# IV1Q12080T3Z – 1200V 80mΩ Automotive SiC MOSFET

Features

- High blocking voltage with low on-resistance
- High speed switching with low capacitance
- High operating junction temperature capability
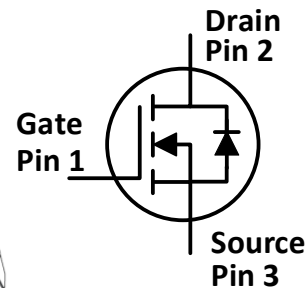- Very fast and robust intrinsic body diode
- AEC-Q101 qualified

Applications

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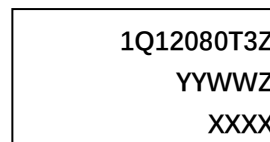- Automotive DC/DC
- Solar inverters
- Switch mode power supplies

Outline:
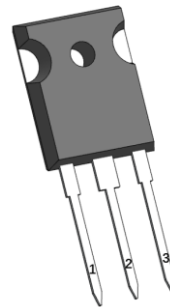
TO247-3

Marking Diagram:

1Q12080T3Z	1Q12080T3Z = Specific Device Code
YYWWZ	YY = Year
	WW = Work Week
XXXX	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	t_{spike}≤200ns and t_{spike}/Period<2%	Note1
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)	42	A	V_{GS}=20V, T_C=25°C	Fig. 21
		31	A	V_{GS}=20V, T_C=100°C	
I_{DM}	Drain current (pulsed)	70	A	Pulse width limited by SOA	Fig. 24
P_{TOT}	Total power dissipation	300	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	

Note

1. Definition of acceptable V_{GS} waveform
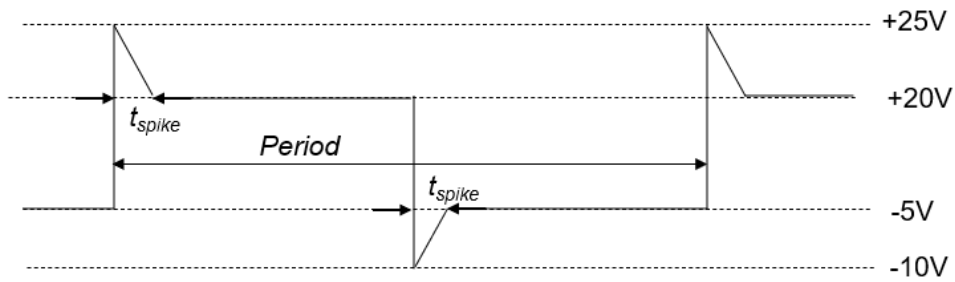
Thermal Data

Symbol	Parameter	Value	Unit	Note
$R_{\theta(J-C)}$	Thermal Resistance from Junction to Case	0.5	°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	3.6	5	V	V$_{GS}$=V$_{DS}$, I$_D$=3.8mA	Fig. 8, 9
			2.7		V	V$_{GS}$=V$_{DS}$, I$_D$=3.8mA @ T$_J$=175°C	
R$_{ON}$	Static drain-source on-resistance		80	100	mΩ	V$_{GS}$=20V, I$_D$=10A @T$_J$=25°C	Fig. 4, 5, 6, 7
			130		mΩ	V$_{GS}$=20V, I$_D$=10A @T$_J$=175°C	
C$_{iss}$	Input capacitance		1680		pF	V$_{DS}$=800V, V$_{GS}$=0V, f=1MHz, V$_{AC}$=25mV	Fig. 16
C$_{oss}$	Output capacitance		69		pF		
C$_{rss}$	Reverse transfer capacitance		6.7		pF		
E$_{oss}$	C$_{oss}$ stored energy		27		μJ		Fig. 17
Q$_g$	Total gate charge		76		nC	V$_{DS}$=800V, I$_D$=20A, V$_{GS}$=-5 to 20V	Fig. 18
Q$_{gs}$	Gate-source charge		29		nC		
Q$_{gd}$	Gate-drain charge		34		nC		
R$_g$	Gate input resistance		4.2		Ω	f=1MHz	
E$_{ON}$	Turn-on switching energy		337		μJ	V$_{DS}$=800V, I$_D$=20A, V$_{GS}$=-3.5 to 20V, R$_{G(ext)}$=2.0Ω, L=290μH	Fig. 19, 20
E$_{OFF}$	Turn-off switching energy		44		μJ		
t$_{d(on)}$	Turn-on delay time		22		ns		
t$_r$	Rise time		17				
t$_{d(off)}$	Turn-off delay time		17				
t$_f$	Fall time		12				

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		4.7		V	I$_{SD}$=10A, V$_{GS}$=0V	Fig. 10, 11, 12
			4.2		V	I$_{SD}$=10A, V$_{GS}$=0V, T$_J$=175°C	
t$_{rr}$	Reverse recovery time		40		ns	V$_{GS}$=0V, I$_{SD}$=20A, V$_R$=800V, di/dt=1100A/μs, R$_{G(ext)}$=11.0Ω	
Q$_{rr}$	Reverse recovery charge		57		nC		
I$_{RRM}$	Peak reverse recovery current		4.7		A		

Typical Performance (curves)
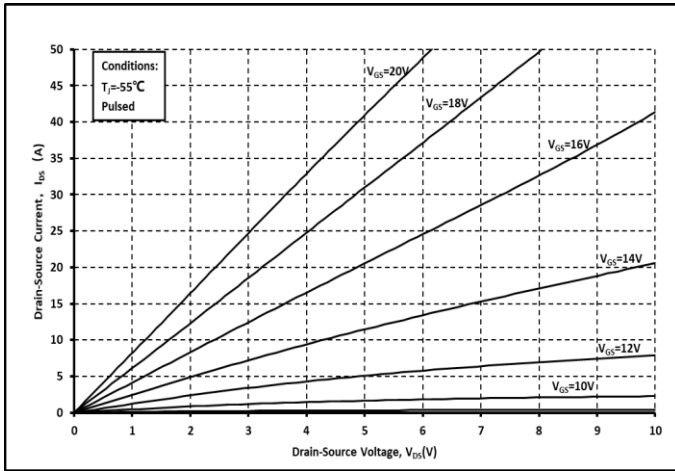
Fig. 1 Output Curve @ T$_J$=-55℃
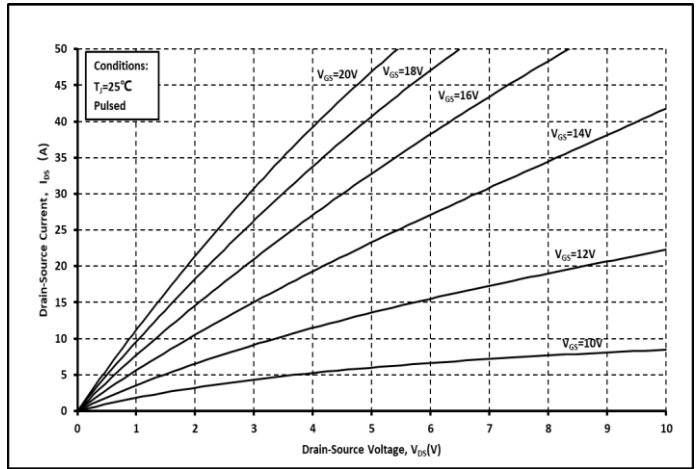
Fig. 2 Output Curve @ T$_J$=25℃
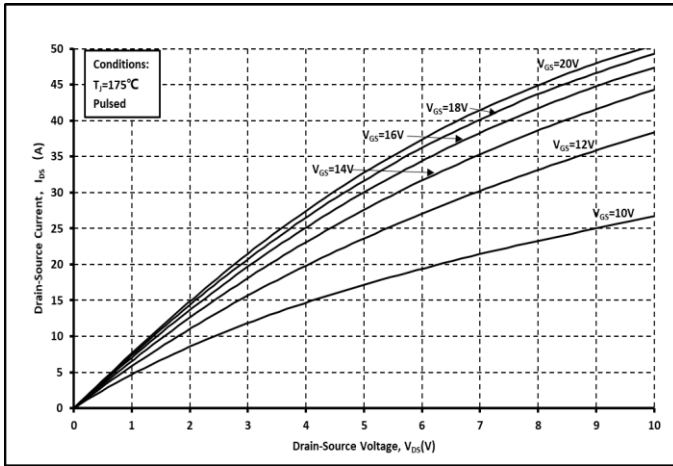

Fig. 3 Output Curve @ T$_J$=175℃
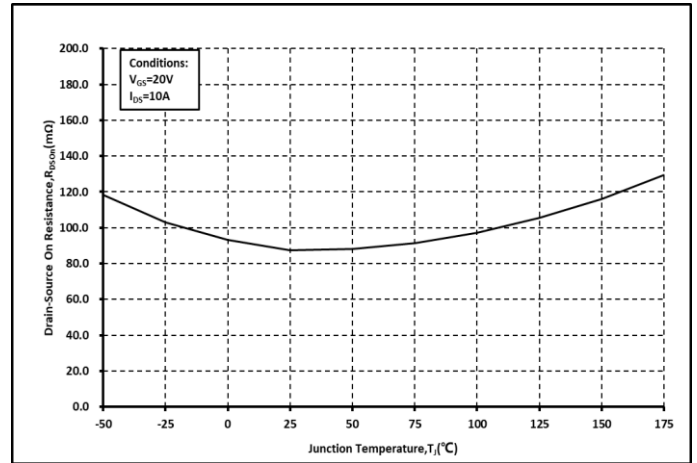

Fig. 4 Ron vs. Temperature
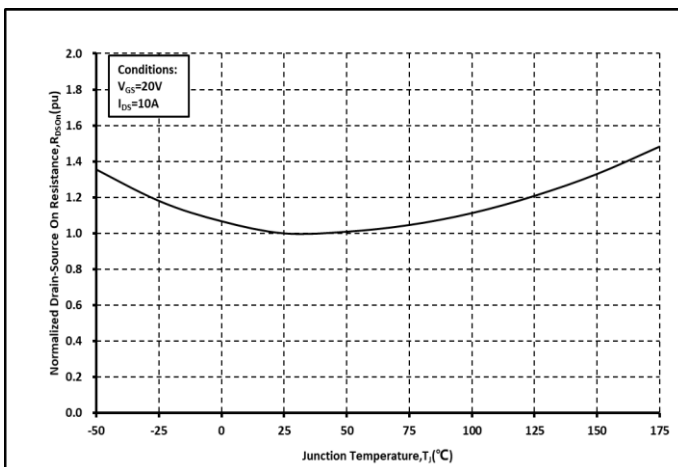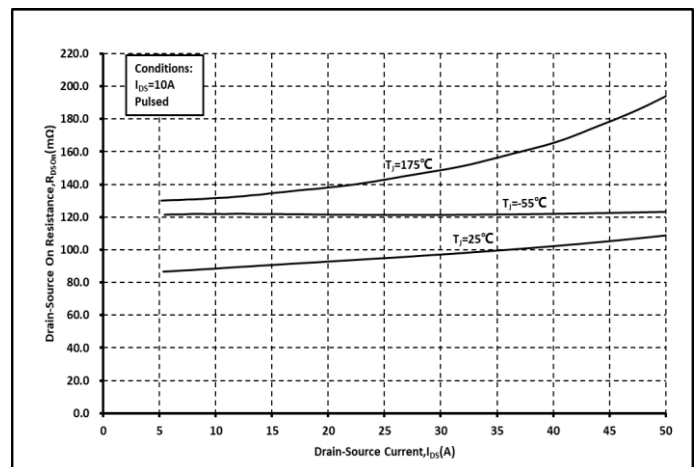

Fig. 5 Normalized Ron vs. Temperature

Fig. 6 Ron vs. I$_{DS}$ @ Various Temperature
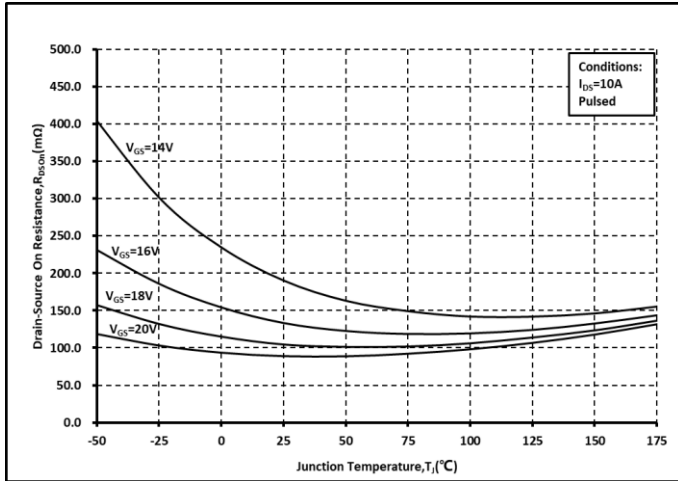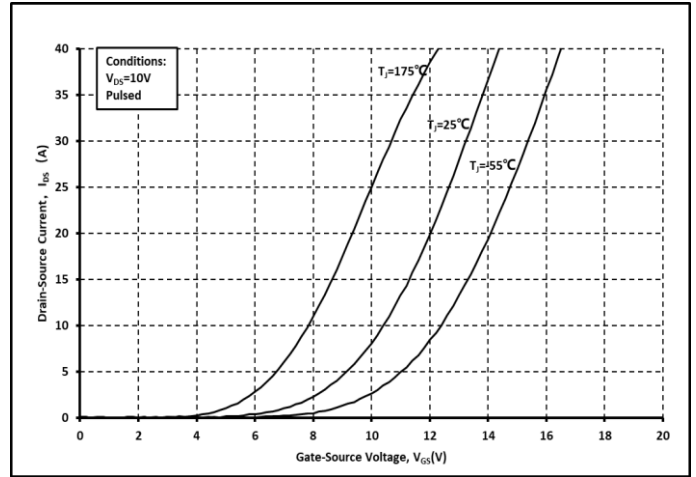
Fig. 7 Ron vs. Temperature @ Various V_GS
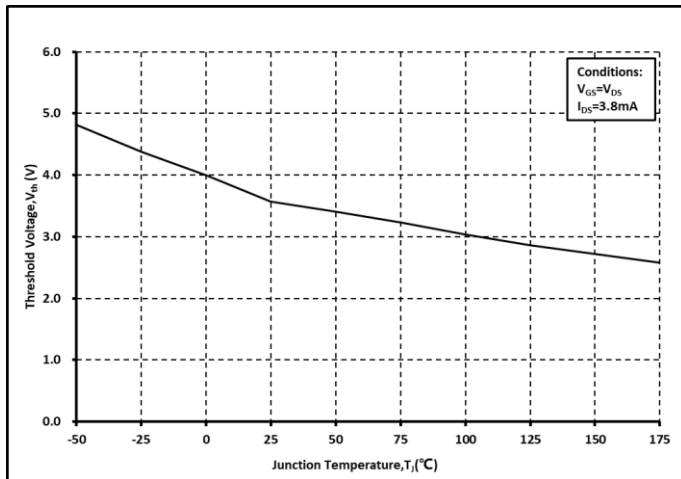

Fig. 8 Transfer Curves @ Various Temperature
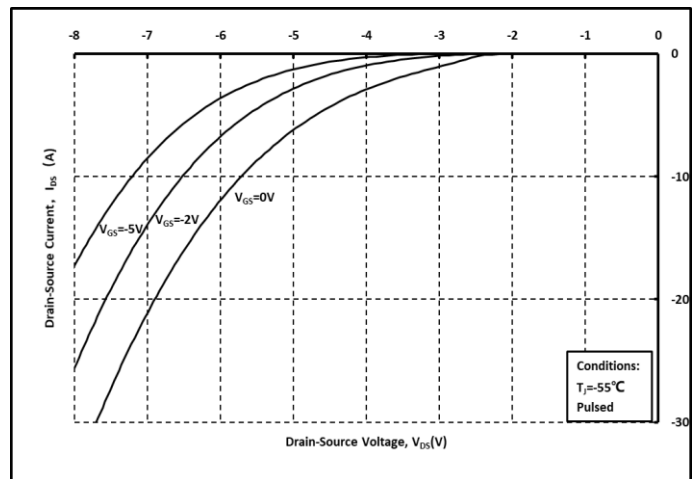

Fig. 9 Threshold Voltage vs. Temperature
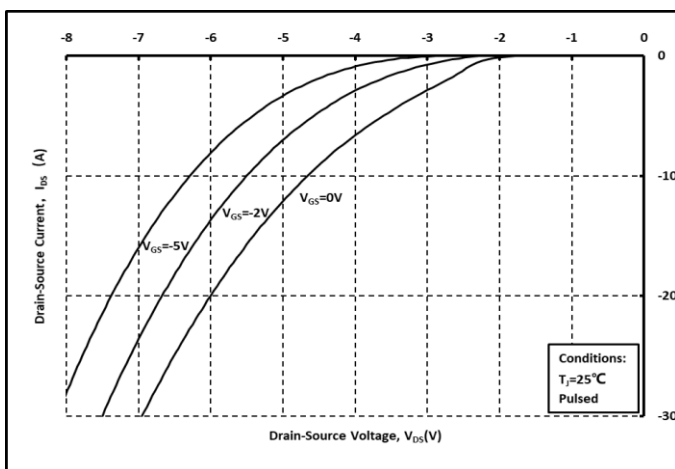

Fig. 10 Body Diode curves @ T_J=-55°C

Fig. 11 Body Diode curves @ T_J=25°C
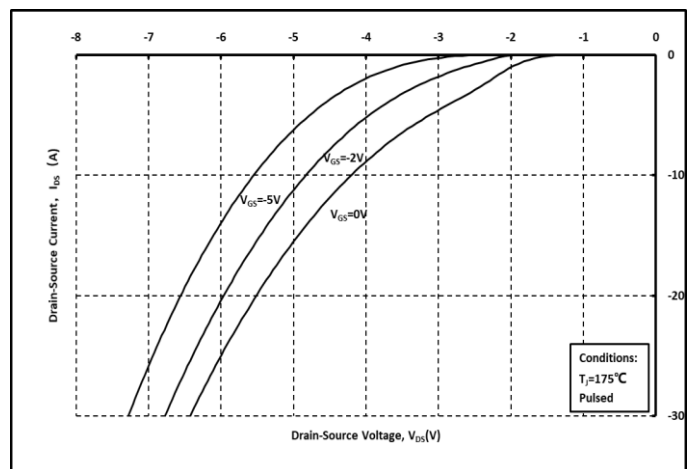
Fig. 12 Body Diode curves @ T_J=175°C
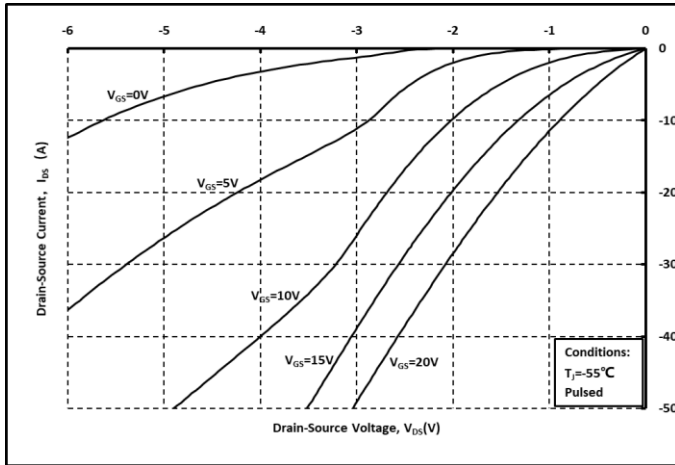
Fig. 13 3rd Quadrant curves @ T$_J$=-55℃
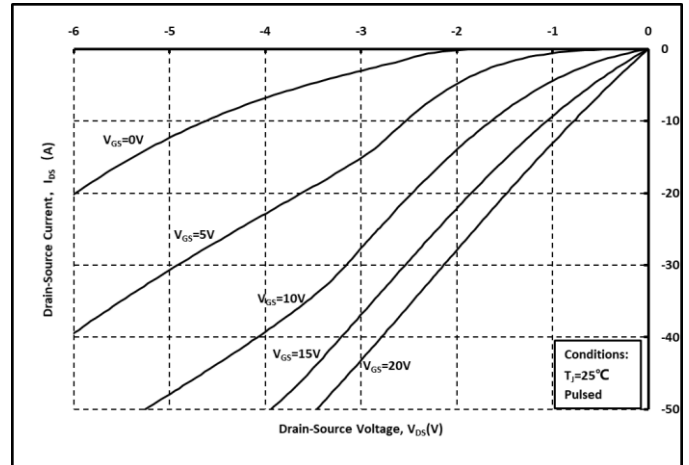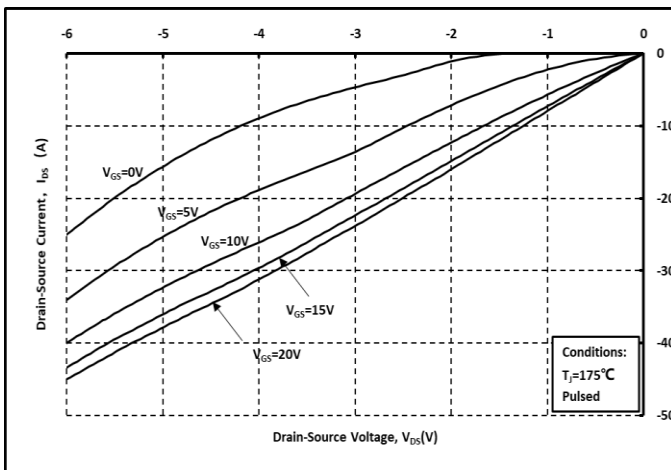

Fig. 14 3rd Quadrant curves @ T$_J$=25℃

Fig. 15 3rd Quadrant curves @ T$_J$=175℃
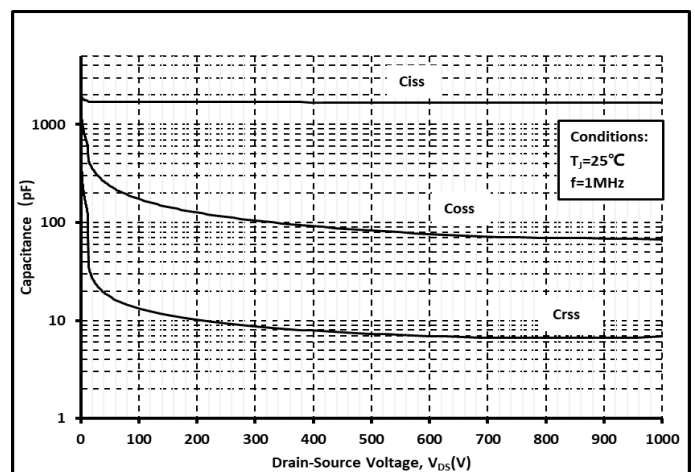
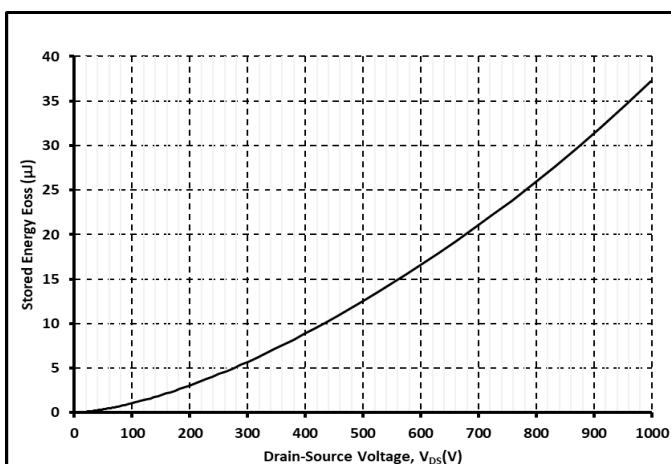Fig. 16 Capacitance vs. V$_{DS}$

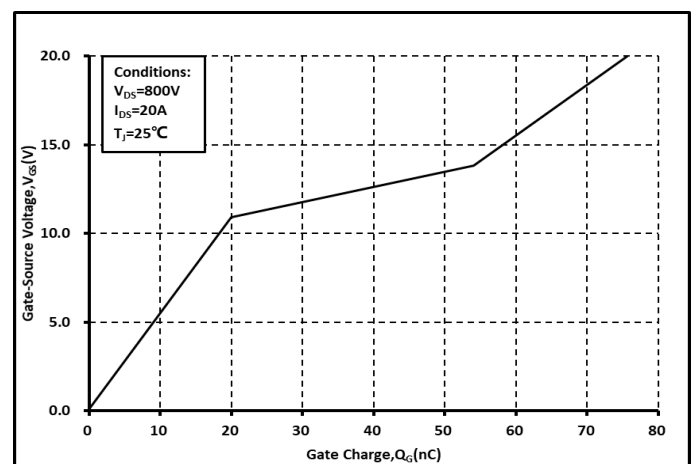Fig. 17 Output Capacitor Stored Energy

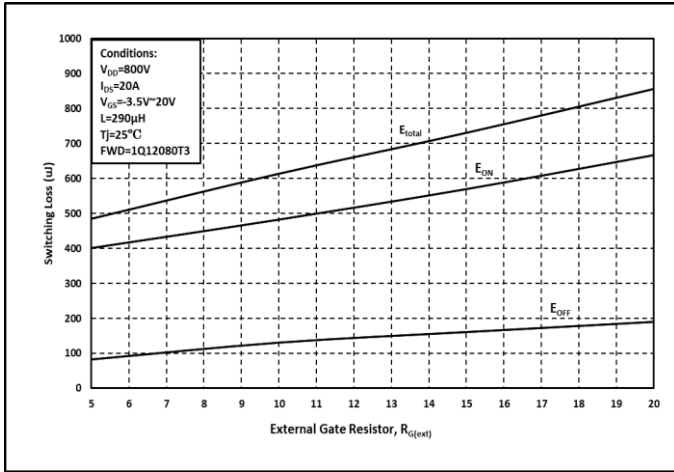Fig. 18 Gate Charge Characteristics

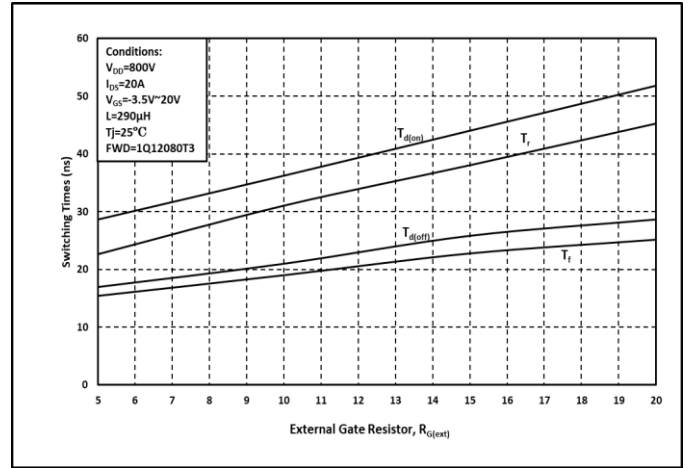**Fig. 19 Switching Energy vs. R$_{G(ext)}$**

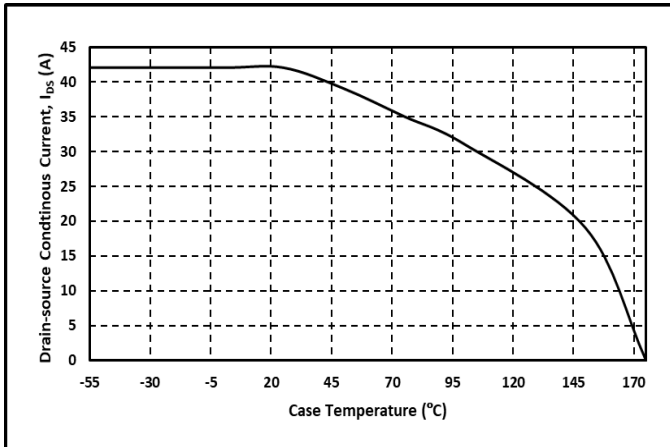**Fig. 20 Switching Times vs. R$_{G(ext)}$**

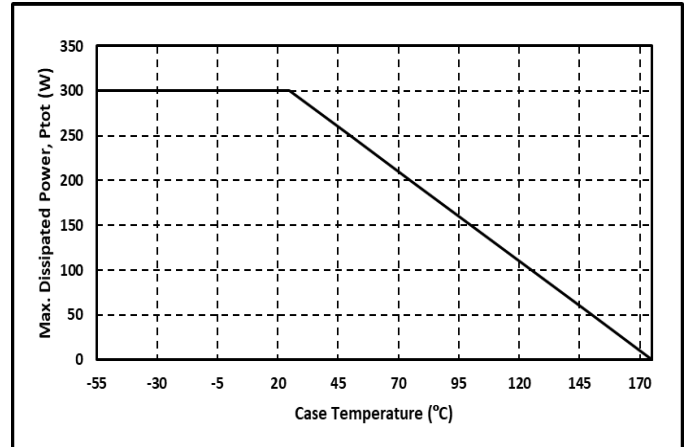**Fig. 21 Continuous Drain Current vs. Case Temperature**
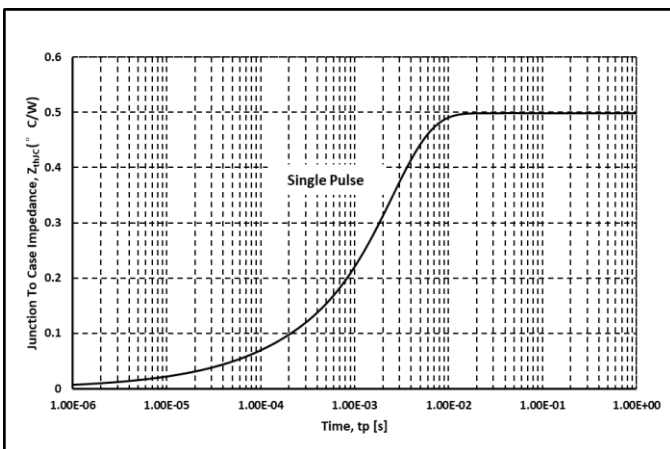

Fig. 22 Max. Power Dissipation Derating vs. Case Temperature
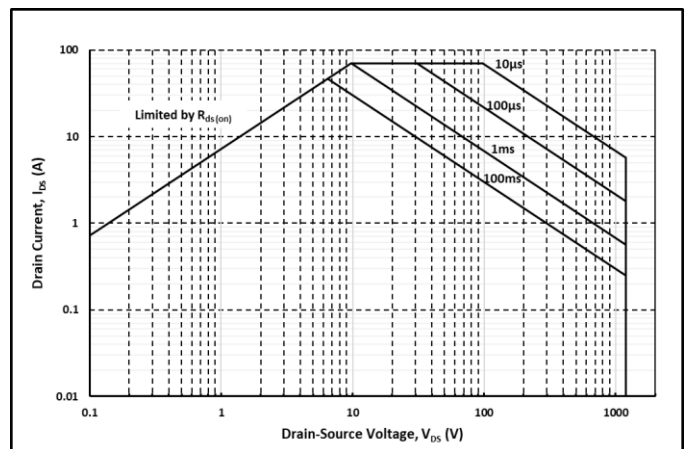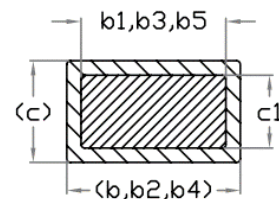

Fig. 23 Thermal impedance

Fig. 24 Safe Operating Area

Package Dimensions
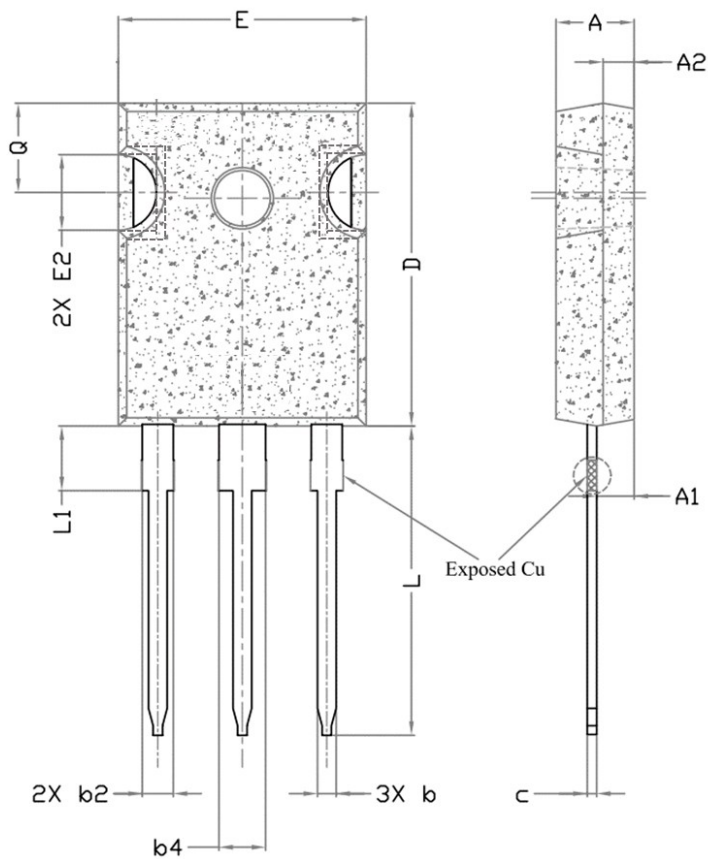
Dimensions In Millimeters		
SYMBOL	MIN.	MAX.
A	4.83	5.21
A1	2.29	2.55
A2	1.50	2.49
b	1.07	1.33
b1	1.07	1.28
b2	1.91	2.41
b3	1.91	2.34
b4	2.87	3.38
b5	2.87	3.18
c	0.55	0.69
c1	0.55	0.65
D	20.80	21.10
D1	16.25	17.65
D2	0.51	1.35
E	15.70	16.13
E1	13.10	14.16
E2	3.68	5.49
e	5.44 BSC	
L	19.80	20.32
L1	3.95	4.40
φP	3.50	3.70
φP1	7.00	7.40
Q	5.39	6.20
S	6.04	6.30
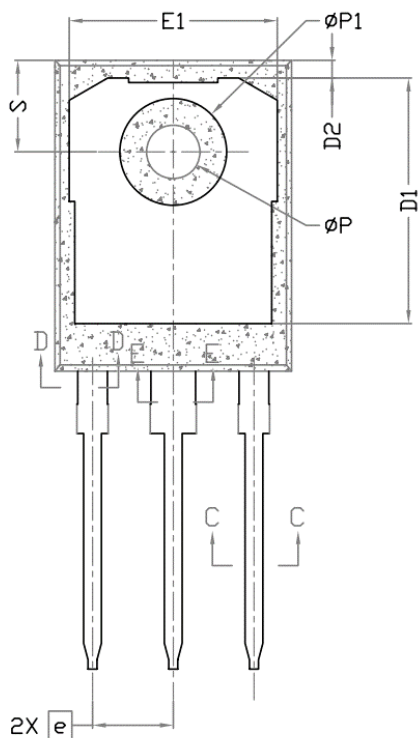
Section C--C,D--D,E–E

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