Data Sheet | July 1999 | File Number 2285.3

1.0A, 100V, 0.6 Ohm, P-Channel Power MOSFET

This advanced power MOSFET is designed, tested, and guaranteed to withstand a specified level of energy in the breakdown avalanche mode of operation. These are P-Channel enhancement mode silicon gate power field effect transistors designed for applications such as switching regulators, switching convertors, motor drivers, relay drivers and drivers for high power bipolar switching transistors requiring high speed and low gate drive power. These types can be operated directly from integrated circuits.

Formerly developmental type TA17501.

Ordering Information

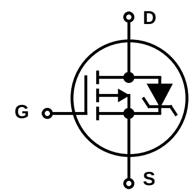
PART NUMBER	PACKAGE	BRAND
IRFD9120	HEXDIP	IRFD9120

NOTE: When ordering, use the entire part number.

Features

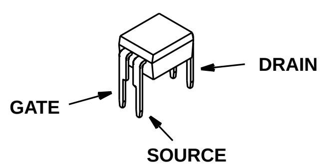
- 1.0A, 100V
- $r_{DS(ON)} = 0.6\Omega$
- Single Pulse Avalanche Energy Rated
- SOA is Power Dissipation Limited
- Nanosecond Switching Speeds
- Linear Transfer Characteristics
- High Input Impedance

Symbol



Packaging

HEXDIP



Absolute Maximum Ratings $T_C = 25^oC$, Unless Otherwise Specified

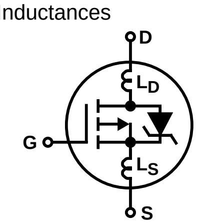
		IRFD9120	UNITS
Drain to Source Breakdown Voltage (Note 1)	V_{DS}	-100	V
Drain to Gate Voltage ($R_{GS} = 20k\Omega$) (Note 1)	V_{DGR}	-100	V
Continuous Drain Current	I_D	-1.0	A
Pulsed Drain Current (Note 3)	I_{DM}	-8.0	A
Gate to Source Voltage	V_{GS}	±20	V
Maximum Power Dissipation (Figure 1)	P_D	1.0	W
Linear Derating Factor (Figure 1)		0.008	$W/^oC$
Single Pulse Avalanche Energy Rating (Note 4)	E_{AS}	370	mJ
Operating and Storage Temperature	T_J, T_{STG}	-55 to 150	^oC
Maximum Temperature for Soldering			
Leads at 0.063in (1.6mm) from Case for 10s	T_L	300	^oC
Package Body for 10s, See Techbrief 334	T_{pkg}	260	^oC

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

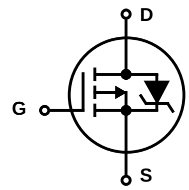
NOTE:

1. $T_J = 25^oC$ to 125^oC.

Electrical Specifications $T_C = 25^oC$, Unless Otherwise Specified

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNITS
Drain to Source Breakdown Voltage	BV_{DSS}	$I_D = -250\mu A$, $V_{GS} = 0V$, (Figure 9)		-100	-	-	V
Gate to Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}$, $I_D = -250\mu A$		-2	-	-4	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = Rated BV_{DSS}, $V_{GS} = 0V$		-	-	-25	µA
		V_{DS} = 0.8 x Rated BV_{DSS}, $V_{GS} = 0V$, $T_C = 125^oC$		-	-	-250	µA
On-State Drain Current (Note 2)	$I_{D(ON)}$	$V_{DS} > I_{D(ON)} \times r_{DS(ON)\,MAX}$, $V_{GS} = -10V$		-1.0	-	-	A
Gate to Source Leakage Current	I_{GSS}	$V_{GS} = \pm 20V$		-	-	±500	nA
Drain to Source On Resistance (Note 2)	$r_{DS(ON)}$	$I_D = -0.8A$, $V_{GS} = -10V$, (Figures 7, 8)		-	0.5	0.6	Ω
Forward Transconductance (Note 2)	g_{fs}	$V_{DS} < 50V$, $I_D = -0.8A$ (Figure 11)		0.8	1.2	-	S
Turn-On Delay Time	$t_{d(ON)}$	V_{DD} = 0.5 x Rated BV_{DSS}, $I_D = -1.0A$, $R_G = 9.1\Omega$, $V_{GS} = -10V$, (Figures 16, 17) $R_L = 50\Omega$ for $V_{DD} = -50V$ MOSFET Switching Times are Essentially Independent of Operating Temperature		-	25	50	ns
Rise Time	t_r			-	50	100	ns
Turn-Off Delay Time	$t_{d(OFF)}$			-	50	100	ns
Fall Time	t_f			-	50	100	ns
Total Gate Charge (Gate to Source + Gate to Drain)	$Q_{g(TOT)}$	$V_{GS} = -10V$, $I_D = -1.0A$, V_{DS} = 0.8 x Rated BV_{DSS} (Figures 13, 18, 19) Gate Charge is Essentially Independent of Operating Temperature		-	16	20	nC
Gate to Source Charge	Q_{gs}			-	9	-	nC
Gate to Drain "Miller" Charge	Q_{gd}			-	7	-	nC
Input Capacitance	C_{ISS}	$V_{DS} = -25V$, $V_{GS} = 0V$, f = 1MHz, (Figure 10)		-	300	-	pF
Output Capacitance	C_{OSS}			-	200	-	pF
Reverse Transfer Capacitance	C_{RSS}			-	50	-	pF
Internal Drain Inductance	L_D	Measured From the Drain Lead, 2.0mm (0.08in) From Header to Center of Die	Modified MOSFET Symbol Showing the Internal Devices Inductances	-	4.0	-	nH
Internal Source Inductance	L_S	Measured From the Source Lead, 2.0mm (0.08in) From Header to Source Bonding Pad		-	6.0	-	nH
Thermal Resistance Junction to Ambient	$R_{\theta JA}$	Typical Socket Mount		-	-	120	$^oC/W$

Source to Drain Diode Specifications

PARAMETER	SYMBOL	TEST CONDITIONS		MIN	TYP	MAX	UNITS
Continuous Source to Drain Current	I_{SD}	Modified MOSFET Symbol Showing the Integral Reverse P-N Junction Diode		-	-	-1.0	A
Pulse Source to Drain Current (Note 3)	I_{SDM}			-	-	-8.0	A
Source to Drain Diode Voltage (Note 2)	V_{SD}	$T_C = 25^oC$, I_{SD} = -1.0A, V_{GS} = 0V, (Figure 12)		-	-	-1.5	V
Reverse Recovery Time	t_{rr}	$T_J = 150^oC$, I_{SD} = -4.0A, dI_{SD}/dt = 100A/µs		-	150	-	ns
Reverse Recovery Charge	Q_{RR}	$T_J = 150^oC$, I_{SD} = -4.0A, dI_{SD}/dt = 100A/µs		-	0.9	-	µC

NOTES:

2. Pulse test: pulse width ≤ 80µs, duty cycle ≤ 2%.
3. Repetitive rating: pulse width limited by maximum junction temperature.
4. V_{DD} = 25V, starting $T_J = 25^oC$, L = 555mH, $R_G = 25\Omega$, Peak I_{AS}= 1.0A (Figures 14, 15).

Typical Performance Curves Unless Otherwise Specified

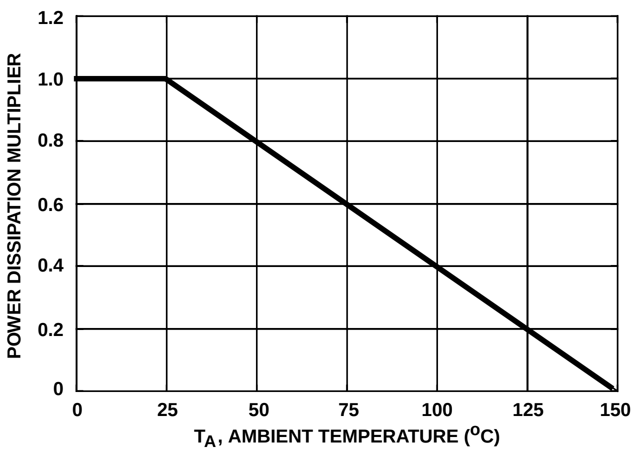


FIGURE 1. NORMALIZED POWER DISSIPATION vs AMBIENT TEMPERATURE

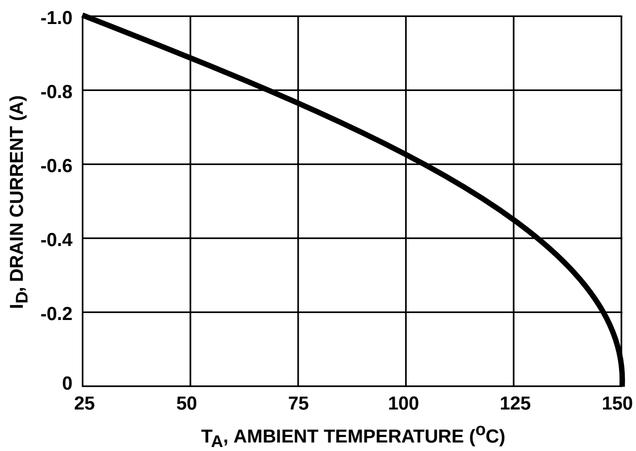


FIGURE 2. MAXIMUM CONTINUOUS DRAIN CURRENT vs AMBIENT TEMPERATURE

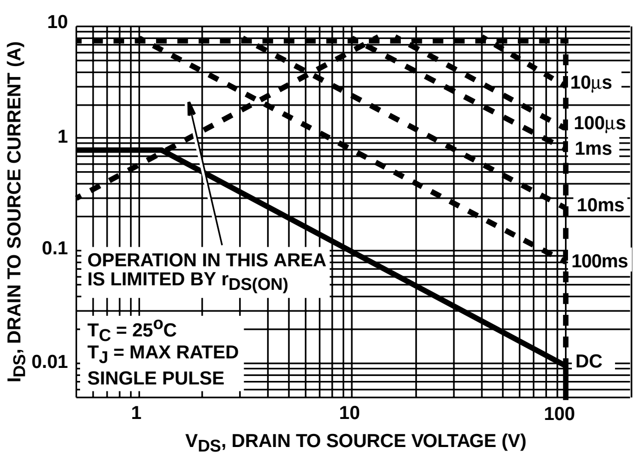


FIGURE 3. FORWARD BIAS SAFE OPERATING AREA

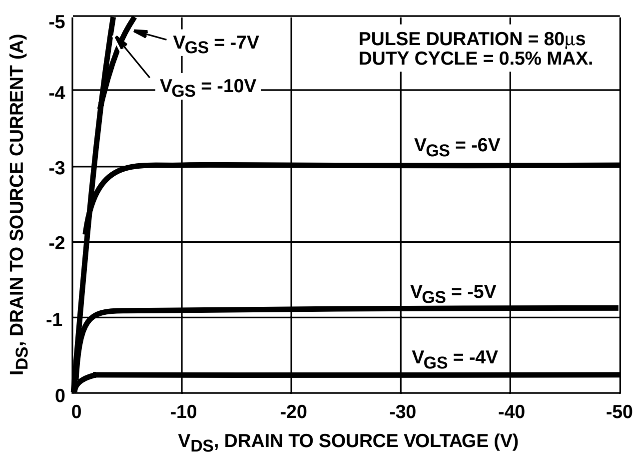


FIGURE 4. OUTPUT CHARACTERISTICS

Typical Performance Curves Unless Otherwise Specified **(Continued)**

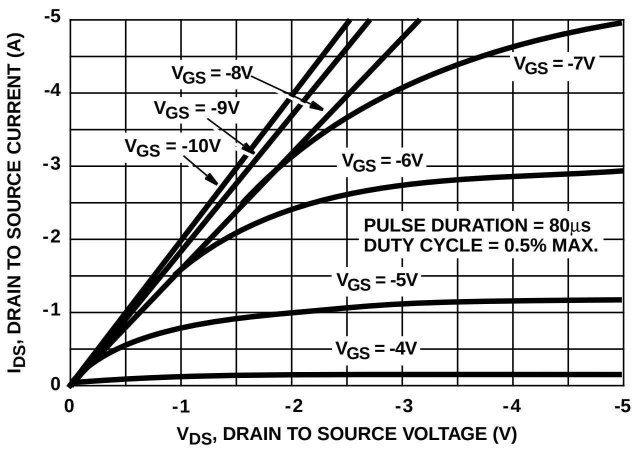


FIGURE 5. SATURATION CHARACTERISTICS

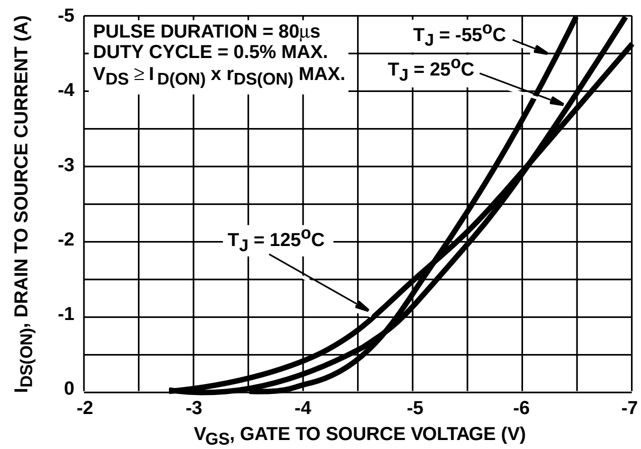
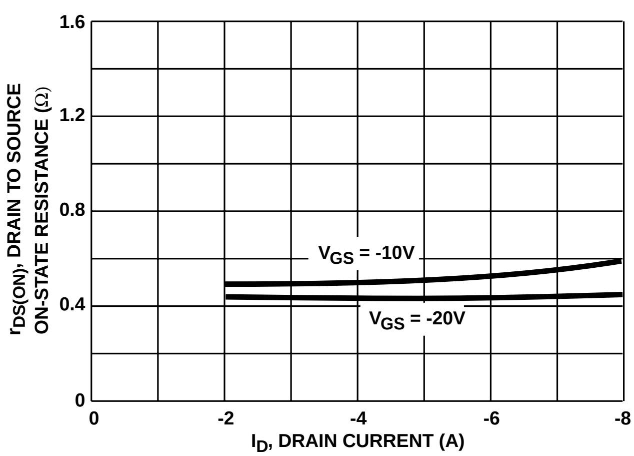


FIGURE 6. TRANSFER CHARACTERISTICS



NOTE: Heating effect of 2µs pulse is minimal.

FIGURE 7. DRAIN TO SOURCE ON RESISTANCE vs GATE VOLTAGE AND DRAIN CURRENT

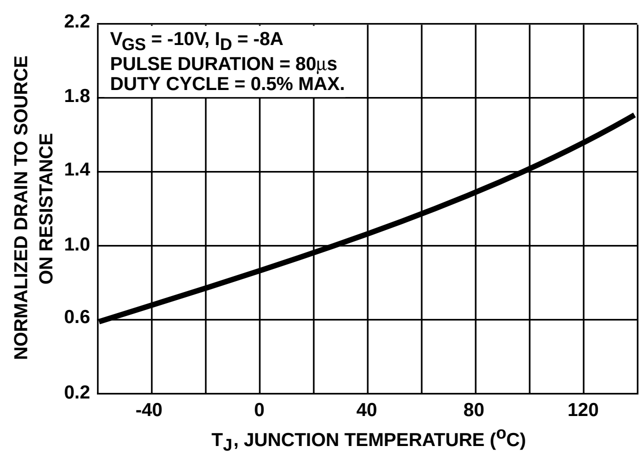


FIGURE 8. NORMALIZED DRAIN TO SOURCE ON RESISTANCE vs JUNCTION TEMPERATURE

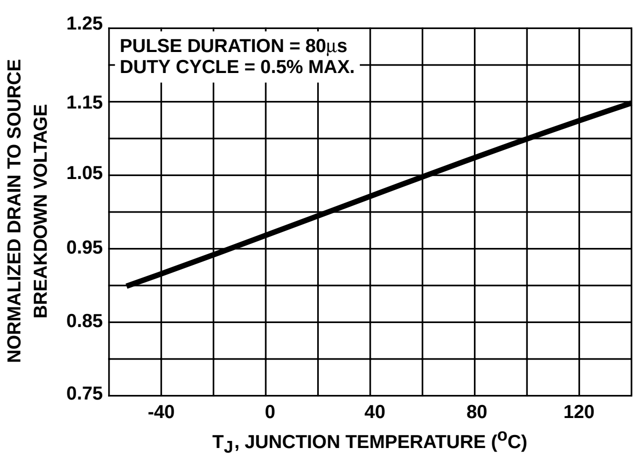


FIGURE 9. NORMALIZED DRAIN TO SOURCE BREAKDOWN VOLTAGE vs JUNCTION TEMPERATURE

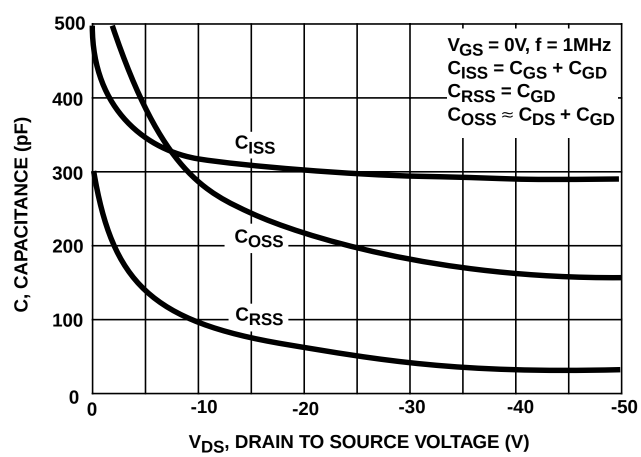


FIGURE 10. CAPACITANCE vs DRAIN TO SOURCE VOLTAGE

Typical Performance Curves Unless Otherwise Specified (Continued)

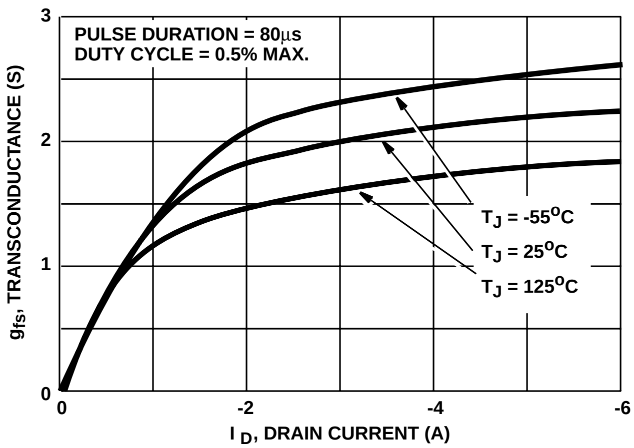


FIGURE 11. TRANSCONDUCTANCE vs DRAIN CURRENT

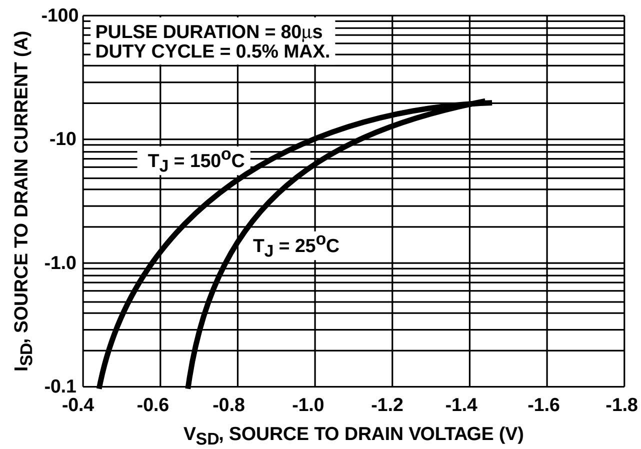


FIGURE 12. SOURCE TO DRAIN DIODE VOLTAGE

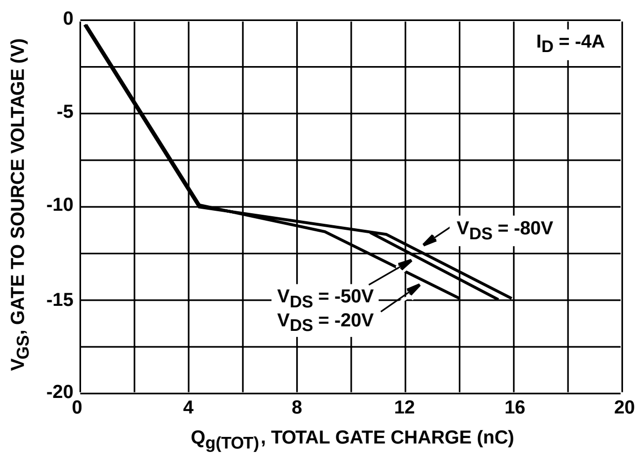


FIGURE 13. GATE TO SOURCE VOLTAGE vs GATE CHARGE

Test Circuits and Waveforms

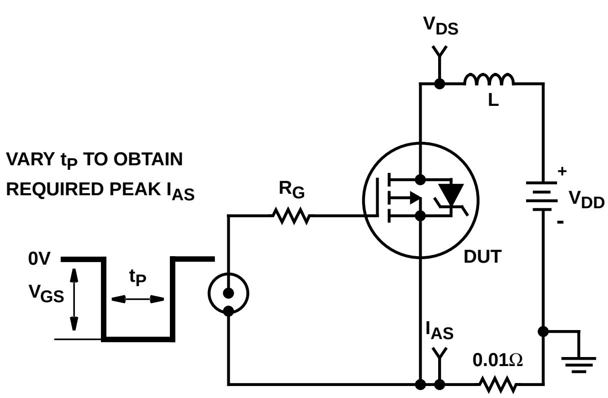


FIGURE 14. UNCLAMPED ENERGY TEST CIRCUIT

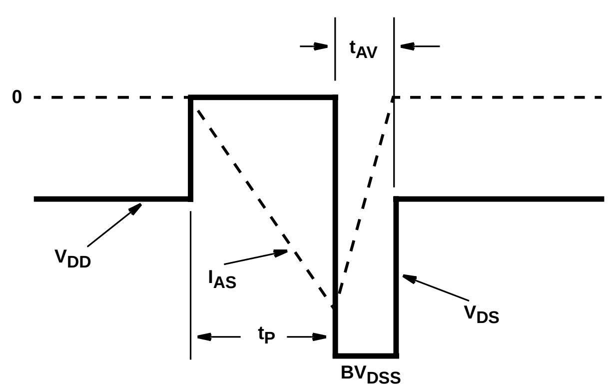


FIGURE 15. UNCLAMPED ENERGY WAVEFORMS

Test Circuits and Waveforms (Continued)

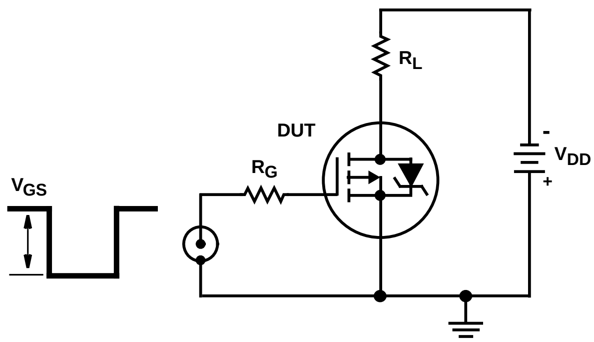


FIGURE 16. SWITCHING TIME TEST CIRCUIT

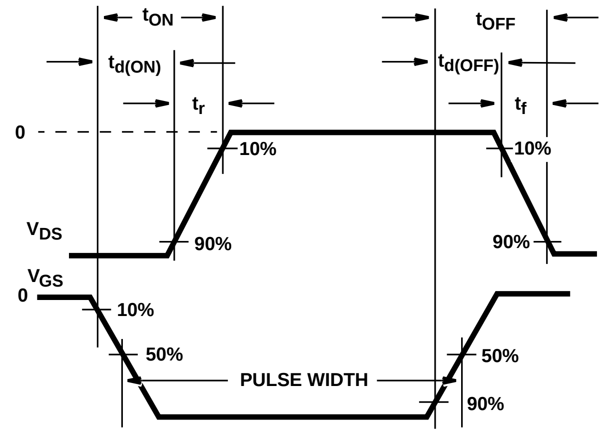


FIGURE 17. RESISTIVE SWITCHING WAVEFORMS

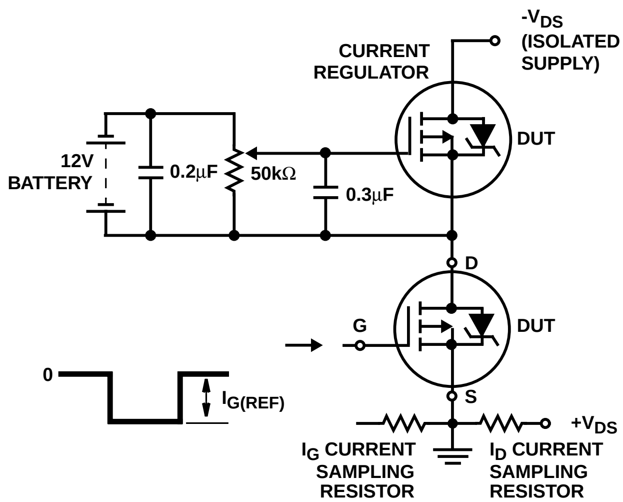


FIGURE 18. GATE CHARGE TEST CIRCUIT

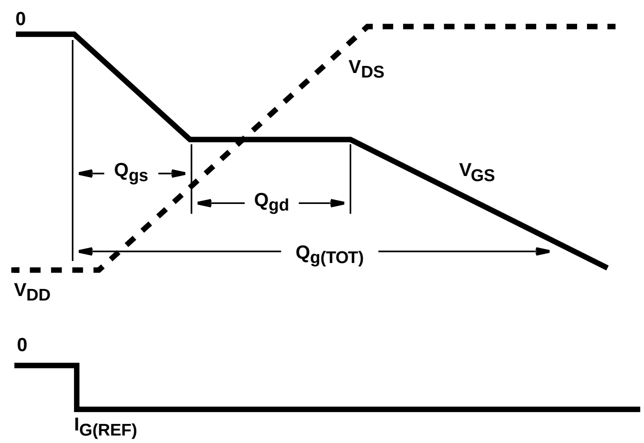


FIGURE 19. GATE CHARGE WAVEFORMS

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Sales Office Headquarters

NORTH AMERICA
Intersil Corporation
P. O. Box 883, Mail Stop 53-204
Melbourne, FL 32902
TEL: (407) 724-7000
FAX: (407) 724-7240

EUROPE
Intersil SA
Mercure Center
100, Rue de la Fusee
1130 Brussels, Belgium
TEL: (32) 2.724.2111
FAX: (32) 2.724.22.05

ASIA
Intersil (Taiwan) Ltd.
7F-6, No. 101 Fu Hsing North Road
Taipei, Taiwan
Republic of China
TEL: (886) 2 2716 9310
FAX: (886) 2 2715 3029