

IV1Q06060T3G – 650V 60mΩ SiC MOSFET

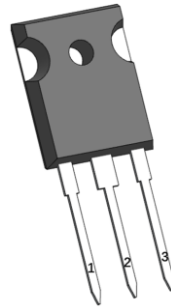
Features

- 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

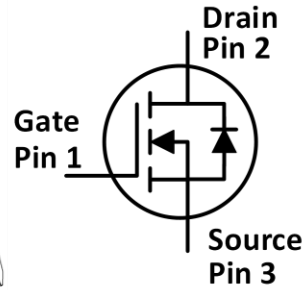
Applications

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

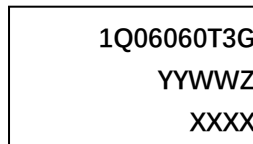
Outline:



TO247-3



Marking Diagram:



1Q06060T3G= 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	$V_{GS}=0V, I_D=100\mu A$	
$V_{GSmax}(DC)$	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)	50	A	$V_{GS}=20V, T_c=25^\circ\text{C}$	Fig. 23
		37	A	$V_{GS}=20V, T_c=100^\circ\text{C}$	
I_{DM}	Drain current (pulsed)	125	A	Pulse width limited by SOA	Fig. 26
P_{TOT}	Total power dissipation	227	W	$T_c=25^\circ\text{C}$	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	0.659	°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	$V_{DS}=650\text{V}, V_{GS}=0\text{V}$	
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	$V_{GS}=V_{DS}, I_D=3.9\text{mA}$	Fig. 8, 9
			2.1			$V_{GS}=V_{DS}, I_D=3.9\text{mA}$ @ $T_J=175^\circ\text{C}$	
R_{ON}	Static drain-source on-resistance		60	80	$\text{m}\Omega$	$V_{GS}=20\text{V}, I_D=15\text{A}$ @ $T_J=25^\circ\text{C}$	Fig. 4, 5, 6, 7
			80		$\text{m}\Omega$	$V_{GS}=20\text{V}, I_D=15\text{A}$ @ $T_J=175^\circ\text{C}$	
C_{iss}	Input capacitance		1640		pF	$V_{DS}=600\text{V}, V_{GS}=0\text{V},$ $f=1\text{MHz}, V_{AC}=25\text{mV}$	Fig. 16
C_{oss}	Output capacitance		130		pF		
C_{rss}	Reverse transfer capacitance		4.2		pF		
E_{oss}	C_{oss} stored energy		25		μJ		Fig. 17
Q_g	Total gate charge		69.5		nC	$V_{DS}=400\text{V}, I_D=15\text{A},$ $V_{GS}=-5$ to 20V	Fig. 18
Q_{gs}	Gate-source charge		21.8		nC		
Q_{gd}	Gate-drain charge		21.6		nC		
R_g	Gate input resistance		2.3		Ω	$f=1\text{MHz}$	
E_{ON}	Turn-on switching energy		129.7		μJ	$V_{DS}=400\text{V}, I_D=15\text{A},$ $V_{GS}=-3.5$ 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		17.4		μJ		
$t_{d(\text{on})}$	Turn-on delay time		17.2		ns		
t_r	Rise time		13.5				
$t_{d(\text{off})}$	Turn-off delay time		16.2				
t_f	Fall time		11.6				

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		3.8		V	$I_{SD}=15\text{A}, V_{GS}=0\text{V}$	Fig. 10, 11, 12
			3.5		V	$I_{SD}=15\text{A}, V_{GS}=0\text{V},$ $T_J=175^\circ\text{C}$	
t_{rr}	Reverse recovery time		44.7		ns	$V_{DS}=400\text{V}, I_D=15\text{A},$ $V_{GS}=-3.5$ to $20\text{V},$ $R_{G(\text{ext})}=24\Omega,$ $L=200\mu\text{H}$ $di/dt=1000\text{A}/\mu\text{s},$	
Q_{rr}	Reverse recovery charge		117.3		nC		
I_{RRM}	Peak reverse recovery current		6.8		A		

Typical Performance (curves)

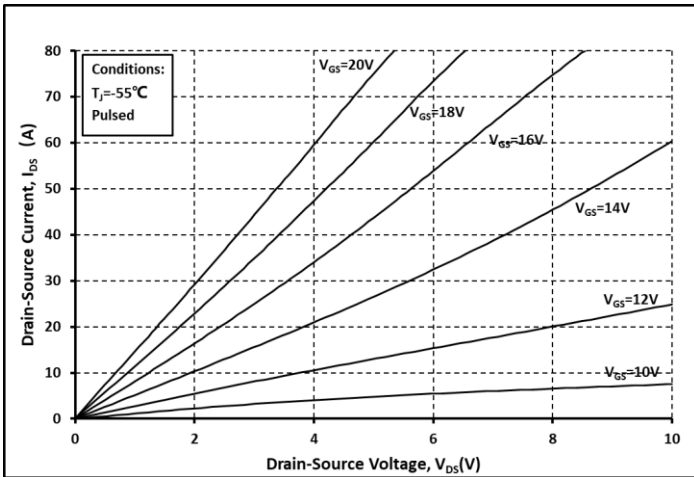


Fig. 1 Output Curve @ $T_j = -55^\circ\text{C}$

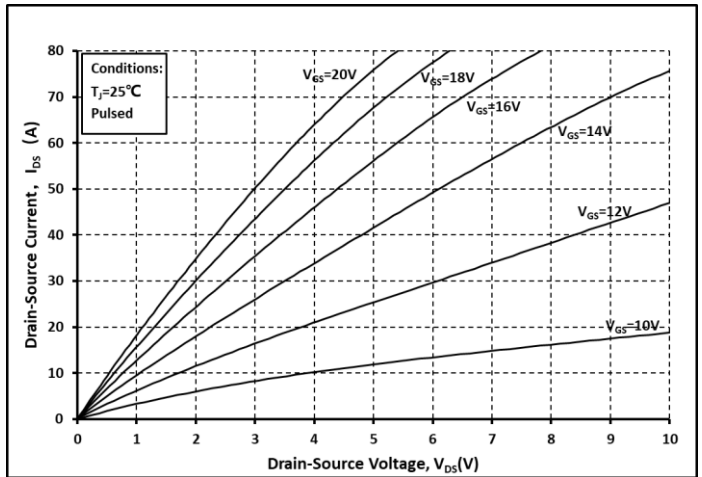


Fig. 2 Output Curve @ $T_j = 25^\circ\text{C}$

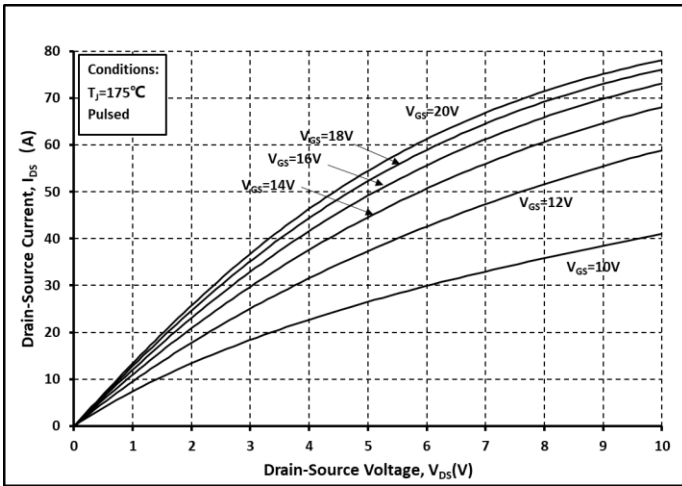


Fig. 3 Output Curve @ $T_j = 175^\circ\text{C}$

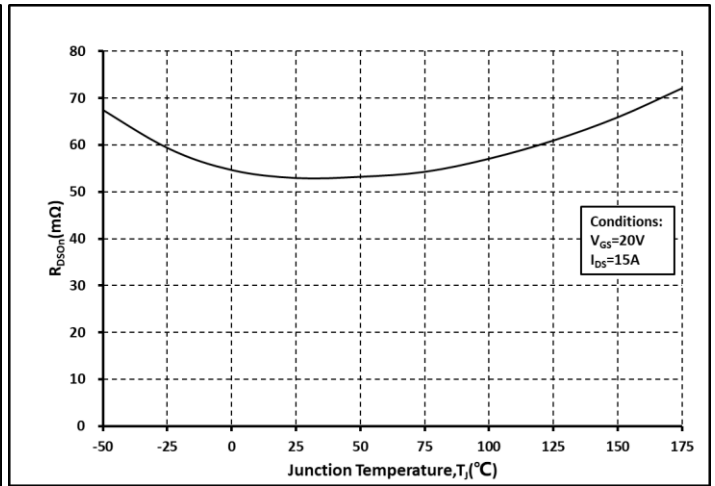


Fig. 4 $R_{DS(on)}$ vs. Temperature

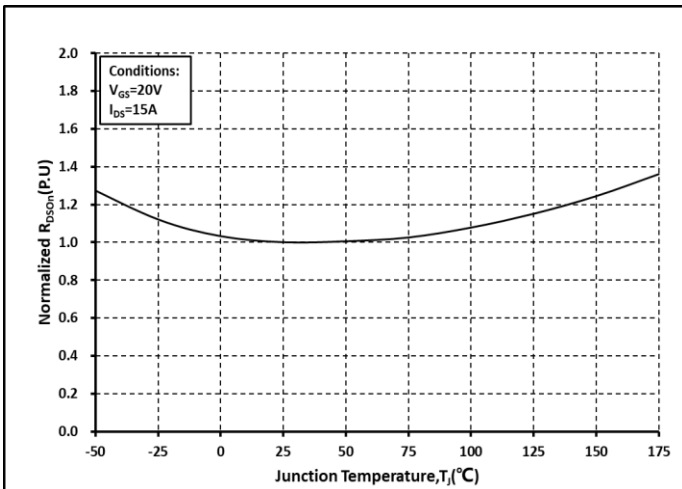


Fig. 5 Normalized $R_{DS(on)}$ vs. Temperature

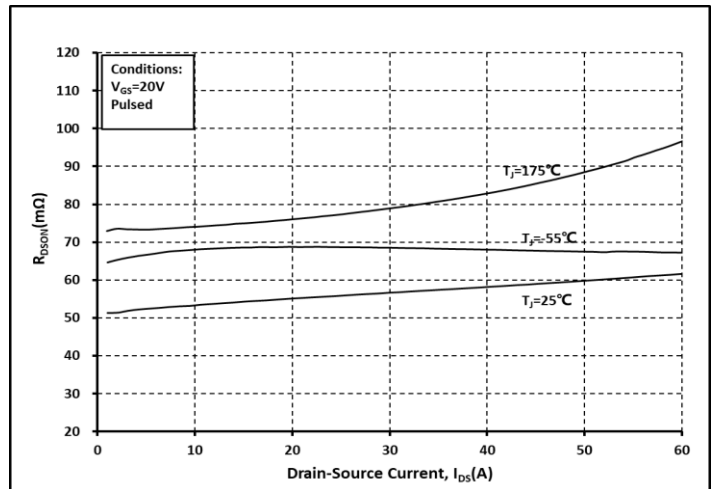


Fig. 6 $R_{DS(on)}$ vs. I_{DS} @ Various Temperature

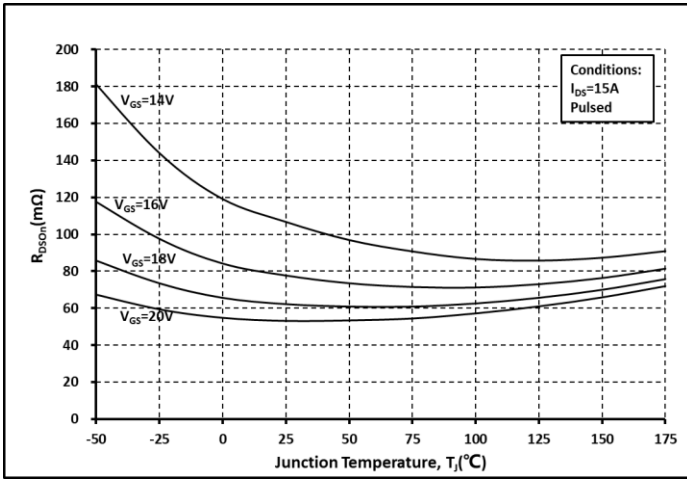


Fig. 7 Ron vs. Temperature @ Various V_{GS}

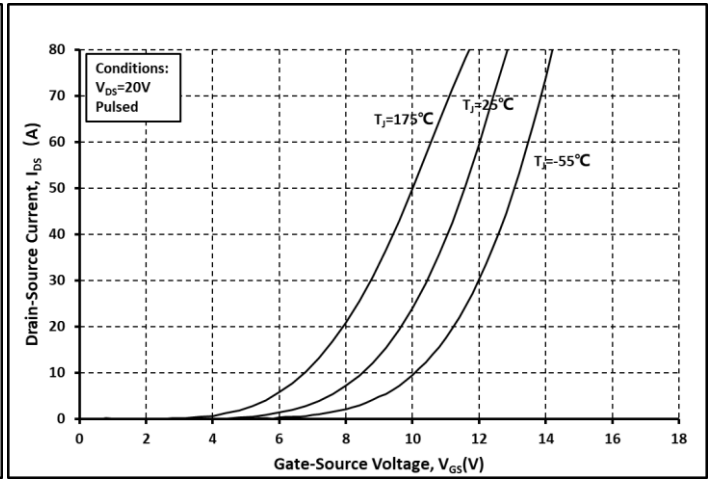


Fig. 8 Transfer Curves @ Various Temperature

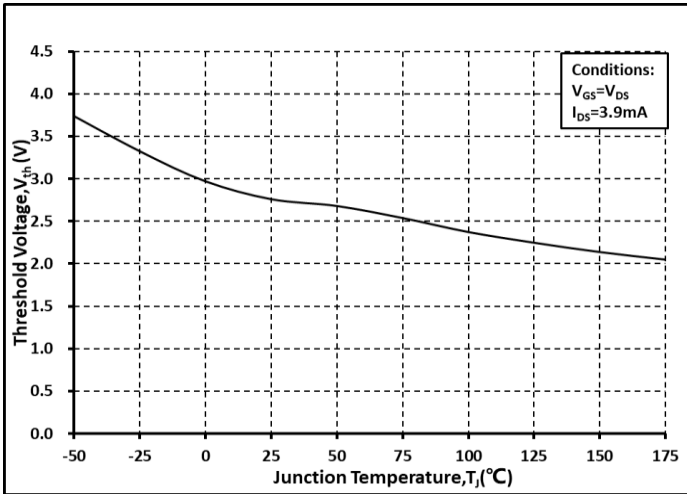


Fig. 9 Threshold Voltage vs. Temperature

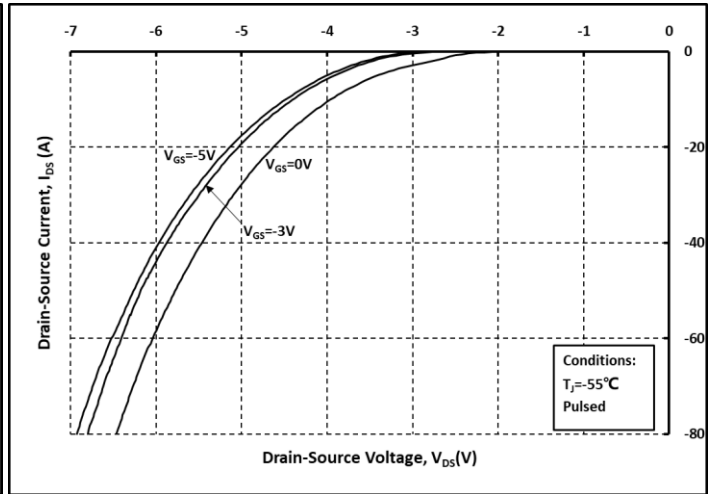


Fig. 10 Body Diode Curves @ $T_J = -55^\circ\text{C}$

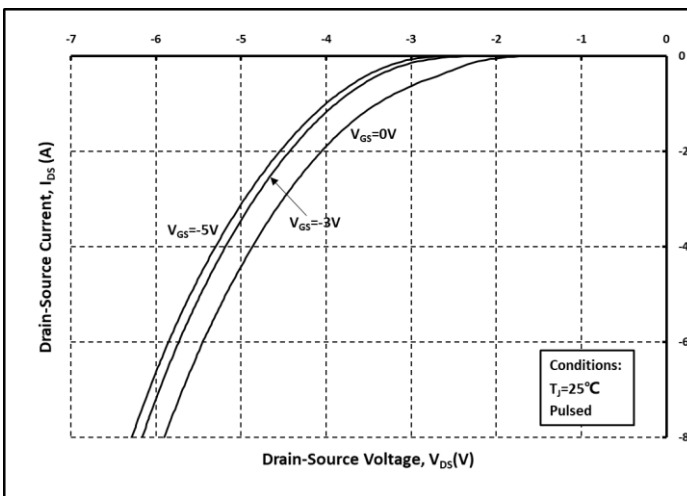


Fig. 11 Body Diode Curves @ $T_J = 25^\circ\text{C}$

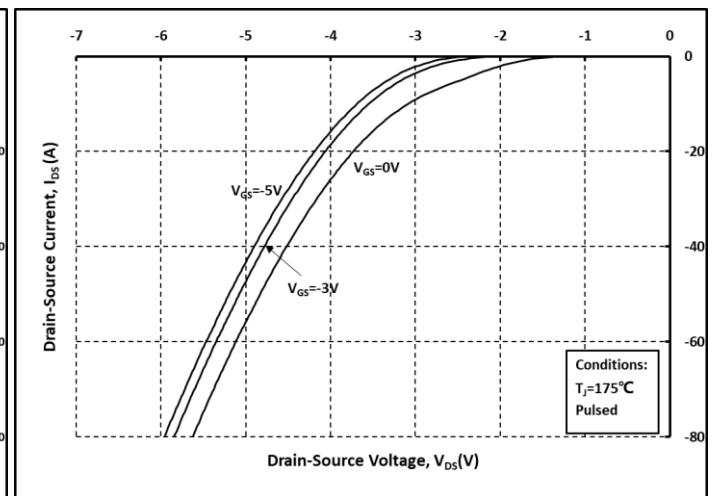


Fig. 12 Body Diode Curves @ $T_J = 175^\circ\text{C}$

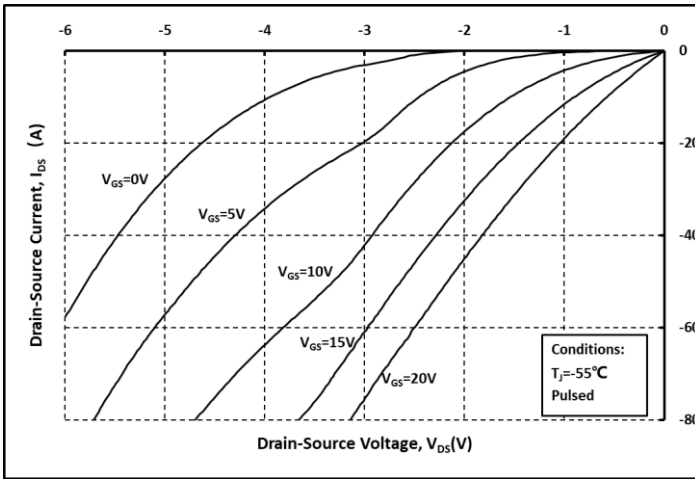


Fig. 13 3rd Quadrant Curves @ $T_j = -55^\circ\text{C}$

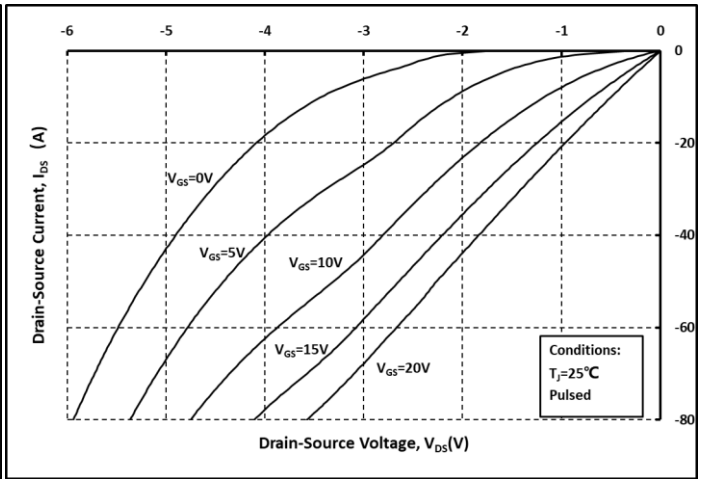


Fig. 14 3rd Quadrant Curves @ $T_j = 25^\circ\text{C}$

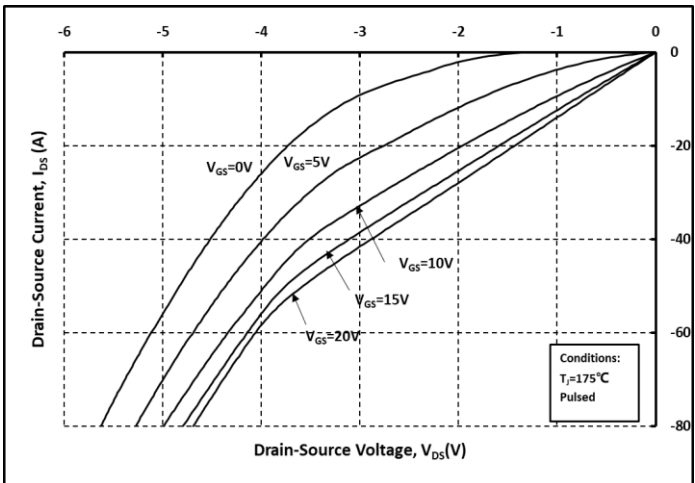


Fig. 15 3rd Quadrant Curves @ $T_j = 175^\circ\text{C}$

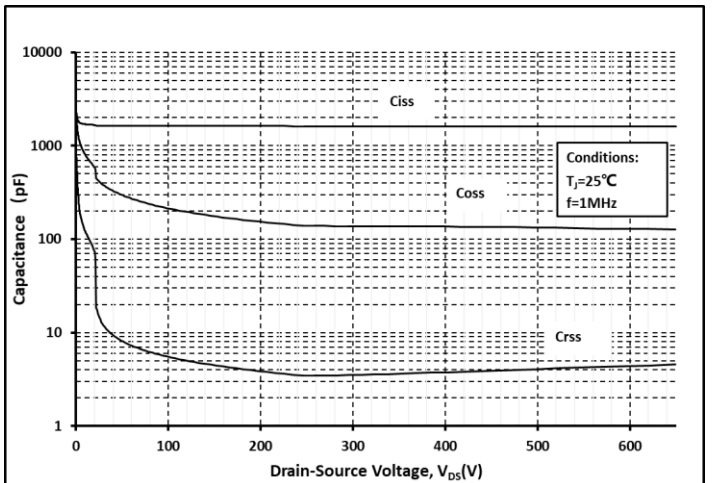


Fig. 16 Capacitance vs. V_{DS}

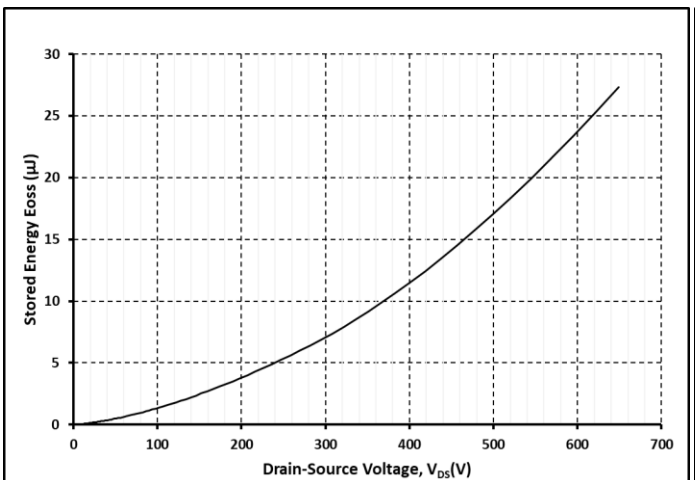


Fig. 17 Output Capacitor Stored Energy

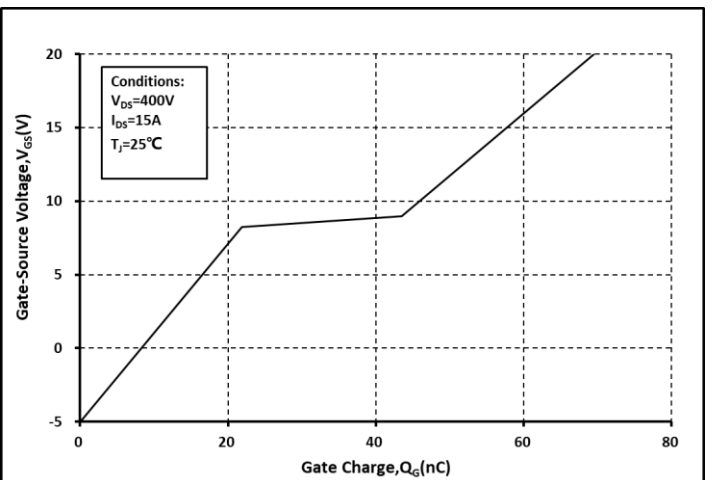


Fig. 18 Gate Charge Characteristics

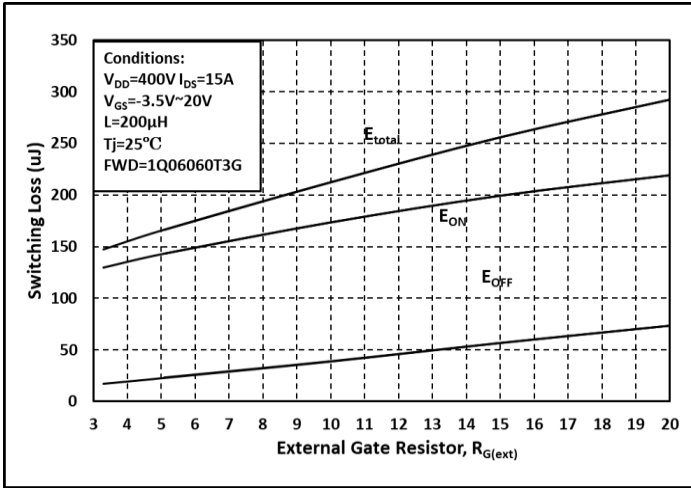


Fig. 19 Switching Energy vs. $R_{G(ext)}$

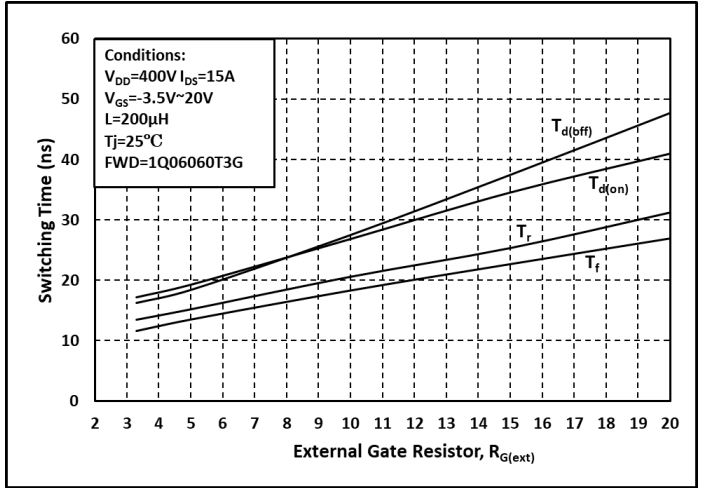


Fig. 20 Switching Times vs. $R_{G(ext)}$

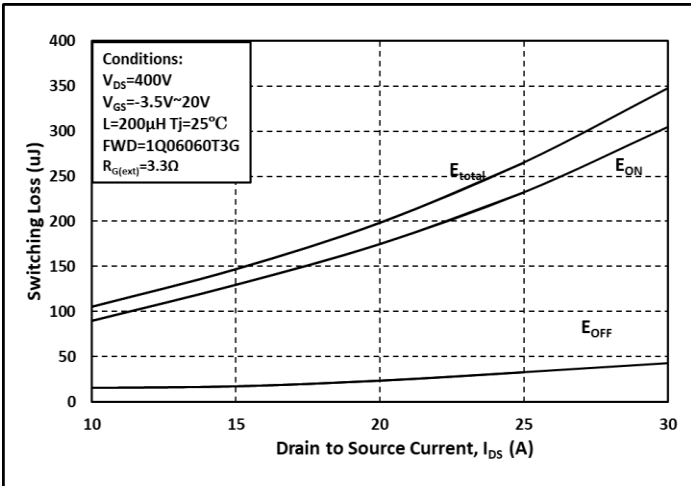


Fig. 21 Switching Energy vs. I_{DS}

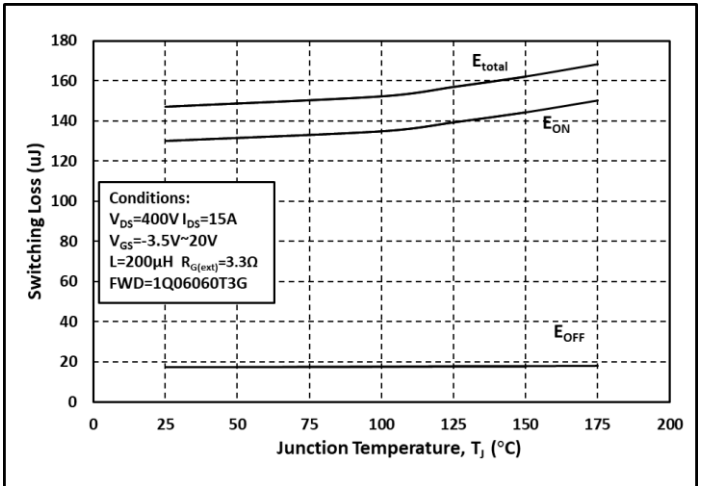


Fig. 22 Switching Times vs. T_j

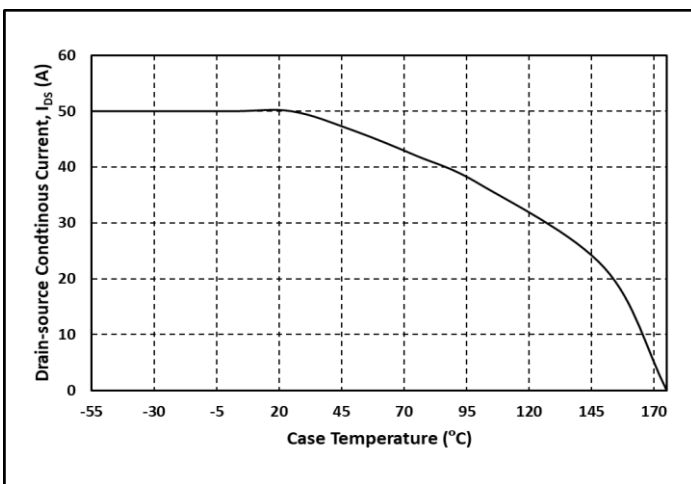


Fig. 23 Continuous Drain Current vs. Case Temperature

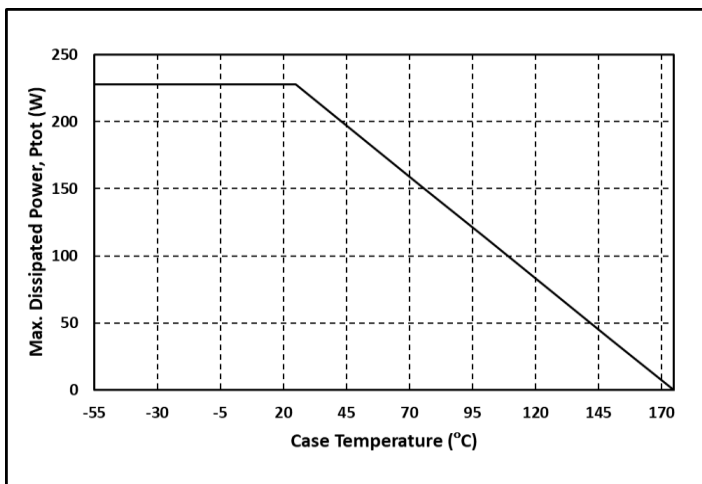


Fig. 24 Max. Power Dissipation Derating vs. Case Temperature

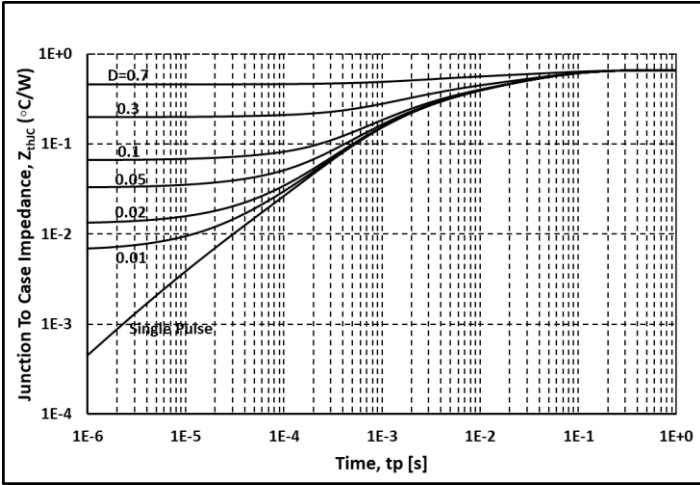


Fig. 25 Thermal Impedance

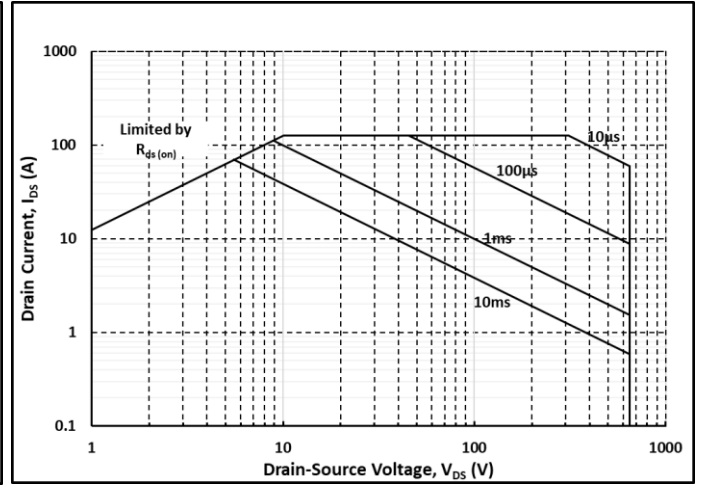
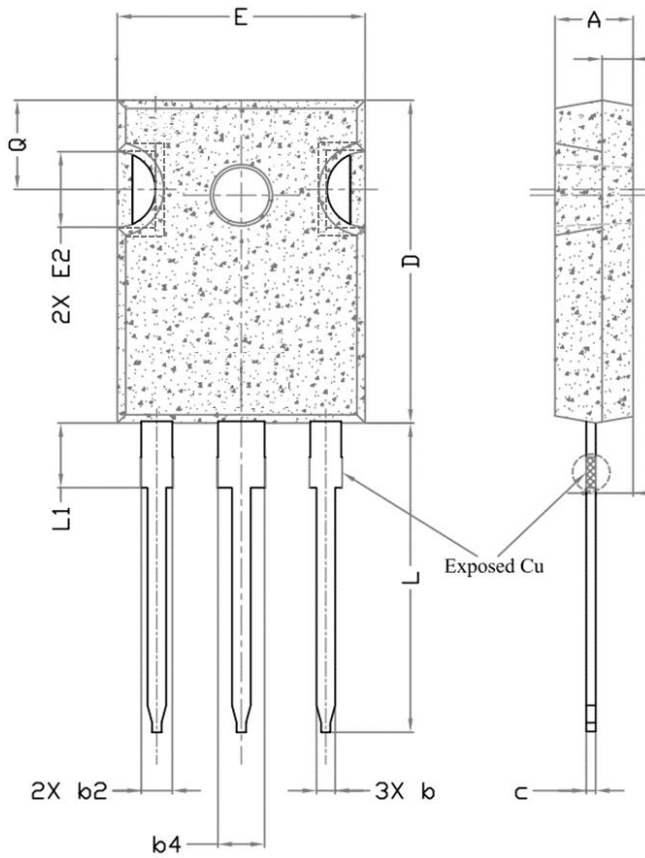
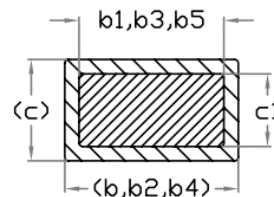
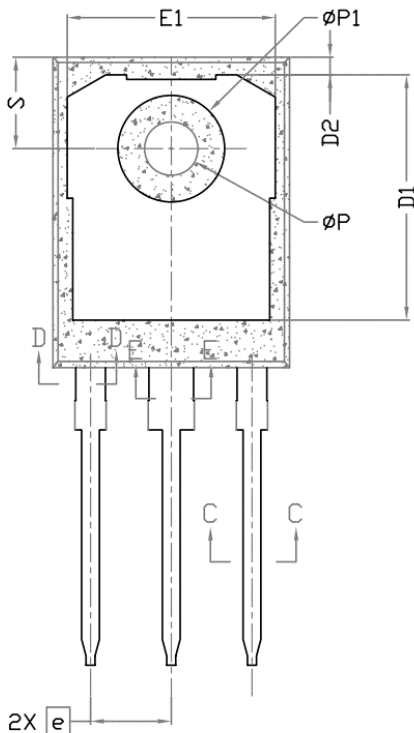


Fig. 26 Safe Operating Area

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	
phi P	3.51	3.65
phi P1	7.18 REF.	
Q	5.49	6
S	6.04	6.3



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

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