

IV3Q12035T4Z- Gen3 1200V 35mΩ Automotive SiC MOSFET

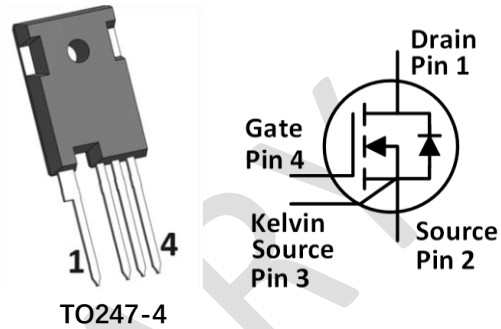
Features

- 3rd Generation SiC MOSFET Technology with +15~+18V gate drive
- High blocking voltage with low on-resistance
- High speed switching with low capacitance
- 175°C operating junction temperature capability
- Ultra fast and robust intrinsic body diode
- Kelvin gate input easing driver circuit design
- AEC-Q101 qualification on-going

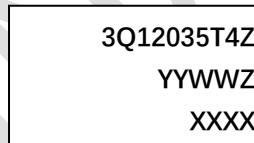
Applications

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

Outline:



Marking Diagram:



3Q12035T4Z= 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	1200	V	$V_{GS}=0V, I_D=100\mu A$	
V_{GSmax} (Transient)	Maximum transient voltage	-10/+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	-5 to -2	V	Typical -3.5V	
I_D	Drain current (continuous)	67	A	$V_{GS}=18V, T_c=25^\circ\text{C}$	Fig. 23
		48	A	$V_{GS}=18V, T_c=100^\circ\text{C}$	
I_{DM}	Drain current (pulsed)	167	A	Pulse width limited by SOA	Fig. 25, 26
I_{SM}	Body diode current (pulsed)	167	A	Pulse width limited by SOA and dynamic $R_{\theta(j-c)}$	Fig. 25, 26
P_{TOT}	Total power dissipation	288	W	$T_c=25^\circ\text{C}$	Fig. 24
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	0.52	$^\circ\text{C}/\text{W}$	Fig. 25

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

Symb ol	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	2.0	2.8	4.0	V	$V_{GS}=V_{DS}, I_D=8\text{mA}$	Fig. 8, 9
			2.0		V	$V_{GS}=V_{DS}, I_D=8\text{mA}$ @ $T_J=175^\circ\text{C}$	
R_{ON}	Static drain-source on-resistance		35	46	$\text{m}\Omega$	$V_{GS}=18\text{V}, I_D=30\text{A}$ @ $T_J=25^\circ\text{C}$	Fig. 4, 5, 6, 7
			57		$\text{m}\Omega$	$V_{GS}=18\text{V}, I_D=30\text{A}$ @ $T_J=175^\circ\text{C}$	
			45		$\text{m}\Omega$	$V_{GS}=15\text{V}, I_D=30\text{A}$ @ $T_J=25^\circ\text{C}$	
			61		$\text{m}\Omega$	$V_{GS}=15\text{V}, I_D=30\text{A}$ @ $T_J=175^\circ\text{C}$	
C_{ISS}	Input capacitance		2082		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		95		pF		
C_{RSS}	Reverse transfer capacitance		3		pF		Fig. 17
E_{OSS}	C_{OSS} stored energy		40		μJ		
Q_g	Total gate charge		83		nC	$V_{DS}=800\text{V}, I_D=30\text{A},$ $V_{GS}=-3\text{ to }18\text{V}$	Fig. 18
Q_{gs}	Gate-source charge		23.5		nC		
Q_{gd}	Gate-drain charge		21		nC		
R_g	Gate input resistance		2.5		Ω	$f=1\text{MHz}$	
E_{ON}	Turn-on switching energy		407.6		μJ	$V_{DS}=800\text{V}, I_D=40\text{A},$ $V_{GS}=-3.5\text{ to }18\text{V},$ $R_{G(\text{ext})}=2.0\Omega,$ $L=200\mu\text{H}$ $T_J=25^\circ\text{C}$	Fig. 19, 20
E_{OFF}	Turn-off switching energy		43.1		μJ		
$t_{d(\text{on})}$	Turn-on delay time		4.1		ns		
t_r	Rise time		13.9				
$t_{d(\text{off})}$	Turn-off delay time		12.8				
t_f	Fall time		6.4				
E_{ON}	Turn-on switching energy		631.1		μJ	$V_{DS}=800\text{V}, I_D=40\text{A},$ $V_{GS}=-3.5\text{ to }18\text{V},$ $R_{G(\text{ext})}=2.0\Omega,$ $L=200\mu\text{H}$ $T_J=175^\circ\text{C}$	Fig. 22
E_{OFF}	Turn-off switching energy		52.5		μJ		

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		4.3		V	$I_{SD}=30\text{A}, V_{GS}=0\text{V}$	Fig. 10, 11, 12
			4.0		V	$I_{SD}=30\text{A}, V_{GS}=0\text{V}, T_J=175^\circ\text{C}$	
I_S	Diode forward current (continuous)			57	A	$V_{GS}=-2\text{V}, T_c=25^\circ\text{C}$	
				33	A	$V_{GS}=-2\text{V}, T_c=100^\circ\text{C}$	
t_{rr}	Reverse recovery time		25.21		ns	$V_{GS}=-3.5\text{V}/+18\text{V}, I_{SD}=40\text{A}, V_R=800\text{V}, R_{G(\text{ext})}=13.5\Omega, L=200\mu\text{H}, di/dt=3000\text{A}/\mu\text{s}$	
Q_{rr}	Reverse recovery charge		239.1		nC		
I_{RRM}	Peak reverse recovery current		25.1		A		

Typical Performance (curves)

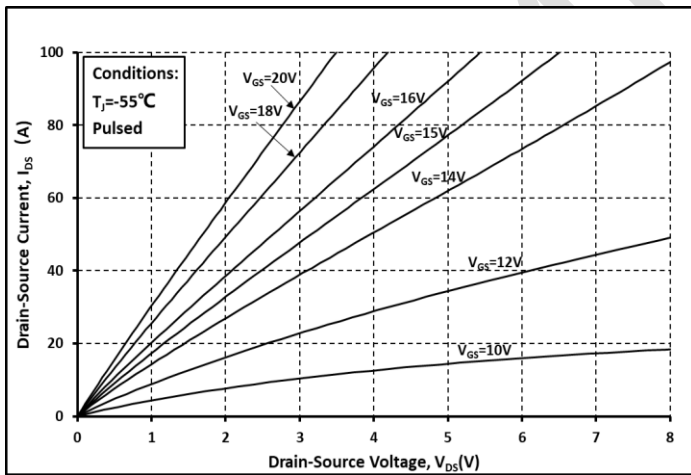


Fig. 1 Output Curve @ $T_J=-55^\circ\text{C}$

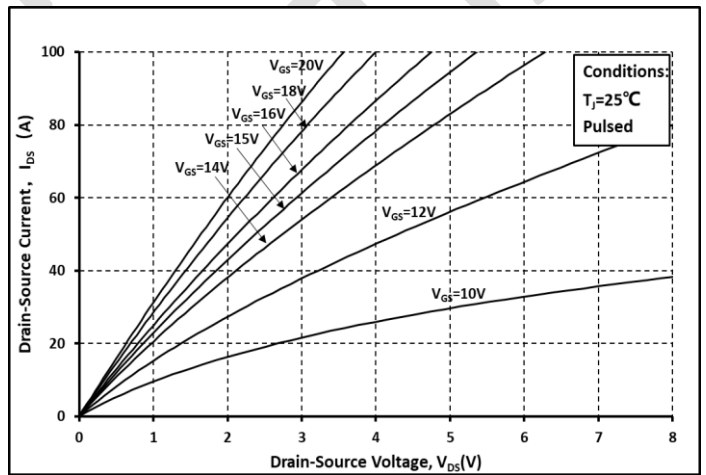


Fig. 2 Output Curve @ $T_J=25^\circ\text{C}$

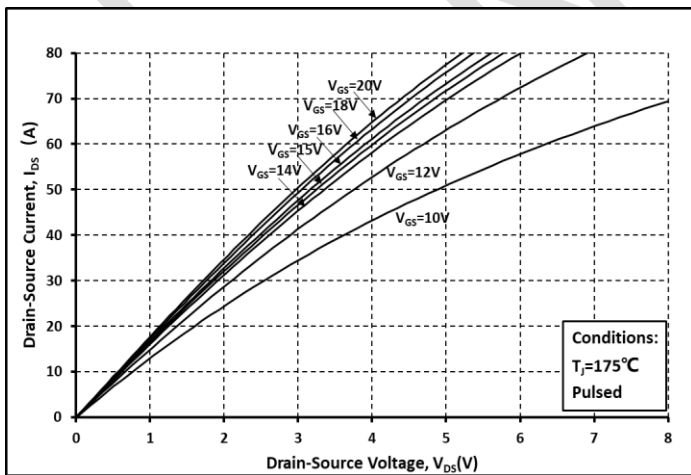


Fig. 3 Output Curve @ $T_J=175^\circ\text{C}$

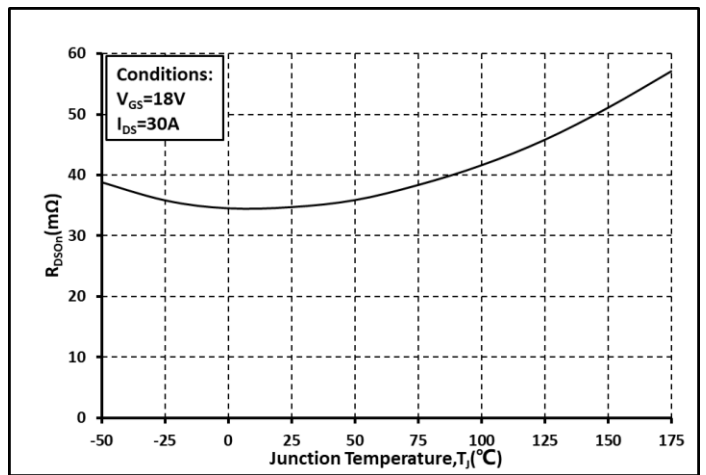


Fig. 4 R_{on} vs. Temperature

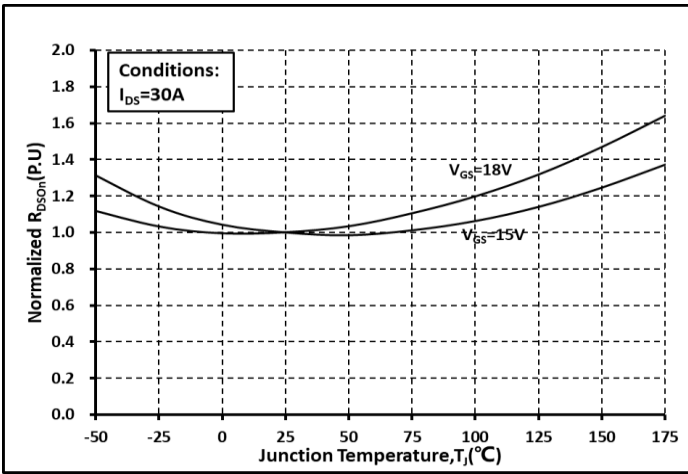


Fig. 5 Normalized Ron vs. Temperature

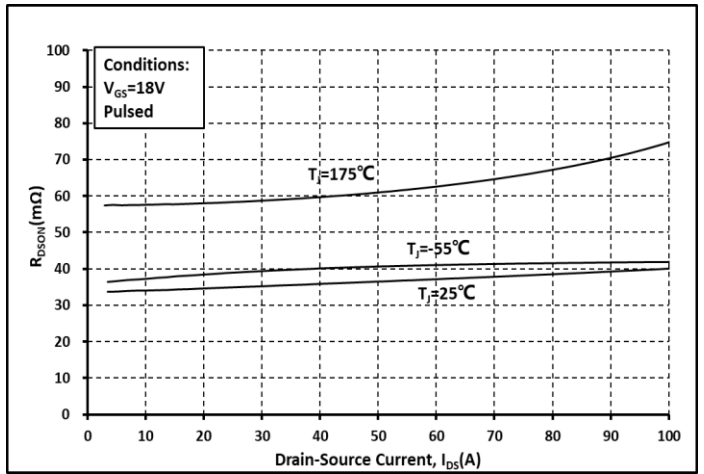


Fig. 6 Ron vs. Ids @ Various Temperature

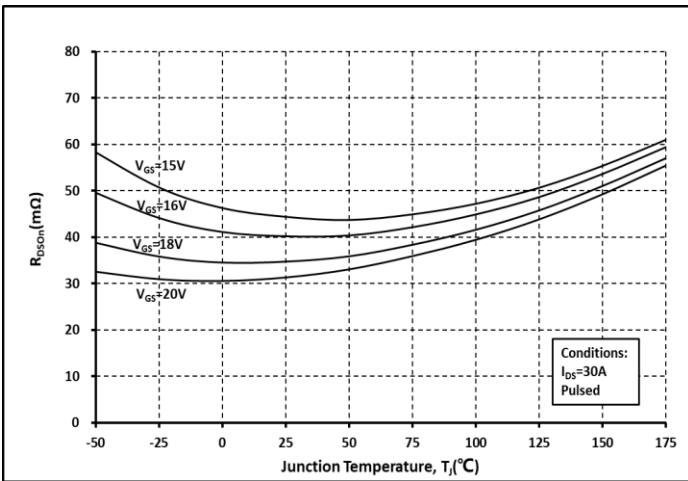


Fig. 7 Ron vs. Temperature @ Various Vgs

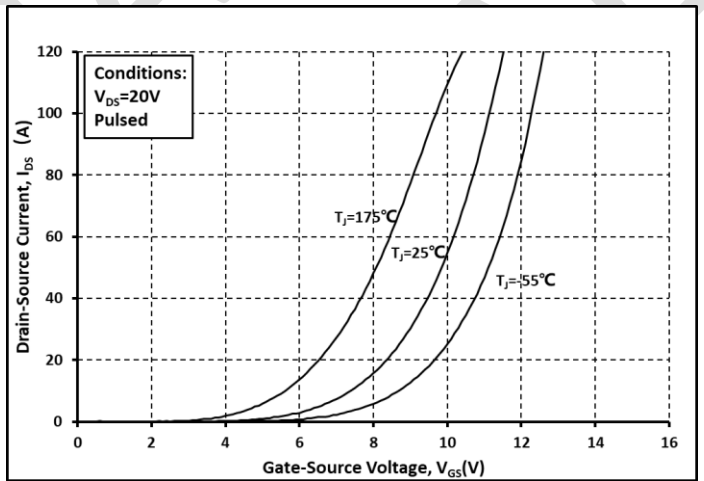


Fig. 8 Transfer Curves @ Various Temperature

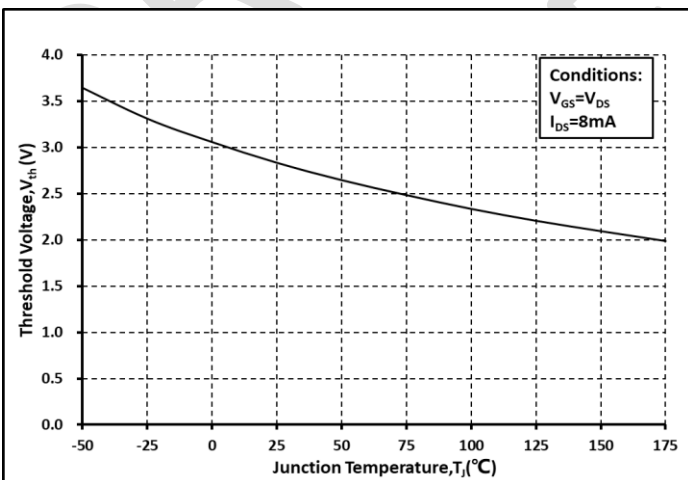


Fig. 9 Threshold Voltage vs. Temperature

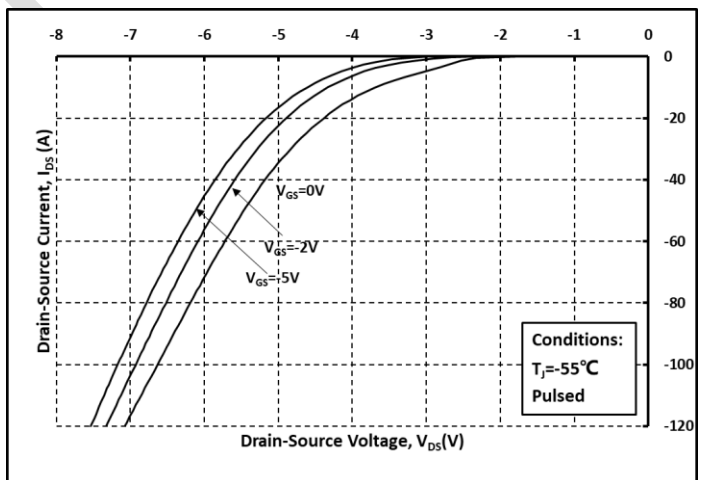


Fig. 10 Body Diode curves @ Tj=-55°C

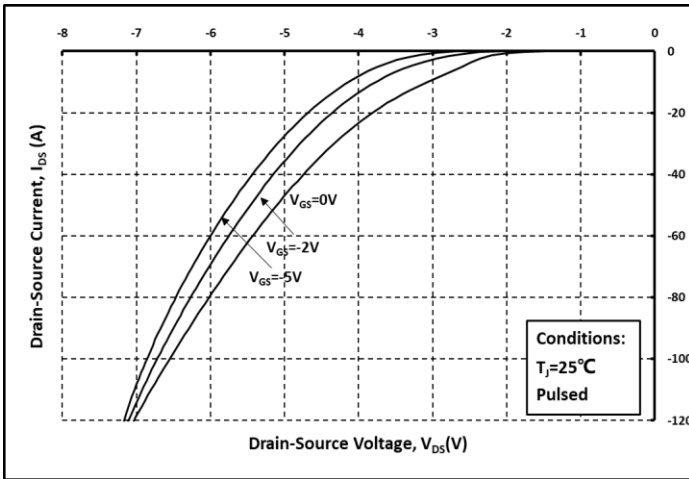


Fig. 11 Body Diode curves @ $T_j=25^\circ\text{C}$

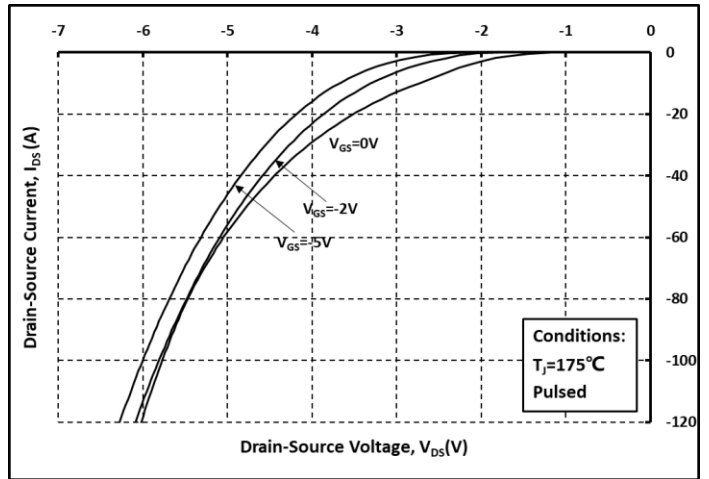


Fig. 12 Body Diode curves @ $T_j=175^\circ\text{C}$

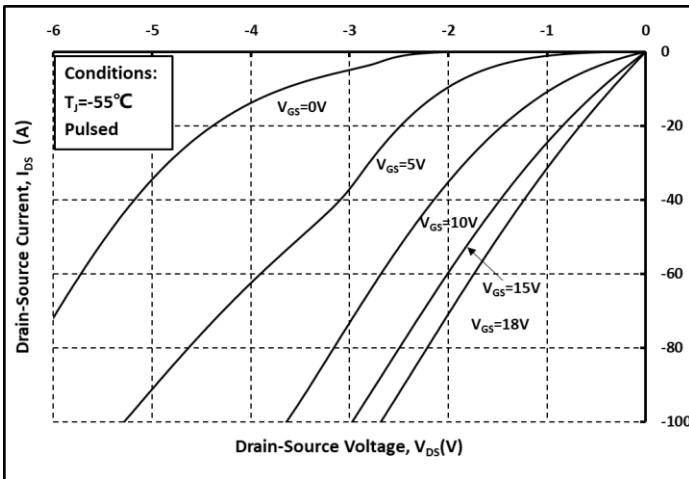


Fig. 13 3rd Quadrant curves @ $T_j=-55^\circ\text{C}$

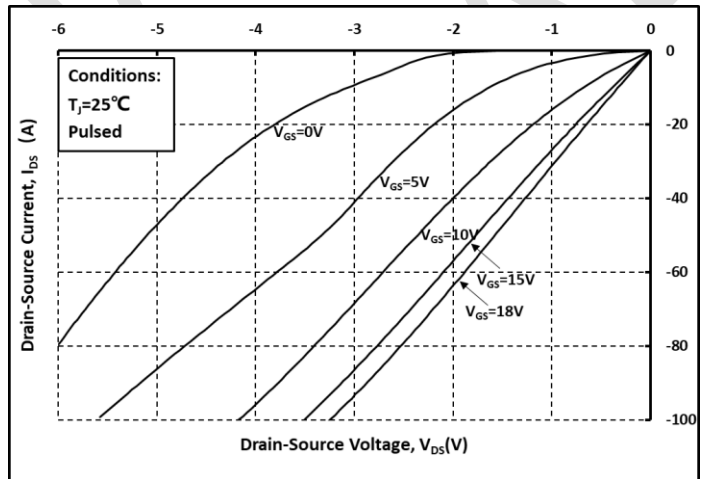


Fig. 14 3rd Quadrant curves @ $T_j=25^\circ\text{C}$

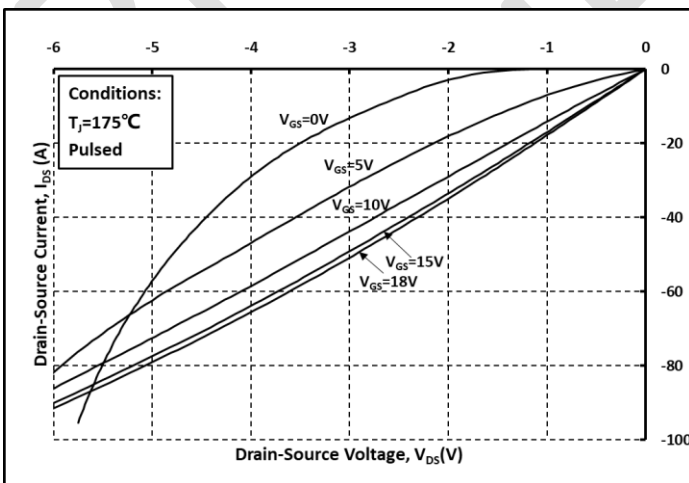


Fig. 15 3rd Quadrant curves @ $T_j=175^\circ\text{C}$

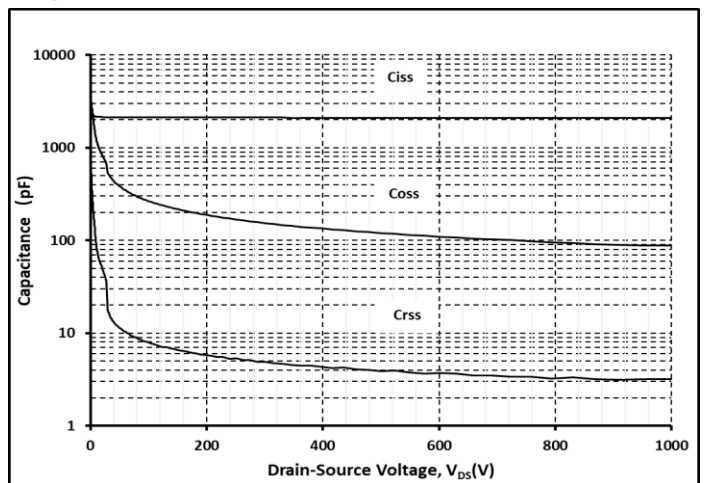


Fig. 16 Capacitance vs. V_{ds}

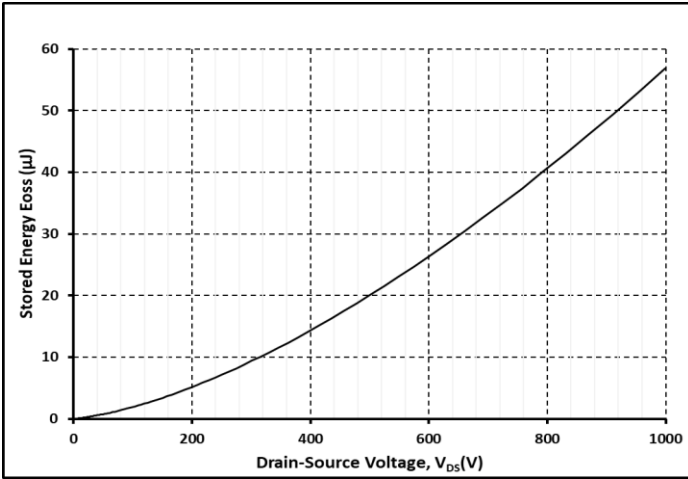


Fig. 17 Output Capacitor Stored Energy

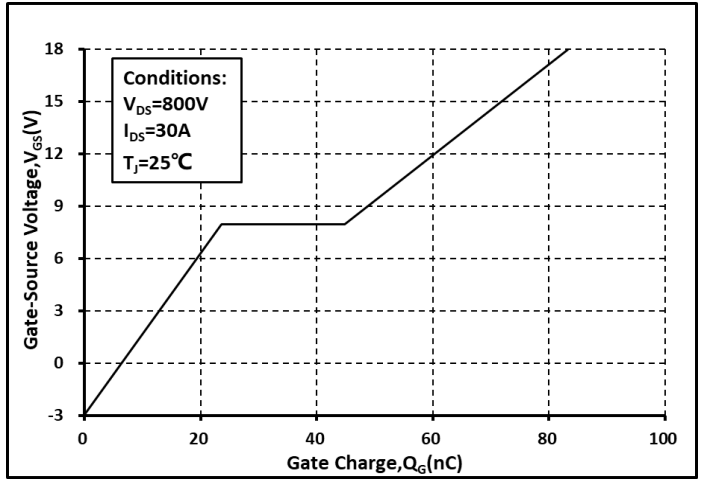


Fig. 18 Gate Charge Characteristics

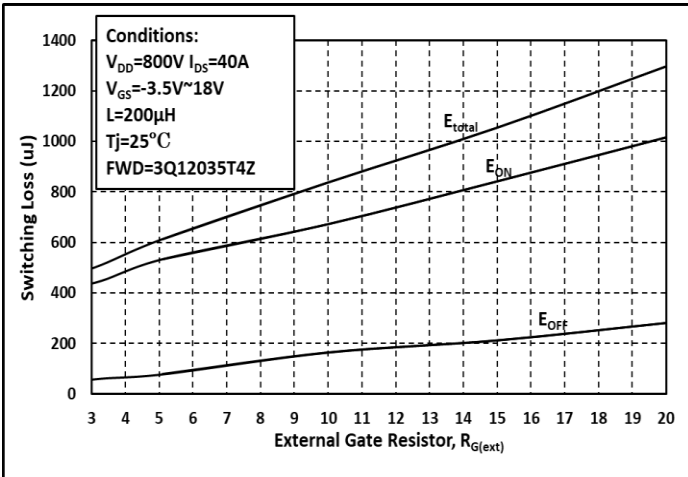


Fig. 19 Switching Energy vs. $R_{G(ext)}$

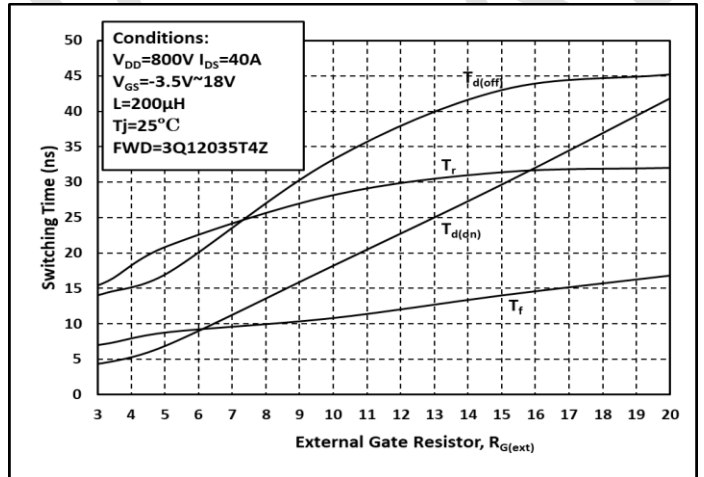


Fig. 20 Switching Times vs. $R_{G(ext)}$

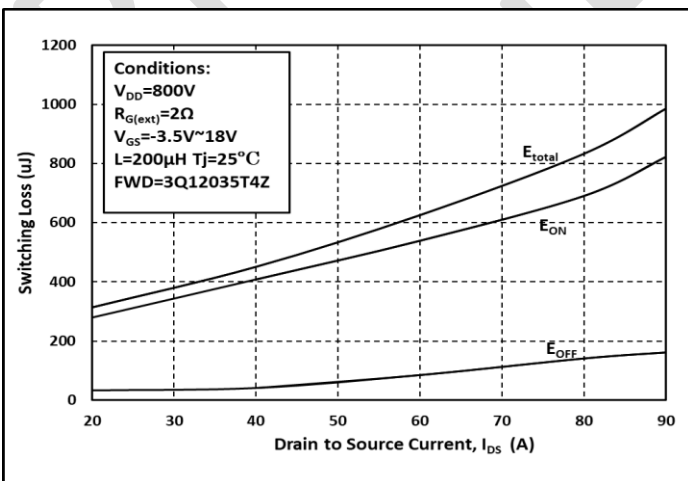


Fig. 21 Switching Energy vs. I_{DS}

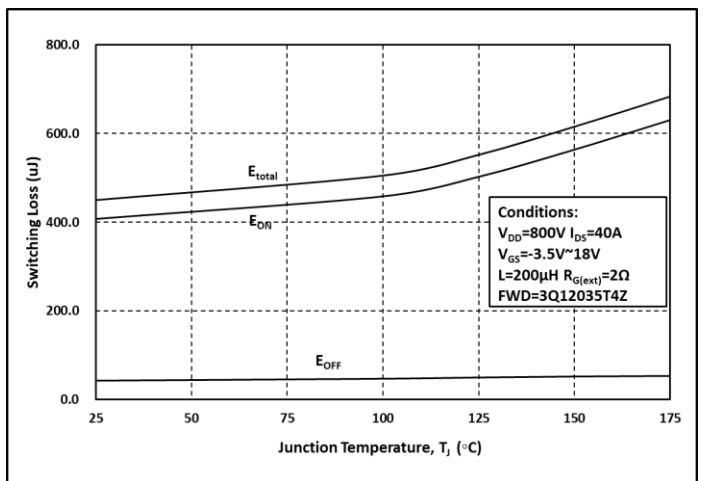


Fig. 22 Switching Energy vs. Temperature

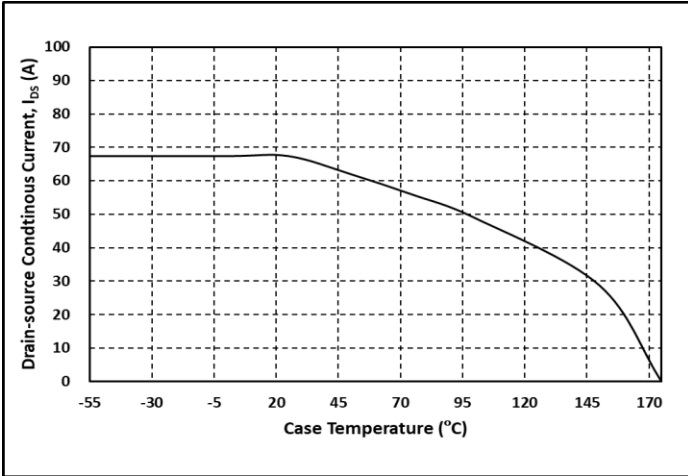


Fig. 23 Continuous Drain Current vs. Case Temperature

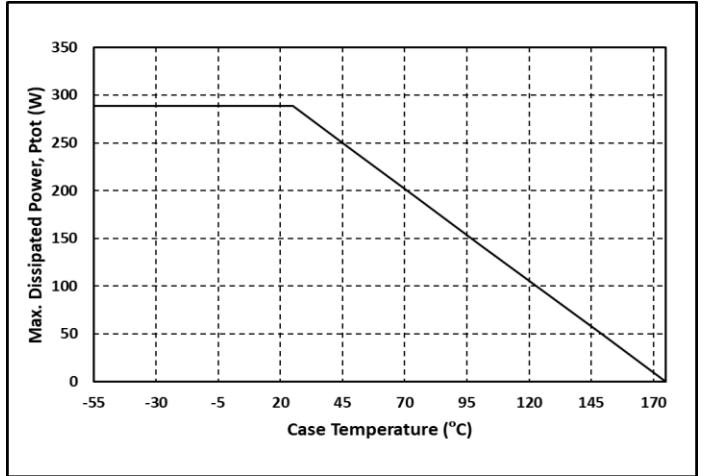


Fig. 24 Max. Power Dissipation Derating vs. Case Temperature

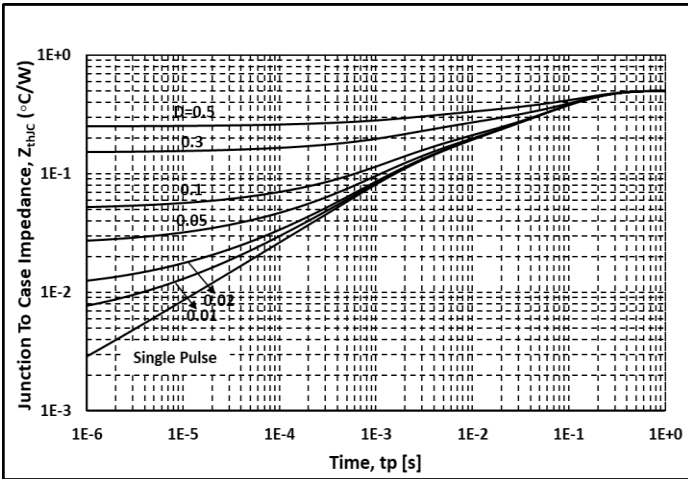


Fig. 25 Thermal impedance

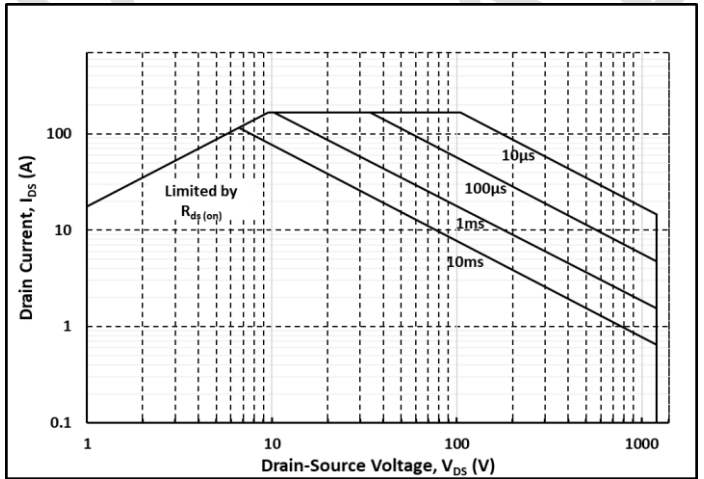
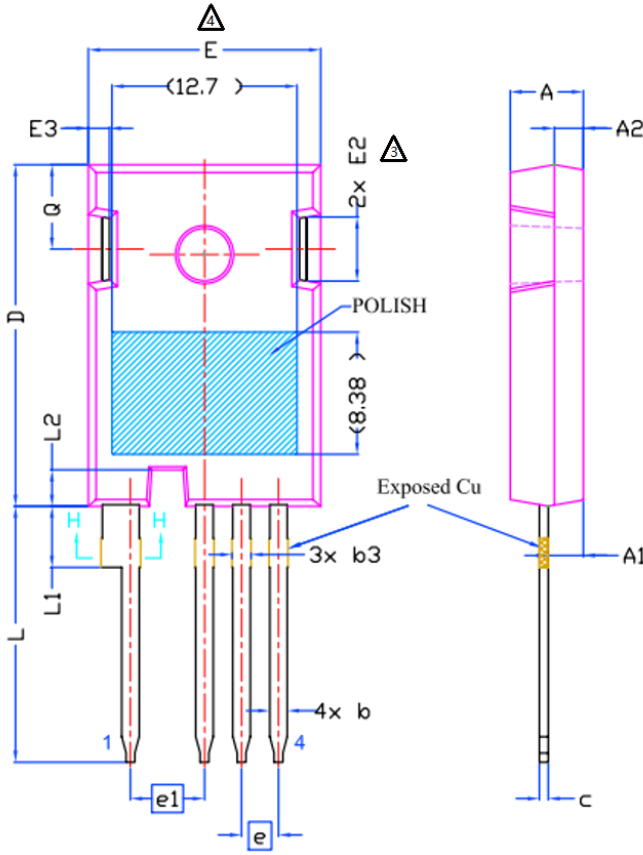


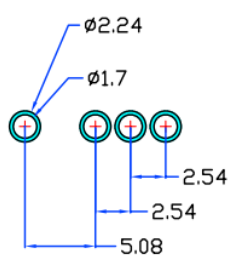
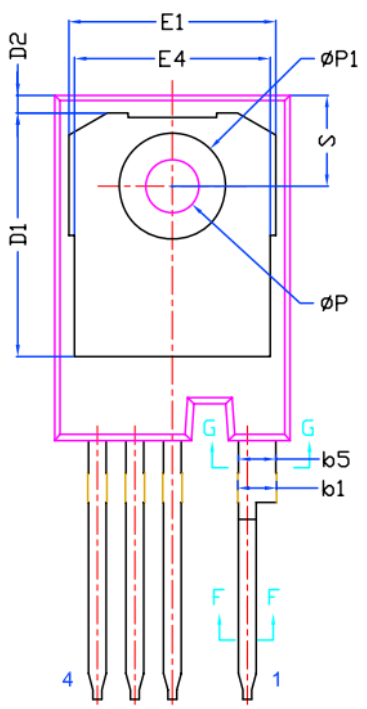
Fig. 26 Safe Operating Area

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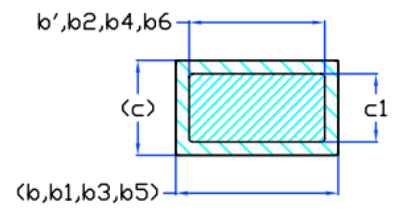
Package Dimensions



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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