

1700V N-Channel Silicon Carbide Power MOSFET

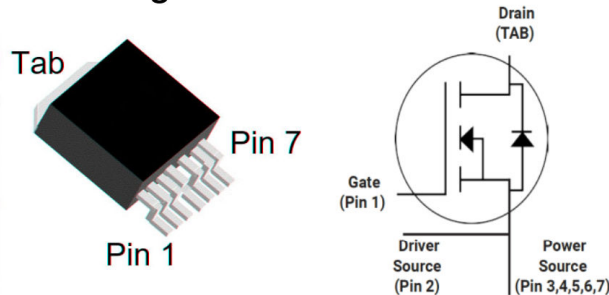
Features:

- Second-generation silicon carbide MOSFET technology
- Fast switching speed with low on-resistance
- Fast intrinsic diode with low reverse recovery (Q_{RR})
- Halogen-free, RoHS compliant
- AEC-Q101 Qualified for Automotive Applications

Applications:

- PFC
- EV battery charges
- High voltage DC/DC converters
- Booster converters
- Solar inverters

Package:



Part Number	Package
DTK063N170SC7	TO-263-7L

Absolute Maximum Ratings ($T_c=25^\circ\text{C}$ unless otherwise specified)

Symbol	Parameter	Value	Unit	Test Conditions
V_{DS}	Drain-Source voltage	1700	V	$V_{GS}=0\text{V}$, $I_D=100\mu\text{A}$
V_{GS}	Gate-Source voltage	-10 to 23	V	Duty cycle < 1%, pulse width < 200ns
V_{GSon}	Recommended turn-on voltage	15 to 18	V	
V_{GSoff}	Recommended turn-off voltage	-5 to -2	V	typical value -3.5V
I_D	Drain current (continuous)	6.3	A	$T_c=25^\circ\text{C}$
		4.8	A	$T_c=100^\circ\text{C}$
I_{DM}	Drain current (pulsed)	15.7	A	
P_{TOT}	Total power dissipation	73	W	$T_c=25^\circ\text{C}$
T_{stg}	Storage temperature range	-55 to 175	$^\circ\text{C}$	
T_J	Operating junction temperature	-55 to 175	$^\circ\text{C}$	

Thermal Data

Symbol	Parameter	Value	Unit
$R_{\theta(J-C)}$	Thermal Resistance from Junction to Case	2.05	$^\circ\text{C/W}$

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

Symbol	Parameter	Value			Unit	Test Conditions
		Min.	Typ.	Max.		
I_{DSS}	Zero gate voltage drain current		1	10	μA	$V_{DS}=1700\text{V}$, $V_{GS}=0\text{V}$
I_{GSS}	Gate leakage current			± 100	nA	$V_{DS}=0\text{V}$, $V_{GS}=-5\sim 20\text{V}$
V_{TH}	Gate threshold voltage	1.8	3.0	4.5	V	$V_{GS}=V_{DS}$, $I_D=380\mu\text{A}$
			2.0		V	$V_{GS}=18\text{V}$, $I_D=380\mu\text{A}$ @ $T_c=175^{\circ}\text{C}$
R_{ON}	Static drain-source on-resistance		700	910	$\text{m}\Omega$	$V_{GS}=18\text{V}$, $I_D=1\text{A}$ @ $T_c=25^{\circ}\text{C}$
			1280		$\text{m}\Omega$	$V_{GS}=18\text{V}$, $I_D=1\text{A}$ @ $T_c=175^{\circ}\text{C}$
C_{iss}	Input capacitance		285		pF	$V_{DS}=1000\text{V}$, $V_{GS}=0\text{V}$, $f=1\text{MHz}$, $V_{AC}=25\text{mV}$
C_{oss}	Output capacitance		15.3		pF	
C_{rss}	Reverse transfer capacitance		2.2		pF	
E_{oss}	C_{oss} stored energy		11		μJ	
Q_g	Total gate charge		16.5		nC	$V_{DS}=1000\text{V}$, $I_D=1\text{A}$, $V_{GS}=-5$ to 18V
Q_{gs}	Gate-source charge		2.7		nC	
Q_{gd}	Gate-drain charge		12.5		nC	
R_g	Gate input resistance		13		Ω	$f=1\text{MHz}$

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

Switching Characteristics						
Symbol	Parameter	Test Conditions	Min	Typ	Max	Units
T _{D(ON)}	Turn On Delay Time	V _{DD} = 1000 V , I _D = 2 A, V _{GS} = -3.5/+18 V, R _{G,EXT} = 10 Ω, L = 2330 μH T _J = 25 °C		4.8		ns
T _R	Rise Time			13.2		ns
T _{D(OFF)}	Turn Off Delay Time			12		ns
T _F	Fall Time			66.8		ns
E _{ON}	Turn On Energy			51		μJ
E _{OFF}	Turn Off Energy			17		μJ
E _{ON}	Turn On Energy	V _{DD} = 1000 V , I _D = 2 A, V _{GS} = -3.5/+18 V, R _{G,EXT} = 10 Ω, L = 2330 μH T _J = 175 °C		90		μJ
E _{OFF}	Turn Off Energy			22		μJ
Drain-Source Diode Characteristics (T _J = 25 °C unless otherwise noted)						
I _S	Maximum Continuous Drain-Source Diode Forward Current	V _{GS} = -2 V , T _J = 25 ° C			11.8	A
		V _{GS} = -2 V , T _J = 175 ° C			6.8	A
V _{SD}	Diode Forward Voltage	V _{GS} = 0 V , I _{SD} = 1 A		4		V
		V _{GS} = 0 V , I _{SD} = 1 A, T _J = 175 °C		3.8		V
I _{RM}	Peak Reverse Recovery Current	V _{GS} = -3.5/+18 V , I _{SD} = 2 A, V _R = 1000 V, di/dt = 5000 A/μS		8.2		A
T _{RR}	Reverse Recovery Time			20.6		ns
Q _{RR}	Reverse Recovery Charge			54.2		nC

Typical Performance (curves)

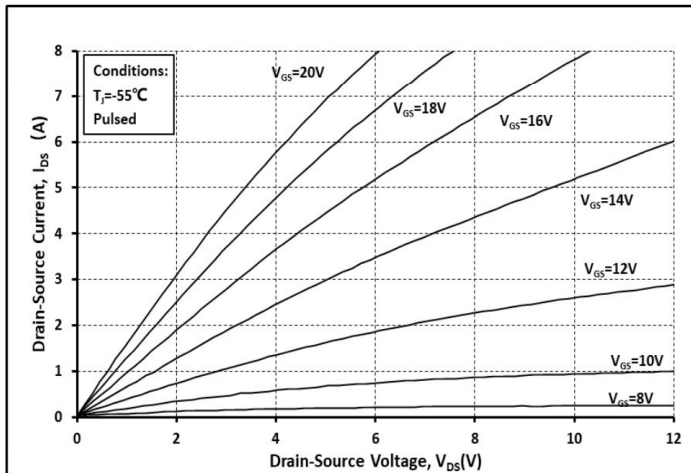


Fig.1 Output Curve @ $T_J = -55^\circ\text{C}$

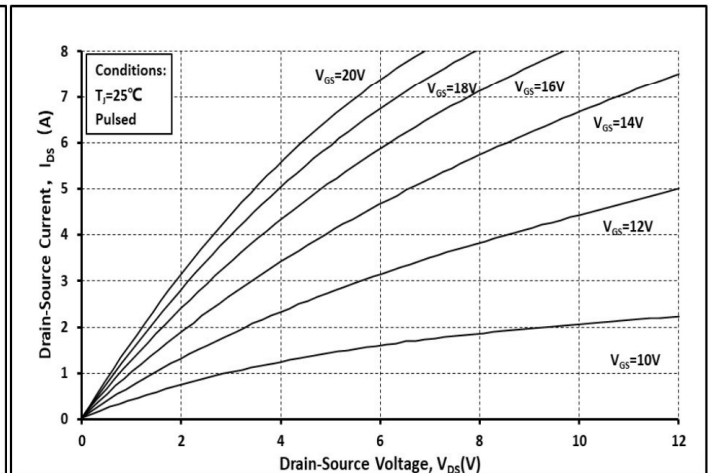


Fig.2 Output Curve @ $T_J = 25^\circ\text{C}$

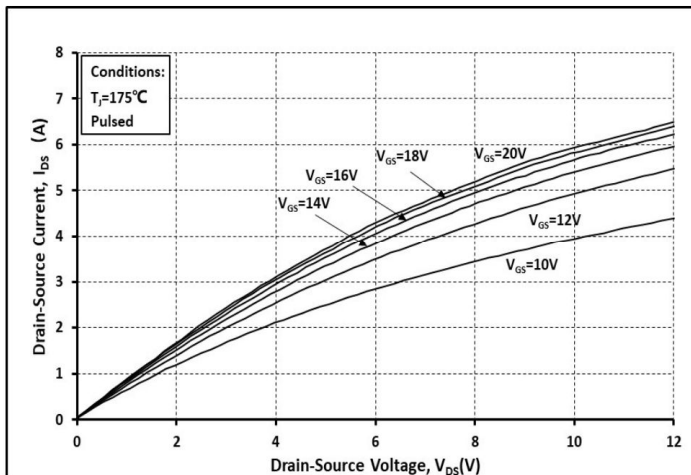


Fig.3 Output Curve @ $T_J = 175^\circ\text{C}$

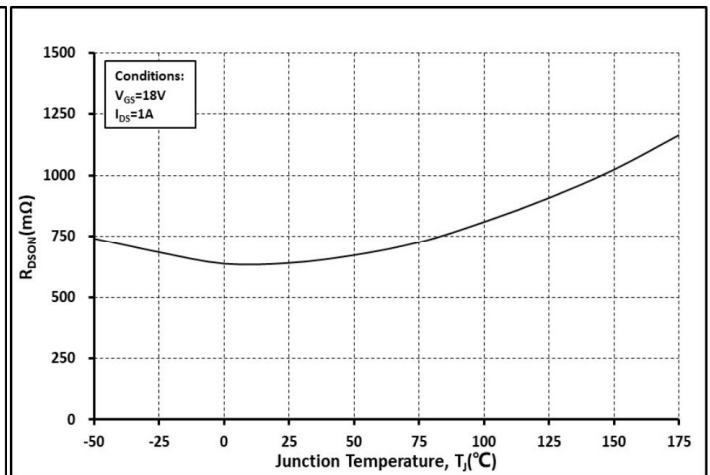


Fig.4 R_{on} vs. Temperature

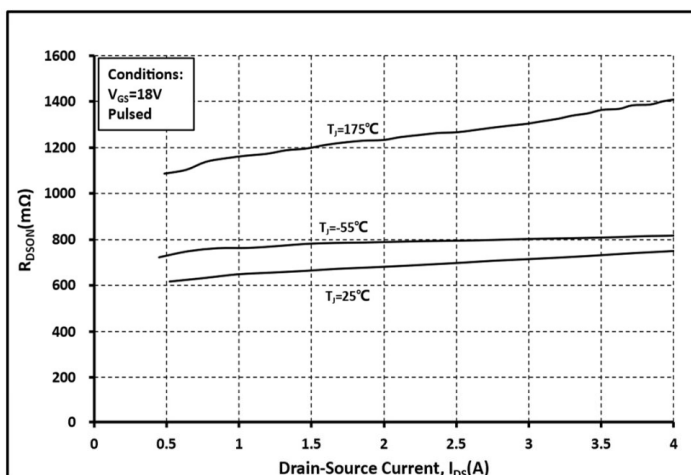


Fig.5 R_{on} vs. I_{DS} @ Various Temperature

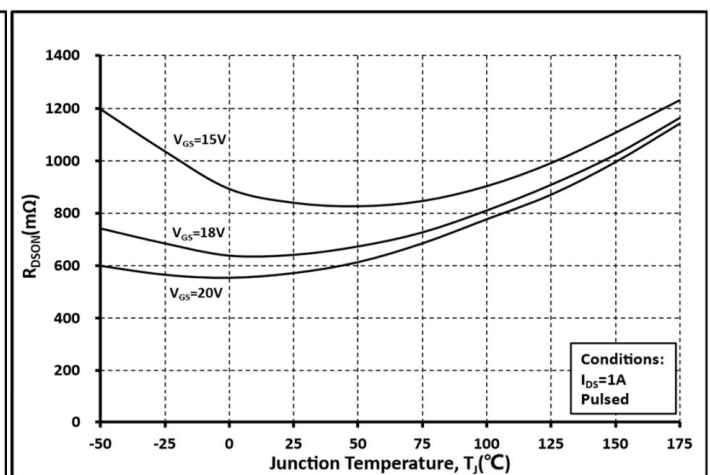


Fig.6 R_{on} vs. Temperature @ Various V_{GS}

Typical Performance (curves)

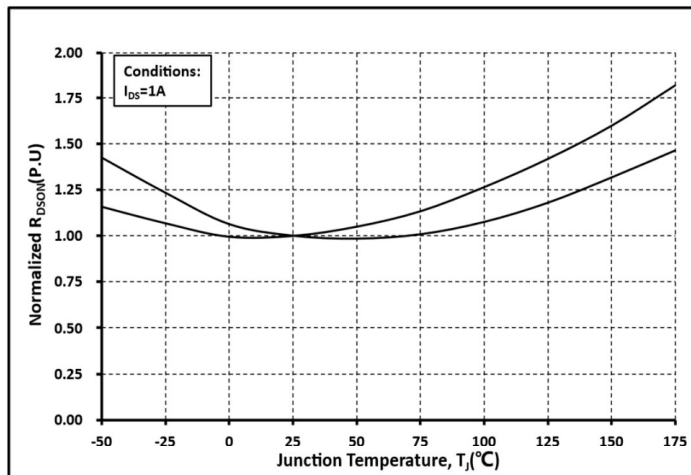


Fig.7 Normalized Ron vs. Temperature

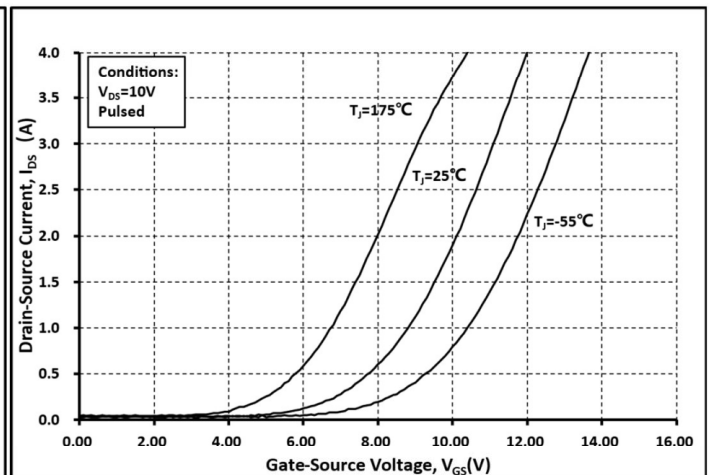


Fig.8 Transfer Curves @ Various Temperature

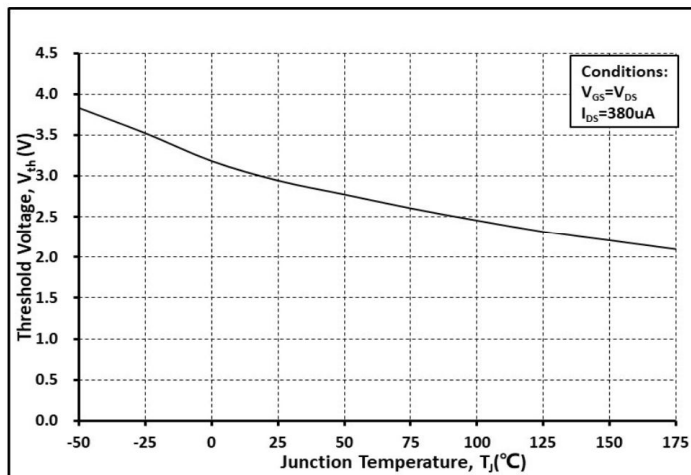


Fig.9 Threshold Voltage vs. Temperature

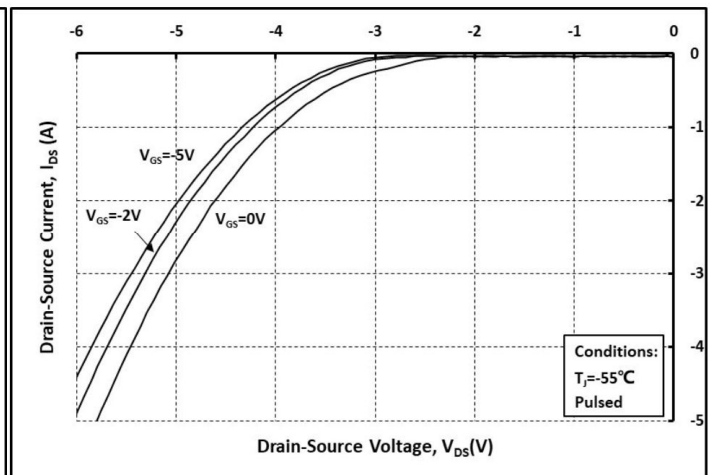


Fig.10 Body Diode Curves @ $T_J = -55^\circ\text{C}$

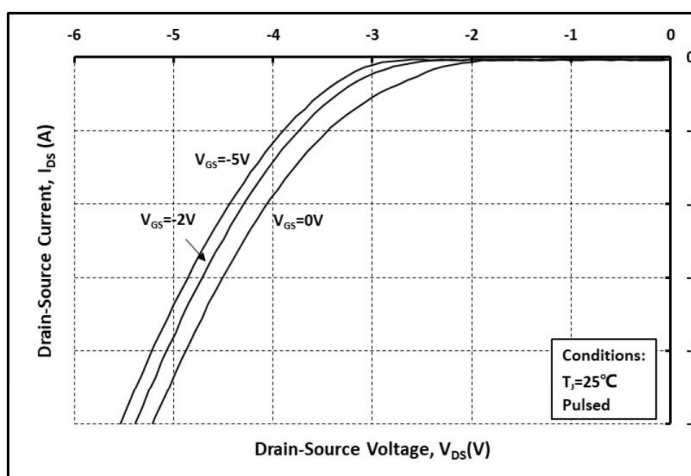


Fig.11 Body Diode Curves @ $T_J = 25^\circ\text{C}$

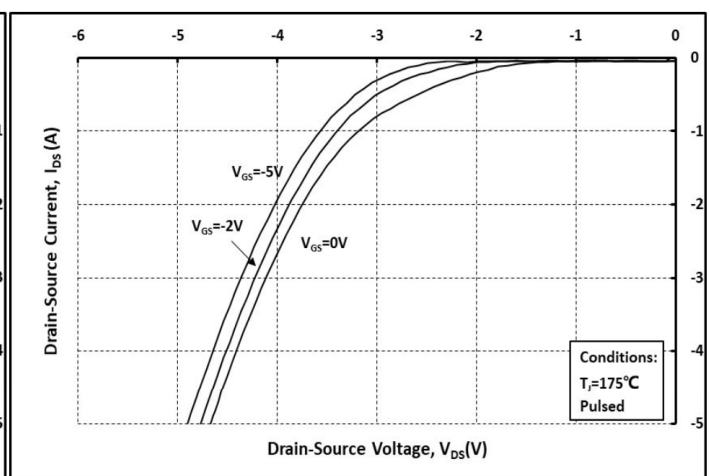


Fig.12 Body Diode Curves @ $T_J = 175^\circ\text{C}$

Typical Performance (curves)

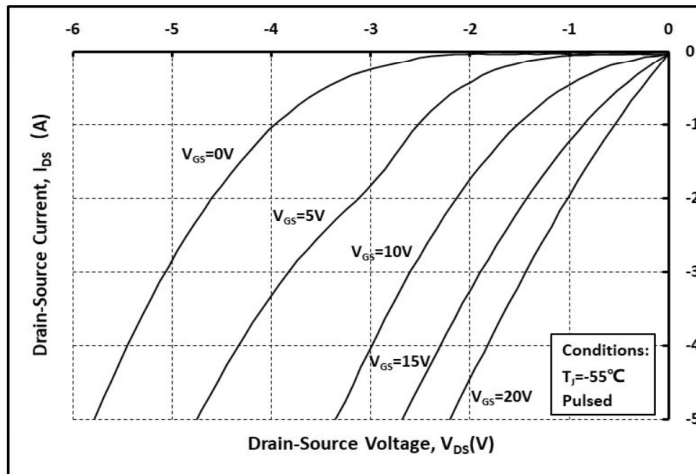


Fig.13 3rd Quadrant Curves @ $T_J = -55^\circ\text{C}$

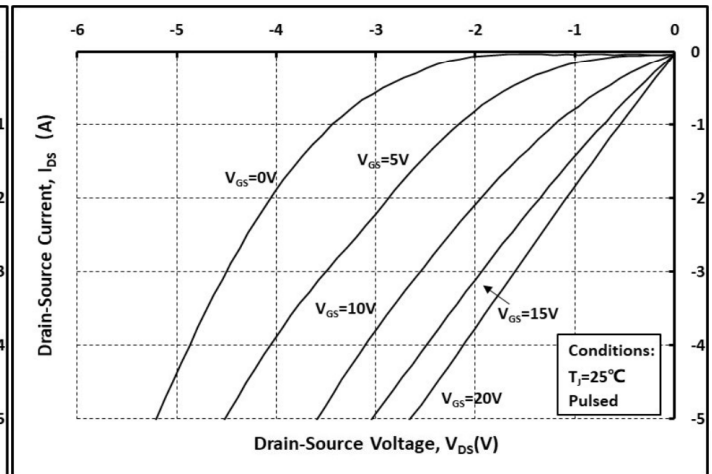


Fig.14 3rd Quadrant Curves @ $T_J = 25^\circ\text{C}$

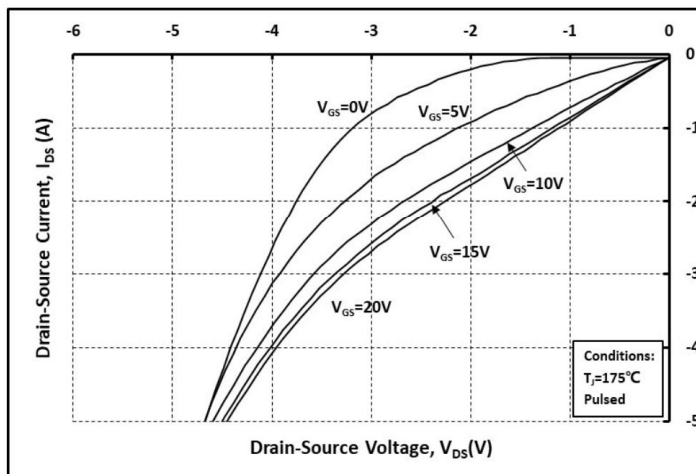


Fig.15 3rd Quadrant Curves @ $T_J = 175^\circ\text{C}$

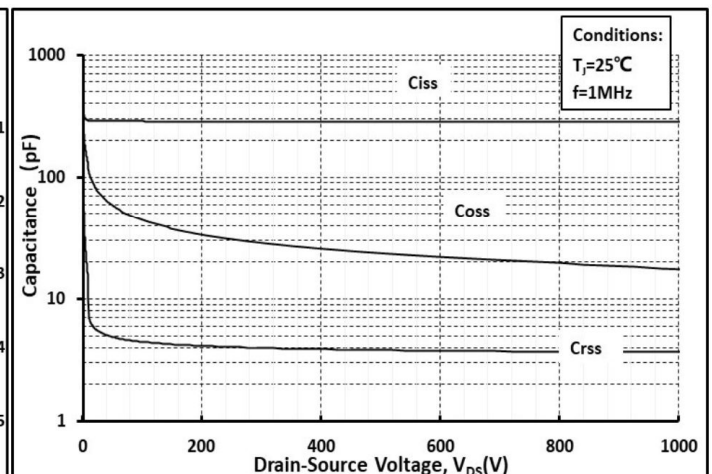


Fig.16 Capacitance vs. V_{DS}

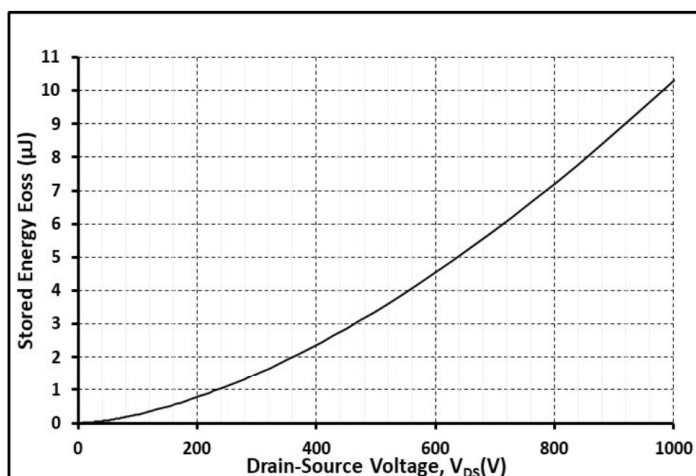


Fig.17 Output Capacitor Stored Energy

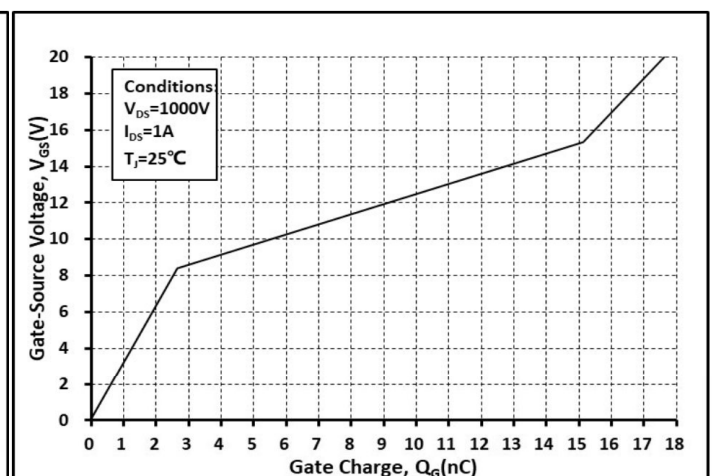


Fig. 18 Gate Charge Characteristics

Typical Performance (curves)

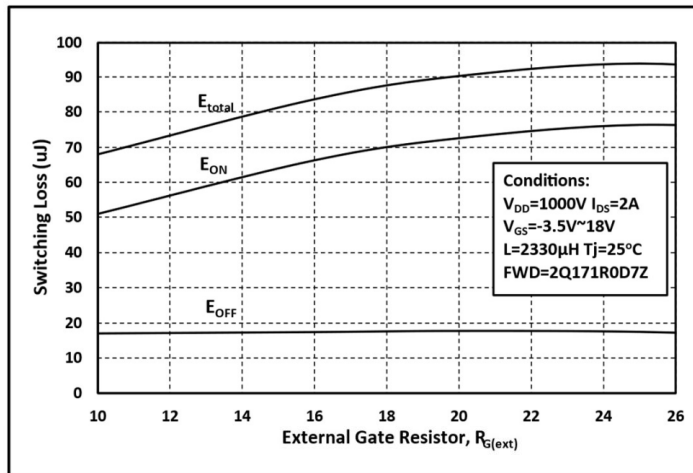


Fig.19 Switching Energy vs. $R_{G(ext)}$

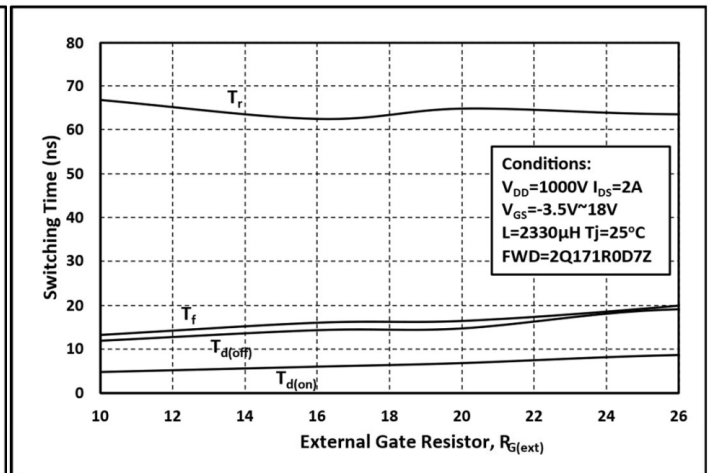


Fig.20 Switching Times vs. $R_{G(ext)}$

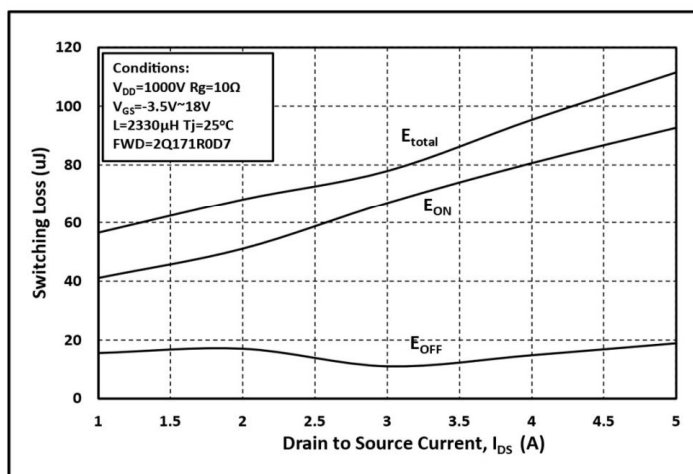


Fig.21 Switching Energy vs. Drain current

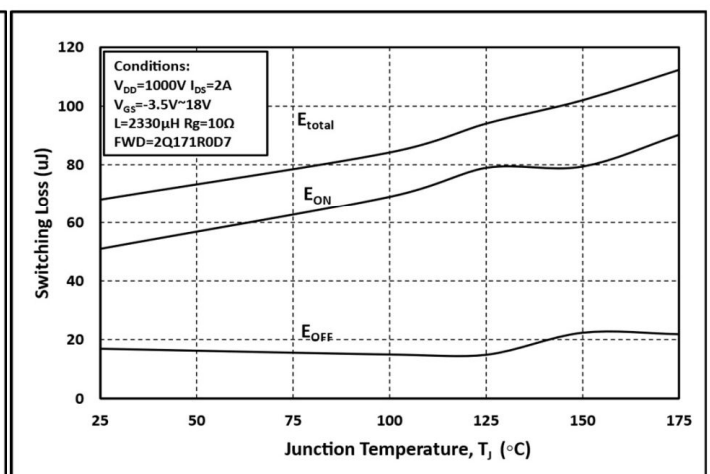


Fig.22 Switching Energy vs. Temperature

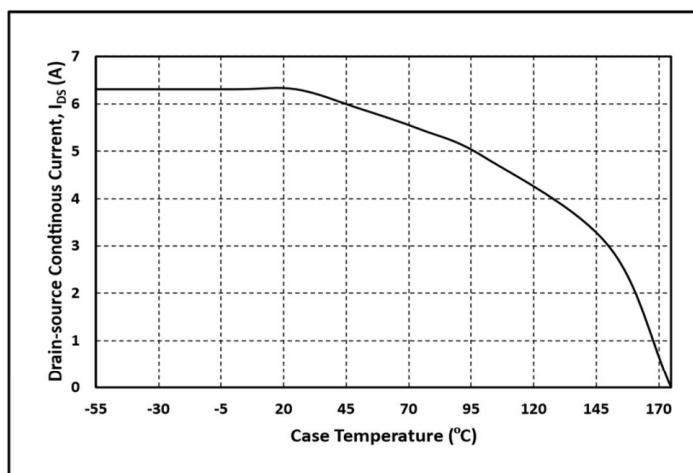


Fig.23 Continuous Drain Current vs. Case Temperature

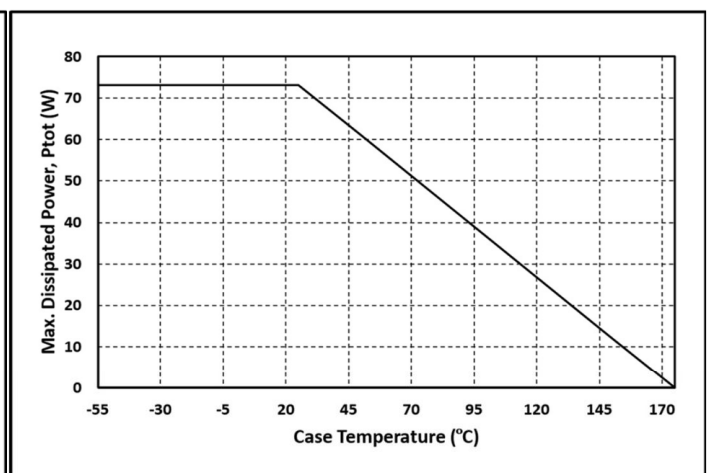


Fig.24 Max. Power Dissipation Derating vs. Case Temperature

Typical Performance (curves)

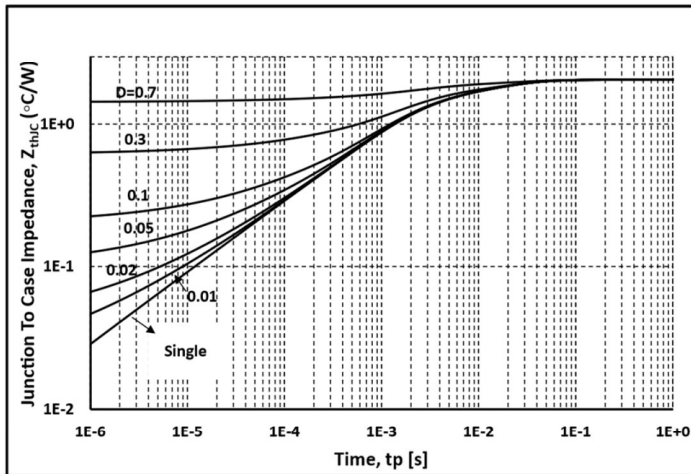


Fig.25 Thermal Impedance

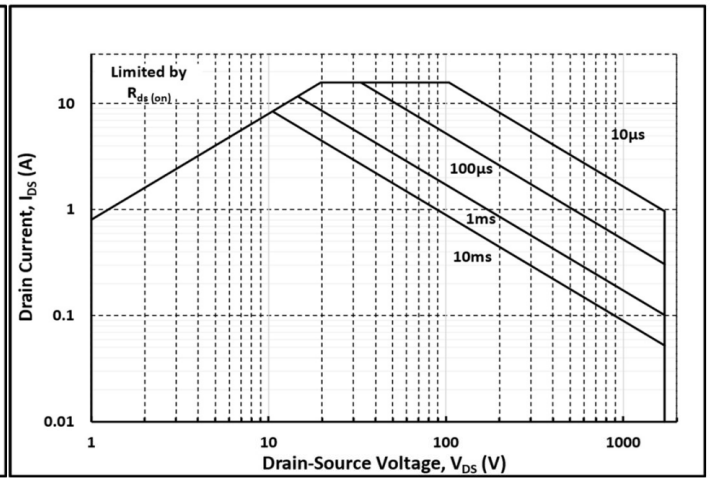


Fig. 26 Safe Operating Area

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