

IV1Q12080T4 – 1200V 80mΩ SiC MOSFET

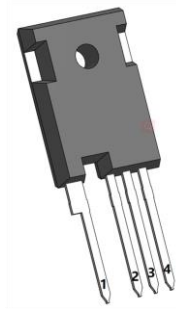
Features

- 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

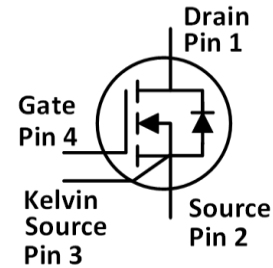
Applications

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

Outline:



TO247-4



Marking Diagram:

1Q12080T4
YYWWZ
XXXX

1Q12080T4 = 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	duty cycle<1%, 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)	42	A	$V_{GS}=20V, T_c=25^\circ\text{C}$	Fig. 23
		31	A	$V_{GS}=20V, T_c=100^\circ\text{C}$	
I_{DM}	Drain current (pulsed)	70	A	Pulse width limited by SOA	Fig. 26
P_{TOT}	Total power dissipation	300	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	0.5	$^\circ\text{C/W}$	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	3.6	5	V	V _{GS} =V _{DS} , I _D =3.8mA	Fig. 8, 9
			2.7			V _{GS} =V _{DS} , I _D =3.8mA @ T _J =175°C	
R _{ON}	Static drain-source on-resistance		80	100	mΩ	V _{GS} =20V, I _D =10A @T _J =25°C	Fig. 4, 5, 6, 7
			130		mΩ	V _{GS} =20V, I _D =10A @T _J =175°C	
C _{iss}	Input capacitance		1680		pF	V _{DS} =800V, V _{GS} =0V, f=1MHz, V _{AC} =25mV	Fig. 16
C _{OSS}	Output capacitance		69		pF		
C _{rss}	Reverse transfer capacitance		6.7		pF		
E _{OSS}	C _{OSS} stored energy		27		μJ		Fig. 17
Q _g	Total gate charge		74		nC	V _{DS} =800V, I _D =20A, V _{GS} = -5 to 20V	Fig. 18
Q _{gs}	Gate-source charge		26		nC		
Q _{gd}	Gate-drain charge		25		nC		
R _g	Gate input resistance		4.2		Ω	f=1MHz	
E _{ON}	Turn-on switching energy		251		μJ	V _{DS} =800V, I _D =20A, V _{GS} = -3.5 to 20V, R _{G(ext)} =3.3Ω, L=200μH T _J =25°C	Fig. 19, 20
E _{OFF}	Turn-off switching energy		47		μJ		
t _{d(on)}	Turn-on delay time		6.9		ns		
t _r	Rise time		15.0				
t _{d(off)}	Turn-off delay time		14.2				
t _f	Fall time		10.1				
E _{ON}	Turn-on switching energy		378		μJ	V _{DS} =800V, I _D =20A, V _{GS} = -3.5 to 20V, R _{G(ext)} =3.3Ω,L=200μH T _J =175°C	Fig. 22
E _{OFF}	Turn-off switching energy		47.2		μJ		

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		4.0		V	I _{SD} =10A, V _{GS} =0V	Fig. 10, 11, 12
			3.6		V	I _{SD} =10A, V _{GS} =0V, T _J =175°C	
t _{rr}	Reverse recovery time		31		ns	V _{GS} =-3.5 to 20V,	
Q _{rr}	Reverse recovery charge		151		nC	I _{SD} =20A, V _R =800V,	
I _{RRM}	Peak reverse recovery current		14.4		A	di/dt=3000A/μs	

Typical Performance (curves)

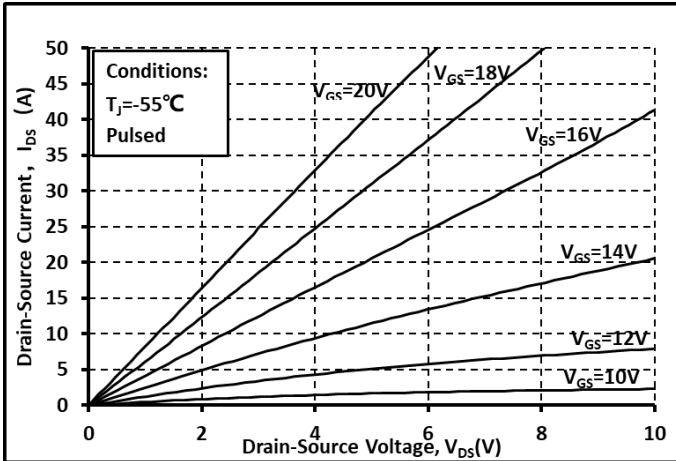


Fig. 1 Output Curve @ $T_j = -55^\circ\text{C}$

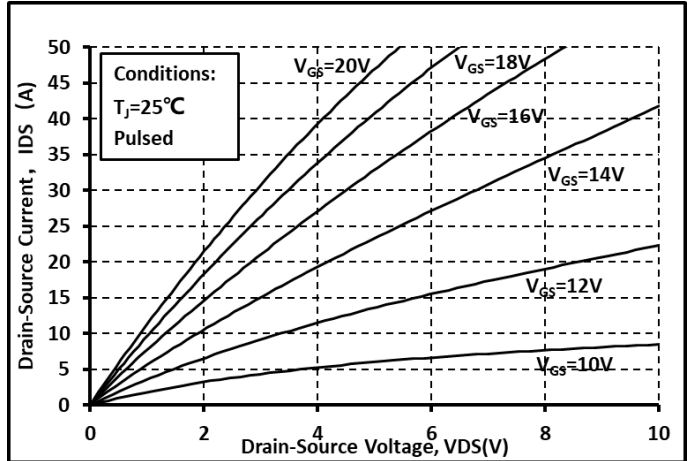


Fig. 2 Output Curve @ $T_j = 25^\circ\text{C}$

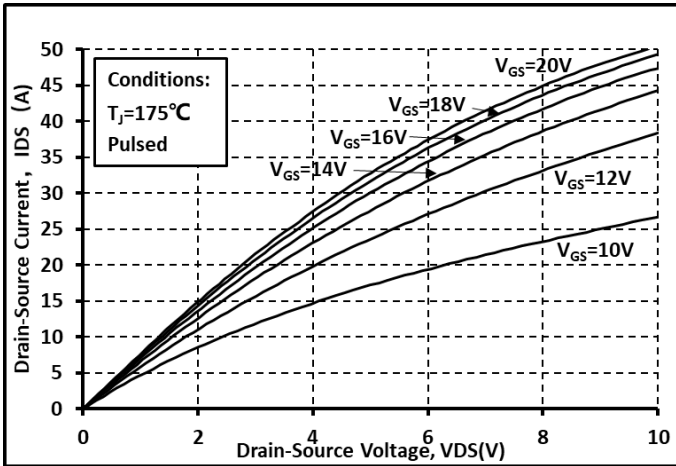


Fig. 3 Output Curve @ $T_j = 175^\circ\text{C}$

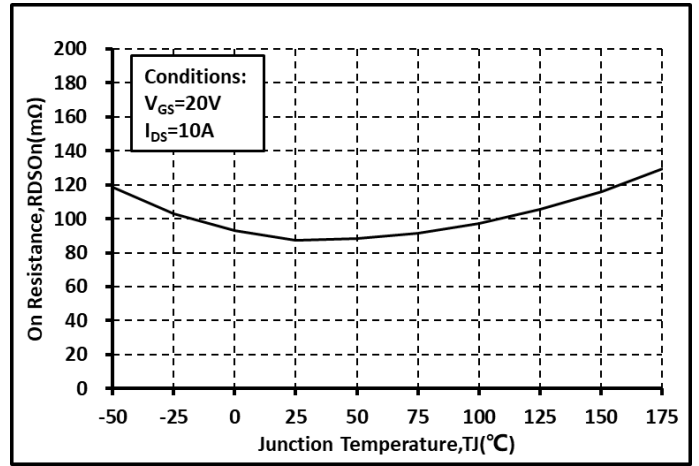


Fig. 4 R_{on} vs. Temperature

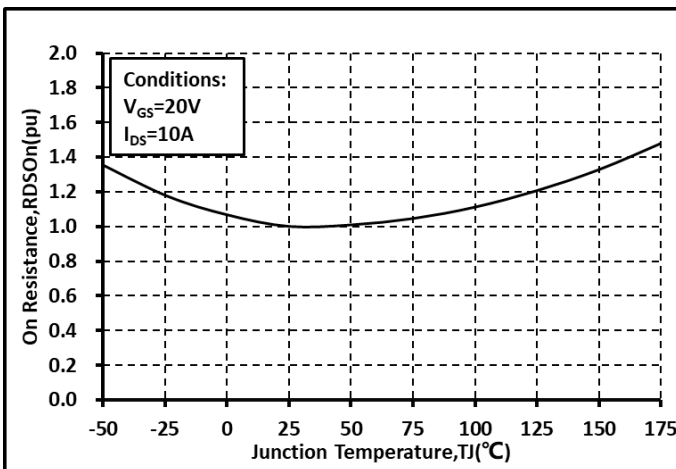


Fig. 5 Normalized R_{on} vs. Temperature

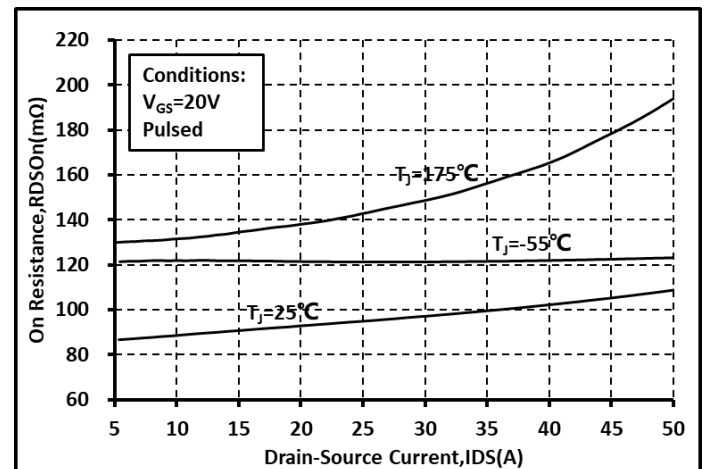


Fig. 6 R_{on} vs. I_{DS} @ Various Temperature

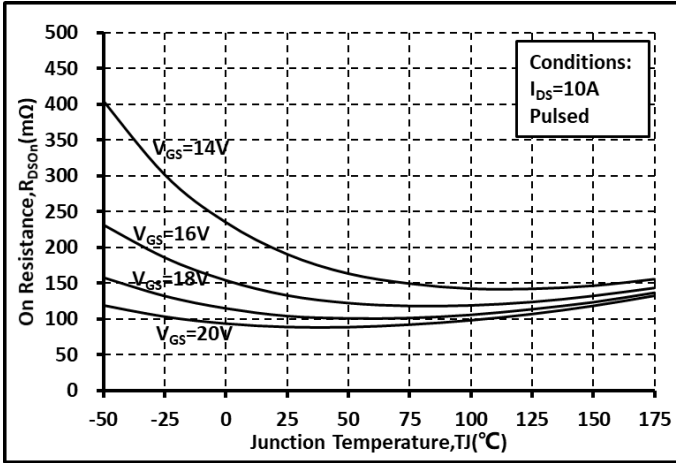


Fig. 7 Ron vs. Temperature @ Various V_{GS}

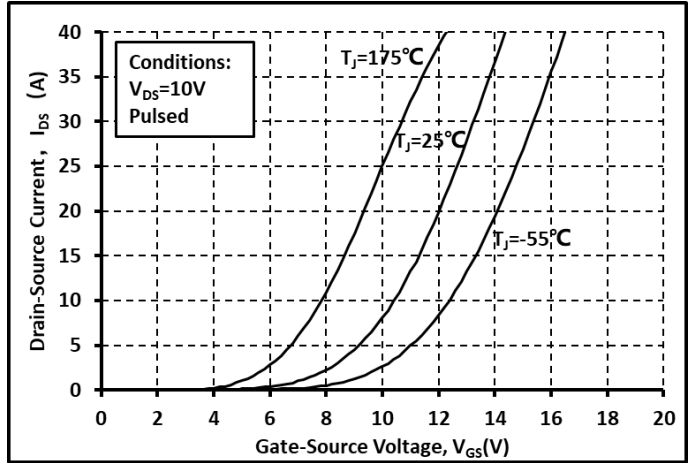


Fig. 8 Transfer Curves @ Various Temperature

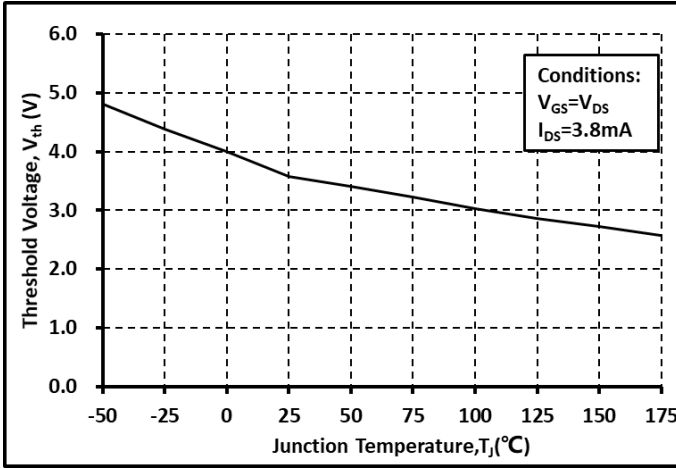


Fig. 9 Threshold Voltage vs. Temperature

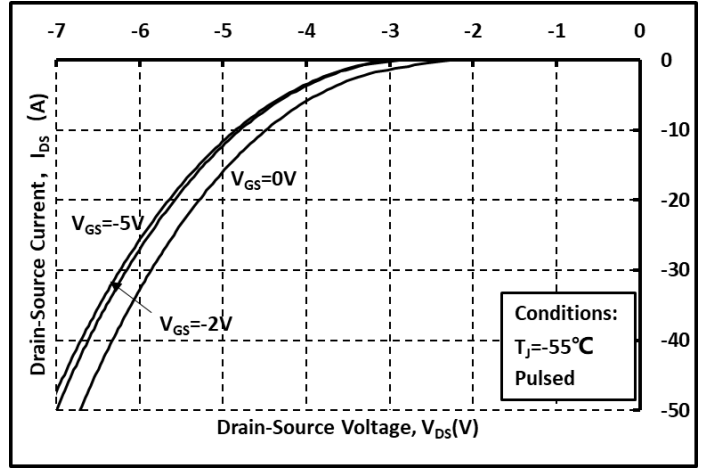


Fig. 10 Body Diode curves @ $T_J=-55°C$

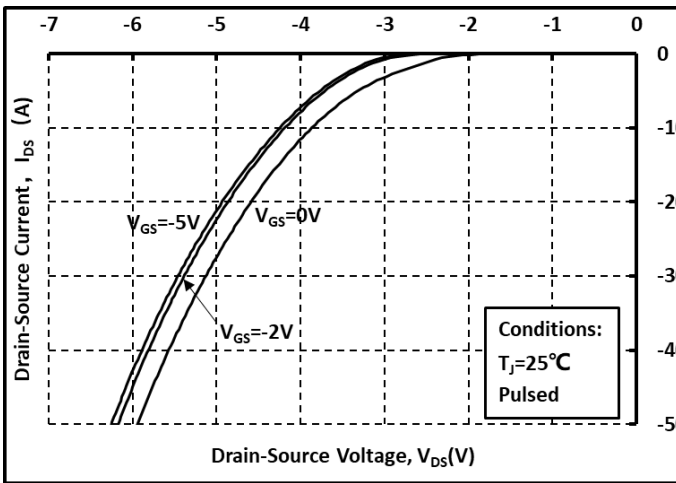


Fig. 11 Body Diode curves @ $T_J=25°C$

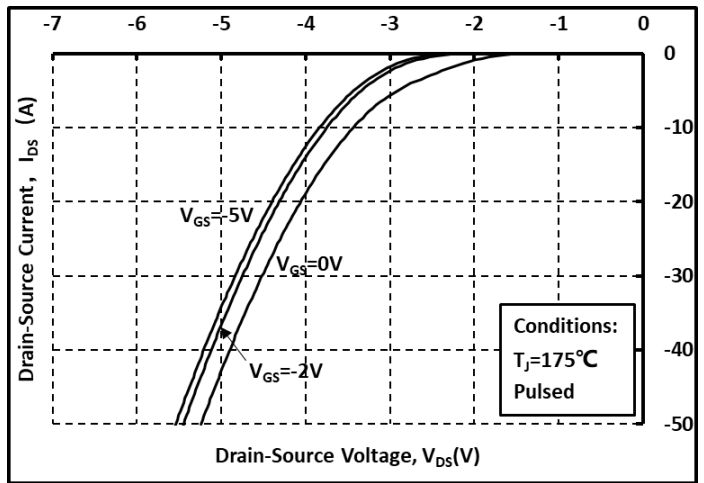


Fig. 12 Body Diode curves @ $T_J=175°C$

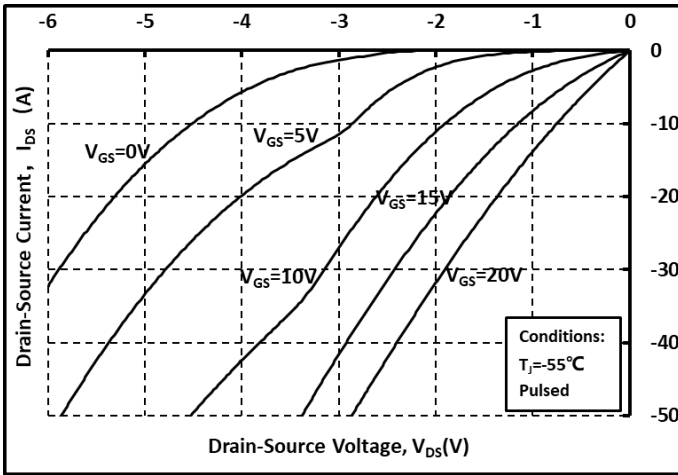


Fig. 13 3rd Quadrant curves @ $T_j = -55^\circ\text{C}$

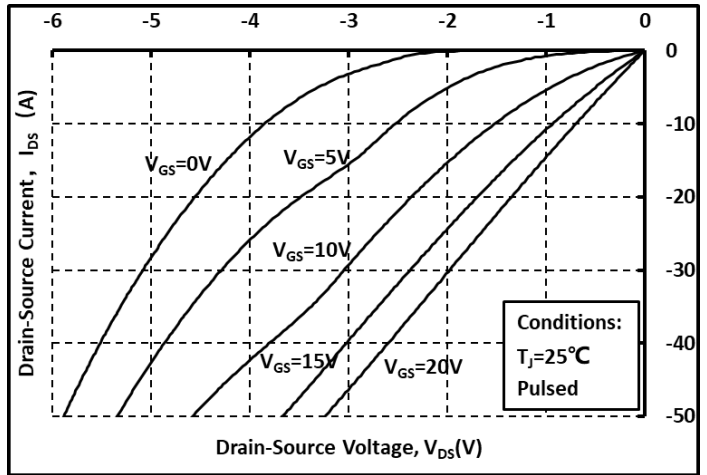


Fig. 14 3rd Quadrant curves @ $T_j = 25^\circ\text{C}$

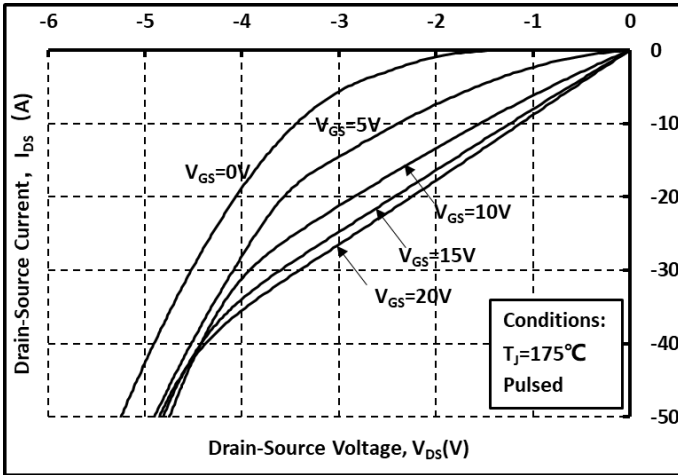


Fig. 15 3rd Quadrant curves @ $T_j = 175^\circ\text{C}$

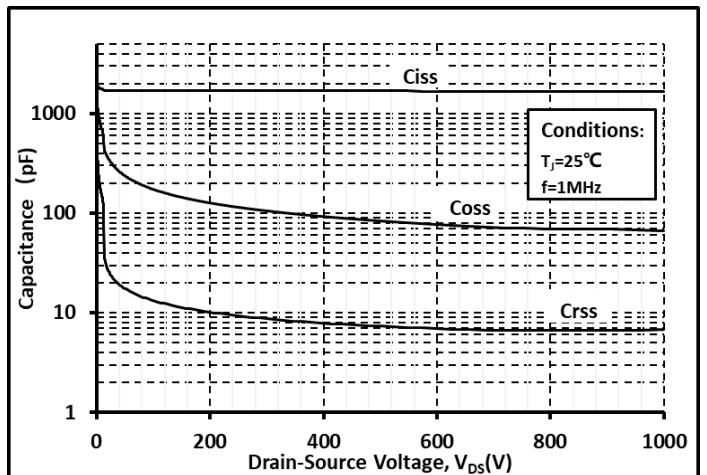


Fig. 16 Capacitance vs. V_{ds}

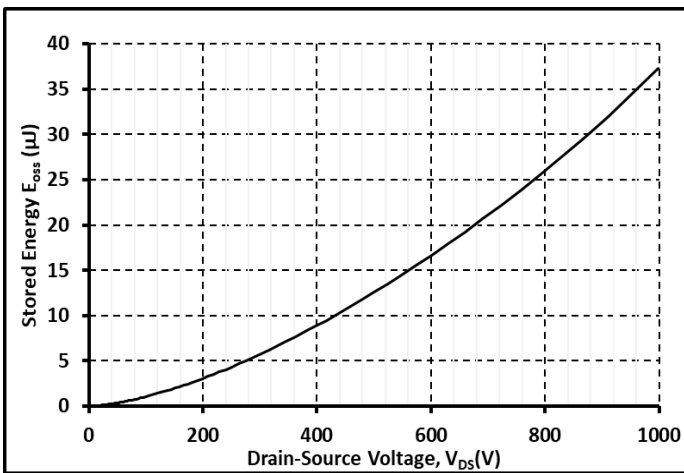


Fig. 17 Output Capacitor Stored Energy

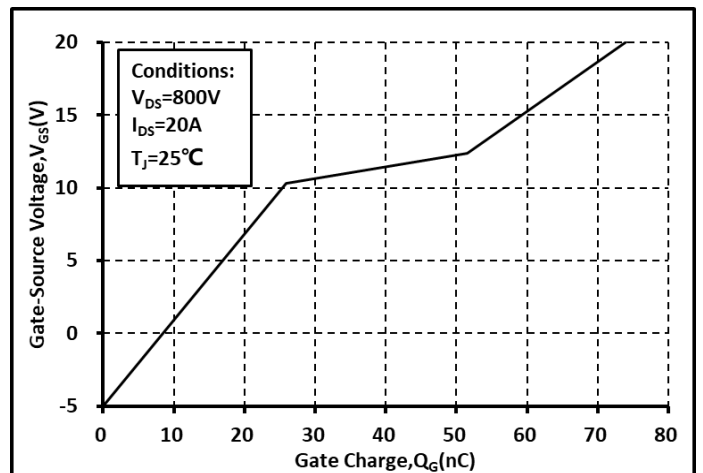


Fig. 18 Gate Charge Characteristics

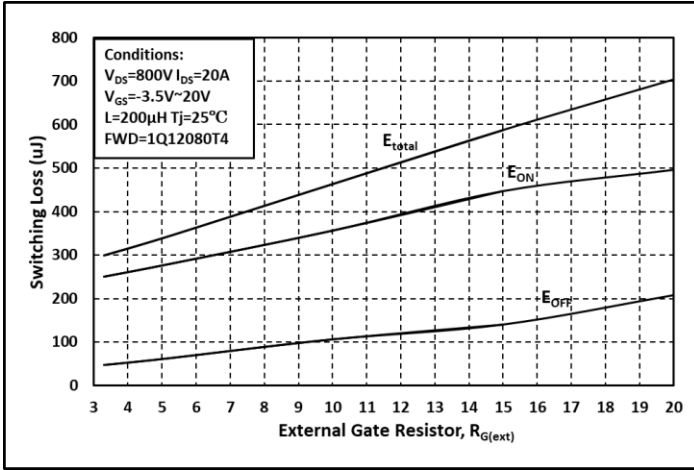


Fig. 19 Switching Energy vs. $R_{G(ext)}$

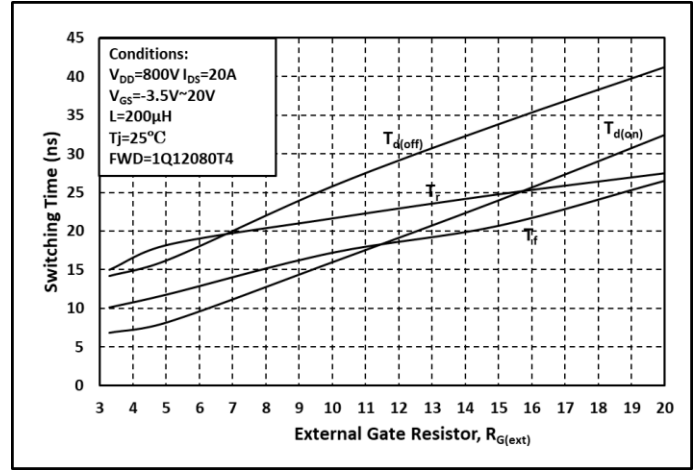


Fig. 20 Switching Times vs. $R_{G(ext)}$

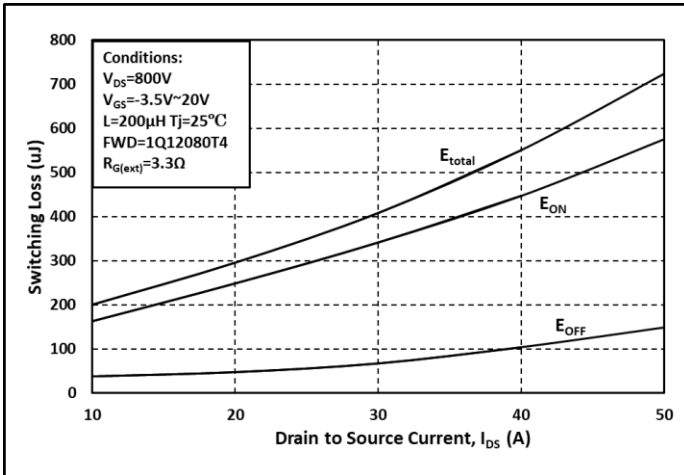


Fig. 21 Switching Energy vs. I_{DS}

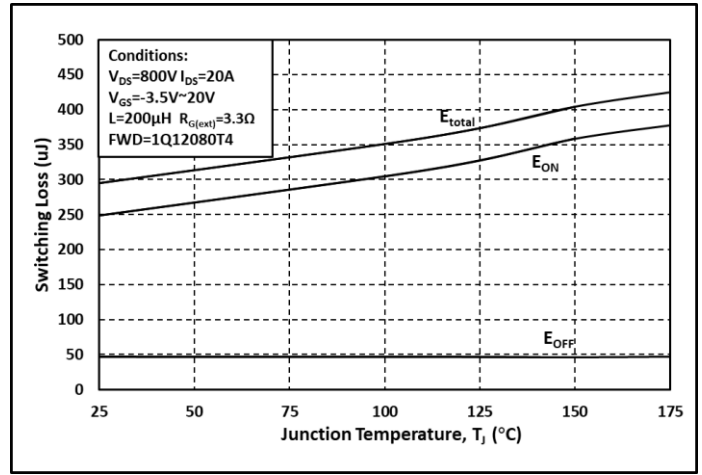


Fig. 22 Switching Energy vs. T_J

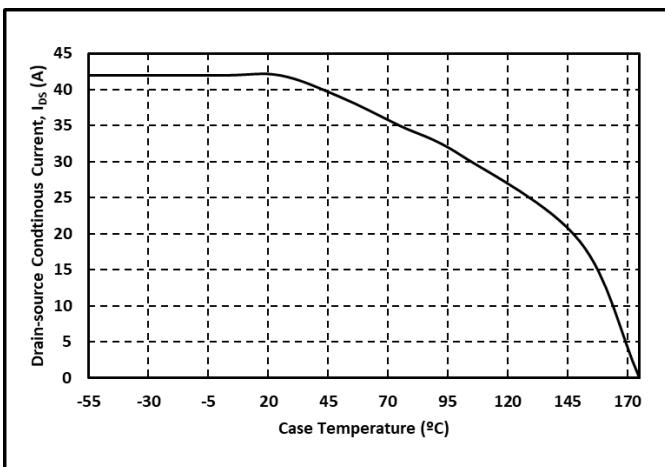


Fig. 23 Continuous Drain Current vs. Case Temperature

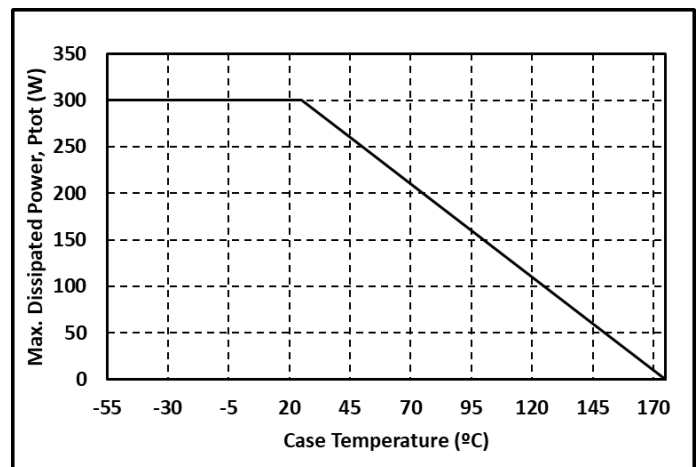


Fig. 24 Max. Power Dissipation Derating vs. Case Temperature

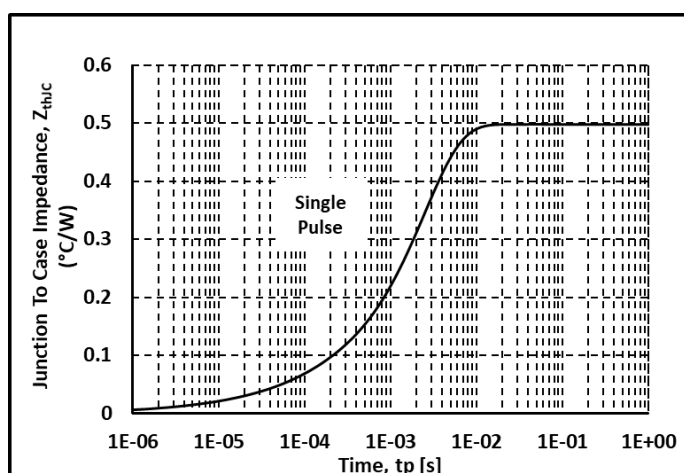


Fig. 25 Thermal impedance

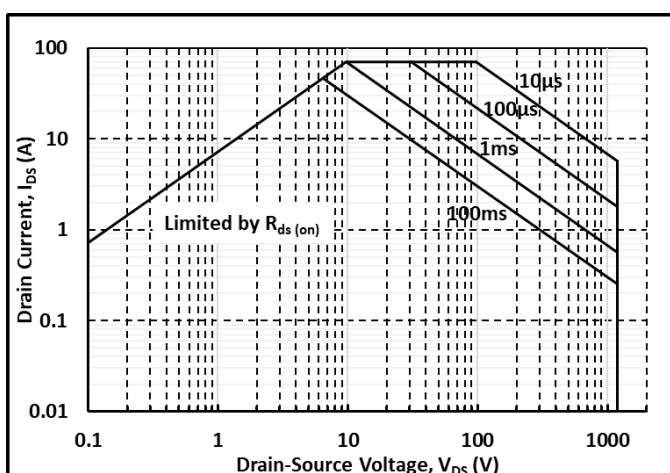
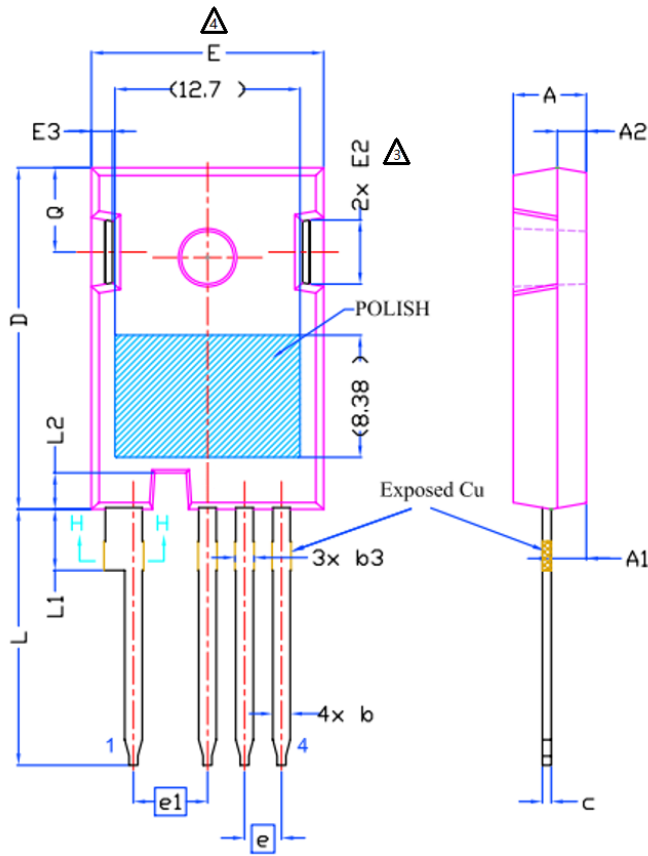
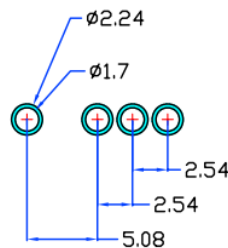
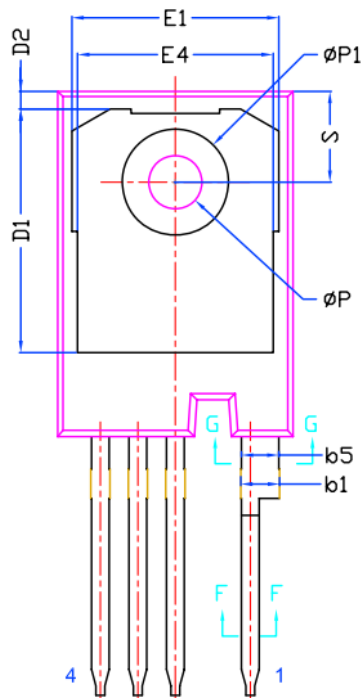


Fig. 26 Safe Operating Area

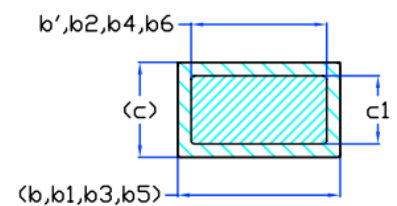
Package Dimensions



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:

- Package Reference: JEDEC TO247, Variation AD
- All Dimensions are in mm
- Slot Required, Notch May Be Rounded
- Dimension D&E Do Not Include Mold Flash
- Subject to Change Without Notice

Notes

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