IVTM12080TA1Z – 1200V 80mΩ SiC MODULE

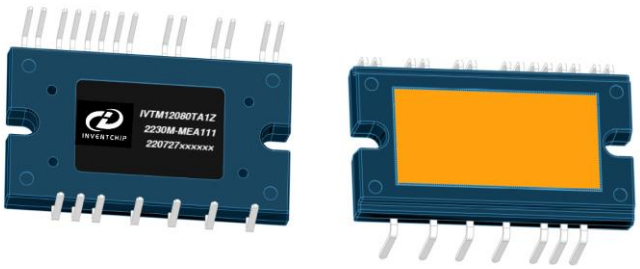
Features

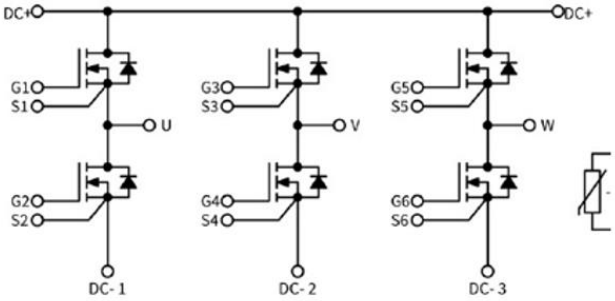
- 3 phase DC/AC inverter
- High speed switching with low capacitance
- High operating junction temperature capability
- Low stray inductance

Applications

- Automotive high voltage auxiliary motors:
  - Compressor motor control for air conditioner
  - Oil/water pumps
  - Super/turbo chargers
- High frequency switching application
- DC-DC converter
- UPS application

Package





Absolute Maximum Ratings (T_C=25°C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
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)	42*	A	V_{GS}=20V, T_C=25°C
		31*	A	V_{GS}=20V, T_C=100°C
T_J	Operating junction temperature	-40 to 175	°C	

Thermal Data

Symbol	Parameter	Value	Unit	Note
$R_{\theta(J-C)}$	Thermal Resistance from Junction to Case	0.5*	°C/W	
L_σ	Package Stray Inductance	26	nH	

*By estimation

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_{GS}=V_{DS}, I_D=3.8mA @ T_C=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
E_{AS}	Avalanche energy, single pulse		0.75		J	I_D=20A, V_{DD}=50V, L=2mH	
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		267		μJ	V_{DS}=800V, I_D=20A, V_{GS}=-3 to 20V, $R_{G(ext)}$=4.7Ω, L=250 μ H	Fig. 19, 20
E_{OFF}	Turn-off switching energy		77.2		μJ		
$t_{d(on)}$	Turn-on delay time		11.6		ns		
t_r	Rise time		11.3				
$t_{d(off)}$	Turn-off delay time		24.1				
t_f	Fall time		13.3				

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		28.9		ns	V_{GS}=0V, I_{SD}=20A, V_R=800V, Rg=18Ω L=250μH di/dt=2.5A/ns	
Q_{rr}	Reverse recovery charge		171		nC		
I_{RRM}	Peak reverse recovery current		14.4		A		

NTC-Thermistor Characteristics

Symbol	Parameter	Conditions	Value			Unit
			Min.	Typ.	Max.	
R_{25}	Rated resistance	T_{NTC}=25℃		10		kΩ
ΔR/R	Deviation of R100	T_{NTC}=100℃, R_{100}=854Ω	-3		3	%
P_{25}	Power dissipation	T_{NTC}=25℃			180	mW
$B_{25/50}$	B-Value	$R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15K))]$		3590		K
$B_{25/85}$	B-Value	$R_2=R_{25}\exp[B_{25/85}(1/T_2-1/(298.15K))]$		3635		K
$B_{25/100}$	B-Value	$R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15K))]$		3650		K

Module

Symbol	Parameter	Conditions	Typ.	Unit
V_{ISOL}	Isolation test voltage	RMS, f=50Hz, t=1min	3.4	kV
	Creepage distance	Terminal to heatsink	6.3	mm
		Terminal to terminal	4.5	mm
	Clearance	Terminal to heatsink	3.5	mm
		Terminal to terminal	4.5	mm

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
	Mounting torque	Mounting screw: M3	0.6	0.7	0.8	N·m

Typical Performance (curves)

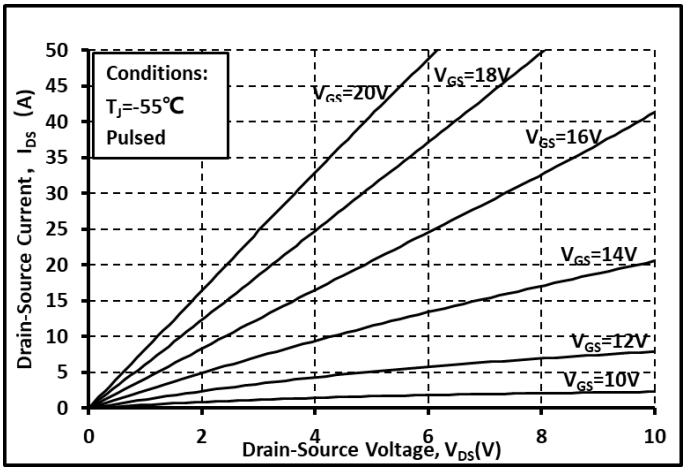


Fig. 1 Output Curve @ T_J=-55℃

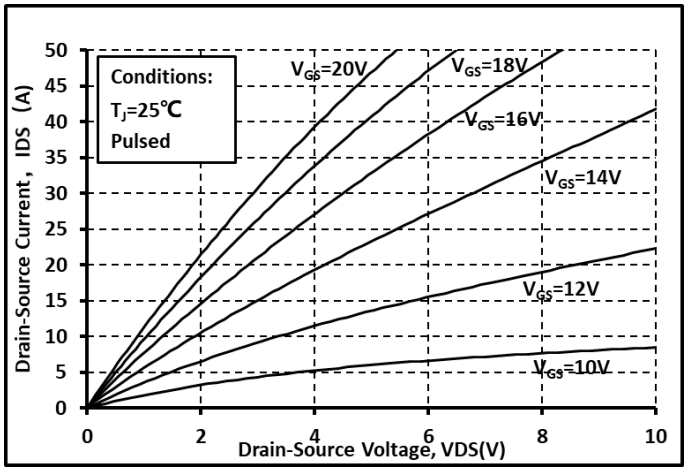


Fig. 2 Output Curve @ T_J=25℃

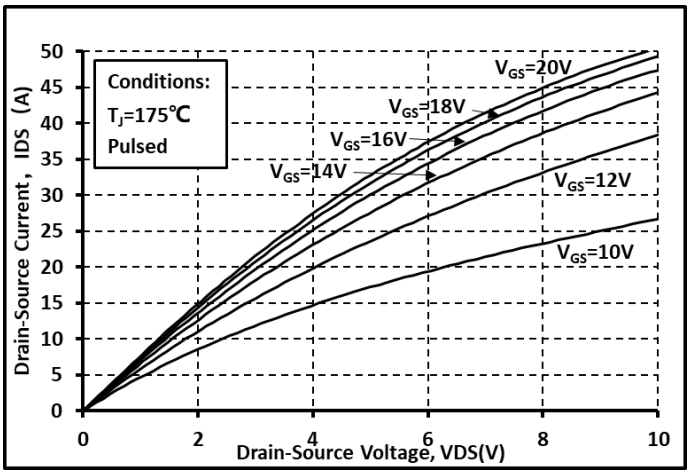


Fig. 3 Output Curve @ T_J=175°C

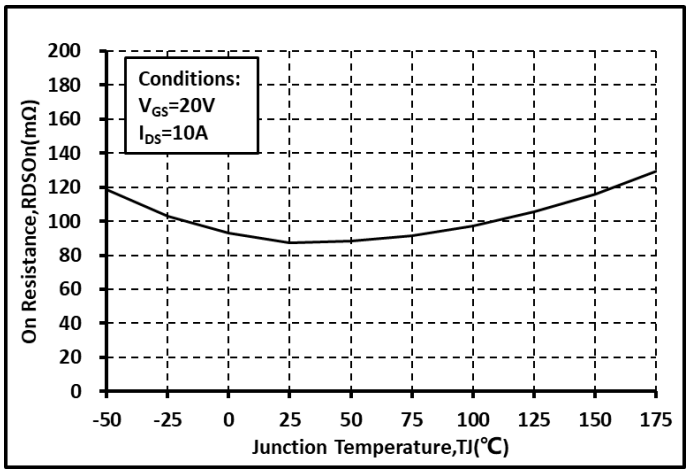


Fig. 4 Ron vs. Temperature

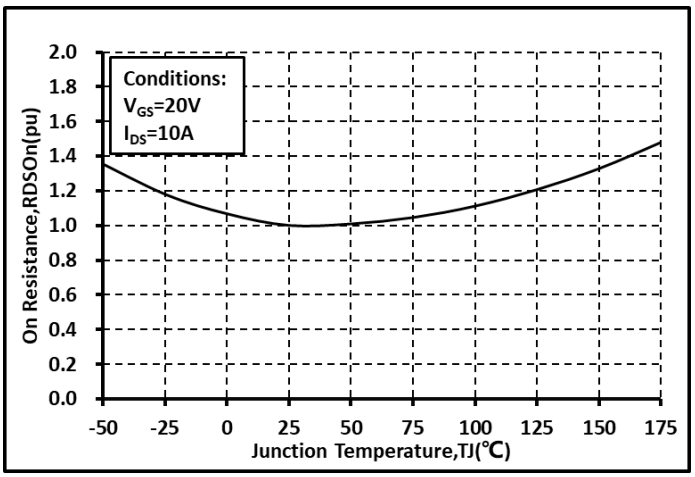


Fig. 5 Normalized Ron vs. Temperature

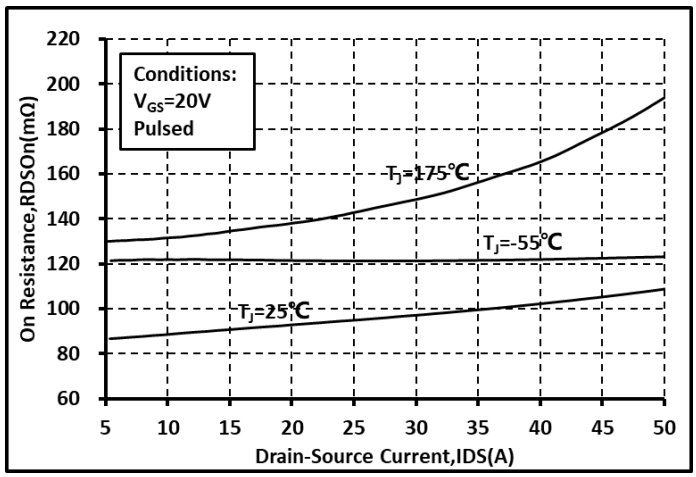


Fig. 6 Ron vs. I_{DS} @ Various Temperature

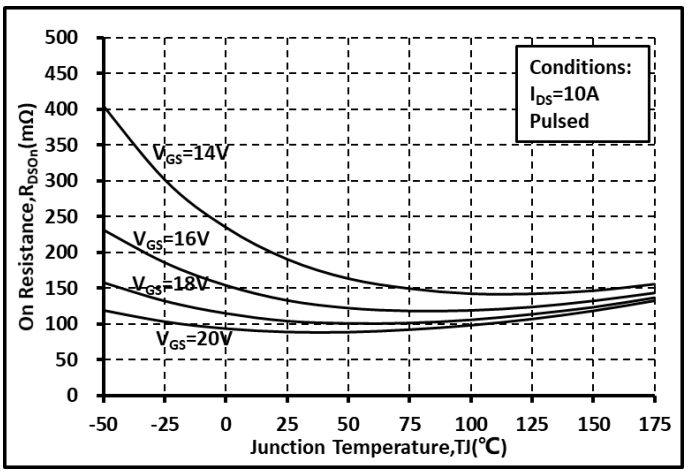


Fig. 7 Ron vs. Temperature @ Various V_{GS}

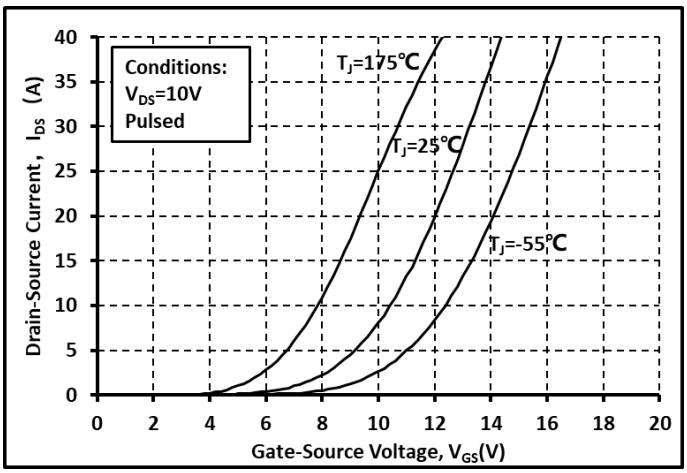


Fig. 8 Transfer Curves @ Various Temperature

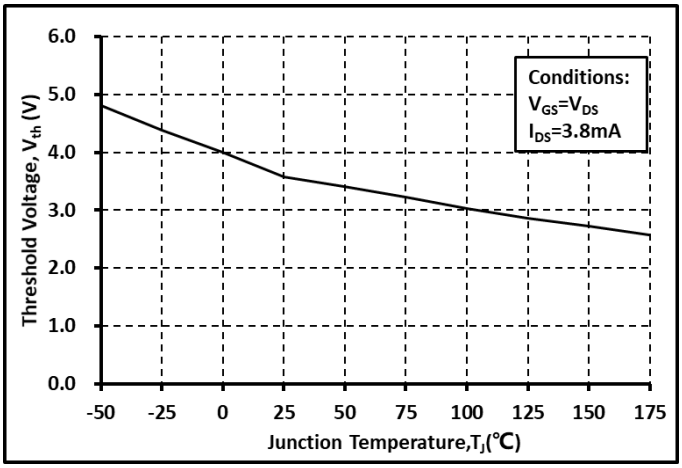


Fig. 9 Threshold Voltage vs. Temperature

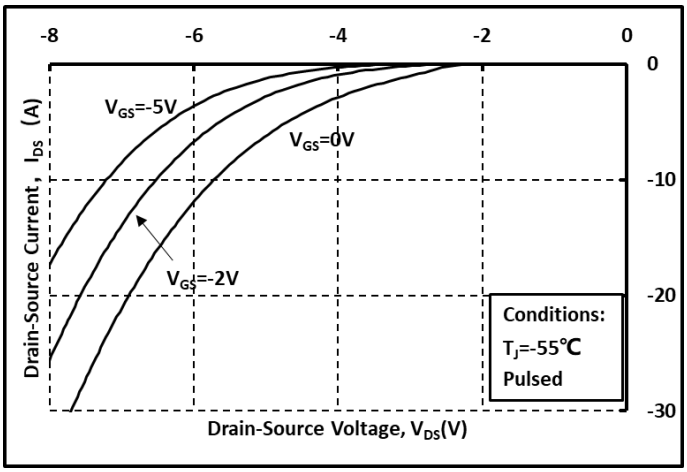


Fig. 10 Body Diode curves @ T_J=-55°C

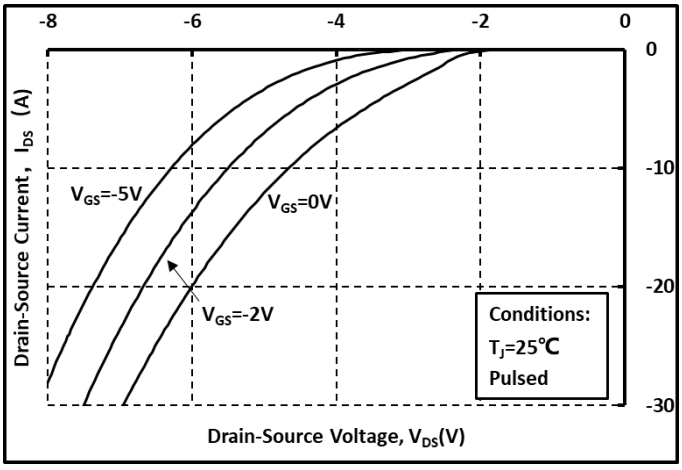


Fig. 11 Body Diode curves @ T_J=25°C

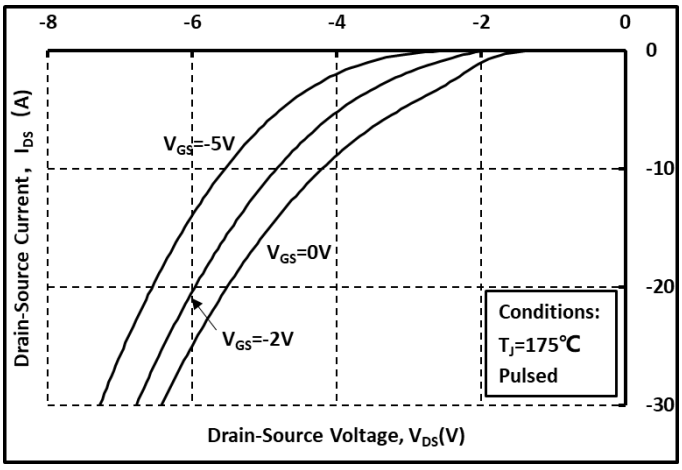


Fig. 12 Body Diode curves @ T_J=175°C

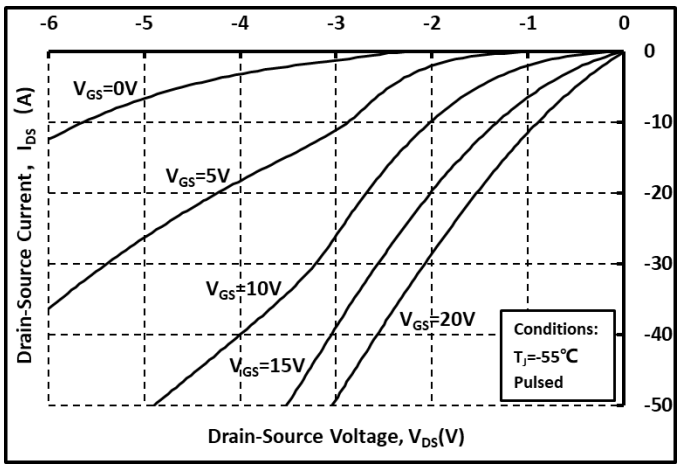


Fig. 13 3rd Quadrant curves @ T_J=-55°C

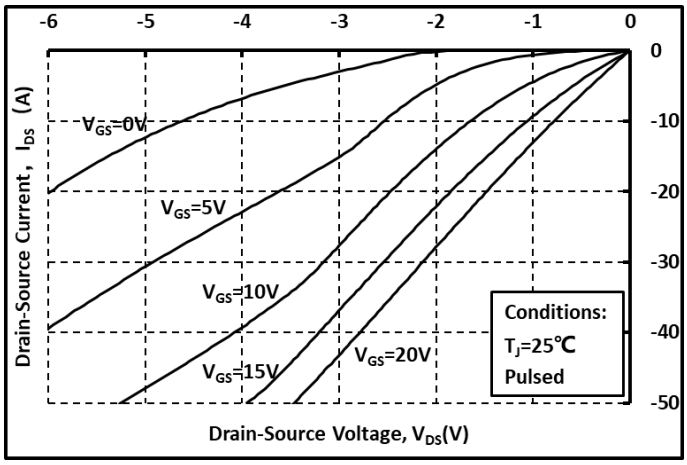


Fig. 14 3rd Quadrant curves @ T_J=25°C

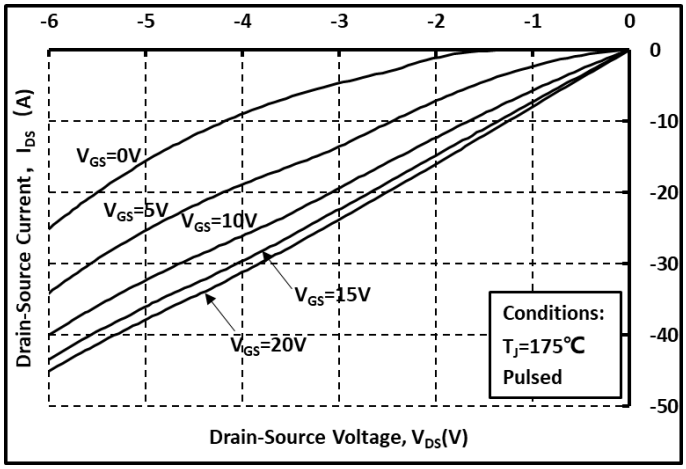


Fig. 15 3rd Quadrant curves @ T_J=175°C

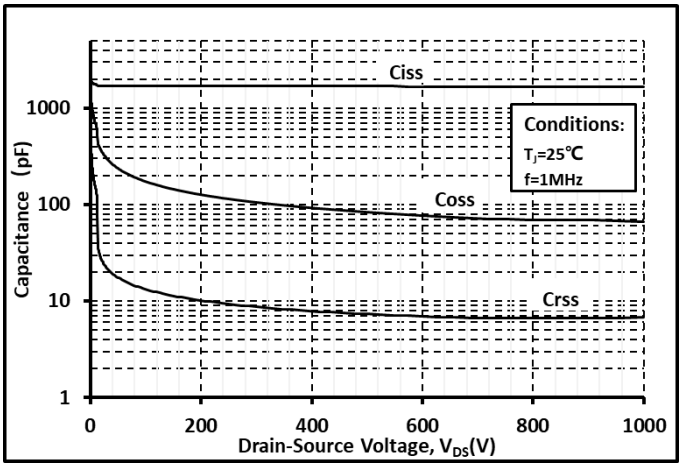


Fig. 16 Capacitance vs. V_{DS}

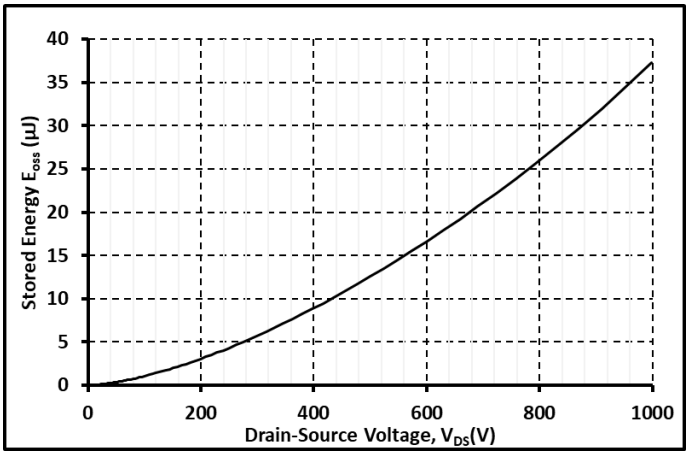


Fig. 17 Output Capacitor Stored Energy

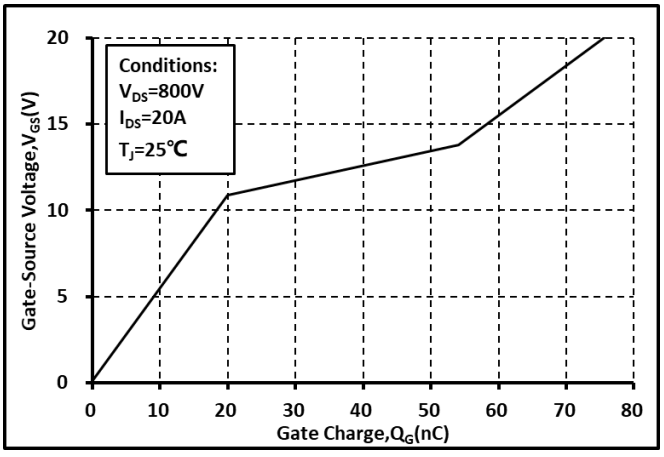


Fig. 18 Gate Charge Characteristics

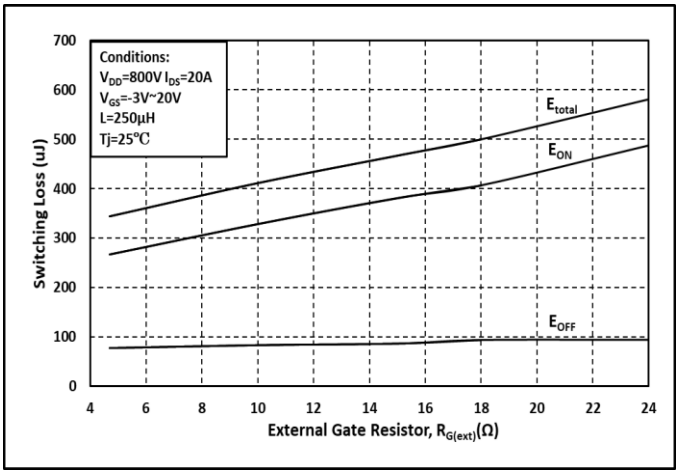


Fig. 19 Switching Energy vs. $R_{G(ext)}$

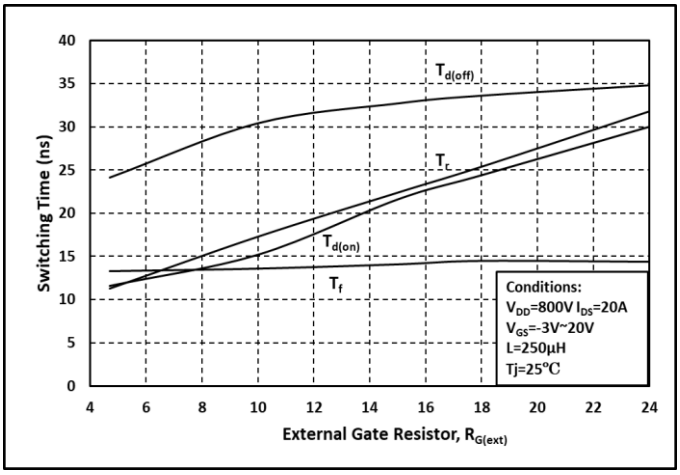


Fig. 20 Switching Times vs. $R_{G(ext)}$

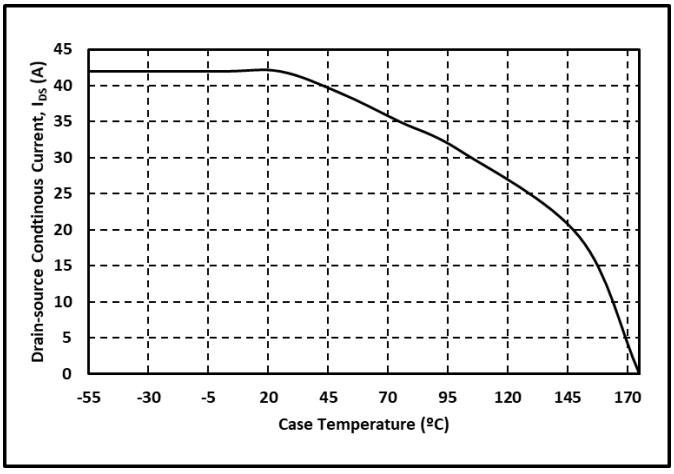


Fig. 21 Continuous Drain Current vs. Case Temperature

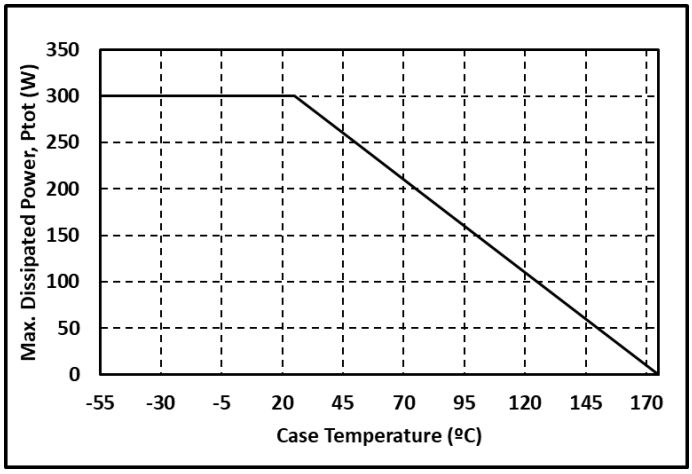


Fig. 22 Max. Power Dissipation Derating vs. Case Temperature

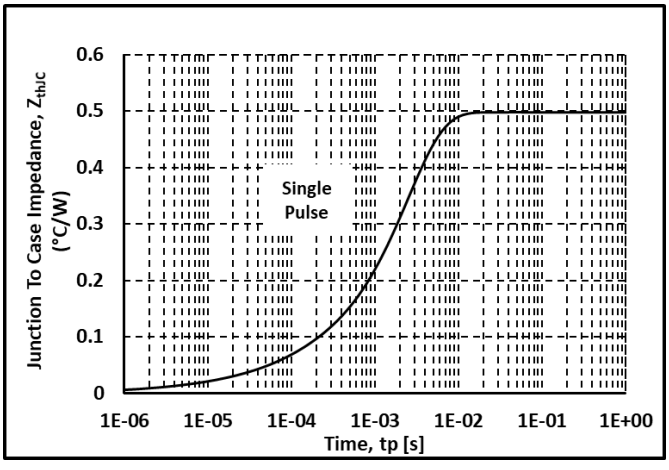


Fig. 23 Thermal impedance

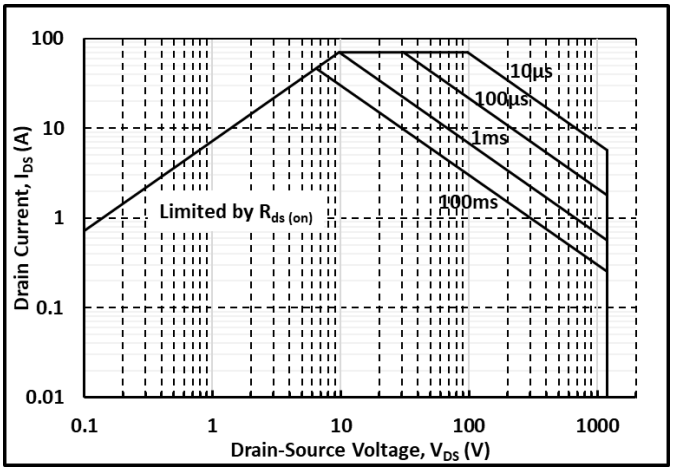
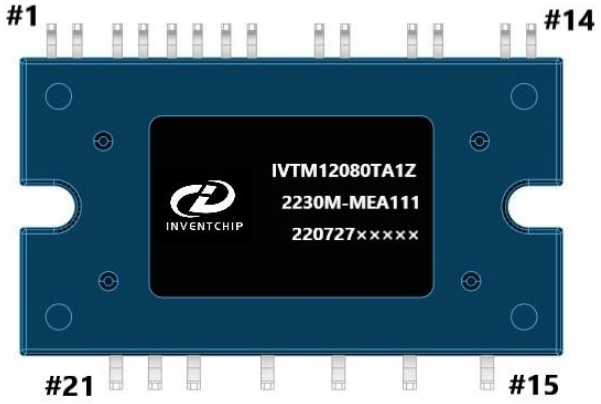


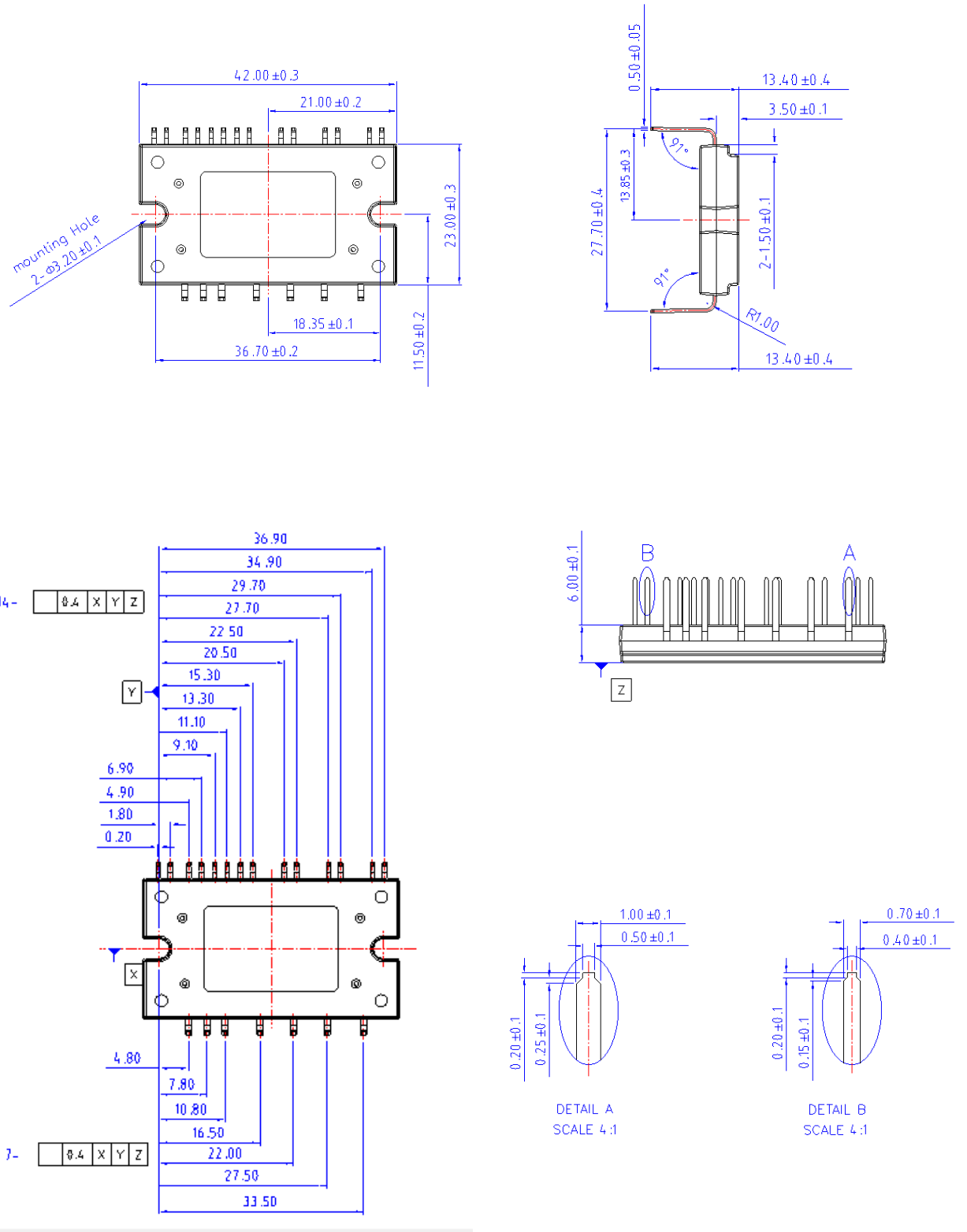
Fig. 24 Safe Operating Area

Pin Map



NO.	Pin Description
#1	Thermistor1
#2	Thermistor2
#3	Q6_Source
#4	Q6_Gate
#5	Q4_Source
#6	Q4_Gate
#7	Q2_Source
#8	Q2_Gate
#9	Q5_Source
#10	Q5_Gate
#11	Q3_Source
#12	Q3_Gate
#13	Q1_Source
#14	Q1_Gate
#15	DC+
#16	Phase U
#17	Phase V
#18	Phase W
#19	DC-1
#20	DC-2
#21	DC-3

Package Dimensions



Notes

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