

1200V 30A 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

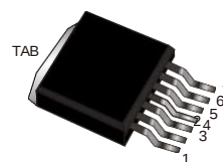
Mechanical Data

- Case: TO-263-7L Package

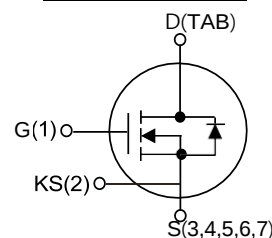
Application

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

TO-263-7L



Block Diagram



Product Summary			
V _{DS}	R _{DS(on)} (mΩ) Typ	I _D (A)	Q _g (Typ)
1200V	80 @ 20V 20A	30	48nc

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(max)}	-10/+25	V
Recommend Gate-Source Voltage	V _{GSop}	-5/+20	V
Continuous Drain Current	I _D	T _C =25°C	30
		T _C =100°C	19.7
Pulsed Drain Current (Note 1)	I _{DM}	80	A
Power Dissipation	P _D	T _C =25°C	113.6
Operating Junction and Storage Temperature	T _J /T _{STG}	-55 ~ +150	°C

Table 2. Thermal Characteristics

Parameter	Symbol	KWSC80N120D7L	Unit
Thermal resistance Junction to Case	R _{θJC}	1.1	°C/W
Thermal resistance Junction to Ambient	R _{θJA}	40	°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	-	1	100	μA
Gate- Source Leakage Current	Forward	I _{GSS}	V _{GS} =20V, V _{DS} =0V	-	-	250	nA
	Reverse		V _{GS} =-5V, V _{DS} =0V	-	-	-250	nA
On Characteristics							
Gate Threshold Voltage		V _{GS(TH)}	V _{DS} =V _{GS} , I _D =5mA	1.8	3.0	5.0	V
Static Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} =20V, I _D =20A, T _J =25°C	-	80	100	mΩ
			V _{GS} =20V, I _D =20A, T _J =150°C	-	130	-	
Gate Resisitance		R _G	f=1MHz	-	2.0	-	Ω
Dynamic Characteristics							
Input Capacitance		C _{ISS}	V _{DS} =1000V, V _{GS} =0V, f=1MHz, V _{AC} =25mV	-	1374	-	pF
Output Capacitance		C _{OSS}		-	63	-	pF
Reverse Transfer Capacitance		C _{RSS}		-	3.5	-	pF
Total switching energy		E _{TOT}	V _{DS} =800V, I _D =20A V _{GS} =-4/+20V, R _G =5.0Ω, L=276nH, T _J =25°C	-	218	-	μJ
Turn-on switching energy		E _{ON}		-	73	-	μJ
Turn-off switching energy		E _{OFF}		-	145	-	μJ
Turn-On Delay Time		td(on)		-	8.2	-	ns
Turn-On Rise Time		t _r		-	10.8	-	ns
Turn-Off Delay Time		td(off)		-	16.7	-	ns
Turn-Off Fall Time		t _f		-	10.5	-	ns
Total Gate Charge		Q _G	V _{DD} =800V, I _D =20A, V _{GS} =-5to20V	-	66	-	nC
Gate-Source Charge		Q _{GS}		-	15	-	nC
Gate-Drain Charge		Q _{GD}		-	30	-	nC
Drain-Source Diode Characteristics and Maximum Ratings(Note 2)							
Drain-Source Diode Forward Voltage		V _{SD}	V _{GS} =-4V, I _S =10A	-	3.7	-	V
Reverse Recovery Time		t _{rr}	V _{GS} =-4V, V _R =800V, I _{SD} =20A, diF/dt=2800A/μs	-	29.3	-	ns
Recovered charge		Q _{rr}		-	156.5	-	nC
Peak reverse recovery current		I _{rrm}		-	9.5	-	A

Notes: 1 RepetitiveRating: Pulse width limited by maximum junction temperature

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

Typical Characteristics Diagrams

Figure 1. Output characteristics at $T_j=25^\circ\text{C}$

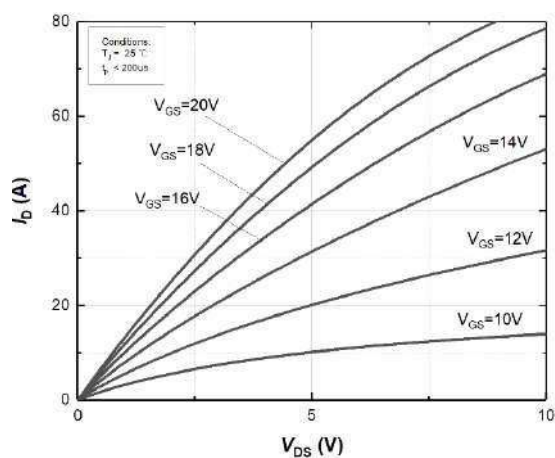


Figure 2. Output characteristics at $T_j=175^\circ\text{C}$

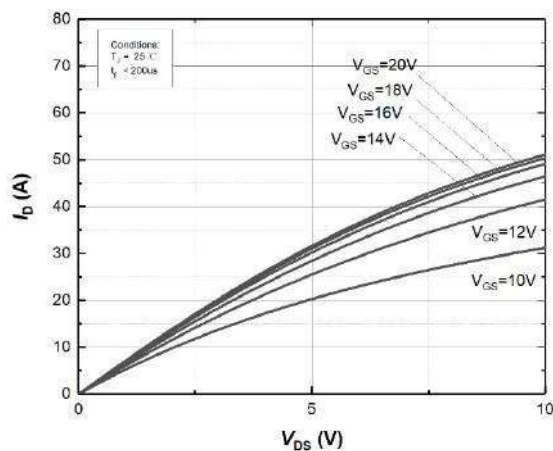


Figure 3. Normalized On-Resistance vs. Temperature

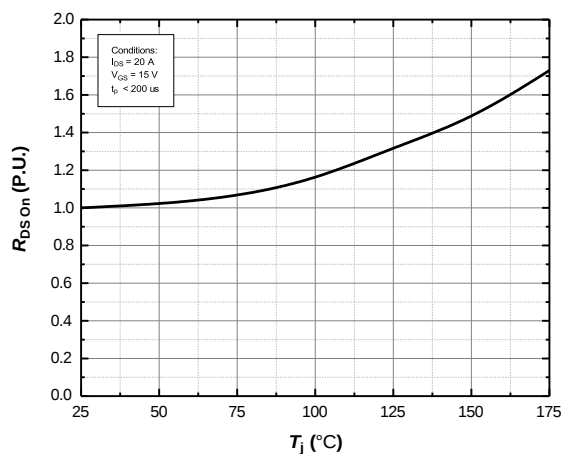


Figure 4. On-Resistance vs. Drain current for Various Temperature

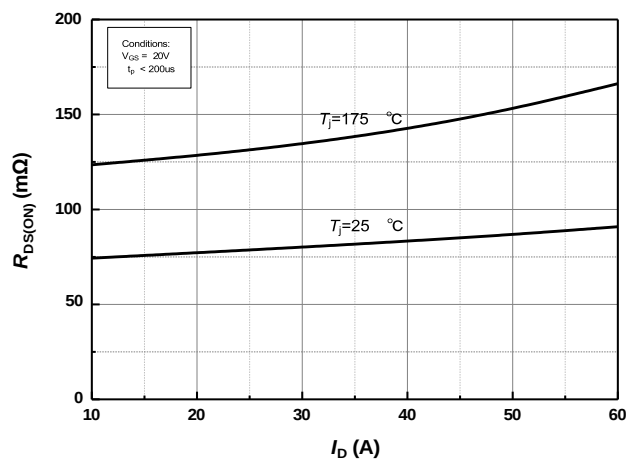


Figure 5. On-Resistance vs. Temperature for Various Gate Voltage

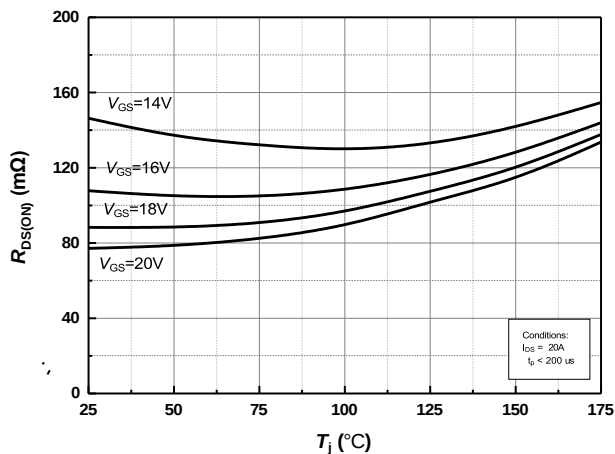
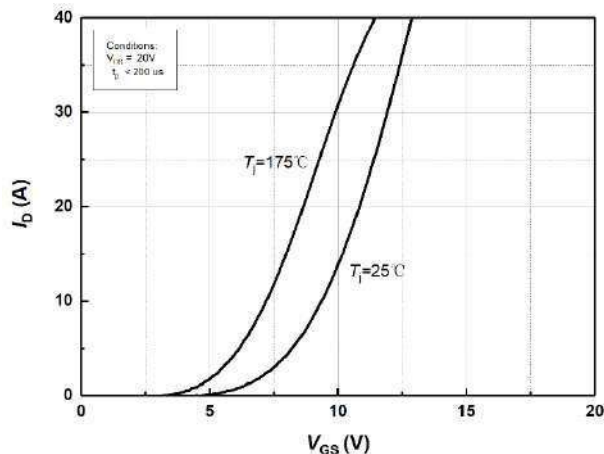


Figure 6. Transfer Characteristics for Various Junction Temperatures



Typical Characteristics Diagrams

Figure 7. Body Diode Characteristics at $T_j=25^\circ\text{C}$

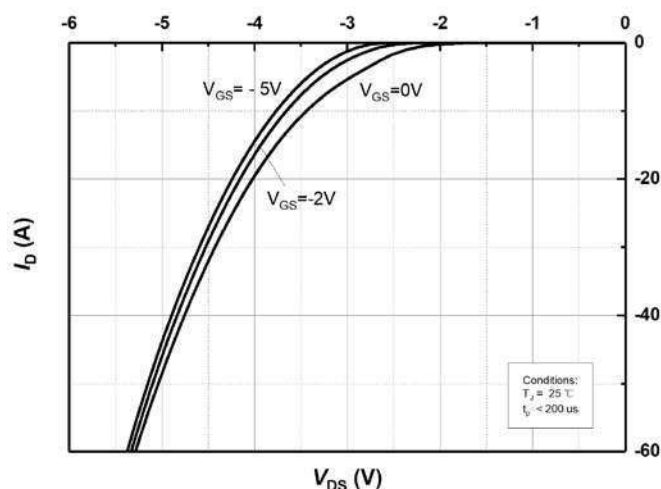


Figure 8. Body Diode Characteristics at $T_j=175^\circ\text{C}$

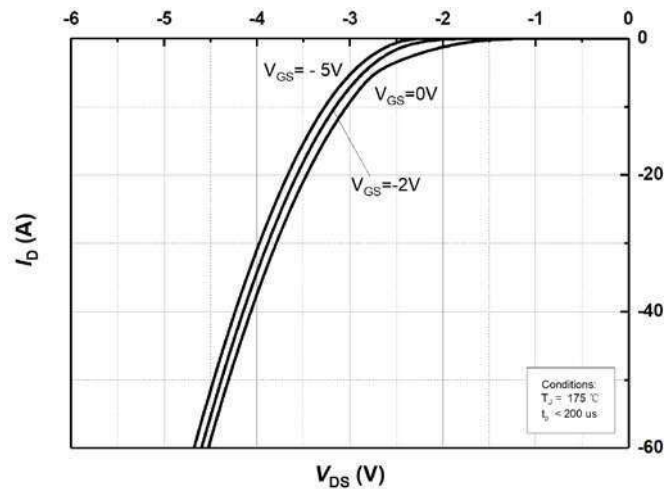


Figure 9. Threshold Voltage vs. Temperature

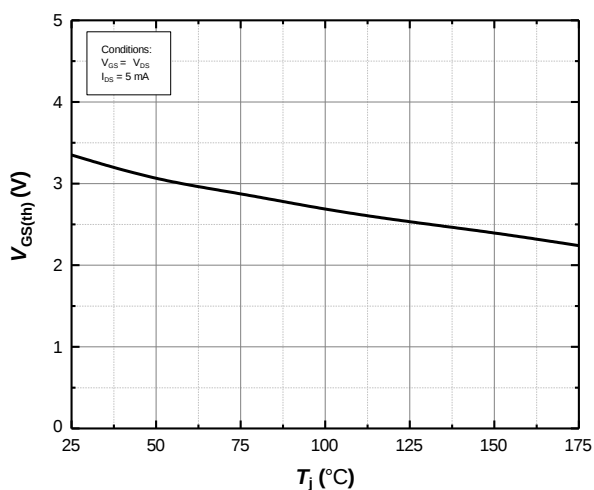


Figure 10. Gate Charge Characteristics

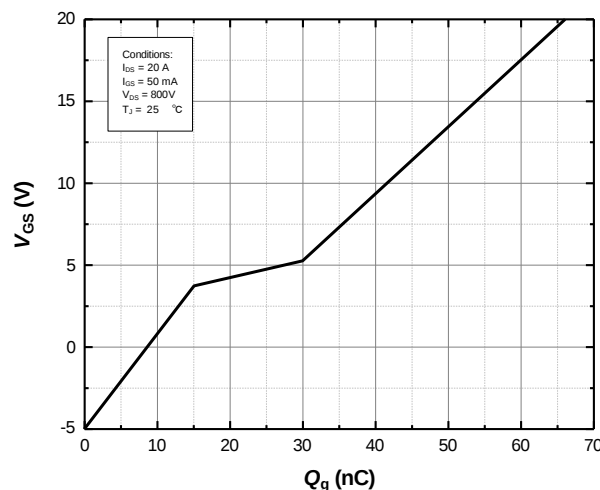


Figure 11. 3rd Quadrant Characteristic at $T_j=25^\circ\text{C}$

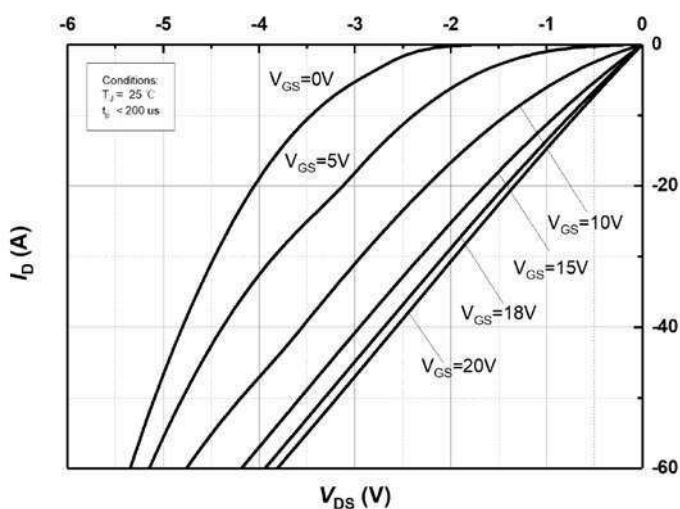
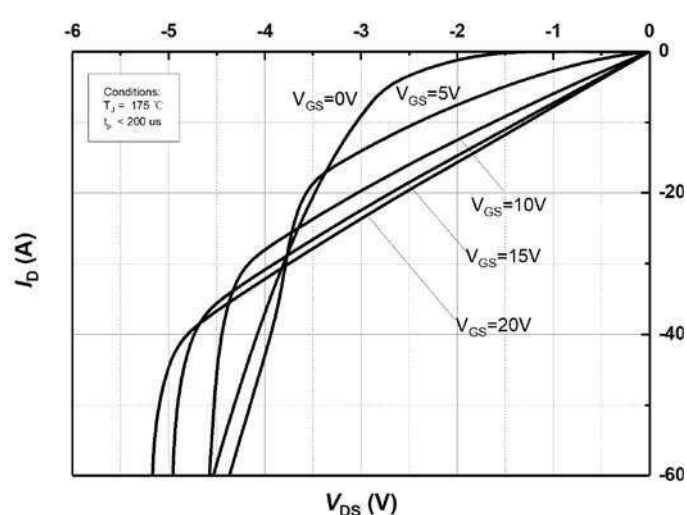


Figure 12. 3rd Quadrant Characteristic at $T_j=175^\circ\text{C}$



Typical Characteristics Diagrams

Figure 13. Capacitances vs. Drain-Source Voltage (0 – 1000V)

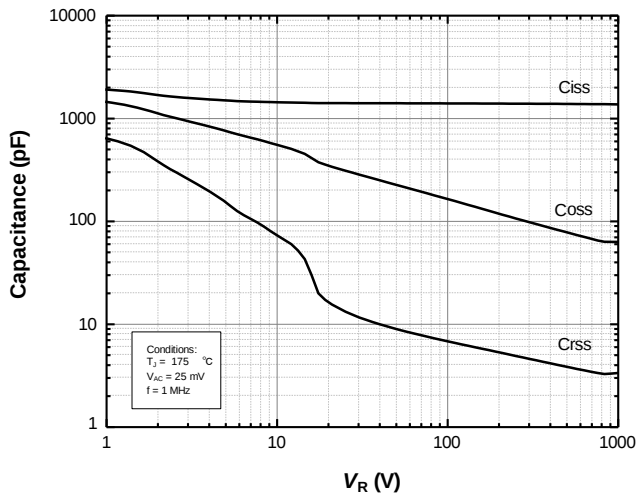


Figure 14. Continuous Drain Current Derating vs Case Temperature

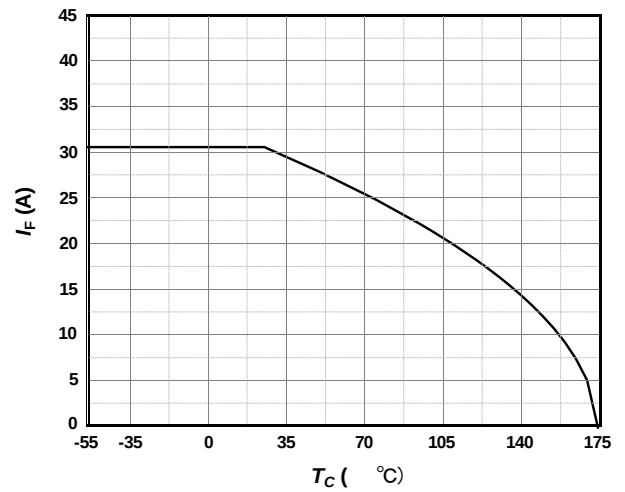


Figure 15. Transient Thermal Impedance (Junction – Case)

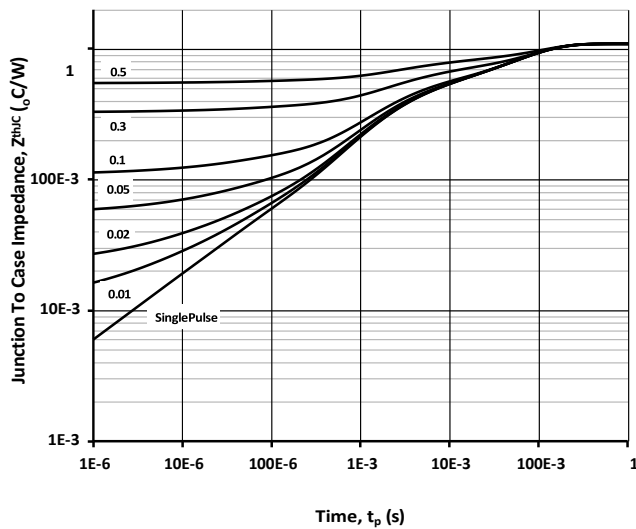


Figure 16. Maximum Power Dissipation Derating vs. Case Temperature

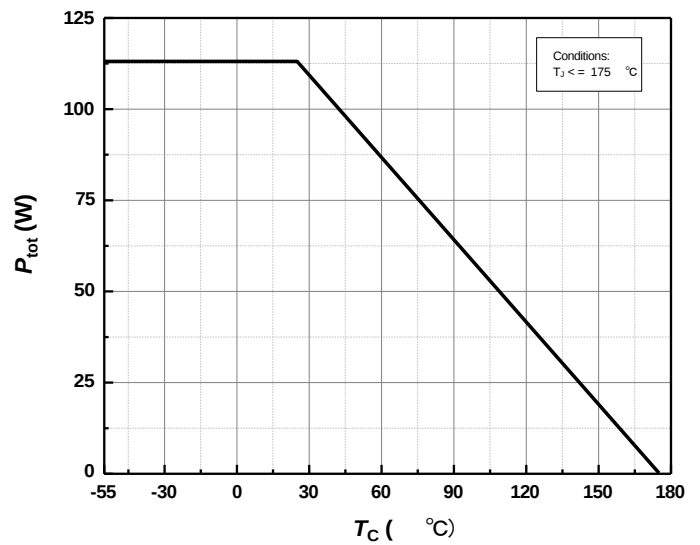


Figure 17. Output Capacitor Stored Energy

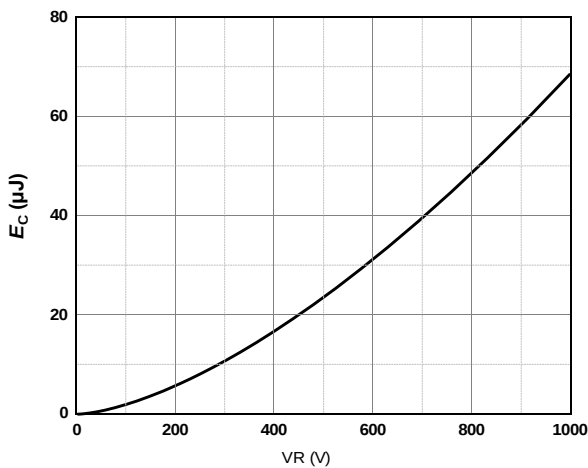
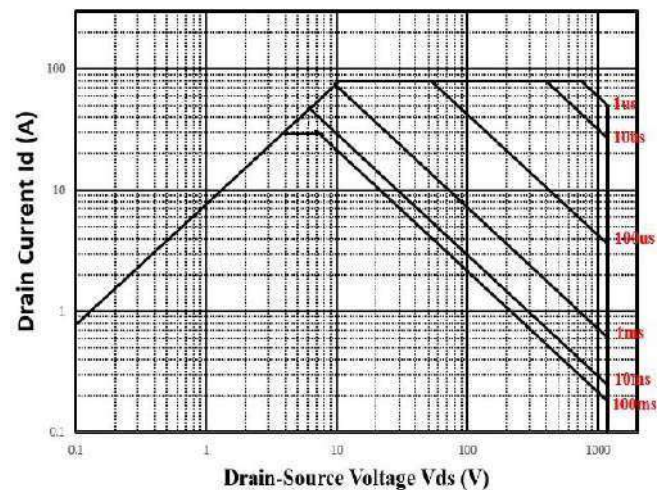


Figure 18. Safe Operating Area



Typical Characteristics Diagrams

Figure 19. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 800V$)

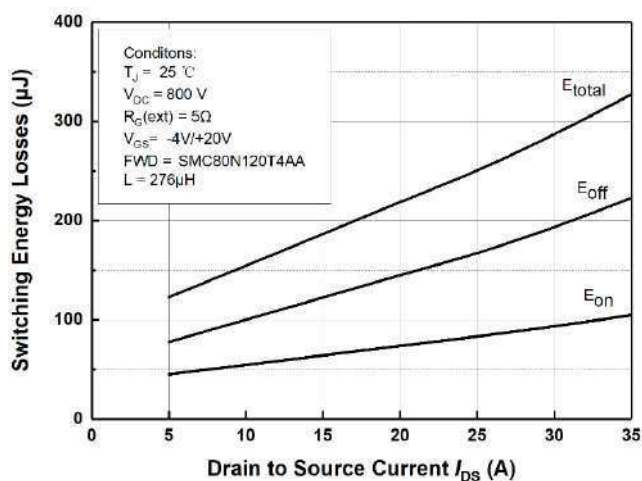


Figure 20. Clamped Inductive Switching Energy vs. Drain Current ($V_{DD} = 600V$)

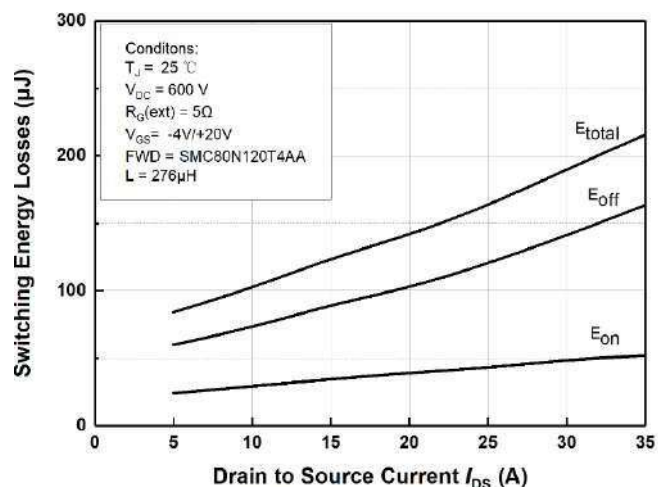


Figure 21. Clamped Inductive Switching Energy vs. $R_{G(ext)}$

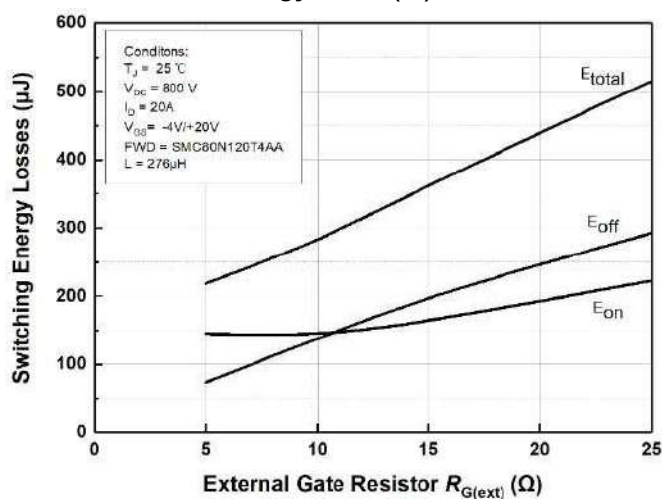
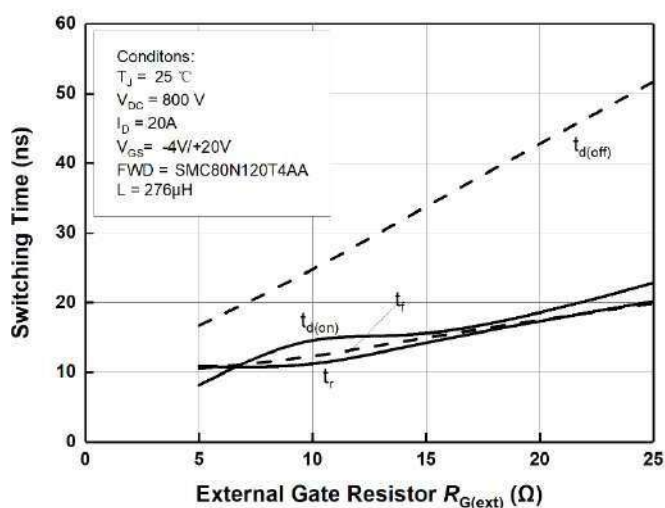
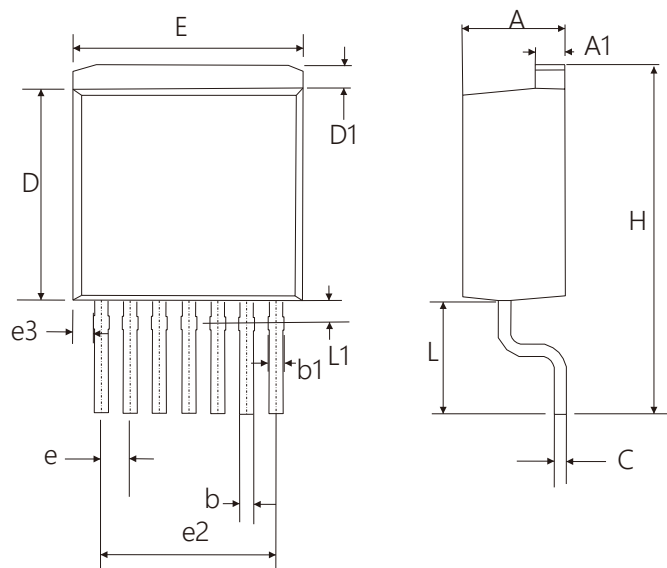


Figure 22. Switching Times vs. $R_{G(ext)}$



Dimensions

TO-263-7L PACKAGE OUTLINE DIMENSIONS



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	4.25	4.75	0.167	0.187
A1	1.2	1.4	0.047	0.055
b	0.5	0.7	0.020	0.028
b1	0.5	0.9	0.020	0.035
C	0.4	0.6	0.016	0.024
D	9.05	9.45	0.356	0.372
D1	0.7	1.3	0.028	0.051
E	9.8	10.3	0.386	0.405
e	1.07	1.47	0.042	0.058
e2	7.32	7.92	0.288	0.312
e3	0.64	1.04	0.025	0.041
H	14.65	15.65	0.577	0.616
L	4.47	5.47	0.176	0.215
L1	0.90	1.50	0.035	0.059

Suggested Pad Layout

(TO-263-7L)

