IVSM06025HA2Z – 650V 25mΩ Gen2 Automotive SiC Module

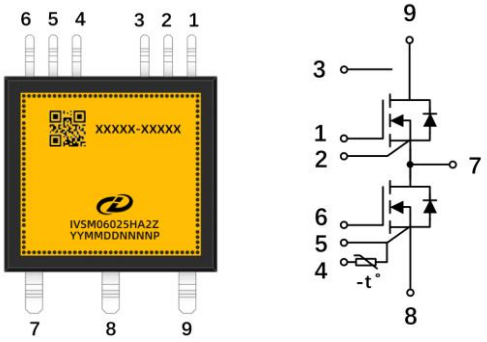
Features

- Standard SMPD package
- 2nd Generation SiC MOSFET Technology with +18V gate drive
- Low leakage inductance
- Half bridge topology
- Isolate top-side cooling
- High blocking voltage with low on-resistance
- High operating junction temperature capability
- Very fast and robust intrinsic body diode
- Kelvin gate input easing driver circuit design
- Integrated NTC temperature sensing

Applications

- Automotive OBC and DC/DC converters
- Automotive compressor inverters
- EV chargers

Outline:



Marking Diagram:

IVSM06025HA2Z	Specific Device Code
XXXXX-XXXXX	Wafer Date Code
	IVCT logo
YYMMDDNNNNP	Lot No. include: YY(year) MM(month) DD(day) NNNN(serial No.) P(mass)
	2D Code (top side and bottom side): Device Code+ Lot No.

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

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DS}	Drain-Source voltage	650	V	V_{GS}=0V, I_D=100μA	
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)	90	A	V_{GS}=18V, T_C=25°C	Fig. 23
		63	A	V_{GS}=18V, T_C=100°C	
I_{DM}	Drain current (pulsed)	224	A	Pulse width limited by SOA	Fig. 26
P_{TOT}	Total power dissipation	266	W	T_C=25°C	Fig. 24
T_{stg}	Storage temperature range	-55 to 175	°C		
T_J	Operating junction temperature	-55 to 175	°C		

Thermal Data

Symbol	Parameter	Value	Unit	Note
$R_{\theta(J-C)}$	Thermal Resistance from Junction to Case	0.562	°C/W	Fig.25

Electrical Characteristics (Per leg/T_C=25°C unless otherwise specified)

Symbol	Parameter	Value			Unit	Test Conditions	Note
		Min.	Typ.	Max.			
I_{DSS}	Zero gate voltage drain current		3	100	μA	V_{DS}=650V, V_{GS}=0V	
I_{GSS}	Gate leakage current			±100	nA	V_{DS}=0V, V_{GS}=-5~20V	
V_{TH}	Gate threshold voltage	1.8	2.8	4.5	V	V_{GS}=V_{DS}, I_D=12mA	Fig.8,9
			2.0		V	V_{GS}=V_{DS}, I_D=12mA @ T_J=175°C	
R_{ON}	Static drain-source on-resistance		25	33	mΩ	V_{GS}=18V, I_D=40A @T_J=25°C	Fig. 4,5,6,7
			38		mΩ	V_{GS}=18V, I_D=40A @T_J=175°C	
C_{iss}	Input capacitance		3080		pF	V_{DS}=600V, V_{GS}=0V, f=1MHz, V_{AC}=25mV	Fig.16
C_{oss}	Output capacitance		250		pF		
C_{rss}	Reverse transfer capacitance		10.7		pF		
E_{oss}	C_{oss} stored energy		48		μJ		Fig.17
Q_g	Total gate charge		125		nC	V_{DS}=400V, I_D=40A, V_{GS}=-3 to 18V	Fig.18
Q_{gs}	Gate-source charge		35.7		nC		
Q_{gd}	Gate-drain charge		38.5		nC		
R_g	Gate input resistance		1.5		Ω	f=1MHz	
E_{ON}	Turn-on switching energy		222.8		μJ	V_{DS}=400V, I_D=40A, V_{GS}=-3.5 to 18V, $R_{G(ext)}$=3.3Ω, L=200μH T_J=25°C	Fig.19,20,21
E_{OFF}	Turn-off switching energy		74.88		μJ		
$t_{d(on)}$	Turn-on delay time		16		ns		
t_r	Rise time		23.6				
$t_{d(off)}$	Turn-off delay time		29.2				
t_f	Fall time		10.8				
E_{ON}	Turn-on switching energy		253.4		μJ	V_{DS}=400V, I_D=40A, V_{GS}=-3.5 to 18V, $R_{G(ext)}$=3.3Ω,L=200μH T_J=175°C	Fig.22
E_{OFF}	Turn-off switching energy		74.08		μJ		

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		3.7		V	I_{SD}=20A, V_{GS}=0V	Fig.10,11, 12
			3.5		V	I_{SD}=20A, V_{GS}=0V, T_J=175°C	
I_S	Diode forward current (continuous)			50	A	V_{GS}=-2V, T_C=25°C	
t_{rr}	Reverse recovery time		36.18		ns	V_{GS}=-3.5V/+18V, I_{SD}=40A, V_R=400V, $R_{G(ext)}$=8.2Ω L=200μH di/dt=3000A/μs	
Q_{rr}	Reverse recovery charge		327.5		nC		
I_{RRM}	Peak reverse recovery current		23.6		A		

NTC Thermistor Characteristics

Symbol	Parameter	Value			Unit	Test Conditions	Note
		Min.	Typ.	Max.			
R_{25}	Rated Resistance		10		kΩ	T_{NTC}=25℃	
ΔR/R	Deviation of R_{100}	-1		1	%		
$B_{25/85}$	B-Value		3610			$R_2=R_{25}\exp[B_{25/85}(1/T_2-1(298.15K))]$	
P_{25}	Power Dissipation			60	mW	Ta=25±0.5℃	

Typical Performance (curves)

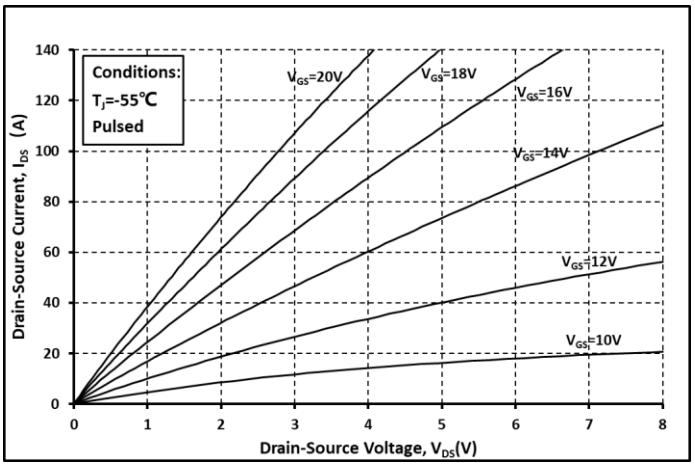


Fig. 1 Output Curve @ T_J=-55℃

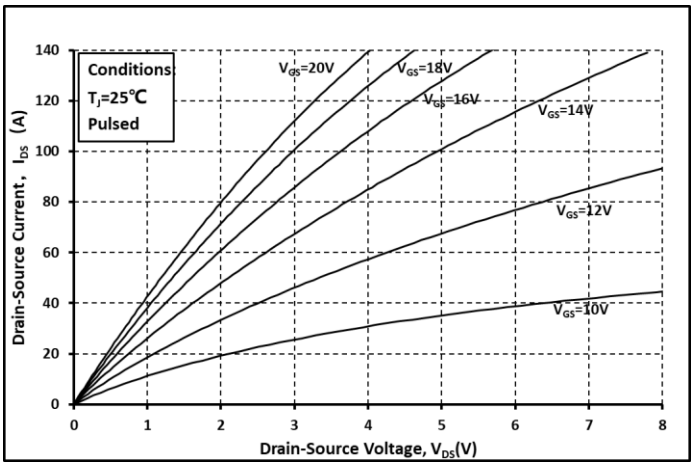


Fig. 2 Output Curve @ T_J=25℃

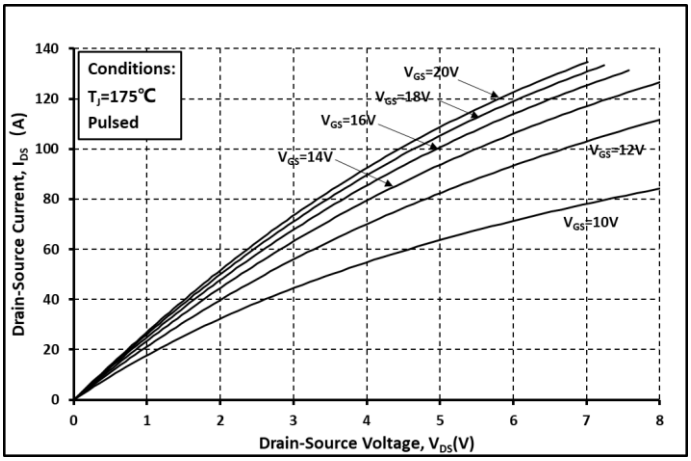


Fig. 3 Output Curve @ T_J=175℃

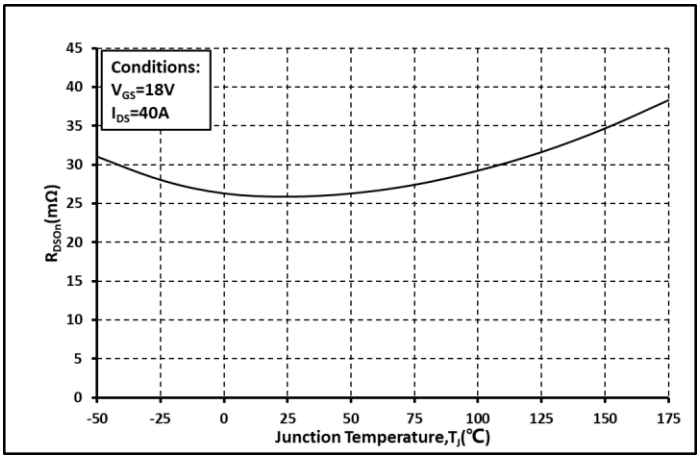


Fig. 4 Ron vs. Temperature

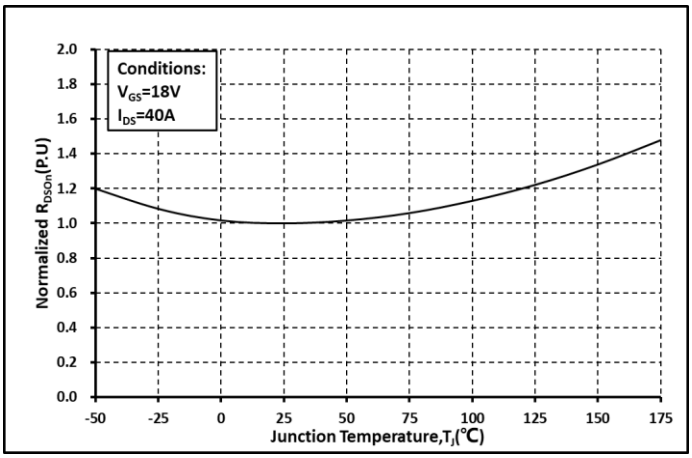


Fig. 5 Normalized Ron vs. Temperature

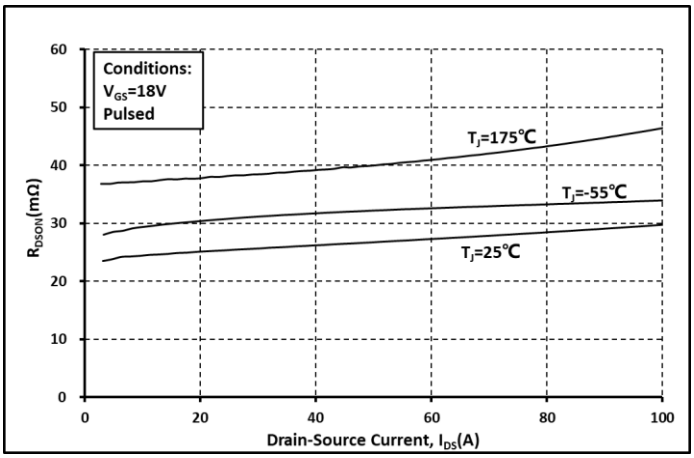


Fig. 6 Ron vs. I_{DS} @ Various Temperature

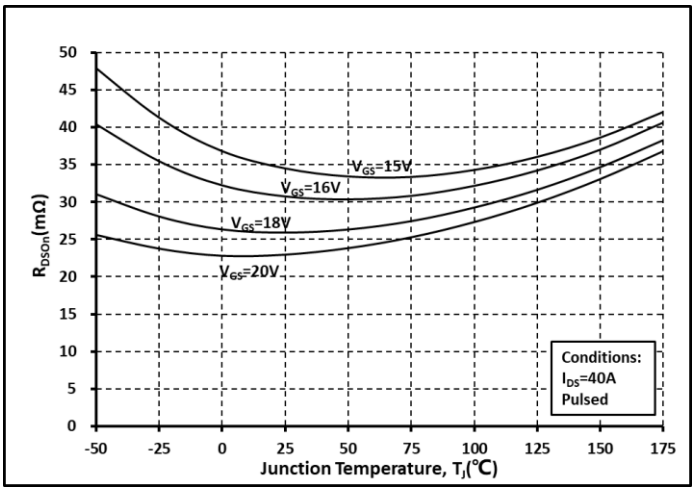


Fig. 7 Ron vs. Temperature @ Various V_{GS}

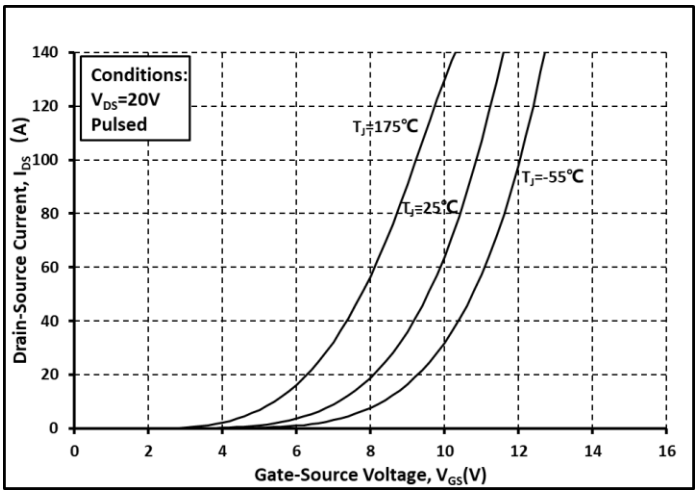


Fig. 8 Transfer Curves @ Various Temperature

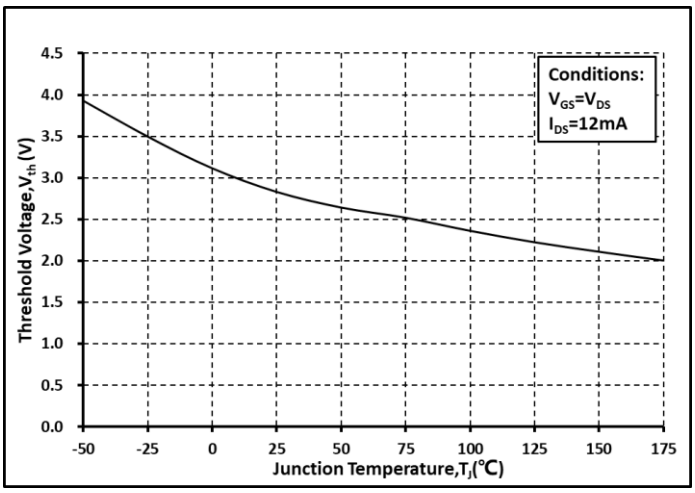


Fig. 9 Threshold Voltage vs. Temperature

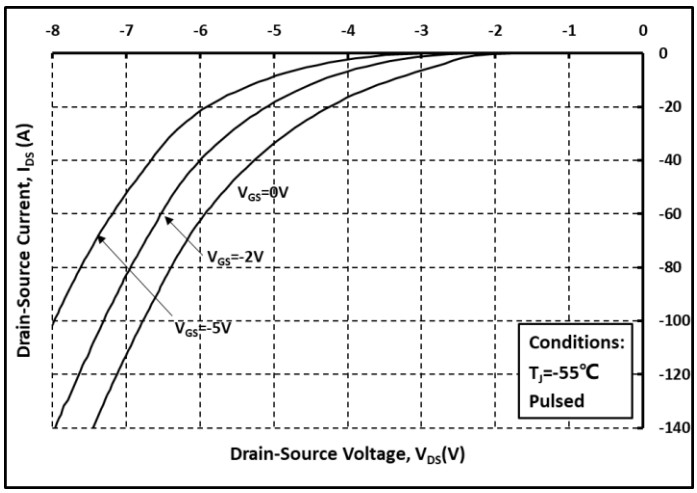


Fig. 10 Body Diode curves @ T_J=-55°C

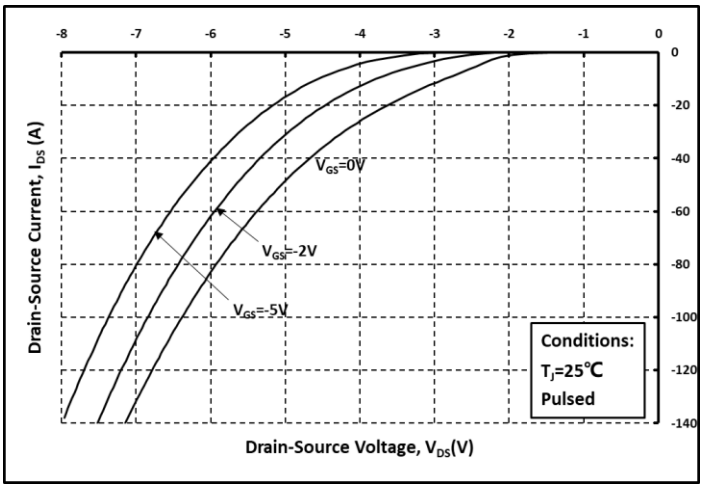


Fig. 11 Body Diode curves @ T_J=25°C

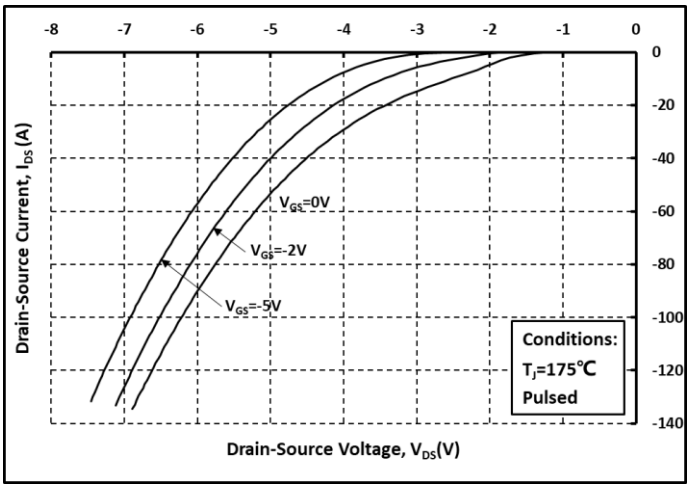


Fig. 12 Body Diode curves @ T_J=175°C

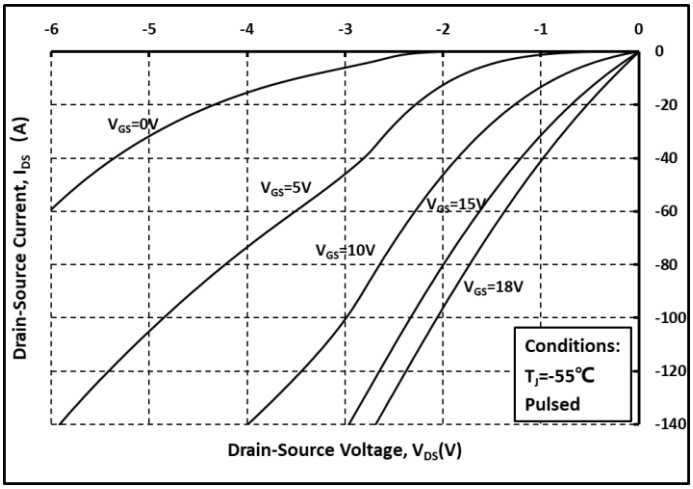


Fig. 13 3rd Quadrant curves @ T_J=-55°C

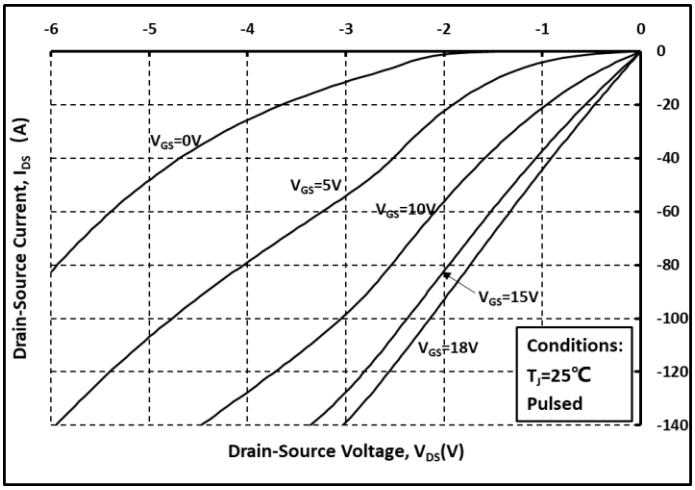


Fig. 14 3rd Quadrant curves @ T_J=25°C

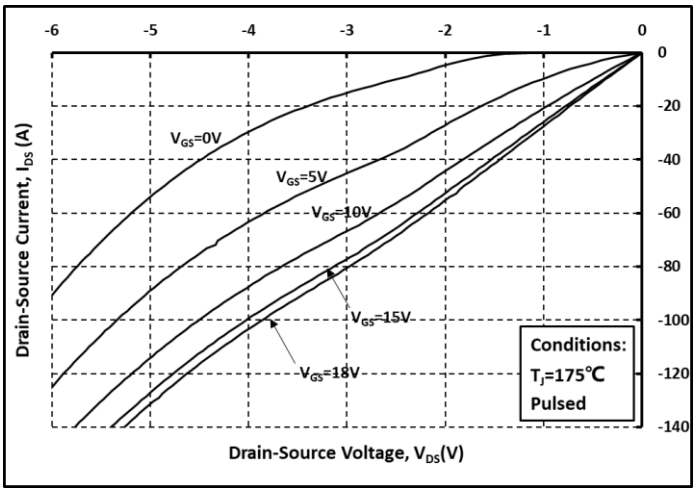


Fig. 15 3rd Quadrant curves @ T_J=175°C

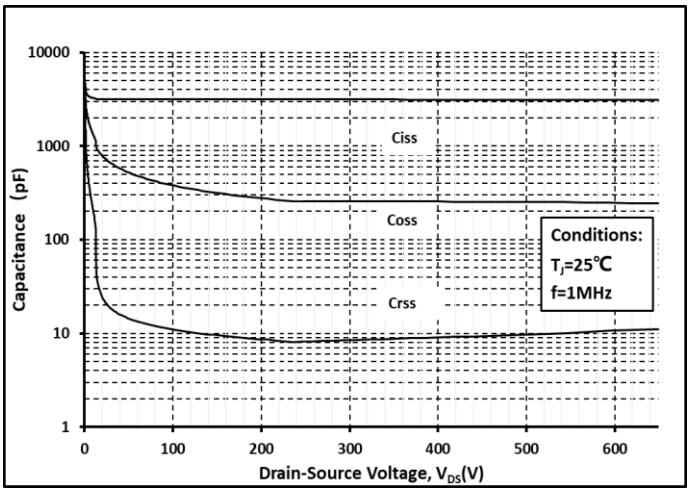


Fig. 16 Capacitance vs. V_{DS}

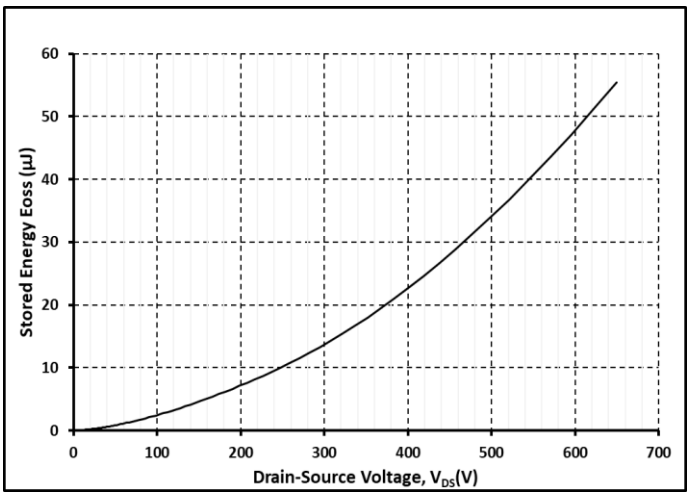


Fig. 17 Output Capacitor Stored Energy

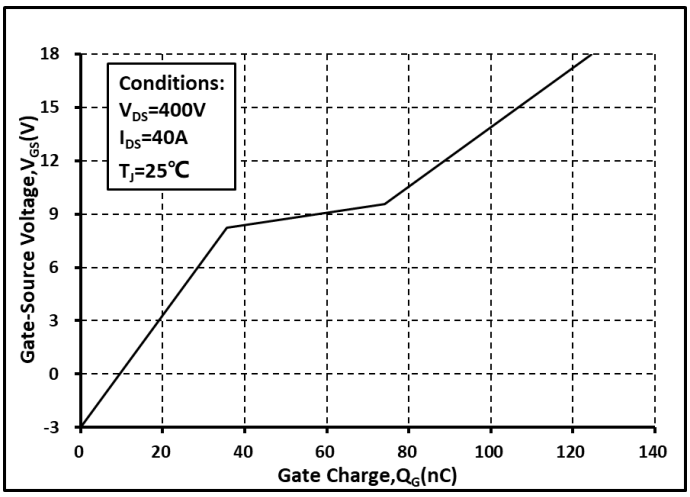


Fig. 18 Gate Charge Characteristics

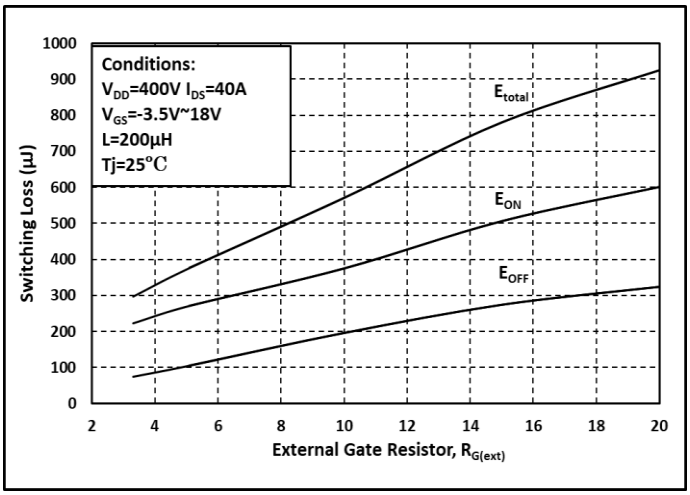


Fig. 19 Switching Energy vs. $R_{G(ext)}$

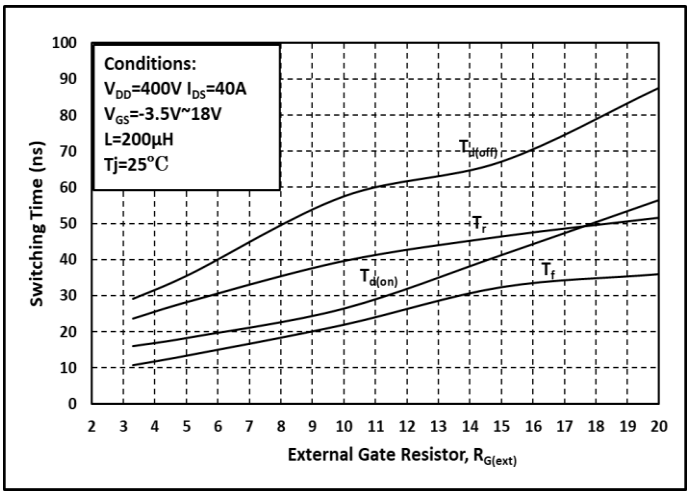


Fig. 20 Switching Times vs. $R_{G(ext)}$

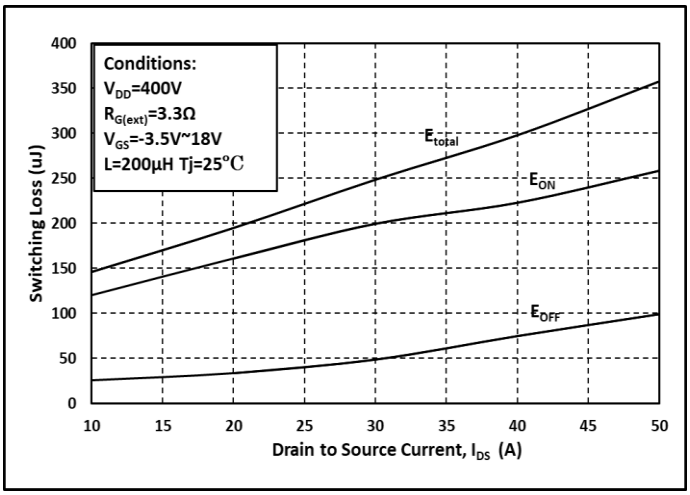


Fig. 21 Switching Energy vs. I_{DS}

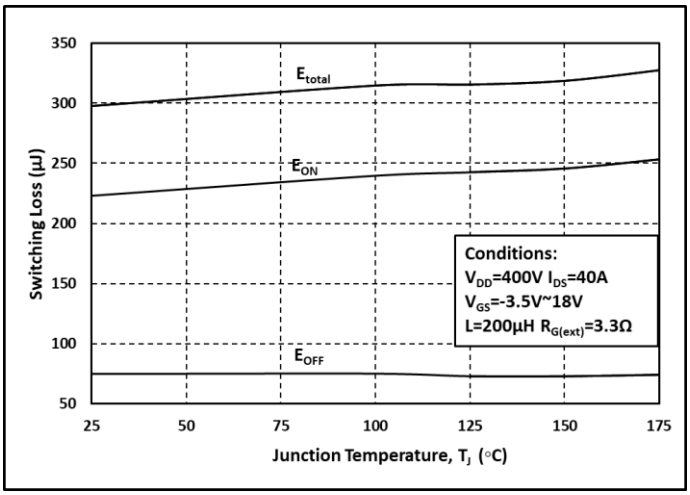


Fig. 22 Switching Energy vs. Temperature

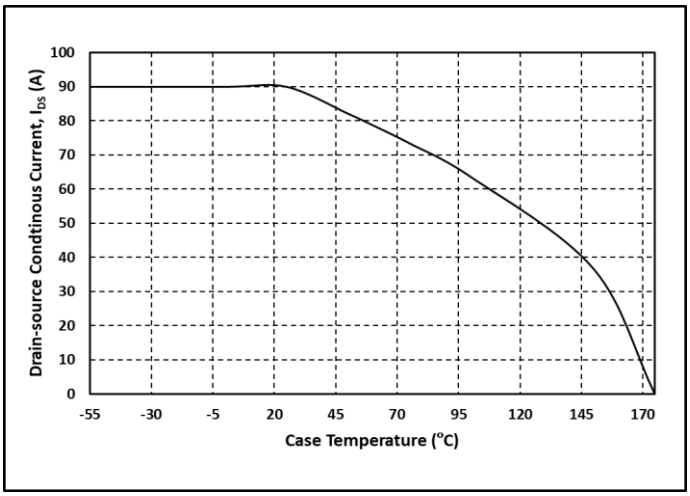


Fig. 23 Continuous Drain Current vs. Case Temperature

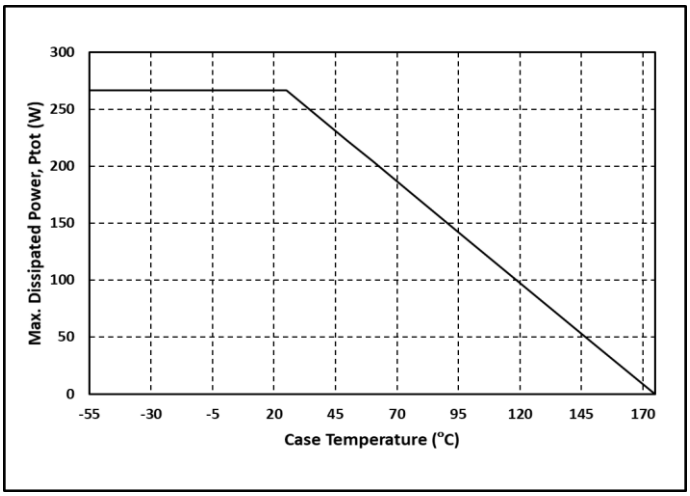


Fig. 24 Max. Power Dissipation Derating vs. Case Temperature

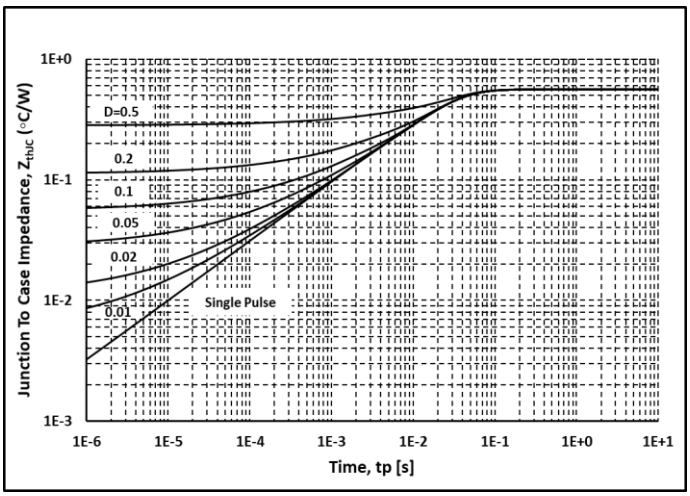


Fig. 25 Thermal impedance

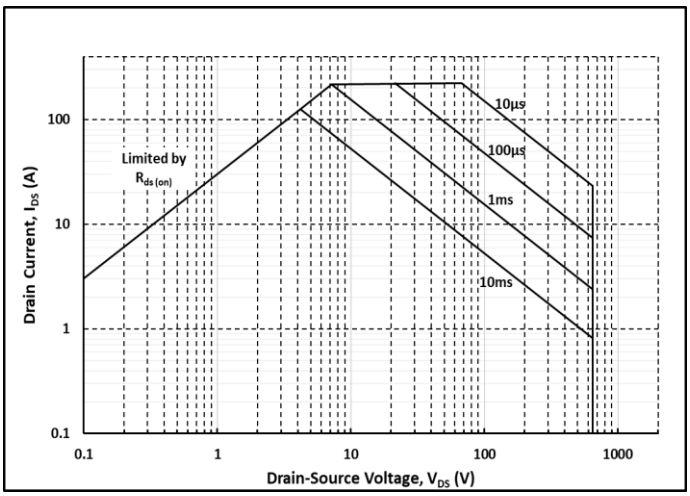
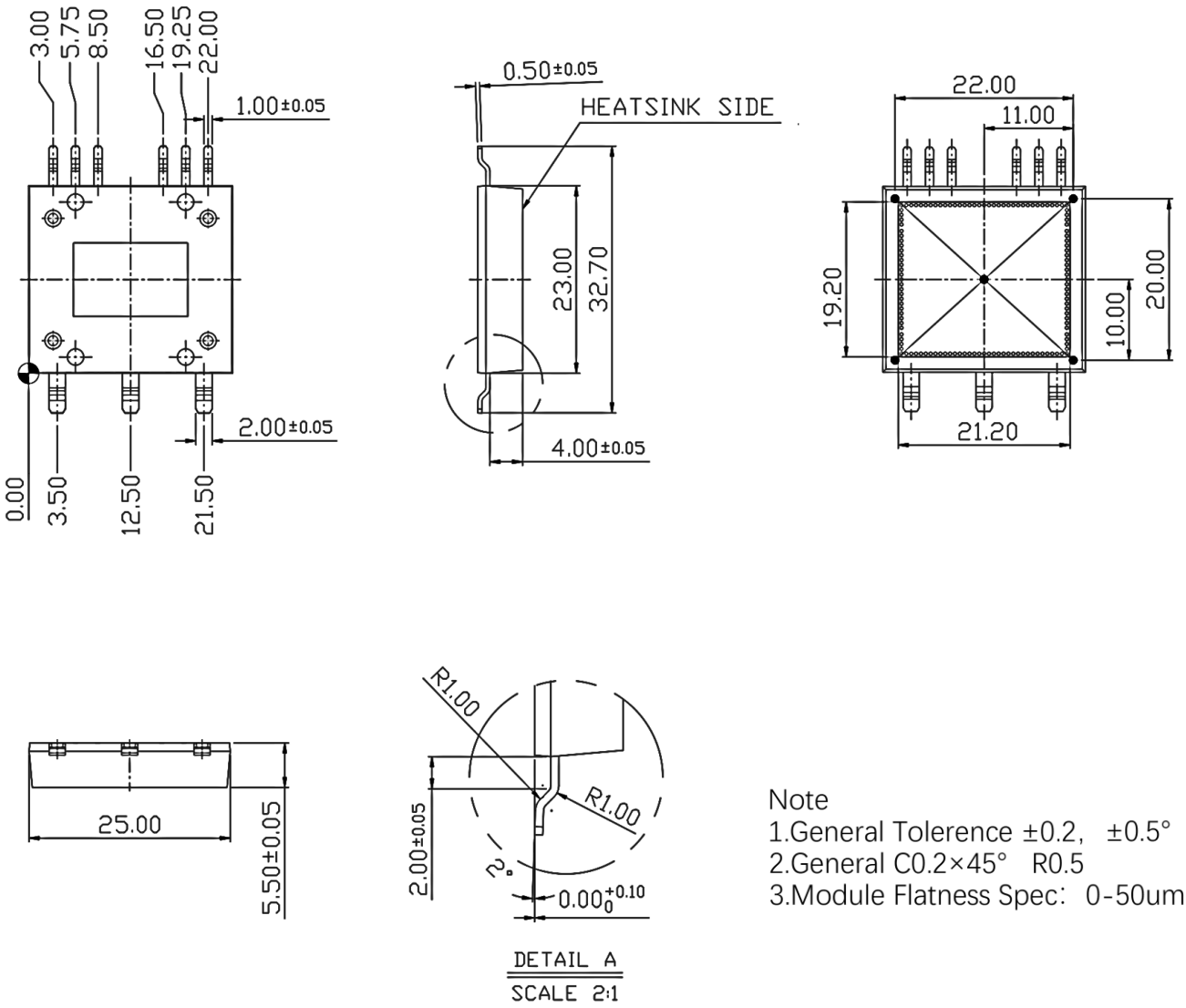


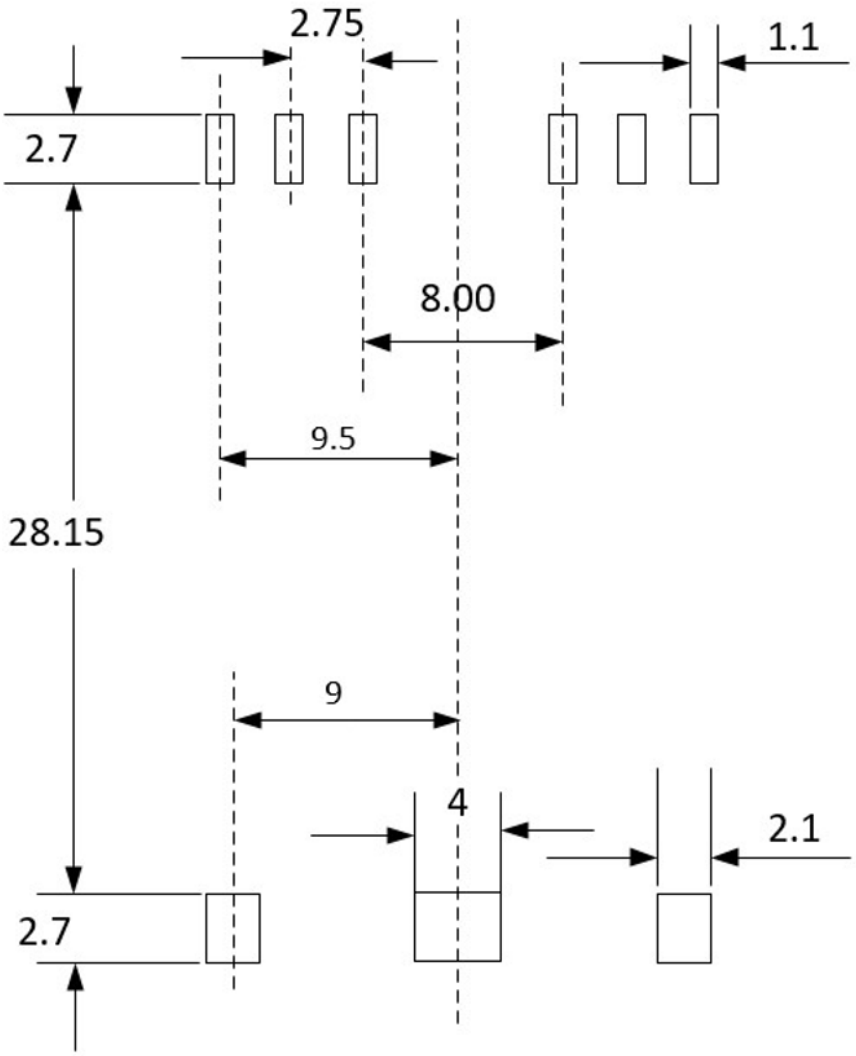
Fig. 26 Safe Operating Area

Package Dimensions



Note
1.General Tolerence ±0.2, ±0.5°
2.General C0.2×45° R0.5
3.Module Flatness Spec: 0-50um

Recommended footprint

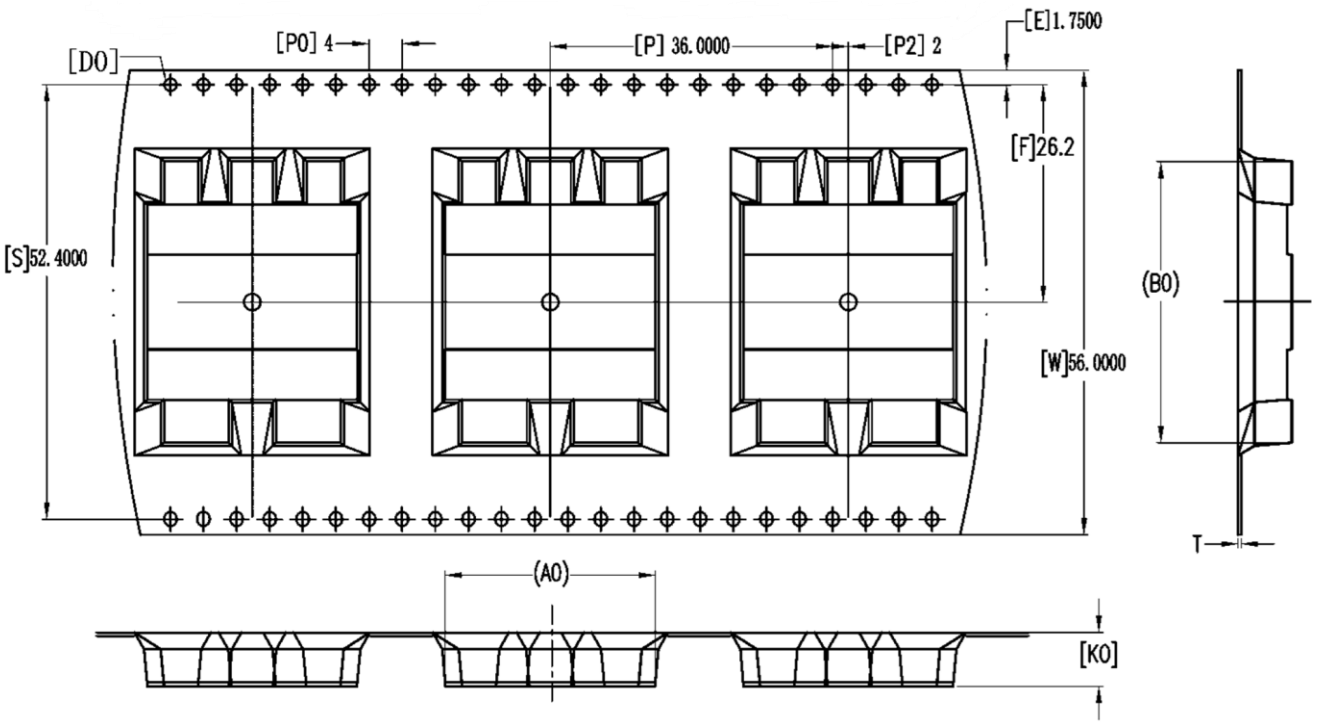


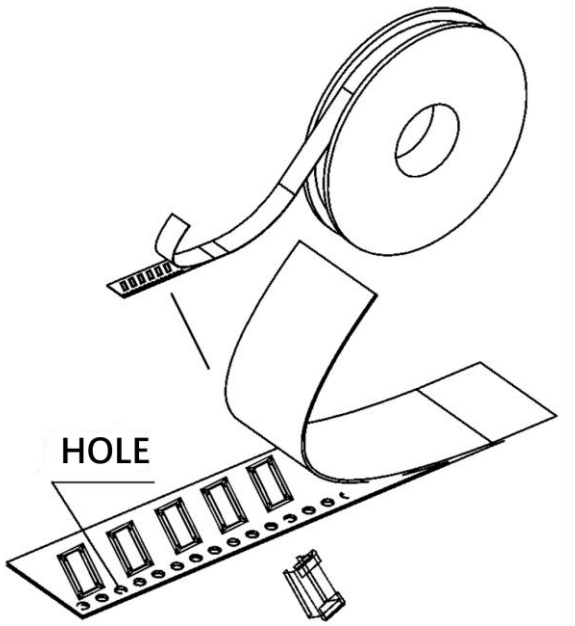
Note:

1.Dimensions in mm.

2.8pin pad is enlarged to accommodate diffetent packages.

Packing information





Dimensions In Millimeters	
A0	25.4±0.1
B0	33.91±0.1
D0	Ø1.50±0.1
E	1.75±0.1
F	26.2±0.15
K0	6.5±0.1
P	36.0±0.1
P0	4.0±0.1
P2	2.0±0.15
S	52.4±0.1
T	0.4±0.05
W	56.0±-0.3

Note:

1. 10 sprocket hole pitch cumulative tolerance ±0.20.
2. Carrier camber is within 1 mm in 250 mm.
3. All dimensions meet EIA-481-C requirements.
4. Material :BLACK PS.
5. Thickness : 0.40±0.05mm.
6. Packing length per 13"reel :9.72Meters.
7. Component load per 13"reel :200 pcs.

Notes

For further information please contact IVCT's office.

The Information in this document is subject to change without notice.

Related Links

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