

1200V N-Channel Silicon Carbide Power MOSFET

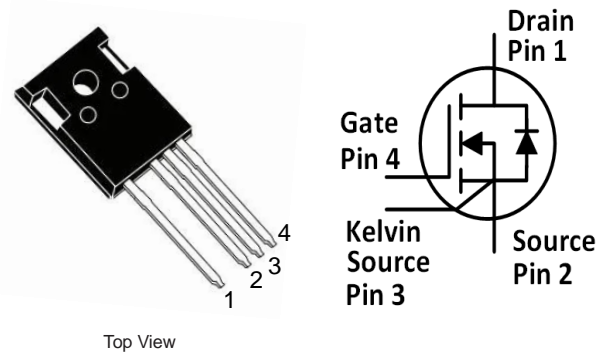
Features:

- 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:



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 _{θ(j-c)}	Thermal Resistance from Junction to Case	0.5	°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}	Zero gate voltage drain current		5	100	μA	$V_{DS}=1200\text{V}, V_{GS}=0\text{V}$	
I_{GSS}	Gate leakage current			± 100	nA	$V_{DS}=0\text{V}, V_{GS}=-5\sim 20\text{V}$	
V_{TH}	Gate threshold voltage		3.6		V	$V_{GS}=V_{DS}, I_D=3.8\text{mA}$	Fig. 8, 9
			2.7			$V_{GS}=V_{DS}, I_D=3.8\text{mA}$ @ $T_c=175^\circ\text{C}$	
R_{ON}	Static drain-source on-resistance		80	100	$\text{m}\Omega$	$V_{GS}=20\text{V}, I_D=10\text{A}$ @ $T_j=25^\circ\text{C}$	Fig. 4, 5, 6, 7
			130		$\text{m}\Omega$	$V_{GS}=20\text{V}, I_D=10\text{A}$ @ $T_j=175^\circ\text{C}$	
C_{iss}	Input capacitance		1680		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		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	$I_D=20\text{A}, V_{DD}=50\text{V},$ $L=2\text{mH}$	
Q_g	Total gate charge		76		nC	$V_{DS}=800\text{V}, I_D=20\text{A},$ $V_{GS}=-5\text{ to }20\text{V}$	Fig. 18
Q_{gs}	Gate-source charge		29		nC		
Q_{gd}	Gate-drain charge		34		nC		
R_g	Gate input resistance		4.2		Ω	$f=1\text{MHz}$	
E_{ON}	Turn-on switching energy		154		μJ	$V_{DS}=800\text{V}, I_D=20\text{A},$ $V_{GS}=-3.5\text{ to }20\text{V},$ $R_{G(\text{ext})}=2.0\Omega,$ $L=290\mu\text{H}$	Fig. 19, 20
E_{OFF}	Turn-off switching energy		80		μJ		
$t_{d(\text{on})}$	Turn-on delay time		8.9		ns		
t_r	Rise time		19.9				
$t_{d(\text{off})}$	Turn-off delay time		14.7				
t_f	Fall time		9.5				

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

Typical Performance (curves)

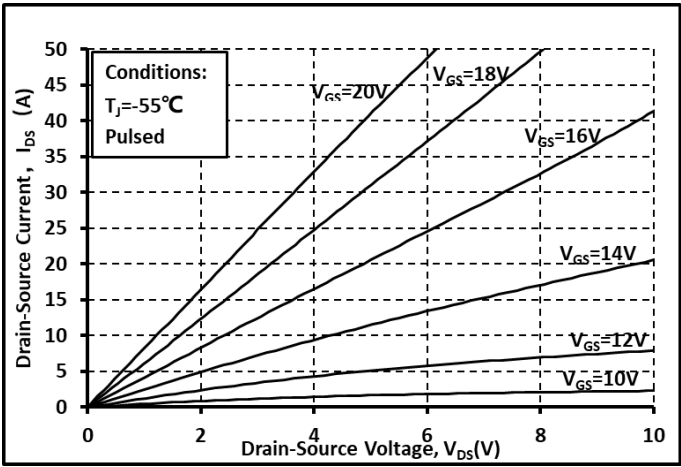


Fig. 1 Output Curve @ $T_j = -55^\circ\text{C}$

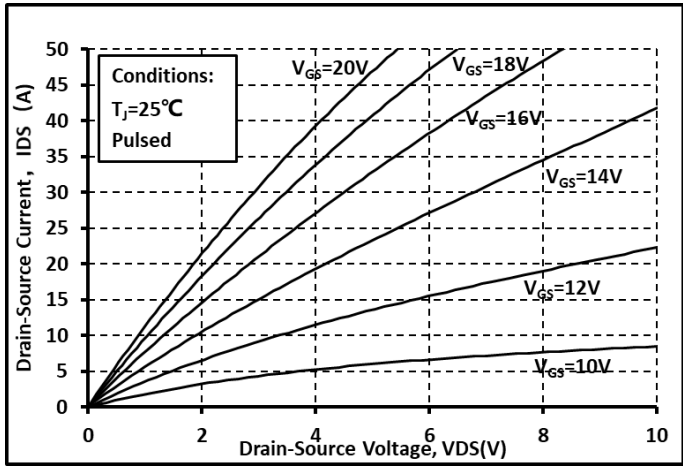


Fig. 2 Output Curve @ $T_j = 25^\circ\text{C}$

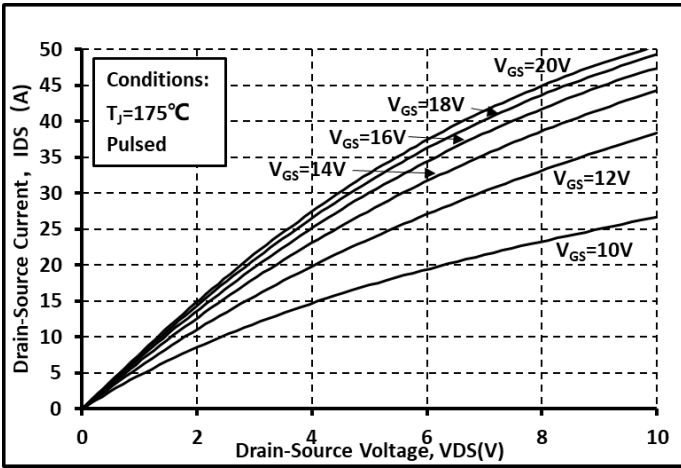


Fig. 3 Output Curve @ $T_j = 175^\circ\text{C}$

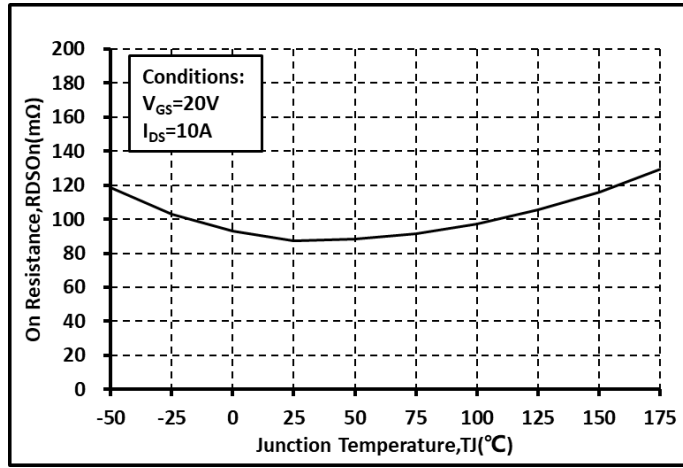


Fig. 4 Ron vs. Temperature

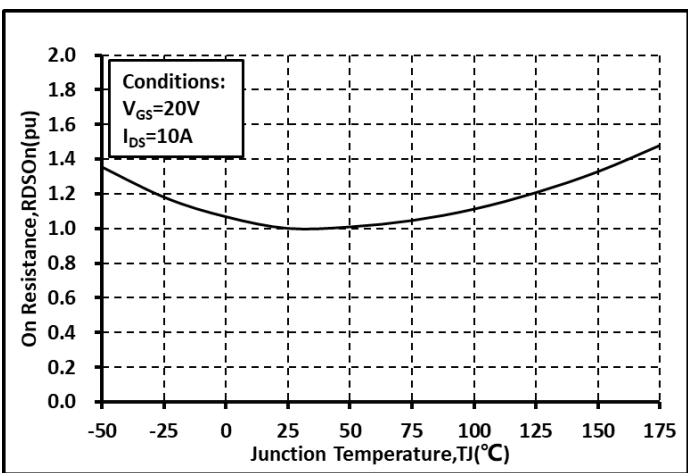


Fig. 5 Normalized Ron vs. Temperature

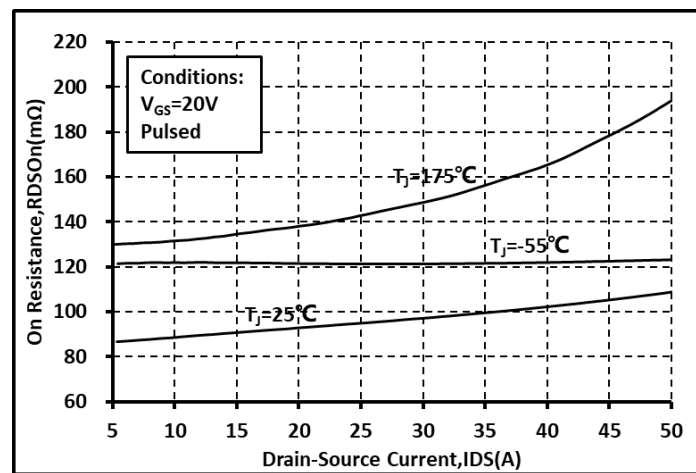


Fig. 6 Ron vs. I_{DS} @ Various Temperature

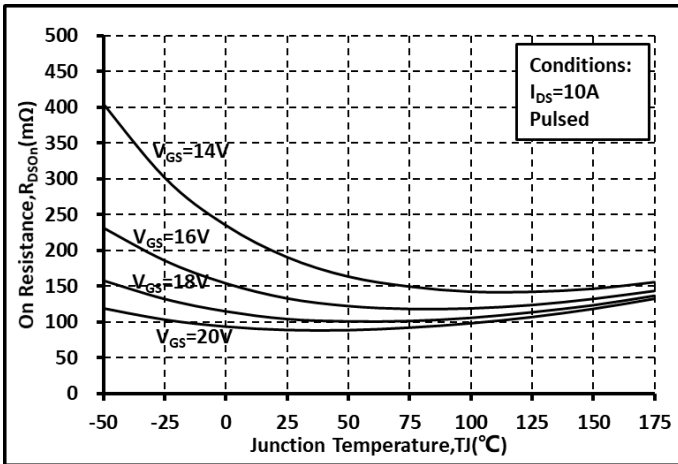


Fig. 7 Ron vs. Temperature @ Various V_{GS}

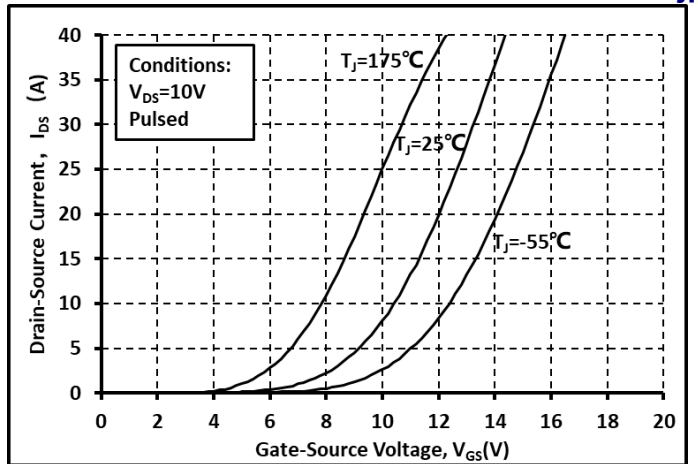


Fig. 8 Transfer Curves @ Various Temperature

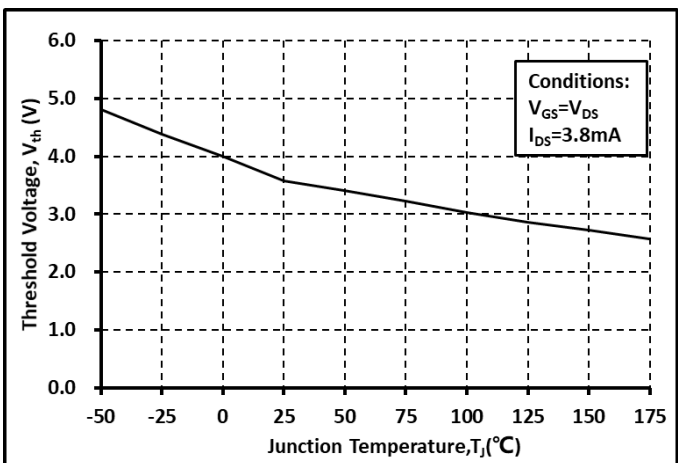


Fig. 9 Threshold Voltage vs. Temperature

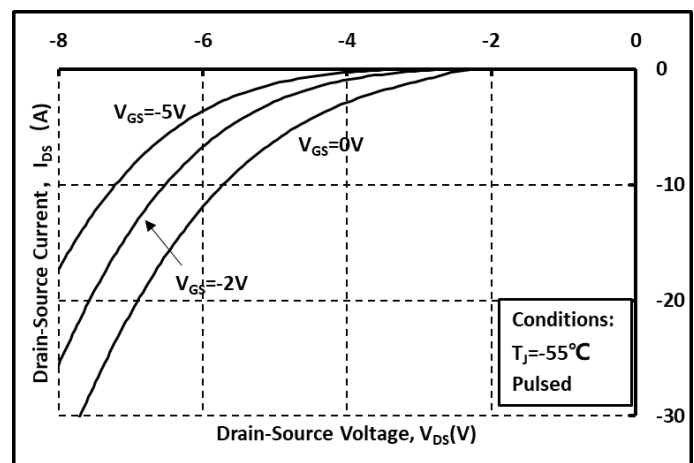


Fig. 10 Body Diode curves @ $T_J=-55^{\circ}C$

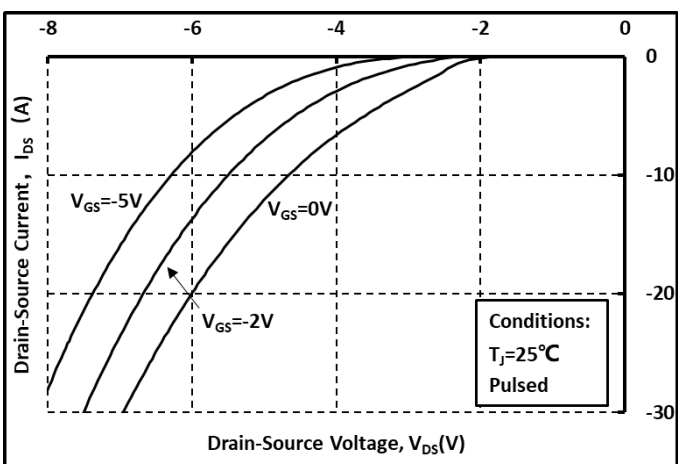


Fig. 11 Body Diode curves @ $T_J=25^{\circ}C$

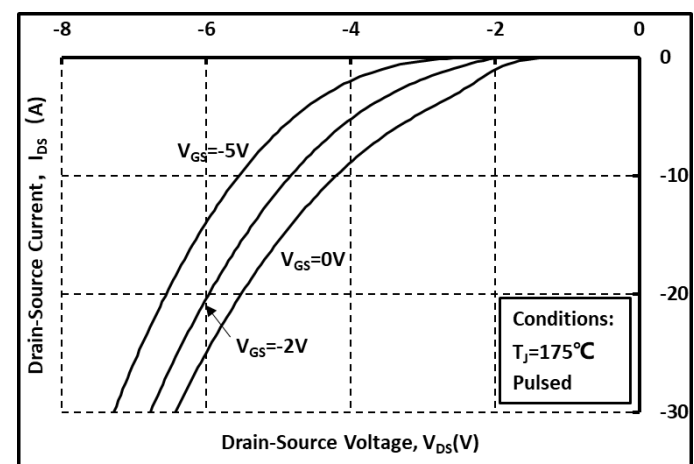


Fig. 12 Body Diode curves @ $T_J=175^{\circ}C$

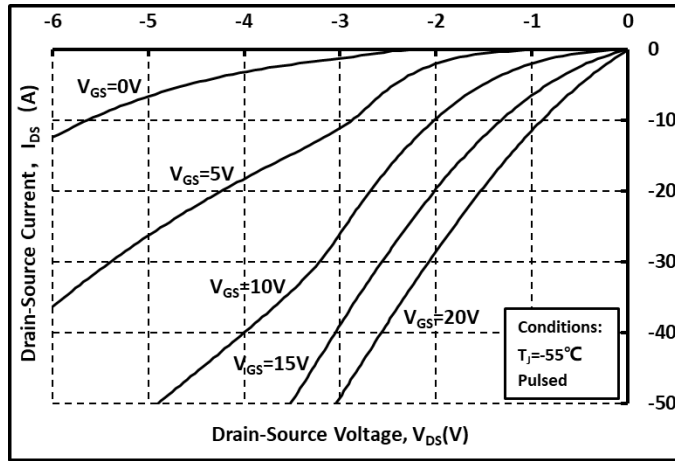


Fig. 13 3rd Quadrant curves @ $T_J = -55^\circ\text{C}$

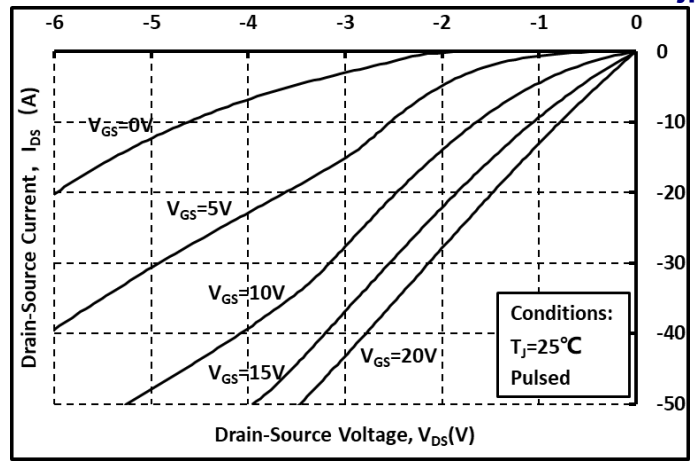


Fig. 14 3rd Quadrant curves @ $T_J = 25^\circ\text{C}$

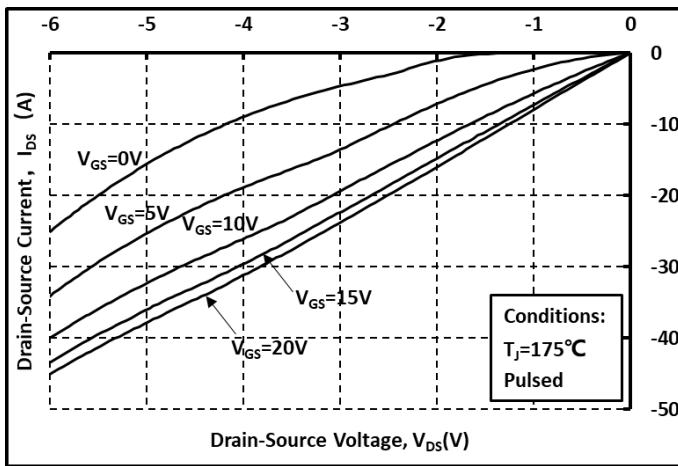


Fig. 15 3rd Quadrant curves @ $T_J = 175^\circ\text{C}$

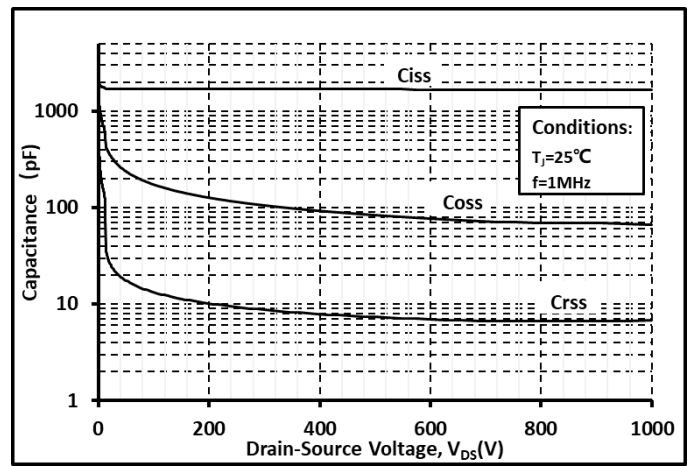


Fig. 16 Capacitance vs. V_{DS}

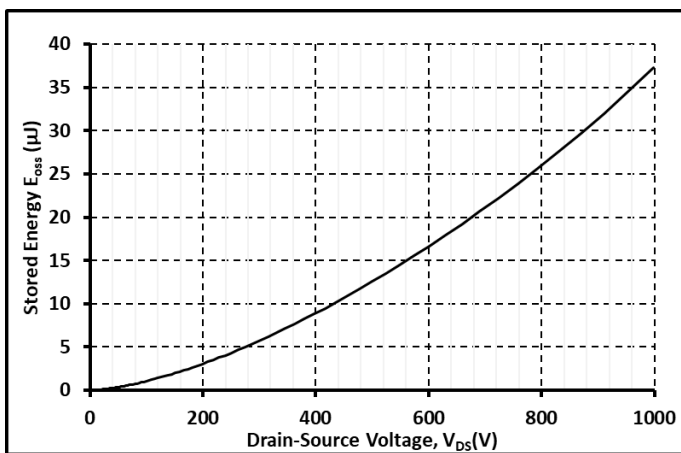


Fig. 17 Output Capacitor Stored Energy

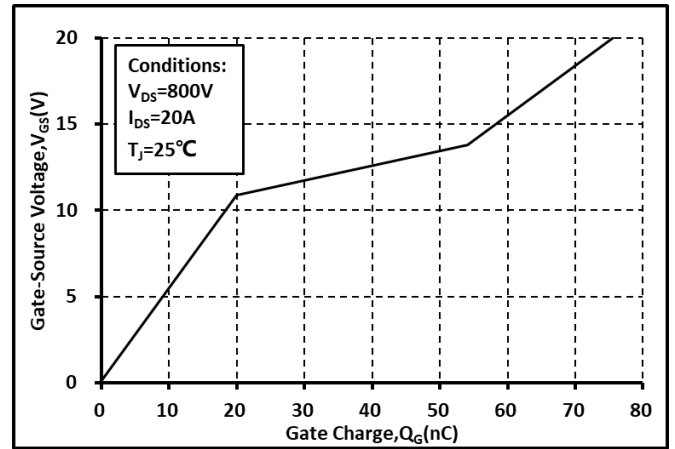


Fig. 18 Gate Charge Characteristics

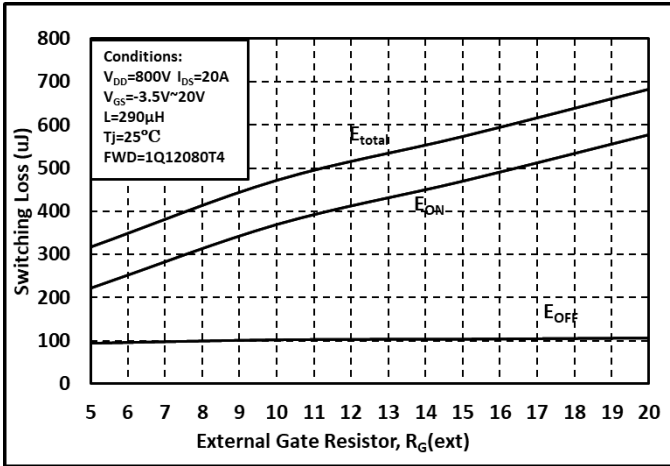


Fig. 19 Switching Energy vs. $R_{G(ext)}$

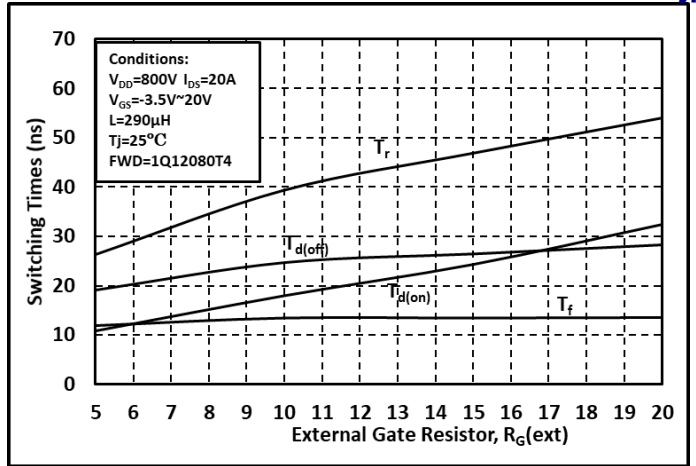


Fig. 20 Switching Times vs. $R_{G(ext)}$

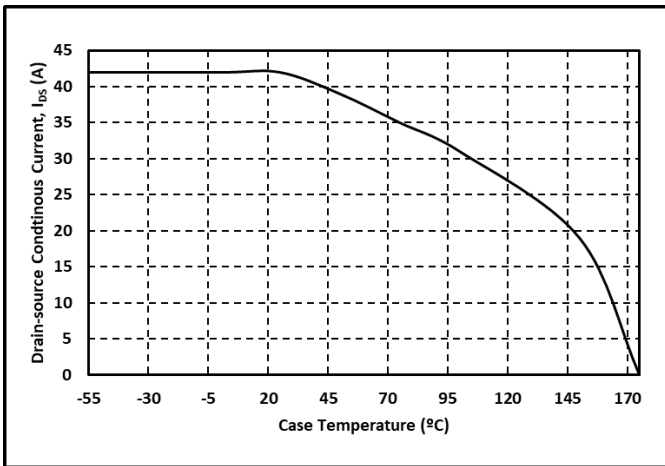


Fig. 21 Continuous Drain Current vs. Case Temperature

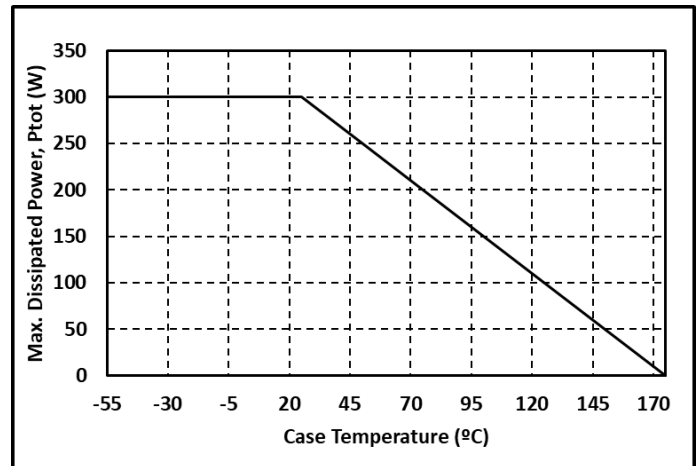


Fig. 22 Max. Power Dissipation Derating vs. Case Temperature

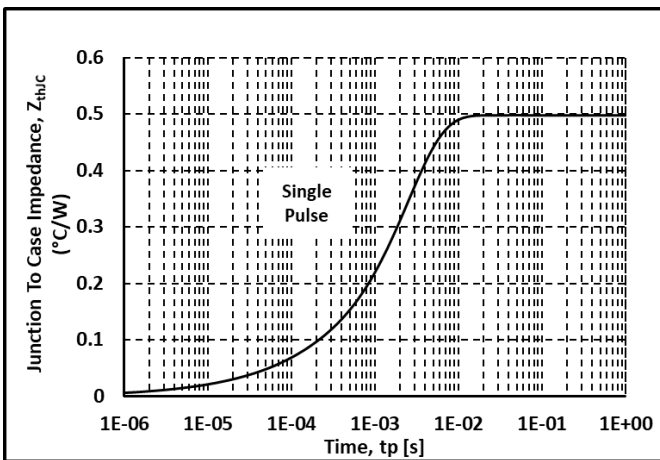


Fig. 23 Thermal impedance

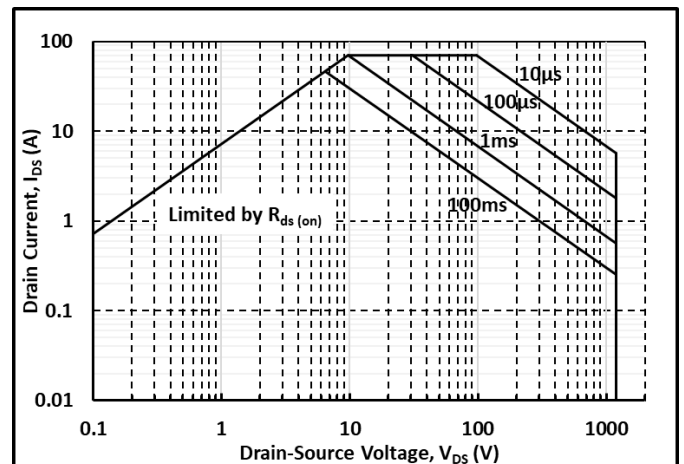
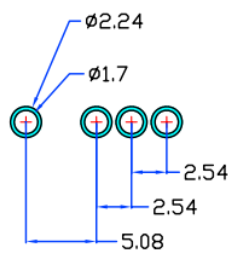
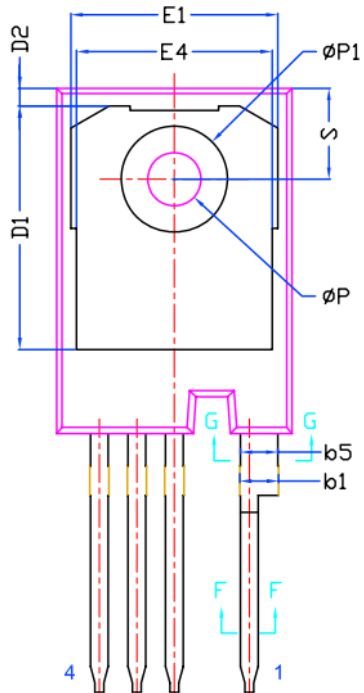
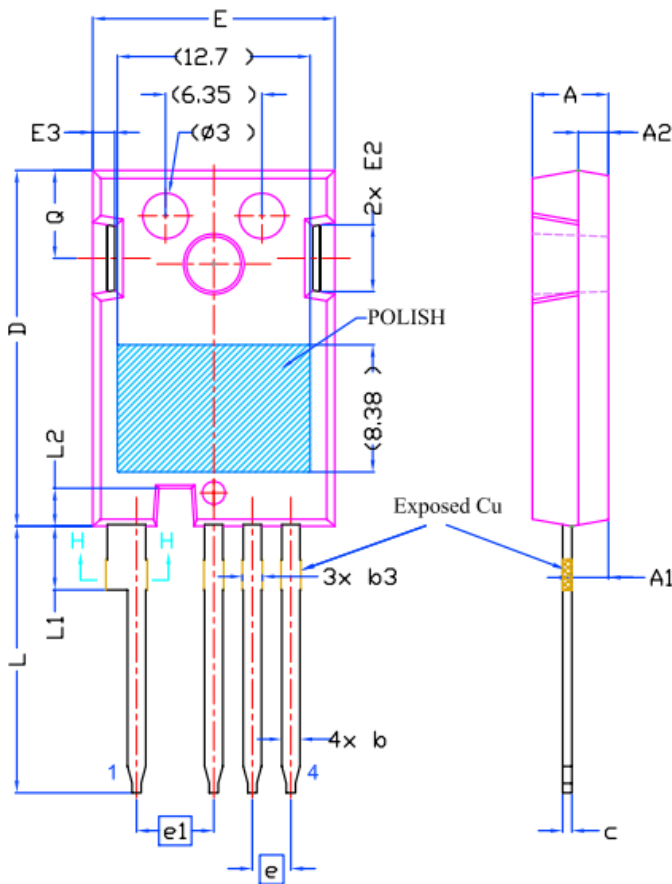


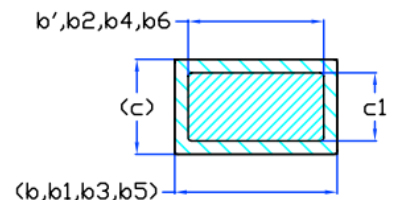
Fig. 24 Safe Operating Area

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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