2N6975, 2N6976, 2N6977, 2N6978

File Number **2297**

N-Channel Enhancement-Mode Conductivity-Modulated Power Field-Effect Transistors

5 A, 400 V and 500 V
$V_{CE(on)}$: 2 V
T_{fi}: 1 μs, 0.5 μs

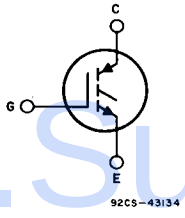
Features:
- *Low on-state voltage*
- *Fast switching speeds*
- *High input impedance*

Applications:
- *Power supplies*
- *Motor drives*
- *Protection circuits*

The 2N6975, 2N6976, 2N6977 and the 2N6978 are n-channel enhancement-mode conductivity-modulated power field-effect transistors designed for high-voltage, low on-dissipation applications such as switching regulators and motor drivers. These types can be operated directly from low-power integrated circuits.

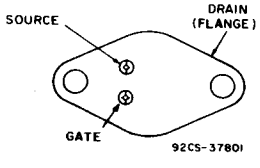
These types are supplied in the JEDEC TO-204AA steel package.

N-CHANNEL ENHANCEMENT MODE



TERMINAL DIAGRAM

TERMINAL DESIGNATION



JEDEC TO-204AA

MAXIMUM RATINGS, *Absolute-Maximum Values (T_C = 25° C):*

	2N6975 2N6977		2N6976 2N6978	
COLLECTOR-EMITTER VOLTAGE, V_{CES}	400*		500*	V
COLLECTOR-GATE VOLTAGE (R_{GE} = 1 MΩ), V_{CGR}	400*		500*	V
REVERSE COLLECTOR-EMITTER VOLTAGE, $V_{CES(rev.)}$		5*		V
GATE-EMITTER VOLTAGE, V_{GE}		±20*		V
COLLECTOR CURRENT, RMS Continuous, I_C		5*		A
Pulsed, I_{CM}		10*		A
POWER DISSIPATION @ T_C = 25°C, P_T		100*		W
Derate above T_C = 25°C		0.8*		W/°C
OPERATING AND STORAGE TEMPERATURE, T_J, T_{stg}		-55 to +150*		°C

*JEDEC registered value.

Harris Semiconductor IGBT product is covered by one or more of the following U.S. patents:

4,364,073	4,417,385	4,430,792	4,443,931	4,466,176	4,532,534	4,567,641
4,587,713	4,618,872	4,620,211	4,631,564	4,639,754	4,639,762	4,641,162
4,644,637	4,682,195	4,684,413	4,717,679	4,794,432	4,801,986	4,803,533
4,809,045	4,810,665					

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ELECTRICAL CHARACTERISTICS *At Case Temperature (T_C) = 25°C Unless Otherwise Specified*

CHARACTERISTICS	SYMBOL	TEST CONDITIONS	LIMITS				UNITS
			2N6975 2N6977		2N6976 2N6978		
			Min.	Max.	Min.	Max.	
Collector-Emitter Breakdown Voltage	BV_{CES}	I_C = 1 mA V_{GE} = 0	400*	—	500*	—	V
Gate Threshold Voltage	$V_{GE(th)}$	$V_{GE} = V_{CE}$ I_C = 1 mA	2*	4.5*	2*	4.5*	V
Zero-Gate Voltage Collector Current	I_{CES}	V_{CE} = 400 V V_{CE} = 500 V	— —	250* —	— —	— 250*	μA
		T_C = 125°C V_{CE} = 400 V V_{CE} = 500 V	— — —	— 1000* —	— — —	— — 1000*	
Gate-Emitter Leakage Current	I_{GES}	V_{GE} = ±20 V V_{CE} = 0	—	100*	—	100*	nA
Reverse Collector-Emitter Leakage Current	I_{ECS}	R_{GE} = 0 Ω V_{EC} = 5 V	—	5*	—	5*	mA
Collector-Emitter On Voltage	$V_{CE(on)}$	I_C = 5 A V_{GE} = 10 V	—	2*	—	2*	V
		I_C = 10 A V_{GE} = 20V	—	2.5	—	2.5	
Gate-Emitter Plateau Voltage	V_{GEP}	I_C = 5 A V_{CE} = 10 V	3.4*	6.8*	3.4*	6.8*	V
On-State Gate Charge	$Q_{g(on)}$	I_C = 5 A V_{CE} = 10 V	12*	25*	12*	25*	nC
Turn-On Delay Time	$t_{d(on)}$	I_C = 5 A $V_{CE(CLP)}$ = 300 V L = 50 μH T_J = 125°C V_{GE} = 10 V R_G = 50 Ω	50 max				ns
Rise Time	t_r		50 max				
Turn-Off Delay Time	$t_{d(off)}$		400 max *				
Fall Time	t_{fi}		2N6975 2N6976	1000 max*			
			2N6977 2N6978	500 max *			
Turn-Off Energy Loss per Cycle (off switching dissipation = E_{off} x frequency)	E_{off}	I_C = 5 A $V_{CE(CLP)}$ = 300 V L = 50 μH T_J = 125°C V_{GE} = 10 V R_G = 50 Ω	2N6975 2N6977	1000 max*			μJ
			2N6976 2N6978	500 max*			
Thermal Resistance Junction-to-Case	$R_{\theta JC}$		1.25*				°C/W

*JEDEC registered value.

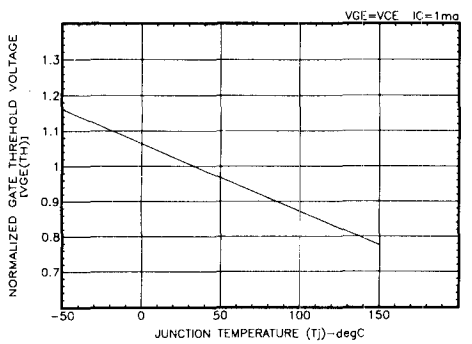

Fig. 1 - Typical normalized gate threshold voltage as a function of junction temperature for all types.

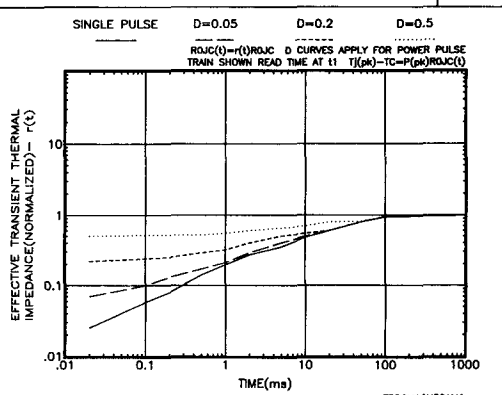

Fig. 2 - Normalized thermal response characteristics for all types.

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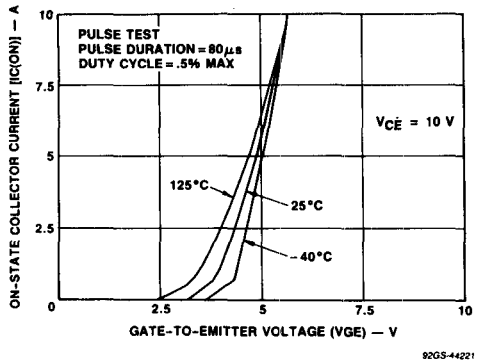

Fig. 3 - Typical transfer characteristics for all types.

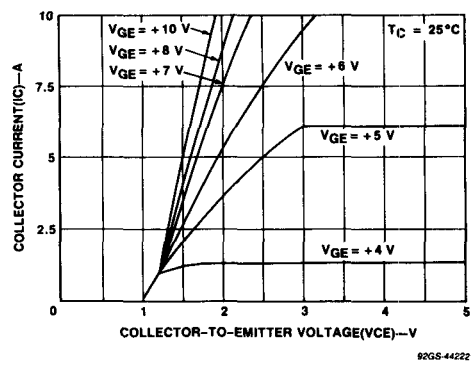

Fig. 4 - Typical saturation characteristics for all types.

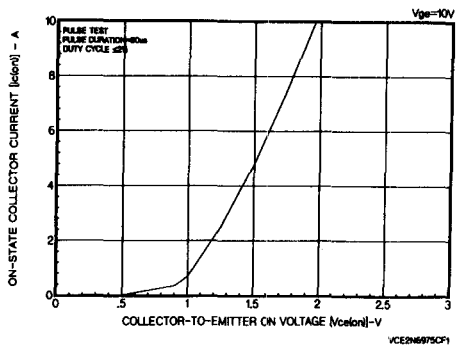

Fig. 5 - Typical collector-to-emitter on-voltage as a function of collector current for all types.

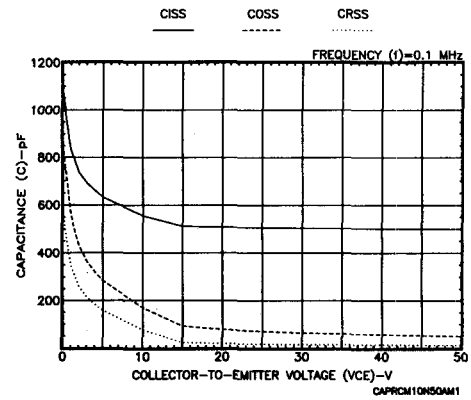

Fig. 6 - Capacitance as a function of collector-to-emitter voltage for all types.

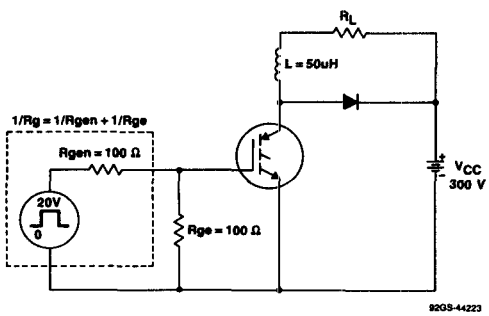

Fig. 7 - Inductive switching test circuit.

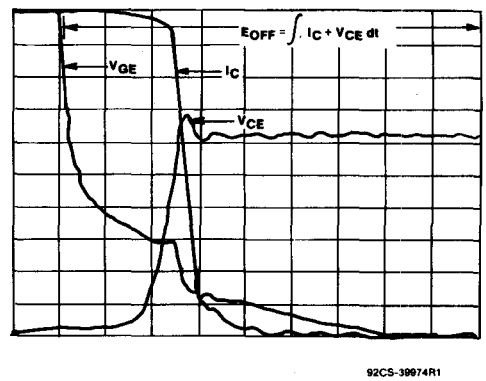

Fig. 8 - Typical inductive switching waveforms.

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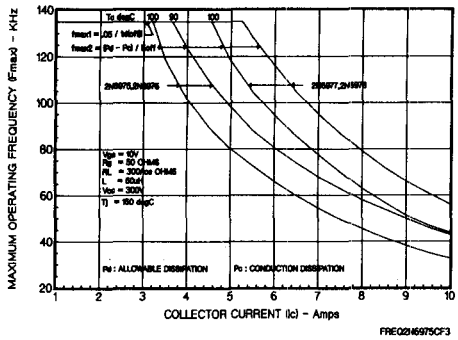

Fig. 9 - Maximum operating frequency vs collector current (typical).

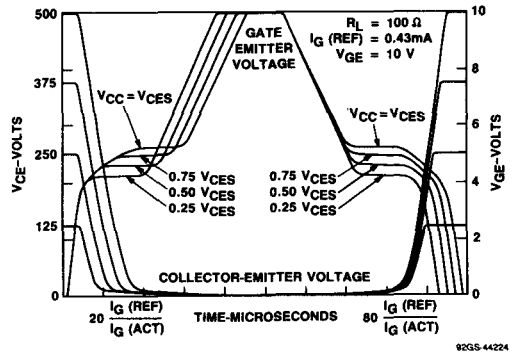

Fig. 10 - Normalized switching waveforms at constant gate current. (Refer to RCA application notes AN-7254 and AN7260.)

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