

TM2G0060065K

650V N-Channel Silicon Carbide Power MOSFET

V_{DS}	=	650 V
$R_{DS(on)}$	=	60 mΩ
I_D	=	56 A

Features

- Optimized package with separate driver source pin
- High blocking voltage with low on-resistance
- Low on-resistance with high junction temperature
- High-speed switching with low capacitances
- Fast intrinsic diode with low reverse recovery (Qrr)
- Easy to parallel
- RoHS compliant

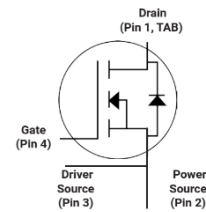
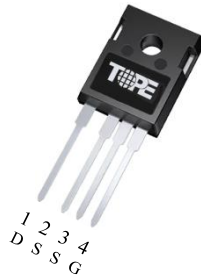
Benefits

- 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

Package



Part Number	Package	Marking
TM2G0060065K	TO-247-4	TM2G0060065K

Maximum Ratings (Tc = 25 °C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DSmax}	Drain-Source Breakdown Voltage	650	V	$V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$	
I_D	Continuous Drain Current	56	A	$V_{GS} = 20\text{ V}, T_C = 25\text{ }^\circ\text{C}$	Fig. 18
$I_{D(pulse)}$	Pulsed Drain Current	112	A	Pulse width t_p limited by T_{jmax}	
P_D	Power Dissipation	259	W	$T_C = 25\text{ }^\circ\text{C}$	Fig. 19
$V_{GS,op}$	Recommend Gate Source Voltage	-5/+20	V		
V_{GSmax}	Maximum Gate Source Voltage	-10/+25	V	AC ($f > 1\text{ Hz}$)	
T_j, T_{stg}	Operating Junction and Storage Temperature Range	-55 to +175	°C		
T_L	Soldering Temperature	260	°C		

Electrical Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
Static							
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	650	--	--	V	$V_{GS} = 0\text{ V}, I_D = 100\ \mu\text{A}$	
I_{DSS}	Zero Gate Voltage Drain Current	--	10	100	μA	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$	
I_{GSS}	Gate-Source Leakage	--	5	250	nA	$V_{GS} = 20\text{ V}$	
$V_{GS(th)}$	Gate-Source Threshold Voltage	2	--	4	V	$I_D = 5\text{ mA}, V_{GS} = V_{DS}$	Fig. 11
$R_{DS(on)}$	Drain-Source On- Stage Resistance	--	60	80	m Ω	$V_{GS} = 20\text{ V}, I_D = 13.2\text{ A}$	Fig. 6
			80		m Ω	$V_{GS} = 18\text{ V}, I_D = 13.2\text{ A}$	
			89		m Ω	$V_{GS} = 15\text{ V}, I_D = 13.2\text{ A}$	
Dynamic							
C_{iss}	Input Capacitance	--	1129	--	pF	$V_{GS} = 0\text{ V}, V_{DS} = 600\text{ V}$ $f = 1.0\text{ MHz}, V_{AC} = 25\text{ mV}$	Fig. 17
C_{oss}	Output Capacitance	--	114	--			
C_{rss}	Reverse Transfer Capacitance	--	6.5	--			
E_{oss}	C_{oss} Stored Energy	--	25	--	μJ		Fig. 16
Q_g	Total Gate Charge	--	62	--	nC	$V_{DS} = 400\text{ V}$ $I_D = 13.2\text{ A}$ $V_{GS} = -5/+20\text{ V}$	Fig. 12
Q_{gs}	Gate-Source Charge	--	18	--			
Q_{gd}	Gate-Drain Charge	--	33	--			
$t_{d(on)}$	Turn-on Delay Time	--	21.3	--	ns	$V_{DS} = 400\text{ V}$ $V_{GS} = -5/+20\text{ V}$ $I_D = 13.2\text{ A}$ $R_{G(ext)} = 2.5\ \Omega$	
t_r	Turn-on Rise Time	--	14.5	--			
$t_{d(off)}$	Turn-off Delay Time	--	132.6	--			
t_f	Turn-off Fall Time	--	42.7	--			
$R_{G(int)}$	Internal Gate Resistance	--	2.8	--	Ω	$f = 1.0\text{ MHz}, V_{AC} = 25\text{ mV}$	

Body Diode Characteristics, at $T_J = 25^\circ\text{C}$, unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions	Note
I_S	Continuous Diode Forward Current	--	--	56	A		
V_{SD}	Diode Forward Voltage	--	3.0	--	V	$V_{GS} = 0\text{ V}, I_S = 6.6\text{ A}$	Fig. 8, 9, 10
t_{rr}	Reverse Recovery Time	--	23	--	ns	$I_S = 3.2\text{ A}, V_{DS} = 400\text{ V}$ $V_{GS} = -5\text{ V}$ $\text{dif}/\text{dt} = 2100\text{ A}/\mu\text{s}$	
Q_{rr}	Reverse Recovery Charge	--	132	--	nC		
I_{rrm}	Peak Reverse Recovery Current	--	13	--	A		

Thermal Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit	Note
$R_{\theta JC}$	Thermal Resistance from Junction to Case	--	0.59	--	$^\circ\text{C}/\text{W}$	Fig. 20

Typical Performance

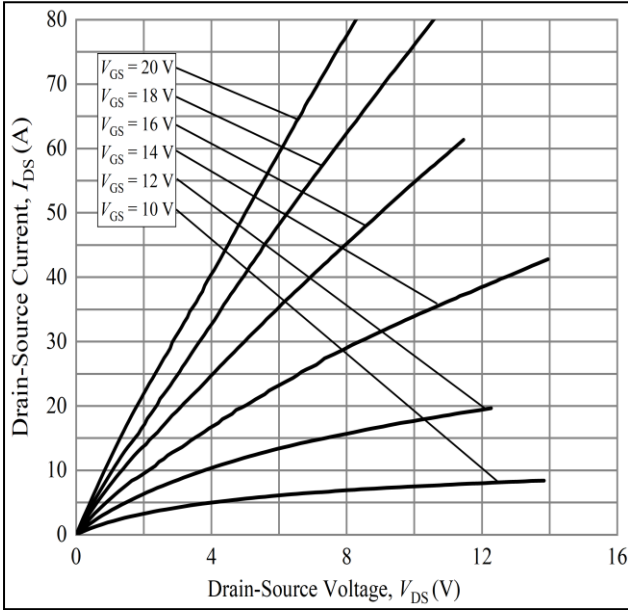


Figure 1: Typical Output Characteristics at $T_j = -55\text{ }^\circ\text{C}$

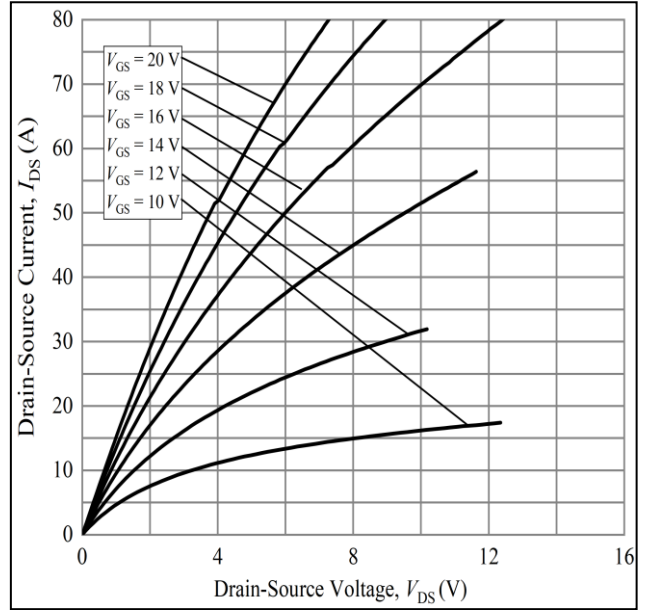


Figure 2: Typical Output Characteristics at $T_j = 25\text{ }^\circ\text{C}$

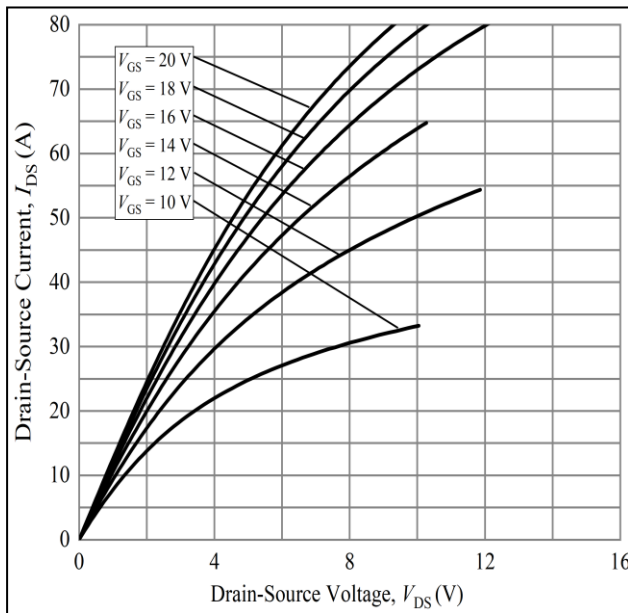


Figure 3: Typical Output Characteristics at $T_j = 175\text{ }^\circ\text{C}$

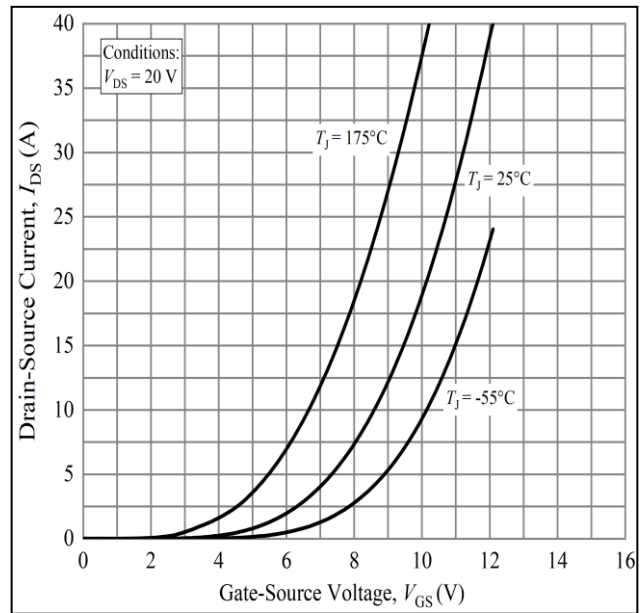


Figure 4: Typical Transfer Characteristics for Various Temperature

Typical Performance

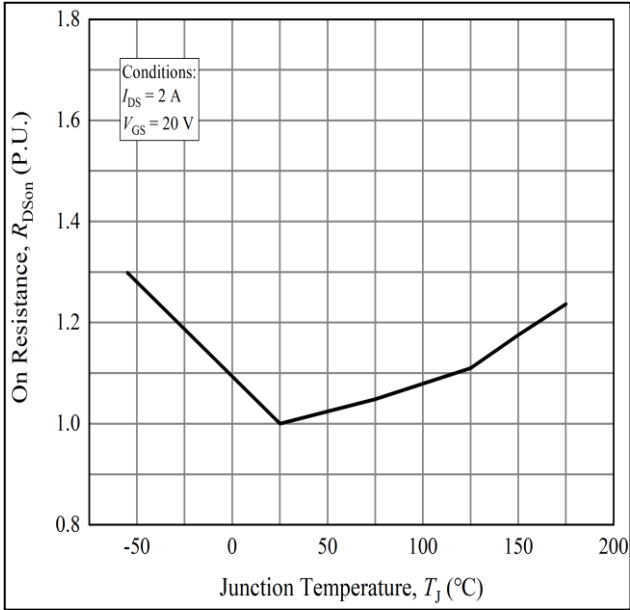


Figure 5: Normalized On-Resistance vs. Temperature

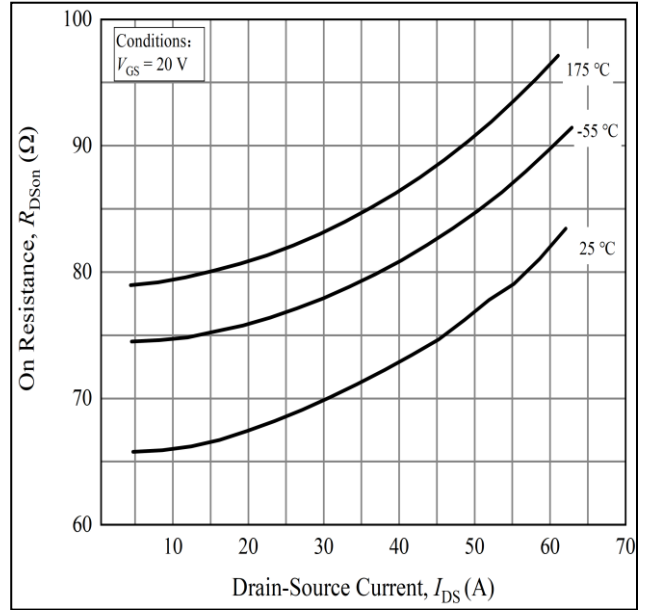


Figure 6: On-Resistance vs. Drain Current for Gate Various Temperatures

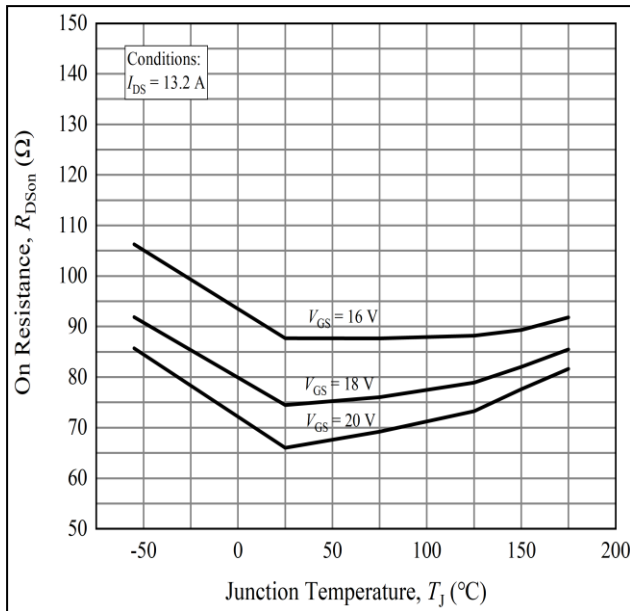


Figure 7: On-Resistance vs. Temperature for Gate Various Voltage

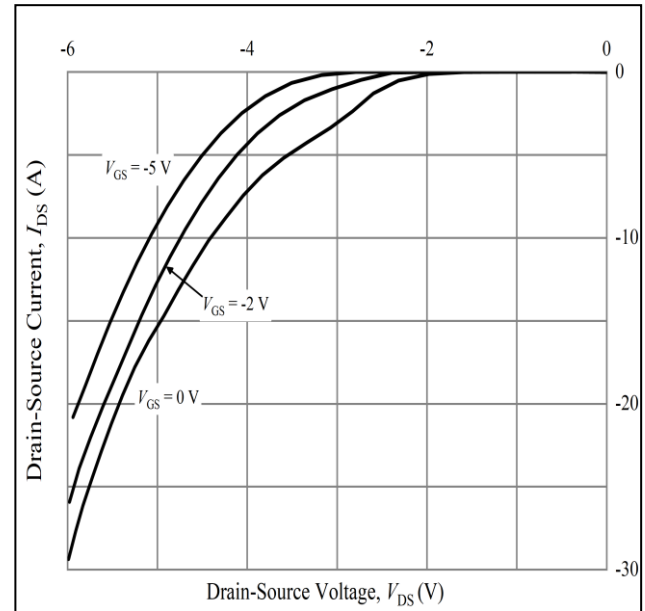


Figure 8: Typical Body Diode Characteristics at $T_J = -55\text{ }^\circ\text{C}$

Typical Performance

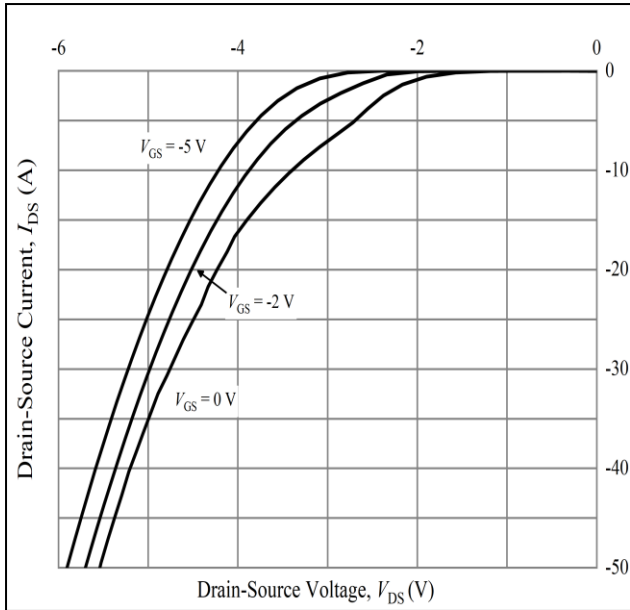


Figure 9: Typical Body Diode Characteristics at $T_j = 25\text{ }^\circ\text{C}$

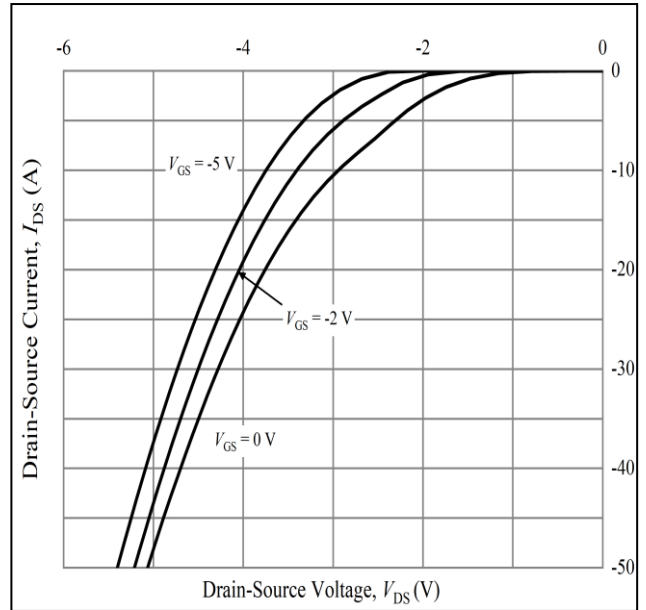


Figure 10: Typical Body Diode Characteristics at $T_j = 175\text{ }^\circ\text{C}$

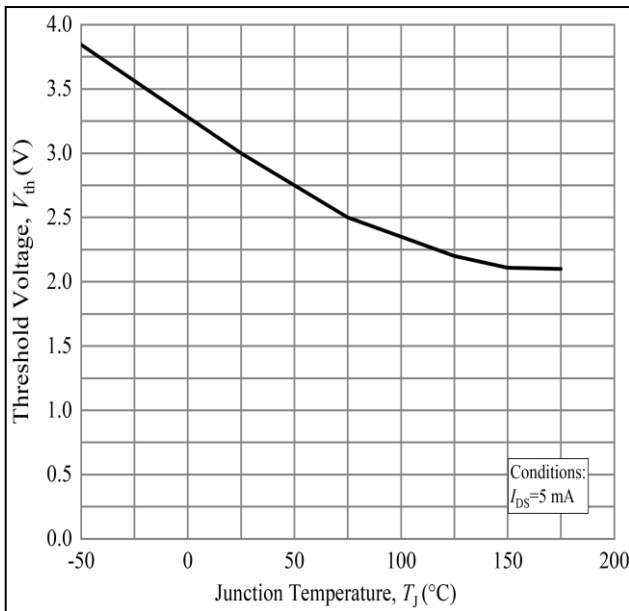


Figure 11: Typical Threshold Voltage vs. Temperature

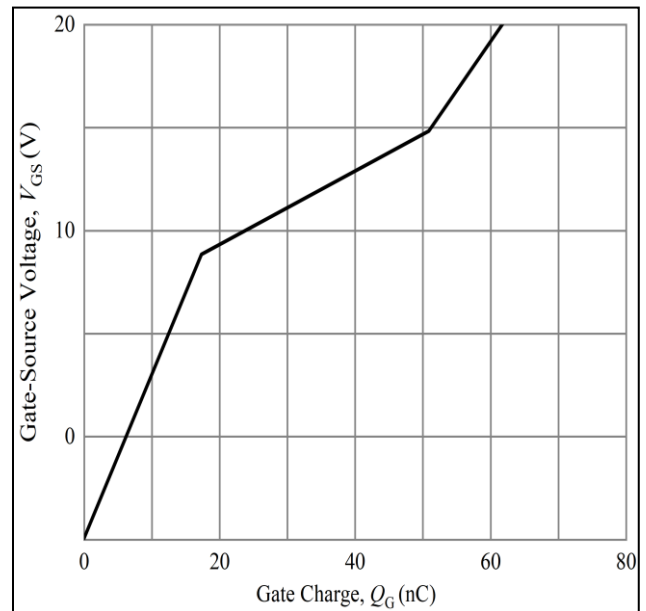


Figure 12: Typical Gate Charge Characteristics at $T_j = 25\text{ }^\circ\text{C}$

Typical Performance

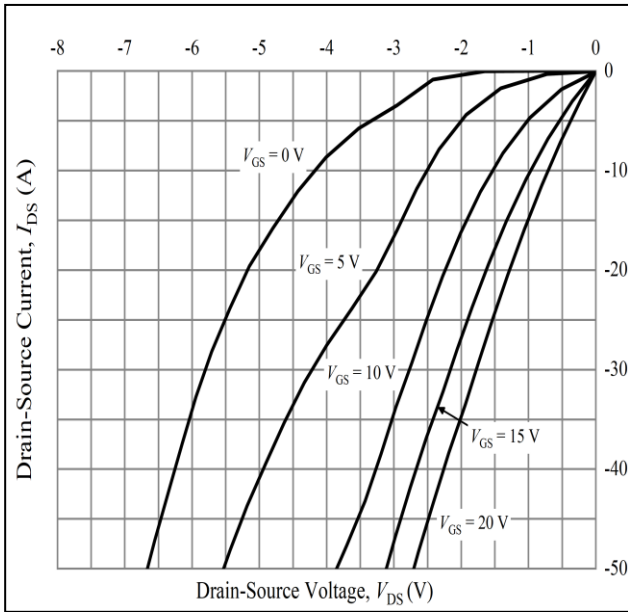


Figure 13: Typical 3rd Quadrant Characteristics
 $T_j = -55\text{ }^\circ\text{C}$

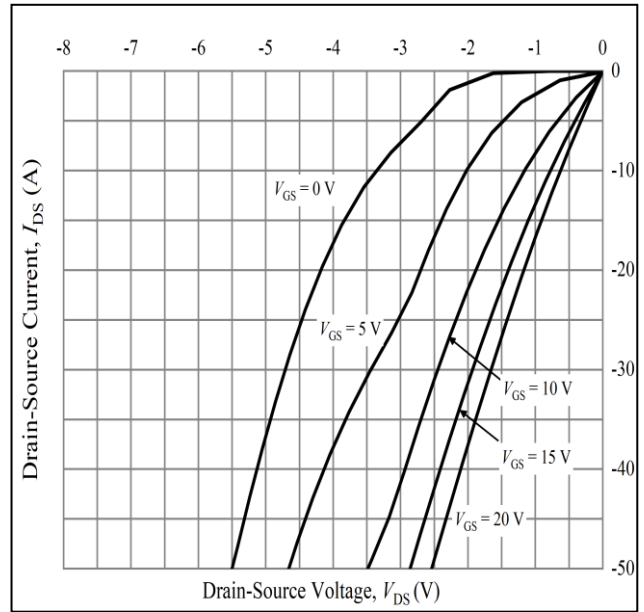


Figure 14: Typical 3rd Quadrant Characteristics at
 $T_j = 25\text{ }^\circ\text{C}$

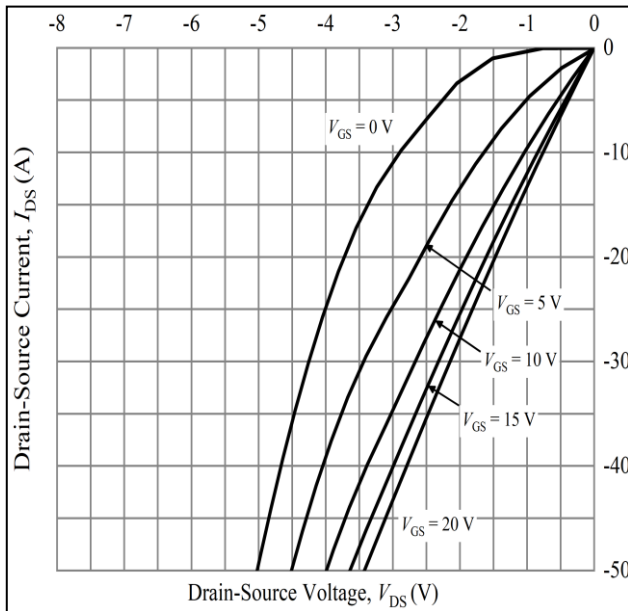


Figure 15: Typical 3rd Quadrant Characteristics
at $T_j = 175\text{ }^\circ\text{C}$

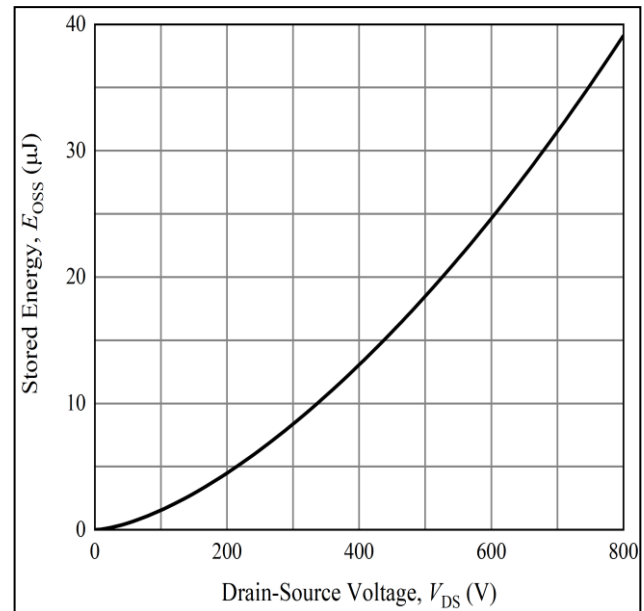


Figure 16: Typical Output Capacitor Stored Energy

Typical Performance

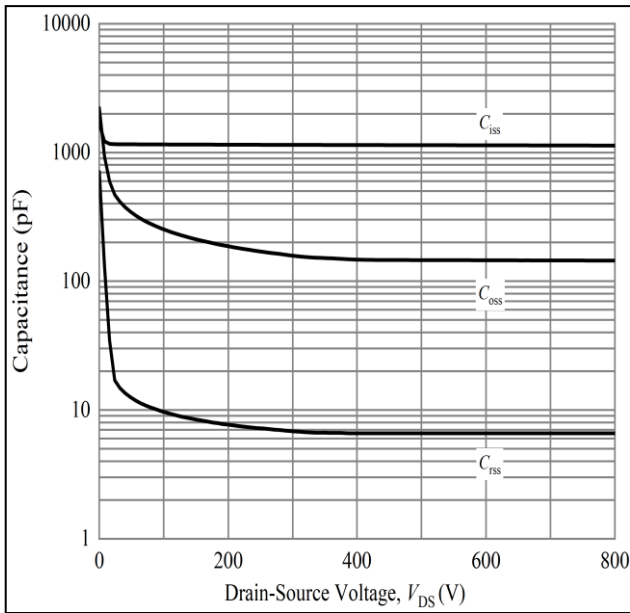


Figure 17: Typical Capacitances vs. Drain-Source Voltage

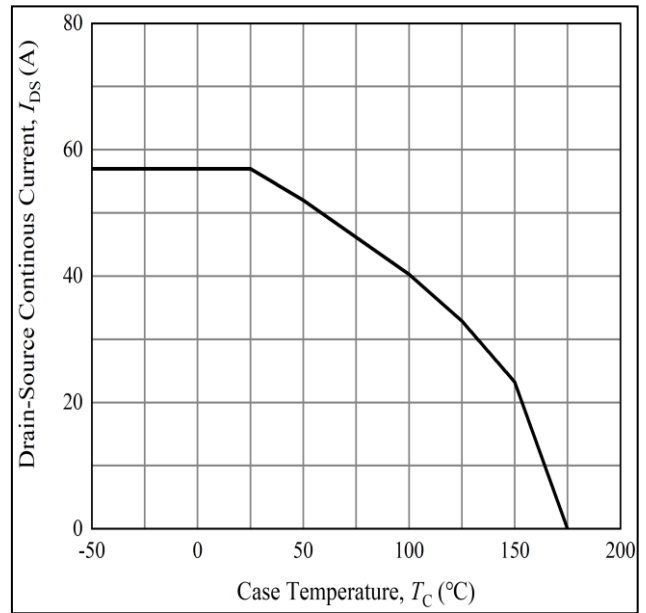


Figure 18: Continuous I_{DS} Current Derating Curve

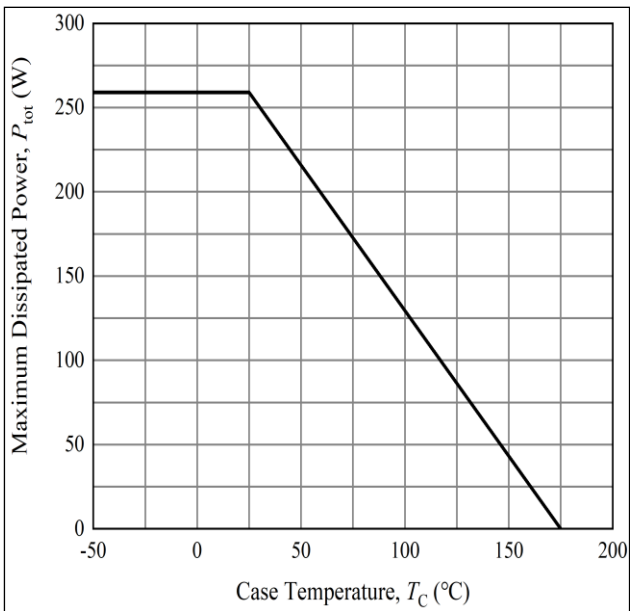


Figure 19: Power Dissipation Derating Curve

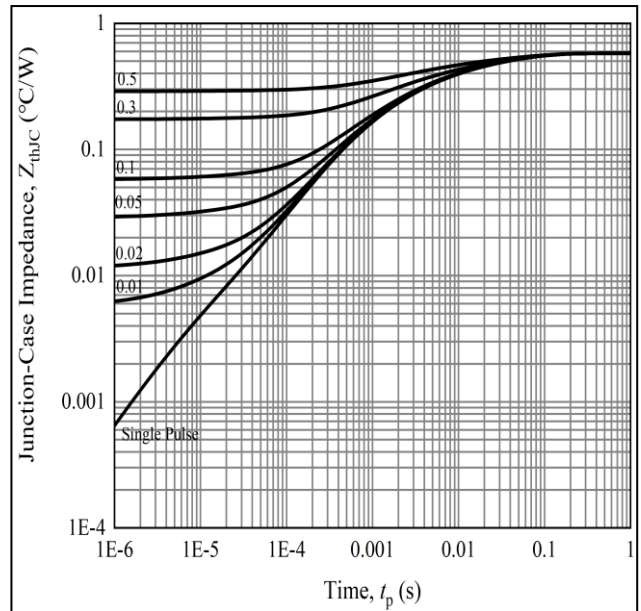


Figure 20: Typical Transient Thermal Impedance (Junction – Case) with Duty Cycle

Typical Performance

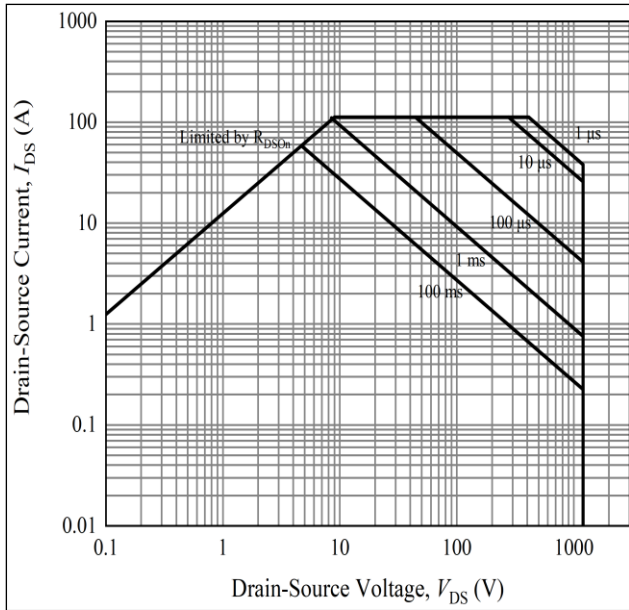


Figure 21: Safe Operate Area

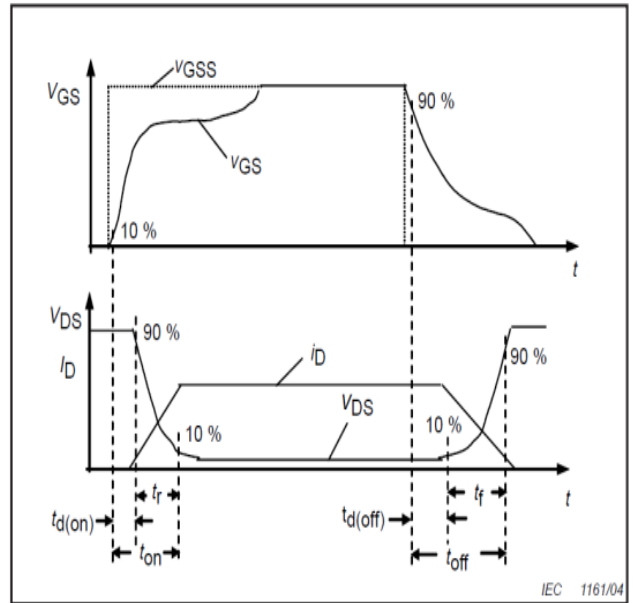


Figure 22: Resistive Switching Time Description

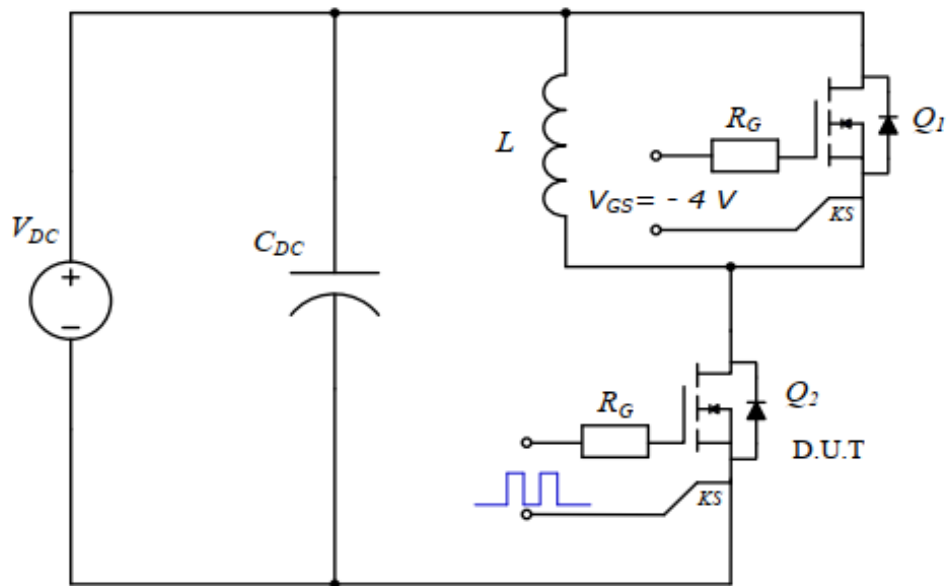
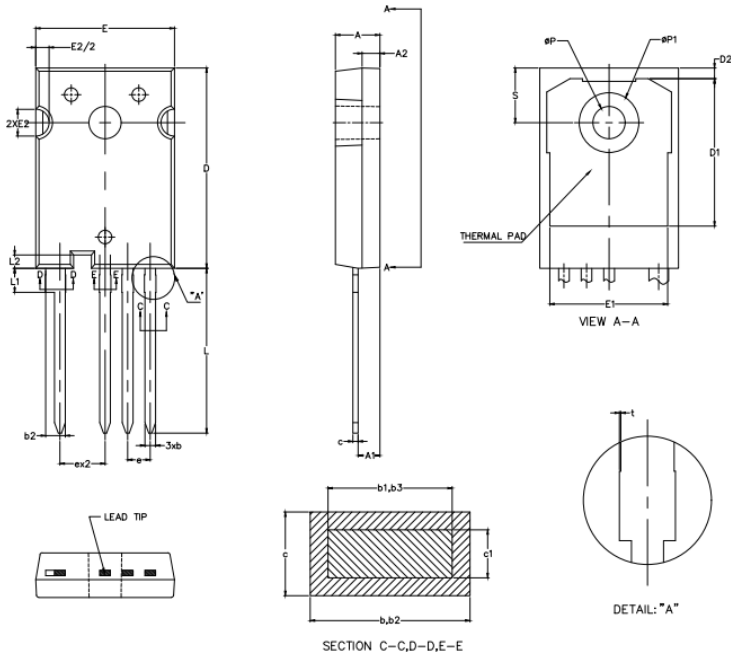


Figure 23: Clamped Inductive Switching Waveform Test Circuit

Package Dimensions

Package: TO-247-4



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	2.16	2.26	0.085	0.089
b3	2.15	2.22	0.085	0.087
c	0.59	0.66	0.023	0.026
c1	0.58	0.62	0.023	0.024
D	22.40	22.60	0.882	0.890
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	2.90	3.10	0.114	0.122
e	2.54BSC		0.1BSC	
L	18.30	18.60	0.720	0.732
L1	—	2.80	—	0.110
L2	—	1.50	—	0.059
ϕP	3.50	3.70	0.138	0.146
$\phi P1$	—	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
Rev.1.0	Released

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