

IV2Q12160D7Z – 1200V 160mΩ Gen2 Automotive SiC MOSFET

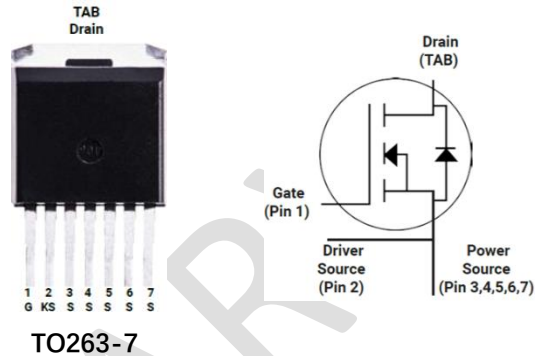
Features

- 2nd Generation SiC MOSFET Technology with +15V~+18V gate drive
- High blocking voltage with low on-resistance
- High speed switching with low capacitance
- 175°C operating junction temperature capability
- Ultra fast and robust intrinsic body diode
- Kelvin gate input easing driver circuit design
- AEC-Q101 qualified

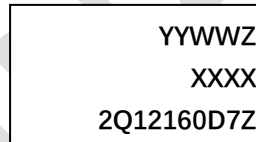
Applications

- EV chargers and OCs
- Solar boosters
- Automotive compressor inverters
- AC/DC power supplies

Outline:



Marking Diagram:



2Q12160D7Z = 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	1200	V	$V_{GS}=0V, I_D=100\mu A$	
V_{GSmax} (Transient)	Maximum transient voltage	-10 to 23	V	Duty cycle<1%, and pulse width<200ns	
V_{GSon}	Recommended turn-on voltage	15 to 18	V		
V_{GSoff}	Recommended turn-off voltage	-5 to -2	V	Typical -3.5V	
I_D	Drain current (continuous)	20	A	$V_{GS}=18V, T_c=25^\circ\text{C}$	Fig. 23
		15	A	$V_{GS}=18V, T_c=100^\circ\text{C}$	
I_{DM}	Drain current (pulsed)	50	A	Pulse width limited by SOA and dynamic $R_{\theta(j-c)}$	Fig. 25, 26
I_{SM}	Body diode current (pulsed)	50	A	Pulse width limited by SOA and dynamic $R_{\theta(j-c)}$	Fig. 25, 26
P_{TOT}	Total power dissipation	136	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	$^\circ\text{C}$		
T_L	Solder Temperature	260	$^\circ\text{C}$	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	1.1	$^\circ\text{C/W}$	Fig. 25

Electrical Characteristics ($T_c=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Value			Unit	Test Conditions	Note
		Min.	Typ.	Max.			
I_{DSS}	Zero gate voltage drain current		1	100	μA	$V_{DS}=1200\text{V}, V_{GS}=0\text{V}$	
I_{GSS}	Gate leakage current			± 100	nA	$V_{DS}=0\text{V}, V_{GS}=-5\sim 20\text{V}$	
V_{TH}	Gate threshold voltage	1.8	3.0	4.5	V	$V_{GS}=V_{DS}, I_D=2\text{mA}$	Fig. 8, 9
			2.2			$V_{GS}=V_{DS}, I_D=2\text{mA}$ @ $T_J=175^{\circ}\text{C}$	
R_{ON}	Static drain-source on-resistance		160	208	$\text{m}\Omega$	$V_{GS}=18\text{V}, I_D=5\text{A}$ @ $T_J=25^{\circ}\text{C}$	Fig. 4, 5, 6, 7
			260		$\text{m}\Omega$	$V_{GS}=18\text{V}, I_D=5\text{A}$ @ $T_J=175^{\circ}\text{C}$	
			210		$\text{m}\Omega$	$V_{GS}=15\text{V}, I_D=5\text{A}$ @ $T_J=25^{\circ}\text{C}$	
			280		$\text{m}\Omega$	$V_{GS}=15\text{V}, I_D=5\text{A}$ @ $T_J=175^{\circ}\text{C}$	
C_{iss}	Input capacitance		580		pF	$V_{DS}=800\text{V}, V_{GS}=0\text{V},$ $f=1\text{MHz}, V_{AC}=25\text{mV}$	Fig. 16
C_{oss}	Output capacitance		35		pF		
C_{rss}	Reverse transfer capacitance		2.5		pF		
E_{oss}	C_{oss} stored energy		14		μJ		Fig. 17
Q_g	Total gate charge		29		nC	$V_{DS}=800\text{V}, I_D=10\text{A},$ $V_{GS}=-3\text{ to }18\text{V}$	Fig. 18
Q_{gs}	Gate-source charge		6.6		nC		
Q_{gd}	Gate-drain charge		14.4		nC		
R_g	Gate input resistance		10		Ω	$f=1\text{MHz}$	
E_{ON}	Turn-on switching energy		148		μJ	$V_{DS}=800\text{V}, I_D=10\text{A},$ $V_{GS}=-3.5\text{ to }18\text{V},$ $R_{G(\text{ext})}=3.3\Omega,$ $L=300\mu\text{H}$ $T_J=25^{\circ}\text{C}$	Fig. 19, 20
E_{OFF}	Turn-off switching energy		14.6		μJ		
$t_{d(\text{on})}$	Turn-on delay time		2.4		ns		
t_r	Rise time		10.4				
$t_{d(\text{off})}$	Turn-off delay time		7.0				
t_f	Fall time		13.0				
E_{ON}	Turn-on switching energy		262		μJ	$V_{DS}=800\text{V}, I_D=10\text{A},$ $V_{GS}=-3.5\text{ to }18\text{V},$ $R_{G(\text{ext})}=3.3\Omega, L=300\mu\text{H}$ $T_J=175^{\circ}\text{C}$	Fig. 22
E_{OFF}	Turn-off switching energy		17.1		μJ		

Reverse Diode Characteristics ($T_c=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value			Unit	Test Conditions	Note
		Min.	Typ.	Max.			
V_{SD}	Diode forward voltage		4.0		V	$I_{SD}=5\text{A}, V_{GS}=0\text{V}$	Fig. 10, 11, 12
			3.7		V	$I_{SD}=5\text{A}, V_{GS}=0\text{V}, T_J=175^\circ\text{C}$	
I_S	Diode forward current (continuous)			23	A	$V_{GS}=-2\text{V}, T_c=25^\circ\text{C}$	
				13	A	$V_{GS}=-2\text{V}, T_c=100^\circ\text{C}$	
t_{rr}	Reverse recovery time		29		ns	$V_{GS}=-3.5\text{V}/+18\text{V}, I_{SD}=10\text{A}, V_R=800\text{V}, R_{G(\text{ext})}=18\Omega, L=300\mu\text{H}, di/dt=3000\text{A}/\mu\text{s}$	
Q_{rr}	Reverse recovery charge		97		nC		
I_{RRM}	Peak reverse recovery current		9.6		A		

Typical Performance (curves)

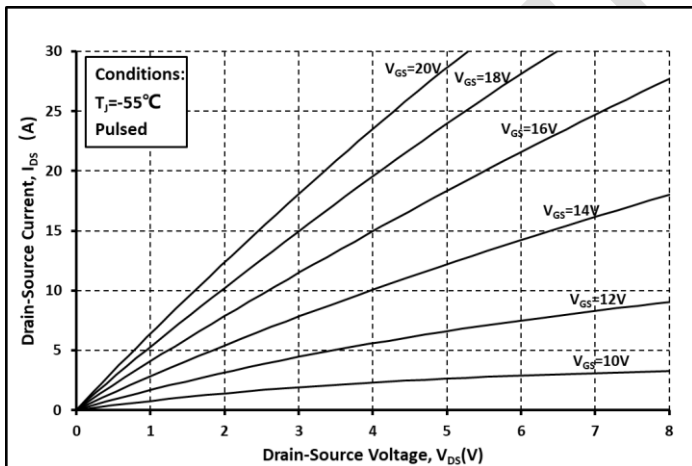


Fig. 1 Output Curve @ $T_j=-55^\circ\text{C}$

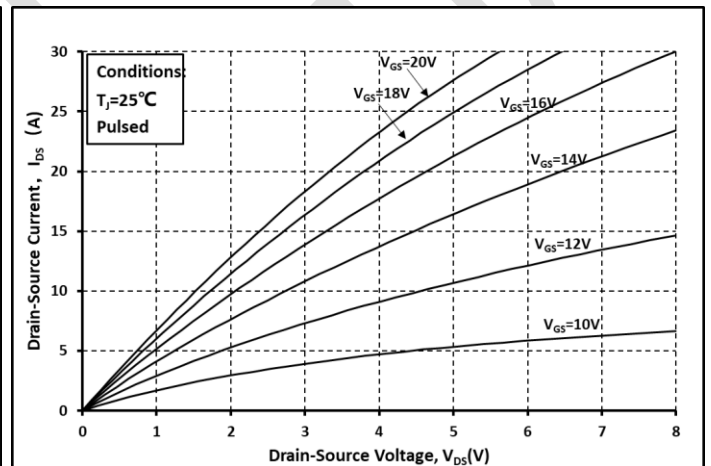


Fig. 2 Output Curve @ $T_j=25^\circ\text{C}$

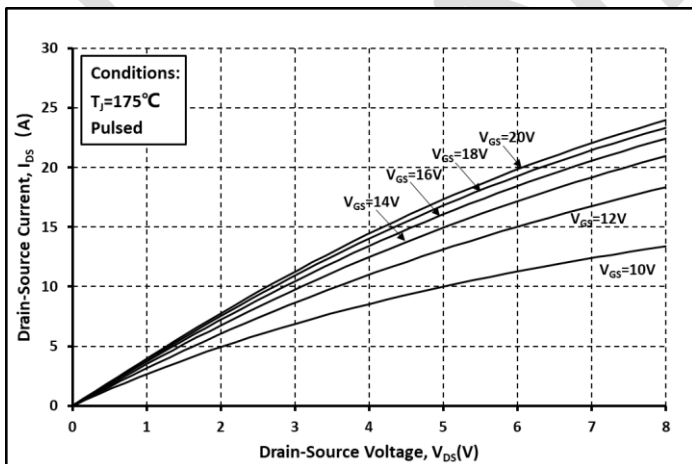


Fig. 3 Output Curve @ $T_j=175^\circ\text{C}$

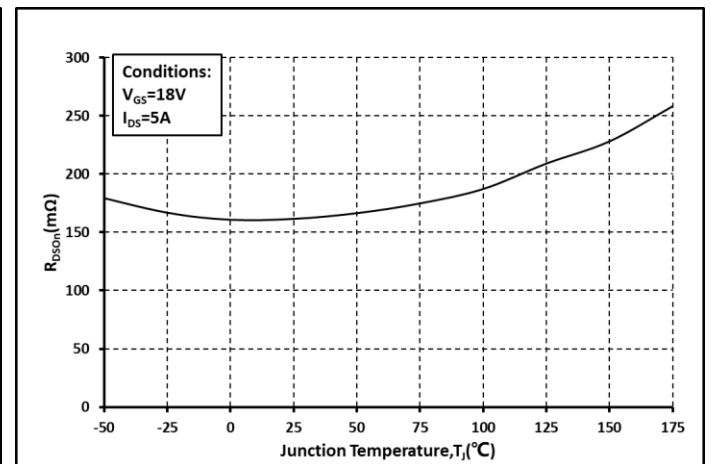


Fig. 4 R_{on} vs. Temperature

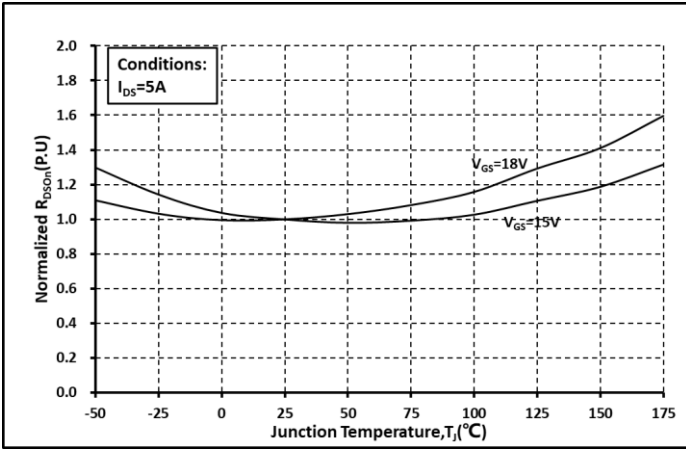


Fig. 5 Normalized Ron vs. Temperature

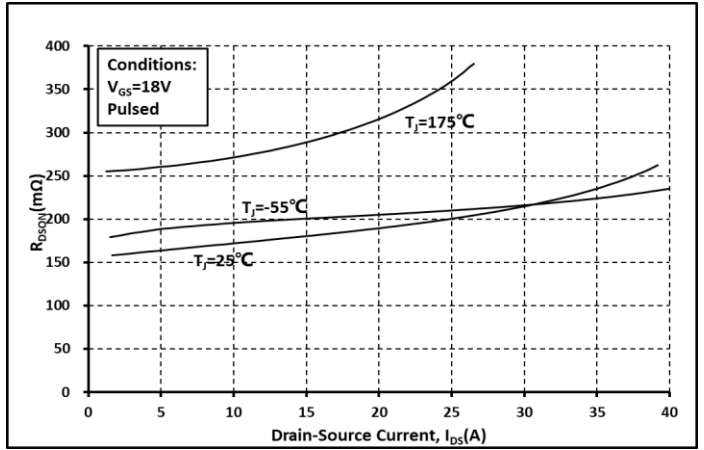


Fig. 6 Ron vs. Ids @ Various Temperature

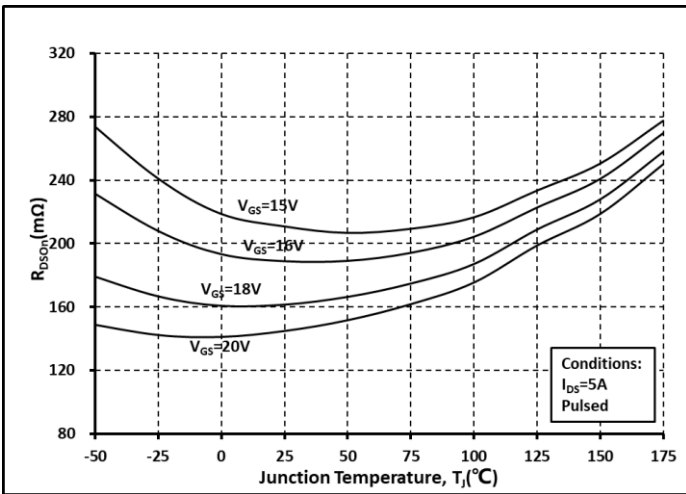


Fig. 7 Ron vs. Temperature @ Various Vgs

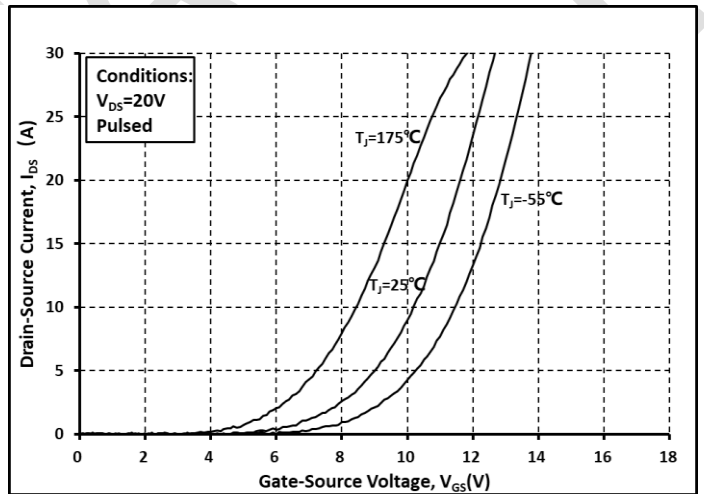


Fig. 8 Transfer Curves @ Various Temperature

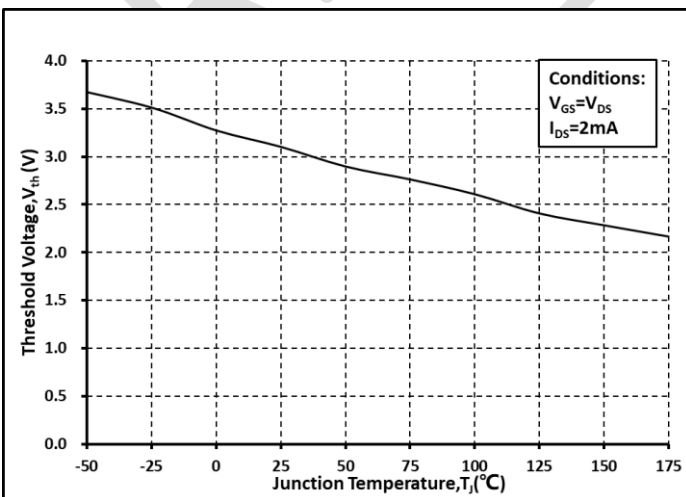


Fig. 9 Threshold Voltage vs. Temperature

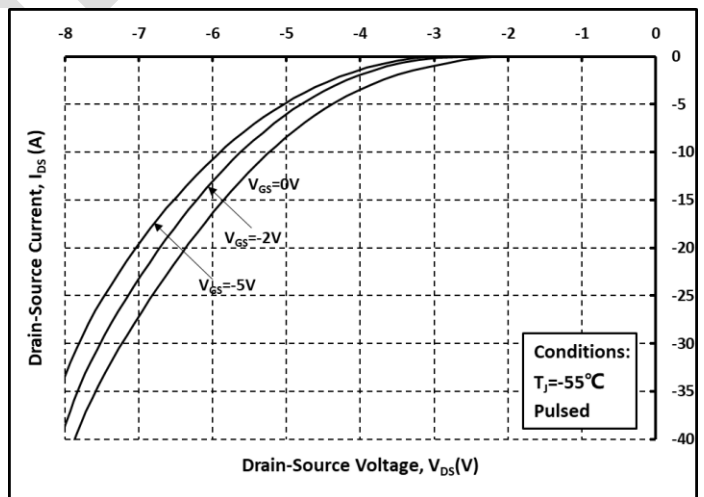


Fig. 10 Body Diode curves @ Tj = -55°C

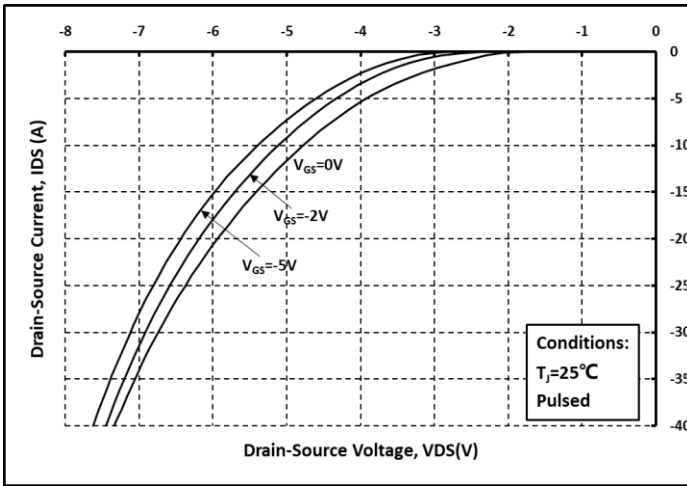


Fig. 11 Body Diode curves @ $T_j=25^\circ\text{C}$

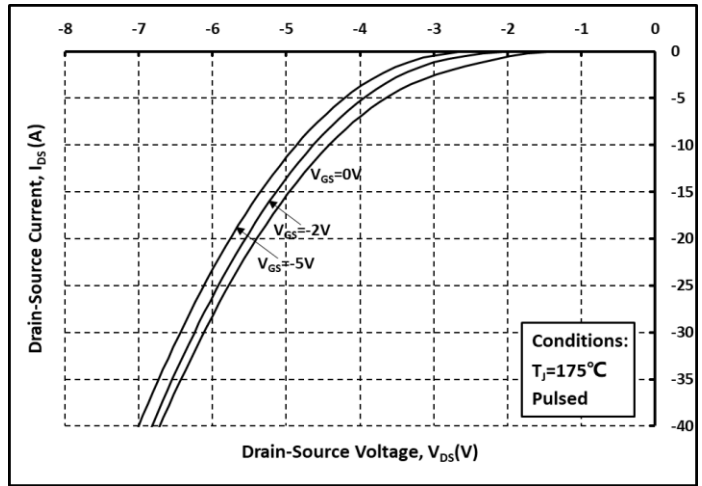


Fig. 12 Body Diode curves @ $T_j=175^\circ\text{C}$

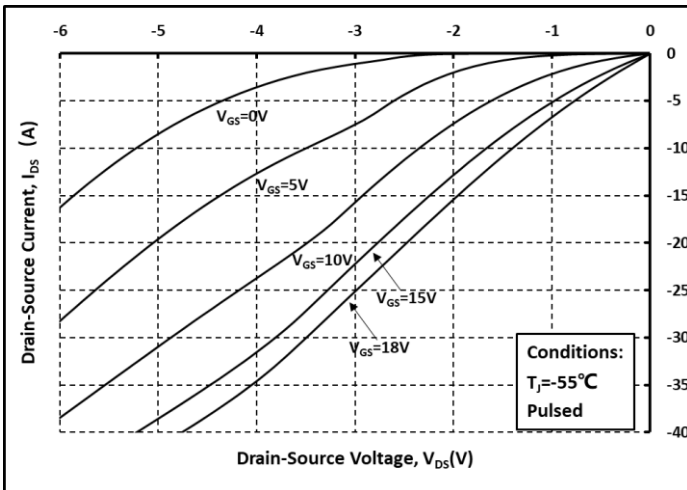


Fig. 13 3rd Quadrant curves @ $T_j=-55^\circ\text{C}$

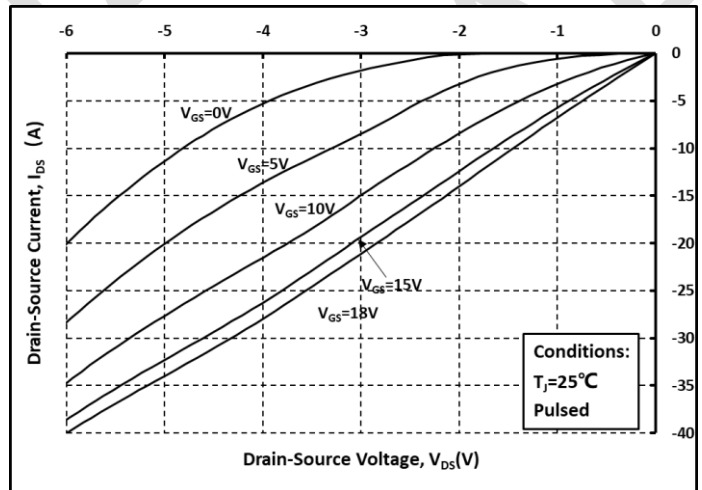


Fig. 14 3rd Quadrant curves @ $T_j=25^\circ\text{C}$

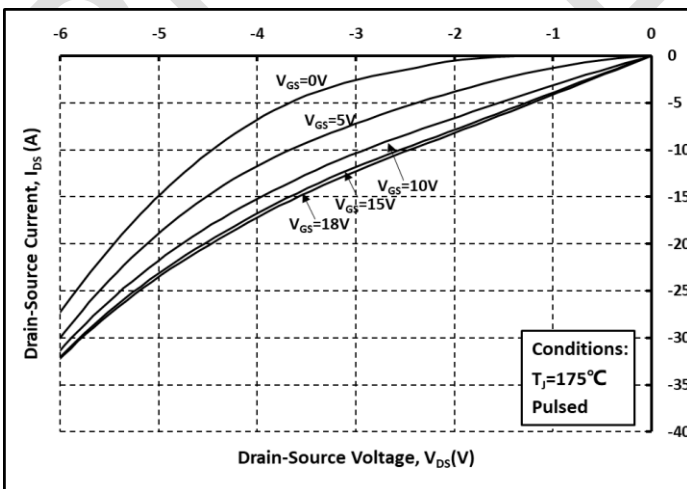


Fig. 15 3rd Quadrant curves @ $T_j=175^\circ\text{C}$

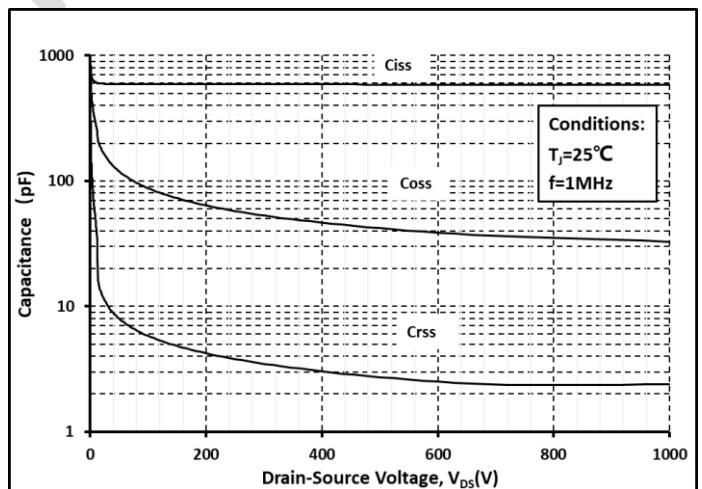


Fig. 16 Capacitance vs. V_{DS}

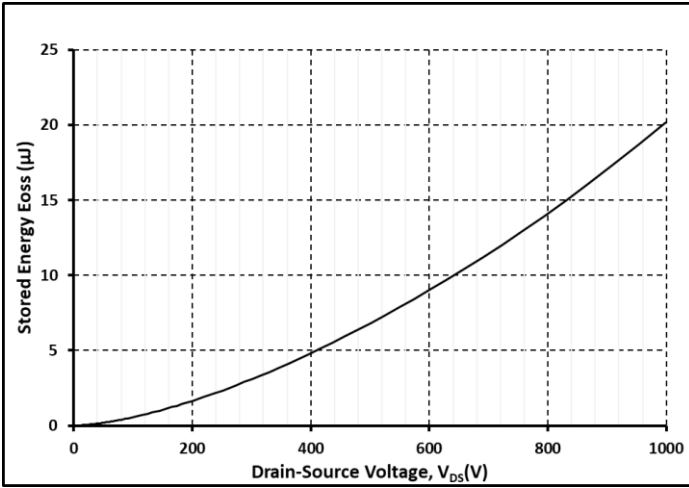


Fig. 17 Output Capacitor Stored Energy

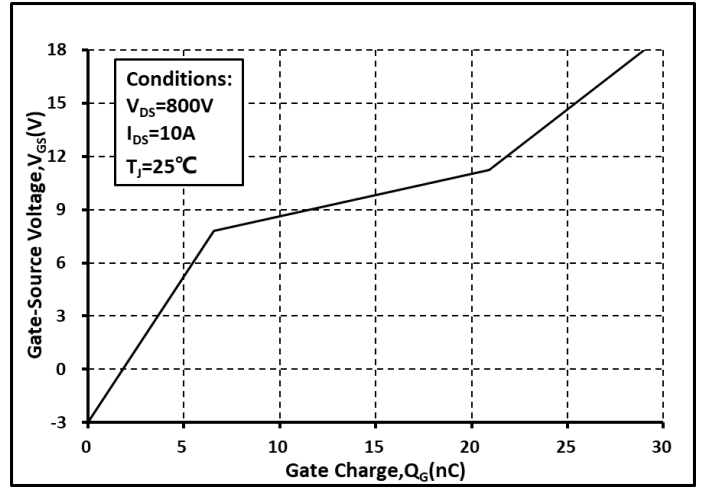


Fig. 18 Gate Charge Characteristics

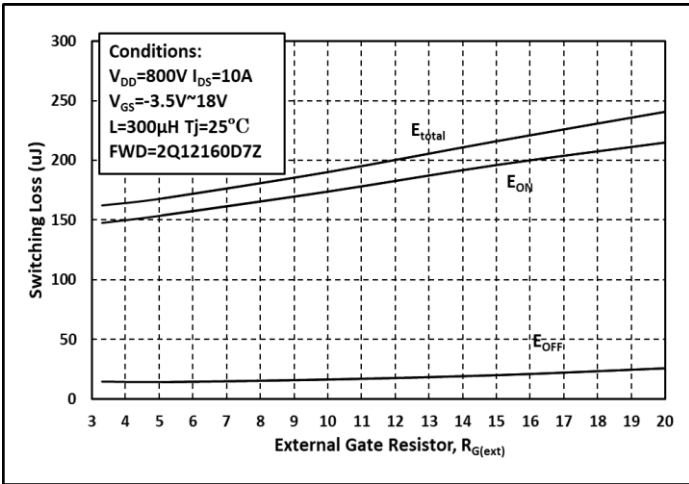


Fig. 19 Switching Energy vs. R_{G(ext)}

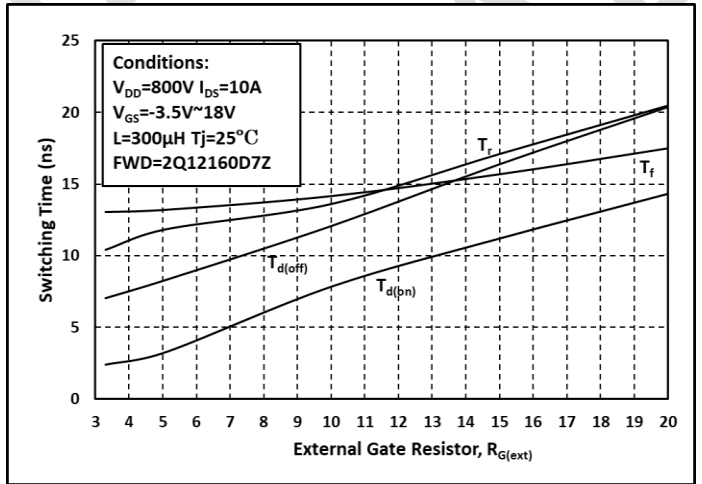


Fig. 20 Switching Times vs. R_{G(ext)}

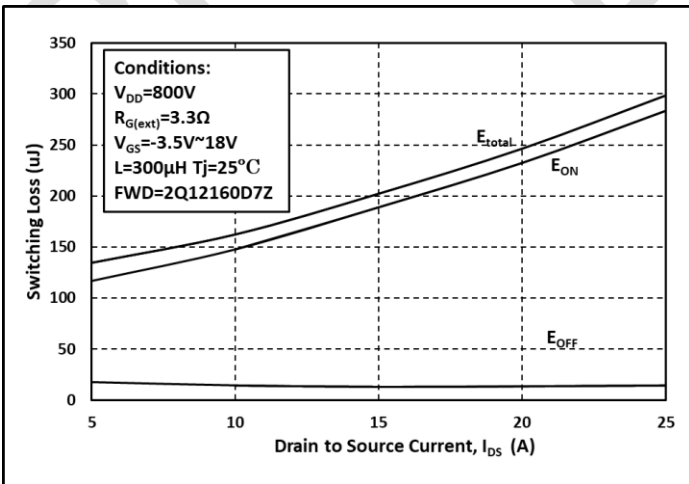


Fig. 21 Switching Energy vs. I_{DS}

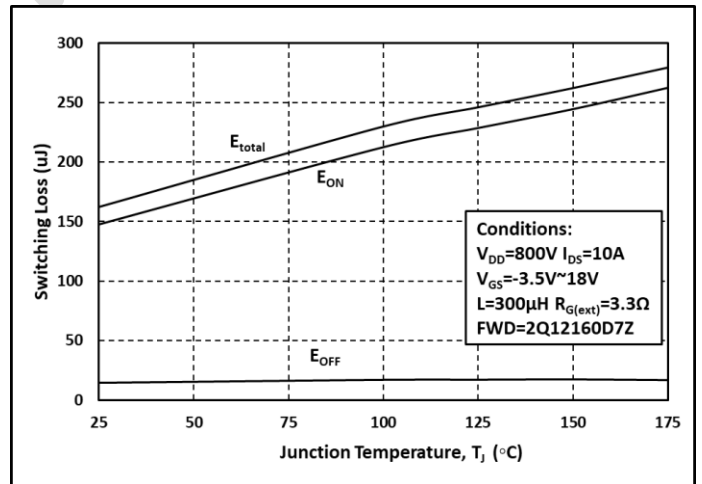


Fig. 22 Switching Energy vs. Temperature

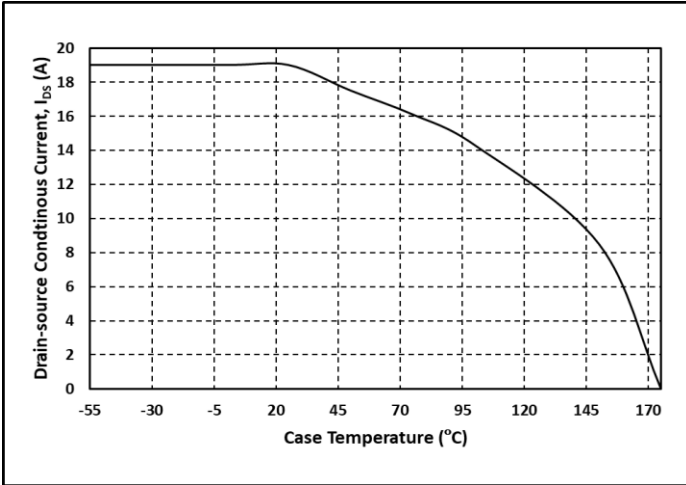


Fig. 23 Continuous Drain Current vs. Case Temperature

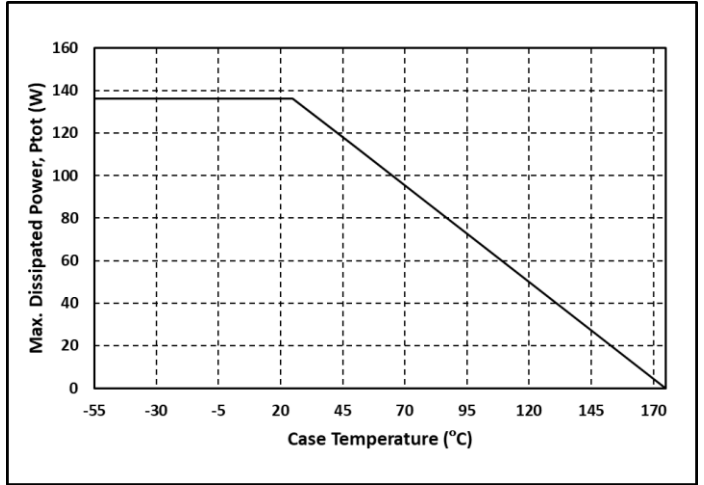


Fig. 24 Max. Power Dissipation Derating vs. Case Temperature

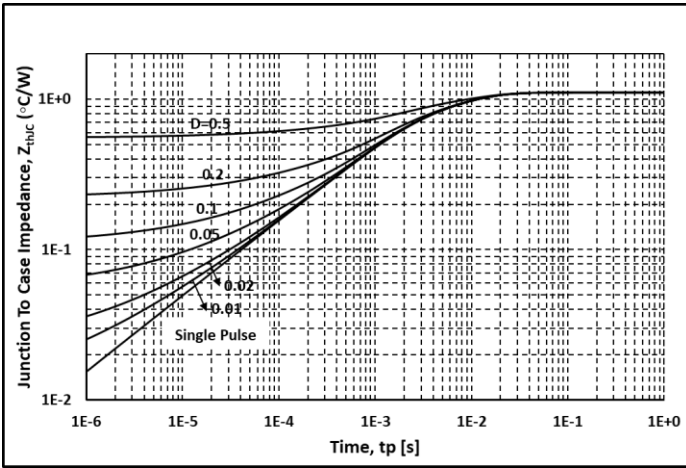


Fig. 25 Thermal impedance

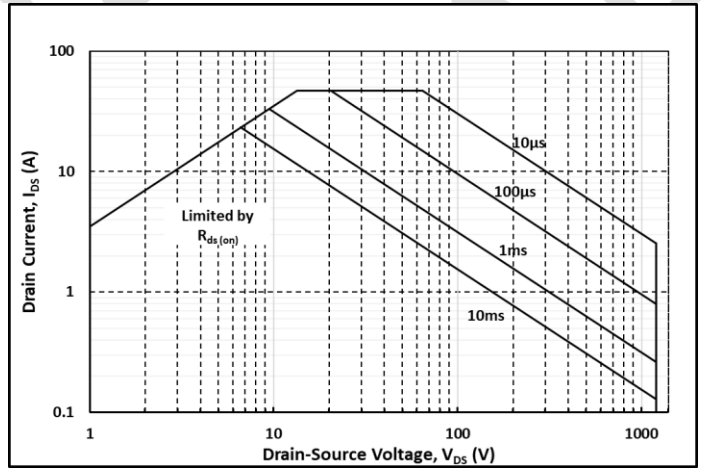
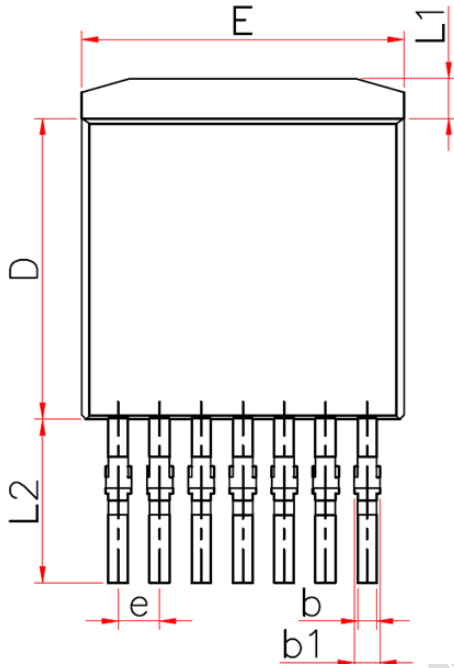


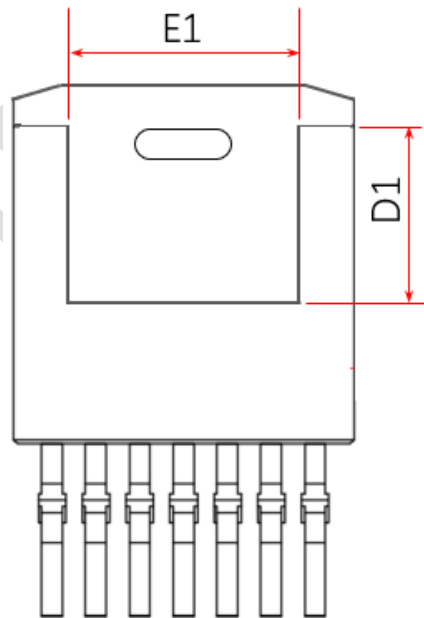
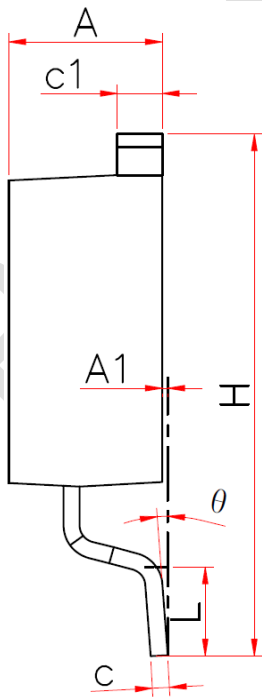
Fig. 26 Safe Operating Area

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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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