

N1M120040PN2

Silicon Carbide Power MOSFET

N-Channel Enhancement Mode

V_{DS}	1200V
$I_D @ 25^\circ C$	68A
$R_{DS(ON)}$	40m Ω

Features

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

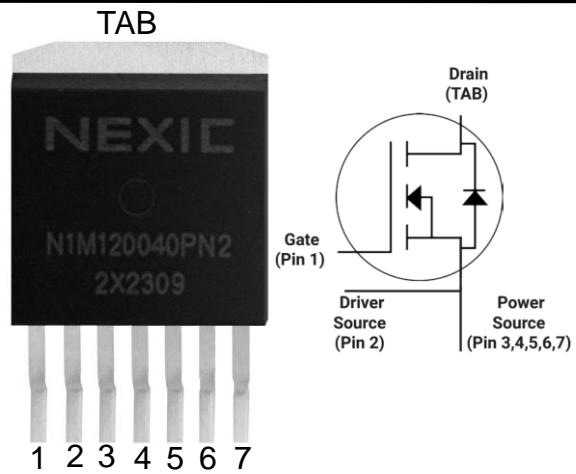
Benefits

- 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



Part Number	Package
N1M120040PN2	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	68	A	$V_{GS} = 18 V, T_C = 25^\circ C$	
		49		$V_{GS} = 18 V, T_C = 100^\circ C$	
$I_{D(pulse)}$	Pulsed Drain Current	100	A	Pulse width t_P limited by T_{jmax}	
P_D	Power Dissipation	340	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 ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note		
$V_{(\text{BR})\text{DSS}}$	Drain-Source Breakdown Voltage	1200			V	$V_{GS}=0\text{V}, I_D=100\mu\text{A}$			
$V_{GS(\text{th})}$	Gate Threshold Voltage	1.9	2.7	4.0	V	$V_{DS}=V_{GS}, I_D=9.5\text{mA}$	Fig.11		
			1.8			$V_{DS}=V_{GS}, I_D=9.5\text{mA}, T_J=175^\circ\text{C}$			
I_{DSS}	Zero Gate Voltage Drain Current		1	100	uA	$V_{DS}=1200\text{V}, V_{GS}=0\text{V}$			
I_{GSS}	Gate-Source Leakage Current		+10	+250	nA	$V_{GS}=+22\text{V}, V_{DS}=0\text{V}$			
			-10	-250		$V_{GS}=-8\text{V}, V_{DS}=0\text{V}$			
$R_{DS(\text{on})}$	Drain-Source On-State Resistance		40	53	mΩ	$V_{GS}=18\text{V}, I_D=33.3\text{A}$	Fig. 4, 5, 6		
			65			$V_{GS}=18\text{V}, I_D=33.3\text{A}, T_J=175^\circ\text{C}$			
g_{fs}	Transconductance		21		S	$V_{DS}=20\text{V}, I_{DS}=33.3\text{A}$	Fig.7		
			17.5			$V_{DS}=20\text{V}, I_{DS}=33.3\text{A}, T_J=175^\circ\text{C}$			
C_{iss}	Input Capacitance		2070		pF	$V_{GS}=0\text{V}, V_{DS}=1000\text{V}, f=1\text{MHz}, V_{AC} = 25\text{mV}$	Fig.15, 16		
C_{oss}	Output Capacitance		112						
C_{rss}	Reverse Transfer Capacitance		11						
E_{OSS}	Stored Energy in Output Capacitance		66		μJ	$V_{DS}=800\text{V}, V_{GS}=-4/18\text{V}, I_D=33\text{A}, R_{G(\text{ext})}=2.5\Omega, L=100\mu\text{H}$			
E_{ON}	Turn-On Switching Energy		1410		μJ				
E_{OFF}	Turn Off Switching Energy		750						
$t_{d(on)}$	Turn-On Delay Time		17		ns	$V_{DS}=800\text{V}, V_{GS}=-4/18\text{V}, I_D=33\text{A}, R_{G(\text{ext})}=2.5\Omega, R_L=20\Omega$			
t_r	Rise Time		58						
$t_{d(off)}$	Turn-Off Delay Time		26						
t_f	Fall Time		15						
$R_{G(\text{int})}$	Internal Gate Resistance		4.9		Ω	$f = 1 \text{ MHz}, V_{AC} = 25 \text{ mV}$			
Q_{gs}	Gate to Source Charge		34		nC	$V_{DS}=800\text{V}, V_{GS}=-4/18\text{V}, I_D=33\text{A}$	Fig.12		
Q_{gd}	Gate to Drain Charge		20						
Q_g	Total Gate Charge		121						

Reverse Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test conditions	Note
V_{SD}	Diode Forward Voltage	4.5		V	$V_{GS}=-4\text{V}, I_{SD}=10\text{A}$	Fig.8, 9, 10
		4.2			$V_{GS}=-4\text{V}, I_{SD}=10\text{A}, T_J=175^\circ\text{C}$	
I_S	Continuous Diode Forward Current		51	A	$T_C=25^\circ\text{C}$	
t_{rr}	Reverse Recovery Time	38		ns	$I_{SD}=20\text{A}, V_R=800\text{V}$	
Q_{rr}	Reverse Recovery Charge	109		nC		
I_{rrm}	Peak Reverse Recovery Current	5		A		

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.44		°C/W		
$R_{\theta JA}$	Thermal Resistance from Junction to Ambient		40			

Typical Performance

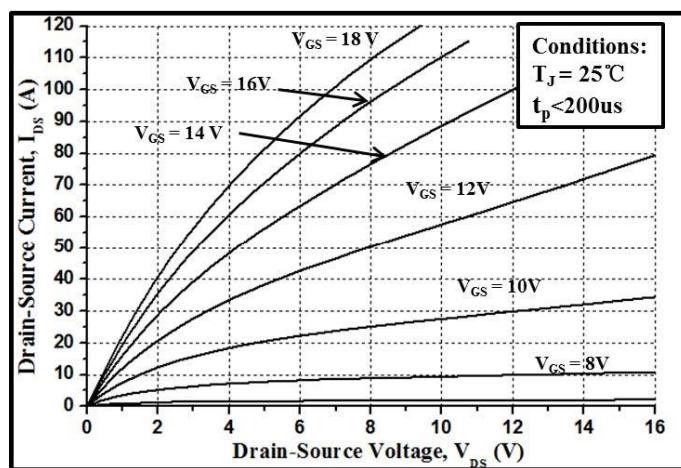
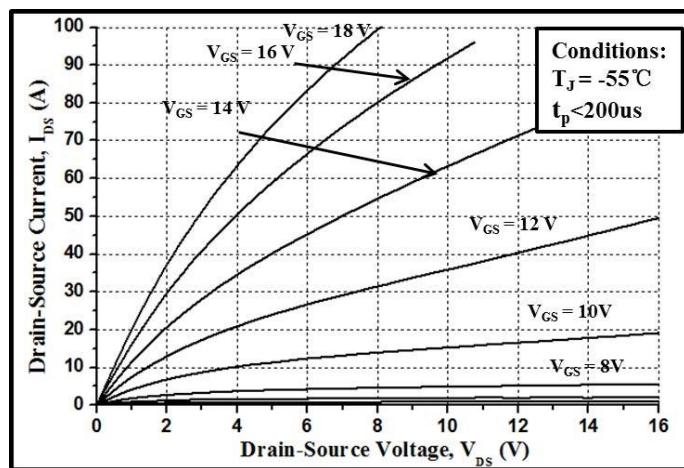


Figure 1. Output Characteristics $T_J = -55\text{ }^{\circ}\text{C}$

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

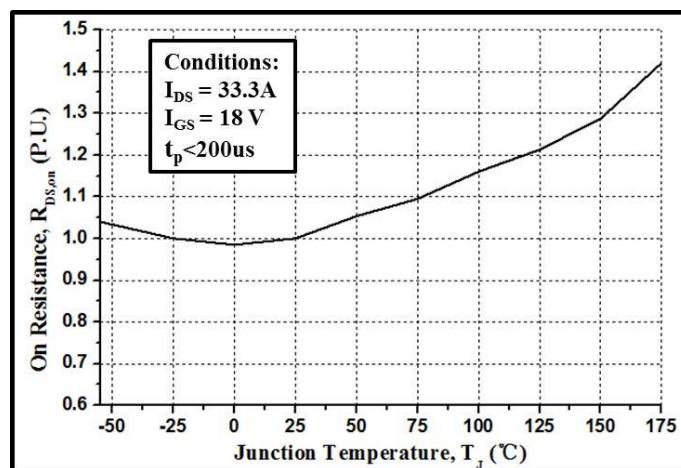
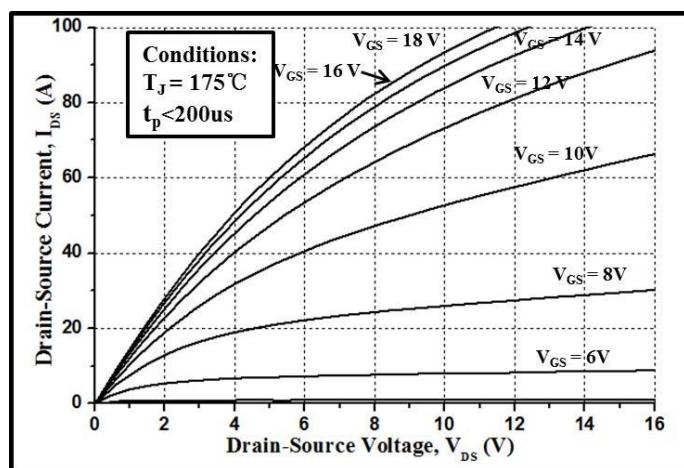


Figure 3. Output Characteristics $T_J = 175\text{ }^{\circ}\text{C}$

Figure 4. Normalized On-Resistance vs. Temperature

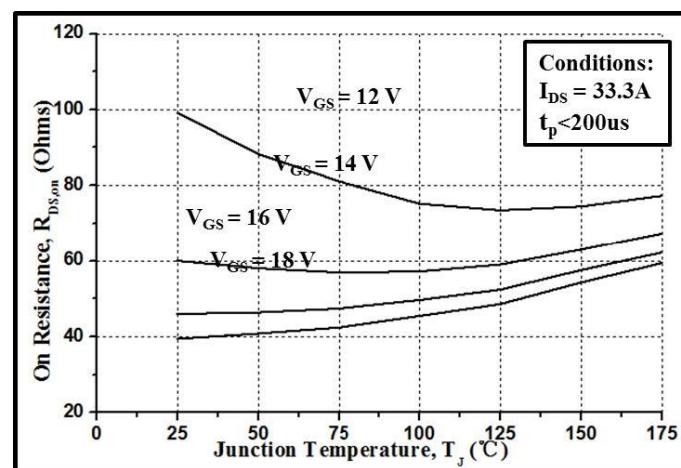
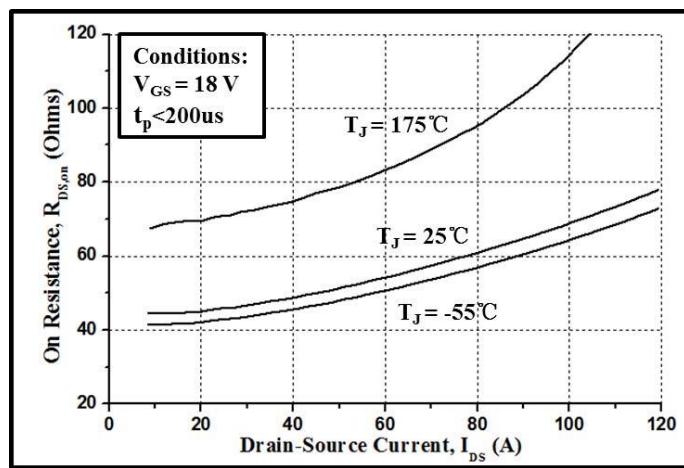


Figure 5. On-Resistance vs. Drain Current for Various Temperatures

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

Typical Performance

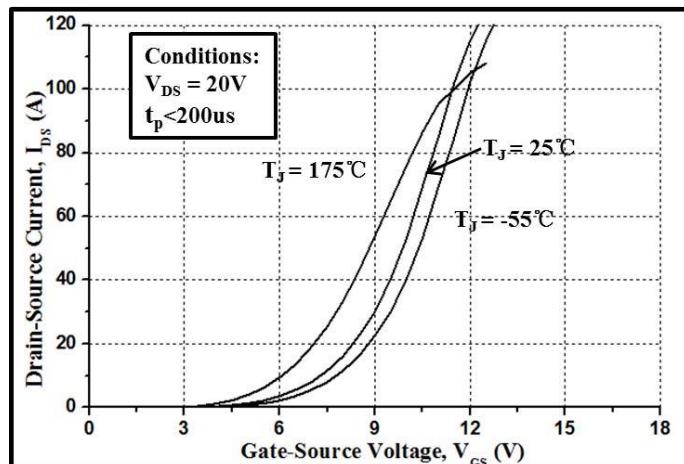


Figure 7. Transfer Characteristics for Various Junction Temperatures

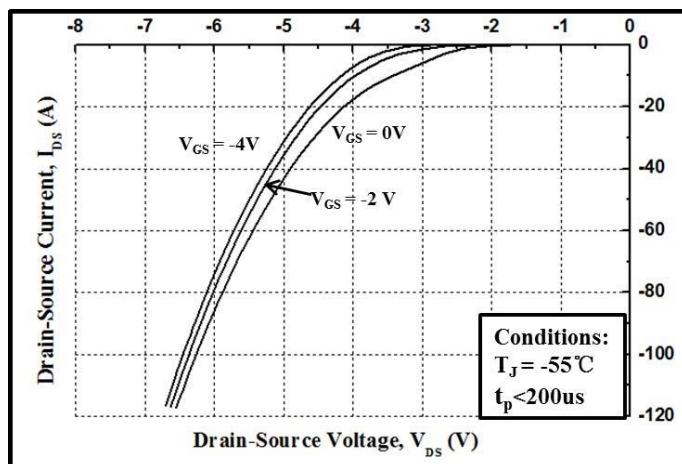


Figure 8. Body Diode Characteristics at $-55^\circ C$

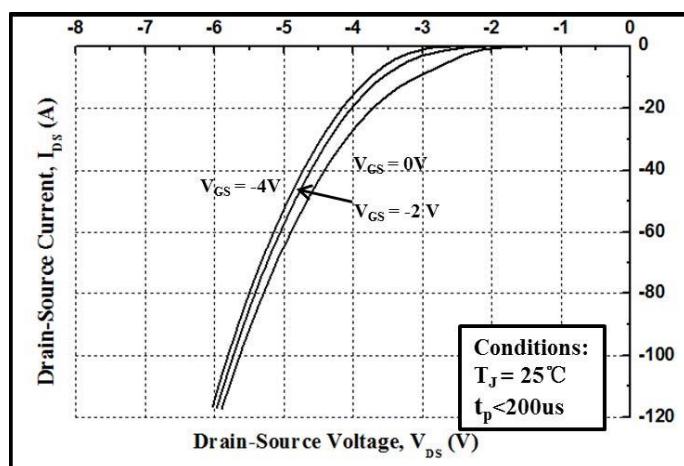


Figure 9. Body Diode Characteristics at $25^\circ C$

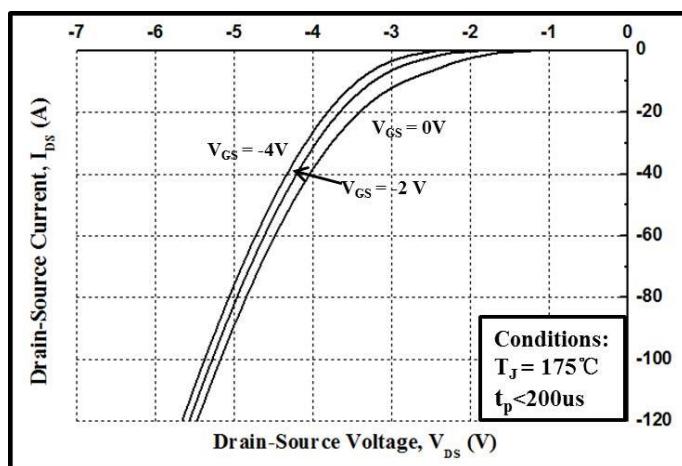


Figure 10. Body Diode Characteristics at $175^\circ C$

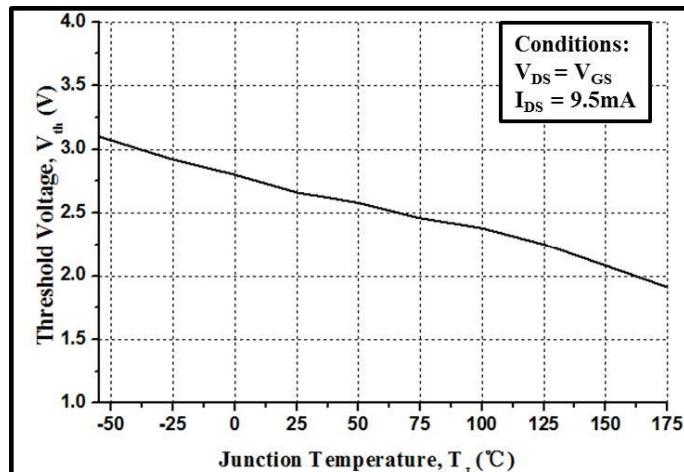


Figure 11. Threshold Voltage vs. Temperature

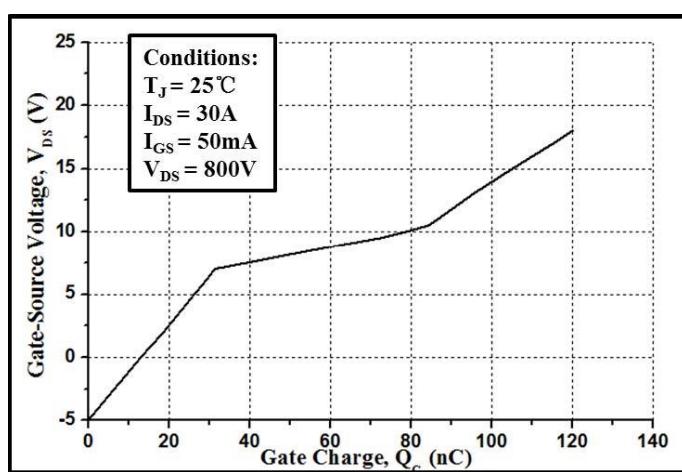


Figure 12. Gate Charge Characteristics

Typical Performance

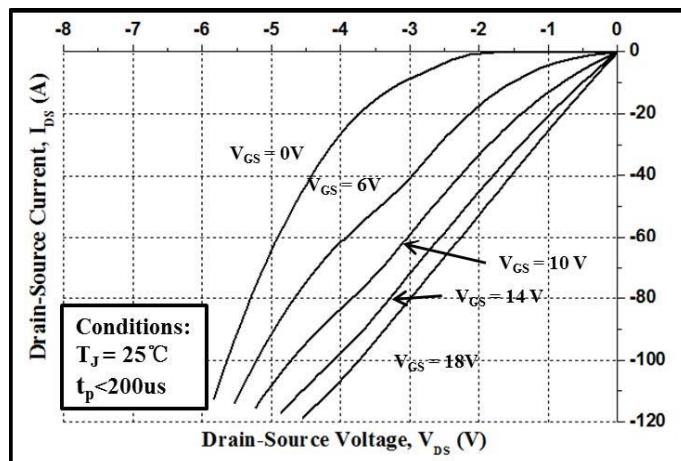


Figure 13. 3rd Quadrant Characteristic at 25 °C

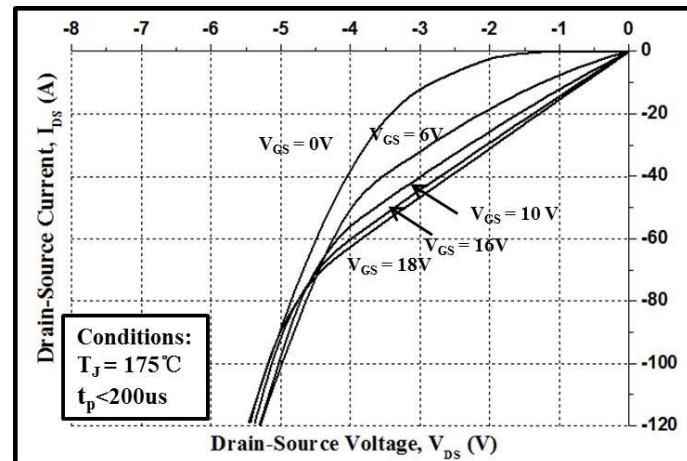


Figure 14. 3rd Quadrant Characteristic at 175 °C

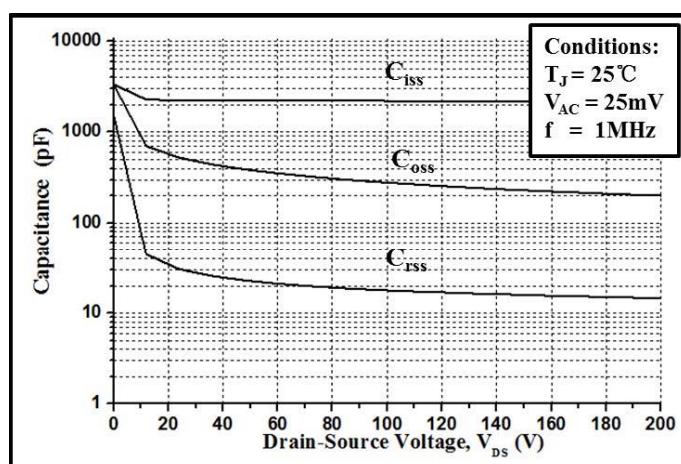


Figure 15. Capacitances vs. Drain-Source Voltage (0 - 200V)

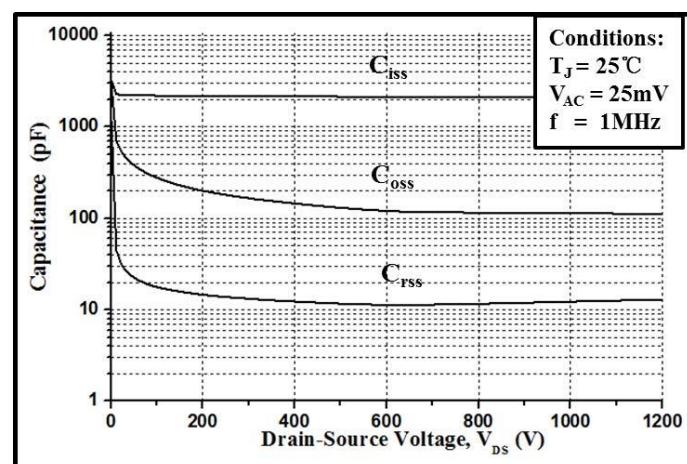
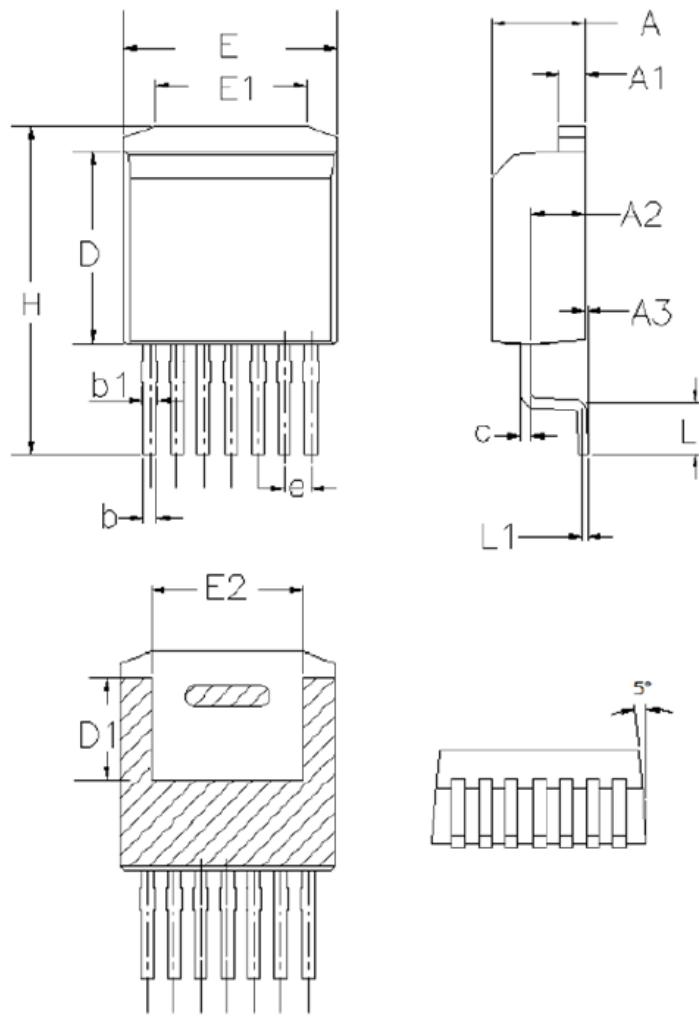


Figure 16. Capacitances vs. Drain-Source Voltage (0 - 1200V)

Package TO-263-7



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