

N1M170045PD2

Silicon Carbide Power MOSFET

N-Channel Enhancement Mode

V_{DS}	1700V
$I_D @ 25^\circ C$	72A
$R_{DS(ON)}$	45mΩ

Features

- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitance

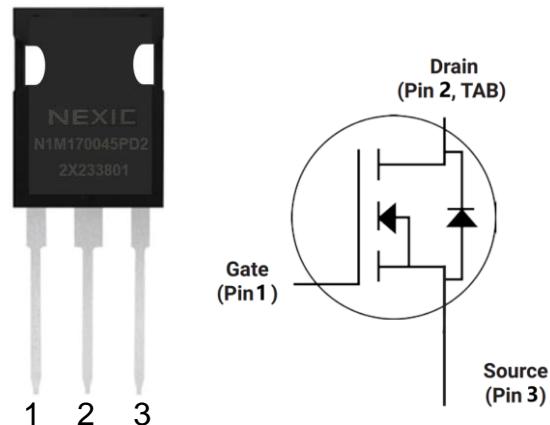
Benefits

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

Applications

- Solar Inverters
- High Voltage DC/DC Converters
- Motor Drives
- Switch Mode Power Supplies
- Pulsed Power Applications

Package



Part Number	Package
N1M170045PD2	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	$V_{GS} = 0 V, I_D = 100 \mu A$	
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	72	A	$V_{GS} = 20 V, T_C = 25^\circ C$	
		48		$V_{GS} = 20 V, T_C = 100^\circ C$	
$I_{D(pulse)}$	Pulsed Drain Current	160	A	Pulse width t_P limited by T_{jmax}	
P_D	Power Dissipation	520	W	$T_C=25^\circ C, T_j=150^\circ C$	
T_J, T_{stg}	Operating Junction and Storage Temperature	-55 to + 150	°C		

Electrical Characteristics (T_C= 25°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 =100μA	
V _{GS(th)}	Gate Threshold Voltage	2.0	2.6	4.0	V	V _{DS} =V _{GS} , I _D =18mA	Fig. 11
			1.8			V _{DS} =V _{GS} , I _D =18mA, T _J =150°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		45	70	mΩ	V _{GS} =20V, I _D =50A	Fig. 4, 5, 6
			90			V _{GS} =20V, I _D =50A, T _J =150°C	
g _{fs}	Transconductance		25.8		S	V _{DS} =20V, I _D =50A	
			27.0			V _{DS} =20V, I _D =50A, T _J =150°C	
C _{iss}	Input Capacitance		3550		pF	V _{GS} =0V, V _{DS} =1000V, f=1MHz, V _{AC} = 25mV	Fig. 15, 16
C _{oss}	Output Capacitance		165				
C _{rss}	Reverse Transfer Capacitance		6.1				
E _{oss}	C _{oss} Stored Energy		101		μJ	mJ	V _{DS} =1200V, V _{GS} = -5/20V, I _D =30A, R _{G(ext)} =2.5Ω, L=100μH
E _{ON}	Turn-On Switching Energy		3.1				
E _{OFF}	Turn-Off Switching Energy		1.1				
t _{d(on)}	Turn-On Delay Time		27				
t _r	Rise Time		32		ns	V _{DS} =1200V, V _{GS} = -5/20V, I _D =30A, R _{G(ext)} =2.5Ω, R _L =20Ω	
t _{d(off)}	Turn-Off Delay Time		36				
t _f	Fall Time		10				
R _{G(int)}	Internal Gate Resistance		2.6		Ω	f = 1 MHz, V _{AC} = 25 mV	
Q _{gs}	Gate to Source Charge		54		nC	V _{DS} =1200V, V _{GS} =-5/20V, I _D =50A	Fig. 17
Q _{gd}	Gate to Drain Charge		25				
Q _g	Total Gate Charge		193				

Reverse Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test conditions	Note
V _{SD}	Diode Forward Voltage	3.6		V	V _{GS} =-5V, I _{SD} =25A	Fig. 8, 9, 10
		3.3			V _{GS} =-5V, I _{SD} =25A, T _J =150°C	
I _S	Continuous Diode Forward Current		72	A	T _C =25°C	
t _{rr}	Reverse Recovery Time	55		ns	I _{SD} =50A, V _R =1200V	
Q _{rr}	Reverse Recovery Charge	220		nC		
I _{rrm}	Peak Reverse Recovery Current	6.7		A		

Thermal Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test conditions	Note
R _{θJC}	Thermal Resistance from Junction to Case	0.24		°C/W		
R _{θJA}	Thermal Resistance from Junction to Ambient		40			

Typical Performance

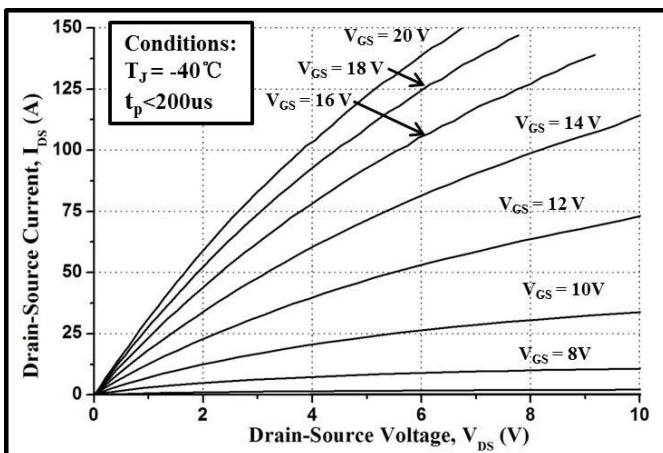


Figure 1. Output Characteristics $T_J = -40^\circ\text{C}$

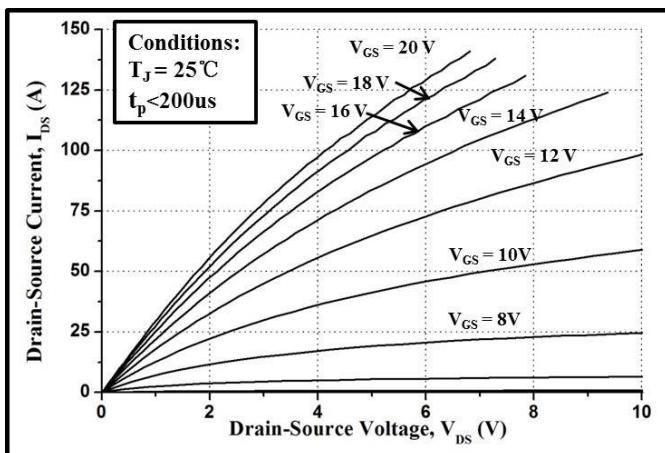


Figure 2. Output Characteristics $T_J = 25^\circ\text{C}$

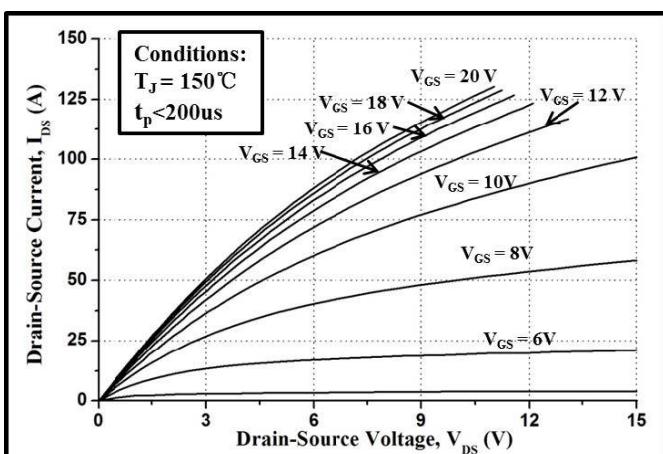


Figure 3. Output Characteristics $T_J = 150^\circ\text{C}$

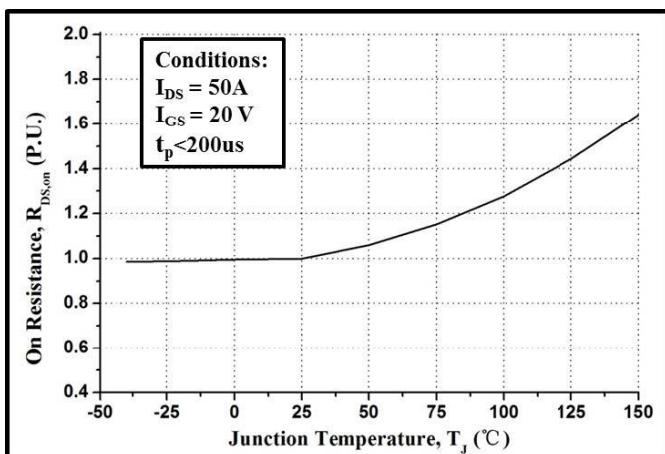


Figure 4. Normalized On-Resistance vs. Temperature

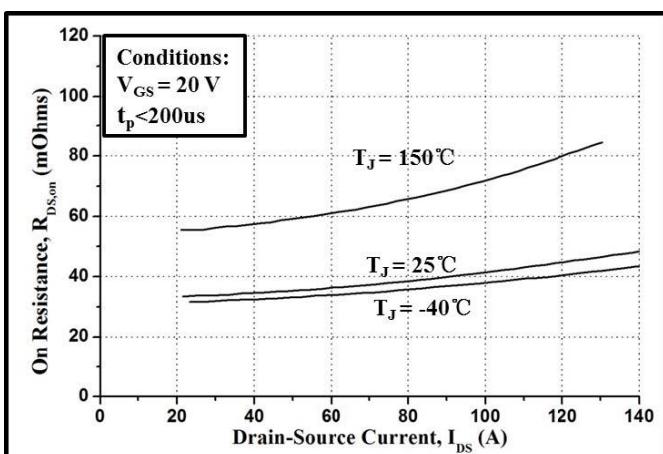


Figure 5. On-Resistance vs. Drain Current for Various Temperatures

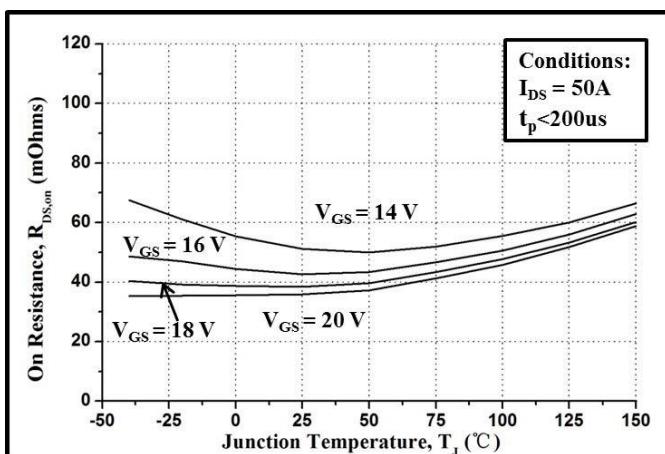


Figure 6. On-Resistance vs. Temperature for Various Gate Voltages

Typical Performance

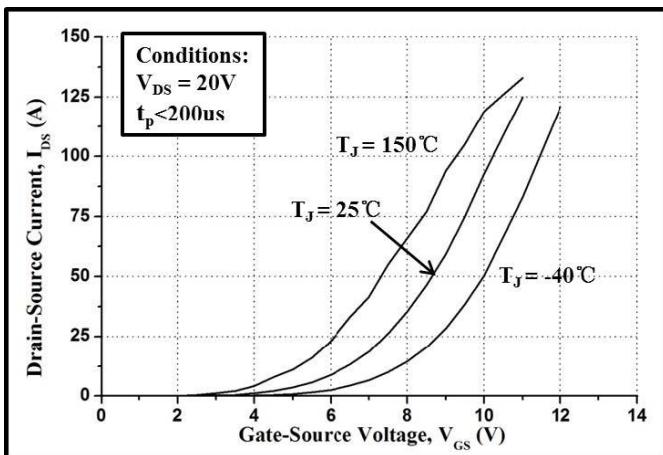


Figure 7. Transfer Characteristics for Various Junction Temperatures

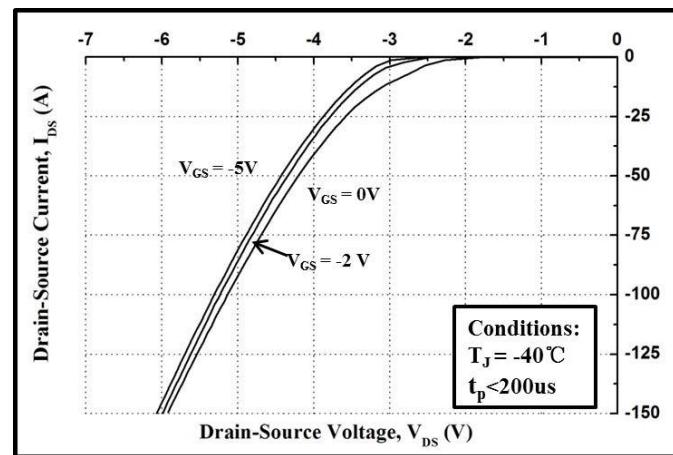


Figure 8. Body Diode Characteristics at $-40^\circ C$

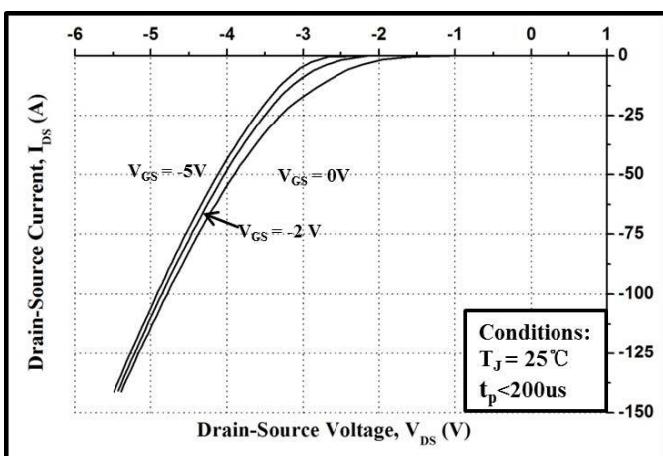


Figure 9. Body Diode Characteristics at $25^\circ C$

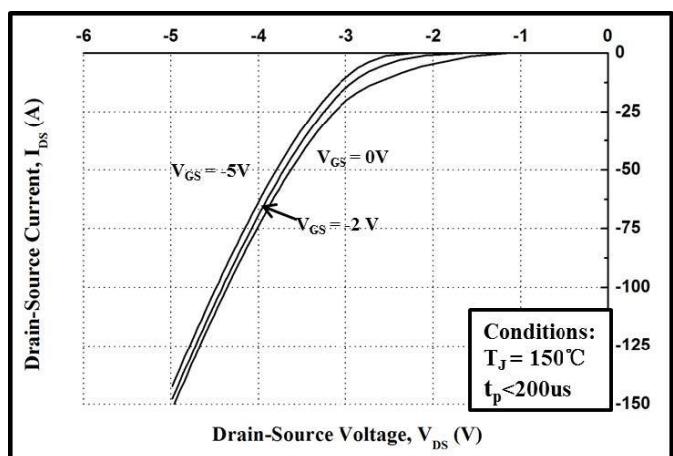


Figure 10. Body Diode Characteristics at $150^\circ C$

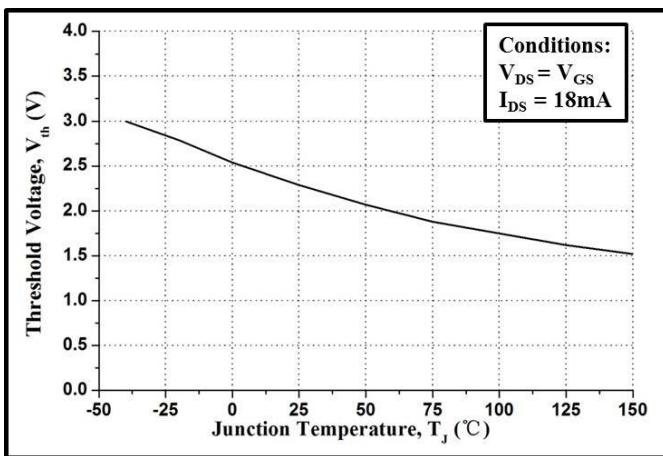


Figure 11. Threshold Voltage vs. Temperature

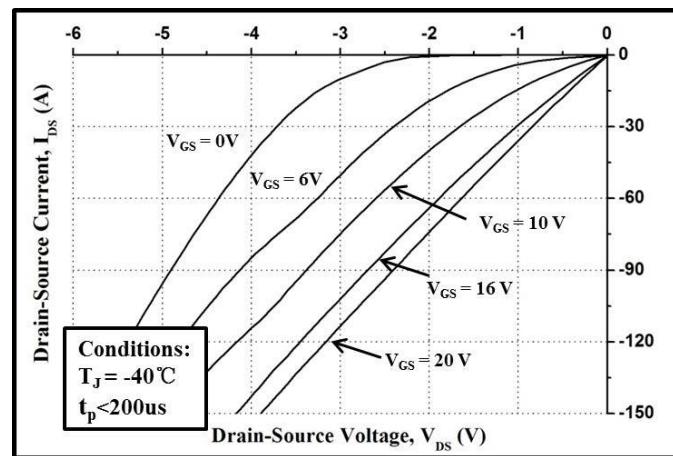


Figure 12. 3rd Quadrant Characteristics at $-40^\circ C$

Typical Performance

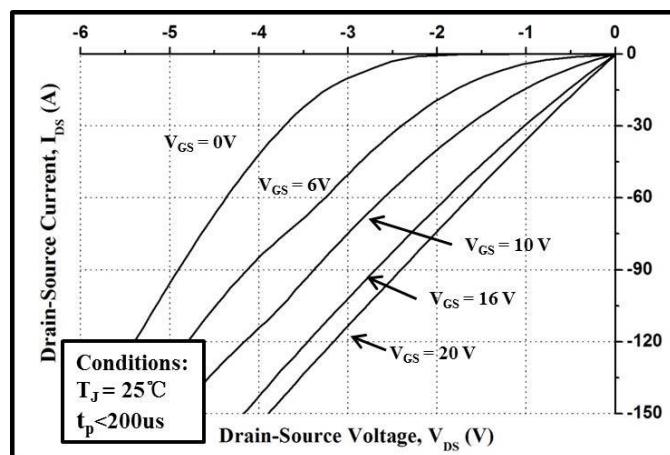


Figure 13. 3rd Quadrant Characteristics at 25 °C

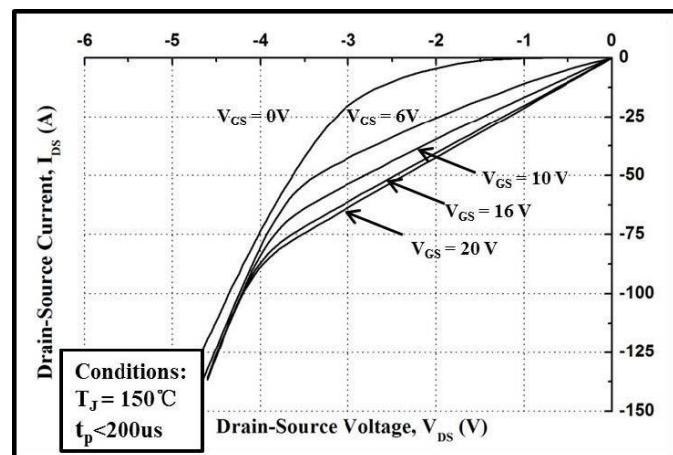


Figure 14. 3rd Quadrant Characteristics at 150 °C

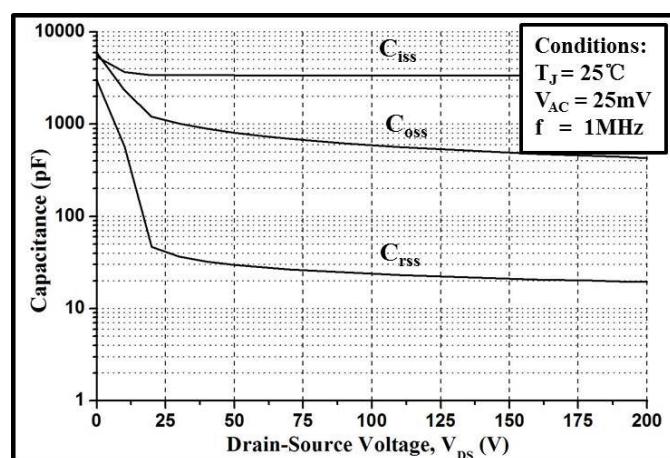


Figure 15. Capacitances vs. Drain-Source Voltage (0 - 200V)

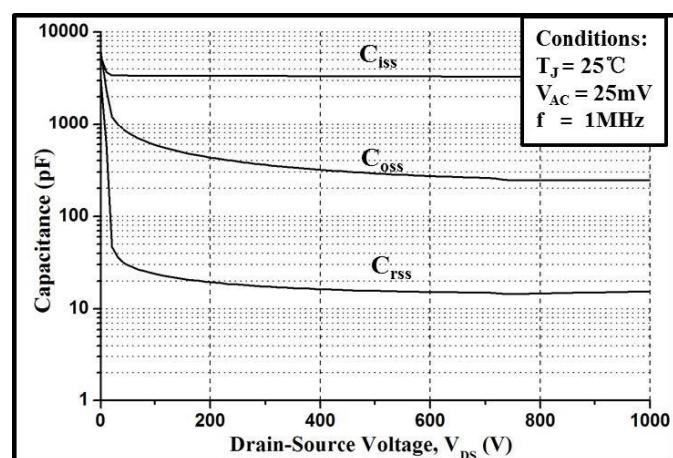


Figure 16. Capacitances vs. Drain-Source Voltage (0 - 1000V)

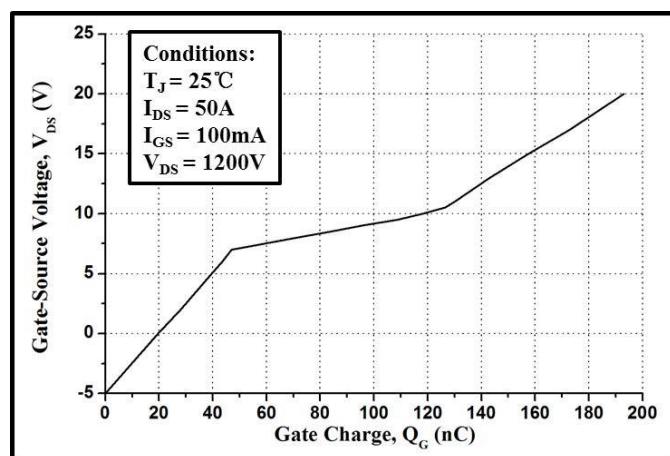


Figure 17. Gate Charge Characteristics

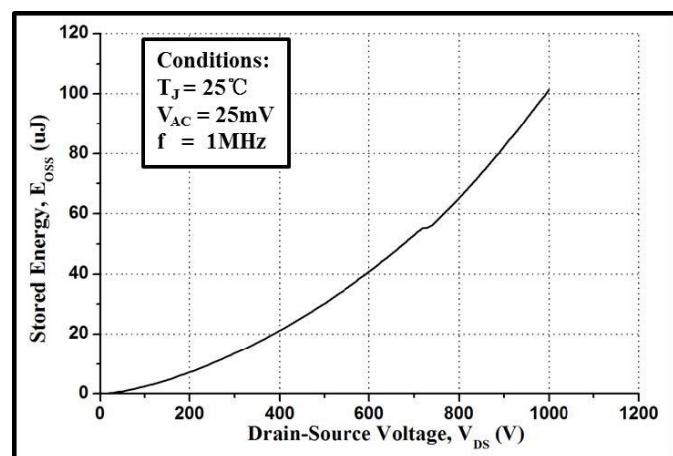
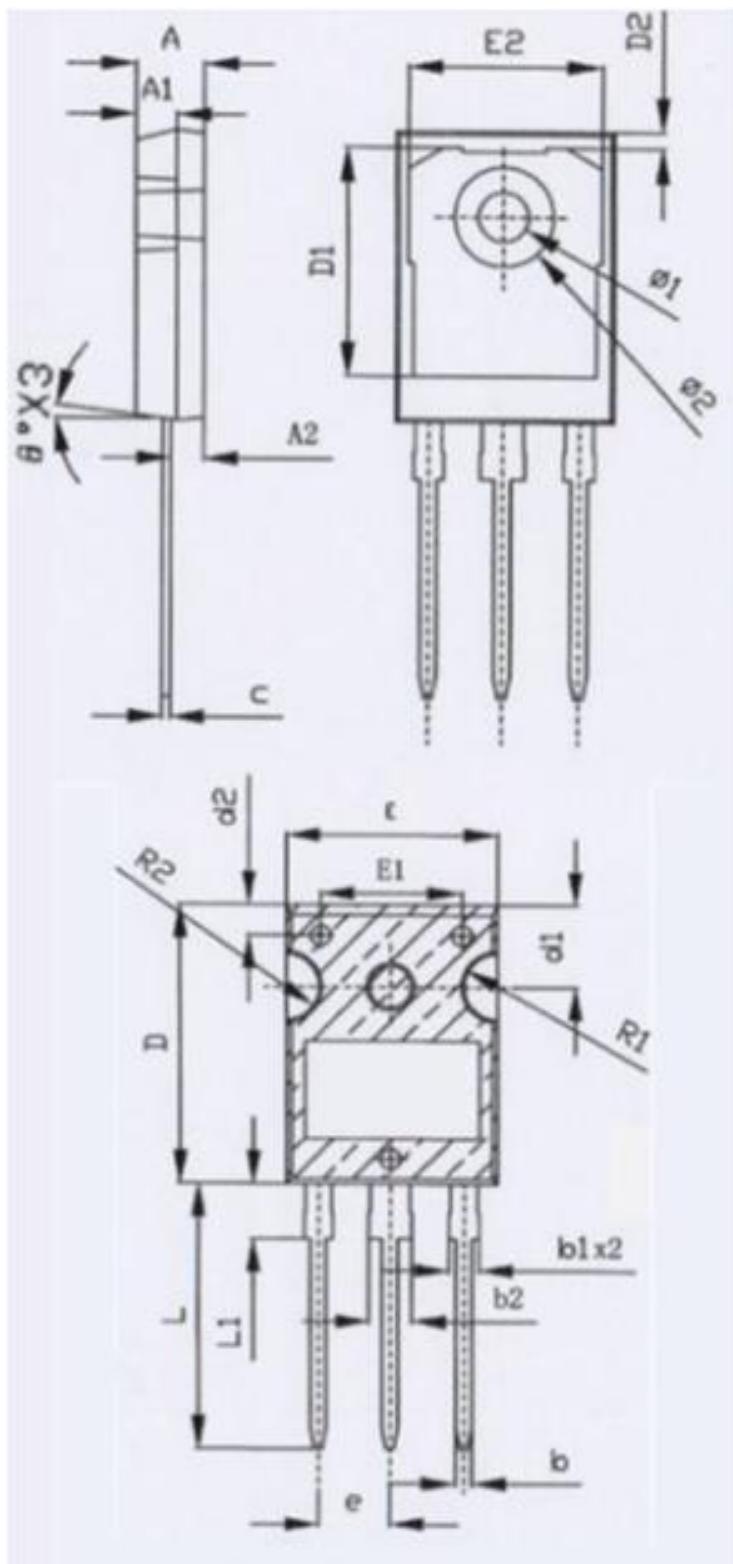


Figure 18. Output Capacitor Stored Energy

Package Dimensions

Package TO-247-3



	mm		
	MIN	NOM	MAX
A	4.9	5.0	5.1
A1	2.9	3.0	3.1
A2	2.31	2.36	2.41
b	1.16	1.20	1.26
b1	2.05	/	2.2
b2	3.05	/	3.2
c	0.58	0.60	0.66
D	20.9	21.0	21.1
D1	16.46	16.56	16.76
D2	/	1.17	/
d1	6.05	6.15	6.25
d2	2.2	2.3	2.4
E	15.7	15.8	15.9
E1	/	10.5	/
E2	/	14.02	/
e	/	1.27bcs	/
L	19.82	19.92	20.02
L1	1.88	1.98	2.08
θ	0°	7°	8°
R1	/	2.7	/
R2	/	2.5	/
φ1	/	3.6	/
φ2	/	7.19	/