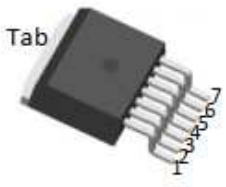
Direct Channel Worldwide Corp.

DC065N65S7

650V 65mΩ Silicon Carbide MOSFET

DESCRIPTION：

- Optimized R_{DS}(on) with Rapid Switching Behavior
- Compatible with Standard Gate Drivers
- Clean Kelvin-Source Switching Pin-out
- High Avalanche Endurance Capability
- Optimized for High Power Density Applications
- RoHS compliant.



TO-263-7L

TYPICAL APPLICATIONS：

- Switching Mode Power Supply
- UPS applications
- PFC & DC/DC Converter
- EV Charging Station
- Renewable Energy
- Power Inverter & Motor Driver

KEY PERFORMANCE PARAMETERS

Characteristic	Symbol	Value	Unit
Drain-Source Voltage	V_{DS} @ Tj(max)	700	V
Recommended Gate-Source Turn-On Voltage	V_{GS}	15~18	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	65	mΩ
Continuous Drain Current	I_D	44	A
Pulse Drain Current	$I_{D,\ PULSE}$	120	A
Power dissipation	P_{tot}	214	W
Avalanche Energy	E_{AS}	500	mJ
Gate Charge	Q_G	69	nC
Output Capacitive Charge	Q_{OSS}	66	nC
Junction & Storage temperature	T_J, T_{STG}	-55~+175	℃

Thermal Characteristics:

Characteristic	Condition	Symbol	Typ.	Unit
Thermal resistance, junction - case		$R_{th(j-C)}$	0.7	K/W
Thermal resistance, junction - ambient	Device on PCB, with 6 cm² of cooling area	$R_{th(j-A)}$	40	K/W

MAXIMUM RATINGS (Tj=25℃ unless otherwise specified)

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Drain-Source Voltage VGS=0V, ID=100μA	V_{DSS}	650			V
Continuous Drain Current VGS=18V, Tc=25°C VGS=18V, Tc=100°C	I_D			44 32	A
Pulse Drain Current , Per Fig. 13l	$I_{D,PULSE)}$			120	A
Continuous Body Diode Current VGS=0V, Tc=25°C	$I_{S)}$			30	A
Avalanche Energy, Single Pulse L=25mH	E_{AS}			500	mJ
Operate Gate Source Voltage Recommended operating values	$V_{GS,OP}$	-8~0		15~18	V
Transient Gate Source Voltage Transient operating limit (AC f >1Hz, pulse width<100ns)	$V_{GE,\ TRAN.)}$	-10		22	V
Power Dissipation, Tc=25℃	P_{tot}			214	W
Junction Temperature	T_J	-55		175	℃
Storage Temperature	T_{STG}	-55		175	℃
Soldering Temperature	T_L			260	℃

ELECTRICAL CHARATERISTICS (Tj=25℃ unless otherwise specified)

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Drain-source Breakdown Voltage VGS=0V, ID=100uA Tj=25℃ VGE=0V, IC=100uA Tj=175℃	$V_{(BR)DSS}$	650	 700		V
Drain-Source On-State Resistance VGS=18V, ID=15A Tj=25℃ VGS=18V, ID=15A Tj=175℃	$R_{DS(ON)}$		65 84	80	mΩ
Gate-Source Threshold Voltage VGS=VDS, ID=20mA	V_{th}		2.5		V
Zero Gate Voltage Drain Current VDS=650V, VGS=0V, Tj=25℃	I_{DSS}		<1	60	uA
Gate-Source Leakage Current VGS=18V, VDS=0V	I_{GSS}			100	nA
Body Diode Forward Voltage VGS=0V, Is=7A Tj=25℃ VGS=0V, Is=7A Tj=175℃	V_{SD}		3.4 2.9		V

Input capacitance f=250KHz, V_{AC}=25mV, VDS=400V, VGS=0V	C_{ies}		1499		pF
Output capacitance f=250KHz, V_{AC}=25mV, VDS=400V, VGS=0V	C_{oes}		113		pF
Reverse capacitance f=250KHz, V_{AC}=25mV, VDS=400V, VGS=0V	C_{res}		17		pF
Effective Output Capacitance, energy related f=250KHz, V_{AC}=25mV, VDS=400V, VGS=0V	$C_{o(er)}$ [1]		124		pF
Effective Output Capacitance, time related f=250KHz, V_{AC}=25mV, VDS=400V, VGS=0V	$C_{o(tr)}$ [2]		164		pF
Coss Stored Energy f=250KHz, V_{AC}=25mV, VDS=400V, VGS=0V	E_{oss}		10		uJ
Output Capacitive Charge f=250KHz, V_{AC}=25mV, VDS=400V, VGS=0V	Q_{oss}		66		nC
Internal Gate Resistance f=1MHz, V_{AC}=25mV	$R_{G,int.}$		2.2		Ω
Gate to Source Charge ID=15A, VDS =400V, VGS=0V/15V	Q_{GS}		11		nC
Gate to Drain Charge ID=15A, VDS =400V, VGS=0V/15V	Q_{GD}		34		nC
Total Gate charge ID=15A, VDS =400V, VGS=0V/15V	Q_G		69		nC

[1] Co(er) is a fixed capacitance that gives the same stored energy as Coss while VDS is rising from 0 to 400V.
[2] Co(tr) is a fixed capacitance that gives the same charging time as Coss while VDS is rising from 0 to 400V.

Inductive Load

Turn-on delay time ID=13A, VDS=400 V, VGS= -3/+15 V, R_G(ext.)=2.7Ω External SiC Diode as an FWD	td $_{(ON)}$		33		ns
Rise time ID=13A, VDS=400 V, VGS= -3/+15 V, R_G(ext.)=2.7Ω External SiC Diode as an FWD	tr		28		ns
Turn-off delay time ID=13A, VDS=400 V, VGS= -3/+15 V, R_G(ext.)=2.7Ω External SiC Diode as an FWD	td $_{(OFF)}$		21		ns
Fall time ID=13A, VDS=400 V, VGS= -3/+15 V, R_G(ext.)=2.7Ω External SiC Diode as an FWD	tf		11		ns
Turn-on Switch energy ID=13A, VDS=400 V, VGS= -3/+15 V, R_G(ext.)=2.7Ω External SiC Diode as an FWD	$E_{(ON)}$		87		uJ

Turn-off Switch energy ID=13A, VDS=400 V, VGS= -3/+15 V, R_G(ext.)=2.7Ω External SiC Diode as an FWD	$E_{(OFF)}$		11		uJ

Resistive Load

Turn-on delay time ID=13.3A, VDS=400 V, VGS= -3/+15 V, R_G(ext.)=2.7Ω R_L=30Ω	$td_{(ON)}$		18		ns
Rise time ID=13.3A, VDS=400 V, VGS= -3/+15 V, R_G(ext.)=2.7Ω R_L=30Ω	tr		11		ns
Turn-off delay time ID=13.3A, VDS=400 V, VGS= -3/+15 V, R_G(ext.)=2.7Ω R_L=30Ω	$td_{(OFF)}$		23		ns
Fall time ID=13.3A, VDS=400 V, VGS= -3/+15 V, R_G(ext.)=2.7Ω R_L=30Ω	tf		24		ns

Body Diode

ELECTRICAL CHARATERISTICS

Characteristic	Symbol	Min.	Typ.	Max.	Unit
Reverse Recovered charge VGS=0V, Is=13A, VDS=400V, di/dt =476A/μs *Qrr herein excluded the Qoss value.	Q_{rr}		42		nC
Reverse Recovered Time VGS=0V, Is=13A, VDS=400V, di/dt =476A/μs *Qrr herein excluded the Qoss value.	T_{rr}		15		ns
Peak reverse recovery current VGS=0V, Is=13A, VDS=400V, di/dt =476A/μs *Qrr herein excluded the Qoss value.	I_{RRM}		4.3		A

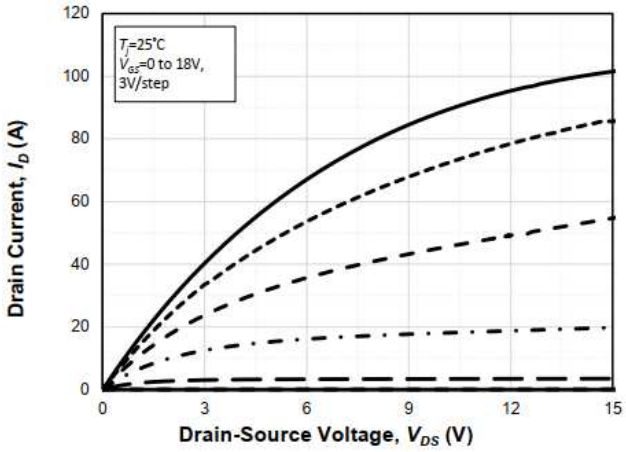


Figure 1. Typical output characteristics (Tj=25℃)

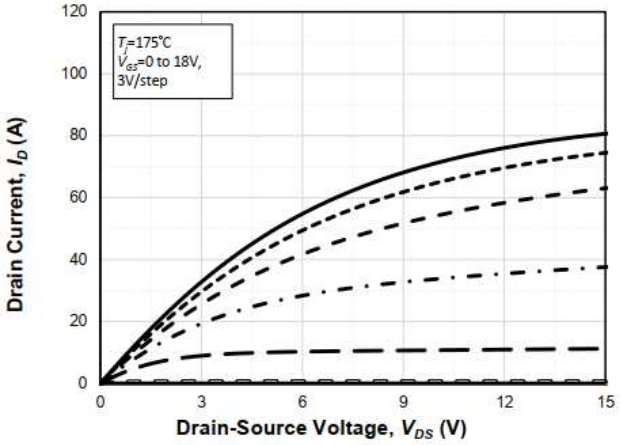


Figure 2. Typical output characteristics (Tj=175℃)

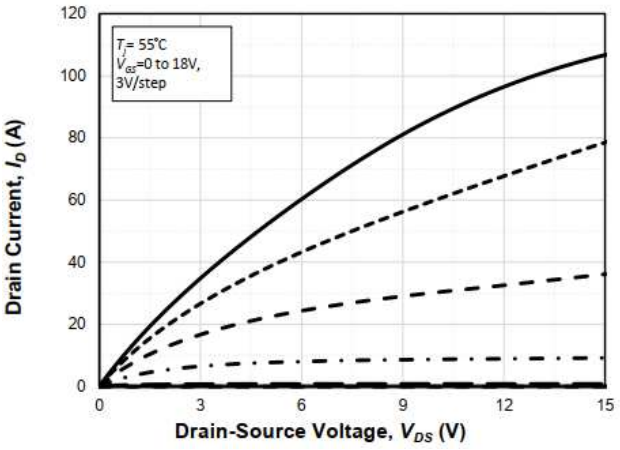


Figure 3. Typical Output Characteristics at Tj=-55°C

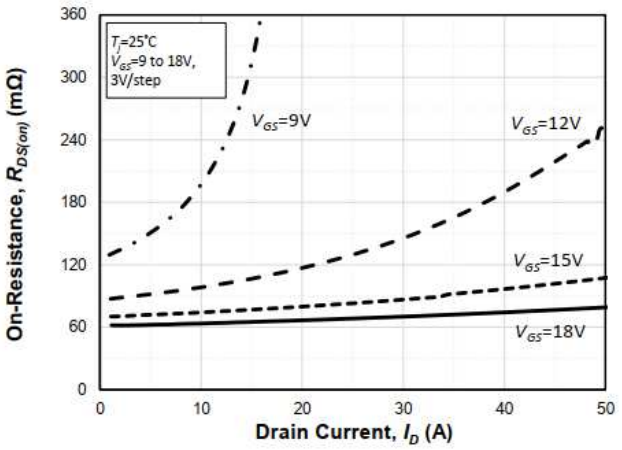


Figure 4. Typ. RDS(on) vs. ID with Various VGS

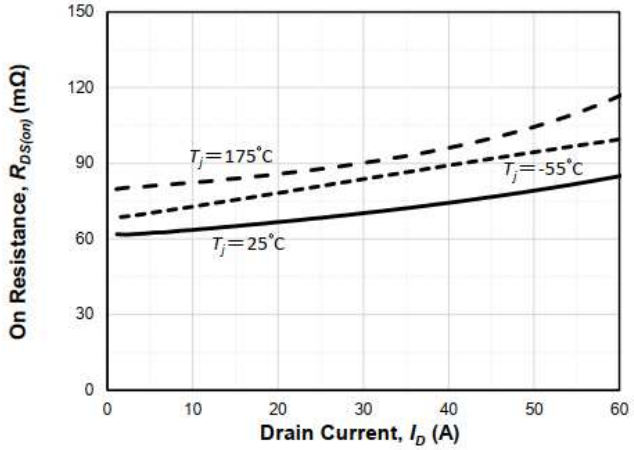


Figure 5. Typ. RDS(on) vs. ID with Various Tj , VGS=18V

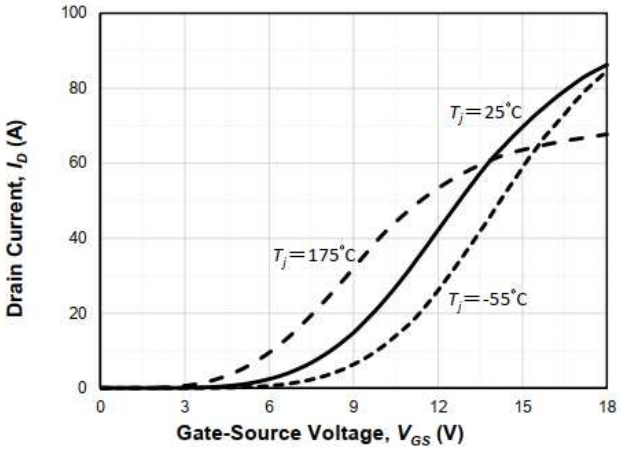


Figure 6. Typ. ID vs. VGS with Various Tj , VDS=10V

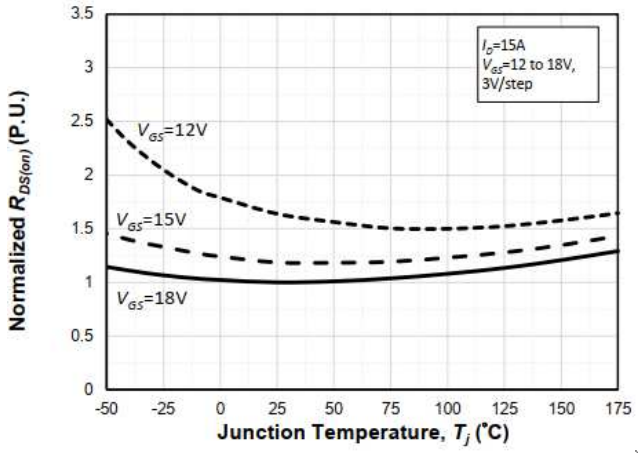


Figure 7. Normalized RDS(on) vs. Tj with Various VGS

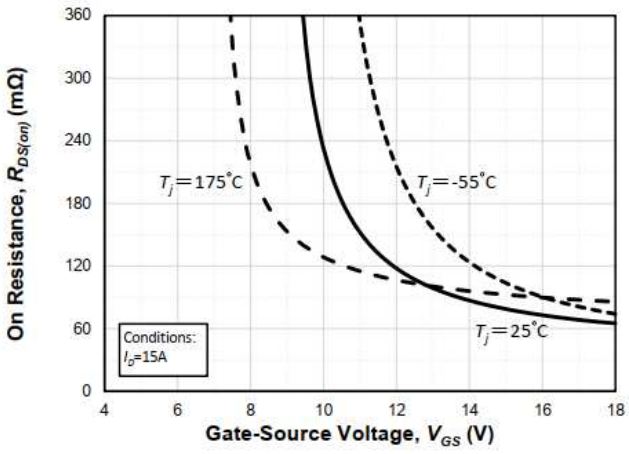


Figure 8. Typ. RDS(on) vs. VGS with Various Tj

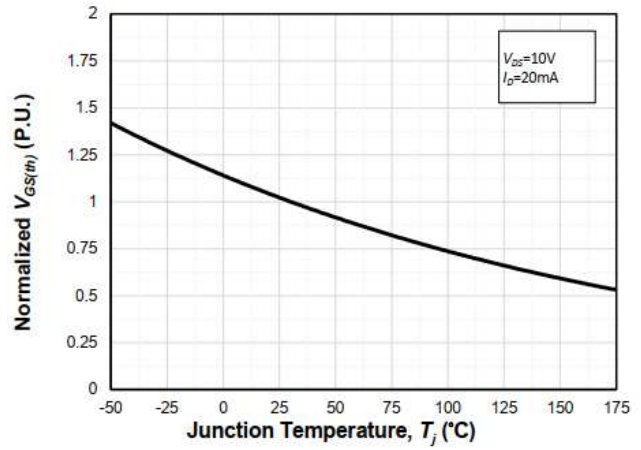


Figure 9. Normalized Vth vs. Tj

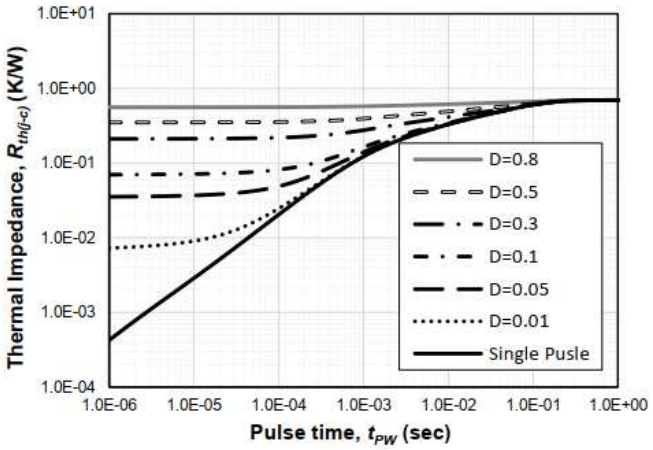


Figure 10. Typ. Transient Thermal Impedance Rth-jc

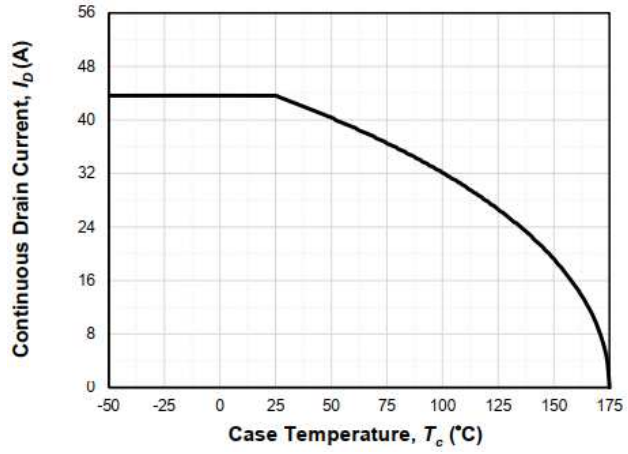


Figure 11. Continuous ID De-rating at VGS=18V, Tj≤175°C

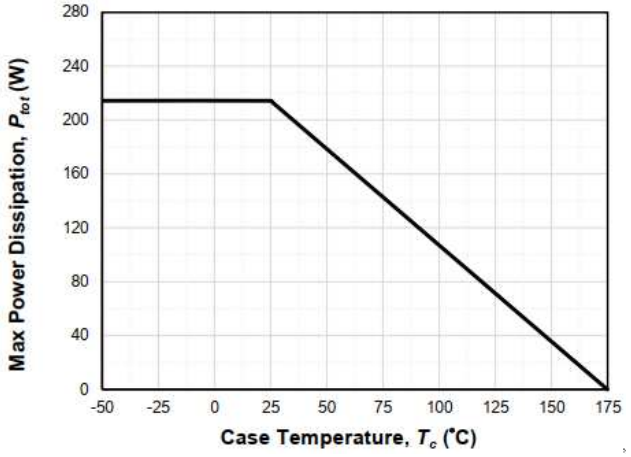


Figure 12. Power Dissipation at VGS=18V, Tj≤175°C

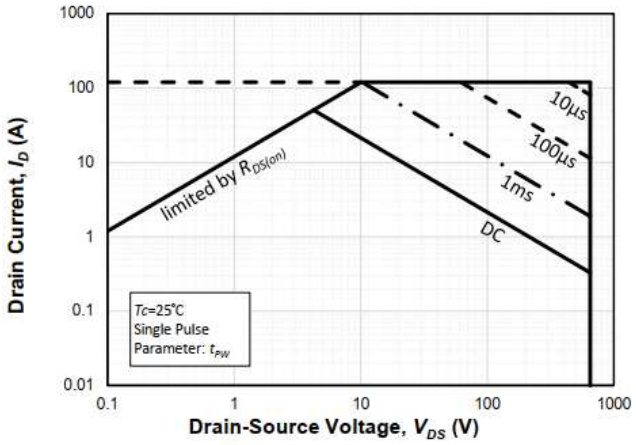


Figure 13. Safe Operating Area at Tc=25°C

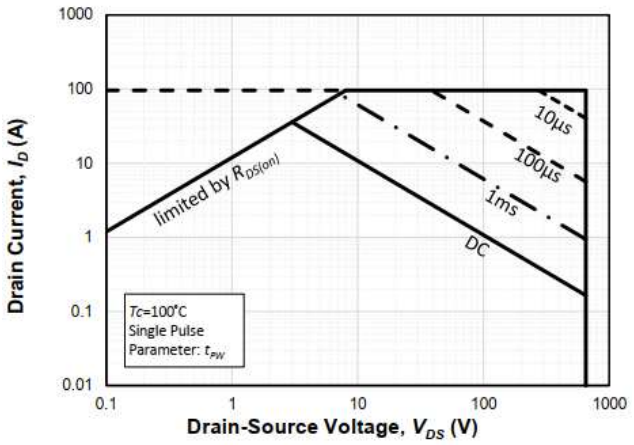


Figure 14. Safe Operating Area at Tc=100°C

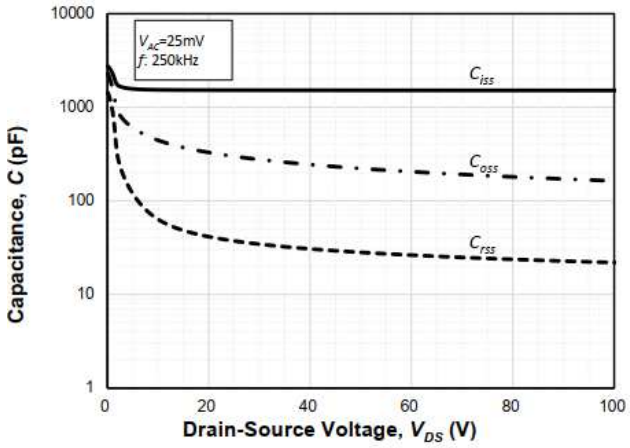


Figure 15. Typ. Capacitance vs. VDS at fsw=250kHz, VDS≤100V

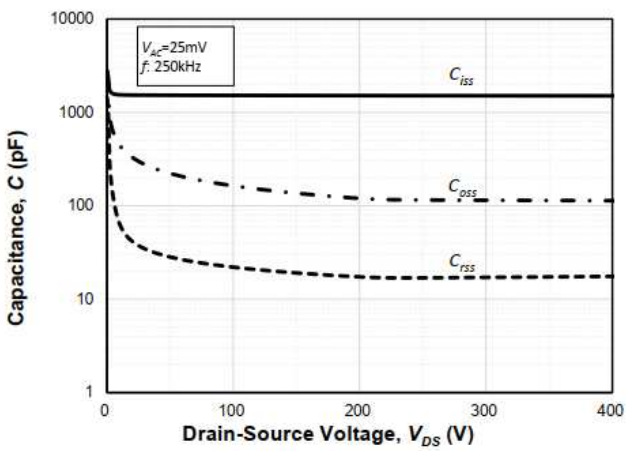


Figure 16. Typ. Capacitance vs. VDS at fsw=250kHz, VDS≤400V

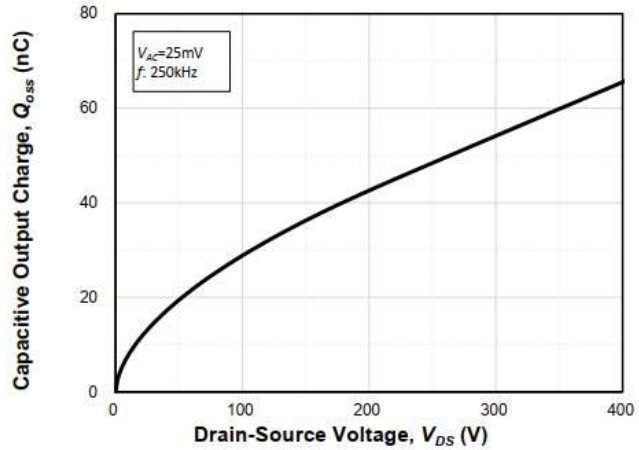


Figure 17.Typ. Capacitive Output Charge at fsw=250kHz

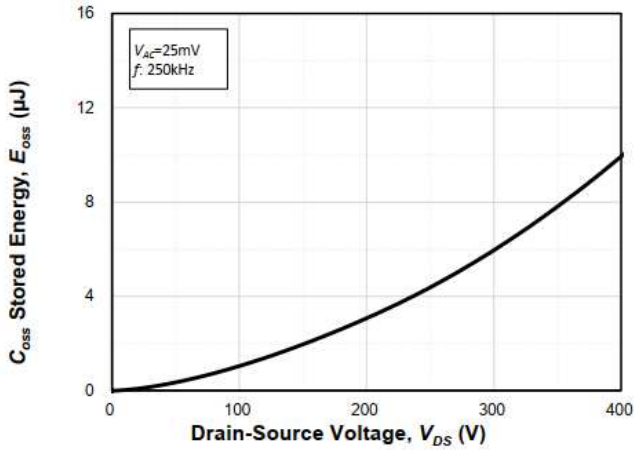


Figure 18. Typ. Coss Stored Energy at fsw=250kHz

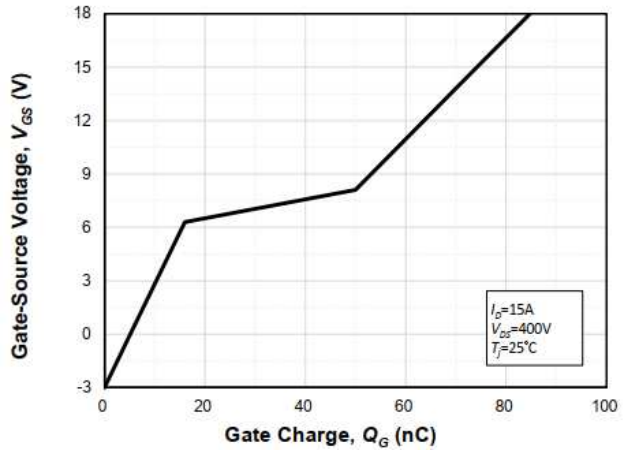


Figure 19. Typ. Gate Charge at VDS=400V, ID=15A

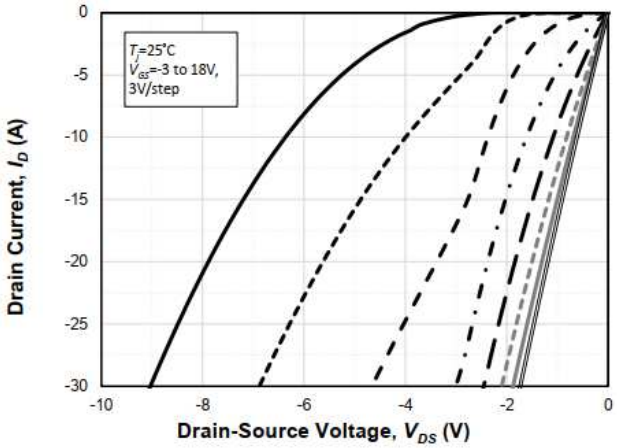


Figure 20. Typical Forward Characteristics of Reverse Conduction at Tj=25°C

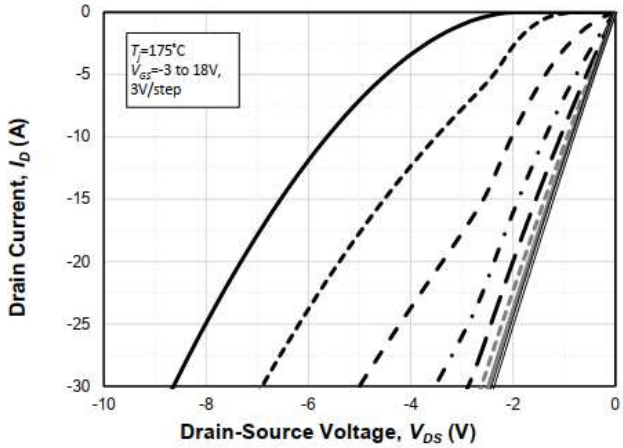


Figure 21. Typical Forward Characteristics of Reverse Conduction at Tj=175°C

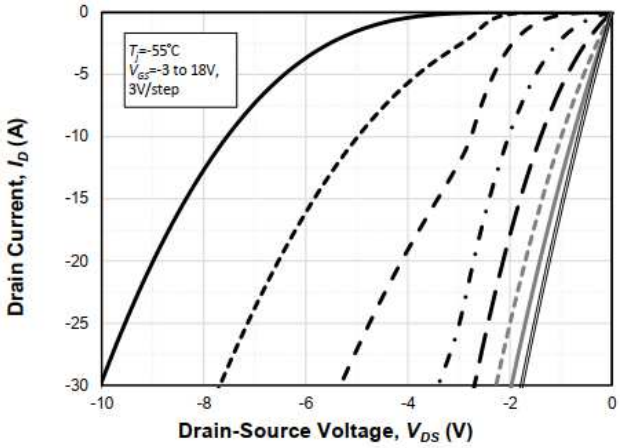


Figure 22. Typical Forward Characteristics of Reverse Conduction at Tj=-55°C

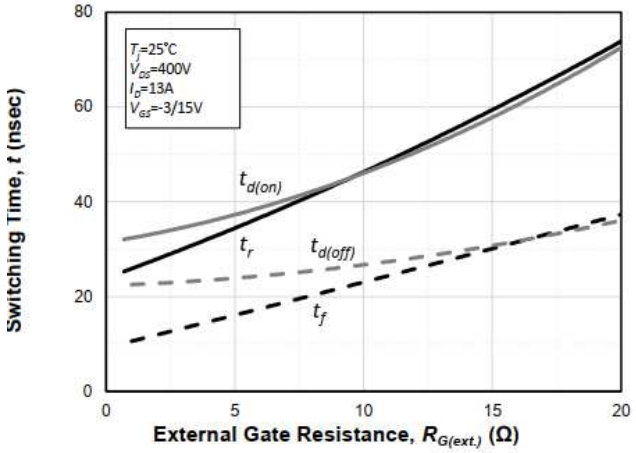


Figure 23. Typ. Switching Time vs. RG(ext.)

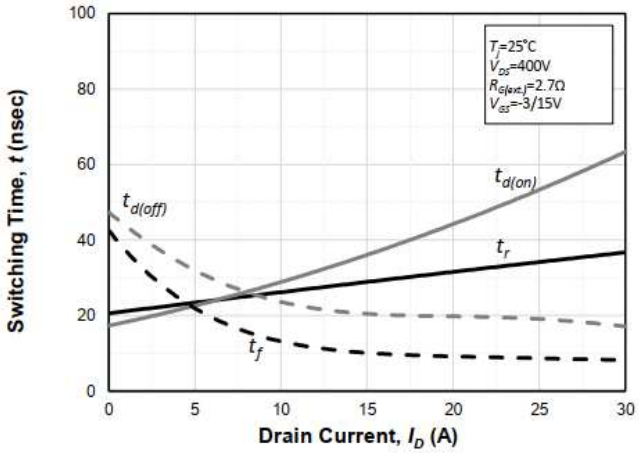
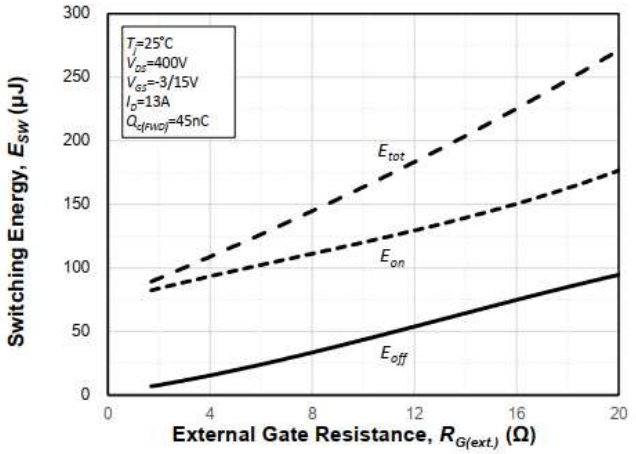
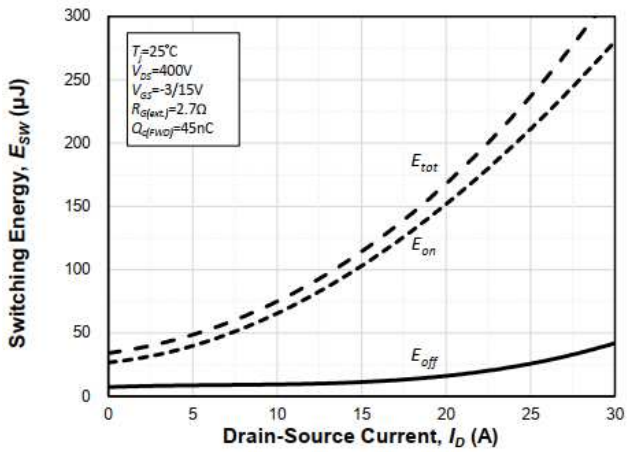
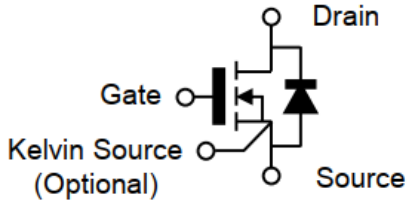


Figure 24. Typ. Switching Time vs. ID





- Circuit diagram



- Package outlines : Dimensions in (mm)