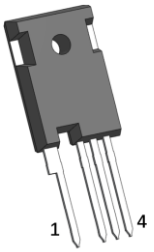
IV3Q12013T4Z- Gen3 1200V 13.5mΩ Automotive SiC MOSFET

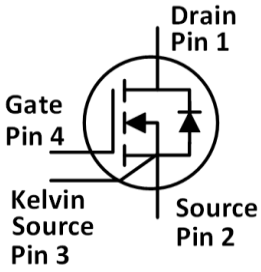
Features

- 3rd Generation SiC MOSFET Technology with +15~+18V gate drive
- High blocking voltage with low on-resistance
- High speed switching with low capacitance
- High operating junction temperature capability
- Very fast, robust and soft-recovery intrinsic body diode
- Kelvin gate input easing driver circuit design
- AEC-Q101 qualified

Outline:



TO247-4



RoHS COMPLIANT

HF

Applications

- EV Motor drivers
- Solar MPPT and inverters
- High voltage DC/DC converters
- Switch mode power supplies

Marking Diagram:

3Q12013T4Z
YYWWZ
XXXX

3Q12013T4Z= 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 20	V	Static (DC)	
V_{GSmax} (Transient)	Maximum transient voltage	-10 to 23	V	Duty cycle<1%, and pulse width<200ns	
V_{GSon}	Recommended turn-on voltage	15 to 18	V		
V_{GSoff}	Recommended turn-off voltage	-3.5 to -2	V		
I_D	Drain current (continuous)	147	A	V_{GS}=18V, T_C=25°C	Fig. 23
		106	A	V_{GS}=18V, T_C=100°C	
I_{DM}	Drain current (pulsed)	367	A	Pulse width limited by SOA	Fig. 26
I_{SM}	Body diode current (pulsed)	367	A	Pulse width limited by SOA and dynamic $R_{\theta(J-C)}$	Fig. 25 26
P_{TOT}	Total power dissipation	553	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		
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
$R_{\theta(J-C)}$	Thermal Resistance from Junction to Case	0.27	°C/W	Fig. 25

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	2.0	2.8	4.0	V	V_{GS}=V_{DS}, I_D=20mA	Fig. 8, 9
			2.0		V	V_{GS}=V_{DS}, I_D=20mA @ T_J=175°C	
R_{ON}	Static drain-source on-resistance		13.5	17	mΩ	V_{GS}=18V, I_D=60A @T_J=25°C	Fig. 4, 5, 6, 7
			22.5		mΩ	V_{GS}=18V, I_D=60A @T_J=175°C	
			17		mΩ	V_{GS}=15V, I_D=60A @T_J=25°C	
			24.5		mΩ	V_{GS}=15V, I_D=60A @T_J=175°C	
C_{iss}	Input capacitance		4774		pF	V_{DS}=800V, V_{GS}=0V, f=100kHz, V_{AC}=25mV	Fig. 16
C_{oss}	Output capacitance		211		pF		
C_{rss}	Reverse transfer capacitance		8.1		pF		
E_{oss}	C_{oss} stored energy		88		μJ		Fig. 17
Q_g	Total gate charge		187		nC	V_{DS}=800V, I_D=100A, V_{GS}=-3 to 18V	Fig. 18
Q_{gs}	Gate-source charge		66		nC		
Q_{gd}	Gate-drain charge		68		nC		
R_g	Gate input resistance		2.3		Ω	f=1MHz	
E_{ON}	Turn-on switching energy		1480		μJ	V_{DS}=800V, I_D=100A, V_{GS}=-3.5 to 18V, $R_{G(ext)}$=2.0Ω, L=200μH T_J=25°C	Fig. 19, 20
E_{OFF}	Turn-off switching energy		430		μJ		
$t_{d(on)}$	Turn-on delay time		22		ns		
t_r	Rise time		33				
$t_{d(off)}$	Turn-off delay time		32				
t_f	Fall time		9.5				

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		3.3		V	I_{SD}=30A, V_{GS}=0V	Fig. 10, 11, 12
			3.0		V	I_{SD}=30A, V_{GS}=0V, T_J=175°C	
I_S	Diode forward current (continuous)			104	A	V_{GS}=-2V, T_C=25°C	
				62	A	V_{GS}=-2V, T_C=100°C	
t_{rr}	Reverse recovery time		48		ns	V_{GS}=-3.5V/+18V, I_{SD}=100A, V_R=800V, $R_{G(ext)}$=10Ω L=200μH di/dt=3000A/μs	
Q_{rr}	Reverse recovery charge		289		nC		
I_{RRM}	Peak reverse recovery current		29		A		

Typical Performance (curves)

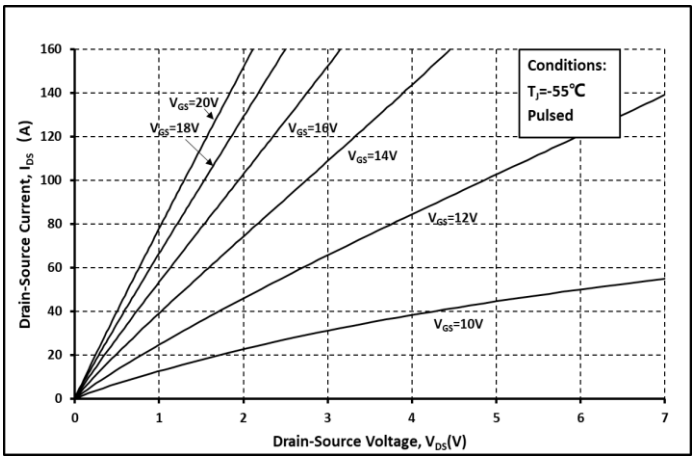


Fig. 1 Output Curve @ T_J=-55°C

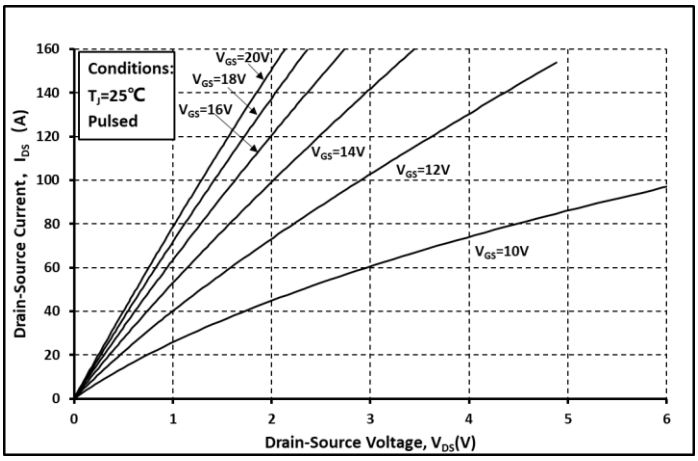


Fig. 2 Output Curve @ T_J=25°C

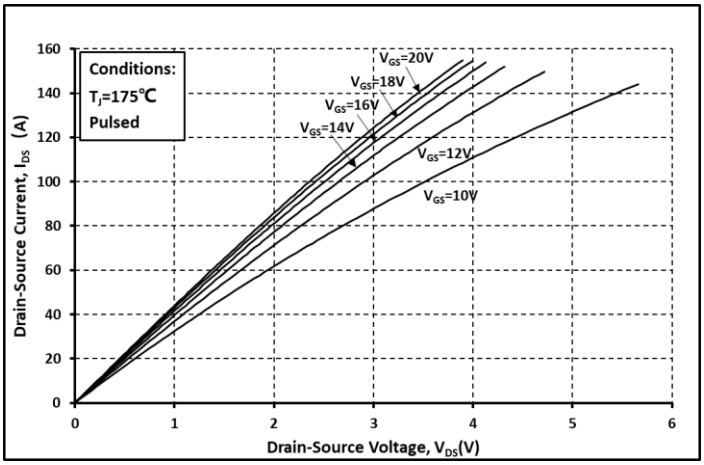


Fig. 3 Output Curve @ T_J=175°C

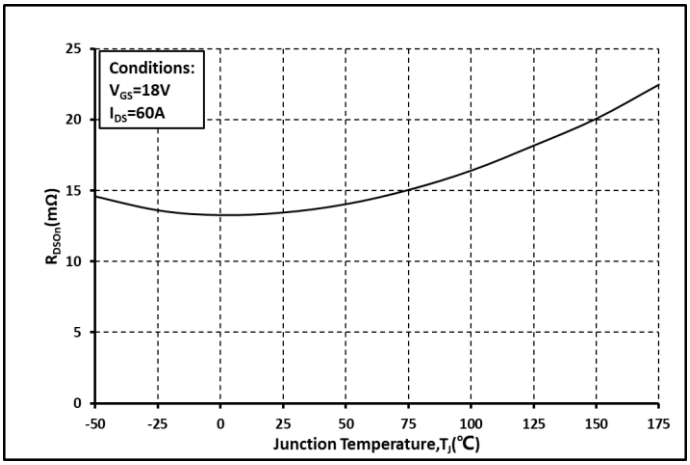


Fig. 4 Ron vs. Temperature

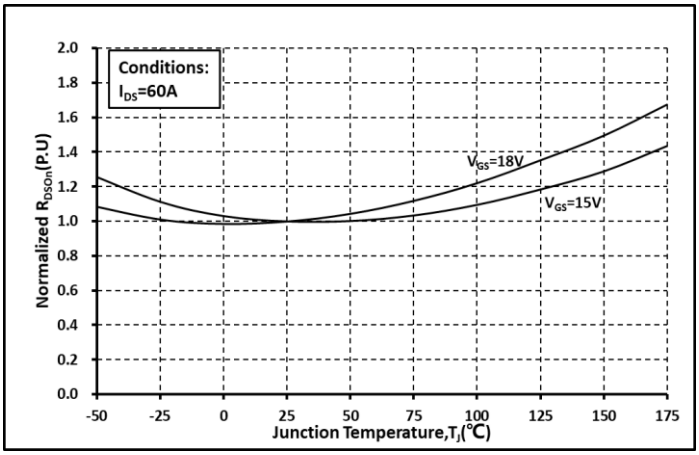


Fig. 5 Normalized Ron vs. Temperature

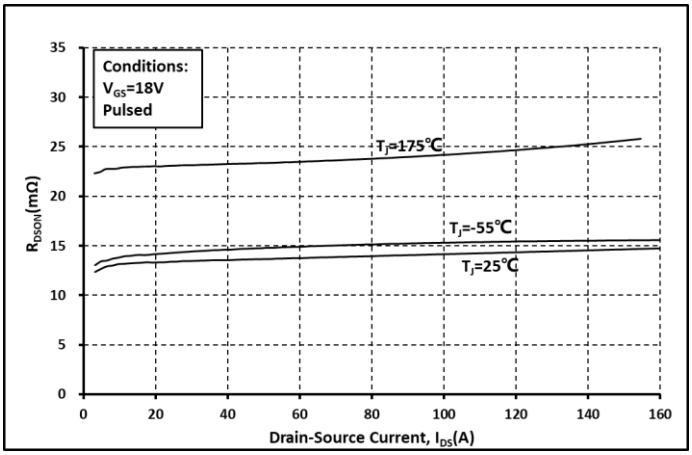


Fig. 6 Ron vs. I_{DS} @ Various Temperature

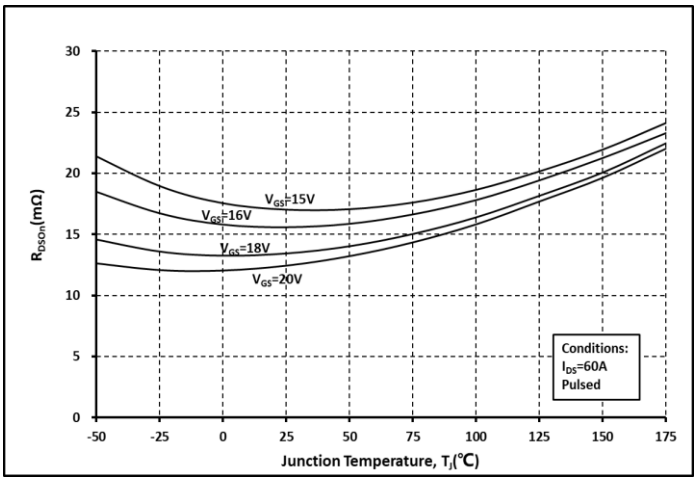


Fig. 7 Ron vs. Temperature @ Various V_{GS}

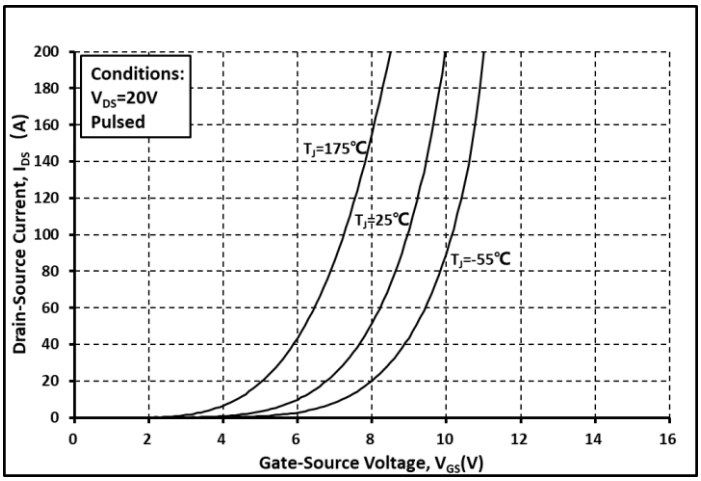


Fig. 8 Transfer Curves @ Various Temperature

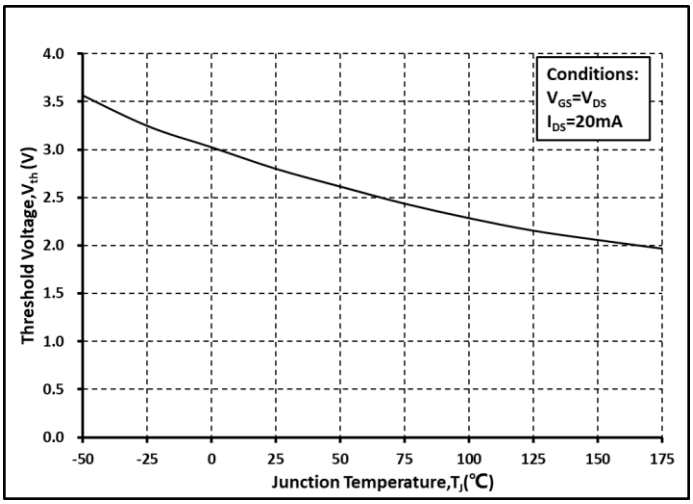


Fig. 9 Threshold Voltage vs. Temperature

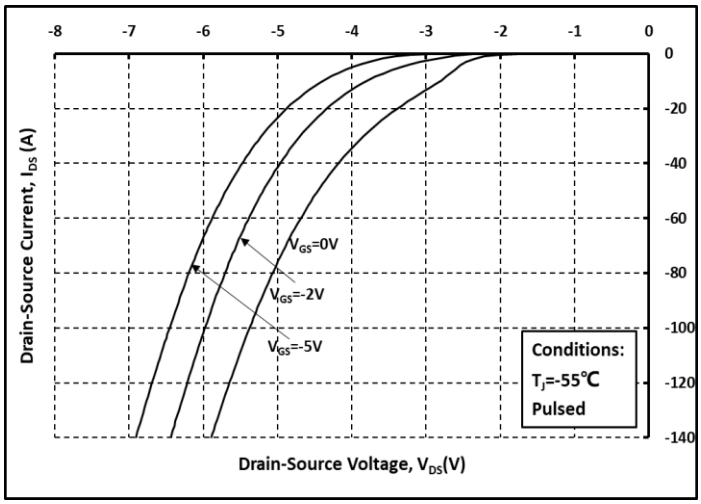


Fig. 10 Body Diode curves @ T_J=-55°C

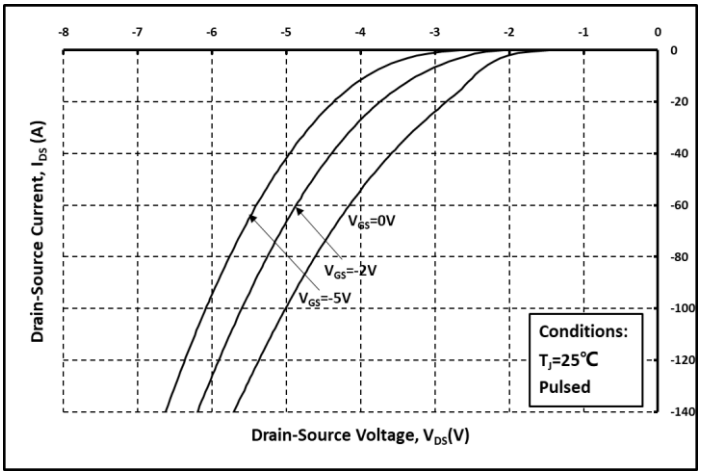


Fig. 11 Body Diode curves @ T_J=25°C

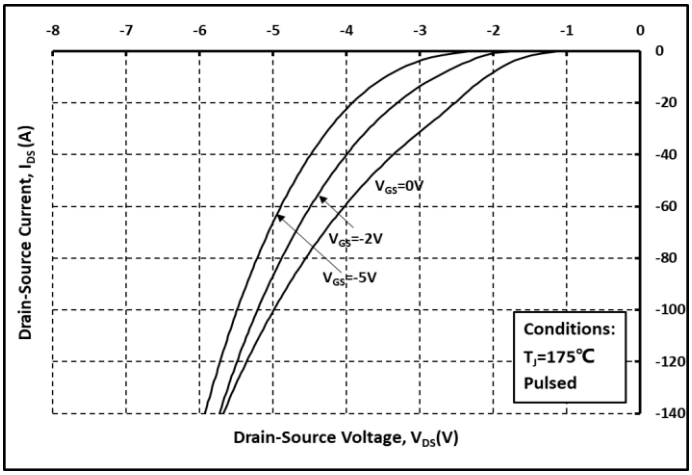


Fig. 12 Body Diode curves @ T_J=175°C

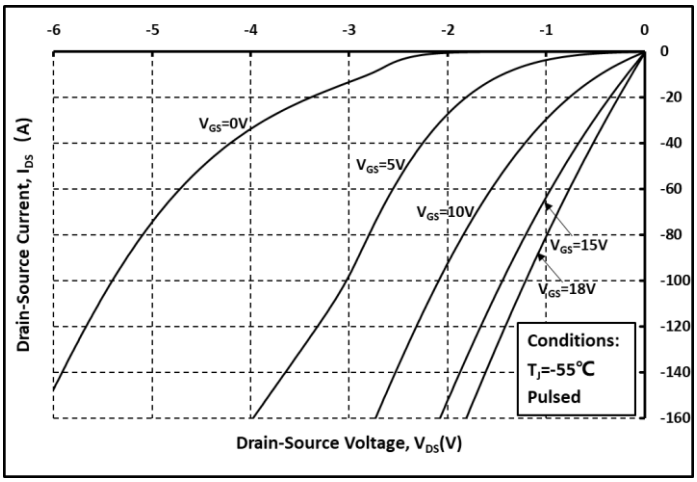


Fig. 13 3rd Quadrant curves @ T_J=-55°C

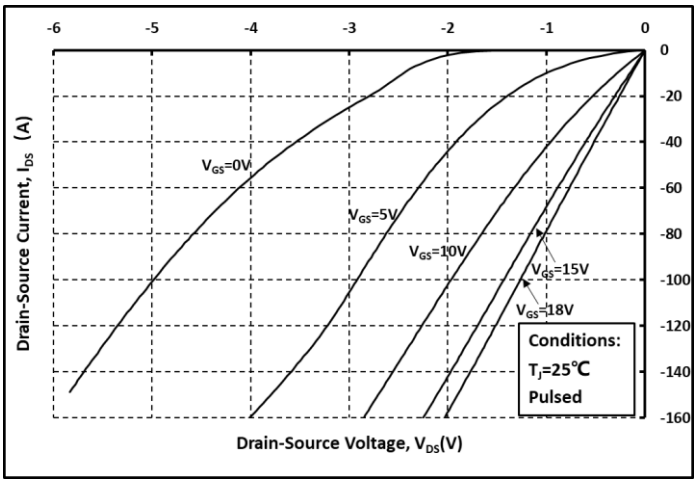


Fig. 14 3rd Quadrant curves @ T_J=25°C

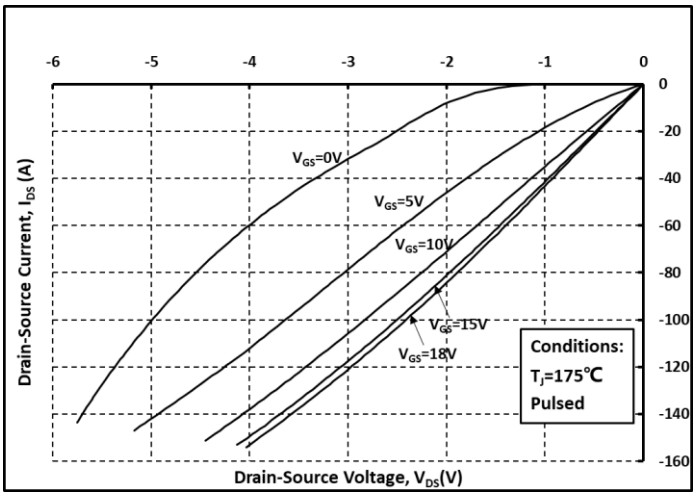


Fig. 15 3rd Quadrant curves @ T_J=175°C

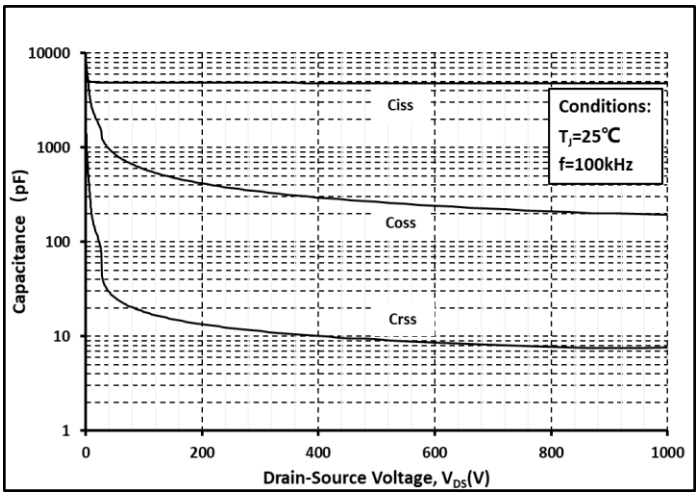


Fig. 16 Capacitance vs. V_{DS}

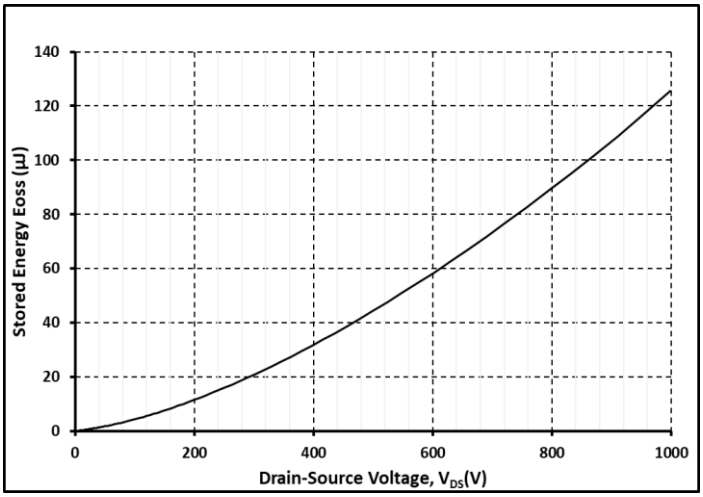


Fig. 17 Output Capacitor Stored Energy

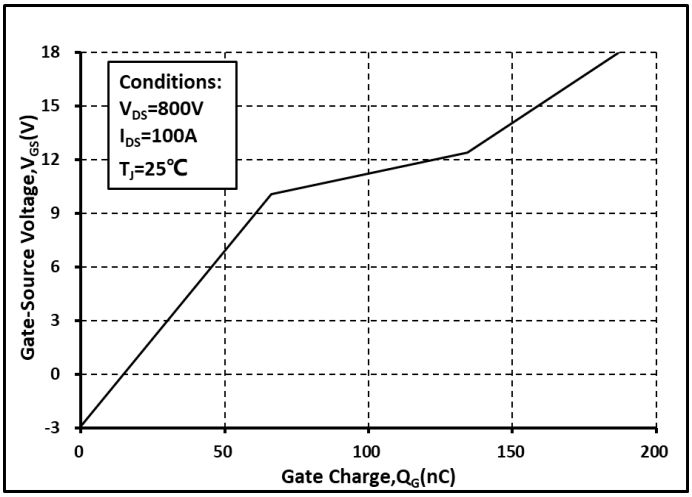


Fig. 18 Gate Charge Characteristics

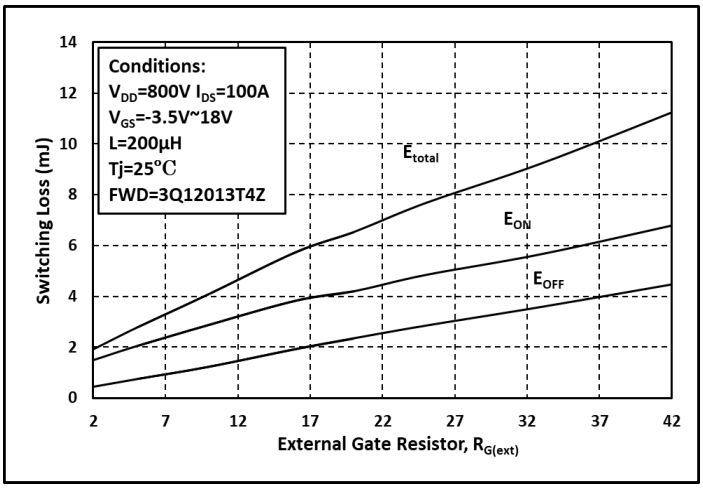


Fig. 19 Switching Energy vs. $R_{G(ext)}$

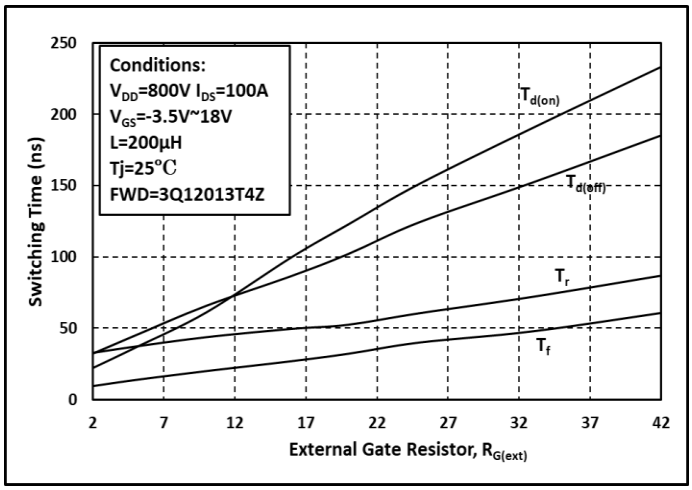


Fig. 20 Switching Times vs. $R_{G(ext)}$

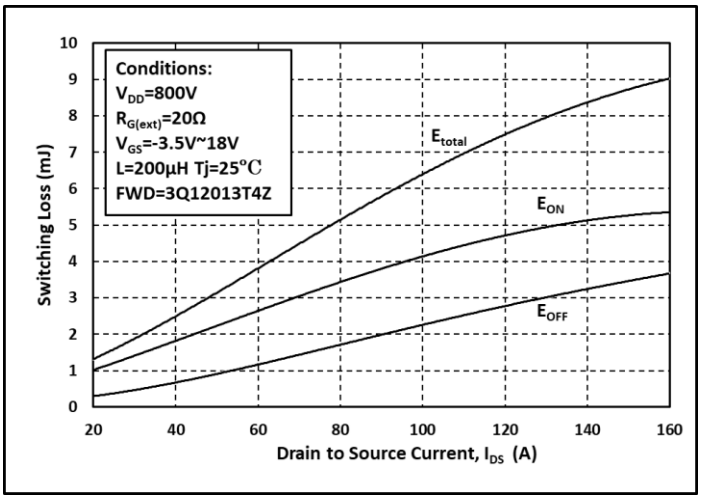


Fig. 21 Switching Energy vs. I_{DS}

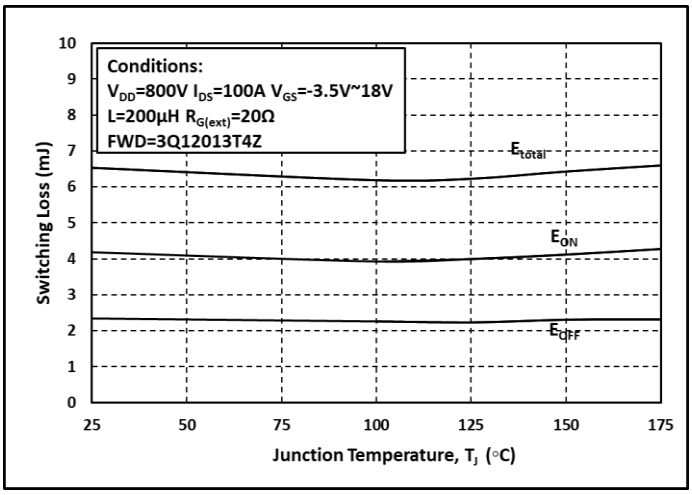


Fig. 22 Switching Energy vs. Temperature

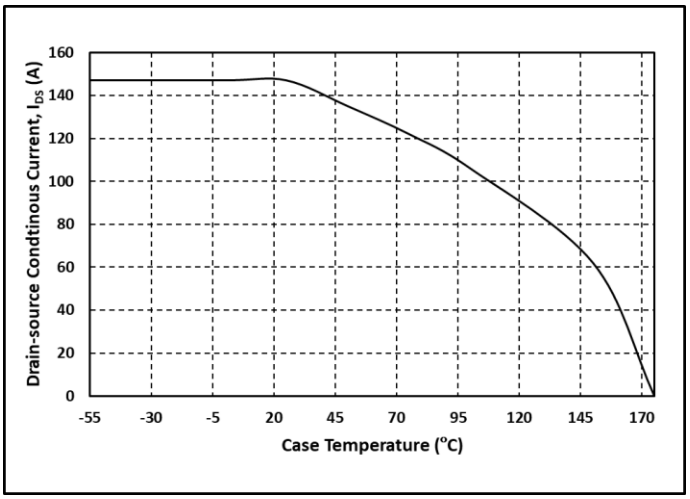


Fig. 23 Continuous Drain Current vs. Case Temperature

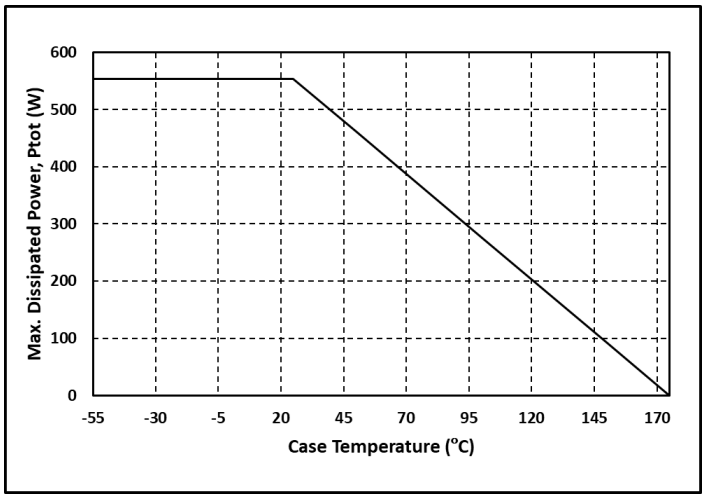


Fig. 24 Max. Power Dissipation Derating vs. Case Temperature

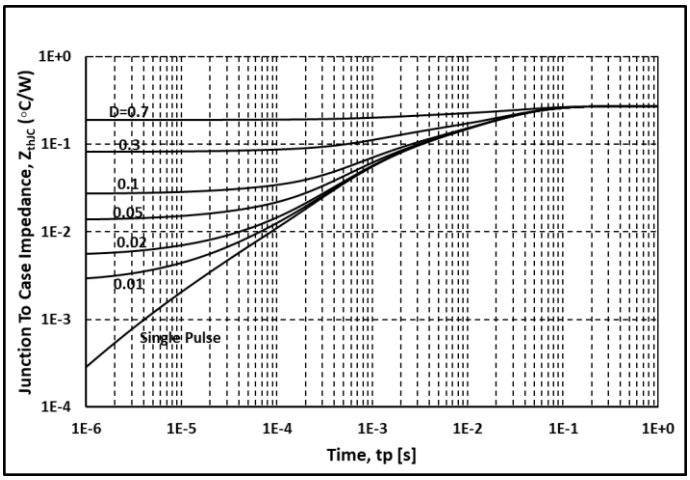


Fig. 25 Thermal impedance

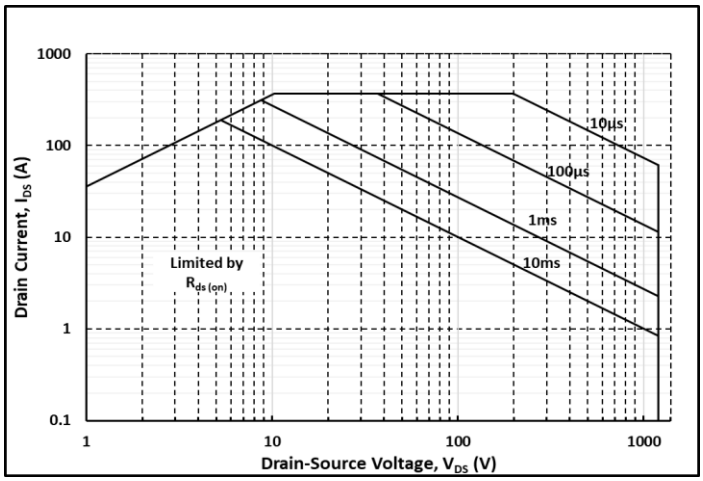
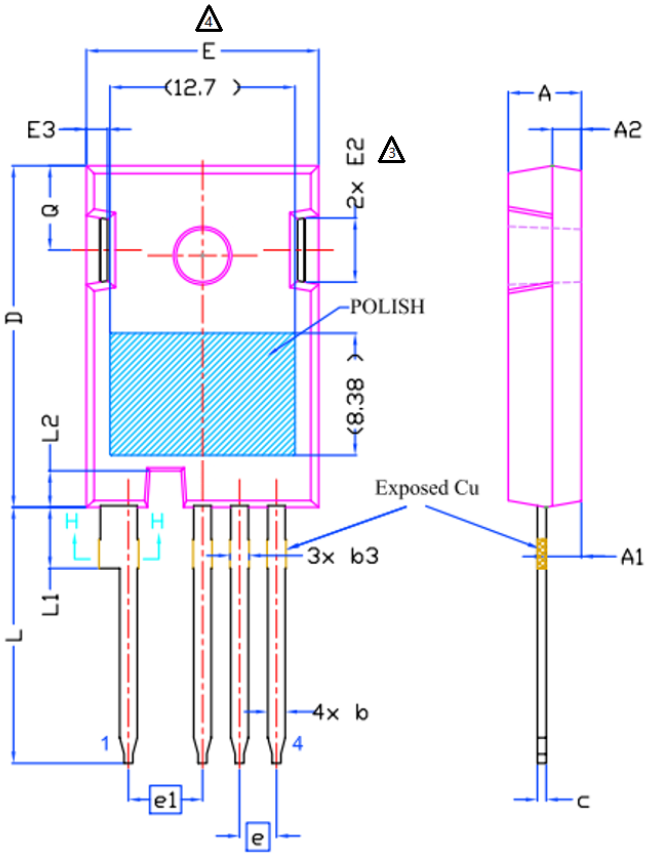
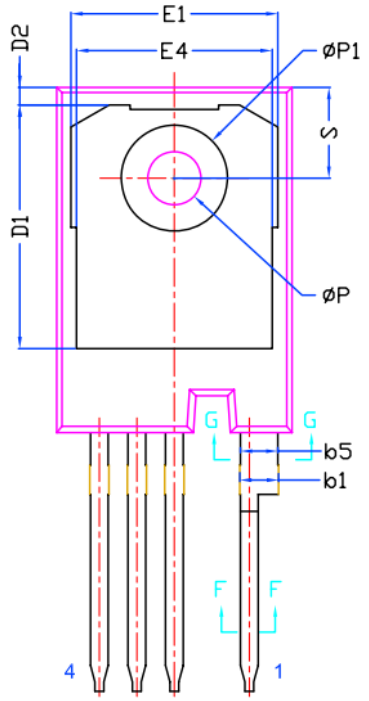


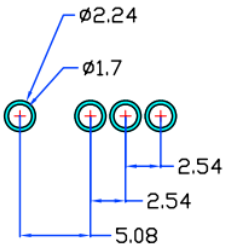
Fig. 26 Safe Operating Area

Package Dimensions

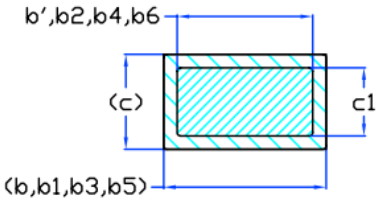


Dimensions In Millimeters		
SYMBOL	MIN.	MAX.
A	4.83	5.21
A1	2.29	2.54
A2	1.91	2.16
b	1.07	1.33
b'	1.07	1.28
b1	2.39	2.94
b2	2.39	2.84
b3	1.07	1.60
b4	1.07	1.50
b5	2.39	2.69
b6	2.39	2.64
c	0.55	0.68
c1	0.55	0.65
D	23.30	23.60
D1	16.25	17.65
D2	0.95	1.25
E	15.75	16.13
E1	13.10	14.15
E2	3.68	5.10
E3	1.00	1.90
E4	12.38	13.43
e	2.54 BSC	
e1	5.08 BSC	
L	17.31	17.82
L1	3.97	4.37
L2	2.35	2.65
N	4	
ϕP	3.51	3.65
ϕP1	7.18 REF.	
Q	5.49	6
S	6.04	6.3





Recommended Solder Pad Layout



Section F--F, G--G, H--H

Note:

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

For further information please contact IVCT's office.

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

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