

IV1Q12160D7Z– 1200V 160mΩ Automotive SiC MOSFET

Features

- Low impedance package with driver source pin
- 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

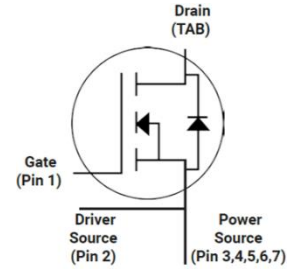
Applications

- Solar inverters
- EV battery chargers
- High voltage DC/DC converters
- Switch mode power supplies

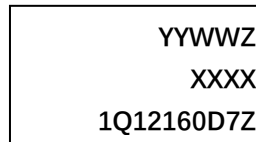
Outline:



TO263-7



Marking Diagram:



1Q12160D7Z = 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	$V_{GS}=0V, I_D=100\mu A$	
$V_{GSmax}(DC)$	Maximum DC voltage	-5 to 22	V	Static (DC)	
$V_{GSmax}(Spike)$	Maximum spike voltage	-10 to 25	V	<1% duty cycle, 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)	19	A	$V_{GS}=20V, T_c=25^\circ\text{C}$	Fig. 21
		14	A	$V_{GS}=20V, T_c=100^\circ\text{C}$	
I_{DM}	Drain current (pulsed)	47.5	A	Pulse width limited by SOA	Fig. 24
P_{TOT}	Total power dissipation	108	W	$T_c=25^\circ\text{C}$	Fig. 22
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	1.380	$^\circ\text{C/W}$	Fig. 23

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	5	V	$V_{GS}=V_{DS}, I_D=1.9\text{mA}$	Fig. 8, 9
			1.9			$V_{GS}=V_{DS}, I_D=1.9\text{mA}$ @ $T_c=175^\circ\text{C}$	
R_{ON}	Static drain-source on-resistance		160	195	$\text{m}\Omega$	$V_{GS}=20\text{V}, I_D=10\text{A}$ @ $T_J=25^\circ\text{C}$	Fig. 4, 5, 6, 7
			250		$\text{m}\Omega$	$V_{GS}=20\text{V}, I_D=10\text{A}$ @ $T_J=175^\circ\text{C}$	
C_{iss}	Input capacitance		885		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		38		pF		
C_{rss}	Reverse transfer capacitance		2		pF		
E_{oss}	C_{oss} stored energy		16		μJ		Fig. 17
Q_g	Total gate charge		43		nC	$V_{DS}=800\text{V}, I_D=10\text{A},$ $V_{GS}=-5\text{ to }20\text{V}$	Fig. 18
Q_{gs}	Gate-source charge		9		nC		
Q_{gd}	Gate-drain charge		19		nC		
R_g	Gate input resistance		9.5		Ω	$f=1\text{MHz}$	
E_{ON}	Turn-on switching energy		115.6		μJ	$V_{DS}=800\text{V}, I_D=10\text{A},$ $V_{GS}=-3.5\text{ to }20\text{V}$ $R_{G(\text{ext})}=5\Omega$ $L=270\mu\text{H}$	Fig. 19, 20
E_{OFF}	Turn-off switching energy		25.9		μJ		
$t_{d(\text{on})}$	Turn-on delay time		4.8		ns		
t_r	Rise time		9.8				
$t_{d(\text{off})}$	Turn-off delay time		12.8				
t_f	Fall time		12.1				

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		4.1		V	$I_{SD}=5\text{A}, V_{GS}=0\text{V}$	Fig. 10, 11, 12
			3.7		V	$I_{SD}=5\text{A}, V_{GS}=0\text{V},$ $T_J=175^\circ\text{C}$	
t_{rr}	Reverse recovery time		32.7		ns	$V_{DS}=800\text{V}, I_D=10\text{A},$ $V_{GS}=-3.5\text{ to }20\text{V}$	
Q_{rr}	Reverse recovery charge		86.0		nC	$R_{G(\text{ext})}=24\Omega$	
I_{RRM}	Peak reverse recovery current		7.6		A	$di/dt=2\text{A/ns}$ $L=270\mu\text{H}$	

Typical Performance (curves)

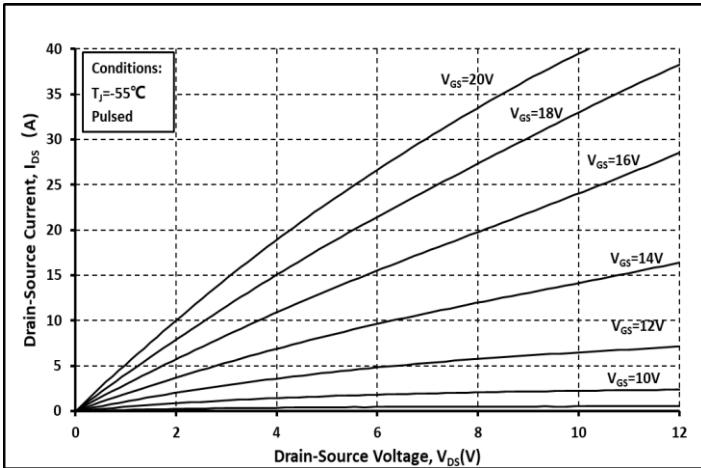


Fig. 1 Output Curve @ $T_j = -55^\circ\text{C}$

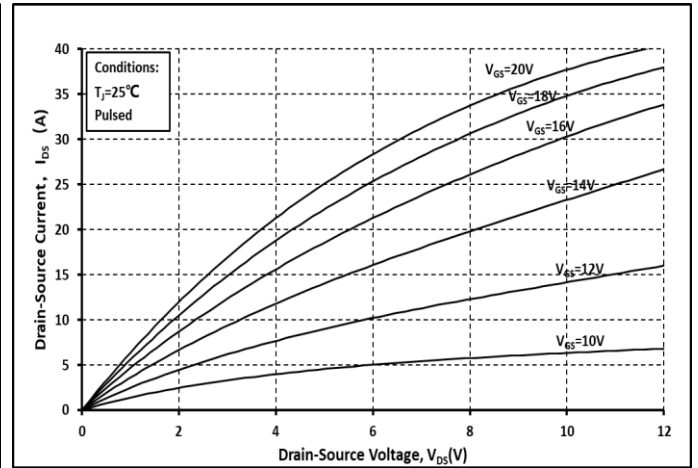


Fig. 2 Output Curve @ $T_j = 25^\circ\text{C}$

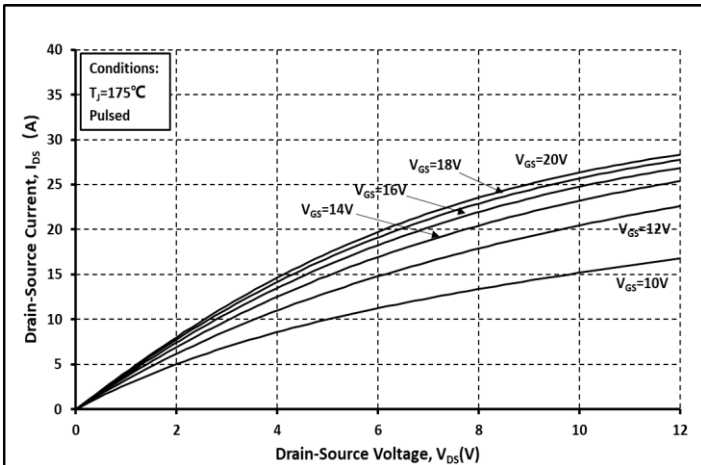


Fig. 3 Output Curve @ $T_j = 175^\circ\text{C}$

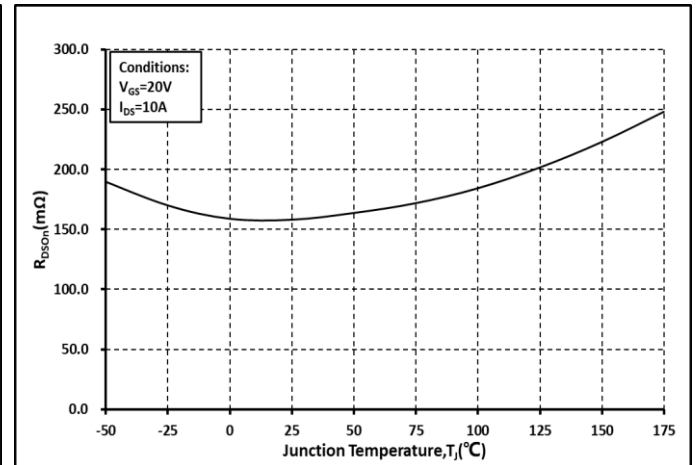


Fig. 4 R_{on} vs. Temperature

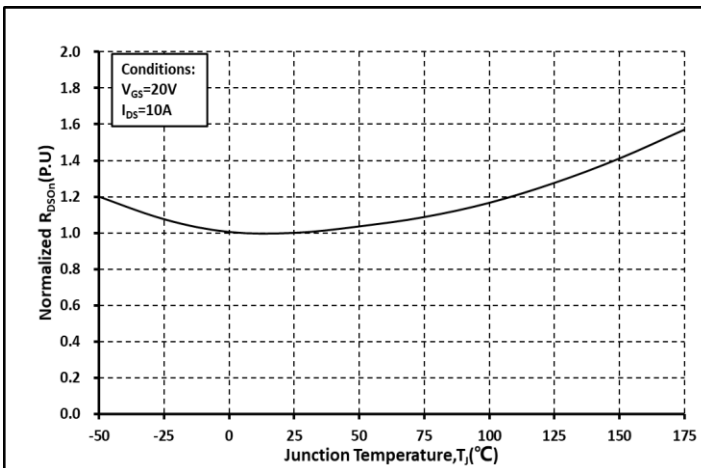


Fig. 5 Normalized R_{on} vs. Temperature

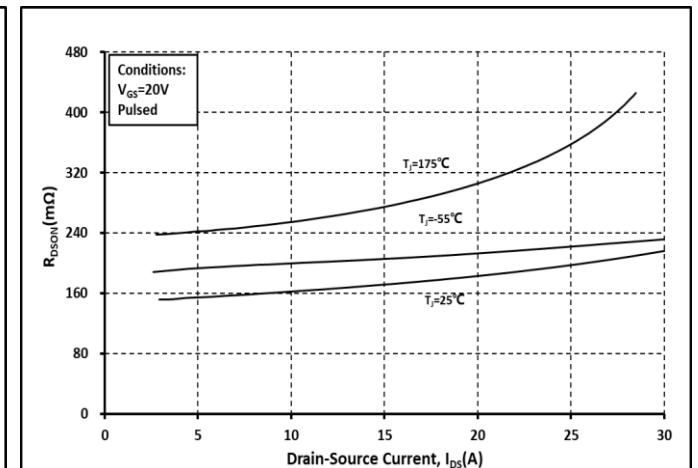


Fig. 6 R_{on} vs. I_{DS} @ Various Temperature

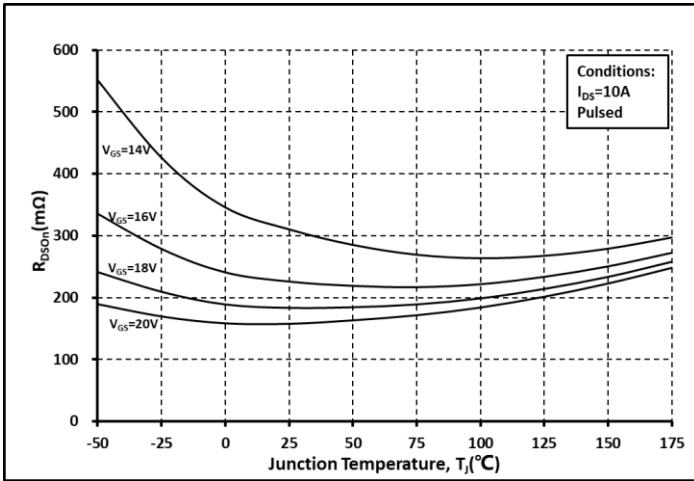


Fig. 7 Ron vs. Temperature @ Various V_{GS}

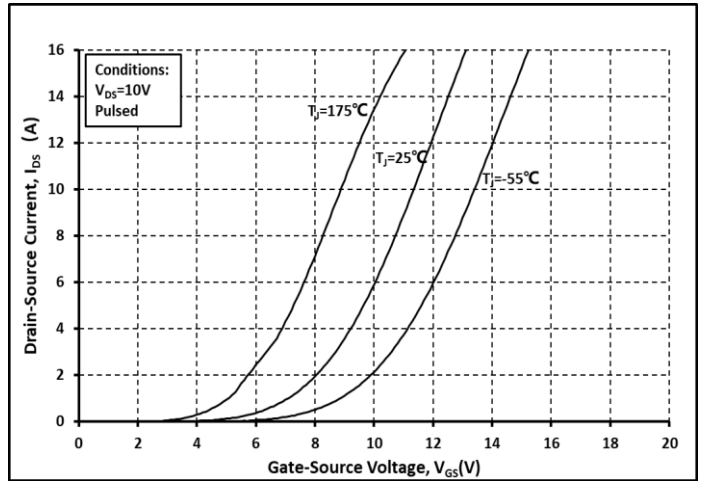


Fig. 8 Transfer Curves @ Various Temperature

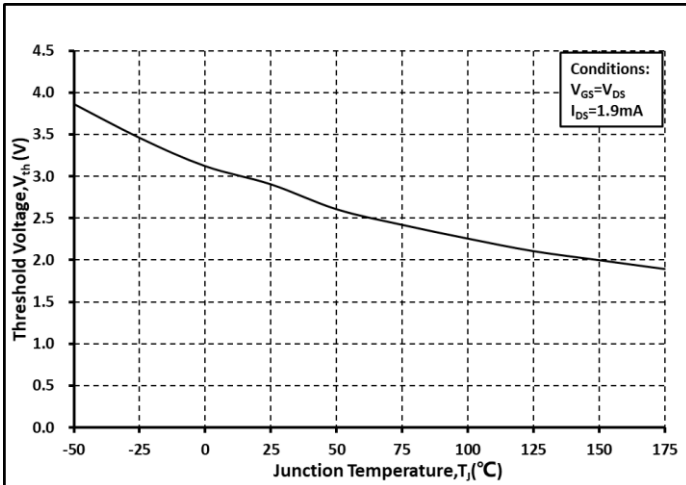


Fig. 9 Threshold Voltage vs. Temperature

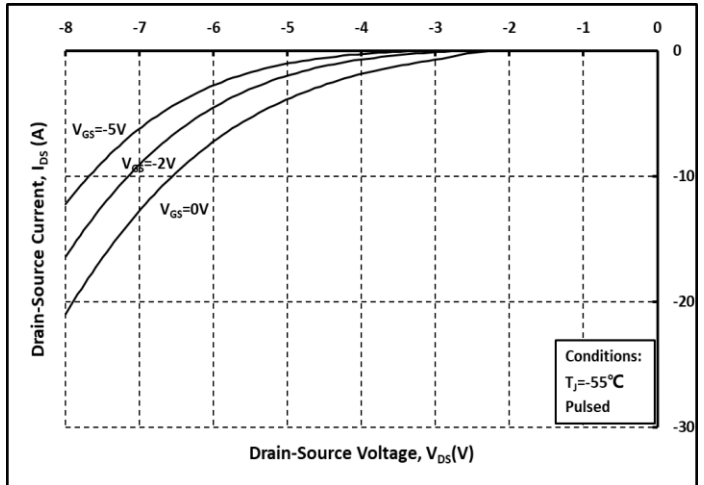


Fig. 10 Body Diode Curves @ $T_J=-55^{\circ}C$

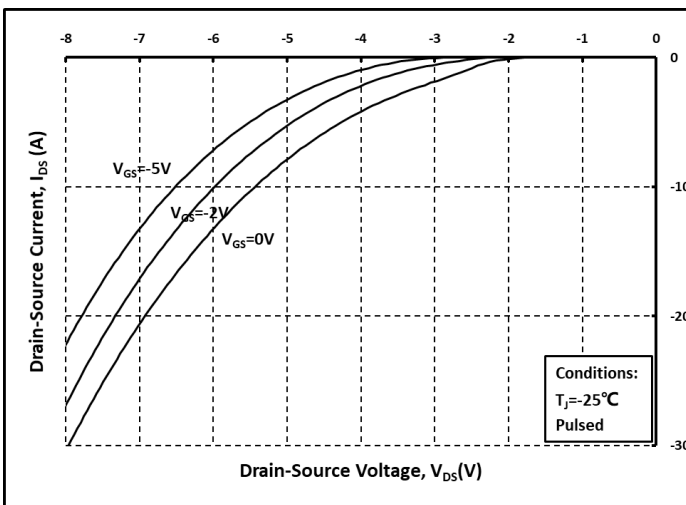


Fig. 11 Body Diode Curves @ $T_J=25^{\circ}C$

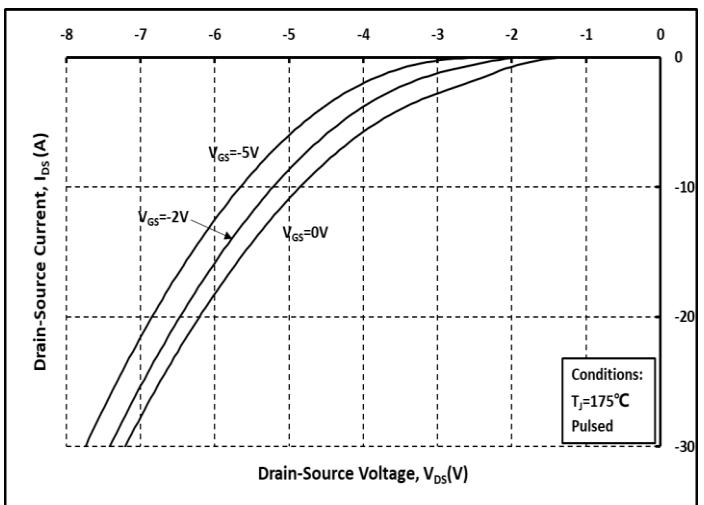


Fig. 12 Body Diode Curves @ $T_J=175^{\circ}C$

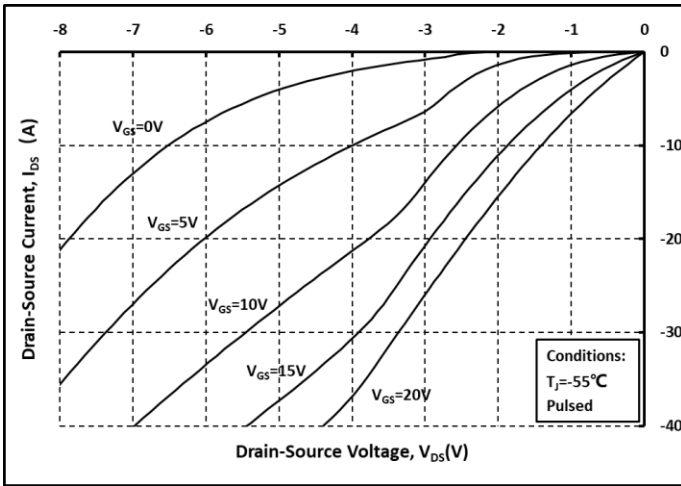


Fig. 13 3rd Quadrant Curves @ $T_j = -55^\circ\text{C}$

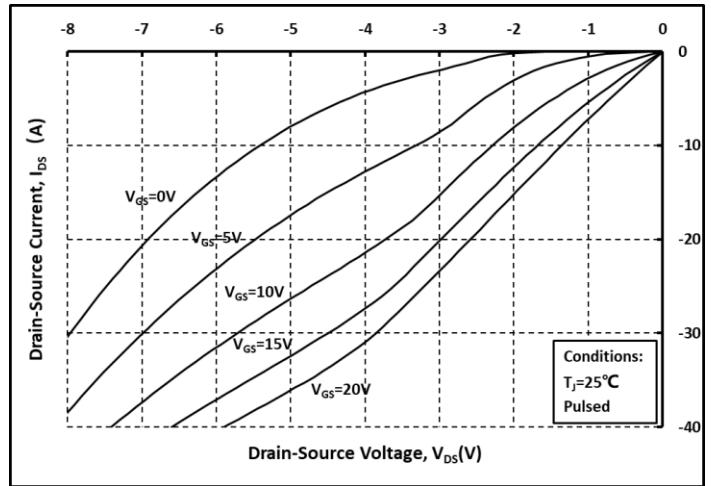


Fig. 14 3rd Quadrant Curves @ $T_j = 25^\circ\text{C}$

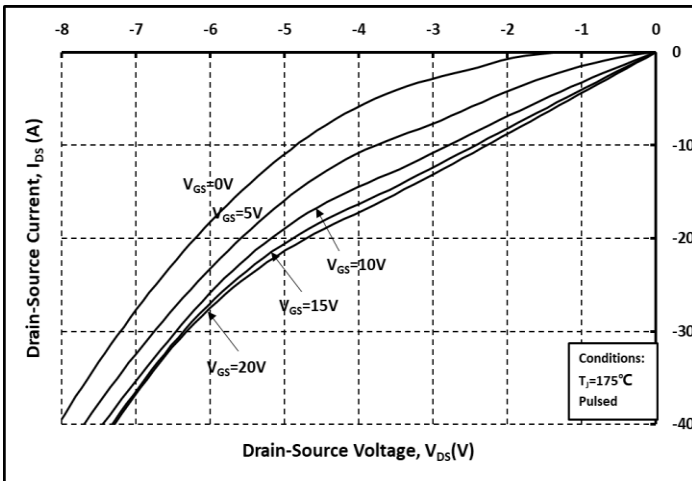


Fig. 15 3rd Quadrant Curves @ $T_j = 175^\circ\text{C}$

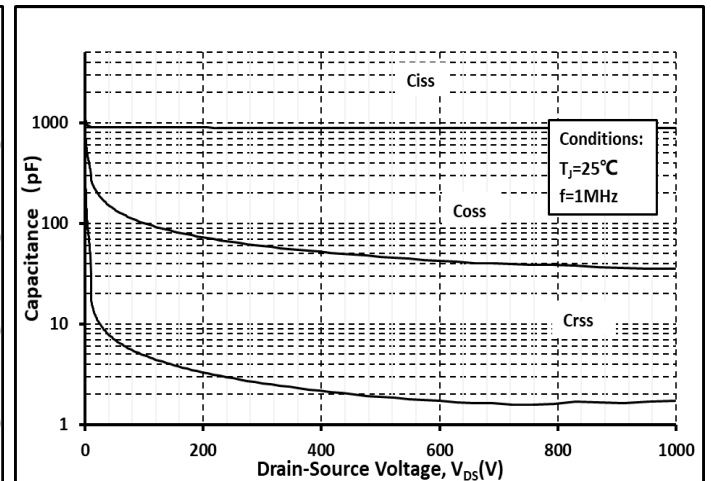


Fig. 16 Capacitance vs. V_{DS}

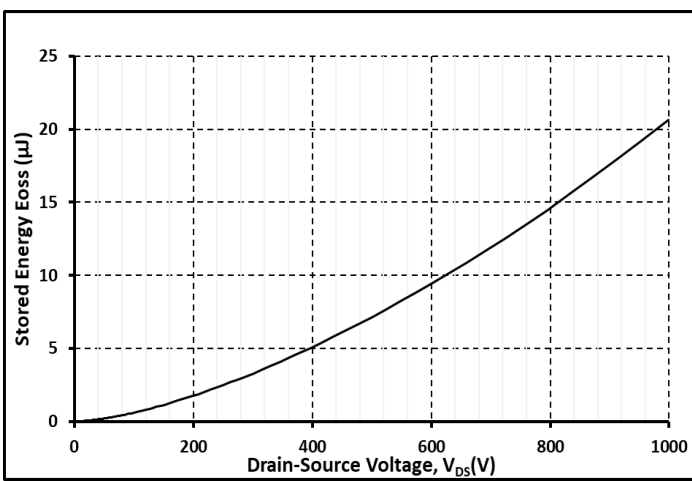


Fig. 17 Output Capacitor Stored Energy

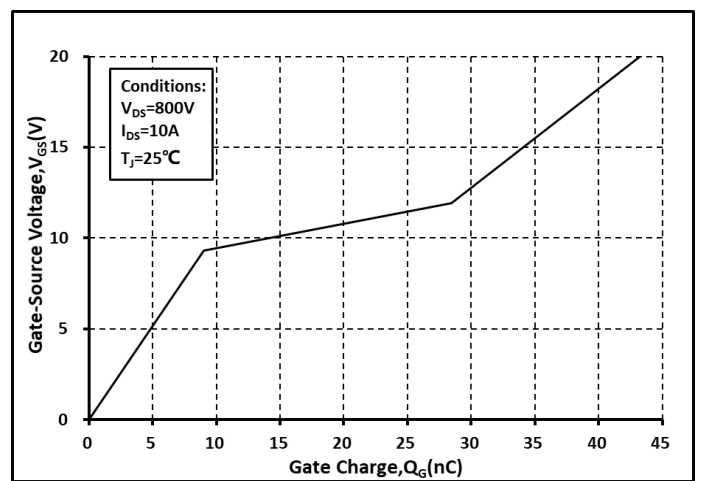


Fig. 18 Gate Charge Characteristics

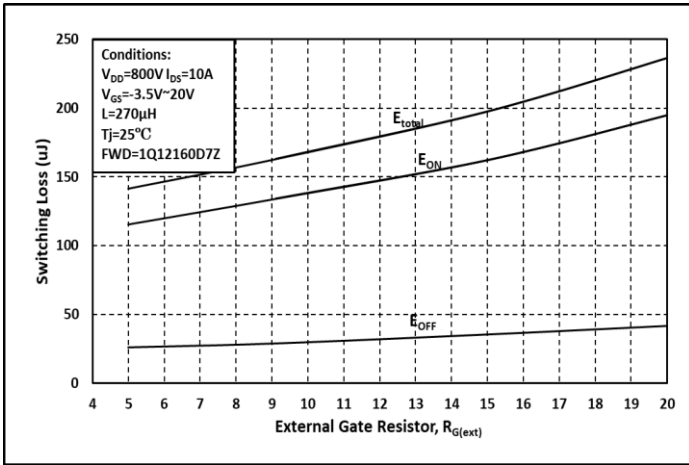


Fig. 19 Switching Energy vs. $R_{G(ext)}$

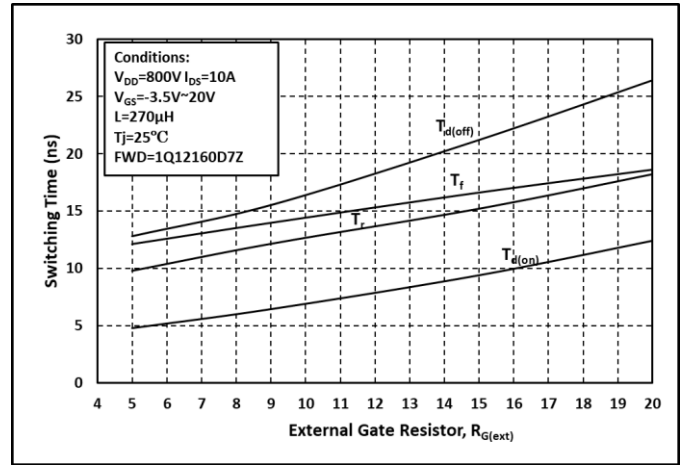


Fig. 20 Switching Times vs. $R_{G(ext)}$

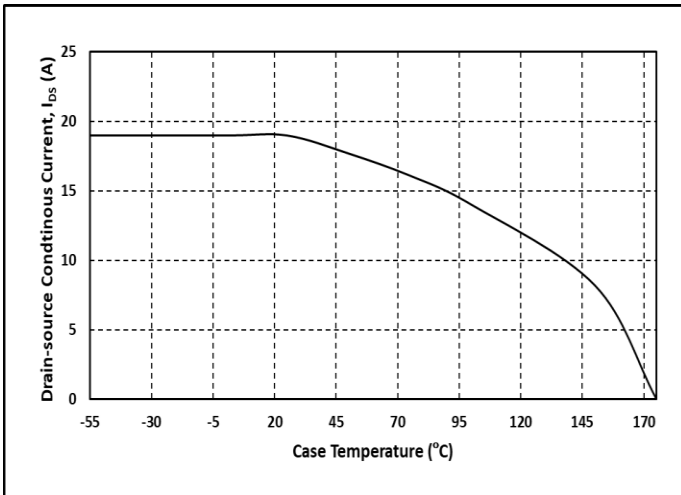


Fig. 21 Continuous Drain Current vs. Case Temperature

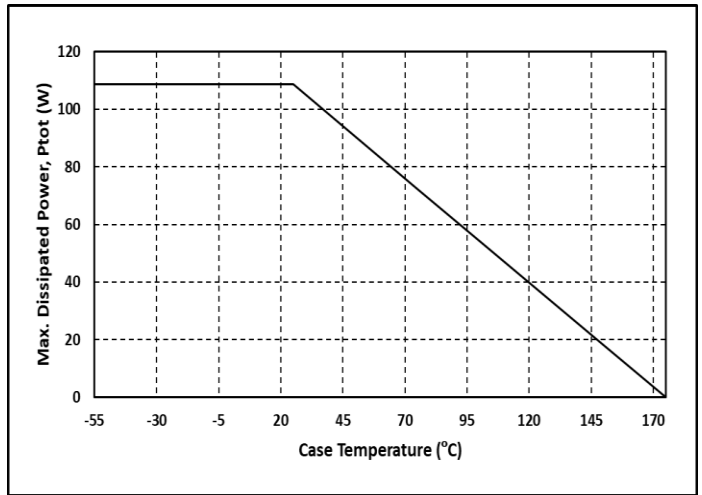


Fig. 22 Max. Power Dissipation Derating vs. Case Temperature

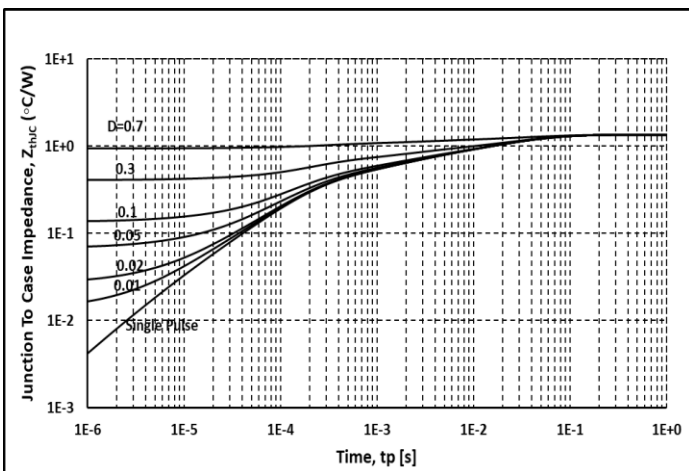


Fig. 23 Thermal Impedance

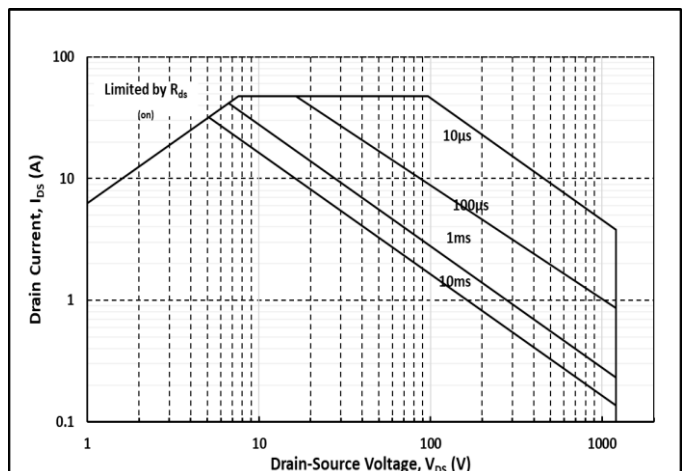
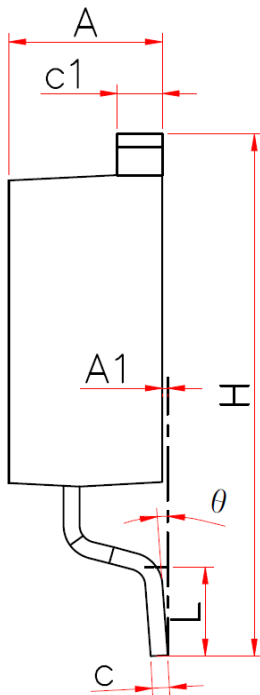
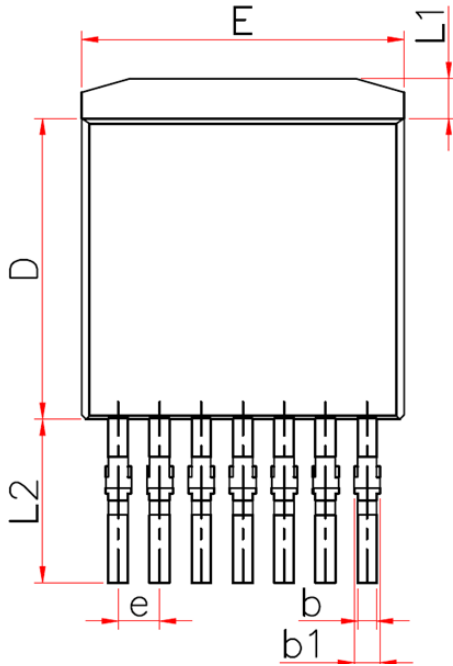
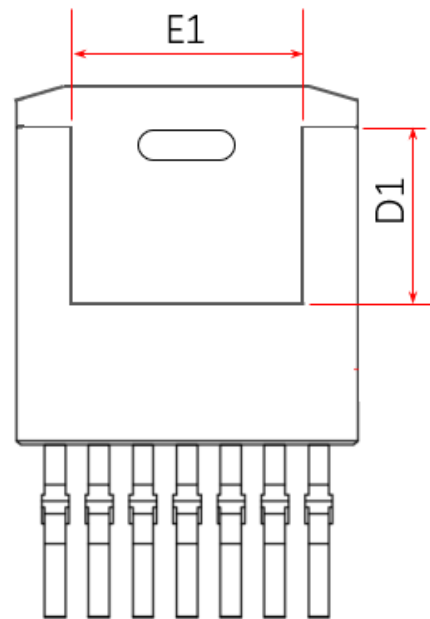


Fig. 24 Safe Operating Area

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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