

1200V 65A N-Channel SIC 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

MECHANICAL DATA

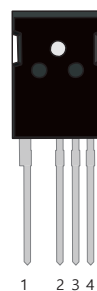
- Case: TO-247-4L Package

APPLICATIONS

- Motor drivers
- Solar inverters
- Automotive DC/DC converters
- Automotive compressor inverters
- Switch mode power supplies

Product Summary			
V _{DS}	R _{DS(on)} (mΩ) Typ	I _D (A)	Q _g (Typ)
1200V	40 @ 18V 20A	65	110nc

TO-247-4L



Block Diagram

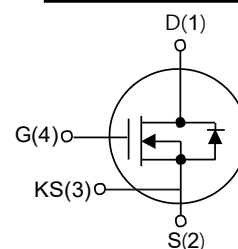


Table1 Absolute Maximum Ratings (T_C=25°C, unless otherwise specified)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V _{DS}	1200	V
Gate-Source Voltage(Max)	V _{GS(DC)}	-5/+20	V
Gate-Source Voltage(Max)	V _{GS (Spike)}	-10/+23	V
Continuous Drain Current	I _D	T _C =25°C	65
		T _C =100°C	48
Pulsed Drain Current (Note 1)	I _{DM}	162	A
Recommended turn-on voltage	V _{GSon}	18±0.5	V
Recommended turn-off voltage	V _{GSoff}	-3.5/-2	V
Power Dissipation T _C =25°C	P _D	417	W
Operating Junction and Storage Temperature	T _J /T _{STG}	-55 ~ +175	°C

Table 2. Thermal Characteristics

Parameter	Symbol	KWSC40N120P4	Unit
Thermal resistance Junction to Case	R _{θJC}	0.36	°C/W

Table 3. Electrical Characteristics ($T_J=25^{\circ}\text{C}$, unless otherwise specified)

Parameter		Symbol	Test Conditions	Min	Typ	Max	Unit
Off Characteristics							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V,I _D =100μA	1200	-	-	V
Drain-Source Leakage Current		I _{DSS}	V _{DS} =1200V,V _{GS} =0V	-	5	100	μA
Gate- Source Leakage Current	Forward	I _{GSS}	V _{GS} =20V,V _{DS} =0V	-	-	100	nA
	Reverse		V _{GS} =-5V,V _{DS} =0V	-	-	-100	nA
On Characteristics							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} =V _{GS} ,I _D =9mA	1.8	2.8	4.5	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} =18V,I _D =20A,T _J =25°C	-	40	52	mΩ
			V _{GS} =18V,I _D =20A,T _J =175°C	-	75	-	
Gate Resisitance		R _G	f=1MHz	-	2.1	-	Ω
Dynamic Characteristics							
Input Capacitance		C _{ISS}	V _{DS} =800V,V _{GS} =0V, f=1MHz,V _{AC} =25mV	-	2160	-	pF
Output Capacitance		C _{OSS}		-	100	-	pF
Reverse Transfer Capacitance		C _{RSS}		-	5.8	-	pF
Coss stored energy		E _{OSS}		-	40	-	μJ
Turn-on switching energy		E _{ON}	V _{DS} =800V,I _D =30A V _{GS} =-3.5/18V,R _G =3.3Ω, L=200μH,T _J =25°C	-	446.3	-	μJ
Turn-off switching energy		E _{OFF}		-	70	-	μJ
Turn-On Delay Time		td(on)		-	9.6	-	ns
Turn-On Rise Time		tr		-	22.1	-	ns
Turn-Off Delay Time		td(off)		-	19.3	-	ns
Turn-Off Fall Time		tf		-	10.5	-	ns
Total Gate Charge		Q _G	V _{DD} =800V,I _D =30A, V _{GS} =-3/18V	-	110	-	nC
Gate-Source Charge		Q _{GS}		-	25	-	nC
Gate-Drain Charge		Q _{GD}		-	59	-	nC
Drain-Source Diode Characteristics and Maximum Ratings(Note 2)							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =0V,I _S =20A	-	4.2	-	V
Reverse Recovery Time		trr	V _{GS} =-3.5V/+18V, VR=800V, R _{G(ext)} =10Ω L=200μH I _{SD} =30A,diF/dt=3000A/μs	-	42	-	ns
Recovered charge		Qrr		-	198.1	-	nC
Peak reverse recovery current		Irrm		-	17.4	-	A

Notes: 1 Repetitive Rating Pulse width limited by maximum junction temperature

2 Pulse Test: Pulse width $\leq 300\mu s$, Duty cycles $\leq 2\%$

Typical Characteristics Diagrams

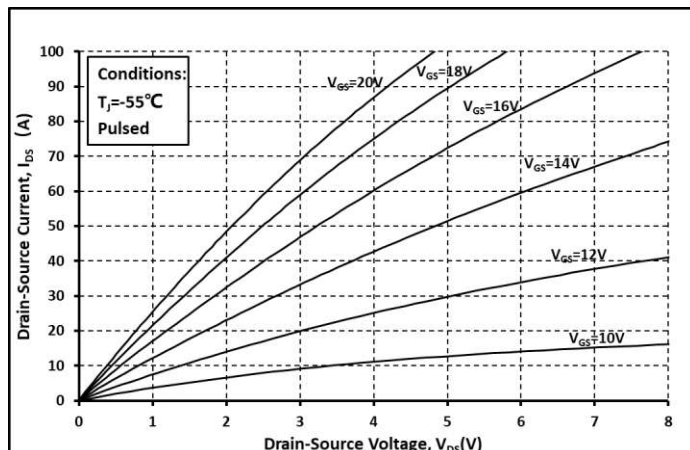


Fig. 1 Output Curve @ $T_j = -55^\circ\text{C}$

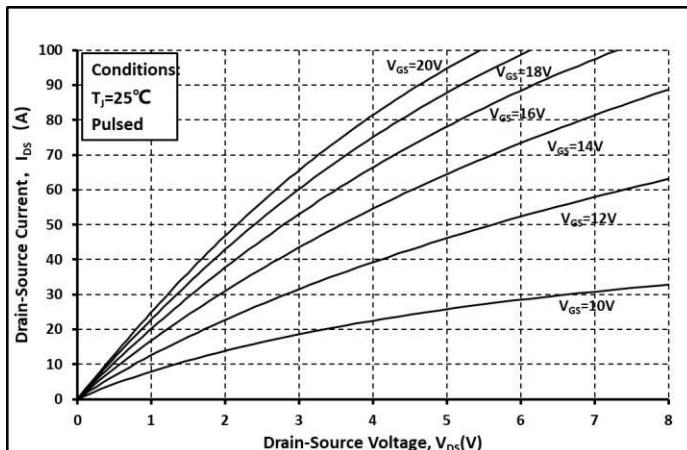


Fig. 2 Output Curve @ $T_j = 25^\circ\text{C}$

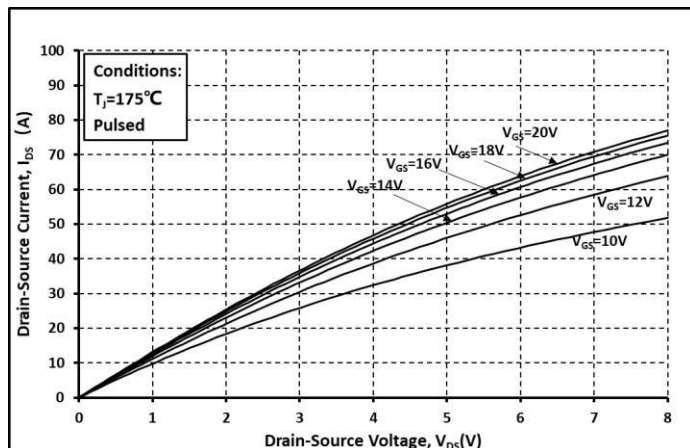


Fig. 3 Output Curve @ $T_j = 175^\circ\text{C}$

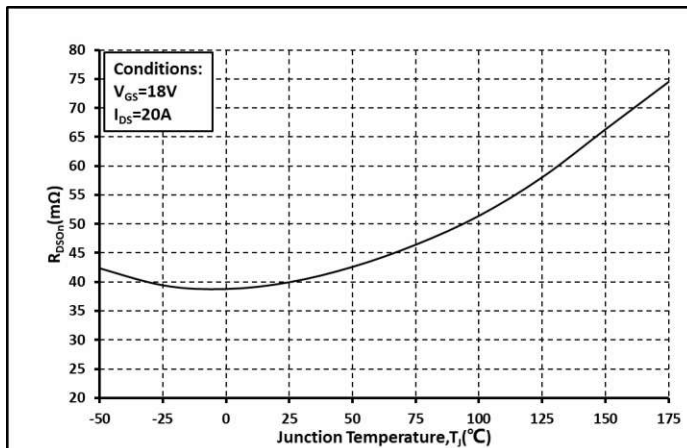


Fig. 4 R_{on} vs. Temperature

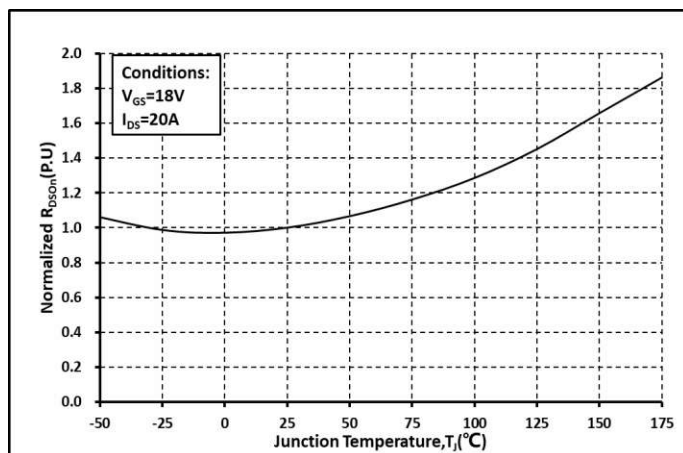


Fig. 5 Normalized R_{on} vs. Temperature

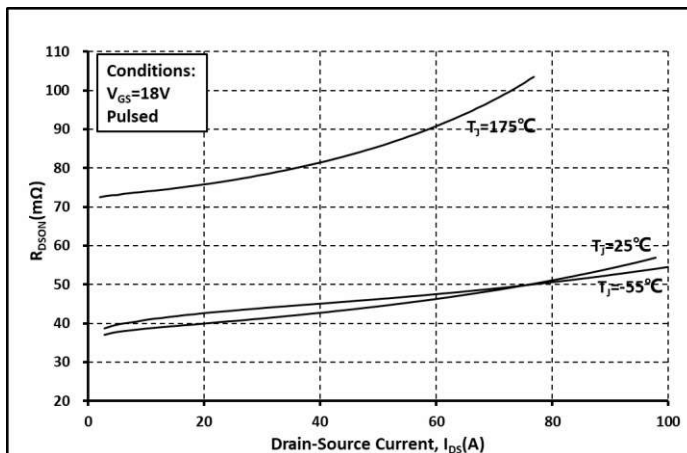


Fig. 6 R_{on} vs. I_{DS} @ Various Temperature

Typical Characteristics Diagrams

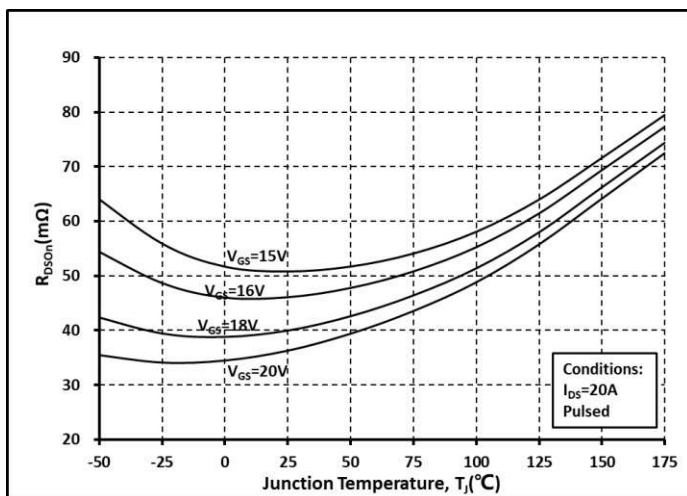


Fig. 7 R_{on} vs. Temperature @ Various V_{GS}

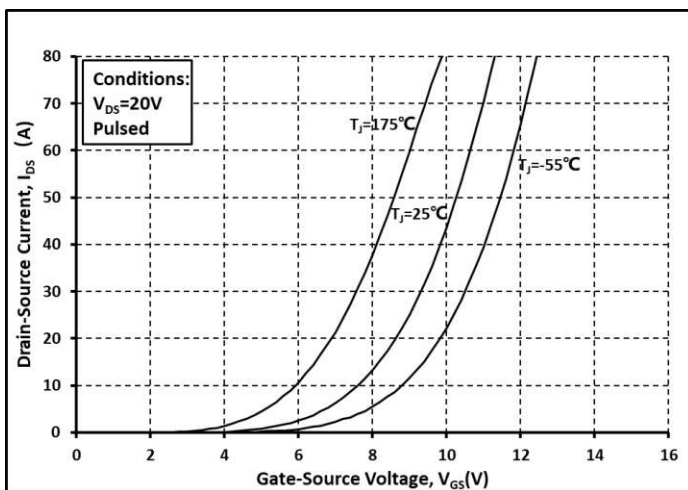


Fig. 8 Transfer Curves @ Various Temperature

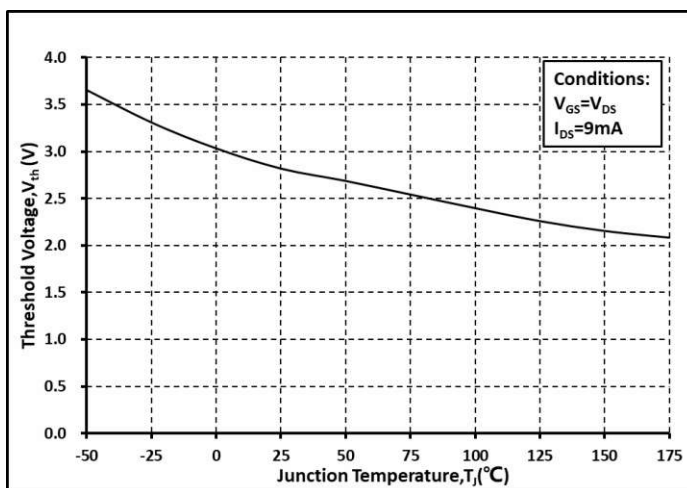


Fig. 9 Threshold Voltage vs. Temperature

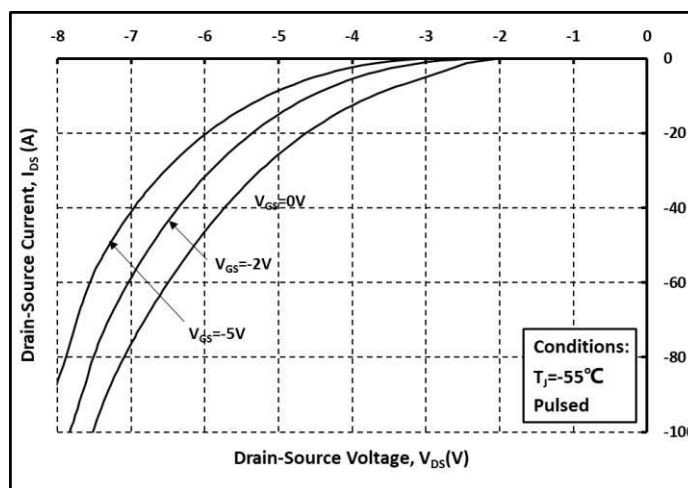


Fig. 10 Body Diode curves @ $T_J = -55°C$

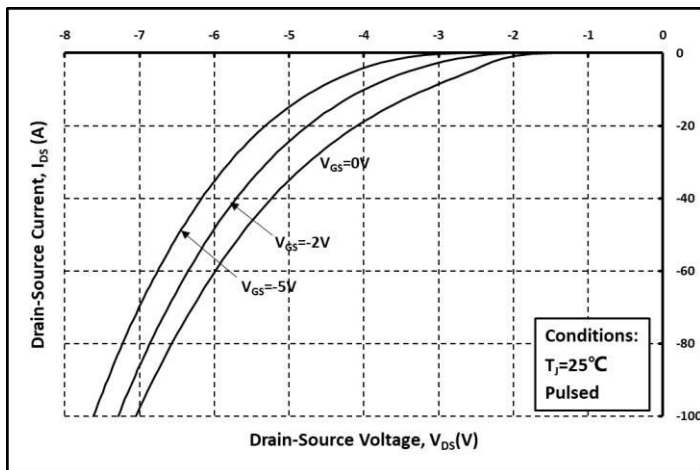


Fig. 11 Body Diode curves @ $T_J = 25°C$

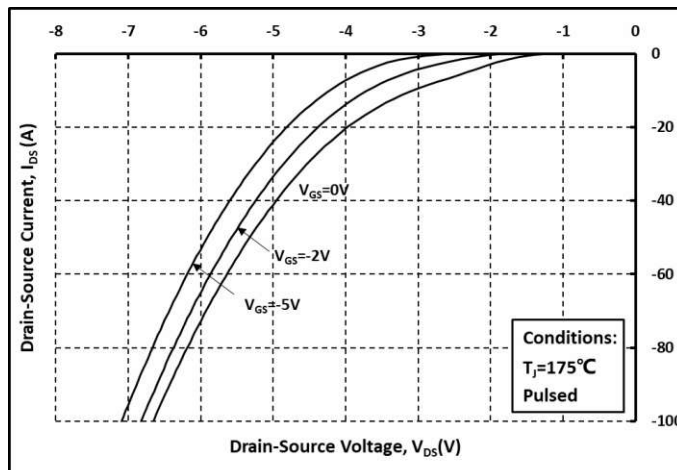


Fig. 12 Body Diode curves @ $T_J = 175°C$

Typical Characteristics Diagrams

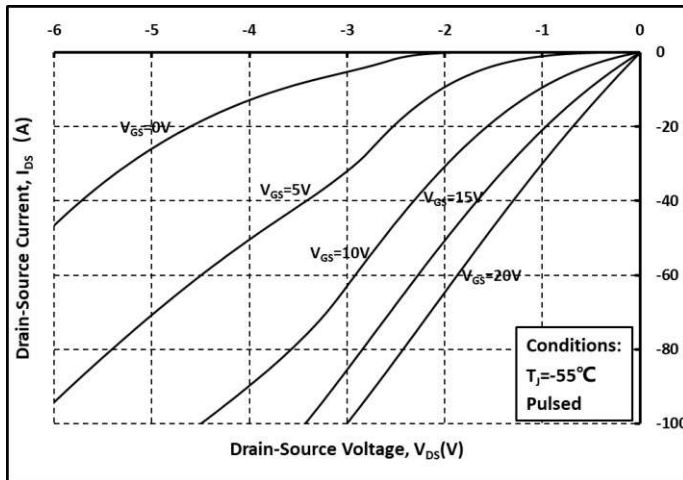


Fig. 13 3rd Quadrant curves @ $T = -55^\circ\text{C}$

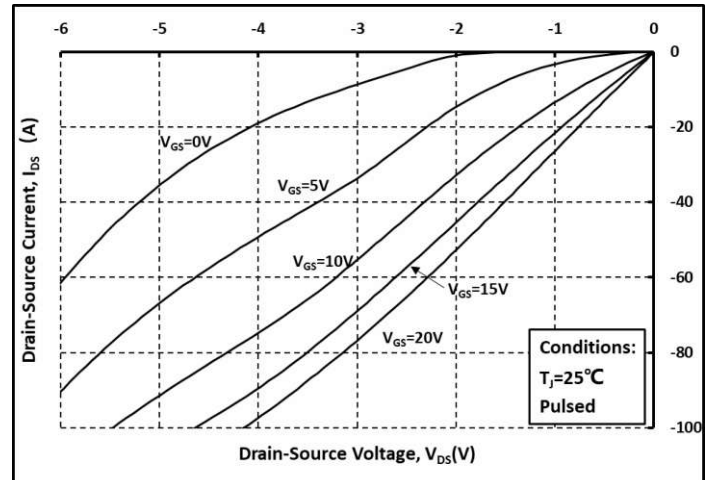


Fig. 14 3rd Quadrant curves @ $T = 25^\circ\text{C}$

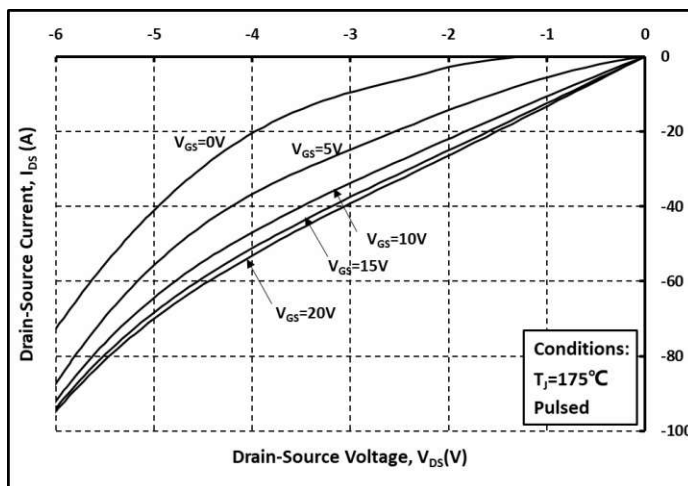


Fig. 15 3rd Quadrant curves @ $T = 175^\circ\text{C}$

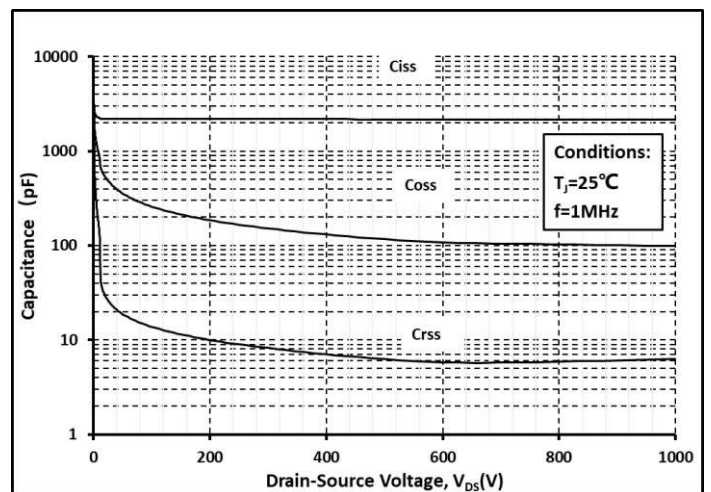


Fig. 16 Capacitance vs. V_{DS}

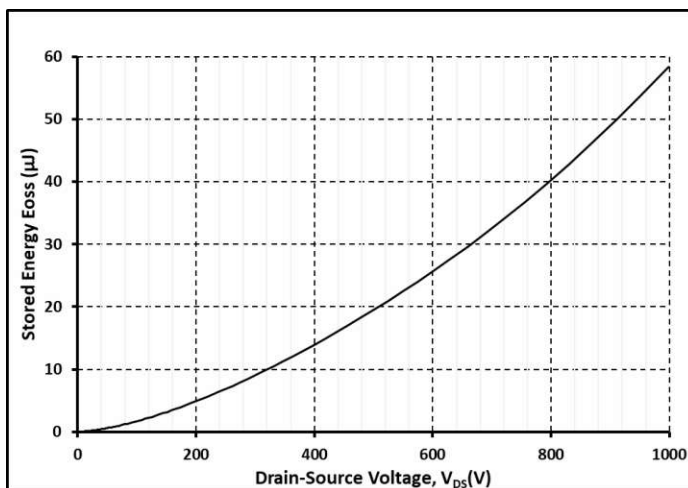


Fig. 17 Output Capacitor Stored Energy

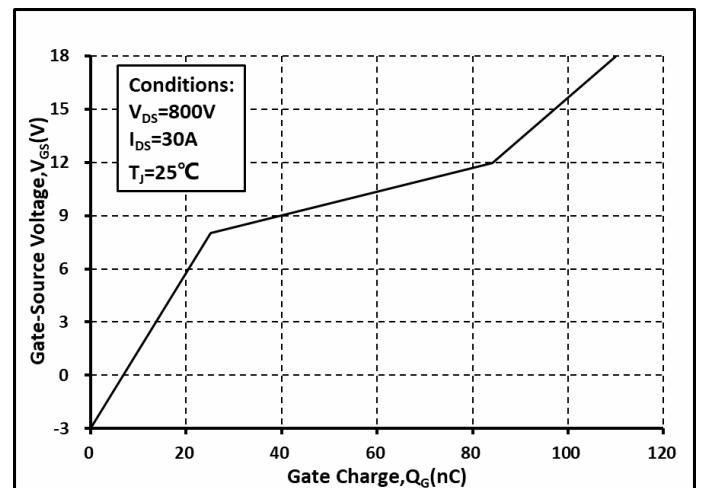


Fig. 18 Gate Charge Characteristics

Typical Characteristics Diagrams

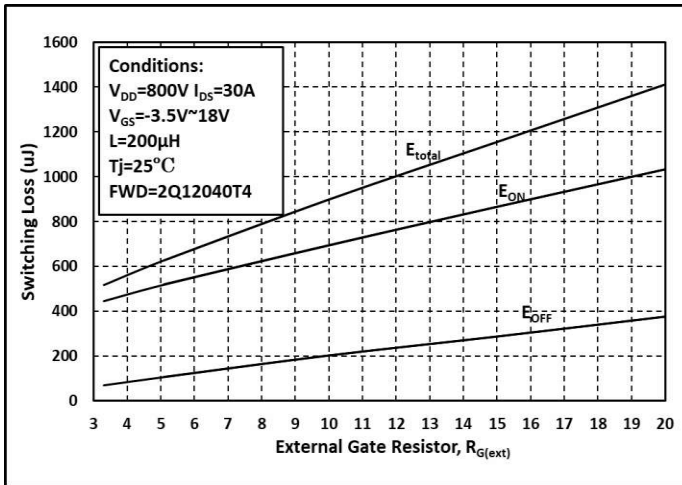


Fig. 19 Switching Energy vs. $R_{G(ext)}$

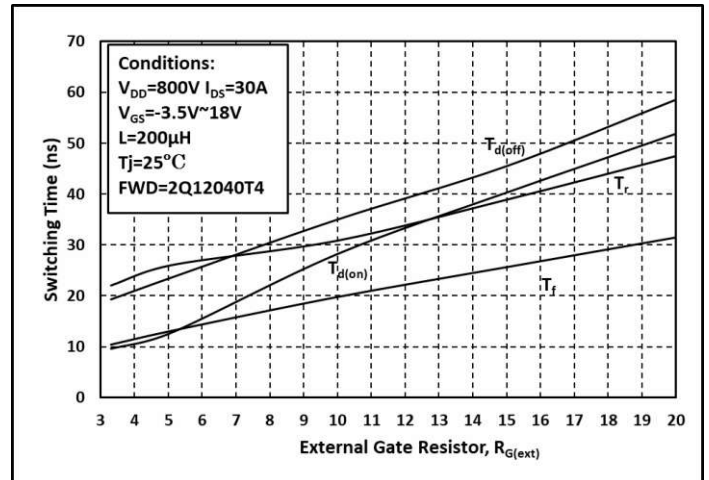


Fig. 20 Switching Times vs. $R_{G(ext)}$

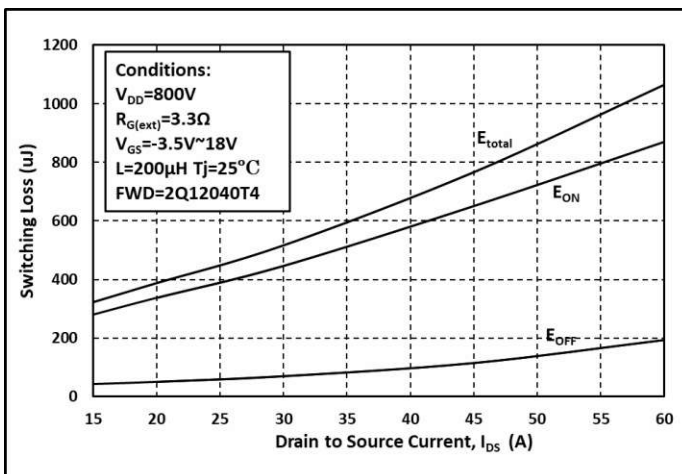


Fig. 21 Switching Energy vs. I_{DS}

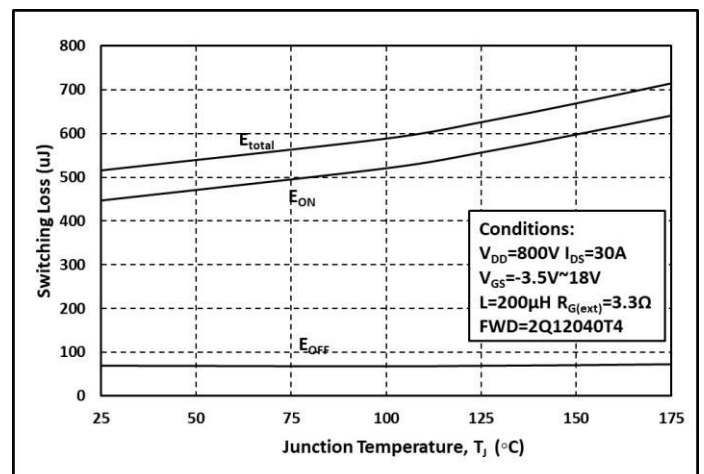


Fig. 22 Switching Energy vs. Temperature

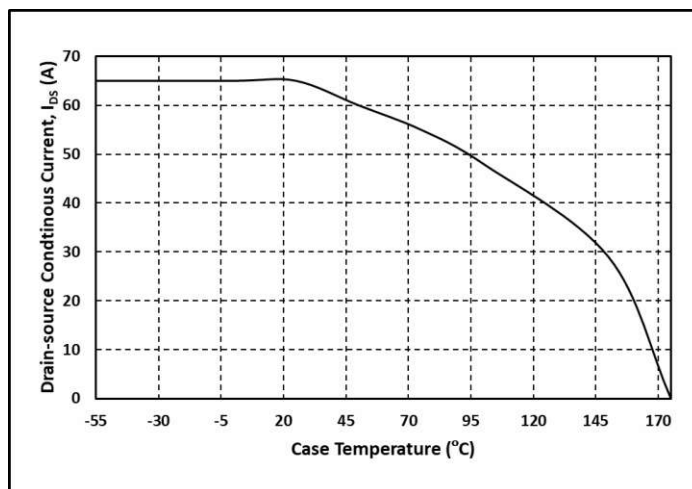


Fig. 23 Continuous Drain Current vs. Case Temperature

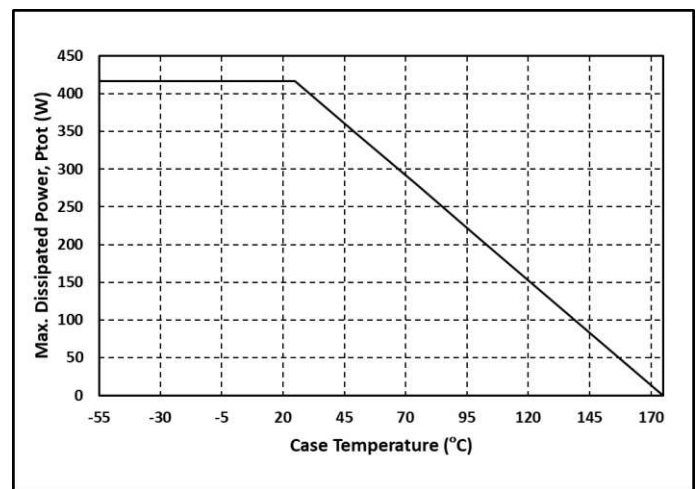


Fig. 24 Max. Power Dissipation Derating vs. Case Temperature

Typical Characteristics Diagrams

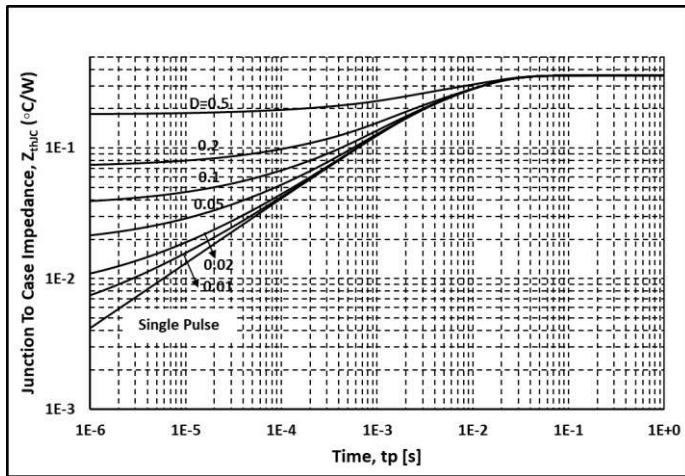


Fig. 25 Thermal impedance

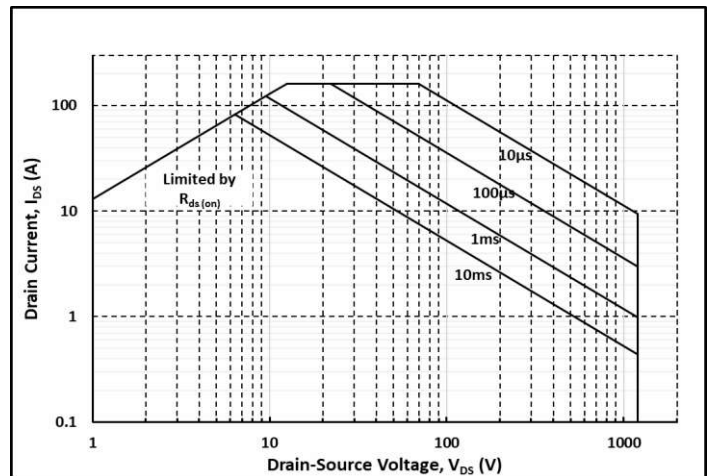


Fig. 26 Safe Operating Area

Dimensions

TO-247-4L package

