V to 10V; V_{DD} = 15V I_D = 15A		32	45	nC
Q_g	Total Gate Charge	V_{GS} = 0V to 5V		17	24	nC
Q_{gs}	Gate to Source Charge			6		nC
Q_{gd}	Gate to Drain “Miller” Charge			7		nC

Drain-Source Diode Characteristics

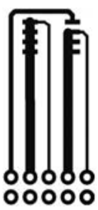
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
V_{SD}	Source to Drain Diode Forward Voltage	V_{GS} = 0V, I_S = 2.1A (Note 2)		0.8	1.2	V
t_{rr}	Reverse Recovery Time	I_F = 15A, di/dt = 100A/μs		24	36	ns
Q_{rr}	Reverse Recovery Charge			15	23	nC

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 $R_{\theta JA}$ is determined by the user's board design.



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



b) 125°C/W when mounted on a minimum pad .

2. Pulse Test: Pulse Width < 300 us, Duty Cycle < 2%.
3. The diode connected between the gate and source serves only as protection against ESD . No gate overvoltage rating is implied.
4. Starting T_J = 25°C, L = 3mH, I_{AS} = 11A, V_{DD} = 30V, V_{GS} = 10V.

Typical Characteristics T_J = 25°C unless otherwise noted

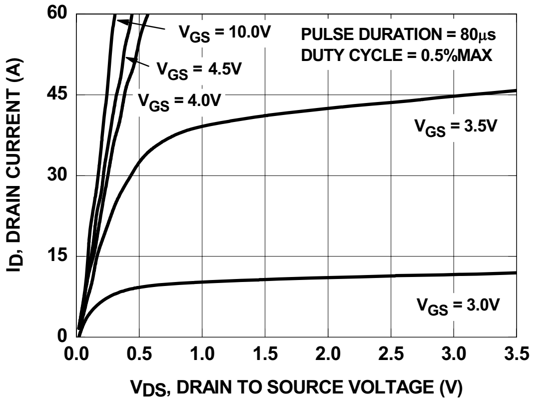


Figure 1. On-Region Characteristics

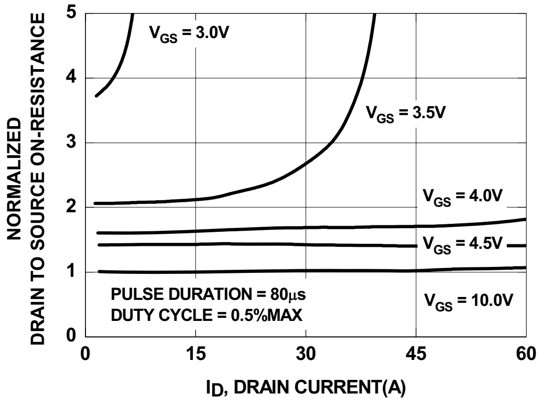


Figure 2. Normalized On-Resistance vs Drain Current and Gate Voltage

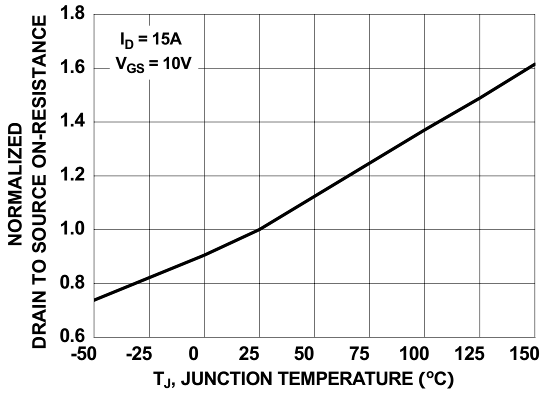


Figure 3. Normalized On-Resistance vs Junction Temperature

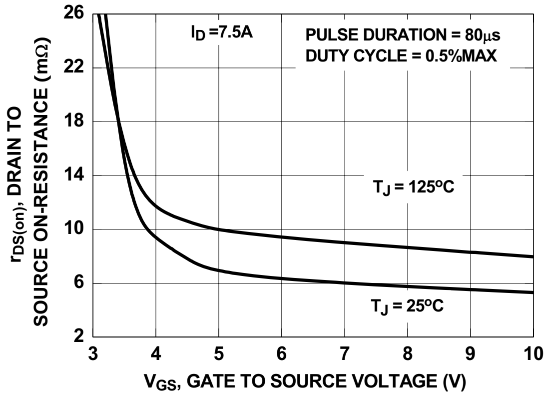


Figure 4. On-Resistance vs Gate to Source Voltage

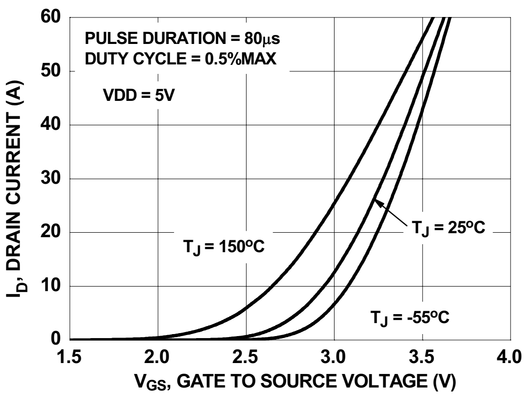


Figure 5. Transfer Characteristics

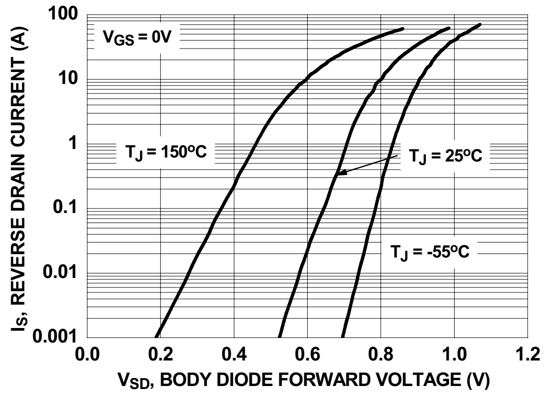


Figure 6. Source to Drain Diode Forward Voltage vs Source Current

Typical Characteristics T_J = 25°C unless otherwise noted

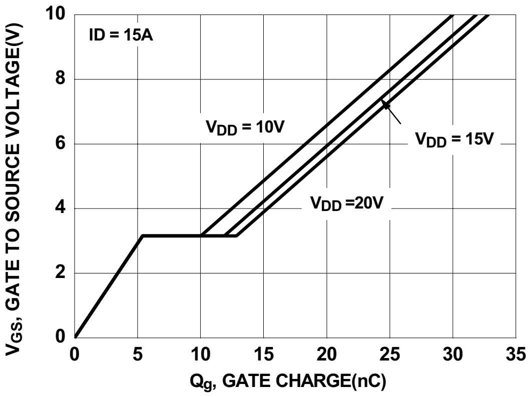


Figure 7. Gate Charge Characteristics

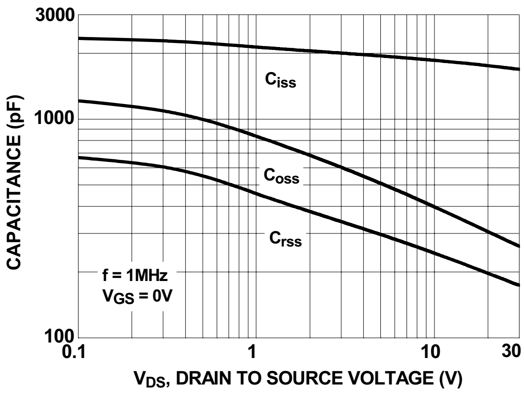


Figure 8. Capacitance vs Drain to Source Voltage

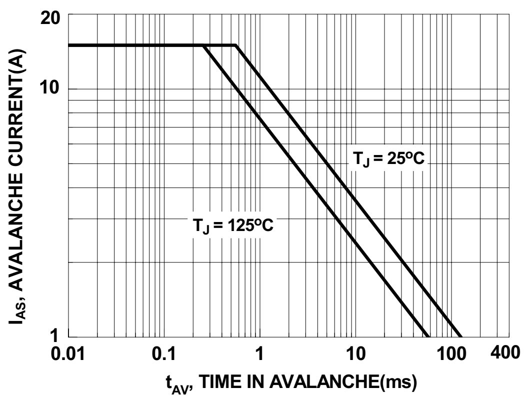


Figure 9. Unclamped Inductive Switching Capability

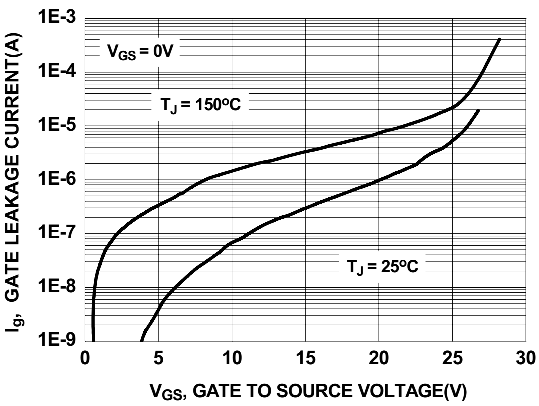


Figure 10. Gate Leakage Current vs Gate to Source Voltage

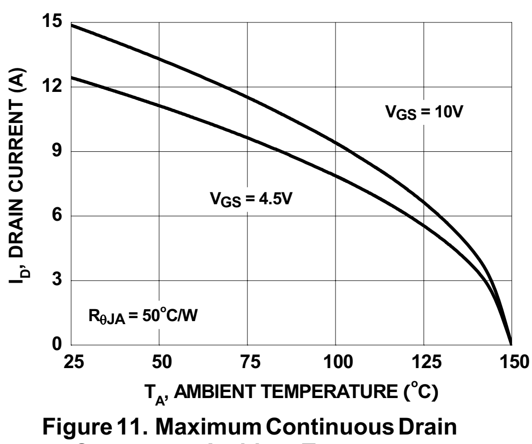


Figure 11. Maximum Continuous Drain Current vs Ambient Temperature

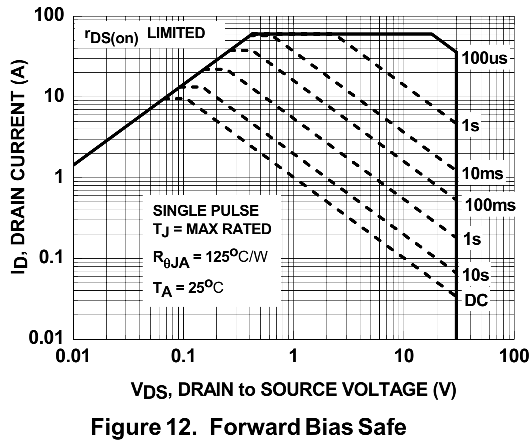


Figure 12. Forward Bias Safe Operating Area

Typical Characteristics T_J = 25°C unless otherwise noted

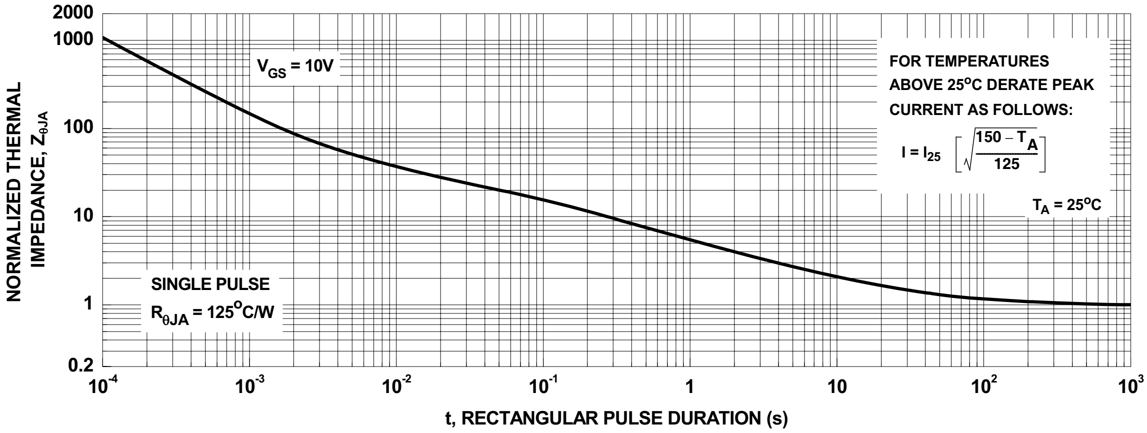


Figure 13. Single Pulse Maximum Power Dissipation

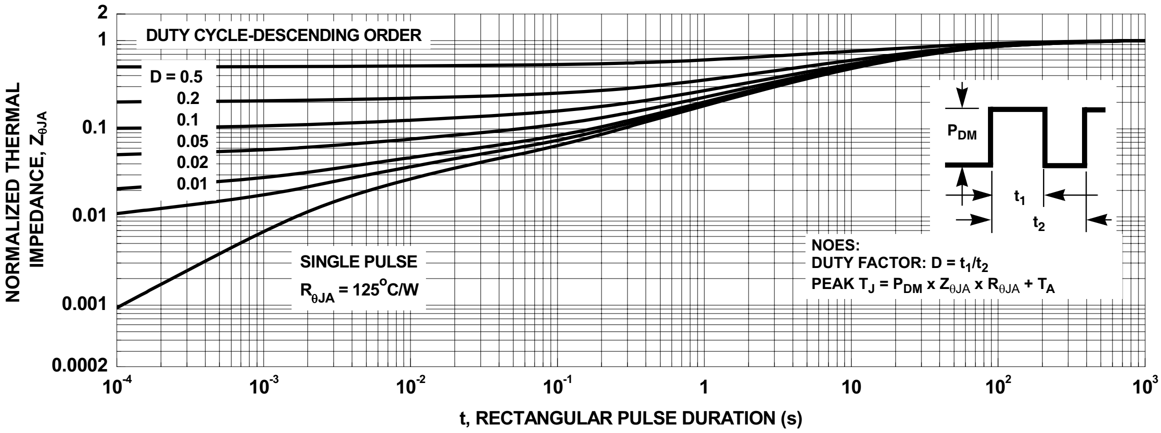


Figure 14. Transient Thermal Response Curve

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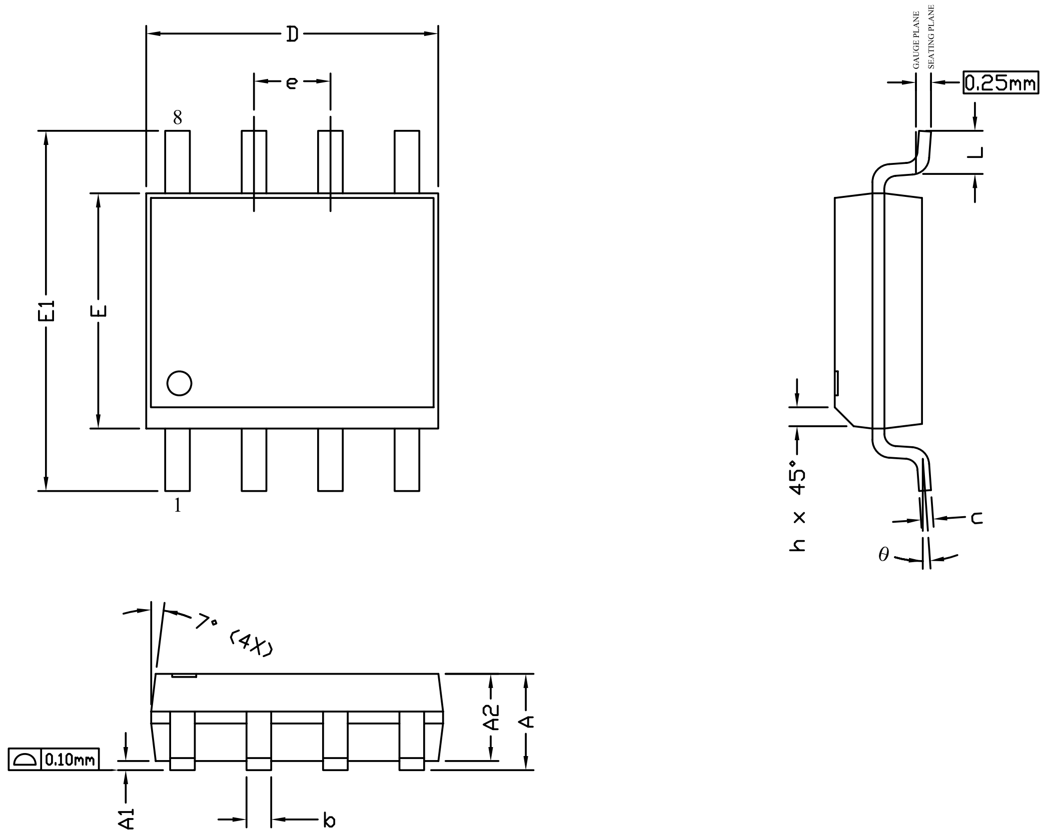
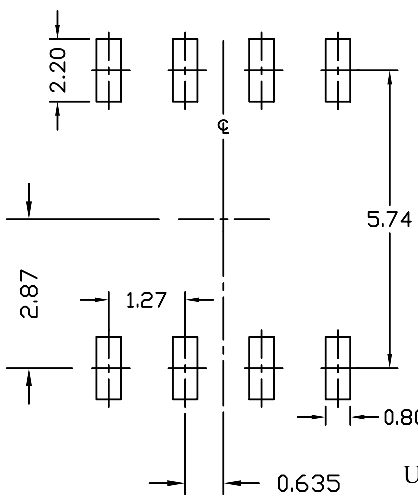


RECOMMENDED LAND PATTERN



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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