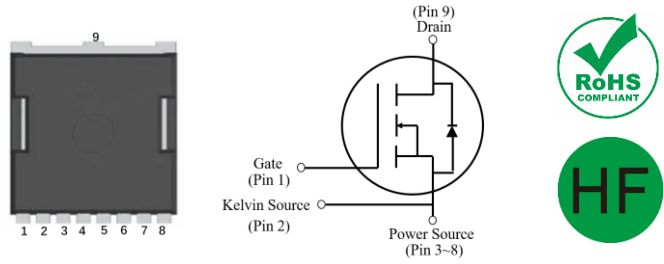


IV2Q06040L1 – 650V 40mΩ Gen2 SiC MOSFET

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 source pin easing driver circuit design

Outline:

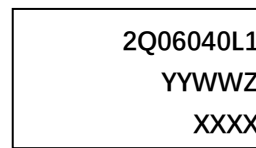


TOLL

Applications

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

Marking Diagram:



2Q06040L1 = 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 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)	60	A	$V_{GS}=18V, T_c=25^\circ\text{C}$	Fig. 21
		43	A	$V_{GS}=18V, T_c=100^\circ\text{C}$	
I_{DM}	Drain current (pulsed)	150	A	Pulse width limited by SOA	Fig. 24
P_{TOT}	Total power dissipation	249	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	0.6	$^\circ\text{C}/\text{W}$	Fig. 23

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		3	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	4.5	V	$V_{GS}=V_{DS}, I_D=7.5\text{mA}$	Fig. 8, 9
			2.1			$V_{GS}=V_{DS}, I_D=7.5\text{mA}$ @ $T_J=175^\circ\text{C}$	
R_{ON}	Static drain-source on-resistance		40	53	$\text{m}\Omega$	$V_{GS}=18\text{V}, I_D=20\text{A}$ @ $T_J=25^\circ\text{C}$	Fig. 4, 5, 6, 7
			60		$\text{m}\Omega$	$V_{GS}=18\text{V}, I_D=20\text{A}$ @ $T_J=175^\circ\text{C}$	
C_{iss}	Input capacitance		2000		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		158		pF		
C_{rssi}	Reverse transfer capacitance		11.4		pF		
E_{oss}	C_{oss} stored energy		31		μJ		Fig. 17
Q_g	Total gate charge		94.7		nC	$V_{DS}=400\text{V}, I_D=20\text{A},$ $V_{GS}=-3\text{ to }18\text{V}$	Fig. 18
Q_{gs}	Gate-source charge		24.5		nC		
Q_{gd}	Gate-drain charge		47.3		nC		
R_g	Gate input resistance		2.9		Ω	$f=1\text{MHz}$	
E_{ON}	Turn-on switching energy		133.4		μJ	$V_{DS}=400\text{V}, I_D=30\text{A},$ $V_{GS}=-3.5\text{ to }18\text{V},$ $R_{G(ext)}=3.3\Omega,$ $L=200\mu\text{H}$ $T_J=25^\circ\text{C}$	Fig. 19, 20
E_{OFF}	Turn-off switching energy		37.6		μJ		
$t_{d(on)}$	Turn-on delay time		7.0		ns		
t_r	Rise time		14.1				
$t_{d(off)}$	Turn-off delay time		17.0				
t_f	Fall time		8.0				

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		4.1		V	$I_{SD}=20\text{A}, V_{GS}=0\text{V}$	Fig. 10, 11, 12
			3.8		V	$I_{SD}=20\text{A}, V_{GS}=0\text{V},$ $T_J=175^\circ\text{C}$	
t_{rr}	Reverse recovery time		33.3		ns	$V_{GS}=-3.5\text{V}/+18\text{V},$ $I_{SD}=30\text{A}, V_R=400\text{V},$ $R_{G(ext)}=15\Omega L=200\mu\text{H}$ $di/dt=3000\text{A}/\mu\text{s}$	
Q_{rr}	Reverse recovery charge		192.1		nC		
I_{RRM}	Peak reverse recovery current		17.5		A		

Typical Performance (curves)

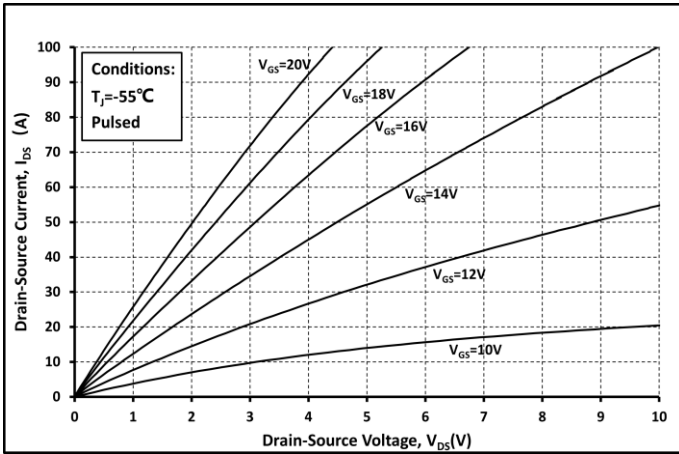


Fig. 1 Output Curve @ $T_j = -55^\circ\text{C}$

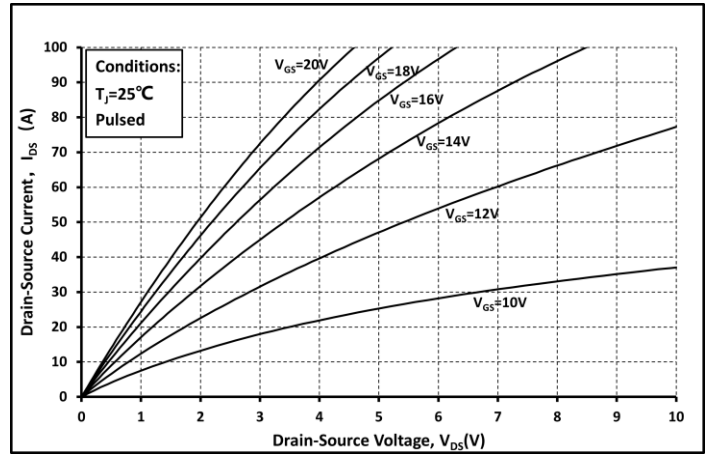


Fig. 2 Output Curve @ $T_j = 25^\circ\text{C}$

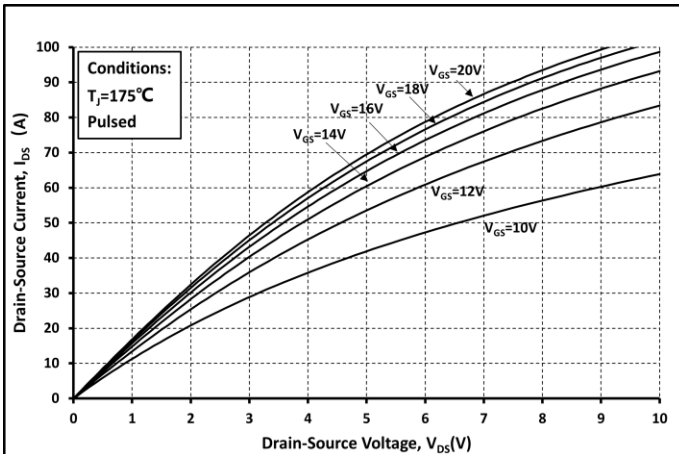


Fig. 3 Output Curve @ $T_j = 175^\circ\text{C}$

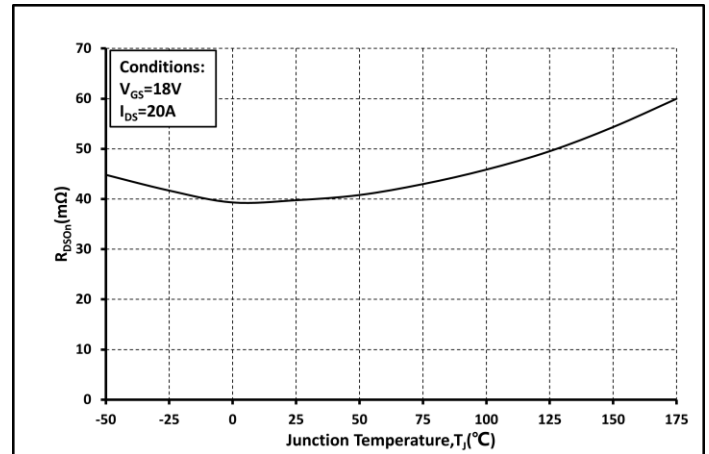


Fig. 4 R_{on} vs. Temperature

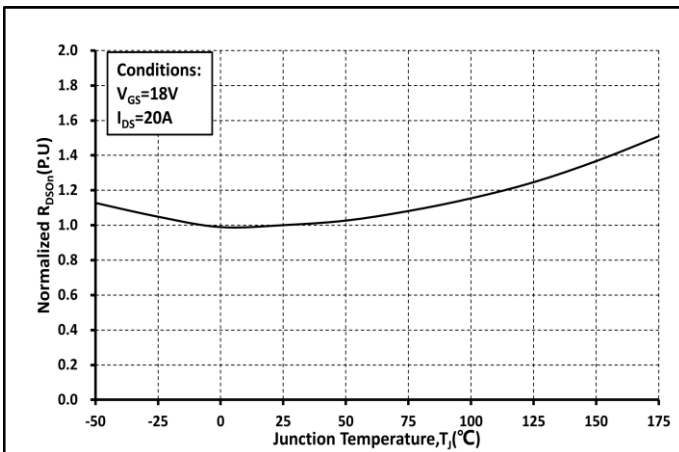


Fig. 5 Normalized R_{on} vs. Temperature

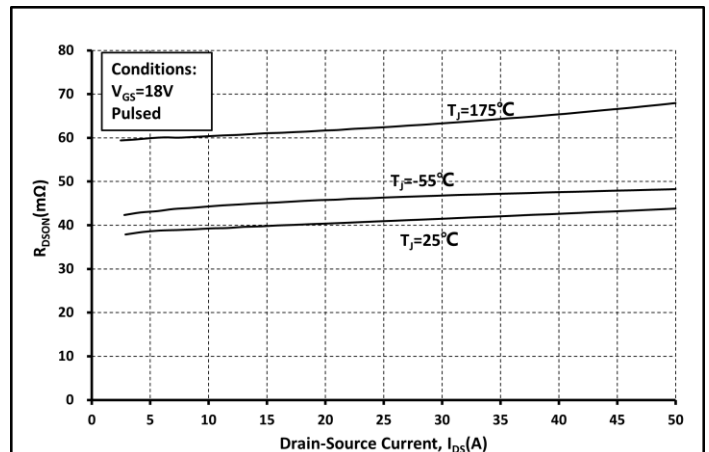


Fig. 6 R_{on} vs. I_{DS} @ Various Temperature

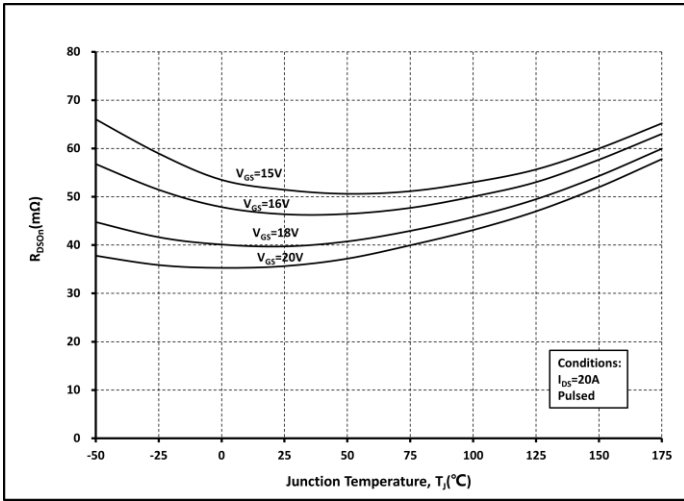


Fig. 7 Ron vs. Temperature @ Various V_{GS}

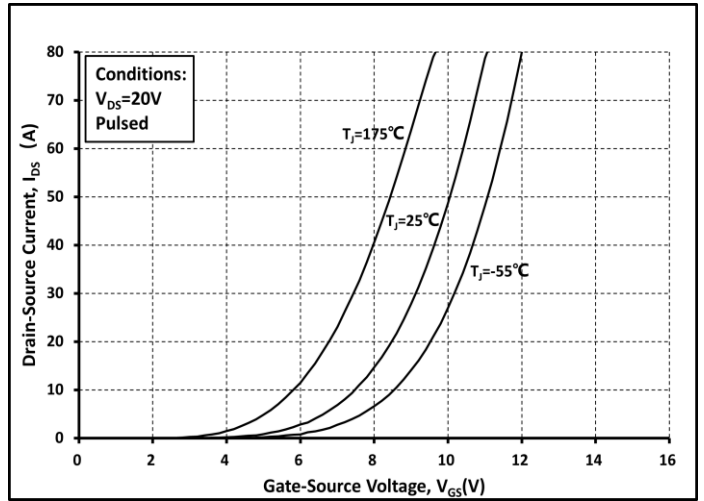


Fig. 8 Transfer Curves @ Various Temperature

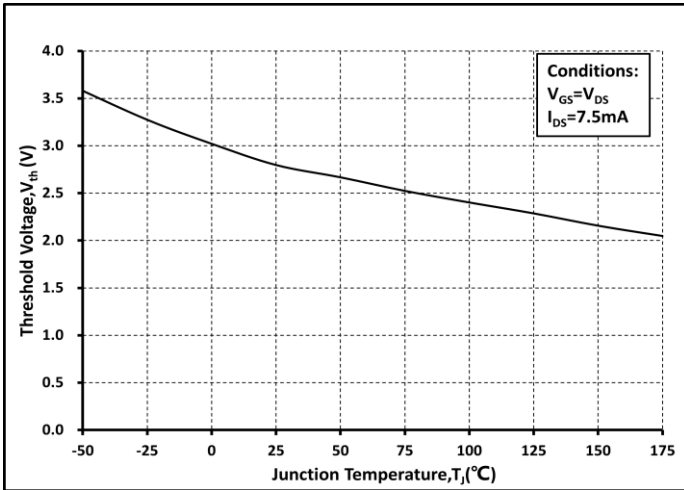


Fig. 9 Threshold Voltage vs. Temperature

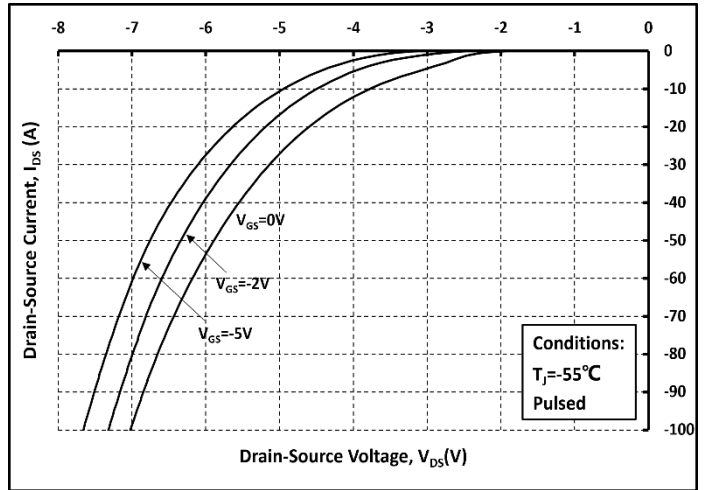


Fig. 10 Body Diode curves @ $T_J = -55^\circ\text{C}$

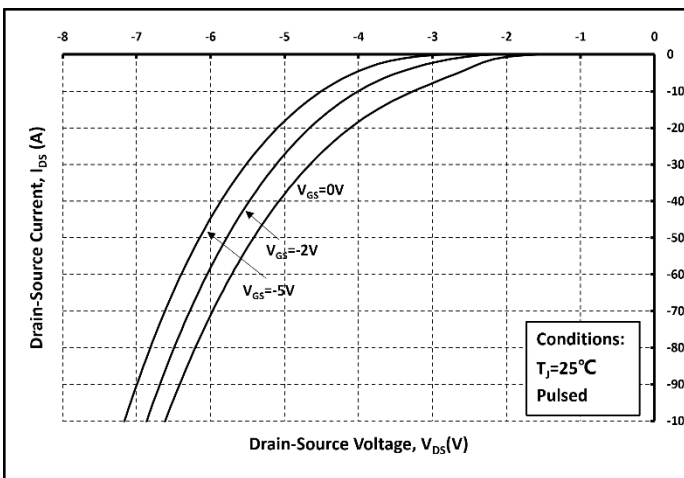


Fig. 11 Body Diode curves @ $T_J = 25^\circ\text{C}$

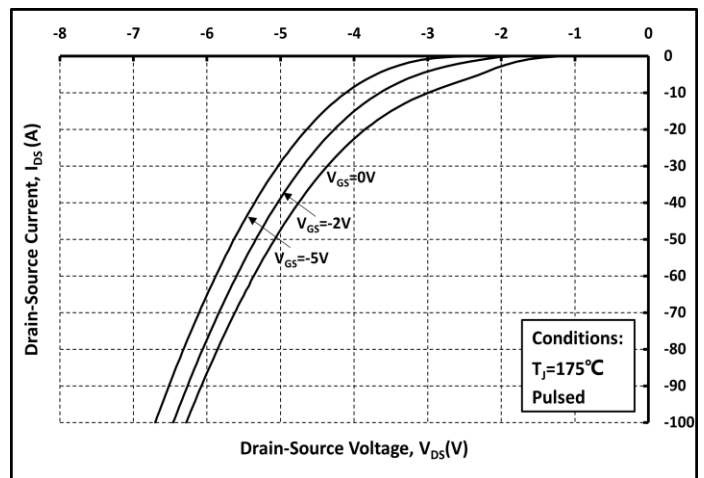


Fig. 12 Body Diode curves @ $T_J = 175^\circ\text{C}$

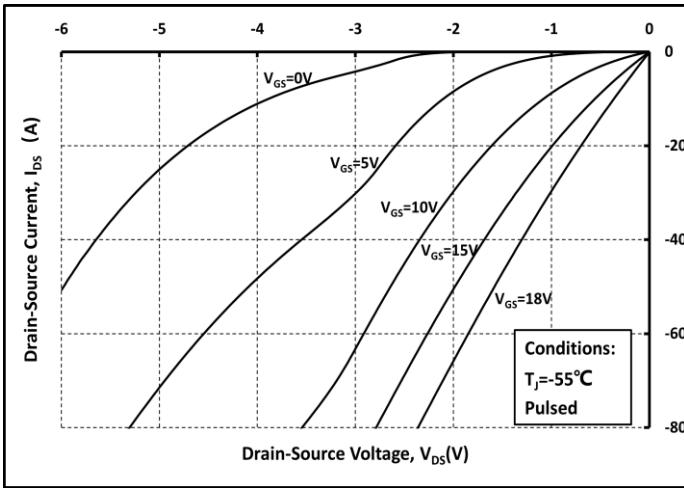


Fig. 13 3rd Quadrant curves @ $T_j = -55^\circ\text{C}$

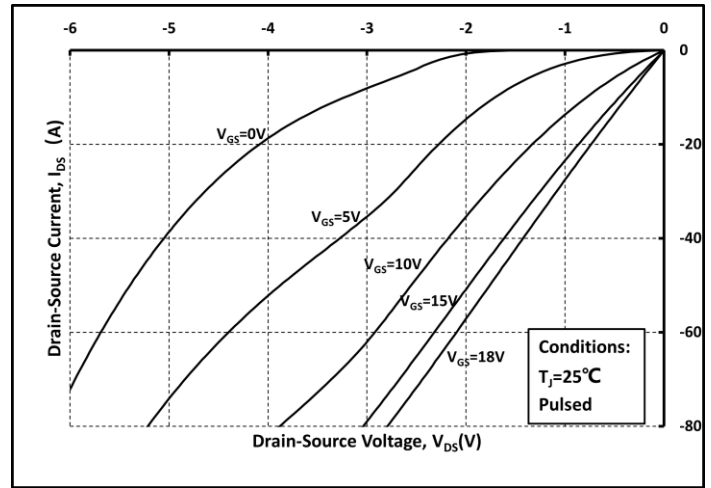


Fig. 14 3rd Quadrant curves @ $T_j = 25^\circ\text{C}$

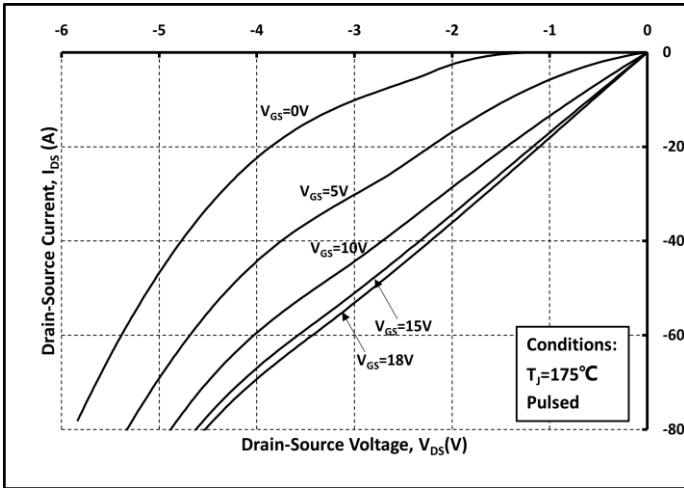


Fig. 15 3rd Quadrant curves @ $T_j = 175^\circ\text{C}$

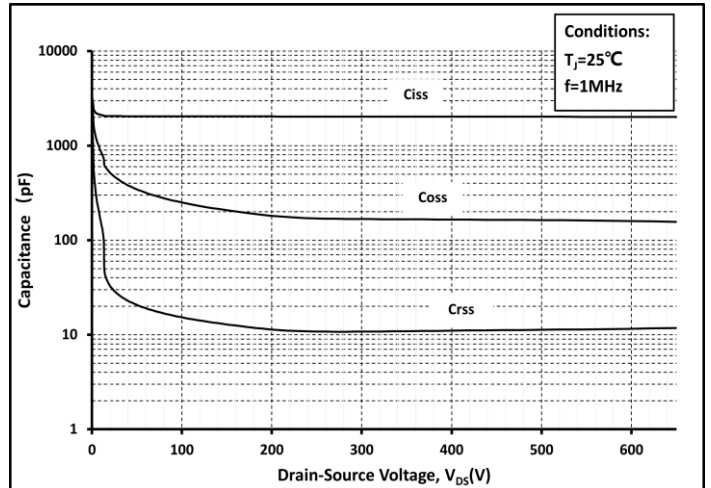


Fig. 16 Capacitance vs. V_{DS}

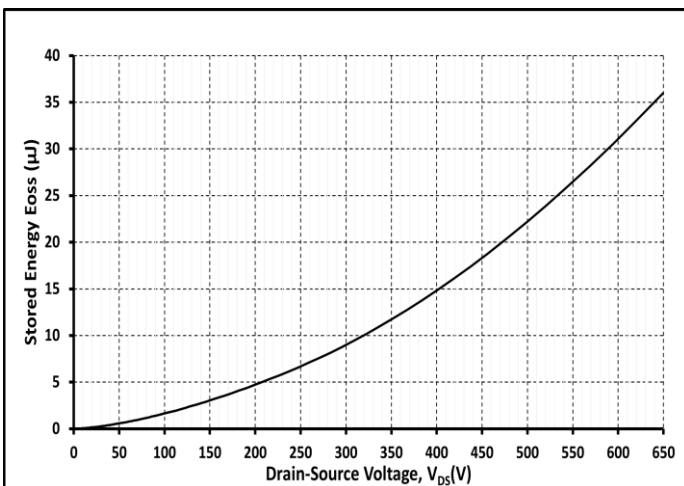


Fig. 17 Output Capacitor Stored Energy

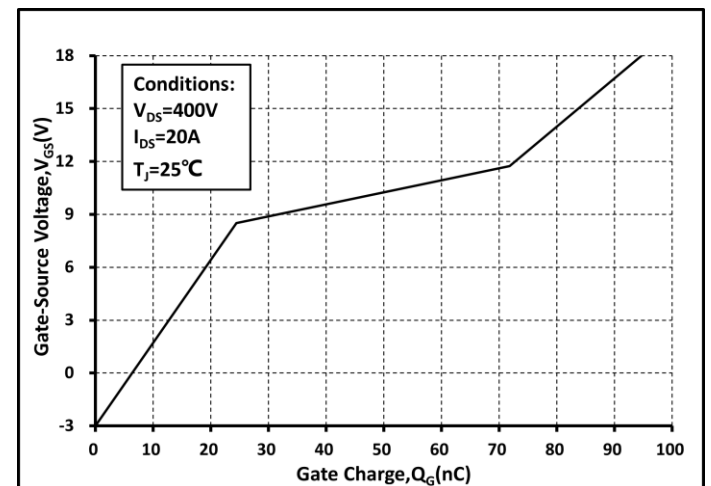


Fig. 18 Gate Charge Characteristics

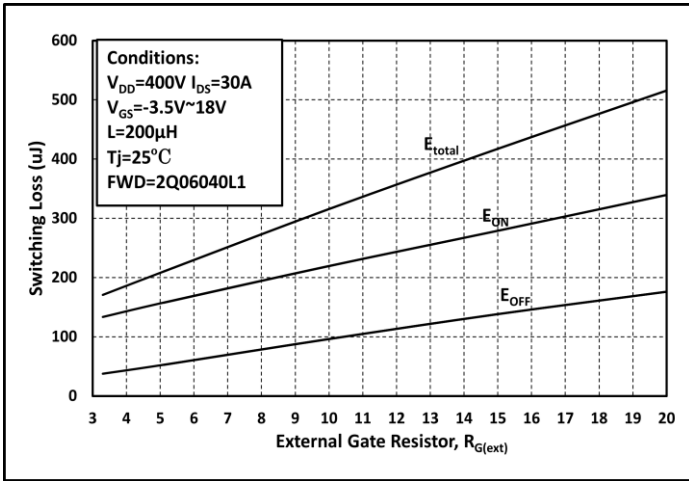


Fig. 19 Switching Energy vs. $R_{G(ext)}$

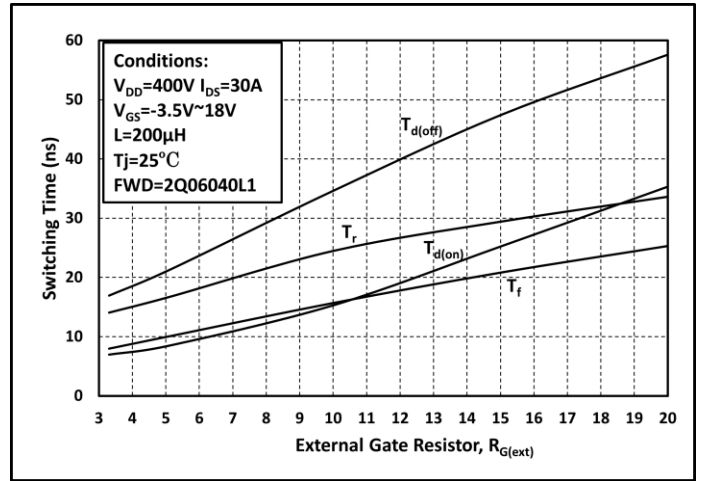


Fig. 20 Switching Times vs. $R_{G(ext)}$

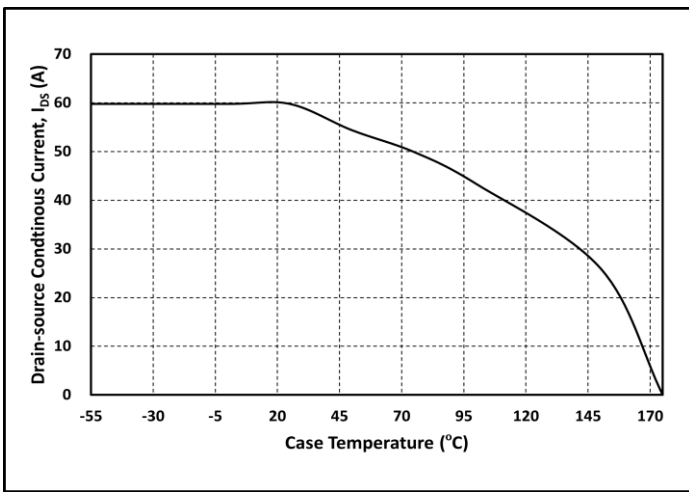


Fig. 21 Continuous Drain Current vs. Case Temperature

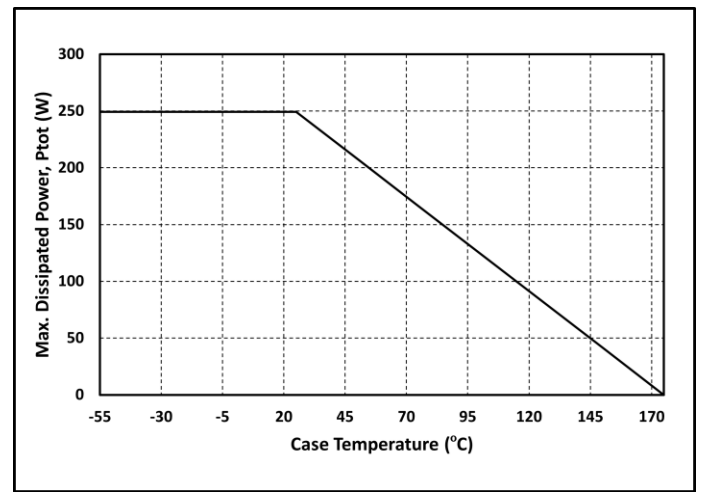


Fig. 22 Max. Power Dissipation Derating vs. Case Temperature

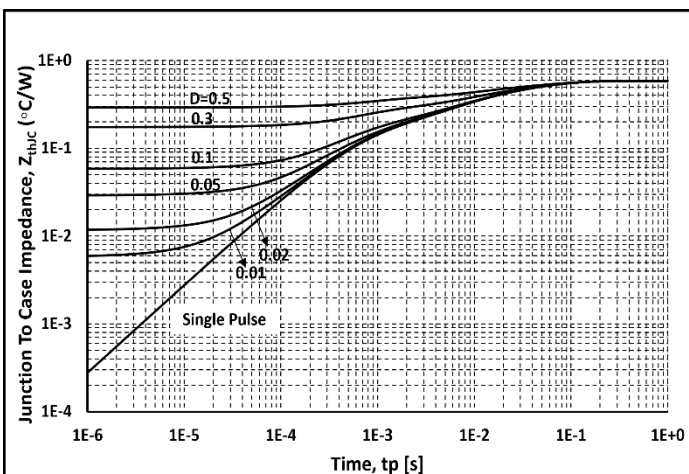


Fig. 23 Thermal impedance

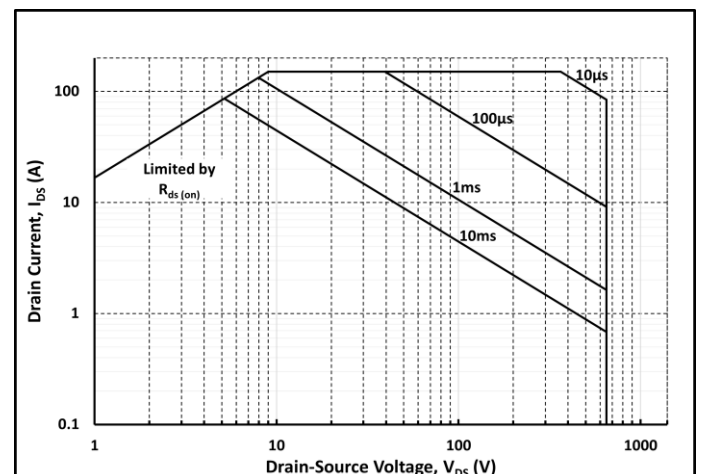
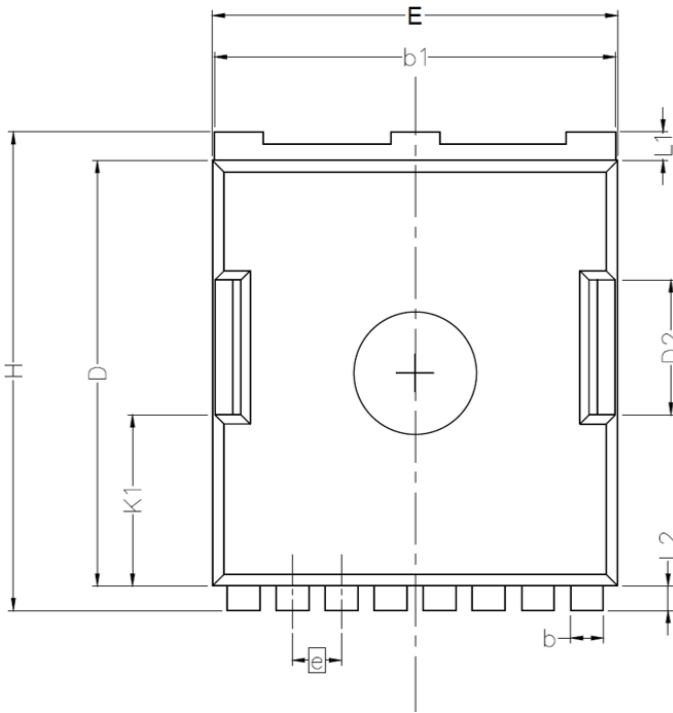
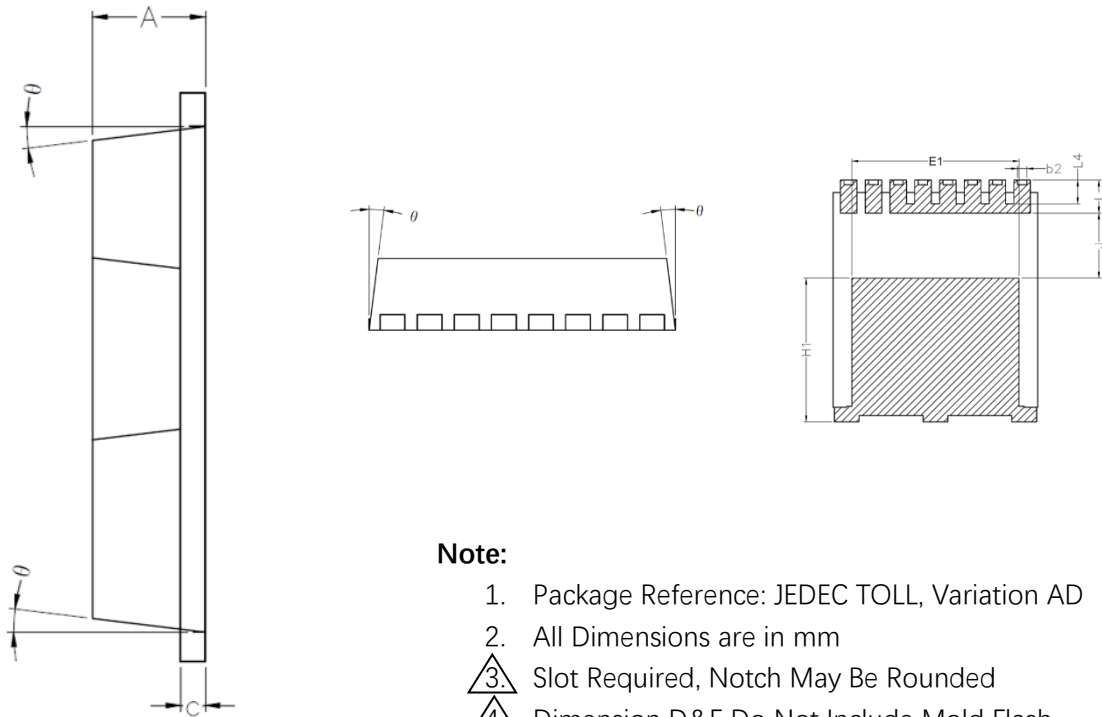


Fig. 24 Safe Operating Area

Package Dimensions



Dimensions In Millimeters [↵]		
SYMBOL [↵]	MIN. [↵]	MAX. [↵]
A [↵]	2.20 [↵]	2.40 [↵]
b [↵]	0.70 [↵]	0.90 [↵]
b1 [↵]	9.70 [↵]	9.90 [↵]
b2 [↵]	0.42 [↵]	0.50 [↵]
c [↵]	0.40 [↵]	0.60 [↵]
D [↵]	10.28 [↵]	10.58 [↵]
D2 [↵]	3.10 [↵]	3.50 [↵]
E [↵]	9.7 [↵]	10.10 [↵]
E1 [↵]	7.90 [↵]	8.30 [↵]
e [↵]	1.20 BSC [↵]	
H [↵]	11.48 [↵]	11.88 [↵]
H1 [↵]	6.75 [↵]	7.15 [↵]
N [↵]	8 [↵]	
J [↵]	3.00 [↵]	3.30 [↵]
K1 [↵]	3.98 [↵]	4.38 [↵]
L [↵]	1.40 [↵]	1.80 [↵]
L1 [↵]	0.60 [↵]	0.80 [↵]
L2 [↵]	0.50 [↵]	0.70 [↵]
L4 [↵]	1.00 [↵]	1.30 [↵]
θ [↵]	4° [↵]	10° [↵]



Note:

1. Package Reference: JEDEC TOLL, 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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[IPS70R2K0CEAKMA1](#) [SQD23N06-31L-GE3](#) [TK16J60W,S1VQ\(O](#) [2SK2614\(TE16L1,Q\)](#) [DMN1017UCP3-7](#) [EFC2J004NUZTDG](#)
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[DMN31D5UDJ-7](#) [DMP22D4UFO-7B](#) [DMN1006UCA6-7](#) [DMN16M9UCA6-7](#) [STF5N65M6](#) [IRF40H233XTMA1](#) [STU5N65M6](#)
[DMN6022SSD-13](#) [DMN13M9UCA6-7](#) [DMTH10H4M6SPS-13](#) [DMN2990UFB-7B](#) [IPB80P04P405ATMA2](#) [2N7002W-G](#) [MCAC30N06Y-](#)
[TP](#) [MCQ7328-TP](#) [NTMC083NP10M5L](#) [NVMFS2D3P04M8LT1G](#) [BXP7N65D](#) [BXP4N65F](#) [AOL1454G](#) [WMJ80N60C4](#) [BXP2N20L](#)
[BXP2N65D](#) [BXT1150N10J](#) [BXT1700P06M](#) [TSM60NB380CP](#) [ROG](#) [RQ7L055BGTCR](#) [DMNH15H110SK3-13](#)