

# 1200V N-Channel Silicon Carbide Power MOSFET

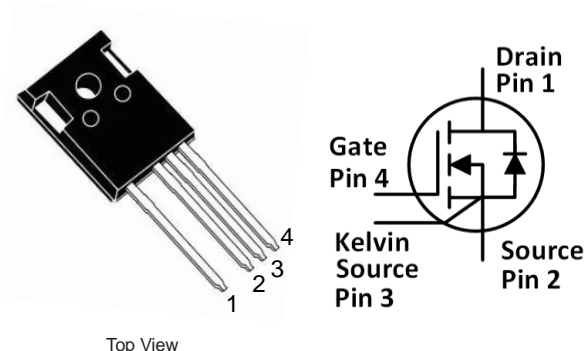
## Features:

- 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

## Applications:

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

## Package:



Part Number	Package
DTN20N120SC4	TO247-4

## 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	$V_{GS}=0V, I_D=100\mu A$	
$V_{GS}$	Gate-Source voltage	-5 to 20	V	Recommended maximum	
$I_D$	Drain current (continuous)	20	A	$V_{GS}=20V, T_c=25^\circ\text{C}$	Fig. 21
		16	A	$V_{GS}=20V, T_c=100^\circ\text{C}$	
$I_{DM}$	Drain current (pulsed)	50	A	Pulse width limited by SOA	Fig. 24
$P_{TOT}$	Total power dissipation	138	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	1.088	$^\circ\text{C/W}$	Fig. 23

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

Symbol	Parameter	Value			Unit	Test Conditions	Note
		Min.	Typ.	Max.			
I <sub>DSS</sub>	Zero gate voltage drain current		5	100	μA	V <sub>DS</sub> =1200V, V <sub>GS</sub> =0V	
I <sub>GSS</sub>	Gate leakage current		1	±100	nA	V <sub>DS</sub> =0V, V <sub>GS</sub> = -5~20V	
V <sub>TH</sub>	Gate threshold voltage		2.9		V	V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =1.9mA	Fig. 8, 9
			1.9			V <sub>GS</sub> =V <sub>DS</sub> , I <sub>D</sub> =1.9mA @ T <sub>C</sub> =175°C	
R <sub>ON</sub>	Static drain-source on-resistance		160	195	mΩ	V <sub>GS</sub> =20V, I <sub>D</sub> =10A @T <sub>J</sub> =25°C	Fig. 4, 5, 6, 7
			250		mΩ	V <sub>GS</sub> =20V, I <sub>D</sub> =10A @T <sub>J</sub> =175°C	
C <sub>iss</sub>	Input capacitance		885		pF	V <sub>DS</sub> =800V, V <sub>GS</sub> =0V, f=1MHz, V <sub>AC</sub> =25mV	Fig. 16
C <sub>Oss</sub>	Output capacitance		38		pF		
C <sub>rss</sub>	Reverse transfer capacitance		2		pF		
E <sub>Oss</sub>	C <sub>Oss</sub> stored energy		16		μJ		Fig. 17
Q <sub>g</sub>	Total gate charge		43		nC	V <sub>DS</sub> =800V, I <sub>D</sub> =10A, V <sub>GS</sub> = -5 to 20V	Fig. 18
Q <sub>gs</sub>	Gate-source charge		9		nC		
Q <sub>gd</sub>	Gate-drain charge		19		nC		
R <sub>g</sub>	Gate input resistance		9.5		Ω	f=1MHz	
E <sub>ON</sub>	Turn-on switching energy		139.3		μJ	V <sub>DS</sub> =800V, I <sub>D</sub> =10A, V <sub>GS</sub> = -2 to 20V, R <sub>G(ext)</sub> =5.1Ω, L=450μH	Fig. 19, 20
E <sub>OFF</sub>	Turn-off switching energy		39.2		μJ		
t <sub>d(on)</sub>	Turn-on delay time		6.4		ns		
t <sub>r</sub>	Rise time		19.4				
t <sub>d(off)</sub>	Turn-off delay time		11.8				
t <sub>f</sub>	Fall time		14				

**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	$I_{SD}=5\text{A}$ , $V_{GS}=0\text{V}$	Fig. 10, 11, 12
			3.7		V	$I_{SD}=5\text{A}$ , $V_{GS}=0\text{V}$ , $T_J=175^\circ\text{C}$	
$t_{rr}$	Reverse recovery time		33.2		ns	$V_{GS}=-2\text{V}/+20\text{V}$ ,	
$Q_{rr}$	Reverse recovery charge		101.5		nC	$I_{SD}=10\text{A}$ , $V_R=800\text{V}$ , $di/dt=1000\text{A}/\mu\text{s}$ ,	
$I_{RRM}$	Peak reverse recovery current		5.6		A	$R_{G(\text{ext})}=13.0\Omega$	

## Typical Performance (curves)

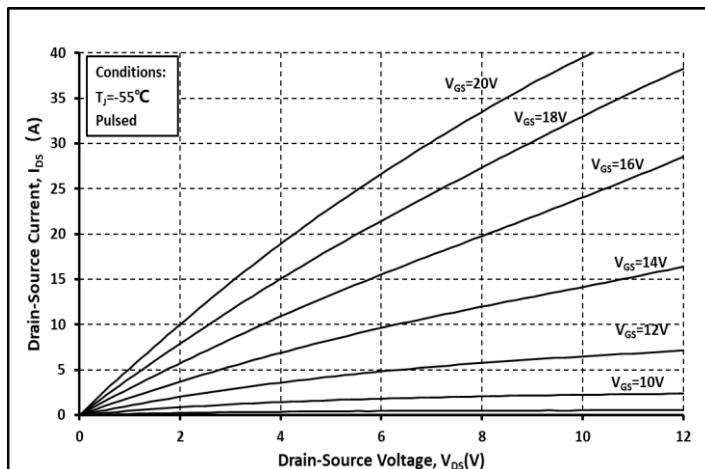


Fig. 1 Output Curve @  $T_j = -55^\circ\text{C}$

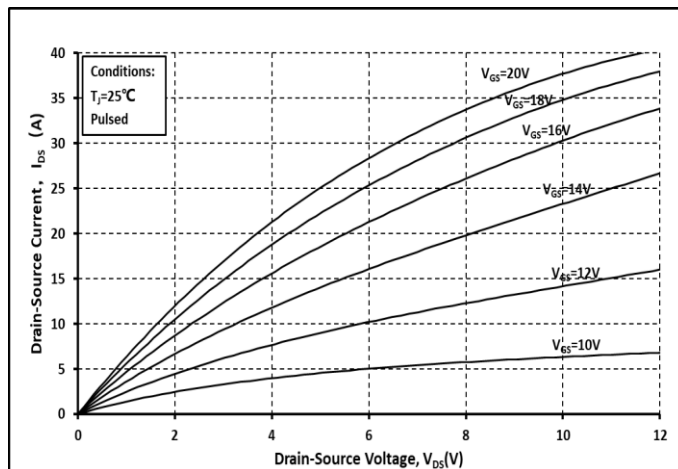


Fig. 2 Output Curve @  $T_j = 25^\circ\text{C}$

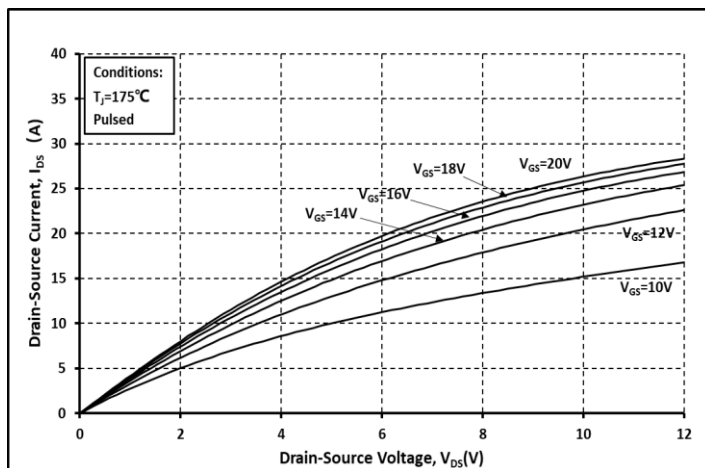


Fig. 3 Output Curve @  $T_j = 175^\circ\text{C}$

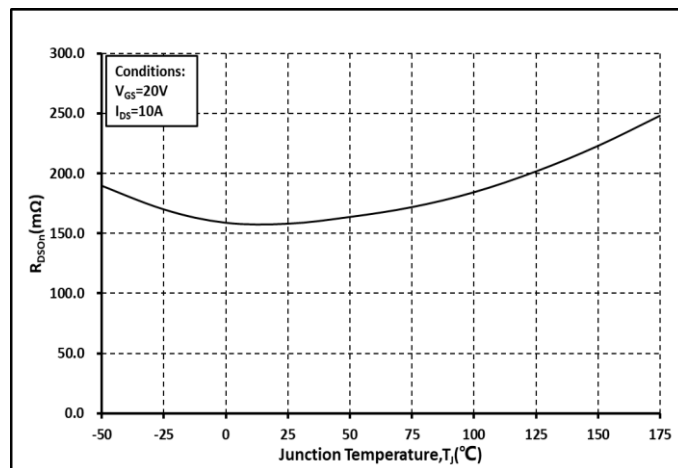


Fig. 4  $R_{on}$  vs. Temperature

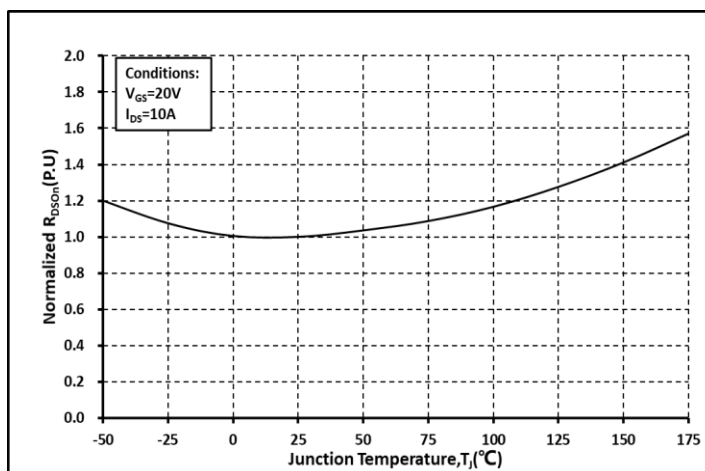


Fig. 5 Normalized  $R_{on}$  vs. Temperature

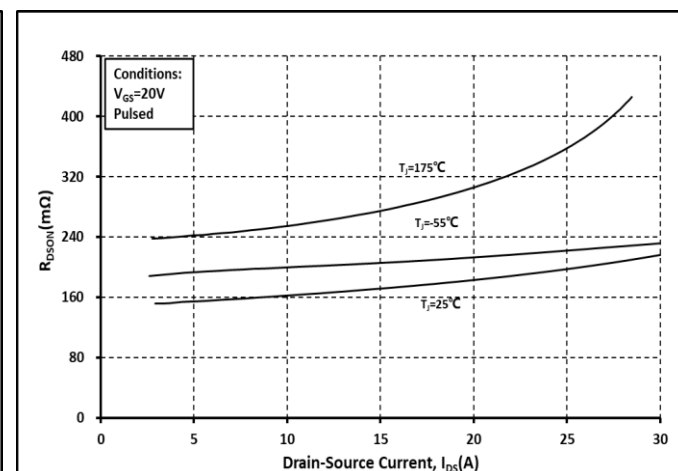


Fig. 6  $R_{on}$  vs.  $I_{DS}$  @ Various Temperature

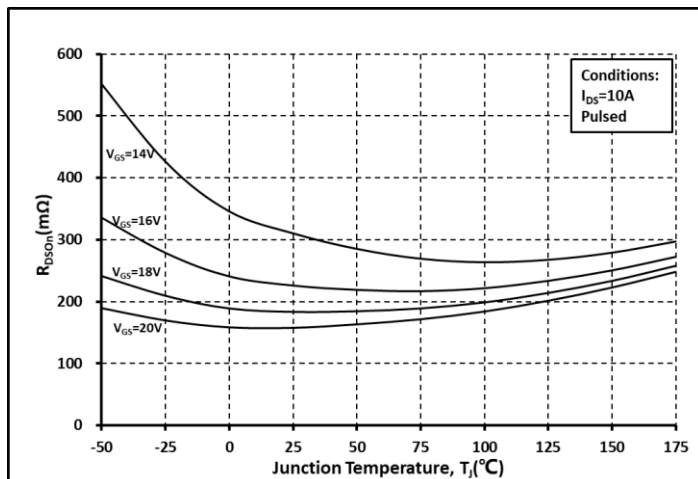


Fig. 7  $R_{on}$  vs. Temperature @ Various  $V_{GS}$

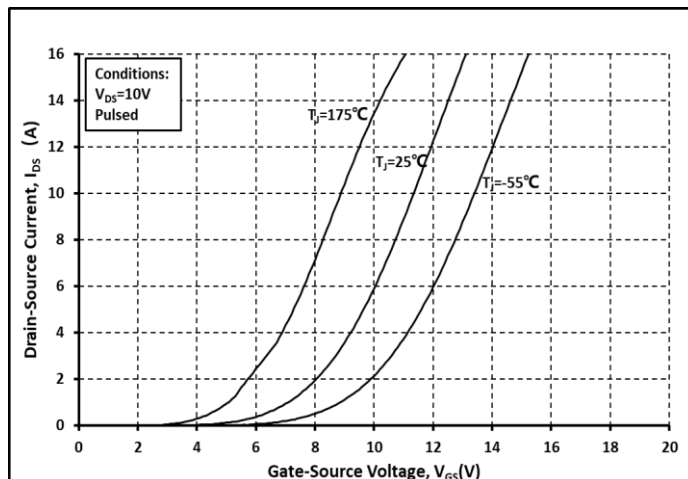


Fig. 8 Transfer Curves @ Various Temperature

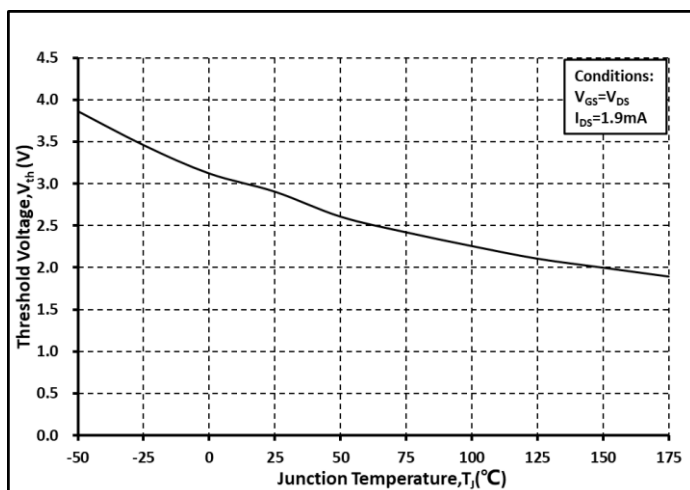


Fig. 9 Threshold Voltage vs. Temperature

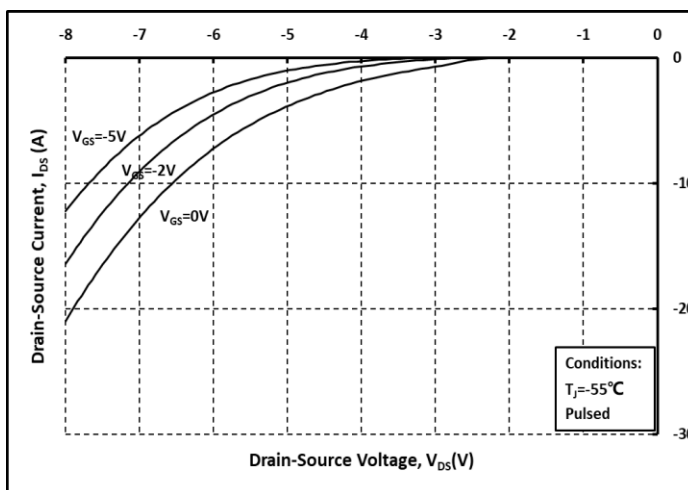


Fig. 10 Body Diode Curves @  $T_J=-55^{\circ}C$

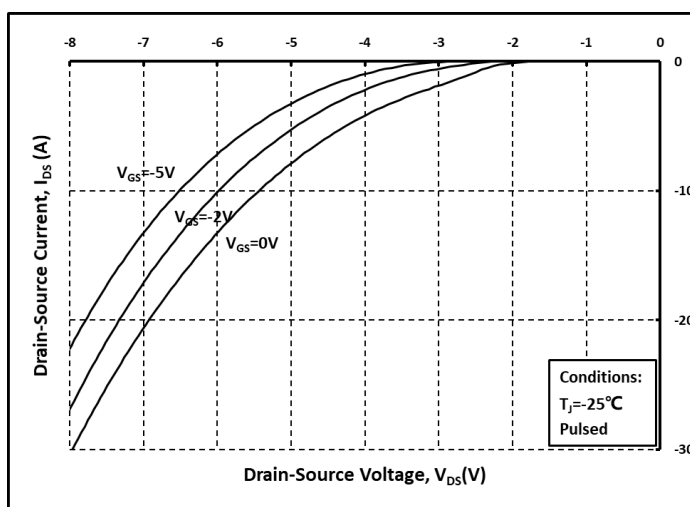


Fig. 11 Body Diode Curves @  $T_J=25^{\circ}C$

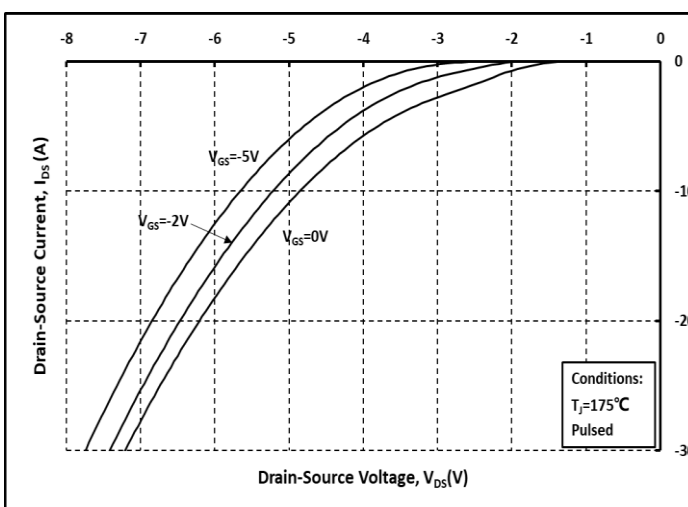


Fig. 12 Body Diode Curves @  $T_J=175^{\circ}C$

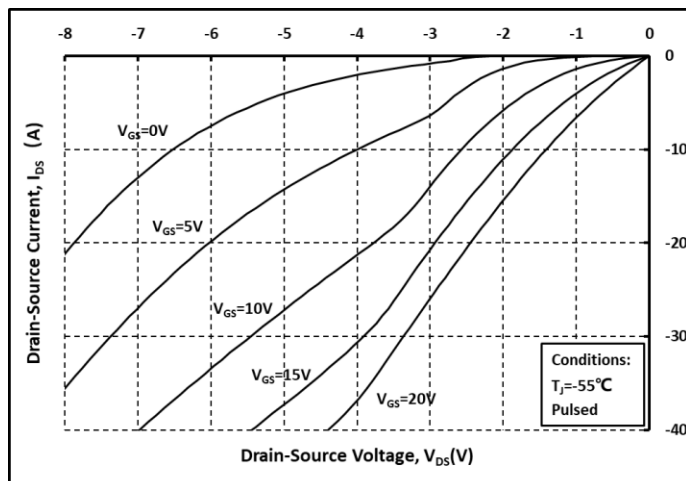


Fig. 13 3<sup>rd</sup> Quadrant Curves @  $T_j = -55^\circ\text{C}$

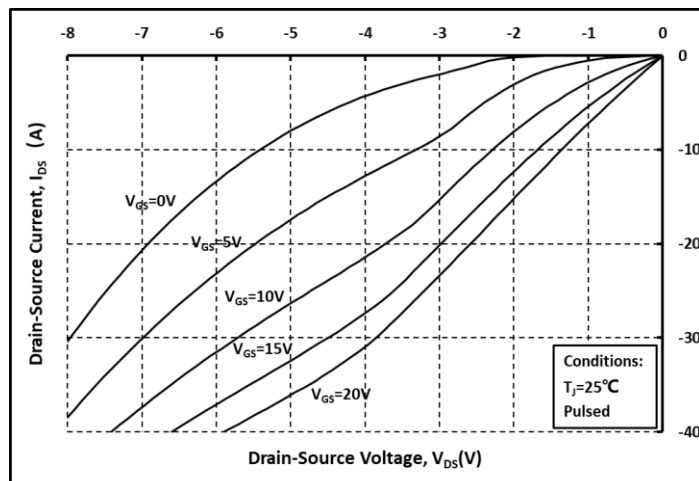


Fig. 14 3<sup>rd</sup> Quadrant Curves @  $T_j = 25^\circ\text{C}$

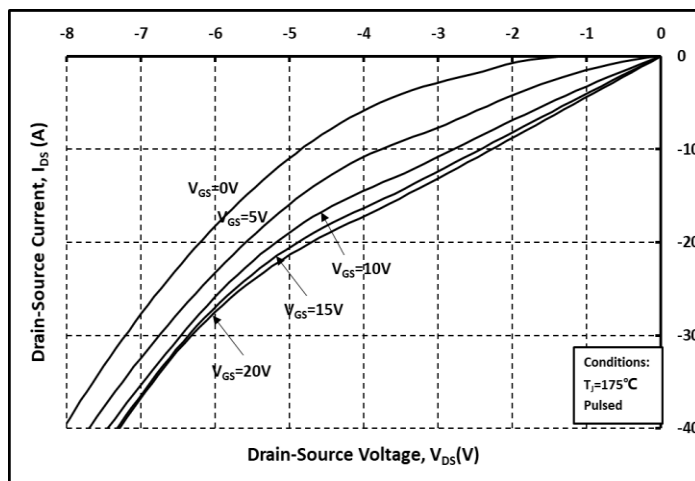


Fig. 15 3<sup>rd</sup> Quadrant Curves @  $T_j = 175^\circ\text{C}$

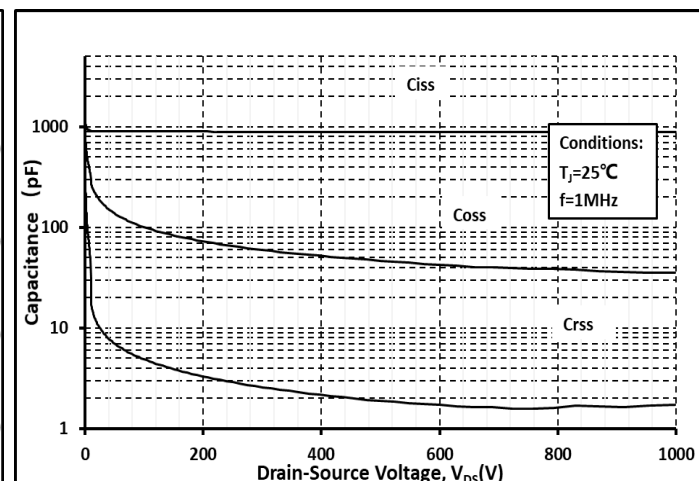


Fig. 16 Capacitance vs.  $V_{DS}$

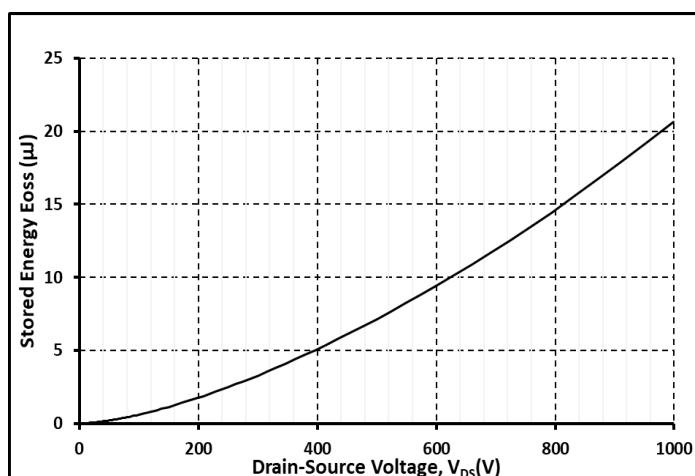


Fig. 17 Output Capacitor Stored Energy

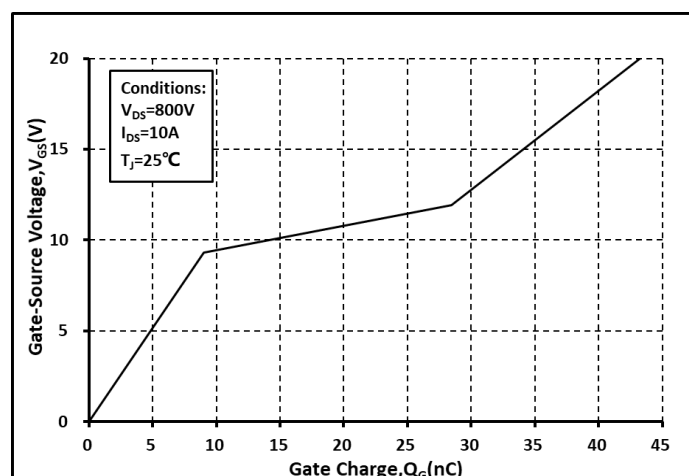


Fig. 18 Gate Charge Characteristics

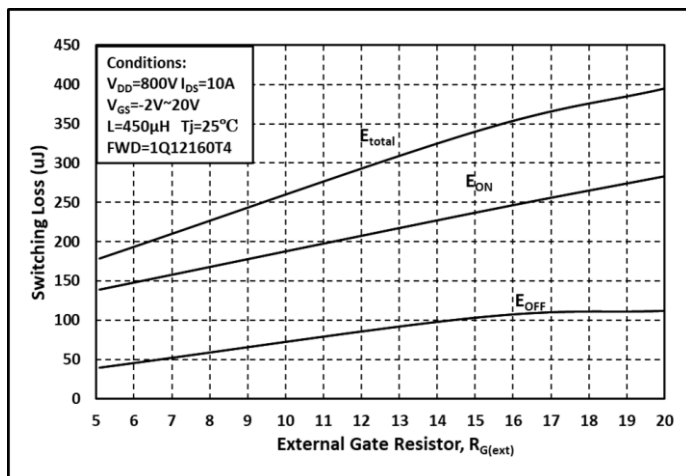


Fig. 19 Switching Energy vs.  $R_{G(ext)}$

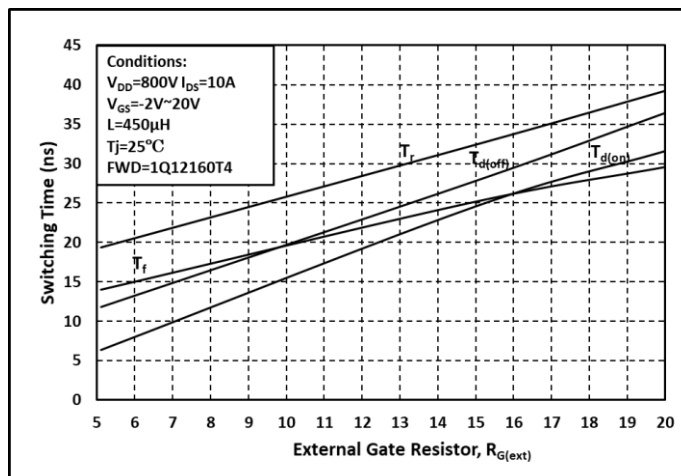


Fig. 20 Switching Times vs.  $R_{G(ext)}$

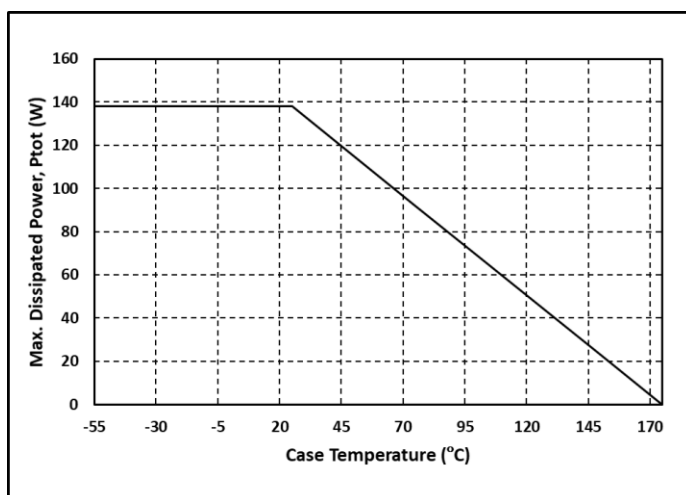


Fig. 21 Continuous Drain Current vs. Case Temperature

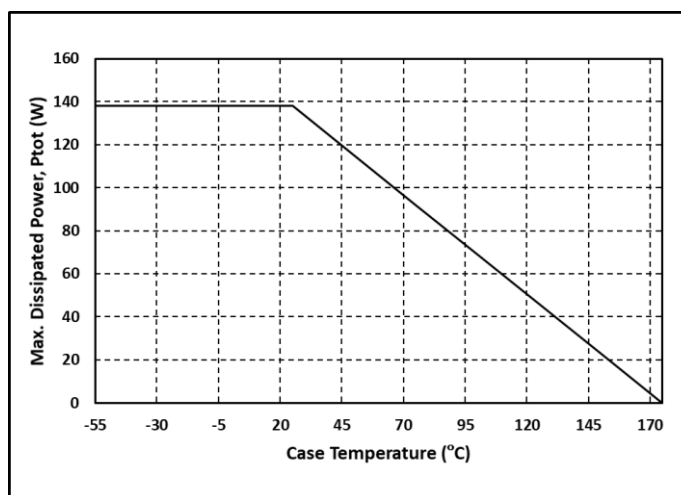


Fig. 22 Max. Power Dissipation Derating vs. Case Temperature

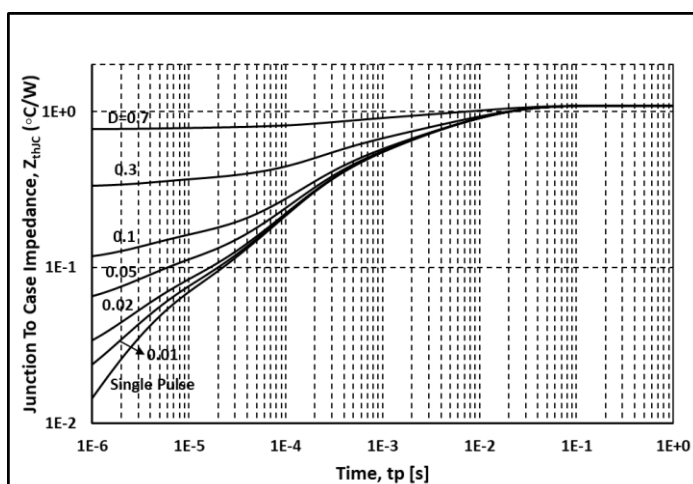


Fig. 23 Thermal Impedance

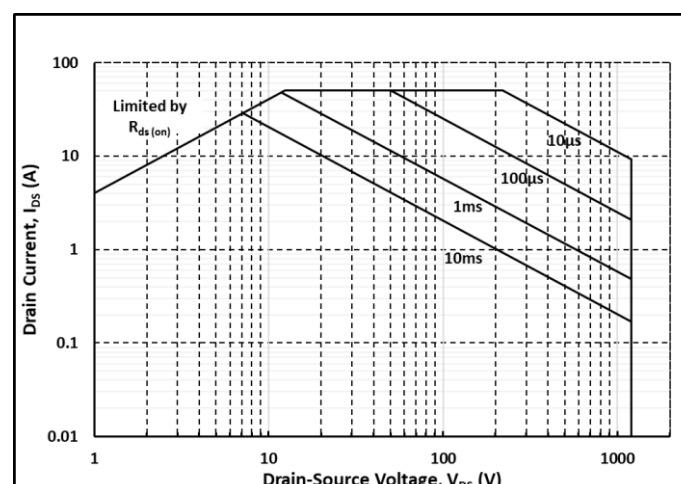
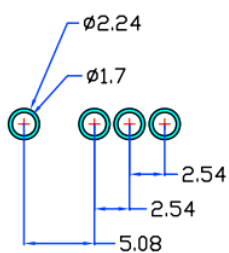
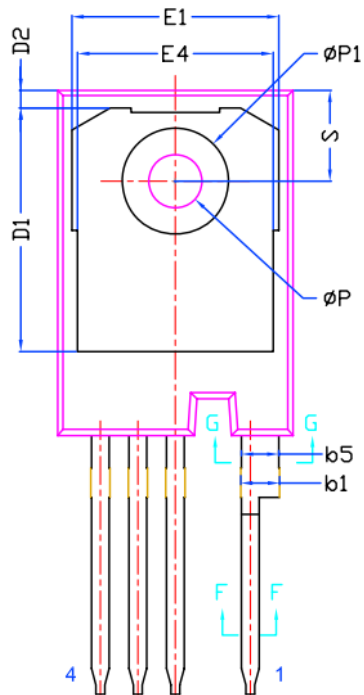
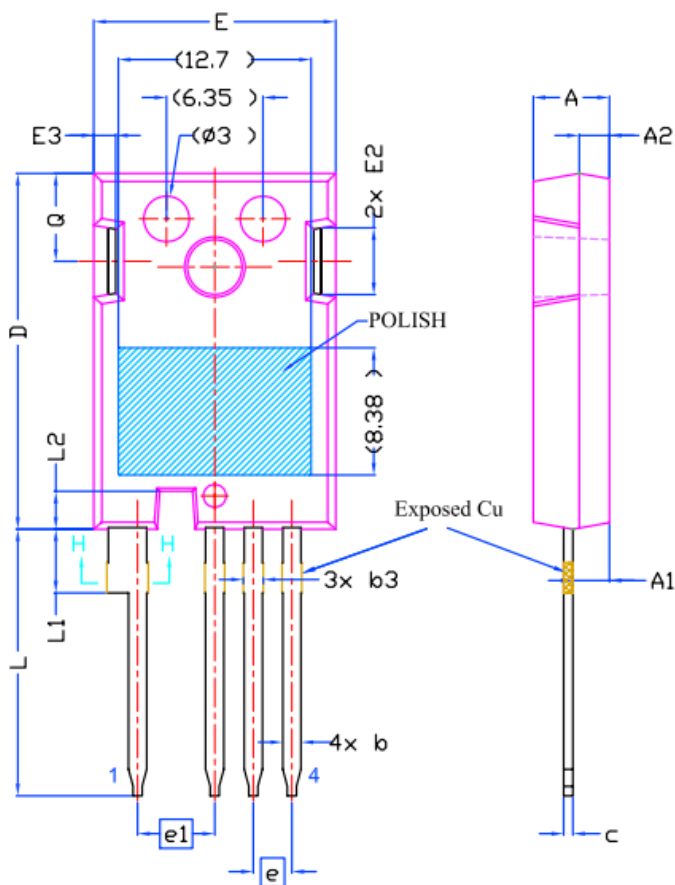


Fig. 24 Safe Operating Area

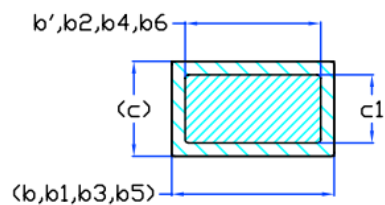


## Package Dimensions



Recommended Solder Pad Layout

SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	4.83	5.02	5.21
A1	2.29	2.41	2.54
A2	1.91	2.00	2.16
b'	1.07	1.20	1.28
b	1.07	1.20	1.33
b1	2.39	2.67	2.94
b2	2.39	2.67	2.84
b3	1.07	1.30	1.60
b4	1.07	1.30	1.50
b5	2.39	2.53	2.69
b6	2.39	2.53	2.64
c	0.55	0.60	0.68
c1	0.55	0.60	0.65
D	23.30	23.45	23.60
D1	16.25	16.55	17.65
D2	0.95	1.19	1.25
E	15.75	15.94	16.13
E1	13.10	14.02	14.15
E2	3.68	4.40	5.10
E3	1.00	1.45	1.90
E4	12.38	13.26	13.43
e	2.54 BSC		
e1	5.08 BSC		
L	17.31	17.57	17.82
L1	3.97	4.19	4.37
L2	2.35	2.50	2.65
ØP	3.51	3.61	3.65
ØP1	7.19 REF.		
Q	5.49	5.79	6.00
S	6.04	6.17	6.30



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



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