

IV1Q12030T4G – 1200V 30mΩ SiC MOSFET

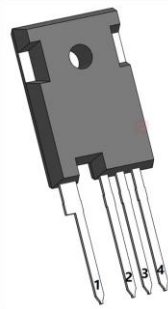
Features

- 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
- Kelvin gate input easing driver circuit design

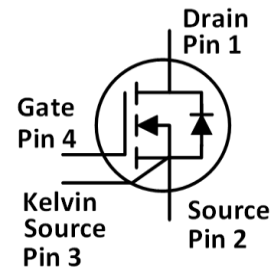
Applications

- Solar inverters
- UPS
- Motor drivers
- High voltage DC/DC converters
- Switch mode power supplies

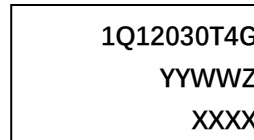
Outline:



TO247-4



Marking Diagram:



1Q12030T4G= 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 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)	79	A	V _{GS} =20V, T _C =25°C	Fig. 23
		58	A	V _{GS} =20V, T _C =100°C	
I _{DM}	Drain current (pulsed)	197	A	Pulse width limited by SOA	Fig. 26
P _{TOT}	Total power dissipation	410	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 _{θ(j-c)}	Thermal Resistance from Junction to Case	0.365	°C/W	Fig. 25

Electrical Characteristics ($T_c=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value			Unit	Test Conditions	Note
		Min.	Typ.	Max.			
I_{DSS}	Zero gate voltage drain current		5	100	μA	$V_{DS}=1200\text{V}, V_{GS}=0\text{V}$	
I_{GSS}	Gate leakage current			± 100	nA	$V_{DS}=0\text{V}, V_{GS}=-5\sim 20\text{V}$	
V_{TH}	Gate threshold voltage	1.8	2.8	5	V	$V_{GS}=V_{DS}, I_D=9.4\text{mA}$	Fig. 8, 9
			2.1			$V_{GS}=V_{DS}, I_D=9.4\text{mA}$ @ $T_J=175^\circ\text{C}$	
R_{ON}	Static drain-source on-resistance		30	40	$\text{m}\Omega$	$V_{GS}=20\text{V}, I_D=40\text{A}$ @ $T_J=25^\circ\text{C}$	Fig. 4, 5, 6, 7
			52		$\text{m}\Omega$	$V_{GS}=20\text{V}, I_D=40\text{A}$ @ $T_J=175^\circ\text{C}$	
C_{iss}	Input capacitance		3980		pF	$V_{DS}=800\text{V}, V_{GS}=0\text{V},$ $f=100\text{kHz},$ $V_{AC}=25\text{mV}$	Fig. 16
C_{oss}	Output capacitance		166		pF		
C_{rss}	Reverse transfer capacitance		10.1		pF		
E_{oss}	C_{oss} stored energy		66		μJ		Fig. 17
Q_g	Total gate charge		168		nC	$V_{DS}=800\text{V}, I_D=40\text{A},$ $V_{GS}=-5$ to 20V	Fig. 18
Q_{gs}	Gate-source charge		80		nC		
Q_{gd}	Gate-drain charge		24.8		nC		
R_g	Gate input resistance		2.4		Ω	$f=1\text{MHz}$	
E_{ON}	Turn-on switching energy		684		μJ	$V_{DS}=800\text{V}, I_D=40\text{A},$ $V_{GS}=-3.5$ to $20\text{V},$ $R_{G(\text{ext})}=3.3\Omega,$ $L=200\mu\text{H}$	Fig. 19, 20
E_{OFF}	Turn-off switching energy		244		μJ		
$t_{d(\text{on})}$	Turn-on delay time		16.4		ns		
t_r	Rise time		29.6				
$t_{d(\text{off})}$	Turn-off delay time		31.6				
t_f	Fall time		18				

Reverse Diode Characteristics ($T_c=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value			Unit	Test Conditions	Note
		Min.	Typ.	Max.			
V_{SD}	Diode forward voltage		3.3		V	$I_{SD}=20\text{A}, V_{GS}=0\text{V}$	Fig. 10, 11, 12
			3.1		V	$I_{SD}=20\text{A}, V_{GS}=0\text{V},$ $T_J=175^\circ\text{C}$	
t_{rr}	Reverse recovery time		20.0		ns	$V_{DS}=800\text{V}, I_D=40\text{A},$ $V_{GS}=-3$ to $20\text{V},$ $R_{G(\text{ext})}=12\Omega,$ $L=272\mu\text{H}$ $di/dt=3000\text{A}/\mu\text{s}$	
Q_{rr}	Reverse recovery charge		238.4		nC		
I_{RRM}	Peak reverse recovery current		22.8		A		

Typical Performance (curves)

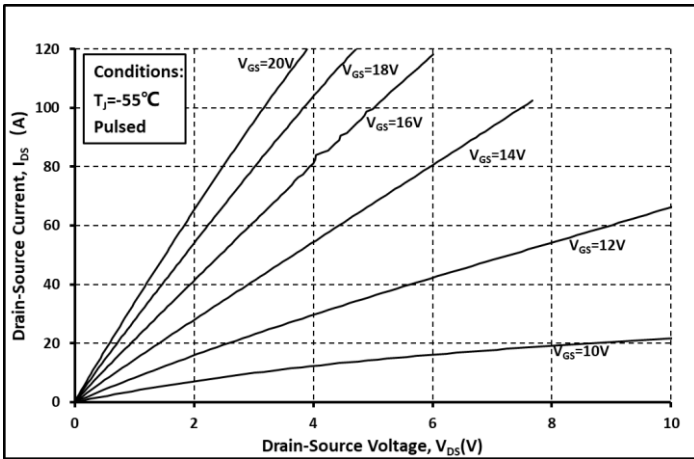


Fig. 1 Output Curve @ $T_j = -55^\circ\text{C}$

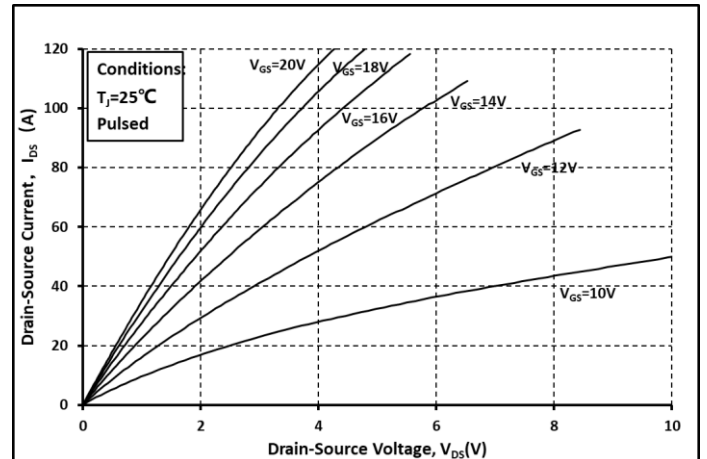


Fig. 2 Output Curve @ $T_j = 25^\circ\text{C}$

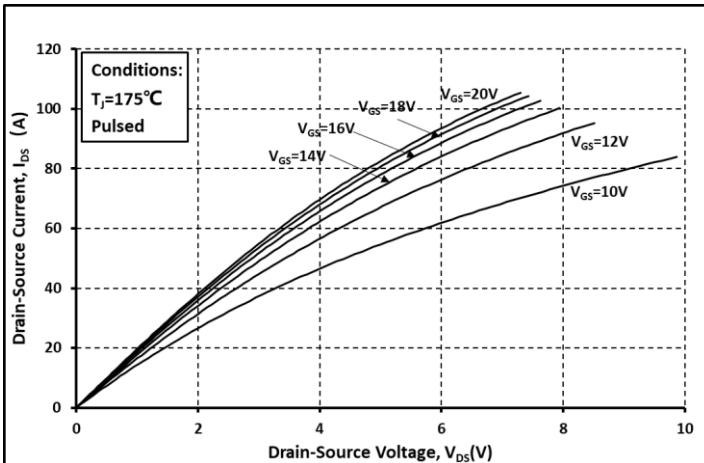


Fig. 3 Output Curve @ $T_j = 175^\circ\text{C}$

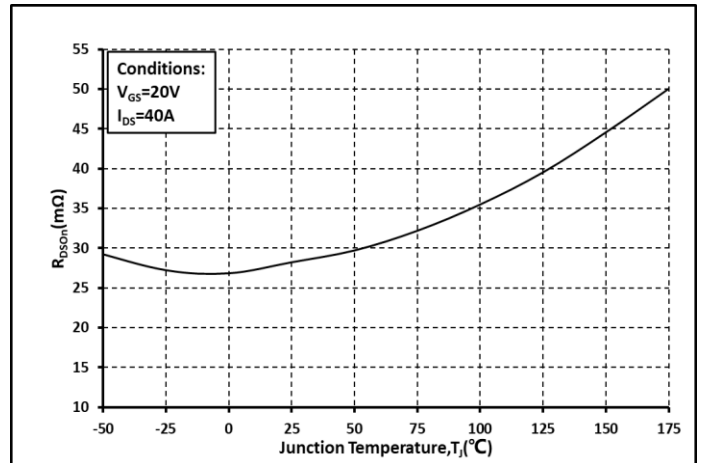


Fig. 4 R_{on} vs. Temperature

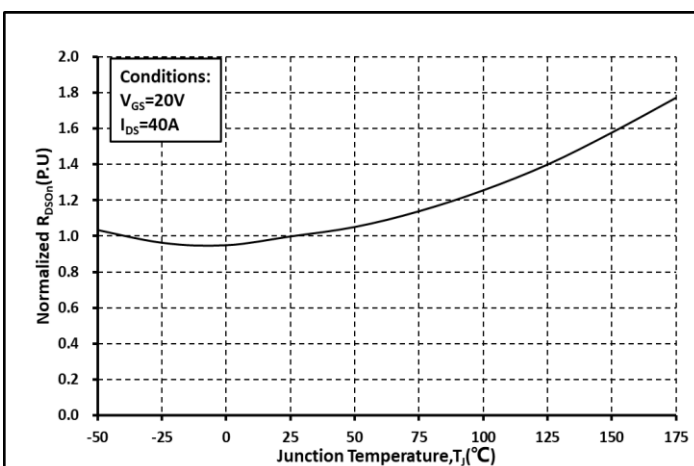


Fig. 5 Normalized R_{on} vs. Temperature

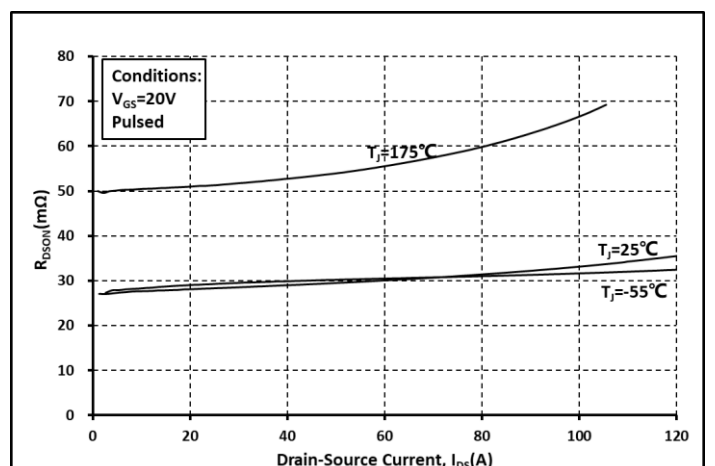


Fig. 6 R_{on} vs. I_{ds} @ Various Temperature

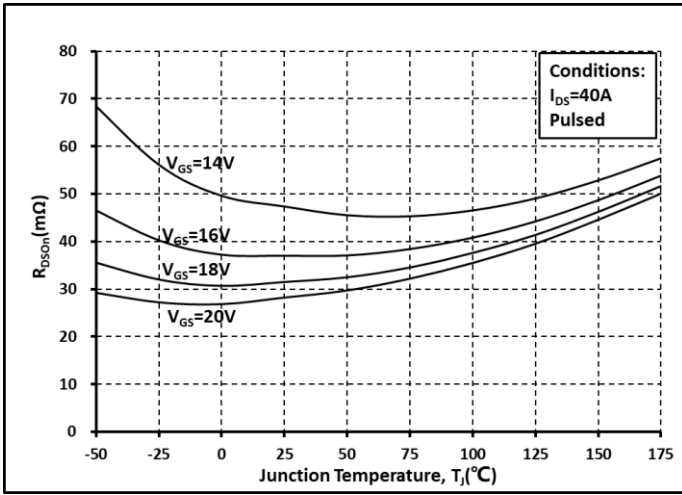


Fig. 7 Ron vs. Temperature @ Various V_{GS}

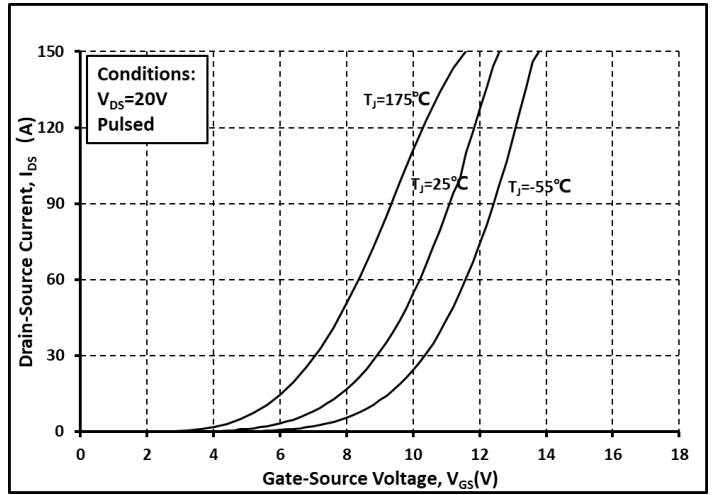


Fig. 8 Transfer Curves @ Various Temperature

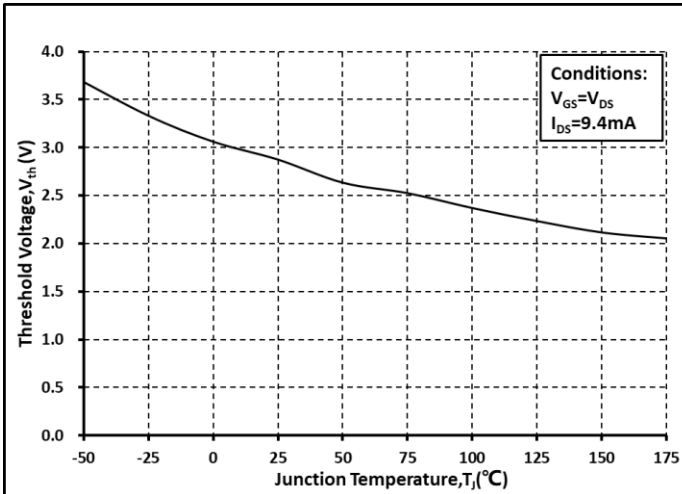


Fig. 9 Threshold Voltage vs. Temperature

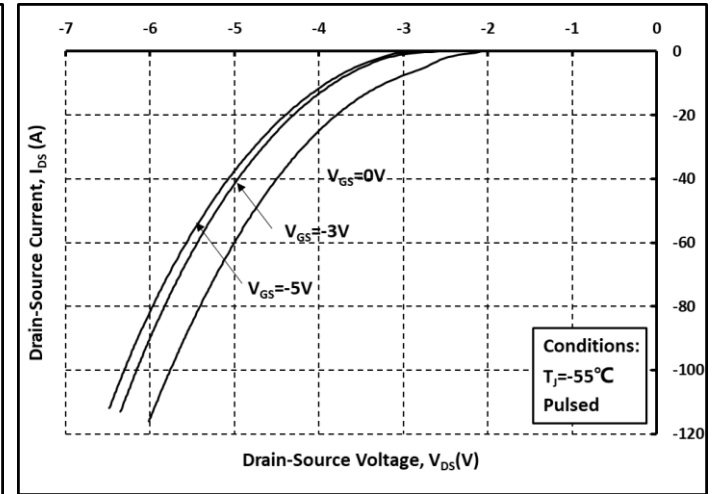


Fig. 10 Body Diode curves @ $T_j=-55^\circ C$

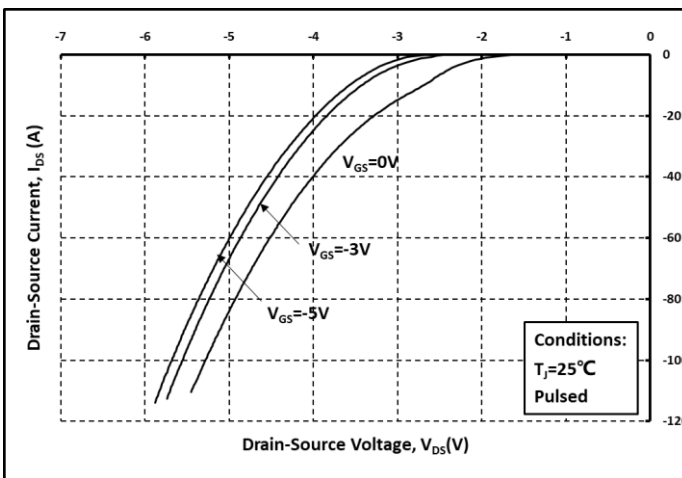


Fig. 11 Body Diode curves @ $T_j=25^\circ C$

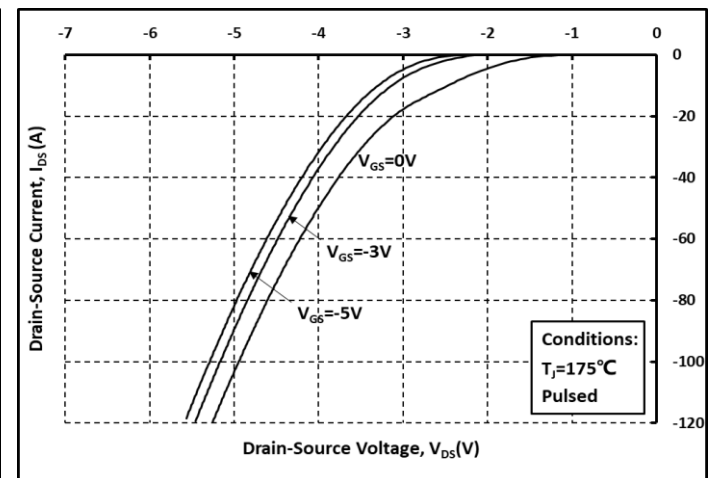


Fig. 12 Body Diode curves @ $T_j=175^\circ C$

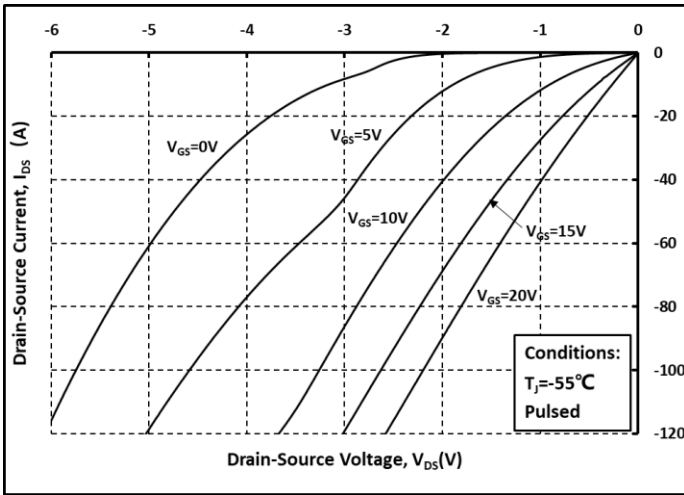


Fig. 13 3rd Quadrant curves @ $T_j = -55^\circ\text{C}$

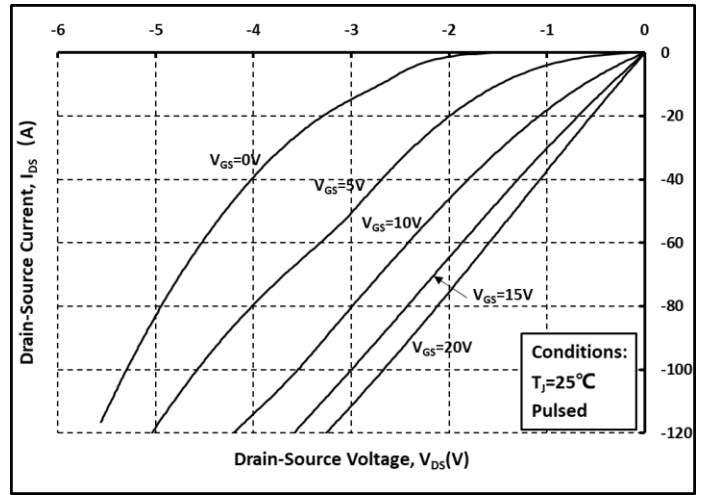


Fig. 14 3rd Quadrant curves @ $T_j = 25^\circ\text{C}$

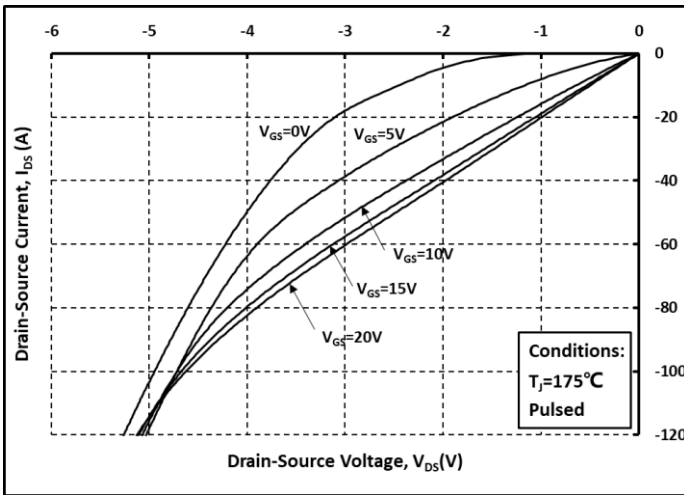


Fig. 15 3rd Quadrant curves @ $T_j = 175^\circ\text{C}$

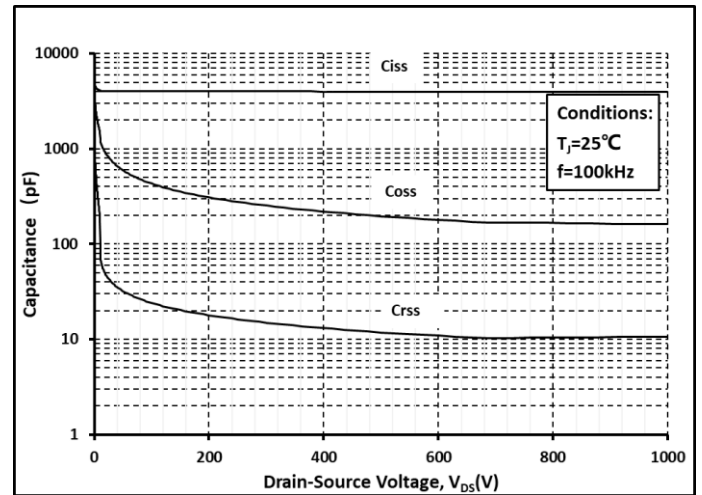


Fig. 16 Capacitance vs. V_{DS}

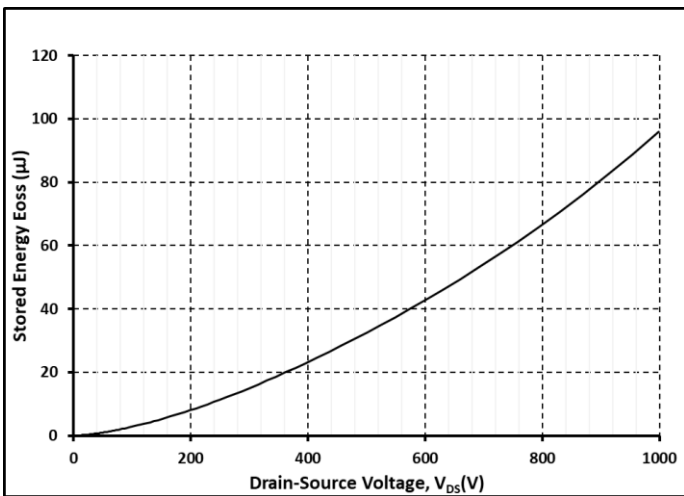


Fig. 17 Output Capacitor Stored Energy

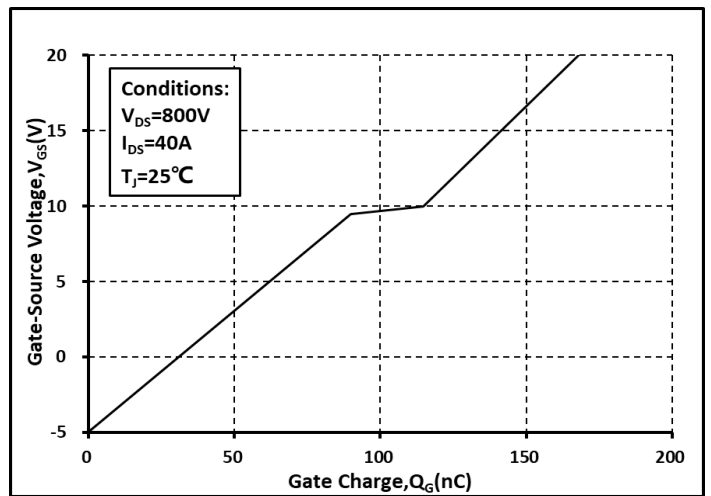


Fig. 18 Gate Charge Characteristics

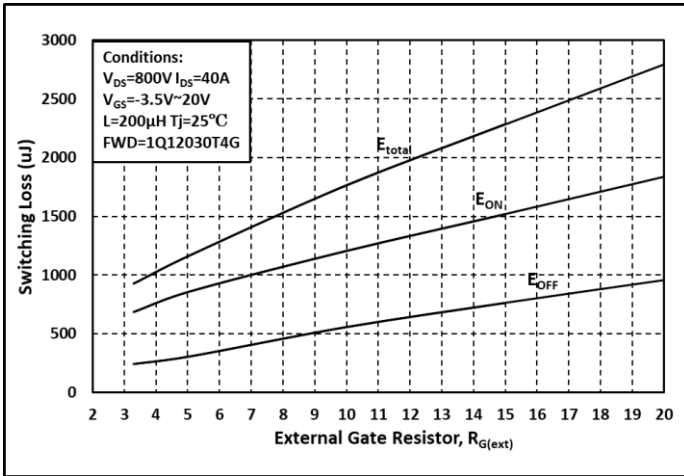


Fig. 19 Switching Energy vs. $R_{G(ext)}$

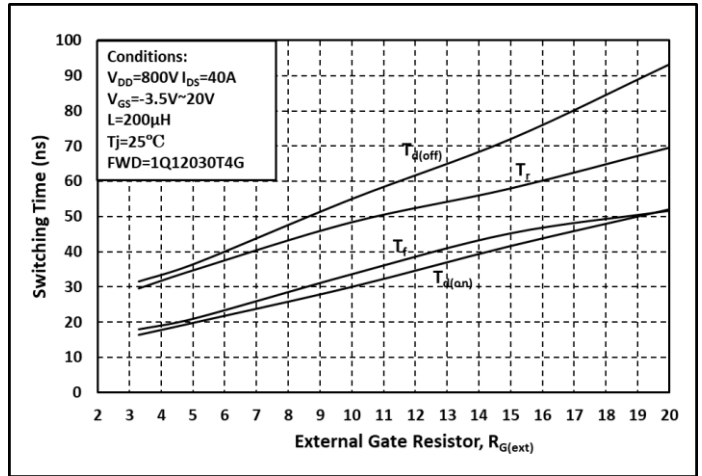


Fig. 20 Switching Times vs. $R_{G(ext)}$

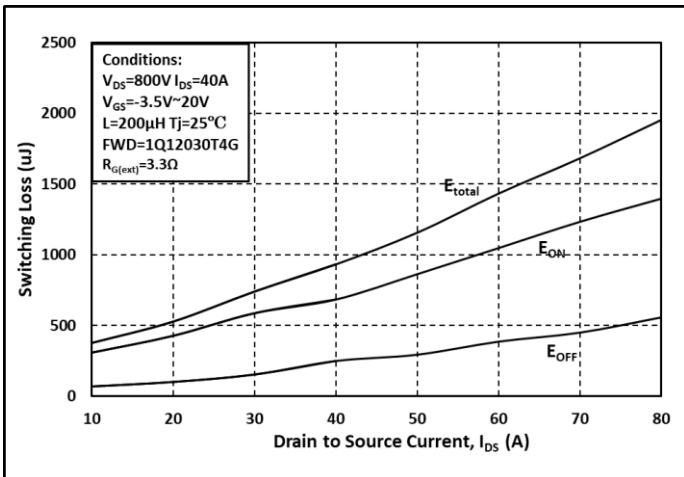


Fig. 21 Switching Energy vs. I_{DS}

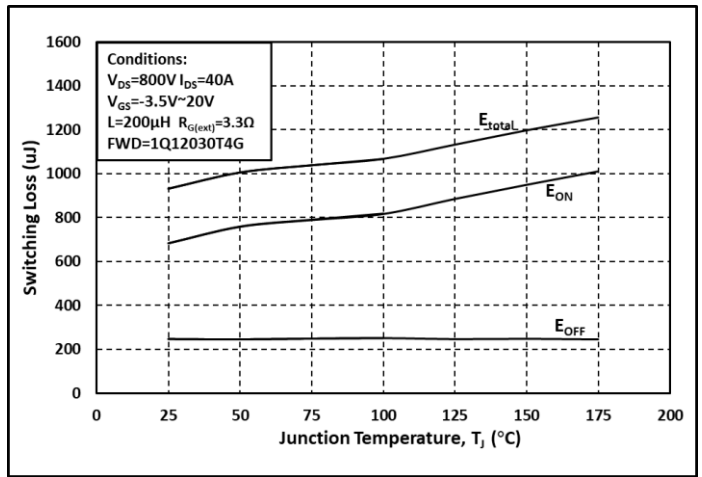


Fig. 22 Switching Energy vs. T_J

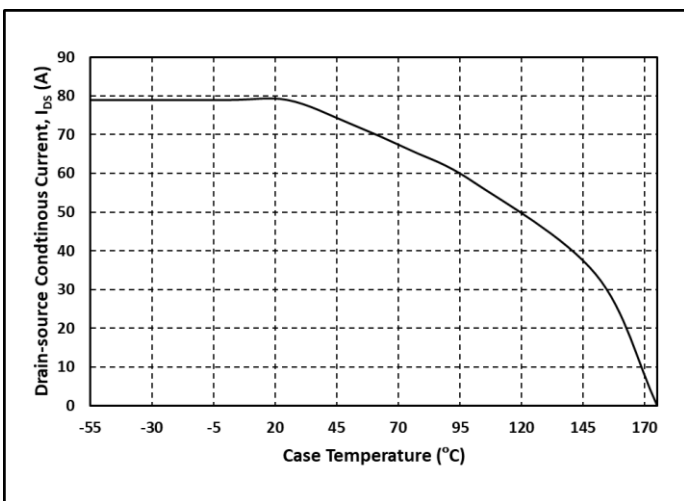


Fig. 23 Continuous Drain Current vs. Case Temperature

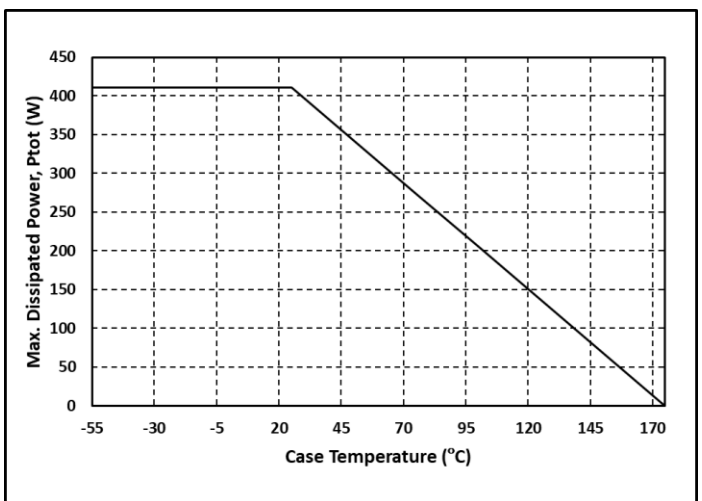


Fig. 24 Max. Power Dissipation Derating vs. Case Temperature

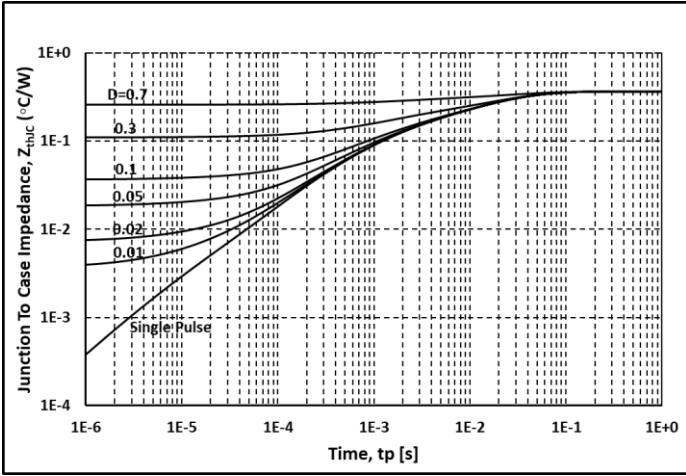


Fig. 25 Thermal impedance

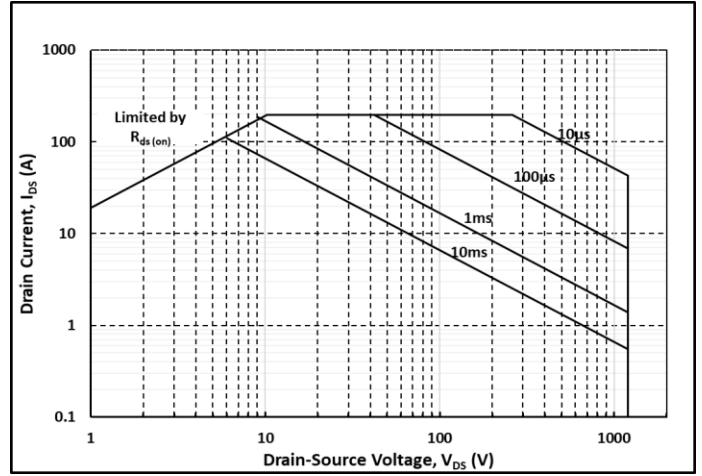
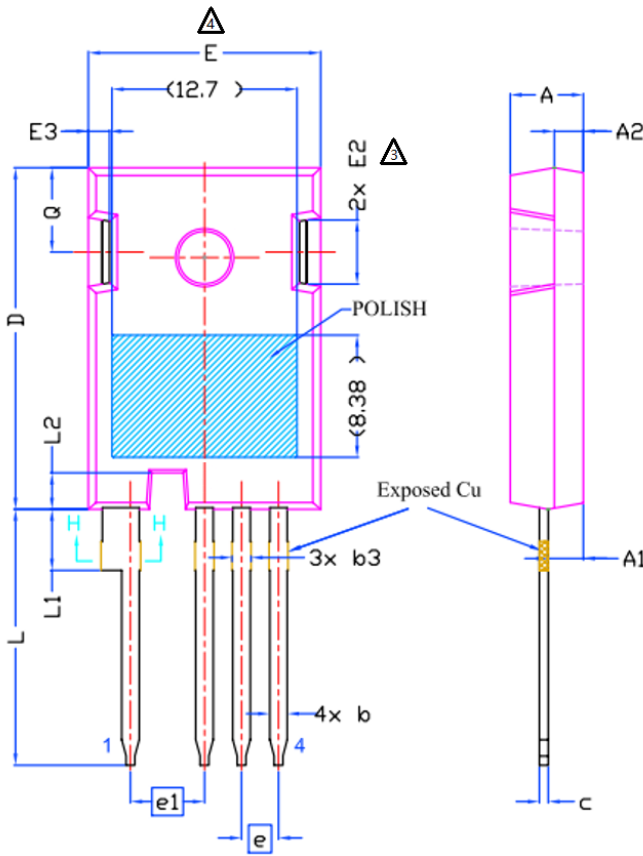
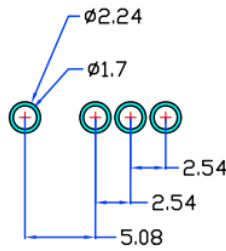
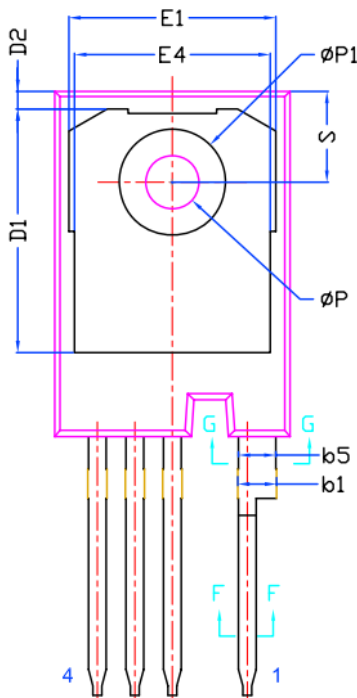


Fig. 26 Safe Operating Area

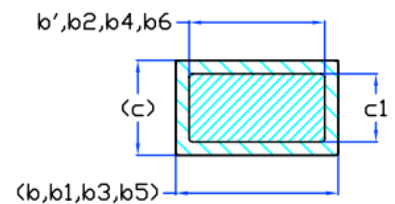
Package Dimensions



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

Notes

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