TM2G0650170D

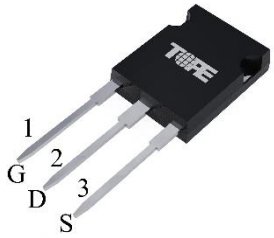
1700V N-Channel Silicon Carbide Power MOSFET

V_{DS}	=	1700 V
$R_{DS\ (on)}$	=	650 mΩ
I_D	=	9 A

Features

- High blocking voltage
- Low on-resistance with high junction temperature
- High-speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Q_{rr})
- RoHS compliant

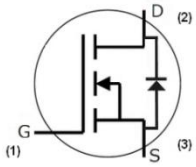
Package



RoHS

Benefits

- Higher System Efficiency
- Reduce cooling requirements
- Increased power density
- Enabling higher frequency
- Minimize gate ringing
- Reduction of system complexity and cost



Applications

- Switch Mode Power Supplies
- DC/DC converters
- Solar Inverters
- Battery Chargers
- Motor Drives

Part Number	Package	Marking
TM2G0650170D	TO-247-3	TM2G0650170D

Maximum Ratings, at T_J = 25°C, unless otherwise specified

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain-Source Breakdown Voltage	1700	V	V_{GS} = 0 V, I_D = 100 µA	
I_D	Continuous Drain Current	9	A	V_{GS} = 20 V, T_C = 25 °C	Fig. 18
$I_{D(pulse)}$	Pulsed Drain Current	18	A	Pulse width t_P limited by T_{jmax}	Fig. 21
P_D	Power Dissipation	85	W	T_C = 25 °C	Fig. 19
$V_{GS,op}$	Recommend Gate Source Voltage	-5/+20	V		
V_{GSmax}	Maximum Gate Source Voltage	-10/+25	V		
T_J, T_{stg}	Operating Junction and Storage Temperature Range	-55 to +175	°C		
T_L	Soldering Temperature	260	°C		

Electrical Characteristics, at T_J = 25°C, unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
Static							
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	1700	--	--	V	V_{GS} = 0 V, I_D = 100 μA	
I_{DSS}	Zero Gate Voltage Drain Current	--	0.9	100	μA	V_{DS} = 1700 V, V_{GS} = 0 V	
I_{GSS}	Gate-Source Leakage	--	2	250	nA	V_{GS} = 20 V	
$V_{GS(th)}$	Gate-Source Threshold Voltage	1.8	--	4.0	V	I_D = 0.5 mA, V_{GS} = V_{DS}	Fig. 11
$R_{DS(on)}$	Drain-Source On- Stage Resistance	--	550	1000	mΩ	V_{GS} = 20 V, I_D = 2 A	Fig. 6
			650		mΩ	V_{GS} = 18 V, I_D = 2 A	
			780		mΩ	V_{GS} = 15 V, I_D = 2 A	
Dynamic							
C_{iss}	Input Capacitance	--	183	--	pF	V_{GS} = 0 V, V_{DS} = 1000 V f = 1.0 MHz, V_{AC} = 25 mV	Fig. 17
C_{oss}	Output Capacitance	--	17.1	--			
C_{rss}	Reverse Transfer Capacitance	--	2.1	--			
E_{oss}	C_{oss} Stored Energy	--	10.1	--	μJ		Fig. 16
Q_g	Total Gate Charge	--	13.2	--	nC	V_{DS} = 1200 V I_D = 2 A V_{GS} = -5/+20 V	Fig. 12
Q_{gs}	Gate-Source Charge	--	5.0	--			
Q_{gd}	Gate-Drain Charge	--	4.5	--			
E_{On}	Turn-On Switching Energy		170		μJ	V_{DS} = 1000 V, V_{GS} = -5/+20 V I_D = 2 A, $R_{G(ext)}$ = 2.5 Ω, L = 70 mH	Fig. 22
E_{Off}	Turn-Off Switching Energy		68				
$t_{d(on)}$	Turn-on Delay Time	--	5	--	ns	V_{DS} = 1000 V V_{GS} = -5/+20 V I_D = 2 A, L = 70 mH $R_{G(ext)}$ = 2.5 Ω	Fig. 24
t_r	Turn-on Rise Time	--	17	--			
$t_{d(off)}$	Turn-off Delay Time	--	13	--			
t_f	Turn-off Fall Time	--	55.6	--			
$R_{G(int)}$	Internal Gate Resistance	--	25.2	--	Ω	f = 1.0 MHz, V_{AC} = 25 mV	

Body Diode Characteristics, at T_J = 25°C, unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
I_S	Continuous Diode Froward Current	--	--	4	A		
V_{SD}	Diode Froward Voltage	--	4.0	--	V	V_{GS} = 0 V, I_S = 1 A	Fig. 8, 9, 10
t_{rr}	Reverse Recovery Time	--	33	--	ns	I_S = 2 A, V_{DS} = 1200 V V_{GS} = -5 V dif/dt = 1200 A/μs	
Q_{rr}	Reverse Recovery Charge	--	32	--	nC		
I_{rrm}	Peak Reverse Recovery Current	--	3	--	A		

Thermal Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	--	1.74	--	°C/W	Fig. 20

Typical Performance

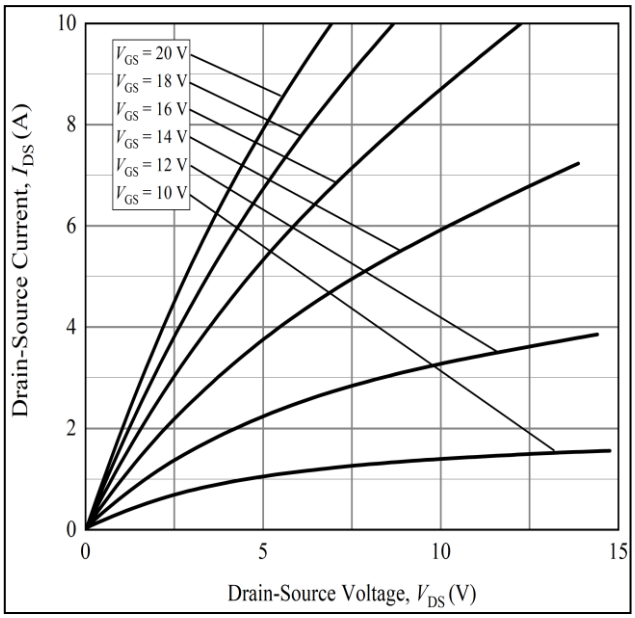


Figure 1: Typical Output Characteristics at T_J = -55 °C

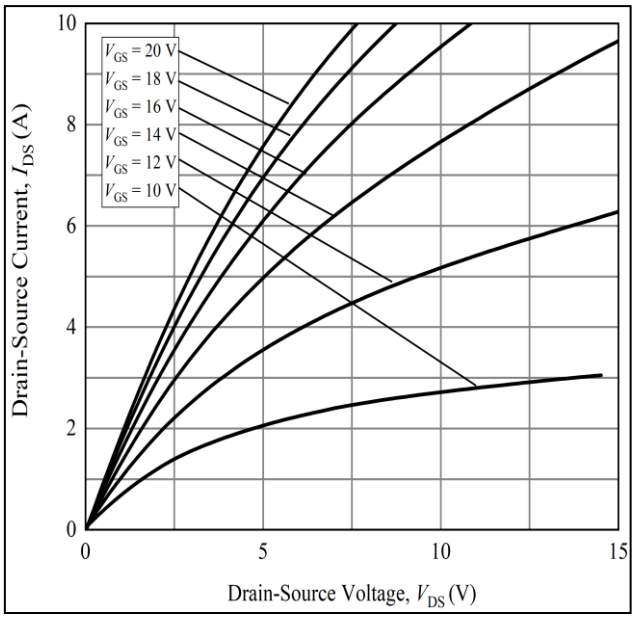


Figure 2: Typical Output Characteristics at T_J = 25 °C

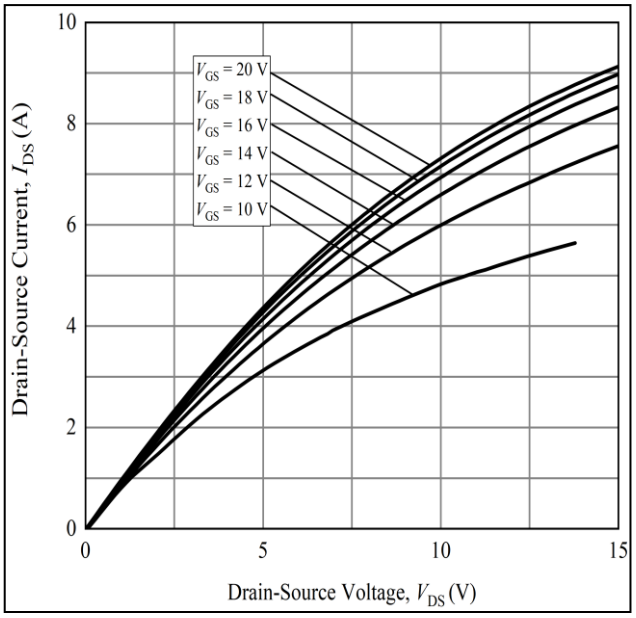


Figure 3: Typical Output Characteristics at T_J = 175 °C

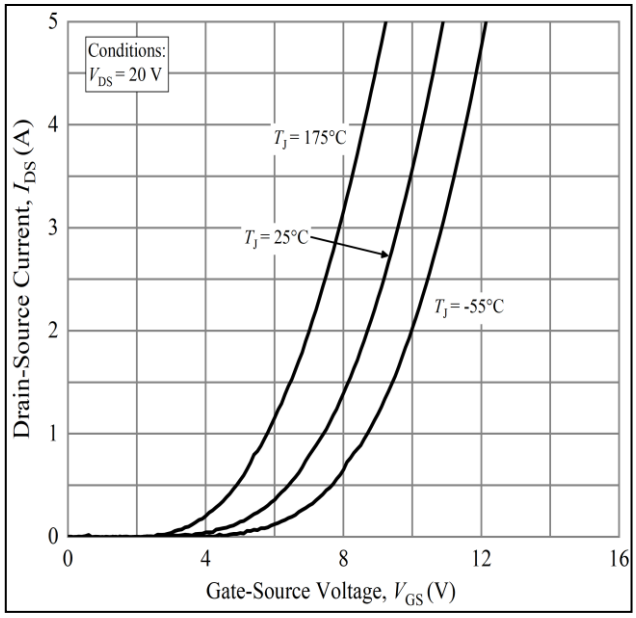


Figure 4: Typical Transfer Characteristics for Various Temperatures

Typical Performance

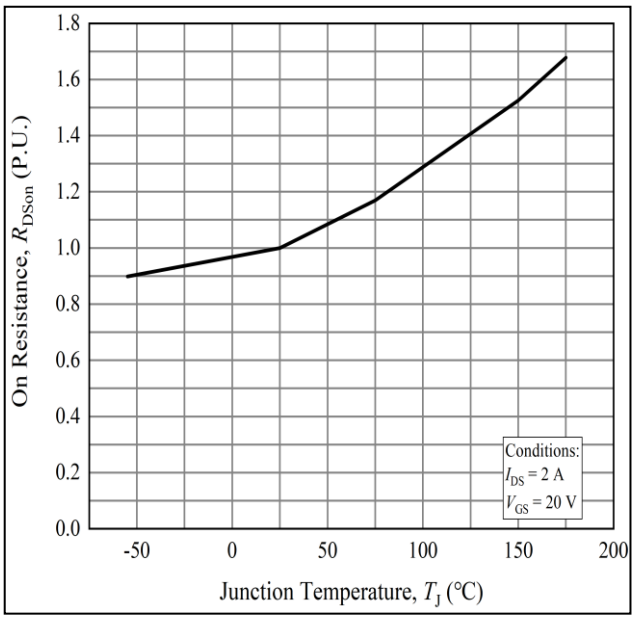


Figure 5: Normalized On-Resistance vs. Temperature

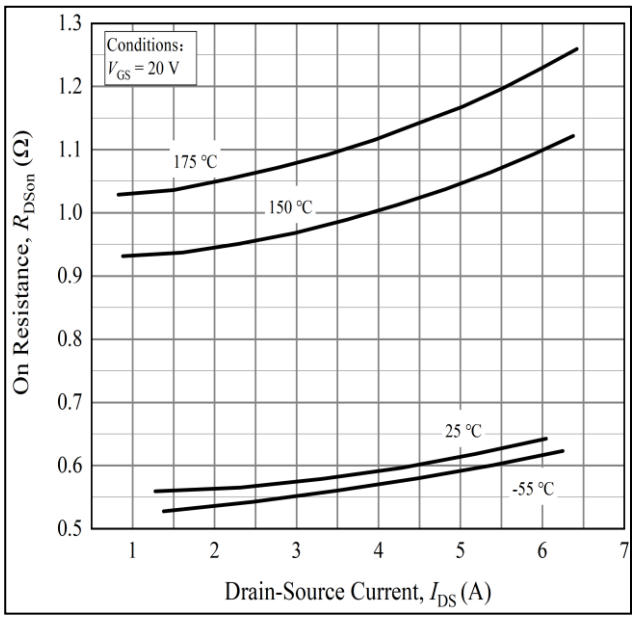


Figure 6: On-Resistance vs. Drain Current for Various Temperatures

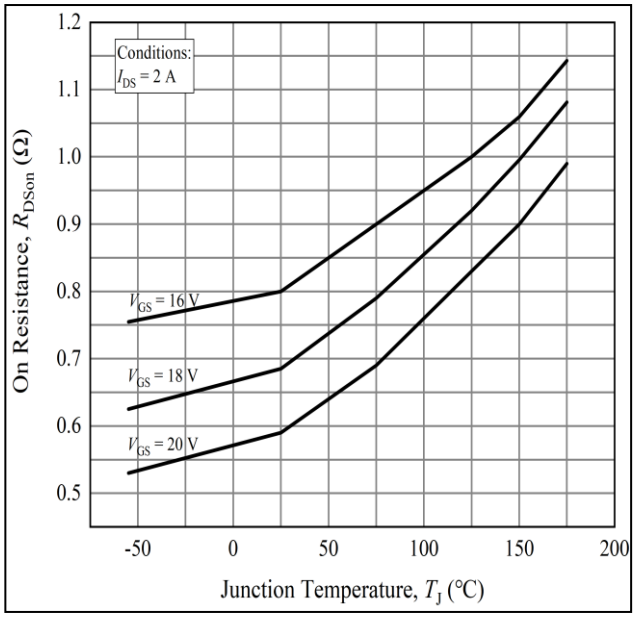


Figure 7: On-Resistance vs. Temperature for Gate Various Voltage

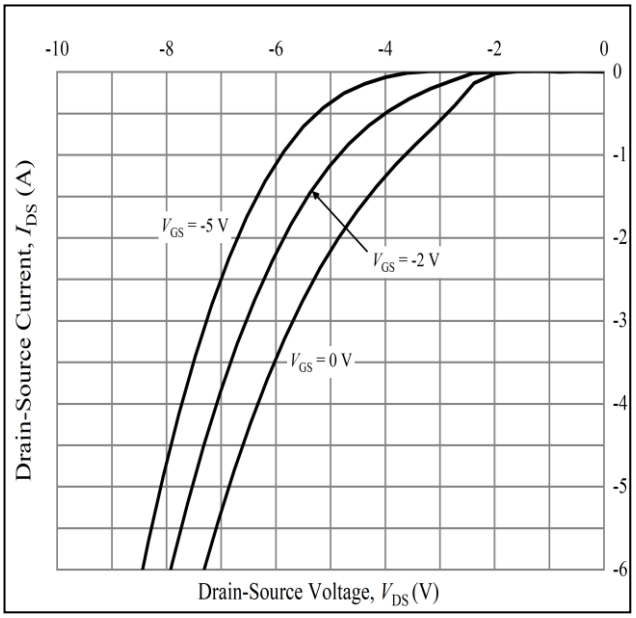


Figure 8: Typical Body Diode Characteristics at T_J = -55 °C

Typical Performance

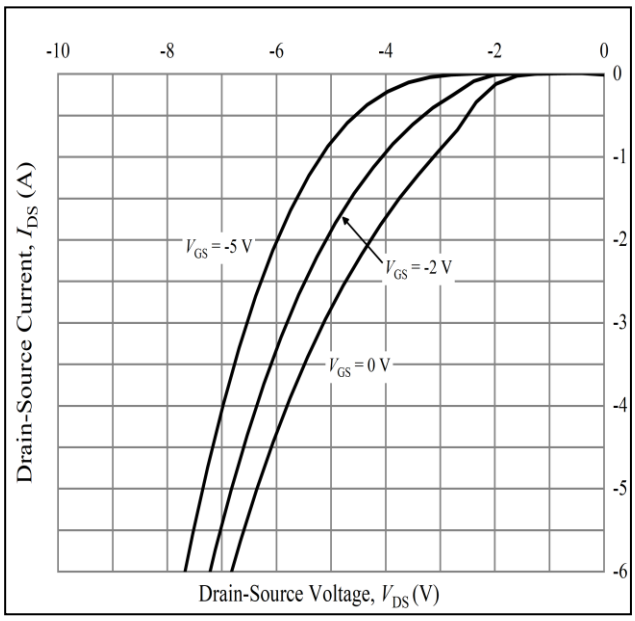


Figure 9: Typical Body Diode Characteristics at T_J = 25 °C

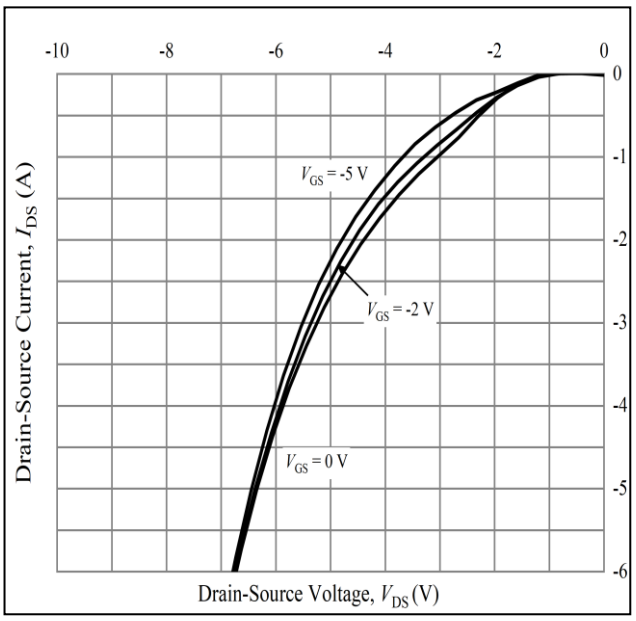


Figure 10: Typical Body Diode Characteristics at T_J = 175 °C

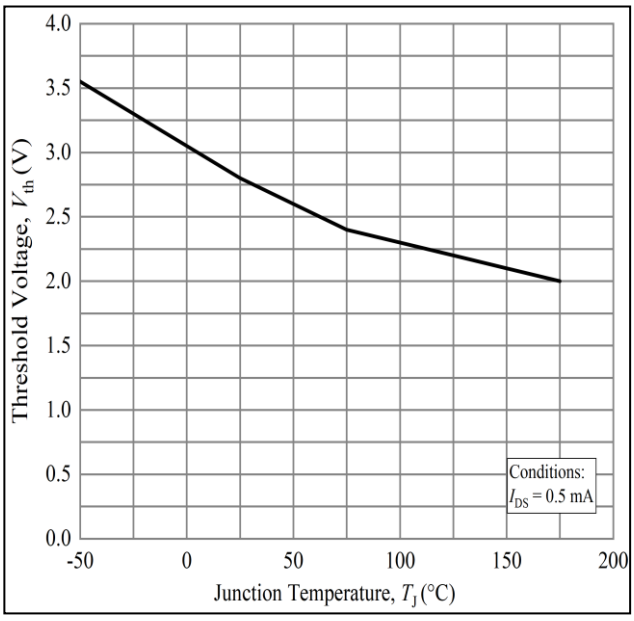


Figure 11: Typical Threshold Voltage vs. Temperature

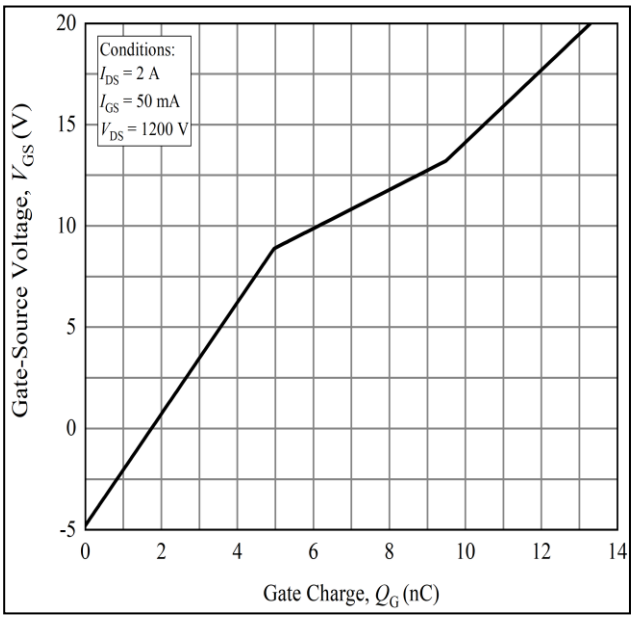


Figure 12: Typical Gate Charge Characteristics at T_J = 25 °C

Typical Performance

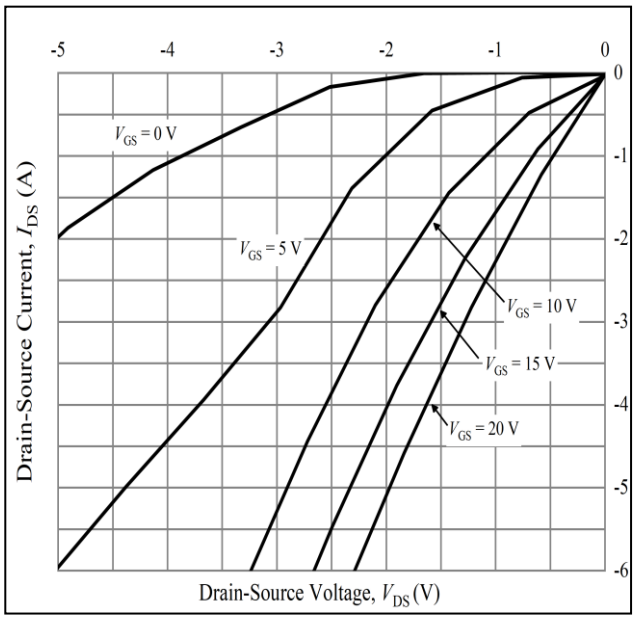


Figure 13: Typical 3rd Quadrant Characteristics T_J = -55 °C

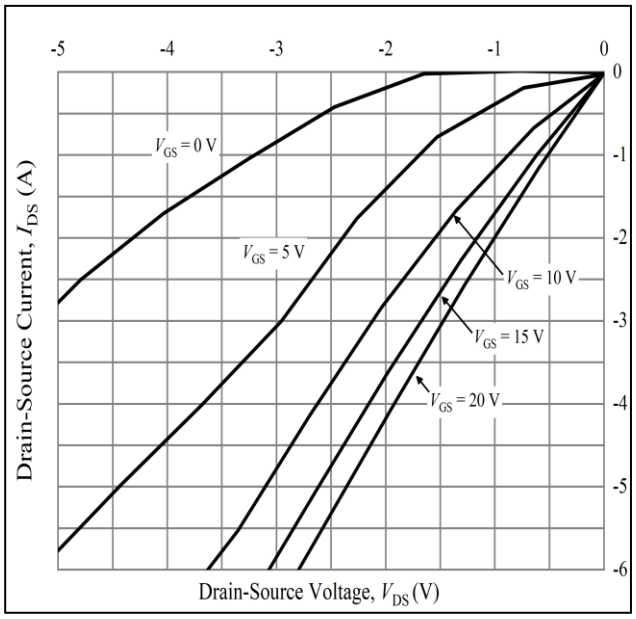


Figure 14: Typical 3rd Quadrant Characteristics at T_J = 25 °C

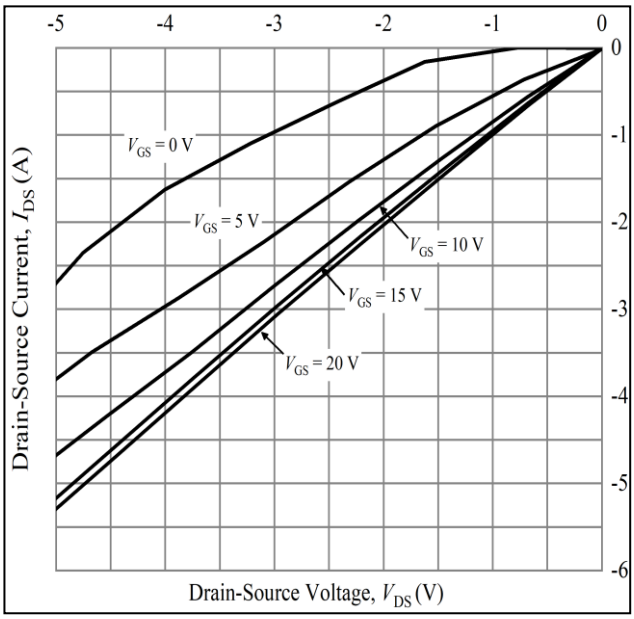


Figure 15: Typical 3rd Quadrant Characteristics at T_J = 175 °C

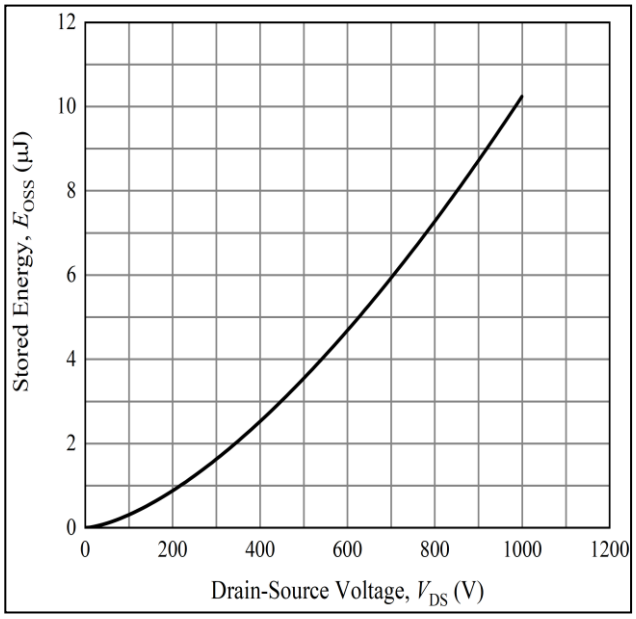


Figure 16: Typical Output Capacitor Stored Energy

Typical Performance

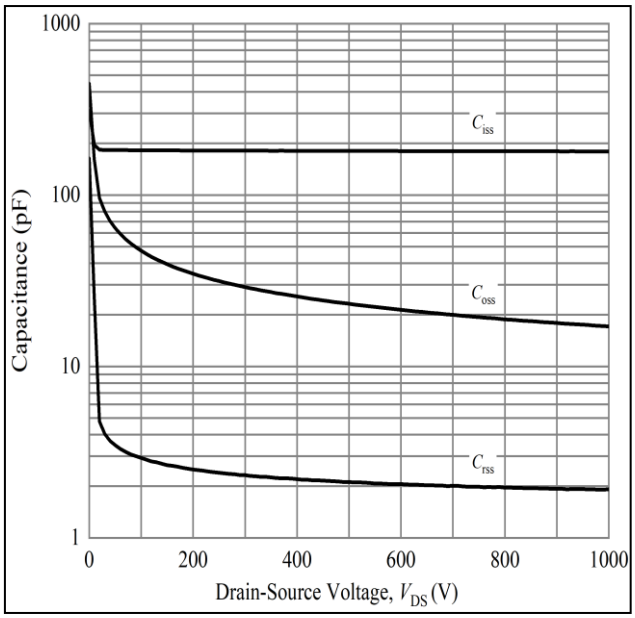


Figure 17: Typical Capacitances vs. Drain-Source Voltage

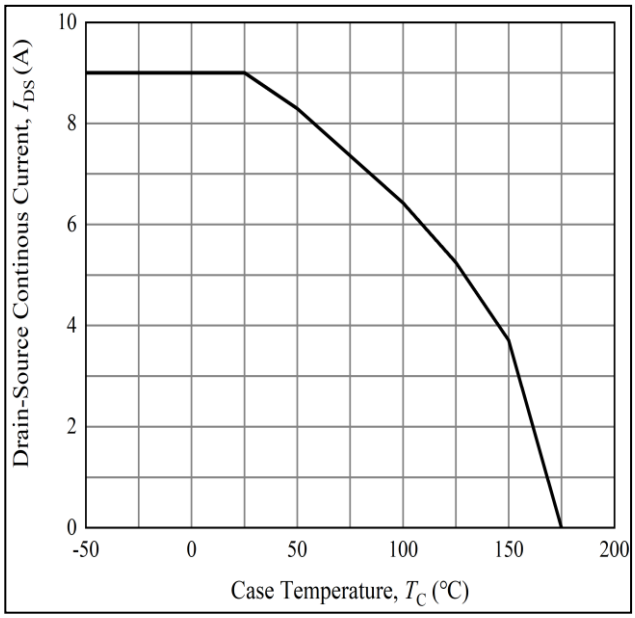


Figure 18: Continuous Drain Current Derating vs. Case Temperature

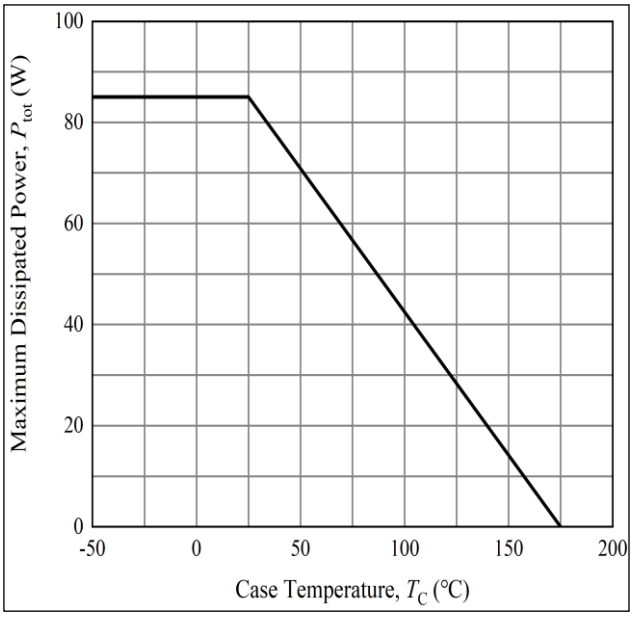


Figure 19: Power Dissipation Derating Curve

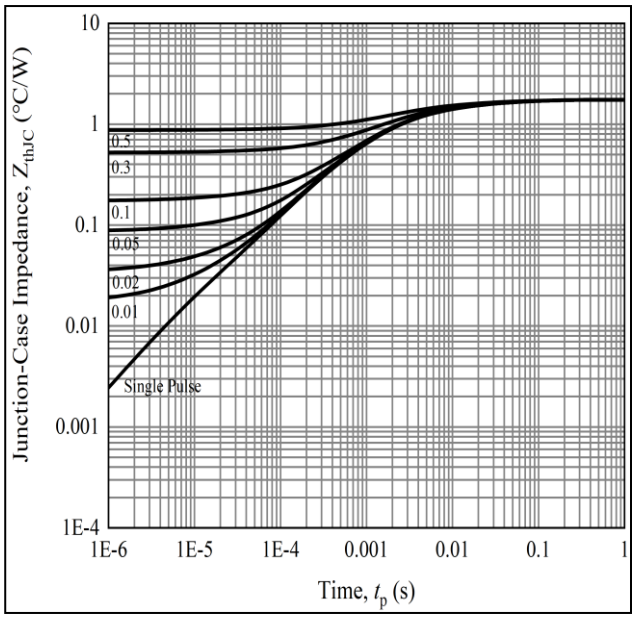


Figure 20: Typical Transient Thermal Impedance (Junction – Case) with Duty Cycle

Typical Performance

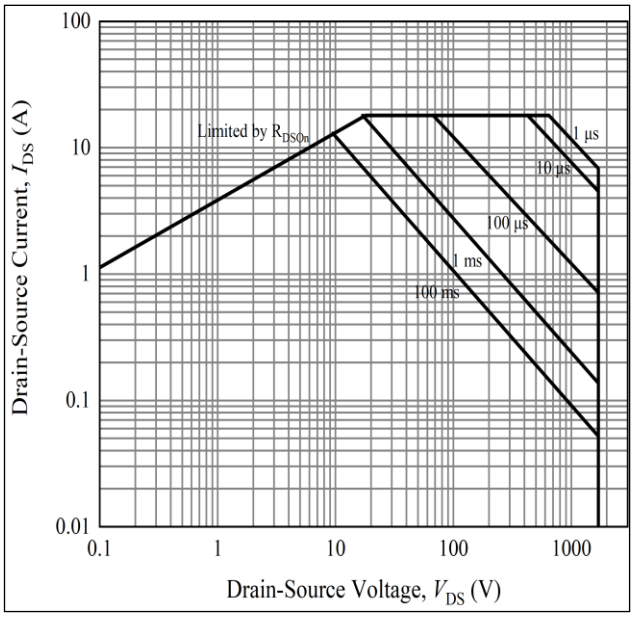


Figure 21: Safe Operate Area

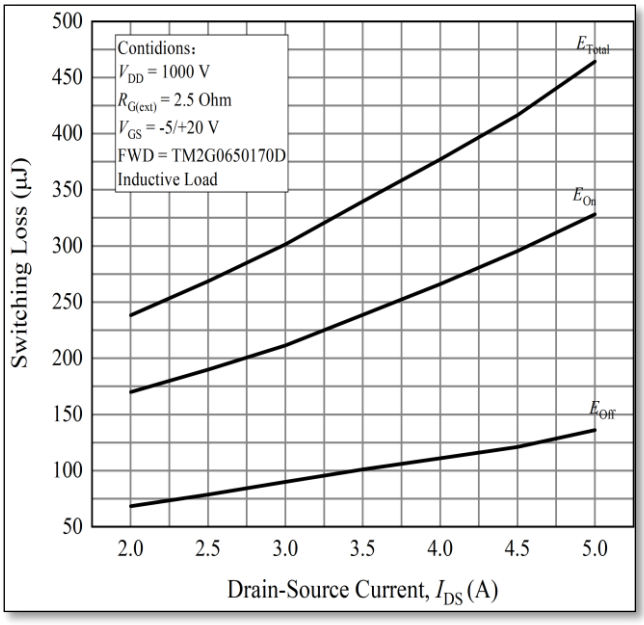


Figure 22: Clamped Inductive Switching Energy vs. Drain Current(V_{DD} = 1000 V)

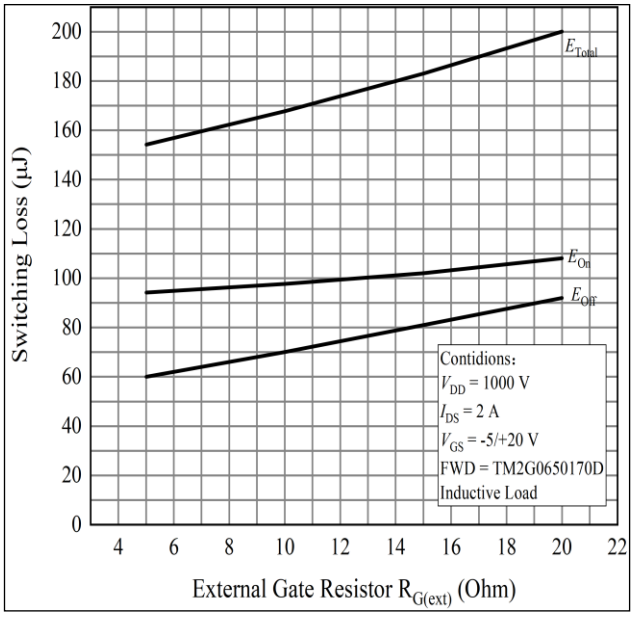


Figure 23: Clamped Inductive Switching Energy vs. $R_{G(ext)}$

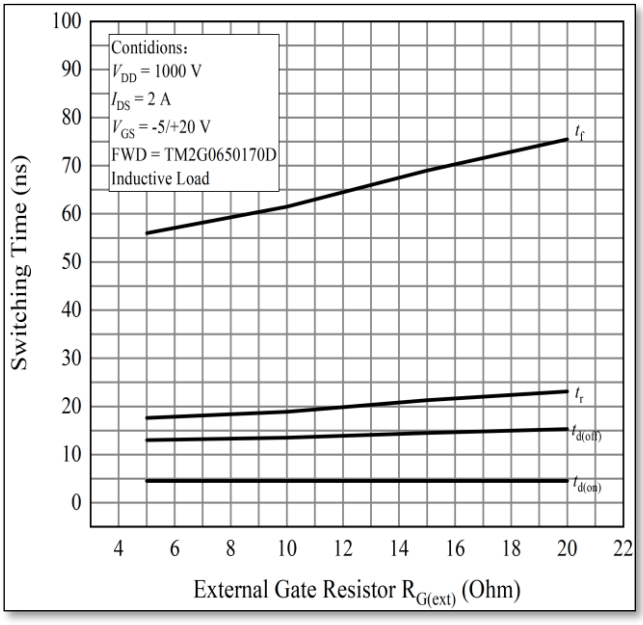


Figure 24: Switching Times vs. $R_{G(ext)}$

Typical Performance

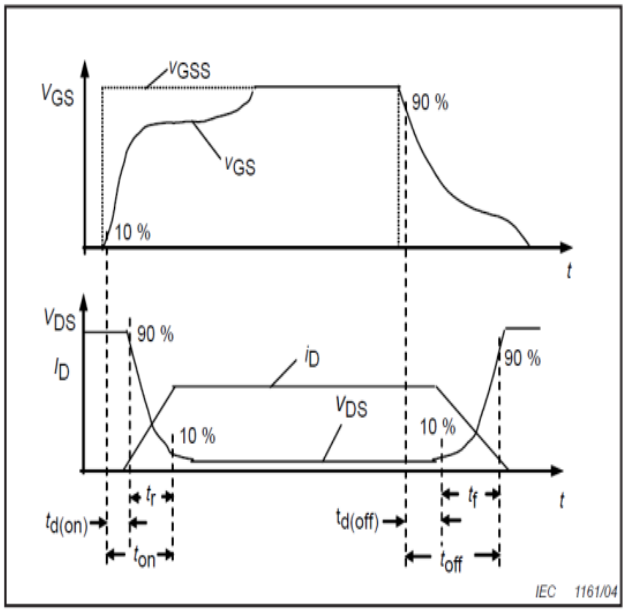


Figure 25: Resistive Switching Time Description

Test Circuit Schematic

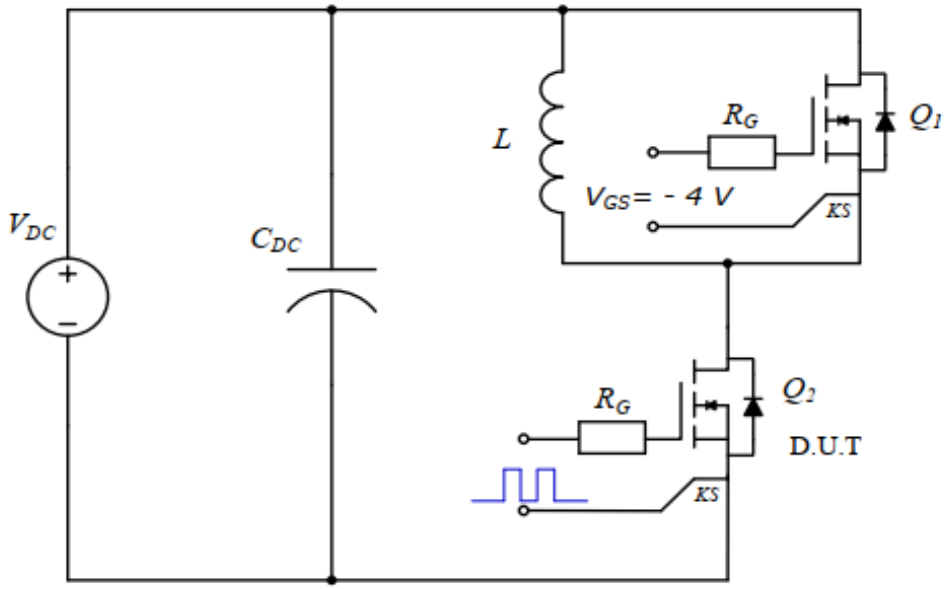
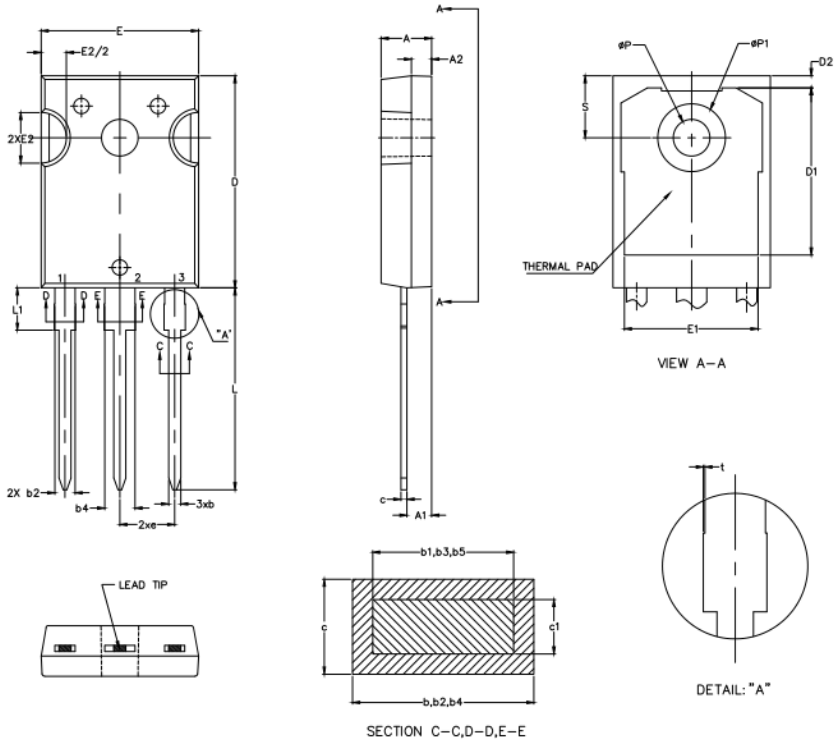


Figure 26: Clamped Inductive Switching Waveform Test Circuit

Package Dimensions

Package：TO-247-3



SYMBOLS	DIMENSIONS			
	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A	4.90	5.10	0.193	0.201
A1	2.31	2.51	0.091	0.099
A2	1.90	2.10	0.075	0.083
b	1.16	1.26	0.046	0.050
b1	1.15	1.22	0.045	0.048
b2	1.96	2.06	0.077	0.081
b3	1.95	2.02	0.077	0.080
b4	2.96	3.06	0.117	0.120
b5	2.95	3.02	0.116	0.119
c	0.59	0.66	0.023	0.026
c1	0.58	0.62	0.023	0.024
D	20.90	21.10	0.823	0.831
D1	16.25	16.85	0.640	0.663
D2	1.05	1.35	0.041	0.053
E	15.75	15.90	0.620	0.626
E1	13.26	—	0.552	—
E2	4.90	5.10	0.193	0.201
e	5.44BSC		0.214BSC	
L	19.80	20.10	0.780	0.791
L1	—	4.30	—	0.169
øP	3.50	3.70	0.138	0.146
øP1	—	7.40	—	0.291
S	6.05	6.25	0.238	0.246
t	0.00	0.15	0.000	0.006

Revision History

Document Version	Description of Changes

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安徽芯塔电子科技有限公司
TOPE Technologies Co., Ltd.
WuHu, Auhui, China 241002
Contact: sale@topelectronics.cn