

IV2Q12080D7Z – 1200V 80mΩ Gen2 Automotive SiC MOSFET

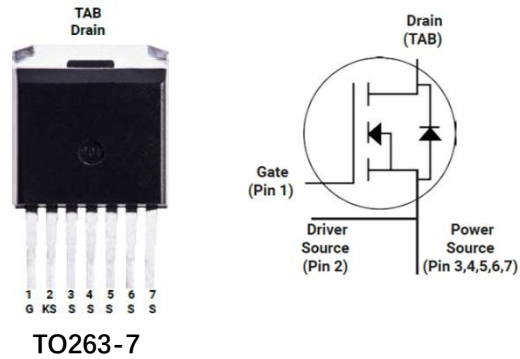
Features

- 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

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

Outline:



Marking Diagram:

YYWWZ XXXX 2Q12080D7Z	2Q12080D7Z = Specific Device Code YY = Year WW = Work Week Z = Assembly Location XXXX = Lot Traceability
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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	$V_{GS}=0V, I_D=100\mu A$	
$V_{GSmax}(DC)$	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)	41	A	$V_{GS}=18V, T_c=25^\circ\text{C}$	Fig. 23
		29	A	$V_{GS}=18V, T_c=100^\circ\text{C}$	
I_{DM}	Drain current (pulsed)	102	A	Pulse width limited by SOA	Fig. 26
P_{TOT}	Total power dissipation	250	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	0.6	$^\circ\text{C/W}$	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		5	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	2.9	4.5	V	$V_{GS}=V_{DS}, I_D=5\text{mA}$	Fig. 8, 9
			2.1			$V_{GS}=V_{DS}, I_D=5\text{mA}$ @ $T_J=175^\circ\text{C}$	
R_{ON}	Static drain-source on-resistance		80	104	$\text{m}\Omega$	$V_{GS}=18\text{V}, I_D=10\text{A}$ @ $T_J=25^\circ\text{C}$	Fig. 4, 5, 6, 7
			150		$\text{m}\Omega$	$V_{GS}=18\text{V}, I_D=10\text{A}$ @ $T_J=175^\circ\text{C}$	
C_{iss}	Input capacitance		1160		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		60.6		pF		
C_{rss}	Reverse transfer capacitance		4.4		pF		
E_{oss}	C_{oss} stored energy		23		μJ		Fig. 17
Q_g	Total gate charge		53		nC	$V_{DS}=800\text{V}, I_D=20\text{A},$ $V_{GS}=-3$ to 18V	Fig. 18
Q_{gs}	Gate-source charge		14		nC		
Q_{gd}	Gate-drain charge		24		nC		
R_g	Gate input resistance		4.1		Ω	$f=1\text{MHz}$	
E_{ON}	Turn-on switching energy		324		μJ	$V_{DS}=800\text{V}, I_D=20\text{A},$ $V_{GS}=-3.5$ to $18\text{V},$ $R_{G(ext)}=3.3\Omega,$ $L=200\mu\text{H}$ $T_J=25^\circ\text{C}$	Fig. 19, 20
E_{OFF}	Turn-off switching energy		23		μJ		
$t_{d(on)}$	Turn-on delay time		5.6		ns		
t_r	Rise time		14.4				
$t_{d(off)}$	Turn-off delay time		11.5				
t_f	Fall time		9.5				
E_{ON}	Turn-on switching energy		479		μJ	$V_{DS}=800\text{V}, I_D=20\text{A},$ $V_{GS}=-3.5$ to $18\text{V},$ $R_{G(ext)}=3.3\Omega, L=200\mu\text{H}$ $T_J=175^\circ\text{C}$	Fig. 22
E_{OFF}	Turn-off switching energy		23		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	$I_{SD}=10\text{A}, V_{GS}=0\text{V}$	Fig. 10, 11, 12
			3.8		V	$I_{SD}=10\text{A}, V_{GS}=0\text{V},$ $T_J=175^\circ\text{C}$	
t_{rr}	Reverse recovery time		36		ns	$V_{GS}=-3.5\text{V}/+18\text{V},$ $I_{SD}=20\text{A}, V_R=800\text{V},$ $R_{G(ext)}=13\Omega, L=200\mu\text{H}$ $di/dt=3000\text{A}/\mu\text{s}$	
Q_{rr}	Reverse recovery charge		128		nC		
I_{RRM}	Peak reverse recovery current		13.4		A		

Typical Performance (curves)

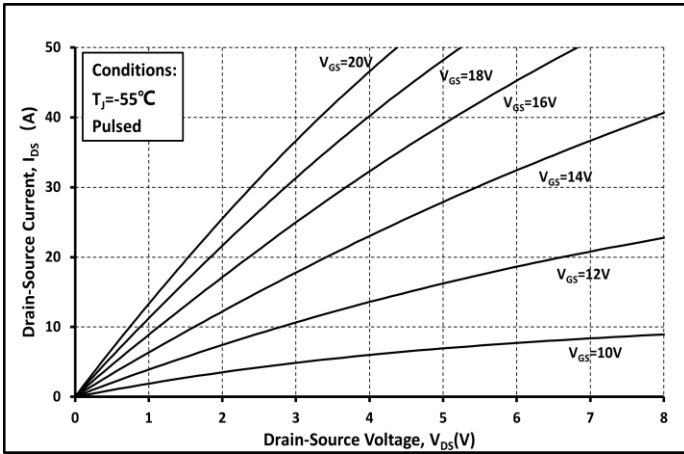


Fig. 1 Output Curve @ $T_j = -55^\circ\text{C}$

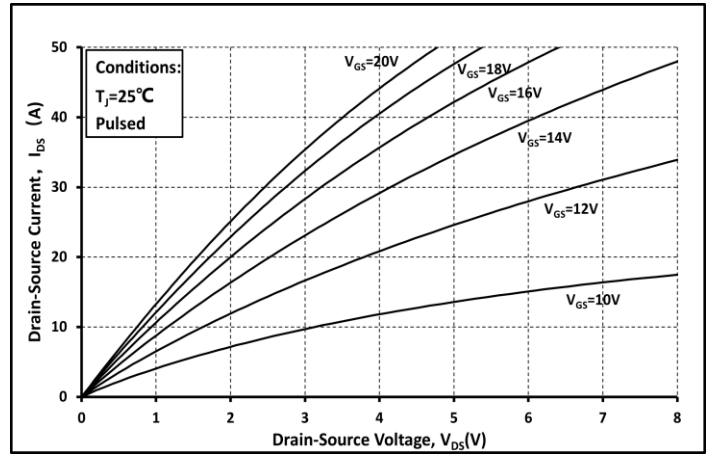


Fig. 2 Output Curve @ $T_j = 25^\circ\text{C}$

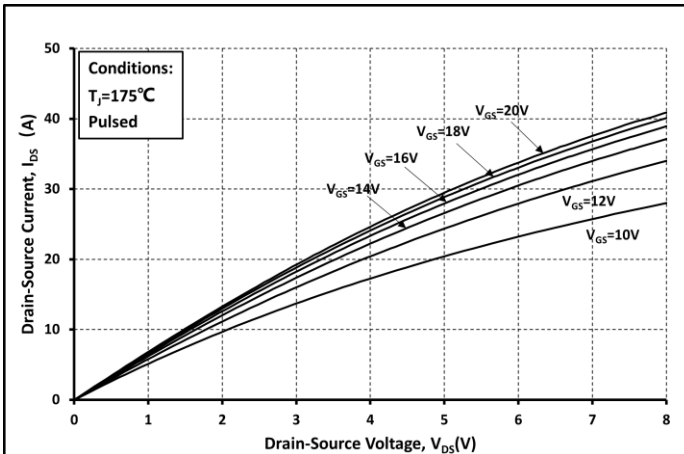


Fig. 3 Output Curve @ $T_j = 175^\circ\text{C}$

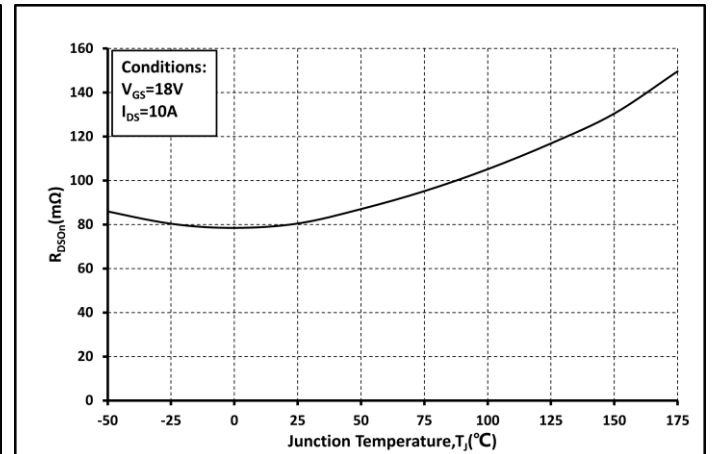


Fig. 4 R_{on} vs. Temperature

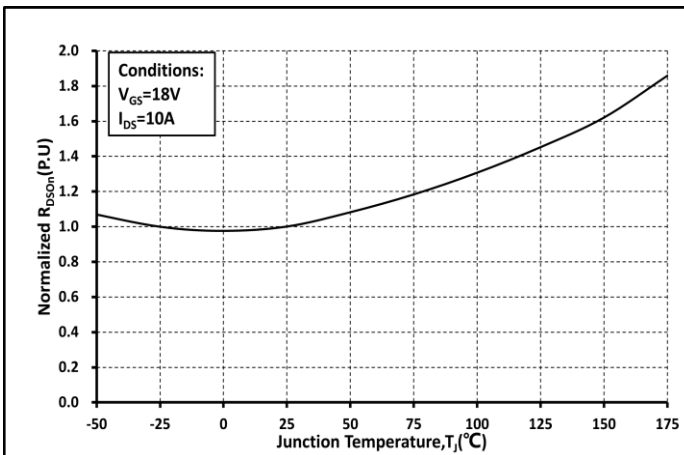


Fig. 5 Normalized R_{on} vs. Temperature

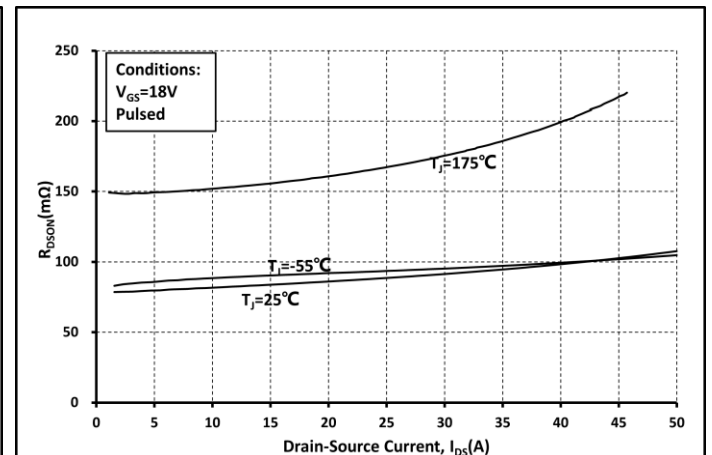


Fig. 6 R_{on} vs. I_{DS} @ Various Temperature

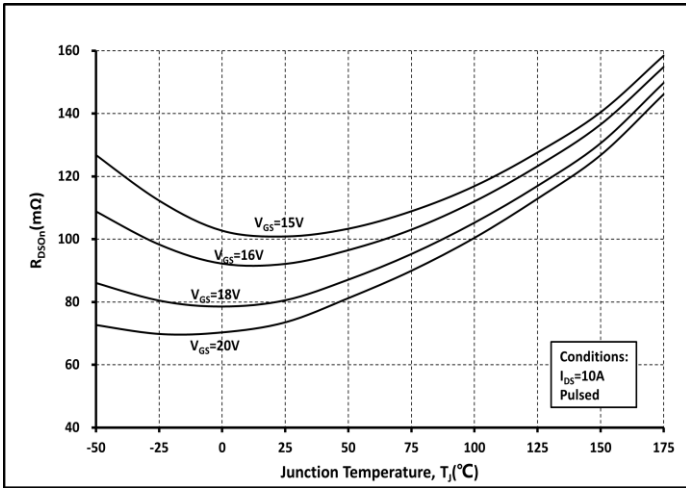


Fig. 7 Ron vs. Temperature @ Various V_{GS}

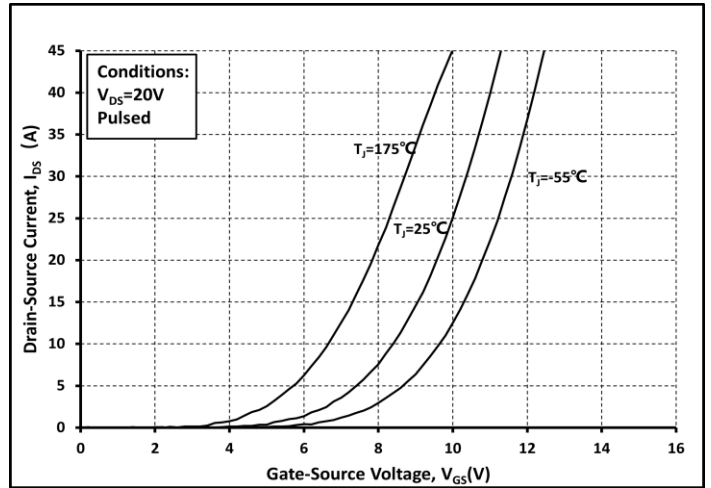


Fig. 8 Transfer Curves @ Various Temperature

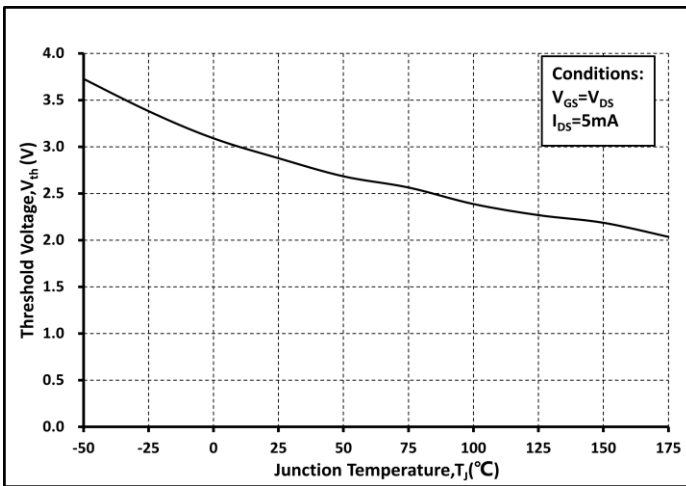


Fig. 9 Threshold Voltage vs. Temperature

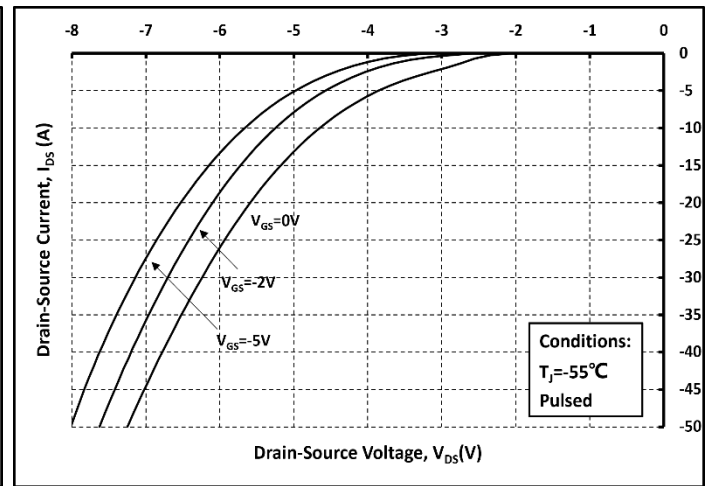


Fig. 10 Body Diode curves @ $T_J = -55^\circ\text{C}$

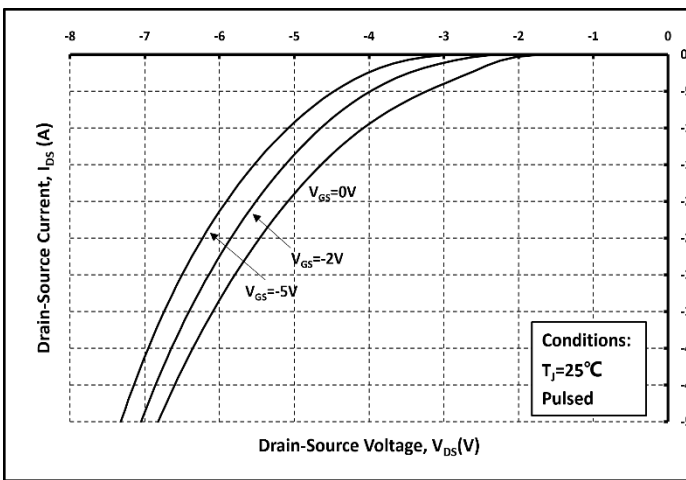


Fig. 11 Body Diode curves @ $T_J = 25^\circ\text{C}$

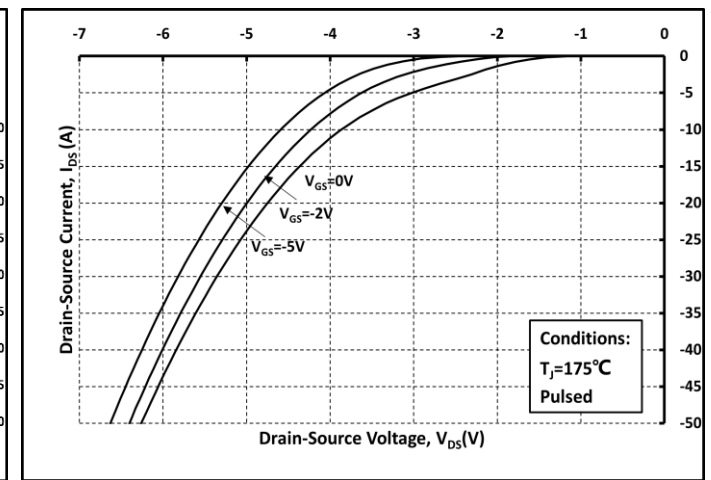


Fig. 12 Body Diode curves @ $T_J = 175^\circ\text{C}$

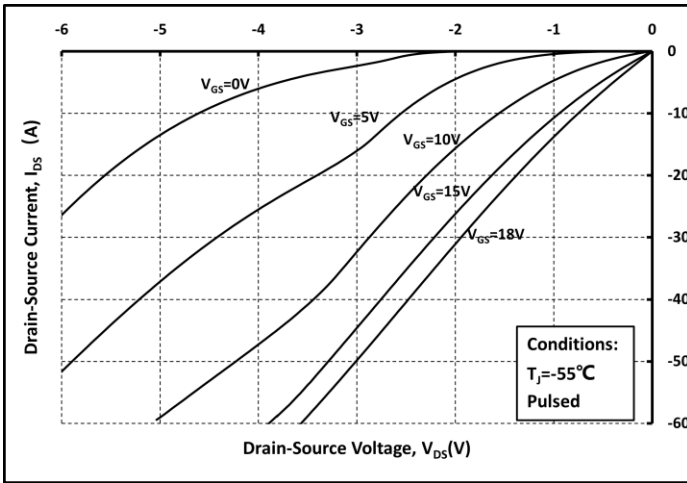


Fig. 13 3rd Quadrant curves @ $T_j = -55^\circ\text{C}$

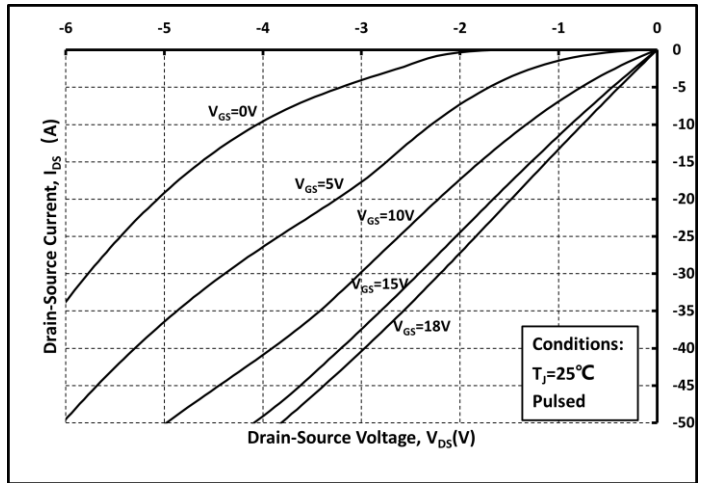


Fig. 14 3rd Quadrant curves @ $T_j = 25^\circ\text{C}$

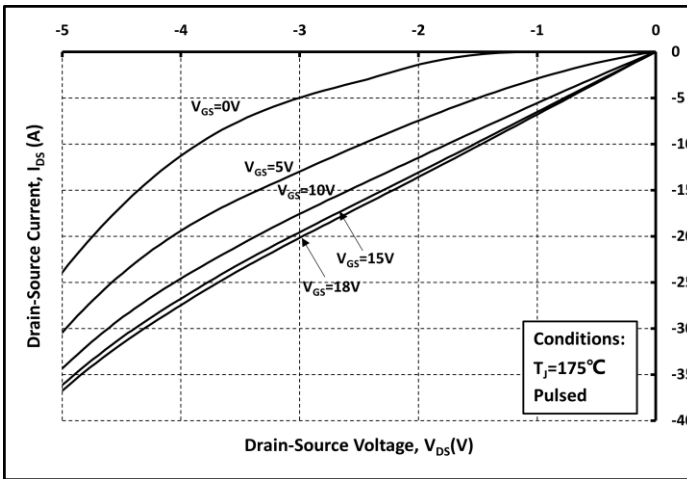


Fig. 15 3rd Quadrant curves @ $T_j = 175^\circ\text{C}$

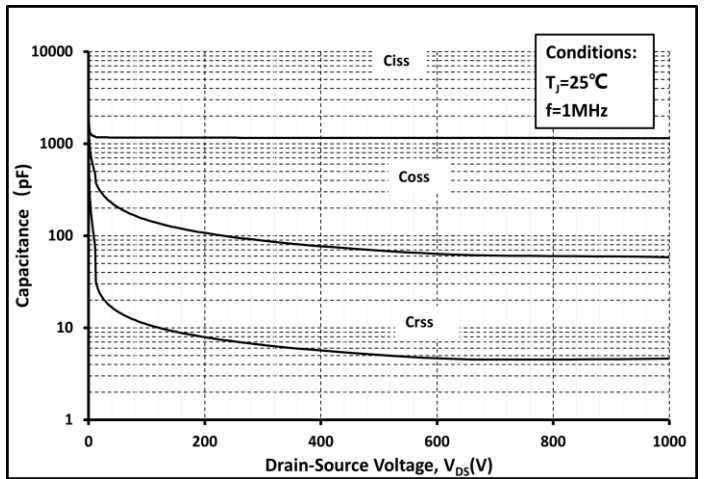


Fig. 16 Capacitance vs. V_{DS}

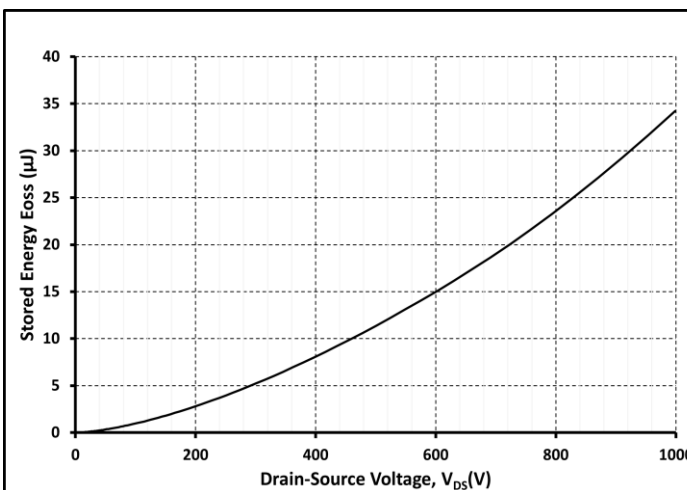


Fig. 17 Output Capacitor Stored Energy

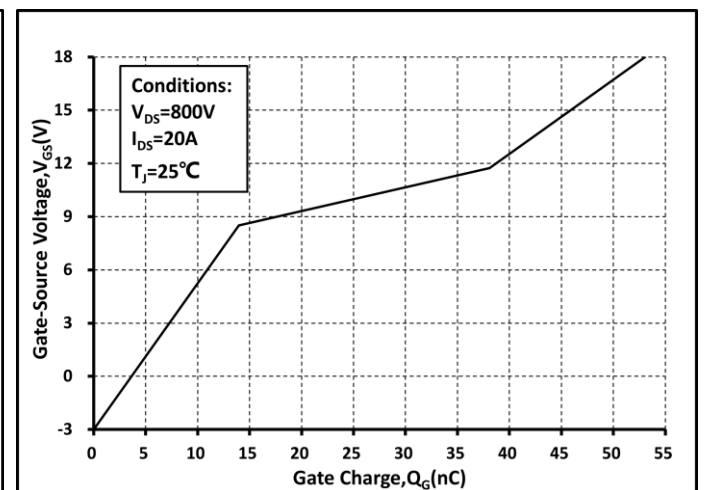


Fig. 18 Gate Charge Characteristics

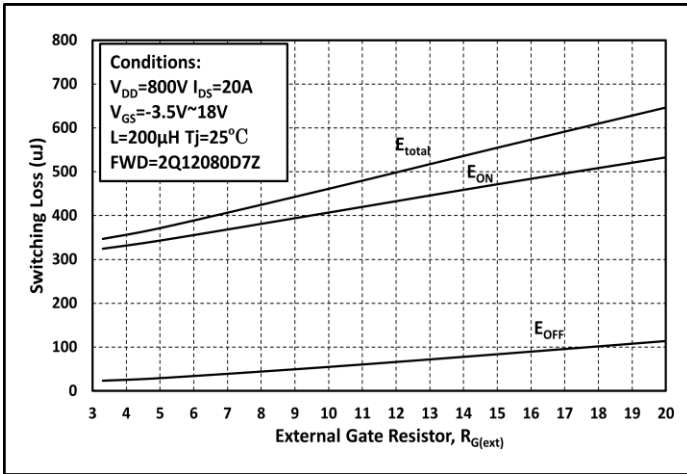


Fig. 19 Switching Energy vs. $R_{G(ext)}$

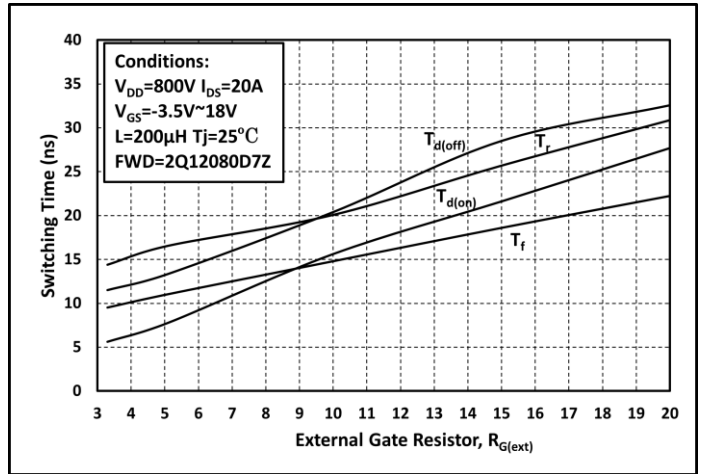


Fig. 20 Switching Times vs. $R_{G(ext)}$

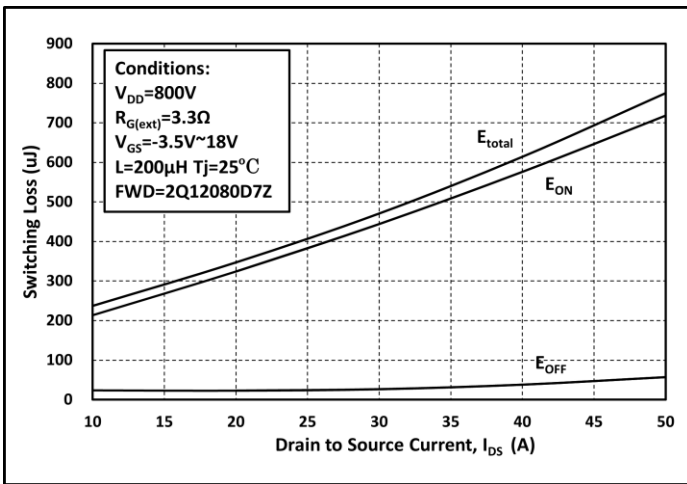


Fig. 21 Switching Energy vs. I_{DS}

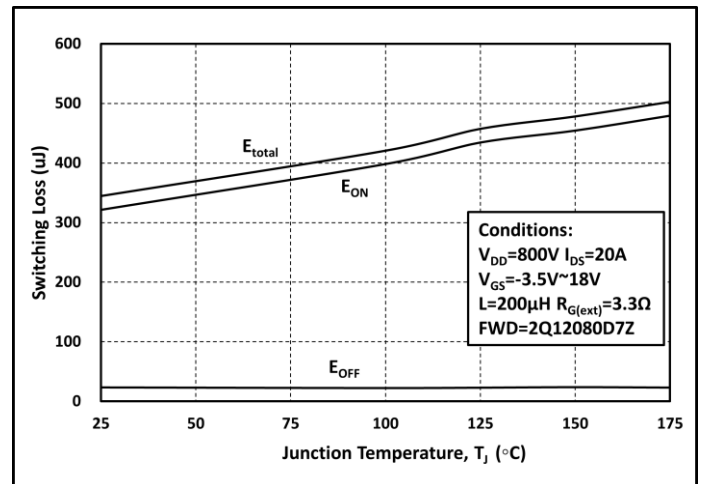


Fig. 22 Switching Energy vs. Temperature

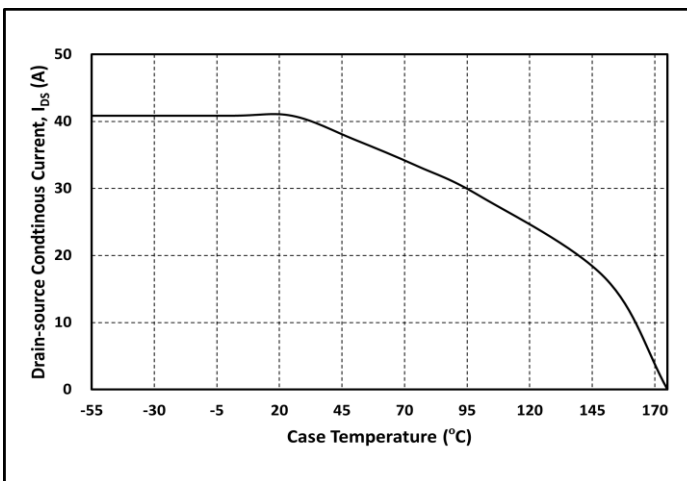


Fig. 23 Continuous Drain Current vs. Case Temperature

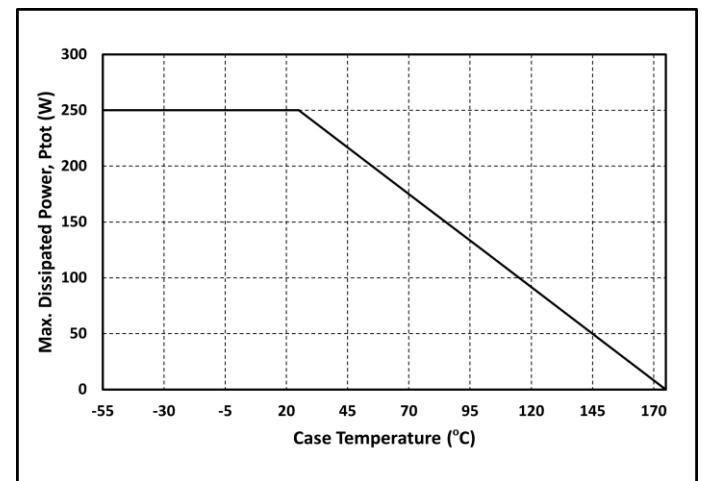


Fig. 24 Max. Power Dissipation Derating vs. Case Temperature

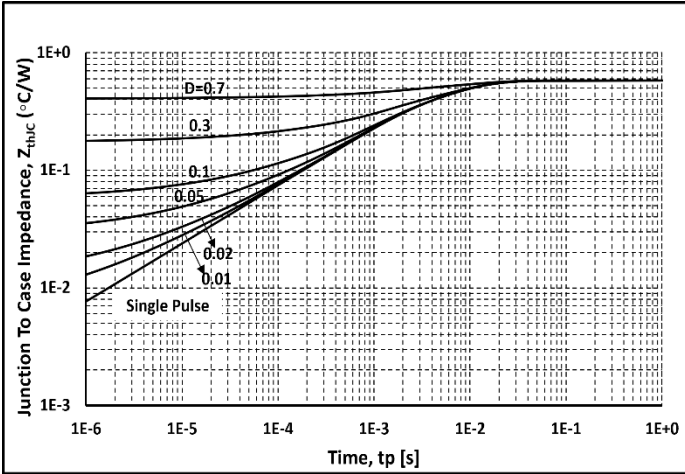


Fig. 25 Thermal impedance

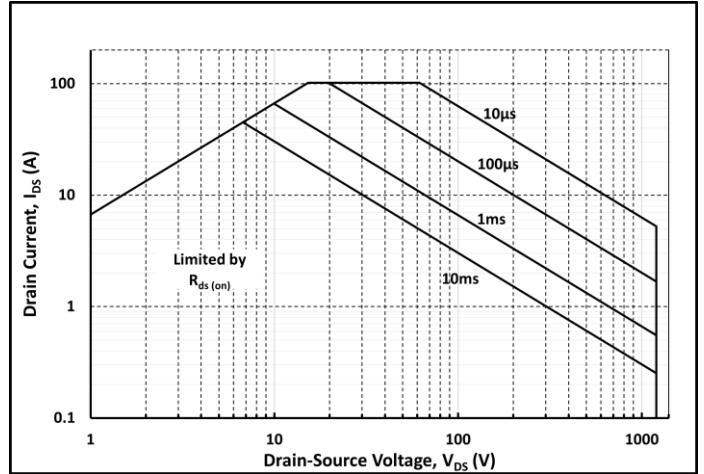
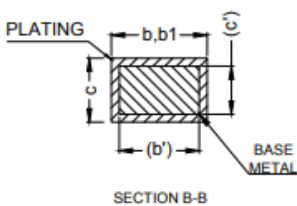
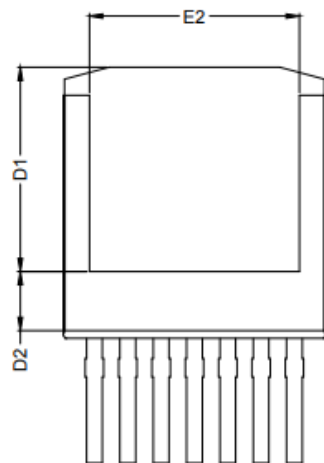
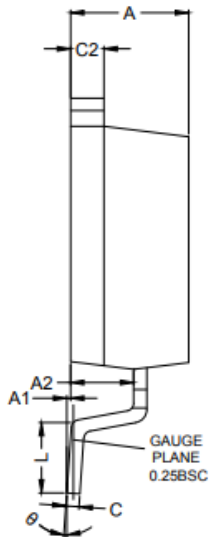
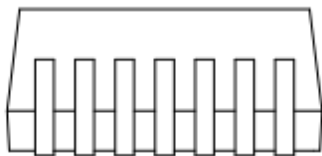
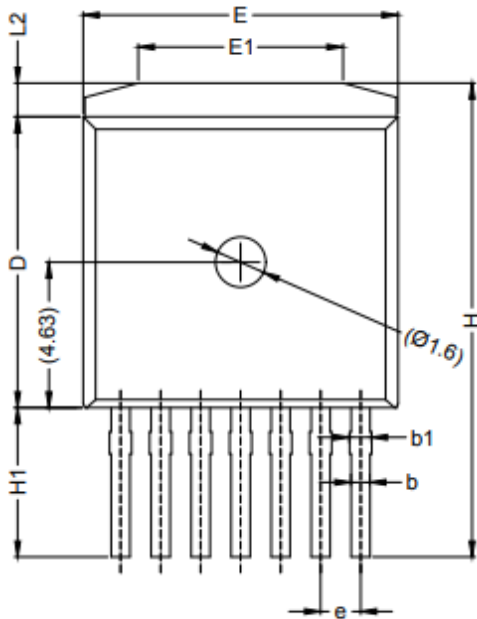


Fig. 26 Safe Operating Area

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