

IV1Q06060D7G – 650V 60mΩ SiC MOSFET

Features

- 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

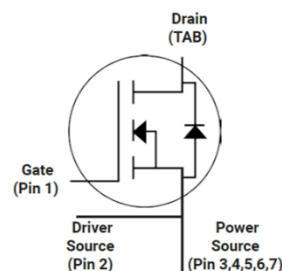
Applications

- On-board charger
- Solar inverters
- UPS
- Motor drivers
- High voltage DC/DC converters
- Switch mode power supplies

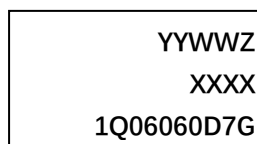
Outline:



TO263-7



Marking Diagram:



1Q06060D7G = Specific Device Code
YY = Year
WW = Work Week
Z = Assembly Location
XXXX = Lot Traceability

Absolute Maximum Ratings ($T_c=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DS}	Drain-Source voltage	650	V	$V_{GS}=0V$, $I_D=100\mu A$	
$V_{GSmax}(DC)$	Maximum DC voltage	-5 to 22	V	Static (DC)	
$V_{GSmax}(Spike)$	Maximum spike voltage	-10 to 25	V	duty cycle<1%, and pulse width<200ns	
V_{GSon}	Recommended turn-on voltage	20 ± 0.5	V		
V_{GSoff}	Recommended turn-off voltage	-3.5 to -2	V		
I_D	Drain current (continuous)	50	A	$V_{GS}=20V$, $T_c=25^\circ\text{C}$	Fig. 23
		37	A	$V_{GS}=20V$, $T_c=100^\circ\text{C}$	
I_{DM}	Drain current (pulsed)	125	A	Pulse width limited by SOA	Fig. 26
P_{TOT}	Total power dissipation	227	W	$T_c=25^\circ\text{C}$	Fig. 24
T_{stg}	Storage temperature range	-55 to 175	$^\circ\text{C}$		
T_J	Operating junction temperature	-55 to 175	$^\circ\text{C}$		

Thermal Data

Symbol	Parameter	Value	Unit	Note
$R_{\theta(J-C)}$	Thermal Resistance from Junction to Case	0.659	$^\circ\text{C/W}$	Fig. 25

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		5	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	5	V	V _{GS} =V _{DS} , I _D =3.9mA	Fig. 8, 9
			2.1			V _{GS} =V _{DS} , I _D =3.9mA @ T _J =175°C	
R _{ON}	Static drain-source on-resistance		60	80	mΩ	V _{GS} =20V, I _D =15A @T _J =25°C	Fig. 4, 5, 6, 7
			80		mΩ	V _{GS} =20V, I _D =15A @T _J =175°C	
C _{iss}	Input capacitance		1640		pF	V _{DS} =600V, V _{GS} =0V, f=1MHz, V _{AC} =25mV	Fig. 16
C _{oss}	Output capacitance		130		pF		
C _{rss}	Reverse transfer capacitance		4.2		pF		
E _{oss}	C _{oss} stored energy		25		μJ		Fig. 17
Q _g	Total gate charge		69.5		nC	V _{DS} =400V, I _D =15A, V _{GS} = -5 to 20V	Fig. 18
Q _{gs}	Gate-source charge		21.8		nC		
Q _{gd}	Gate-drain charge		21.6		nC		
R _g	Gate input resistance		5.2		Ω	f=1MHz	
E _{ON}	Turn-on switching energy		86.7		μJ	V _{DS} =400V, I _D =15A, V _{GS} = -3.5 to 20V, R _{G(ext)} =3.3Ω, L=200μH	Fig. 19, 20
E _{OFF}	Turn-off switching energy		16.3		μJ		
t _{d(on)}	Turn-on delay time		6.7		ns		
t _r	Rise time		12.6				
t _{d(off)}	Turn-off delay time		25.0				
t _f	Fall time		11.1				
E _{ON}	Turn-on switching energy		117.1		μJ	V _{DS} =400V, I _D =15A, V _{GS} = -3.5 to 20V, R _{G(ext)} =3.3Ω, L=200μH	Fig. 22
E _{OFF}	Turn-off switching energy		18.0		μJ		

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		3.8		V	I _{SD} =15A, V _{GS} =0V	Fig. 10, 11, 12
			3.5		V	I _{SD} =15A, V _{GS} =0V, T _J =175°C	
t _{rr}	Reverse recovery time		35.5		ns	V _{DS} =400V, I _D =15A, V _{GS} =-3 to 20V, R _{G(ext)} =13Ω, L=200μH di/dt=3000A/μs,	
Q _{rr}	Reverse recovery charge		118.6		nC		
I _{RRM}	Peak reverse recovery current		14.0		A		

Typical Performance (curves)

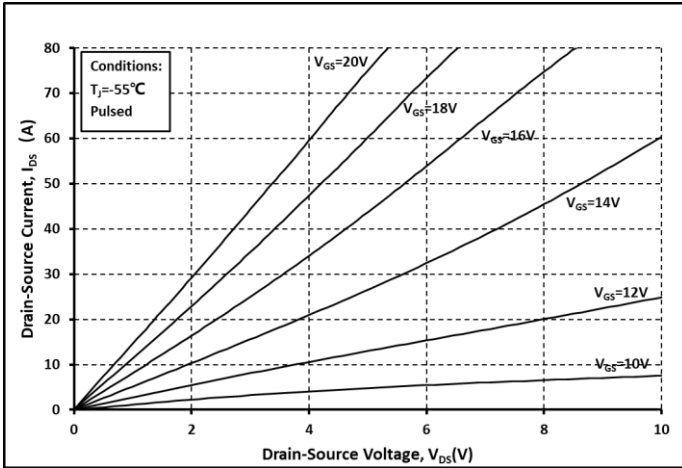


Fig. 1 Output Curve @ $T_j = -55^\circ\text{C}$

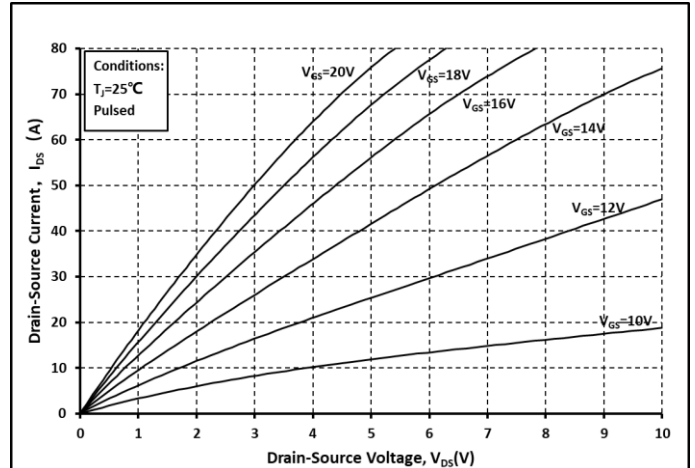


Fig. 2 Output Curve @ $T_j = 25^\circ\text{C}$

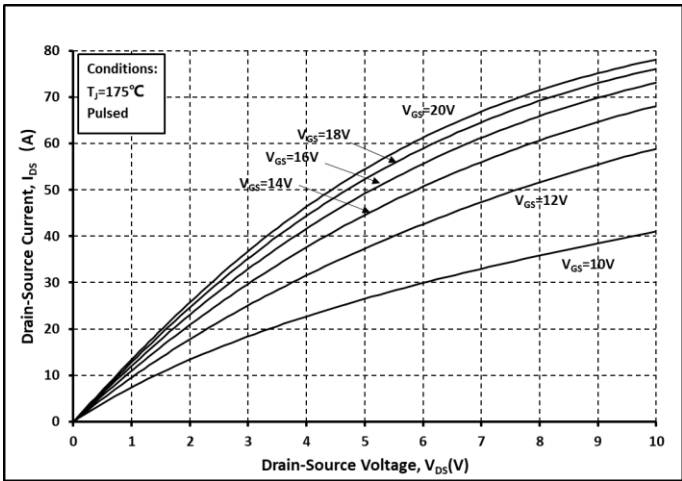


Fig. 3 Output Curve @ $T_j = 175^\circ\text{C}$

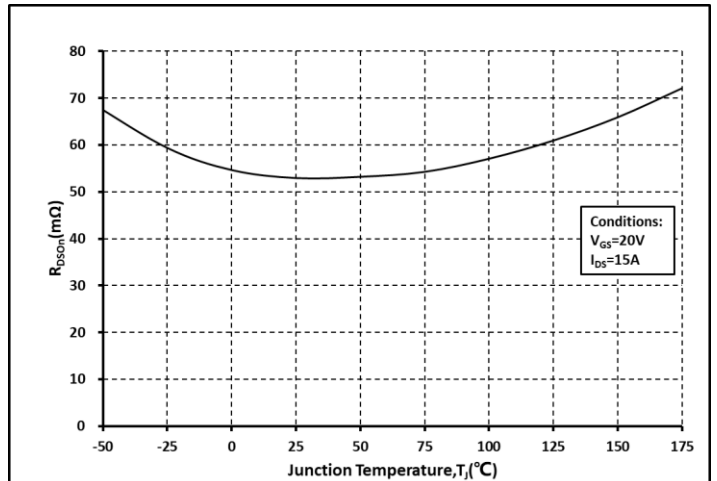


Fig. 4 R_{on} vs. Temperature

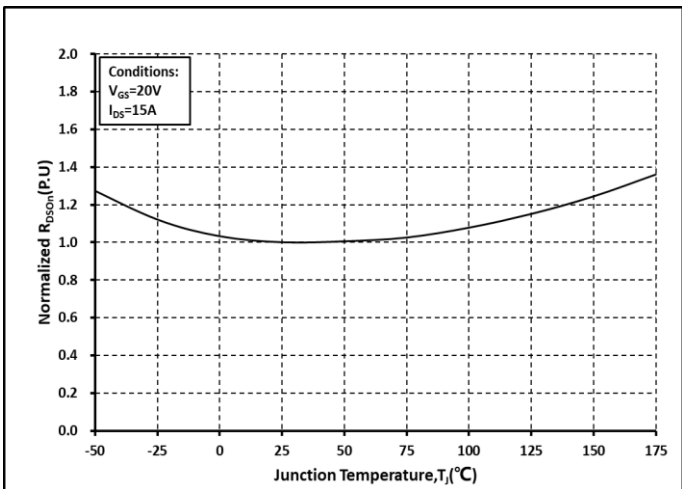


Fig. 5 Normalized R_{on} vs. Temperature

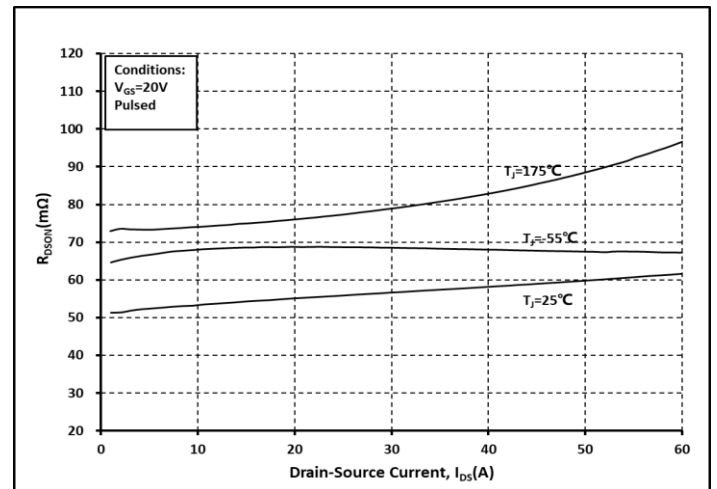


Fig. 6 R_{on} vs. I_{DS} @ Various Temperature

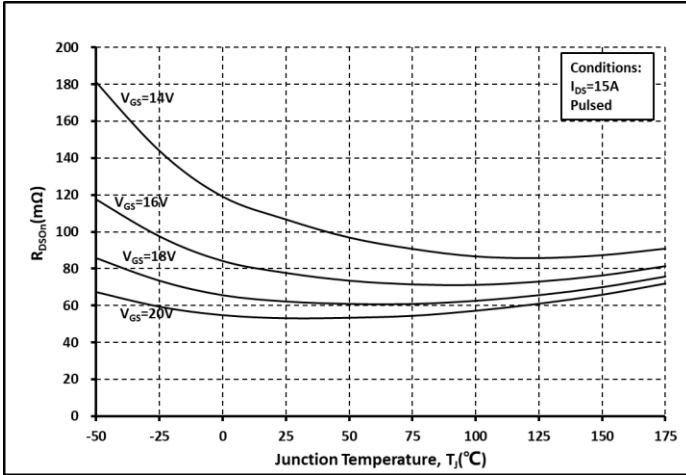


Fig. 7 Ron vs. Temperature @ Various V_{GS}

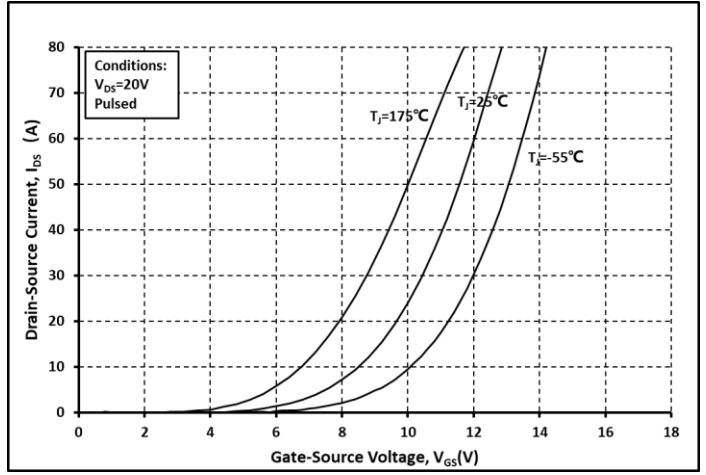


Fig. 8 Transfer Curves @ Various Temperature

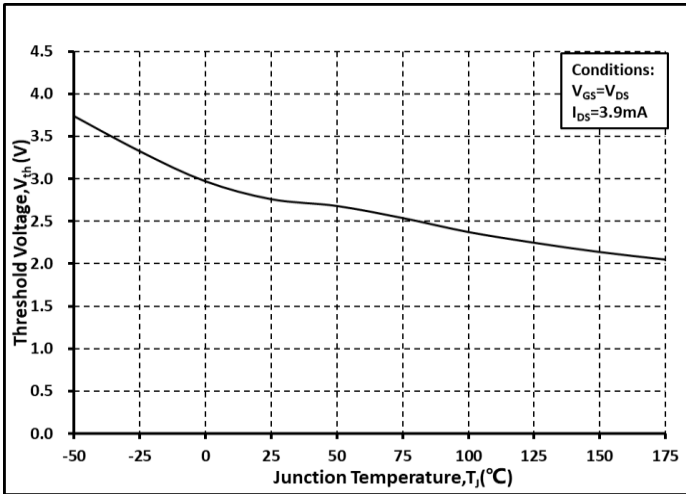


Fig. 9 Threshold Voltage vs. Temperature

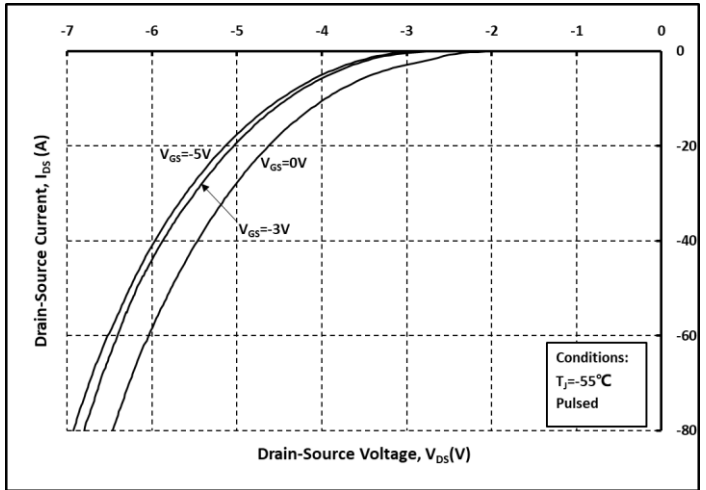


Fig. 10 Body Diode Curves @ $T_J=-55^{\circ}C$

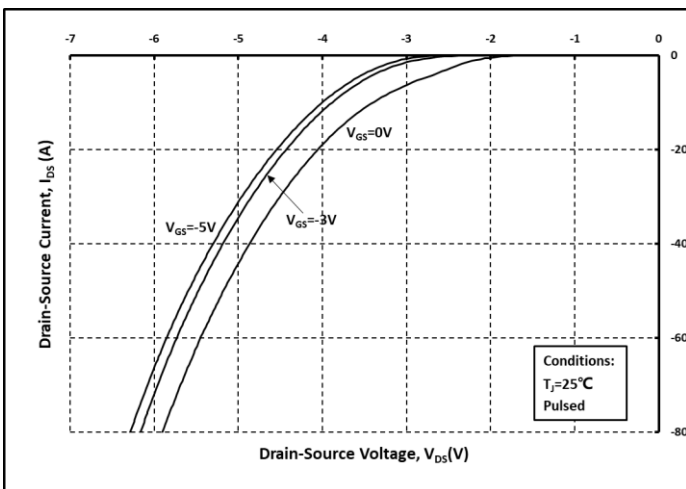


Fig. 11 Body Diode Curves @ $T_J=25^{\circ}C$

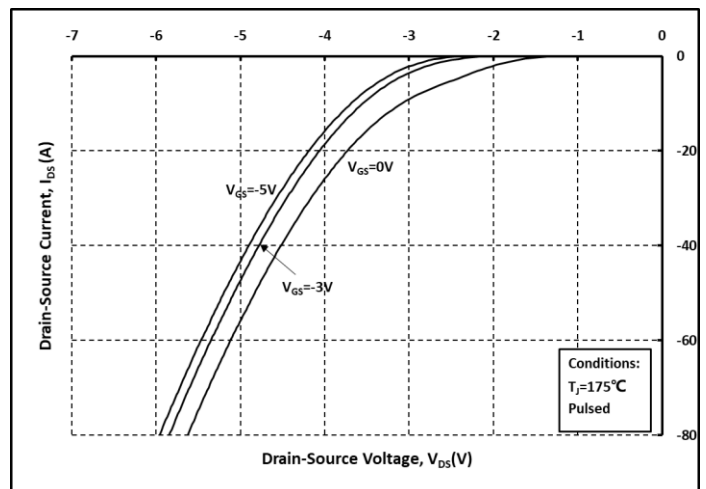


Fig. 12 Body Diode Curves @ $T_J=175^{\circ}C$

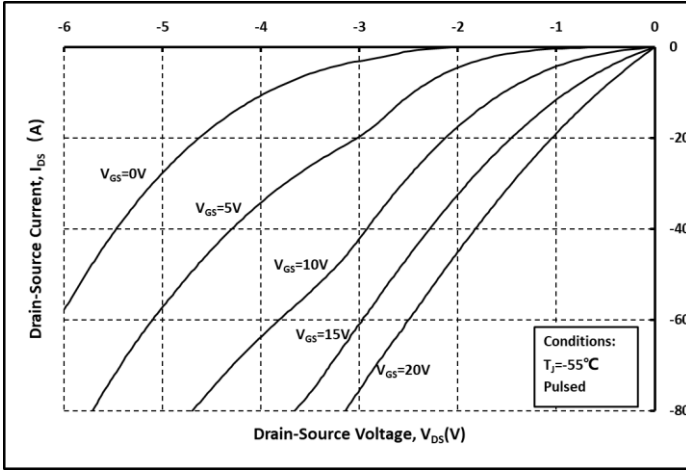


Fig. 13 3rd Quadrant Curves @ $T_j = -55^\circ\text{C}$

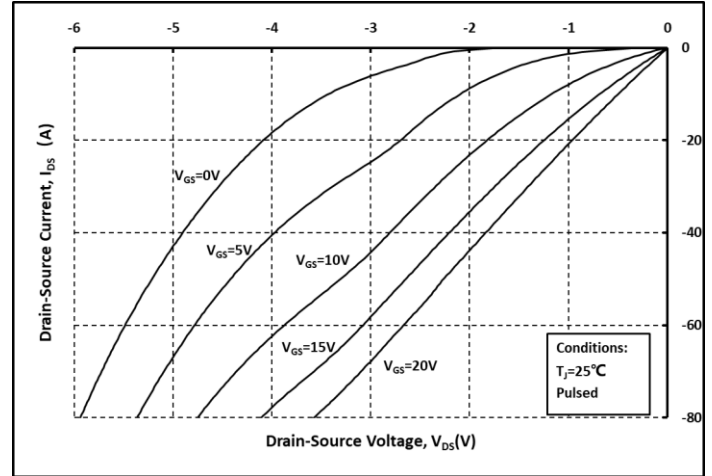


Fig. 14 3rd Quadrant Curves @ $T_j = 25^\circ\text{C}$

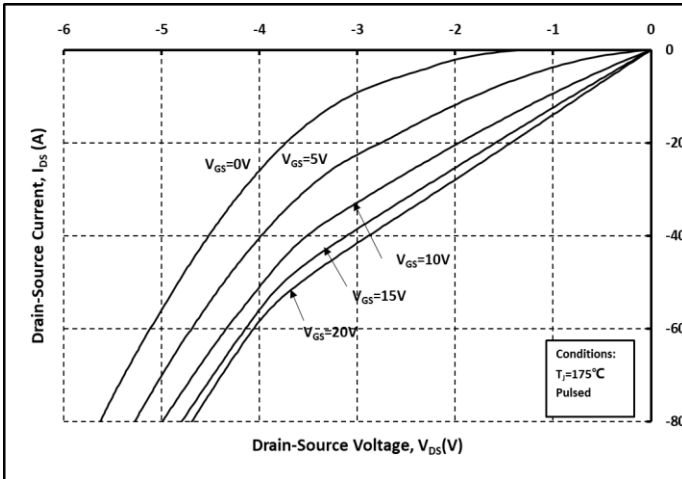


Fig. 15 3rd Quadrant Curves @ $T_j = 175^\circ\text{C}$

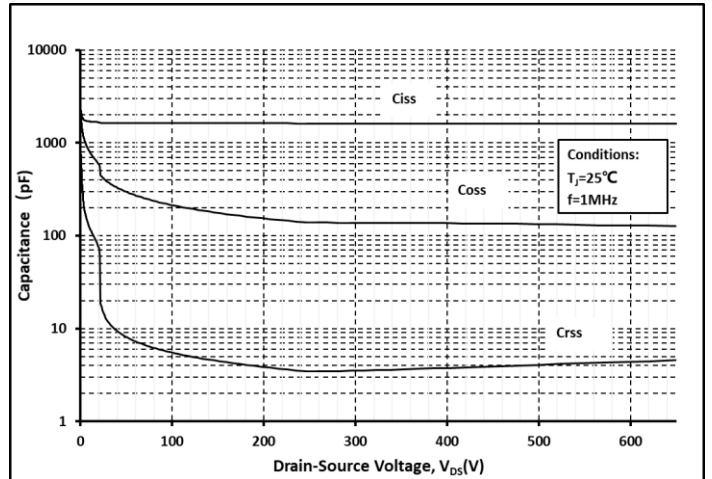


Fig. 16 Capacitance vs. V_{ds}

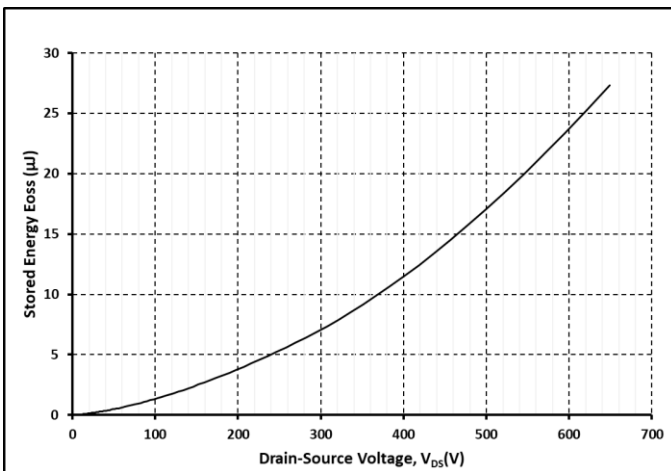


Fig. 17 Output Capacitor Stored Energy

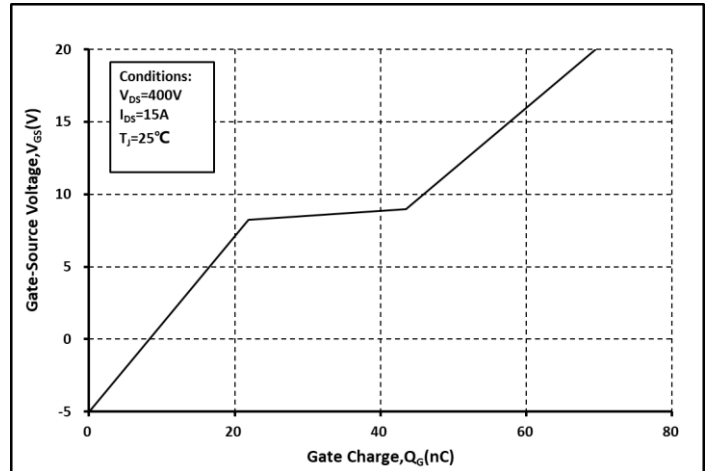


Fig. 18 Gate Charge Characteristics

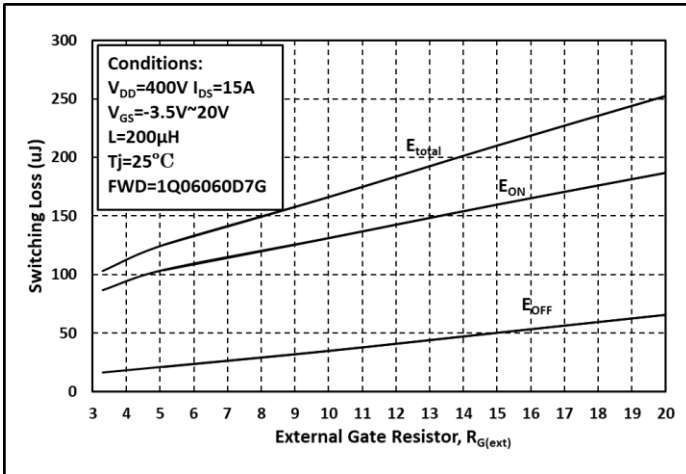


Fig. 19 Switching Energy vs. $R_{G(ext)}$

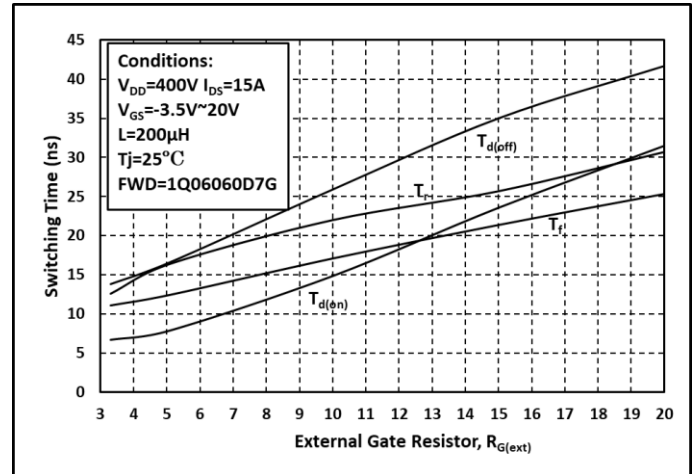


Fig. 20 Switching Times vs. $R_{G(ext)}$

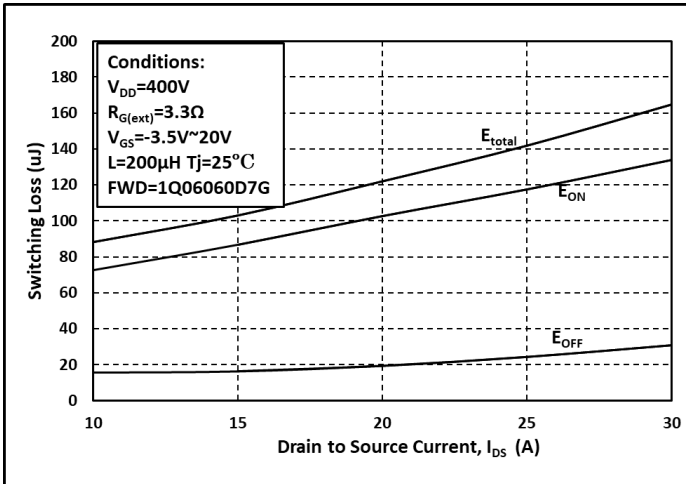


Fig. 21 Switching Energy vs. I_{DS}

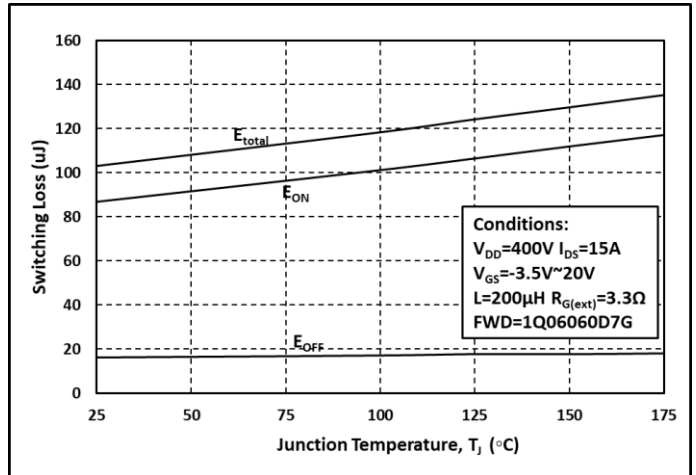


Fig. 22 Switching Energy vs. Temperature

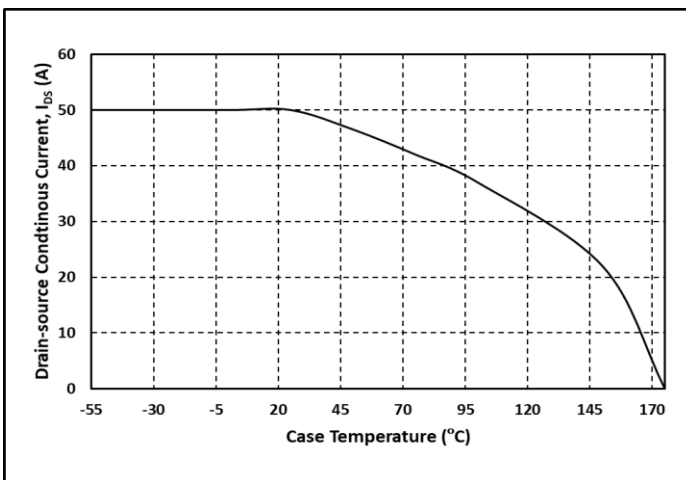


Fig. 23 Continuous Drain Current vs. Case Temperature

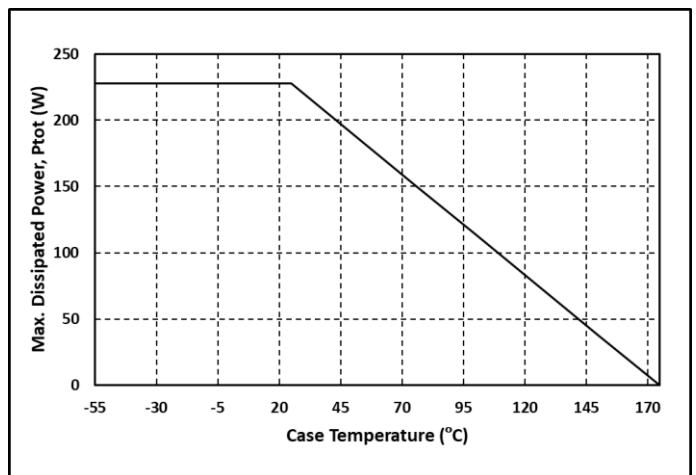


Fig. 24 Max. Power Dissipation Derating vs. Case Temperature

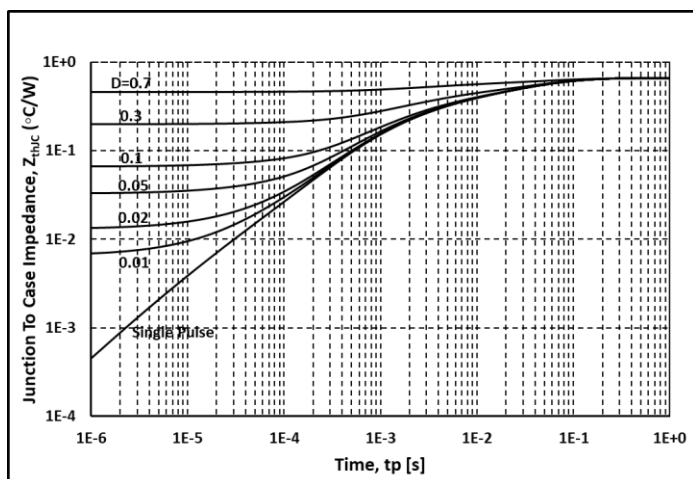


Fig. 25 Thermal Impedance

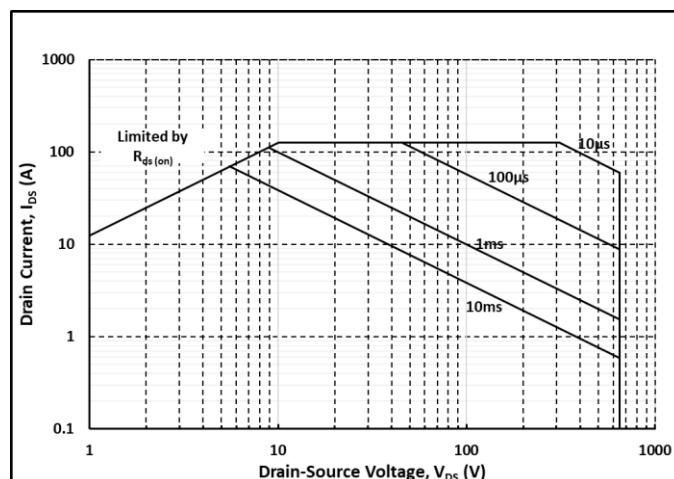
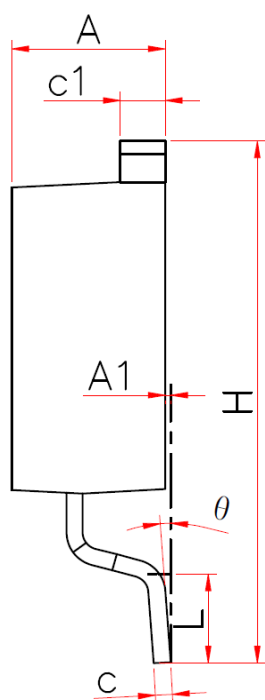
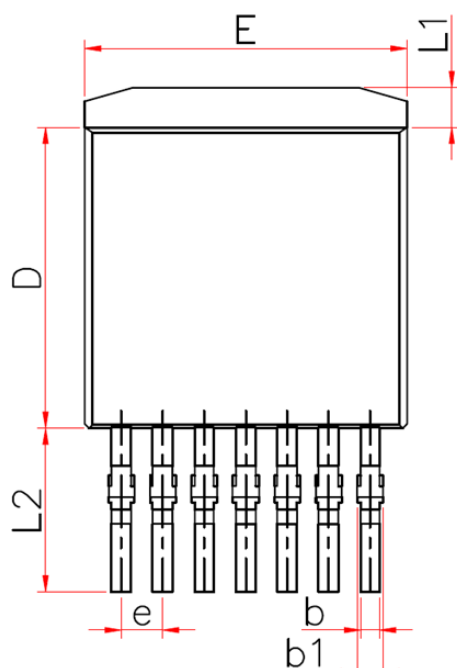
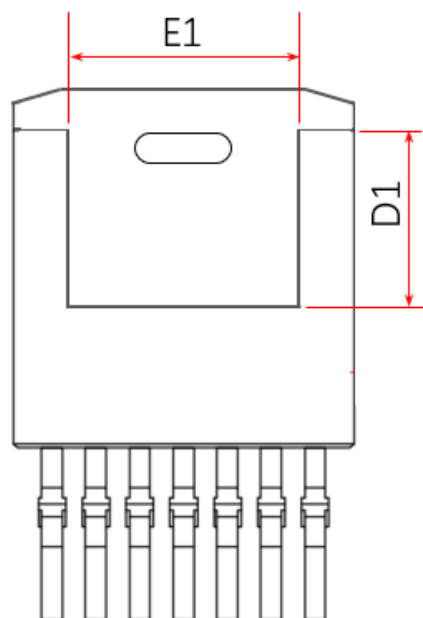


Fig. 26 Safe Operating Area

Package Dimensions



Symbol	Dimensions In Millimeters	
	Min.	Max.
A	4.300	4.560
A1	—	0.250
b	0.500	0.700
b1	0.600	0.900
c	0.450	0.600
c1	1.200	1.400
D	8.930	9.230
D1	4.650	4.950
E	10.08 0	10.28 0
E1	6.820	7.620
e	1.27 REF.	
H	15.00 0	16.00 0
L	1.900	2.500
L1	0.980	1.420
L2	4.350	5.890
θ	0°	7°



Note:

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

Notes

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