

# N1M120080PN2

## Silicon Carbide Power MOSFET

N-Channel Enhancement Mode

$V_{DS}$	1200V
$I_D @ 25^\circ C$	33A
$R_{DS(ON)}$	80m $\Omega$

### Features

- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitance
- Easy to Parallel
- Simple to Drive

### Benefits

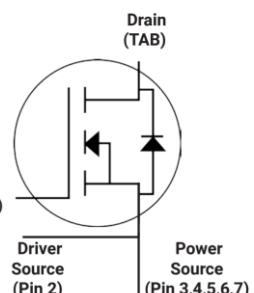
- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

### Applications

- Renewable Energy
- EV Battery Chargers
- High Voltage DC/DC Converters
- Switch Mode Power Supplies

### Package

TAB



1 2 3 4 5 6 7

Part Number	Package
N1M120080PN2	TO-263-7

### Maximum Ratings ( $T_C = 25^\circ C$ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
$V_{DSmax}$	Drain - Source Voltage	1200	V	$V_{GS} = 0 V, I_D = 100 \mu A$	
$V_{GSmax}$	Gate - Source Voltage	-8/+22	V	Absolute maximum values	
$V_{GSop}$	Gate - Source Voltage	-4/+18	V	Recommended operational values	
$I_D$	Continuous Drain Current	33	A	$V_{GS} = 18 V, T_C = 25^\circ C$	
		23.8		$V_{GS} = 18 V, T_C = 100^\circ C$	
$I_{D(pulse)}$	Pulsed Drain Current	80	A	Pulse width $t_P$ limited by $T_{jmax}$	
$P_D$	Power Dissipation	136	W	$T_C=25^\circ C, T_j=175^\circ C$	
$T_J, T_{stg}$	Operating Junction and Storage Temperature	-55 to + 175	°C		

**Electrical Characteristics (T<sub>C</sub>= 25°C unless otherwise specified)**

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note		
V <sub>(BR)DSS</sub>	Drain-Source Breakdown Voltage	1200			V	V <sub>GS</sub> =0V, I <sub>D</sub> =100μA			
V <sub>GS(th)</sub>	Gate Threshold Voltage	1.9	2.6	4.0	V	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =5mA	Fig.11		
			1.8			V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =5mA, T <sub>J</sub> =175°C			
I <sub>DSS</sub>	Zero Gate Voltage Drain Current		1	100	uA	V <sub>DS</sub> =1200V, V <sub>GS</sub> =0V			
I <sub>GSS</sub>	Gate-Source Leakage Current		+10	+250	nA	V <sub>GS</sub> =+22V, V <sub>DS</sub> =0V			
			-10	-250		V <sub>GS</sub> =-8V, V <sub>DS</sub> =0V			
R <sub>DS(on)</sub>	Drain-Source On-State Resistance		80	95	mΩ	V <sub>GS</sub> =18V, I <sub>D</sub> =20A	Fig. 4, 5, 6		
			121			V <sub>GS</sub> =18V, I <sub>D</sub> =20A, T <sub>J</sub> =175°C			
g <sub>fs</sub>	Transconductance		10.4		S	V <sub>DS</sub> =20V, I <sub>DS</sub> =20A	Fig.7		
			9.2			V <sub>DS</sub> =20V, I <sub>DS</sub> =20A, T <sub>J</sub> =175°C			
C <sub>iss</sub>	Input Capacitance	1200			pF	V <sub>GS</sub> =0V, V <sub>DS</sub> =1000V, f=1MHz, V <sub>AC</sub> = 25mV	Fig.15, 16		
C <sub>oss</sub>	Output Capacitance	63							
C <sub>rss</sub>	Reverse Transfer Capacitance	9.8							
E <sub>OSS</sub>	Stored Energy in Output Capacitance	41			μJ	V <sub>DS</sub> =800V, V <sub>GS</sub> = -4/18V, I <sub>D</sub> =20A, R <sub>G(ext)</sub> =2.5Ω, L=100μH			
E <sub>ON</sub>	Turn-On Switching Energy	586			μJ				
E <sub>OFF</sub>	Turn Off Switching Energy	273							
t <sub>d(on)</sub>	Turn-On Delay Time	13			ns	V <sub>DS</sub> =800V, V <sub>GS</sub> = -4/18V, I <sub>D</sub> =20A, R <sub>G(ext)</sub> =2.5Ω, R <sub>L</sub> =20Ω			
t <sub>r</sub>	Rise Time	12							
t <sub>d(off)</sub>	Turn-Off Delay Time	16							
t <sub>f</sub>	Fall Time	10							
R <sub>G(int)</sub>	Internal Gate Resistance	5.5			Ω	f = 1 MHz, V <sub>AC</sub> = 25 mV			
Q <sub>gs</sub>	Gate to Source Charge	21.5			nC	V <sub>DS</sub> =800V, V <sub>GS</sub> =-4/18V, I <sub>D</sub> =20A	Fig.12		
Q <sub>gd</sub>	Gate to Drain Charge	14.6							
Q <sub>g</sub>	Total Gate Charge	68.1							

**Reverse Diode Characteristics**

Symbol	Parameter	Typ.	Max.	Unit	Test conditions	Note
V <sub>SD</sub>	Diode Forward Voltage	4.1		V	V <sub>GS</sub> =-4V, I <sub>SD</sub> =10A	Fig.8, 9, 10
		3.8			V <sub>GS</sub> =-4V, I <sub>SD</sub> =10A, T <sub>J</sub> =175°C	
I <sub>S</sub>	Continuous Diode Forward Current		33	A	T <sub>C</sub> =25°C	
t <sub>rr</sub>	Reverse Recovery Time	28		ns	I <sub>SD</sub> =20A, V <sub>R</sub> =800V	
Q <sub>rr</sub>	Reverse Recovery Charge	62		nC		
I <sub>rrm</sub>	Peak Reverse Recovery Current	3.7		A		

**Thermal Characteristics**

Symbol	Parameter	Typ.	Max.	Unit	Test conditions	Note
R <sub>θJC</sub>	Thermal Resistance from Junction to Case	0.84		°C/W		
R <sub>θJA</sub>	Thermal Resistance from Junction to Ambient		40			

## Typical Performance

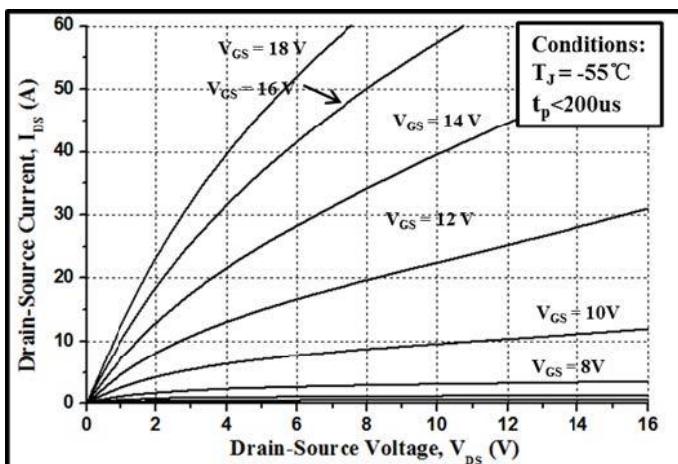


Figure 1. Output Characteristics  $T_J = -55 \text{ }^{\circ}\text{C}$

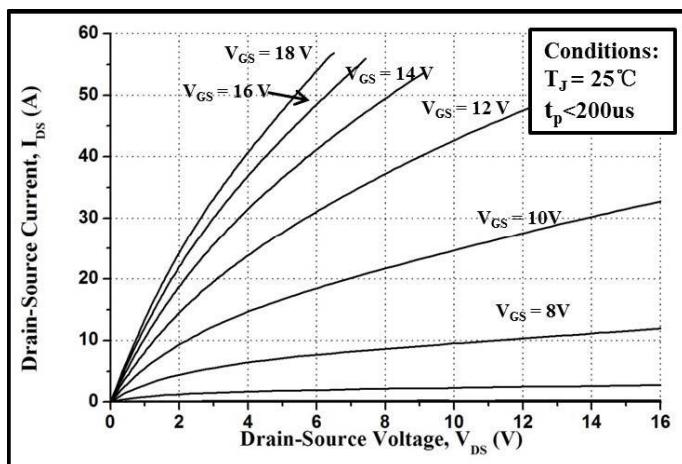


Figure 2. Output Characteristics  $T_J = 25 \text{ }^{\circ}\text{C}$

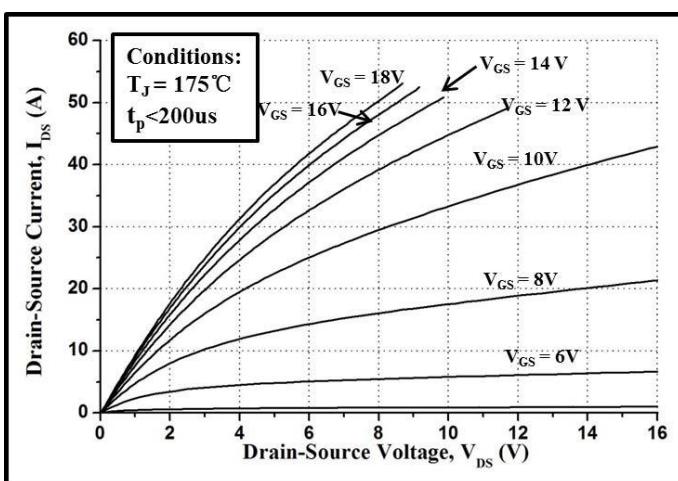


Figure 3. Output Characteristics  $T_J = 175 \text{ }^{\circ}\text{C}$

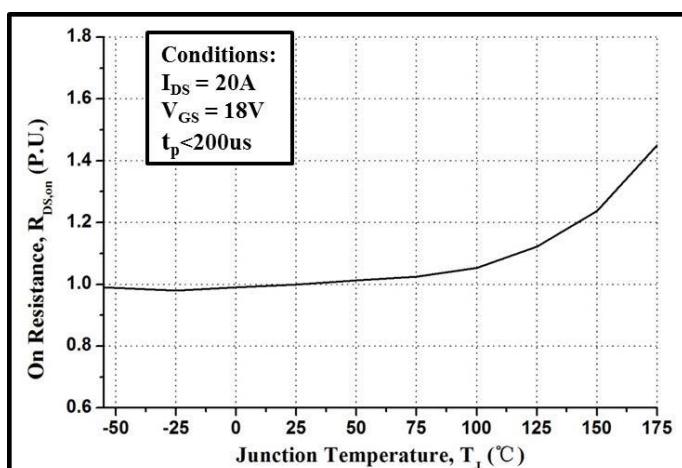


Figure 4. Normalized On-Resistance vs. Temperature

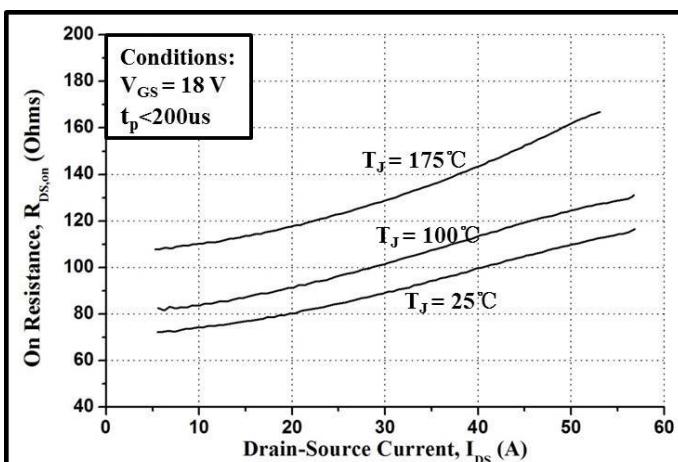


Figure 5. On-Resistance vs. Drain Current for Various Temperatures

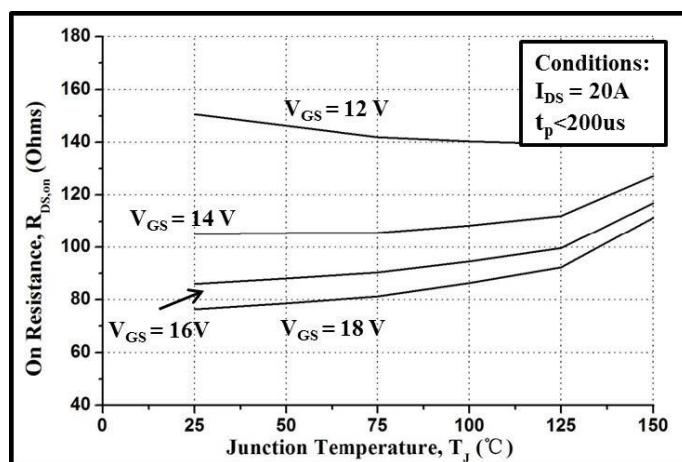
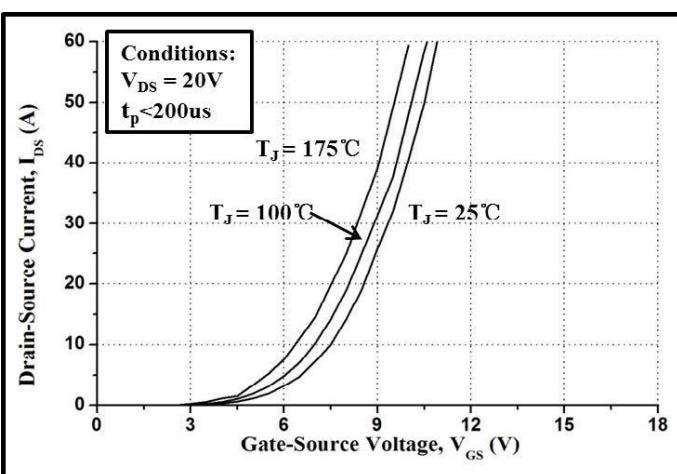
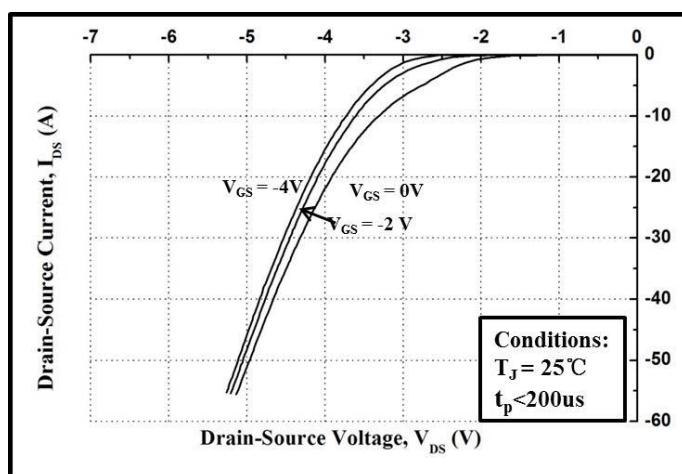


Figure 6. On-Resistance vs. Temperature for Various Gate Voltage

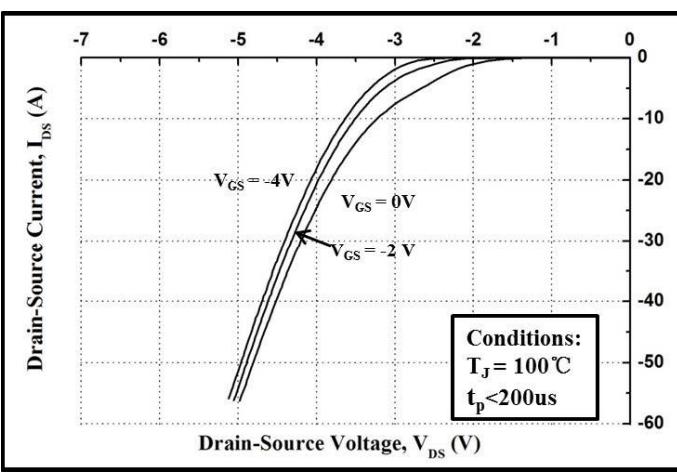
## Typical Performance



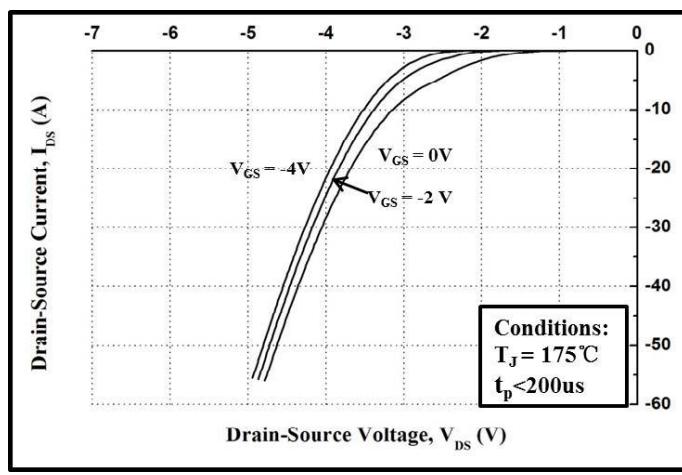
**Figure 7. Transfer Characteristics for Various Junction Temperatures**



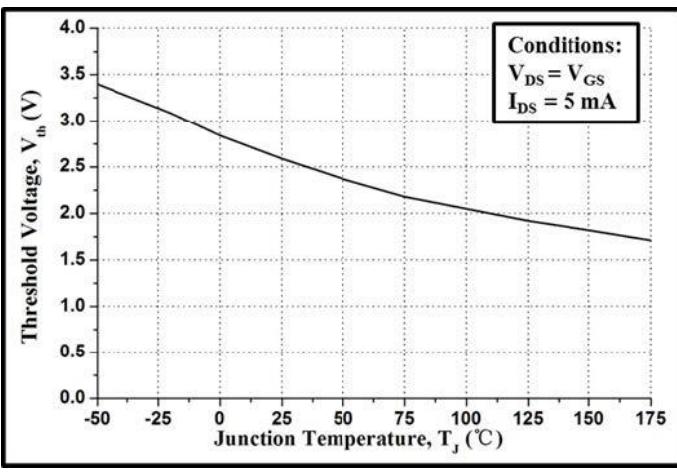
**Figure 8. Body Diode Characteristics at 25 °C**



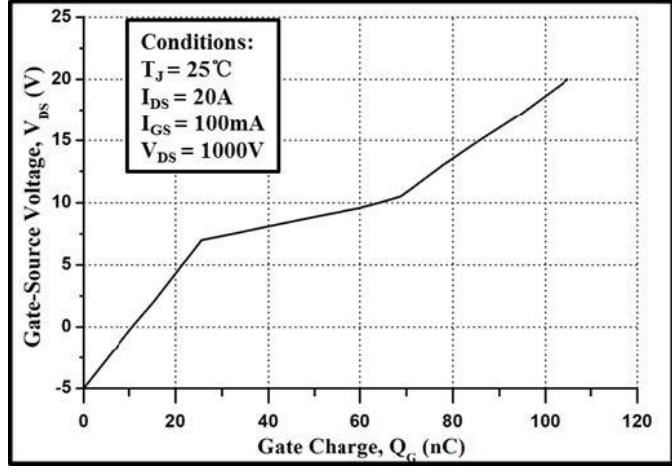
**Figure 9. Body Diode Characteristics at 100 °C**



**Figure 10. Body Diode Characteristics at 175 °C**



**Figure 11. Threshold Voltage vs. Temperature**



**Figure 12. Gate Charge Characteristics**

## Typical Performance

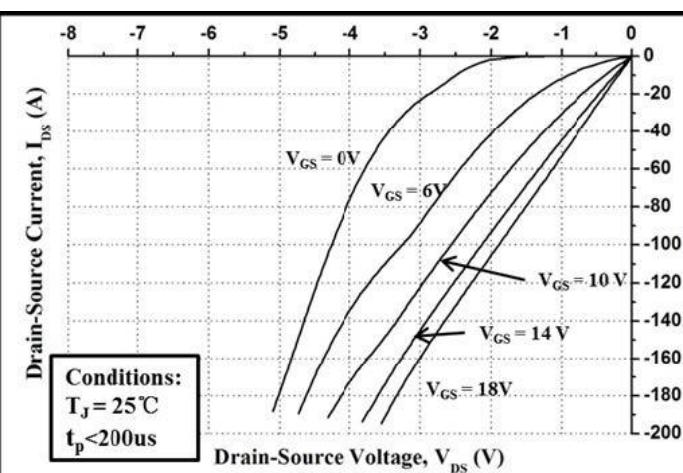


Figure 13. 3rd Quadrant Characteristic at 25 °C

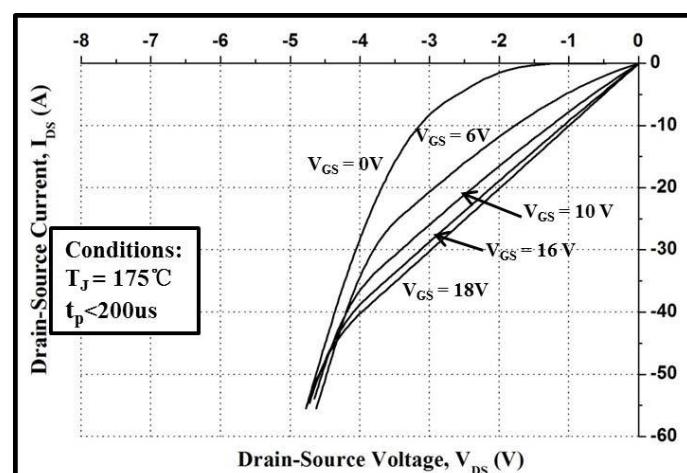


Figure 14. 3rd Quadrant Characteristic at 175 °C

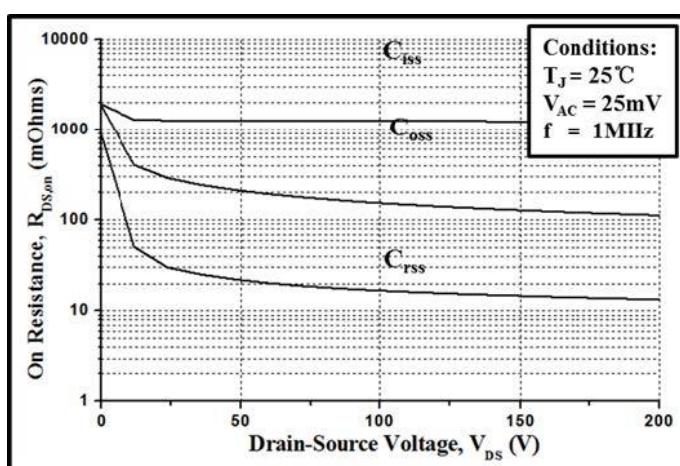


Figure 15. Capacitances vs. Drain-Source Voltage (0 - 200V)

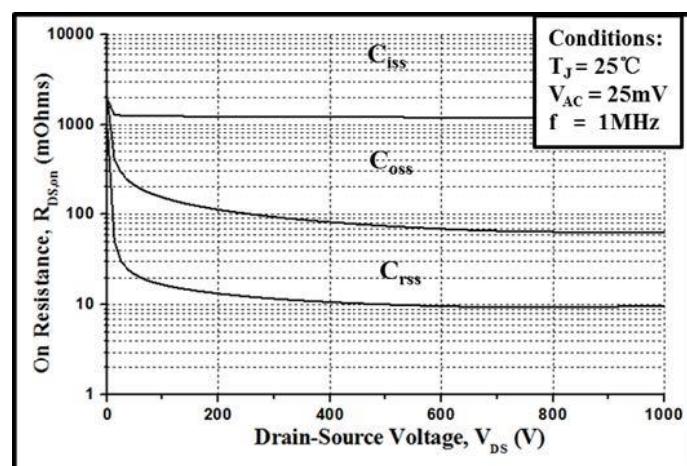
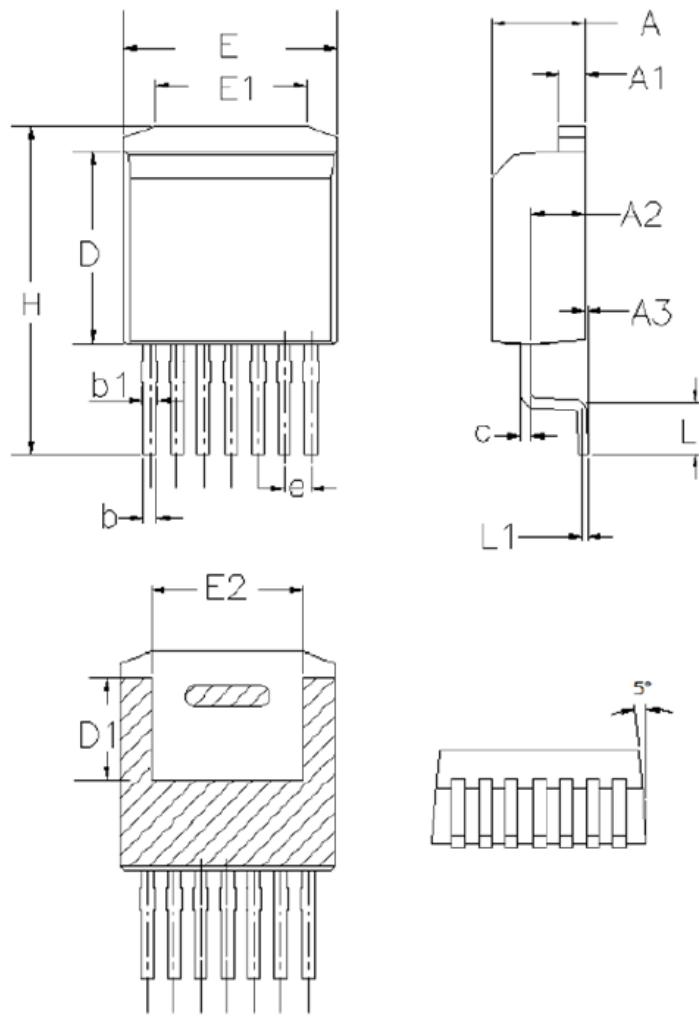


Figure 16. Capacitances vs. Drain-Source Voltage (0 - 1000V)

## Package TO-263-7



	<b>mm</b>		
	<b>MIN</b>	<b>NOM</b>	<b>MAX</b>
<b>A</b>	<b>4.30</b>	<b>4.43</b>	<b>4.56</b>
<b>A1</b>	<b>1.2</b>	<b>1.3</b>	<b>1.4</b>
<b>A3</b>	<b>0</b>	<b>0.13</b>	<b>0.25</b>
<b>b</b>	<b>0.5</b>	<b>0.6</b>	<b>0.7</b>
<b>b1</b>	<b>0.6</b>	<b>0.7</b>	<b>0.9</b>
<b>c</b>	<b>0.45</b>	<b>0.5</b>	<b>0.6</b>
<b>D</b>	<b>8.93</b>	<b>9.08</b>	<b>9.23</b>
<b>D1</b>	<b>4.65</b>	<b>4.8</b>	<b>4.95</b>
<b>e</b>		<b>1.27</b>	
<b>E</b>	<b>10.08</b>	<b>10.18</b>	<b>10.28</b>
<b>E1</b>	<b>6.5</b>	<b>7.0</b>	<b>7.5</b>
<b>E2</b>	<b>6.82</b>	<b>7.22</b>	<b>7.62</b>
<b>H</b>	<b>15.0</b>	<b>15.5</b>	<b>16.0</b>
<b>L</b>	<b>1.9</b>	<b>2.2</b>	<b>2.5</b>