

HCW65N45M1

N-Channel SiC Silicon Carbide Power MOSFET

650 V, 44 A, 45 mΩ

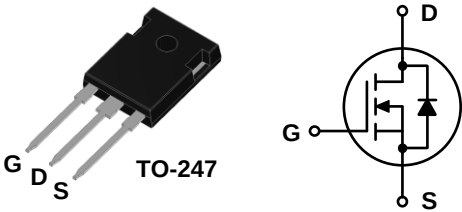
Features

- 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

$BV_{DSS}, T_C=25^{\circ}C$	$I_D, T_C=25^{\circ}C$	$R_{DS(on),typ}$	$Q_{g,typ}$
650 V	44 A	45 mΩ	56 nC

Benefits

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



Applications

- Server & Telecom power
- EV charging station
- Solar inverter / ESS / UPS
- Industrial power supply



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

Symbol	Parameter		Value	Unit
V_{DSS}	Drain to Source Voltage		650	V
V_{GS}	Gate to Source Voltage (DC)		-10 / +22	V
V_{GSop}	Recommended Operation Value		-5 / +18	V
I_D	Drain Current	Continuous ($T_C = 25^{\circ}C$)	44	A
		Continuous ($T_C = 100^{\circ}C$)	31	
I_{DM}	Drain Current	Pulsed (Note1)	117	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
HCW65N45M1	HCW65N45M1	TO-247	Tube	30 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	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	650			V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}$		1	100	μA
		$V_{DS} = 650\text{ V}, V_{GS} = 0\text{ V}, T_J = 175^\circ\text{C}$		10		
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	$V_{GS} = V_{DS}, I_D = 7\text{ mA}$ (tested after $V_{GS} = 22\text{ V}, 1\text{ ms pulse}$)	1.8	2.8	4.5	V
$R_{DS(on)}$	Static Drain to Source On Resistance	$V_{GS} = 18\text{ V}, I_D = 20\text{ A}$		45	63	$\text{m}\Omega$
		$V_{GS} = 18\text{ V}, I_D = 20\text{ A}, T_J = 175^\circ\text{C}$		59		
g_{fs}	Transconductance	$V_{DS} = 20\text{ V}, I_D = 20\text{ A}$		13.4		S

Dynamic Characteristics

C_{iss}	Input Capacitance	$V_{DS} = 400\text{ V}, V_{GS} = 0\text{ V}, f = 250\text{ kHz}$		1048		pF
C_{oss}	Output Capacitance			131		
C_{rss}	Reverse Capacitance			9.1		
E_{oss}	Stored Energy in Output Capacitance	$V_{DS} = 0\text{ V to } 400\text{ V}, V_{GS} = 0\text{ V}$		13.0		μJ
$C_{o(er)}$	Energy Related Output Capacitance			162.0		pF
$C_{o(tr)}$	Time Related Output Capacitance			236		
$Q_{g(tot)}$	Total Gate Charge	$V_{DS} = 400\text{ V}, I_D = 20\text{ A},$ $V_{GS} = -5\text{ V} / 18\text{ V},$ Inductive load		56		nC
Q_{gs}	Gate to Source Charge			14		
Q_{gd}	Gate to Drain "Miller" Charge			15		
R_G	Internal Gate Resistance	$f = 1\text{ MHz}$		4.0		Ω

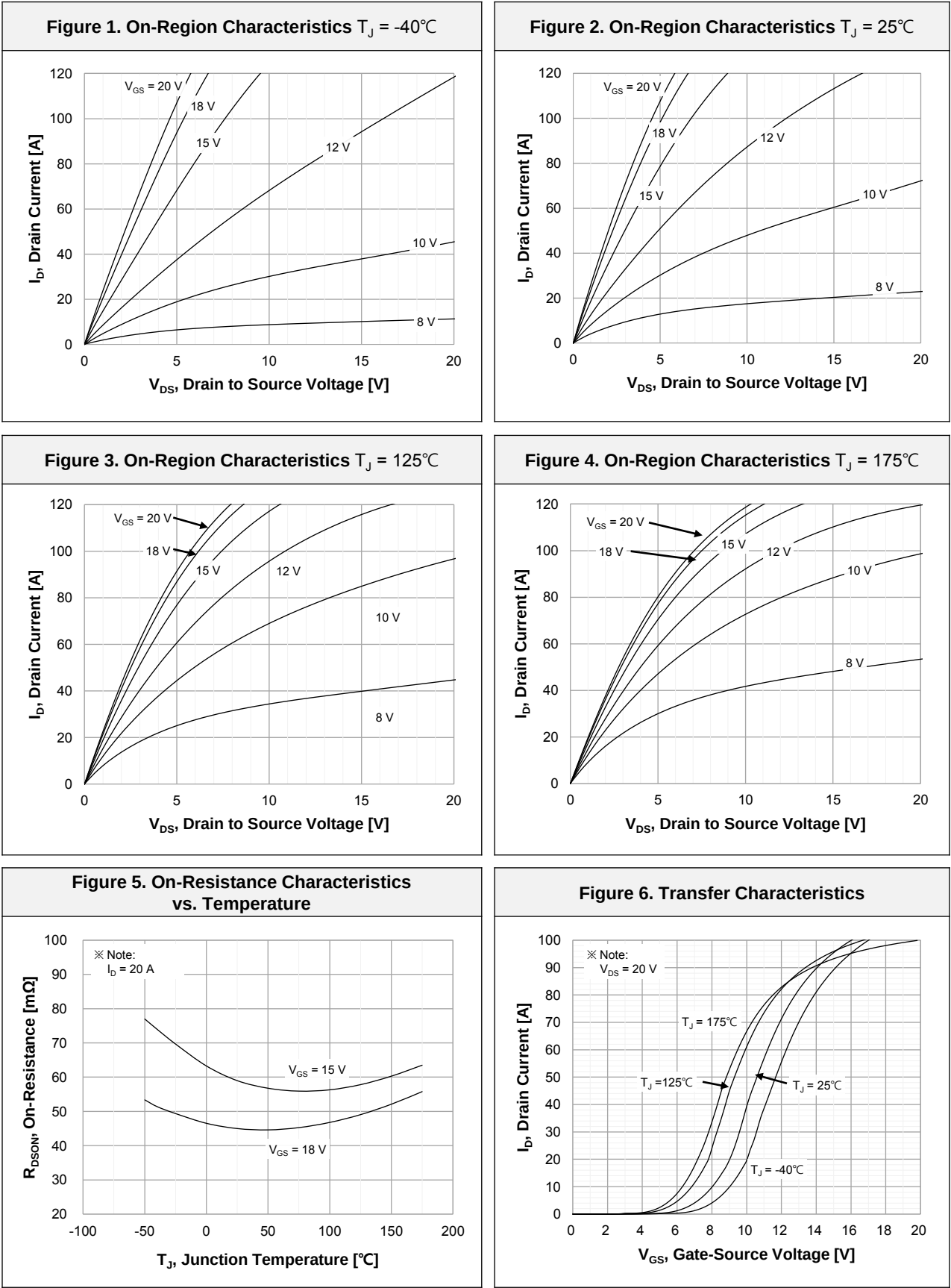
Switching Characteristics

$t_{d(on)}$	Turn-On Delay Time	$V_{DS} = 400\text{ V}, I_D = 20\text{ A},$ $V_{GS} = -5\text{ V} / 18\text{ V}, R_G = 2.7\text{ }\Omega,$ FWD : HCH65S12D1, Inductive load		16		ns
t_r	Turn-On Rise Time			24		
$t_{d(off)}$	Turn-Off Delay Time			27		
t_f	Turn-Off Fall Time			7		
E_{on}	Turn-on Switching Energy			111		μJ
E_{off}	Turn-off Switching Energy			14		
E_{tot}	Total Switching Energy			125		

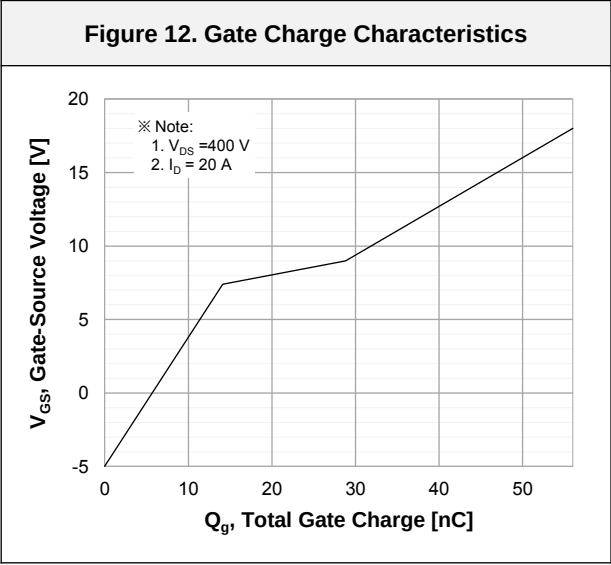
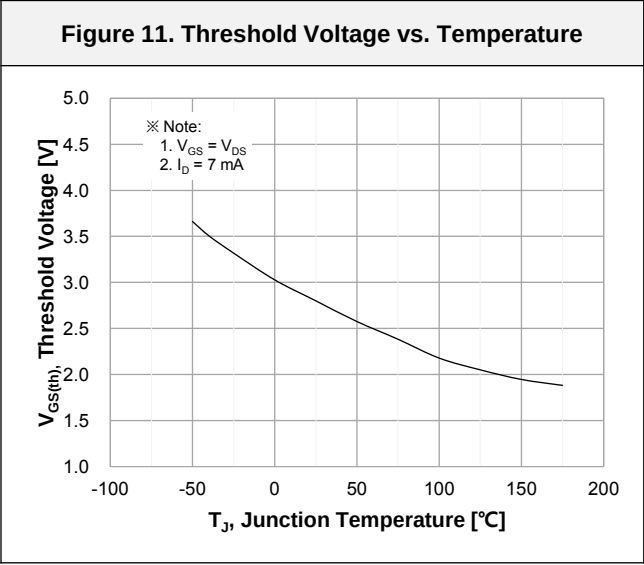
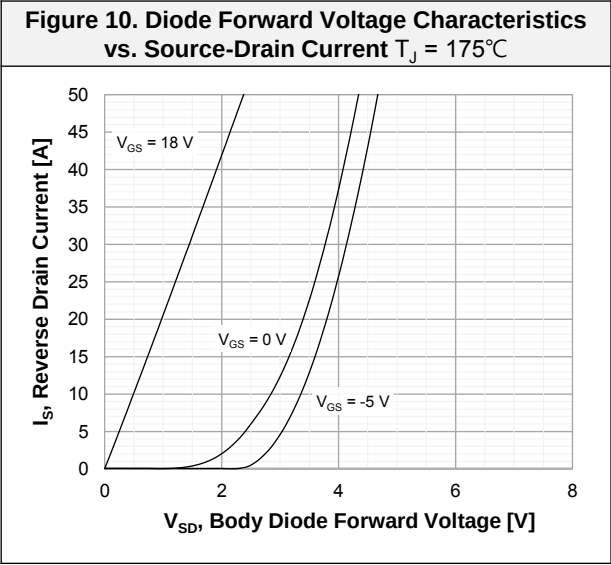
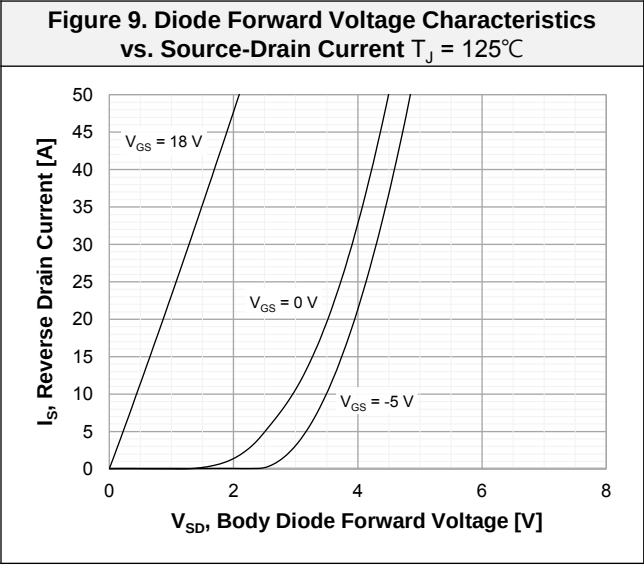
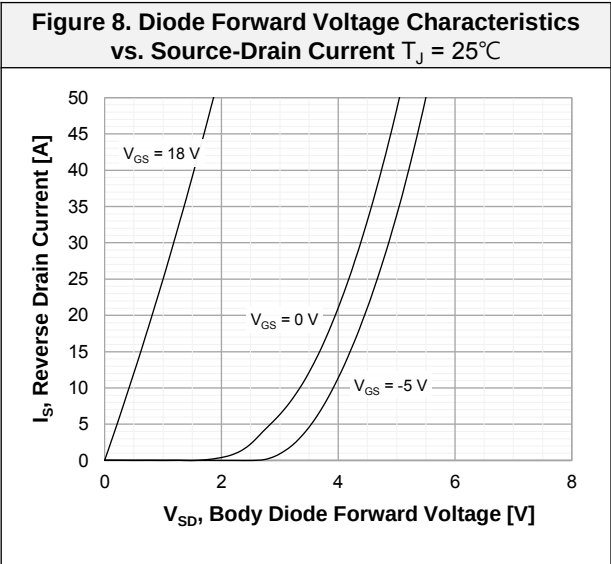
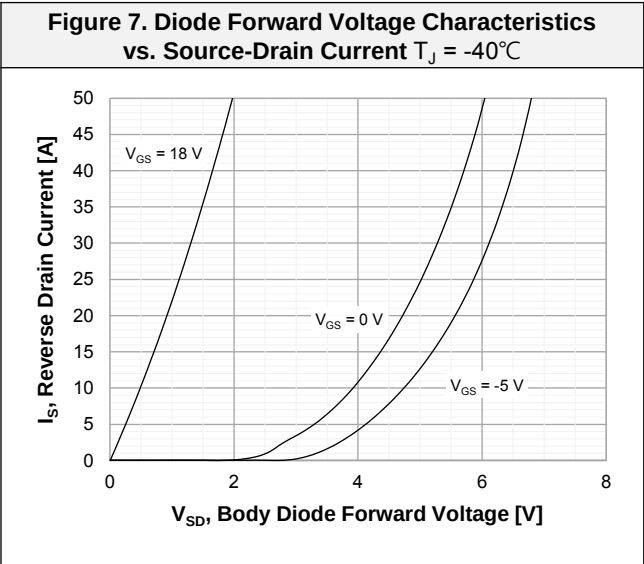
Source-Drain Diode Characteristics

I_S	Maximum Continuous Diode Forward Current			44	A
I_{SM}	Maximum Pulsed Diode Forward Current			117	
V_{SD}	Diode Forward Voltage	$V_{GS} = -5\text{ V}, I_{SD} = 20\text{ A}$		4.2	V
t_{rr}	Reverse Recovery Time	$V_{DD} = 400\text{ V}, I_{SD} = 20\text{ A},$ $di_F/dt = 1000\text{ A}/\mu\text{s},$ Includes Q_{OSS}		17	ns
Q_{rr}	Reverse Recovery Charge			104	nC
I_{rrm}	Peak Reverse Recovery Current			10	A

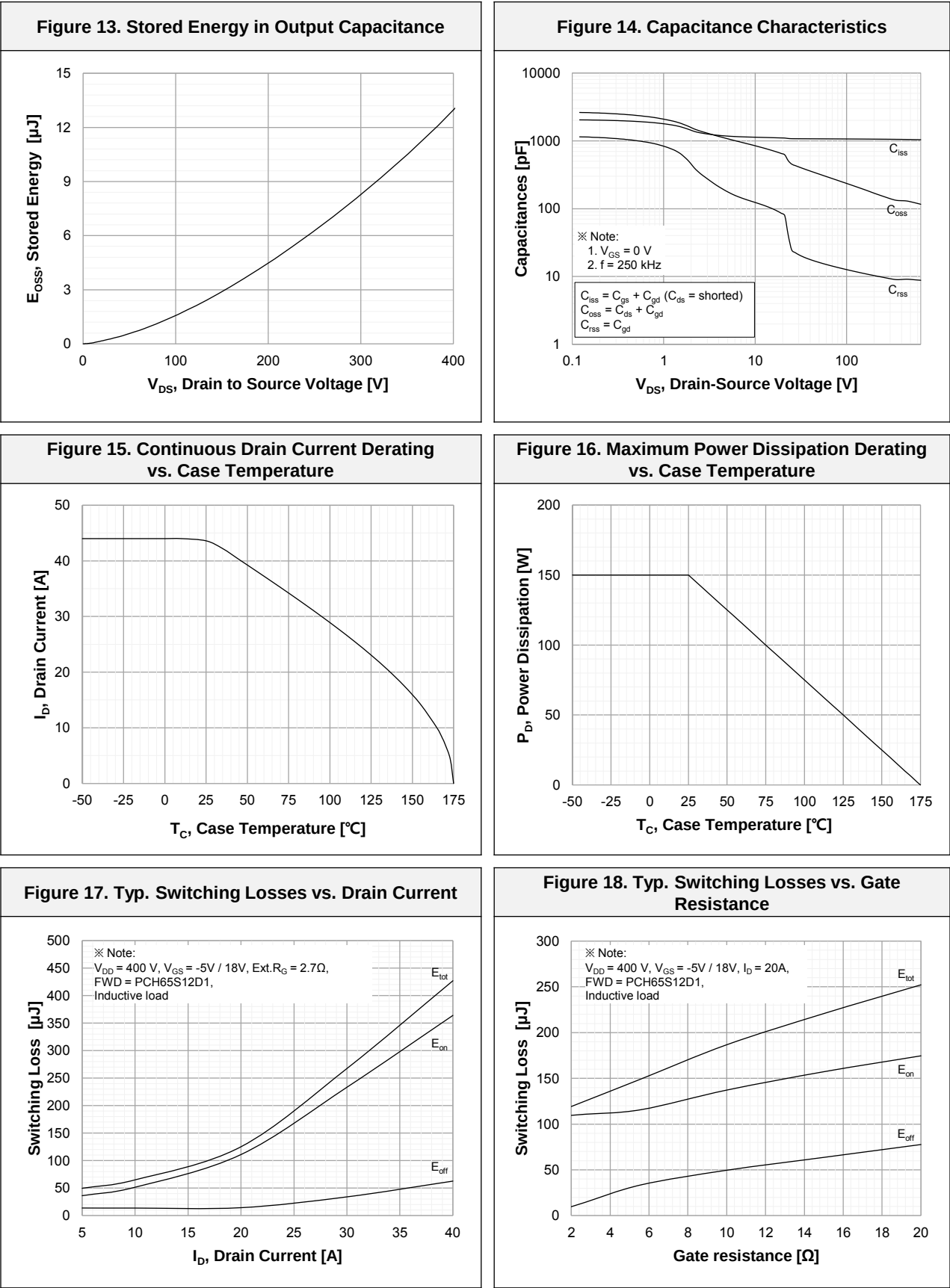
Typical Performance Characteristics



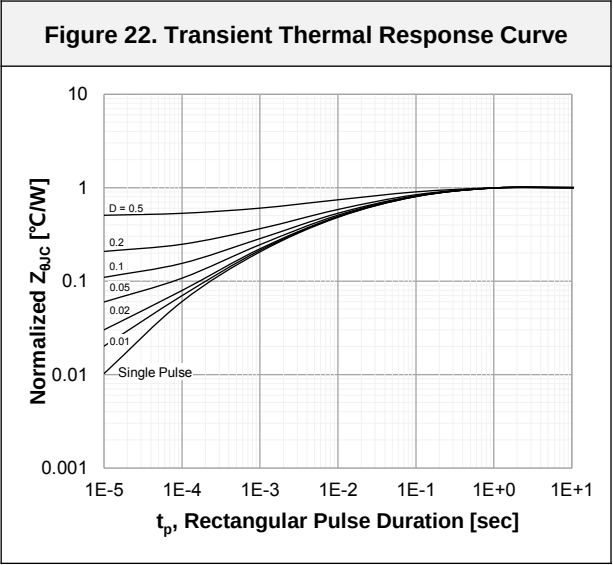
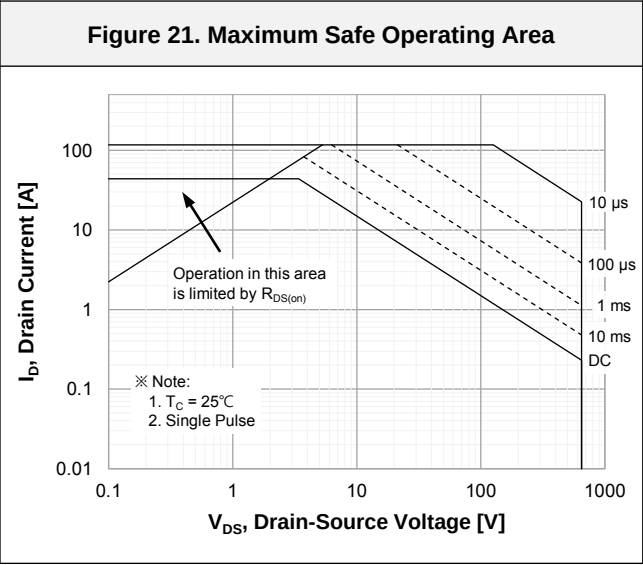
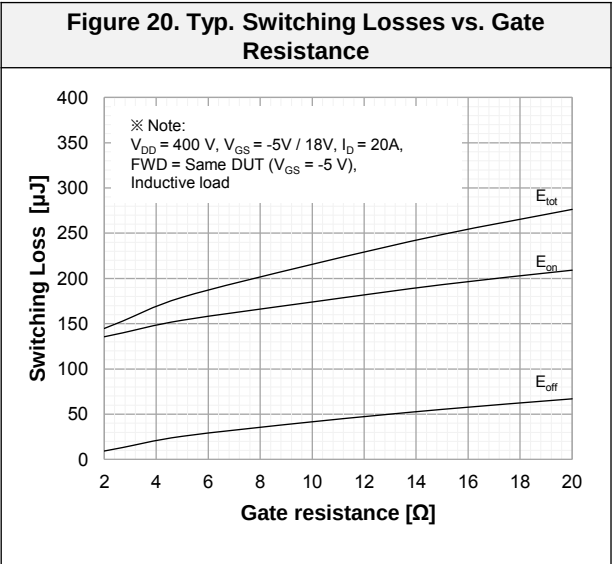
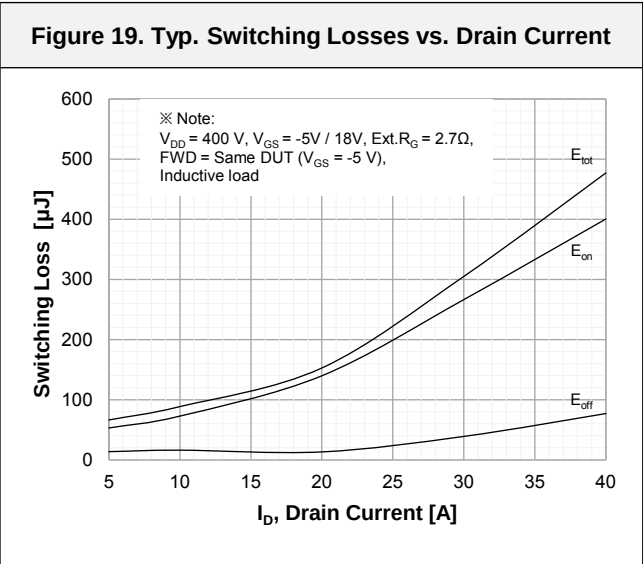
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Typical Performance Characteristics

Figure 23. Inductive Load Switching Test Circuit and Waveforms

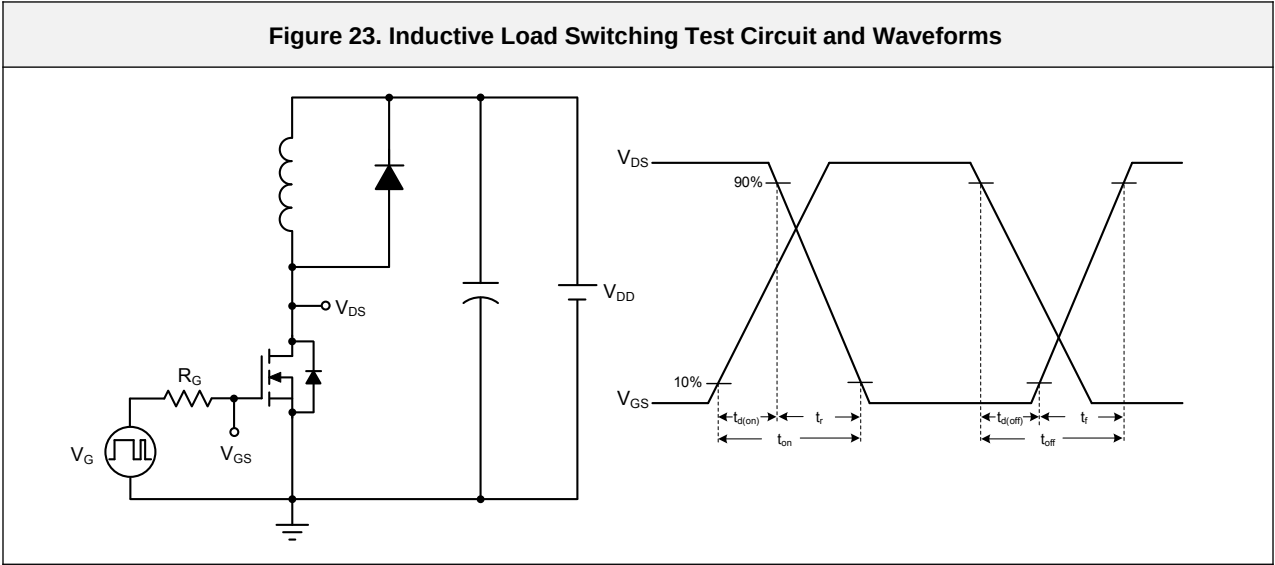
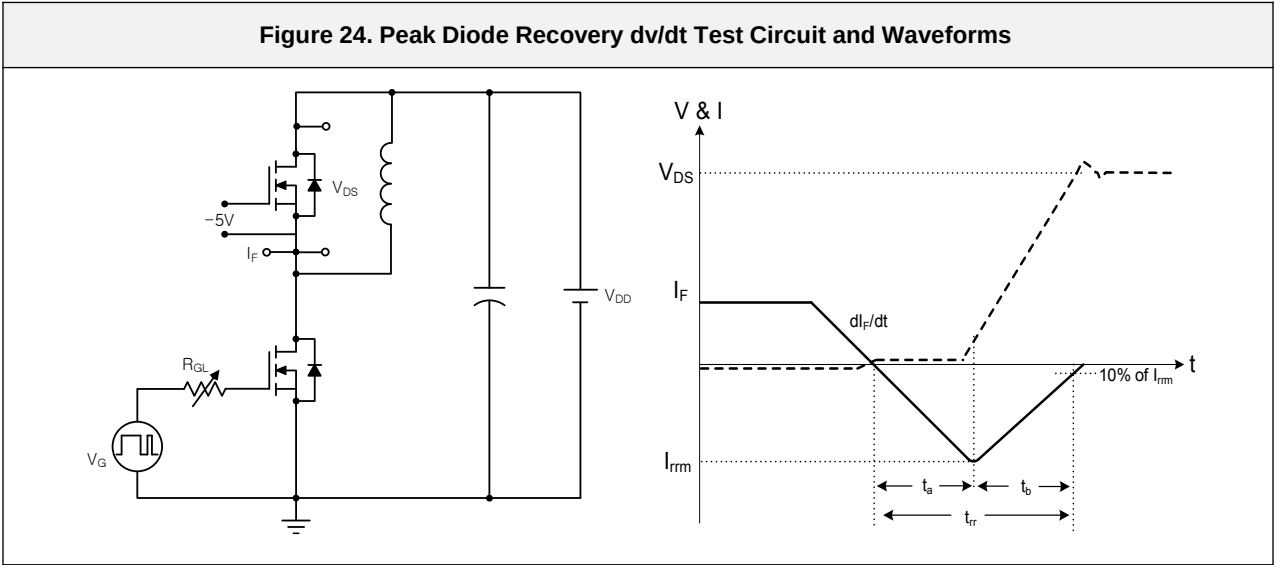
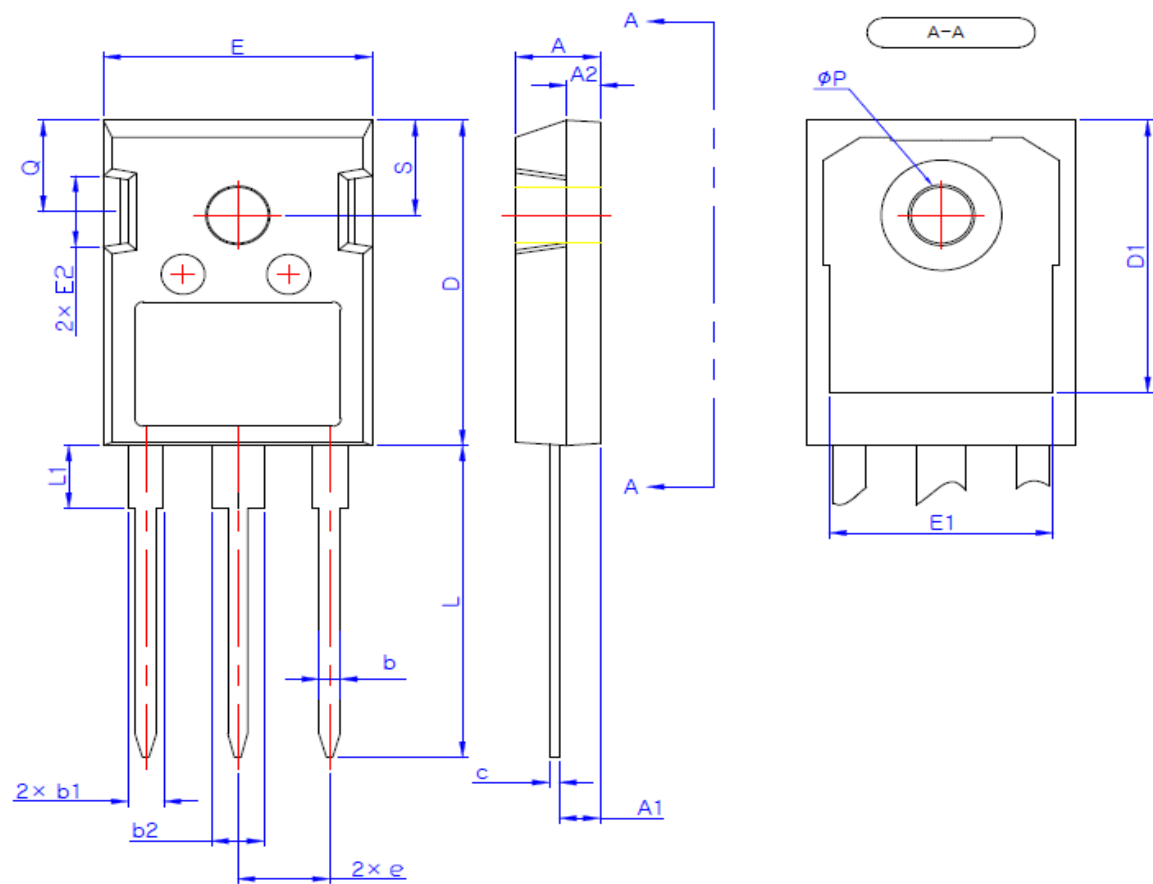


Figure 24. Peak Diode Recovery dv/dt Test Circuit and Waveforms



Package Outlines

TO-247-3L (S)



SYMBOL	MIN	NOM	MAX
A	4.80	5.00	5.20
A1	2.29	2.42	2.54
A2	1.90	2.00	2.10
b	1.10	1.20	1.30
b1	1.91	2.06	2.20
b2	2.92	3.06	3.20
c	0.50	0.60	0.70
D	20.80	21.07	21.34
D1	17.43	17.63	17.83
E	15.75	15.94	16.13
E1	13.06	13.26	13.46
E2	4.32	4.58	4.83
e	5.45 BSC		
L	19.85	20.05	20.25
L1	4.05	4.27	4.49
ΦP	3.55	3.60	3.65
Q	5.59	5.89	6.19
S	6.15 BSC		

* Dimensions in millimeters