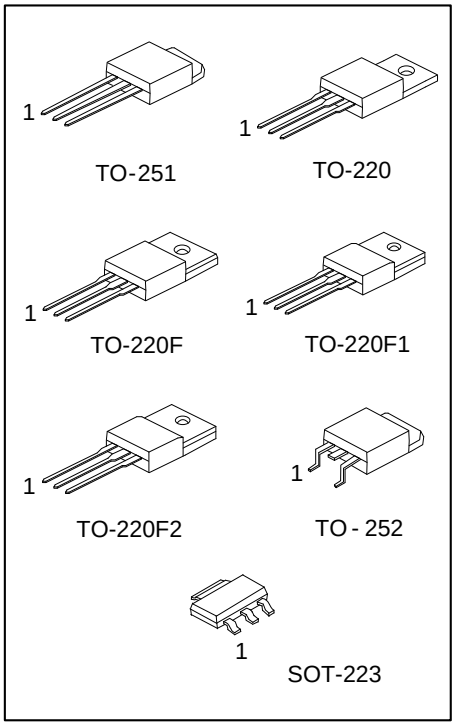
4NM65A

Power MOSFET

4A, 650V N-CHANNEL SUPER-JUNCTION MOSFET



■ DESCRIPTION

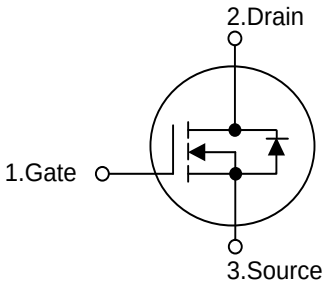
The UTC **4NM65A** is a high voltage super junction MOSFET and is designed to have better characteristics.

The UTC **4NM65A** Utilizing an advanced charge-balance technology, enhance system efficiency, improve EMI and reliability. such as low gate charge, low on-state resistance and have a high power density and high rugged avalanche characteristics. This super junction MOSFET usually used at AC/DC power conversion, and industrial power applications.

■ FEATURES

* $R_{DS(ON)} \leq 1.44\ \Omega$ @ V_{GS}=10V, I_D=2.0A
* Fast Switching Capability
* Avalanche Energy Specified
* Improved dv/dt Capability, High Ruggedness

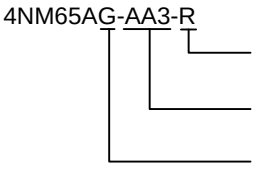
■ SYMBOL



■ ORDERING INFORMATION

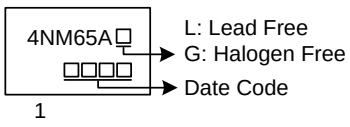
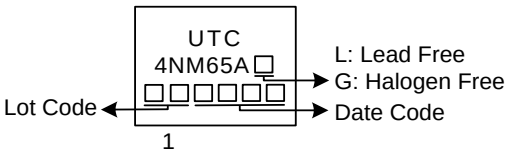
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
4NM65AL-AA3-R	4NM65AG-AA3-R	SOT-223	G	D	S	Tape Reel
4NM65AL-TA3-T	4NM65AG-TA3-T	TO-220	G	D	S	Tube
4NM65AL-TF1-T	4NM65AG-TF1-T	TO-220F1	G	D	S	Tube
4NM65AL-TF2-T	4NM65AG-TF2-T	TO-220F2	G	D	S	Tube
4NM65AL-TF3-T	4NM65AG-TF3-T	TO-220F	G	D	S	Tube
4NM65AL-TM3-T	4NM65AG-TM3-T	TO-251	G	D	S	Tube
4NM65AL-TN3-R	4NM65AG-TN3-R	TO-252	G	D	S	Tape Reel

Note: Pin Assignment: G: Gate D: Drain S: Source



(1) T: Tube, R: Tape Reel
(2) AA3: SOT-223, TA3: TO-220, TF3: TO-220F, TF1: TO-220F1,TF2: TO-220F2, TM3: TO-251, TN3: TO-252
(3) G: Halogen Free and Lead Free, L: Lead Free

■ MARKING

SOT-223	TO-220 / TO-220F / TO-220F1 TO-220F2 / TO-251 / TO-252
	

■ ABSOLUTE MAXIMUM RATINGS (T_C = 25°C, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DSS}	650	V
Gate-Source Voltage		V_{GSS}	±30	V
Drain Current	Continuous	I_D	4	A
	Pulsed (Note2)	I_{DM}	16	A
Avalanche Current (Note 2)		I_{AR}	1.3	A
Avalanche Energy	Single Pulsed (Note3)	E_{AS}	122	mJ
Peak Diode Recovery dv/dt (Note4)		dv/dt	4.83	V/ns
Power Dissipation	SOT-223	P_D	15	W
	TO-220		72	W
	TO-220F/TO-220F1 TO-220F2		23	W
	TO-251/TO-252		45	W
Junction Temperature		T_J	+150	°C
Storage Temperature		T_{STG}	-55 ~ +150	°C

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.
2. Repetitive Rating : Pulse width limited by maximum junction temperature
3. L=144mH, I_{AS}=1.3A, V_{DD}=50V, R_G=25 Ω, Starting T_J = 25°C
4. I_{SD}≤4.0A, di/dt≤200A/μs, V_{DD}≤ BV_{DSS}, Starting T_J = 25°C

■ THERMAL DATA

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	SOT-223	θ_{JA}	150	°C/W
	TO-220/TO-220F TO-220F1/TO-220F2		62.5	°C/W
	TO-251/TO-252		110	°C/W
Junction to Case	SOT-223	θ_{JC}	8.33	°C/W
	TO-220		1.73	°C/W
	TO-220F/TO-220F1 TO-220F2		5.43	°C/W
	TO-251/TO-252		2.77 (Note)	°C/W

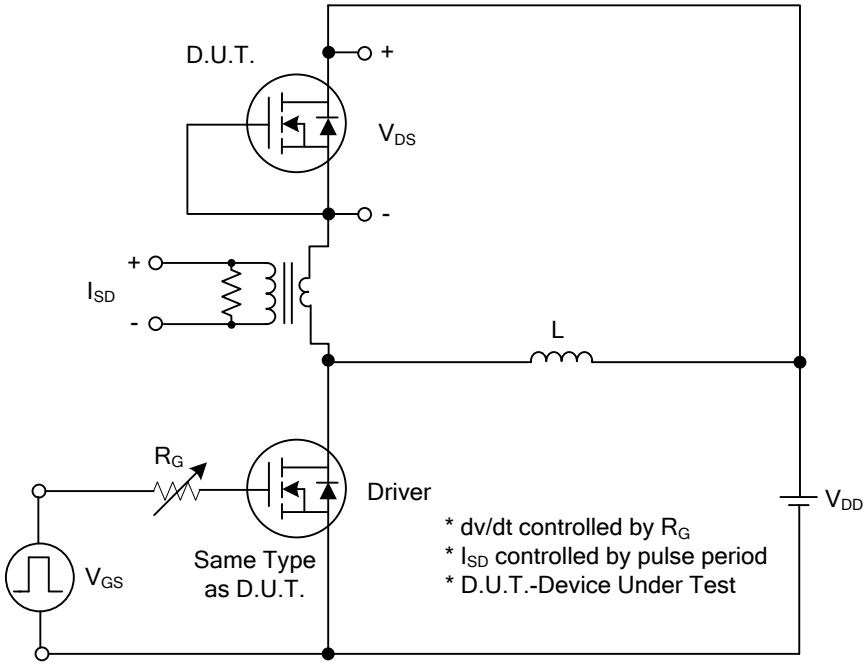
Note: Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

■ ELECTRICAL CHARACTERISTICS (T_J=25°C, unless otherwise specified)

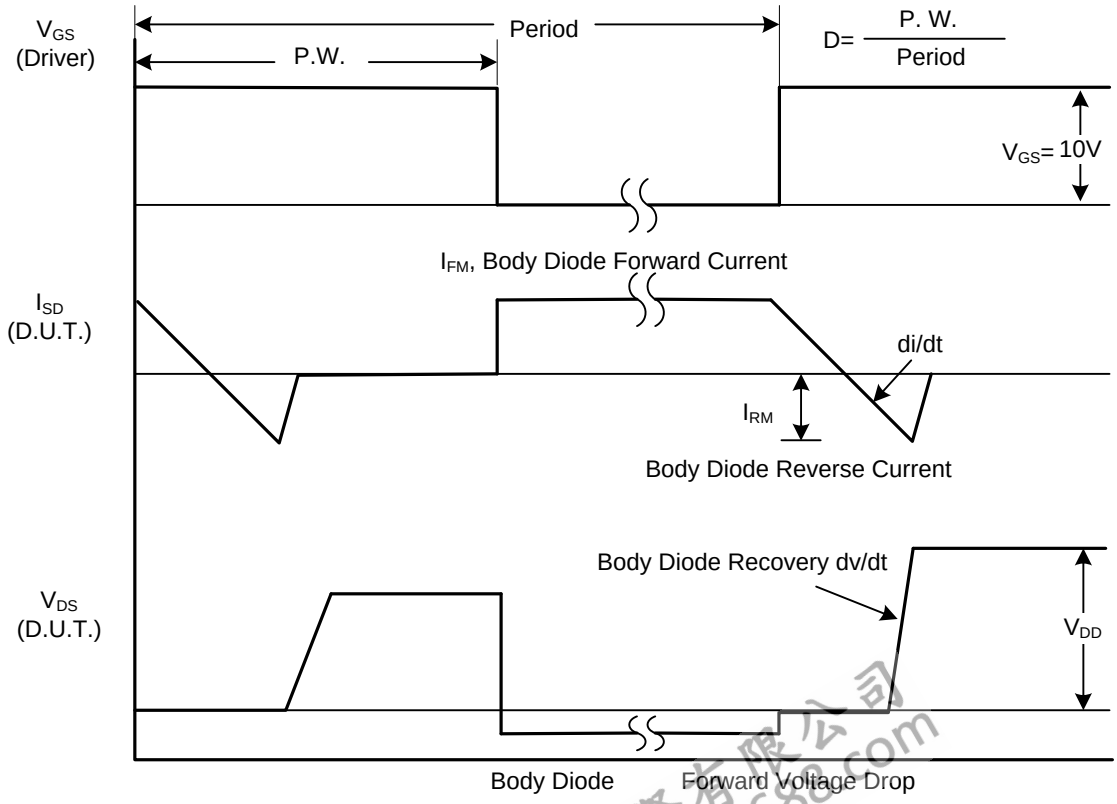
PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	V_{GS} = 0 V, I_D = 250μA	650			V
Drain-Source Leakage Current		I_{DSS}	V_{DS} = 650 V, V_{GS} = 0 V			10	μA
Gate-Source Leakage Current	Forward	I_{GSS}	V_{GS} = 30 V, V_{DS} = 0 V			100	nA
	Reverse		V_{GS} = -30 V, V_{DS} = 0 V			-100	nA
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	V_{DS} = V_{GS}, I_D = 250μA	2.5		4.5	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	V_{GS} = 10 V, I_D = 2.0A			1.44	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	V_{GS}=0V, V_{DS}=25V, f=1MHz		250		pF
Output Capacitance		C_{OSS}			184		pF
Reverse Transfer Capacitance		C_{RSS}			17		pF
SWITCHING CHARACTERISTICS							
Total Gate Charge (Note 1)		Q_G	V_{DS}=50V, V_{GS}=10V, I_D=1.0A I_G=1mA (Note 1, 2)		10		nC
Gate-Source Charge		Q_{GS}			2.7		nC
Gate-Drain Charge		Q_{GD}			2.5		nC
Turn-On Delay Time (Note 1)		$t_{D(ON)}$	V_{DD}=100V, V_{GS}=10V, I_D=4.0A, R_{GS}=25Ω		5.6		ns
Turn-On Rise Time		t_R			17		ns
Turn-Off Delay Time		$t_{D(OFF)}$			30		ns
Turn-Off Fall Time		t_F			27		ns
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Maximum Continuous Drain-Source Diode Forward Current		I_S				4	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				16	A
Drain-Source Diode Forward Voltage (Note 1)		V_{SD}	I_S=4.0A, V_{GS}=0V			1.4	V
Body Diode Reverse Recovery Time (Note 1)		t_{rr}	I_S=4.0A, V_{GS}=0V dI_F/dt=100A/μs		236		ns
Body Diode Reverse Recovery Charge		Q_{rr}			3.85		μC

Notes: 1. Pulse Test: Pulse width ≤ 300μs, Duty cycle≤2%
2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

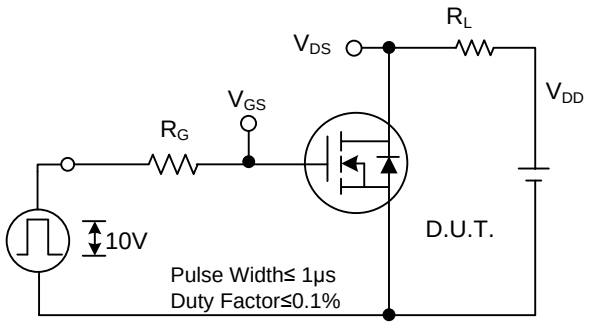


Peak Diode Recovery dv/dt Test Circuit

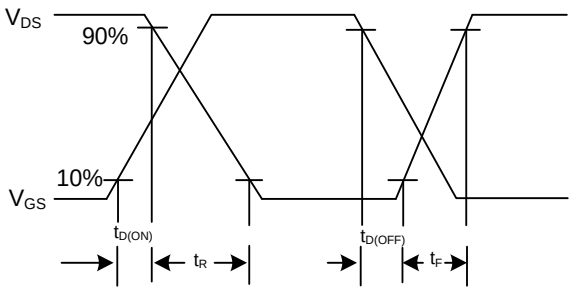


Peak Diode Recovery dv/dt Waveforms

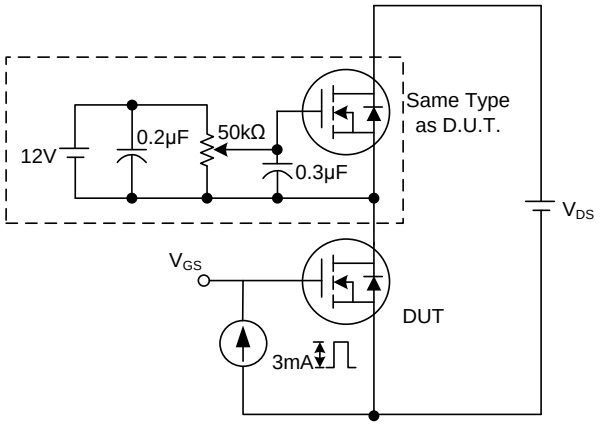
■ TEST CIRCUITS AND WAVEFORMS



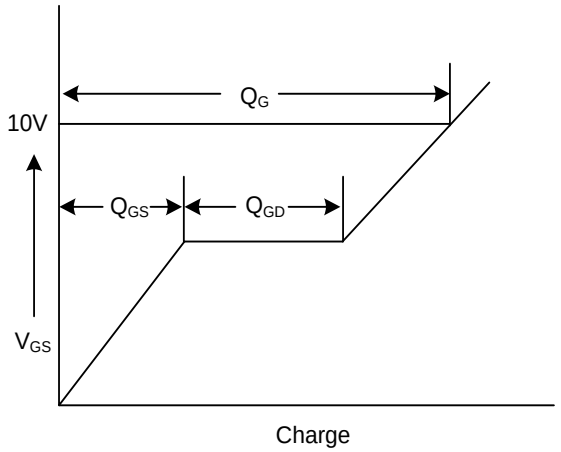
Switching Test Circuit



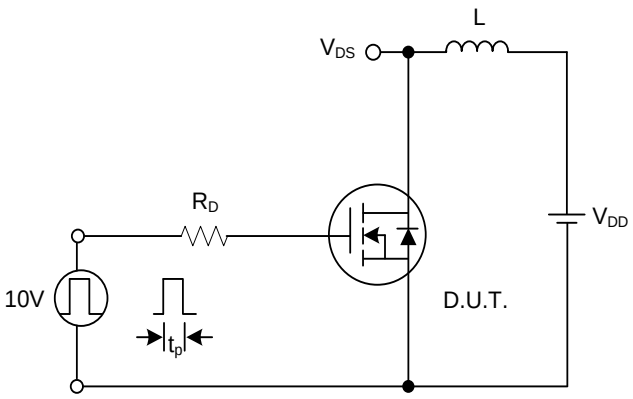
Switching Waveforms



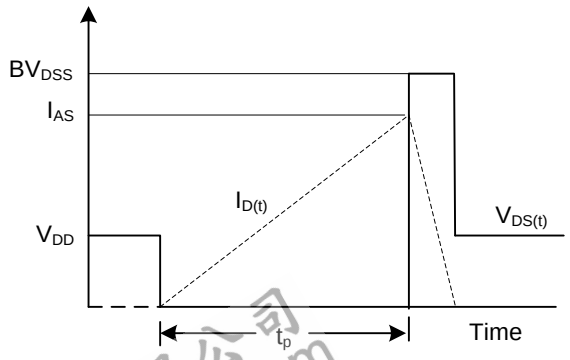
Gate Charge Test Circuit



Gate Charge Waveform



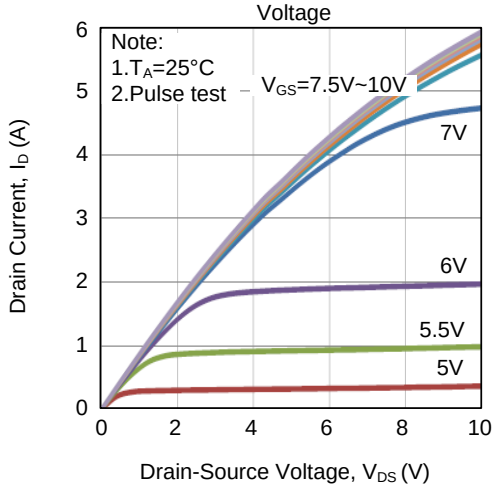
Unclamped Inductive Switching Test Circuit



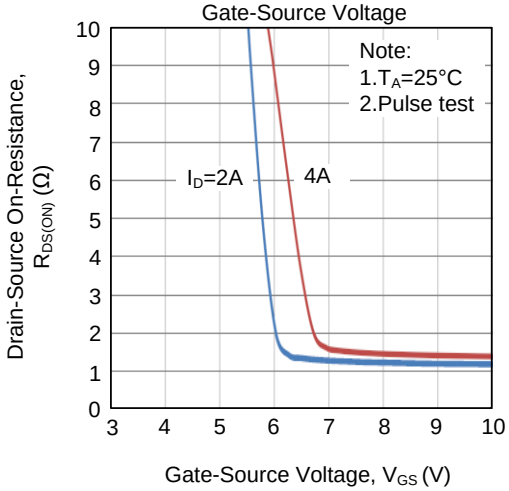
Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS

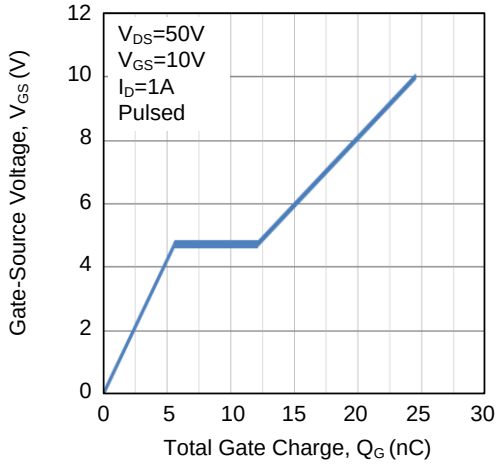
Drain Current vs. Drain-Source Voltage



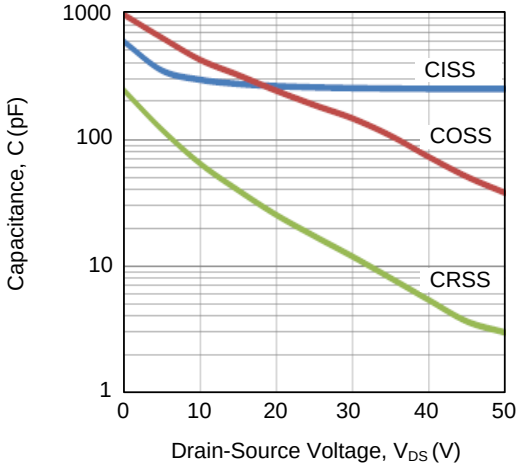
Drain-Source On-Resistance vs. Gate-Source Voltage



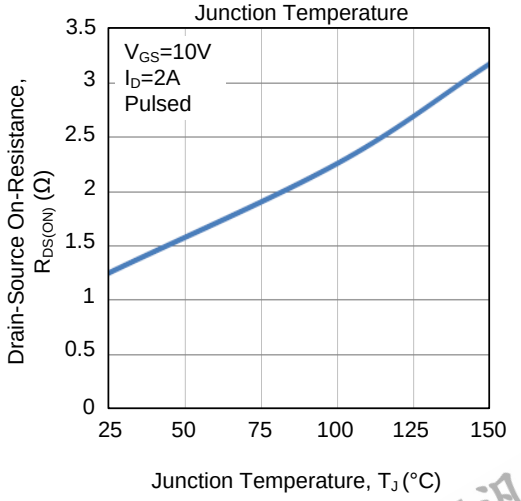
Gate Charge Characteristics



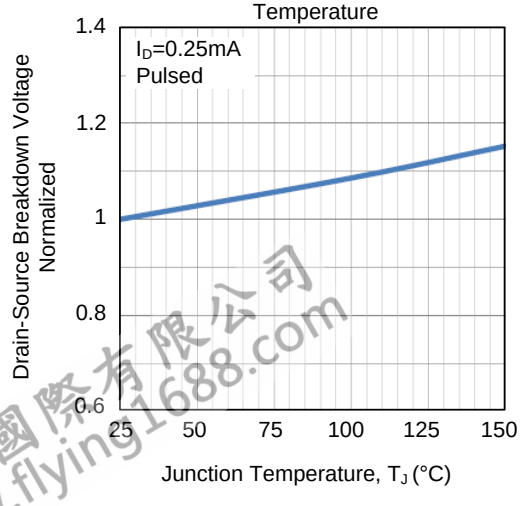
Capacitance Characteristics



Drain-Source On-Resistance vs. Junction Temperature

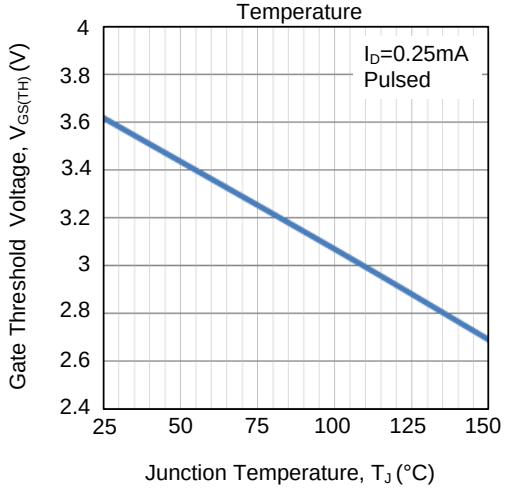


Breakdown Voltage vs. Junction Temperature

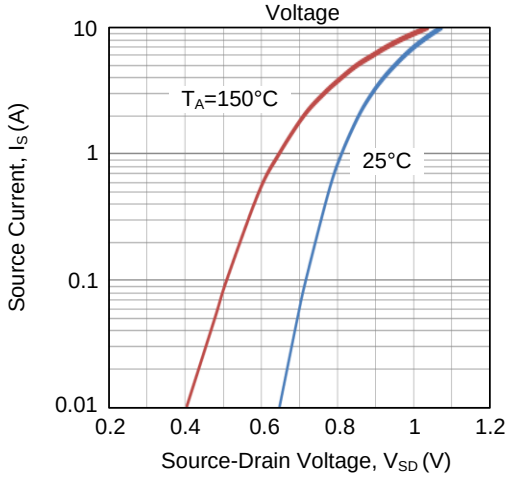


■ TYPICAL CHARACTERISTICS (Cont.)

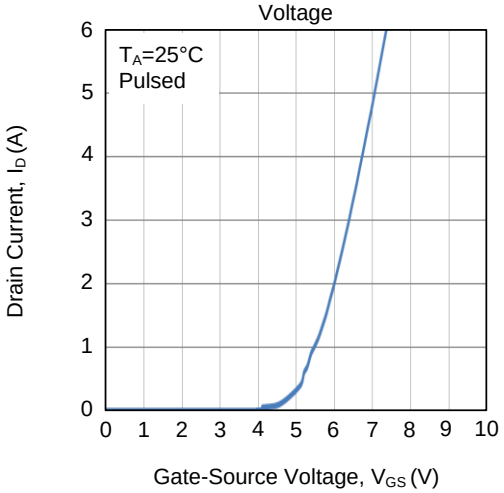
Gate Threshold Voltage vs. Junction Temperature



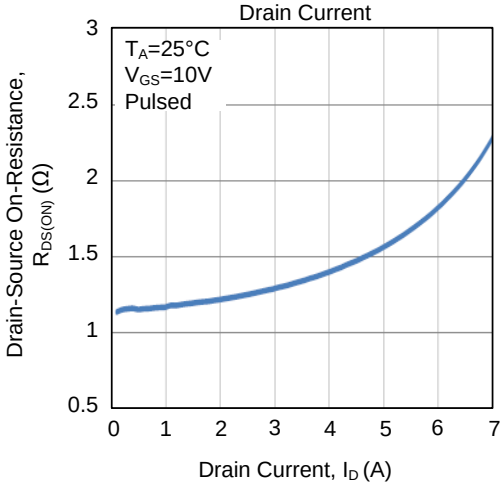
Source Current vs. Source-Drain Voltage



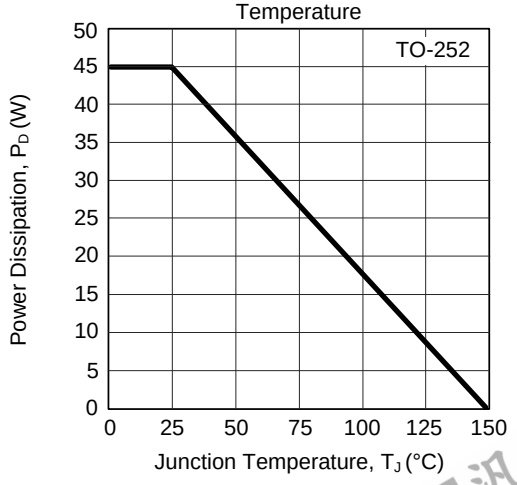
Drain Current vs. Gate-Source Voltage



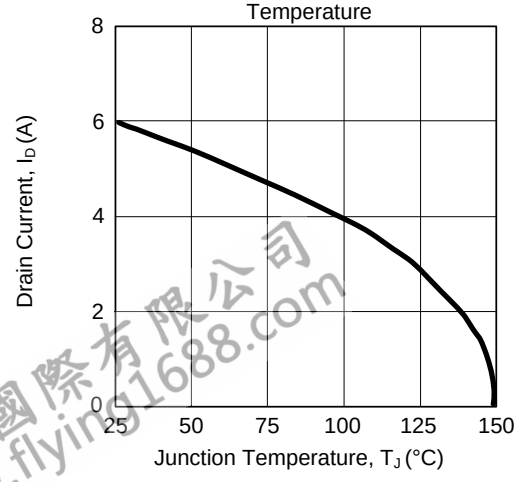
Drain-Source On-Resistance vs. Drain Current



Power Dissipation vs. Junction Temperature



Drain Current vs. Junction Temperature



■ TYPICAL CHARACTERISTICS (Cont.)