IV2Q06040D7Z – 650V 40mΩ Gen2 Automotive SiC MOSFET

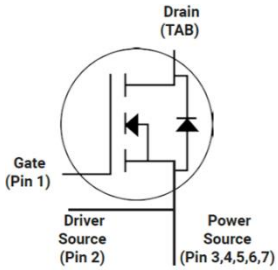
Features

- 2nd Generation SiC MOSFET Technology with +18V gate drive
- High blocking voltage with low on-resistance
- High speed switching with low capacitance
- High operating junction temperature capability
- Very fast and robust intrinsic body diode
- Kelvin gate input easing driver circuit design

Applications

- Motor drivers
- Solar inverters
- Automotive DC/DC converters
- Automotive compressor inverters
- Switch mode power supplies

Outline:



TO263-7

Marking Diagram:

YYWWZ
XXXX
2Q06040D7Z

2Q06040D7Z = Specific Device Code
YY = Year
WW = Work Week
Z = Assembly Location
XXXX = Lot Traceability

Absolute Maximum Ratings (T_C=25°C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DS}	Drain-Source voltage	650	V	V_{GS}=0V, I_D=100μA	
V_{GSmax} (DC)	Maximum DC voltage	-5 to 20	V	Static (DC)	
V_{GSmax} (Spike)	Maximum spike voltage	-10 to 23	V	Duty cycle<1%, and pulse width<200ns	
V_{GSon}	Recommended turn-on voltage	18±0.5	V		
V_{GSoff}	Recommended turn-off voltage	-3.5 to -2	V		
I_D	Drain current (continuous)	60	A	V_{GS}=18V, T_C=25°C	Fig. 23
		43	A	V_{GS}=18V, T_C=100°C	
I_{DM}	Drain current (pulsed)	150	A	Pulse width limited by SOA	Fig. 26
P_{TOT}	Total power dissipation	249	W	T_C=25°C	Fig. 24
T_{stg}	Storage temperature range	-55 to 175	°C		
T_J	Operating junction temperature	-55 to 175	°C		
T_L	Solder Temperature	260	°C	wave soldering only allowed at leads, 1.6mm from case for 10 s	

Thermal Data

Symbol	Parameter	Value	Unit	Note
$R_{\theta(J-C)}$	Thermal Resistance from Junction to Case	0.6	°C/W	Fig. 23

Electrical Characteristics (T_C=25°C unless otherwise specified)

Symbol	Parameter	Value			Unit	Test Conditions	Note
		Min.	Typ.	Max.			
I_{DSS}	Zero gate voltage drain current		3	100	μA	V_{DS}=650V, V_{GS}=0V	
I_{GSS}	Gate leakage current			±100	nA	V_{DS}=0V, V_{GS}=-5~20V	
V_{TH}	Gate threshold voltage	1.8	2.8	4.5	V	V_{GS}=V_{DS}, I_D=7.5mA	Fig. 8, 9
			2.1			V_{GS}=V_{DS}, I_D=7.5mA @ T_J=175°C	
R_{ON}	Static drain-source on-resistance		40	53	mΩ	V_{GS}=18V, I_D=20A @T_J=25°C	Fig. 4, 5, 6, 7
			60		mΩ	V_{GS}=18V, I_D=20A @T_J=175°C	
C_{iss}	Input capacitance		2000		pF	V_{DS}=600V, V_{GS}=0V, f=1MHz, V_{AC}=25mV	Fig. 16
C_{oss}	Output capacitance		158		pF		
C_{rss}	Reverse transfer capacitance		11.4		pF		
E_{oss}	C_{oss} stored energy		31		μJ		Fig. 17
Q_g	Total gate charge		94.7		nC	V_{DS}=400V, I_D=20A, V_{GS}=-3 to 18V	Fig. 18
Q_{gs}	Gate-source charge		24.5		nC		
Q_{gd}	Gate-drain charge		47.3		nC		
R_g	Gate input resistance		2.9		Ω	f=1MHz	
E_{ON}	Turn-on switching energy		171.4		μJ	V_{DS}=400V, I_D=30A, V_{GS}=-3.5 to 18V, $R_{G(ext)}$=3.3Ω, L=200μH T_J=25°C	Fig. 19, 20
E_{OFF}	Turn-off switching energy		32.0		μJ		
$t_{d(on)}$	Turn-on delay time		7.6		ns		
t_r	Rise time		15.6				
$t_{d(off)}$	Turn-off delay time		18.5				
t_f	Fall time		8.8				
E_{ON}	Turn-on switching energy		219.1			V_{DS}=400V, I_D=30A, V_{GS}=-3.5 to 18V, $R_{G(ext)}$=3.3Ω,L=200μH T_J=175°C	Fig. 22
E_{OFF}	Turn-off switching energy		34.2				

Reverse Diode Characteristics (T_C=25°C unless otherwise specified)

Symbol	Parameter	Value			Unit	Test Conditions	Note
		Min.	Typ.	Max.			
V_{SD}	Diode forward voltage		4.1		V	I_{SD}=20A, V_{GS}=0V	Fig. 10, 11, 12
			3.8		V	I_{SD}=20A, V_{GS}=0V, T_J=175°C	
t_{rr}	Reverse recovery time		35.3		ns	V_{GS}=-3.5V/+18V, I_{SD}=30A, V_R=800V, $R_{G(ext)}$=10Ω L=200μH di/dt=3000A/μs	
Q_{rr}	Reverse recovery charge		144.5		nC		
I_{RRM}	Peak reverse recovery current		17.3		A		

Typical Performance (curves)

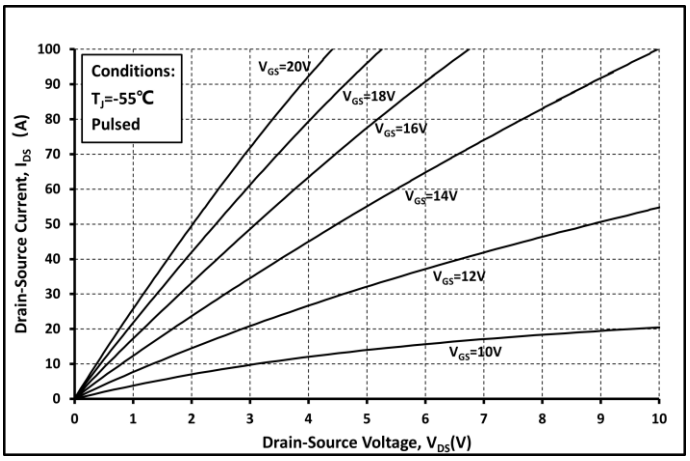


Fig. 1 Output Curve @ T_J=-55℃

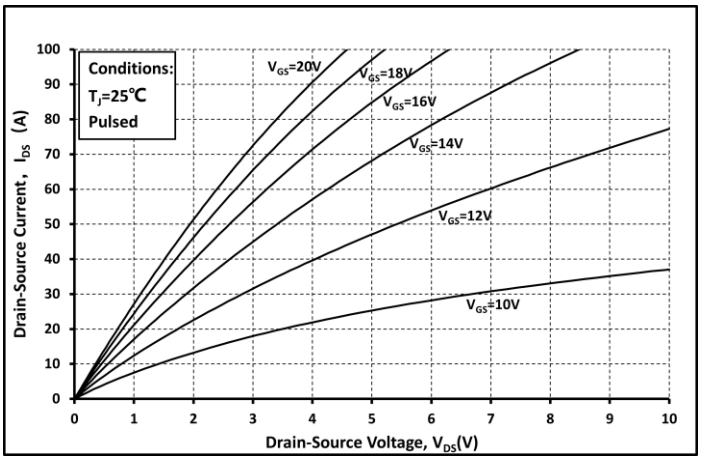


Fig. 2 Output Curve @ T_J=25℃

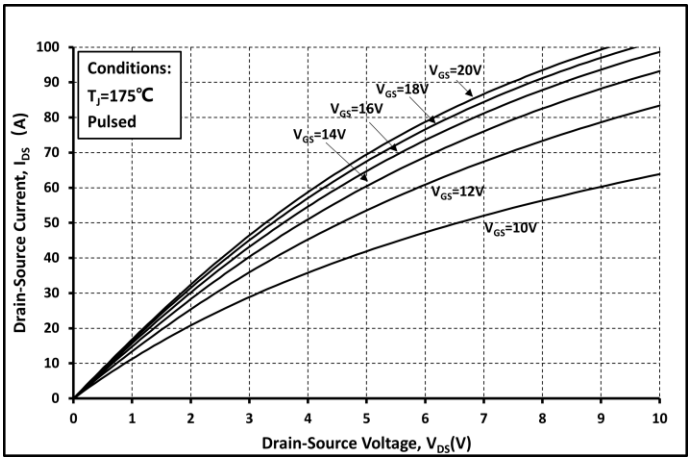


Fig. 3 Output Curve @ T_J=175℃

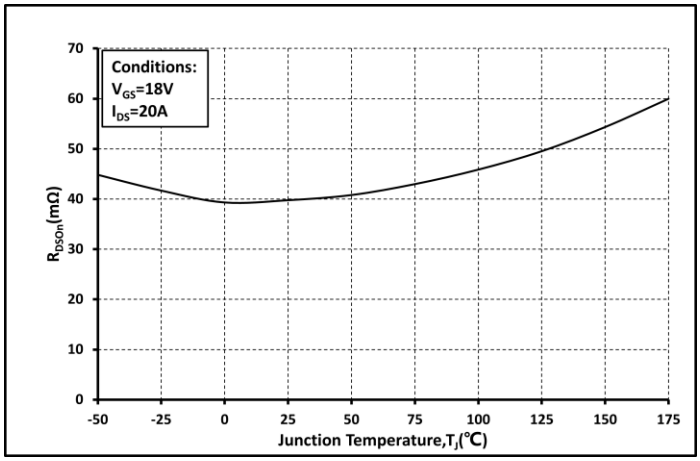


Fig. 4 Ron vs. Temperature

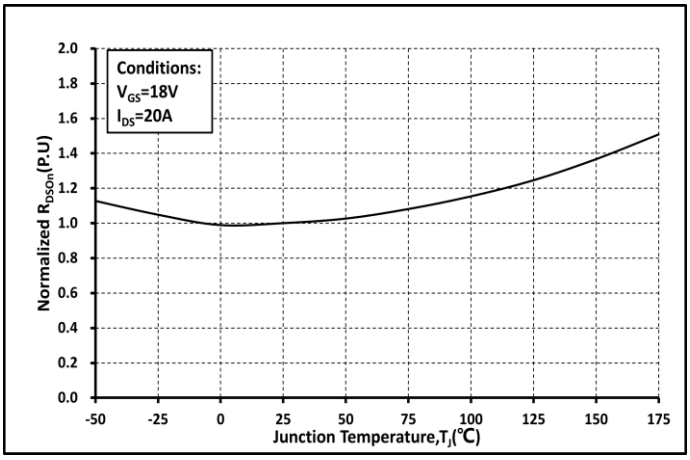


Fig. 5 Normalized Ron vs. Temperature

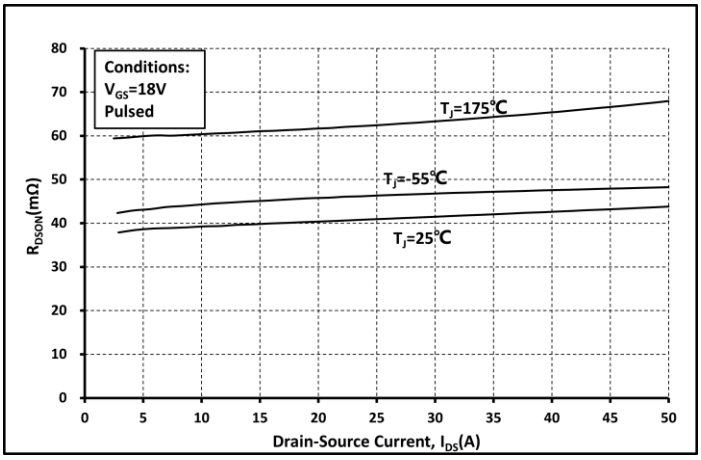


Fig. 6 Ron vs. I_{DS} @ Various Temperature

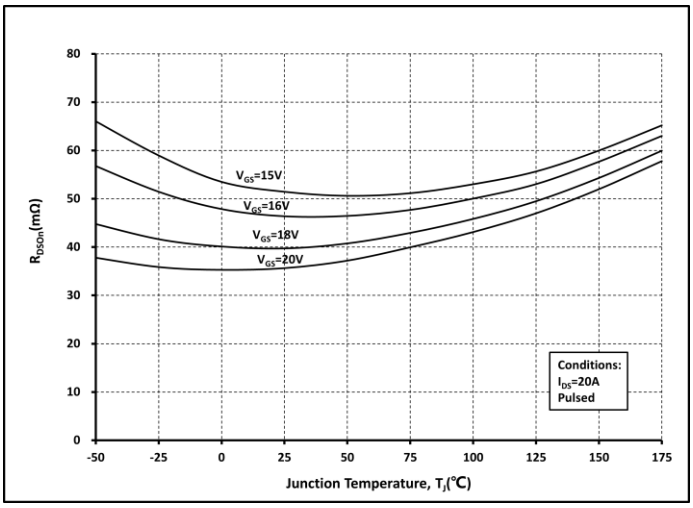


Fig. 7 Ron vs. Temperature @ Various V_{GS}

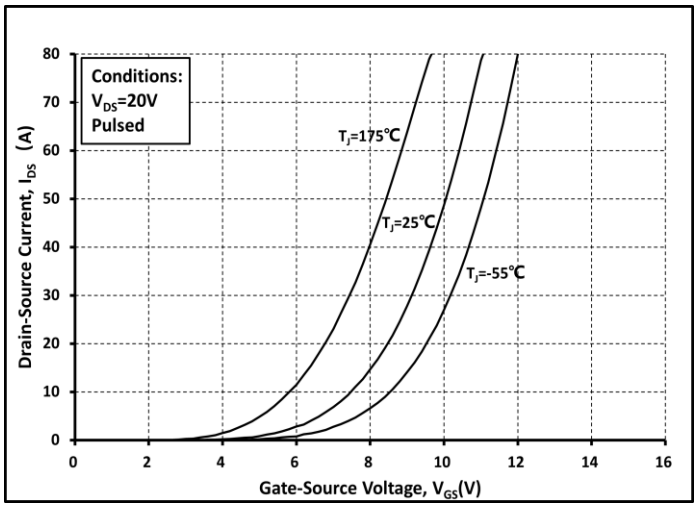


Fig. 8 Transfer Curves @ Various Temperature

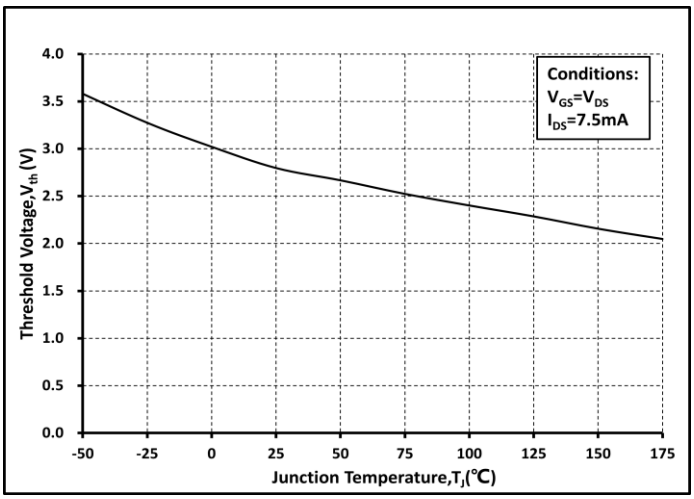


Fig. 9 Threshold Voltage vs. Temperature

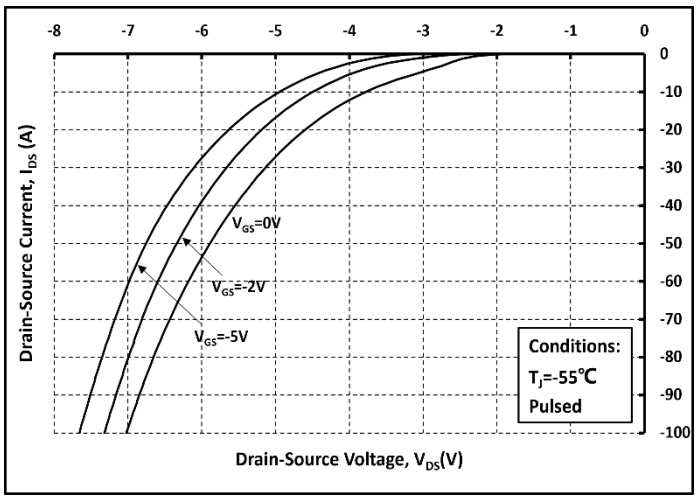


Fig. 10 Body Diode curves @ T_J=-55℃

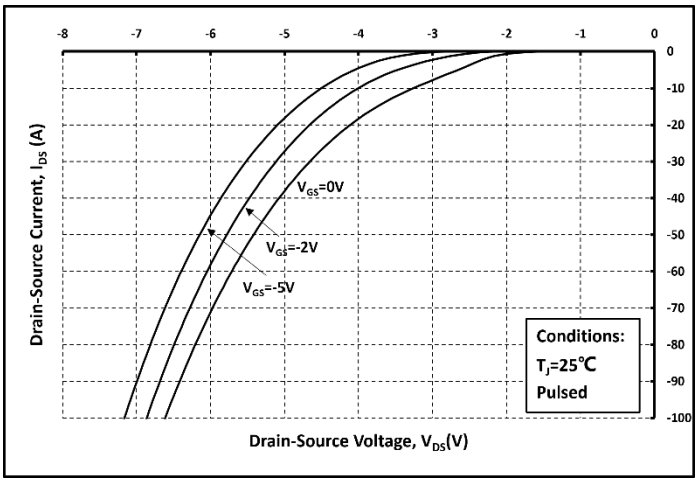


Fig. 11 Body Diode curves @ T_J=25℃

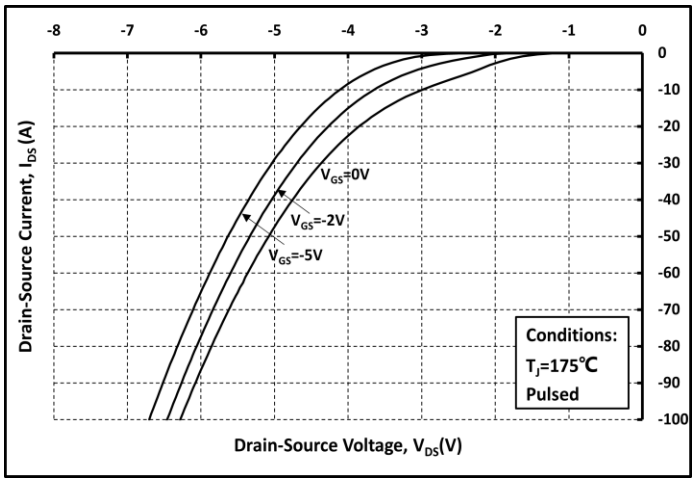


Fig. 12 Body Diode curves @ T_J=175℃

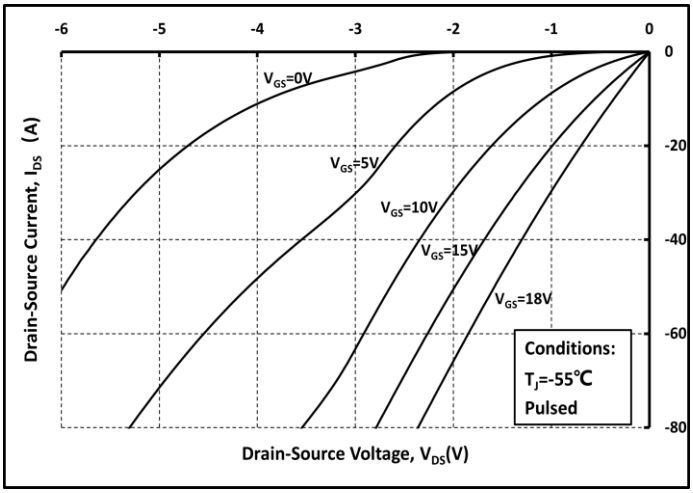


Fig. 13 3rd Quadrant curves @ T_J=-55°C

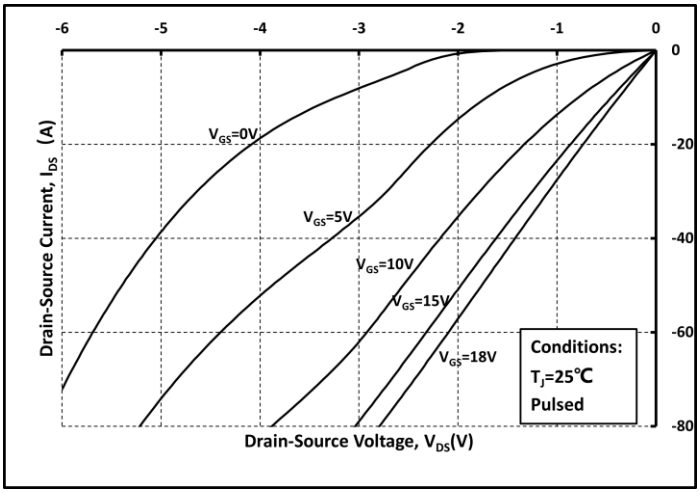


Fig. 14 3rd Quadrant curves @ T_J=25°C

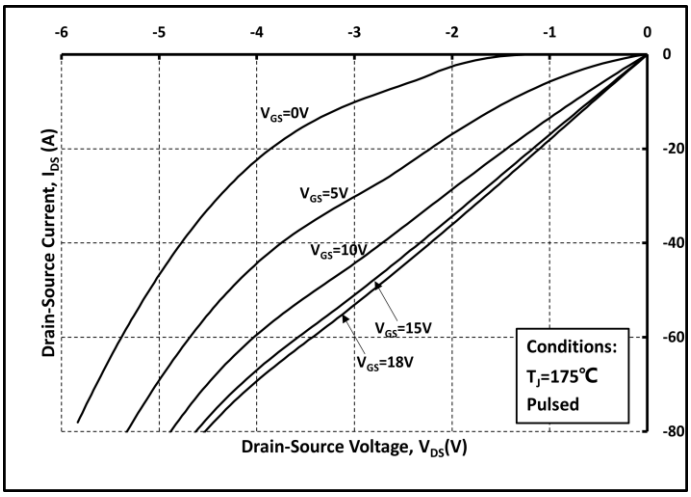


Fig. 15 3rd Quadrant curves @ T_J=175°C

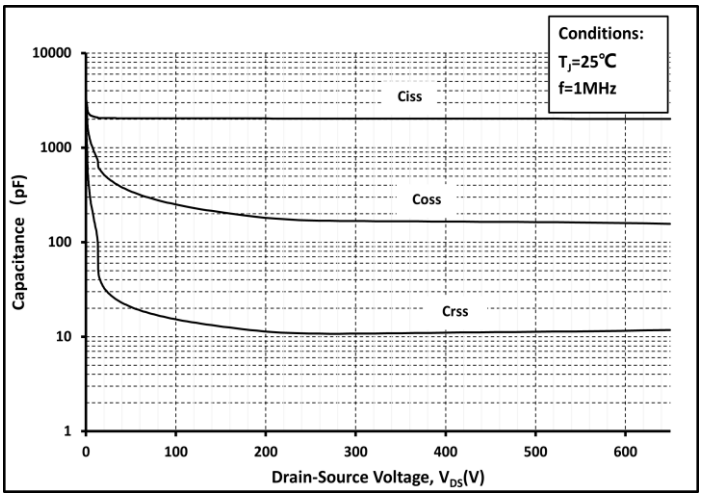


Fig. 16 Capacitance vs. V_{DS}

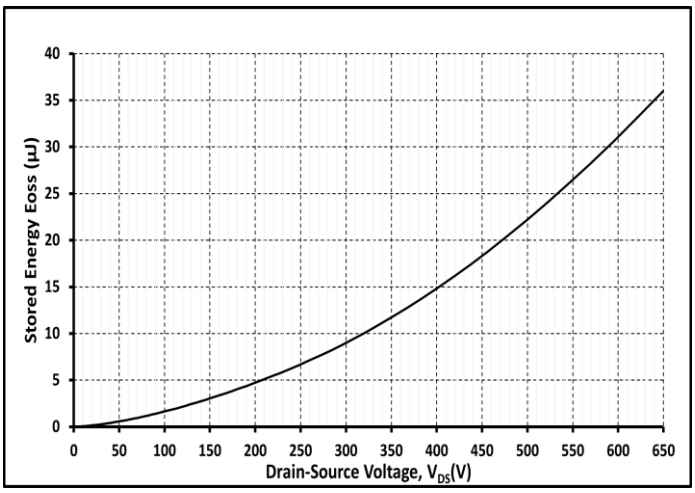


Fig. 17 Output Capacitor Stored Energy

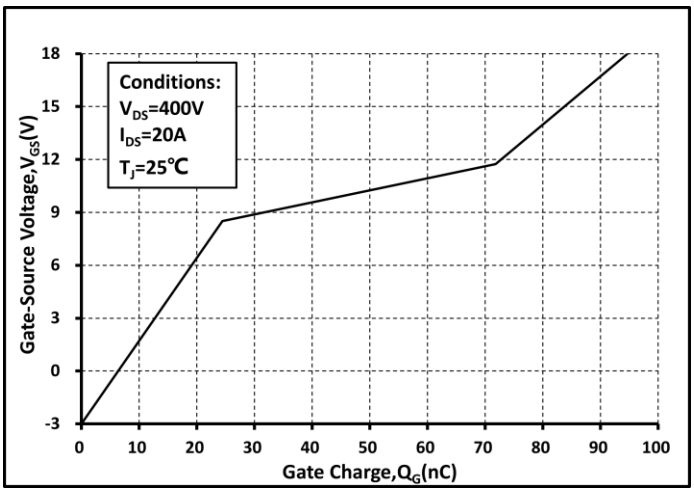


Fig. 18 Gate Charge Characteristics

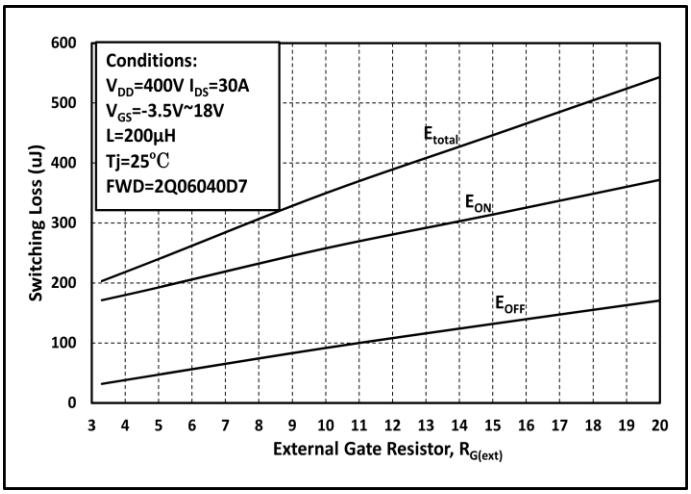


Fig. 19 Switching Energy vs. $R_{G(ext)}$

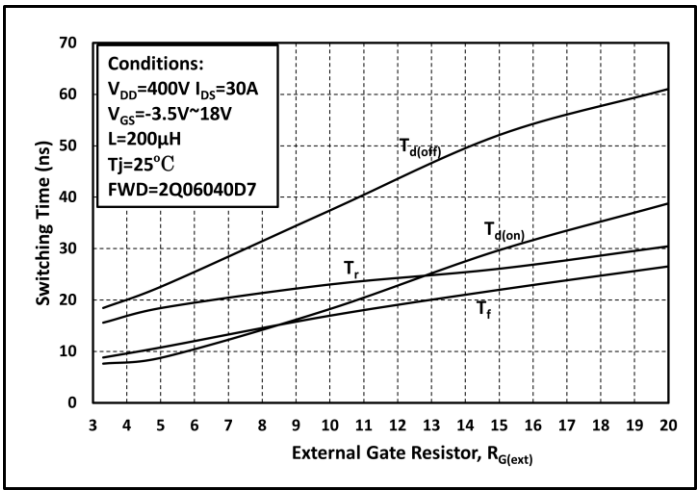


Fig. 20 Switching Times vs. $R_{G(ext)}$

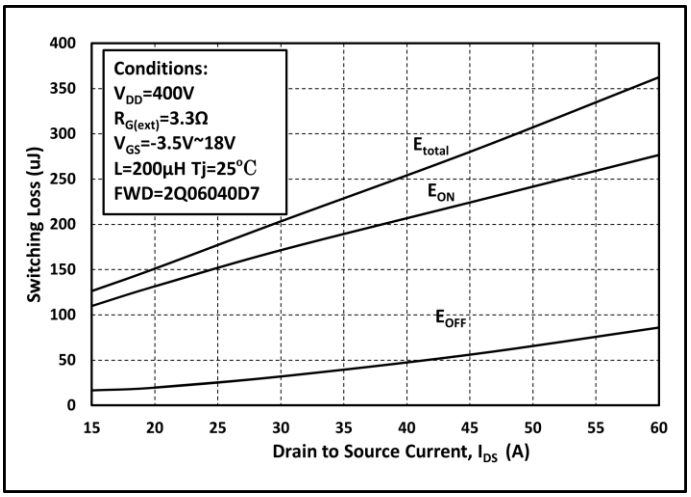


Fig. 21 Switching Energy vs. I_{DS}

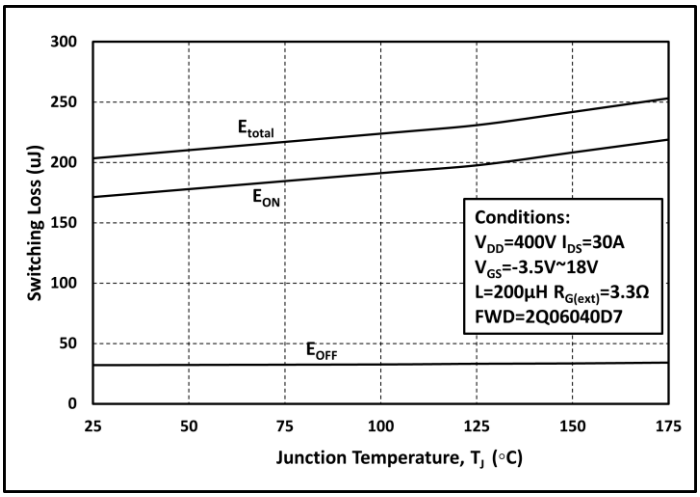


Fig. 22 Switching Energy vs. Temperature

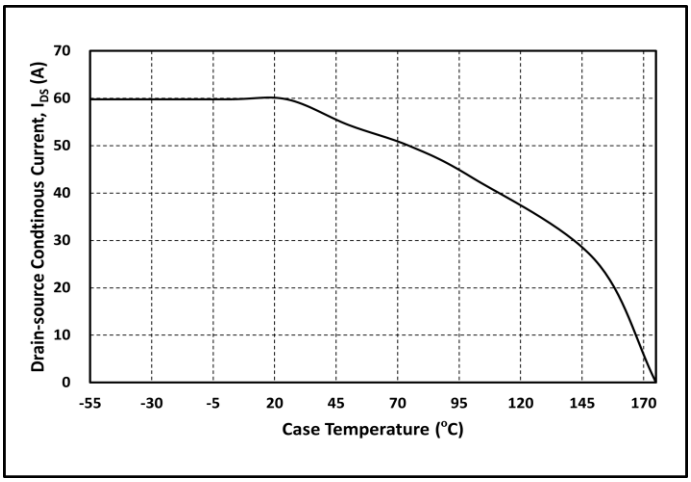


Fig. 23 Continuous Drain Current vs. Case Temperature

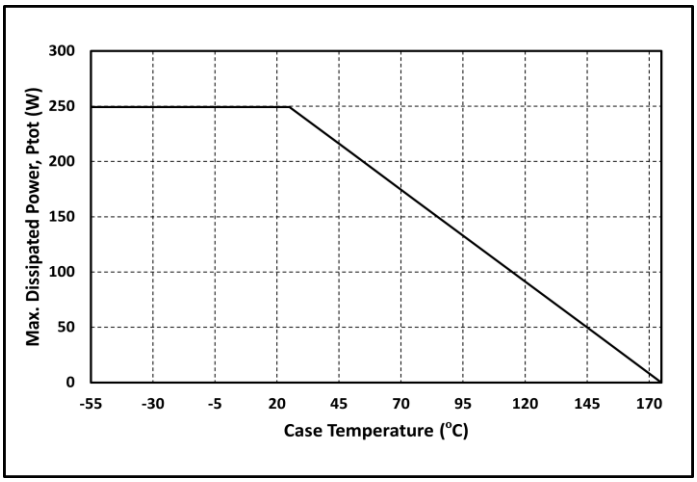


Fig. 24 Max. Power Dissipation Derating vs. Case Temperature

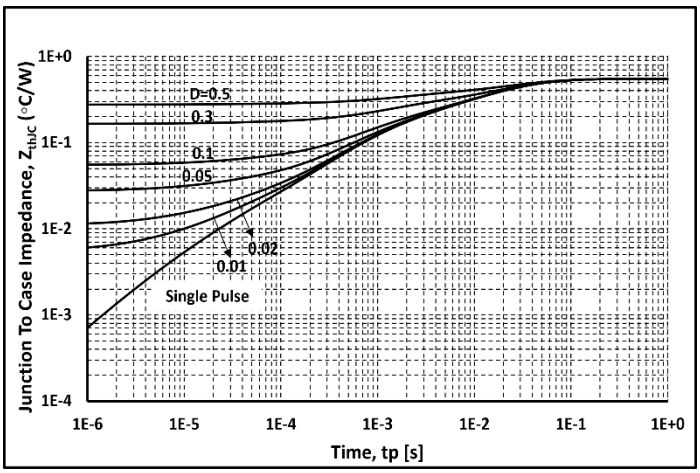


Fig. 25 Thermal impedance

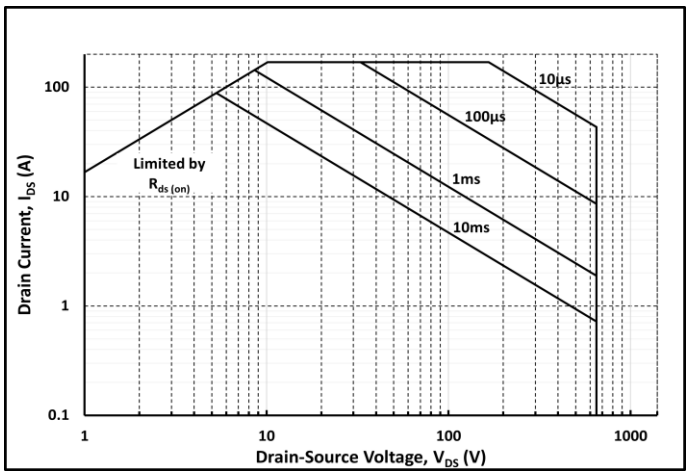
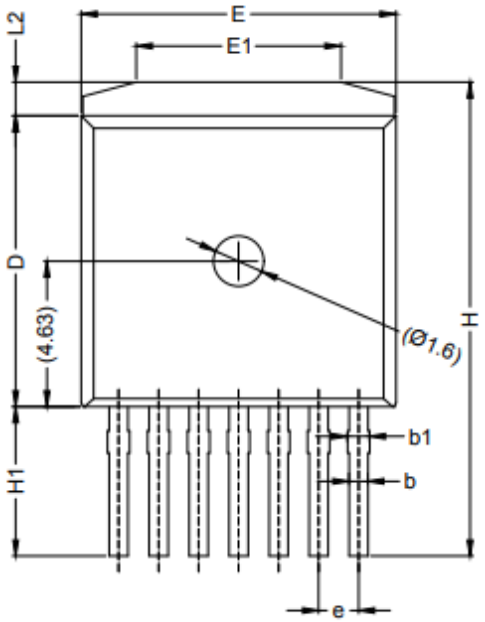
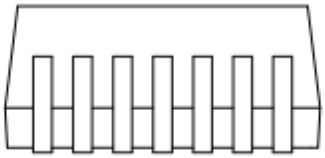
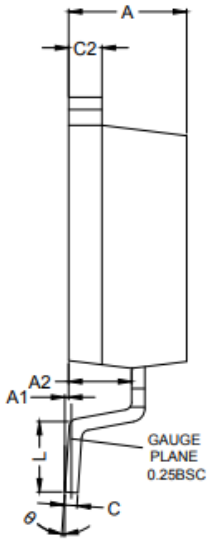


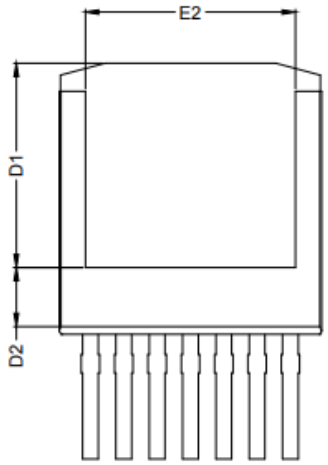
Fig. 26 Safe Operating Area

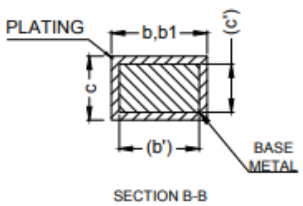
Package Dimensions











Items	Min	Max
A	4.30	4.70
A1	-	0.25
A2	2.20	2.60
b	0.52	0.72
b'	0.50	0.70
b1	0.60	0.80
c	0.42	0.62
c'	0.40	0.60
c2	1.07	1.47
D	9.05	9.45
D1	7.58	7.98
D2	2.05	2.45
e	1.27 BSC	
E	9.80	10.20
E1	6.30	6.70
E2	7.80	8.20
L	2.48	2.88
L2	0.87	1.27
H	14.87	15.27
H1	4.55	4.95
θ	0°	8°

Note:

1. Package Reference: JEDEC TO263, Variation AD
2. All Dimensions are in mm
3. Subject to Change Without Notice

Notes

For further information please contact IVCT's office.

The Information in this document is subject to change without notice.

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