1200V N-Channel Silicon Carbide Power MOSFET

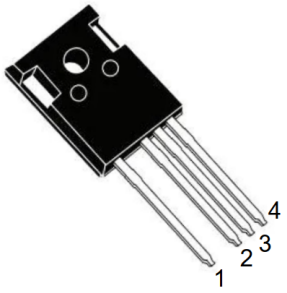
Features:

- 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

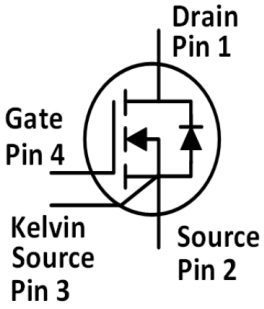
Applications:

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

Package:



Top View



Part Number	Package
DTN40N120SC4	TO247-4

Absolute Maximum Ratings (T_C=25°C unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions	Note
V_{DS}	Drain-Source voltage	1200	V	V_{GS}=0V, I_D=100μA	
V_{GS}	Gate-Source voltage	-5 to 20	V	Recommended maximum	
I_D	Drain current (continuous)	42	A	V_{GS}=20V, T_C=25°C	Fig. 21
		31	A	V_{GS}=20V, T_C=100°C	
I_{DM}	Drain current (pulsed)	70	A	Pulse width limited by SOA	Fig. 24
P_{TOT}	Total power dissipation	300	W	T_C=25°C	Fig. 22
T_{stg}	Storage temperature range	-55 to 175	°C		
T_J	Operating junction temperature	-55 to 175	°C		
T_L	Solder Temperature	260	°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	°C/W	Fig. 23

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		3.6		V	V_{GS}=V_{DS}, I_D=3.8mA	Fig. 8, 9
			2.7			V_{GS}=V_{DS}, I_D=3.8mA @ T_C=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
E_{AS}	Avalanche energy, single pulse		0.75		J	I_D=20A, V_{DD}=50V, L=2mH	
Q_g	Total gate charge		76		nC	V_{DS}=800V, I_D=20A, V_{GS}=-5 to 20V	Fig. 18
Q_{gs}	Gate-source charge		29		nC		
Q_{gd}	Gate-drain charge		34		nC		
R_g	Gate input resistance		4.2		Ω	f=1MHz	
E_{ON}	Turn-on switching energy		154		μJ	V_{DS}=800V, I_D=20A, V_{GS}=-3.5 to 20V, $R_{G(ext)}$=2.0Ω, L=290 μ H	Fig. 19, 20
E_{OFF}	Turn-off switching energy		80		μJ		
$t_{d(on)}$	Turn-on delay time		8.9		ns		
t_r	Rise time		19.9				
$t_{d(off)}$	Turn-off delay time		14.7				
t_f	Fall time		9.5				

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		4.7		V	I_{SD}=10A, V_{GS}=0V	Fig. 10, 11, 12
			4.2		V	I_{SD}=10A, V_{GS}=0V, T_J=175°C	
t_{rr}	Reverse recovery time		10.2		ns	V_{GS}=0V, I_{SD}=20A, V_R=800V, di/dt=1100A/us	
Q_{rr}	Reverse recovery charge		64		nC		
I_{RRM}	Peak reverse recovery current		11.3		A		

Typical Performance (curves)

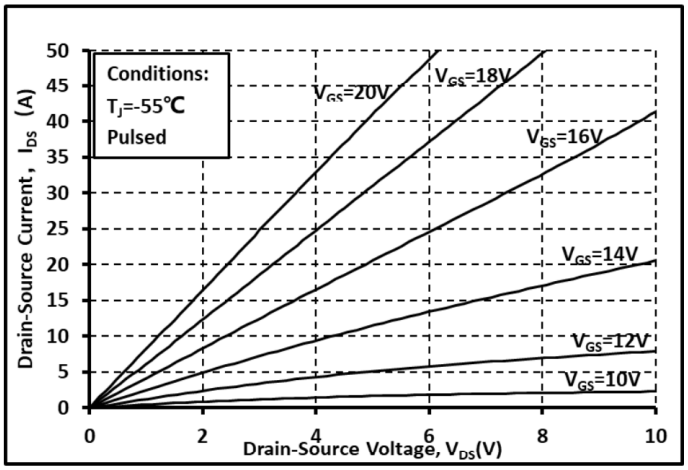


Fig. 1 Output Curve @ T_J=-55℃

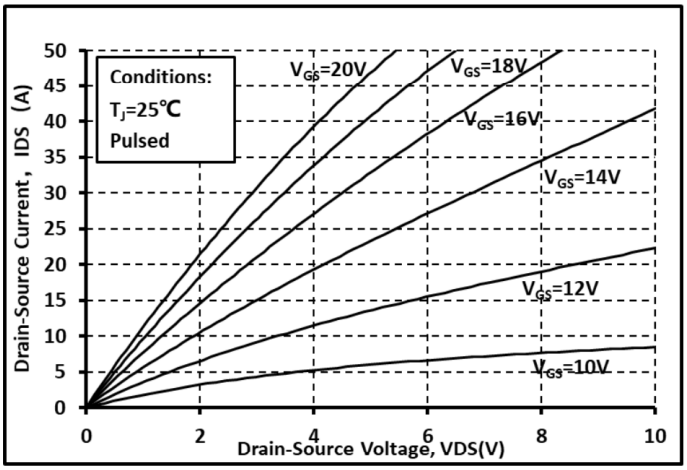


Fig. 2 Output Curve @ T_J=25℃

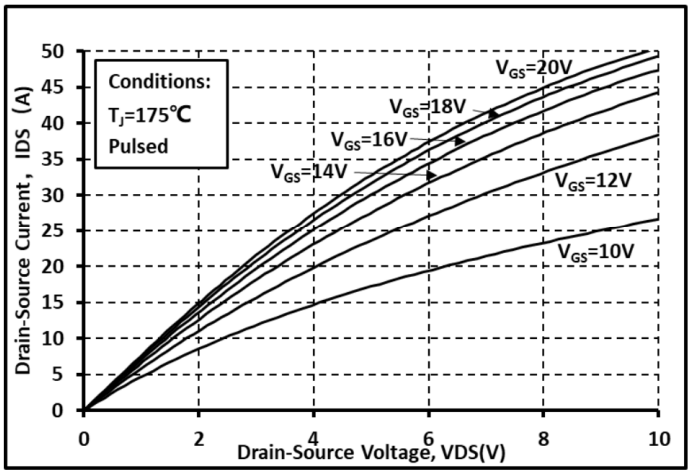


Fig. 3 Output Curve @ T_J=175℃

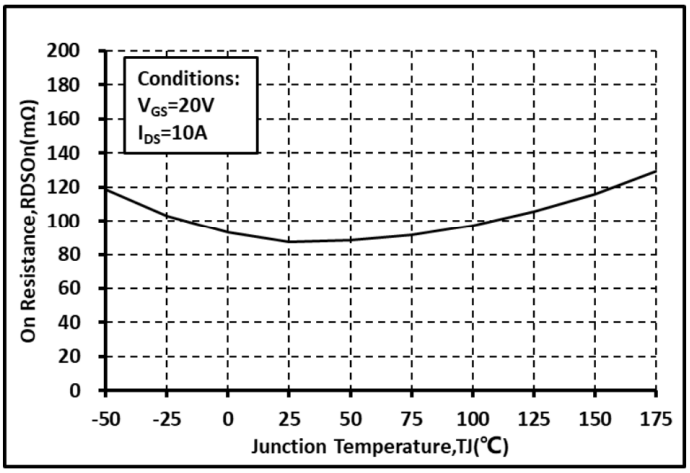


Fig. 4 Ron vs. Temperature

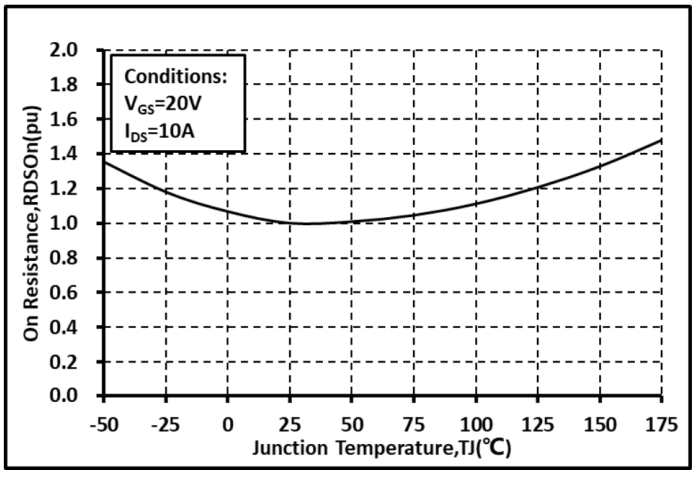


Fig. 5 Normalized Ron vs. Temperature

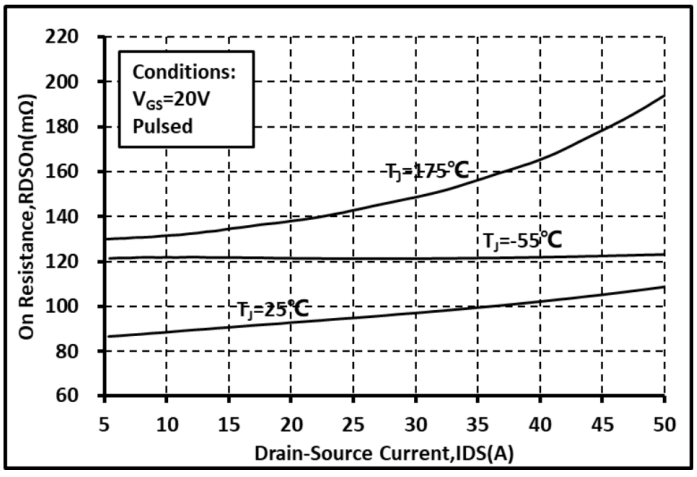


Fig. 6 Ron vs. I_{DS} @ Various Temperature

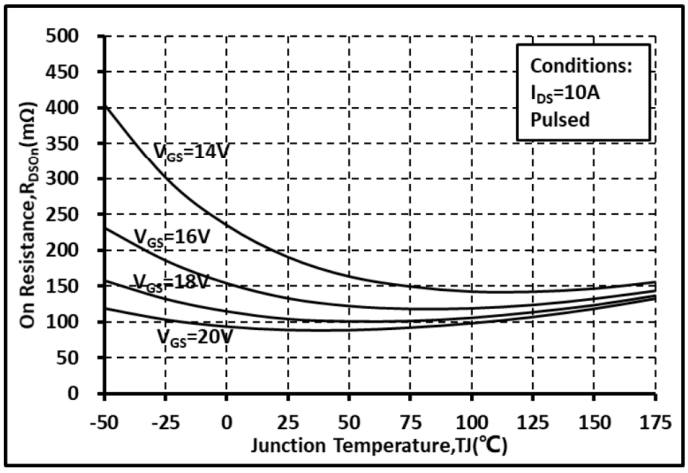


Fig. 7 Ron vs. Temperature @ Various V_{GS}

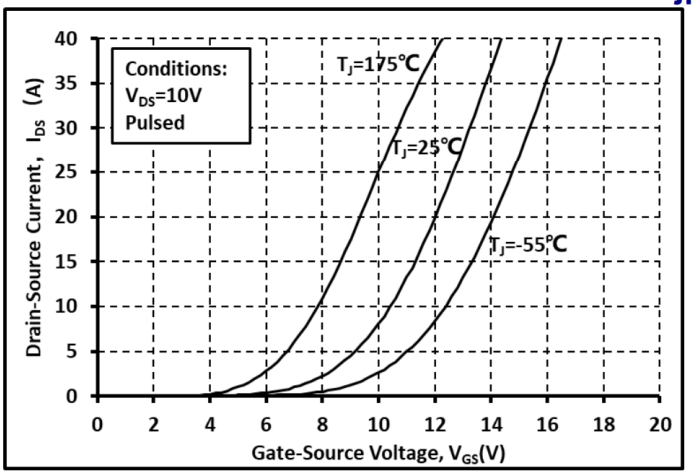


Fig. 8 Transfer Curves @ Various Temperature

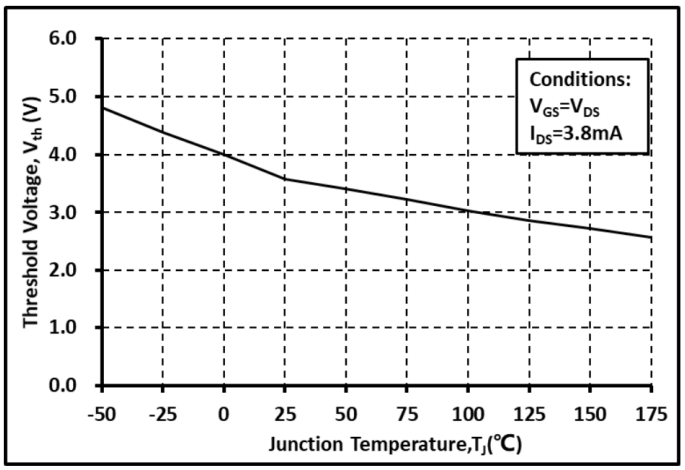


Fig. 9 Threshold Voltage vs. Temperature

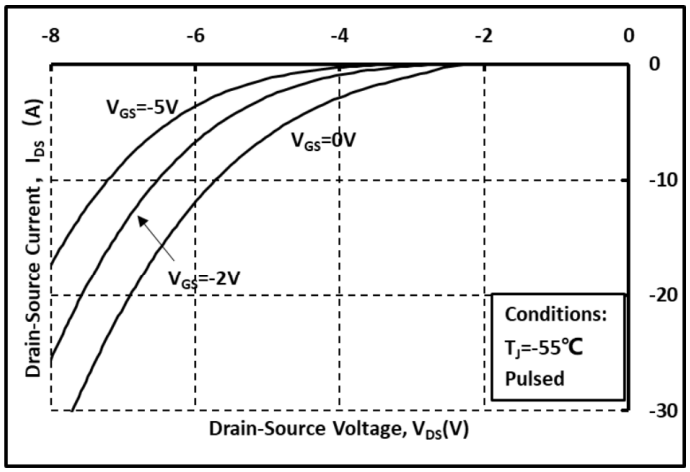


Fig. 10 Body Diode curves @ T_J=-55°C

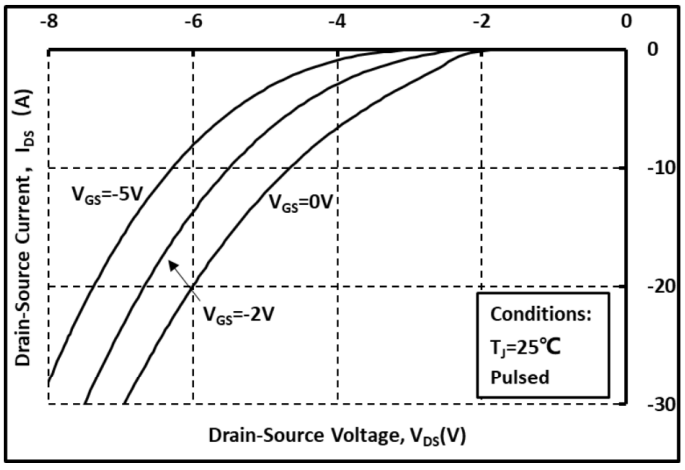


Fig. 11 Body Diode curves @ T_J=25°C

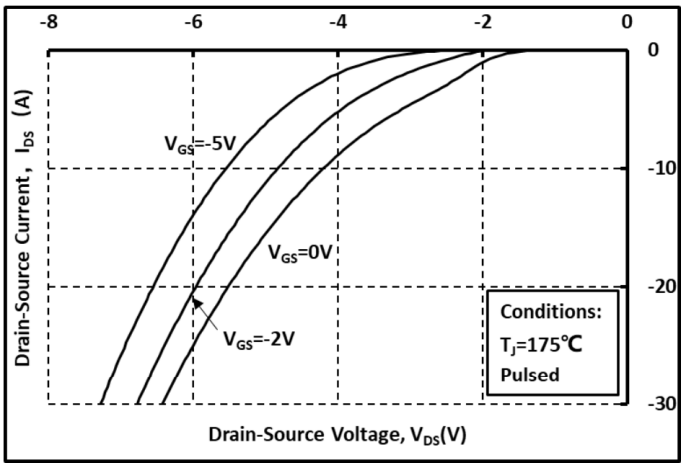


Fig. 12 Body Diode curves @ T_J=175°C

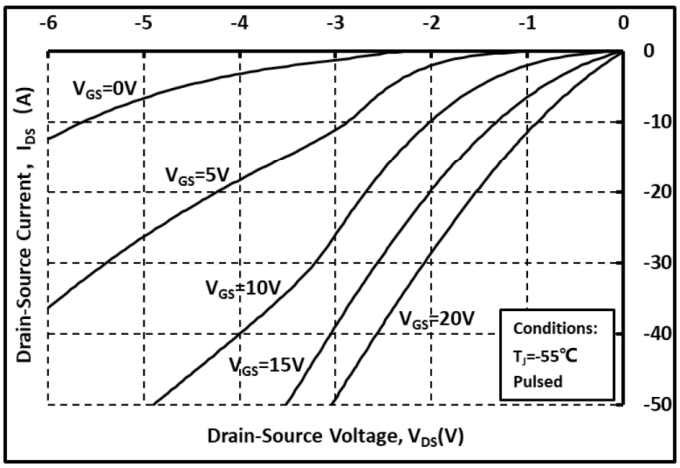


Fig. 13 3rd Quadrant curves @ T_J=-55°C

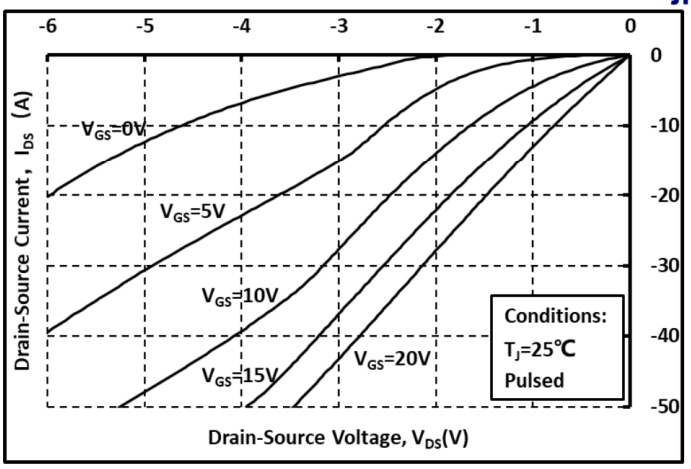


Fig. 14 3rd Quadrant curves @ T_J=25°C

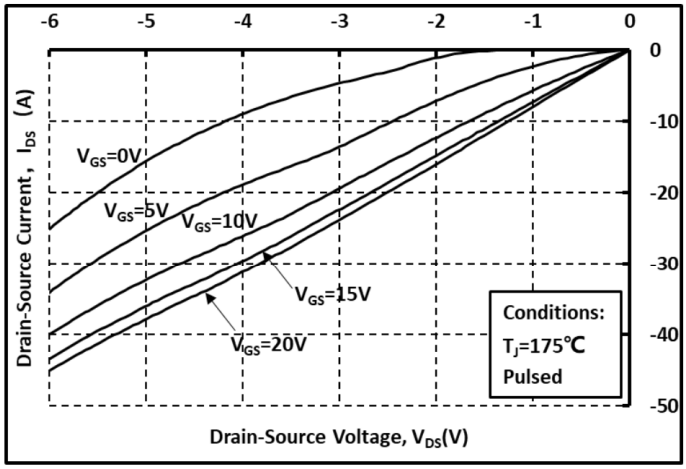


Fig. 15 3rd Quadrant curves @ T_J=175°C

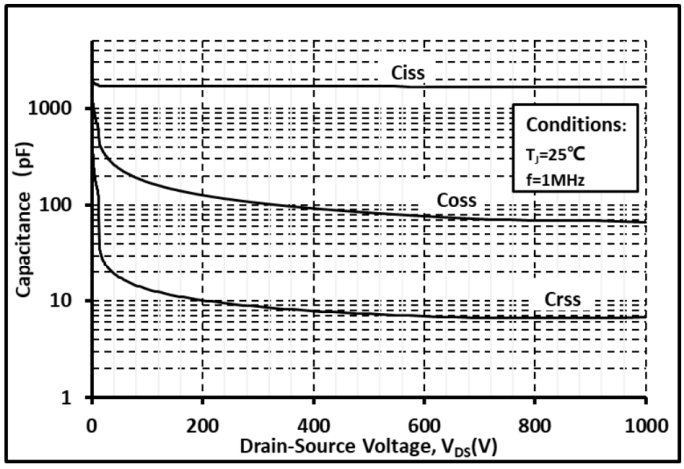


Fig. 16 Capacitance vs. V_{DS}

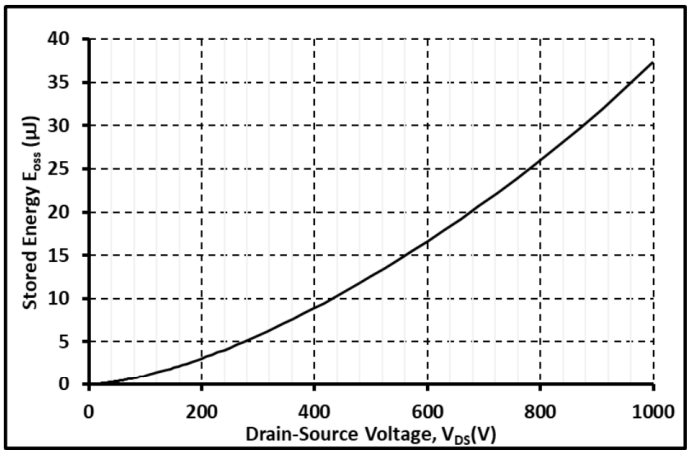


Fig. 17 Output Capacitor Stored Energy

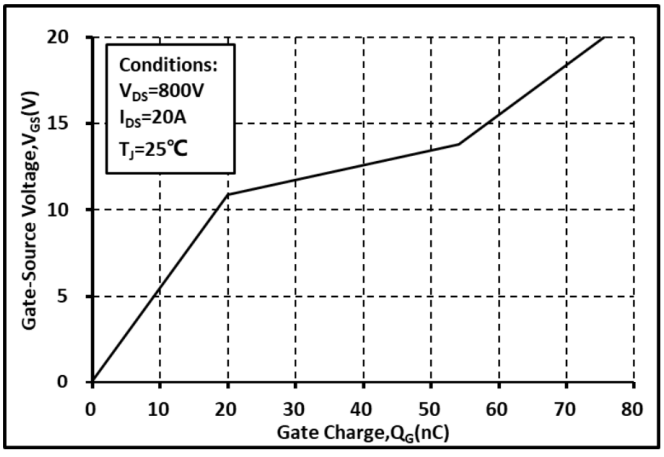


Fig. 18 Gate Charge Characteristics

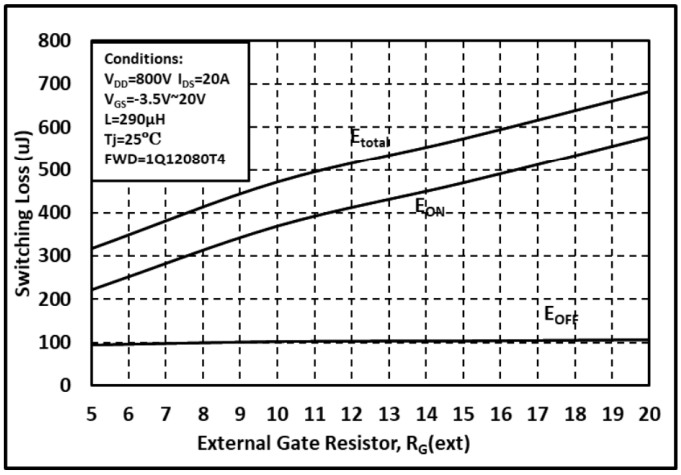


Fig. 19 Switching Energy vs. $R_{G(ext)}$

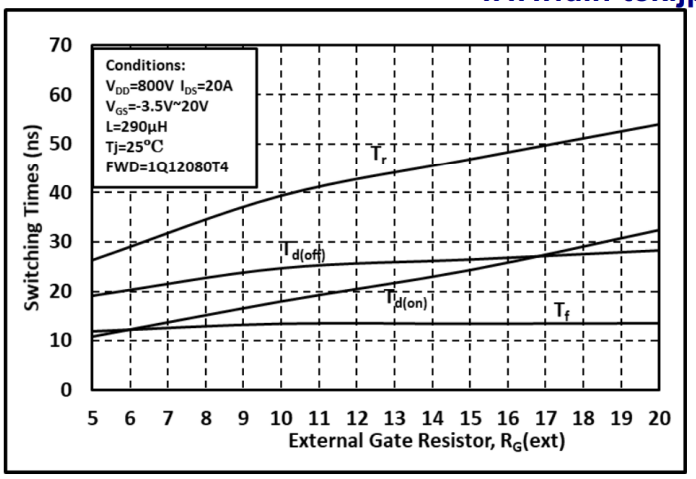


Fig. 20 Switching Times vs. $R_{G(ext)}$

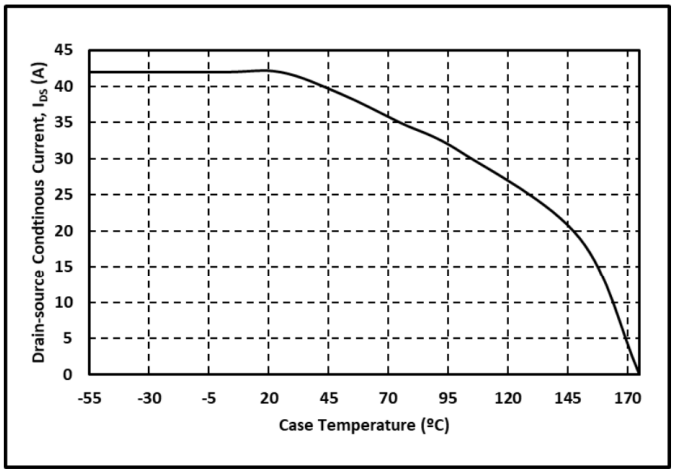


Fig. 21 Continuous Drain Current vs. Case Temperature

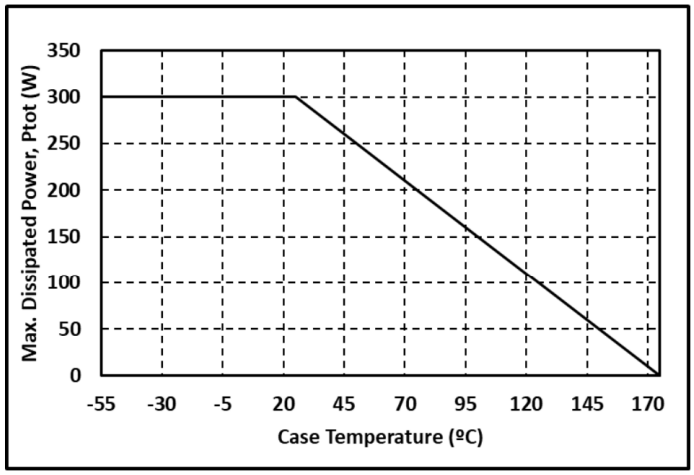


Fig. 22 Max. Power Dissipation Derating vs. Case Temperature

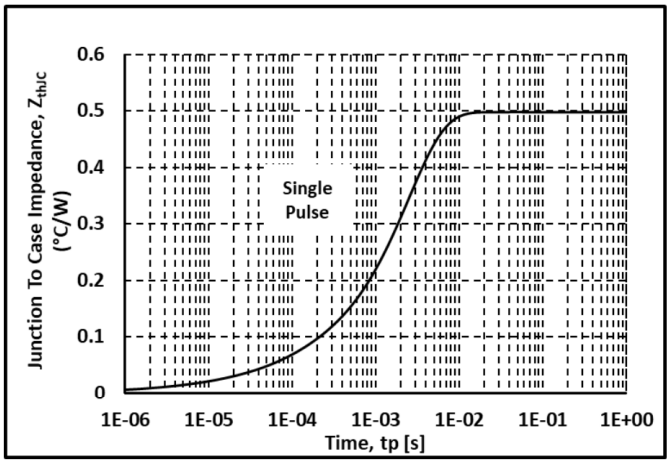


Fig. 23 Thermal impedance

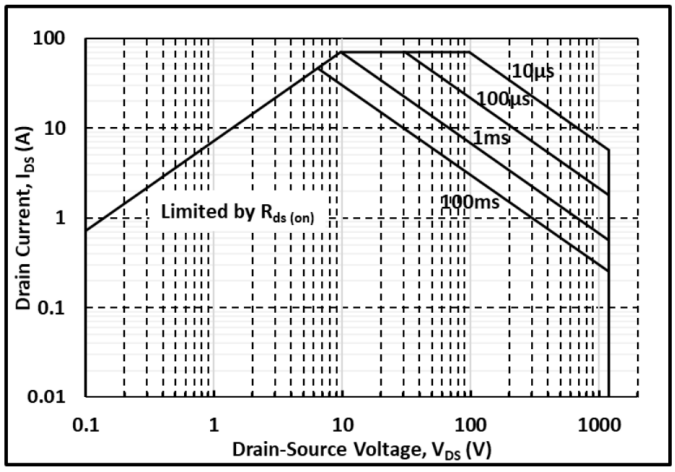
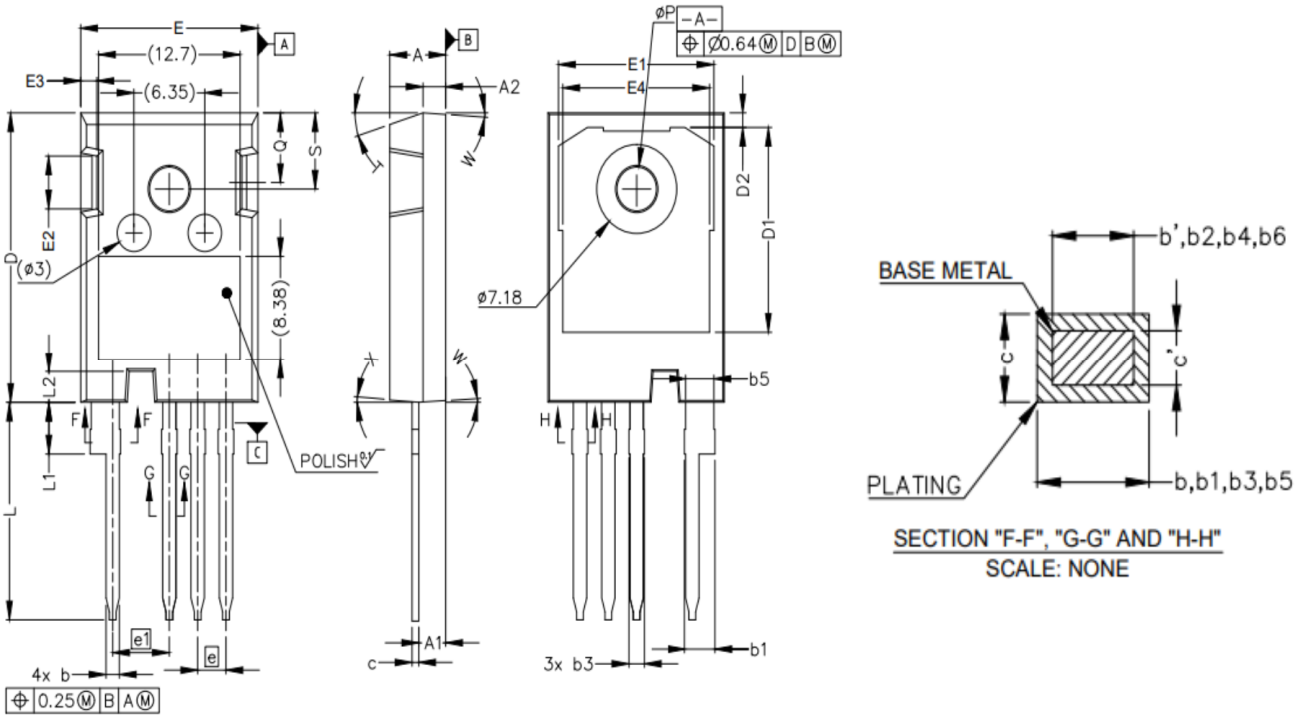


Fig. 24 Safe Operating Area

TO-247_4L PACKAGE OUTLINE



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	TYP	MAX	SYMBOL	MIN	TYP	MAX
A	4.50	5.02	5.50	E1	12.50	14.02	15.00
A1	2.00	2.40	2.80	E2	3.00	4.40	5.00
A2	1.80	2.00	2.30	E3	0.80	1.45	2.10
b'	0.90	1.20	1.40	E4	11.50	13.26	14.00
b	0.90	1.20	1.45	e	2.54BSC		
b1	2.15	2.67	3.10	e1	5.08BSC		
b2	2.15	2.67	3.05	N	4.00		
b3	0.90	1.30	1.80	L	16.00	17.57	19.00
b4	0.90	1.30	1.70	L1	3.47	4.19	4.87
b5	2.20	2.53	2.89	L2	2.05	2.50	2.95
b6	2.20	2.53	2.84	ΦP	3.21	3.61	3.95
c'	0.48	0.60	0.75	Q	5.09	5.79	6.40
c	0.48	0.60	0.78	S	5.74	6.21	6.60
D	22.50	23.45	24.50	T	17.5°REF		
D1	15.50	16.55	18.10	W	3.5°REF		
D2	0.85	1.19	1.35	X	4°REF		
E	15.00	15.94	17.00				

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