MGSF3442VT1

Preferred Device

Power MOSFET 4 Amps, 20 Volts

N−Channel TSOP−6

These miniature surface mount MOSFETs low $R_{DS(on)}$ assure minimal power loss and conserve energy, making these devices ideal for use in small power management circuitry. Typical applications are dc−dc converters, power management in portable and battery−powered products such as computers, printers, PCMCIA cards, cellular and cordless telephones.

- Low $R_{DS(on)}$ Provides Higher Efficiency and Extends Battery Life
- Miniature TSOP−6 Surface Mount Package Saves Board Space

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

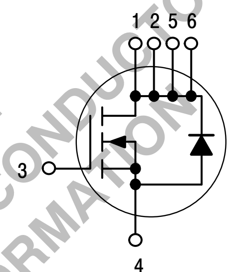
Rating	Symbol	Value	Unit
Drain−to−Source Voltage	V_{DSS}	20	Vdc
Gate−to−Source Voltage − Continuous	V_{GS}	± 8.0	Vdc
Drain Current − Continuous @ T_A = 25°C − Pulsed Drain Current ($t_p \leq 10$ µs)	 I_D I_{DM}	 4.0 20	A
Total Power Dissipation @ T_A = 25°C Mounted on FR4 $t \leq 5$ sec	P_D	2.0	W
Operating and Storage Temperature Range	T_J, T_{stg}	− 55 to 150	°C
Thermal Resistance − Junction−to−Ambient	$R_{\theta JA}$	62.5	°C/W
Maximum Lead Temperature for Soldering Purposes, for 10 seconds	T_L	260	°C

ON Semiconductor™

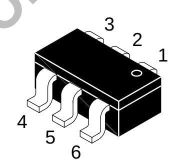
http://onsemi.com

4 AMPERES
20 VOLTS
$R_{DS(on)}$ = 70 mΩ

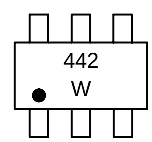
N−Channel



MARKING DIAGRAM

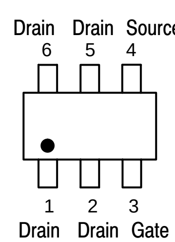


TSOP−6
CASE 318G
STYLE 1



442 = Device Code
W = Work Week

PIN ASSIGNMENT



ORDERING INFORMATION

Device	Package	Shipping
MGSF3442VT1	TSOP−6	3000 Tape & Reel

Preferred devices are recommended choices for future use and best overall value.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain−to−Source Breakdown Voltage (V_{GS} = 0 Vdc, I_D = 10 μA)	$V_{(BR)DSS}$	20	−	−	Vdc
Zero Gate Voltage Drain Current	I_{DSS}				μAdc
(V_{DS} = 20 Vdc, V_{GS} = 0 Vdc)		−	−	1.0	
(V_{DS} = 20 Vdc, V_{GS} = 0 Vdc, T_J = 70°C)		−	−	5.0	
Gate−Body Leakage Current (V_{GS} = ± 8.0 Vdc, V_{DS} = 0)	I_{GSS}	−	−	±100	nAdc
ON CHARACTERISTICS (Note 1.)					
Gate Threshold Voltage (V_{DS} = V_{GS}, I_D = 250 μAdc)	$V_{GS(th)}$	0.6	−	−	Vdc
Static Drain−to−Source On−Resistance	$r_{DS(on)}$				Ohms
(V_{GS} = 4.5 Vdc, I_D = 4.0 A)		−	0.058	0.070	
(V_{GS} = 2.5 Vdc, I_D = 3.4 A)		−	0.072	0.095	
DYNAMIC CHARACTERISTICS					
Input Capacitance (V_{DS} = 5.0 V)	C_{iss}	−	90	−	pF
Output Capacitance (V_{DS} = 5.0 V)	C_{oss}	−	50	−	
Transfer Capacitance (V_{DG} = 5.0 V)	C_{rss}	−	10	−	
SWITCHING CHARACTERISTICS (Note 2.)					
Turn−On Delay Time (V_{DD} = 10 Vdc, I_D = 1.0 A, V_{GEN} = 10 V, R_L = 10 Ω)	$t_{d(on)}$	−	8.0	20	ns
Rise Time	t_r	−	24	40	
Turn−Off Delay Time	$t_{d(off)}$	−	36	60	
Fall Time	t_f	−	10	20	
Gate Charge	Q_T	−	−	−	nC
SOURCE−DRAIN DIODE CHARACTERISTICS					
Continuous Current	I_S	−	−	1.0	A
Pulsed Current	I_{SM}	−	−	5.0	A
Forward Voltage (Note 2.)	V_{SD}	−	−	1.2	V

1. Pulse Test: Pulse Width ≤ 300 μs, Duty Cycle ≤ 2%.
2. Switching characteristics are independent of operating junction temperature.

TYPICAL ELECTRICAL CHARACTERISTICS

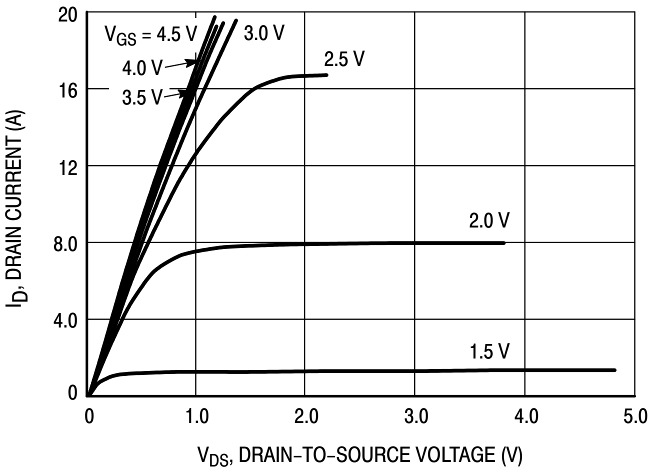


Figure 1. Output Characteristics

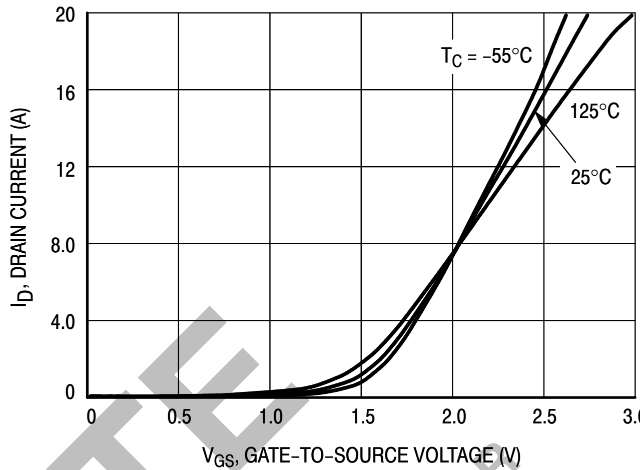


Figure 2. Transfer Characteristics

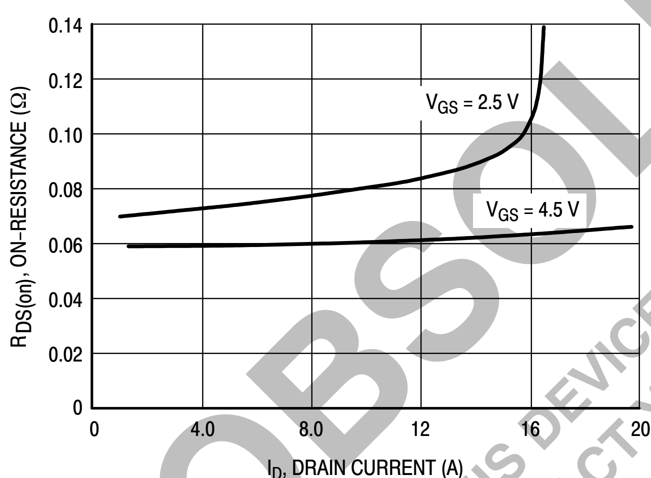


Figure 3. On−Resistance versus Drain Current

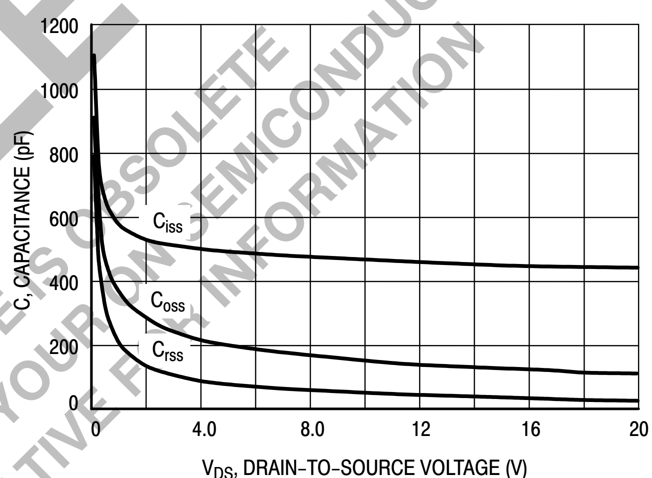


Figure 4. Capacitance

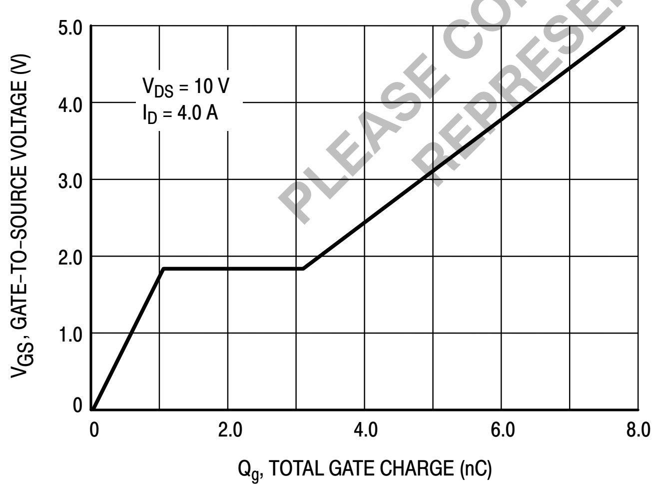


Figure 5. Gate Charge

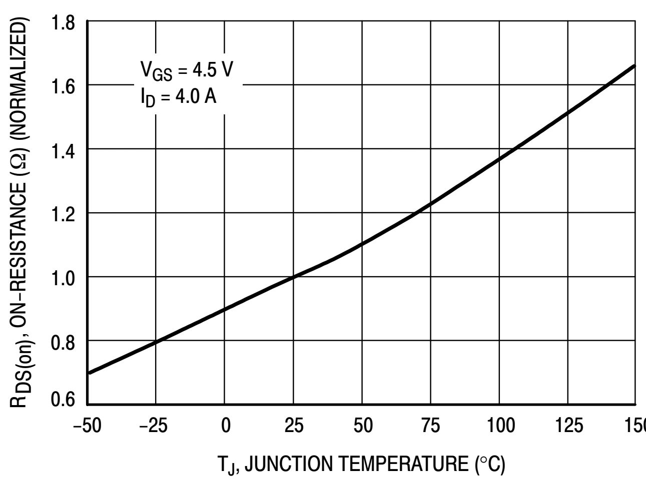


Figure 6. On−Resistance versus Junction Temperature

TYPICAL ELECTRICAL CHARACTERISTICS

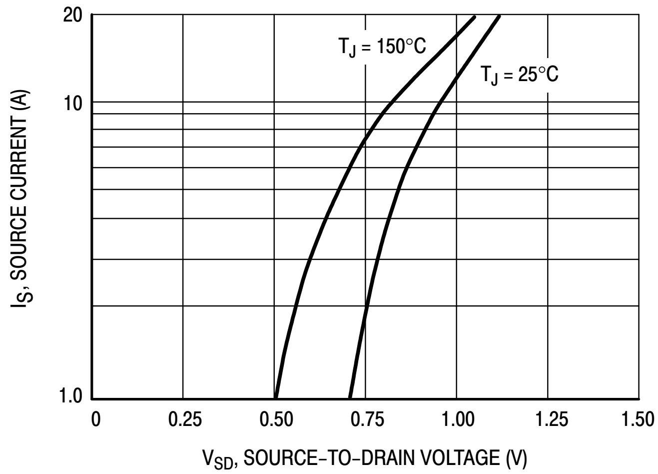


Figure 7. Source−Drain Diode Forward Voltage

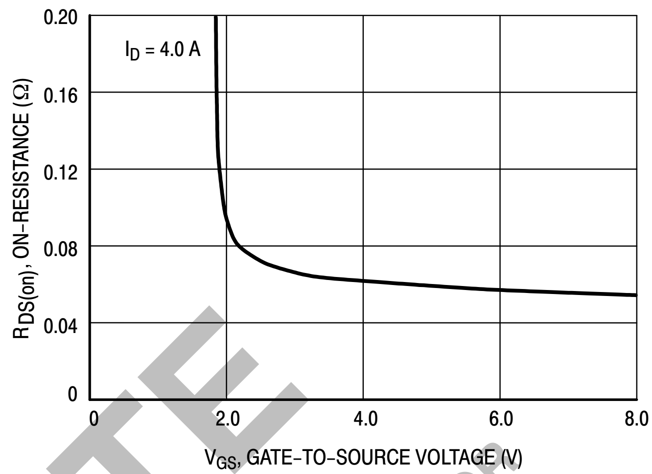


Figure 8. On−Resistance versus Gate−to−Source Voltage

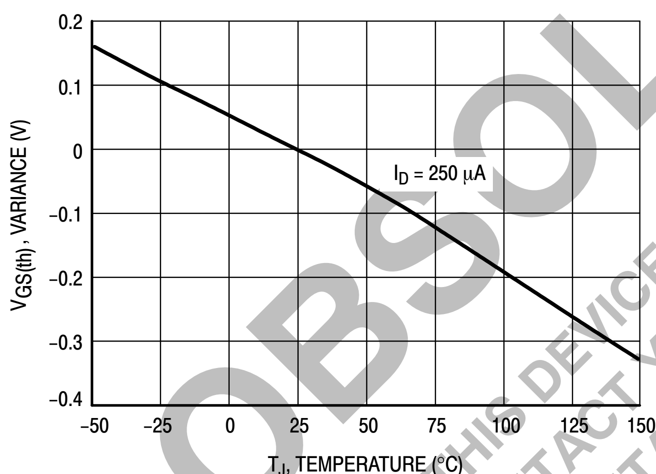


Figure 9. Threshold Voltage

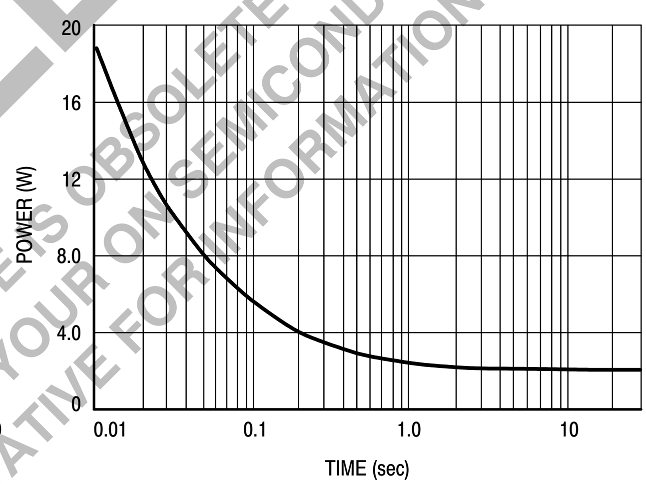


Figure 10. Single Pulse Power

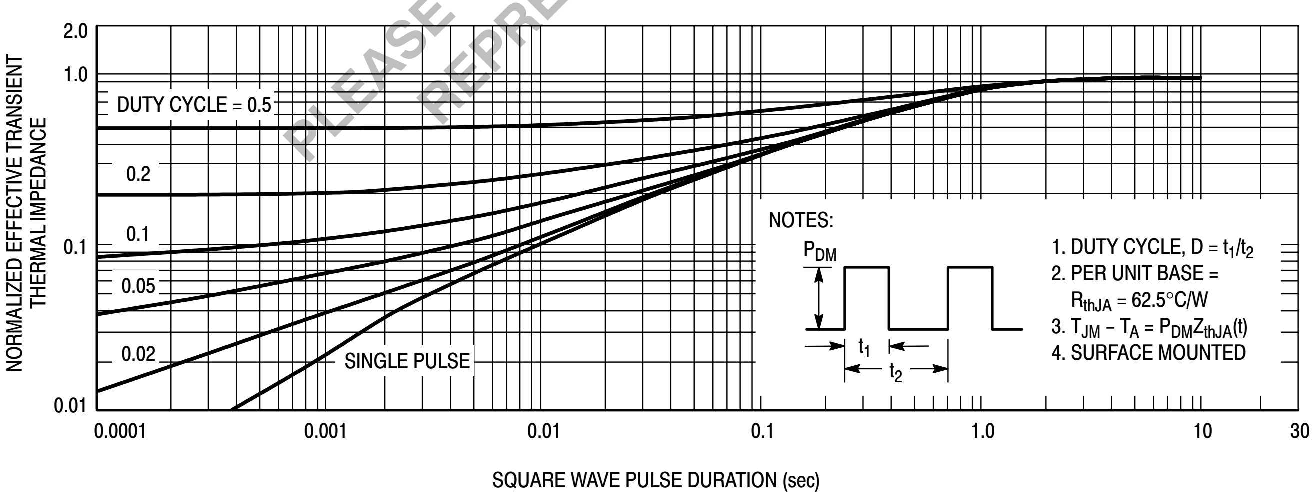
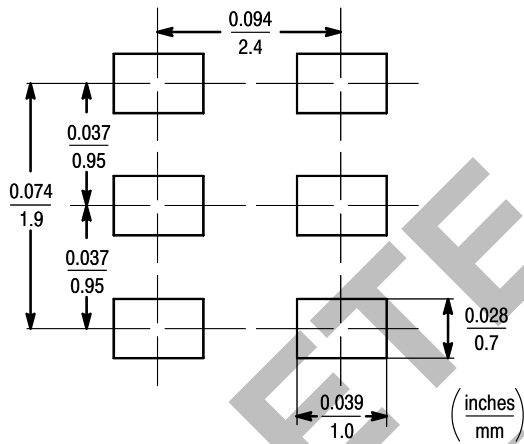


Figure 11. Normalized Thermal Transient Impedance, Junction−to−Ambient

INFORMATION FOR USING THE TSOP−6 SURFACE MOUNT PACKAGE

MINIMUM RECOMMENDED FOOTPRINT FOR SURFACE MOUNTED APPLICATIONS

Surface mount board layout is a critical portion of the total design. The footprint for the semiconductor packages must be the correct size to insure proper solder connection interface between the board and the package. With the correct pad geometry, the packages will self align when subjected to a solder reflow process.



TSOP−6 POWER DISSIPATION

The power dissipation of the TSOP−6 is a function of the drain pad size. This can vary from the minimum pad size for soldering to a pad size given for maximum power dissipation. Power dissipation for a surface mount device is determined by $T_{J(max)}$, the maximum rated junction temperature of the die, $R_{\theta JA}$, the thermal resistance from the device junction to ambient, and the operating temperature, T_A. Using the values provided on the data sheet for the TSOP−6 package, P_D can be calculated as follows:

$$P_D = \frac{T_{J(max)} - T_A}{R_{\theta JA}}$$

The values for the equation are found in the maximum ratings table on the data sheet. Substituting these values into the equation for an ambient temperature T_A of 25°C, one can calculate the power dissipation of the device which in this case is 2.0 watts.

$$P_D = \frac{150°C - 25°C}{62.5°C/W} = 2.0 \text{ watts}$$

The 62.5°C/W for the TSOP−6 package assumes the use of the recommended footprint on a glass epoxy printed circuit board to achieve a power dissipation of 2.0 watts. There are other alternatives to achieving higher power dissipation from the TSOP−6 package. Another alternative would be to use a ceramic substrate or an aluminum core board such as Thermal Clad™. Using a board material such as Thermal Clad, an aluminum core board, the power dissipation can be doubled using the same footprint.

SOLDERING PRECAUTIONS

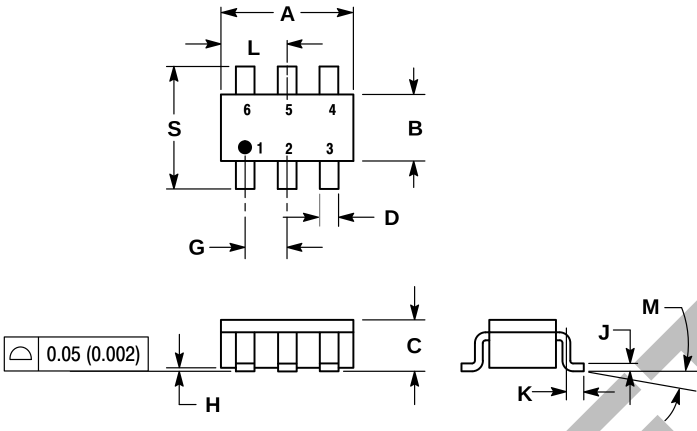
The melting temperature of solder is higher than the rated temperature of the device. When the entire device is heated to a high temperature, failure to complete soldering within a short time could result in device failure. Therefore, the following items should always be observed in order to minimize the thermal stress to which the devices are subjected.

- Always preheat the device.
- The delta temperature between the preheat and soldering should be 100°C or less.*
- When preheating and soldering, the temperature of the leads and the case must not exceed the maximum temperature ratings as shown on the data sheet. When using infrared heating with the reflow soldering method, the difference shall be a maximum of 10°C.
- The soldering temperature and time shall not exceed 260°C for more than 10 seconds.
- When shifting from preheating to soldering, the maximum temperature gradient shall be 5°C or less.
- After soldering has been completed, the device should be allowed to cool naturally for at least three minutes. Gradual cooling should be used as the use of forced cooling will increase the temperature gradient and result in latent failure due to mechanical stress.
- Mechanical stress or shock should not be applied during cooling.

* Soldering a device without preheating can cause excessive thermal shock and stress which can result in damage to the device.

PACKAGE DIMENSIONS

TSOP−6
CASE 318G−02
ISSUE G



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH THICKNESS. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	2.90	3.10	0.1142	0.1220
B	1.30	1.70	0.0512	0.0669
C	0.90	1.10	0.0354	0.0433
D	0.25	0.50	0.0098	0.0197
G	0.85	1.05	0.0335	0.0413
H	0.013	0.100	0.0005	0.0040
J	0.10	0.26	0.0040	0.0102
K	0.20	0.60	0.0079	0.0236
L	1.25	1.55	0.0493	0.0610
M	0 °	10 °	0 °	10 °
S	2.50	3.00	0.0985	0.1181

STYLE 1:
PIN 1. DRAIN
2. DRAIN
3. GATE
4. SOURCE
5. DRAIN
6. DRAIN

Notes

Thermal Clad is a registered trademark of the Bergquist Company.

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