

1200V N-Channel Silicon Carbide Power MOSFET

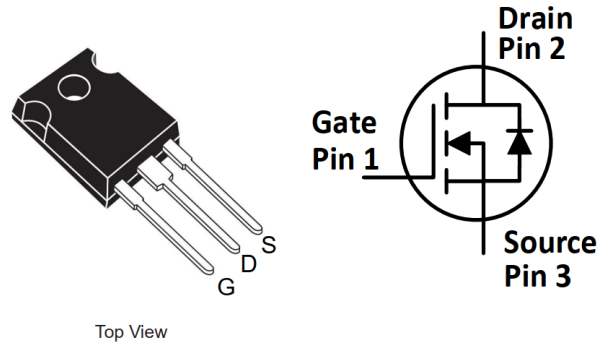
Features

- High blocking voltage
- High speed switching with low capacitance
- High operating junction temperature capability
- Very fast and robust intrinsic body diode

Applications

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

Package



Part Number	Package
DTN6N120SC3	TO247-3

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	$V_{GS}=0V, I_D=10\mu A$	
$V_{GSmax}(DC)$	Maximum Gate-Source Voltage (DC)	-5 to 22	V	Static (DC)	
$V_{GSmax}(Spike)$	Maximum Gate-Source Voltage (Spike)	-10 to 25	V	Duty cycle<1% Pulse width<200ns	
$V_{GS(on)}$	Recommended Turn-on Voltage	20 ± 0.5	V		
$V_{GS(off)}$	Recommended Turn-off Voltage	-3.5 to -2	V		
I_D	Drain Current (Continuous)	6.8	A	$V_{GS}=20V, T_c=25^\circ\text{C}$	Fig. 21
		5.3	A	$V_{GS}=20V, T_c=100^\circ\text{C}$	
I_{DM}	Drain Current (Pulsed)	13.6	A	Pulse width limited by SOA	Fig. 24
P_{TOT}	Total Power Dissipation	78.4	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	1.91	$^\circ\text{C/W}$	Fig. 23

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

Symbol	Parameter	Value			Unit	Test Conditions	Note
		Min.	Typ.	Max.			
I_{DSS}	Drain Leakage Current (Zero Gate Voltage)		0.1	10	μA	$V_{DS}=1200\text{V}, V_{GS}=0\text{V}$	
I_{GSS}	Gate Leakage Current		1	± 100	nA	$V_{DS}=0\text{V}, V_{GS}=-5\sim 20\text{V}$	
V_{th}	Gate Threshold Voltage		4.3		V	$V_{GS}=V_{DS}, I_D=380\mu\text{A}$	Fig. 9
			3.3		V	$V_{GS}=V_{DS}, I_D=380\mu\text{A}$ @ $T_c=175^\circ\text{C}$	
R_{on}	Static Drain-Source On-resistance		750	900	$\text{m}\Omega$	$V_{GS}=20\text{V}, I_D=1.5\text{A}$ @ $T_j=25^\circ\text{C}$	Fig. 4, 5, 6, 7
			1070		$\text{m}\Omega$	$V_{GS}=20\text{V}, I_D=1.5\text{A}$ @ $T_j=175^\circ\text{C}$	
C_{iss}	Input Capacitance		260		pF	$V_{DS}=800\text{V}, V_{GS}=0\text{V},$ $f=1\text{MHz}, V_{AC}=25\text{mV}$	Fig. 16
C_{oss}	Output Capacitance		15		pF		
C_{riss}	Reverse Transfer Capacitance		2.6		pF		
E_{oss}	C_{oss} Stored Energy		5.8		μJ		Fig. 17
Q_G	Total Gate Charge		15.8		nC	$V_{DS}=800\text{V}, I_D=1.5\text{A},$ $V_{GS}=-5\text{ to }20\text{V}$	Fig. 18
Q_{GS}	Gate-Source Charge		3.3		nC		
Q_{GD}	Gate-Drain Charge		11.6		nC		
R_G	Gate Input Resistance		26.8		Ω	$f=1\text{MHz}$	
E_{on}	Turn-on Switching Energy		24		μJ	$V_{DS}=800\text{V}, I_D=1.5\text{A},$ $V_{GS}=-3.5\text{V to }20\text{V},$ $R_{G(ext)}=0\Omega,$ $L=1550\mu\text{H}$	Fig. 19, 20
E_{off}	Turn-off Switching Energy		4.1		μJ		
$t_{d(on)}$	Turn-on Delay Time		8.5		ns		
t_r	Rise Time		9.6				
$t_{d(off)}$	Turn-off Delay Time		12.4				
t_f	Fall Time		34.8				

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	$I_{SD}=1.5\text{A}, V_{GS}=0\text{V}$	Fig. 11, 12
			3.6		V	$I_{SD}=1.5\text{A}, V_{GS}=0\text{V},$ @ $T_j=175^\circ\text{C}$	
t_{rr}	Reverse Recovery Time		59		ns	$V_{GS}=-3.5\text{V}/+20\text{V},$	
Q_{rr}	Reverse Recovery Charge		26		nC	$I_{SD}=1.5\text{A}, V_R=800\text{V},$	
I_{RRM}	Peak Reverse Recovery Current		1.3		A	$di/dt=276\text{A}/\mu\text{s},$ $R_{G(ext)}=82\Omega$	

Typical Performance (curves)

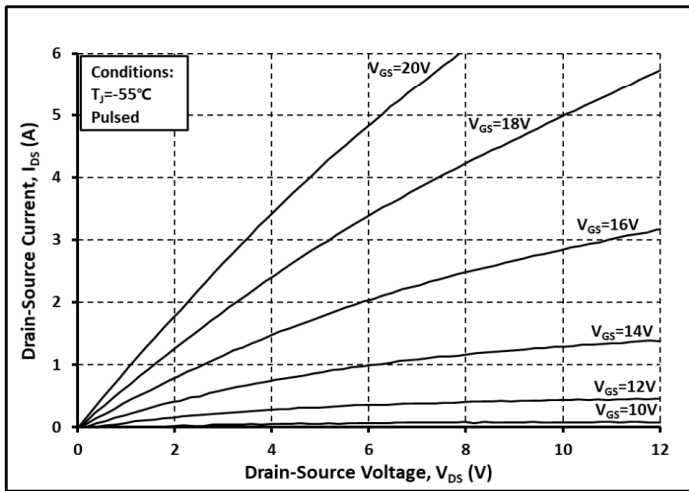


Fig. 1 Output Curve @ T_j = -55°C

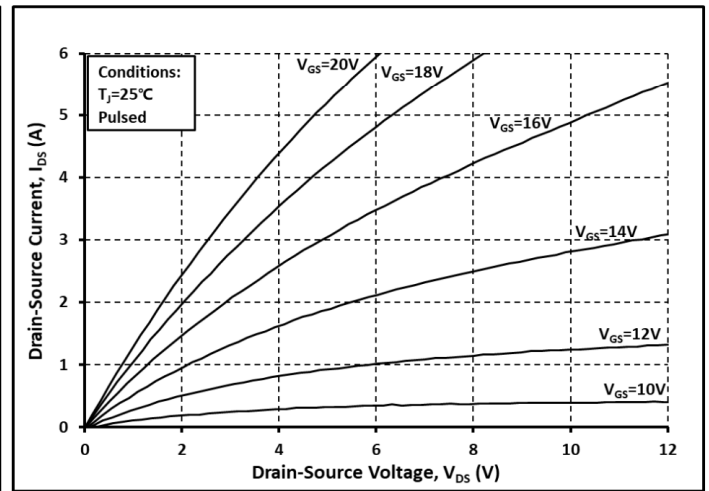


Fig. 2 Output Curve @ T_j = 25°C

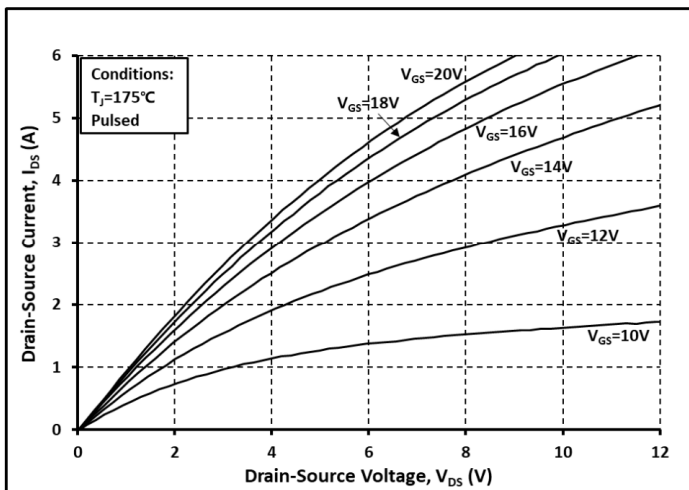


Fig. 3 Output Curve @ T_j = 175°C

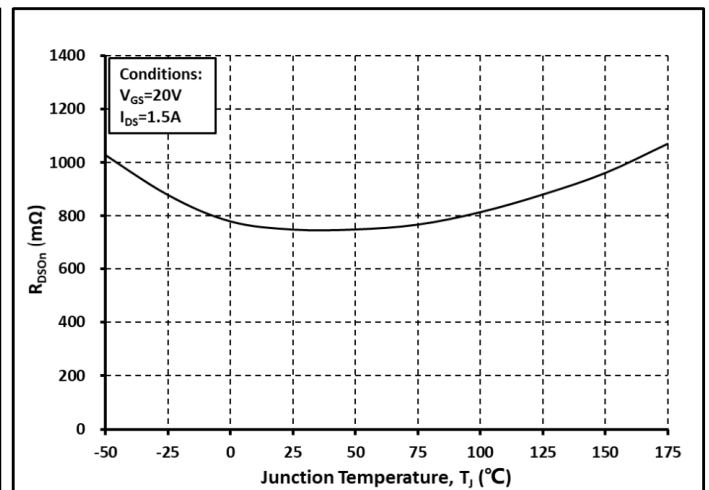


Fig. 4 Ron vs. Temperature

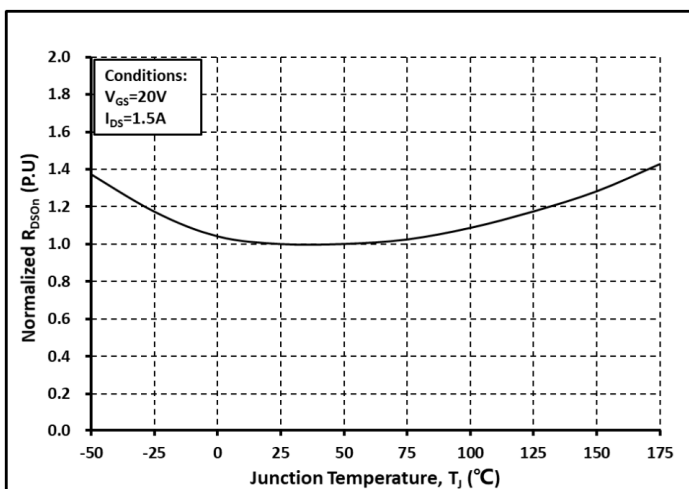


Fig. 5 Normalized Ron vs. Temperature

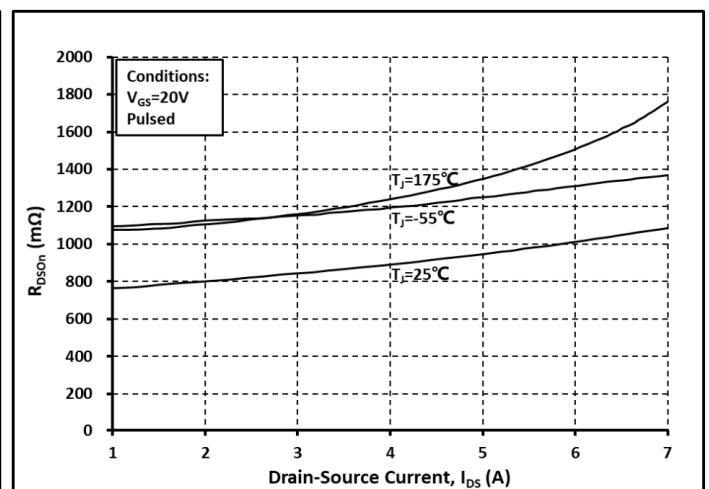


Fig. 6 Ron vs. I_{DS} @ Various Temperature

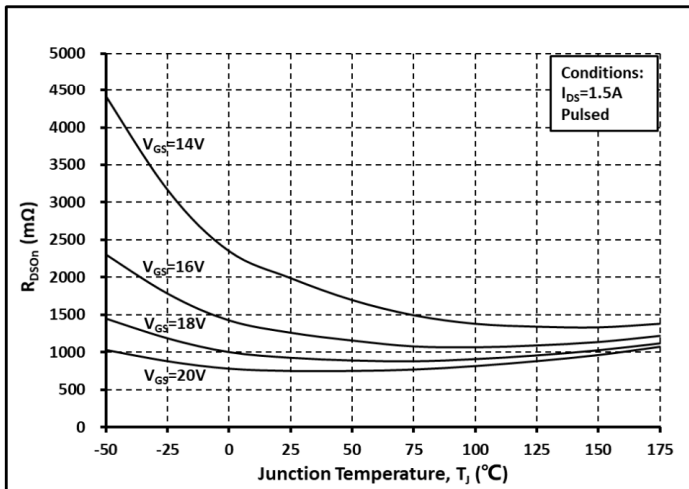


Fig. 7 Ron vs. Temperature @ Various V_{GS}

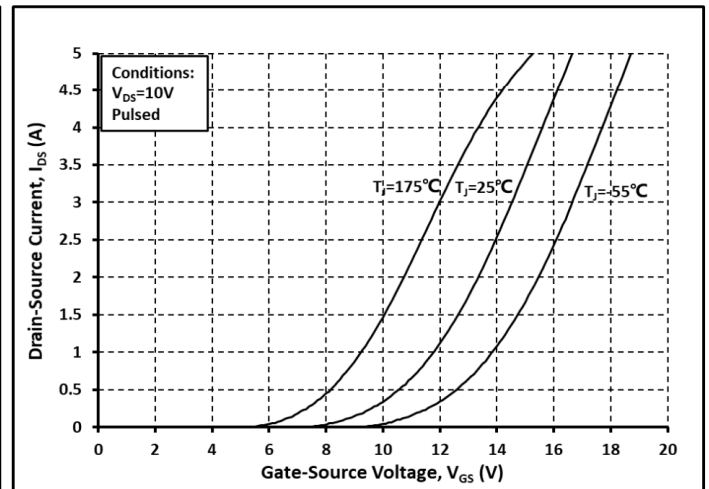


Fig. 8 Transfer Curves @ Various Temperature

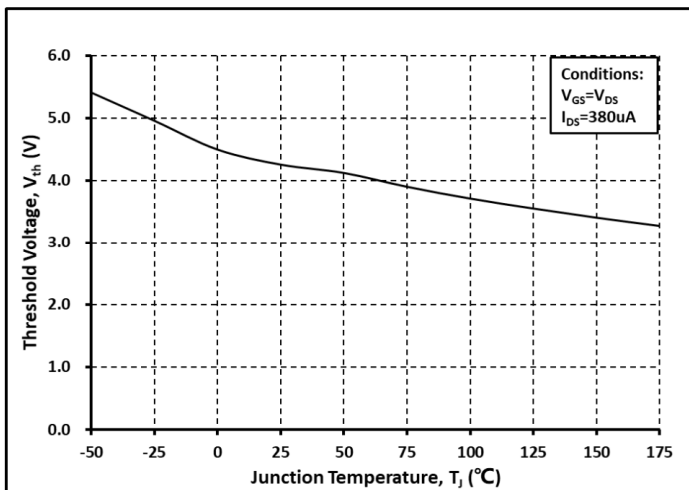


Fig. 9 Threshold Voltage vs. Temperature

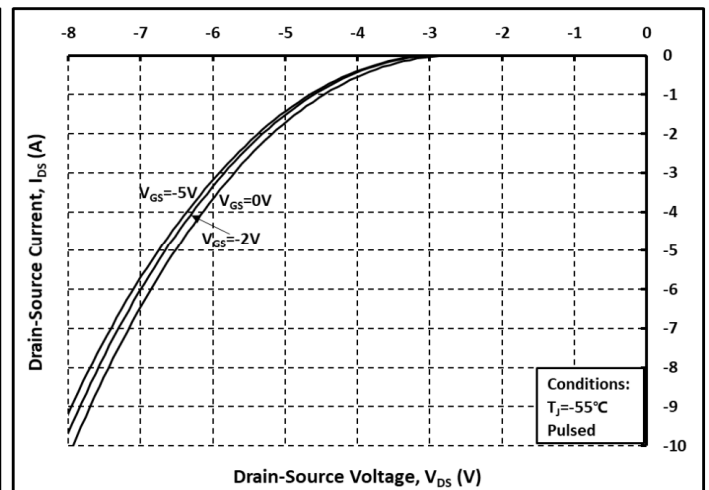


Fig. 10 Body Diode Curves @ $T_J = -55^\circ\text{C}$

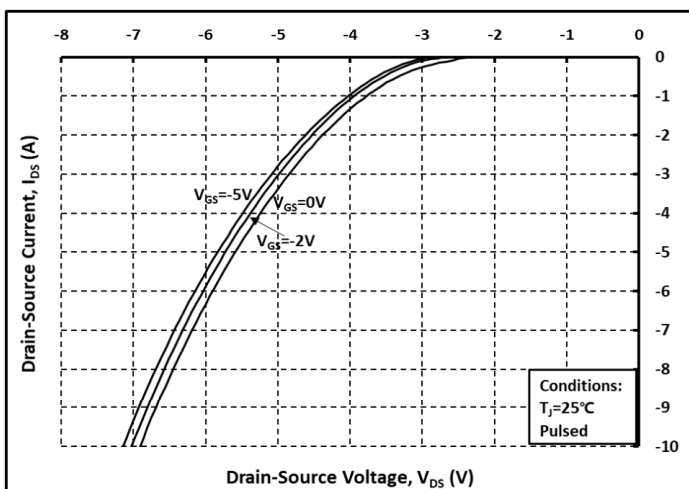


Fig. 11 Body Diode Curves @ $T_J = 25^\circ\text{C}$

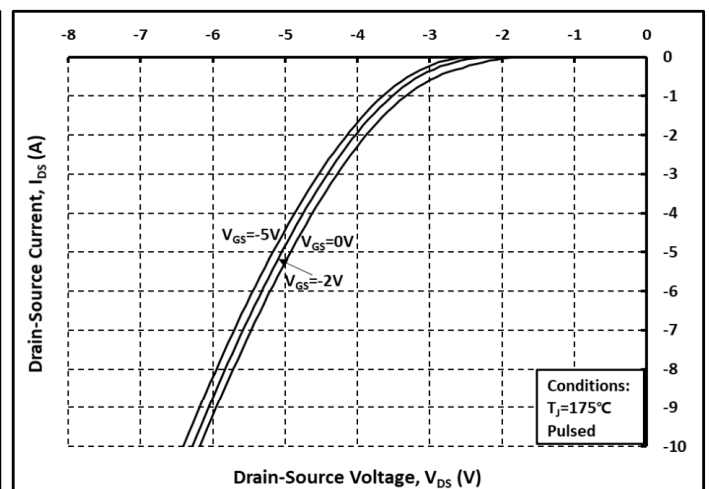


Fig. 12 Body Diode Curves @ $T_J = 175^\circ\text{C}$

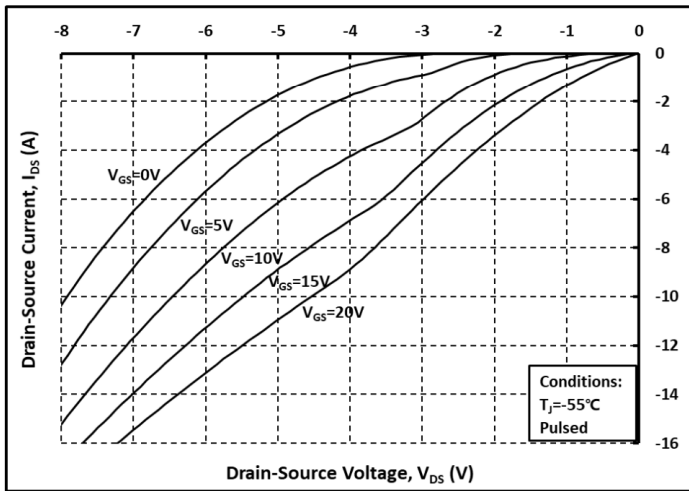


Fig. 13 3rd Quadrant Curves @ $T_j = -55^\circ\text{C}$

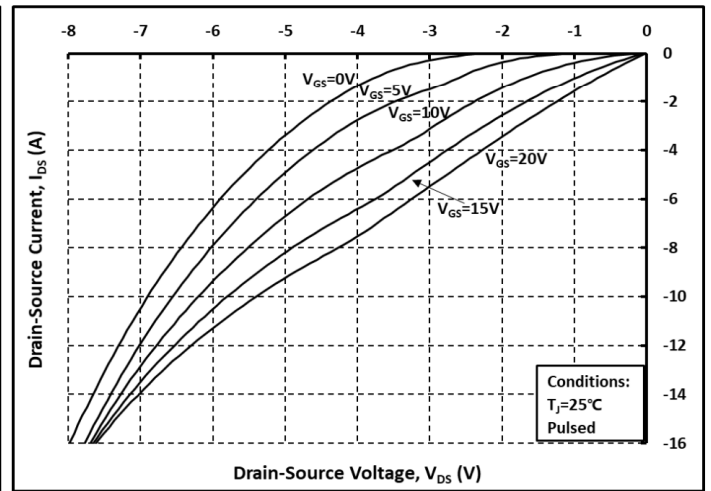


Fig. 14 3rd Quadrant Curves @ $T_j = 25^\circ\text{C}$

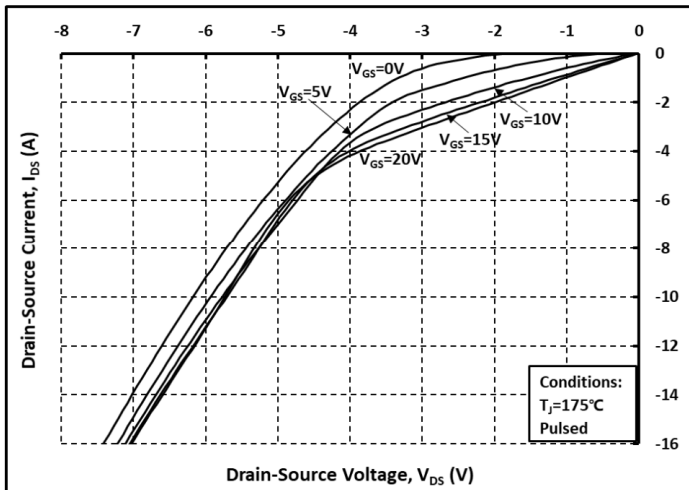


Fig. 15 3rd Quadrant Curves @ $T_j = 175^\circ\text{C}$

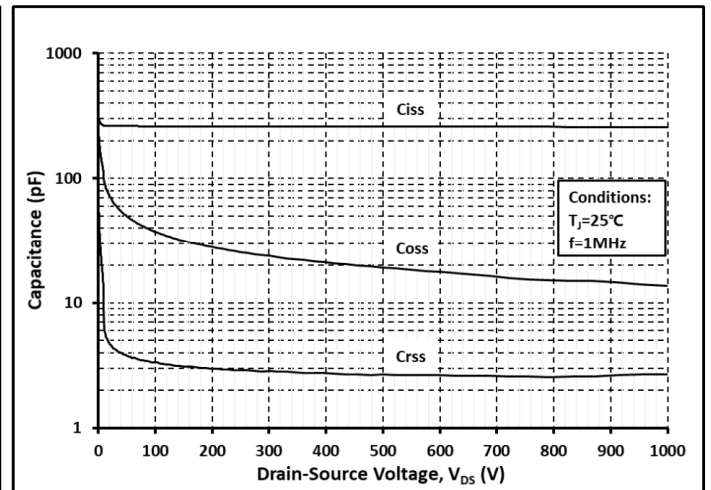


Fig. 16 Capacitance vs. V_{DS}

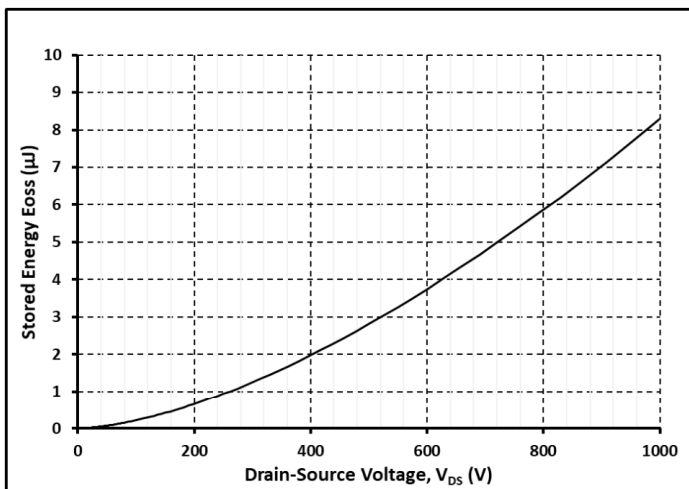


Fig. 17 Output Capacitor Stored Energy

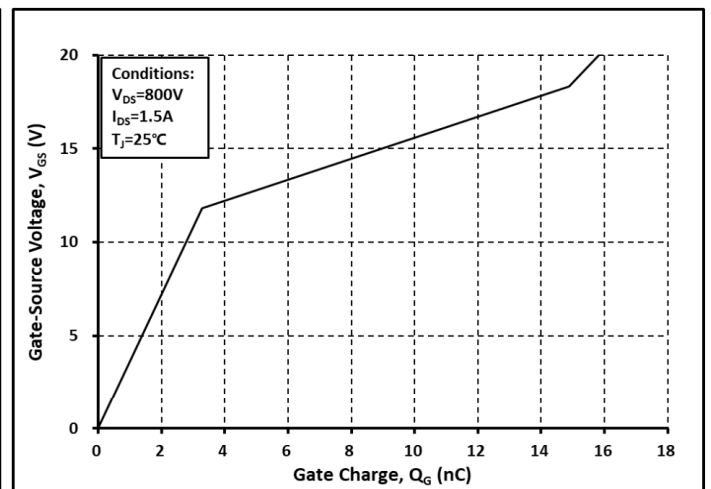


Fig. 18 Gate Charge Characteristics

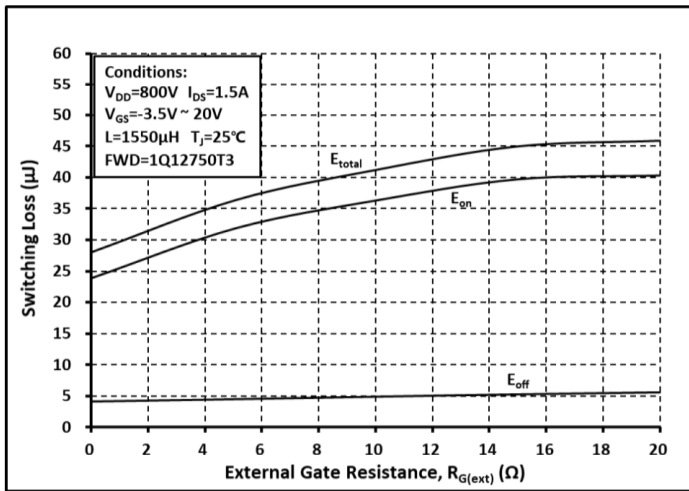


Fig. 19 Switching Energy vs. $R_{G(ext)}$

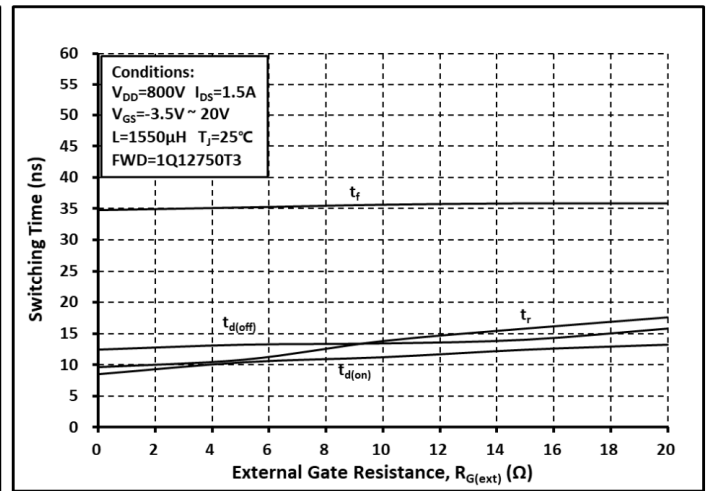


Fig. 20 Switching Time vs. $R_{G(ext)}$

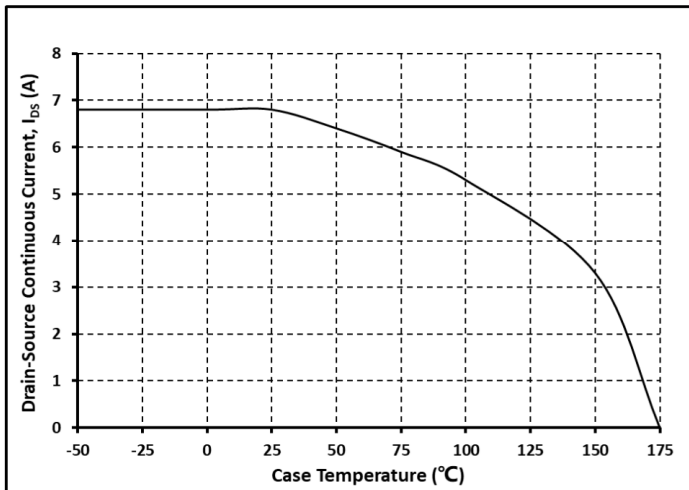


Fig. 21 Continuous I_{DS} vs. T_c

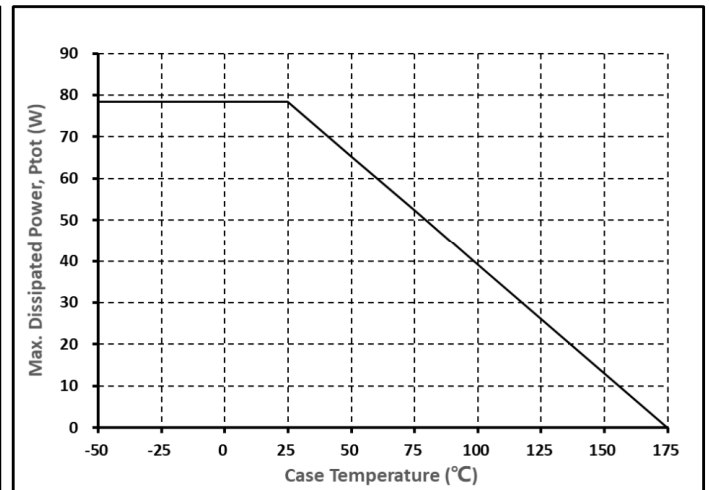


Fig. 22 Max. Power Dissipation Derating vs. T_c

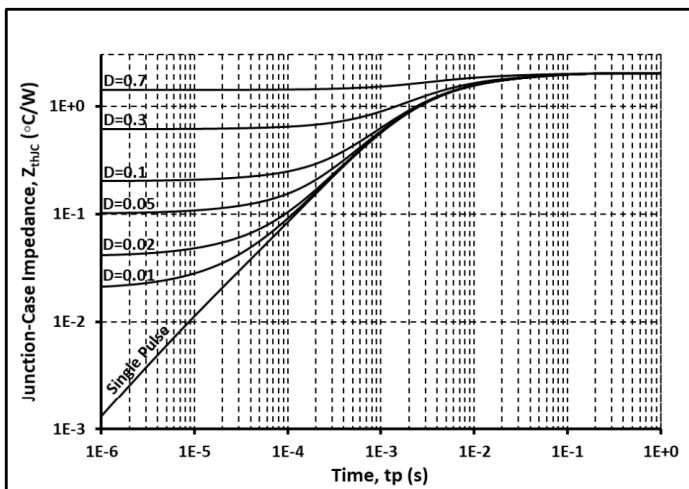


Fig. 23 Thermal Impedance

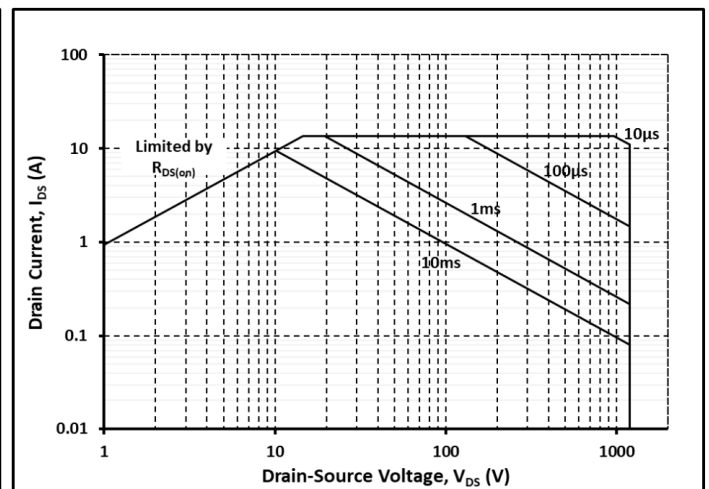
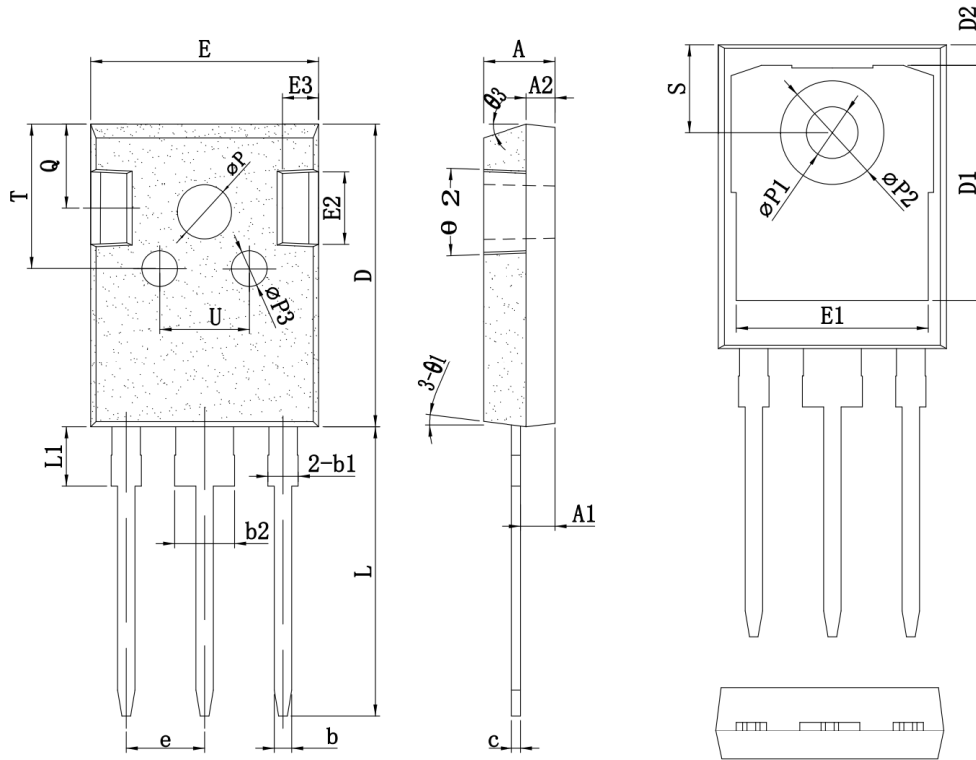


Fig. 24 Safe Operating Area

TO-247_3L PACKAGE OUTLINE



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	MIN	TYP	MAX	SYMBOL	MIN	TYP	MAX
A	4.60	5.00	5.40	e	2.10	5.44	5.70
A1	2.10	2.41	2.70	L	19.00	19.98	21.00
A2	1.70	2.00	2.30	L1	-	-	4.50
b	1.00	1.20	1.40	ΦP	3.30	3.70	4.00
b1	1.80	2.10	2.40	$\Phi P1$	3.25	3.55	3.85
b2	2.80	3.10	3.40	$\Phi P2$	6.80	7.18	7.60
C	0.45	0.60	0.75	$\Phi P3$	2.30	2.50	3.30
D	19.00	21.00	23.00	Q	5.50	5.80	6.30
D1	16.00	16.55	17.00	S	5.60	6.15	6.30
D2	0.95	1.20	1.45	T	9.50	10.00	10.50
E	15.70	15.80	16.50	U	6.00	-	8.00
E1	12.80	13.25	13.70	$\theta 1$	5°	7°	9°
E2	4.20	5.00	5.30	$\theta 2$	1°	3°	5°
E3	2.20	2.50	2.80	$\theta 3$	13°	15°	17°

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