

N1M170045PK2

Silicon Carbide Power MOSFET
N-Channel Enhancement Mode

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

Features

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

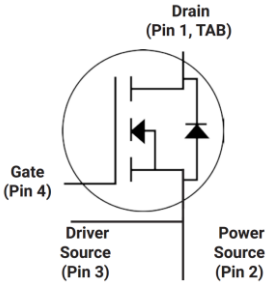
Benefits

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

Applications

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

Package



Part Number	Package
N1M170045PK2	TO-247-4

Maximum Ratings (T_C = 25°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	72	A	$V_{GS} = 20\text{ V}, T_C = 25^{\circ}C$	
		48		$V_{GS} = 20\text{ V}, T_C = 100^{\circ}C$	
$I_{D(pulse)}$	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 ($T_C = 25^{\circ}\text{C}$ 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	$V_{DS}=V_{GS}, I_D=18mA$	Fig. 11
			1.8			$V_{DS}=V_{GS}, I_D=18mA, T_J=150^{\circ}\text{C}$	
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		45	70	m Ω	$V_{GS}=20V, I_D=50A$	Fig. 4, 5, 6
			90			$V_{GS}=20V, I_D=50A, T_J=150^{\circ}\text{C}$	
g_{fs}	Transconductance		25.8		S	$V_{DS}=20V, I_D=50A$	
			27.0			$V_{DS}=20V, I_D=50A, T_J=150^{\circ}\text{C}$	
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		
E_{ON}	Turn-On Switching Energy		3.1		mJ	$V_{DS}=1200V, V_{GS}=-5/20V, I_D=30A, R_{G(ext)}=2.5\Omega, L=100\mu H$	
E_{OFF}	Turn-Off Switching Energy		1.1				
$t_{d(on)}$	Turn-On Delay Time		27		ns	$V_{DS}=1200V, V_{GS}=-5/20V, I_D=30A, R_{G(ext)}=2.5\Omega, R_L=20\Omega$	
t_r	Rise Time		32				
$t_{d(off)}$	Turn-Off Delay Time		36				
t_f	Fall Time		10				
$R_{G(int)}$	Internal Gate Resistance		2.6		Ω	$f=1MHz, V_{AC}=25mV$	
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			$V_{GS}=-5V, I_{SD}=25A, T_J=150^{\circ}\text{C}$	
I_S	Continuous Diode Forward Current		72	A	$T_C=25^{\circ}\text{C}$	
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
$R_{\theta JC}$	Thermal Resistance from Junction to Case	0.24	0.28	$^{\circ}\text{C/W}$		

Typical Performance

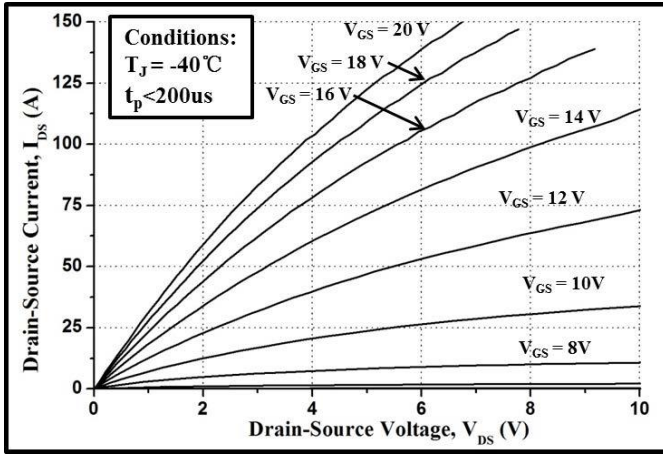


Figure 1. Output Characteristics $T_J = -40\text{ }^{\circ}\text{C}$

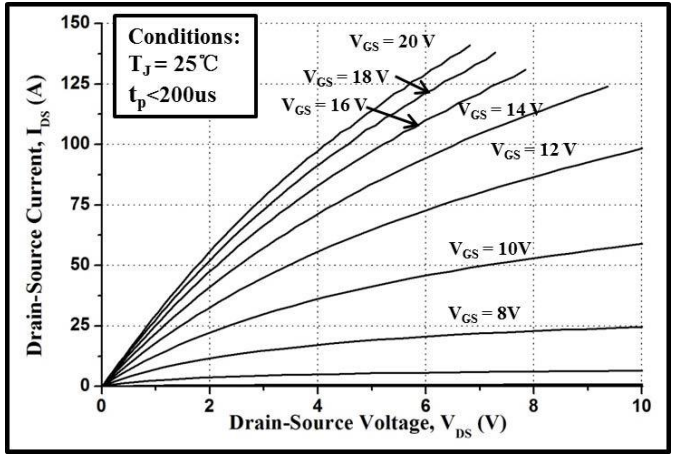


Figure 2. Output Characteristics $T_J = 25\text{ }^{\circ}\text{C}$

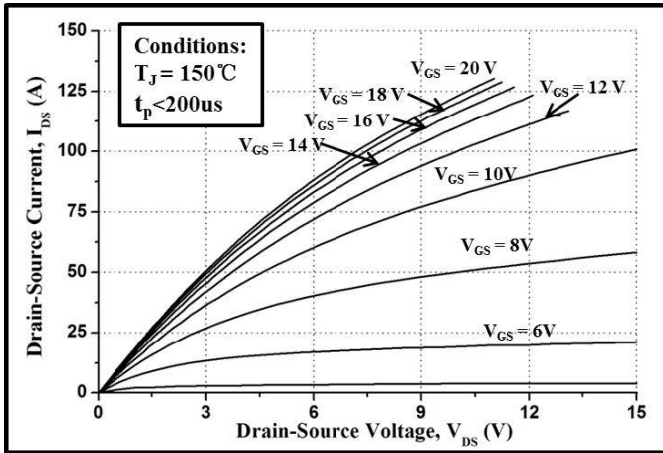


Figure 3. Output Characteristics $T_J = 150\text{ }^{\circ}\text{C}$

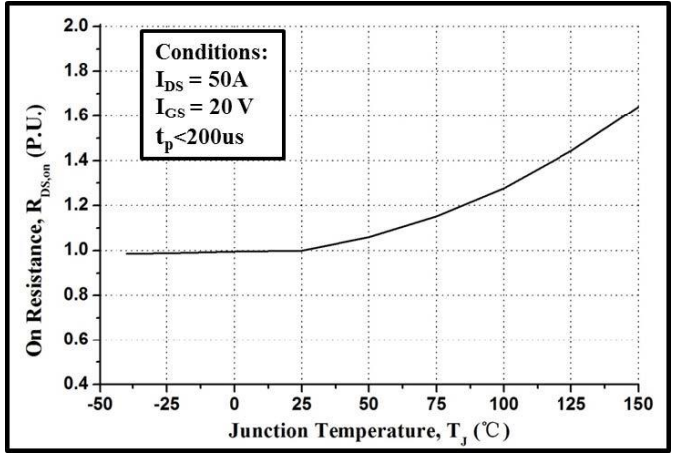


Figure 4. Normalized On-Resistance vs. Temperature

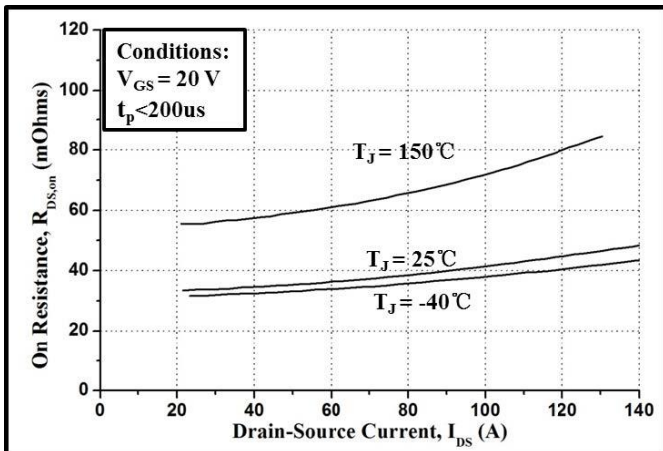


Figure 5. On-Resistance vs. Drain Current for Various Temperatures

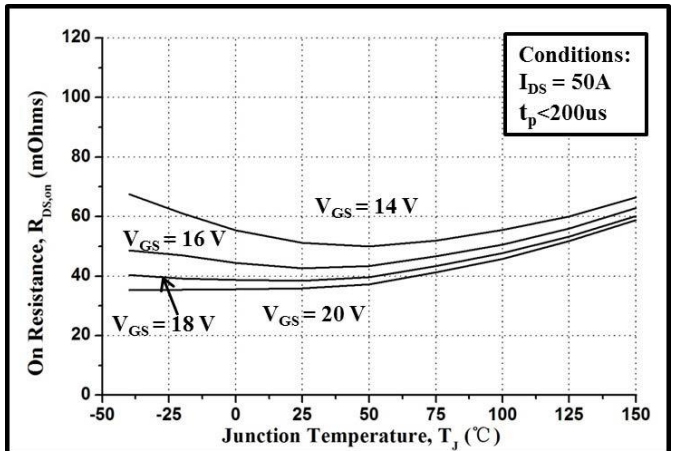


Figure 6. On-Resistance vs. Temperature for Various Gate Voltages

Typical Performance

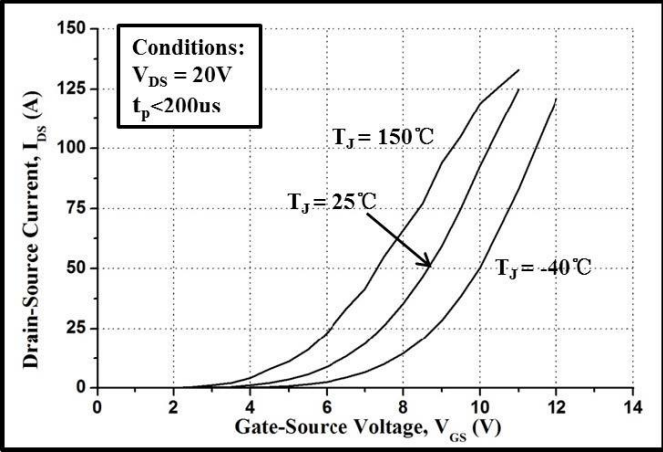


Figure 7. Transfer Characteristics for Various Junction Temperatures

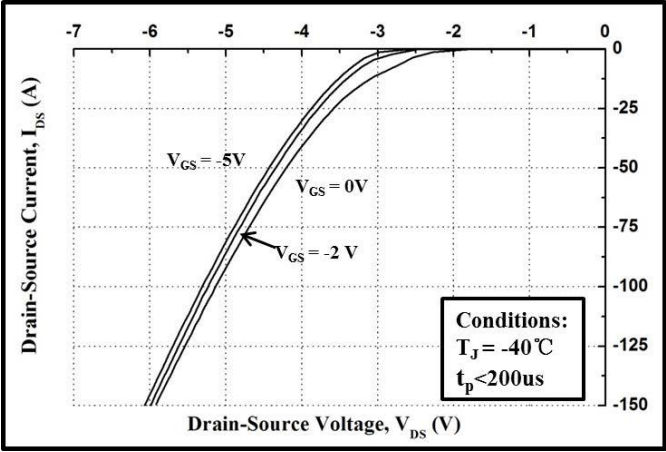


Figure 8. Body Diode Characteristics at -40 °C

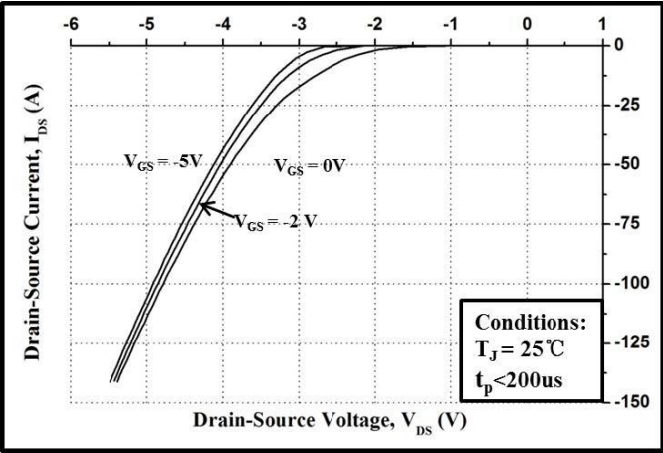


Figure 9. Body Diode Characteristics at 25 °C

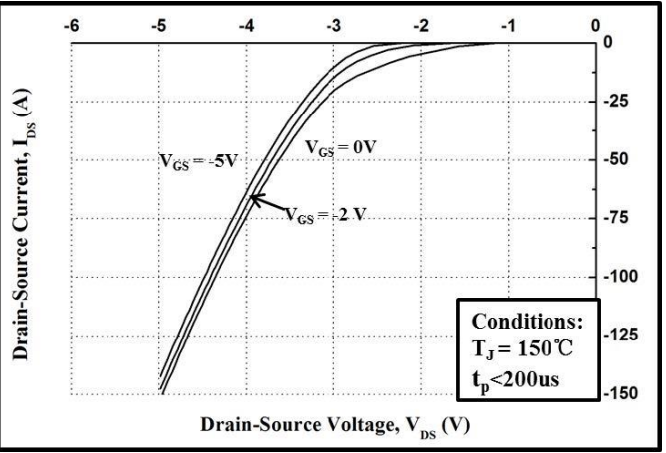


Figure 10. Body Diode Characteristics at 150 °C

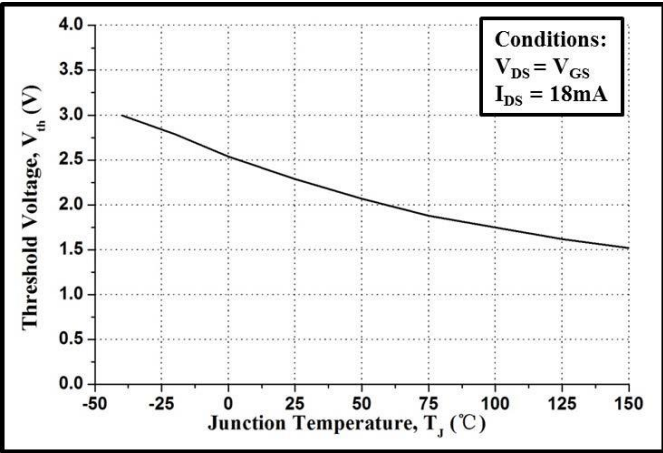


Figure 11. Threshold Voltage vs. Temperature

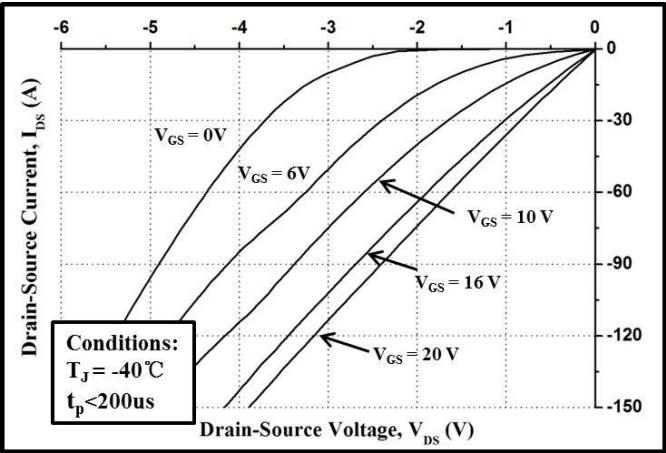


Figure 12. 3rd Quadrant Characteristics at -40 °C

Typical Performance

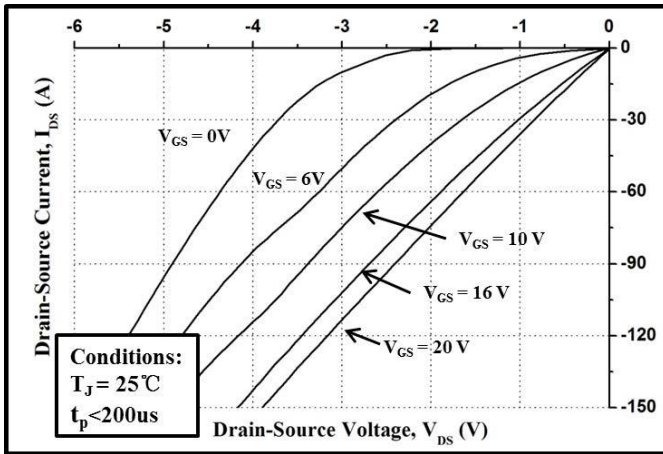


Figure 13. 3rd Quadrant Characteristics at 25 °C

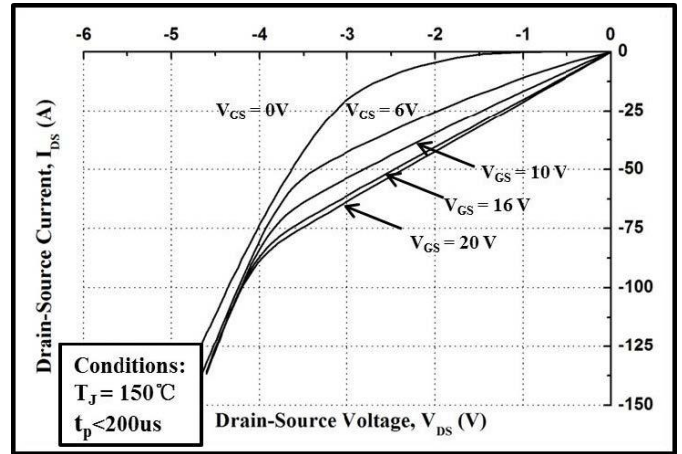


Figure 14. 3rd Quadrant Characteristics at 150 °C

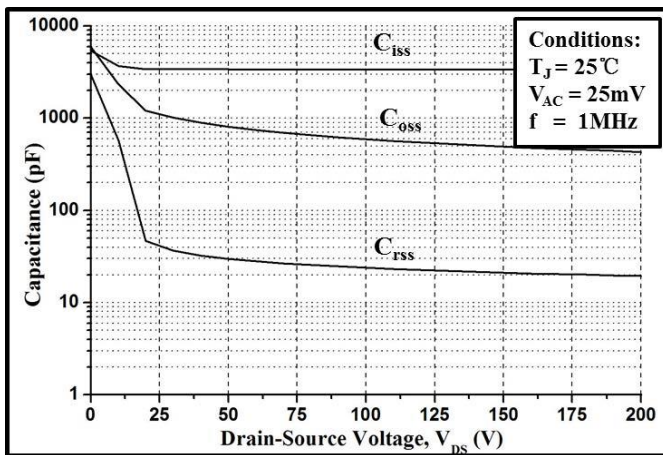


Figure 15. Capacitances vs. Drain-Source Voltage (0 - 200V)

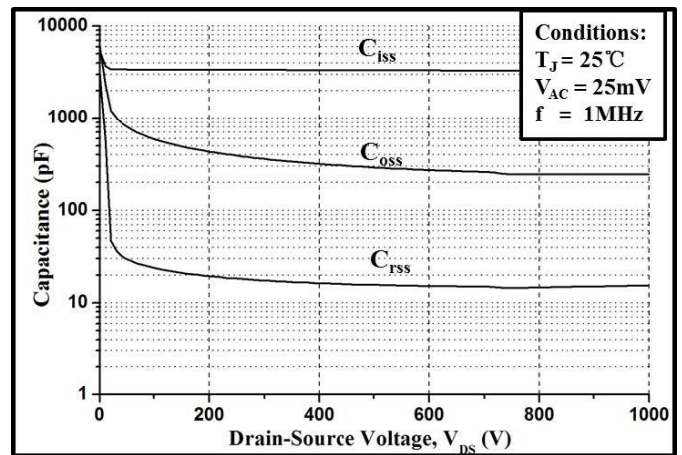


Figure 16. Capacitances vs. Drain-Source Voltage (0 - 1000V)

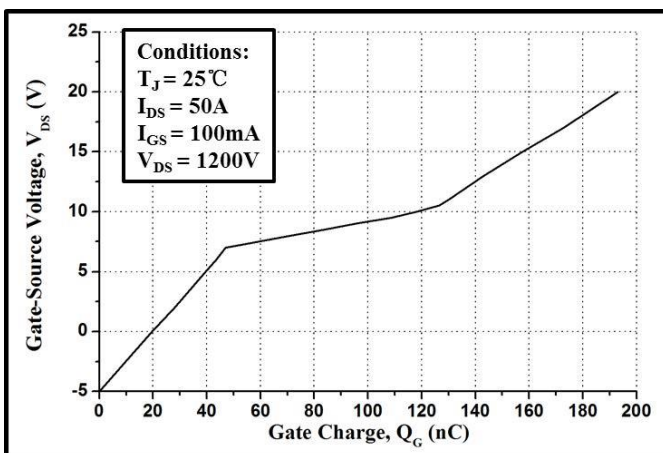


Figure 17. Gate Charge Characteristics

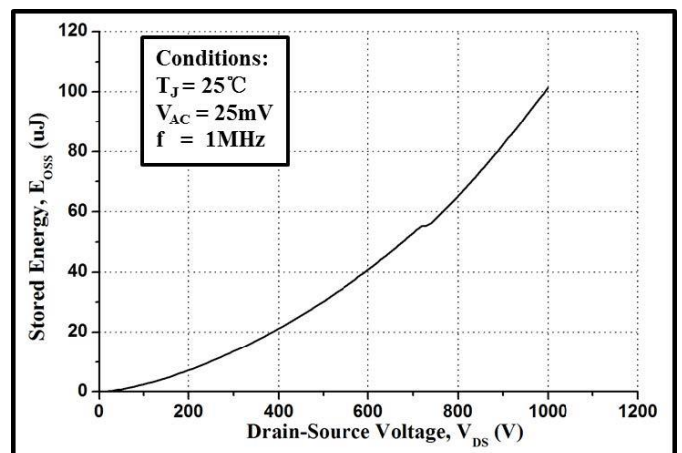
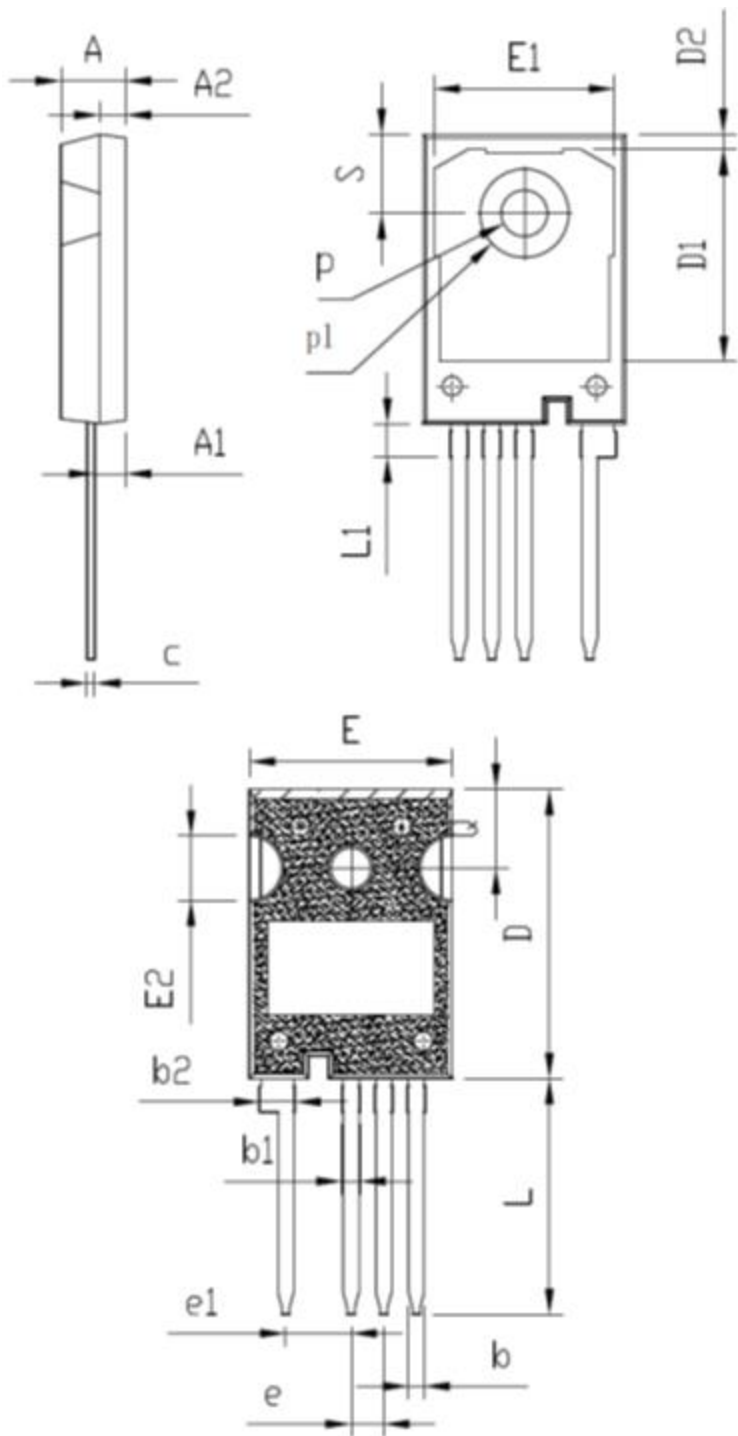


Figure 18. Output Capacitor Stored Energy

Package TO-247-4



	mm		
	MIN	NOM	MAX
A	/	5.00	/
A1	/	2.40	/
A2	/	2.00	/
b	/	1.20	/
b1	/	1.30	/
b2	/	2.65	/
c	/	0.6	/
D	/	22.54	/
D1	/	16.50	/
D2	/	1.17	/
e	/	2.54	/
e1	/	5.08	/
E	/	15.80	/
E1	/	14.00	/
E2	/	5.00	/
L	/	18.38	/
L1	/	2.58	/
p	/	3.60	/
p1	/	6.80	/
Q	/	6.15	/
S	/	6.15	/