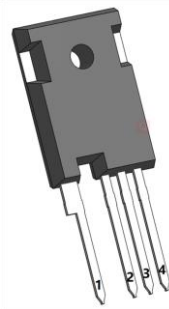


IV1Q12050T4Z – 1200V 50mΩ Automotive SiC MOSFET

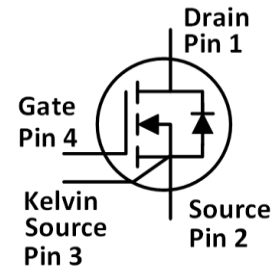
Features

- 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
- AEC-Q101 qualified

Outline:



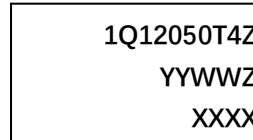
TO247-4



Applications

- On-board chargers
- Automotive compressor inverters
- Automotive DC/DC
- Solar inverters
- Switch mode power supplies

Marking Diagram:



1Q12050T4Z= 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	$V_{GS}=0V, I_D=100\mu A$	
$V_{GSmax}(DC)$	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)	58	A	$V_{GS}=20V, T_c=25^\circ\text{C}$	Fig. 23
		43	A	$V_{GS}=20V, T_c=100^\circ\text{C}$	
I_{DM}	Drain current (pulsed)	145	A	Pulse width limited by SOA	Fig. 26
P_{TOT}	Total power dissipation	344	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	0.436	$^\circ\text{C/W}$	Fig. 25

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		5	100	μA	V _{DS} =1200V, 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 =6mA	Fig. 8, 9
			2.2			V _{GS} =V _{DS} , I _D =6mA @ T _J =175°C	
R _{ON}	Static drain-source on-resistance		50	65	mΩ	V _{GS} =20V, I _D =20A @T _J =25°C	Fig. 4, 5, 6, 7
			80		mΩ	V _{GS} =20V, I _D =20A @T _J =175°C	
C _{iss}	Input capacitance		2750		pF	V _{DS} =800V, V _{GS} =0V, f=1MHz, V _{AC} =25mV	Fig. 16
C _{Oss}	Output capacitance		106		pF		
C _{rss}	Reverse transfer capacitance		5.2		pF		
E _{Oss}	C _{Oss} stored energy		43		μJ		Fig. 17
Q _g	Total gate charge		120		nC	V _{DS} =800V, I _D =20A, V _{GS} = -5 to 20V	Fig. 18
Q _{gs}	Gate-source charge		25		nC		
Q _{gd}	Gate-drain charge		48		nC		
R _g	Gate input resistance		2.8		Ω	f=1MHz	
E _{ON}	Turn-on switching energy		470.9		μJ	V _{DS} =800V, I _D =30A, V _{GS} = -3.5 to 20V, R _{G(ext)} =3.3Ω, L=200μH	Fig. 19, 20
E _{OFF}	Turn-off switching energy		102.3		μJ		
t _{d(on)}	Turn-on delay time		11.0		ns		
t _r	Rise time		22.2				
t _{d(off)}	Turn-off delay time		22.0				
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		4.9		V	I _{SD} =20A, V _{GS} =0V	Fig. 10, 11, 12
			4.4		V	I _{SD} =20A, V _{GS} =0V, T _J =175°C	
t _{rr}	Reverse recovery time		27.9		ns	V _{GS} =-3.5V/+20V, I _{SD} =30A, V _R =800V, di/dt=3000A/us, R _{G(ext)} =9.1Ω L=200μH	
Q _{rr}	Reverse recovery charge		233.8		nC		
I _{RRM}	Peak reverse recovery current		19.8		A		

Typical Performance (curves)

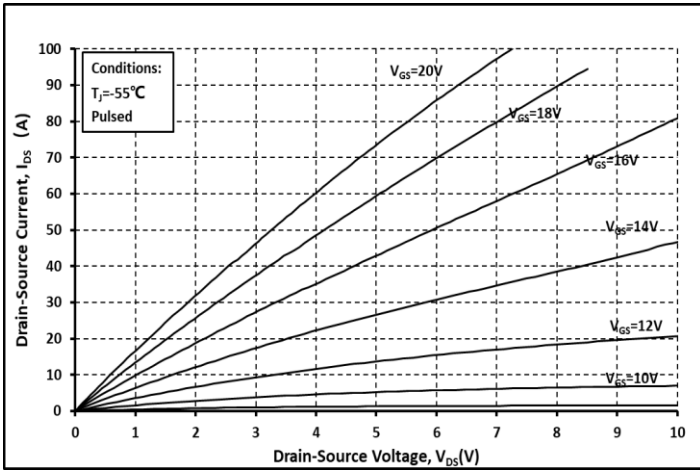


Fig. 1 Output Curve @ $T_j = -55^\circ\text{C}$

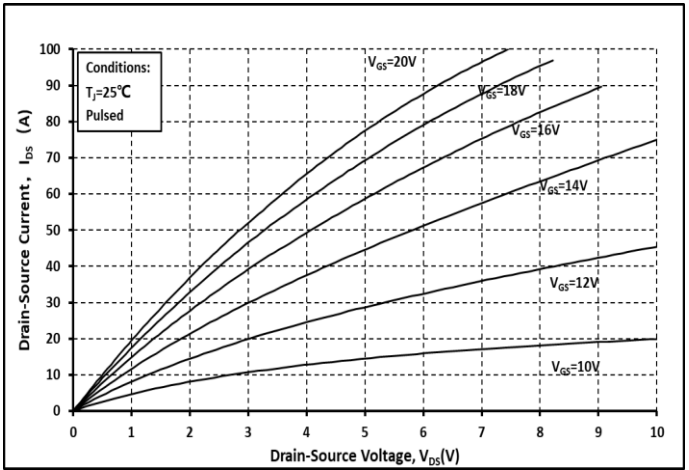


Fig. 2 Output Curve @ $T_j = 25^\circ\text{C}$

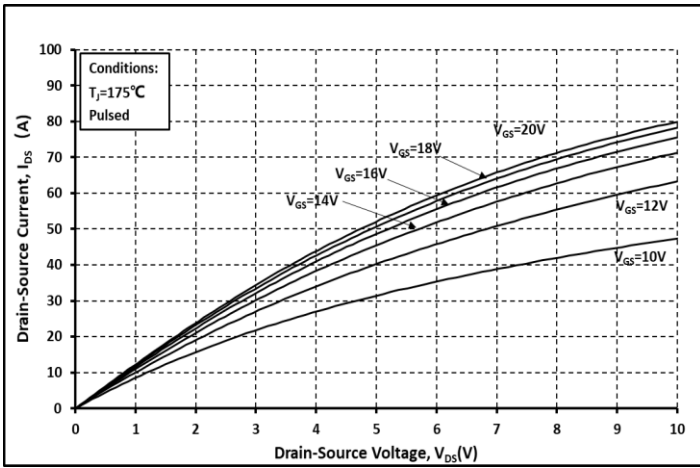


Fig. 3 Output Curve @ $T_j = 175^\circ\text{C}$

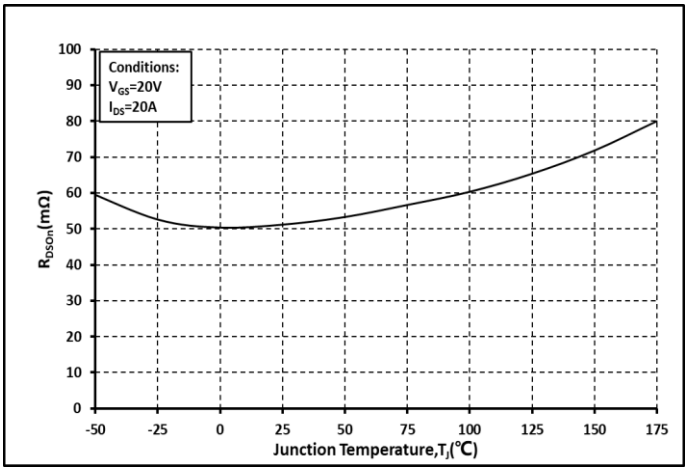


Fig. 4 R_{on} vs. Temperature

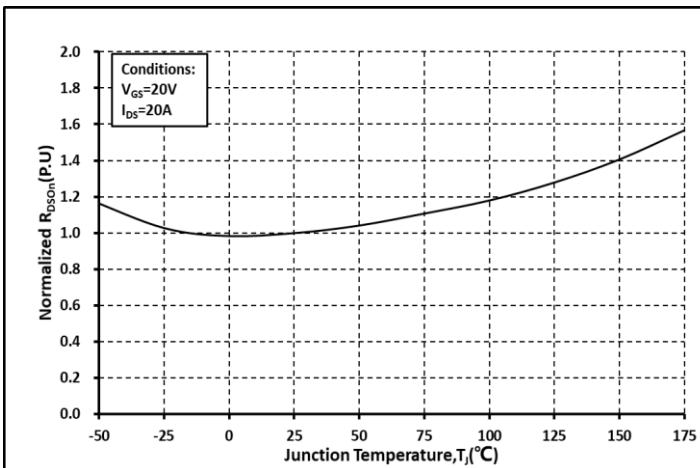


Fig. 5 Normalized R_{on} vs. Temperature

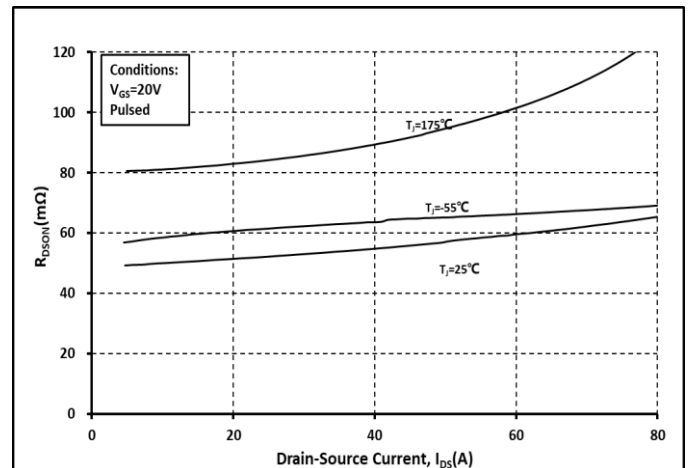


Fig. 6 R_{on} vs. I_{DS} @ Various Temperature

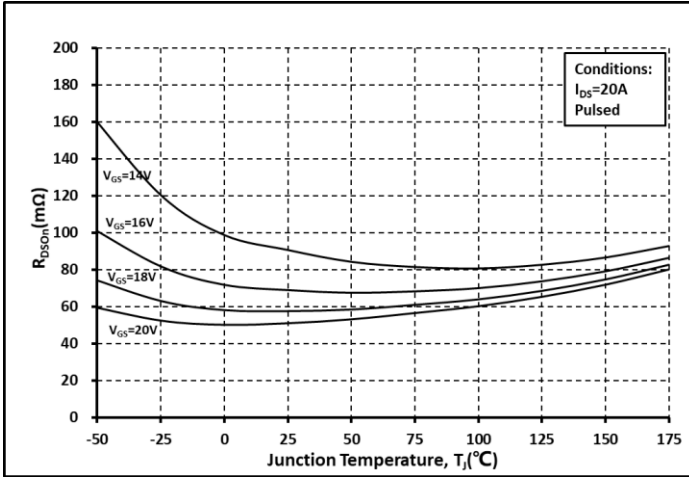


Fig. 7 R_{on} vs. Temperature @ Various V_{GS}

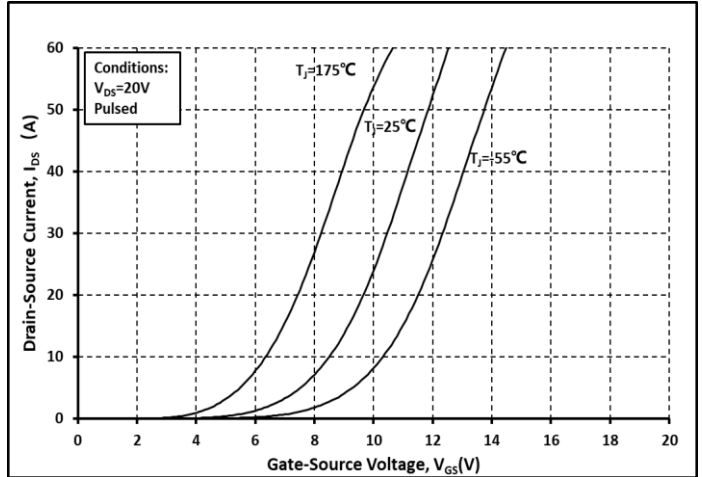


Fig. 8 Transfer Curves @ Various Temperature

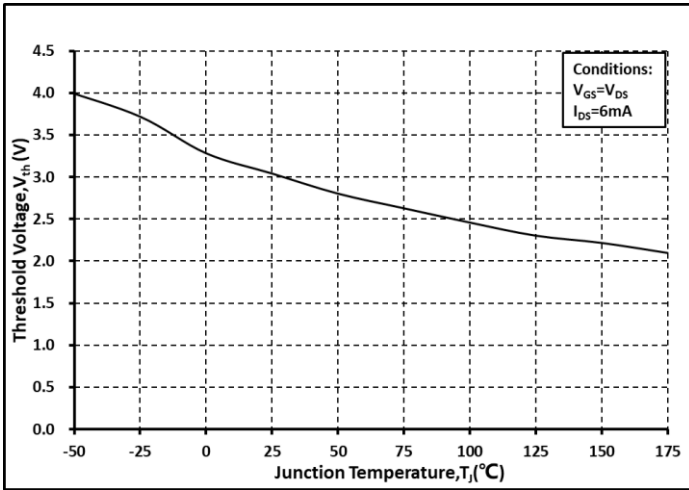


Fig. 9 Threshold Voltage vs. Temperature

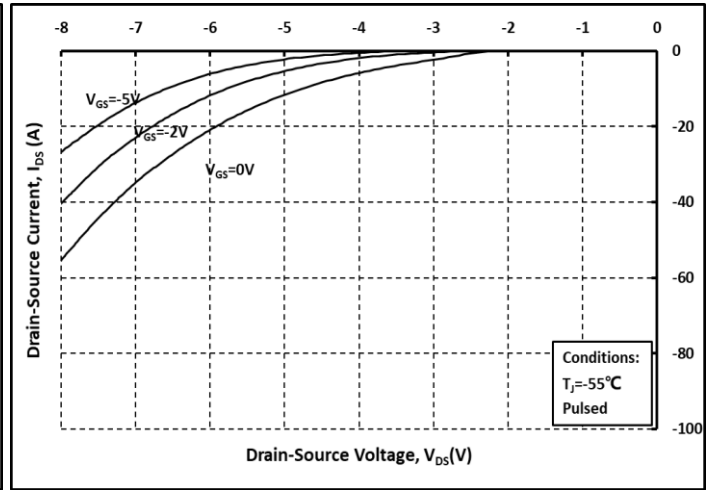


Fig. 10 Body Diode Curves @ $T_J=-55^{\circ}C$

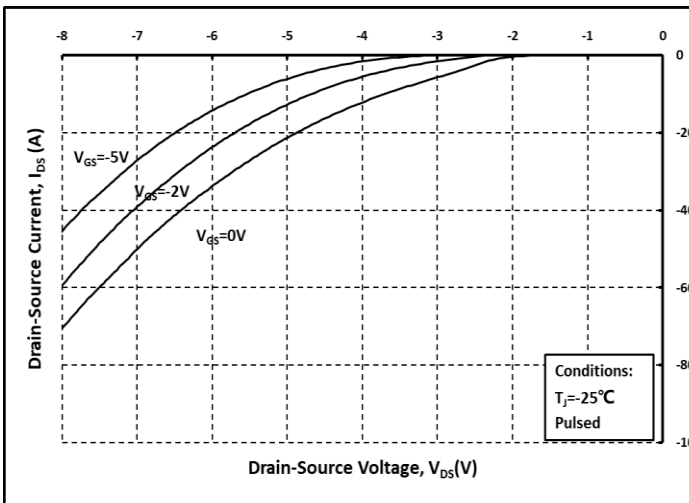


Fig. 11 Body Diode Curves @ $T_J=25^{\circ}C$

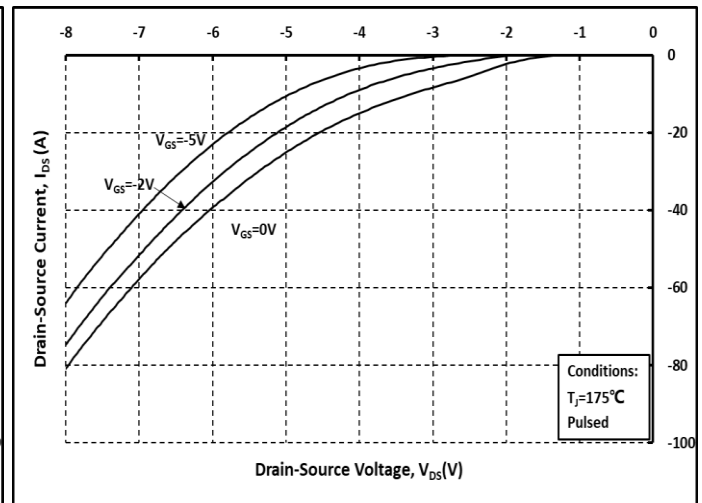


Fig. 12 Body Diode Curves @ $T_J=175^{\circ}C$

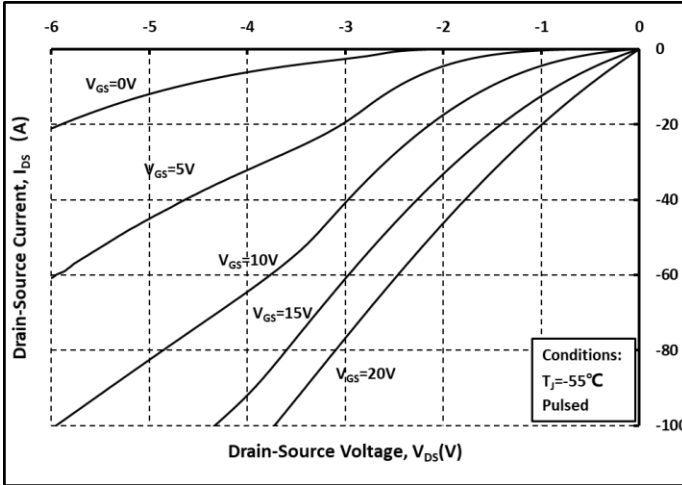


Fig. 13 3rd Quadrant Curves @ $T_j = -55^\circ\text{C}$

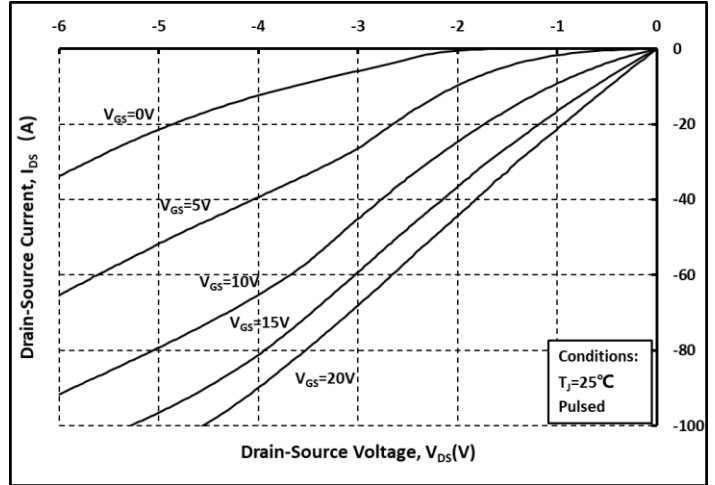


Fig. 14 3rd Quadrant Curves @ $T_j = 25^\circ\text{C}$

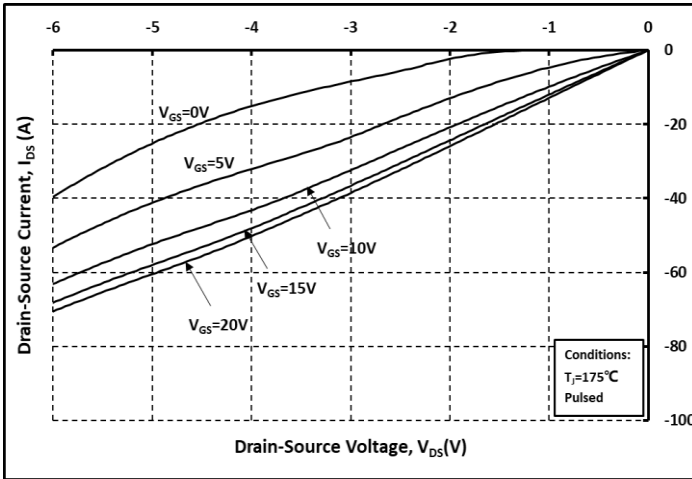


Fig. 15 3rd Quadrant Curves @ $T_j = 175^\circ\text{C}$

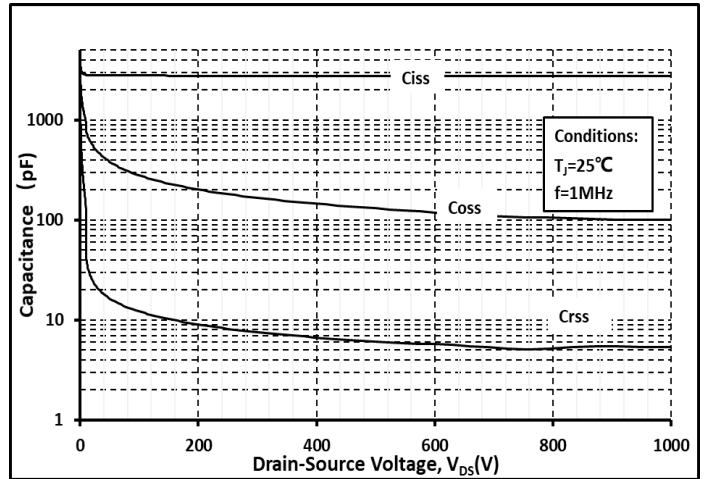


Fig. 16 Capacitance vs. V_{ds}

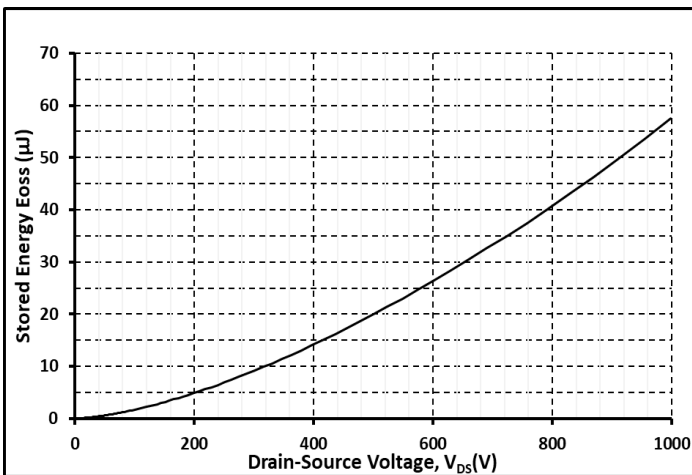


Fig. 17 Output Capacitor Stored Energy

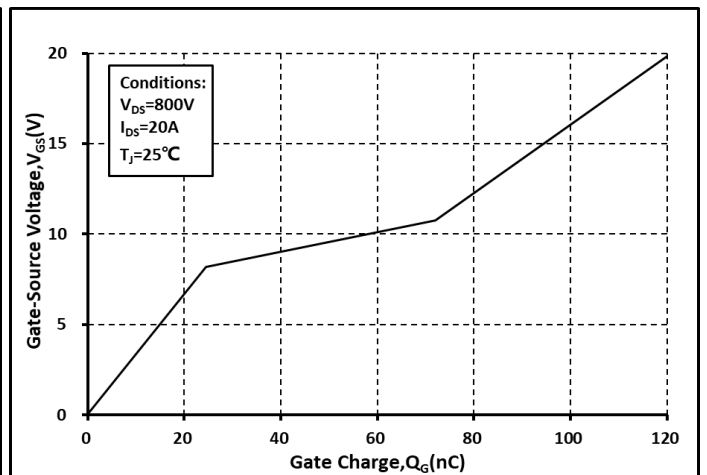


Fig. 18 Gate Charge Characteristics

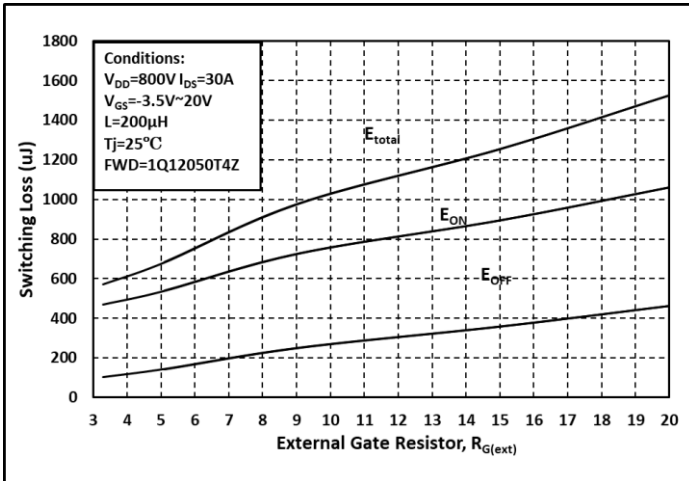


Fig. 19 Switching Energy vs. $R_{G(ext)}$

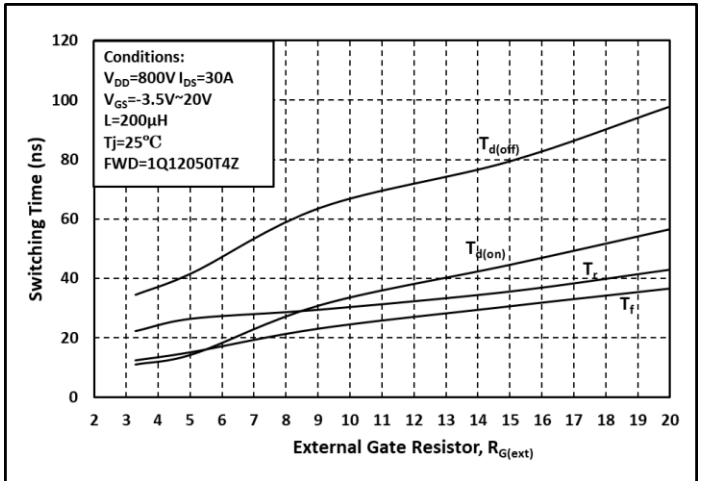


Fig. 20 Switching Times vs. $R_{G(ext)}$

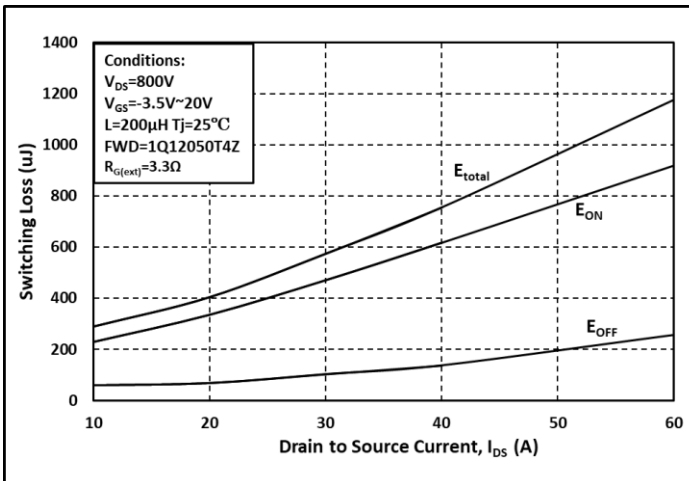


Fig. 21 Switching Energy vs. I_{DS}

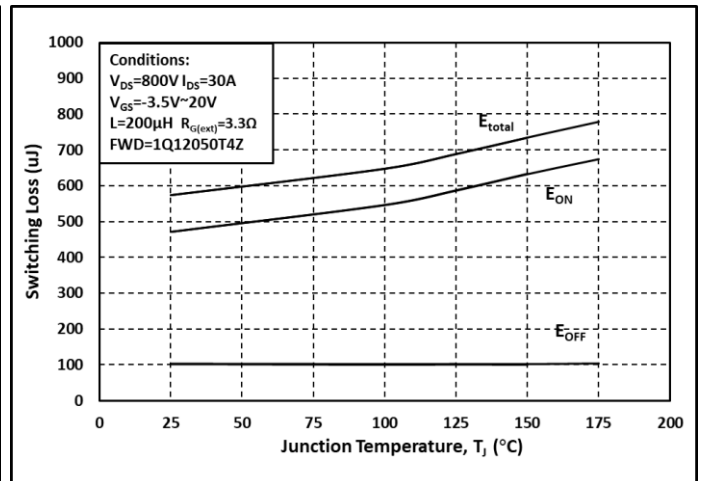


Fig. 22 Switching Energy vs. T_j

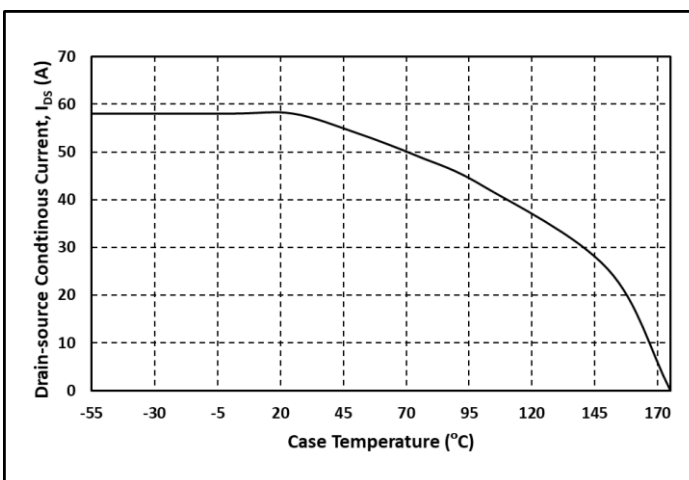


Fig. 22 Continuous Drain Current vs. Case Temperature

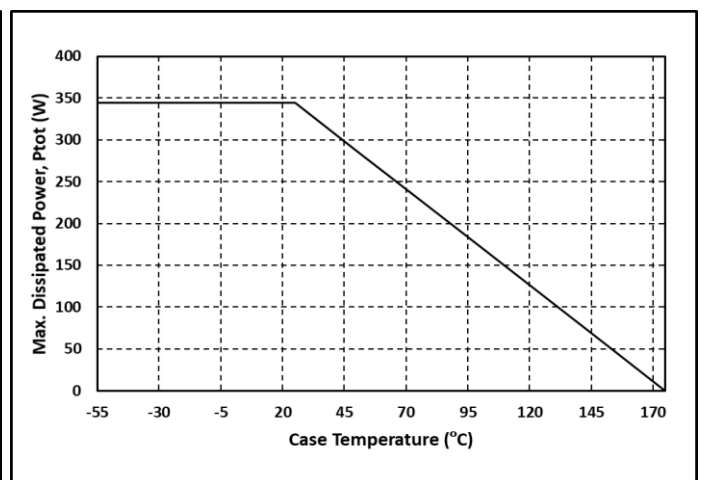


Fig. 23 Max. Power Dissipation Derating vs. Case Temperature

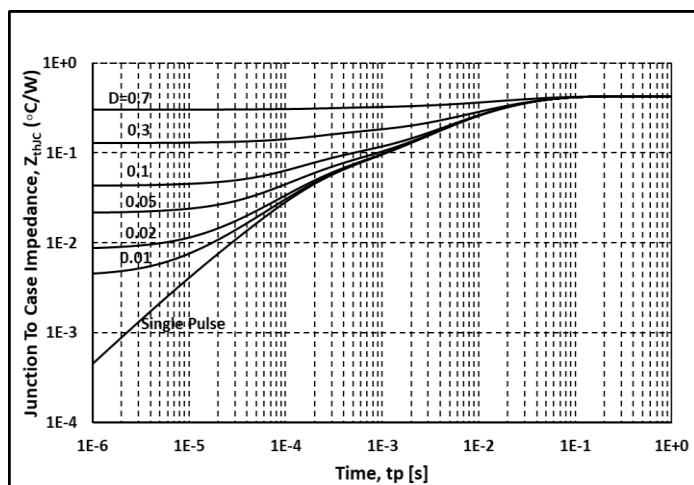


Fig. 24 Thermal Impedance

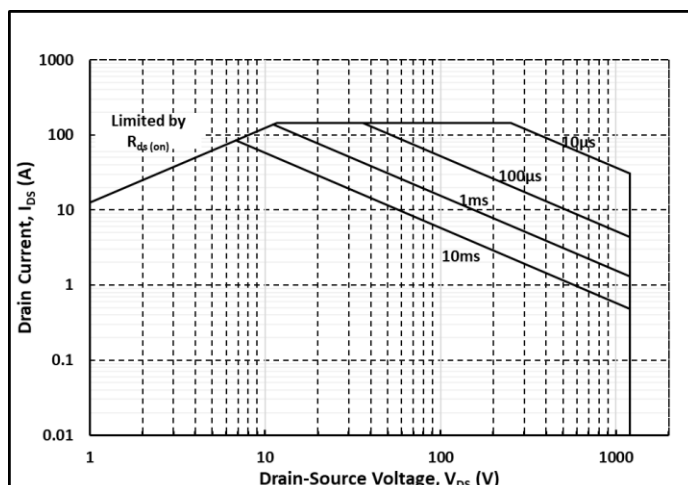
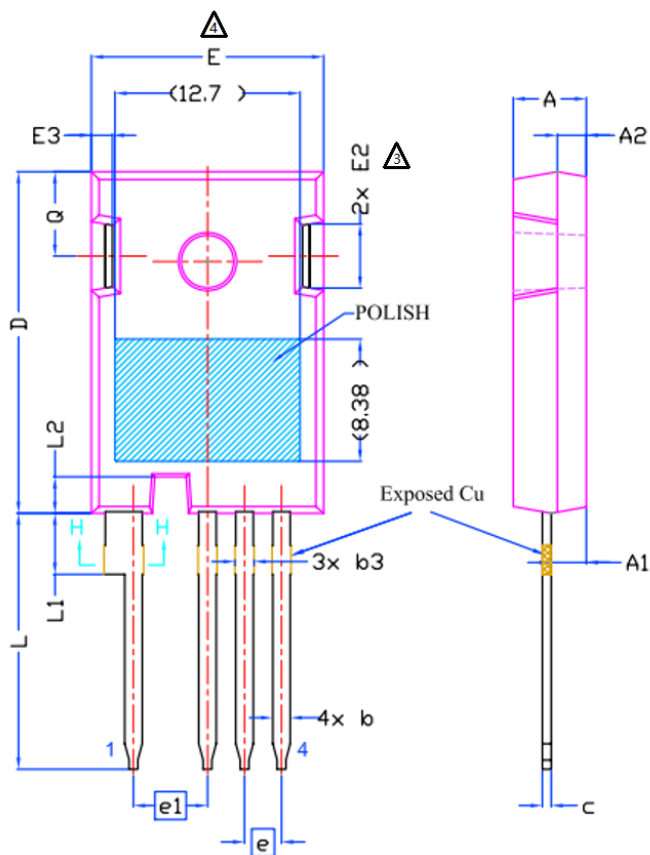
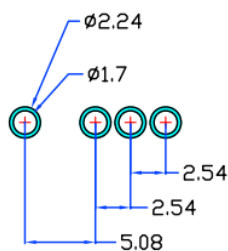
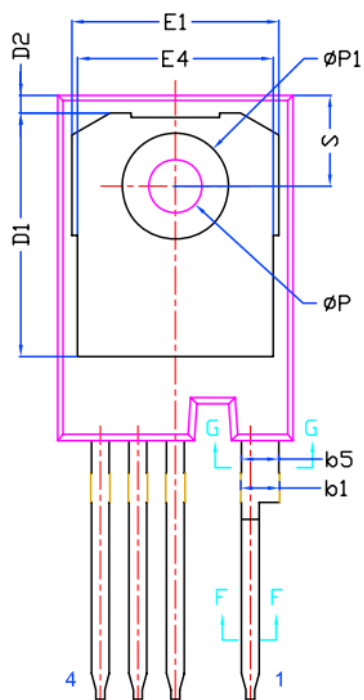


Fig. 25 Safe Operating Area

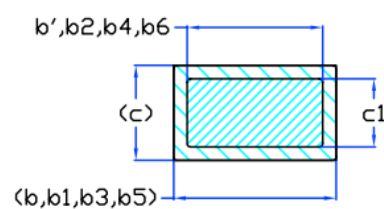
Package Dimensions



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	
φ P	3.51	3.65
φ P1	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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