

TM2G0060065JA

650V N-Channel Silicon Carbide Power MOSFET

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

Features

- Low inductance package with driver source pin
- 7mm of creepage distance between drain and source
- High blocking voltage with low on-resistance
- High-speed switching
- Low on-resistance with high junction temperature
- Fast intrinsic diode with low reverse recovery (Q_{tr})
- RoHS compliant

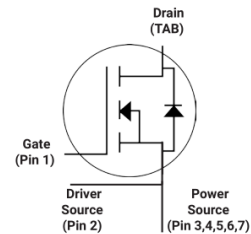
Benefits

- Higher System Efficiency
- Reduce cooling requirements
- Increased power density
- Enabling higher frequency
- Minimize gate ringing
- High manufacturing process efficiency

Applications

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

Package



Part Number	Package	Marking
TM2G0060065JA	TO-263-7	TM2G0060065JA

Maximum Ratings, at $T_J = 25^\circ\text{C}$, 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	$V_{GS} = 20\text{ V}, T_C = 25\ ^\circ\text{C}$	Fig. 18
$I_{D(pulse)}$	Pulsed Drain Current	112	A	Pulse width t_p limited by T_{jmax}	
P_D	Power Dissipation	259	W	$T_C = 25\ ^\circ\text{C}$	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	$^\circ\text{C}$		
T_L	Soldering Temperature	260	$^\circ\text{C}$		

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

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 Current	--	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-State 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		
$I_{S(pulse)}$	Diode pulse Current	--	112	--	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	$I_S = 13.2\text{ A}, V_{DS} = 400\text{ V}$ $V_{GS} = -5\text{ V}$ $di/dt = 2100\text{ A}/\mu\text{s}$	
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	--	0.747	--	$^\circ\text{C}/\text{W}$	Fig. 20

Typical Performance

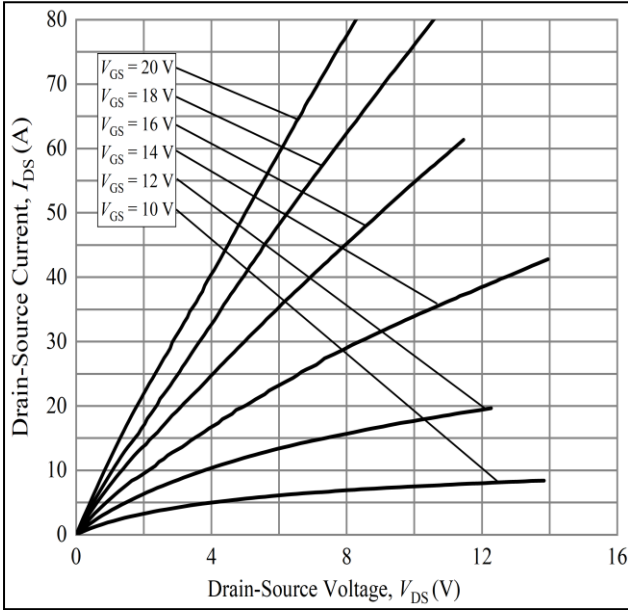


Figure 1: Typical Output Characteristics at $T_j = -55\text{ }^\circ\text{C}$

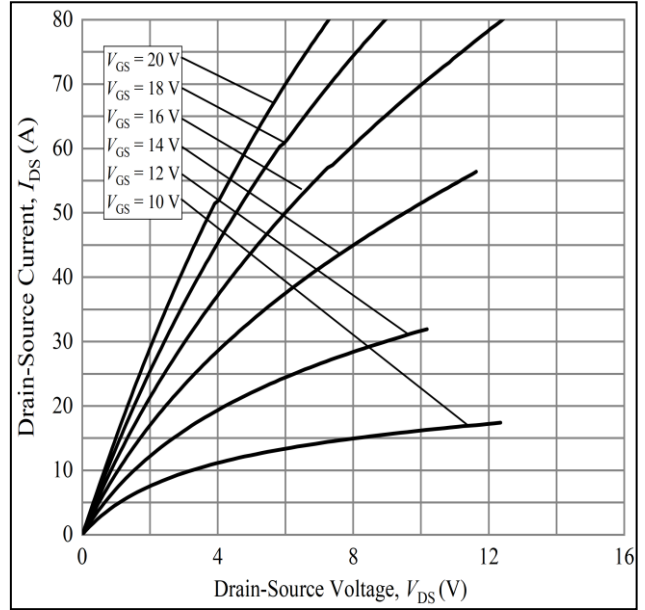


Figure 2: Typical Output Characteristics at $T_j = 25\text{ }^\circ\text{C}$

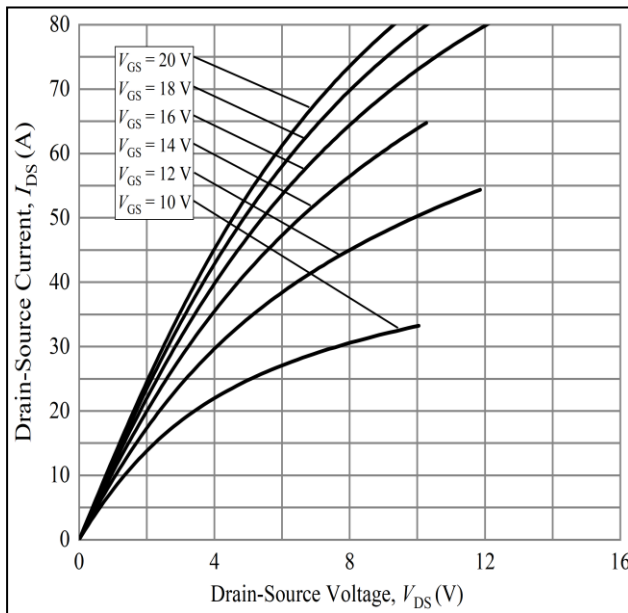


Figure 3: Typical Output Characteristics at $T_j = 175\text{ }^\circ\text{C}$

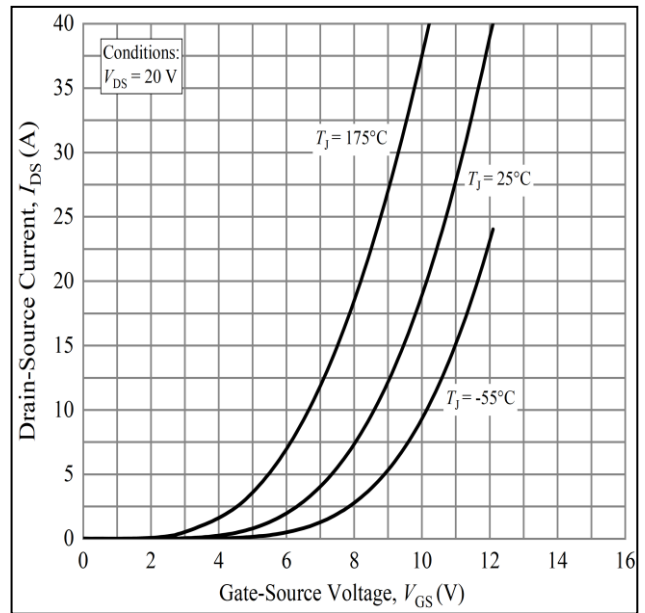


Figure 4: Typical Transfer Characteristics for Various Temperatures

Typical Performance

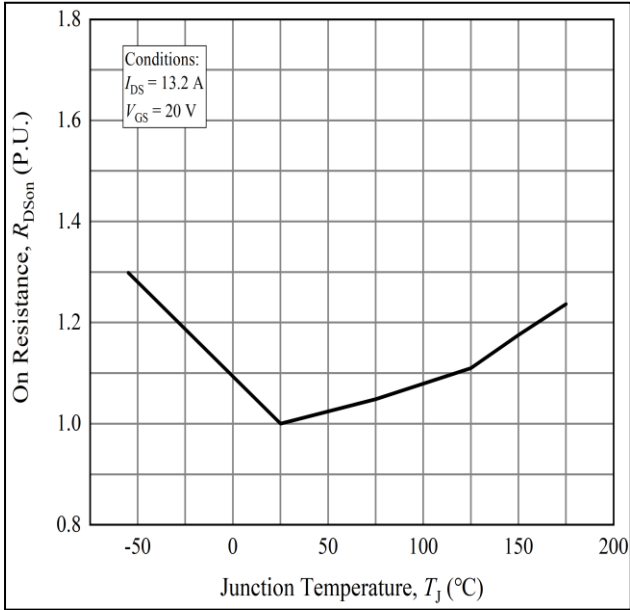


Figure 5: Normalized On-Resistance vs. Temperature

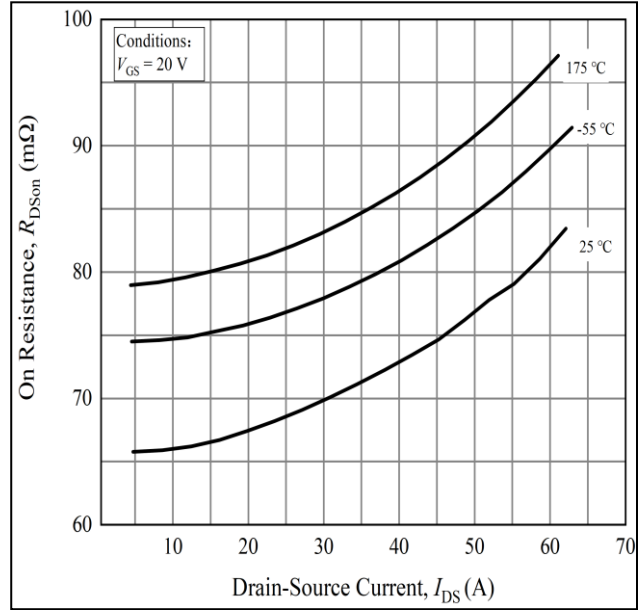


Figure 6: On-Resistance vs. Drain Current for Various Temperatures

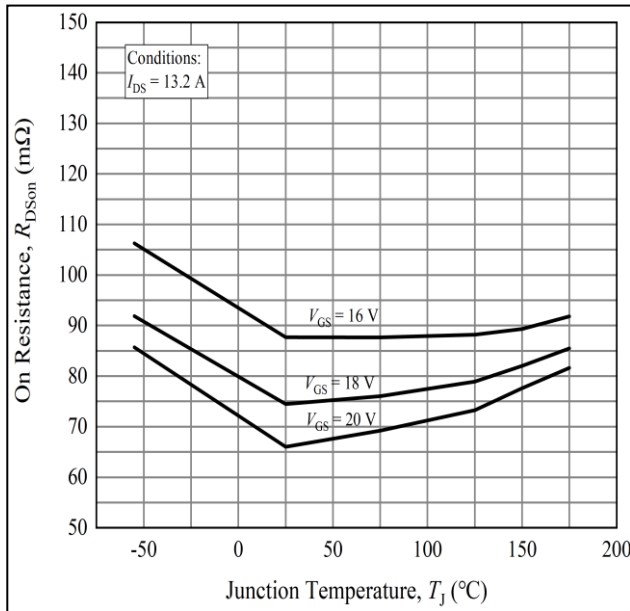


Figure 7: On-Resistance vs. Temperature for Gate Various Voltage

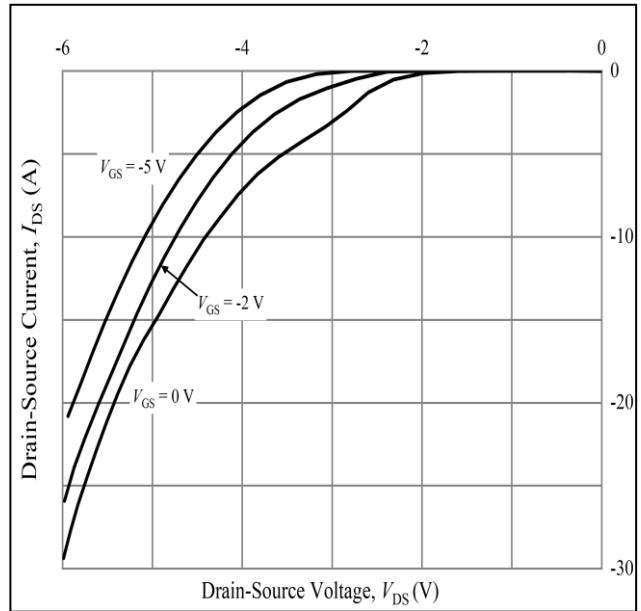


Figure 8: Typical Body Diode Characteristics at $T_J = -55\text{ }^\circ\text{C}$

Typical Performance

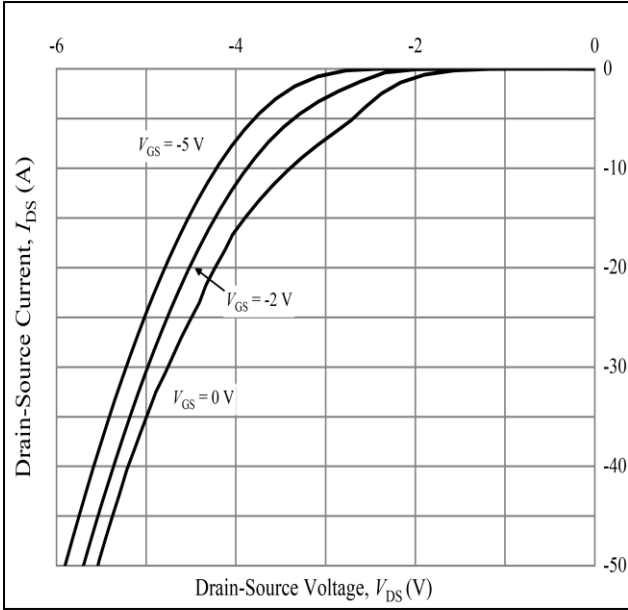


Figure 9: Typical Body Diode Characteristics at $T_j = 25\text{ }^\circ\text{C}$

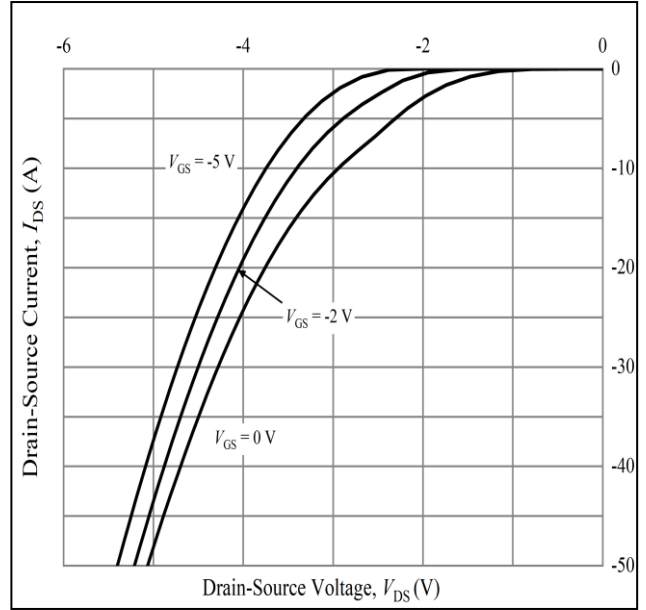


Figure 10: Typical Body Diode Characteristics at $T_j = 175\text{ }^\circ\text{C}$

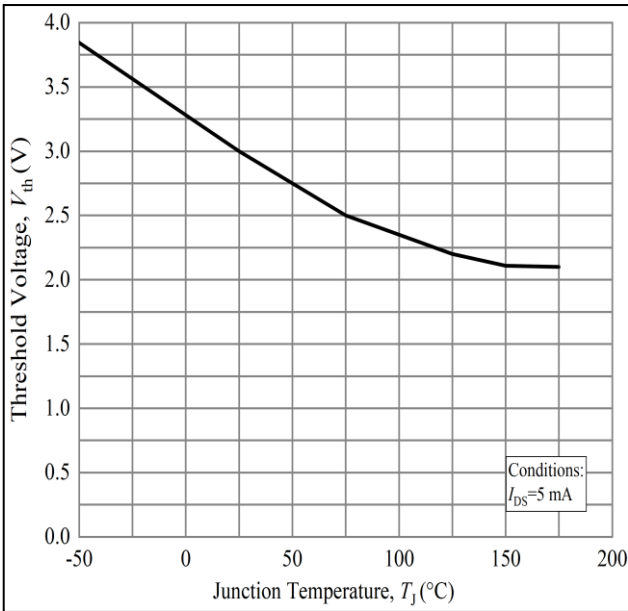


Figure 11: Typical Threshold Voltage vs. Temperature

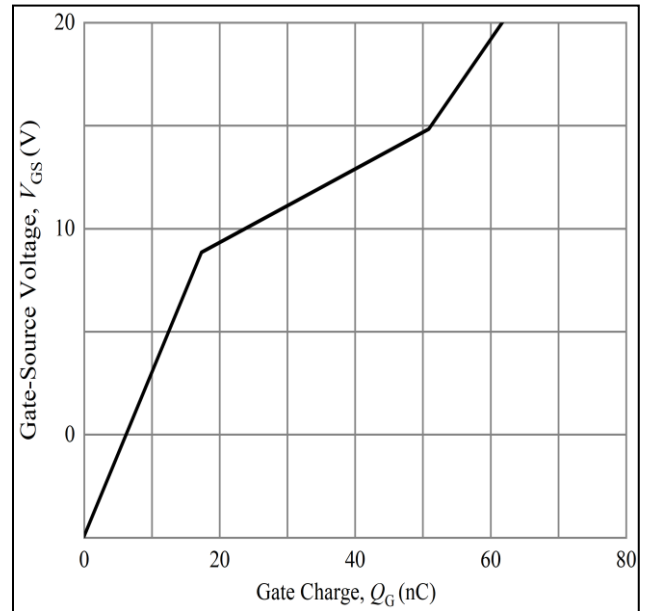


Figure 12: Typical Gate Charge Characteristics at $T_j = 25\text{ }^\circ\text{C}$

Typical Performance

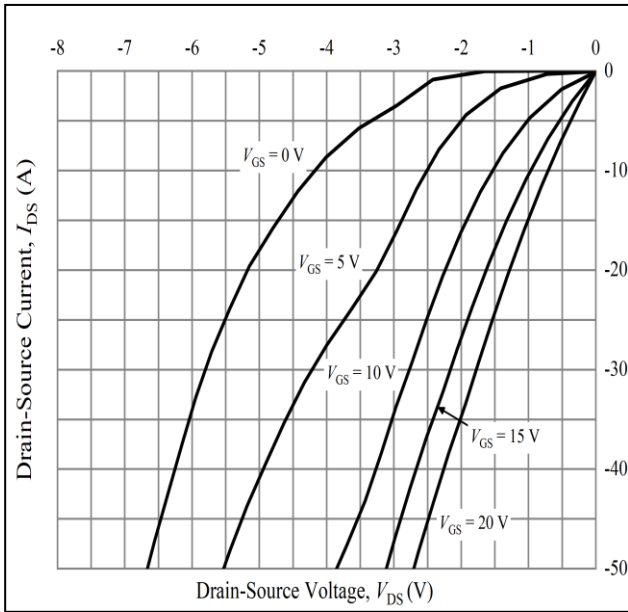


Figure 13: Typical 3rd Quadrant Characteristics
 $T_j = -55\text{ }^\circ\text{C}$

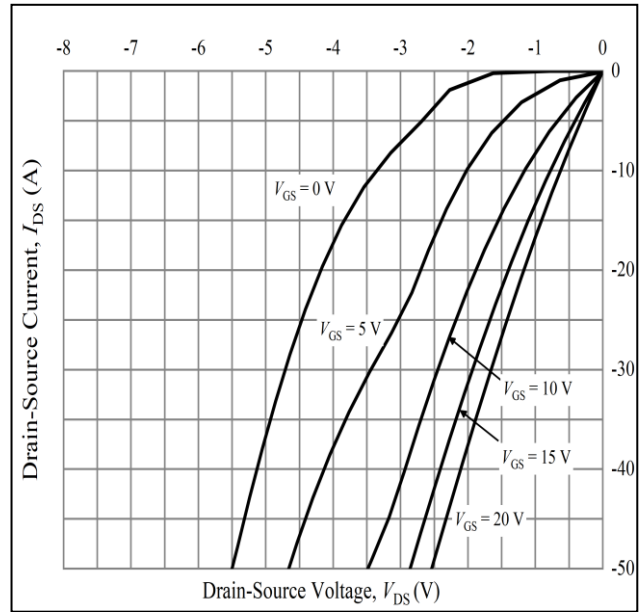


Figure 14: Typical 3rd Quadrant Characteristics at
 $T_j = 25\text{ }^\circ\text{C}$

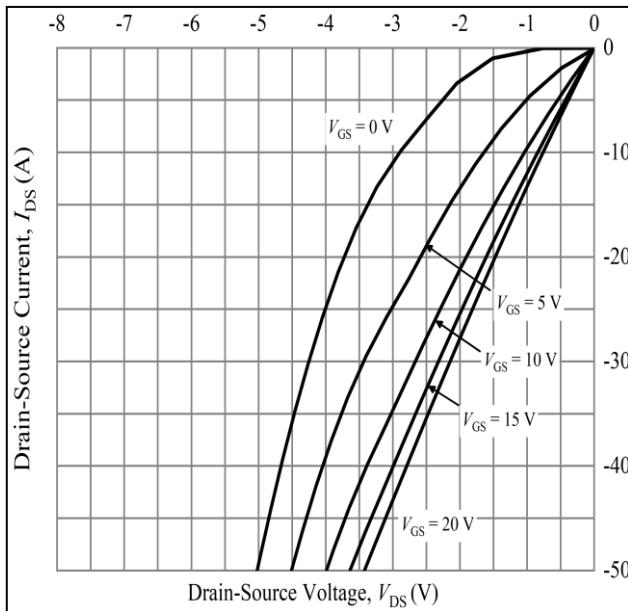


Figure 15: Typical 3rd Quadrant Characteristics
at $T_j = 175\text{ }^\circ\text{C}$

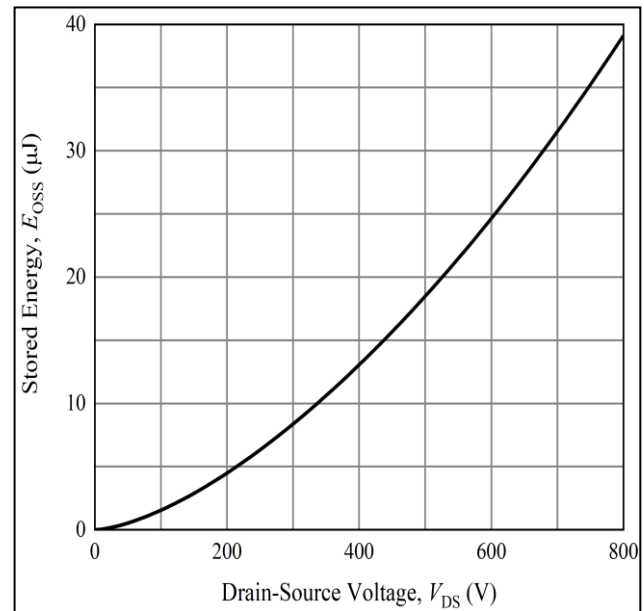


Figure 16: Typical Output Capacitor Stored Energy

Typical Performance

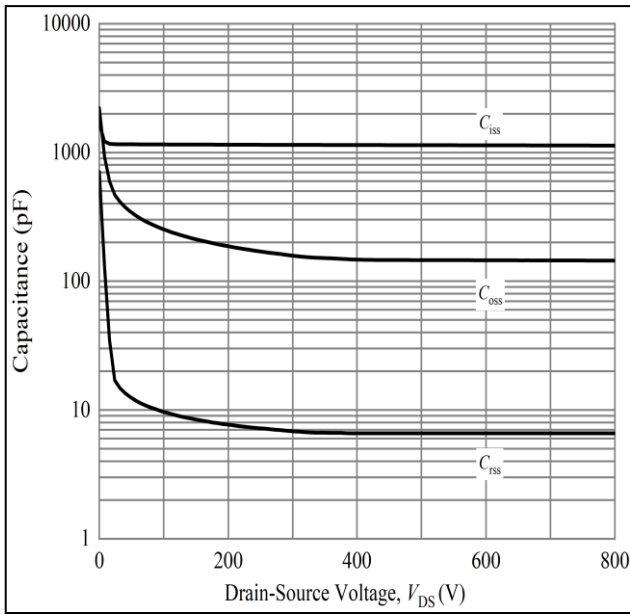


Figure 17: Typical Capacitances vs. Drain-Source

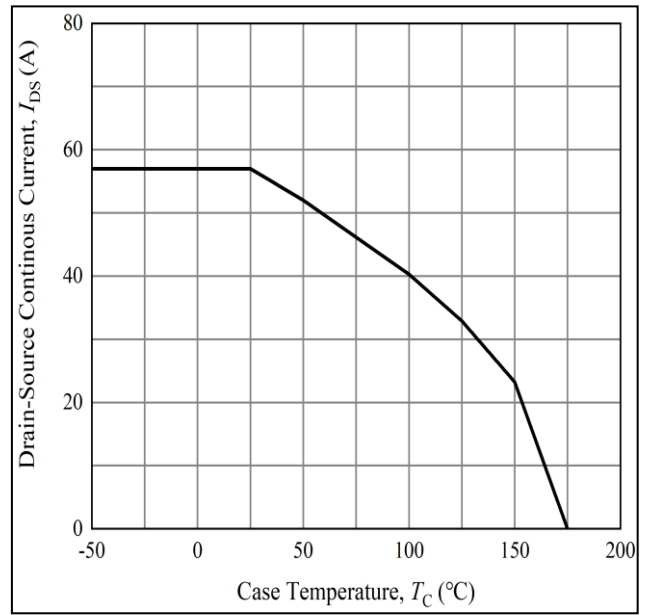


Figure 18: Continuous Drain Current Derating vs. Case Temperature

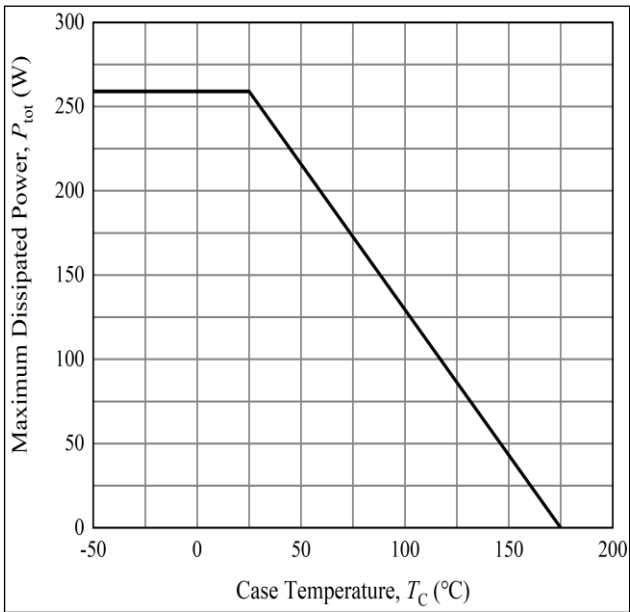


Figure 19: Power Dissipation Derating Curve

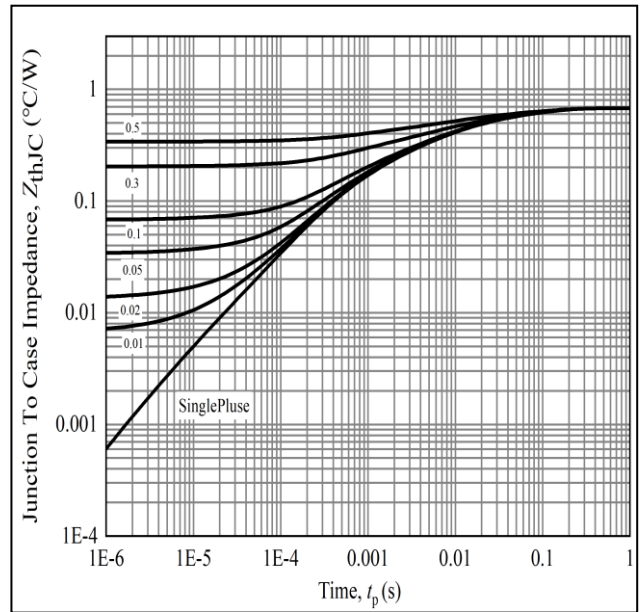


Figure 20: Typical Transient Thermal Impedance (Junction – Case) with Duty Cycle

Typical Performance

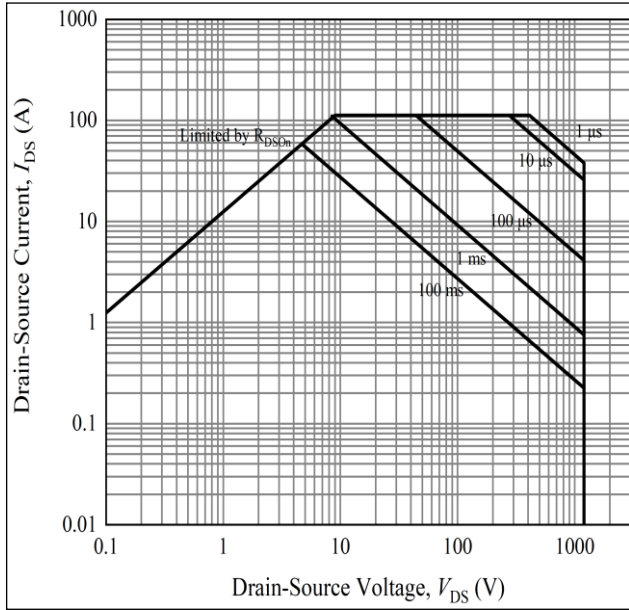


Figure 21: Safe Operating Area

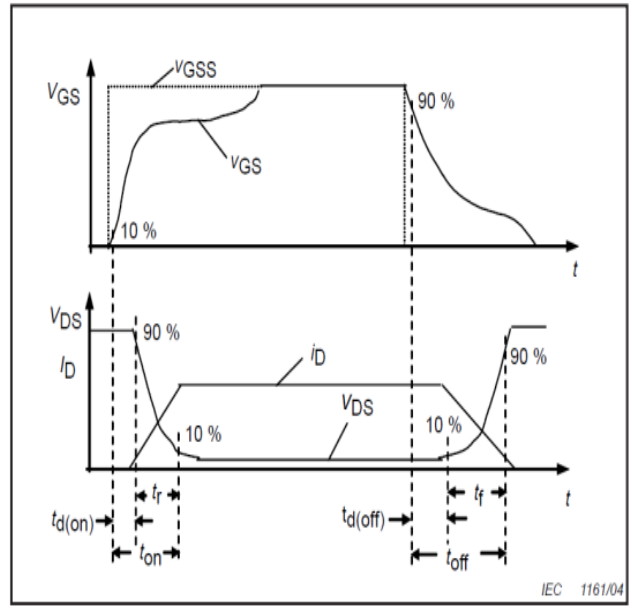


Figure 22: Resistive Switching Time Description

Test Circuit Schematic

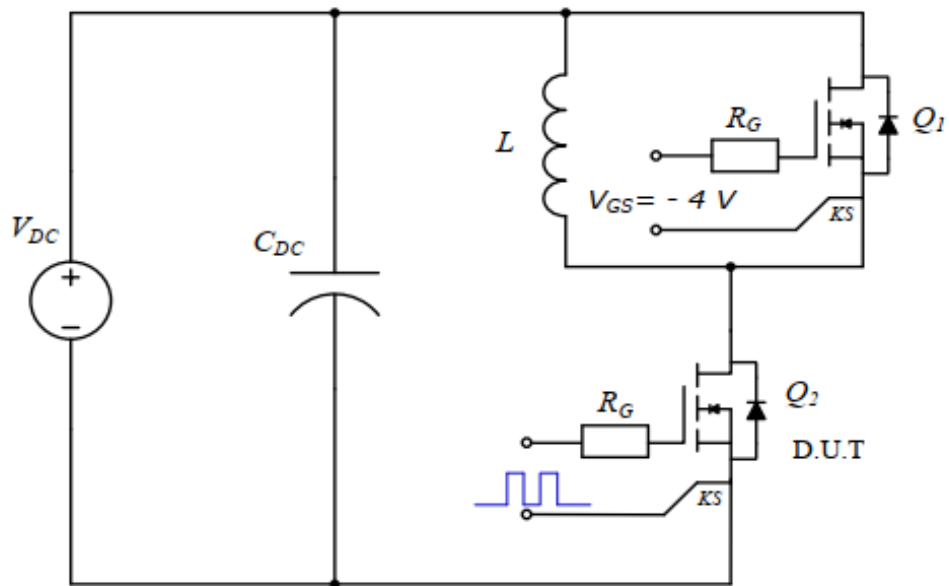
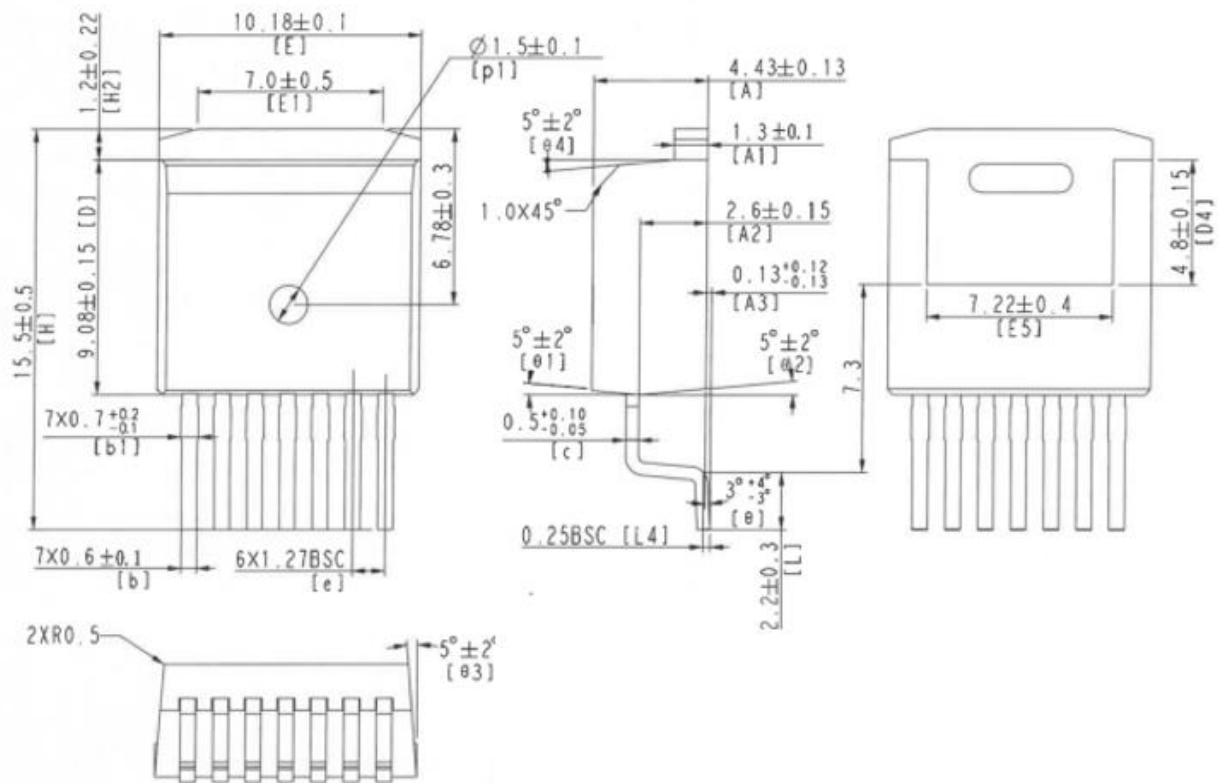


Figure 23: Clamped Inductive Switching Waveform Test Circuit

Package Dimensions

Package: TO-263-7



Revision History

Document Version	Description of Changes
Rev.1.0	Released

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