



3300V / 50mOhm SiC MOSFET - Bare Die

HWDS50SCM330X61

Product Overview

The HWDS50SCM330X61 is a high-voltage 3rd Generation silicon carbide MOSFET in bare die form, designed for high-efficiency, high-frequency power conversion. Its low on-resistance, robust body diode, and high junction temperature capability support demanding industrial and transportation applications.

Features

- 3rd Generation SiC MOSFET Technology with +15~+18V gate drive
- High blocking voltage with low on-resistance
- High speed switching with low capacitance
- 175°C operating junction temperature capability
- Ultra fast and robust intrinsic body diode
- Bare die format: suitable for custom packaging and direct die attach
- AlCu source/gate metallization; Ti/Ni/Ag bottom drain metallization

Applications

- Transportation traction inverters
- Medical applications
- High voltage DC-DC converters
- AC/DC power supplies
- Custom power modules and hybrid assemblies

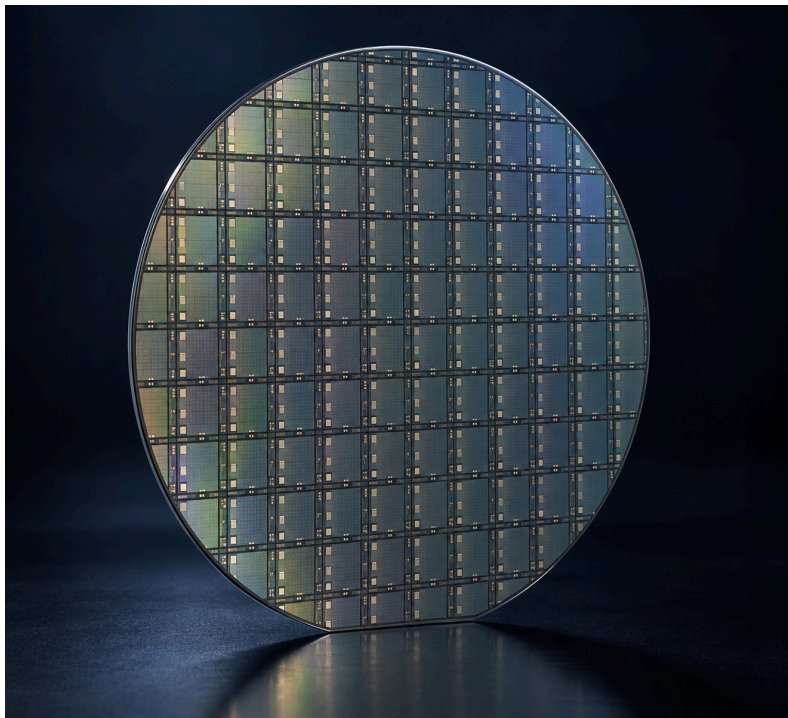
Part Number Information

HWDS50SCM330X61	Gen3 3300V 50mΩ SiC MOSFET Bare Die	Die (X suffix)
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Absolute Maximum Ratings

Ta=25°C unless otherwise specified

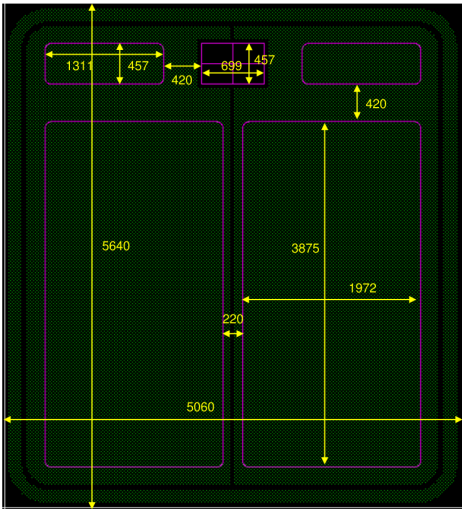
Vds	Drain-Source voltage	3300	V	Vgs=0V, Id=0μA	
Vgsmax (Transient)	Maximum transient voltage	-10 to 23	V	Duty cycle<1%, pulse width<200ns	
Vgson	Recommended turn-on voltage	15 to 16	V		
Vgsoff	Recommended turn-off voltage	-5 to -2	V	Typical -3.5V	
Id	Drain current (continuous)	61	A	Vgs=18V, Tc=25°C	Fig.23
Id	Drain current (continuous)	45	A	Vgs=18V, Tc=100°C	Fig.23
Idm	Drain current (pulsed)	152	A	Pulse width limited by SOA and dynamic θ(j-c)	Fig. 25,26
Isss	Body diode current (pulsed)	152	A	Pulse width limited by SOA and dynamic θ(j-c)	Fig. 25,26
Ptot	Total power dissipation	600	W	Tj=25°C	
Tstg	Storage temperature range	-55 to 175	°C		
Tj	Operating junction temperature	-55 to 175	°C		
TI	Solder Temperature (bottom)	260	°C	Wave soldering only; 1.6mm from case for 10s	

Note1: Assumes θ(j-c) <0.3°C/W.



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Chip size (W/O scribe line): 5060um*5640um
Chip size (With scribe line): 5140um*5720um
Gate Pad: 699um*457um

Mechanical Parameters

Die Size	5060 × 5640	μm ²
Source Pad Size (L×W)	1972 × 3875 × 2	μm ²
Kelvin Pad Size (L×W)	1311 × 457 × 2	μm ²
Gate Pad Size (L×W)	699 × 457	μm ²
Thickness	180 ± 20	μm
Wafer Size	150	mm
Top Side Source Metallization (AlCu)	4	μm
Top Side Gate Metallization (AlCu)	4	μm
Bottom Drain Metallization (Ti/Ni/Ag)	0.2 / 0.2 / 1	μm
Frontside Passivation (Polyimide)	5	μm



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Electrical Characteristics

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Idss	Zero gate voltage drain current		5	100	μA	Vds=3300V, Vgs=0V	
Igss	Gate leakage current			±100	nA	Vds=0V, Vgs=5~20V	
Vth	Gate threshold voltage	2.0	3.0	4.0	V	Vgs=Vds, Id=7mA	Fig. 8,9
Vth	Gate threshold voltage	2.3			V	Vgs=Vds, Id=7mA @Tj=75°C	
Ron	Static drain-source on-resistance		50	65	mΩ	Vgs=18V, Id=25A @Tj=25°C	Fig. 4,5,6,7
Ron	Static drain-source on-resistance		145		mΩ	Vgs=16V, Id=25A @Tj=175°C	
Ron	Static drain-source on-resistance		56		mΩ	Vgs=15V, Id=25A @Tj=25°C	
Ron	Static drain-source on-resistance		147		mΩ	Vgs=15V, Id=25A @Tj=175°C	
Ciss	Input capacitance		6111		pF	Vds=1700V, Vgs=0V, f=100kHz, Vac=25mV	Fig. 16
Coss	Output capacitance		95.4		pF		
Crss	Reverse transfer capacitance		0.75		pF		
Eoss	Coss stored energy		162		μJ		Fig.17
Qg	Total gate charge		218		nC	Vds=1700V, Id=10A, Vgs=3 to 18V	Fig. 18
Qgs	Gate-source charge		67		nC		
Qgd	Gate-drain charge		44		nC		
Rg	Gate input resistance		1.9		Ω	f=1MHz	
Eon	Turn-on switching energy		1927		μJ	Vds=1700V, Id=30A, Rg(Ext)=3.3Ω, L=400μH, Tj=25°C	Fig. 19,20
Eoff	Turn-off switching energy		301		μJ		
td(on)	Turn-on delay time		20.6		ns		
tr	Rise time		25.8		ns		
td(off)	Turn-off delay time		32		ns		
tf	Fall time		19.6		ns		
Eon	Turn-on switching energy		2497		μJ	Vds=1700V, Id=30A, Vgs=-3.5 to 16V, Rg(ext)=3.3Ω, L=400μH, Tj=175°C	Fig. 22
Eoff	Turn-off switching energy		305		μJ		

Reverse Diode Characteristics

Ta=25°C unless otherwise specified

Vsd	Diode forward voltage		3.7		V	Isd=20A, Vgs=0V	Fig.10, 11,12
Vsd	Diode forward voltage		4.4		V	Isd=20A, Vgs=0V, Tj=175°C	
IS	Diode forward current (continuous)		99.4		A	Vgs=2V, Tc=25°C	
IS	Diode forward current (continuous)		56		A	Vgs=2V, Tc=100°C	
trr	Reverse recovery time		46.1		ns	Vgs=-3.5V to 15V, Isd=30A, VR=1700V, Rg(ext)=7.3Ω, L=400μH, Hd/dt=3000A/μs	
Qrr	Reverse recovery charge		506.7		nC		
Irrm	Peak inverse recovery current		43.5		A		



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Typical Performance (curves)

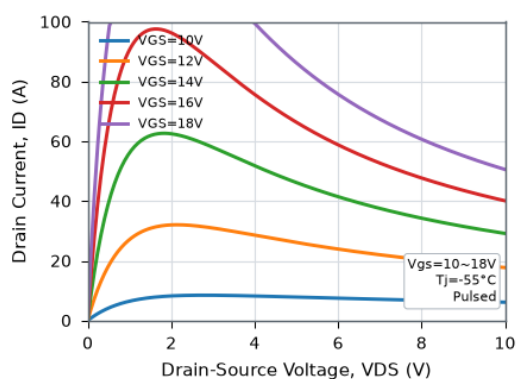


Fig. 1 — Output Curve @ Tj=-55°C

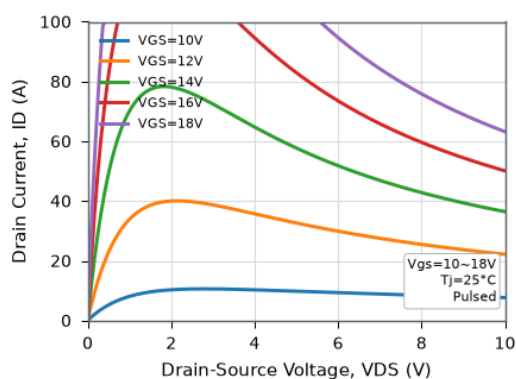


Fig. 2 — Output Curve @ Tj=25°C

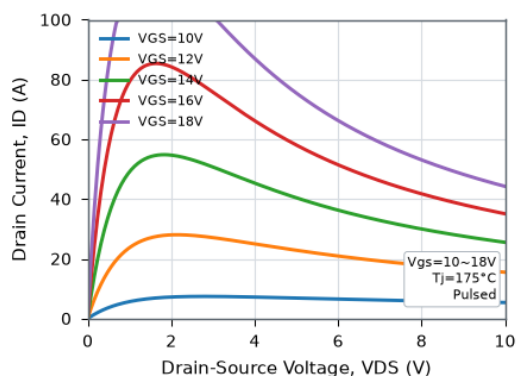


Fig. 3 — Output Curve @ Tj=175°C

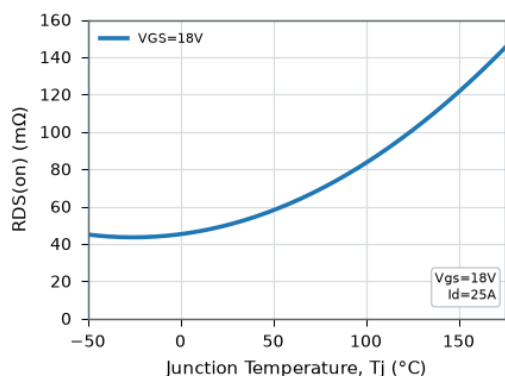


Fig. 4 — RDS(on) vs. Junction Temperature



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Typical Performance (curves)

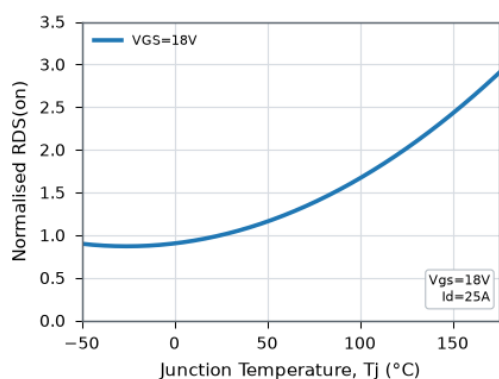


Fig. 5 — Normalised RDS(on) vs. Junction Temp

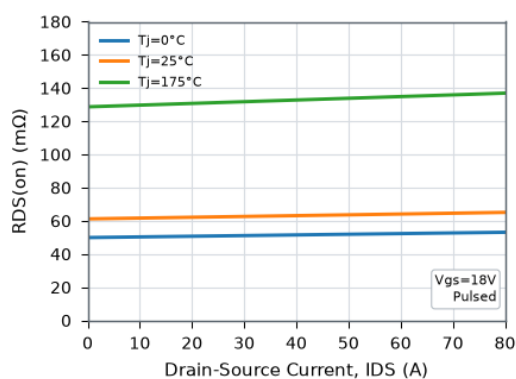


Fig. 6 — RDS(on) vs. IDS @ Various Temperal

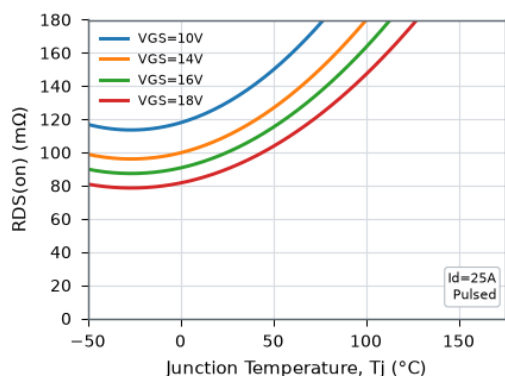


Fig. 7 — RDS(on) vs. Tj @ Various VGS

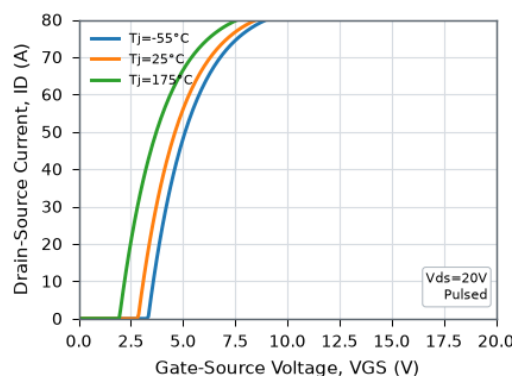


Fig. 8 — Transfer Curves @ Various Temperal



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Typical Performance (curves)

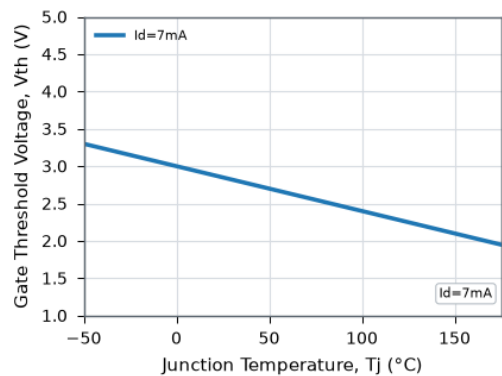


Fig. 9 — V_{th} vs. Junction Temperature

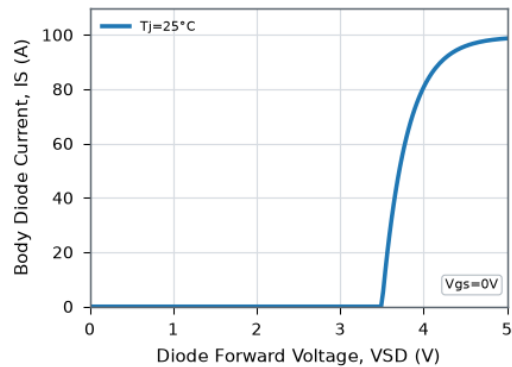


Fig. 10 — Body Diode I-V @ $T_j = 25^\circ C$

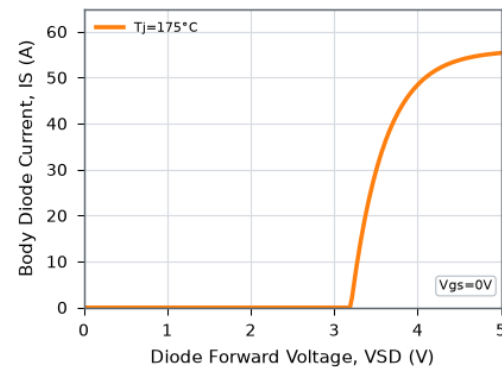


Fig. 11 — Body Diode I-V @ $T_j = 175^\circ C$

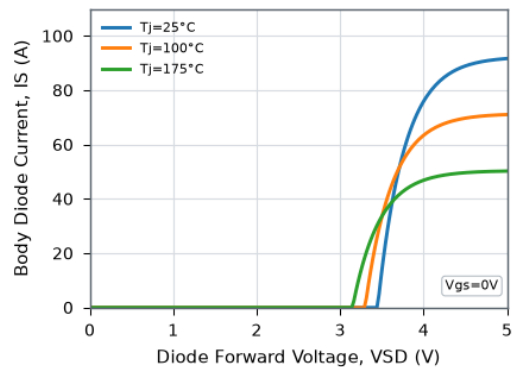


Fig. 12 — Body Diode I-V vs. Temperature



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Typical Performance (curves)

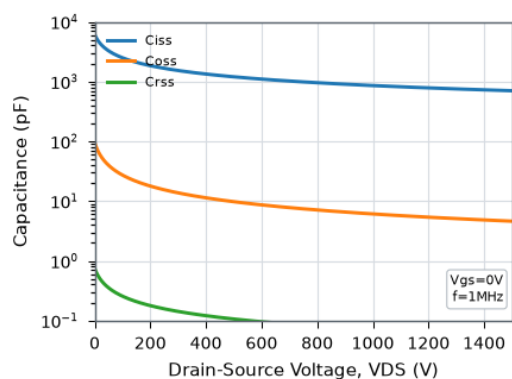


Fig. 13 — Capacitance vs. VDS

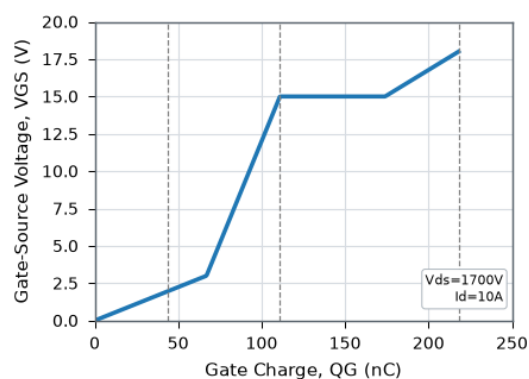


Fig. 14 — Gate Charge

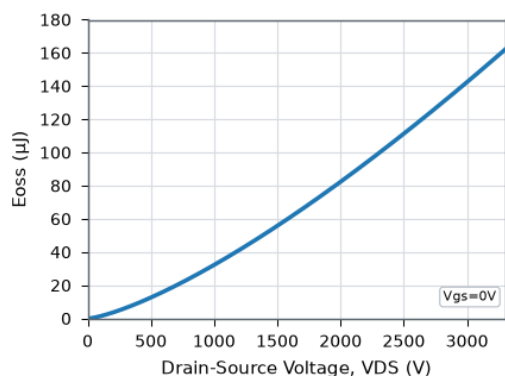


Fig. 15 — Eoss vs. VDS

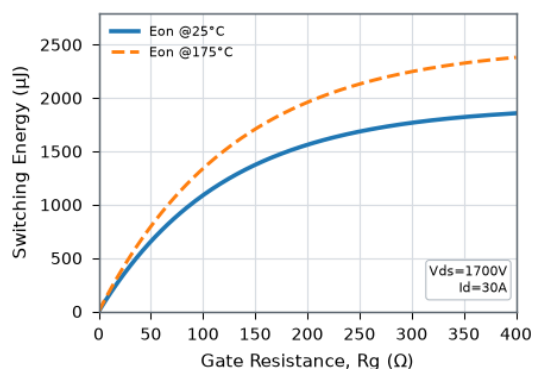


Fig. 16 — Eon vs. Gate Resistance



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Typical Performance (curves)

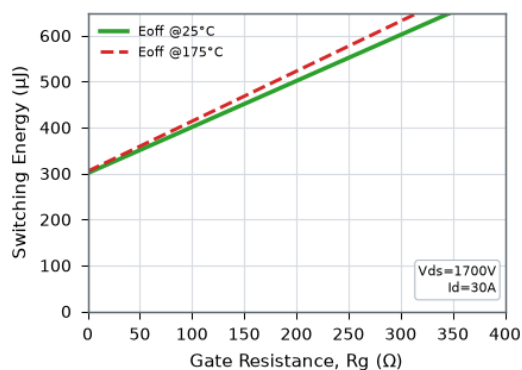


Fig. 17 — Eoff vs. Gate Resistance

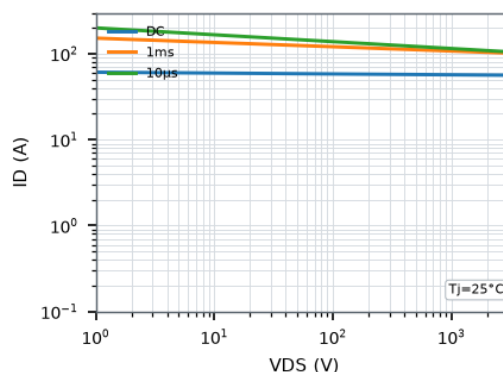


Fig. 18 — Safe Operating Area

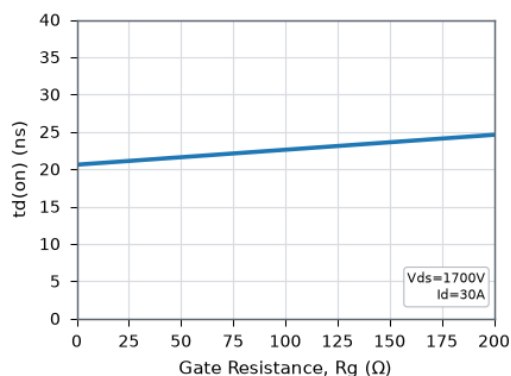


Fig. 19 — $t_{d(on)}$ vs. Gate Resistance

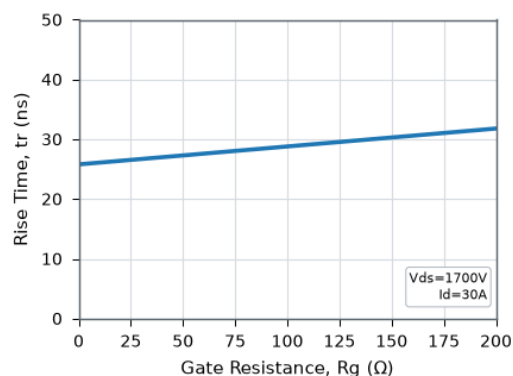


Fig. 20 — Rise Time vs. Gate Resistance



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Typical Performance (curves)

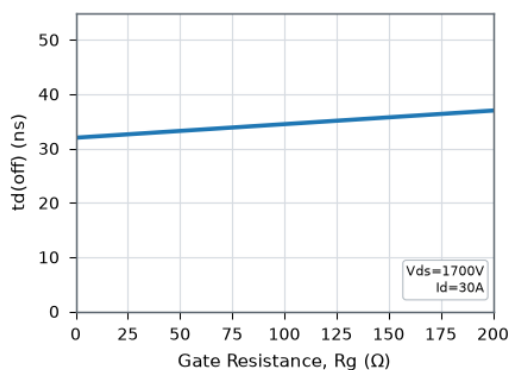


Fig. 21 — $t_d(\text{off})$ vs. Gate Resistance

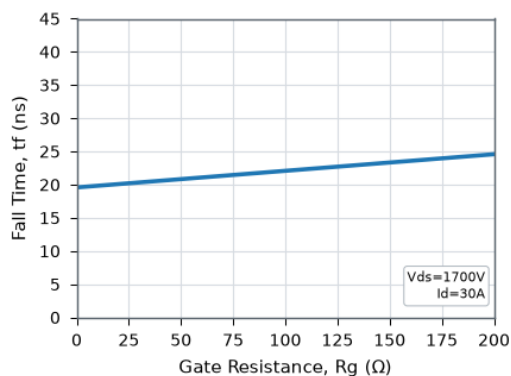


Fig. 22 — Fall Time vs. Gate Resistance

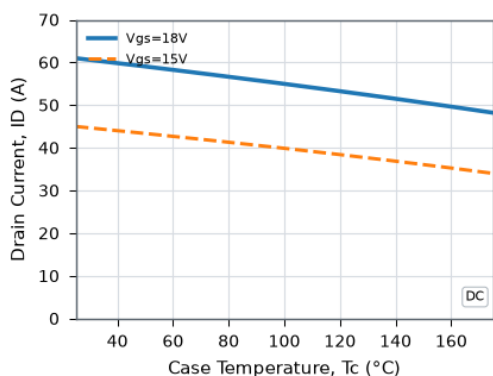


Fig. 23 — I_D vs. Case Temperature

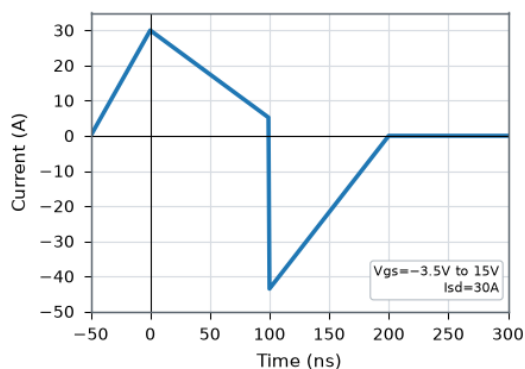


Fig. 24 — Body Diode Recovery @ $25^{\circ}C$



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Typical Performance (curves)

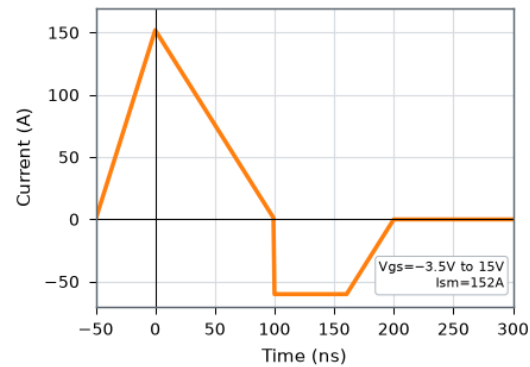


Fig. 25 — Body Diode Recovery (pulsed]

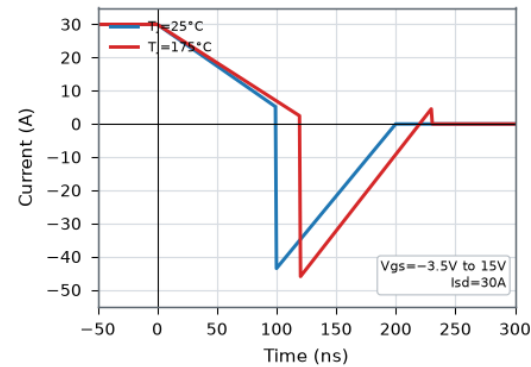


Fig. 26 — Body Diode Recovery vs. Tempera