



**DMN2028USS**

**20V N-CHANNEL ENHANCEMENT MODE MOSFET**

**Product Summary**

$V_{(BR)DSS}$	$R_{DS(on) \max}$	$I_D \max$ $T_A = 25^\circ C$ (Note 3)
20V	20m $\Omega$ @ $V_{GS} = 4.5V$	9.8A
	28m $\Omega$ @ $V_{GS} = 2.5V$	8.3A

**Description and Applications**

This MOSFET has been designed to minimize the on-state resistance ( $R_{DS(on)}$ ) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

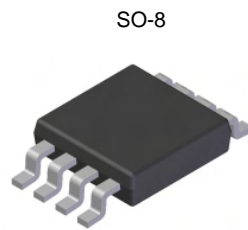
- Battery charging
- Power management functions
- DC-DC converters
- Portable power adaptors

**Features and Benefits**

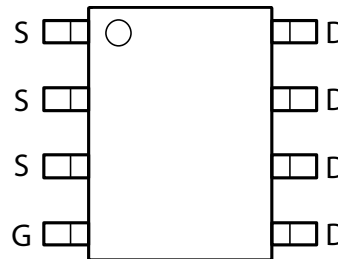
- Low On-Resistance
- Low Input Capacitance
- Fast Switching Speed
- Low Output Leakage
- **ESD Protected Up to 2kV**
- **Lead Free/RoHS Compliant (Note 1)**
- **Halogen and Antimony Free. "Green" Device (Note 1)**
- **Qualified to AEC-Q101 Standards for High Reliability**

**Mechanical Data**

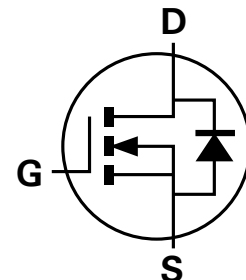
- Case: SO-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0 (Note 1)
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram Below
- Terminals: Finish – Matte Tin annealed over Copper leadframe. Solderable per MIL-STD-202, Method 208
- Weight: 0.074 grams (approximate)



Top View



Top View



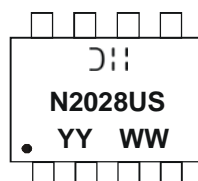
Equivalent Circuit

**Ordering Information** (Note 1)

Product	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
DMN2028USS-13	N2028US	13	12	2,500

Notes: 1. No purposefully added lead. Diodes Inc.'s "Green" policy and packaging details can be found on our website at <http://www.diodes.com>

**Marking Information**



⑆ = Manufacturer's Marking  
 N2028US = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Year (ex: 10 = 2010)  
 WW = Week (01-53)

**Maximum Ratings** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

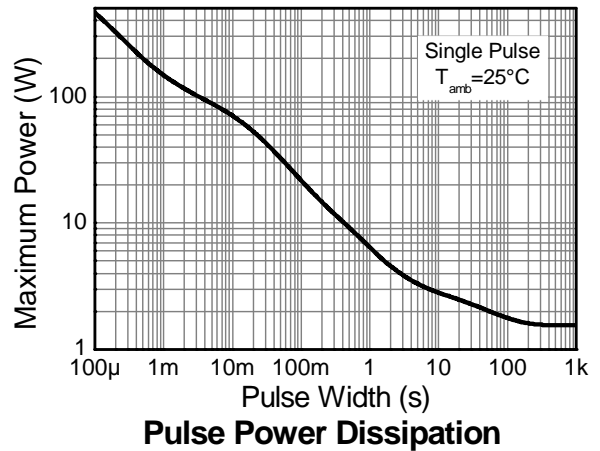
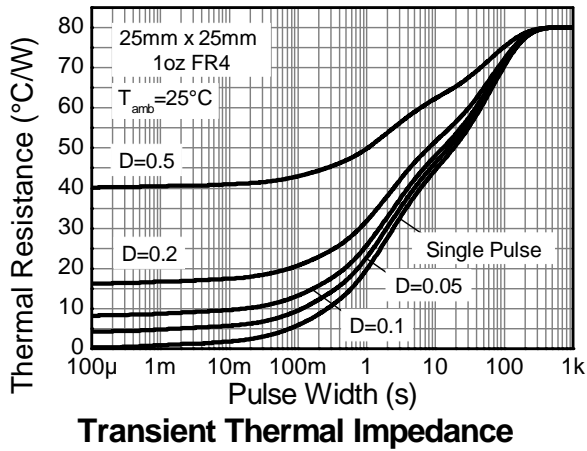
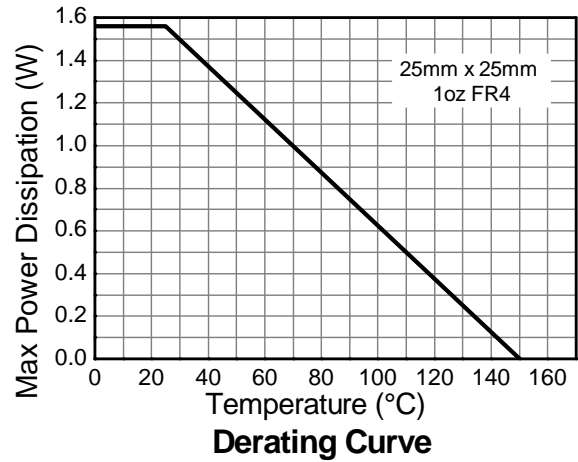
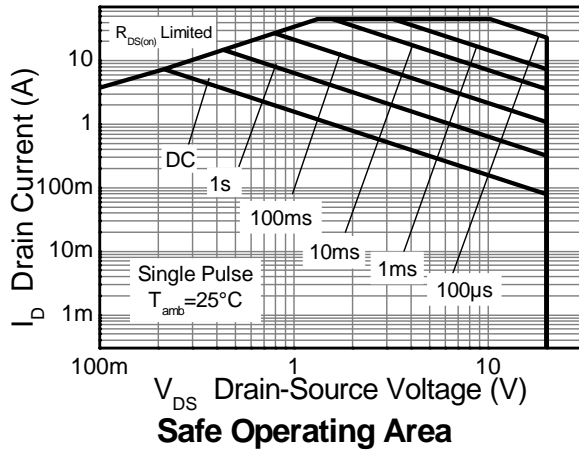
Characteristic			Symbol	Value	Unit
Drain-Source voltage			$V_{DSS}$	20	V
Gate-Source voltage			$V_{GS}$	$\pm 12$	
Continuous Drain current	$V_{GS} = 4.5\text{V}$	(Note 3)	$I_D$	9.8	A
		$T_A = 70^\circ\text{C}$ (Note 3)		7.9	
		(Note 2)		7.3	
Pulsed Drain current	$V_{GS} = 4.5\text{V}$	(Note 4)	$I_{DM}$	45.0	
Continuous Source current (Body diode)			(Note 3)	$I_S$	
Pulsed Source current (Body diode)			(Note 4)	$I_{SM}$	45.0

**Thermal Characteristics** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

Characteristic		Symbol	Value	Unit
Power dissipation	(Note 2)	$P_D$	1.56	W
	Linear derating factor		(Note 3)	
			2.81	
Thermal Resistance, Junction to Ambient	(Note 2)	$R_{\theta JA}$	80.0	$^\circ\text{C/W}$
	(Note 3)		44.5	
Thermal Resistance, Junction to Lead	(Note 5)	$R_{\theta JL}$	37.0	
Operating and storage temperature range		$T_J, T_{STG}$	-55 to 150	$^\circ\text{C}$

- Notes:
- For a device surface mounted on 25mm x 25mm x 1.6mm FR4 PCB with high coverage of single sided 1oz copper, in still air conditions; the device is measured when operating in a steady-state condition.
  - Same as note (2), except the device is measured at  $t \leq 10$  sec.
  - Same as note (2), except the device is pulsed with  $D = 0.02$  and pulse width 300 $\mu\text{s}$ .
  - Thermal resistance from junction to solder-point (at the end of the drain lead).

**Thermal Characteristics**



**Electrical Characteristics** @ $T_A = 25^\circ\text{C}$  unless otherwise specified

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	20	-	-	V	$V_{GS} = 0V, I_D = 250\mu A$
Zero Gate Voltage Drain Current	$I_{DSS}$	-	-	1.0	$\mu A$	$V_{DS} = 20V, V_{GS} = 0V$
Gate-Source Leakage	$I_{GSS}$	-	-	$\pm 10$	$\mu A$	$V_{GS} = \pm 12V, V_{DS} = 0V$
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(th)}$	0.6	1.0	1.3	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
Static Drain-Source On-Resistance (Note 6)	$R_{DS(on)}$	-	11	20	m $\Omega$	$V_{GS} = 4.5V, I_D = 9.4A$
			15	28		$V_{GS} = 2.5V, I_D = 8.3A$
Forward Transfer Admittance (Note 6 & 7)	$ Y_{fs} $	-	16	-	S	$V_{DS} = 5V, I_D = 9.4A$
Diode Forward Voltage (Note 6)	$V_{SD}$	-	0.7	1.3	V	$V_{GS} = 0V, I_S = 1.3A$
<b>DYNAMIC CHARACTERISTICS (Note 7)</b>						
Input Capacitance	$C_{iss}$	-	1000	-	pF	$V_{DS} = 10V, V_{GS} = 0V,$ $f = 1.0MHz$
Output Capacitance	$C_{oss}$	-	166	-		
Reverse Transfer Capacitance	$C_{rss}$	-	158	-		
Gate Resistance	$R_g$	-	1.51	-	$\Omega$	$V_{DS} = 0V, V_{GS} = 0V, f = 1MHz$
Total Gate Charge (Note 8)	$Q_g$	-	7.0	-	nC	$V_{DS} = 10V$ $I_D = 9.4A$
Total Gate Charge (Note 8)	$Q_g$	-	11.6	-		
Gate-Source Charge (Note 8)	$Q_{gs}$	-	2.7	-		
Gate-Drain Charge (Note 8)	$Q_{gd}$	-	3.4	-		
Turn-On Delay Time (Note 8)	$t_{D(on)}$	-	11.67	-	ns	$V_{GS} = 4.5V, V_{DS} = 10V,$ $R_G = 6\Omega, I_D = 1A$
Turn-On Rise Time (Note 8)	$t_r$	-	12.49	-		
Turn-Off Delay Time (Note 8)	$t_{D(off)}$	-	35.89	-		
Turn-Off Fall Time (Note 8)	$t_f$	-	12.33	-		

- Notes:
6. Measured under pulsed conditions. Pulse width  $\leq 300\mu s$ ; duty cycle  $\leq 2\%$
  7. For design aid only, not subject to production testing.
  8. Switching characteristics are independent of operating junction temperatures.

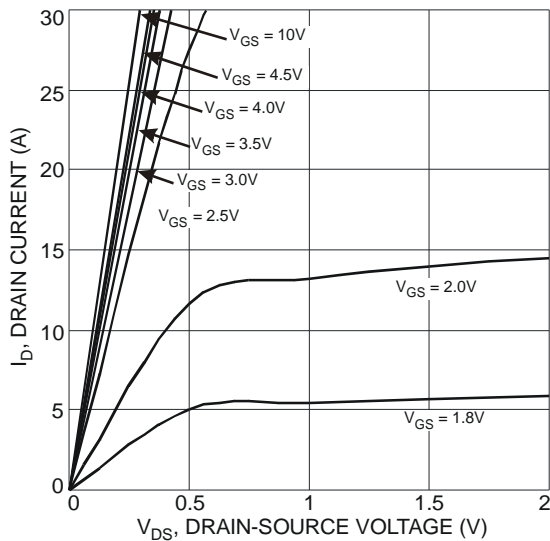


Fig. 1 Typical Output Characteristic

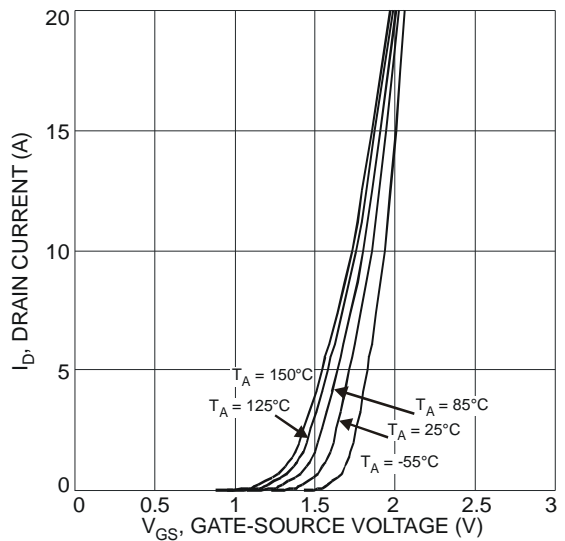


Fig. 2 Typical Transfer Characteristic

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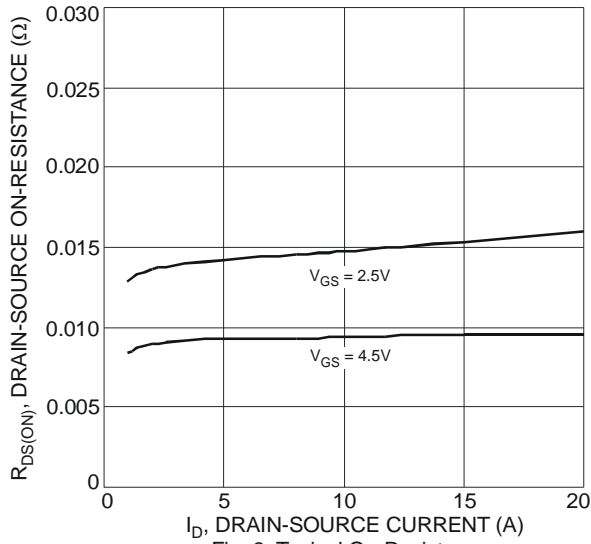


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

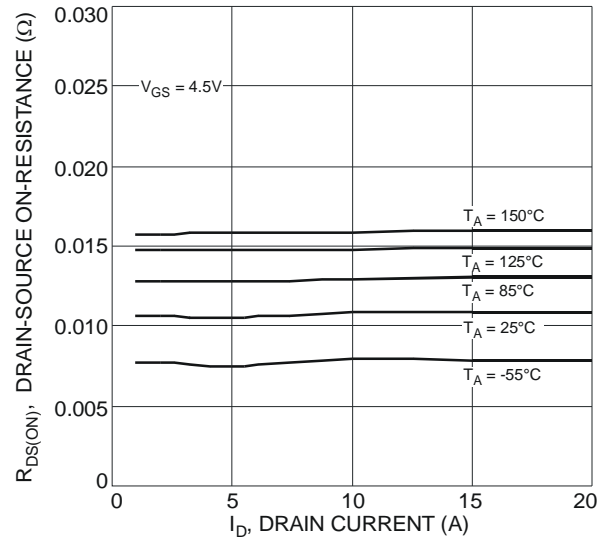


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

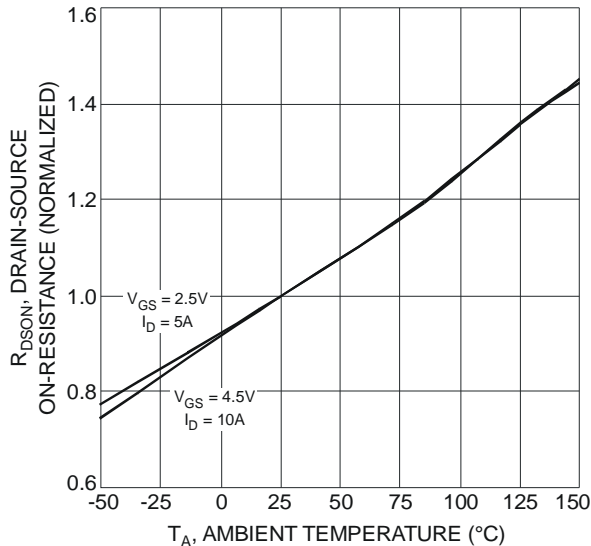


Fig. 5 On-Resistance Variation with Temperature

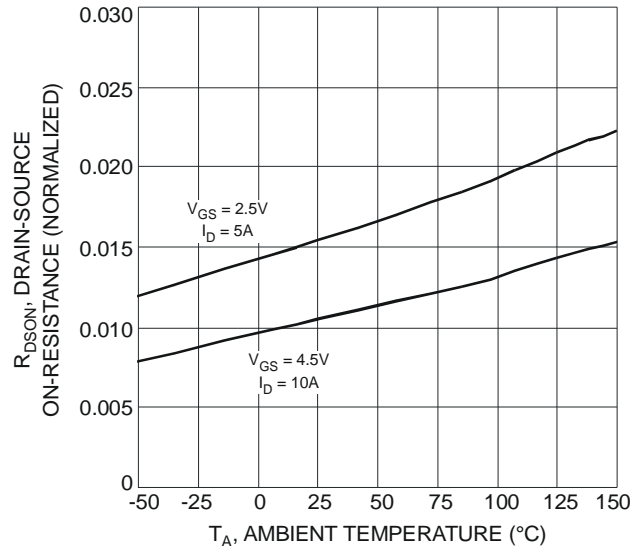


Fig. 6 On-Resistance Variation with Temperature

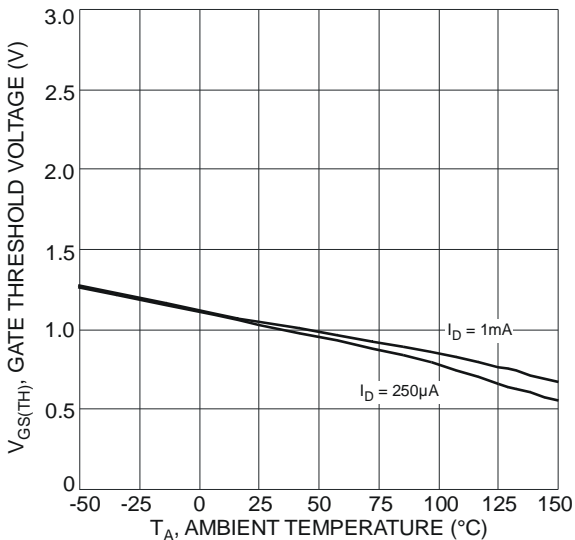


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

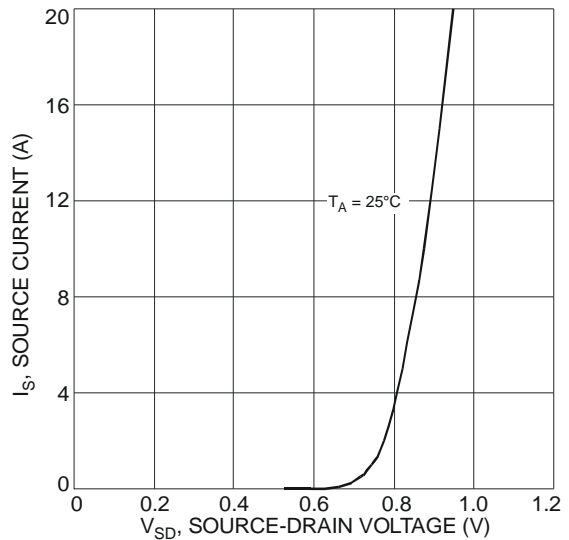


Fig. 8 Diode Forward Voltage vs. Current

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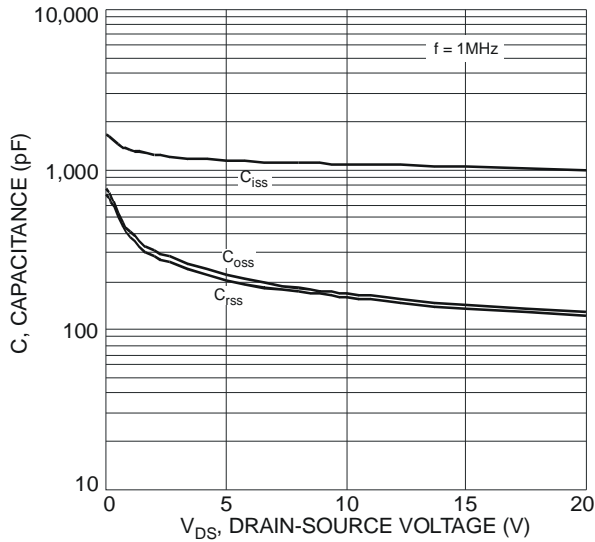


Fig. 9 Typical Total Capacitance

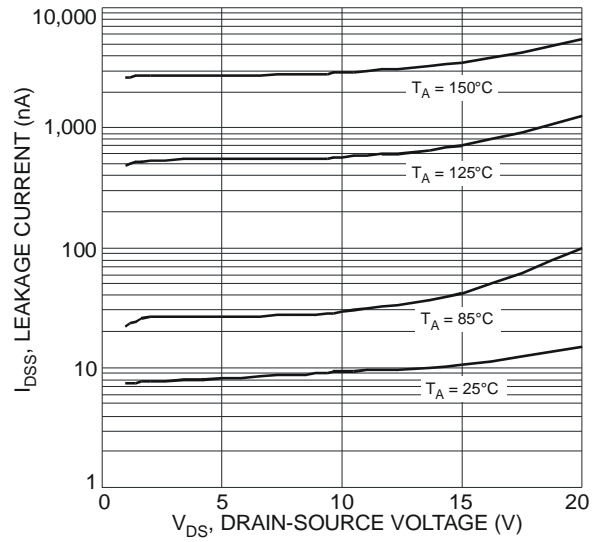


Fig. 10 Typical Leakage Current vs. Drain-Source Voltage

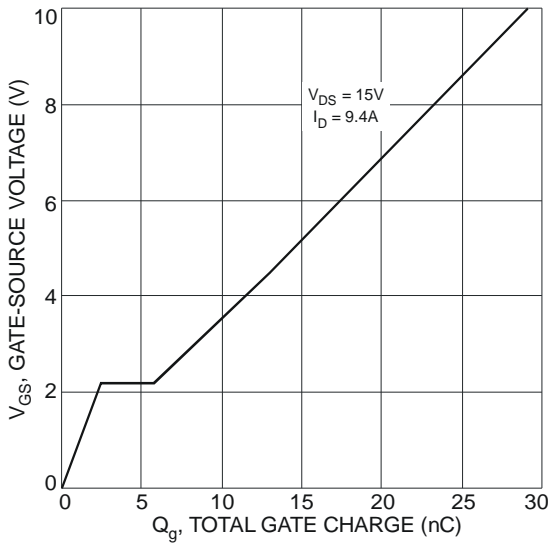
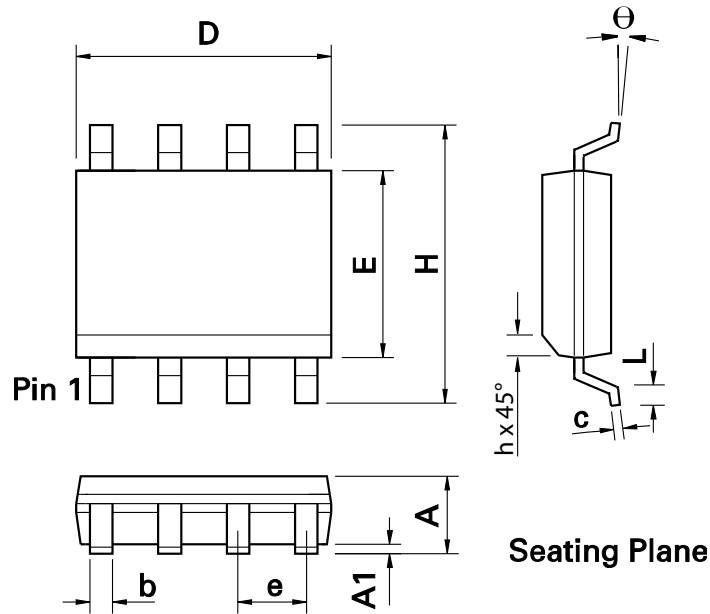


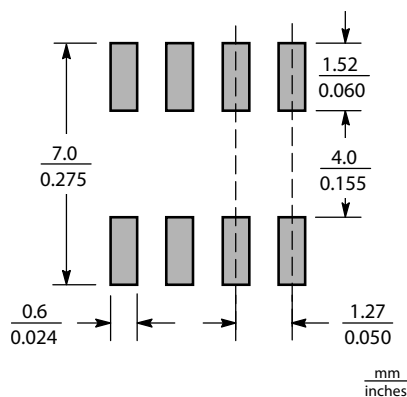
Fig. 11 Gate-Charge Characteristics

**Package Outline Dimensions**



DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.053	0.069	1.35	1.75	e	0.050 BSC		1.27 BSC	
A1	0.004	0.010	0.10	0.25	b	0.013	0.020	0.33	0.51
D	0.189	0.197	4.80	5.00	c	0.008	0.010	0.19	0.25
H	0.228	0.244	5.80	6.20	$\theta$	0°	8°	0°	8°
E	0.150	0.157	3.80	4.00	h	0.010	0.020	0.25	0.50
L	0.016	0.050	0.40	1.27	-	-	-	-	-

**Suggested Pad Layout**



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