

IV1Q06040T3 – 650V 40mΩ SiC MOSFET

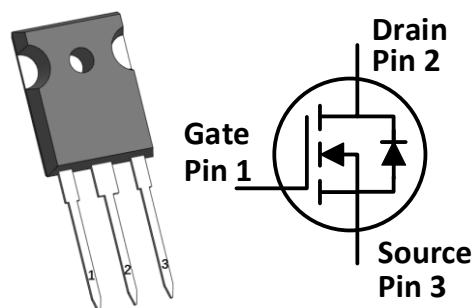
Features

- 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:

1Q06040T3
YYWWZ
XXXX

1Q06040T3 = Specific Device Code
YY = Year
WW = Work Week
Z = Assembly Location
XXXX = Lot Traceability

Absolute Maximum Ratings ($T_c=25^{\circ}\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DS}	Drain-Source voltage	650	V	$V_{GS}=0\text{V}$, $I_D=100\mu\text{A}$	
$V_{GSmax}(\text{DC})$	Maximum DC voltage	-5 to 22	V	Static (DC)	
$V_{GSmax}(\text{Spike})$	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)	72	A	$V_{GS}=20\text{V}$, $T_c=25^{\circ}\text{C}$	Fig. 21
		58	A	$V_{GS}=20\text{V}$, $T_c=100^{\circ}\text{C}$	
I_{DM}	Drain current (pulsed)	180	A	Pulse width limited by SOA	Fig. 24
P_{TOT}	Total power dissipation	348	W	$T_c=25^{\circ}\text{C}$	Fig. 22
T_{stg}	Storage temperature range	-55 to 175	$^{\circ}\text{C}$		
T_J	Operating junction temperature	-55 to 175	$^{\circ}\text{C}$		
T_L	Solder Temperature	260	$^{\circ}\text{C}$	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	0.431	$^{\circ}\text{C/W}$	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		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	3.2	5	V	V _{GS} =V _{DS} , I _D =6.1mA	Fig. 8, 9
			2.2		V	V _{GS} =V _{DS} , I _b =6.1mA @ T _J =175°C	
R _{ON}	Static drain-source on-resistance		40	55	mΩ	V _{GS} =20V, I _D =20A @T _J =25°C	Fig. 4, 5, 6, 7
			53		mΩ	V _{GS} =20V, I _D =20A @T _J =175°C	
C _{iss}	Input capacitance		2692		pF	V _{DS} =600V, V _{GS} =0V, f=1MHz, V _{AC} =25mV	Fig. 16
C _{oss}	Output capacitance		179		pF		
C _{rss}	Reverse transfer capacitance		10.8		pF		
E _{oss}	C _{oss} stored energy		35.6		μJ		Fig. 17
Q _g	Total gate charge		110.8		nC	V _{DS} =400V, I _D =20A, V _{GS} = -5 to 20V	Fig. 18
Q _{gs}	Gate-source charge		26.8		nC		
Q _{gd}	Gate-drain charge		35.7		nC		
R _g	Gate input resistance		2		Ω	f=1MHz	
E _{ON}	Turn-on switching energy		289.1		μJ	V _{DS} =400V, I _D =30A, V _{GS} = -2 to 20V, R _{G(ext)} =3.3Ω, L=450μH	Fig. 19, 20
E _{OFF}	Turn-off switching energy		117.1		μJ		
t _{d(on)}	Turn-on delay time		24.7		ns		
t _r	Rise time		20.3				
t _{d(off)}	Turn-off delay time		29.6				
t _f	Fall time		12.4				

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		4.0		V	I _{SD} =20A, V _{GS} =0V	Fig. 10, 11, 12
			3.6		V	I _{SD} =20A, V _{GS} =0V, T _J =175°C	
t _{rr}	Reverse recovery time		23		ns	V _{GS} =-2V/+20V, I _{SD} =30A, V _R =400V, di/dt=1700A/μs, R _{G(ext)} =3.3Ω L=450μH	
Q _{rr}	Reverse recovery charge		161		nC		
I _{RRM}	Peak reverse recovery current		10.4		A		

Typical Performance (curves)

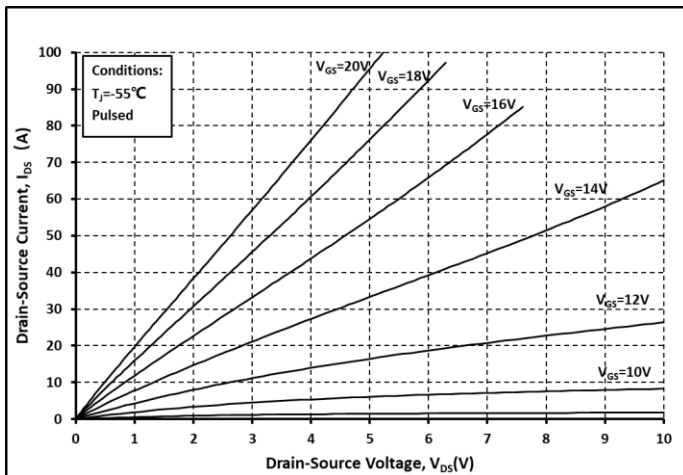


Fig. 1 Output Curve @ $T_j = -55^\circ\text{C}$

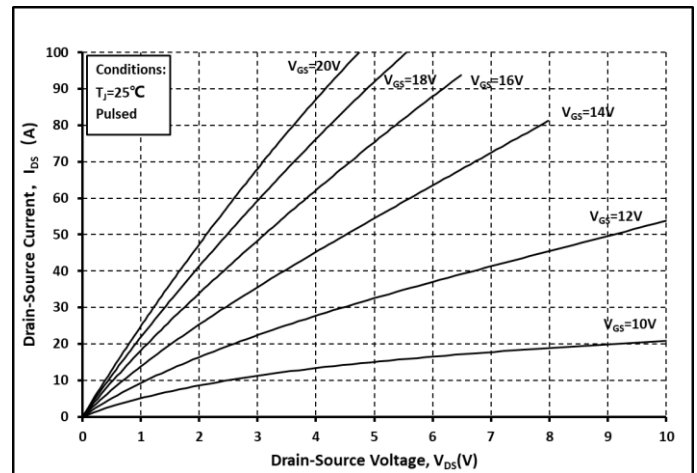


Fig. 2 Output Curve @ $T_j = 25^\circ\text{C}$

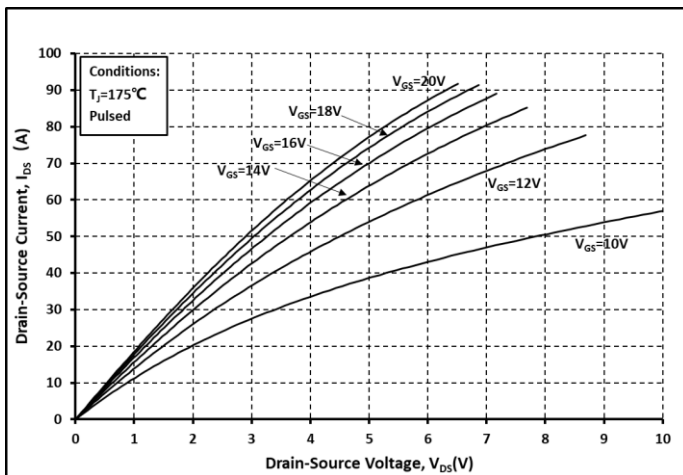


Fig. 3 Output Curve @ $T_j = 175^\circ\text{C}$

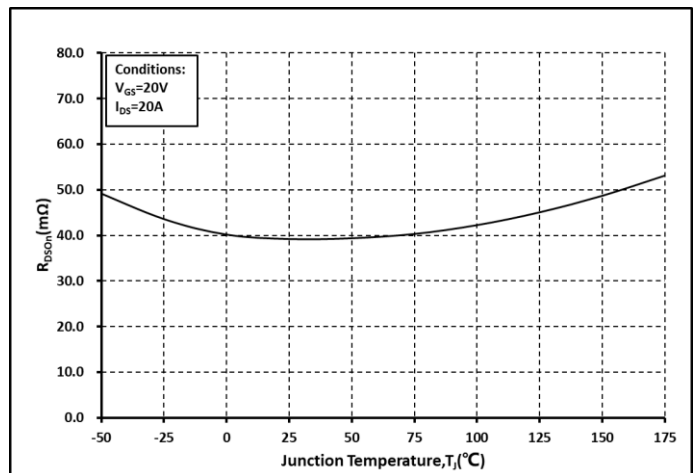


Fig. 4 R_{on} vs. Temperature

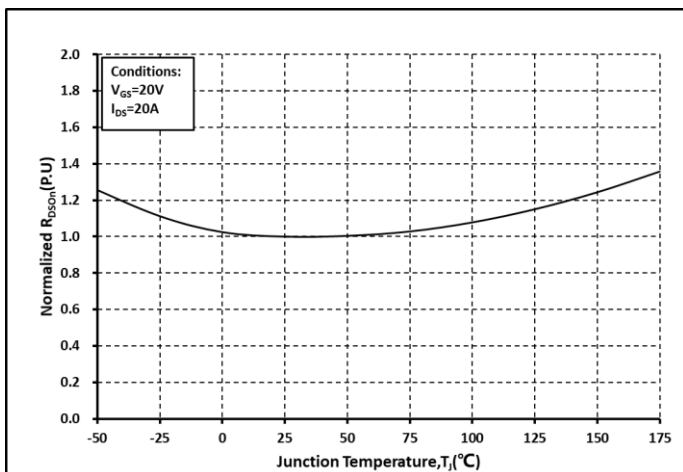


Fig. 5 Normalized R_{on} vs. Temperature

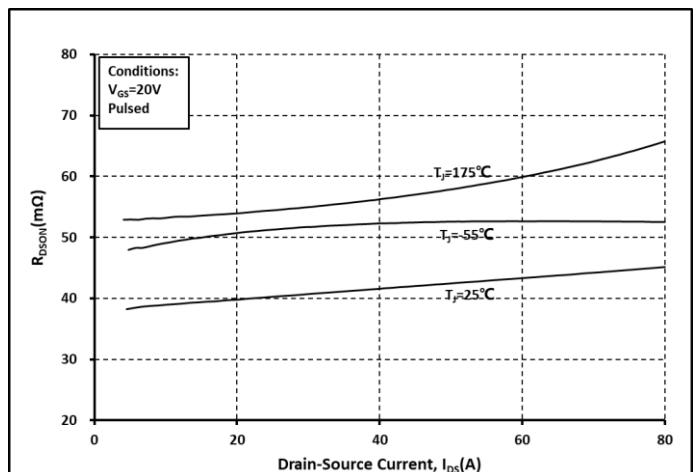


Fig. 6 R_{on} vs. I_{DS} @ Various Temperature

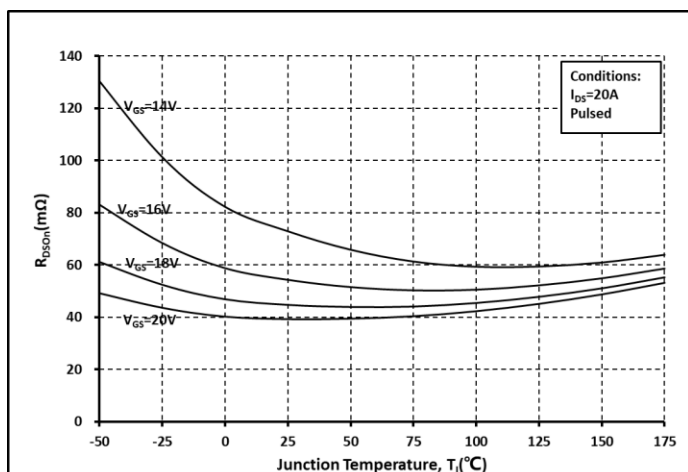


Fig. 7 Ron vs. Temperature @ Various V_{GS}

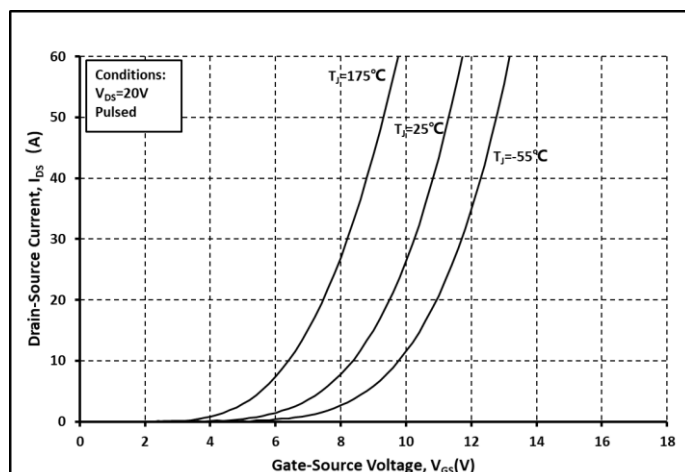


Fig. 8 Transfer Curves @ Various Temperature

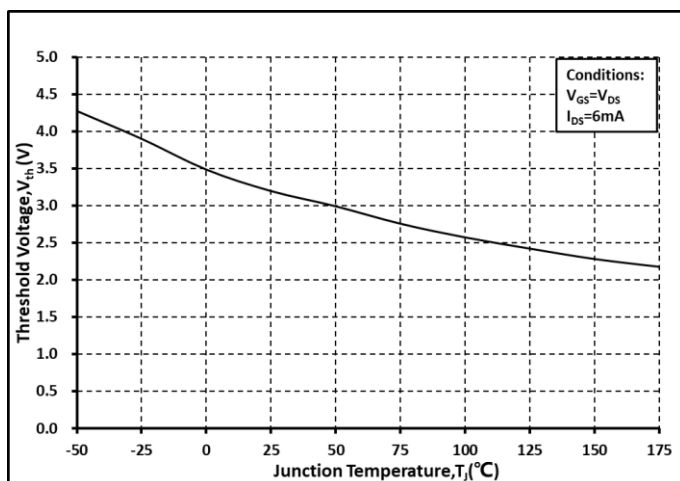


Fig. 9 Threshold Voltage vs. Temperature

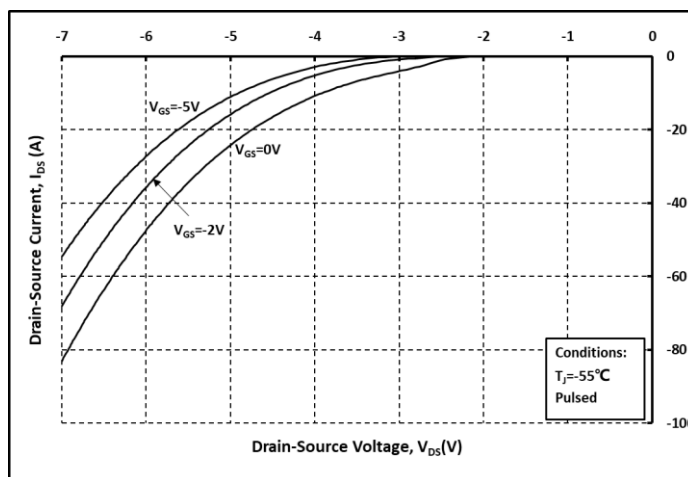


Fig. 10 Body Diode Curves @ $T_J = -55^{\circ}\text{C}$

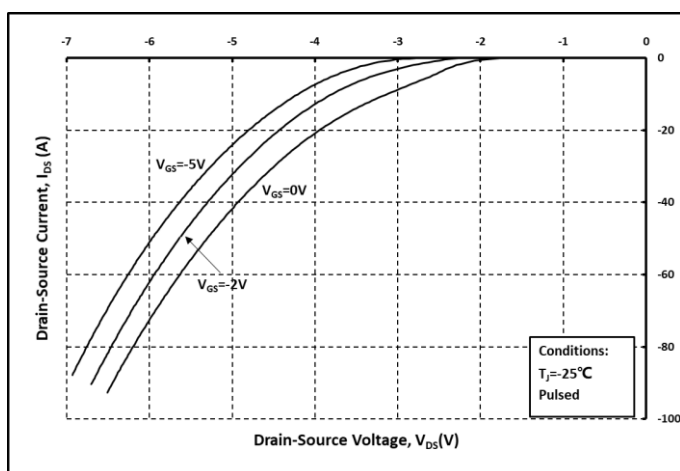


Fig. 11 Body Diode Curves @ $T_J = 25^{\circ}\text{C}$

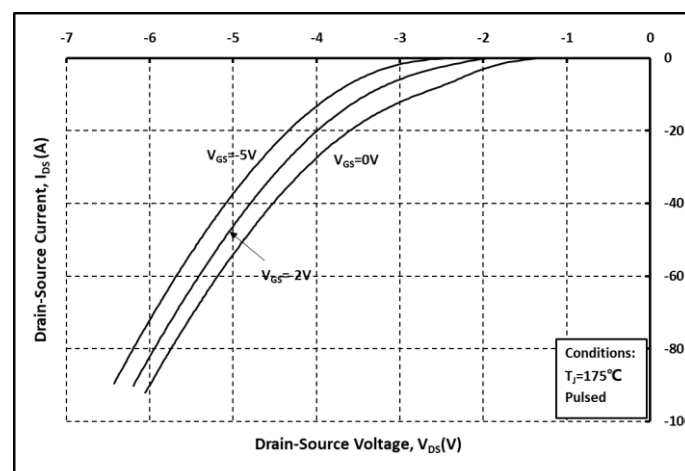


Fig. 12 Body Diode Curves @ $T_J = 175^{\circ}\text{C}$

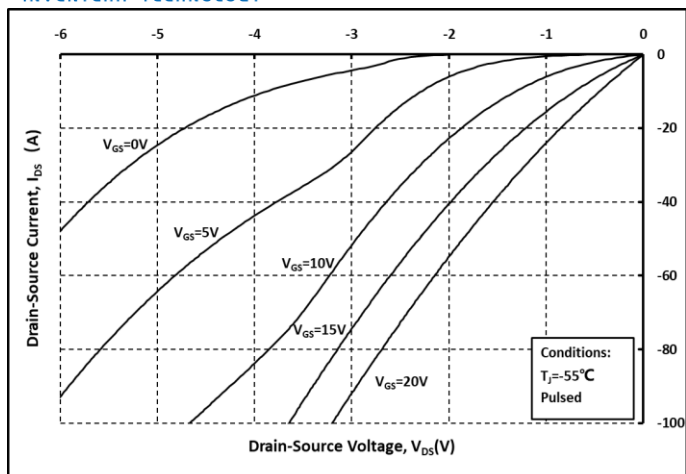


Fig. 13 3rd Quadrant Curves @ $T_j = -55^\circ\text{C}$

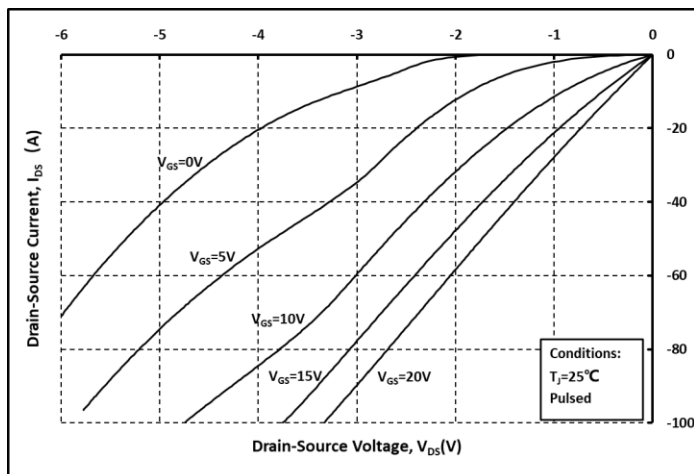


Fig. 14 3rd Quadrant Curves @ $T_j = 25^\circ\text{C}$

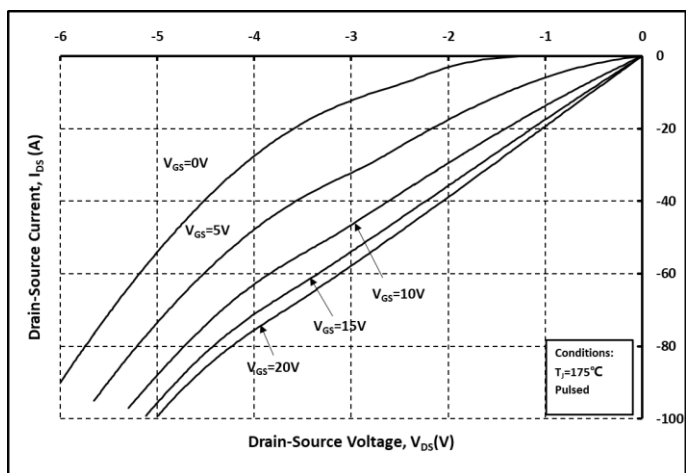


Fig. 15 3rd Quadrant Curves @ $T_j = 175^\circ\text{C}$

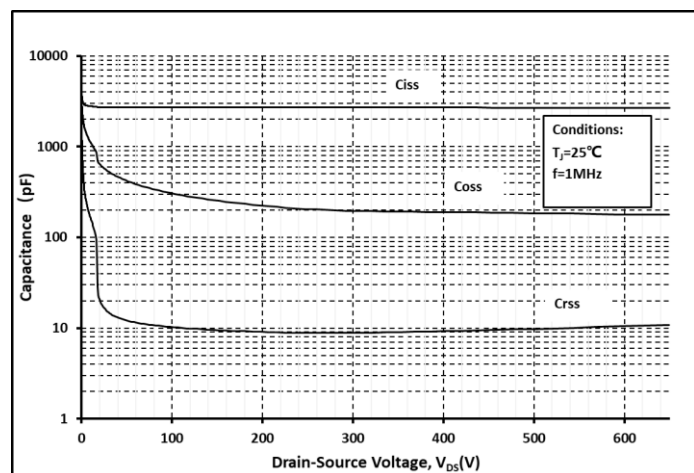


Fig. 16 Capacitance vs. V_{DS}

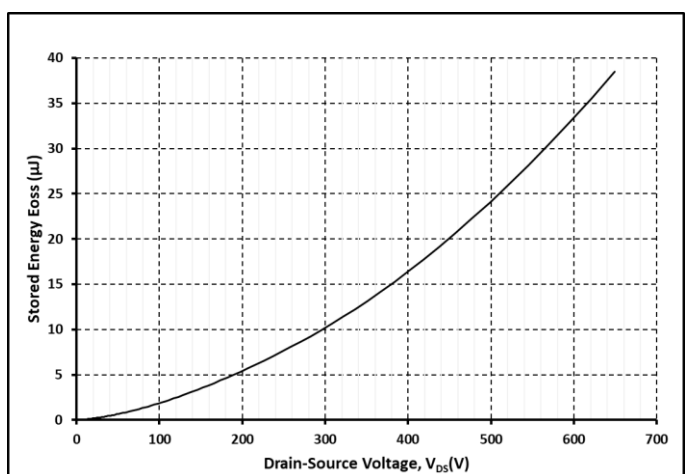


Fig. 17 Output Capacitor Stored Energy

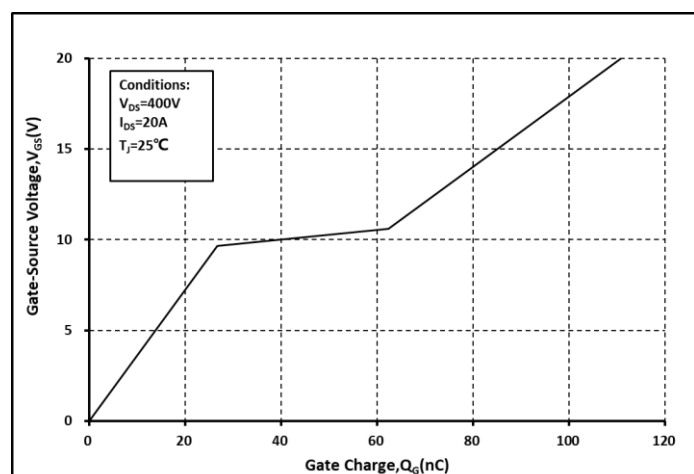


Fig. 18 Gate Charge Characteristics

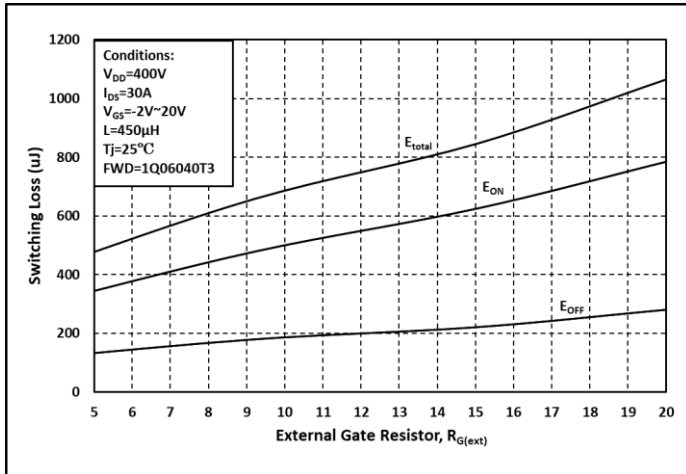


Fig. 19 Switching Energy vs. $R_{G(ext)}$

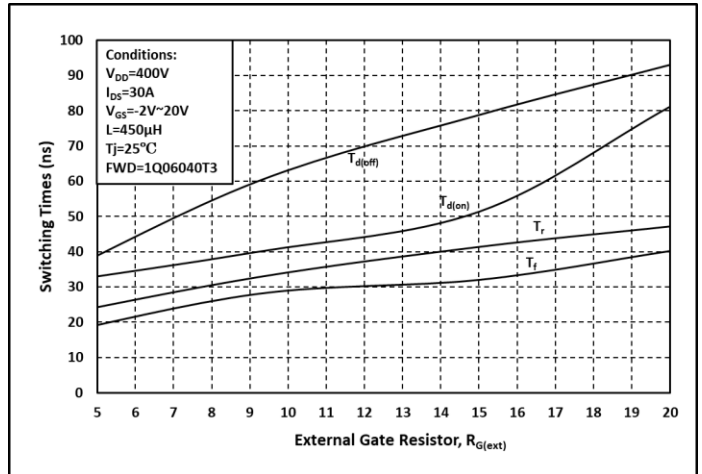


Fig. 20 Switching Times vs. $R_{G(ext)}$

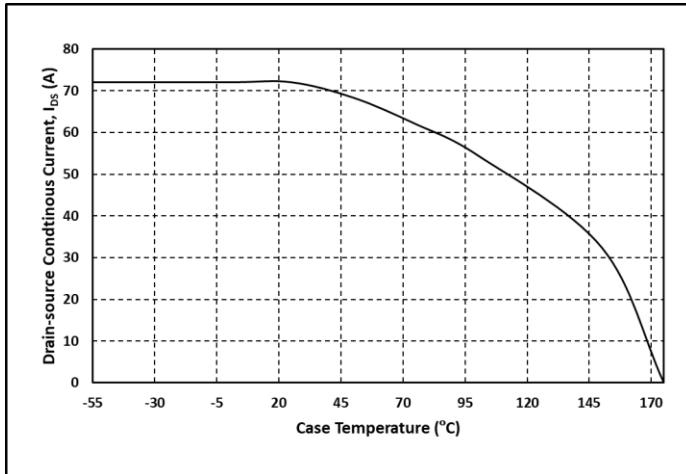


Fig. 21 Continuous Drain Current vs. Case Temperature

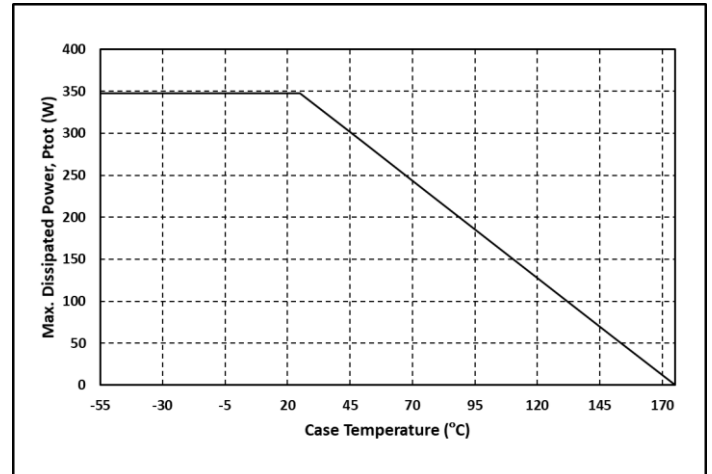


Fig. 22 Max. Power Dissipation Derating vs. Case Temperature

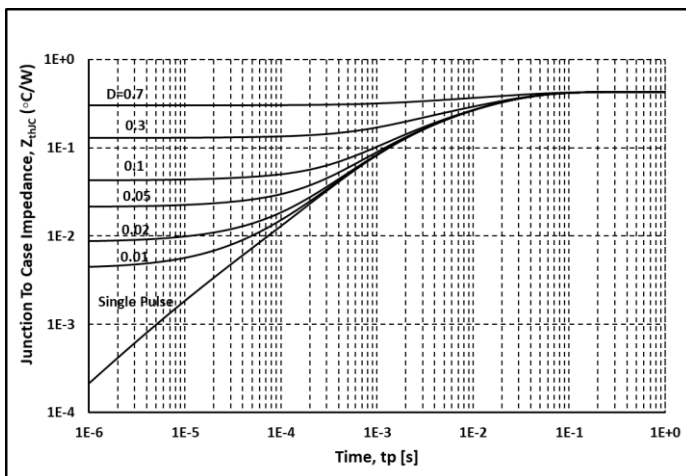


Fig. 23 Thermal Impedance

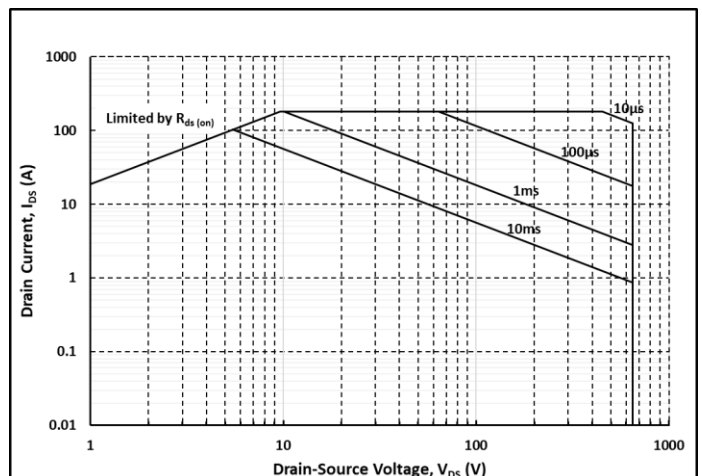
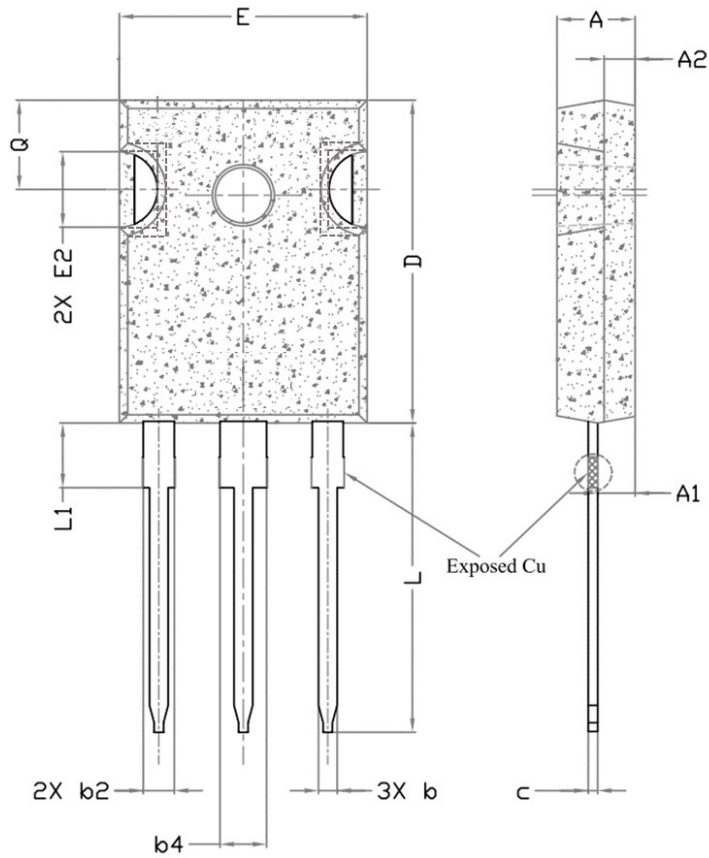
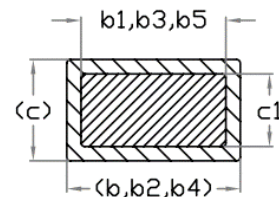
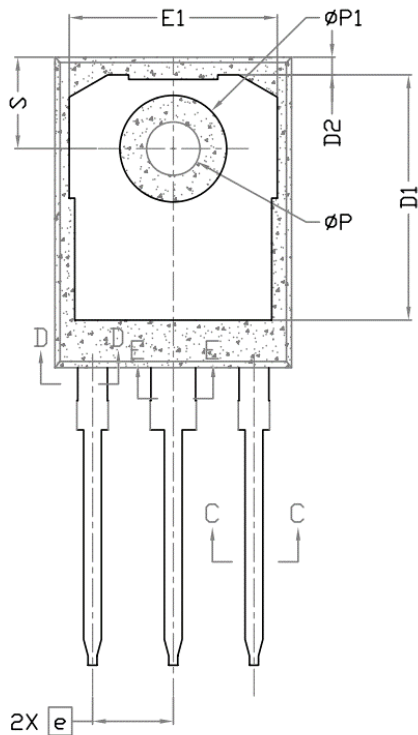


Fig. 24 Safe Operating Area

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
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

Notes

Current revision is preliminary one, for further information please contact IVCT's Office.

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