

HCBF120N80M1A

SiC Automotive Silicon Carbide Power MOSFET

1200 V, 30 A, 80 mΩ

Features

- High switching speed with a low gate charge
- Fast intrinsic diode with low reverse recovery
- Robust Avalanche Capability
- 100% Avalanche Tested
- Pb-free, Halogen Free, and RoHS Compliant
- AEC Q101 Qualified

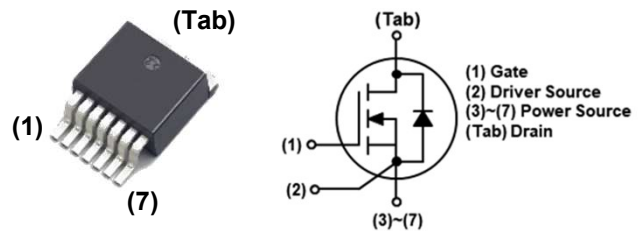
Benefits

- System efficiency improvement
- Higher frequency applicability
- Increased power density
- Reduced cooling effort

Applications

- xEV
- Solar inverter
- EV charging station
- UPS
- Industrial power supply

$BV_{DSS, T_C=25^\circ C}$	$I_D, T_C=25^\circ C$	$R_{DS(on), typ}$	$Q_{g, typ}$
1200 V	30 A	80 mΩ	50 nC



TO-263-7L



Absolute Maximum Ratings ($T_C = 25^\circ C$ unless otherwise noted)

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		1200	V
V_{GS}	Gate to Source Voltage (DC)		-10 / +22	V
V_{GSop}	Recommended Operation Value		-5 / +18	V
I_D	Drain Current	Continuous ($T_C = 25^\circ C$)	30	A
		Continuous ($T_C = 100^\circ C$)	21	
I_{DM}	Drain Current	Pulsed (Note1)	80	A
P_D	Power Dissipation	($T_C = 25^\circ C$)	150	W
		Derate Above $25^\circ C$	1.0	W/ $^\circ C$
T_J, T_{STG}	Operating and Storage Temperature Range		-55 to 175	$^\circ C$
T_L	Maximum Lead Temperature for Soldering, 1/8" from Case for 10 Seconds		260	$^\circ C$

※Note 1 : Limited by maximum junction temperature.

Thermal Characteristics

Symbol	Parameter	Value	Unit
$R_{\theta JC}$	Thermal Resistance, Junction to Case, Max.	1.0	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction to Ambient, Max.	40	

Package Marking and Ordering Information

Part Number	Top Marking	Package	Packing Method	Quantity
HCBF120N80M1A	HCBF120N80M1A	TO-263-7L	Tape & Reel	500 units

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

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
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Off Characteristics

BV_{DSS}	Drain to Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	1200			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}$		1	100	μA
		$V_{DS} = 1200\text{ V}, V_{GS} = 0\text{ V}, T_J = 175^\circ\text{C}$		5		
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = +22\text{ V}, V_{DS} = 0\text{ V}$			+100	nA
		$V_{GS} = -10\text{ V}, V_{DS} = 0\text{ V}$			-100	

On Characteristics

$V_{GS(th)}$	Gate Threshold Voltage	$V_{GS} = V_{DS}, I_D = 5.0\text{ mA}$ (tested after $V_{GS} = 22\text{ V}, 1\text{ ms pulse}$)	2.0	3.0	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 18\text{ V}, I_D = 15\text{ A}$		80	110	m Ω
		$V_{GS} = 18\text{ V}, I_D = 15\text{ A}, T_J = 175^\circ\text{C}$		128		
g_{fs}	Transconductance	$V_{DS} = 20\text{ V}, I_D = 15\text{ A}$		11.4		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 800\text{ V}, V_{GS} = 0\text{ V}, f = 250\text{ kHz}$		880		pF
C_{oss}	Output Capacitance			64		
C_{rss}	Reverse Capacitance			5		
E_{oss}	Stored Energy in Output Capacitance	$V_{DS} = 0\text{ V to } 800\text{ V}, V_{GS} = 0\text{ V}$		26		μJ
$C_{o(er)}$	Energy Related Output Capacitance			80		pF
$C_{o(tr)}$	Time Related Output Capacitance			142		
$Q_{g(tot)}$	Total Gate Charge	$V_{DS} = 800\text{ V}, I_D = 15\text{ A},$ $V_{GS} = -5\text{ V} / 18\text{ V},$ Inductive load		50		nC
Q_{gs}	Gate to Source Charge			13		
Q_{gd}	Gate to Drain "Miller" Charge			17		
R_G	Internal Gate Resistance	$f = 1\text{ MHz}, V_{AC} = 30\text{ mV}$		4.0		Ω

Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 800\text{ V}, I_D = 15\text{ A},$ $V_{GS} = -5\text{ V} / 18\text{ V}, R_G = 2\text{ }\Omega,$ FWD : HCH120S10D1, Inductive load		12		ns
t_r	Turn-On Rise Time			10		
$t_{d(off)}$	Turn-Off Delay Time			24		
t_f	Turn-Off Fall Time			9		
E_{on}	Turn-on Switching Energy			71		μJ
E_{off}	Turn-off Switching Energy			41		
E_{tot}	Total Switching Energy			112		

Source-Drain Diode Characteristics

I_S	Maximum Continuous Diode Forward Current			30	A
I_{SM}	Maximum Pulsed Diode Forward Current			80	
V_{SD}	Diode Forward Voltage	$V_{GS} = -5\text{ V}, I_{SD} = 15\text{ A}$		4.1	V
t_{rr}	Reverse Recovery Time	$V_{DD} = 800\text{ V}, I_{SD} = 15\text{ A},$ $di_F/dt = 3000\text{ A}/\mu\text{s},$ Includes Q_{oss}		12	ns
Q_{rr}	Reverse Recovery Charge			121	nC

Typical Performance Characteristics

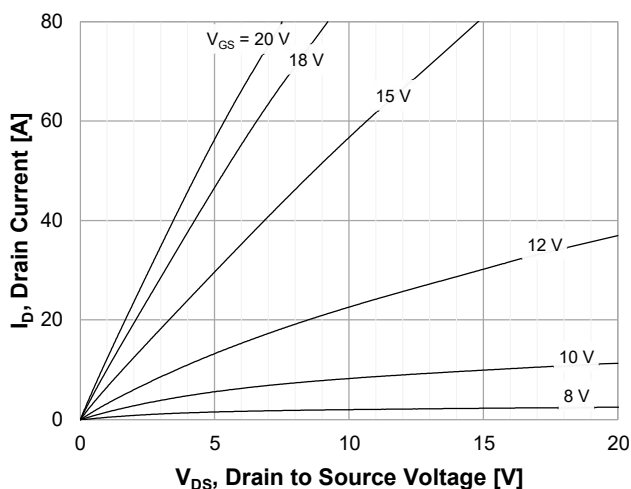
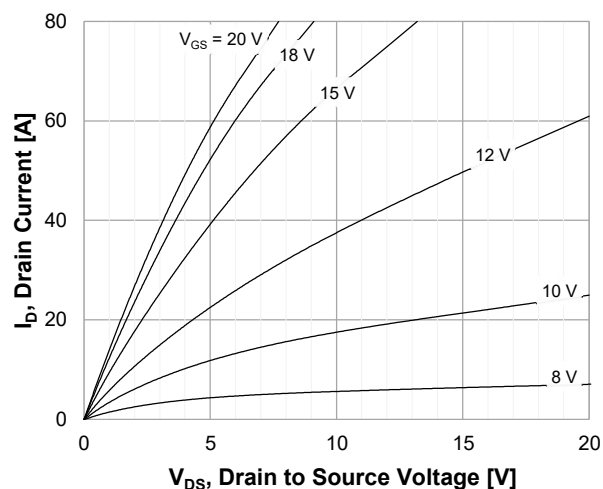
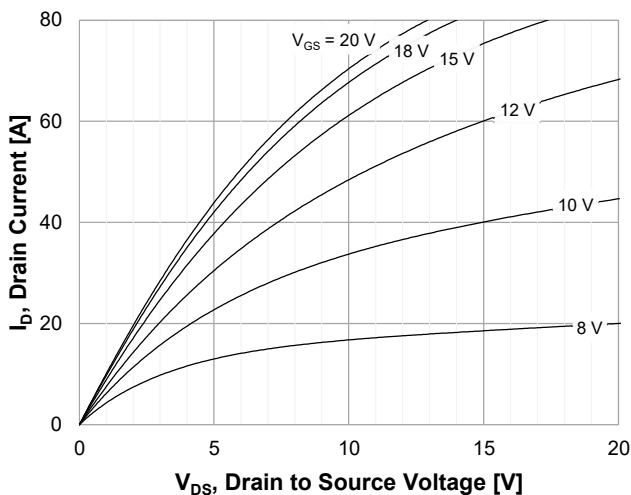
Figure 1. On-Region Characteristics $T_J = -40^\circ\text{C}$ Figure 2. On-Region Characteristics $T_J = 25^\circ\text{C}$ Figure 3. On-Region Characteristics $T_J = 175^\circ\text{C}$ 

Figure 4. Normalized On-Resistance Characteristics vs. Temperature

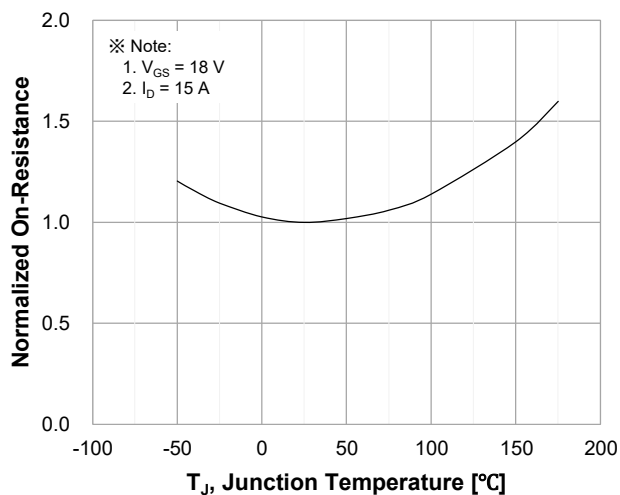
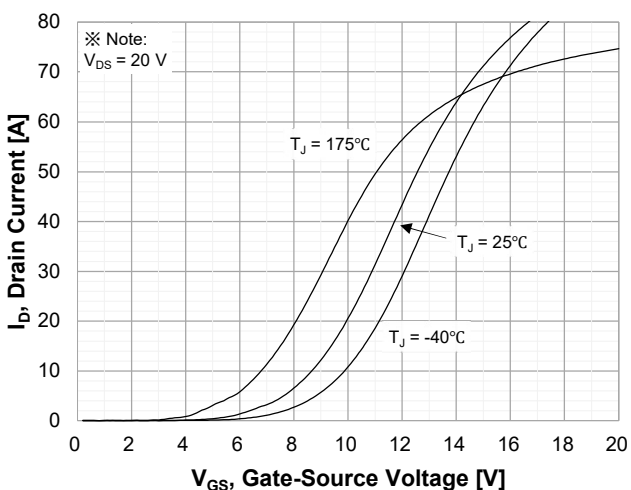
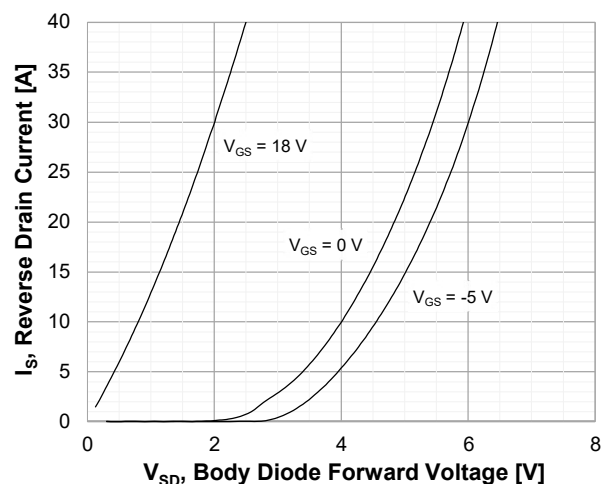


Figure 5. Transfer Characteristics

Figure 6. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = -40^\circ\text{C}$ 

Typical Performance Characteristics

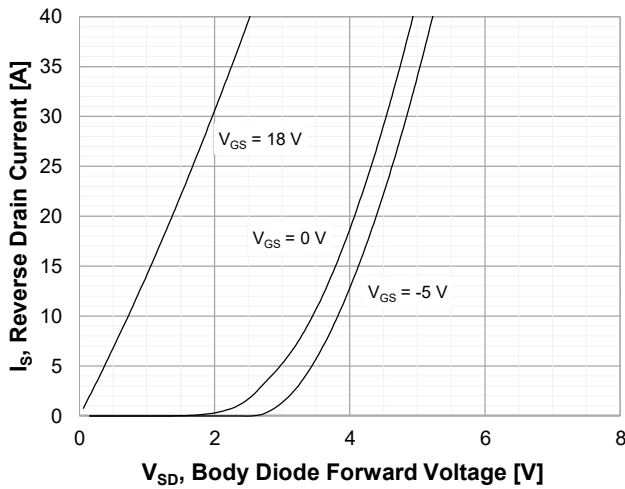
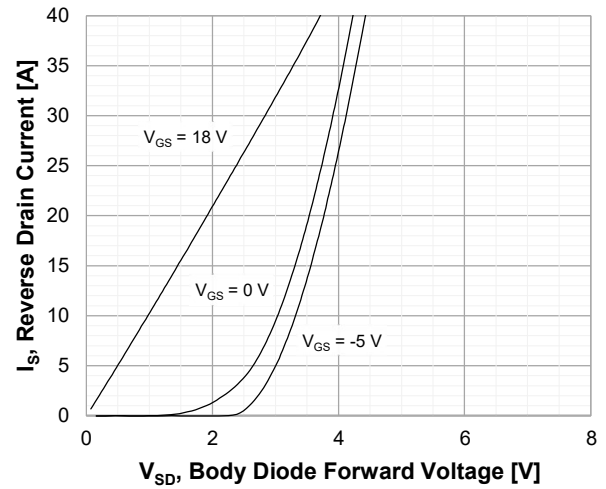
Figure 7. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = 25^\circ\text{C}$ Figure 8. Diode Forward Voltage Characteristics vs. Source-Drain Current $T_J = 175^\circ\text{C}$ 

Figure 9. Threshold Voltage vs. Temperature

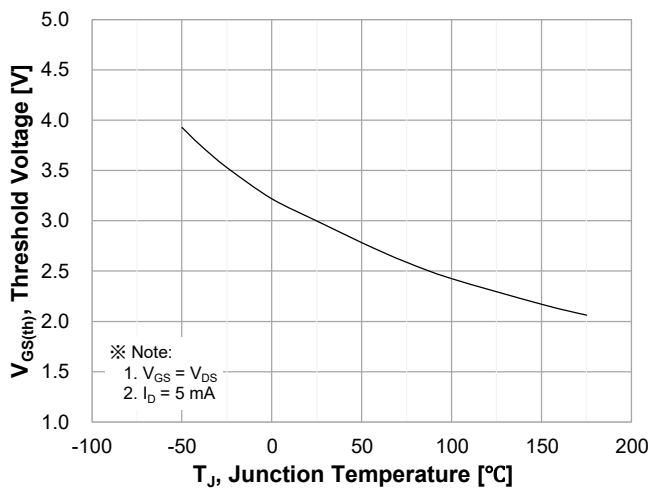


Figure 10. Gate Charge Characteristics

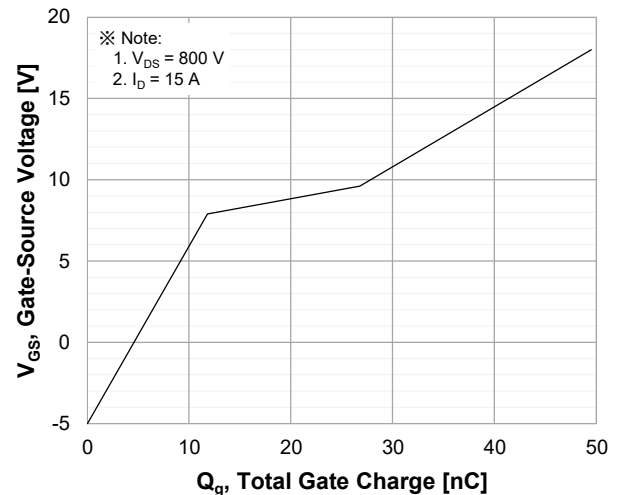


Figure 11. Stored Energy in Output Capacitance

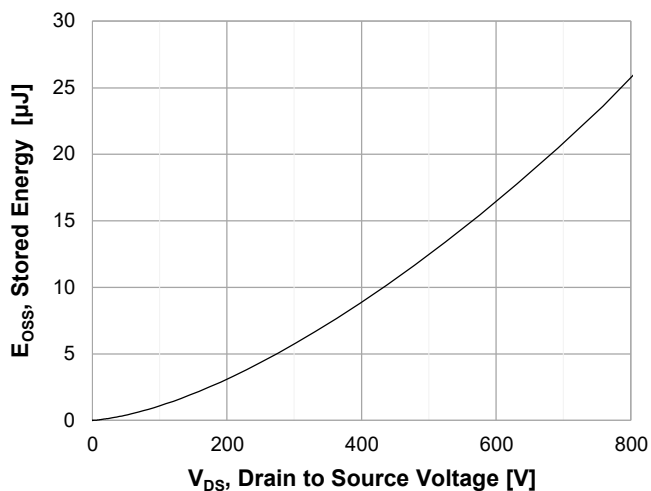
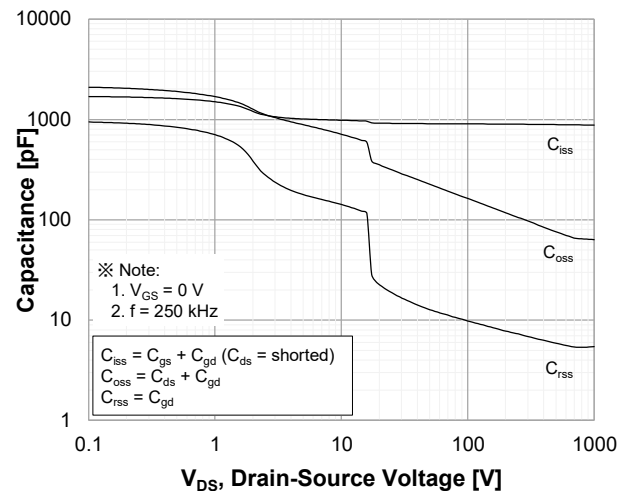


Figure 12. Capacitance Characteristics



Typical Performance Characteristics

Figure 13. Continuous Drain Current Derating vs. Case Temperature

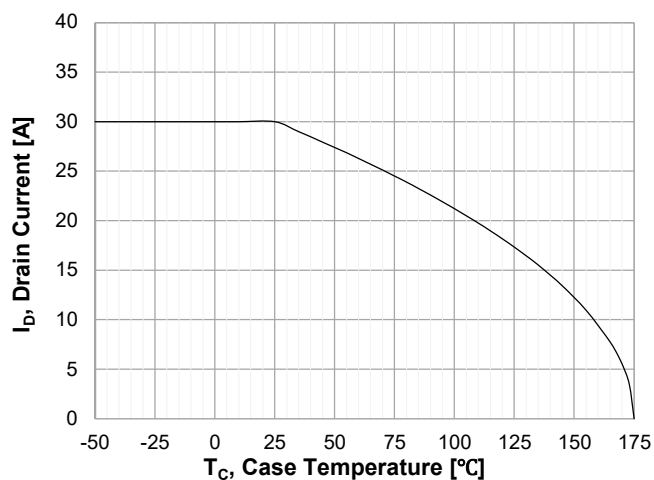


Figure 14. Maximum Power Dissipation Derating vs. Case Temperature

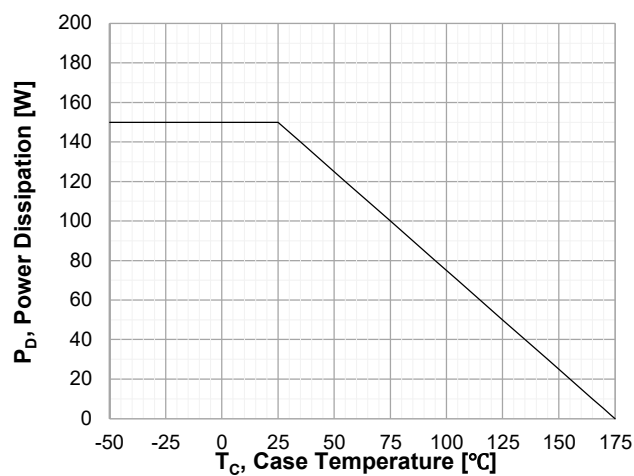


Figure 15. Typ. Switching Losses vs. Drain Current

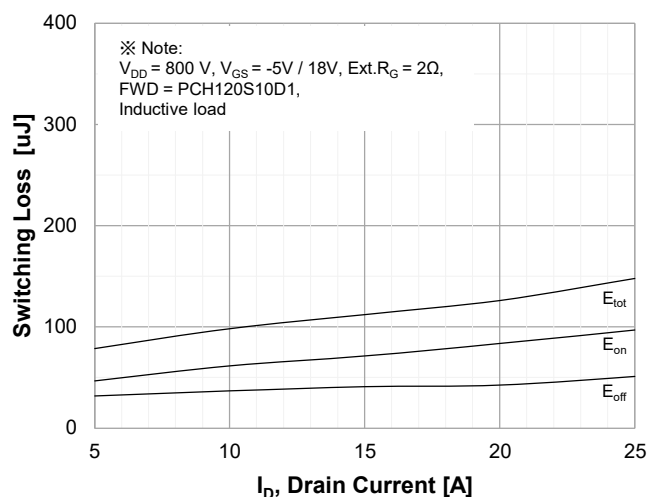


Figure 16. Typ. Switching Losses vs. Gate Resistance

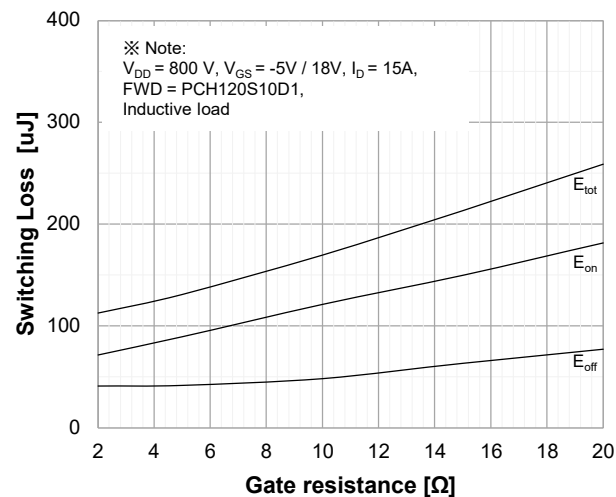


Figure 17. Typ. Switching Losses vs. Drain Current

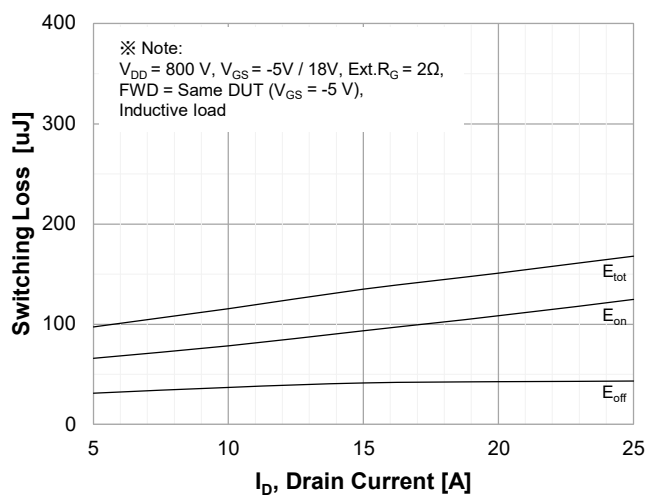
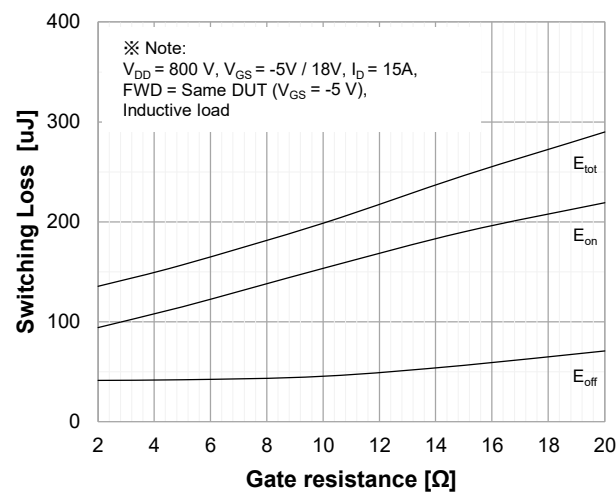


Figure 18. Typ. Switching Losses vs. Gate Resistance



Typical Performance Characteristics

Figure 19. Maximum Safe Operating Area

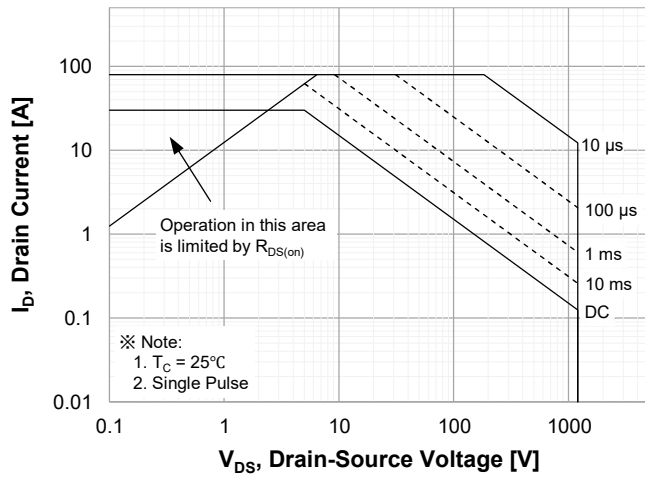


Figure 20. Transient Thermal Response Curve

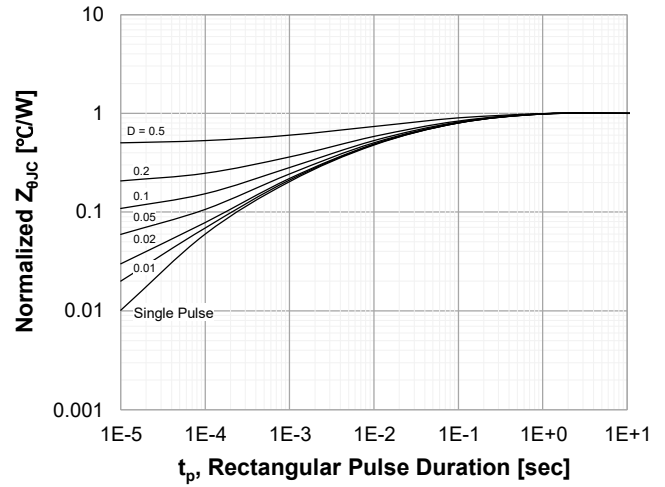


Figure 21. Inductive Load Switching Test Circuit and Waveforms

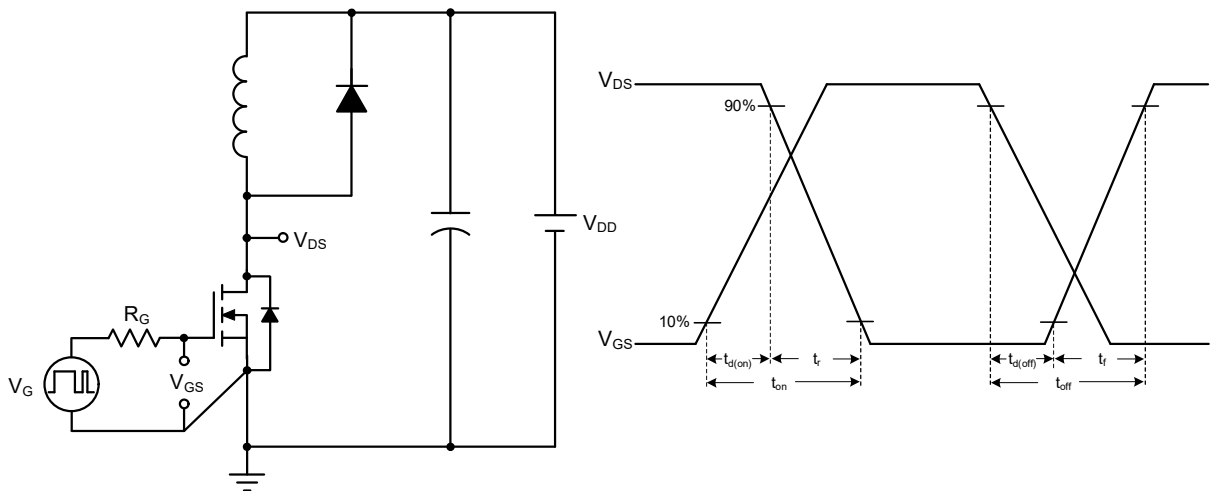
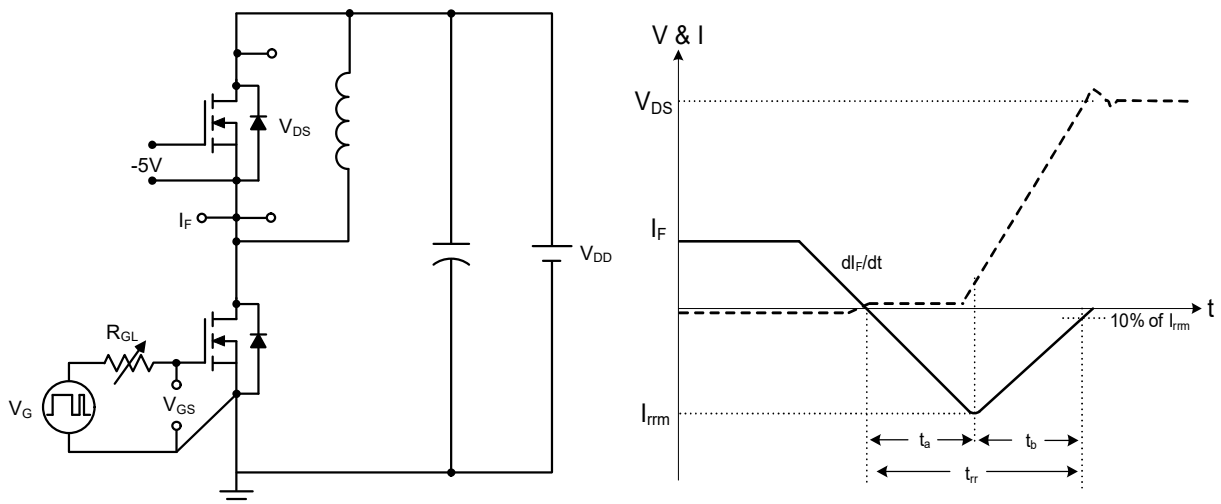
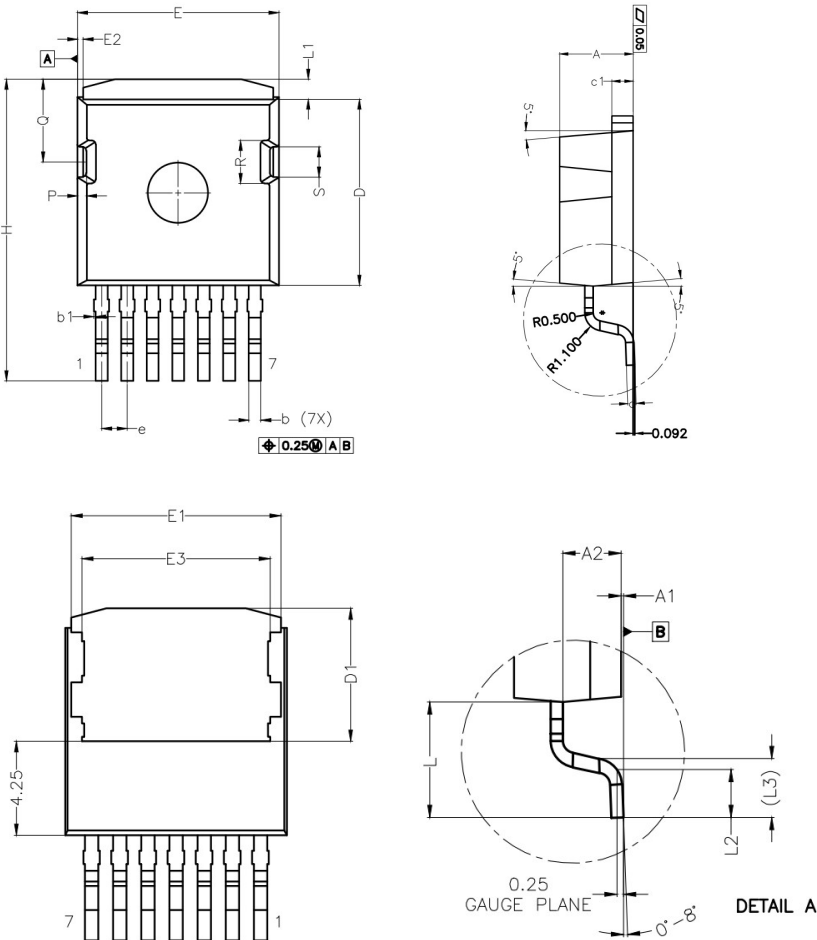


Figure 22. Peak Diode Recovery dv/dt Test Circuit and Waveforms



Package Outlines

TO-263-7L



SYMBOL	Common		
	DEMINSIONS MILLIMETER		
	MIN.	NOM.	MAX.
A	4.30	4.40	4.50
A1	0.00	0.10	0.20
A2	2.30	2.40	2.50
b	0.50	0.60	0.70
b1	0.00	0.08	0.15
c	0.40	0.50	0.60
c1	1.17	1.27	1.37
D	9.05	9.25	9.45
D1	5.90	6.00	6.10
E	9.80	10.00	10.20
E1	9.36	9.46	9.56
E2	0.00	0.15	0.30
E3	8.40	8.50	8.60
e	1.27		
H	15.00		
L	4.20	4.75	5.20
L1	0.70	1.00	1.30
L2	1.70	2.00	2.30
L3	2.70		
P	0.35	0.45	0.55
Q	4.02	4.12	4.22
R	2.03	2.13	2.23
S	1.40	1.50	1.60