

N1M170650PD2

Silicon Carbide Power MOSFET

N-Channel Enhancement Mode

V_{DS}	1700V
$I_D @ 25^{\circ}C$	7A
$R_{DS(ON)}$	650m Ω

Features

- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitance
- Ultra-Low Drain-Gate Capacitance

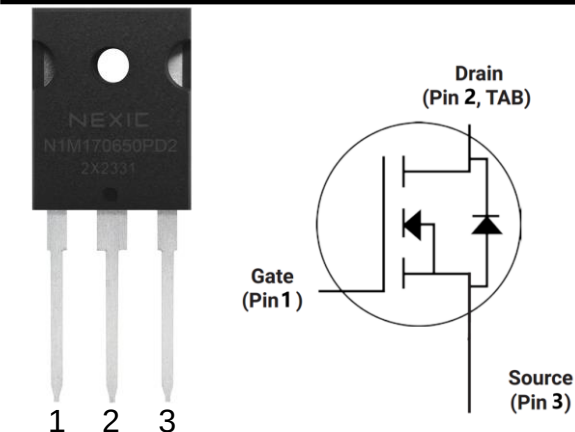
Benefits

- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency
- Easy to Parallel and Simple to Drive

Applications

- Auxiliary Power Supplies
- Switch Mode Power Supplies
- High-Voltage Capacitive

Package



Part Number	Package
N1M170650PD2	TO-247-3

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

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain - Source Voltage	1700	V	$V_{GS} = 0\text{ V}, I_D = 100\text{ }\mu\text{A}$	
V_{GSmax}	Gate - Source Voltage	-10/+25	V	Absolute maximum values	
V_{GSop}	Gate - Source Voltage	-5/+20	V	Recommended operational values	
I_D	Continuous Drain Current	7.0	A	$V_{GS} = 20\text{ V}, T_C = 25^{\circ}C$	
		4.5		$V_{GS} = 20\text{ V}, T_C = 100^{\circ}C$	
$I_{D(pulse)}$	Pulsed Drain Current	9.0	A	Pulse width t_p limited by T_{jmax}	
P_D	Power Dissipation	62	W	$T_C=25^{\circ}C, T_J=150^{\circ}C$	
T_J, T_{stg}	Operating Junction and Storage Temperature	-55 to + 150	$^{\circ}C$		

Electrical Characteristics ($T_C = 25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	1700	/	/	V	$V_{GS}=0V, I_D=100\mu A$	
$V_{GS(th)}$	Gate Threshold Voltage	2.0	2.6	4.0	V	$V_{DS}=V_{GS}, I_D=1mA$	Fig. 11
		/	1.8	/		$V_{DS}=V_{GS}, I_D=1mA, T_J=150^\circ\text{C}$	
I_{DSS}	Zero Gate Voltage Drain Current	/	1	100	μA	$V_{DS}=1700V, V_{GS}=0V$	
I_{GSS}	Gate-Source Leakage Current	/	10	250	nA	$V_{GS}=+25V, V_{DS}=0V$	
		/	10	250	nA	$V_{GS}=-10V, V_{DS}=0V$	
$R_{DS(on)}$	Drain-Source On-State Resistance	/	650	850	m Ω	$V_{GS}=20V, I_D=2A$	Fig. 4, 5, 6
		/	950	/		$V_{GS}=20V, I_D=2A, T_J=150^\circ\text{C}$	
g_{fs}	Transconductance	/	1.06	/	S	$V_{DS}=20V, I_D=2A$	Fig. 7
		/	1.14	/		$V_{DS}=20V, I_D=2A, T_J=150^\circ\text{C}$	
C_{iss}	Input Capacitance	/	198	/	pF	$V_{GS}=0V, V_{DS}=1000V, f=1MHz, V_{AC}=25mV$	Fig. 17, 18
C_{oss}	Output Capacitance	/	13	/			
C_{rss}	Reverse Transfer Capacitance	/	2.1	/			
E_{OSS}	C_{OSS} Stored Energy	/	6.6	/	μJ		Fig. 16
E_{ON}	Turn-On Switching Energy	/	5	/	mJ	$V_{DS}=1200V, V_{GS}=-5/20V, I_D=2A, R_{G(ext)}=2.5\Omega, L=1500\mu H$	
E_{OFF}	Turn-Off Switching Energy	/	9.2	/			
$t_{d(on)}$	Turn-On Delay Time	/	13.8	/	ns	$V_{DS}=1200V, V_{GS}=-5/20V, I_D=2A, R_{G(ext)}=2.5\Omega, R_L=20\Omega$	
t_r	Rise Time	/	22.8	/			
$t_{d(off)}$	Turn-Off Delay Time	/	38	/			
t_f	Fall Time	/	14	/			
$R_{G(int)}$	Internal Gate Resistance	/	18	/	Ω	$f=1MHz, V_{AC}=25mV$	
Q_{gs}	Gate to Source Charge	/	5.4	/	nC	$V_{DS}=1200V, V_{GS}=-5/20V, I_D=2A$	Fig. 12
Q_{gd}	Gate to Drain Charge	/	7.6	/			
Q_g	Total Gate Charge	/	23	/			

Reverse Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test conditions	Note
V_{SD}	Diode Forward Voltage	4.2	/	V	$V_{GS}=-5V, I_{SD}=3.5A$	Fig. 8, 9, 10
		3.9	/		$V_{GS}=-5V, I_{SD}=3.5A, T_J=150^\circ\text{C}$	
I_S	Continuous Diode Forward Current	/	7.0	A	$T_C=25^\circ\text{C}$	
t_{rr}	Reverse Recovery Time	25	/	ns	$I_{SD}=2A, V_R=1200V$	
Q_{rr}	Reverse Recovery Charge	15	/	nC		
I_{rrm}	Peak Reverse Recovery Current	2.8	/	A		

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test conditions	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	1.8	/	$^\circ\text{C/W}$		
$R_{\theta JA}$	Thermal Resistance from Junction to Ambient	/	40			

Typical Performance

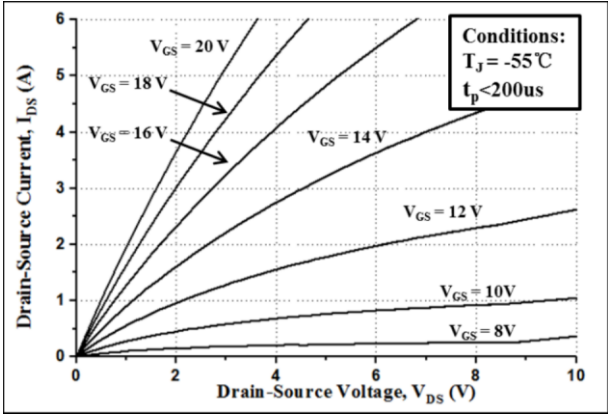


Figure 1. Output Characteristics $T_J = -55\text{ }^{\circ}\text{C}$

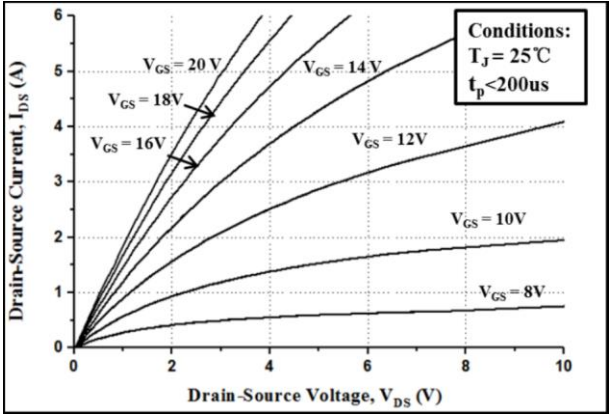


Figure 2. Output Characteristics $T_J = 25\text{ }^{\circ}\text{C}$

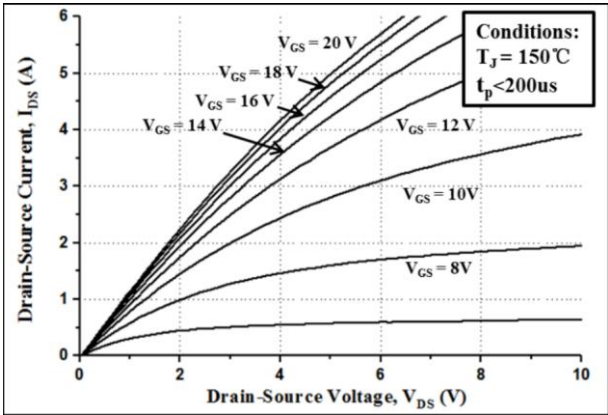


Figure 3. Output Characteristics $T_J = 150\text{ }^{\circ}\text{C}$

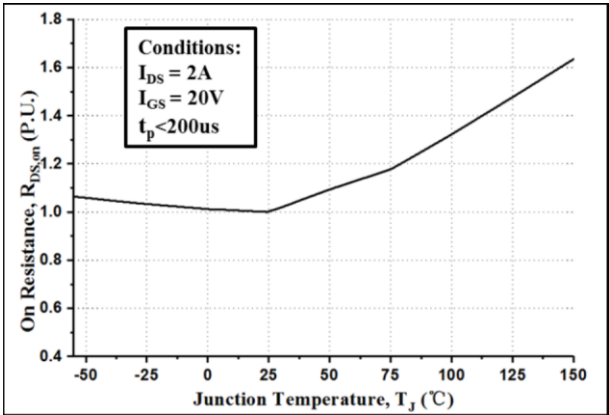


Figure 4. Normalized On-Resistance vs. Temperature

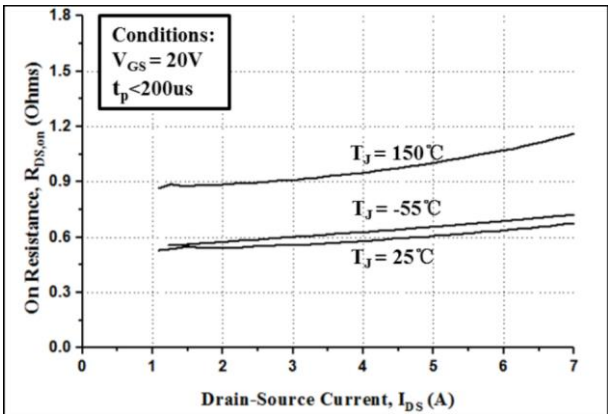


Figure 5. On-Resistance vs. Drain Current for Various Temperatures

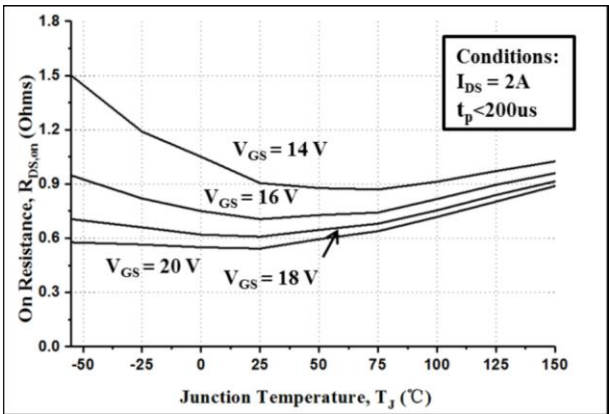


Figure 6. On-Resistance vs. Temperature for Various Gate Voltages

Typical Performance

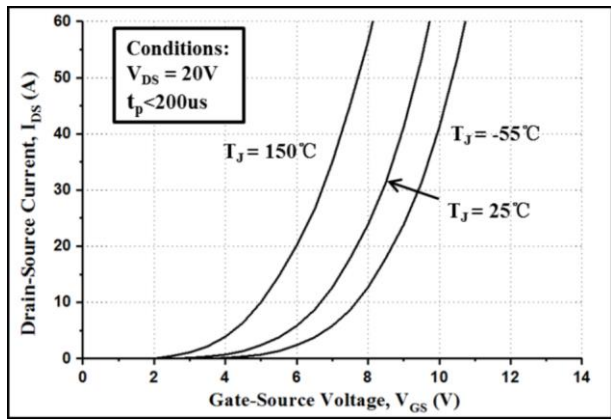


Figure 7. Transfer Characteristics for Various Junction Temperatures

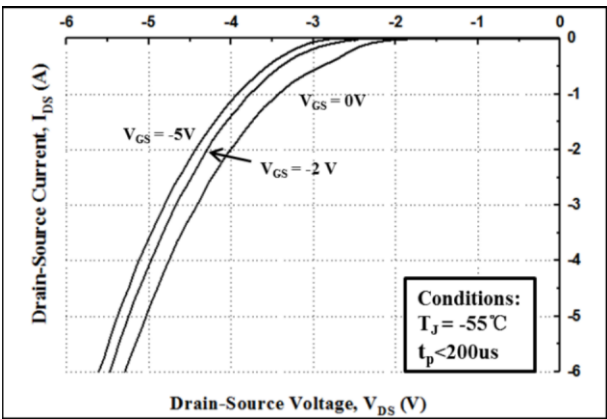


Figure 8. Body Diode Characteristics at -55°C

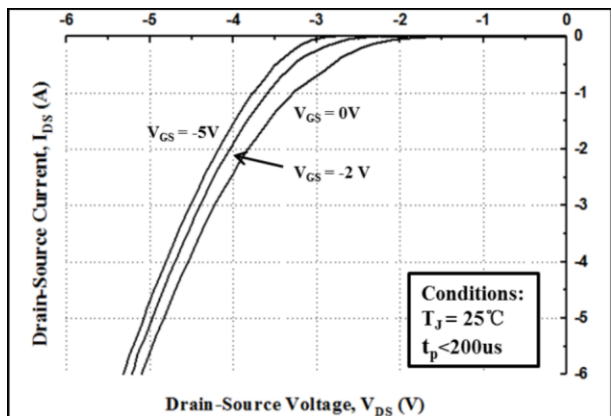


Figure 9. Body Diode Characteristics at 25°C

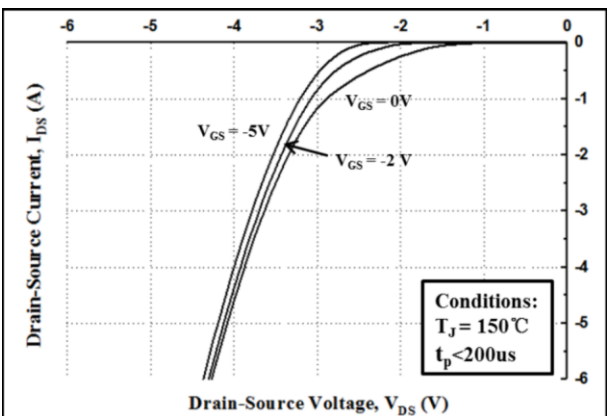


Figure 10. Body Diode Characteristics at 150°C

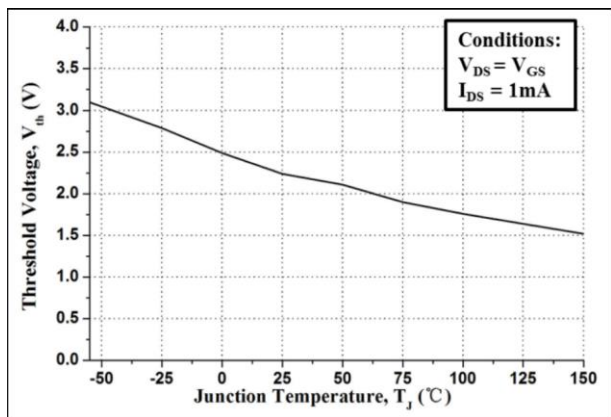


Figure 11. Threshold Voltage vs. Temperature

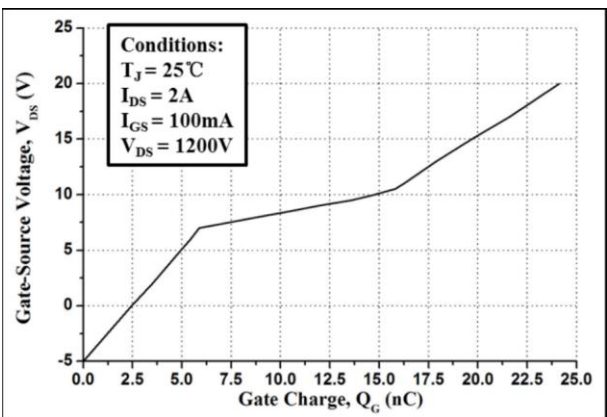


Figure 12. Gate Charge Characteristics

Typical Performance

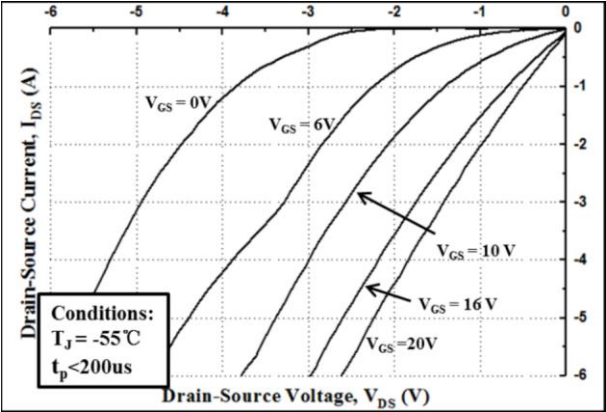


Figure 13. 3rd Quadrant Characteristics at -55 °C

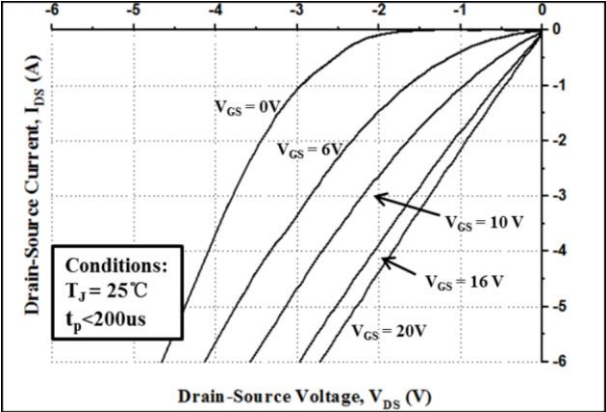


Figure 14. 3rd Quadrant Characteristics at 25 °C

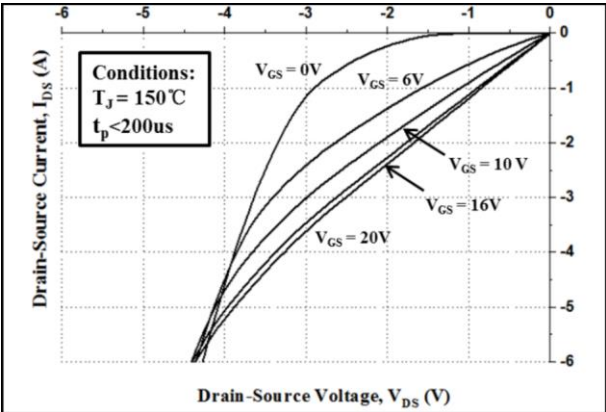


Figure 15. 3rd Quadrant Characteristics at 150 °C

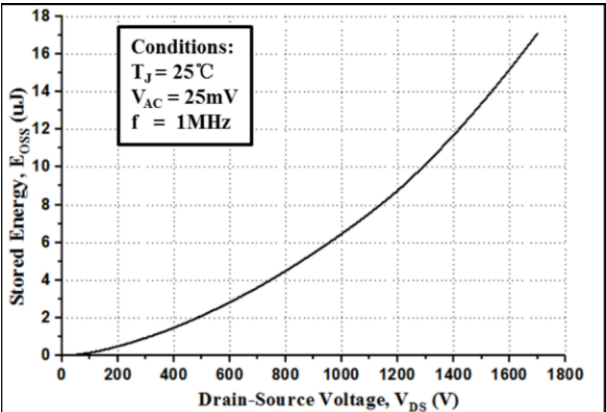


Figure 16. Output Capacitor Stored Energy

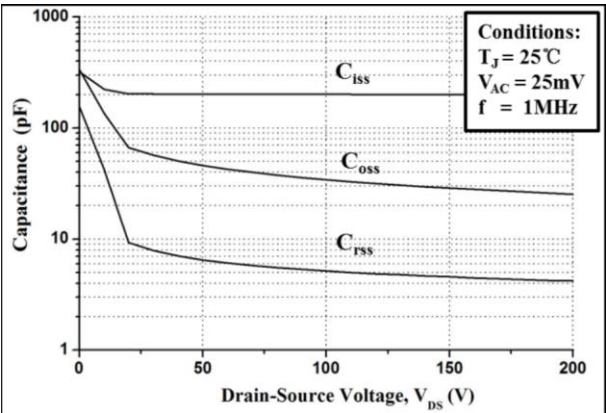


Figure 17. Capacitances vs. Drain-Source Voltage (0 - 200V)

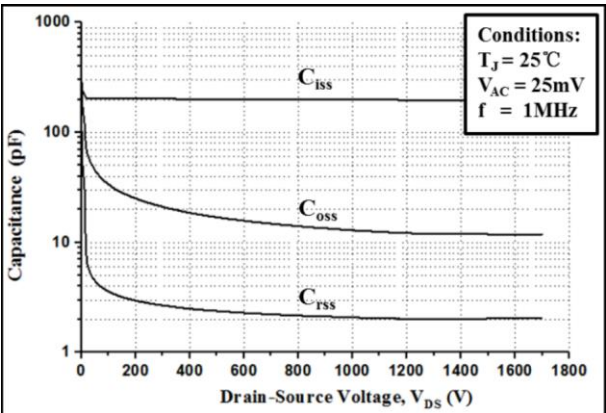
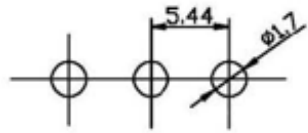
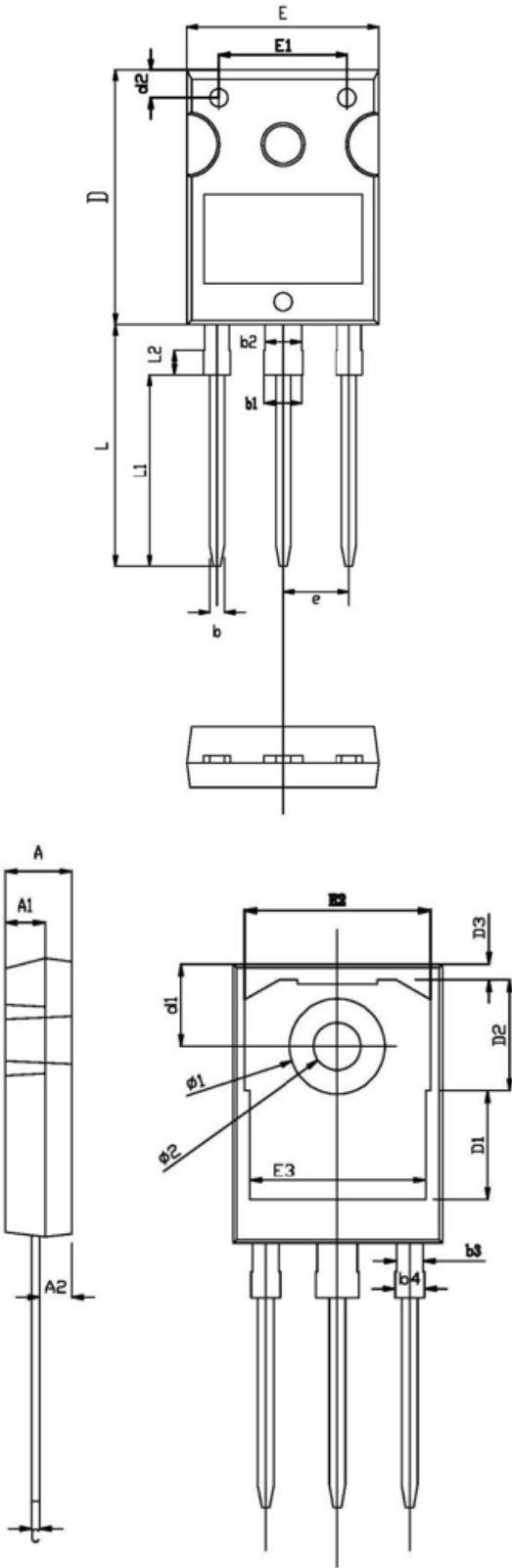


Figure 18. Capacitances vs. Drain-Source Voltage (0 - 1700V)

Package TO-247-3

RECOMMENDED LAND PATTERN



	mm		
	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.80	3.00	3.20
A2	2.26	2.41	2.56
b	1.10	1.20	1.30
b1	2.90	/	3.20
b2	2.90	3.00	3.10
b3	1.90	2.00	2.10
b4	2.00	/	2.20
c	0.50	0.60	0.70
D	20.80	21.00	21.20
D1	/	8.23	/
D2	/	8.32	/
D3	/	1.17	/
d1	6.00	6.15	6.30
d2	2.20	2.30	2.40
E	15.60	15.80	16.00
E1	/	10.50	/
E2	/	14.02	/
E3	/	13.50	/
e	5.34	5.44	5.54
L	19.72	19.92	20.12
L1	/	15.79	/
L2	/	1.98	/
φ1	7.10	7.19	7.30
φ2	3.50	3.60	3.70