Silicon Carbide Power MOSFET

N-Channel Enhancement Mode

Features

- High Blocking Voltage with Low On-Resistance
- High Speed Switching with Low Capacitances
- Easy to Parallel and Simple to Drive
- Avalanche Ruggedness
- Halogen Free, RoHS Compliant

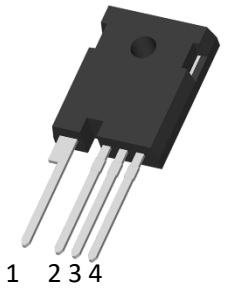
Benefits

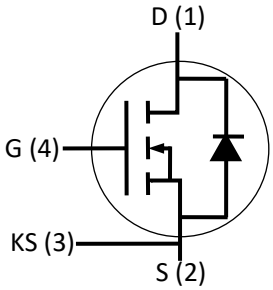
- Higher System Efficiency
- Reduced Cooling Requirements
- Increased Power Density
- Increased System Switching Frequency

Applications

- Solar Inverters
- Switch Mode Power Supplies
- High Voltage DC/DC Converters
- Battery Chargers
- Motor Drives
- Pulsed Power applications

Package





Part Number	Package
CI40N65SM4	TO-247-4

Maximum Ratings (T_C = 25°C Unless Otherwise Specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain-Source Voltage	650	V	V_{GS} = 0 V, I_D = 100 μA	
V_{GSmax}	Gate-Source Voltage	-10/+22	V	Absolute maximum values	
V_{GSop}	Gate-Source Voltage	-5/+18	V	Recommended operating values	
I_D[1]	Drain Current (Continuous)	55 39	A	T_C = 25°C T_C = 100°C	
I_{DM}[2]	Drain Current (Pulsed)	162	A		
P_{TOT}	Total Power Dissipation	288	W	T_C = 25°C, T_J = 175°C	Fig. 6
T_{stg}, T_J	Storage and Operating Junction Temperature Range	-55 to +175	°C		

[1] *I_D is limited by package.*

[2] *Pulse width is limited by Safe Operating Area (SOA).*

Electrical Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	650			V	V_{GS} = 0 V, I_D = 1 mA	
I_{DSS}	Zero Gate Voltage Drain Current		1	100	μA	V_{GS} = 0 V, V_{DS} = 650 V	
I_{GSS+}	Gate-Source Leakage Current			200	nA	V_{DS} = 0 V, V_{GS} = +22 V	
I_{GSS-}	Gate-Source Leakage Current			200	nA	V_{DS} = 0 V, V_{GS} = -10 V	
$V_{GS(th)}$	Gate Threshold Voltage	2.2	3.2	4.2	V	V_{GS} = V_{DS}, I_{DS} = 5 mA, T_J = 25°C	Fig. 14
			2.3			V_{GS} = V_{DS}, I_{DS} = 5 mA, T_J = 175°C	
$R_{DS(on)}$	Static Drain-Source On-Resistance		40	55	mΩ	V_{GS} = 18 V, I_D = 20 A, T_J = 25°C	Fig. 15
			67			V_{GS} = 18 V, I_D = 20 A, T_J = 175°C	
C_{iss}	Input Capacitance		1552		pF	V_{DS} = 400 V, f = 1 MHz, V_{GS} = 0 V	Fig. 8
C_{oss}	Output Capacitance		105				
C_{rss}	Reverse Transfer Capacitance		8				
Q_g	Total Gate Charge		63		nC	V_{DD} = 400 V, V_{GS} = -5/18 V, I_D = 20 A	Fig. 7
Q_{gs}	Gate-Source Charge		21				
Q_{gd}	Gate-Drain Charge		8				
$R_{G(int)}$	Gate Input Resistance		4.2		Ω	f = 1 MHz, I_D = 0 A	
E_{on}	Turn-On Switching Energy		87		μJ	V_{DD} = 400 V, I_D = 20 A, R_G = 15 Ω, V_{GS} = -5/18 V	Fig. 12
E_{off}	Turn-Off Switching Energy		82				
$t_{d(on)}$	Turn-On Delay Time		8		ns	V_{DD} = 400 V, I_D = 20 A, R_G = 15 Ω, V_{GS} = -5/18 V	
t_r	Rise Time		20				
$t_{d(off)}$	Turn-Off Delay Time		35				
t_f	Fall Time		15				

Reverse SiC Diode Characteristics

Symbol	Parameter	Typ.	Max.	Unit	Test Conditions	Note
V_{SD}	Diode Forward Voltage	3.4		V	V_{GS} = -5 V, I_{SD} = 10 A, T_J = 25°C	Fig. 16
		3.1			V_{GS} = -5 V, I_{SD} = 10 A, T_J = 175°C	Fig. 17
I_{SD}[1]	Continuous Diode Forward Current		64	A	T_C = 25°C	
			36		T_C = 100°C	
t_{rr}	Reverse Recovery Time	14		ns	I_{SD} = 20 A, di/dt = 1000 A/μs, V_{DD} = 400 V, V_{GS} = -5 V	
Q_{rr}	Reverse Recovery Charge	73		nC		
I_{RRM}	Peak Reverse Recovery Current	8.6		A		

[1] *I_{SD} is limited by bonding wires.*

Thermal Characteristics

Symbol	Parameter	Typ.	Unit	Test Conditions	Note
R_{thJC}	Thermal Resistance from Junction to Case	0.52	°C/W		Fig. 2
R_{thJA}	Thermal Resistance from Junction to Ambient	40			

Electrical Characteristics (Curves)

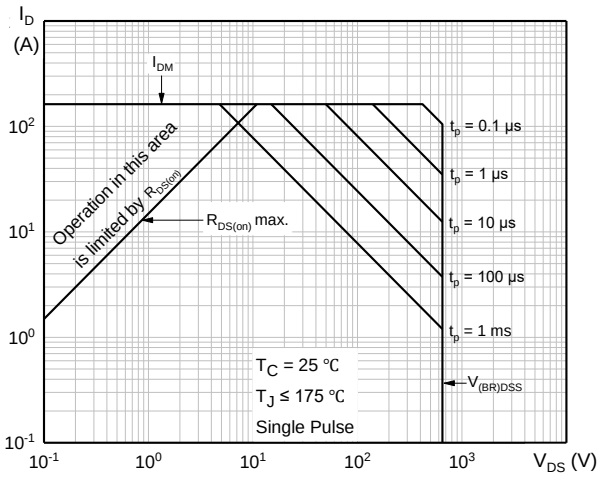


Figure 1. Safe Operating Area

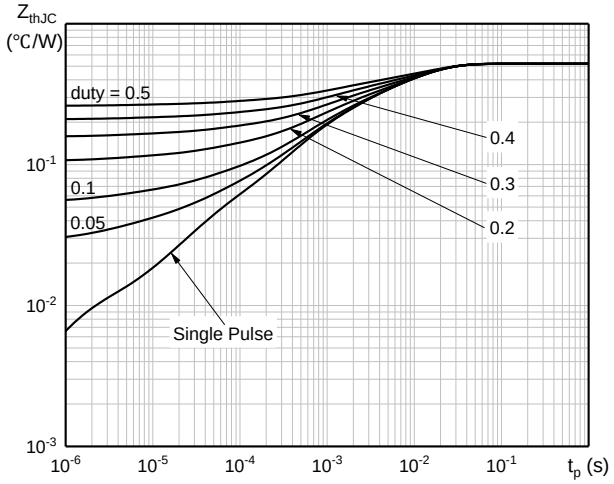


Figure 2. Maximum Transient Thermal Impedance

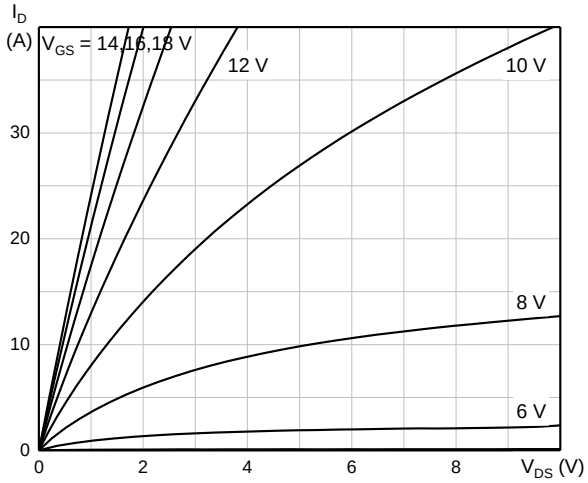


Figure 3. Typical Output Characteristics, T_J = 25°C

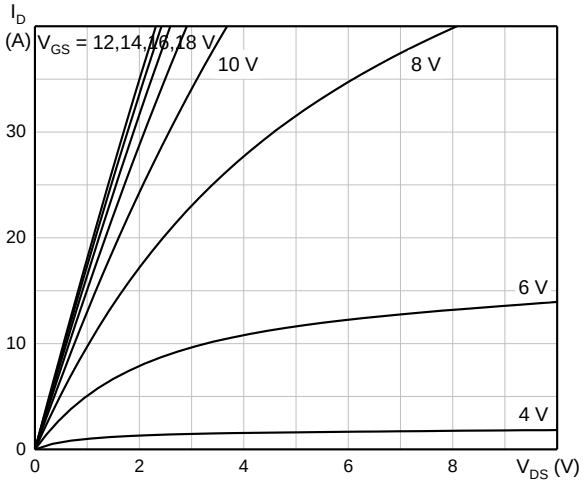


Figure 4. Typical Output Characteristics, T_J = 175°C

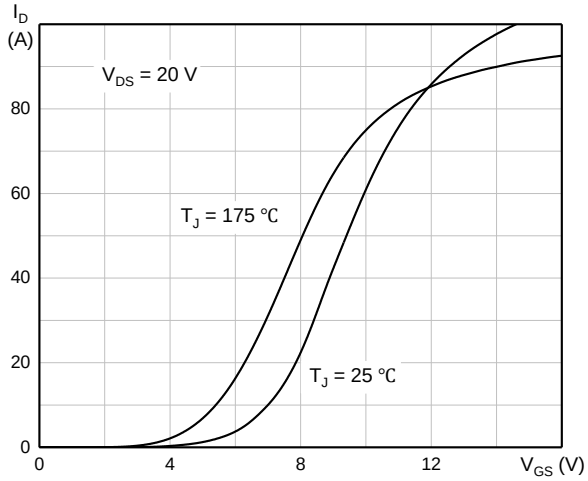


Figure 5. Typical Transfer Characteristics

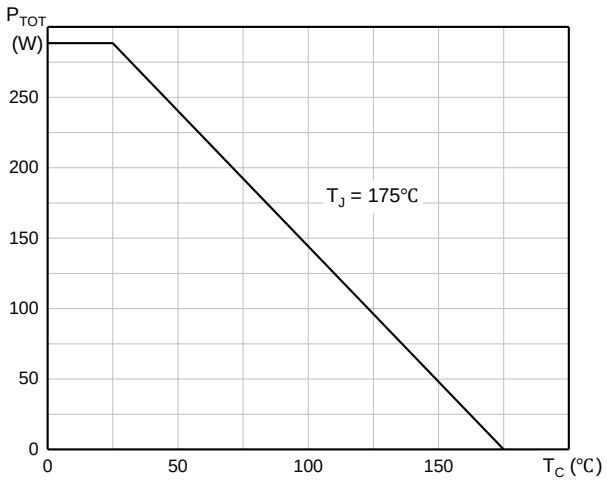


Figure 6. Total Power Dissipation

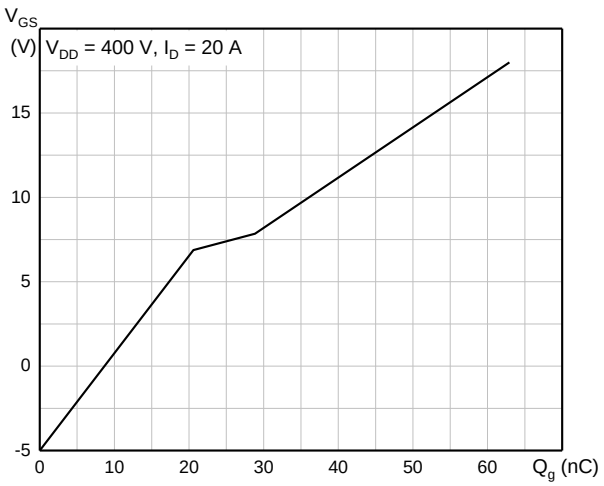


Figure 7. Typical Gate Charge Characteristics

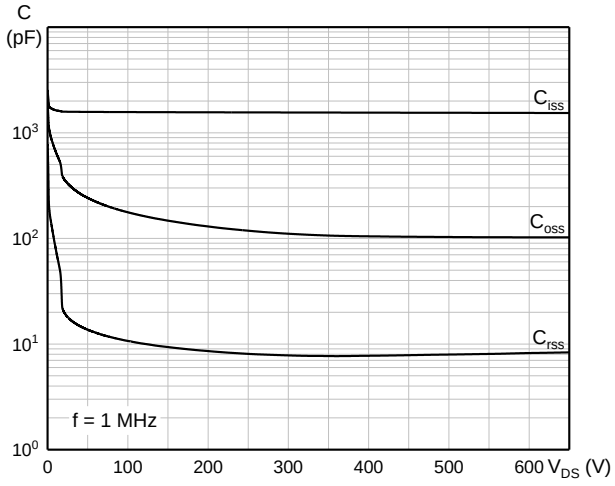


Figure 8. Typical Capacitance Characteristics

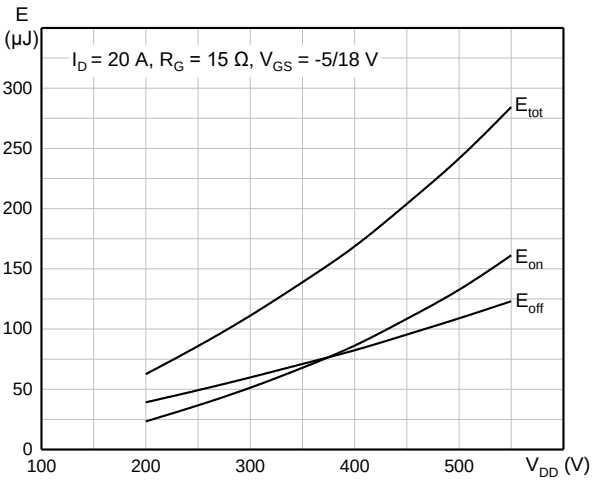


Figure 9. Typical Switching Energy vs. Supply Voltage

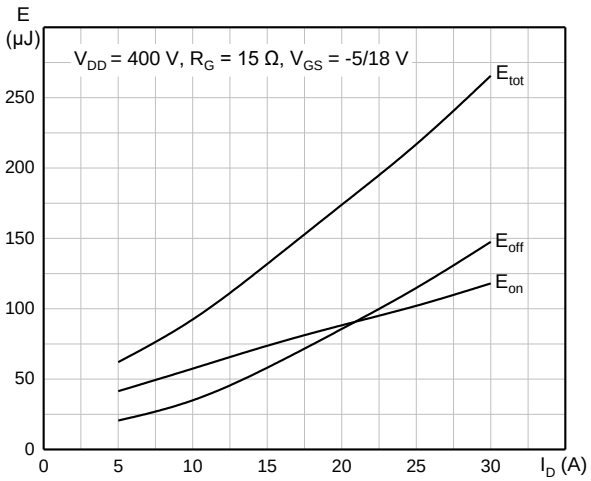


Figure 10. Typical Switching Energy vs. Drain Current

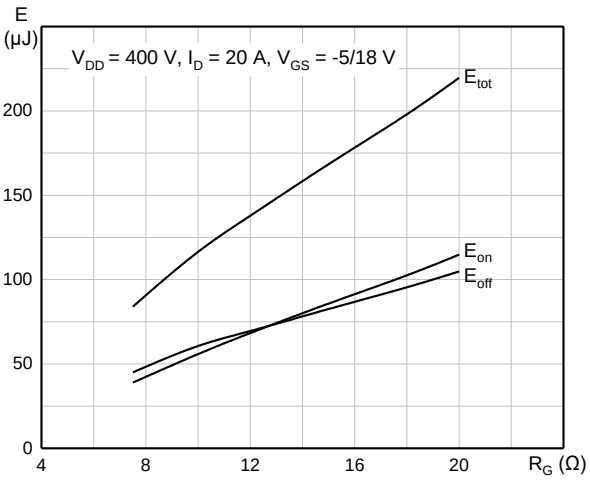


Figure 11. Typical Switching Energy vs. Gate Resistance

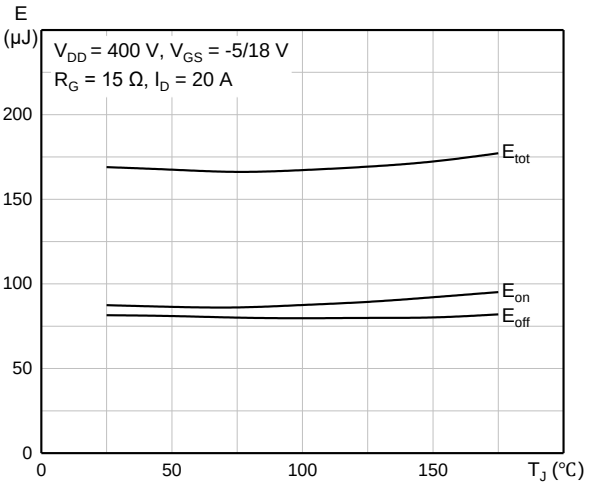


Figure 12. Typical Switching Energy vs. Temperature

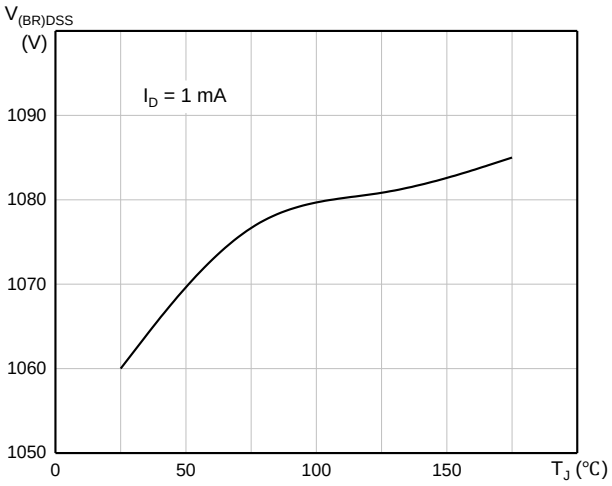


Figure 13. Breakdown Voltage vs. Temperature

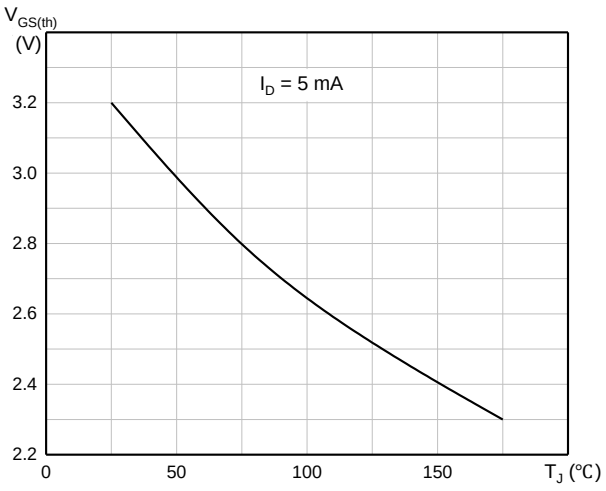


Figure 14. Gate Threshold vs. Temperature

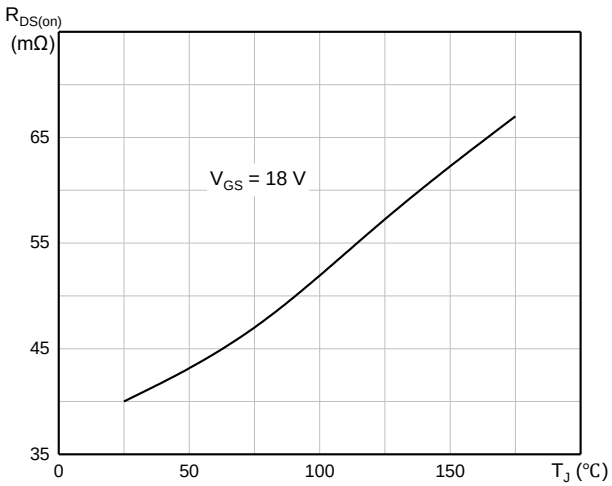


Figure 15. On-Resistance vs. Temperature

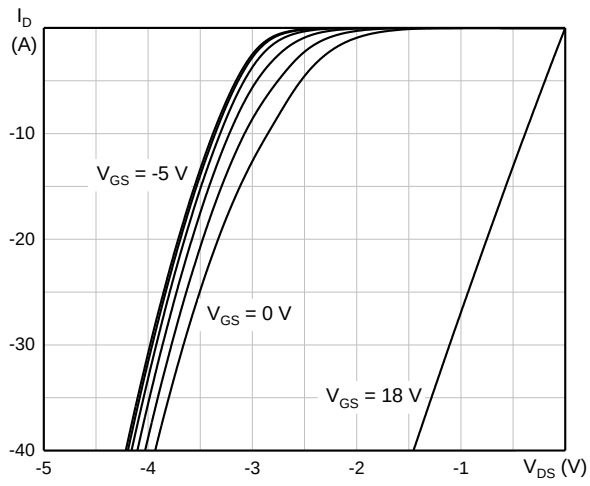


Figure 16. Body Diode Characteristics, T_J = 25°C

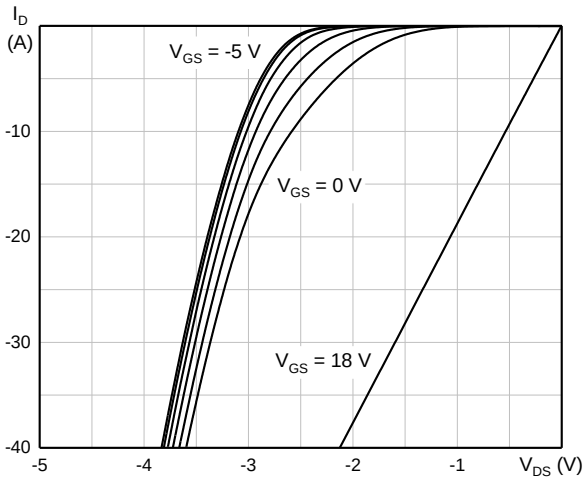
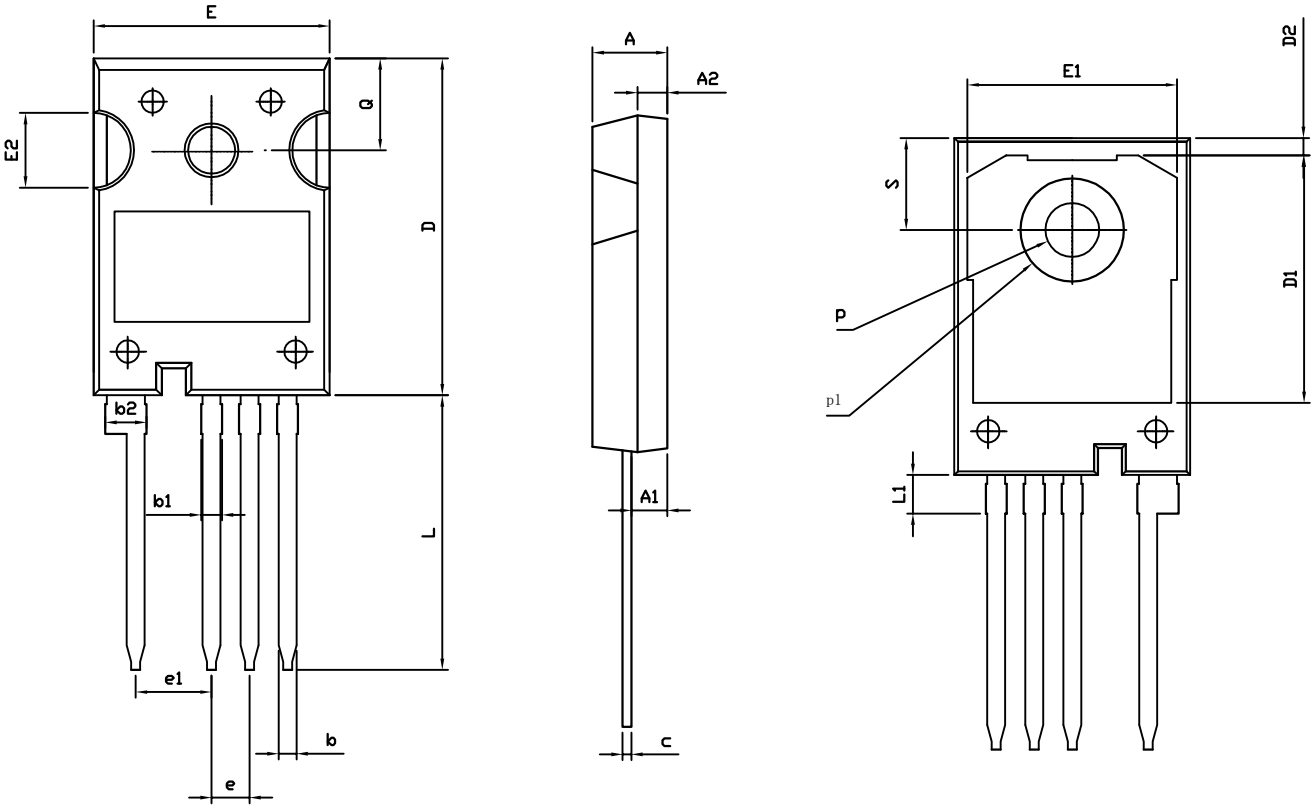


Figure 17. Body Diode Characteristics, T_J = 175°C

Package Information



Dimension	Min.	Typ.	Max.	Unit
A	4.80	5.00	5.20	mm
A1	2.25	2.40	2.45	
A2	1.85	2.00	2.15	
b	1.05	1.20	1.35	
b1	1.00	1.30	1.60	
b2	2.35	2.65	2.95	
c	0.50	0.60	0.70	
D	22.34	22.54	22.74	
D1	16.00	16.50	17.00	
D2	0.97	1.17	1.37	
e	2.34	2.54	2.74	
e1	4.88	5.08	5.28	
E	15.60	15.80	16.00	
E1	13.50	14.00	14.50	
E2	4.80	5.00	5.20	
L	18.08	18.38	18.68	
L1	2.38	2.58	2.78	
p	3.50	3.60	3.70	
p1	7.00	7.20	7.40	
Q	6.00	6.15	6.30	
S	6.00	6.15	6.30	

RECOMMENDED LAND PATTERN

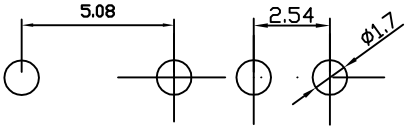


Figure 18. TO-247-4 Package Outline