

1200V N-Channel Silicon Carbide Power MOSFET

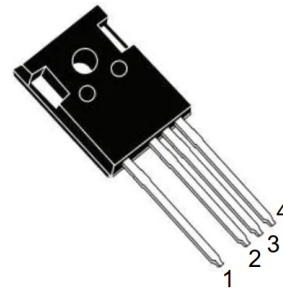
Features

- 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

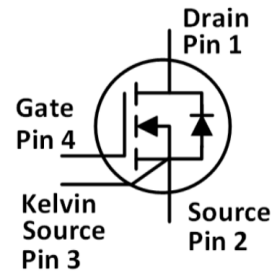
Applications

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

Package



Top View



Part Number	Package
DTN125N120SC4	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	$V_{GS}=0\text{V}$, $I_D=100\mu\text{A}$	
$V_{GSmax}(DC)$	Maximum DC voltage	-6 to 18	V	Static (DC)	
$V_{GSmax}(Spike)$	Maximum spike voltage	-10 to 22	V	<1% duty cycle, and pulse width<200ns	
I_D	Drain current (continuous)	125	A	$V_{GS}=20\text{V}$, $T_c=25^\circ\text{C}$	Fig. 21
		90	A	$V_{GS}=20\text{V}$, $T_c=100^\circ\text{C}$	
I_{DM}	Drain current (pulsed)	200	A	Pulse width limited by SOA	Fig. 22
P_{TOT}	Total power dissipation	600	W	$T_c=25^\circ\text{C}$	Fig. 20
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	0.25	$^\circ\text{C}/\text{W}$	Fig. 21

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

Symbol	Parameter	Value			Unit	Test Conditions	Note
		Min.	Typ.	Max.			
I_{DSS}	Zero gate voltage drain current		5	50	μA	$V_{DS}=1200\text{V}, V_{GS}=0\text{V}$	
I_{GSS}	Gate leakage current			± 100	nA	$V_{DS}=0\text{V}, V_{GS}=-6\sim 18\text{V}$	
V_{TH}	Gate threshold voltage	2.2	3.2	4.5	V	$V_{GS}=V_{DS}, I_D=23\text{mA}$	Fig. 11
			2.2			$V_{GS}=V_{DS}, I_D=23\text{mA}$ @ $T_c=175^\circ\text{C}$	
R_{ON}	Static drain-source on-resistance		16	23	$\text{m}\Omega$	$V_{GS}=18\text{V}, I_D=75\text{A}$ @ $T_j=25^\circ\text{C}$	Fig. 5, 6
			27		$\text{m}\Omega$	$V_{GS}=18\text{V}, I_D=75\text{A}$ @ $T_j=175^\circ\text{C}$	
C_{iss}	Input capacitance		5225		pF	$V_{DS}=800\text{V}, V_{GS}=0\text{V},$ $f=100\text{kHz}, V_{AC}=25\text{mV}$	Fig. 18
C_{oss}	Output capacitance		240		pF		
C_{rss}	Reverse transfer capacitance		29		pF		
E_{oss}	C_{oss} stored energy		102		μJ		Fig. 16
Q_g	Total gate charge		293		nC	$V_{DS}=800\text{V}, I_D=75\text{A},$ $V_{GS}=-5\text{ to }18\text{V}$	Fig. 12
Q_{gs}	Gate-source charge		66		nC		
Q_{gd}	Gate-drain charge		155		nC		
R_g	Gate input resistance		1.7		Ω	$f=1\text{MHz}$	
E_{ON}	Turn-on switching energy		4980		μJ	$V_{DS}=800\text{V}, I_D=75\text{A},$ $V_{GS}=-5\text{ to }18\text{V},$ $R_{G(\text{ext})}=10\Omega,$ $L=99\mu\text{H}$	Fig. 23, 24
E_{OFF}	Turn-off switching energy		1466		μJ		
$t_{d(\text{on})}$	Turn-on delay time		102		ns		
t_r	Rise time		55				
$t_{d(\text{off})}$	Turn-off delay time		136				
t_f	Fall time		43				

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

Symbol	Parameter	Value			Unit	Test Conditions	Note
		Min.	Typ.	Max.			
I_S	Maximum continuous diode forward current		125		A	$T_J=25^\circ\text{C}$	
V_{SD}	Diode forward voltage		5.2		V	$I_{SD}=37.5\text{A}, V_{GS}=-4\text{V}$	Fig. 10, 11, 12
			4.7		V	$I_{SD}=37.5\text{A}, V_{GS}=-4\text{V}, T_J=175^\circ\text{C}$	
t_{rr}	Reverse recovery time		35		ns	$V_{GS}=-4\text{V},$	
Q_{rr}	Reverse recovery charge		498		nC	$I_{SD}=75\text{A}, V_R=800\text{V},$	
I_{RRM}	Peak reverse recovery current		26.5		A	$di/dt=1400\text{A/us}$	

Typical Performance (curves)

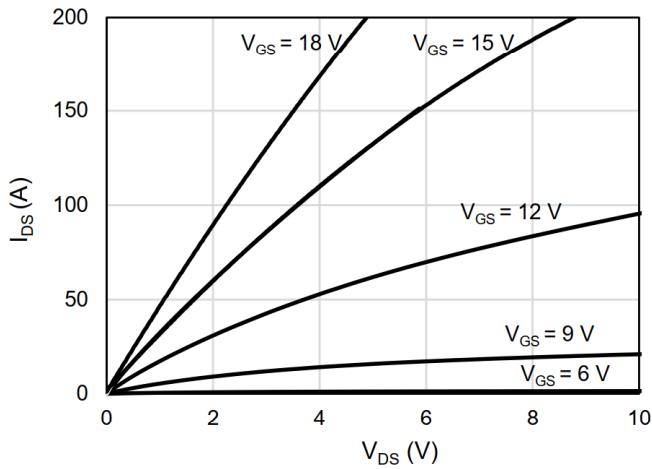


Figure 1: Output Characteristics $T_J = -40^\circ\text{C}$

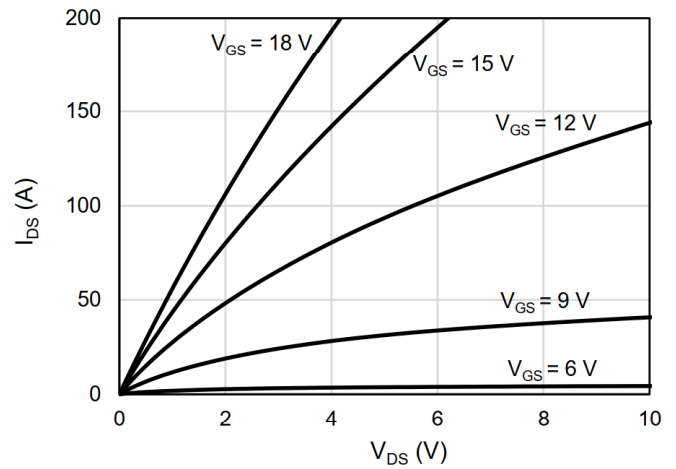


Figure 2: Output Characteristics $T_J = 25^\circ\text{C}$

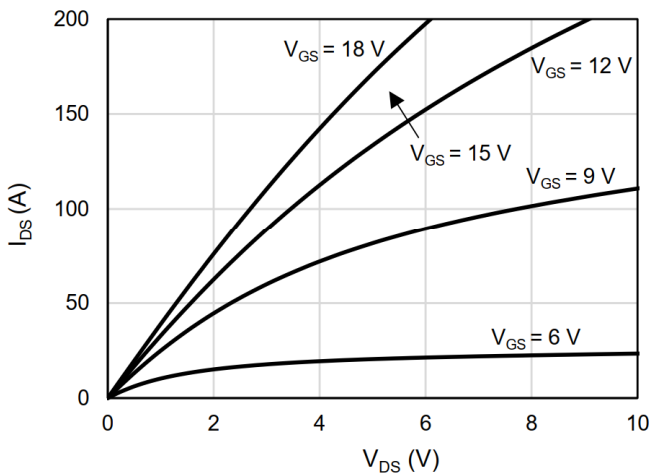


Figure 3: Output Characteristics $T_J = 175^\circ\text{C}$

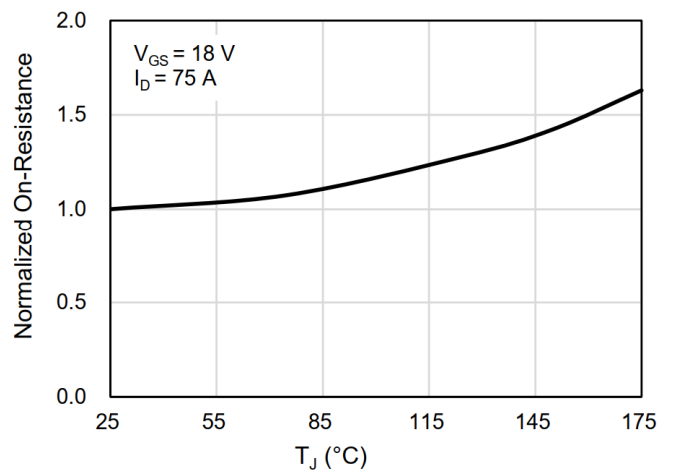


Figure 4: Normalized On-Resistance vs. Temperature

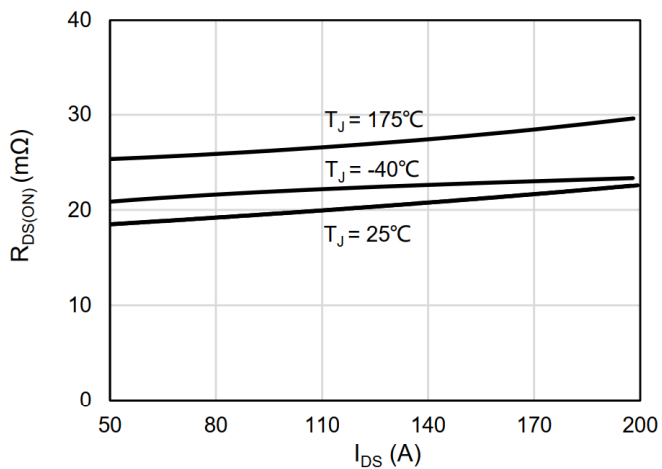


Figure 5: On-Resistance vs. Drain Current For Various Temperatures

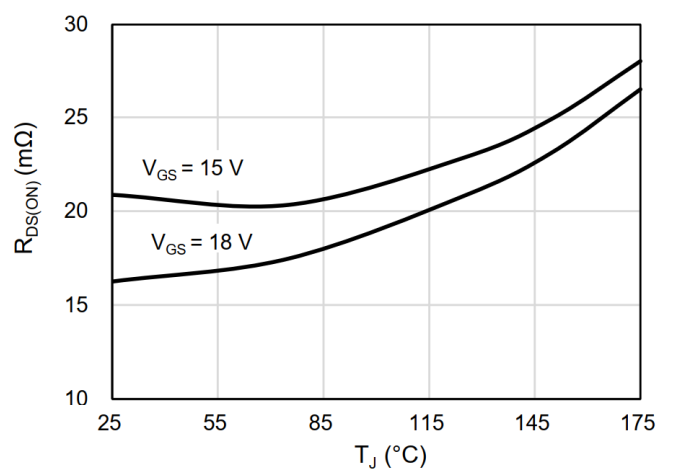


Figure 6: On-Resistance vs. Temperature For Various Gate Voltage

Typical Performance (curves)

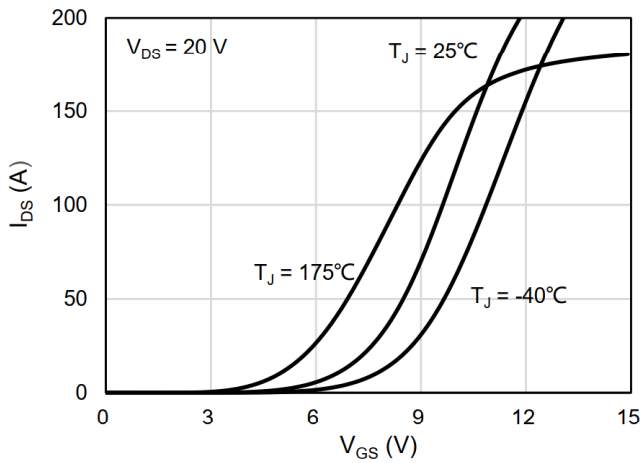


Figure 7: Transfer Characteristics For Various Junction Temperature

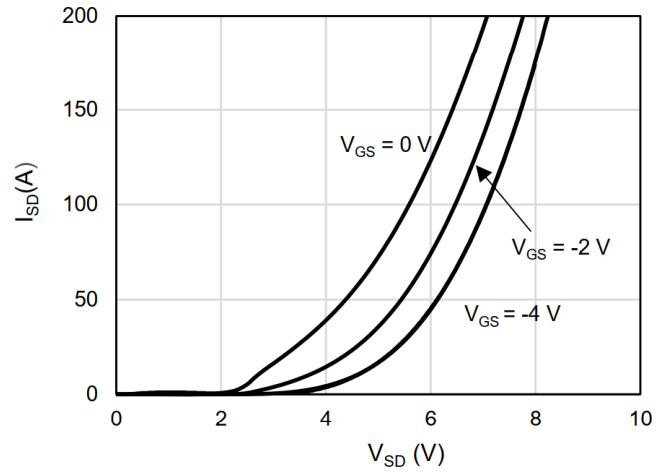


Figure 8: Body Diode Characteristics at -40°C

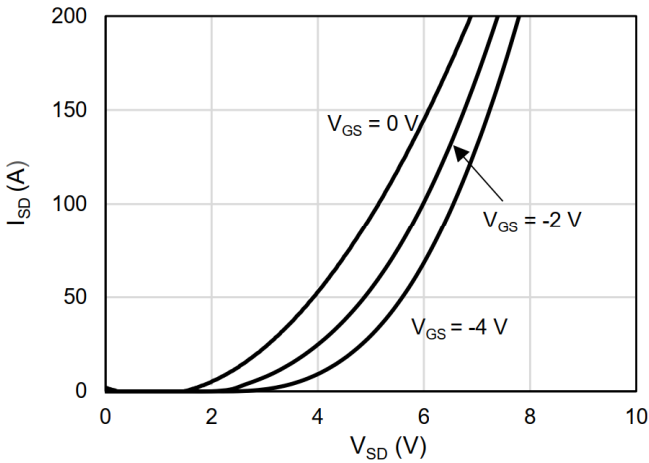


Figure 9: Body Diode Characteristics at 25°C

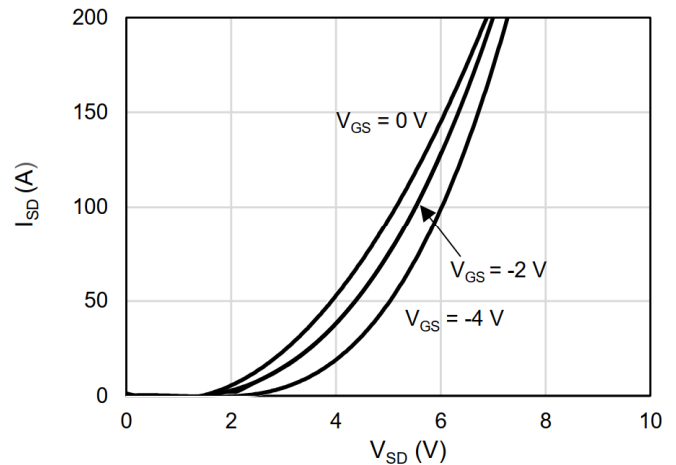


Figure 10: Body Diode Characteristics at 175°C

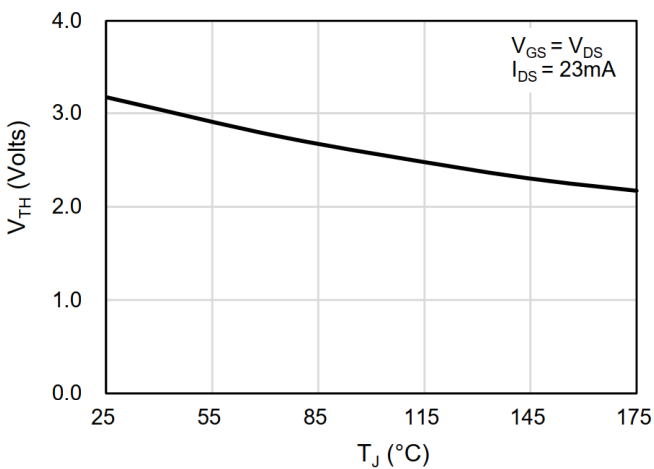


Figure 11: Threshold Voltage vs. Temperature

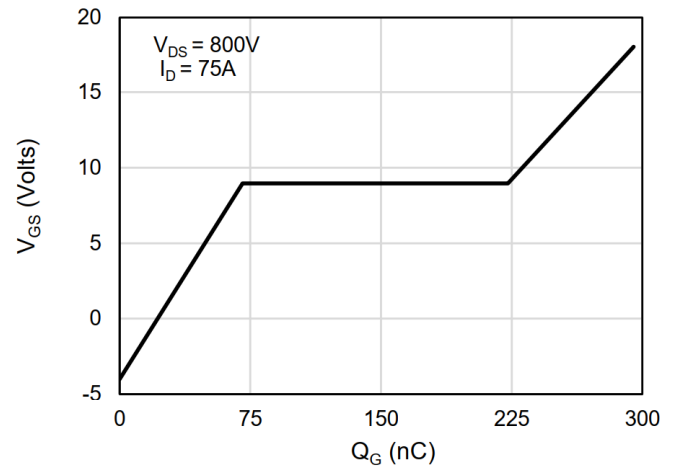


Figure 12: Gate-Charge Characteristics

Typical Performance (curves)

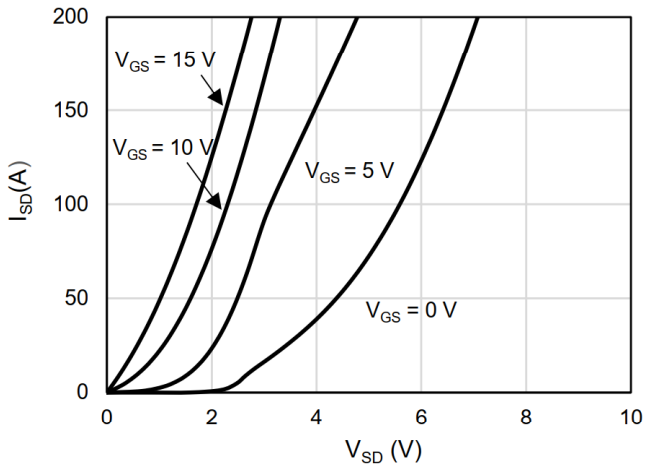


Figure 13: 3rd Quadrant Characteristics at -40°C

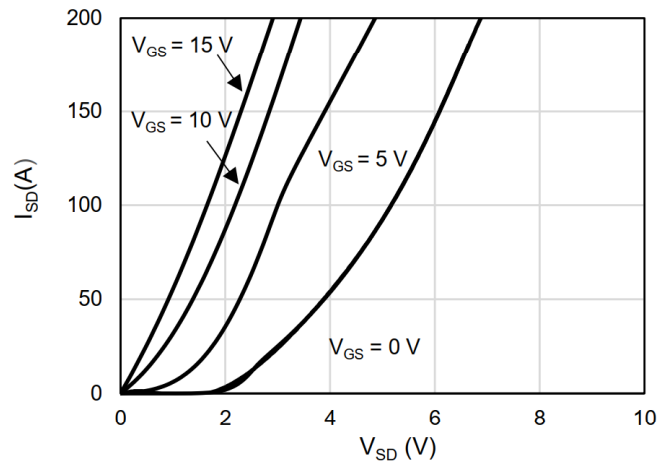


Figure 14: 3rd Quadrant Characteristics at 25°C

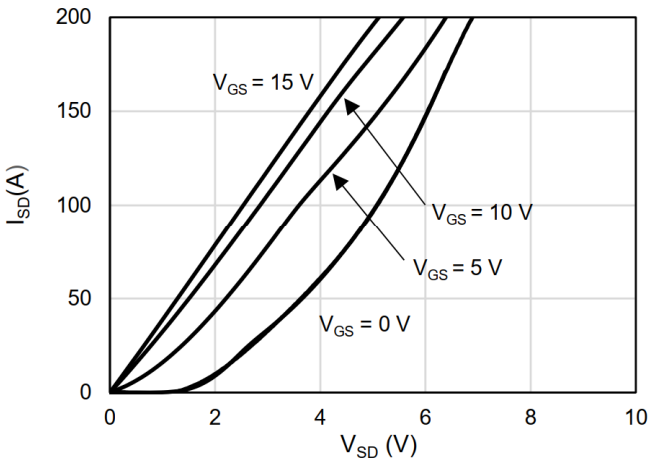


Figure 15: 3rd Quadrant Characteristics at 175°C

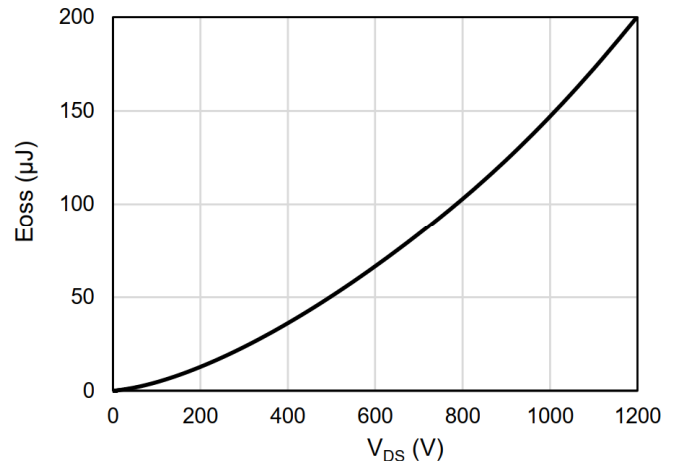


Figure 16: Output Capacitor Stored Energy

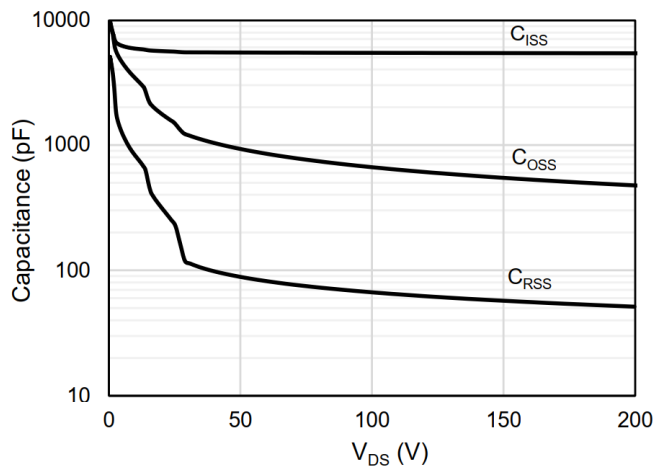


Figure 17: Capacitance Characteristics (0 - 200V)

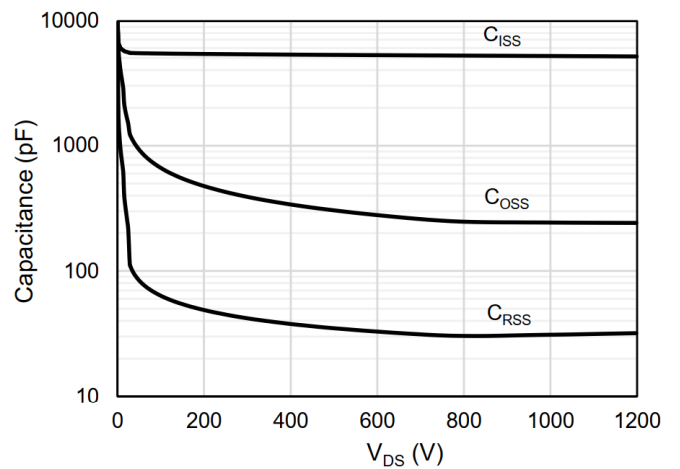


Figure 18: Capacitance Characteristics (0-1200V)

Typical Performance (curves)

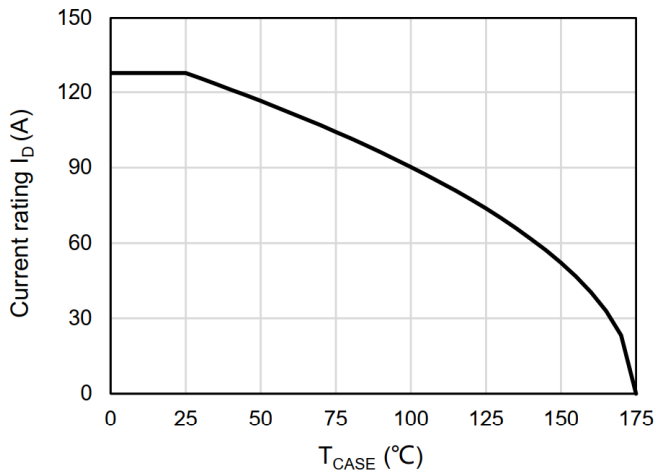


Figure 19: Current De-rating

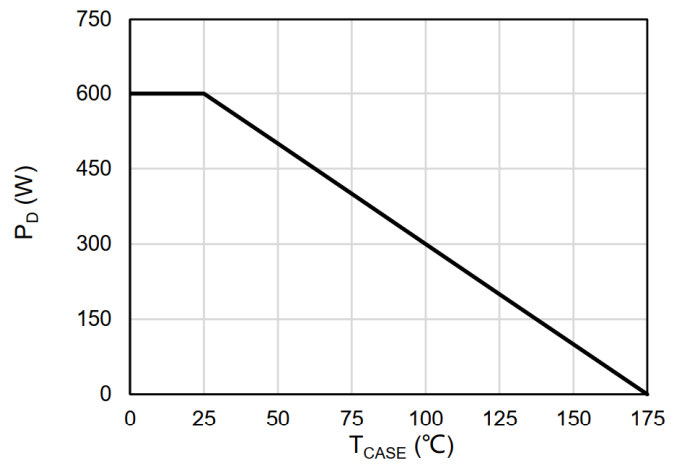


Figure 20: Maximum Power Dissipation Derating vs Case Temperature

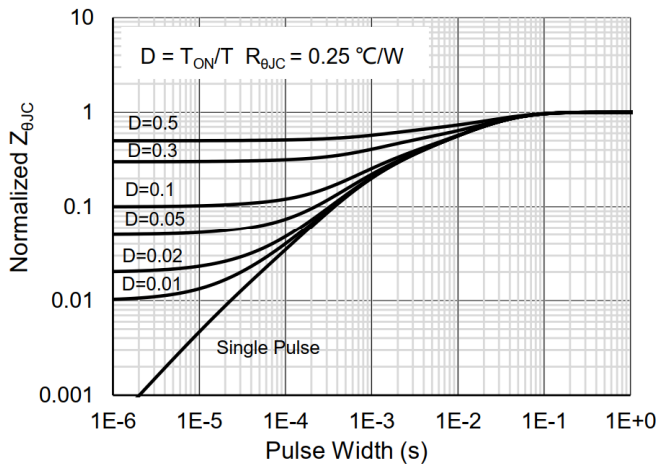


Figure 21: Normalized Maximum Transient Thermal Impedance

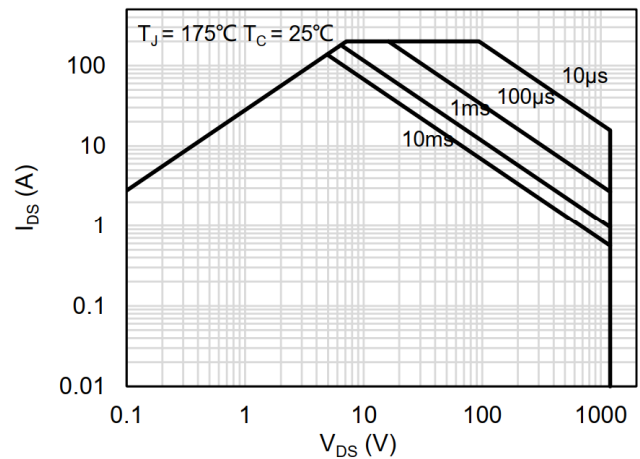


Figure 22: Maximum Forward Biased Safe Operating Area

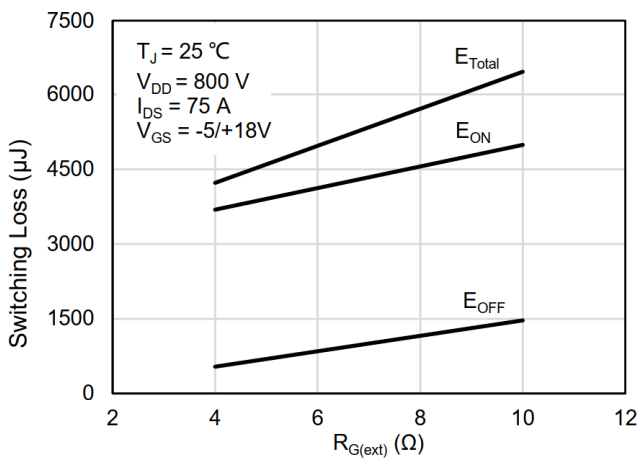


Figure 23: Clamped Inductive Switching Energy vs. $R_{G(ext)}$

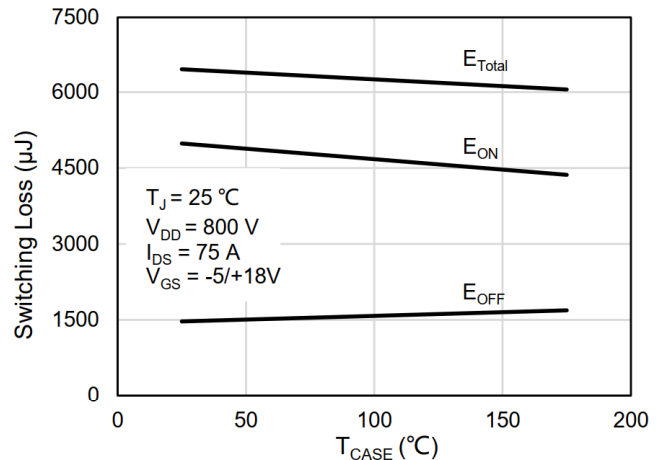
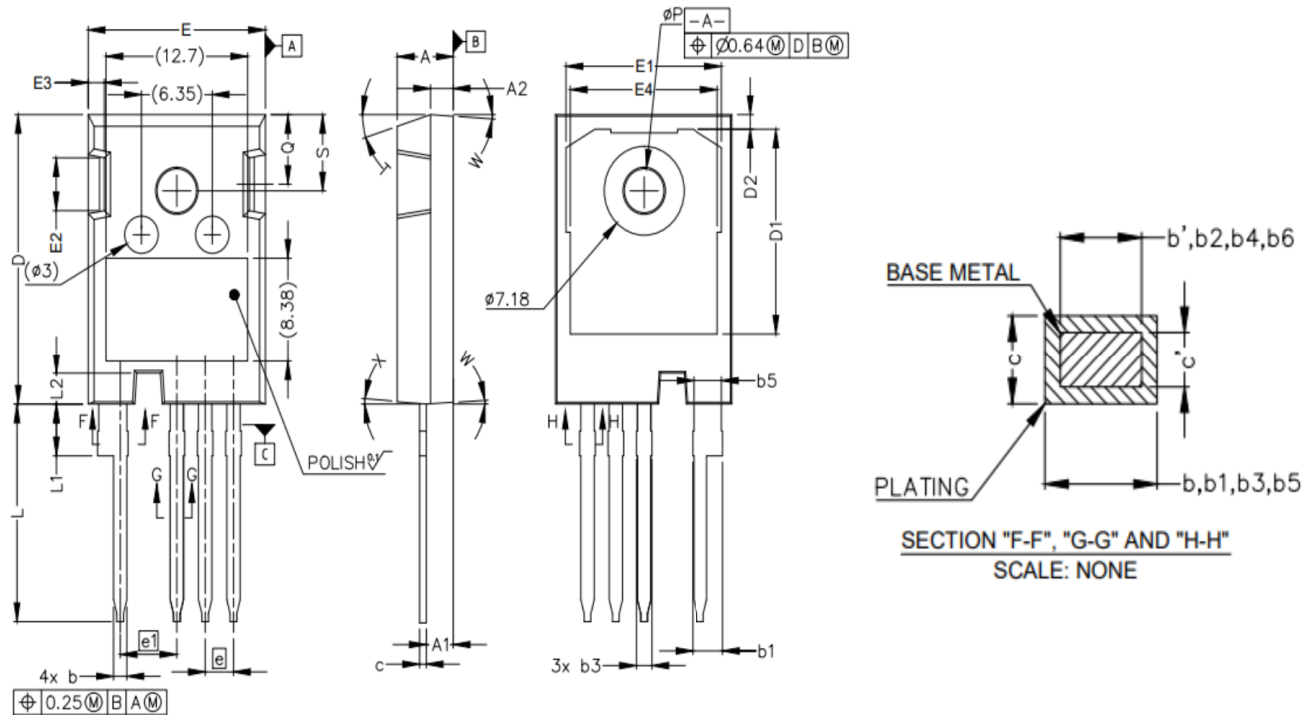


Figure 24: Clamped Inductive Switching Energy vs. Temperature

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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