N-Channel Reduced Q_g, Fast Switching MOSFET

PRODUCT SUMMARY		
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A)
30	0.0085 at V_{GS} = 10 V	15
	0.0125 at V_{GS} = 4.5 V	12

FEATURES

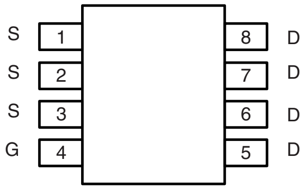
- **Halogen-free According to IEC 61249-2-21 Available**
- TrenchFET® Gen II Power MOSFETs
- PWM Optimized
- 100 % R_g Tested

Pb
RoHS
COMPLIANT
HALOGEN
FREE
Available

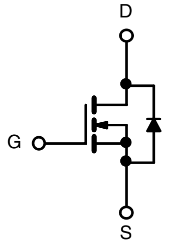
APPLICATIONS

- High-Side DC/DC Conversion
  - Notebook
  - Desktop
  - Server

SO-8



Top View



N-Channel MOSFET

Ordering Information: Si4384DY-T1-E3 (Lead (Pb)-free)
Si4384DY-T1-GE3 (Lead (Pb)-free and Halogen-free)

ABSOLUTE MAXIMUM RATINGS T_A = 25 °C, unless otherwise noted

Parameter		Symbol	10 s	Steady State	Unit
Drain-Source Voltage		V_{DS}	30		V
Gate-Source Voltage		V_{GS}	± 20		
Continuous Drain Current (T_J = 150 °C)[a]	T_A = 25 °C	I_D	15	10	A
	T_A = 70 °C		12	8	
Pulsed Drain Current		I_{DM}	± 50		
Continuous Source Current (Diode Conduction)[a]		I_S	2.8	1.3	
Single Pulse Avalanche Current	L = 0.1 mH	I_{AS}	25		
Avalanche Energy		E_{AS}	31		mJ
Maximum Power Dissipation[a]	T_A = 25 °C	P_D	3.1	1.47	W
	T_A = 70 °C		20	.95	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	- 55 to 150		°C

THERMAL RESISTANCE RATINGS

Parameter Symb		ol	Typical	Maximum	Unit
Maximum Junction-to-Ambient (MOSFET)[a]	t ≤ 10 s	R_{thJA}	34	40	°C/W
	Steady State		71	85	
Maximum Junction-to-Foot (Drain)	Steady State	R_{thJF}	17	20	

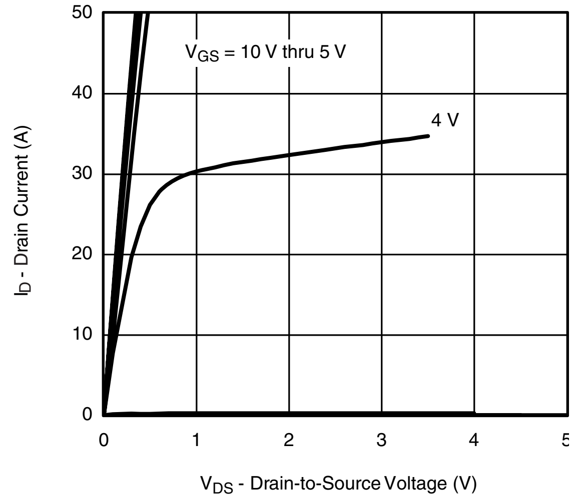
Notes:
a. Surface Mounted on 1" x 1" FR4 board.

MOSFET SPECIFICATIONS T_J = 25 °C, unless otherwise noted						
Parameter	**Symbol**	**Test Conditions**	**Min.**	**Typ.**	**Max.**	**Unit**
Static						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, I_D = 250 µA	1.0		3.0	V
Gate-Body Leakage	I_{GSS}	V_{DS} = 0 V, V_{GS} = ± 20 V			± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 30 V, V_{GS} = 0 V			1	µA
		V_{DS} = 30 V, V_{GS} = 0 V, T_J = 70 °C			10	
On-State Drain Current[a]	$I_{D(on)}$ V	$_{DS}$ ≥ 5 V, V_{GS} = 10 V	40			A
Drain-Source On-State Resistance[a]	$R_{DS(on)}$	V_{GS} = 10 V, I_D = 15 A		0.007	0.0085	Ω
		V_{GS} = 4.5 V, I_D = 12 A		0.0105	0.0125	
Forward Transconductance[a]	g_{fs}	V_{DS} = 15 V, I_D = 15 A		56		S
Diode Forward Voltage[a]	V_{SD}	I_S = 2.8 A, V_{GS} = 0 V		0.75	1.1	V
Dynamic[b]						
Total Gate Charge	Q_g	V_{DS} = 15 V, V_{GS} = 4.5 V, I_D = 15 A		12	18	nC
Gate-Source Charge	Q_{gs}			5.9		
Gate-Drain Charge	Q_{gd}			4.0		
Gate Resistance	R_g		0.8	1.7	2.5	Ω
Turn-On Delay Time	$t_{d(on)}$	V_{DD} = 15 V, R_L = 15 Ω I_D ≅ 1 A, V_{GEN} = 10 V, R_g = 6 Ω		10	15	ns
Rise Time	t_r			13	20	
Turn-Off Delay Time	$t_{d(off)}$			45	70	
Fall Time	t_f			13	20	
Source-Drain Reverse Recovery Time	t_{rr}	I_F = 2.8 A, dI/dt = 100 A/µs		25	50	

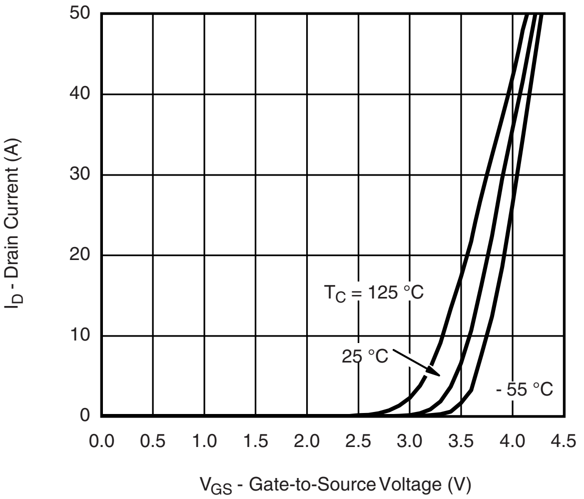
Notes:
a. Pulse test; pulse width ≤ 300 µs, duty cycle ≤ 2 %.
b. Guaranteed by design, not subject to production testing.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

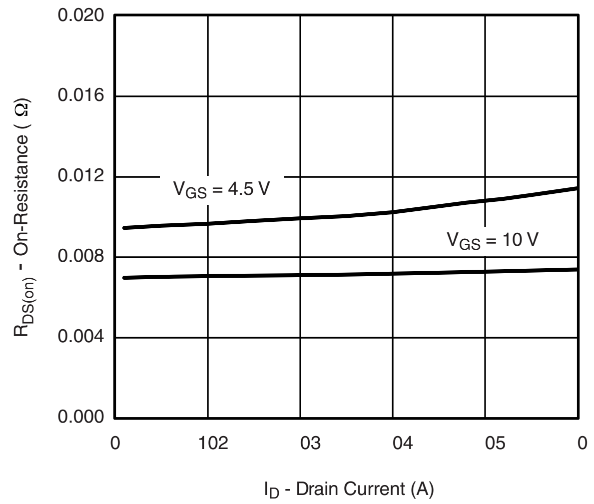


Output Characteristics

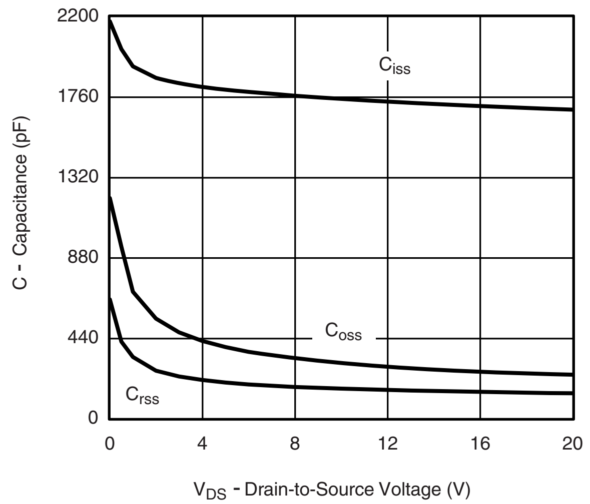


Transfer Characteristics

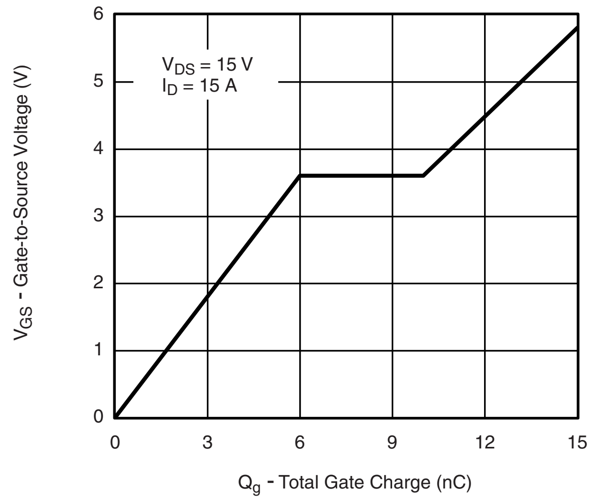
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



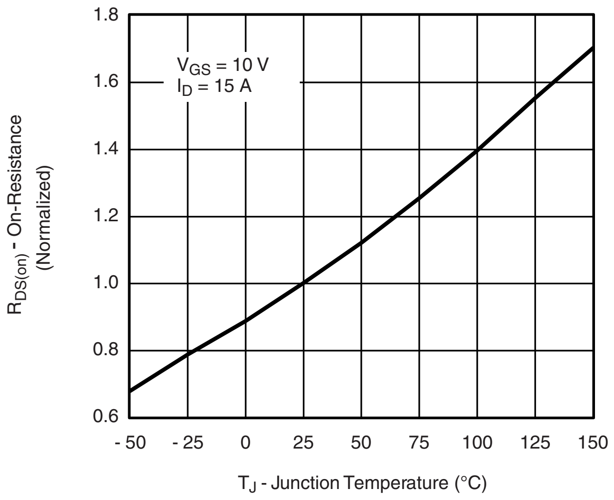
On-Resistance vs. Drain Current



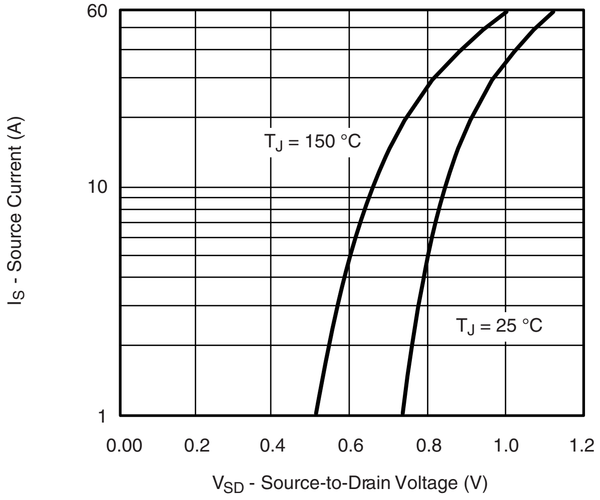
Capacitance



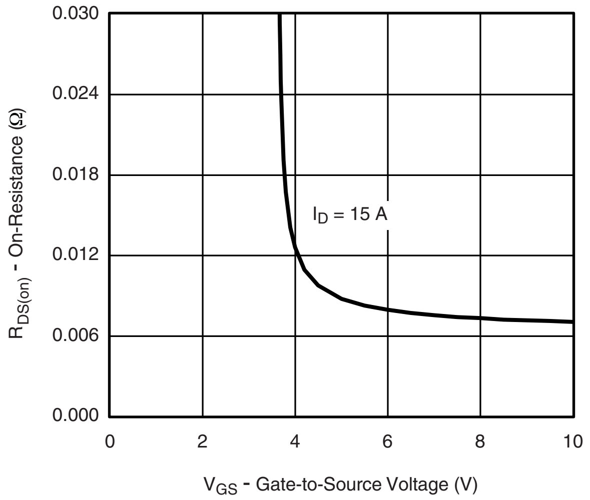
Gate Charge



On-Resistance vs. Junction Temperature

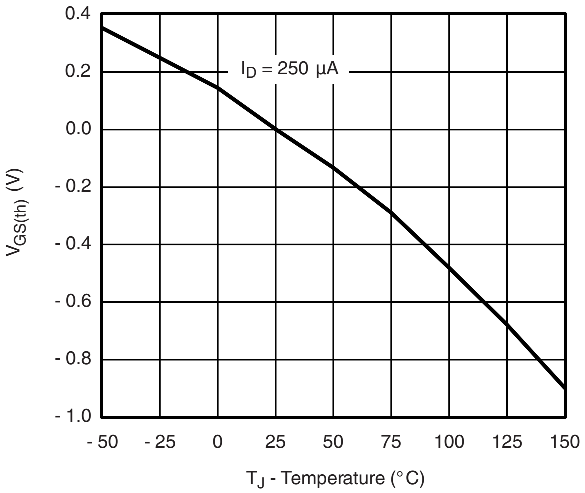


Source-Drain Diode Forward Voltage

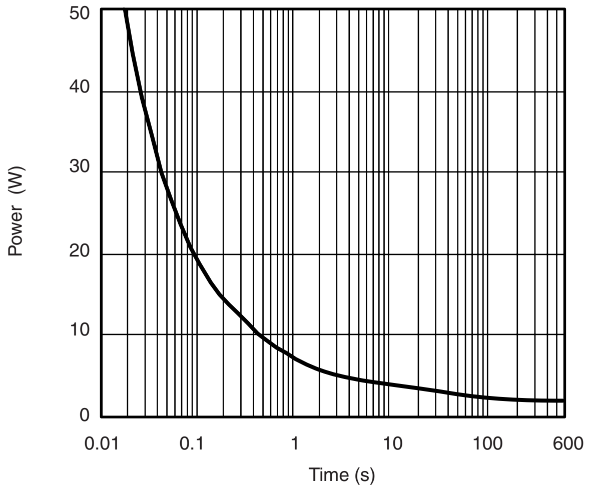


On-Resistance vs. Gate-to-Source Voltage

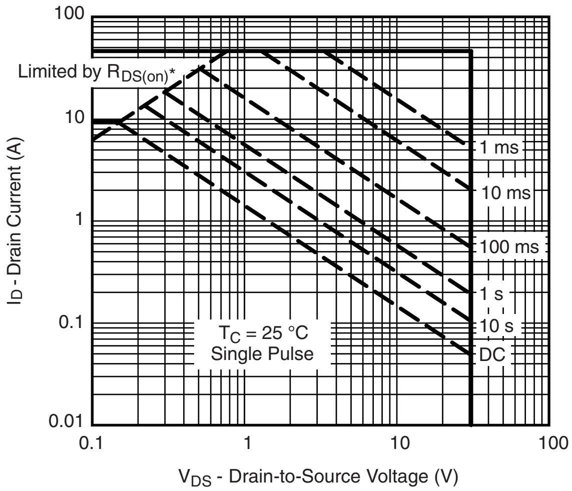
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



Threshold Voltage

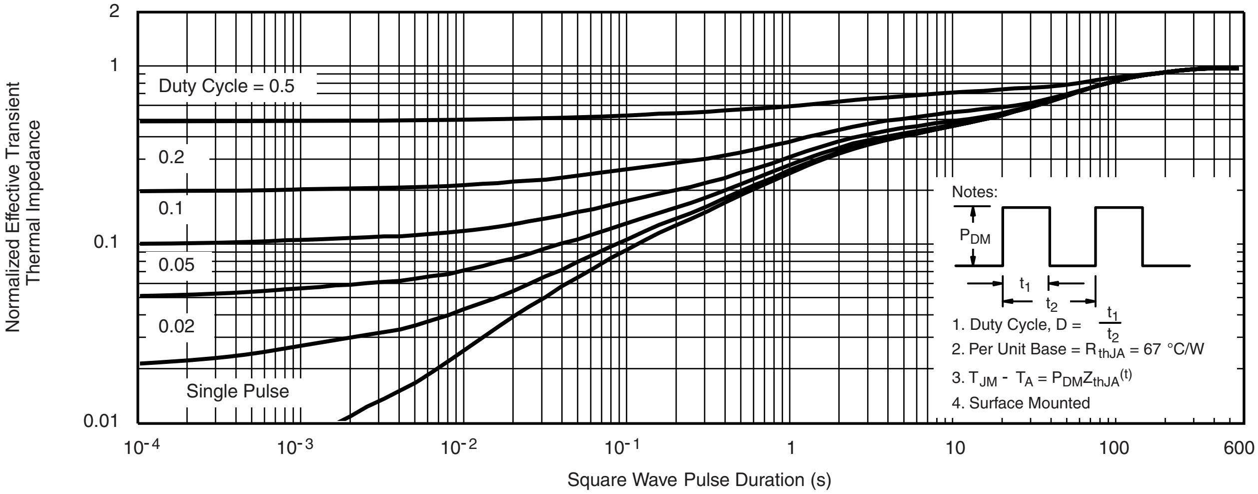


Single Pulse Power



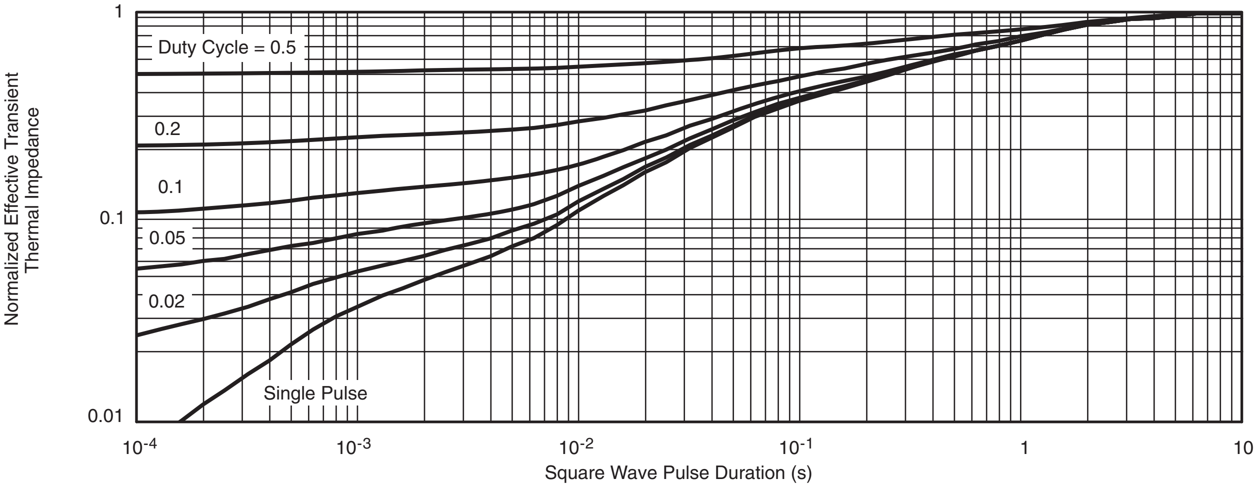
*V_{GS} > minimum V_{GS} at which $R_{DS(on)}$ is specified

Safe Operating Area, Junction-to-Case



Normalized Thermal Transient Impedance, Junction-to-Ambient

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

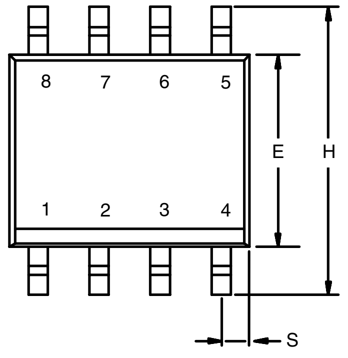


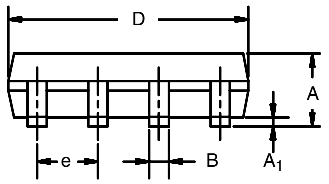
Normalized Thermal Transient Impedance, Junction-to-Foot

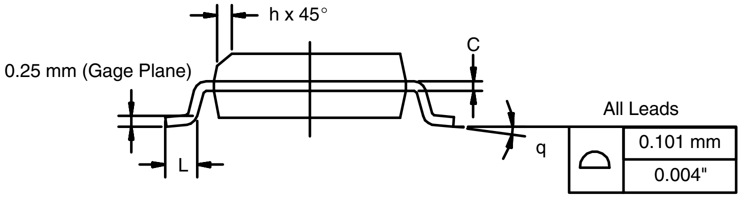
Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?72645.

SOIC (NARROW): 8-LEAD

JEDEC Part Number: MS-012







DIM	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A_1	0.10	0.20	0.004	0.008
B	0.35	0.51	0.014	0.020
C	0.19	0.25	0.0075	0.010
D	4.80	5.00	0.189	0.196
E	3.80	4.00	0.150	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
h	0.25	0.50	0.010	0.020
L	0.50	0.93	0.020	0.037
q	0°8	°0	°8	°
S	0.44	0.64	0.018	0.026
ECN: C-06527-Rev. I, 11-Sep-06 DWG: 5498				

VISHAY SILICONIX

TrenchFET® Power MOSFETs

Application Note 808

Mounting LITTLE FOOT®, SO-8 Power MOSFETs

Wharton McDaniel

Surface-mounted LITTLE FOOT power MOSFETs use integrated circuit and small-signal packages which have been been modified to provide the heat transfer capabilities required by power devices. Leadframe materials and design, molding compounds, and die attach materials have been changed, while the footprint of the packages remains the same.

See Application Note 826, *Recommended Minimum Pad Patterns With Outline Drawing Access for Vishay Siliconix MOSFETs*, (http://www.vishay.com/ppg?72286), for the basis of the pad design for a LITTLE FOOT SO-8 power MOSFET. In converting this recommended minimum pad to the pad set for a power MOSFET, designers must make two connections: an electrical connection and a thermal connection, to draw heat away from the package.

In the case of the SO-8 package, the thermal connections are very simple. Pins 5, 6, 7, and 8 are the drain of the MOSFET for a single MOSFET package and are connected together. In a dual package, pins 5 and 6 are one drain, and pins 7 and 8 are the other drain. For a small-signal device or integrated circuit, typical connections would be made with traces that are 0.020 inches wide. Since the drain pins serve the additional function of providing the thermal connection to the package, this level of connection is inadequate. The total cross section of the copper may be adequate to carry the current required for the application, but it presents a large thermal impedance. Also, heat spreads in a circular fashion from the heat source. In this case the drain pins are the heat sources when looking at heat spread on the PC board.

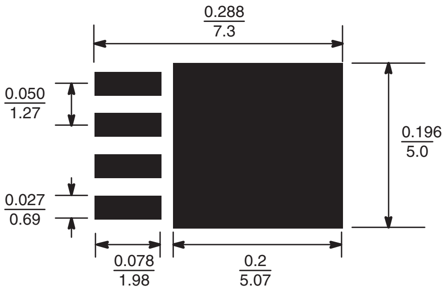


Figure 1. Single MOSFET SO-8 Pad Pattern With Copper Spreading

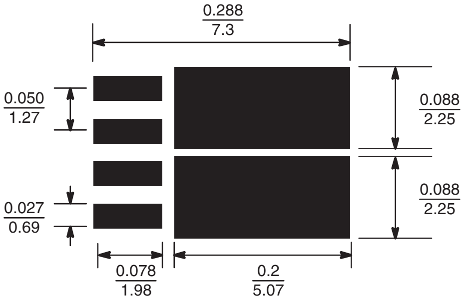


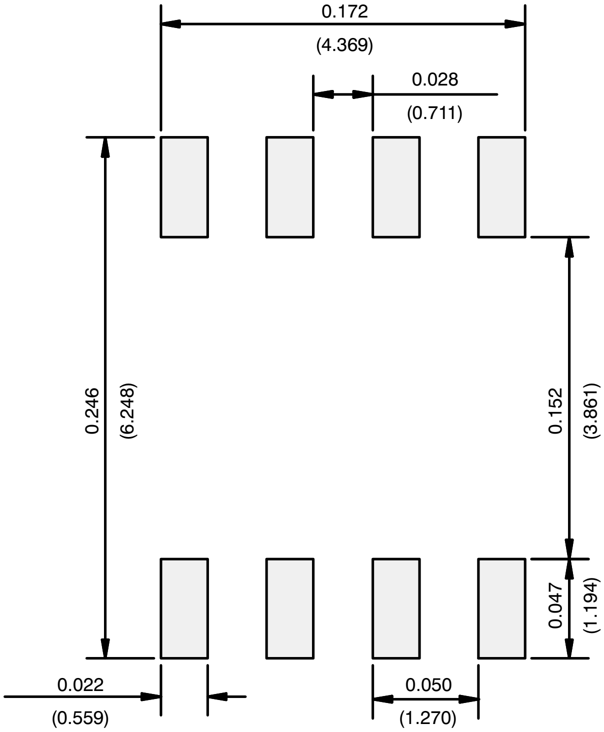
Figure 2. Dual MOSFET SO-8 Pad Pattern With Copper Spreading

The minimum recommended pad patterns for the single-MOSFET SO-8 with copper spreading (Figure 1) and dual-MOSFET SO-8 with copper spreading (Figure 2) show the starting point for utilizing the board area available for the heat-spreading copper. To create this pattern, a plane of copper overlies the drain pins. The copper plane connects the drain pins electrically, but more importantly provides planar copper to draw heat from the drain leads and start the process of spreading the heat so it can be dissipated into the ambient air. These patterns use all the available area underneath the body for this purpose.

Since surface-mounted packages are small, and reflow soldering is the most common way in which these are affixed to the PC board, “thermal” connections from the planar copper to the pads have not been used. Even if additional planar copper area is used, there should be no problems in the soldering process. The actual solder connections are defined by the solder mask openings. By combining the basic footprint with the copper plane on the drain pins, the solder mask generation occurs automatically.

A final item to keep in mind is the width of the power traces. The absolute minimum power trace width must be determined by the amount of current it has to carry. For thermal reasons, this minimum width should be at least 0.020 inches. The use of wide traces connected to the drain plane provides a low impedance path for heat to move away from the device.

RECOMMENDED MINIMUM PADS FOR SO-8



Recommended Minimum Pads
Dimensions in Inches/(mm)

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