

## MI8405-VB Datasheet

### P-Channel 12 V (G-S) MOSFET

#### PRODUCT SUMMARY

$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>	$Q_g$ (Typ.)
- 12	0.015 at $V_{GS} = - 4.5$ V	- 25	35 nC
	0.021 at $V_{GS} = - 2.5$ V	- 24	
	0.023 at $V_{GS} = - 1.8$ V	- 24	

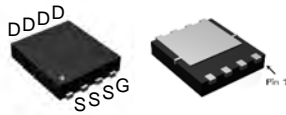
#### FEATURES

- Halogen-free according to IEC 61249-2-21 Definition
- TrenchFET<sup>®</sup> Power MOSFET
- Ultra Small DFN3x3 Chipscale Packaging Reduces Footprint Area, Profile (0.62 mm) and On-Resistance Per Footprint Area
- Compliant to RoHS Directive 2002/95/EC


**RoHS**  
 COMPLIANT

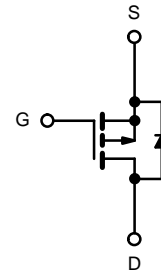
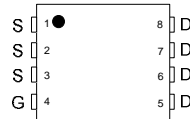
#### Pin Description

Top View Bottom View



DFN3x3-8(punch type)

Top View



P-Channel MOSFET

#### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	$V_{DS}$	- 12	V
Gate-Source Voltage	$V_{GS}$	$\pm 8$	
Continuous Drain Current ( $T_J = 150$ °C)	$I_D$	$T_C = 25$ °C	A
		$T_C = 70$ °C	
		$T_A = 25$ °C	
		$T_A = 70$ °C	
Pulsed Drain Current	$I_{DM}$	- 80	A
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25$ °C	
		$T_A = 25$ °C	W
Maximum Power Dissipation	$P_D$	$T_C = 25$ °C	
		$T_C = 70$ °C	
		$T_A = 25$ °C	
		$T_A = 70$ °C	
Operating Junction and Storage Temperature Range	$T_J, T_{stg}$	- 55 to 150	°C
Package Reflow Conditions <sup>d</sup>	IR/Convection	260	

Notes:

 a. Based on  $T_C = 25$  °C.

b. Surface mounted on 1" x 1" FR4 board.

 c.  $t = 10$  s.

d. Refer to IPC/JEDEC (J-STD-020), no manual or hand soldering.

e. In this document, any reference to the Case represents the body of the DFN2X2 device and Foot is the bump.

**THERMAL RESISTANCE RATINGS**

Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>a, b</sup>	$R_{thJA}$	31	42	°C/W
Maximum Junction-to-Foot (Drain)	Steady State $R_{thJF}$	13	16	

Notes:

a. Surface mounted on 1" x 1" FR4 board.

b. Maximum under steady state conditions is 72 °C/W.

**SPECIFICATIONS** ( $T_J = 25\text{ °C}$ , unless otherwise noted)

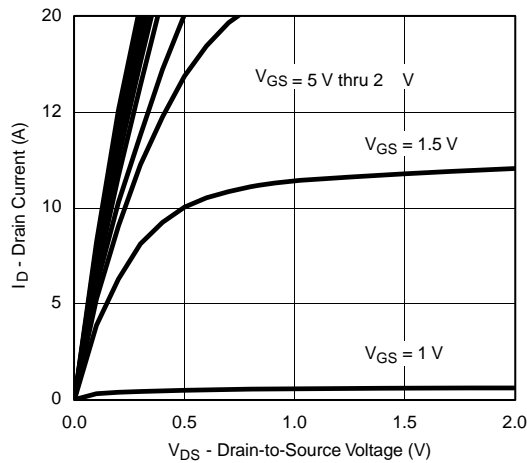
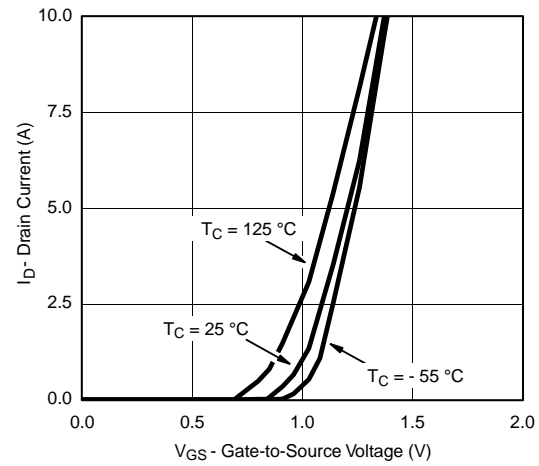
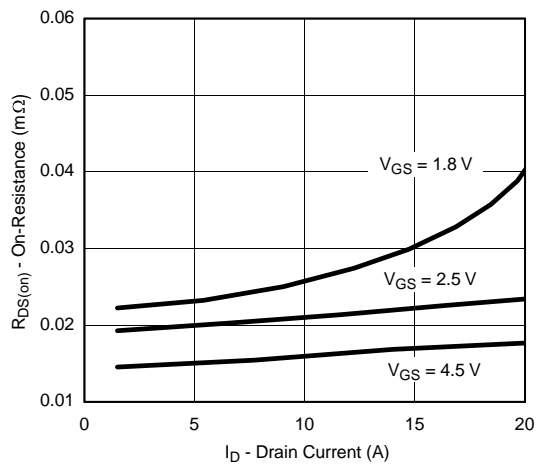
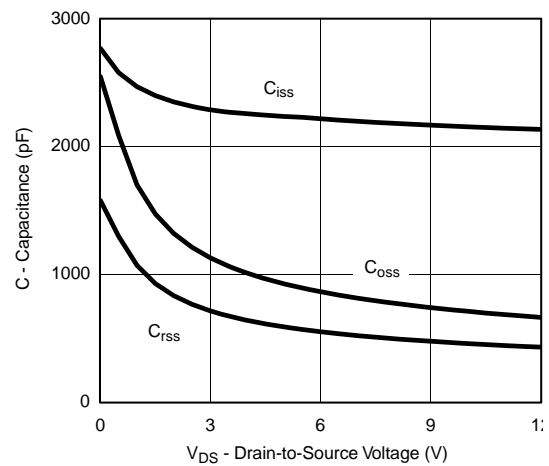
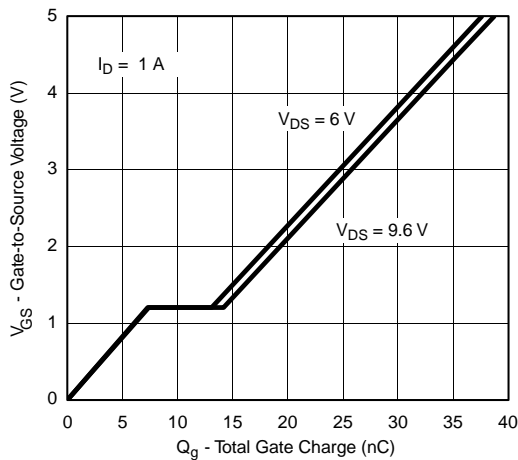
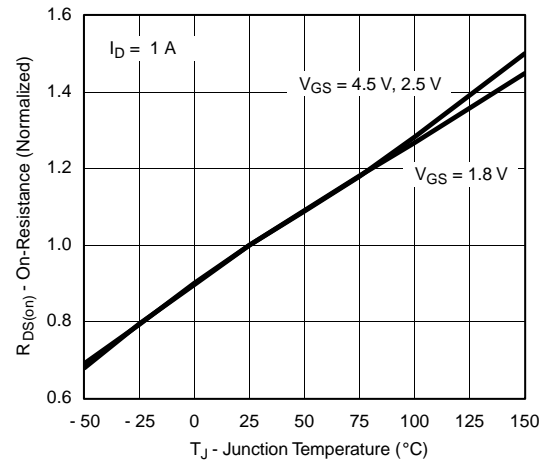
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	- 12			V
$V_{DS}$ Temperature Coefficient	$\Delta V_{DS}/T_J$	$I_D = -250\text{ }\mu\text{A}$		- 13.3		mV/°C
$V_{GS(th)}$ Temperature Coefficient	$\Delta V_{GS(th)}/T_J$			2.4		
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	- 0.5		- 1.5	V
Gate-Source Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = 5\text{ V}$			- 100	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -12\text{ V}, V_{GS} = 0\text{ V}$			- 1	$\mu\text{A}$
		$V_{DS} = -12\text{ V}, V_{GS} = 0\text{ V}, T_J = 70\text{ °C}$			- 10	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} \leq 5\text{ V}, V_{GS} = -4.5\text{ V}$	- 20			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -4.5\text{ V}, I_D = -1\text{ A}$		0.015		$\Omega$
		$V_{GS} = -2.5\text{ V}, I_D = -1\text{ A}$		0.021		
		$V_{GS} = -1.8\text{ V}, I_D = -1\text{ A}$		0.023		
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -4\text{ V}, I_D = -1\text{ A}$		8.3		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{DS} = -6\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		2220		pF
Output Capacitance	$C_{oss}$			865		
Reverse Transfer Capacitance	$C_{rss}$			555		
Total Gate Charge	$Q_g$	$V_{DS} = -6\text{ V}, V_{GS} = -5\text{ V}, I_D = -1\text{ A}$		38	57	nC
Gate-Source Charge	$Q_{gs}$			35	53	
Gate-Drain Charge	$Q_{gd}$			7.3		
Gate Resistance	$R_g$			5.9		
Gate Resistance	$R_g$	$V_{GS} = -0.1\text{ V}, f = 1\text{ MHz}$		28		$\Omega$
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -6\text{ V}, R_L = 4\text{ }\Omega$ $I_D \cong -1\text{ A}, V_{GEN} = -4.5\text{ V}, R_g = 6\text{ }\Omega$		14	21	ns
Rise Time	$t_r$			25	40	
Turn-Off Delay Time	$t_{d(off)}$			380	570	
Fall Time	$t_f$			240	360	

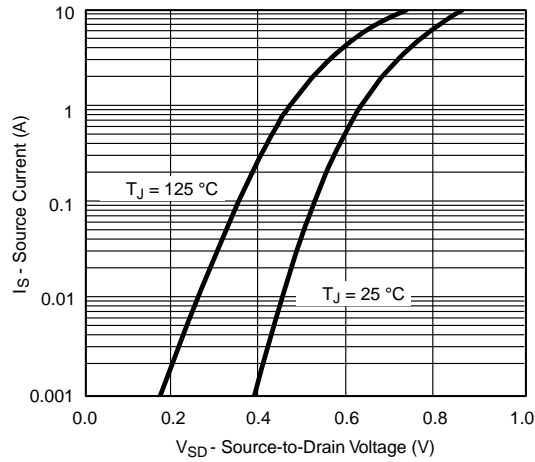
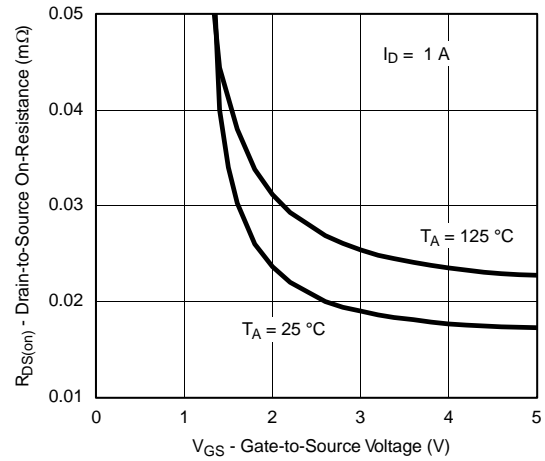
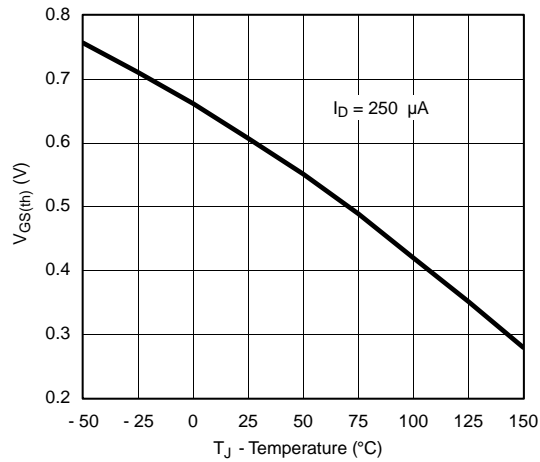
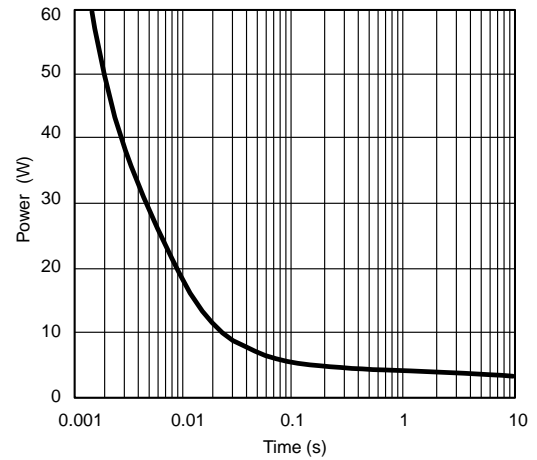
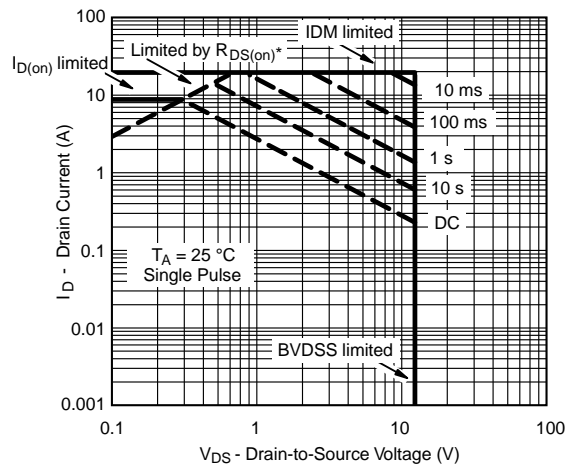
<b>SPECIFICATIONS</b> $T_J = 25\text{ }^{\circ}\text{C}$ , unless otherwise noted						
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>Drain-Source Body Diode Characteristics</b>						
Continuous Source-Drain Diode Current	$I_S$	$T_C = 25\text{ }^{\circ}\text{C}$		- 8		A
Pulse Diode Forward Current	$I_{SM}$			- 25		
Body Diode Voltage	$V_{SD}$	$I_S = -1\text{ A}, V_{GS} = 0\text{ V}$		- 0.65	- 1.2	V
Body Diode Reverse Recovery Time	$t_{rr}$	$I_F = -1\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}, T_J = 25\text{ }^{\circ}\text{C}$		311	467	ns
Body Diode Reverse Recovery Charge	$Q_{rr}$			1.136	1.705	$\mu\text{C}$
Reverse Recovery Fall Time	$t_a$			116		ns
Reverse Recovery Rise Time	$t_b$			195		

Notes:

- a. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .  
b. Guaranteed by design, not subject to production testing.

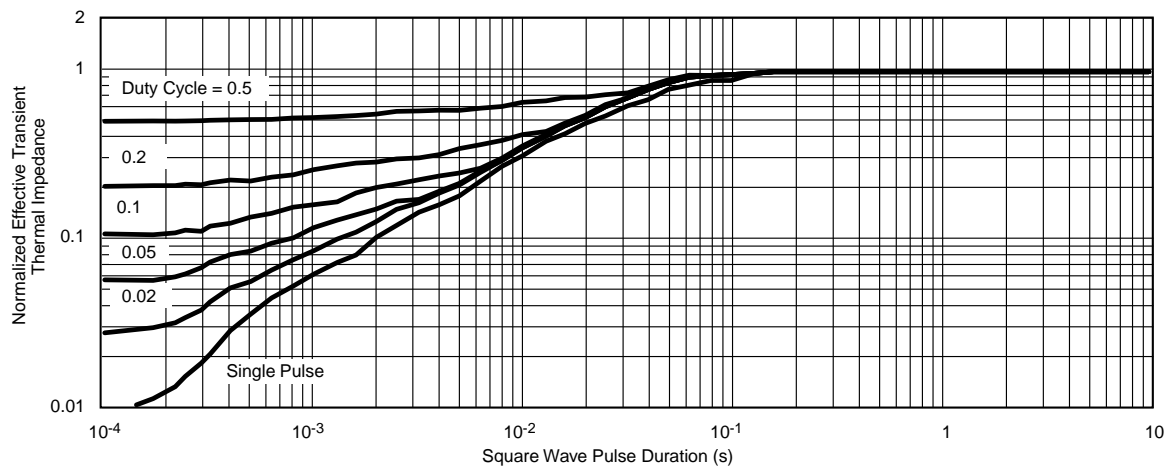
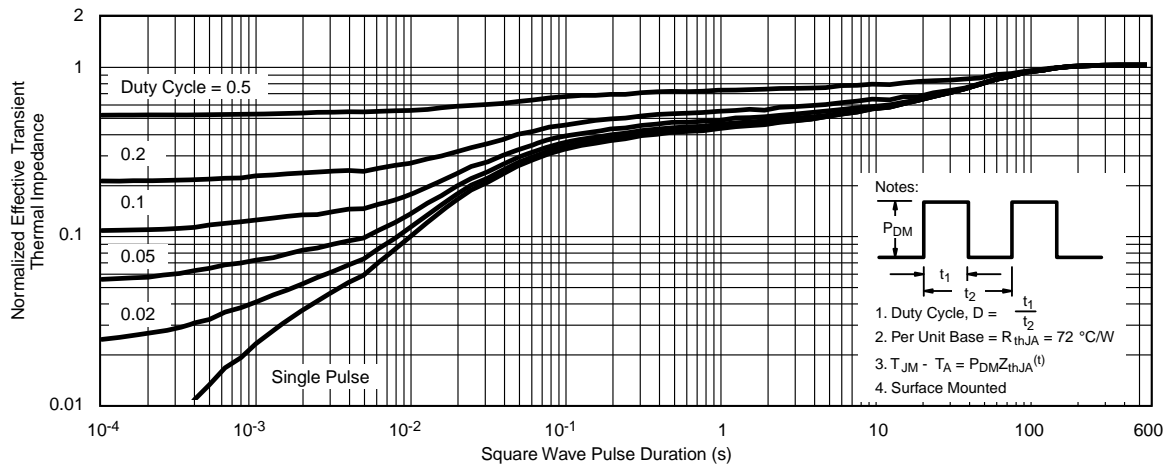
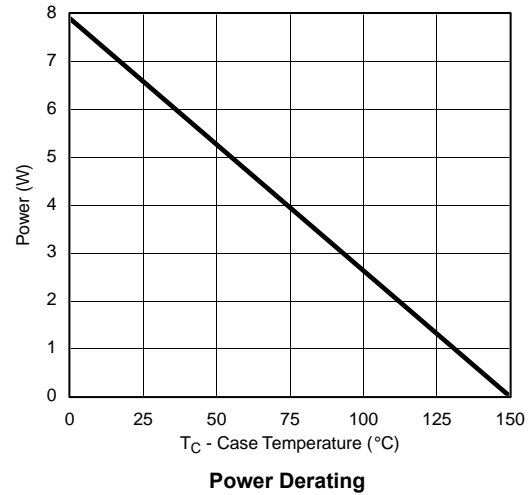
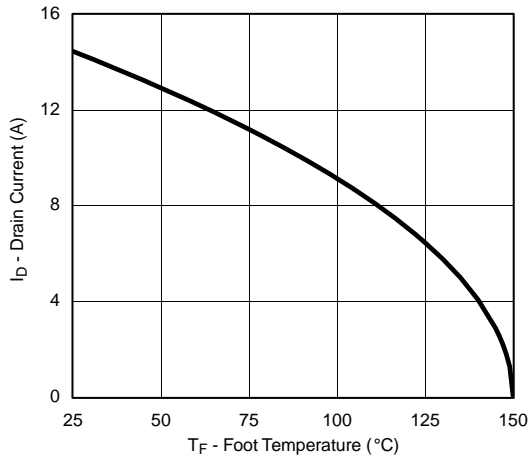
*Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Output Characteristics**

**Transfer Characteristics**

**On-Resistance vs. Drain Current and Gate Voltage**

**Capacitance**

**Gate Charge**

**On-Resistance vs. Junction Temperature**

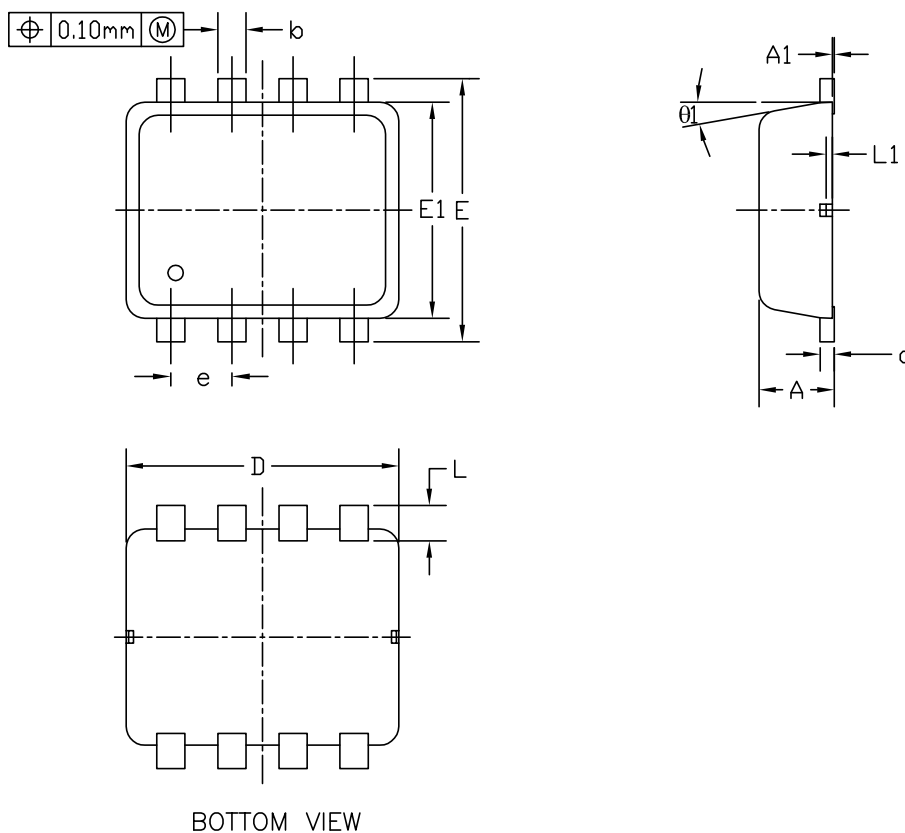
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Source-Drain Diode Forward Voltage**

**On-Resistance vs. Gate-to-Source Voltage**

**Threshold Voltage**

**Single Pulse Power, Junction-to-Ambient**


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

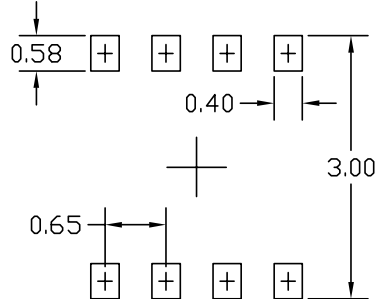
**Safe Operating Area, Junction-to-Ambient**

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)


## DFN3x3A\_8L\_NEP\_P PACKAGE OUTLINE



## RECOMMENDED LAND PATTERN



UNIT: mm

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.70	0.80	0.90	0.028	0.031	0.035
A1	0.00	—	0.05	0.000	—	0.002
b	0.24	0.30	0.35	0.009	0.012	0.014
c	0.08	0.15	0.25	0.003	0.006	0.010
D	2.80	2.90	3.00	0.110	0.114	0.118
E	2.70	2.80	2.90	0.106	0.110	0.114
E1	2.20	2.30	2.40	0.0087	0.091	0.095
e	0.65 BSC			0.026 BSC		
L	0.20	0.38	0.45	0.008	0.015	0.018
L1	0.05	—	0.10	0.002	—	0.004
$\theta 1$	0°	10°	12°	0°	10°	12°

## NOTE

1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.  
MOLD FLASH AT THE NON-LEAD SIDES SHOULD BE LESS THAN 6 MIL EACH.
2. CONTROLLING DIMENSION IS MILLIMETER.  
CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.

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