

1200V N-Channel Silicon Carbide Power MOSFET

Features

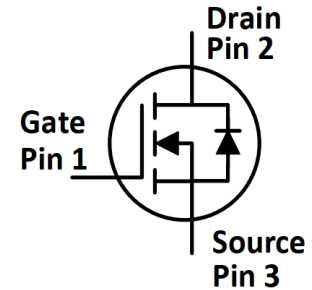
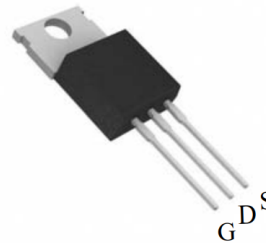
- High blocking voltage
- High speed switching with low capacitance
- High operating junction temperature capability
- Very fast and robust intrinsic body diode

Applications

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

Package

TO-220 Pin Configuration



Part Number	Package
DTP6N120SC	TO220-3

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	$V_{GS}=0\text{V}$, $I_D=10\mu\text{A}$	
$V_{GSmax(DC)}$	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)	6.4	A	$V_{GS}=20\text{V}$, $T_c=25^\circ\text{C}$	Fig. 21
		4.9	A	$V_{GS}=20\text{V}$, $T_c=100^\circ\text{C}$	
I_{DM}	Drain Current (Pulsed)	12.8	A	Pulse width limited by SOA	Fig. 24
P_{TOT}	Total Power Dissipation	66.9	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	2.24	$^\circ\text{C/W}$	Fig. 23

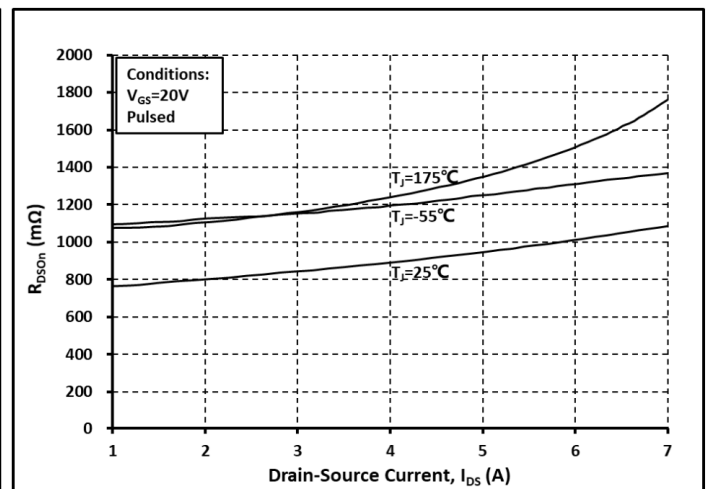
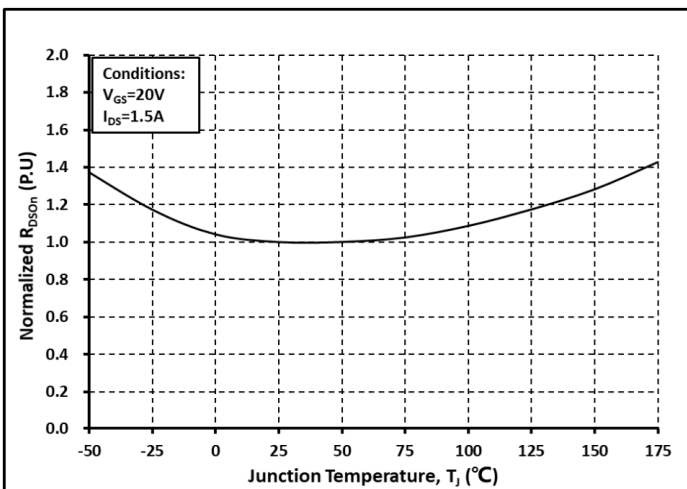
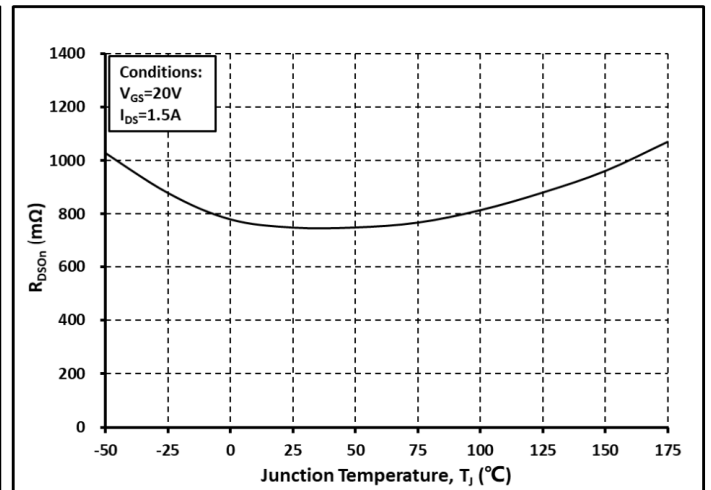
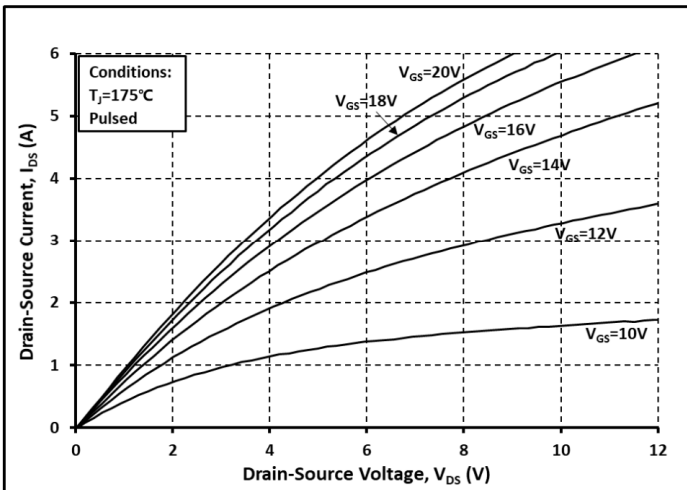
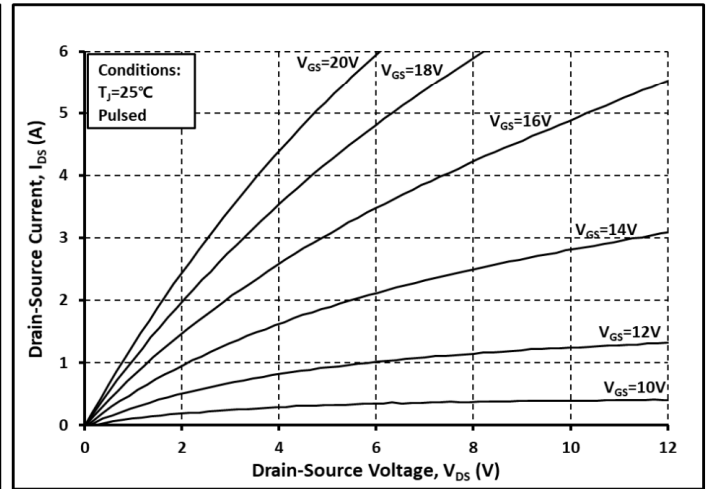
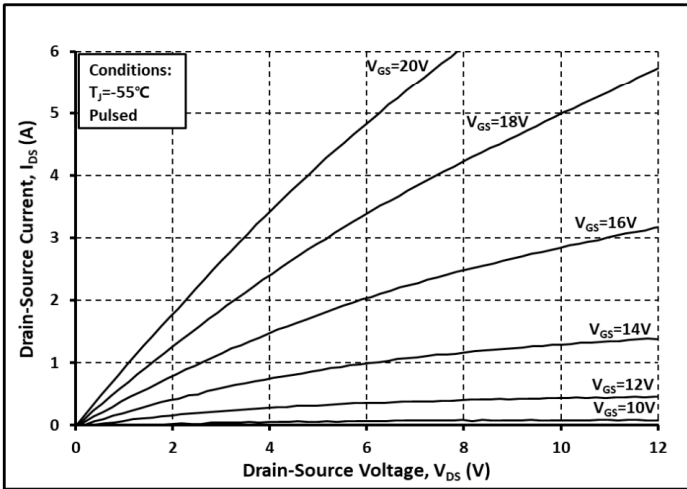
Electrical Characteristics ($T_c=25^\circ\text{C}$ unless otherwise specified)

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)



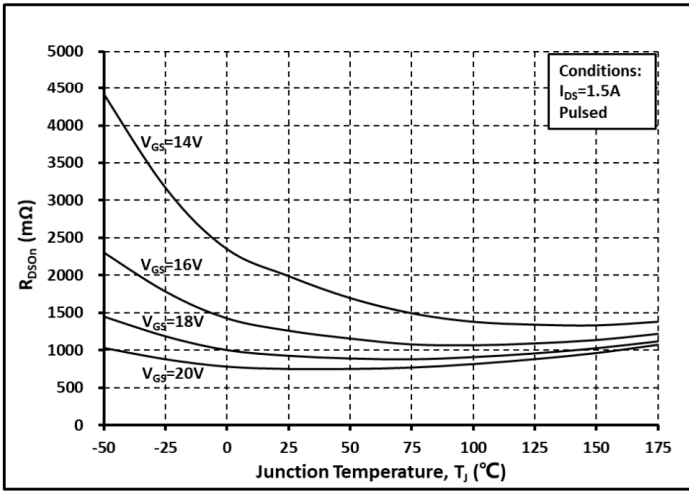


Fig. 7 Ron vs. Temperature @ Various V_{GS}

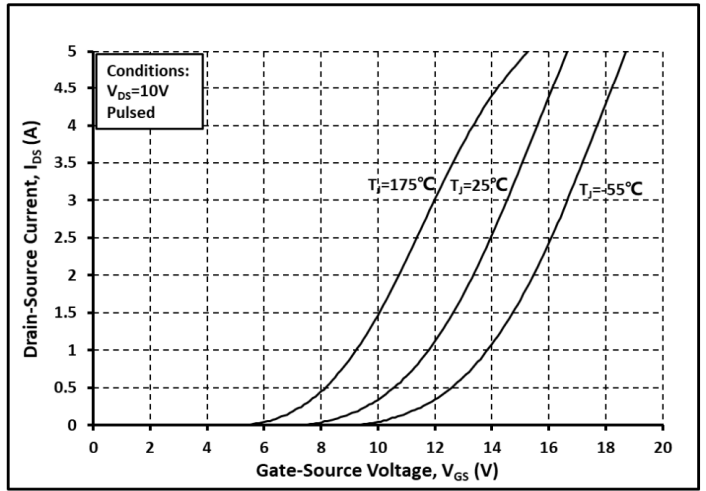


Fig. 8 Transfer Curves @ Various Temperature

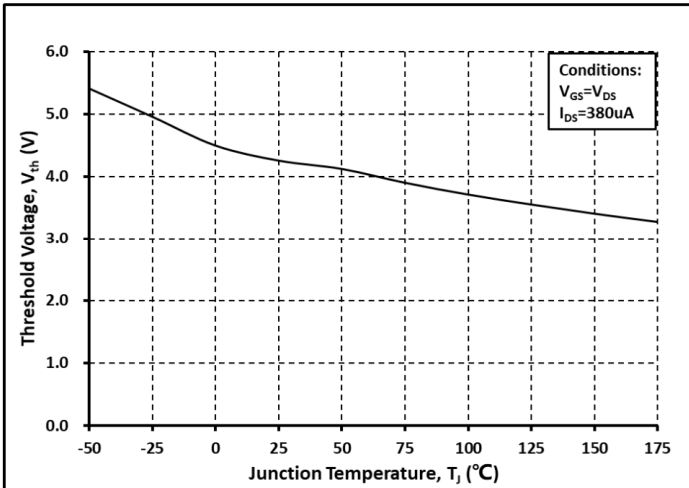


Fig. 9 Threshold Voltage vs. Temperature

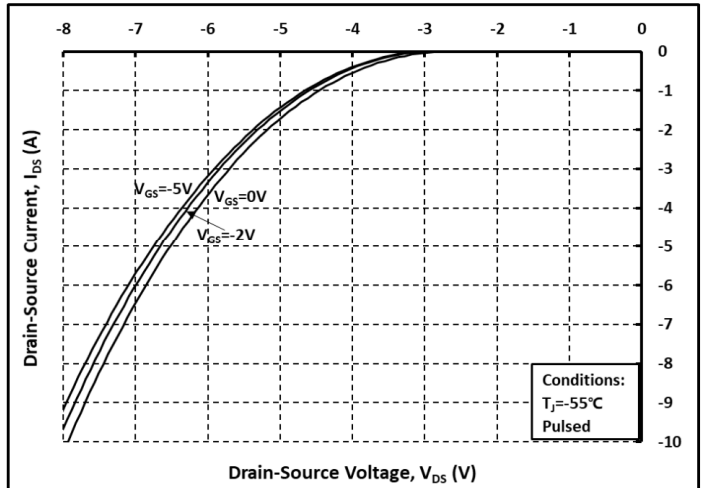


Fig. 10 Body Diode Curves @ $T_J = -55^\circ C$

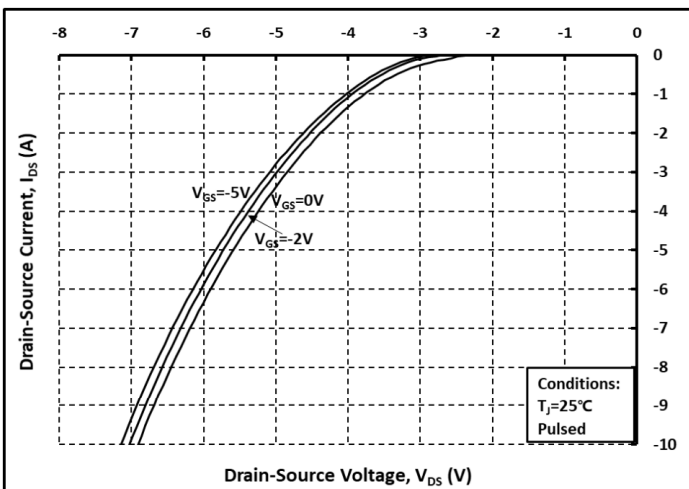


Fig. 11 Body Diode Curves @ $T_J = 25^\circ C$

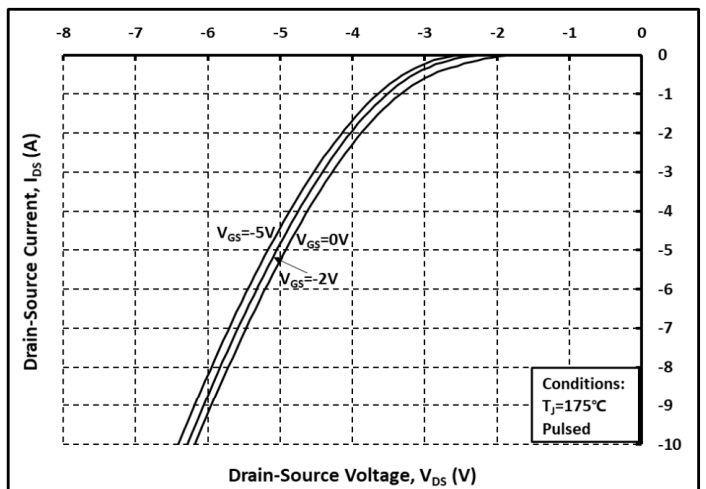


Fig. 12 Body Diode Curves @ $T_J = 175^\circ C$

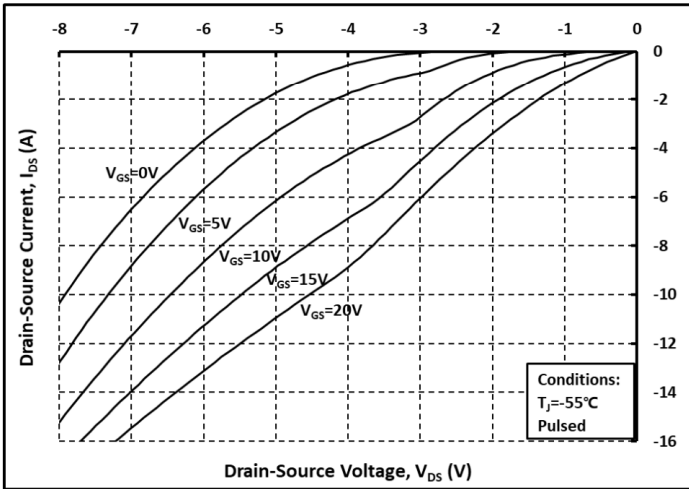


Fig. 13 3rd Quadrant Curves @ $T_j = -55^\circ\text{C}$

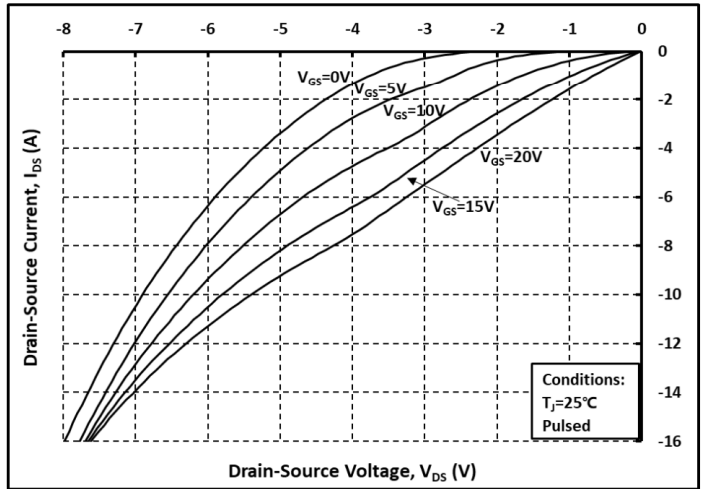


Fig. 14 3rd Quadrant Curves @ $T_j = 25^\circ\text{C}$

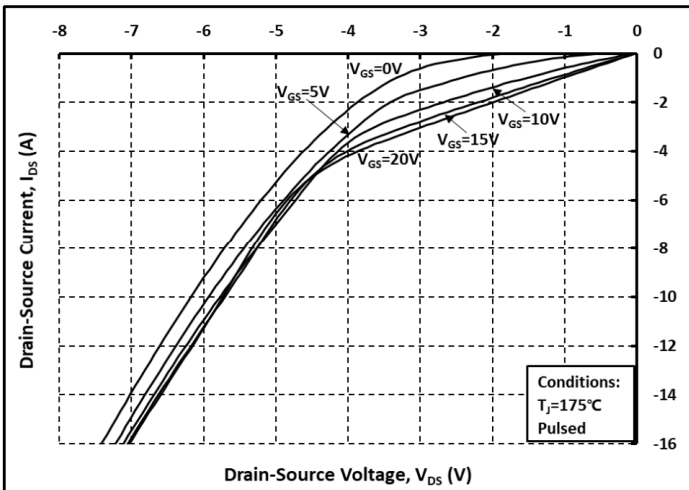


Fig. 15 3rd Quadrant Curves @ $T_j = 175^\circ\text{C}$

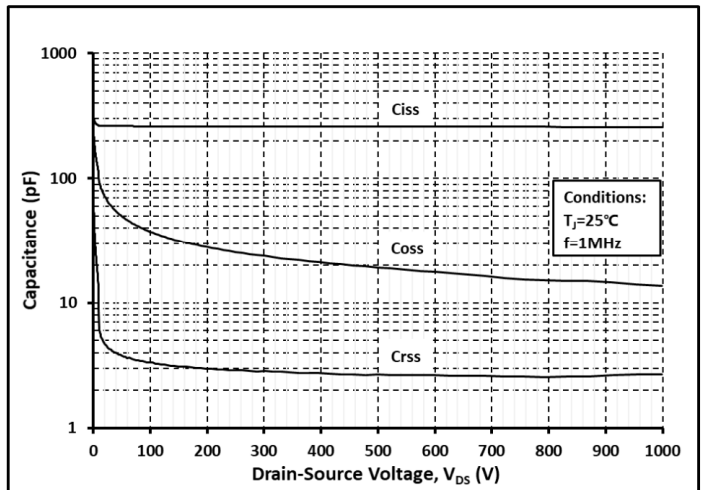


Fig. 16 Capacitance vs. V_{DS}

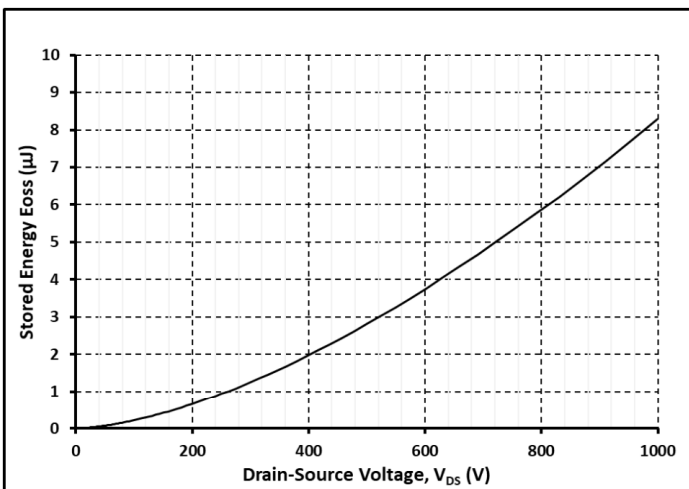


Fig. 17 Output Capacitor Stored Energy

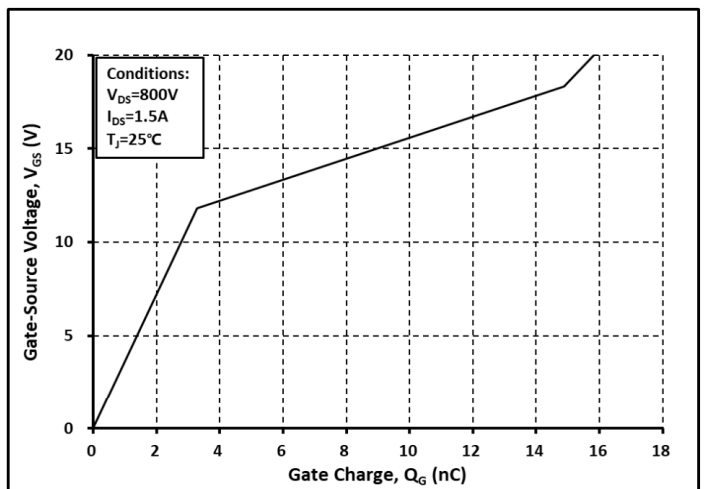


Fig. 18 Gate Charge Characteristics

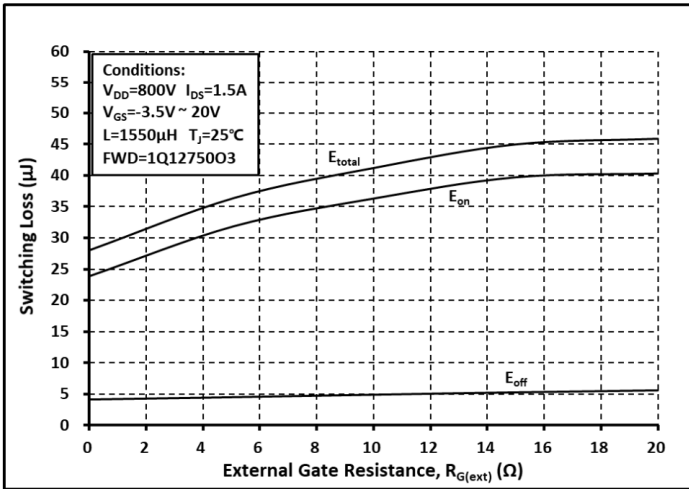


Fig. 19 Switching Energy vs. $R_{G(ext)}$

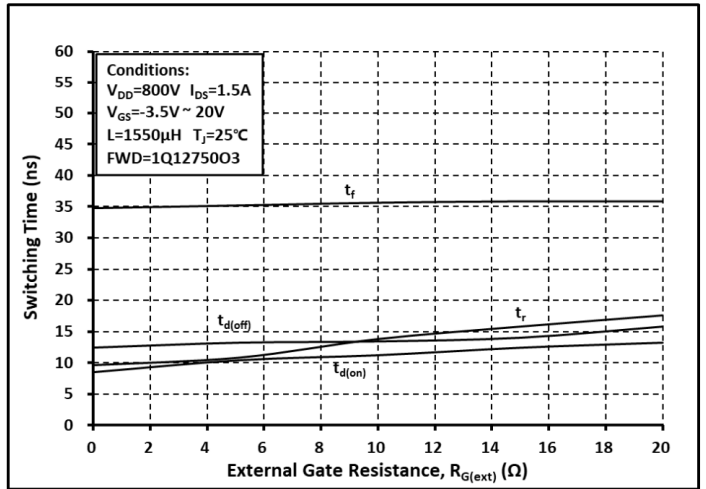


Fig. 20 Switching Time vs. $R_{G(ext)}$

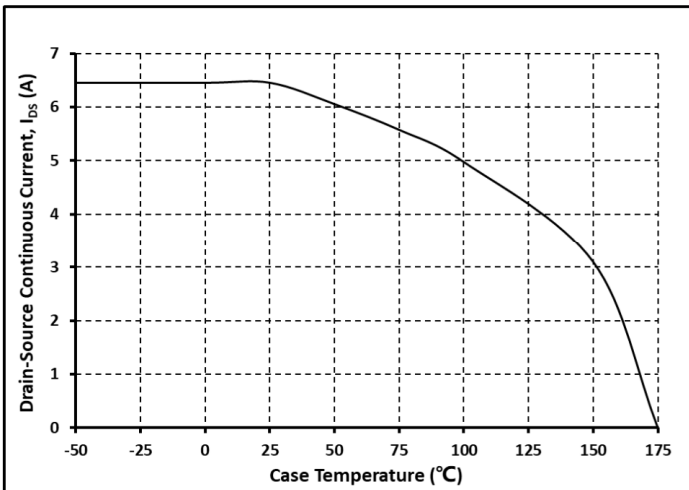


Fig. 21 Continuous I_{DS} vs. T_c

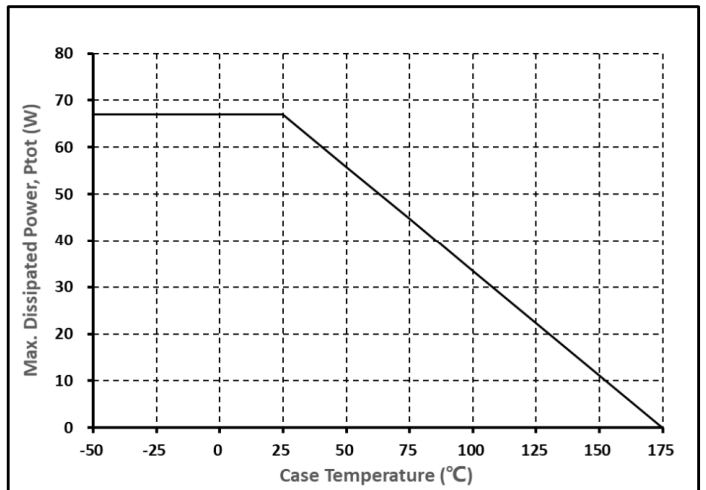


Fig. 22 Max. Power Dissipation Derating vs. T_c

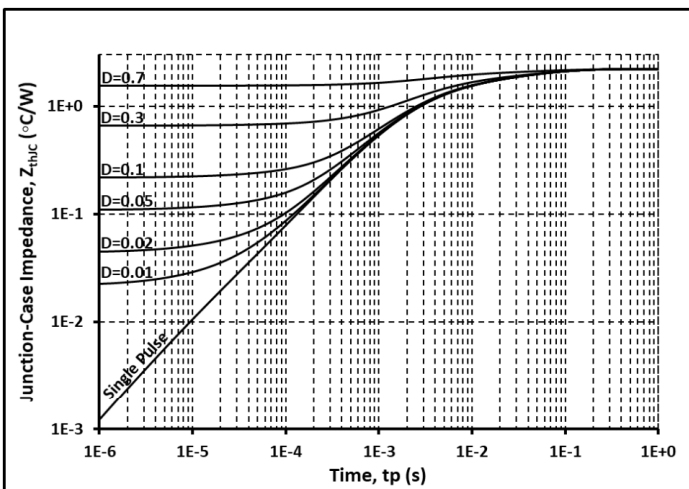


Fig. 23 Thermal Impedance

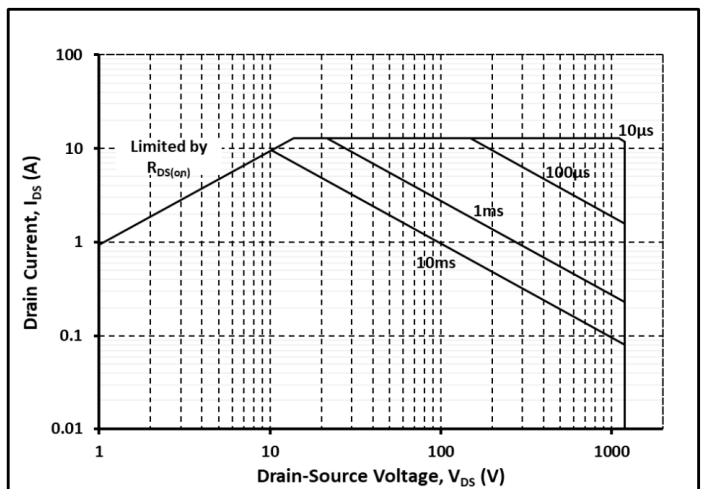
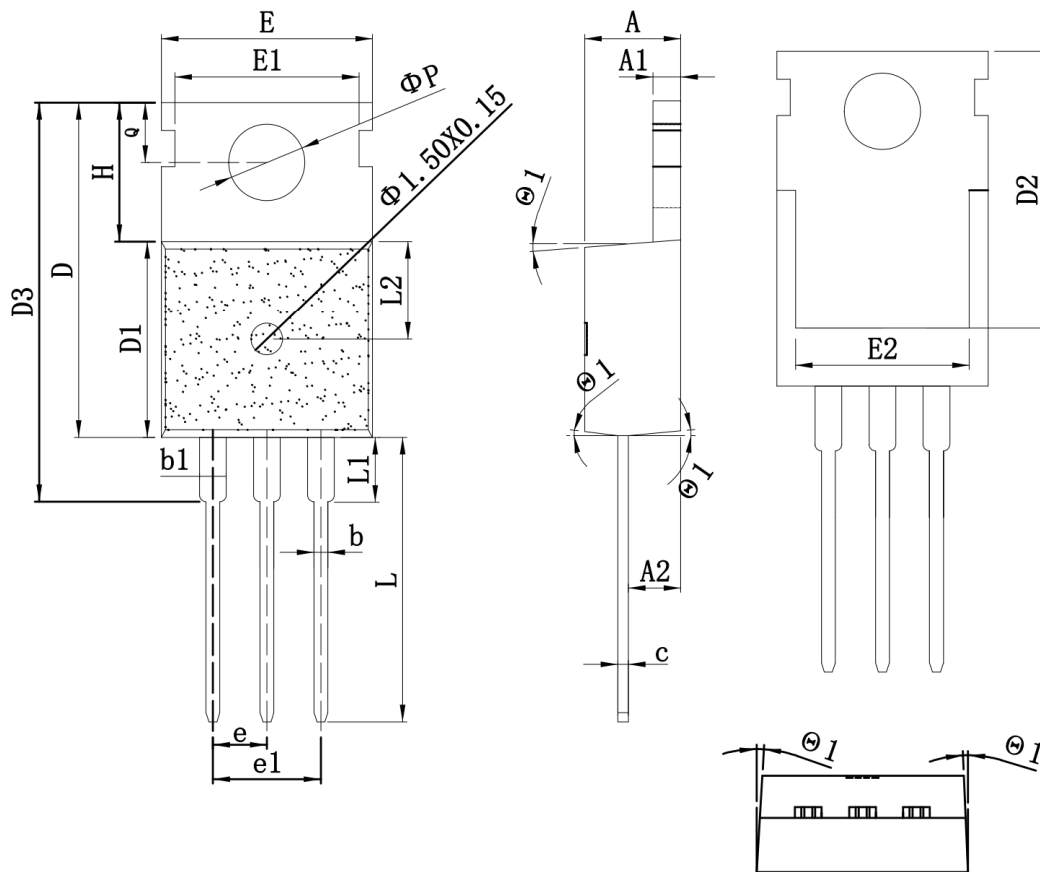


Fig. 24 Safe Operating Area

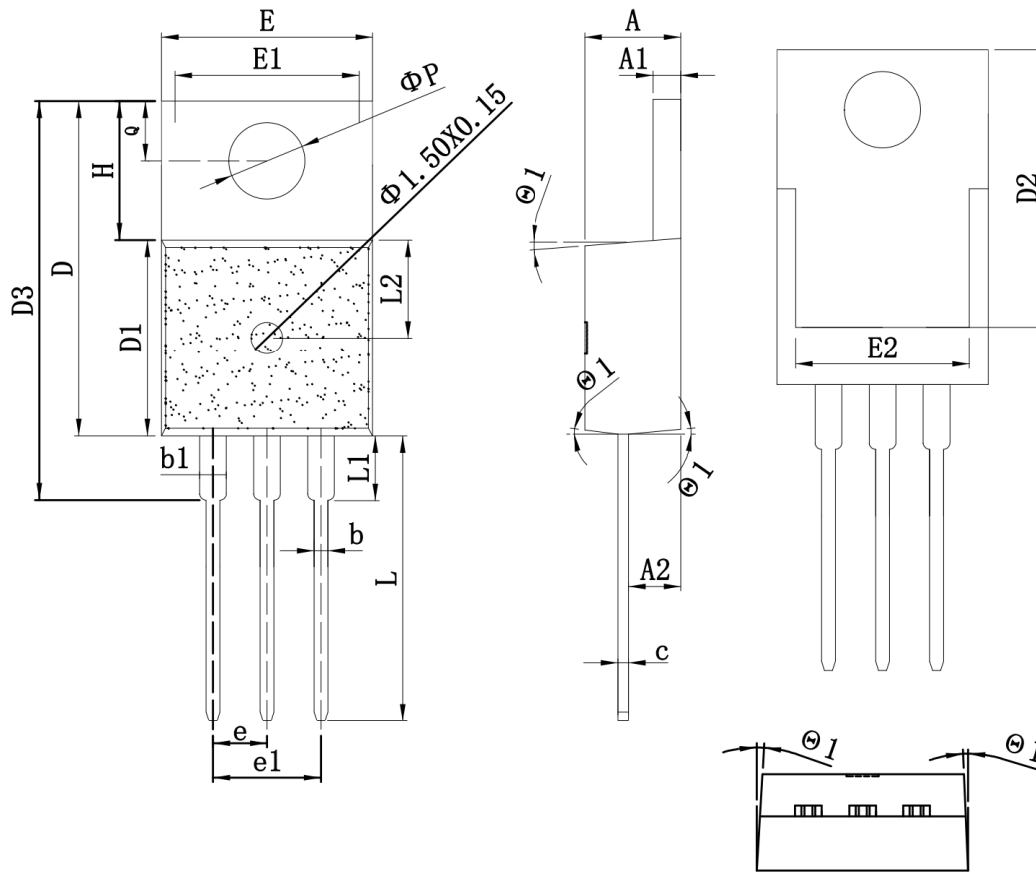
TO-220_3L-A PACKAGE OUTLINE



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	mm			SYMBOL	mm		
	MIN	TYP	MAX		MIN	TYP	MAX
A	4.15	4.50	4.80	E1	8.25	8.70	9.15
A1	1.15	1.30	1.50	E2	7.20	8.00	8.80
A2	2.10	2.40	2.65	e	2.38	2.54	2.74
b	0.65	0.80	1.00	e1	5.08REF		
b1	1.10	1.33	1.80	H	6.20	6.50	6.90
c	0.35	0.50	0.65	L	12.75	13.28	13.70
D	14.25	15.75	16.15	L1	-	-	3.50
D1	8.70	9.20	9.60	L2	2.30	4.65	7.00
D2	12.30	13.10	13.85	ϕP	3.40	3.65	3.85
D3	16.20	18.80	20.60	Q	2.50	2.80	3.00
E	8.68	10.02	11.00	θ	2°	-	7°

TO-220_3L-B PACKAGE OUTLINE



COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	mm			SYMBOL	mm		
	MIN	TYP	MAX		MIN	TYP	MAX
A	4.15	4.50	4.80	E1	8.25	8.70	9.15
A1	1.15	1.30	1.50	E2	7.20	8.00	8.80
A2	2.10	2.40	2.65	e	2.38	2.54	2.74
b	0.65	0.80	1.00	e1	5.08REF		
b1	1.10	1.33	1.80	H	6.20	6.50	6.90
c	0.35	0.50	0.65	L	12.75	13.28	13.70
D	14.25	15.75	16.15	L1	-	-	3.50
D1	8.70	9.20	9.60	L2	2.30	4.65	7.00
D2	12.30	13.10	13.85	ϕP	3.40	3.65	3.85
D3	16.20	18.80	20.60	Q	2.50	2.80	3.00
E	8.68	10.02	11.00	θ	2°	-	7°

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