

IV1Q12160T3 – 1200V 160mΩ SiC MOSFET

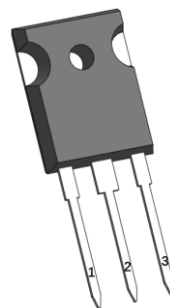
Features

- 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

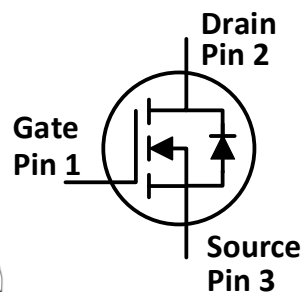
Applications

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

Outline:



TO247-3



Marking Diagram:

1Q12160T3
YYWWZ
XXXX

1Q12160T3 = 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	1200	V	V _{GS} =0V, I _D =100μA	
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°C	Fig. 21
		14	A	V _{GS} =20V, T _c =100°C	
I _{DM}	Drain current (pulsed)	48	A	Pulse width limited by SOA	Fig. 24
P _{TOT}	Total power dissipation	134	W	T _c =25°C	Fig. 22
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 _{θ(j-c)}	Thermal Resistance from Junction to Case	1.122	°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		5	100	μA	V _{DS} =1200V, V _{GS} =0V	
I _{GSS}	Gate leakage current			±100	nA	V _{DS} =0V, V _{GS} = -5~20V	
V _{TH}	Gate threshold voltage	1.8	2.9	5	V	V _{GS} =V _{DS} , I _D =1.9mA	Fig. 8, 9
			1.9		V	V _{GS} =V _{DS} , I _D =1.9mA @ T _J =175°C	
R _{ON}	Static drain-source on-resistance		160	195	mΩ	V _{GS} =20V, I _D =10A @T _J =25°C	Fig. 4, 5, 6, 7
			285		mΩ	V _{GS} =20V, I _D =10A @T _J =175°C	
C _{iss}	Input capacitance		895		pF	V _{DS} =800V, V _{GS} =0V, f=1MHz, V _{AC} =25mV	Fig. 16
C _{oss}	Output capacitance		43		pF		
C _{rss}	Reverse transfer capacitance		2		pF		Fig. 17
E _{oss}	C _{oss} stored energy		4.2		μJ		
Q _g	Total gate charge		43		nC	V _{DS} =800V, I _D =10A, V _{GS} = -5 to 20V	Fig. 18
Q _{gs}	Gate-source charge		9		nC		
Q _{gd}	Gate-drain charge		19		nC		
R _g	Gate input resistance		8.5		Ω	f=1MHz	
E _{ON}	Turn-on switching energy		204		μJ	V _{DS} =800V, I _D =10A, V _{GS} = -2 to 20V, R _{G(ext)} =3.3Ω, L=450μH	Fig. 19, 20
E _{OFF}	Turn-off switching energy		34.4		μJ		
t _{d(on)}	Turn-on delay time		15.2		ns		
t _r	Rise time		14.4				
t _{d(off)}	Turn-off delay time		11.3				
t _f	Fall time		13.1				

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} =5A, V _{GS} =0V	Fig. 10, 11, 12
			3.7		V	I _{SD} =5A, V _{GS} =0V, T _J =175°C	
t _{rr}	Reverse recovery time		33.2		ns	V _{GS} = -2V/+20V, I _{SD} =10A, V _R =800V, di/dt=1000A/us, R _{G(ext)} =13Ω	
Q _{rr}	Reverse recovery charge		101.5		nC		
I _{RRM}	Peak reverse recovery current		5.6		A		

Typical Performance (curves)

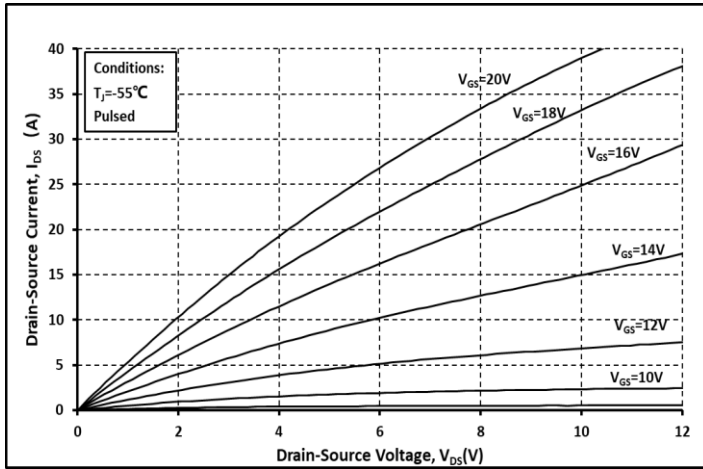


Fig. 1 Output Curve @ $T_j = -55^\circ\text{C}$

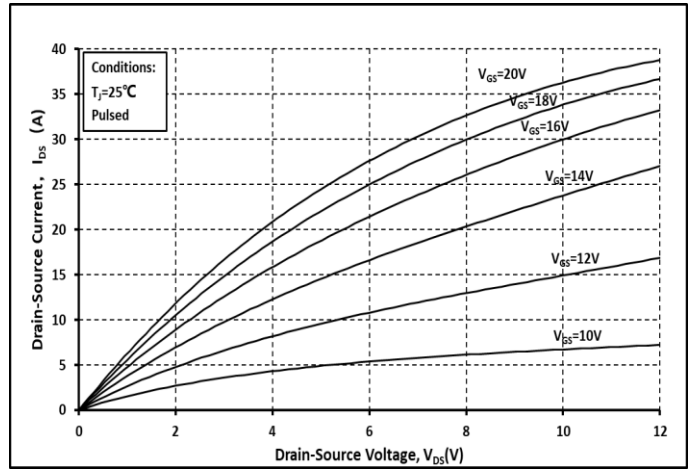


Fig. 2 Output Curve @ $T_j = 25^\circ\text{C}$

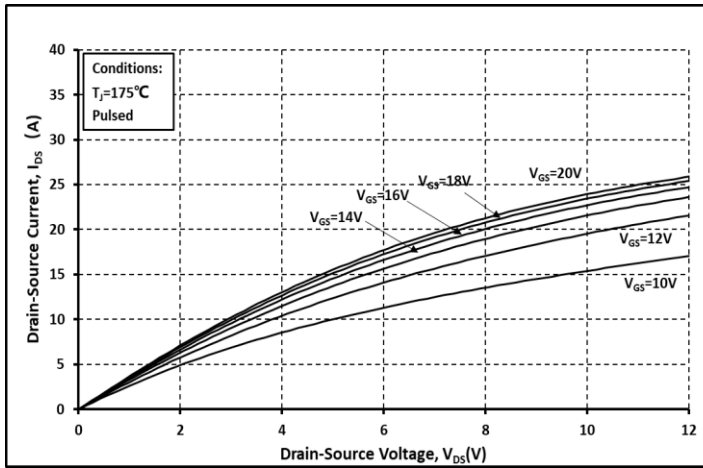


Fig. 3 Output Curve @ $T_j = 175^\circ\text{C}$

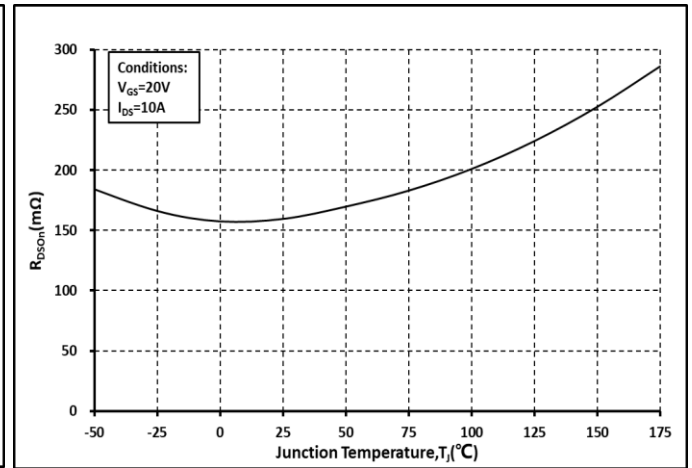


Fig. 4 R_{on} vs. Temperature

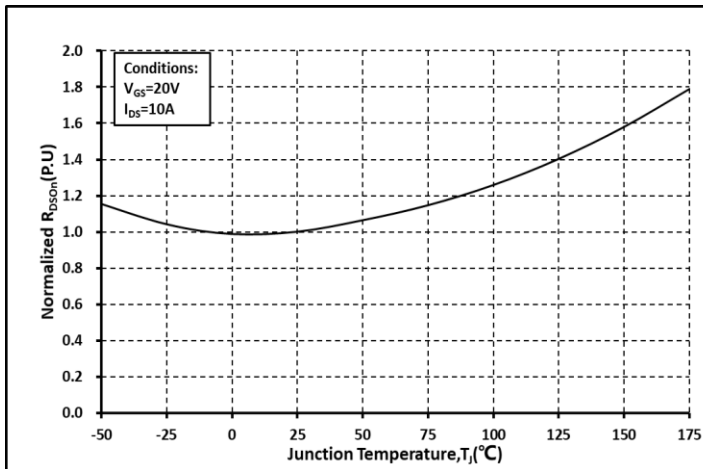


Fig. 5 Normalized R_{on} vs. Temperature

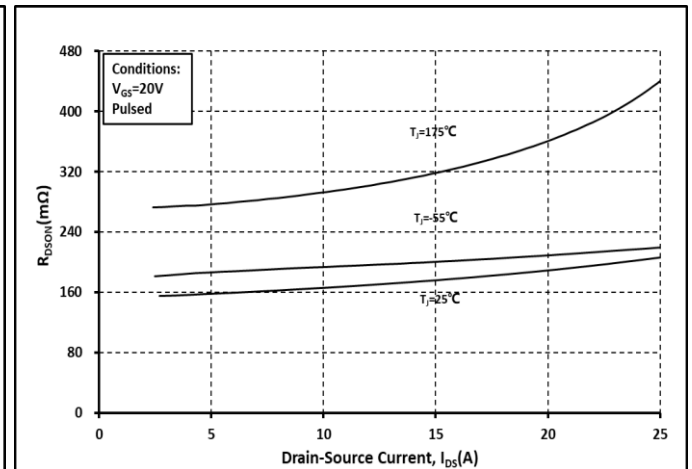


Fig. 6 R_{on} vs. I_{DS} @ Various Temperature

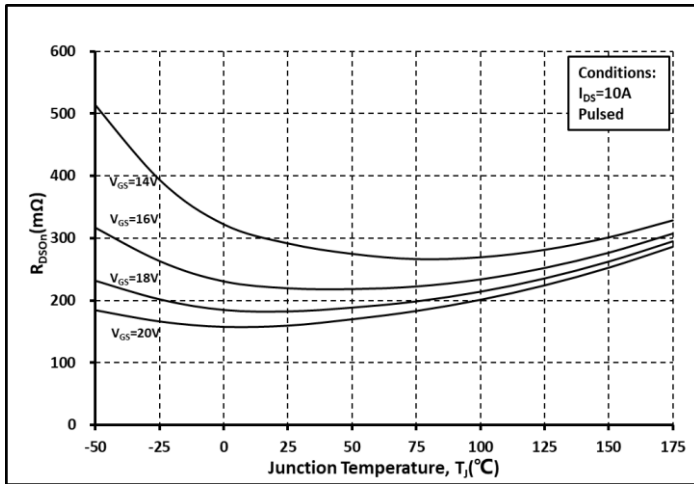


Fig. 7 Ron vs. Temperature @ Various V_{GS}

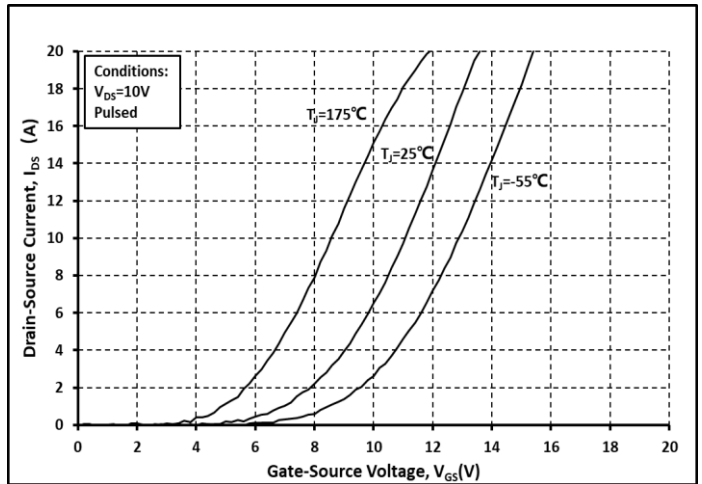


Fig. 8 Transfer Curves @ Various Temperature

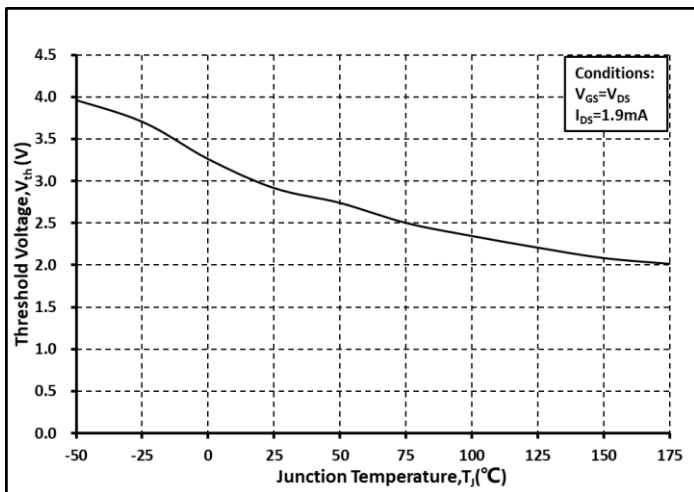


Fig. 9 Threshold Voltage vs. Temperature

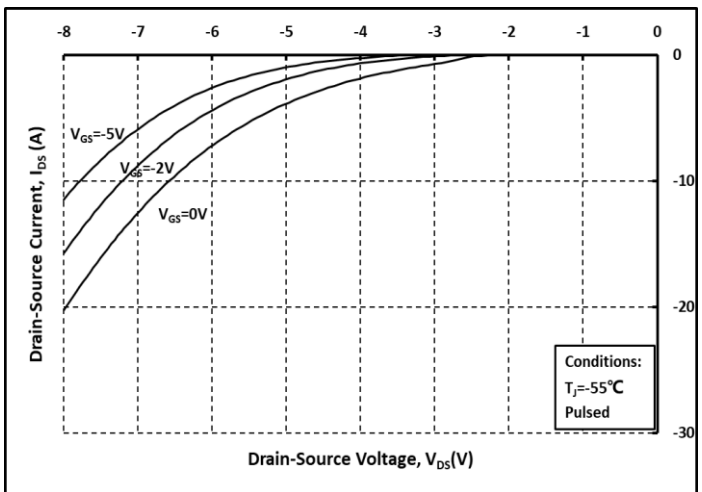


Fig. 10 Body Diode Curves @ $T_J = -55^\circ\text{C}$

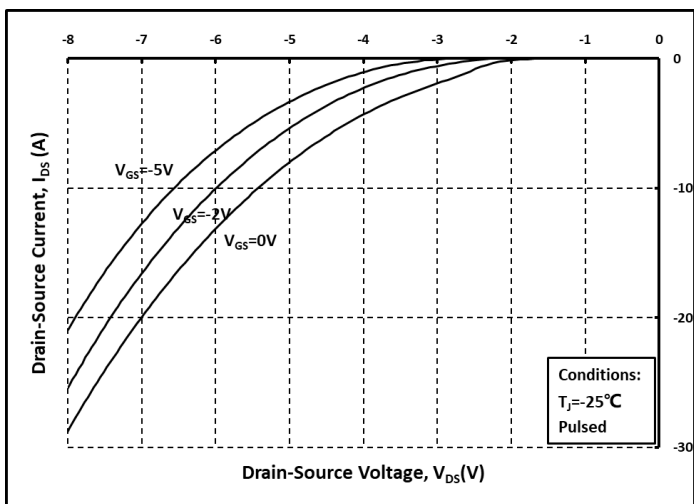


Fig. 11 Body Diode Curves @ $T_J = 25^\circ\text{C}$

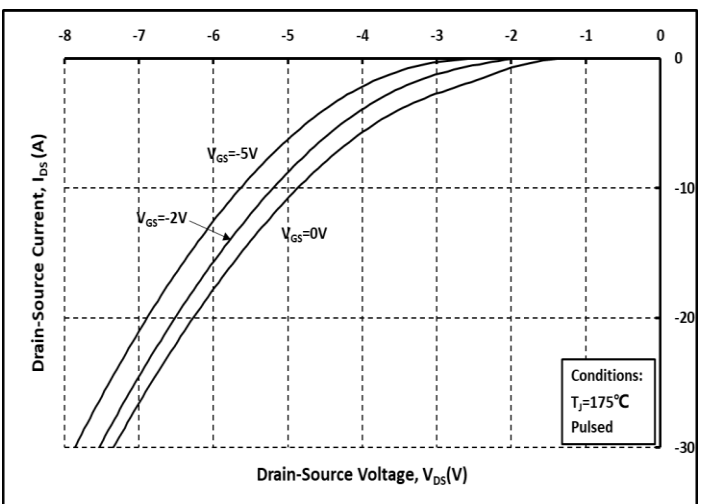


Fig. 12 Body Diode Curves @ $T_J = 175^\circ\text{C}$

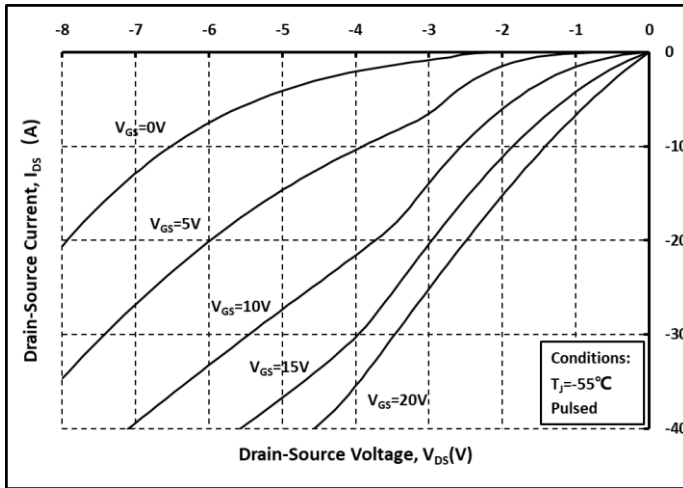


Fig. 13 3rd Quadrant Curves @ $T_j = -55^\circ\text{C}$

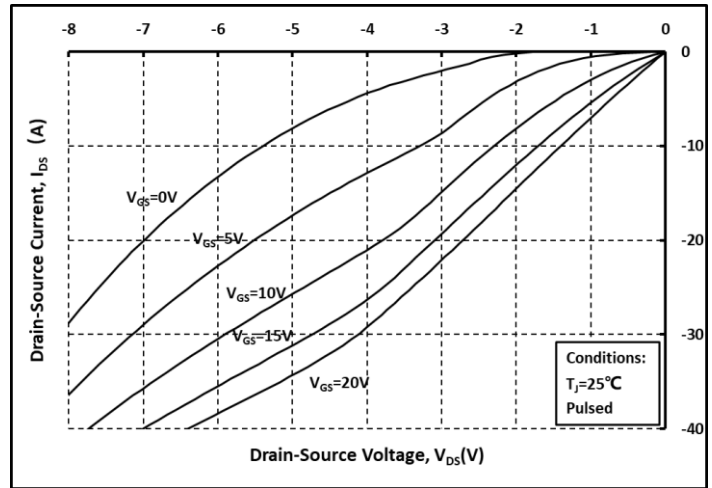


Fig. 14 3rd Quadrant Curves @ $T_j = 25^\circ\text{C}$

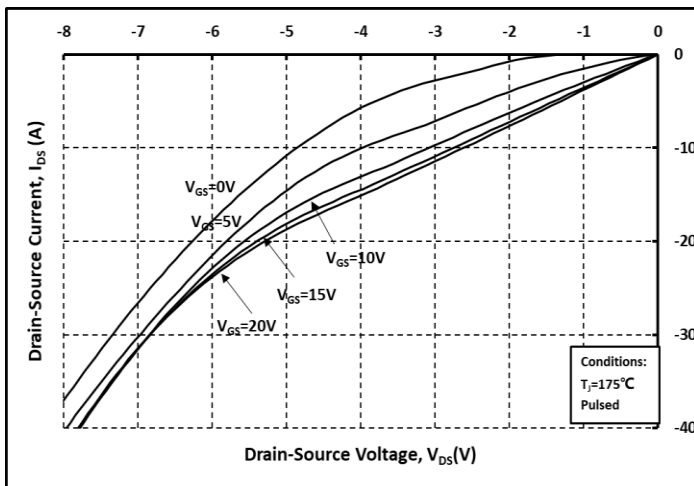


Fig. 15 3rd Quadrant Curves @ $T_j = 175^\circ\text{C}$

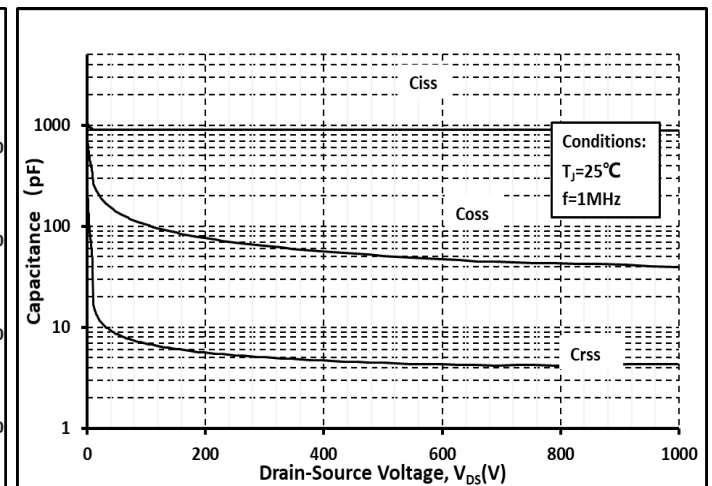


Fig. 16 Capacitance vs. V_{DS}

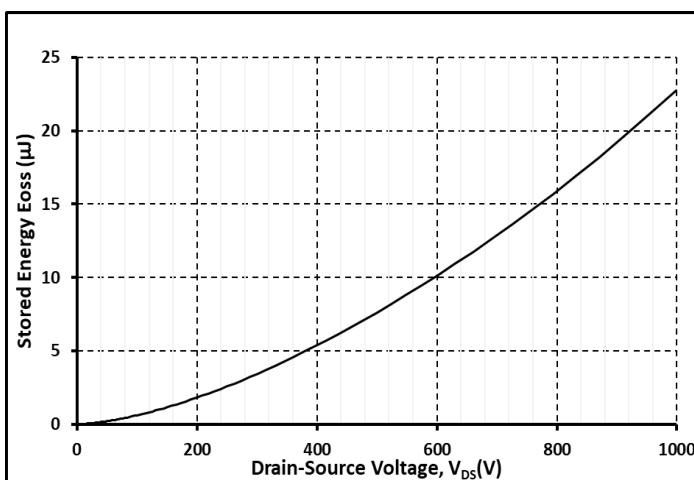


Fig. 17 Output Capacitor Stored Energy

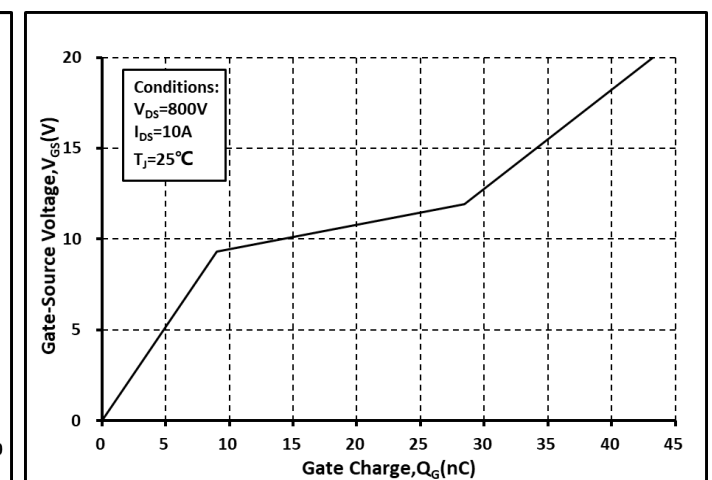


Fig. 18 Gate Charge Characteristics

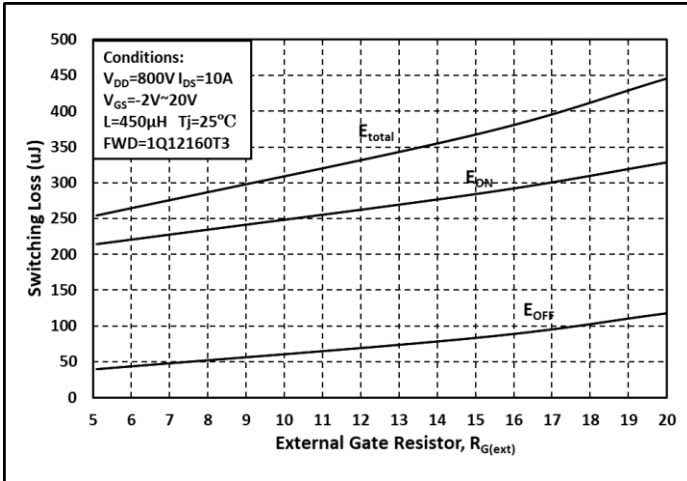


Fig. 19 Switching Energy vs. $R_{G(ext)}$

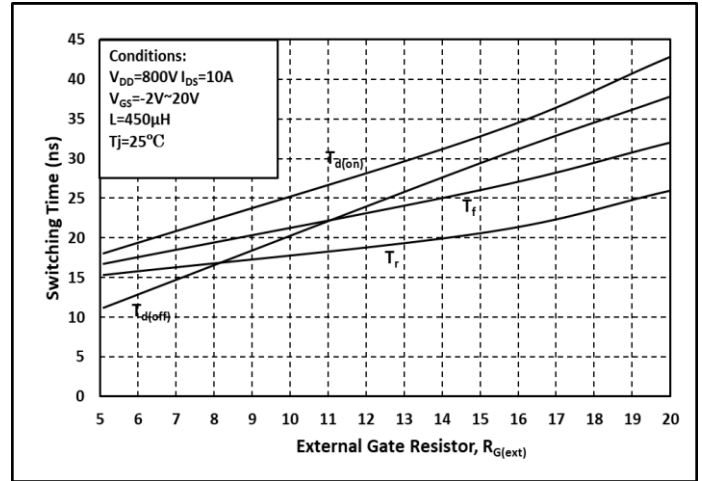


Fig. 20 Switching Times vs. $R_{G(ext)}$

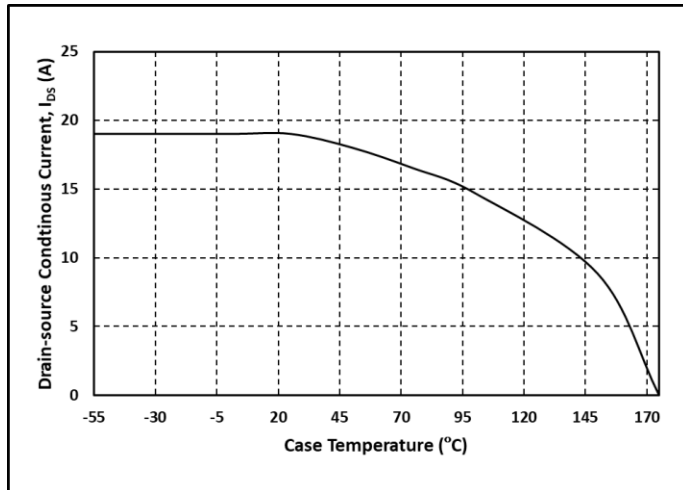


Fig. 21 Continuous Drain Current vs. Case Temperature

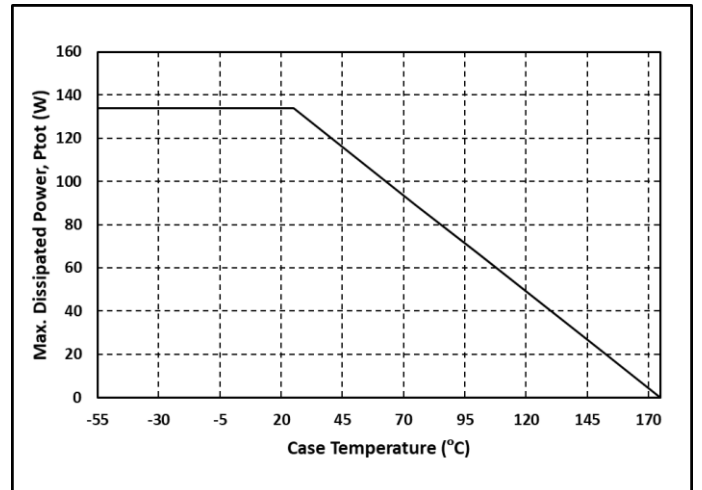


Fig. 22 Max. Power Dissipation Derating vs. Case Temperature

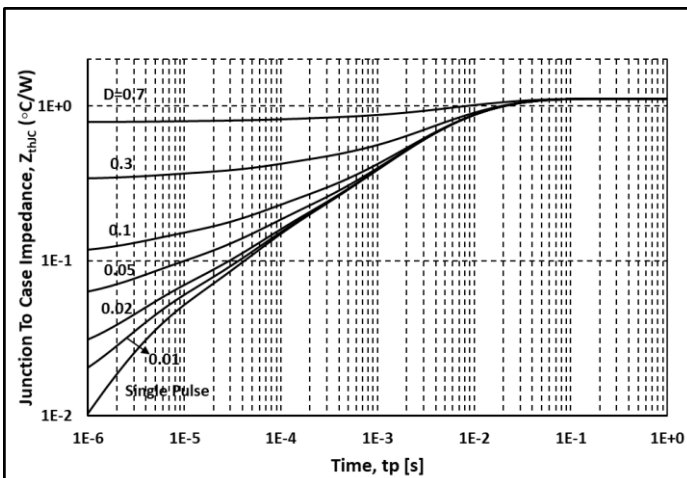


Fig. 23 Thermal Impedance

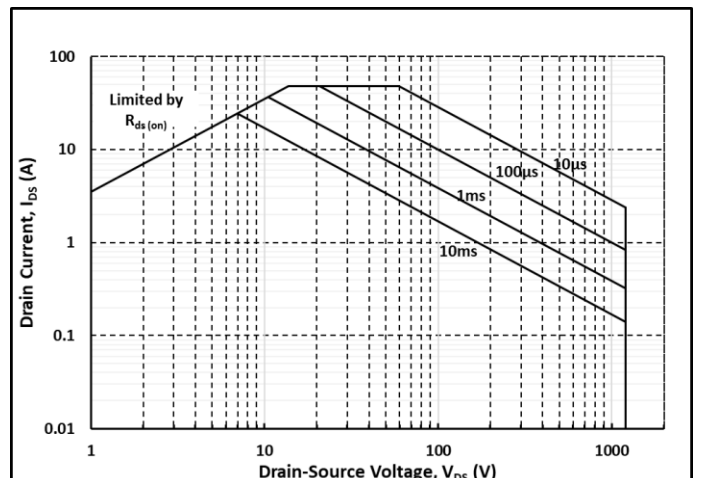
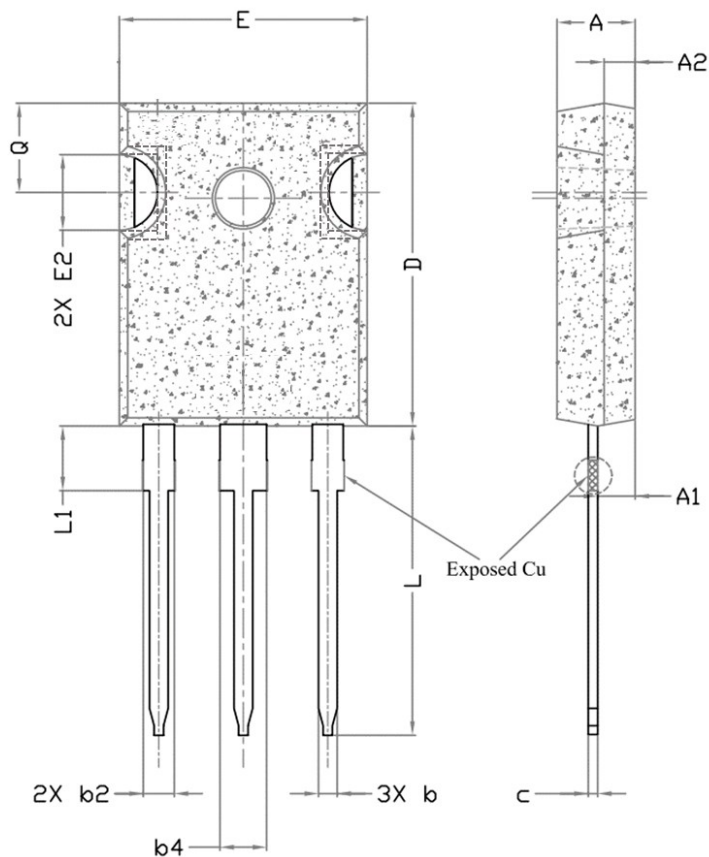
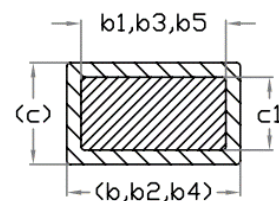
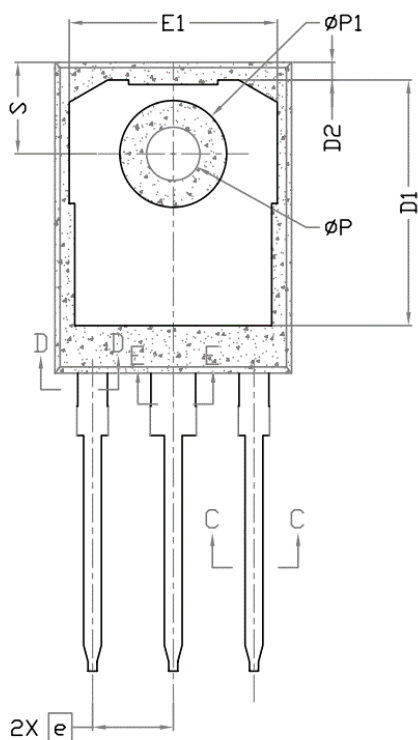


Fig. 24 Safe Operating Area

Package Dimensions



Dimensions In Millimeters		
SYMBOL	MIN.	MAX.
A	4.83	5.21
A1	2.29	2.55
A2	1.50	2.49
b	1.07	1.33
b1	1.07	1.28
b2	1.91	2.41
b3	1.91	2.34
b4	2.87	3.38
b5	2.87	3.18
c	0.55	0.69
c1	0.55	0.65
D	20.80	21.10
D1	16.25	17.65
D2	0.51	1.35
E	15.70	16.13
E1	13.10	14.16
E2	3.68	5.49
e	5.44 BSC	
L	19.80	20.32
L1	3.95	4.40
φ P	3.50	3.70
φ P1	7.00	7.40
Q	5.39	6.20
S	6.04	6.30



Section C--C,D--D,E--E

Note:

1. Package Reference: JEDEC TO247, Variation AD
2. All Dimensions are in mm
3. Slot Required, Notch May Be Rounded or Rectangular
4. Dimension D&E Do Not Include Mold Flash
5. Subject to Change Without Notice

Notes

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